Appendix C

Liner and Final Cover System Stability Analysis

Slope Stability Analysis
Lateral Expansion
American Environmental Landfill

American Environmental Landfill

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Index and Certification Page

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CERTIFICATION

This Slope Stability Analysis has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the plan discussed, and it has been prepared in accordance with good engineering practice including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

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1.0 INTRODUCTION/EXECUTIVE SUMMARY

SCS Engineers (SCS) has completed a geotechnical slope stability analysis of the construction, working and post-closure phase slopes for a 203-acre expansion at the American Environmental Landfill. SCS used the general limit equilibrium (GLE) equation 2-D numeric model from Sequence - GeoSlope International[1] (GeoStudio Suite – Slope/W® 2023.1.1). This report presents the results of the analysis. The following computational scenarios were considered:

- Case 1 - Construction Phase
- Case 2- Working (Filling Operations) Phase
- Case 3- Post Closure Phase

The scenario analysis constituted a series of global analyses using methodologies employed and reported in Aquaterra Environmental Solutions (AES) Phase IVA report (December 2011)[2], SCS Aquaterra (SA) Phase IVB report (March 2014)[3] and SA Phase IVB (November 2014)[4] that were applied to the Phase IV which immediately abuts this proposed expansion to the east. (There has been an evolution in the material shear strength properties of the underlying gray shale during this period as additional subsurface exploration and strength tests took place. The shear strengths employed in this modeling effort reflect the most recent shale data used in the 2014 evaluations which consider the potential anisotropic strengths related to observed in vertical jointing and horizontal bedding planes.)

SCS is of the opinion that the analysis performed and discussed herein is conservative in nature and indicates that the proposed lateral expansion at the AEL can be constructed, operated and ultimately closed within a suitable range in factors of safety when considering global slope stability of the waste mass and containment components, and laminar stability of the layered primary liner sequences. We strongly encourage the reader to review the remainder of this report and attachments for the details of the evaluation.

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[1] "Stability Modeling with SlopeW™ – An Engineering Methodology" by John Krahn – Geo-Slope/W International, Ltd., Calgary, Alberta, Canada, 2007 Web: http://www.geo-slope.com

[2] Aquaterra Environmental Solutions, "Liner Anchor Trench and Slope Stability for American Environmental Landfill – Tier 1 Permit Modification – Phase IVA" #4926.10, December 2011.

[3] SCS Aquaterra, Inc. "Slope Stability Analysis for American Environmental Landfill – Tier 1 Permit Modification – Phase IVB", #27213780.10, March 2014.

[4] SCS Aquaterra, Inc. "American Environmental Landfill Phase IV Slope Stability Analysis", #27213780.10, November 2014.

2.0 STABILITY ANALYSIS

2.1 PROPOSED WASTE FOOTPRINT

This proposed 203-acre lateral expansion is located immediately west of AEL Phase IV waste boundary. The design primary liner subgrade surface, and post-closure final cover surface plan sheets, drawings 1 and 2, respectively, are provided in Attachment A. In addition, drawing 3 depicts the soil boring locations proximate to the critical profile(s) evaluated for this study and is also included in Attachment A.

- Proposed Vertical limit of waste will be ~1,132 feet above mean sea level (amsl) at the highest point
- Final closure cover side slopes
  - Maximum aggregate slope ~4 horizontal (H) to 1 vertical (V)
  - Add-on Drainage Berms installed with the final cover at ~40 ft. vertical spacing
- Maximum thickness of waste will be ~400 ft
- Maximum height of waste above the lowest level of the bottom liner will be ~421 ft

2.2 CRITICAL PROFILE(S)

The analysis evaluated the stability of the proposed waste critical profile(s) relative to the following scenarios:

- Construction Phase, Working Phase and Post Closure Phase: Profile C-C': Runs from Sta. South -5+00 ft. through Sta. North 30+00 ft.
- Construction Phase (worst case slope height): Profile C – C'' – C''': Runs from Sta. South -5+00 ft. to a pivot point to the east at Sta. North 23+70 ft. through Sta. 'North' 33+00 ft.

Critical Profile C – C' is provided in Attachment A on Drawing 4. The worst-case construction height has been appended and substituted for the C''' terminus resulting in an embankment height of 115 ft, as opposed to the C – C' northern embankment height of 85 ft.

The critical profile for slope stability attempts to minimize slide-resisting forces while maximizing the driving forces. This is accomplished by cutting the lowest interior resisting buttress base slope at the heights exterior toe embankment while extending the profile perpendicular to the post-closure cover contours upward through the maximum height of waste. The construction slope is evaluated by cutting the maximum height of cut native soil or compacted soil embankment perpendicular to the design subgrade contour. Where applicable, an added factor of a downward and outward-sloping primary liner also reduces resisting forces. This condition was present in the southern half of Profile C – C'. The minimum buttress and maximum height of waste conditions were met with profile C – C' where the buttressing south embankment (exterior – south side ~ 40 ft. and interior – north side ~39 ft.) is cut approximately 400 ft west of the proposed lateral expansion's southeast corner. Profile C – C' runs northward across the post-closure cover crest at Sta. N 16+12 ft at an elevation of ~1,132.5 ft amsl. Maximum height of waste occurs 600 ft. due east of this profile crest at an elevation of 1,134 ft. amsl. Thereafter, the profile passes down the reverse slope northward to the north buttressing embankment at Sta. N 27+95 ft. Profile C – C' terminated northward beyond the toe of the constructed slope at Sta. N 33+00 ft. This profile represents the critical profile for the Construction Phase Global, Working Phase Global and Post Closure Global scenarios.

To evaluate the critical laminar stability of the constructed side slope primary liner, an alternative 'dog leg' was substituted for the 'northern most' 1,000 ft of the profile. This pivoted profile is designated as Profile C'' – C'''. The height of the eastern buttress was 115 ft and the entire side slope will be excavated in bedrock, so this profile was used only to assess the worst-case liner sequence laminar stability.

2.3 LINER SEQUENCES

The proposed lateral expansion waste mass will be bounded by primary and side slope composite liner and a soil final cover liner. These sequences have been modeled in analysis and are shown in top-down order below:

- Final cover
    1. 12-inch Vegetation Layer
    2. 24-inch Vegetative Support Layer
    3. 12-inch Intermediate Cover Layer
- Primary Liner
    1. 24-inch Leachate Collection Granular Layer
    2. Non-Woven, Needle Punched (NW/NP) Geotextile
    3. 60-mil Geomembrane Layer
    4. 24-inch Recompacted Clay Layer
    5. Prepared / Compacted Subgrade

Each soil material layer is included in the model in the noted layer thicknesses with corresponding unit weight and shear strength properties. The interface shear strength of the geosynthetic sequence in the primary liner was evaluated to determine the critical weakest geosynthetic interface (WGI) and the uppermost 6 inches of the underlying 24-inch thick CCL was assigned the WGI shear strength properties. These values are presented below.

2.4 MATERIAL PROPERTIES

Competent bedrock immediately underlies the site (except for the extreme ends of the Profile C – C' where earthen embankments are to be constructed from cohesive soils present at the site. Running from south to north along Profile C – C', seven borings were referenced to establish the approximate lithology of the foundational material at and below the design subgrade. These borings were B-6 @ Sta. N -03.90 ft.; MW-38 @ Sta. N. 4+25 ft.; B-21 @ Sta. N. 7+10 ft.; B-26 @ Sta. N. 12+25 ft.; GP-25 @ Sta. 17+00 ft.; B-34 @ Sta. N. 22+50 ft.; and P-39 @ Sta. 27+30 ft. These borings are shown on the slope stability graphic results in Attachment C. Their positions are also shown relative to Profile C – C' on drawings provided in Attachment A.

Bedrock properties - The anisotropic shear strengths for the more massive and blocky bedrock units (sandstone, and un-weathered shale) were estimated based on rock core samples so as to replicate vertical rock face spalling observed at the site. These values were employed in SA (March 2014)[5] and were used here for the foundational shale and sandstone even though these materials

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[5] ibid

presented themselves on the cell floor and on 3H to 1V cut side slope and no vertical benching is anticipated or required in this lateral expansion.

Table 1. Material Properties

Material	Density	Cohesion (c)	ϕ	Reference
	pcf	psf	Degrees	
Impenetrable Bedrock	Impenetrable			*Slope W™ default values*
Sandstone	140	2000 (H) 250 (V)	15 (H) 9 (V)	Core samples and field observation
Gray Shale	145.5	5000 (H) 240 (V)	15 (H) 9 (V)	
Recompacted Clay Liner (CCL) (CL)	127.5	1600	22.9	Ref [6, 7 & 8]
Silty Clay (Native Undisturbed)	129.9	50	23.7	Ref [6, 7 & 8]
Stiff Silty Clay (Compacted Subgrade)	129.9	1600	23.7	Ref [6, 7 & 8]
Clay (CL) (Stiff: Native Undisturbed)	129.9	13,023	26	Ref [6, 7 & 8]
Leachate Collection Granular Drainage Layer (GDL) (SW)	143.6	0	37	Ref [6]
1- Weak Geosynthetic Interface (WGI) – 60 mil. HDPE Double Sided Smooth (DSS) Peak (Bottom – All Phases)	129.9	0	11	Ref [9]
2-WGI – 60 mil. HDPE Double-sided Textured (DST) Peak (Side Slope – Construction)	129.9	α=0 σ_2=1,364.9	σ_1=33 σ_2=28	Ref [9]
3-WGL – 60 mil. HDPE (DST) Residual (Side Slope – Working and Post Closure)	129.9	167	17	Ref [9]
Sandy Silt (Native Undisturbed) (ML-CL)	124.7	180	30	Ref [6, 7]
Municipal Solid Waste (MSW)	85	125	35 / 30 @ σ = 4,177 psf	Ref [10]
Intermediate Soil Cover	127.5	240	23.7	Ref [6, 7 & 8]
Vegetative Support Layer	102	240	26	Ref [6, 7 & 8]
Vegetative Cover Soil	104	240	23.7	Ref [6, 7 & 8]

Soil properties - As noted in the SA (November 2014)11 report, where we used available boring logs and testing data to estimate the strength and unit weight properties of the native or recompacted soil materials, the above-referenced boring logs showed similar materials. Therefore, these soil unit weight

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[6] Huang, Y.H., Stability Analysis of Earth Slopes, University of Kentucky, Van Nostrand Reinhold Co., New York, 1983, pp 305.

[7] Stark, T.D., Choi, H., McCone, S., "Drained Shear Strength Parameters for Analysis of Landslides", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, May 2005.

[8] "Atterberg Limit and Moisture Density Data Summary", Golder Associates and Terracon Consultants, Feb 2009. And soil boring logs by SCS Engineers (2021), Std Proctor Data Summary Worksheet Dated 20 Nov 2023 by SCS Engineers., Cardinal Environmental, Inc. (2001), and Aquaterra Environmental Solutions, Inc. (2011), and Unconfined compression tests for gray shale by Alpha Omega, Inc. (2011).

[9] Narego, D. and Koerner, G.R., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces", GRI Report #30, April 2005, Geosynthetic Research Institute, Folsom, PA., Table 1. (With Mohr bilinear failure envelope chart by Hartwell (2023).

[10] Stark, T.D., Huvaj-Sarihan, N., Li, G., "Shear strength of municipal solid waste for stability analyses", Environmental Geology (2009) 1911-1923, DOI 10.1007/s00254-008-1480-0. (With Mohr bilinear failure envelope chart by Hartwell (2023).

[11] ibid

and shear strength properties were used again for this modeling evaluation. The sources of these values are noted in the footnoted references in the above table. Site-specific data were used where possible. When insufficient site-specific data were available, the design engineer used the most conservative values reported by Huang (1983). In the case of unit weight, the highest wet unit weight in the range was calculated to provide a conservative driving force. With strength parameters, (ϕ and c) the low end of the reported range was used to reduce the resisting forces along the critical slip surface. The pertinent portions of these references have been provided for informational purposes.

2.5 GEOSYNTHETIC INTERFACE STRENGTH PROPERTIES

SCS Aquaterra performed a literature evaluation to determine the weakest geo-synthetic interface (WGI) shear strength (adhesion or cohesion, designated as α or c and internal or interface friction angle, ϕ or δ) of the permitted primary bottom and side slope liner geosynthetic sequence. The interface strengths of the primary liner sequences were assigned based on an evaluation of the individual interface contact strengths as developed using soil strengths of adjoining layers from the references noted above. Soil-to-geosynthetic and geosynthetic-to-geosynthetic contact strengths were developed using Koerner and Narejo (2005)[12]. The strengths of each contact are shown in Table 2 for each liner configuration. Two separate liner configurations were considered for the primary liner (Side slope and floor or bottom). Residual (or large displacement) strengths were used for the primary liner side slope post-closure configuration as this portion of the liner could experience displacement caused by settling waste whose downslope movement could translate across the protective soil onto the geosynthetic sequence. Although this is a remote possibility considering the thickness of the protective soil layers, the designers believe it is a conservative assumption which results in a conservative analytical solution. This practice is recommended by Stark (2004)[13]. Peak strengths from the Koerner and Narejo database were used for the geosynthetic sequences in the side slope Construction Phase analysis and the primary liner floor sequence as no relative movement along the liner due to waste settlement is anticipated.

Using this approach for selecting the appropriate strength factors, a single contact was selected as the weakest contact based first on the lowest δ angle and then the lowest α value. On the side slope of the primary liner, the DST (Textured) HDPE to granular layer contact was used. As stated above, the peak strength was used for the construction condition, and the residual strength was used for the post-closure condition. For the liner side slope (Construction Phase condition), the weakest contact was not readily apparent so shear strength was plotted versus normal load, and a 'bilinear' Mohr coulomb envelope was employed to represent the probable peak strength. The critical contact surfaces employed were both the unsaturated CCL liner to DST HDPE and the DST HDPE to granular layer contacts. A plot of the bilinear envelope is provided in Attachment B. The floor liner critical interface is the DSS HDPE to the overlying granular layer.

As noted above in the section on Liner Sequences, while geosynthetics are to be employed in this cell, the modeling algorithms do not handle these very thin material thicknesses in a manner that will consistently produce reasonable results. Therefore, the strength values were assigned to the "geosynthetic region" that was assigned a region that was culled out of the top 6 inches of the CCL.

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[12] ibid

[13] Stark, T.D., and Choi, H., "Technical Note: Peak versus residual interface strengths for landfill liner and cover design", Geosynthetics International, 2004 No. 6, pp. 491 – 498.

Table 2. Weak Geosynthetic Interface Properties

Component Sequence Description					Detail	Drawing
Cross-Section Layer Component	Thickness or Weight	Cross Section Interface Contact	Critical Interface	Density (γ) pcf	C or α psf	ϕ or δ (degrees)
1. Primary Liner (Floor) *(Using Peak Shear Strengths)*						
Granular Drainage Layer (GDL) (SW)	12 in	SW		143.6	0	37
NW-NP Geotextile		SW to NW-NP GT		78*	0	33
HPDE DSS	60 mil	NW-NP GT to DSS HDPE	X	78*	0	11
		DSS HDPE to CCL			0	22
CCL	24 in	CCL		131	1600	22.9
2. Primary Liner (Side Slope - Construction Phase) *(Using Peak Shear Strengths)*						
GDL (SW)	12 in	SW		143.6	0	37
		SW to DST HDPE		78*	0	34
NW-NP Geotextile		SW to NW-NP GT		78*	0	33
HPDE DST	60 mil	NW-NP GT to DST HDPE	X	78*	167	25
CCL		DST HDPE to CCL		78*	480	19
	24 in	CCL		131	1600	22.9
3. Primary Liner (Side Slope - Working and Post Closure Phases) *(Using Residual Strengths)*						
GDL (SW)	12 in	SW		143.6	0	37
NW-NP Geotextile		SW to NW-NP GT		78*	0	33
HPDE DST	60 mil	NW-NP GT to DST HDPE		78*	0	17
		DST HDPE to CCL	**X**		**0**	**22**
CCL	24 in	CCL		131	1600	22.9
* (note used γ = 131 psf as the WGL was included in the CCL modeling region)						

For stability modeling, we applied peak interface shear strengths for the nearly flat primary liner floor for Liner Sequence 1 in Table 2. As noted earlier in this section, and as described by Stark and Choi (2004)[14], the potential exists for liner down drag along the primary liner 3H to 1V side slope due to the settlement of overlying waste. To be conservative, we applied residual (or large displacement) interface shear strengths for the surfaces (Liner Sequence 2 in Table 2). Since no waste settlement-induced drag-down forces would be present during liner construction, peak strengths were used for the Construction Phase operations to determine static laminar stability of the constructed cut slope. In both cases, this practice is conservative and consistent with Stark (2004). Stark and Choi recommend the designer to "assign residual shear strengths to the side slopes and peak shear strengths to the base of the liner system and satisfy a factor of safety greater than 1.5, and assign residual strengths to the side slopes and base of the liner system and satisfy a factor of safety greater than 1.0 or 1.1 if direct shear data are used. In the case of the former condition, the FOSs obtained as noted below exceed 1.5. Applying the second later condition results in FOSs exceeding 1.0 and 1.1 (using direct interface shear data). Stark and Choi similarly recommend for the stability of the geosynthetic cover system assigning "peak shear strength of the weakest interface, or the weakest composite interface, with a factor of safety greater than 1.5 because of the lack of or limited amount of detrimental shear displacement along the weakest interface in a cover system

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[14] ibid

compared with the liner side slope. However, if the average slope angle (3H to 1V or 18.3° in this case) is greater than the peak interface friction angle, or large displacements such as construction-induced displacements or seismically induced displacements are expected, a residual interface friction angle should be used for design." The peak friction angle for the weakest interface is 19°, no significant construction-induced displacements are anticipated as long as construction of the final cover is allowed to proceed from the base of the slope only, and the seismic induced peak acceleration (a_{max}) of 0.089g at the primary liner is much less than the calculated yield acceleration (A_y) of 0.32g. Therefore, no permanent lateral liner displacement is anticipated.

2.6 SEISMIC HAZARD LOADING

The peak acceleration (K_p) in the bedrock near the center of the proposed waste footprint (Latitude 36° 10' 05" N, Longitude -96° 12' 04" E) is estimated to be 0.089g based on the USGS Custom Hazard Map (2018)[15]. If the peak acceleration (K_p) at the base of a facility is greater than 0.10g with a 10 percent Probability of Exceedance (PE) in 250 years the site is considered to be in a seismic impact zone. Therefore, the landfill is not located in a seismic impact zone as stipulated by the USEPA. Regardless, a seismic deformation analysis was performed to determine the potential impact of a design event.

SCS evaluated the stability of the waste mass for the final closure condition where the Exposure Time (ET) was 250 yrs. and the PE was 10%, which resulted in a Final Closure Return Period (RP) of 2,373 years. To perform a seismic analysis of the critical profile, the peak seismic acceleration (K_p) is transferred from the top of the bedrock to the base of the landfill. The resulting $A_{max\text{-}base}$ value was 0.089g for the post-closure scenario since the waste directly contacts the excavated bedrock surface.

Seismic loading is transferred into the waste mass from the landfill base. Singh and Sun (1995)[16] were used to estimate the A_{max} at the top of the critical slip surface along the critical profile. The critical slip surfaces intercept the proposed final cover surface near the mid-point of the side slope mid-point and the top of the slope. The height of the cover surface at the failure surface intercept is approximately 200 feet above the waste/bedrock contact. Using Singh and Sun, the A_{max} was estimated to be 0.138g and 0.082g, for the post-closure scenario for the cover liner at a height of 100 ft. (side slope 1/3-point) and 200 ft. (midpoint of slope) above the bottom liner, respectively. These analyses are shown in Attachment C - Seismic Analysis and Supporting Information.

With these A_{max} loading conditions, we were able to evaluate the likelihood of permanent deformation of each waste profile scenario once the critical slip surface was identified.

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[15] USGS – 2018 National Seismic Hazard Model for the Conterminous United States, Peak Horizontal Acceleration with a 2% Probability of Exceedance in 50 Years – NEHRP Site Class B/C (V_{s30} = 760 m's) Custom Hazard Map, https://geohazards.usgs.gov/hazards/apps/cmaps/

[16] Singh, S. and Sun, J.I., (1995). "Seismic Evaluation of Municipal Solid Waste Landfills" Proc. Spec. Conf. on Geoenvironment 2000, ASCE, Geotechnical Special Publication No. 46, New Orleans, LA, Vol. 2, pp.1081-1096.

3.0 METHODOLOGY DISCUSSION

GeoStudio - SlopeW® solves two factors-of-safety (FOS) equations: one satisfying force equilibrium and one satisfying moment equilibrium. The stability process involves passing a slip surface through the earth's mass and dividing the inscribed portion into vertical slices. The slip surface may be circular, composite (i.e., combination of circular and linear portions) or consist of any shape defined by a series of straight lines (i.e., fully specified slip surface). The limit equilibrium formulation assumes that:

- The FOS of the cohesive component and the frictional component of strength are equal for all soils involved
- The FOS is the same for all slices

SlopeW® uses a General Limit Equilibrium (GLE) formulation in the FOS computation. In summary, the following equations of static equilibrium are used:

- The forces in a vertical direction are summed for each slice. The equation is solved for the normal force at the base of the slice, N
- The forces in a horizontal direction are summed for each slice and used to compute the interslice normal force, E. This equation is applied in an iterative manner across the sliding mass (i.e., from left to right)
- The moments about a common point are summed for all slices. The equation can be rearranged and solved for the moment equilibrium FOS (F_m)
- The summation of forces in a horizontal direction for all slices, giving rise to a force equilibrium FOS (F_f)

Although the analysis is still indeterminate, a further assumption is made regarding the direction of the resultant interslice forces. The direction is assumed to be described by an interslice force function. The FOS can now be computed based on moment equilibrium F_m and force equilibrium F_f. The FOSs may vary depending on the percentage (Lambda, λ) of the force function used in the computation.

Using the same GLE formulation, it is possible to specify a variety of interslice force conditions and satisfy only the moment or force equilibrium conditions. The assumptions made to the interslice forces and the selection of overall force (F_f) and/or moment (F_m) equilibrium in the FOS equation, give rise to the various methods of analysis. A rigorous method satisfies both moment and force equilibrium ($F_f = F_m$). The method used and presented in this report (Morgenstern-Price) satisfies both moment and force equilibrium.

The GLE method implemented in SlopeW® allows the specification of lambda values, and a plot of FOS versus λ. The intersection point ($F_f = F_m$) represents the converged FOS of the GLE method.

The protocol used to accomplish this first performs a trial run using the ordinary (Fellenius) method to develop starting values for the FOS calculations, thereafter the computation sets the interslice shear forces to zero and solves for the moment equilibrium FOS (Bishop Method). Following this computation, the force equilibrium FOS (Janbu Method) can be solved for all the computational slip surfaces, and lastly, both moment and force equilibrium equations can be solved (were solved in this project using the Morgenstern-Price Method) once the interslice forces are computed, and the Lambda function (λ) is determined by iteration and computational closure.

4.0 SLOPE STABILITY ANALYSIS RESULTS

Slope stability analyses were performed on the most critical final closure landfill configuration (Profile C-C'). This profile was used to evaluate several Working Phase conditions where the fill proceeds from north to south across the profile.

As indicated above, the numerical computer model used to compute the slope stability was GeoStudio - SlopeW® by Geo-Slope International Ltd.

The SlopeW® graphic output depicts the weakest slip surface using the Morgenstern-Price method. The critical slip surface is divided into at least 30 vertical slices and the individual slice forces and moments are computed using the general limit equilibrium (GLE) methodology discussed in the next section. Multiple automated search routines were employed to develop the most critical slip surface(s) for each profile. These search routines included; auto-locate, entry and exit, grid and radius and block-specified techniques. For each analysis, from 1,000 to 50,000 trial slip surfaces were generated to identify the critical circular slip surface. Thereafter, the most critical slip surface was modified using an iterative (minimum 5,000 iterations) optimization algorithm that typically created a unique non-circular slip surface that exhibited a more critical (lower FOS) surface.

4.1 STATIC ANALYSIS

Static global slope stability analyses were performed on each profile configuration discussed above applying the Morgenstern-Price method. After the critical circular or block slip surface was identified, the slip surface was optimized as described in the prior section.

Stability analyses were performed on construction, working and Post Closure Phase scenarios with global evaluation of the full depth of the soil and rock profile material regions down to the modeled impenetrable boundary limit. These static stability Factor of Safety (FOS_{static}) results were 4.12, 3.76, 2.11 and 3.11 for Construction Profile C-C', Construction Phase C''-C''', Working Phase Profile C-C', and Post Closure Phase Profile C-C', respectively. The slip surface search was then focused on the WGI zone in the side slope and bottom primary liner (Noted as "Forced to DSS or DST" to explore the potential slip surface largely occurring in the geosynthetic sequence as typical for the modern composite liner systems. The focused search was accomplished by changing the underlying gray shale bedrock and overlying CCL material properties to 'impenetrable' which forced the model search routine to stop within the overlying WGI region. In each case, the WGI analysis resulted in a lower FOS_{static}. These WGI potential surfaces were determined to be the critical potential slippage surfaces and are discussed below, the results of the full-depth analyses are also provided in Attachment D. Similarly, only the 'forced' solutions for working and Post Closure Phases were further evaluated for the seismic loading described below. The results of the static analysis are presented below.

- Construction Phase FOS_{static} for the constructed cut slope at the north end of Profile C-C' following installation of the primary liner sequence was 2.14 for a vertical height of 85 ft. The FOS_{static} for the eastern end of Profile C''-C''' was also 2.14. Profile C''-C''' represents the worst-case Construction Phase scenario due to its overall vertical slope height being 115 ft.

- Working Phase (north to south development) configuration with a maximum working slope of 3H to 1V filled to the maximum permitted waste limit elevation had a (FOS_{static}) was 2.11 when the slip surface was forced along the WGI which was similar to the unrestricted global slip surface noted above.

- Post Closure Phase computed minimum static Factor of Safety (FOS_{static}) for the critical slip surface was 2.68.

A detailed model scenario report is attached for each of the above-bulleted phase analyses (see Attachment D).

4.2 SEISMIC DEFORMATION ANALYSIS

A seismic deformation analysis was performed by computing the estimated yield acceleration (A_y) at which the critical slip surface would experience permanent deformation (by definition a FOS < 1.0) for each of the Working and Post Closure Phase scenarios discussed above. The computed A_y for each scenario is given in Table 3. The A_{max} value for the post-closure condition is 0.089g for slippage north to south on the primary liner.

Table 3. Static and Seismic Stability Results

Scenario	Phase	Static FOS	A_y (A_{max})
Profile C''-C'''	Construction Phase	2.07	N/A
Profile C-C'		2.06	
	Working Phase	2.10	0.31g (0.089g)
	Post Closure – Global Analysis	1.86	0.17g (0.089g)

When the A_y is greater than the A_{max}, no permanent deformation can take place. Accordingly, no permanent deformation is anticipated for the seismic design event at either the base of the waste liner during post-closure or of the primary liner during the Working Phase filling period where waste may be placed from north to south.

The graphic presentations of the critical slip surface from each case reported above are provided in Attachment D. Each graphic shows only the weakest or most critical slip surface (surface with the lowest computed FOS).

4.3 HYDROSTATIC CONDITIONS

Piezometric surfaces equal to one foot of hydraulic head were positioned on the primary bottom and side slope liner contact surfaces and the cover liner with a one-foot flow depth being present in each bench terrace. Model constraints were set to allow the piezometric head to act on the material layers immediately above the FML.

5.0 CONCLUSIONS

Based on the global slope stability analyses of the critical profile for the proposed Lateral Expansion landfill footprint, SCS concludes the following:

- Static FOSs for global post-closure conditions were 1.86. Therefore, it is concluded that the proposed final closure slopes and grades are suitable with regard to global and final cover static stability.

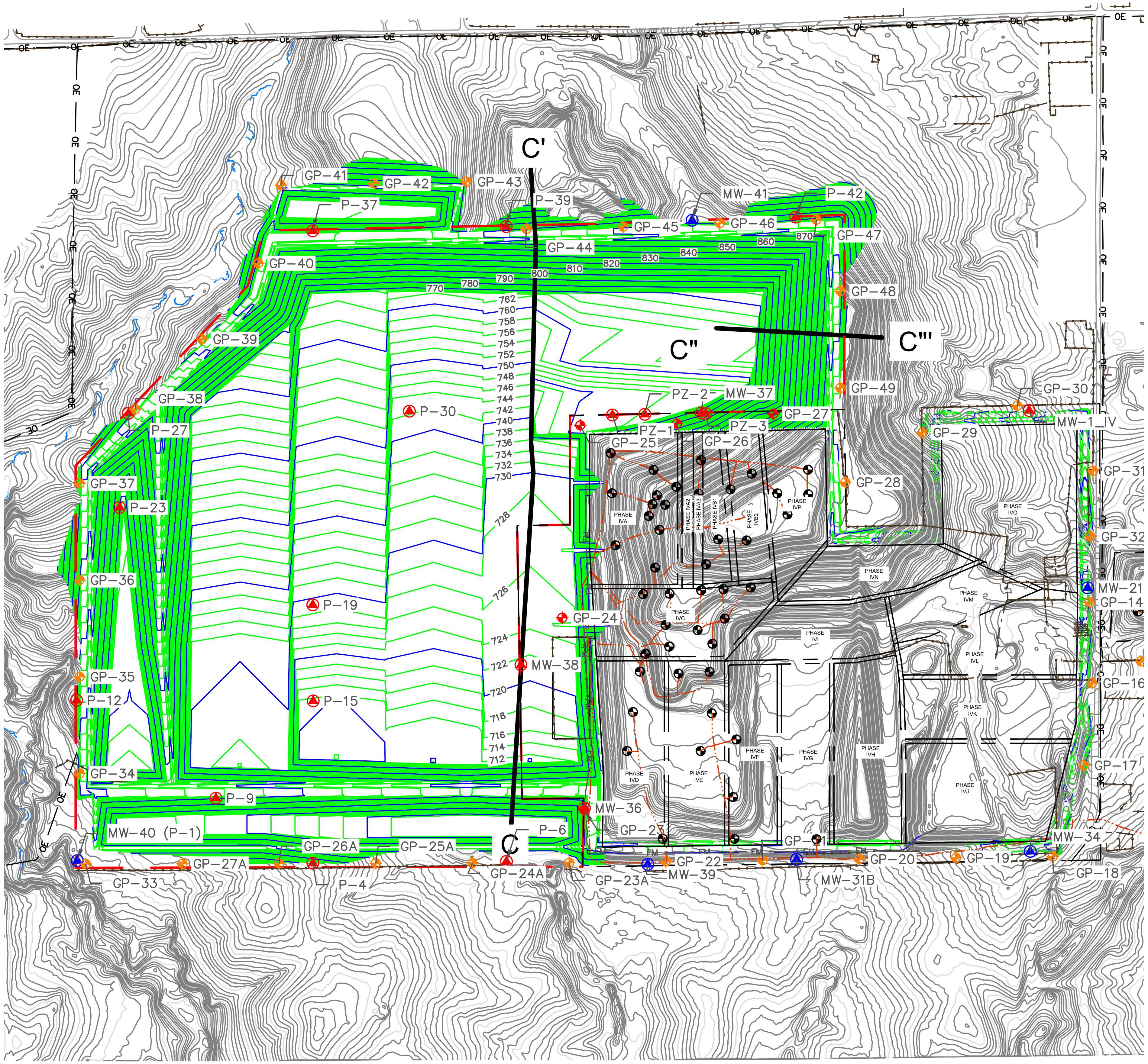
- Working Phase static FOS was 2.10 where waste fill placement was conservatively assumed to proceed from north to south creating an un-buttressed toe of slope that extended to the maximum permitted top of slope. The working slope was set at 3H to 1V and the bottom liner slope was downward to the south setting up the worst-case filling condition stability-wise. It is therefore concluded that the filling can proceed at a 3H to 1V working slope with suitable global stability.

- The construction of the high-cut slopes at a 3H to 1V grade also achieves FOSs of ~2.06 with the installation of the primary side slope liner. This also appears to be suitable for the temporary condition. No seismic loading analysis was performed due to the temporary nature of this slope before the placement of waste.

- Seismic analysis indicates that the yield acceleration (A_y) of the critical slip surfaces is greater than the maximum design event accelerations (A_{max}). When A_y exceeds A_{max}, there is no permanent displacement experienced along the critical slip surface resulting from the design earthquake event (10% PE at 250 years). Therefore, we conclude that no permanent deformation of the primary liner during the Construction, Working and Post Closure Phases for this lateral expansion is anticipated based on the A_y values discussed above.

Attachment A

Critical Profile Information

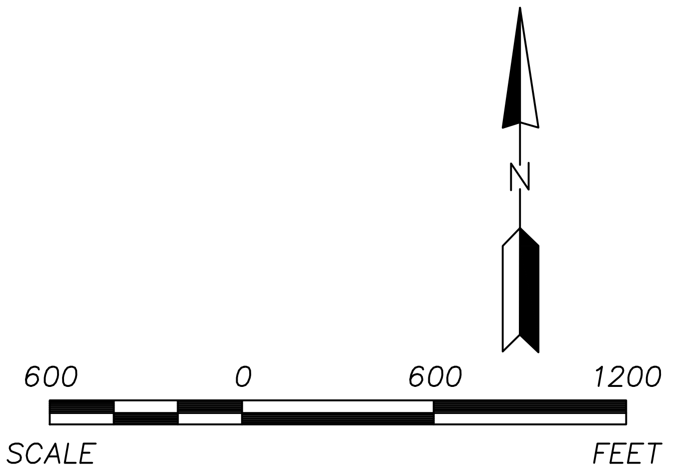


LEGEND:

	EXISTING MINOR CONTOURS
740	EXISTING MAJOR CONTOURS
	SOLID WASTE PHASE BOUNDARIES
	SOLID WASTE PERMIT BOUNDARY
	PROPOSED WASTE PERMIT BOUNDARY
FM FM	EXISTING FORCEMAIN
	EXISTING PAVED ROAD
	EXISTING UNPAVED ROAD
	EXISTING FENCE LINE
	EXISTING GAS PROBE
▲	EXISTING MONITORING WELL
▲	DECOMMISSIONED PIEZOMETER/MW
	EXISTING LANDFILL GAS COLLECTION PIPING
●	EXISTING EXTRACTION WELL
	EXISTING ELECTRICAL CONDUIT
OE	EXISTING OVERHEAD ELECTRIC
	EXISTING STREAM
	PROPOSED MINOR CONTOURS
	PROPOSED MAJOR CONTOURS
	CRITICAL CROSS SECTION

NOTES:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.



REV.	DATE	DESCRIPTION	CK. BY
△			
△			
△			
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△			

SHEET TITLE

EXCAVATION PLAN

PROJECT TITLE

SLOPE STABILITY ANALYSIS

CLIENT

AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

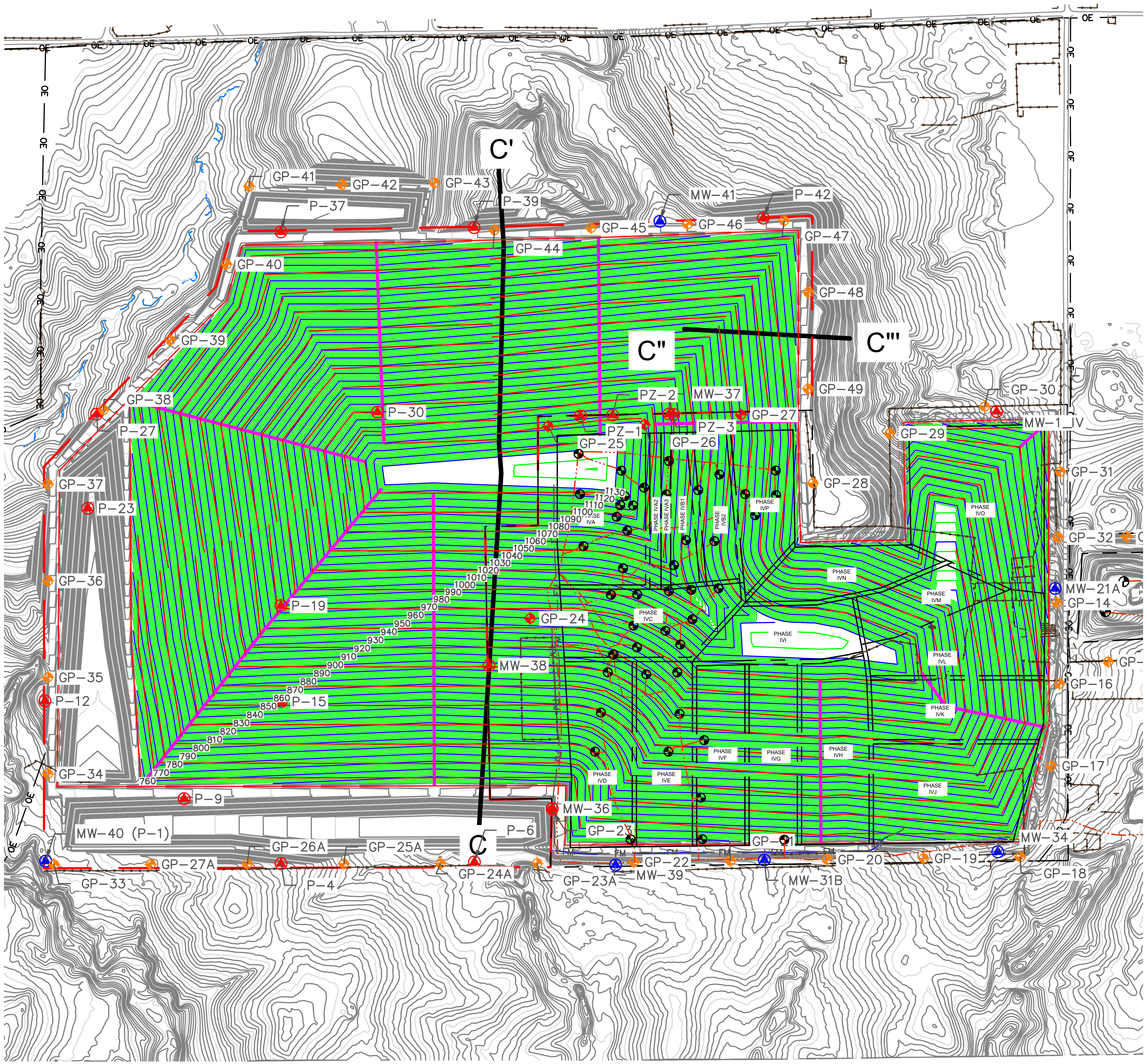
PROJ. NO. 27220345.00	DWN. BY: TWL	Q/A RVW BY: WJM
DSN. BY: TWL	CHK. BY: CF	PROJ. MGR. WJM

CADD FILE: AEL WEST EXPANSION PROPOSED LAYOUT.DWG

DATE: 12/13/23

SCALE:

DRAWING NO. 1 of 4



LEGEND:

- EXISTING MINOR CONTOURS
- 740 EXISTING MAJOR CONTOURS
- SOLID WASTE PHASE BOUNDARIES
- SOLID WASTE PERMIT BOUNDARY
- PROPOSED WASTE PERMIT BOUNDARY
- FM — FM EXISTING FORCEMAIN
- EXISTING PAVED ROAD
- EXISTING UNPAVED ROAD
- EXISTING FENCE LINE
- EXISTING GAS PROBE
- EXISTING MONITORING WELL
- DECOMMISSIONED PIEZOMETER/MW
- EXISTING LANDFILL GAS COLLECTION PIPING
- ◐ EXISTING EXTRACTION WELL
- EXISTING ELECTRICAL CONDUIT
- OE EXISTING OVERHEAD ELECTRIC
- EXISTING STREAM
- PROPOSED MINOR CONTOURS
- PROPOSED MAJOR CONTOURS
- CRITICAL CROSS SECTION
- PROPOSED STORMWATER BERM
- PROPOSED STORMWATER LETDOWN

NOTES:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.
2. AREAS OF THE LANDFILL THAT WILL BE CONSTRUCTED PRIOR TO FINAL COVER ARE SHOWN AS EXISTING CONTOURS.

REV.	DATE	DESCRIPTION	CK. BY
△			
△			
△			
△			
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△			

SHEET TITLE
FINAL COVER PLAN

PROJECT TITLE
SLOPE STABILITY ANALYSIS

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

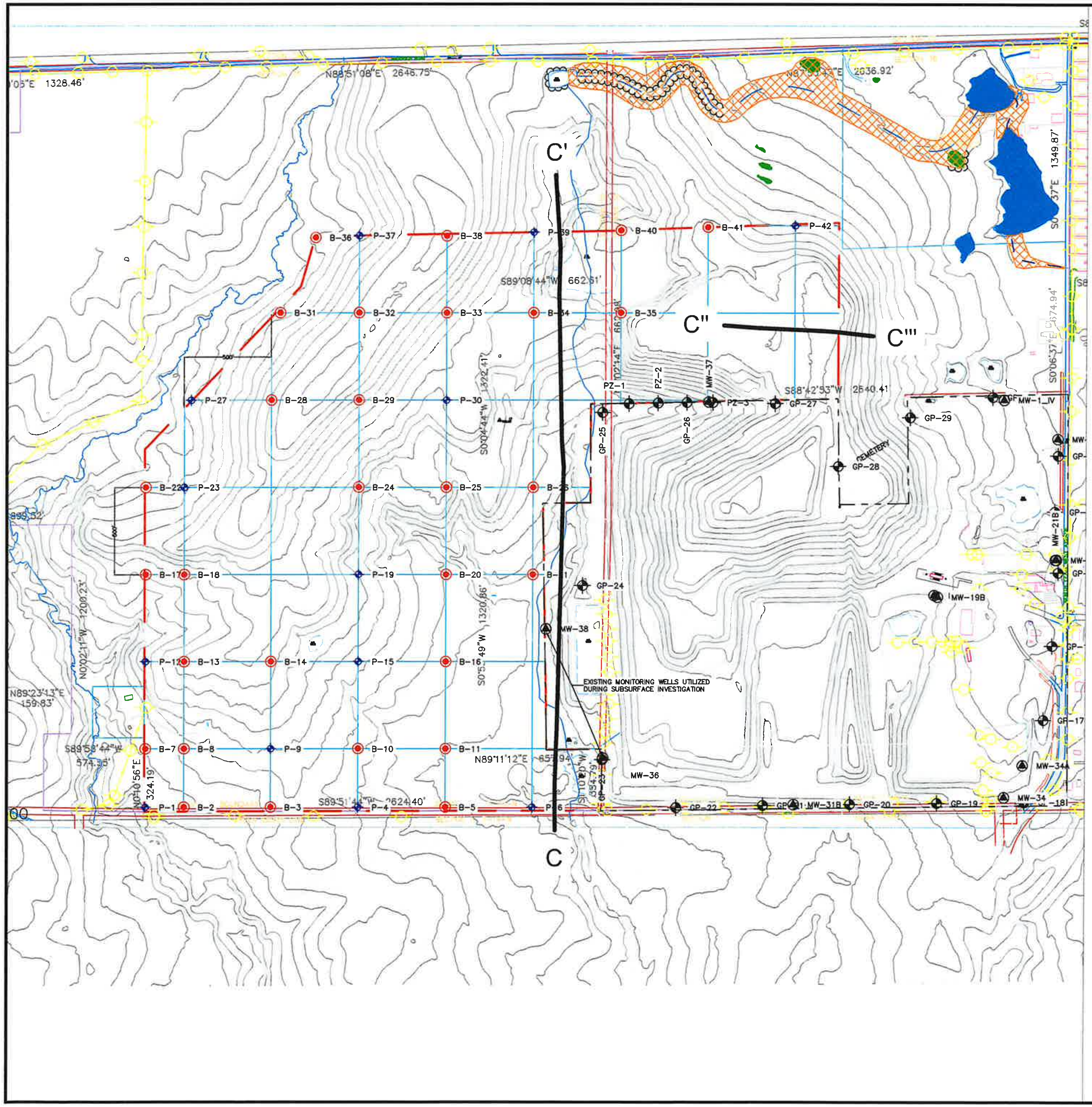
PROJ. NO. 27220345.00
DSN. BY: TWL
DWN. BY: TWL
CHK. BY: CF
Q/A RVW BY: WJM
PROJ. MGR. WJM

CADD FILE: AEL WEST EXPANSION PROPOSED LAYOUT.DWG

DATE: 12/13/23

SCALE:

DRAWING NO. 2 of 4



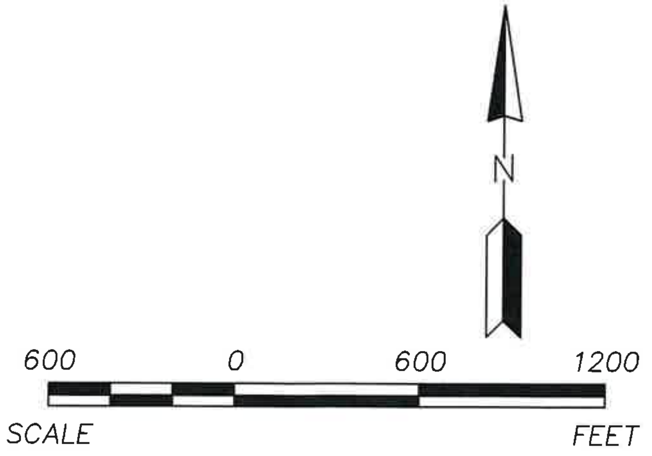
LEGEND

- MINOR CONTOUR
- MAJOR CONTOUR
- WATER/STREAM
- FENCELINE
- BUILDING
- EXISTING PERMIT BOUNDARY
- PROPOSED PERMIT BOUNDARY
- PROPERTY BOUNDARY
- PROPERTY EASEMENTS
- TRAIL
- EXISTING CULVERT
- GRID SPACING
- OVERHEAD UTILITY LINES
- 🟩 WETLAND
- ▨ PROPOSED MITIGATION–PROJECT AREA

- ⊕ EXISTING PIEZOMETER LOCATION
- ◉ BORING LOCATION
- ▲ EXISTING MONITORING WELL
- ⊕ EXISTING PIEZOMETER/GAS PROBE

NOTES:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.



REV.	DATE	DESCRIPTION	CK. BY
△			
△			
△			
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△			

SHEET TITLE
BORING LOCATION MAP

PROJECT TITLE
SLOPE STABILITY ANALYSIS

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27219016.00
DSN. BY: TWL
DWN. BY: TWL
CHK. BY: WJM
Q/A RVW BY: WJM
PROJ. MGR. WJM

CADD FILE: BORING LOCATION MAP.DWG

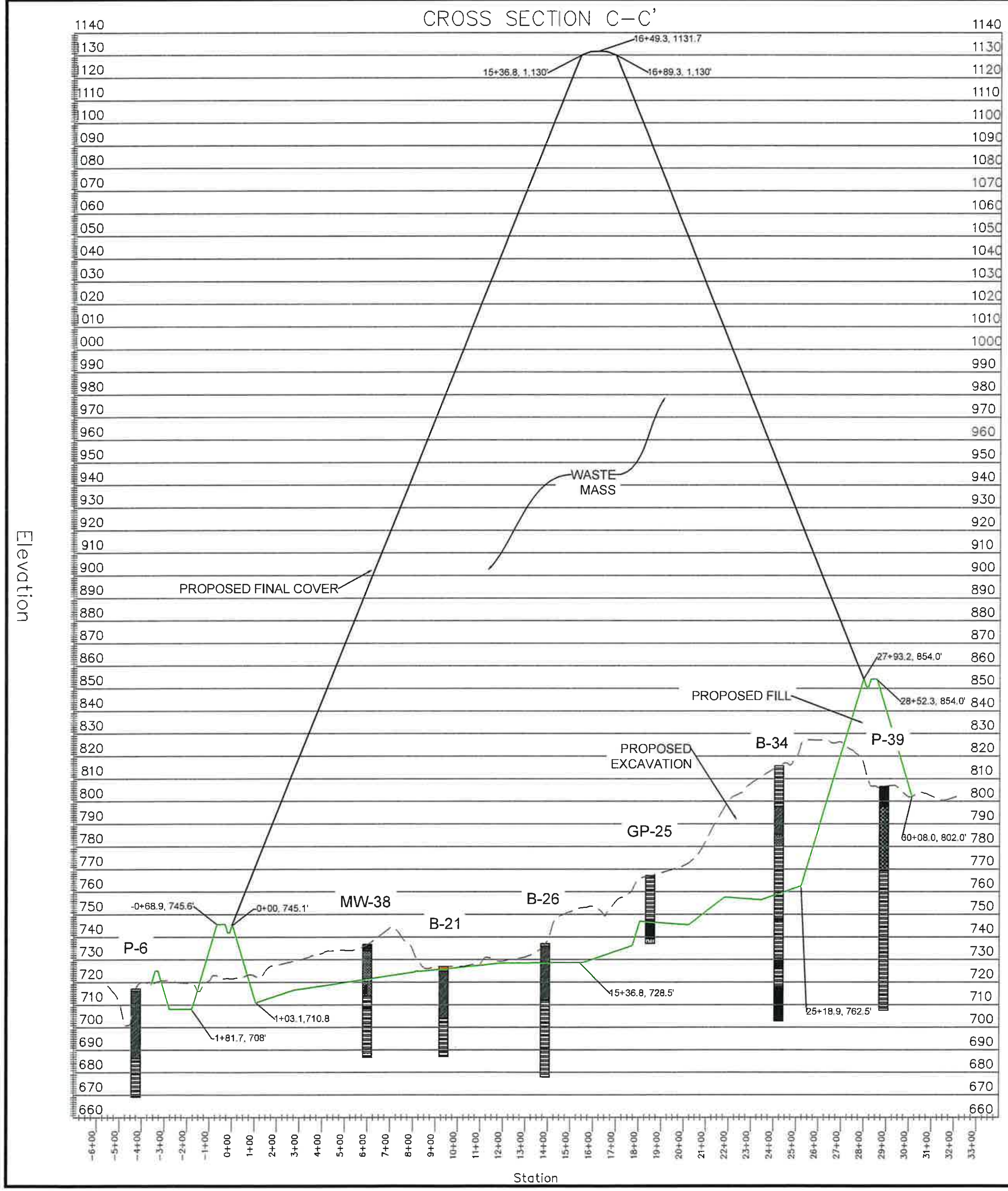
DATE: 5/11/23

SCALE: 1"=500'

DRAWING NO.
3 of 4

C:\Users\4810twl\Desktop\AEL\Permit Drawing Packet\Cross Sections.dwg May 11, 2023 - 12:22pm Layout Name: C-C' By: 4810twl

CROSS SECTION C–C'

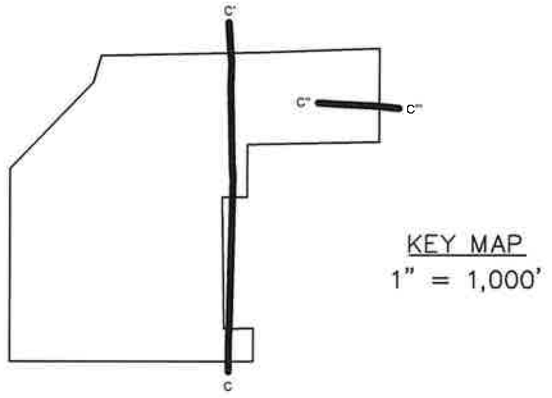


LEGEND:

– – –	EXISTING GRADE
━	PROPOSED EXCAVATION
━	PROPOSED FINAL COVER
🟧	TOP SOIL
▤	SILTY SAND
▤	SANDY SILT
▤	CLAYEY SAND
▤	CLAY
▨	SILTY CLAY
▤	SANDY CLAY
▤	SHALE
▨	SANDSTONE
▤	LIMESTONE
▨	SILTSTONE

NOTES:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.
2. BECAUSE THE LAYERS ENCOUNTERED DURING THE SUBSURFACE INVESTIGATION GENERALLY FOLLOWED THE EXISTING GROUND ELEVATIONS, THE NEAREST BORINGS TO THE CRITICAL PROFILE WERE INTERPOLATED TO SHOW WHAT IS GENERALLY EXPECTED TO MAKE UP THE SUBGRADE ALONG THE CRITICAL PROFILE.
3. BORINGS SHOWN ARE INTERPOLATED FROM EXISTING BORINGS AS PART OF THE SUBSURFACE INVESTIGATION.



KEY MAP
1" = 1,000'

5 0 5 10
SCALE FEET
VERTICAL SCALE

50 0 50 100
SCALE FEET
HORIZONTAL SCALE

REV.	DATE	DESCRIPTION	CK. BY
1	11/2020	DETAIL REVISION	WM
0	10/2020	SUBMIT TO ODEQ	WM

SHEET TITLE
CRITICAL CROSS SECTION C-C'

PROJECT TITLE
SLOPE STABILITY ANALYSIS

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27220345.00	DWN. BY: TWL	Q/A RVW BY: WJM
DSN. BY: TWL	CHK. BY: CF	PROJ. MGR. WJM

CADD FILE: CROSS SECTIONS.DWG

DATE: 5/11/23

DRAWING NO.
4 of 4

Attachment B

Material Properties and Supporting Information

SCS Engineers, Inc.

American Environmental Landfill
Lateral Expansion
27220345.00

By: J. Hartwell
Date: 11/20/2023 15:44

Data source: **Golder Associates, inc.**

										$\gamma_{(w\ at\ OMC)}$		**Cover**	
										SG/GF	**CCL**	**SG/GF**	**CCL**
									average	**129.9 pcf**	**127.5 pcf**	**104.0 pcf**	**102.0 pcf**
												80%	of MDD
	Group	Mat'l	Description	MDD	OMC	SG	SG/GF	CCL		SG/GF	CCL	SG/GF	CCL
10/22/2020	A	CL-1	Silty Clay Olive Shale	108.4 pcf	18.5%	2.7		x			128.5 pcf		102.8 pcf
10/22/2020		CL-2	"	108.0 pcf	17.2%	2.7		x			126.6 pcf		101.3 pcf
10/23/2023		CL-3	"	109.2 pcf	16.6%	2.7		x			127.3 pcf		101.9 pcf
10/23/2023		CL-4	"	109.5 pcf	16.2%	2.7		x			127.2 pcf		101.8 pcf
2/8/2022	B	CL-1	Lean Clay	107.9 pcf	19.0%	2.7		x			128.4 pcf		102.7 pcf
2/8/2022		CL-2	"	107.6 pcf	18.6%	2.7		x			127.6 pcf		102.1 pcf
2/8/2022		CL-3	Lean Clay w Sand	110.7 pcf	16.4%	2.7	x			128.9 pcf		103.1 pcf	
2/9/2022		CL-4	Lean Clay	107.3 pcf	17.3%	2.7		x			125.9 pcf		100.7 pcf
2/9/2022		CL-5	"	106.6 pcf	18.4%	2.7		x			126.2 pcf		101.0 pcf
2/10/2022		SG-2	"	104.0 pcf	20.5%	2.7	x			125.3 pcf		100.3 pcf	
8/16/2012	C	SG-1	Gray Shale	120.0 pcf	12.7%	2.7	x			135.2 pcf		108.2 pcf	
11/9/12023	D	CL-1	Silty Clay Olive Brown	112.7 pcf	16.1%	2.7		x			130.8 pcf		104.7 pcf
11/8/2023	E	GF-1	Sandy silty clay Reddish Brown	109.3 pcf	16.0%	2.7	x			126.8 pcf		101.4 pcf	
Nov-20	CL	SG	Silty Clay and Sand	119.3 pcf	11.9%	2.7	x			133.5 pcf		106.8 pcf	
Nov-20	CH	CL	Clay, some fine to course sand	104.5 pcf	18.3%	2.7		x			123.6 pcf		98.9 pcf
Nov-20	CL	CL	Sandy silty clay	111.8 pcf	16.4%	2.7		x			130.1 pcf		104.1 pcf

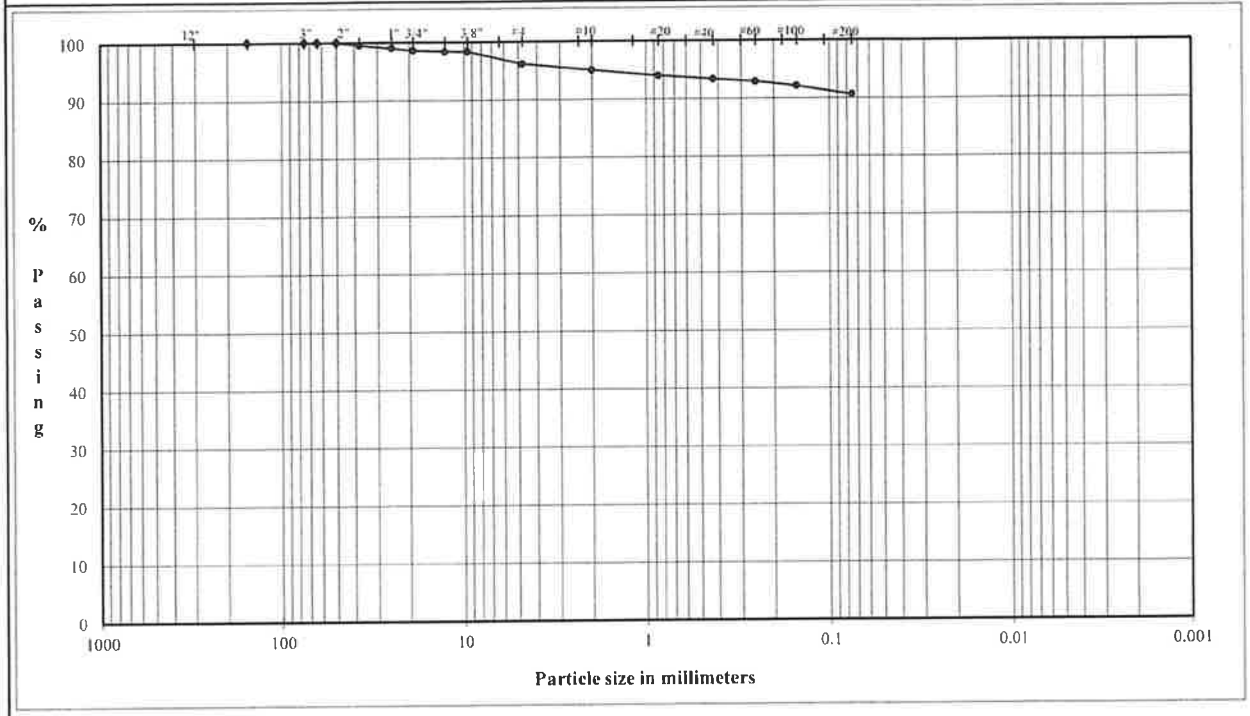
A CL

OCTOBER 2020 **20412336**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D6913, D4318

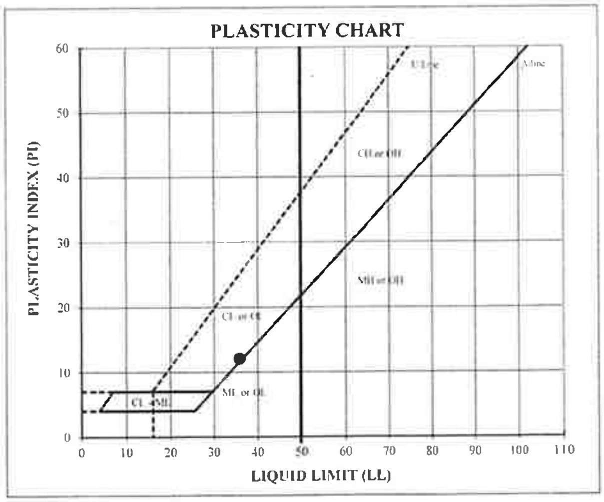
PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
SAMPLE ID: **CL-1** - Depth: -
TYPE: **Bulk**



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
6.0"	154.2	**100.0**		
3.0"	75.0	**100.0**	Cobbles	**0.00**
2.5"	63.5	**100.0**		
2.0"	50.0	**100.0**		
1.5"	37.5	**99.5**		
1.0"	25.0	**99.0**		
0.75"	19.0	**98.6**	Coarse Gravel	**1.45**
0.50"	12.7	**98.4**		
0.375"	9.5	**98.4**		
#4	4.8	**96.2**	Fine Gravel	**2.40**
#10	2.0	**95.0**	Coarse Sand	**1.18**
#20	0.85	**94.0**		
#40	0.43	**93.3**	Medium Sand	**1.64**
#60	0.25	**92.9**		
#100	0.15	**92.1**		
#200	0.075	**90.6**	Fine Sand	**2.76**
			Fines	**90.6**



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
16.8	36	24	12	-0.58

LL (oven-dried)	
< 0.75 = ORGANIC (OL OH)	

DESCRIPTION: SILTY CLAY, some fine to coarse sand, trace fine to coarse gravel; olive, shale.

USCS: CL

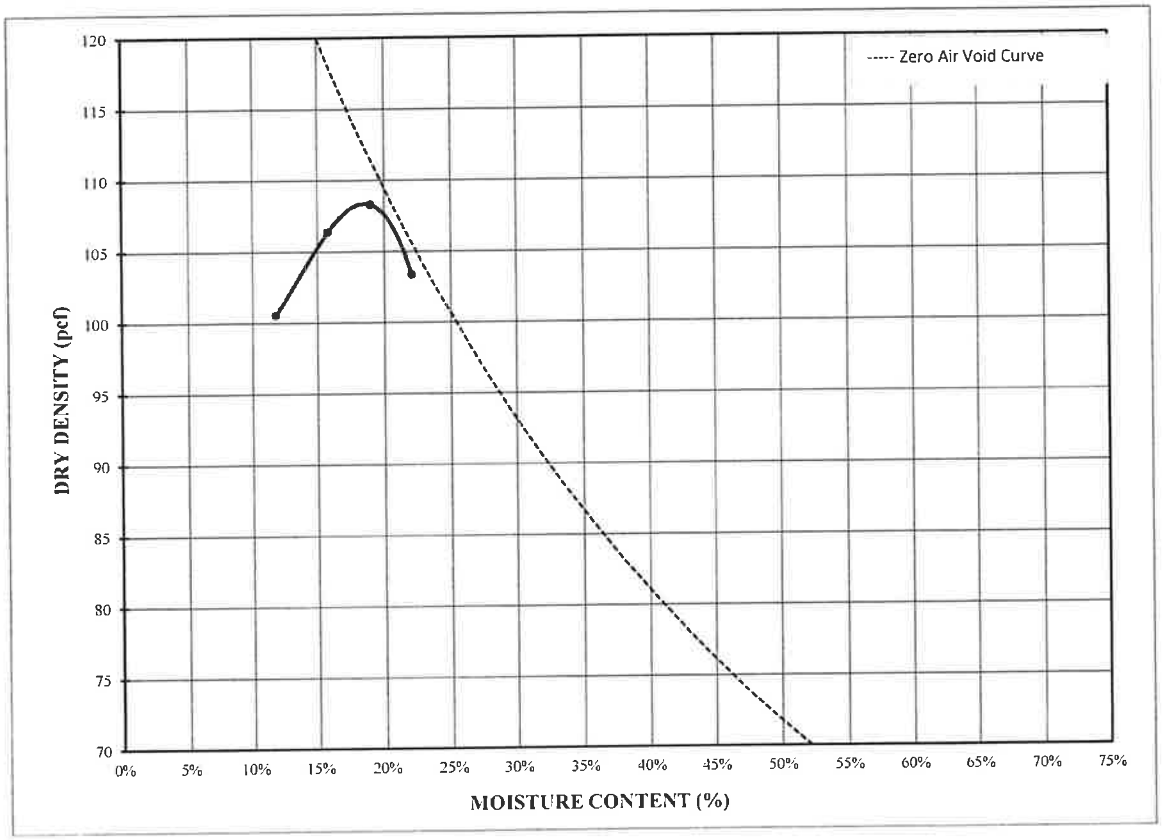
TECH	LH/VB/HL
DATE	10/22/20
CHECK	
REVIEW	PWM
APPROVE	

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
PROJECT NUMBER: **20412336**
SAMPLE ID: **CL-1** DEPTH: SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	100.5	11.8%
2	106.3	15.8%
3	108.3	19.0%
4	103.4	22.1%

Maximum Dry Density (pcf)	108.4
Optimum Moisture (%)	18.5
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	16.8%

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

% Retained on # 4 sieve	
% Retained on 3/8" sieve	1.6%
% Retained on 3/4" sieve	
Specific Gravity (assumed/tested)	2.7

DESCRIPTION SILTY CLAY, some fine to coarse sand, trace fine to coarse gravel; olive, shale.

USCS CL

CHECK
REVIEW
APPROVE

Golder Associates Inc.

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	SCS/AEL S/2 PH IVD/IVE/IVF/OK	**Board #**	3
PROJECT NUMBER	20412336	**Flow Pump**	2
SAMPLE ID	CL-1 -	**Flow Pump Speed**	9
SAMPLE TYPE	Bulk	**Technician**	FT

COMMENTS The sample was remolded to 94.8% of the Maximum Dry Density and OPTM + 0.2% (using ASTM D 698).

Sample Data, Initial			
Height, inches	3.001	**B-Value, f**	1.00
Diameter, inches	2.790	**Cell Pres.**	90.0
Area, cm²	39.44	**Bot. Pres.**	80.0
Volume, cm³	300.65	**Top Pres.**	80.0
Mass, g	587.52	**Tot. B.P.**	80.0
Moisture Content, %	18.7	**Head, max.**	126.61
Dry Density, pcf	102.7	**Head, min.**	126.61
Spec. Gravity(assumed)	2.700	**Max. Grad.**	16.46
Volume Solids, cm³	183.26	**Min. Grad.**	16.46
Volume Voids, cm³	117.39		
Void Ratio	0.64		
Saturation, %	79.0%		

Flow Pump Rate 4.26E-05 cm³/sec

Sample Data, Final	
Height, inches	3.028
Diameter, inches	2.830
Area, cm²	40.58
Volume, cm³	312.12
Mass, g	618.19
Moisture Content, %	24.94
Dry Density, pcf	98.92
Volume Solids, cm³	183.26
Volume Voids, cm³	128.86
Void Ratio	0.70
Saturation, %	95.8%

USCS CL

WATER CONTENTS		**Sample Initial**	**Sample Final**
Wt Soil & Tare, i	g	587.52	626.67
Wt Soil & Tare, f	g	494.81	503.33
Wt Tare	g	0.00	8.69
Wt Moisture Lost	g	92.71	123.34
Wt Dry Soil	g	494.81	494.64
Water Content	%	18.74%	24.94%

DESCRIPTION
SILTY CLAY, some fine to coarse sand, trace fine to coarse gravel; olive, shale.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
10/29/20	44133	8	0	20.5	0	0	0	0	1.80	126.61	16.46	6.3E-08
10/29/20	44133	8	5	20.5	5	5	300	300	1.80	126.61	16.46	6.3E-08
10/29/20	44133	8	10	20.5	5	10	300	600	1.80	126.61	16.46	6.3E-08
10/29/20	44133	8	15	20.5	5	15	300	900	1.80	126.61	16.46	6.3E-08 *
10/29/20	44133	8	20	20.5	5	20	300	1200	1.80	126.61	16.46	6.3E-08 *
10/29/20	44133	8	25	20.5	5	25	300	1500	1.80	126.61	16.46	6.3E-08 *
10/29/20	44133	8	30	20.5	5	30	300	1800	1.80	126.61	16.46	6.3E-08 *

TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 6.3E-08 cm/sec **

DATE	10/29/20
CHECK	
REVIEW	DA
APPROVE	

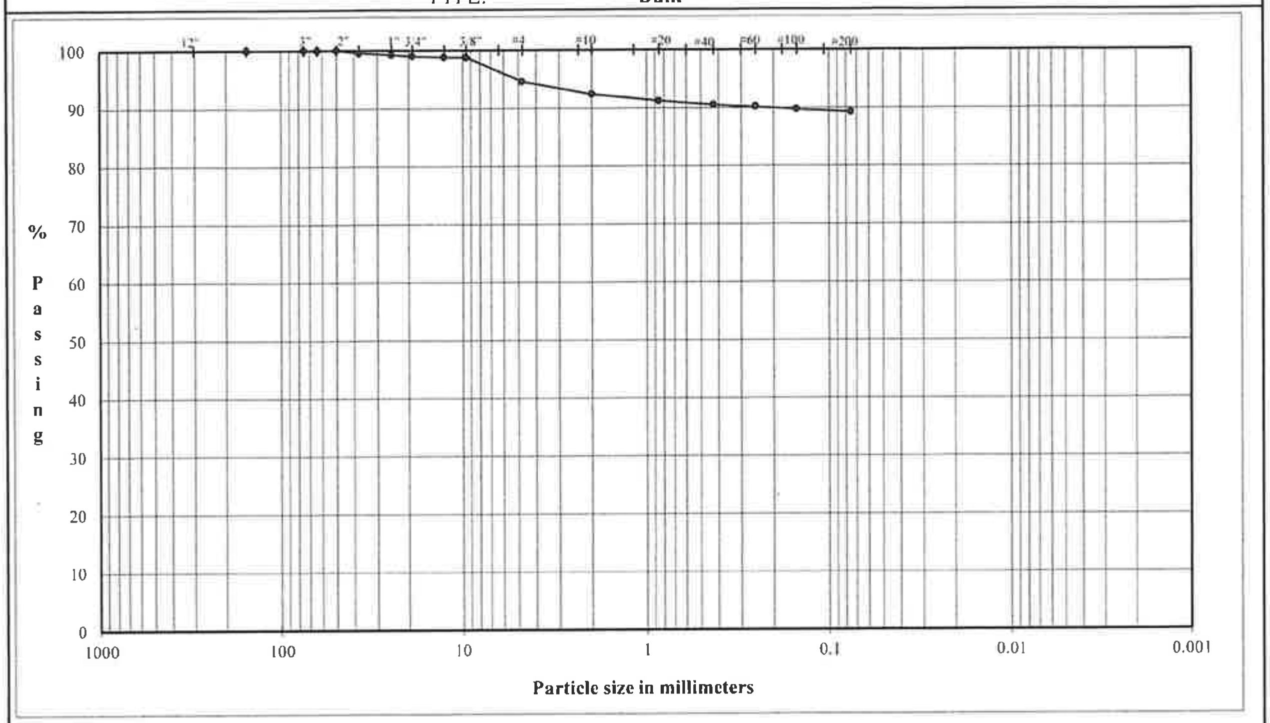
OCTOBER 2020

20412336

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D6913, D4318

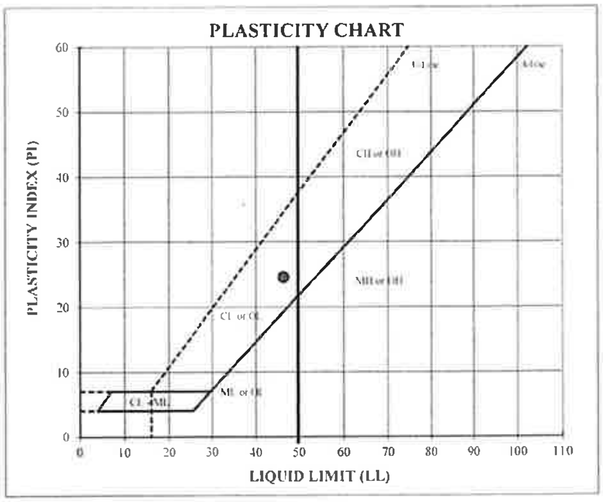
PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
SAMPLE ID: **CL-2** - Depth: -
TYPE: **Bulk**



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
2.5"	63.5	**100.0**	Coarse Gravel	**1.01**
2.0"	50.0	**100.0**		
1.5"	37.5	**99.6**		
1.0"	25.0	**99.2**		
0.75"	19.0	**99.0**		
0.50"	12.7	**98.8**	Fine Gravel	**4.43**
0.375"	9.5	**98.8**		
#4	4.8	**94.6**		
#10	2.0	**92.3**	Coarse Sand	**2.21**
#20	0.85	**91.1**	Medium Sand	**1.85**
#40	0.43	**90.5**		
#60	0.25	**90.1**	Fine Sand	**1.26**
#100	0.15	**89.7**		
#200	0.075	**89.2**		
			Fines	**89.2**



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
14.4	46	22	24	-0.31

DESCRIPTION: SILTY CLAY, some fine to coarse sand, some fine to coarse gravel; olive, shale.

USCS: CL

LL (oven-dried)
< 0.75 = ORGANIC (OL/OH)

TECH	LH/VB
DATE	10/22/20
CHECK	
REVIEW	
APPROVE	

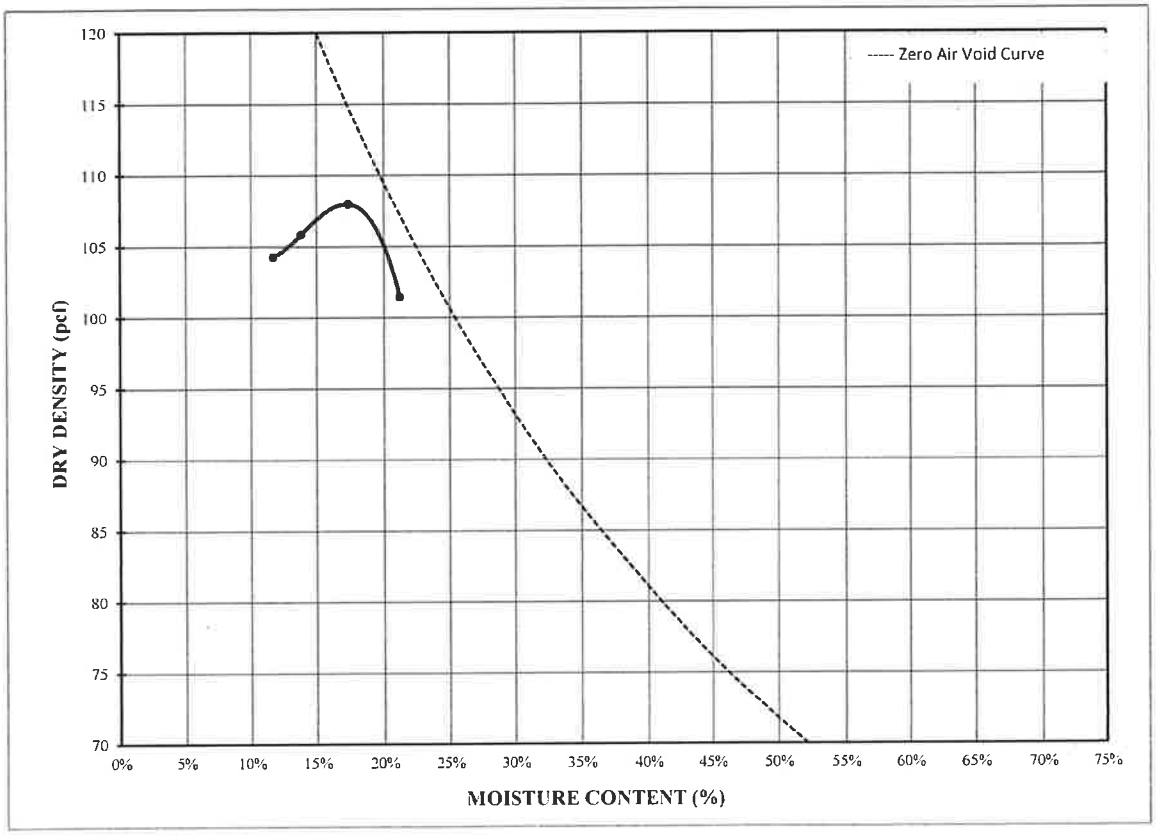
NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

OCTOBER 2020 20412336

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
PROJECT NUMBER: **20412336**
SAMPLE ID: **CL-2**
DEPTH:
SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	104.3	11.7%
2	105.8	13.8%
3	108.0	17.4%
4	101.4	21.2%

Maximum Dry Density (pcf)	**108.0**
Optimum Moisture (%)	**17.2**
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	**14.4%**

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

% Retained on # 4 sieve	
% Retained on 3/8" sieve	**1.2%**
% Retained on 3/4" sieve	
Specific Gravity (assumed/tested)	**2.7**

DESCRIPTION SILTY CLAY, some fine to coarse sand, some fine to coarse gravel; olive, shale.

USCS CL

CHECK
REVIEW
APPROVE

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	SCS/AEL S/2 PH IVD/IVE/IVF/OK		
PROJECT NUMBER	20412336		
SAMPLE ID	CL-2	-	
SAMPLE TYPE	Bulk		

Board #	4
Flow Pump	2
Flow Pump Speed	9
Technician	FT

COMMENTS: The sample was remolded to 95.2% of the Maximum Dry Density and OPTM - 0.3% (using ASTM D 698).

Sample Data, Initial

Height, inches	3.001	B-Value, f	0.99
Diameter, inches	2.790	Cell Pres.	90.0
Area, cm²	39.44	Bot. Pres.	80.0
Volume, cm³	300.65	Top Pres.	80.0
Mass, g	578.93	Tot. B.P.	80.0
Moisture Content, %	16.9	Head, max.	123.80
Dry Density, pcf	102.8	Head, min.	123.80
Spec. Gravity(assumed)	2.700	Max. Grad.	16.14
Volume Solids, cm³	183.37	Min. Grad.	16.14
Volume Voids, cm³	117.29		
Void Ratio	0.64		
Saturation, %	71.5%		

Sample Data, Final

Height, inches	3.019
Diameter, inches	2.790
Area, cm²	39.44
Volume, cm³	302.46
Mass, g	617.45
Moisture Content, %	24.71
Dry Density, pcf	102.14
Volume Solids, cm³	183.37
Volume Voids, cm³	119.09
Void Ratio	0.65
Saturation, %	102.7%

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	578.93	625.50
Wt Soil & Tare, f	g	495.09	503.25
Wt Tare	g	0.00	8.59
Wt Moisture Lost	g	83.84	122.25
Wt Dry Soil	g	495.09	494.66
Water Content	%	16.93%	24.71%

DESCRIPTION: SILTY CLAY, some fine to coarse sand, some fine to coarse gravel; olive, shale.

Flow Pump Rate 4.26E-05 cm³/sec

USCS CL

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
10/29/20	44133	9	0	20.5	0	0	0	0	1.76	123.80	16.14	6.6E-08
10/29/20	44133	9	5	20.5	5	5	300	300	1.76	123.80	16.14	6.6E-08
10/29/20	44133	9	10	20.5	5	10	300	600	1.76	123.80	16.14	6.6E-08
10/29/20	44133	9	15	20.5	5	15	300	900	1.76	123.80	16.14	6.6E-08 *
10/29/20	44133	9	20	20.5	5	20	300	1200	1.76	123.80	16.14	6.6E-08 *
10/29/20	44133	9	25	20.5	5	25	300	1500	1.76	123.80	16.14	6.6E-08 *
10/29/20	44133	9	30	20.5	5	30	300	1800	1.76	123.80	16.14	6.6E-08 *

TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 6.6E-08 cm/sec **

DATE	10/29/20
CHECK	
REVIEW	DA
APPROVE	

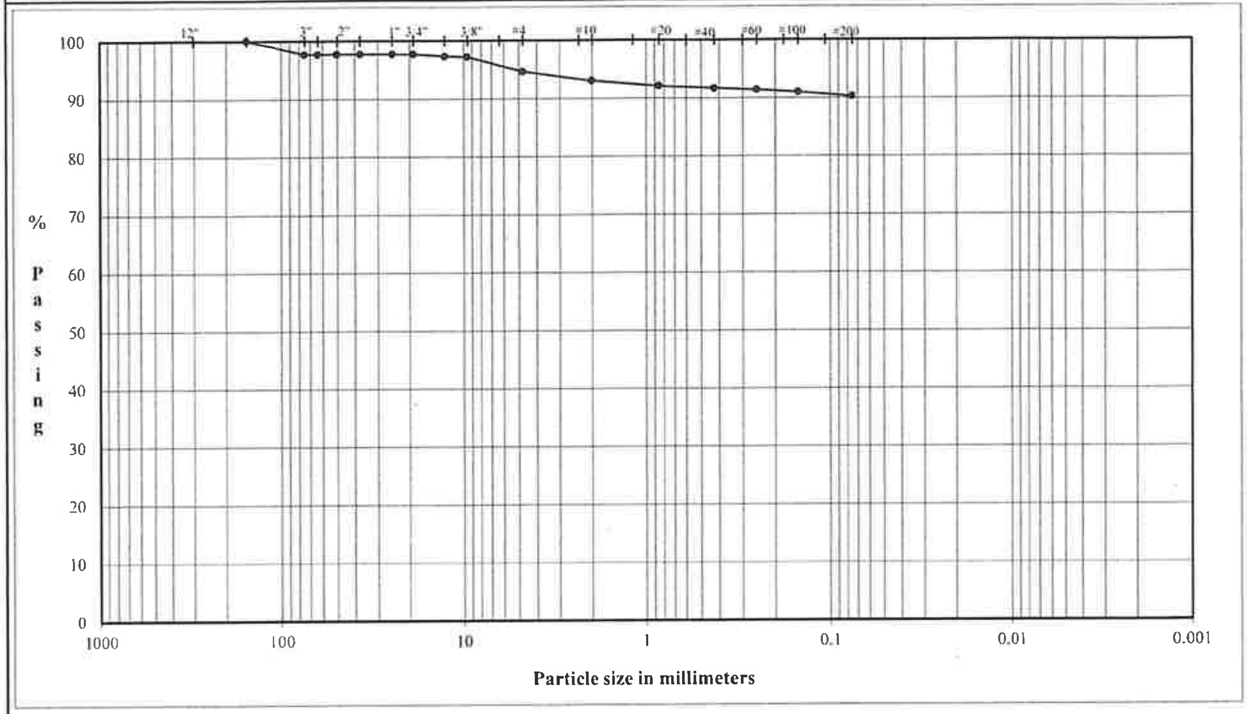
OCTOBER 2020

20412336

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D6913, D4318

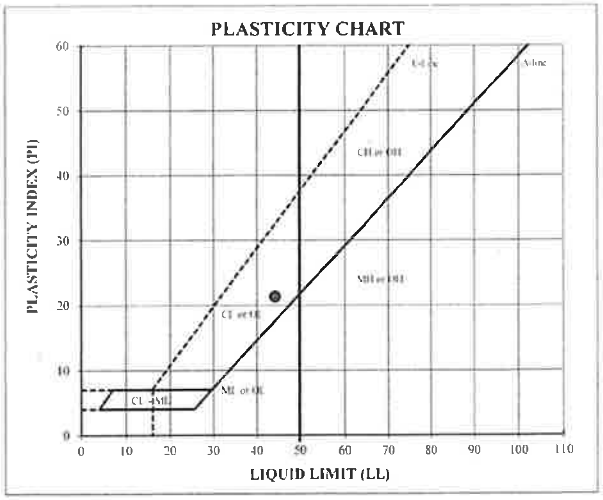
PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
SAMPLE ID: **CL-3** - Depth: -
TYPE: **Bulk**



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
6.0"	154.2	**100.0**	Cobbles	**2.30**
3.0"	75.0	**97.7**		
2.5"	63.5	**97.7**	Coarse Gravel	**0.04**
2.0"	50.0	**97.7**		
1.5"	37.5	**97.7**		
1.0"	25.0	**97.7**		
0.75"	19.0	**97.7**		
0.50"	12.7	**97.3**	Fine Gravel	**3.03**
0.375"	9.5	**97.2**		
#4	4.8	**94.6**		
#10	2.0	**93.0**	Coarse Sand	**1.64**
#20	0.85	**92.0**	Medium Sand	**1.35**
#40	0.43	**91.6**		
#60	0.25	**91.3**	Fine Sand	**1.44**
#100	0.15	**91.0**		
#200	0.075	**90.2**		
			Fines	**90.2**



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
13.9	44	23	21	-0.41

LL (oven-dried)
< 0.75 = ORGANIC (OL OH)

DESCRIPTION: SILTY CLAY, trace fine to coarse gravel, trace fine to coarse sand; olive, with cobbles.

USCS: CL

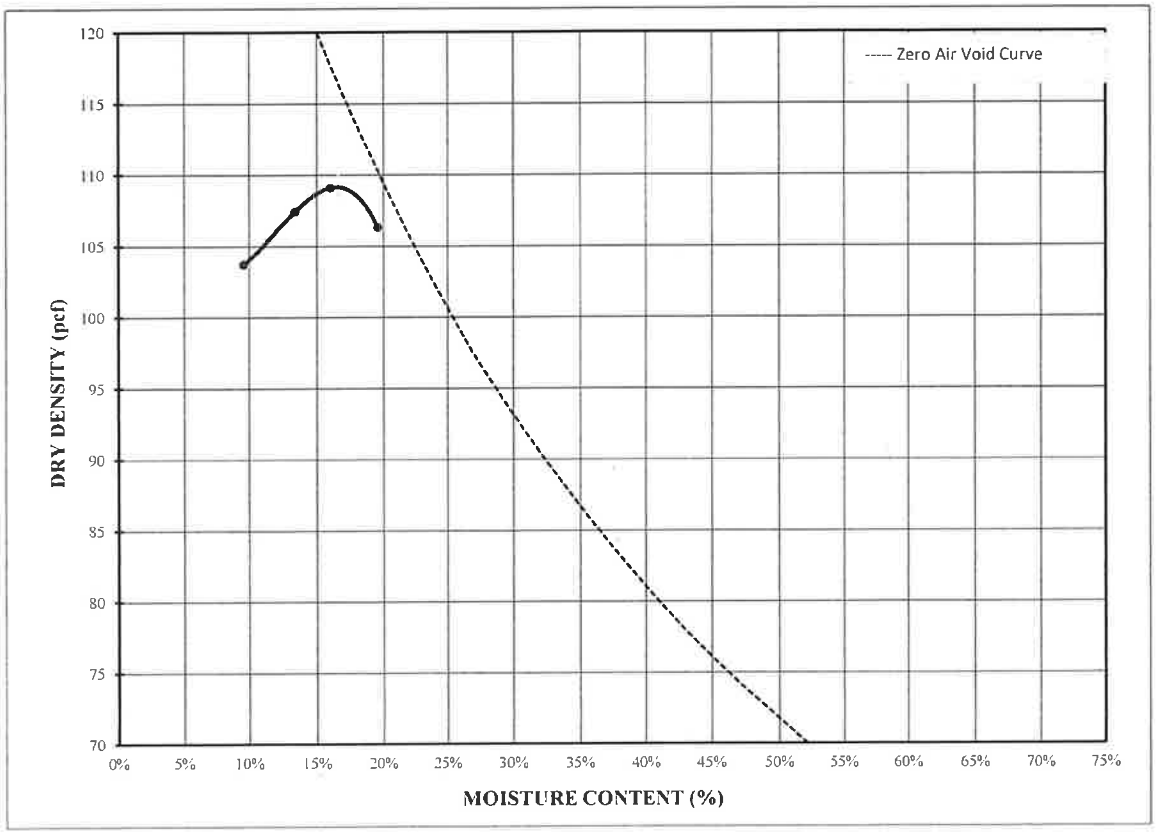
TECH	LH/VB
DATE	10/23/20
CHECK	
REVIEW	
APPROVE	

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
PROJECT NUMBER: **20412336**
SAMPLE ID: **CL-3** DEPTH: SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	103.7	9.6%
2	107.4	13.4%
3	109.1	16.0%
4	106.3	19.6%

Maximum Dry Density (pcf)	109.2
Optimum Moisture (%)	16.6
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	

As-Received Moisture Content **13.9%**

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING

% Retained on # 4 sieve	
% Retained on 3/8" sieve	2.8%
% Retained on 3/4" sieve	

Specific Gravity (assumed/tested) **2.7**

DESCRIPTION SILTY CLAY, trace fine to coarse gravel, trace fine to coarse sand; olive, with cobbles.

USCS CL

CHECK
REVIEW
APPROVE

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	SCS/AEL S/2 PH IVD/IVE/IVF/OK		Board #	3
PROJECT NUMBER	20412336		Flow Pump	2
SAMPLE ID	CL-3	A	Flow Pump Speed	9
SAMPLE TYPE	Bulk		Technician	FT

COMMENTS The sample was remolded to 95.8% of the Maximum Dry Density and OPTM 0.6% (using ASTM D 698).

Sample Data, Initial			
Height, inches	3.000	B-Value, f	0.98
Diameter, inches	2.790	Cell Pres.	90.0
Area, cm²	39.44	Bot. Pres.	80.0
Volume, cm³	300.55	Top Pres.	80.0
Mass, g	589.87	Tot. B.P.	80.0
Moisture Content, %	17.2	Head, max.	130.13
Dry Density, pcf	104.5	Head, min.	130.13
Spec. Gravity(assumed)	2.700	Max. Grad.	17.06
Volume Solids, cm³	186.48	Min. Grad.	17.06
Volume Voids, cm³	114.07		
Void Ratio	0.61		
Saturation, %	75.7%		

Sample Data, Final	
Height, inches	3.003
Diameter, inches	2.857
Area, cm²	41.36
Volume, cm³	315.48
Mass, g	620.65
Moisture Content, %	23.27
Dry Density, pcf	99.59
Volume Solids, cm³	186.48
Volume Voids, cm³	128.99
Void Ratio	0.69
Saturation, %	90.8%

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	589.87	627.07
Wt Soil & Tare, f	g	503.50	510.31
Wt Tare	g	0.00	8.46
Wt Moisture Lost	g	86.37	116.76
Wt Dry Soil	g	503.50	501.85
Water Content	%	17.15%	23.27%

DESCRIPTION

SILTY CLAY, trace fine to coarse gravel, trace fine to coarse sand; olive, with cobbles.

Flow Pump Rate 4.26E-05 cm³/sec

USCS CL

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
11/03/20	44138	9	0	21.4	0	0	0	0	1.85	130.13	17.06	5.8E-08
11/03/20	44138	9	5	21.4	5	5	300	300	1.85	130.13	17.06	5.8E-08
11/03/20	44138	9	10	21.4	5	10	300	600	1.85	130.13	17.06	5.8E-08
11/03/20	44138	9	15	21.4	5	15	300	900	1.85	130.13	17.06	5.8E-08 *
11/03/20	44138	9	20	21.4	5	20	300	1200	1.85	130.13	17.06	5.8E-08 *
11/03/20	44138	9	25	21.4	5	25	300	1500	1.85	130.13	17.06	5.8E-08 *
11/03/20	44138	9	30	21.4	5	30	300	1800	1.85	130.13	17.06	5.8E-08 *

TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS** 5.8E-08 cm/sec**

DATE	11/3/20
CHECK	FT
REVIEW	PWM
APPROVE	

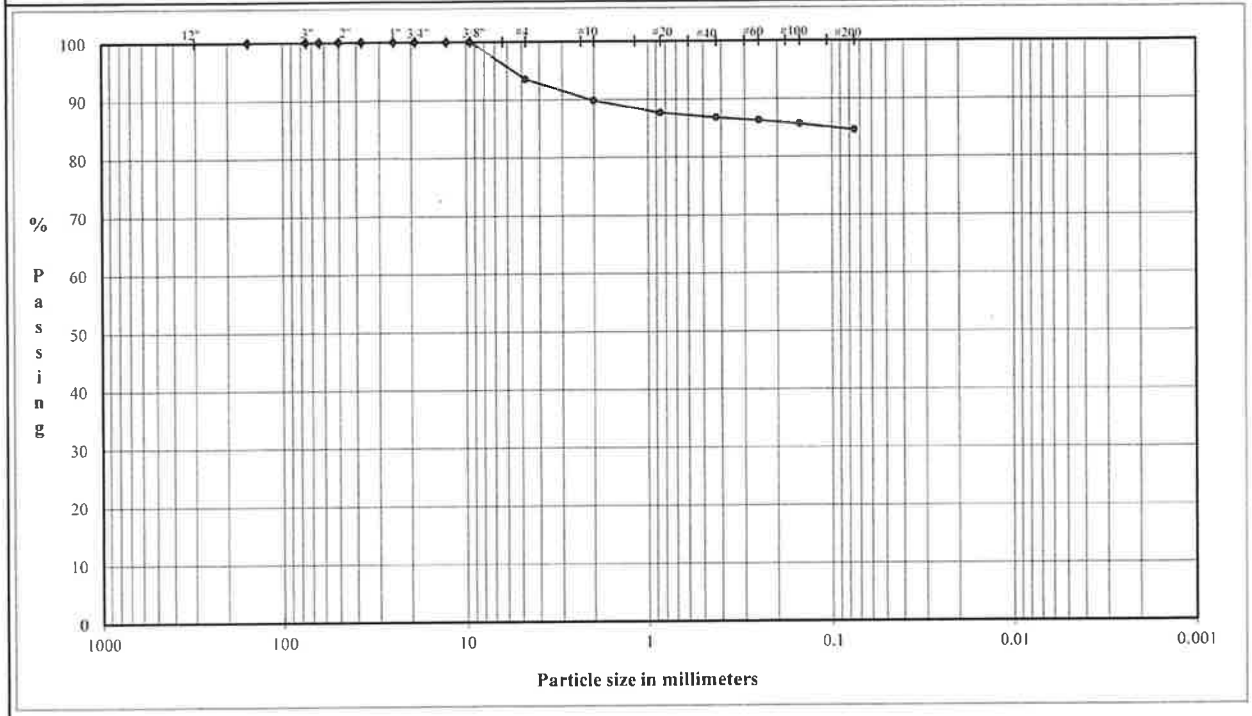
Golder Associates Inc.

OCTOBER 2020 **20412336**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D6913, D4318

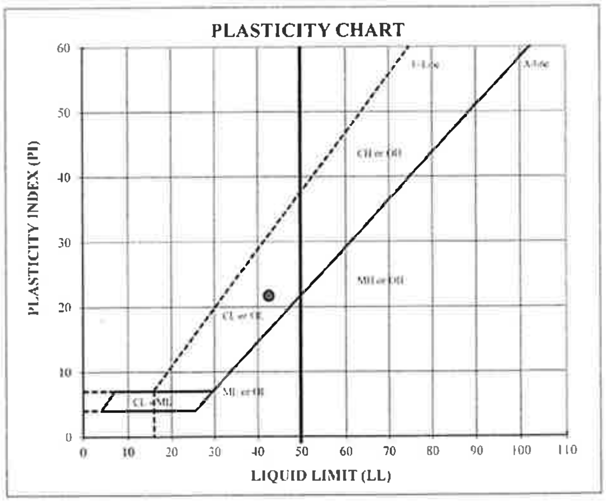
PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
SAMPLE ID: **CL-4** - Depth: -
TYPE: **Bulk**



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
2.5"	63.5	**100.0**	Coarse Gravel	**0.00**
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**		
0.50"	12.7	**100.0**	Fine Gravel	**6.51**
0.375"	9.5	**100.0**		
#4	4.8	**93.5**		
#10	2.0	**89.8**	Coarse Sand	**3.70**
#20	0.85	**87.7**	Medium Sand	**3.00**
#40	0.43	**86.8**		
#60	0.25	**86.3**	Fine Sand	**2.24**
#100	0.15	**85.7**		
#200	0.075	**84.5**		
			Fines	**84.5**



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
11.7	**43**	**21**	**22**	**-0.41**

LL (oven-dried)	
< 0.75 = ORGANIC (OL,OH)	

DESCRIPTION: SILTY CLAY, some fine gravel, some fine to coarse sand; olive, shale.

USCS: CL

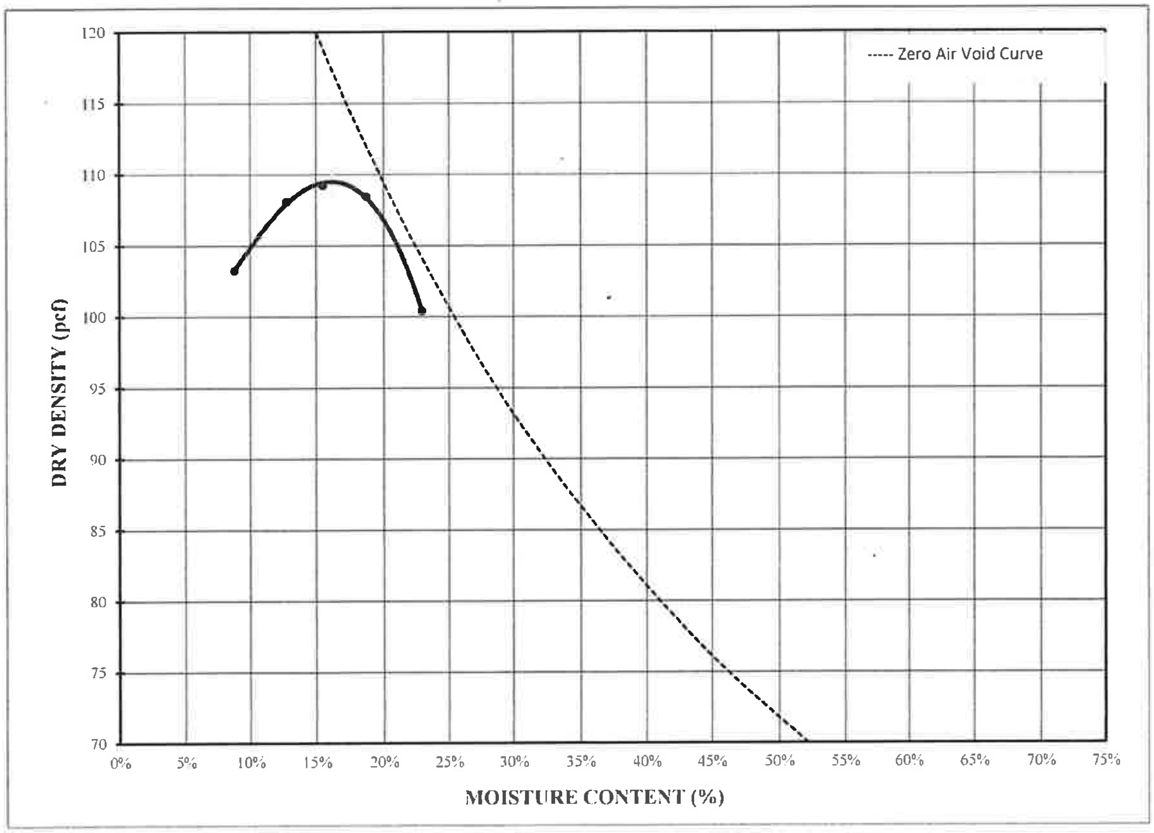
TECH	LH/VB
DATE	10/23/20
CHECK	
REVIEW	
APPROVE	

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL S/2 PH IVD/IVE/IVF/OK**
PROJECT NUMBER: **20412336**
SAMPLE ID: **CL-4** DEPTH: SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	103.2	8.8%
2	108.1	12.8%
3	109.2	15.5%
4	108.4	18.7%
5	100.4	22.9%

Maximum Dry Density (pcf)	**109.5**
Optimum Moisture (%)	**16.2**
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	**11.7%**

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

% Retained on 3/8" sieve	
% Retained on 3/4" sieve	
Specific Gravity (assumed/tested)	**2.7**

DESCRIPTION SILTY CLAY, some fine gravel, some fine to coarse sand; olive, shale.

USCS CL

CHECK
REVIEW
APPROVE

Golder Associates Inc.

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	SCS/AEL S/2 PH IVD/IVE/IVF/OK		Board #	2
PROJECT NUMBER	20412336		Flow Pump	2
SAMPLE ID	CL-4	A	Flow Pump Speed	9
SAMPLE TYPE	Bulk		Technician	FT

COMMENTS: The sample was remolded to 95.6% of the Maximum Dry Density and OPTM + 0.6% (using ASTM D 698).

Sample Data, Initial			
Height, inches	3.001	B-Value, f	0.97
Diameter, inches	2.790	Cell Pres.	90.0
Area, cm²	39.44	Bot. Pres.	80.0
Volume, cm^3	300.65	Top Pres.	80.0
Mass, g	588.32	Tot. B.P.	80.0
Moisture Content, %	16.8	Head, max.	81.59
Dry Density, pcf	104.6	Head, min.	81.59
Spec. Gravity(assumed)	2.700	Max. Grad.	10.70
Volume Solids, cm^3	186.61	Min. Grad.	10.70
Volume Voids, cm^3	114.05		
Void Ratio	0.61		
Saturation, %	74.1%		

Sample Data, Final	
Height, inches	3.001
Diameter, inches	2.823
Area, cm²	40.38
Volume, cm^3	307.81
Mass, g	617.79
Moisture Content, %	22.62
Dry Density, pcf	102.14
Volume Solids, cm^3	186.61
Volume Voids, cm^3	121.20
Void Ratio	0.65
Saturation, %	94.0%

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	588.32	625.97
Wt Soil & Tare, f	g	503.84	512.04
Wt Tare	g	0.00	8.31
Wt Moisture Lost	g	84.48	113.93
Wt Dry Soil	g	503.84	503.73
Water Content	%	16.77%	22.62%

DESCRIPTION
SILTY CLAY, some fine gravel, some fine to coarse sand; olive, shale.

Flow Pump Rate 4.26E-05 cm^3/sec

USCS CL

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
11/03/20	44138	11	0	21.4	0	0	0	0	1.16	81.59	10.70	9.5E-08
11/03/20	44138	11	5	21.4	5	5	300	300	1.16	81.59	10.70	9.5E-08
11/03/20	44138	11	10	21.4	5	10	300	600	1.16	81.59	10.70	9.5E-08
11/03/20	44138	11	15	21.4	5	15	300	900	1.16	81.59	10.70	9.5E-08 *
11/03/20	44138	11	20	21.4	5	20	300	1200	1.16	81.59	10.70	9.5E-08 *
11/03/20	44138	11	25	21.4	5	25	300	1500	1.16	81.59	10.70	9.5E-08 *
11/03/20	44138	11	30	21.4	5	30	300	1800	1.16	81.59	10.70	9.5E-08 *

TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS** 9.5E-08 cm/sec**

DATE	11/3/20
CHECK	FT
REVIEW	PWM
APPROVE	

B

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SUMMARY OF LABORATORY RESULTS

PAGE 1 OF 1

CLIENT SCS Engineers

PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK

PROJECT NUMBER 202206520

PROJECT LOCATION Oklahoma

Sample ID	Lift	Natural Moisture (%)	Atterberg Limits			%<#200 Sieve	Class-ification	Unit Weight		Permeability (cm/sec)	Additional Lab Testing
			Liquid Limit	Plastic Limit	Plasticity Index			Moisture Content (%)	Dry Density (pcf)		
CL-1	0	7.4	44	18	26	87	CL	19.0	102.7	1.54E-08	
CL-2	0	5.6	43	18	25	87	CL	18.7	102.2	3.18E-08	
CL-3	0	8.6	41	17	24	84	CL	16.3	105.2	5.00E-08	
CL-4	0	12.6	40	17	23	87	CL	17.8	102.1	2.23E-08	
CL-5	0	6.8	41	17	24	86	CL	18.3	101.2	2.68E-08	
SG-2	0	9.0	45	18	27	92	CL				

LAB SUMMARY - CQA - GINT STD US LAB.GDT - 3/22/22 12:46 - L:\2022 - 2022 FILE FOLDERS\SCS ENGINEERS\AEL\202206520_SCS_AEL.GPJ

GOLDER
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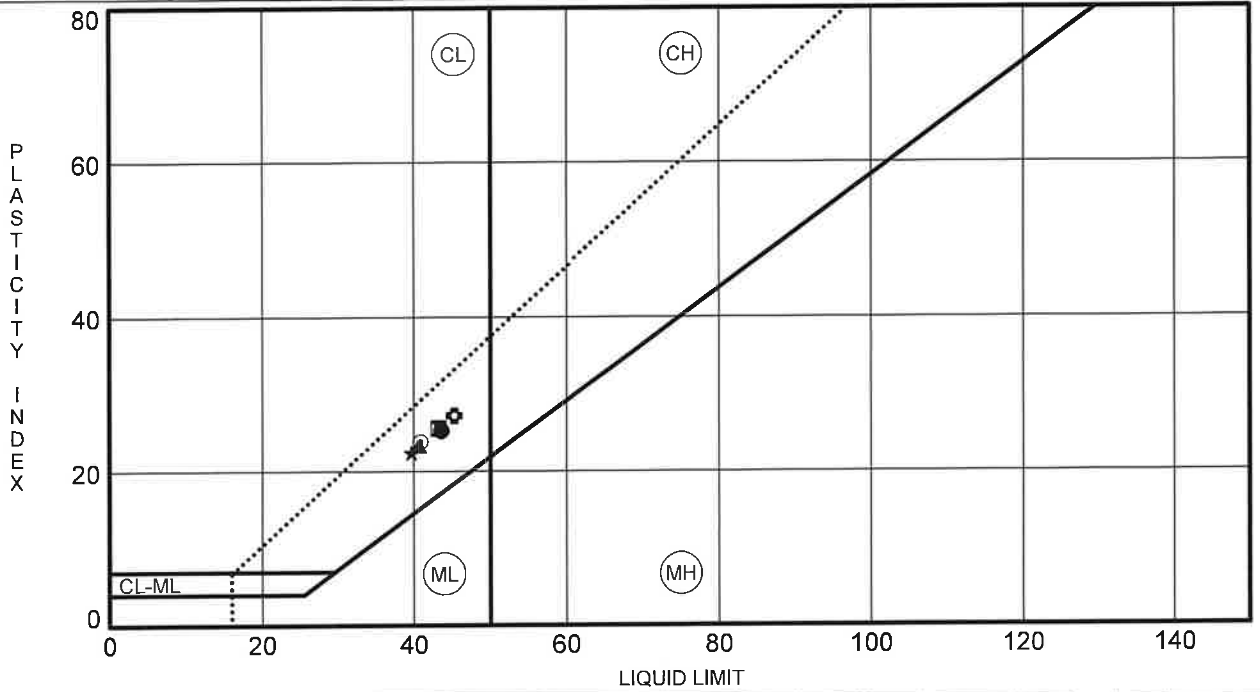
PAGE 1 OF 1

ATTERBERG LIMITS RESULTS
ASTM D4318
LL Machine Type:Mechanical
Plastic Limit Type:Hand Rolled
Grooving Tool Type:Plastic

CLIENT SCS Engineers
PROJECT NUMBER 202206520
PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK
PROJECT LOCATION Oklahoma



	BOREHOLE	LL	PL	PI	Fines	Classification	Max Grain Size	% RET. #40	As Rec. WC %	Method	Date Tested	Prep. Type	Tech.	Review	Description	Notes
●	CL-1	44	18	26	87	LEAN CLAY (CL)	2.0 mm	9.2%	7.43%	B	02/07/2022	Wet	MR	AH	Lt. Brown	
⧗	CL-2	43	18	25	87	LEAN CLAY (CL)	2.0 mm	10.6%	5.56%	B	02/07/2022	Wet	MR	AH	Lt. Gray, Brown	
▲	CL-3	41	17	24	84	LEAN CLAY with SAND (CL)	2.0 mm	11.7%	8.64%	B	02/07/2022	Wet	MR	AH	Lt. Brown	
★	CL-4	40	17	23	87	LEAN CLAY (CL)	2.0 mm	6.8%	12.60%	B	02/07/2022	Wet	MR	AH	Lt. Brown	
⊙	CL-5	41	17	24	86	LEAN CLAY (CL)	2.0 mm	11.6%	6.82%	B	02/07/2022	Wet	MR	AH	Lt. Brown	
✿	SG-2	45	18	27	92	LEAN CLAY (CL)	2.0 mm	3.7%	9.03%	B	02/07/2022	Wet	MR	AH	Lt. Brown	

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PAGE 1 OF 1

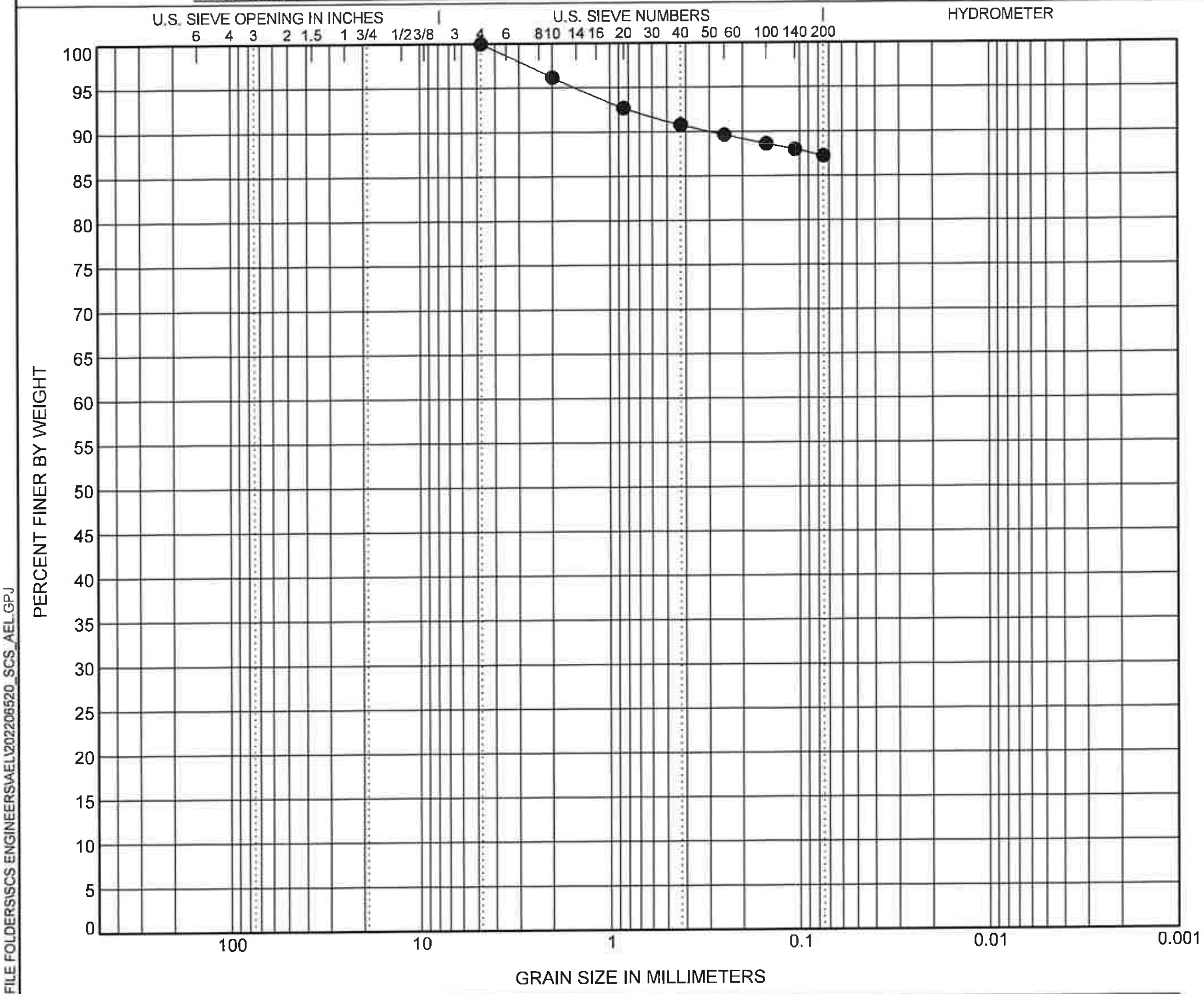
GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT SCS Engineers

PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK

PROJECT NUMBER 202206520

PROJECT LOCATION Oklahoma



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test.?	Test Date	Description	Tech.	Review	Notes
●	CL-1	LEAN CLAY (CL)	B	Oven	No		16 hrs.	No	02/08/2022		MR	AH	

	BOREHOLE	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CL-1	4.75				0.0	12.8	87	

SIEVE_NO DEPTH - GINT STD US LAB.GDT - 2/11/22 19:46 - L:\2022 - 2022 FILE FOLDERS\SCS ENGINEERS\AEL\202206520_SCS_AEL.GPJ

GOLDER
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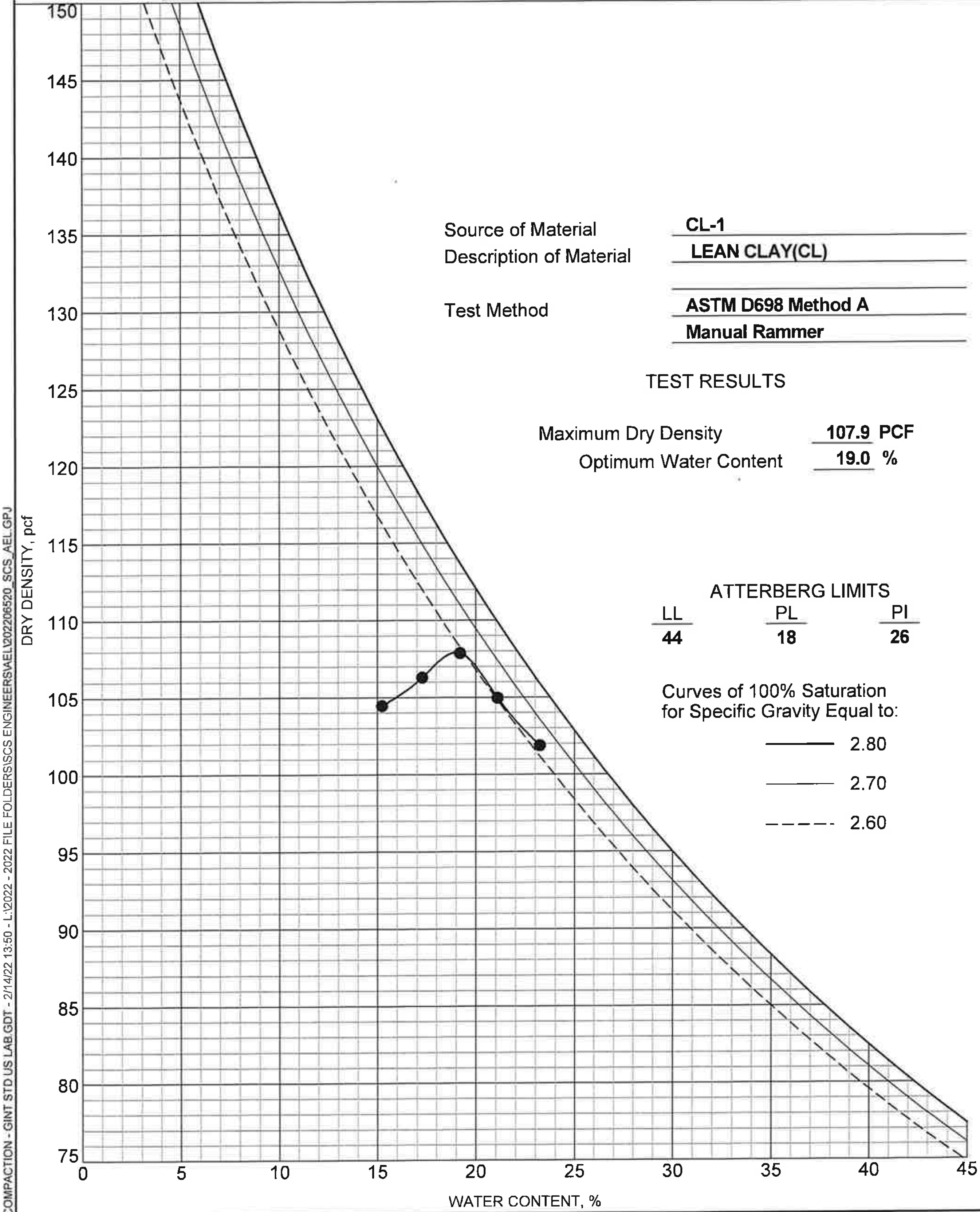
MOISTURE-DENSITY RELATIONSHIP

TECHNICIAN:MR
DATE PERFORMED:02/02/2022
COLOR: Lt. Brown
NATURAL MOISTURE %:

CLIENT SCS Engineers
PROJECT NUMBER 202206520
PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK
PROJECT LOCATION Oklahoma



Source of Material CL-1
Description of Material **LEAN CLAY(CL)**

Test Method **ASTM D698 Method A**
Manual Rammer

TEST RESULTS

Maximum Dry Density **107.9 PCF**
Optimum Water Content **19.0 %**

ATTERBERG LIMITS

LL	PL	PI
44	**18**	**26**

GOLDER
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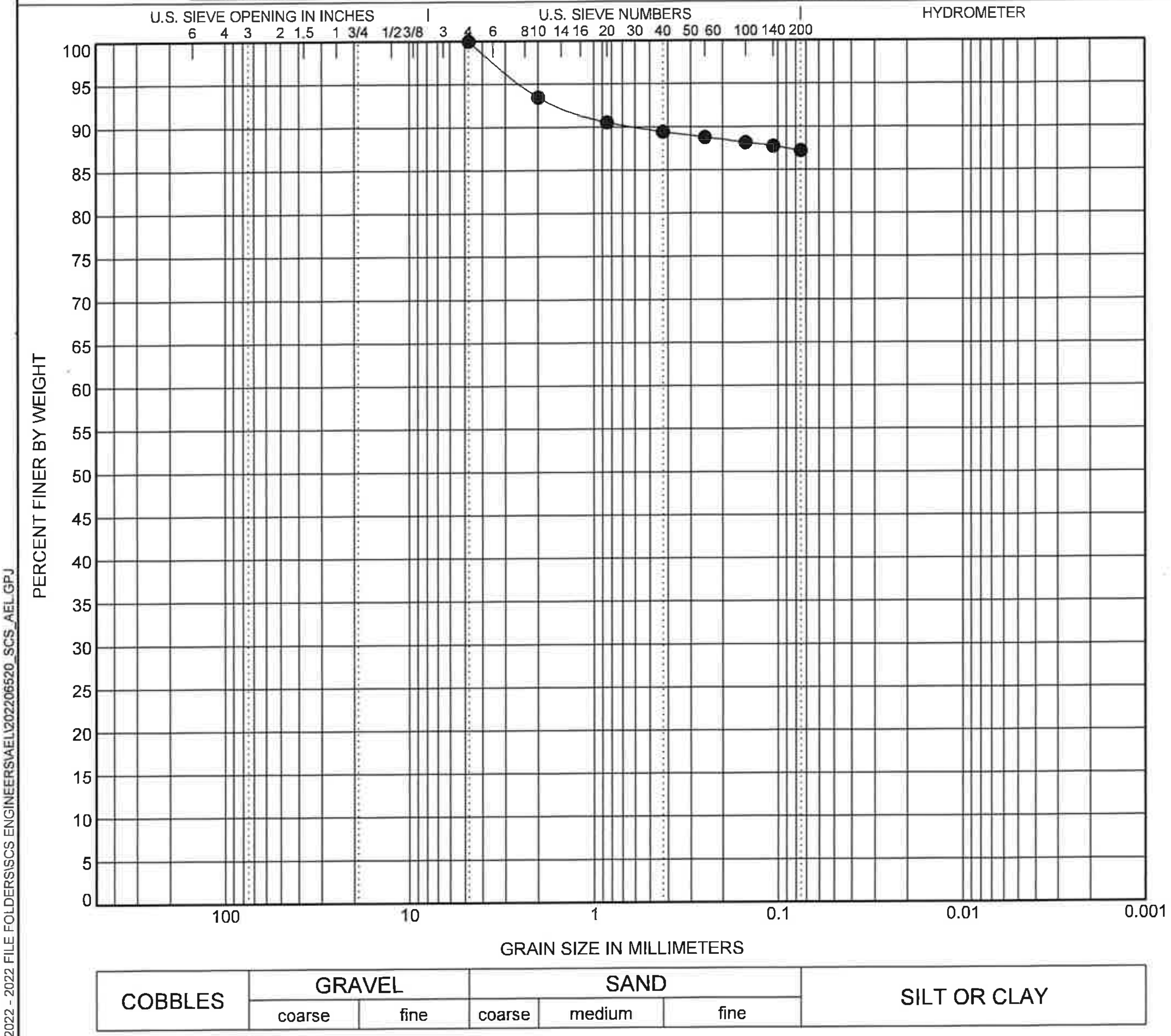
GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT SCS Engineers

PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK

PROJECT NUMBER 202206520

PROJECT LOCATION Oklahoma



	BOREHOLE	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test ?	Test Date	Description	Tech.	Review	Notes
●	CL-2	LEAN CLAY (CL)	B	Oven	No		16 hrs.	No	02/08/2022		MR	AH	

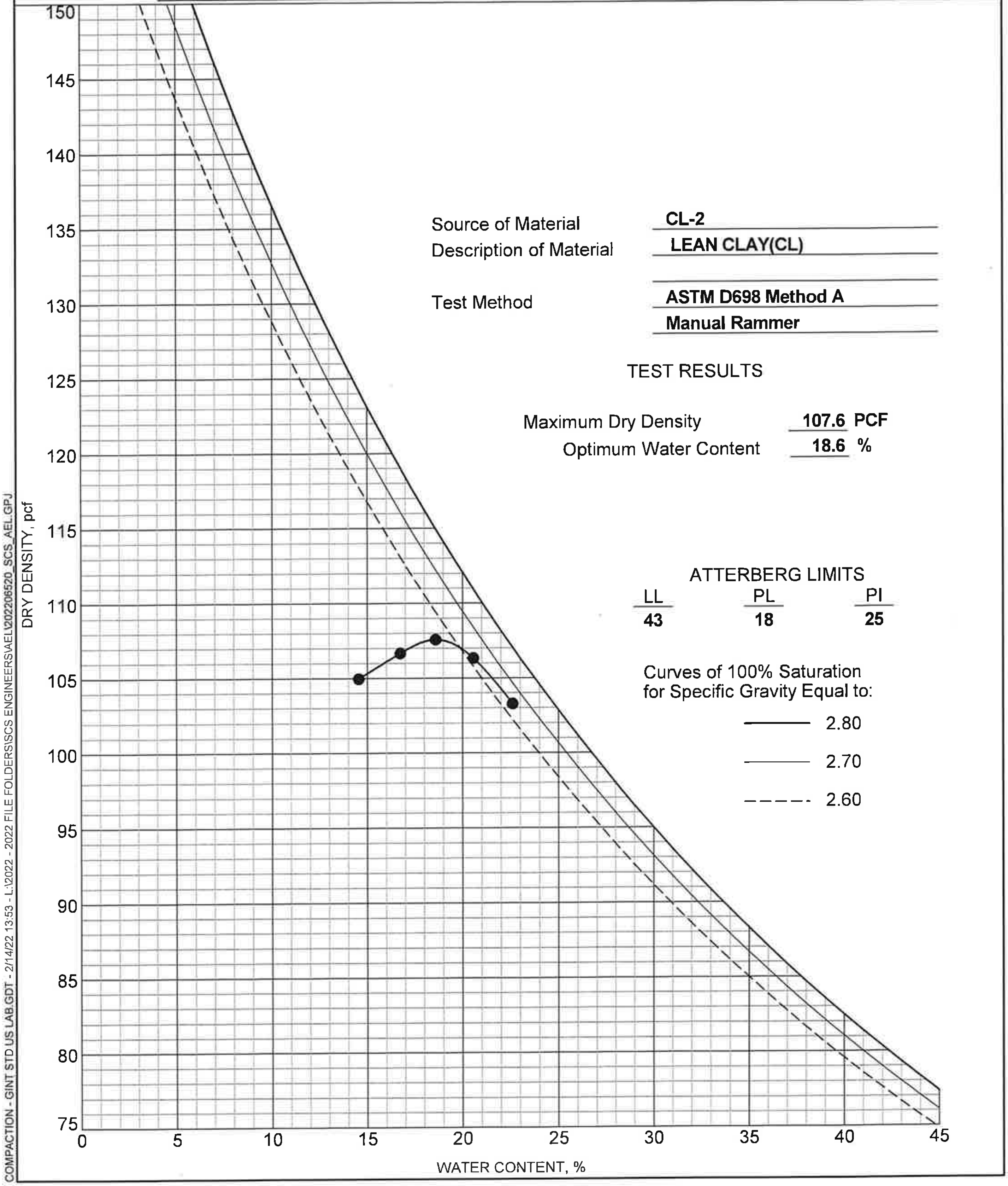
	BOREHOLE	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CL-2	4.75				0.0	12.8	87	

GOLDER
MEMBER OF WSP

MOISTURE-DENSITY RELATIONSHIP

TECHNICIAN:MR
DATE PERFORMED:02/02/2022
COLOR: Gray. Brown
NATURAL MOISTURE %:

CLIENT SCS Engineers
PROJECT NUMBER 202206520
PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK
PROJECT LOCATION Oklahoma



Source of Material **CL-2**
Description of Material **LEAN CLAY(CL)**

Test Method **ASTM D698 Method A**
Manual Rammer

TEST RESULTS

Maximum Dry Density	**107.6**	**PCF**
Optimum Water Content	**18.6**	**%**

ATTERBERG LIMITS

LL	PL	PI
43	**18**	**25**

GOLDER
MEMBER OF WSP

PAGE 1 OF 1

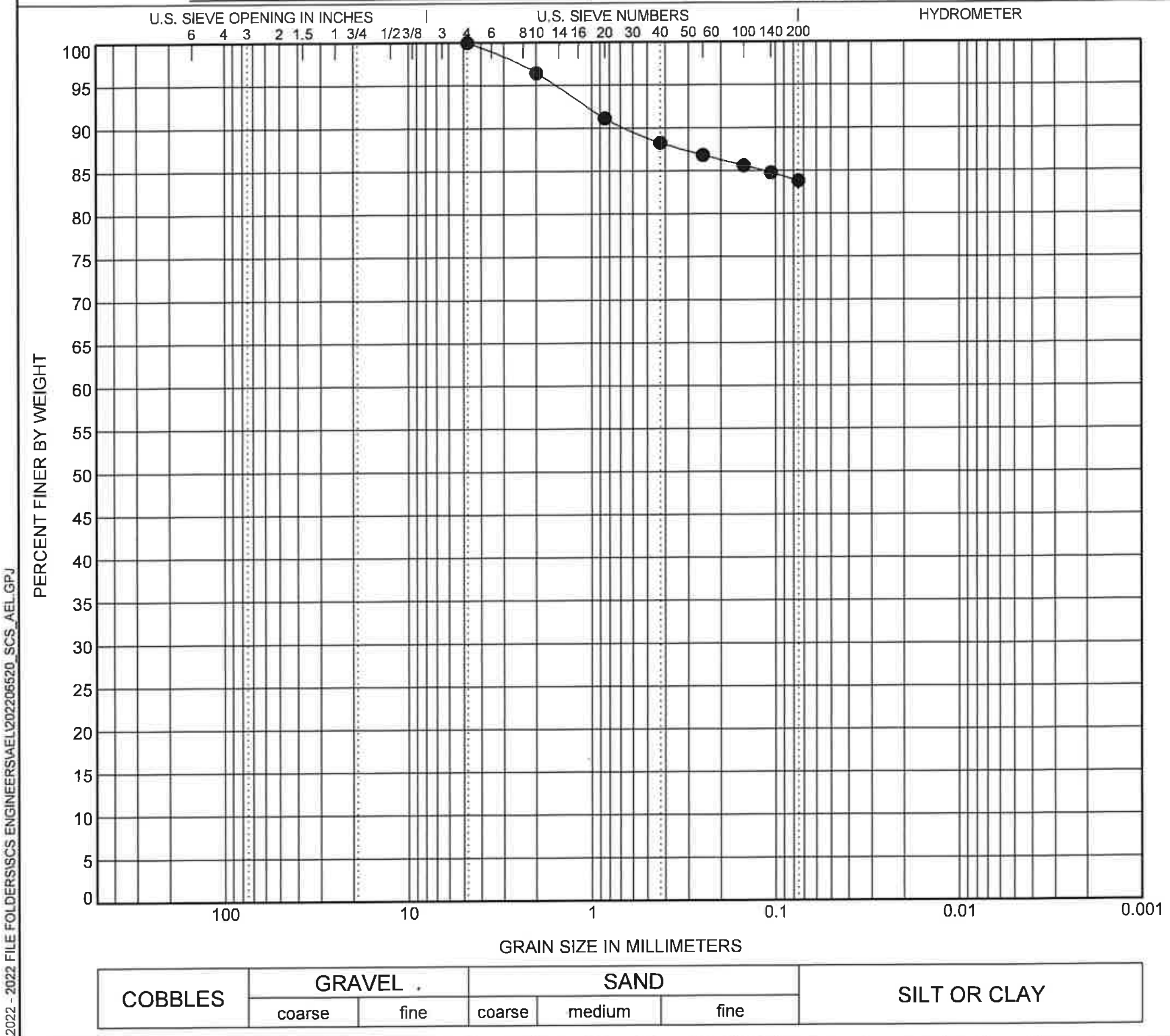
GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT SCS Engineers

PROJECT NUMBER 202206520

PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK

PROJECT LOCATION Oklahoma



	BOREHOLE	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test ?	Test Date	Description	Tech.	Review	Notes
●	CL-3	LEAN CLAY with SAND (CL)	B	Oven	No		16 hrs.	No	02/09/2022		MR	AH	

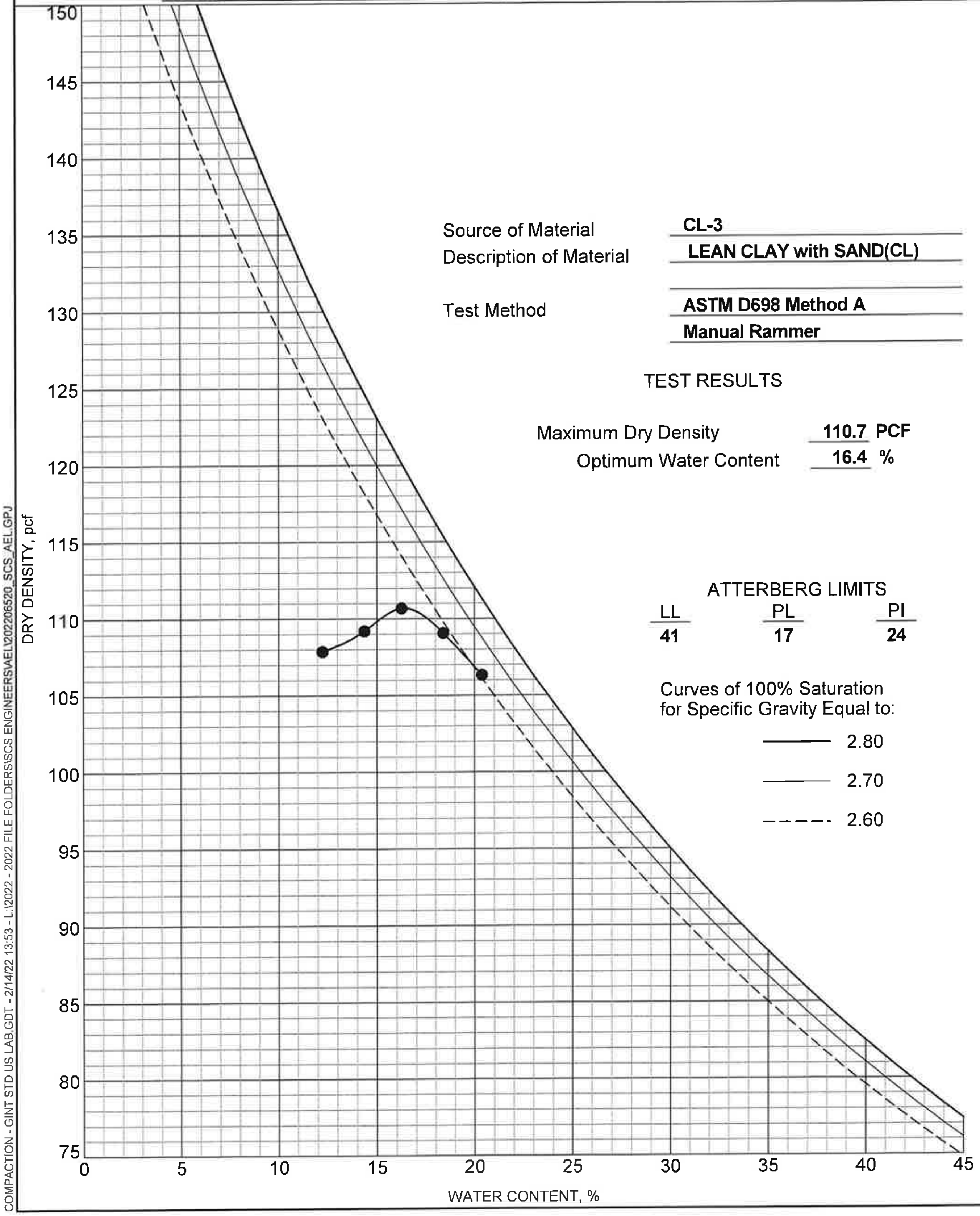
	BOREHOLE	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CL-3	4.75				0.0	16.2	84	

GOLDER
MEMBER OF WSP

MOISTURE-DENSITY RELATIONSHIP

TECHNICIAN: MR
DATE PERFORMED: 02/02/2022
COLOR: Lt. Brown
NATURAL MOISTURE %:

CLIENT SCS Engineers
PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK
PROJECT NUMBER 202206520
PROJECT LOCATION Oklahoma



Source of Material **CL-3**
Description of Material **LEAN CLAY with SAND(CL)**

Test Method **ASTM D698 Method A**
Manual Rammer

TEST RESULTS

Maximum Dry Density	**110.7**	**PCF**
Optimum Water Content	**16.4**	**%**

ATTERBERG LIMITS

LL	PL	PI
41	**17**	**24**

GOLDER
MEMBER OF WSP

PAGE 1 OF 1

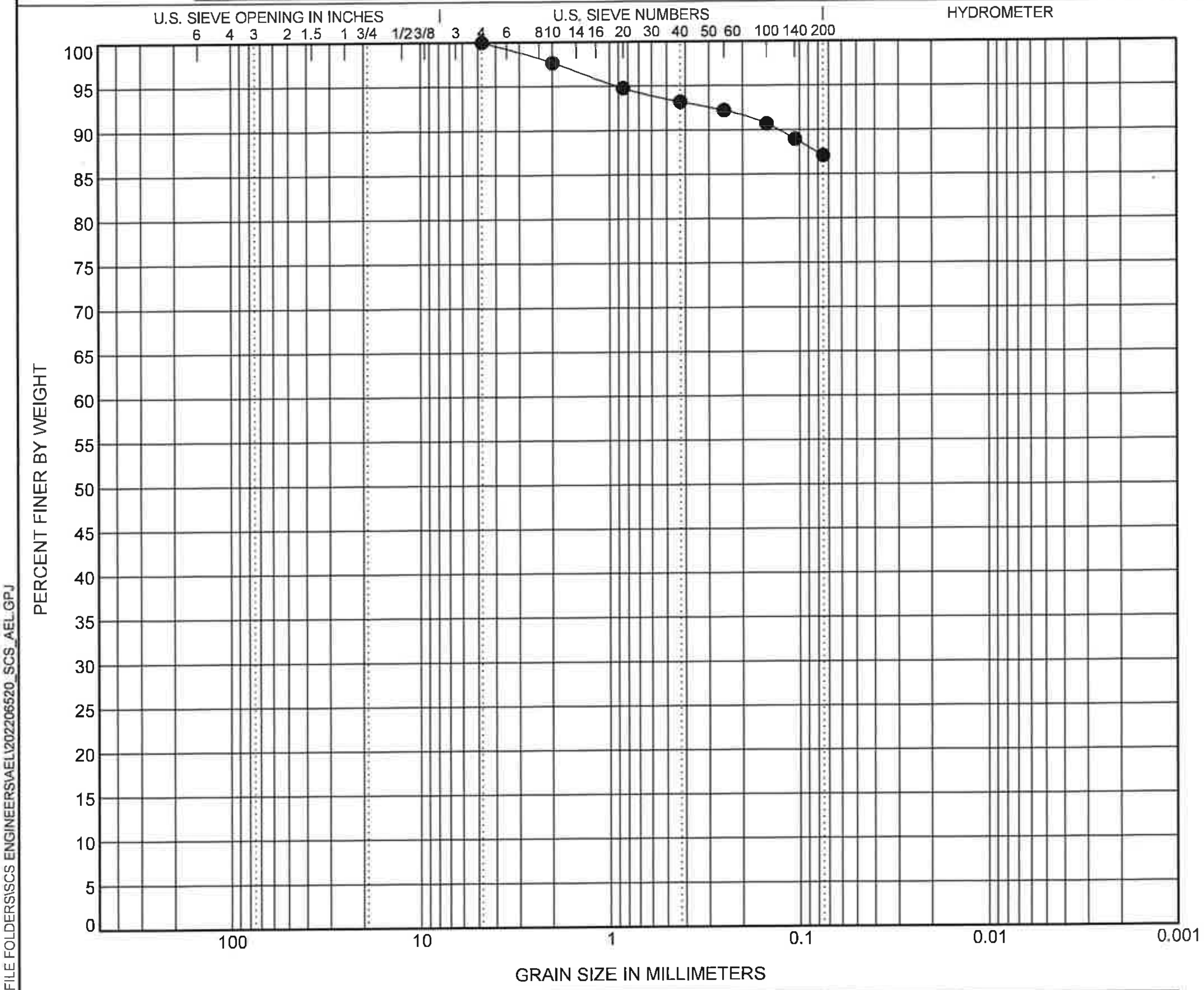
GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT SCS Engineers

PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK

PROJECT NUMBER 202206520

PROJECT LOCATION Oklahoma



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test ?	Test Date	Description	Tech.	Review	Notes
●	CL-4	LEAN CLAY (CL)	B	Oven	No		16 hrs.	No	02/09/2022		MR	AH	

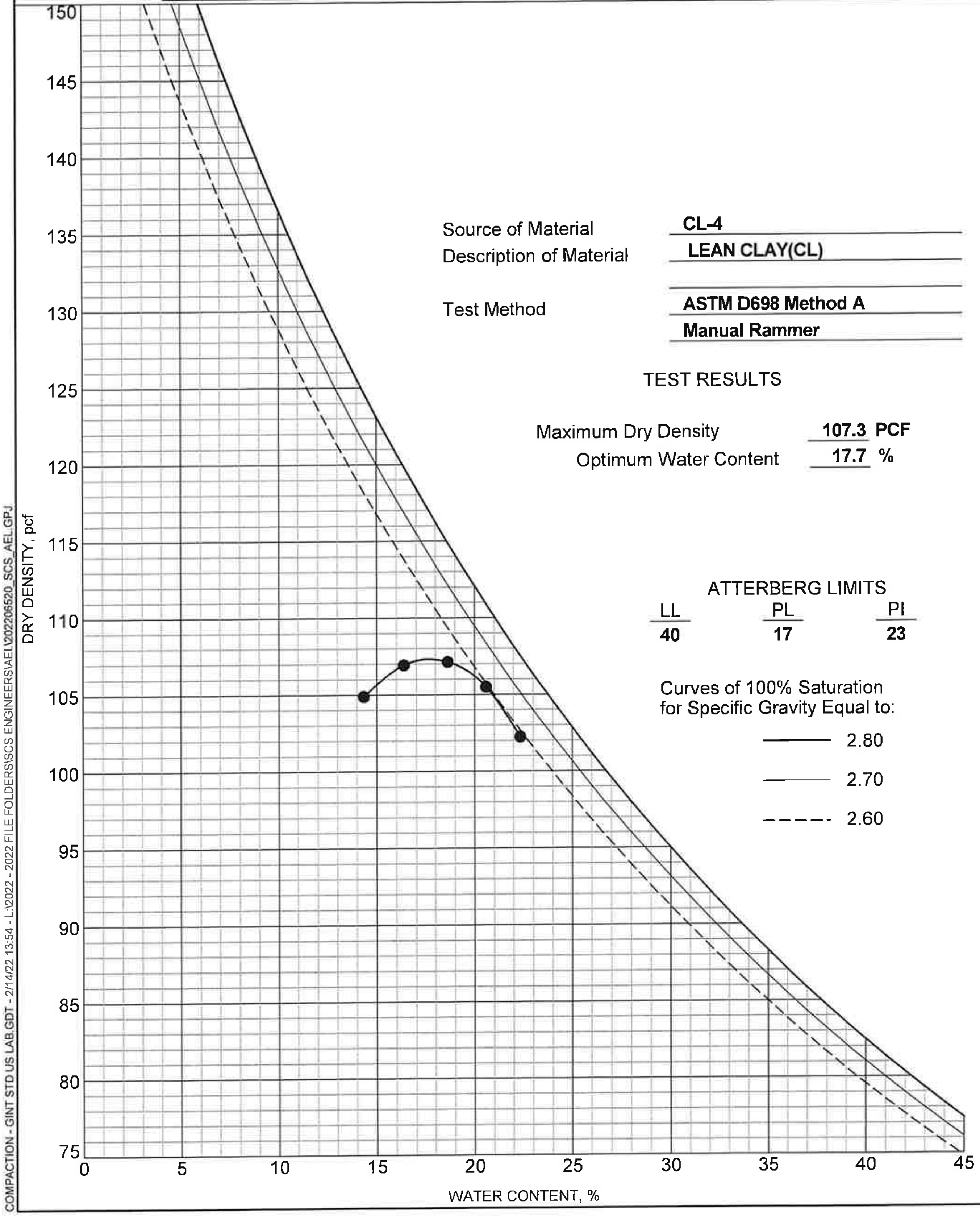
	BOREHOLE	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CL-4	4.75				0.0	12.9	87	

GOLDER
MEMBER OF WSP

MOISTURE-DENSITY RELATIONSHIP

TECHNICIAN:MR
DATE PERFORMED:02/03/2022
COLOR:Lt. Brown
NATURAL MOISTURE %:

CLIENT SCS Engineers
PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK
PROJECT NUMBER 202206520
PROJECT LOCATION Oklahoma



Source of Material **CL-4**
Description of Material **LEAN CLAY(CL)**

Test Method **ASTM D698 Method A**
Manual Rammer

TEST RESULTS

Maximum Dry Density **107.3** **PCF**
Optimum Water Content **17.7** **%**

ATTERBERG LIMITS

LL	PL	PI
40	**17**	**23**

GOLDER
MEMBER OF WSP

PAGE 1 OF 1

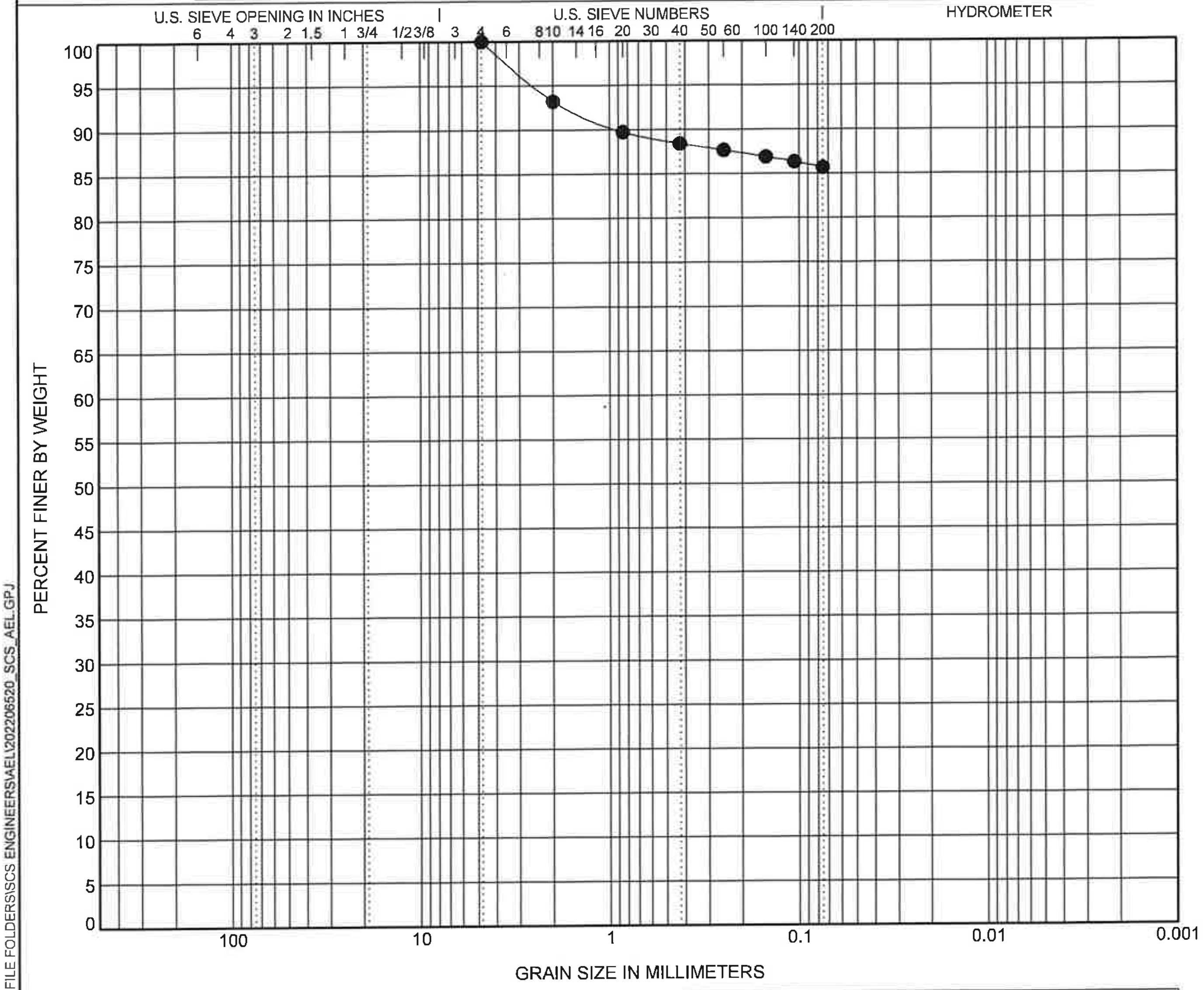
GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT SCS Engineers

PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK

PROJECT NUMBER 202206520

PROJECT LOCATION Oklahoma



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test.?	Test Date	Description	Tech.	Review	Notes
●	CL-5	LEAN CLAY (CL)	B	Oven	No		16 hrs.	No	02/09/2022		MR	AH	

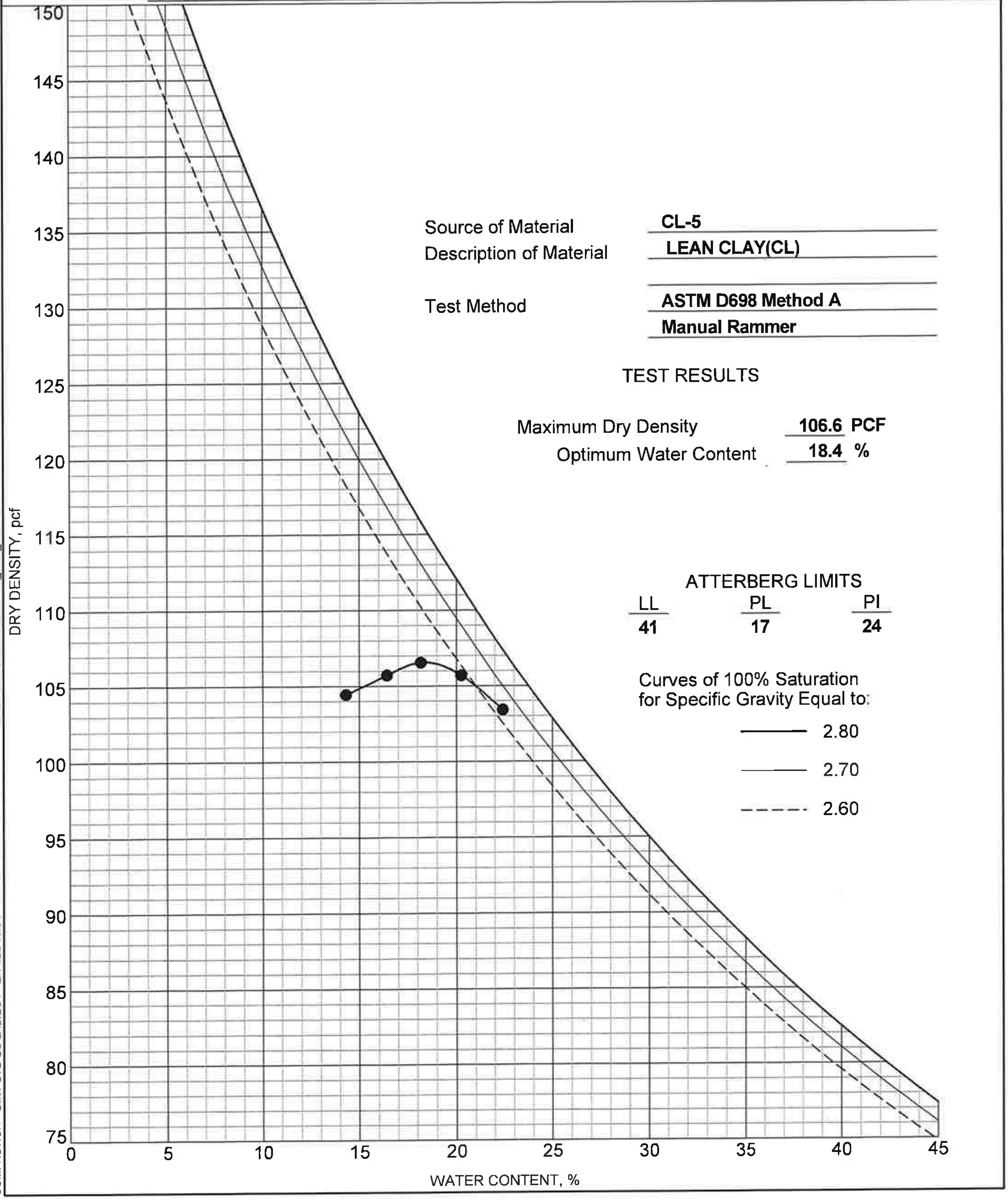
	BOREHOLE	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CL-5	4.75				0.0	14.3	86	

GOLDER
MEMBER OF WSP

MOISTURE-DENSITY RELATIONSHIP

TECHNICIAN:MR
DATE PERFORMED:02/03/2022
COLOR:Lt. Brown
NATURAL MOISTURE %:

CLIENT SCS Engineers
PROJECT NUMBER 202206520
PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK
PROJECT LOCATION Oklahoma



Source of Material	**CL-5**
Description of Material	**LEAN CLAY(CL)**
Test Method	**ASTM D698 Method A** **Manual Rammer**

TEST RESULTS

Maximum Dry Density **106.6 PCF**
Optimum Water Content **18.4 %**

ATTERBERG LIMITS

LL	PL	PI
41	**17**	**24**

GOLDER
MEMBER OF WSP

PAGE 1 OF 1

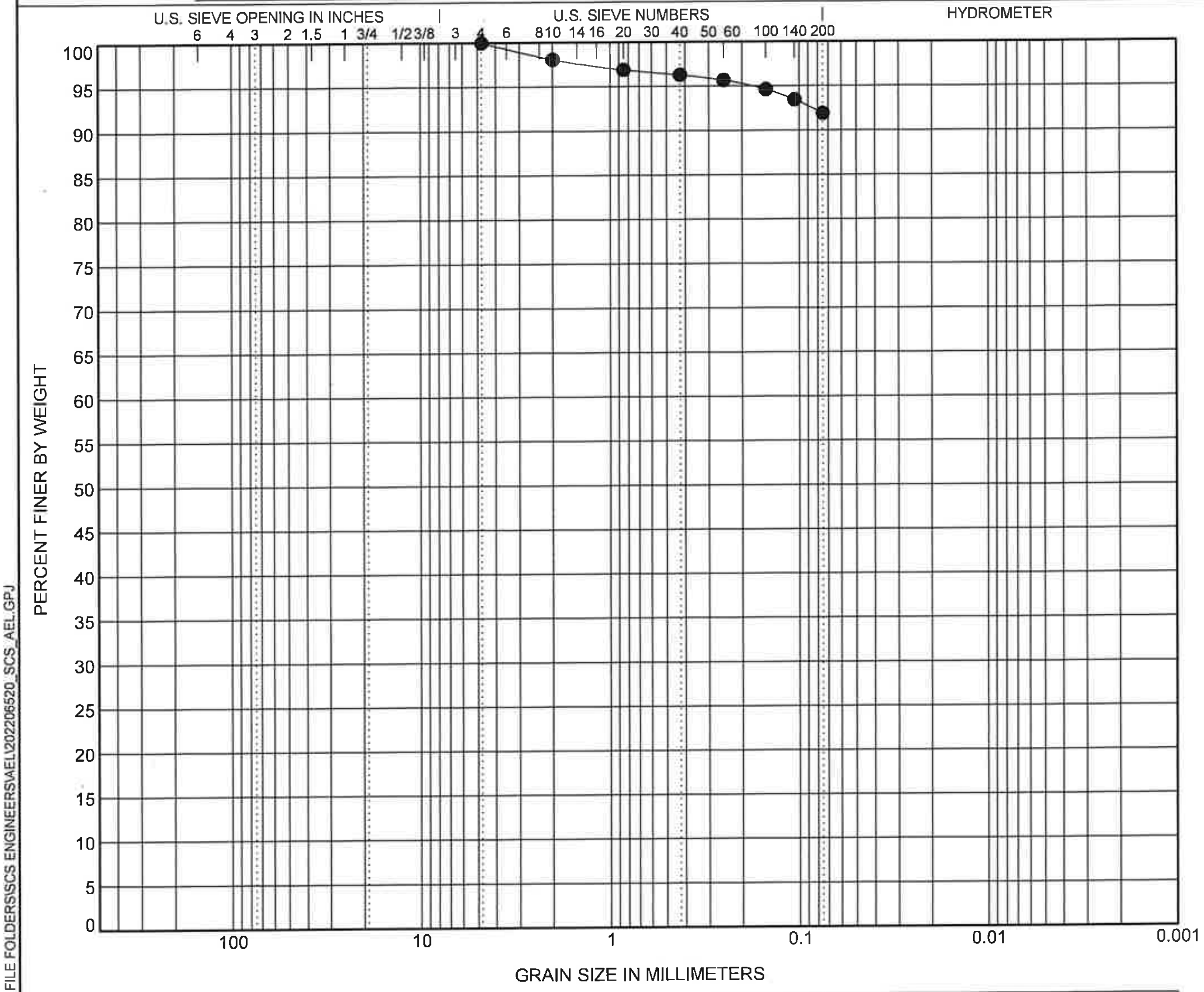
GRAIN SIZE DISTRIBUTION
ASTM D6913

CLIENT SCS Engineers

PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK

PROJECT NUMBER 202206520

PROJECT LOCATION Oklahoma



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	Classification	Method	Proced.	Comp. Sieve?	Separ. Sieve	Soak Time	Prior Test.?	Test Date	Description	Tech.	Review	Notes
●	SG-2	LEAN CLAY (CL)	B	Oven	No		16 hrs.	No	02/09/2022		MR	AH	

	BOREHOLE	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SG-2	4.75				0.0	8.1	92	

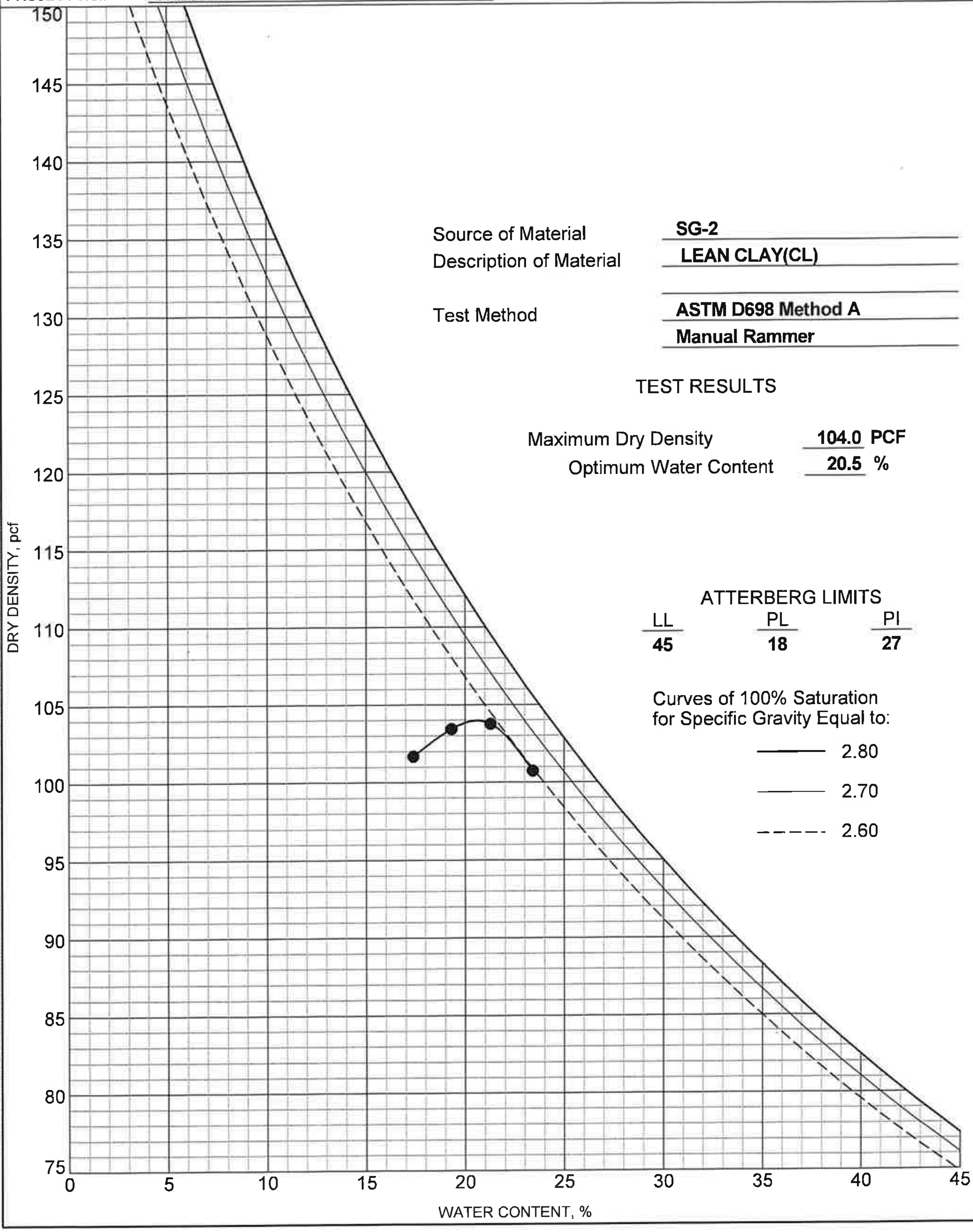
SIEVE_NO DEPTH - GINT STD US LAB.GDT - 2/11/22 19:53 - L:\2022 - 2022 FILE FOLDERS\SCS ENGINEERS\AEL\202206520_SCS_AEL.GPJ

GOLDER
MEMBER OF WSP

MOISTURE-DENSITY RELATIONSHIP

TECHNICIAN: MR
DATE PERFORMED: 02/03/2022
COLOR: Lt. Brown
NATURAL MOISTURE %:

CLIENT SCS Engineers
PROJECT NAME SCS/AEL Phase IVG/IVI/IVN CQA/OK
PROJECT NUMBER 202206520
PROJECT LOCATION Oklahoma



Source of Material	**SG-2**
Description of Material	**LEAN CLAY(CL)**
Test Method	**ASTM D698 Method A** **Manual Rammer**

TEST RESULTS

Maximum Dry Density	**104.0**	**PCF**
Optimum Water Content	**20.5**	**%**

ATTERBERG LIMITS

LL	PL	PI
45	**18**	**27**

Curves of 100% Saturation for Specific Gravity Equal to:

- ——— 2.80
- ——— 2.70
- - - - - 2.60

COMPACTION - GINT STD US LAB.GDT - 2/14/22 13:55 - L:\2022 - 2022 FILE FOLDERS\SCS ENGINEERS\AEL\202206520_SCS_AEL.GPJ

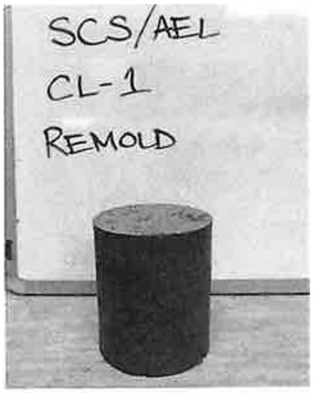
FLEXIBLE WALL TRIAXIAL PERMEABILITY

ASTM D 5084 METHOD F, CONSTANT VOLUME - FALLING HEAD

PROJECT TITLE:	SCS/AEL
PROJECT NUMBER:	202206520
SAMPLE ID:	CL-1 Remold
LIFT NUMBER:	N/A

Cell Pressure =	80	psi
Backwater Pressure =	70	psi
Run Number =	1	
Permeant Used=	De-Aired Water	

Sample Data, Initial		centimeters	**Sample Data, Final**		centimeters
Height, in	3.533	8.97	Height, in	3.548	9.01
Top Diameter, mm	72.700		Top Diameter, mm	73.530	
Middle Diameter, mm	72.570		Middle Diameter, mm	73.530	
Bottom Diameter, mm	72.700		Bottom Diameter, mm	73.390	
Average Diameter, cm	7.266		Average Diameter, cm	7.348	
Area, cm²	41.46		Area, cm²	42.41	
Volume, cm³	372.06		Volume, cm³	382.19	
Wet Mass, g	728.8		Wet Mass, g	760.76	
Wt. tare, gm	152.9		Wt. tare, gm	152.9	
Wt. wet soil + tare, gm	323.39		Wt. wet soil + tare, gm	919.35	
Wt. dry soil + tare, gm	296.14		Wt. dry soil + tare, gm	777.99	
Moisture Content, %	19.0%		Moisture Content, %	22.6%	
Dry Density, pcf	102.7		Dry Density, pcf	101.3	
Specific Gravity	2.65	Assumed	Specific Gravity	2.65	
Void Ratio	0.61		Void Ratio	0.63	
Saturation, %	83%		Saturation, %	95%	
Effective Stress, psi	10				



Manometer Constants:

$a_{annulus}$ = 0.76712 cm²

$a_{center\ pipette}$ = 0.03142 cm³

Initial Manometer Readings

Pipette = 22.0

Annulus = 0.85

Minutes	Seconds	Δt (sec)	Pipette (cm)	Annulus (cm)	Flowrate (cm^3/s)	Gradient (i)	Hydraulic Conductivity (cm/sec)	Temp. °C	rt temp. corr.	Hydraulic Conductivity (cm/sec) @20°C
0	0	0	22.0	0.85		29.60		23	0.931	
4	15	255	21.3	0.88	8.624E-05	27.95	7.28E-08	23	0.931	6.77E-08
13	45	570	20.5	0.91	4.409E-05	26.72	3.89E-08	23	0.931	3.62E-08
23	56	611	19.9	0.94	3.085E-05	25.99	2.80E-08	23	0.931	2.61E-08
34	19	623	19.4	0.96	2.521E-05	25.34	2.35E-08	23	0.931	2.18E-08
50	7	948	18.8	0.98	1.988E-05	24.40	1.92E-08	23	0.931	1.79E-08
67	32	1045	18.2	1.01	1.804E-05	23.53	1.81E-08	23	0.931	1.68E-08
84	14	1002	17.7	1.03	1.568E-05	22.87	1.62E-08	23	0.931	1.50E-08
98	11	837	17.3	1.04	1.501E-05	22.37	1.58E-08	23	0.931	1.47E-08
108	43	632	17.0	1.05	1.491E-05	22.00	1.60E-08	23	0.931	1.49E-08
					HYDRAULIC CONDUCTIVITY REPORTED AS					**1.54E-08** cm/sec

TECH:	MR	CHECKED:	AH
DATE:	2/8/2022	DATE:	2/10/2022

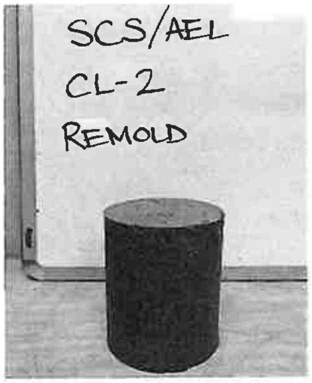
FLEXIBLE WALL TRIAXIAL PERMEABILITY
ASTM D 5084 METHOD F, CONSTANT VOLUME - FALLING HEAD

PROJECT TITLE:	SCS/AEL
PROJECT NUMBER:	202206520
SAMPLE ID:	CL-2 Remold
LIFT NUMBER:	N/A

Cell Pressure =	80	psi
Backwater Pressure =	70	psi
Run Number =	1	
Permeant Used=	De-Aired Water	

Sample Data, Initial		centimeters
Height, in	3.568	9.06
Top Diameter, mm	72.700	
Middle Diameter, mm	72.590	
Bottom Diameter, mm	72.670	
Average Diameter, cm	7.265	
Area, cm²	41.46	
Volume, cm³	375.72	
Wet Mass, g	730.2	
Wt. tare, gm	151.51	
Wt. wet soil + tare, gm	372.04	
Wt. dry soil + tare, gm	337.34	
Moisture Content, %	18.7%	
Dry Density, pcf	102.2	
Specific Gravity	2.65	Assumed
Void Ratio	0.62	
Saturation, %	80%	
Effective Stress, psi	10	

Sample Data, Final		centimeters
Height, in	3.579	9.09
Top Diameter, mm	72.910	
Middle Diameter, mm	73.050	
Bottom Diameter, mm	72.870	
Average Diameter, cm	7.294	
Area, cm²	41.79	
Volume, cm³	379.89	
Wet Mass, g	756.63	
Wt. tare, gm	151.51	
Wt. wet soil + tare, gm	884.8	
Wt. dry soil + tare, gm	748.23	
Moisture Content, %	22.9%	
Dry Density, pcf	101.1	
Specific Gravity	2.65	
Void Ratio	0.64	
Saturation, %	96%	



Manometer Constants:

$a_{annulus}$ = 0.76712 cm²

$a_{center\ pipette}$ = 0.03142 cm³

Initial Manometer Readings

Pipette = 22.0

Annulus = 0.85

Minutes	Seconds	Δt (sec)	Pipette (cm)	Annulus (cm)	Flowrate (cm³/s)	Gradient (i)	Hydraulic Conductivity (cm/sec)	Temp. °C	rt temp. corr.	Hydraulic Conductivity (cm/sec) @20°C
0	0	0	22.0	0.85		29.31		23	0.931	
2	10	130	21.2	0.88	1.933E-04	27.49	1.68E-07	23	0.931	1.57E-07
7	27	317	20.1	0.93	1.090E-04	25.69	1.02E-07	23	0.931	9.46E-08
18	22	655	18.7	0.99	6.715E-05	23.45	6.85E-08	23	0.931	6.38E-08
28	4	582	17.8	1.02	4.858E-05	22.53	5.16E-08	23	0.931	4.81E-08
40	13	729	16.9	1.06	3.879E-05	21.23	4.37E-08	23	0.931	4.07E-08
51	17	664	16.2	1.09	3.312E-05	20.37	3.89E-08	23	0.931	3.62E-08
60	35	558	15.7	1.11	2.815E-05	19.80	3.40E-08	23	0.931	3.17E-08
72	44	729	15.1	1.13	2.586E-05	18.86	3.28E-08	23	0.931	3.05E-08
83	51	667	14.6	1.15	2.355E-05	18.22	3.09E-08	23	0.931	2.88E-08

HYDRAULIC CONDUCTIVITY REPORTED AS **3.18E-08** **cm/sec**

TECH:	MR	CHECKED:	AH
DATE:	2/8/2022	DATE:	2/11/2022

GOLDER
MEMBER OF WSP

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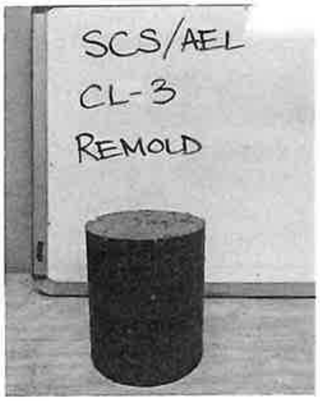
FLEXIBLE WALL TRIAXIAL PERMEABILITY
ASTM D 5084 METHOD F, CONSTANT VOLUME - FALLING HEAD

PROJECT TITLE:	SCS/AEL
PROJECT NUMBER:	202206520
SAMPLE ID:	CL-3 Remold
LIFT NUMBER:	N/A

Cell Pressure =	80	psi
Backwater Pressure =	70	psi
Run Number =	1	
Permeant Used=	De-Aired Water	

Sample Data, Initial		centimeters	**Sample Data, Final**		centimeters
Height, in	3.573	9.08	Height, in	3.537	8.98
Top Diameter, mm	72.570		Top Diameter, mm	72.970	
Middle Diameter, mm	72.530		Middle Diameter, mm	73.110	
Bottom Diameter, mm	72.570		Bottom Diameter, mm	73.050	
Average Diameter, cm	7.256		Average Diameter, cm	7.304	
Area, cm^2	41.35		Area, cm^2	41.90	
Volume, cm^3	375.24		Volume, cm^3	376.46	
Wet Mass, g	735.6		Wet Mass, g	762.25	
Wt. tare, gm	151.34		Wt. tare, gm	151.37	
Wt. wet soil + tare, gm	373.19		Wt. wet soil + tare, gm	887.2	
Wt. dry soil + tare, gm	342.07		Wt. dry soil + tare, gm	756.71	
Moisture Content, %	16.3%		Moisture Content, %	21.6%	
Dry Density, pcf	105.2		Dry Density, pcf	103.9	
Specific Gravity	2.65	Assumed	Specific Gravity	2.65	
Void Ratio	0.57		Void Ratio	0.59	
Saturation, %	76%		Saturation, %	97%	
Effective Stress, psi	10				



Manometer Constants:

$a_{annulus}$ = 0.76712 cm^2

$a_{center\ pipette}$ = 0.03142 cm^3

Initial Manometer Readings

Pipette = 22.5

Annulus = 0.85

Minutes	Seconds	Δt (sec)	Pipette (cm)	Annulus (cm)	Flowrate (cm^3/s)	Gradient (i)	Hydraulic Conductivity (cm/sec)	Temp. °C	rt temp. corr.	Hydraulic Conductivity (cm/sec) @20°C
0	0	0	22.5	0.85		29.96		23	0.931	
5	44	344	20.7	0.92	1.644E-04	26.32	1.49E-07	23	0.931	1.39E-07
17	35	711	18.7	1.01	8.837E-05	23.25	9.07E-08	23	0.931	8.45E-08
25	19	464	17.8	1.04	6.094E-05	22.77	6.39E-08	23	0.931	5.95E-08
37	20	721	16.6	1.09	5.229E-05	20.80	6.00E-08	23	0.931	5.59E-08
48	5	645	15.7	1.13	4.384E-05	19.71	5.31E-08	23	0.931	4.94E-08
60	3	718	14.8	1.17	3.938E-05	18.40	5.11E-08	23	0.931	4.76E-08
73	2	779	13.9	1.20	3.630E-05	17.09	5.07E-08	23	0.931	4.72E-08
						HYDRAULIC CONDUCTIVITY REPORTED AS				**5.00E-08** cm/sec

TECH:	MR	CHECKED:	AH
DATE:	2/8/2022	DATE:	2/11/2022

GOLDER
MEMBER OF WSP

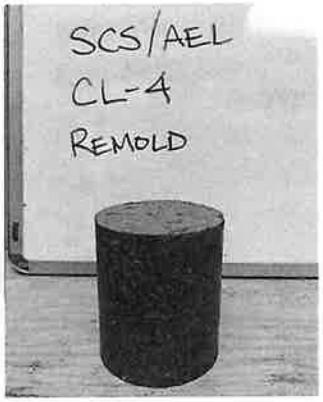
FLEXIBLE WALL TRIAXIAL PERMEABILITY

ASTM D 5084 METHOD F, CONSTANT VOLUME - FALLING HEAD

PROJECT TITLE:	SCS/AEL
PROJECT NUMBER:	202206520
SAMPLE ID:	CL-4 Remold
LIFT NUMBER:	

Cell Pressure =	80	psi
Backwater Pressure =	70	psi
Run Number =	1	
Permeant Used=	De-Aired Water	

Sample Data, Initial		centimeters	**Sample Data, Final**		centimeters
Height, in	3.528	8.96	Height, in	3.53	8.97
Top Diameter, mm	72.650		Top Diameter, mm	72.660	
Middle Diameter, mm	72.530		Middle Diameter, mm	72.780	
Bottom Diameter, mm	72.630		Bottom Diameter, mm	72.690	
Average Diameter, cm	7.260		Average Diameter, cm	7.271	
Area, cm²	41.40		Area, cm²	41.52	
Volume, cm³	370.99		Volume, cm³	372.29	
Wet Mass, g	715.58		Wet Mass, g	738.22	
Wt. tare, gm	152.86		Wt. tare, gm	152.85	
Wt. wet soil + tare, gm	320.62		Wt. wet soil + tare, gm	890.99	
Wt. dry soil + tare, gm	295.23		Wt. dry soil + tare, gm	754.31	
Moisture Content, %	17.8%		Moisture Content, %	22.7%	
Dry Density, pcf	102.1		Dry Density, pcf	100.8	
Specific Gravity	2.65	Assumed	Specific Gravity	2.65	
Void Ratio	0.62		Void Ratio	0.64	
Saturation, %	76%		Saturation, %	94%	
Effective Stress, psi	10				



Manometer Constants:

$a_{annulus}$ = 0.76712 cm²

$a_{center\ pipette}$ = 0.03142 cm³

Initial Manometer Readings

Pipette = 22.0

Annulus = 0.85

Minutes	Seconds	Δt (sec)	Pipette (cm)	Annulus (cm)	Flowrate (cm³/s)	Gradient (i)	Hydraulic Conductivity (cm/sec)	Temp. °C	η_t temp. corr.	Hydraulic Conductivity (cm/sec) @20°C
0	0	0	22.0	0.85		29.64		23	0.931	
3	15	195	21.3	0.88	1.128E-04	28.09	9.67E-08	23	0.931	9.00E-08
10	13	418	20.5	0.91	6.013E-05	26.85	5.39E-08	23	0.931	5.02E-08
22	27	734	19.6	0.95	3.852E-05	25.47	3.64E-08	23	0.931	3.39E-08
32	20	593	19.1	0.97	2.649E-05	25.03	2.55E-08	23	0.931	2.37E-08
40	25	485	18.7	0.99	2.591E-05	24.52	2.54E-08	23	0.931	2.37E-08
51	12	647	18.2	1.01	2.428E-05	23.72	2.47E-08	23	0.931	2.30E-08
67	29	977	17.6	1.03	1.929E-05	22.77	2.04E-08	23	0.931	1.90E-08
						HYDRAULIC CONDUCTIVITY REPORTED AS				**2.23E-08** **cm/sec**

TECH:	MR	CHECKED:	JYC
DATE:	3/7/2022	DATE:	3/15/2022

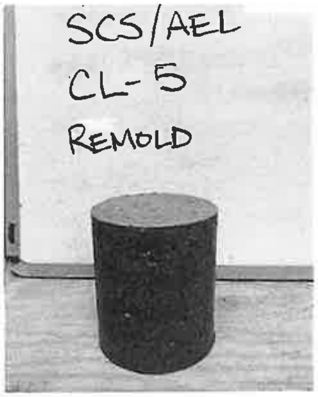
FLEXIBLE WALL TRIAXIAL PERMEABILITY

ASTM D 5084 METHOD F, CONSTANT VOLUME - FALLING HEAD

PROJECT TITLE: SCS/AEL
PROJECT NUMBER: 202206520
SAMPLE ID: CL-5 Remold
LIFT NUMBER:

Cell Pressure = 80 psi
Backwater Pressure = 70 psi
Run Number = 1
Permeant Used= De-Aired Water

Sample Data, Initial		centimeters	**Sample Data, Final**		centimeters
Height, in	3.549	9.01	Height, in	3.548	9.01
Top Diameter, mm	72.670		Top Diameter, mm	73.200	
Middle Diameter, mm	72.550		Middle Diameter, mm	73.330	
Bottom Diameter, mm	72.630		Bottom Diameter, mm	73.300	
Average Diameter, cm	7.262		Average Diameter, cm	7.328	
Area, cm²	41.42		Area, cm²	42.17	
Volume, cm³	373.34		Volume, cm³	380.05	
Wet Mass, g	715.82		Wet Mass, g	747.07	
Wt. tare, gm	151.26		Wt. tare, gm	151.25	
Wt. wet soil + tare, gm	329.32		Wt. wet soil + tare, gm	898.25	
Wt. dry soil + tare, gm	301.83		Wt. dry soil + tare, gm	763.14	
Moisture Content, %	18.3%		Moisture Content, %	22.1%	
Dry Density, pcf	101.2		Dry Density, pcf	100.5	
Specific Gravity	2.65	Assumed	Specific Gravity	2.65	
Void Ratio	0.63		Void Ratio	0.65	
Saturation, %	76%		Saturation, %	91%	
Effective Stress, psi	10				



Manometer Constants:

$a_{annulus}$ = 0.76712 cm²
$a_{center\ pipette}$ = 0.03142 cm³

Initial Manometer Readings

Pipette = 22.0
Annulus = 0.85

Minutes	Seconds	Δt (sec)	Pipette (cm)	Annulus (cm)	Flowrate (cm³/s)	Gradient (i)	Hydraulic Conductivity (cm/sec)	Temp °C	rt temp. corr.	Hydraulic Conductivity (cm/sec) @20°C
0	0	0	22.0	0.85		29.47		23	0.931	
4	13	253	20.5	0.91	1.863E-04	26.20	1.69E-07	23	0.931	1.57E-07
17	43	810	18.7	0.99	6.981E-05	23.36	7.09E-08	23	0.931	6.60E-08
27	50	607	17.8	1.02	4.658E-05	22.72	4.86E-08	23	0.931	4.53E-08
45	36	1066	16.7	1.07	3.242E-05	20.98	3.66E-08	23	0.931	3.41E-08
55	30	594	16.2	1.09	2.644E-05	20.70	3.03E-08	23	0.931	2.82E-08
66	35	665	15.7	1.11	2.362E-05	19.97	2.80E-08	23	0.931	2.61E-08
79	52	797	15.1	1.13	2.365E-05	19.03	2.95E-08	23	0.931	2.74E-08
92	12	740	14.6	1.15	2.123E-05	18.38	2.74E-08	23	0.931	2.55E-08

HYDRAULIC CONDUCTIVITY REPORTED AS 2.68E-08 cm/sec

TECH: MR
DATE: 3/7/2022

CHECKED: JYC
DATE: 3/15/2022

GOLDER
MEMBER OF WSP

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C

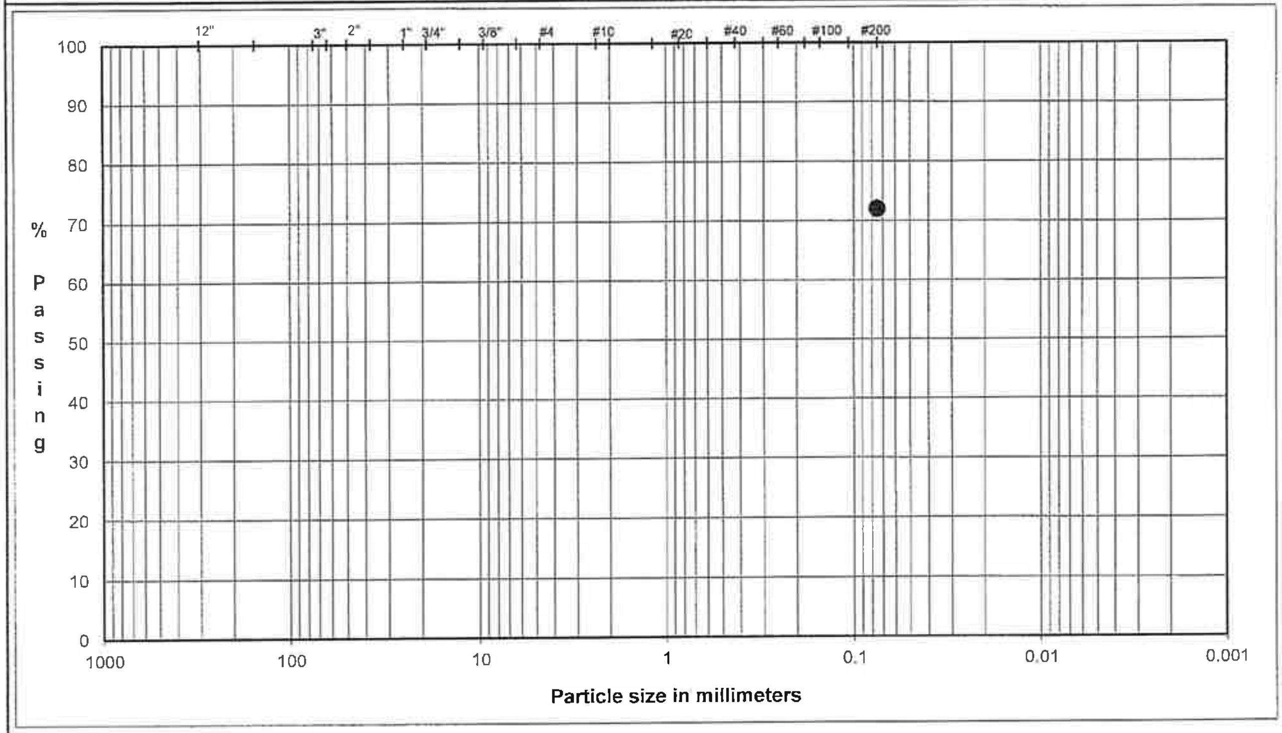
AUGUST 2012

123-90103

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

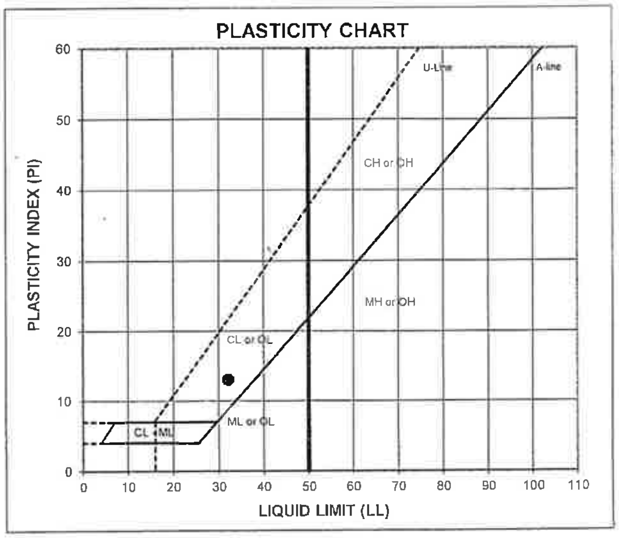
ASTM D421, D1140, D4318

PROJECT NAME:	AQUATERRA/AEL FINAL COVER CQA/OK
SAMPLE ID:	SG-1 -
Depth:	-
TYPE:	Bulk



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers	(mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8		Cobbles	
3.0"	75.0			
2.5"	63.5		Coarse Gravel	
2.0"	50.0			
1.5"	37.5			
1.0"	25.0			
0.75"	19.0			
0.50"	12.7		Fine Gravel	
0.375"	9.5			
#4	4.8			
#10	2.00		Coarse Sand	
#20	0.85		Medium Sand	
#40	0.43			
#60	0.25		Fine Sand	
#100	0.15			
#200	0.075	72.0		
			Fines	72.0



DESCRIPTION: Gray, (Shale) SILTY CLAY, some medium to fine sand.

USCS: CL

ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
3.9	32	19	13	-1.12

LL (oven-dried)	
< 0.75 = ORGANIC (OL/OH)	

TECH	TJ
DATE	8/16/12
CHECK	
REVIEW	
APPROVE	

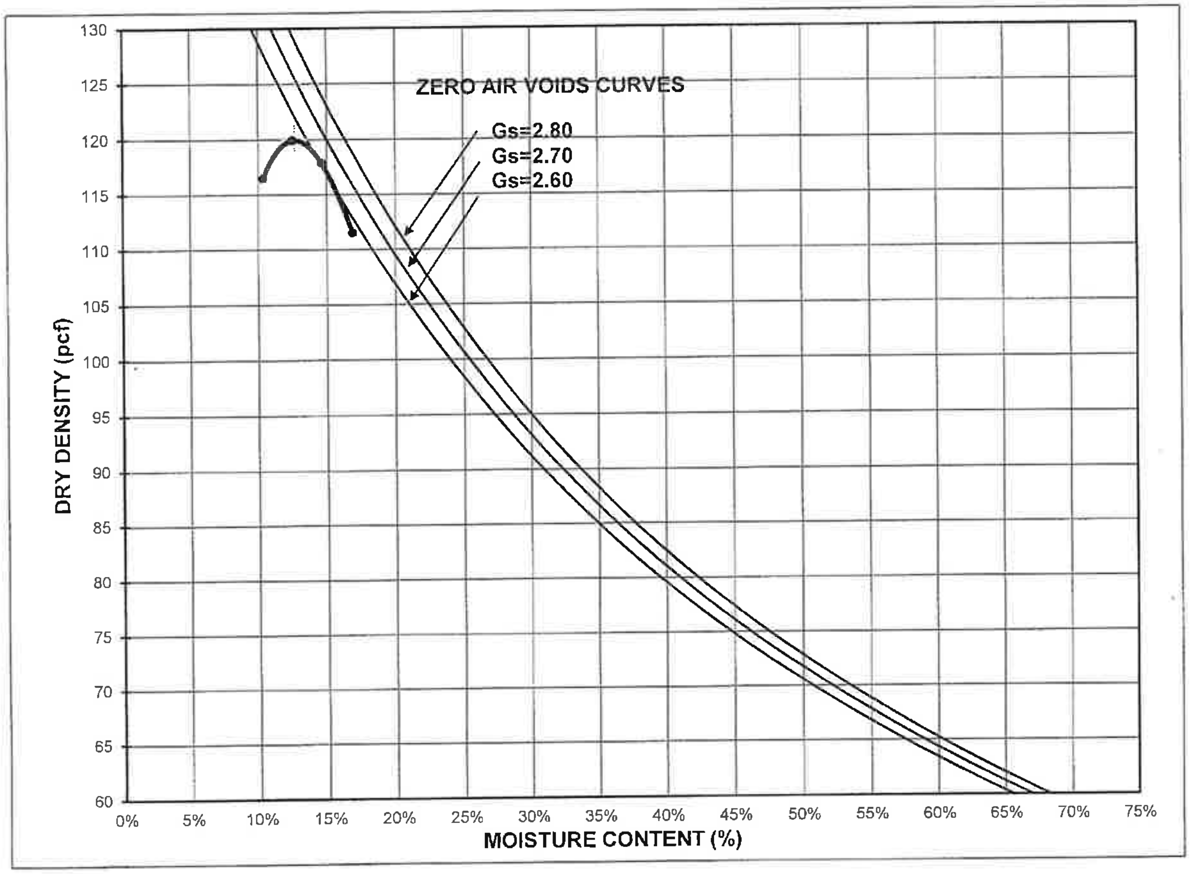
NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

Golder Associates Inc.

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: AQUATERRA/AEL FINAL COVER CQA/OK
PROJECT NUMBER: 123-90103
SAMPLE ID: SG-1 - DEPTH: - SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	116.5	10.4%
2	119.9	12.5%
3	117.8	14.6%
4	111.5	16.8%

Maximum Dry Density (pcf)	120.0
Optimum Moisture (%)	12.7
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	

As-Received Moisture Content 3.9%

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION Gray, (Shale) SILTY CLAY, some medium to fine sand.

USCS CL

CHECK	
REVIEW	
APPROVE	

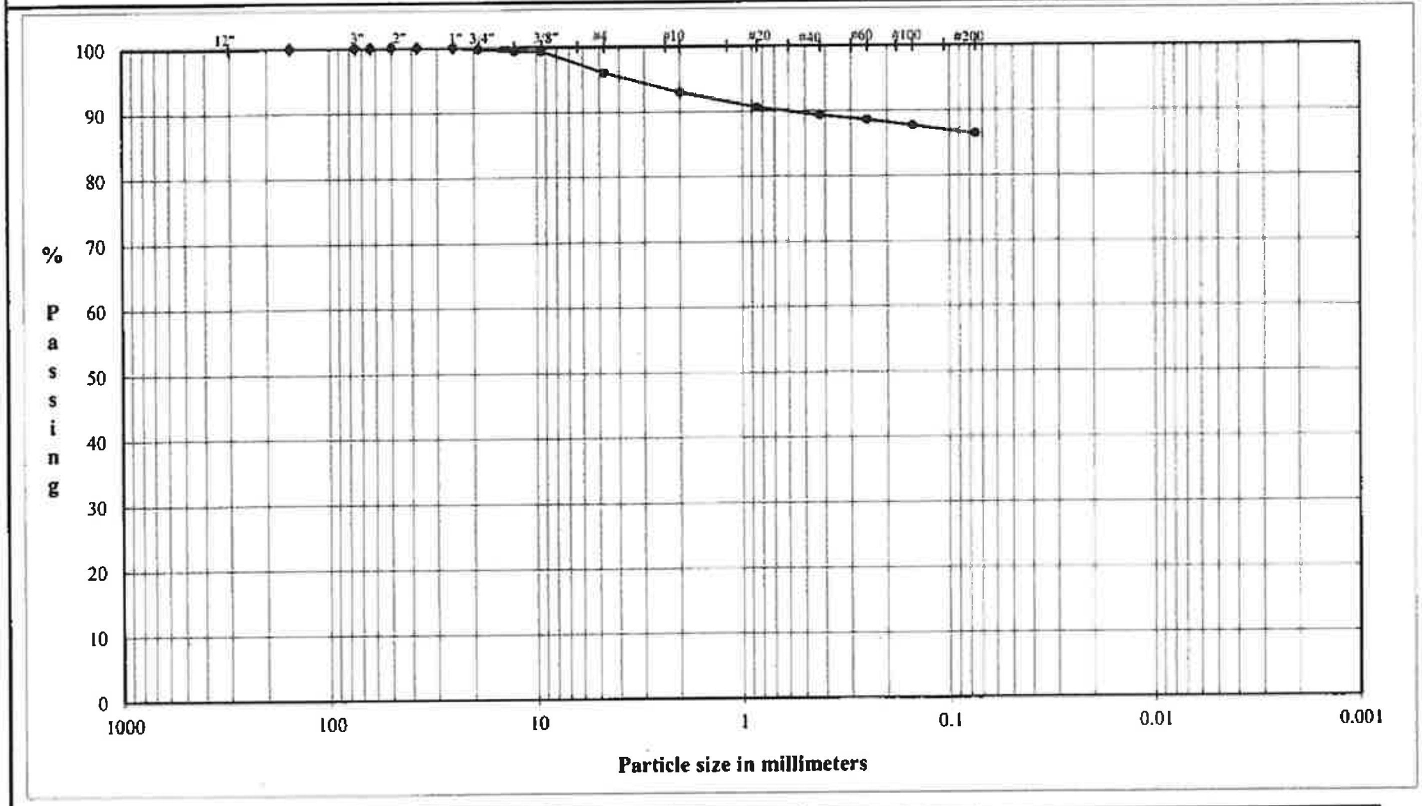
D

NOVEMBER 2023 **SCS**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913 & D4318

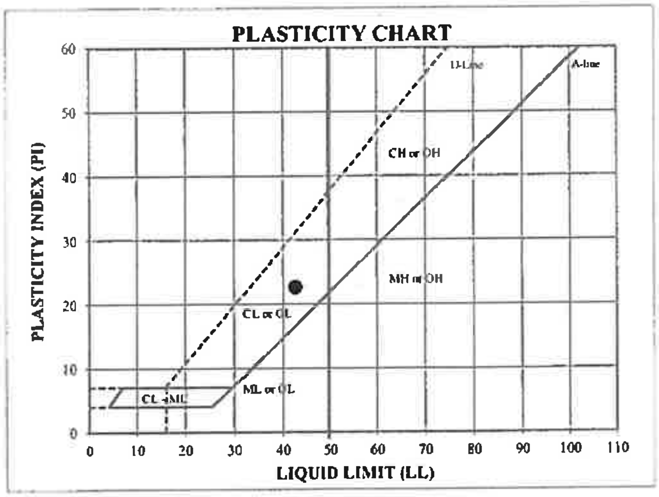
PROJECT NAME: **SCS/AEL - SAND SPRINGS/OK**
SAMPLE ID: **CL-1** - Depth: -
TYPE: **Bulk**



COBBLES	GRAVEL Coarse	GRAVEL Fine	SAND Coarse	SAND Medium	SAND Fine	FINES Silt or Clay

U.S. Standard Sieves Sizes and Numbers	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
6.0"	154.2	100.0	Cobbles	0.0
3.0"	75.0	100.0		
2.5"	63.5	100.0	Coarse Gravel	0.2
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	99.8		
0.50"	12.7	99.5	Fine Gravel	3.8
0.375"	9.5	99.4		
#4	4.8	96.0		
#10	2.0	93.0	Coarse Sand	3.1
#20	0.85	90.6	Medium Sand	3.6
#40	0.43	89.4		
#60	0.25	88.6	Fine Sand	2.9
#100	0.15	87.7		
#200	0.075	86.4		
			Fines	86.4

PLASTICITY CHART



ATTERBERG LIMITS

Method - B (Dry preparation)

M_c	LL	PL	PI	LI
12.8	43	20	23	-0.32

LL (oven-dried)	
<0.75 = ORGANIC (OL OH)	

DESCRIPTION: SILTY CLAY, some fine to coarse sand, trace fine to coarse gravel; olive brown.

USCS: CL

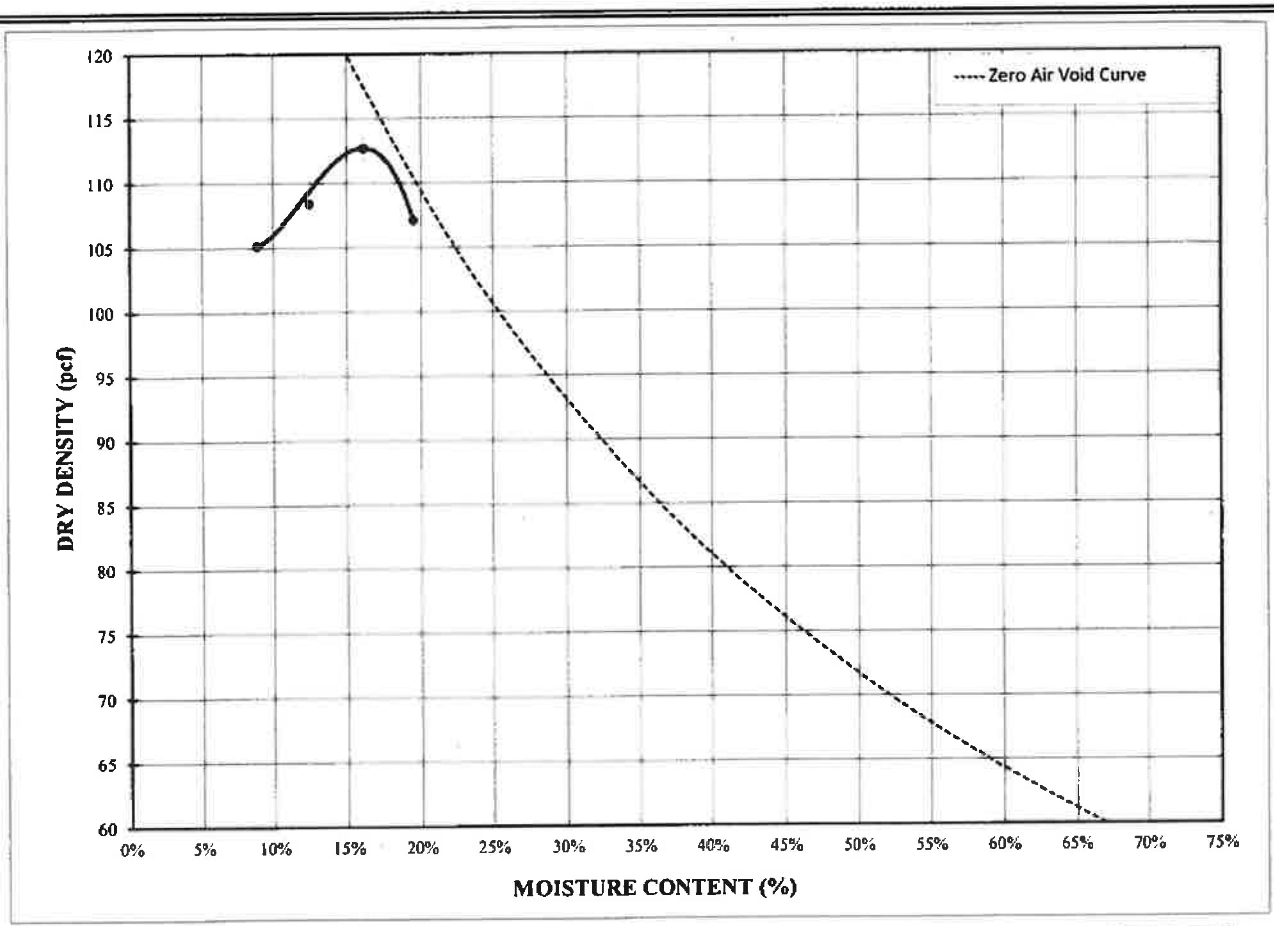
TECH	JC
DATE	11/9/23
CHECK	DA
REVIEW	
APPROVE	

NOVEMBER 2023 **SCS**

MOISTURE / DRY DENSITY CURVE
ASTM D698 Method B

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL - SAND SPRINGS/OK**
PROJECT NUMBER: **SCS**
SAMPLE ID: **CL-1** DEPTH: **-** SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	105.1	8.9%
2	108.4	12.5%
3	112.7	16.1%
4	107.1	19.5%

Maximum Dry Density (pcf)	112.7
Optimum Moisture (%)	16.1
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	12.8%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	0.6%
% Retained on 3/4" sieve	
Specific Gravity (assumed)	2.7

DESCRIPTION SILTY CLAY, some fine to coarse sand, trace fine to coarse gravel; olive brown.

USCS CL

CHECK	DA
REVIEW	
APPROVE	

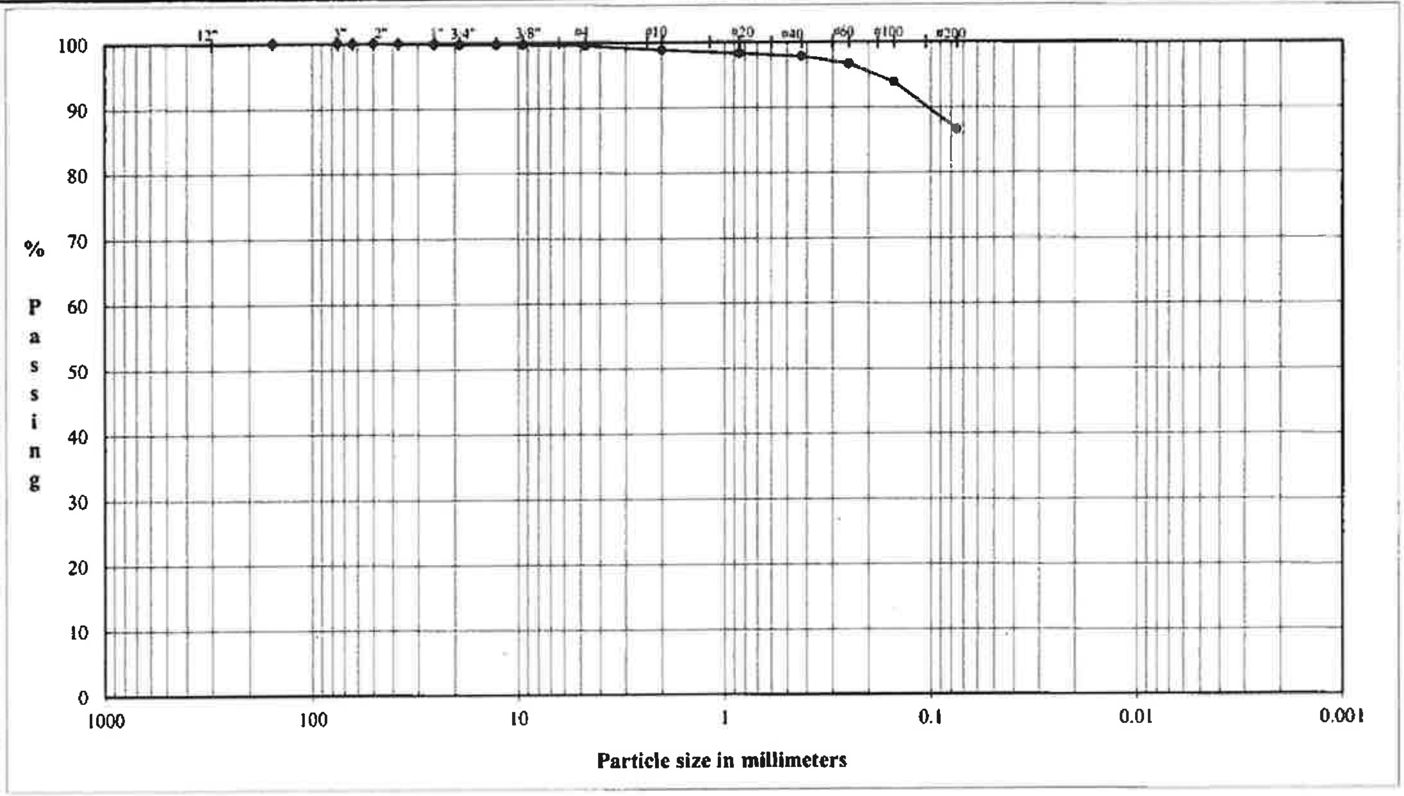
E

NOVEMBER 2023 **SCS**

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913 & D4318

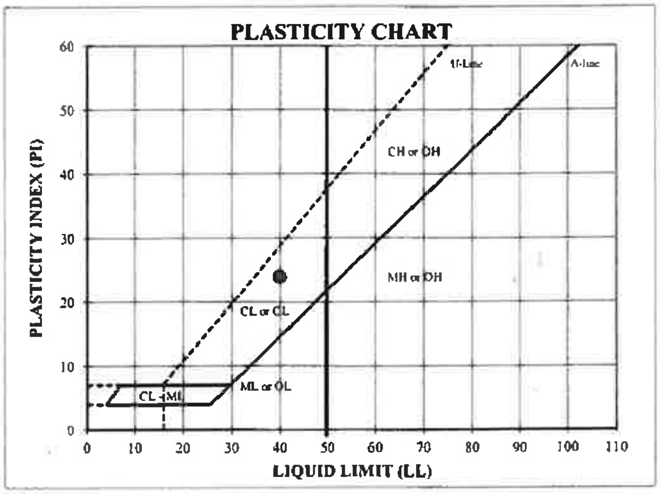
PROJECT NAME: **SCS/AEL - SAND SPRINGS/OK**
SAMPLE ID: **GF-1** - Depth: -
TYPE: **Bulk**



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
6.0"	154.2	100.0	Cobbles	0.0
3.0"	75.0	100.0		
2.5"	63.5	100.0	Coarse Gravel	0.2
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	99.8		
0.75"	19.0	99.8		
0.50"	12.7	99.7	Fine Gravel	0.2
0.375"	9.5	99.7		
#4	4.8	99.5		
#10	2.0	98.9	Coarse Sand	0.7
#20	0.85	98.3	Medium Sand	1.1
#40	0.43	97.8		
#60	0.25	96.6	Fine Sand	11.2
#100	0.15	93.8		
#200	0.075	86.6		
			Fines	86.6



ATTERBERG LIMITS

Method - B (Dry preparation)

M_c	LL	PL	PI	LI
11.7	40	16	24	-0.16

DESCRIPTION: sandy SILTY CLAY, fine to coarse sand, trace fine to coarse gravel; reddish brown.

USCS: CL

LL (oven-dried)	
< 0.75 = ORGANIC (OL OH)	

TECH	JC
DATE	11/8/23
CHECK	DA
REVIEW	
APPROVE	

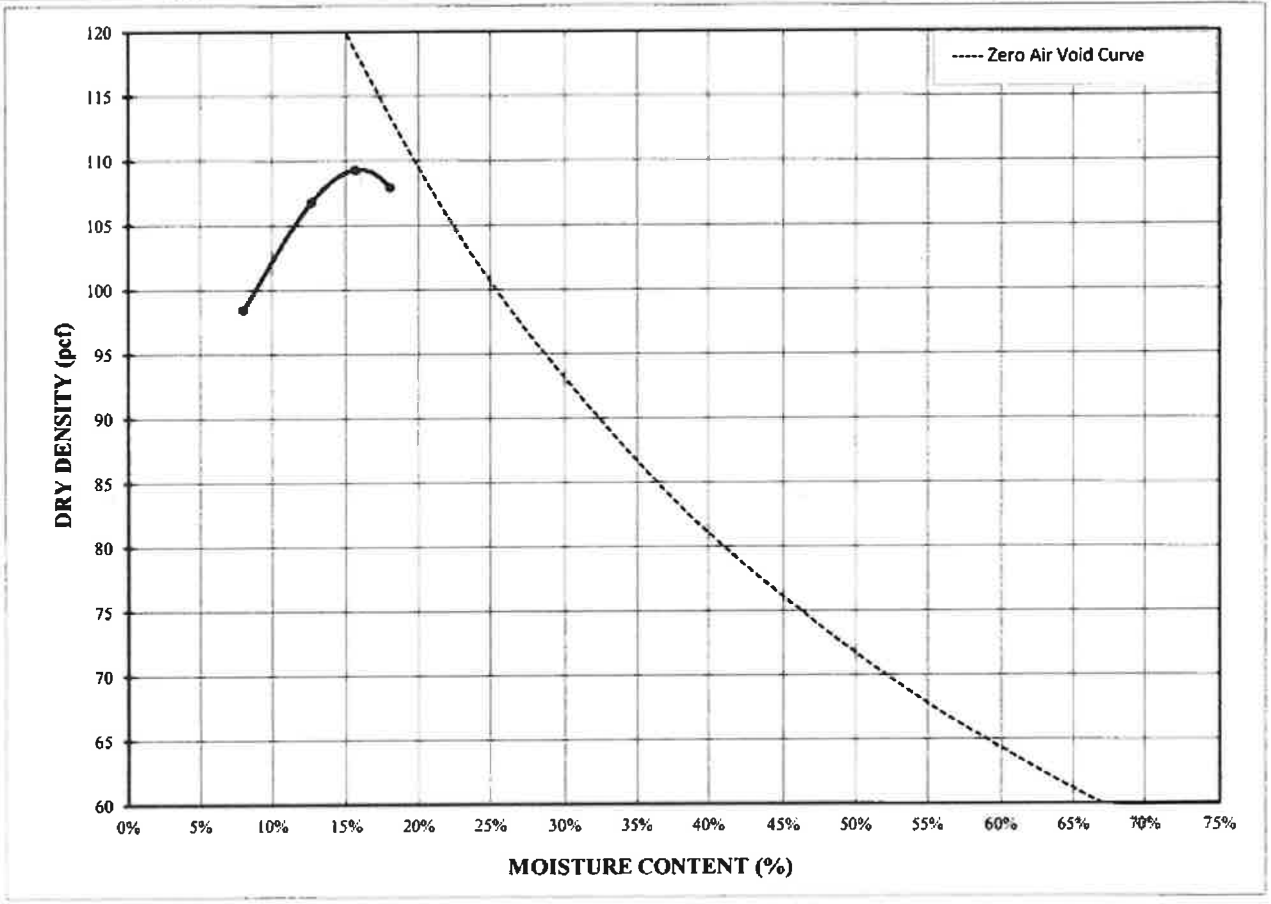
WSP USA

NOVEMBER 2023 **SCS**

MOISTURE / DRY DENSITY CURVE
ASTM D698 Method B

Mechanical	Standard	Dry Method

PROJECT NAME: **SCS/AEL - SAND SPRINGS/OK**
PROJECT NUMBER: **SCS**
SAMPLE ID: **GF-1** DEPTH: **-** SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	98.4	8.0%
2	106.8	12.7%
3	109.3	15.7%
4	107.9	18.0%

Maximum Dry Density (pcf)	109.3
Optimum Moisture (%)	16.0
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	11.7%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	0.3%
% Retained on 3/4" sieve	
Specific Gravity (assumed)	2.7

DESCRIPTION sandy SILTY CLAY, fine to coarse sand, trace fine to coarse gravel; reddish brown.

USCS CL

CHECK	DA
REVIEW	
APPROVE	

Determination of break points among three Mohr Coulomb Envelopes

1 - Primary Liner (Floor)

version jfh v5a WGI Bottom Liner (DSS HDPE Top) (Peak)

Peak Strengths

	Upper	Lower	Strength Type	δ	α	Tanδ
A	GDL	NW-NP GT	Peak	33.0 deg	0 psf	0.649
B	NW-NP GT	DSS HDPE FML (40 Mil)		11.0 deg	0 psf	0.194
C	DSS HDPE FML (40 Mil)	Recompacted Clay Layer (RCL) Cover (CL)		22.0 deg	0 psf	0.404

	σ	τ_A	τ_B	τ_C	τ_{MIN}
	0.0 psf	0.0 psf	000.0E+00 psf	000.0E+00 psf	000.0E+00 psf
1	0 psf	0.0 psf	000.0E+00 psf	000.0E+00 psf	000.0E+00 psf
2	#N/A	#N/A	#N/A	#N/A	#N/A
3	#N/A	#N/A	#N/A	#N/A	#N/A
4	10000 psf	6494.1 psf	1.9E+03 psf	4.0E+03 psf	1.9E+03 psf
5	10000 psf	6494.1 psf	1.9E+03 psf	4.0E+03 psf	1.9E+03 psf

Bilinear Envelope

	σ	$\tau_{Bilinear}$
1	-15000 psf	-9741 psf
2	0 psf	0 psf
3	625 psf	121 psf
4	1250 psf	243 psf
5	2500 psf	486 psf
6	5000 psf	972 psf
7	7500 psf	1458 psf
8	10000 psf	1944 psf

Break Even Points

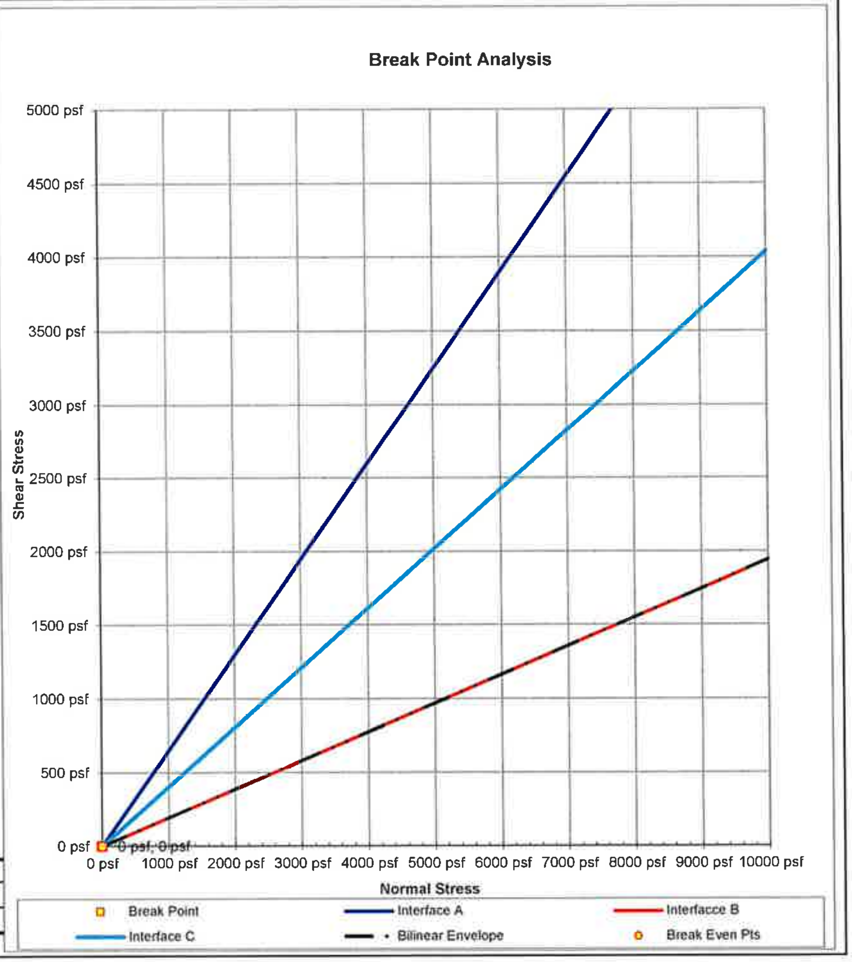
	Combo	σ_a	τ_a
1	A and C		
2	#N/A	#N/A	#N/A
3	#N/A	#N/A	#N/A

Determination of secant* value on 'multi' linear case

Critical σ_a= ☐ α= ☐

Critical τ_a= δ_1=

*Secant value above the minimum adhesion (α_{min}) δ_2=



Determination of break points among three Mohr Coulomb Envelopes

2 - Primary Liner (Side-Slope) (Construction Phase)

version jfh v5a WGI Cover Liner (DST HDPE Top) (Peak)

Peak Strengths

	Upper	Lower	Strength Type	δ	α	Tanδ
A	Gran Drain Layer (GDL)	NW-NP GT	Peak	33.0 deg	0 psf	0.649
B	NW-NP GT	DST HDPE FML (60 Mil)		25.0 deg	167 psf	0.466
C	DST HDPE FML (60 Mil)	CCL		19.0 deg	480 psf	0.344

	σ	τ_A	τ_B	τ_C	τ_{MIN}
	0.0 psf	0.0 psf	167.0E+00 psf	480.4E+00 psf	000.0E+00 psf
1	912 psf	592.3 psf	592.3E+00 psf	794.4E+00 psf	592.3E+00 psf
2	1575 psf	1022.5 psf	901.2E+00 psf	1.0E+03 psf	901.2E+00 psf
3	2569 psf	1668.3 psf	1.4E+03 psf	1.4E+03 psf	1.4E+03 psf
4	10000 psf	6494.1 psf	4.8E+03 psf	3.9E+03 psf	3.9E+03 psf
5	10000 psf	6494.1 psf	4.8E+03 psf	3.9E+03 psf	3.9E+03 psf

Bilinear Envelope

	σ	$\tau_{Bilinear}$
1	-15000 psf	-9741 psf
2	0 psf	0 psf
3	625 psf	406 psf
4	1250 psf	750 psf
5	2500 psf	1333 psf
6	5000 psf	2202 psf
7	7500 psf	3063 psf
8	10000 psf	3924 psf

Break Even Points

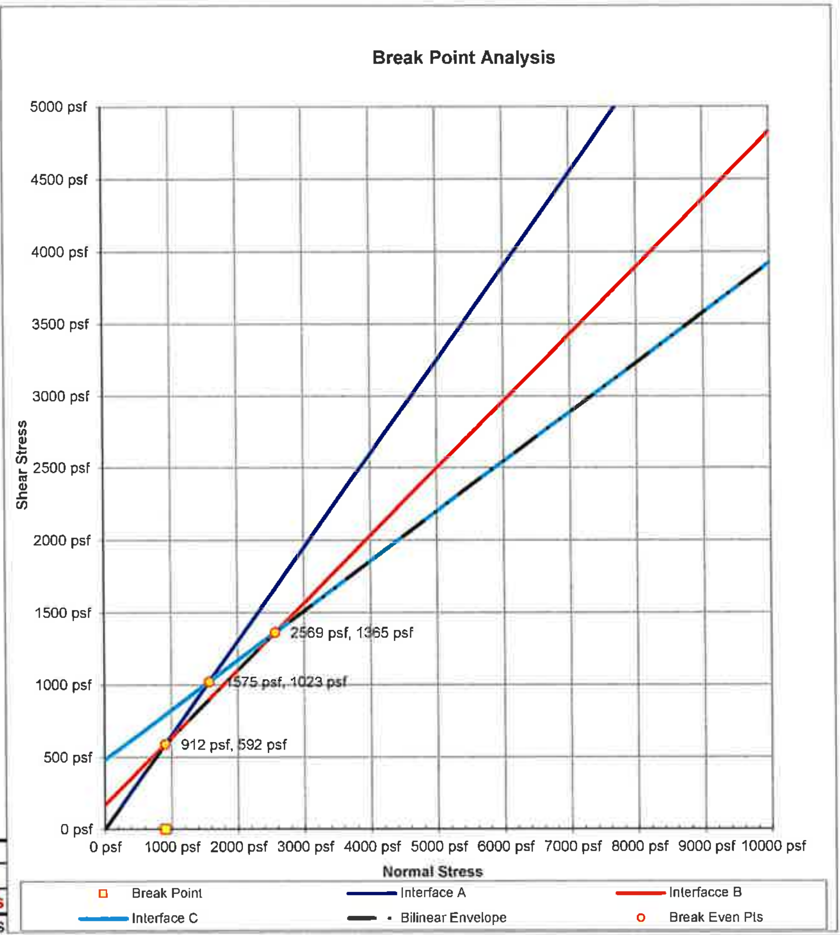
	Combo	σ_a	τ_a
1	A and B	912.1	592.3
2	A and C	1574.6	1022.5
3	B and C	2569.0	1364.9

Determination of secant* value on 'multi' linear case

Critical σ_a= 2,569.0 psf α= 0.0 psf

Critical τ_a= 1,364.9 psf δ_1= 27.98 degs

*Secant value above the minimum adhesion (α_{min}) δ_2= 19.0 degs



Determination of break points among three Mohr Coulomb Envelopes

3 - Primary Liner (Side Slope) w Compacted Clay Liner (CCL) (Working ad Post Closure Phases)

version jfh v5a

Residual Strengths

	Upper	Lower	Strength Type	δ	α	Tanδ
A	Gran Drain Layer (GDL)	NW-NP GT	Residual	33.0 deg	0 psf	0.649
B	NW-NP GT	DST HDPE FML (60 Mil)		17.0 deg	0 psf	0.306
C	DST HDPE FML (60 Mil)	CCL		22.0 deg	0 psf	0.404

	σ	τ_A	τ_B	τ_C	τ_{MIN}
	0.0 psf	0.0 psf	000.0E+00 psf	000.0E+00 psf	000.0E+00 psf
1	0 psf	0.0 psf	000.0E+00 psf	000.0E+00 psf	000.0E+00 psf
2	#N/A	#N/A	#N/A	#N/A	#N/A
3	#N/A	#N/A	#N/A	#N/A	#N/A
4	10000 psf	6494.1 psf	3.1E+03 psf	4.0E+03 psf	3.1E+03 psf
5	10000 psf	6494.1 psf	3.1E+03 psf	4.0E+03 psf	3.1E+03 psf

Bilinear Envelope

	σ	$\tau_{Bilinear}$
1	-50000 psf	-32470 psf
2	0 psf	0 psf
3	625 psf	191 psf
4	1250 psf	382 psf
5	2500 psf	764 psf
6	5000 psf	1529 psf
7	7500 psf	2293 psf
8	10000 psf	3057 psf

Break Even Points

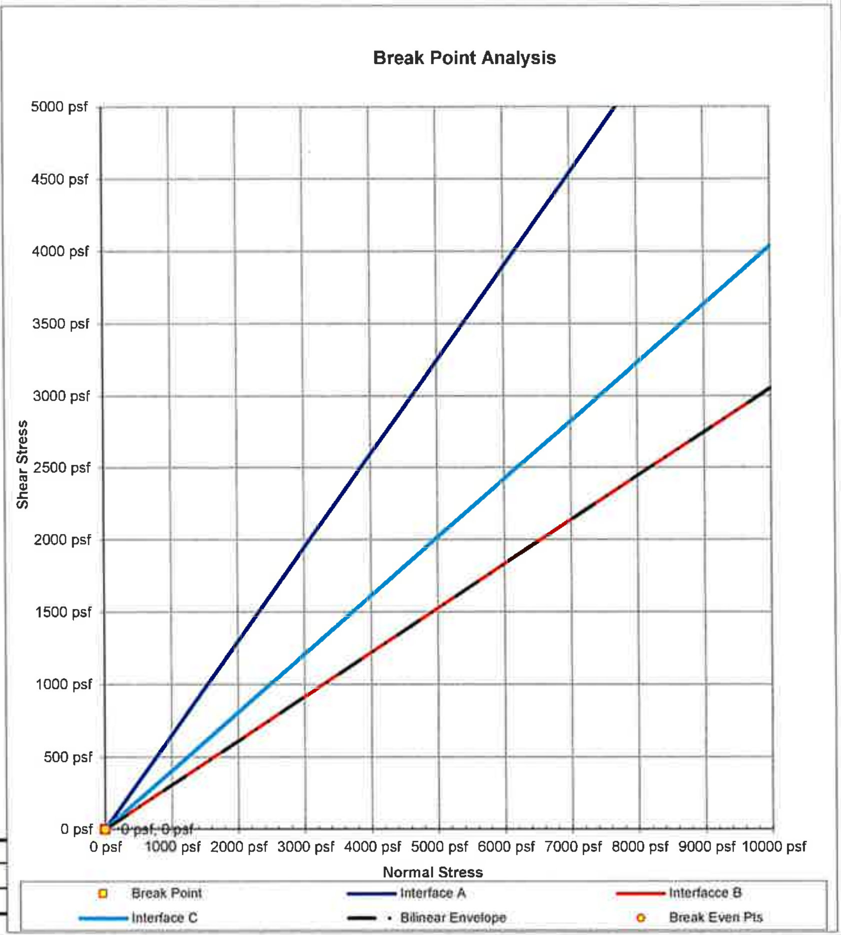
	Combo	σ_a	τ_a
1	A and C		
2	#N/A	#N/A	#N/A
3	#N/A	#N/A	#N/A

Determination of secant* value on 'multi' linear case

Critical σ_a= α=

Critical τ_a= δ_1=

*Secant value above the minimum adhesion (α_{min}) δ_2=



LINER ANCHOR TRENCH AND SLOPE STABILITY FOR AMERICAN ENVIRONMENTAL LANDFILL TIER 1 PERMIT MODIFICATION – PHASE IVA

Aquaterra Project Number 4926.10

DECEMBER 2011

Prepared For:

American Environmental Landfill
212 North 177th West Avenue
Sand Springs, OK 74063

footprint width of each terrace is 24 feet over a 9-foot vertical fall on the 4H to 1V sideslope. One of these terraces was modeled at near the mid-slope on each post closure sideslope. These analyses are labeled Case 5 as noted above.

The location and extent of Profile West – East is depicted on a plan sheet in Attachment J-2 – Supporting Information, for reference, while the results of each critical slope stability analysis based on the above referenced cases are shown in Attachment J-1, Model Runs.

2.2 Material Properties

The material properties used as input into the slope stability analysis are summarized below in Table 1. The underlying stratigraphy consists of lean silt and clay residual soils which extends from ground surface to depths of a few feet to as much as 30 ft below ground surface (bgs). Beneath the residual lean silt and clay soils brown moderately weathered shale is typically encountered that typically grades into unweathered gray shale at depth. The shale bedrock extended to 220 ft bgs in B-7A which is located at the eastern end of Profile A-A'. Occasional seams of limestone were interspersed at depth in the borings performed along the profile (B-13, B-4B, B-11A and B-7A) and for the purpose of modeling, the uppermost limestone layer was assumed to represent the lower limit of slip surface stability analysis and the modeling default "strength" of impenetrability was assigned as bedrock at this interface and below.

The boring logs used to develop the stratigraphic profiles beneath the critical west to east profile as noted in the prior paragraph were B-13, B-4B, B-11A, and B-7A, dated Dec 2001 by Cardinal Environmental and June 2011 by Aquaterra Environmental Solutions. These boring logs have been copied and included in Attachment 3 – References. The projected locations of each of these borings are presented on each model profile for ease of reference (Attachment 1 – Model Runs).

Aquaterra assigned material strengths to the stratigraphic regions developed in the critical profiles that reflect the geometric configuration of the landfill waste containment structures (primary and cover liner sequences, waste mass, and underlying foundational soils). The soils native to the site were assigned strength values based on previously performed field and geotechnical laboratory testing results. The cohesion of the brown and gray shale present at the site were developed from undisturbed test pit samples obtained by Aquaterra staff from nearby exposed bedrock slopes elsewhere on site. The remaining material constituents were assigned strength values based on published technical literature. The material properties employed in the modeling scenarios are shown below in tabular form.

Material	Density	Cohesion (c)	ϕ	Reference (Attachment J-3)
	pcf	psf	Degrees	
Limestone *(acts as Bedrock)*	Impenetrable			*Slope W^{TM} 2004 default values*
Sandstone	140	10000	0	Ref[5]
Gray Shale	145.5	12230	0	Ref[6]
Brown Shale	139.3	13023	0	Ref [6]
Stiff Silty Clay (CL) (compacted subgrade)	131	1600	23.7	Ref[7],[8]&[9]
Compacted Clay Liner (CCL) (CL)	131	1600	22.9	Ref [7]
Clay (Cover –CCL)	131	240	28	Ref [7]
Granular Drainage Layer (SW)	143.6	0	37	Ref [7]
WGL - Liner Floor	131	167	25 / 19 @ 2607psf	Ref [8]
Weak Geosynthetic Layer (WGL)-Liner Sideslope	131	0	17	Ref[10]
Stiff Silty Clay (CL) (native undisturbed subgrade)	131	240	23.7	Ref [7]
Solid Waste	65	522	35	Ref [11]
Silty Clay (Intermediate Cover) (CL)	131	240	23.7	Ref [7]
Silty Clay (Vegetative Layer) (CL)	131	240	23.7	Ref [7]
Silty Clay (Vegetative Layer) (CL)	131	240	23.7	Ref [7]

Material Properties-

Soil Properties – Aquaterra used available boring log and testing data to estimate the strength and unit weight properties of the native or recompacted soil materials used to construct the waste containment envelope. The sources of these values are noted in the footnoted references in the above table. Site specific data (PSI (1994)) were used where

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[5] Day, R.W., Geotechnical Engineering Portable Handbook, McGraw Hill, 2000, pp

[6] Alpha Omega Geotech, Inc. Unconfined Strength Data for Brown and Gray Shale, AES Project # 4926.10, for AEPI Landfill. 30 Sept 2011.

[7] Haung, Y.H., Stability Analysis of Earth Slopes, Univ of Kentucky, Van Nostrand Reinhold Co., New York, 1983, pp 305.

[8] Stark, T.D., Choi, H., McCone, S., "Drained Shear Strength Parameters for Analysis of Landslides", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, May 2005.

[9] "Atterberg Limit and Moisture Density Data Summary", Golder Associates and Terracon Consultants, Feb 2009.

[10] Koerner, G.R. and Narejo, D., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces", Geosynthetic Research Institute, GRI Report #30, Folsom, PA, April 2005.

[11] Eid, H.D., Stark, T.S., Evans, W.D. and Sherry, P.E., "Municipal Solid Waste Slope Failure. I: Waste and Foundation Soil Properties", Journal of Geotechnical and Geoenvironmental Engineering, May 2000, pg. 405.

SCS AQUATERRA

Slope Stability Analysis for American Environmental Landfill Tier 1 Permit Modification – Phase IVB

Presented to:

American Environmental Landfill

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March 2014
File No. 27213780.10

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2.3 MATERIAL PROPERTIES

The material properties used as input into the slope stability analysis are summarized below in Table 1. AES 2011 provided a detailed discussion of the rationale for assigning material properties to the various stratigraphic units and the landfill components. The reader will note that this evaluation contains considerably more detail on the structure of the bedrock that forms the post closure embankment at the east end of the cell. This detail was obtained as a result of additional borings (Core – 1 through Core – 4) performed in the area to depths of up to 150 feet below ground surface (see Boring Location Map Drawing 1 in Attachment 2).

Bedrock properties - Bedrock joint shear strength testing (Samples 2 and 3 in Attachment 2) performed to evaluate the nature of the bedding joints located beneath area limestone layers as these joints tended to be saturated and as such created planes of weakness that tend to govern the lateral stability of the mass. The worst case saturated shear strength of the weathered shale obtained from these borings was assigned to a series of joints estimated at depth in the eastern rock slope. The anisotropic shear strengths for the more massive and blocky bedrock units (limestone, sandstone, and un-weathered shale) were estimated based on rock core samples so as to replicate vertical rock face spalling observed at the site.

Table 1. Material Properties

Material	Density	Cohesion (c)	ϕ	Reference
	pcf	psf	Degrees	
Impenetrable	Impenetrable			*Slope W^{TM} 2004 default values*
Limestone	150	2000 (H) 250 (V)	15 (H) 9 (V)	Core samples and field observation
Sandstone	140			
Gray Shale (Sound)	145.5	5000 (H) 240 (V)	15 (H) 9 (V)	
Brown Shale (Sound)	139.3	13023	0	Ref^4
Brown Shale (Weathered)	139.3	5000 (H) 240 (V)	15 (H) 9 (V)	Core samples and field observations
Shale Joint 1	145.5	240	11.5	
Shale Joint 1 (2)	145.5	200	14	Ref^5
Shale Joint 1 (3) & (4)	145.5	180	17.5	
Compacted Clay Liner (CCL) (CL)	131	1600	22.9	Ref$^{6,7\&8}$
Silty Clay	131	50	23.7	Ref ^{7}

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[4] Alpha Omega Geotech, Inc. Unconfined Strength Data for Brown and Gray Shale, AES Project #4926.10 for AEPI Landfill. 30 Sept 2011.

[5] Alpha Omega Geotech, Inc. AEL Shale Interface Testing, AOG # 13-182T, Samples #1, 2 and 3.

[6] Haung, Y.H., Stability Analysis of Earth Slopes, University of Kentucky, Van Nostrand Reinhold Co., New York, 1983, pp 305.

[7] Stark, T.D., Choi, H., McCone, S., "Drained Shear Strength Parameters for Analysis of Landslides", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, May 2005.

[8] "Atterberg Limit and Moisture Density Data Summary", Golder Associates and Terracon Consultants, Feb 2009.

Stiff Silty Clay (Compacted Subgrade)	131	1600	23.7	Ref[7]
Clay	131	240	23.7	Ref[7]
Granular Drainage Layer (SW)	143.6	0	37	Ref[7]
Weak Geosynthetic Layer (WGL) - Liner Floor	131	0	11	Ref[9]
WGL – Liner Side Slope (construction)	131	167	25 / 19 @ 2607psf	Ref[9]
WGL - Liner Side Slope (post closure)	131	0	17	Ref[9]
Stiff Silty Clay (CL) (native undisturbed subgrade)	131	240	23.7	Ref[7]
Municipal Solid Waste	65	500	35	Ref[10]
Intermediate Soil Cover	131	240	23.7	Ref[7]
Cover CCL	131	240	28	Ref[7]
Vegetative Cover Soil	131	240	23.7	Ref[7]

Soil properties - As noted in our AES 2011 report, we used available boring log and testing data to estimate the strength and unit weight properties of the native or recompacted soil materials used to construct the waste containment envelope. The sources of these values are noted in the footnoted references in the above table. Site specific data (PSI (1994)) were used where possible. When insufficient site specific data were available, the design engineer used the most conservative values reported by Haung (1983). In the case of unit weight, the highest wet unit weight in the range was calculated to provide a conservative driving force. With strength parameters, (ϕ and c) the low end of the reported range was used to reduce the resisting forces along the critical slip surface. The pertinent portions of these references have been provided for informational purposes.

Geosynthetic Interface Strength properties – SCS Aquaterra performed a literature evaluation to determine the weakest geo-synthetic layer (WGL) interface strength (adhesion or cohesion, designated as α or c below and internal or interface friction angle, ϕ or δ) of the permitted primary and cover liner geosynthetic sequences. The interface strengths of the primary liner and cover liner sequences were assigned based on an evaluation of the individual interface contact strengths as developed using soil strengths of adjoining layers from the references noted above for the pertinent ϕ and c (cohesion). Soil to geosynthetic and geosynthetic to geosynthetic contact strengths were developed using Koerner and Narejo (2005). The strengths of each contact are shown in the following table for each liner configuration. Two separate liner configurations were considered for the primary liner (Sideslope and floor or bottom). Residual (or large displacement) strengths were used for the primary liner sideslope post closure configuration as this portion of the liner could experience displacement caused by settling waste whose down slope movement could translate across the protective soil onto the geosynthetic sequence. Although this is a remote

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[9] Koerner, G.R. and Narejo, D., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces", Geosynthetic Research Institute, GRI Report #30, Folsom, PA, April 2005.

[10] Eid, H.D., Stark, T.S., Evans, W.D. and Sherry, P.E., "Municipal Solid Waste Slope Failure. I: Waste and Foundation Soil Properties", Journal of Geotechnical and Geoenvironmental Engineering, May 2000, pg. 405.

American Environmental Landfill
Phase IV Slope Stability Analysis

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2.3 MATERIAL PROPERTIES

The material properties used as input into the slope stability analysis are summarized below in Table 1. AES 2011 provided a detailed discussion of the rationale for assigning material properties to the various stratigraphic units and the landfill components. The reader will note that this evaluation contains considerably more detail on the structure of the bedrock that forms the post closure embankment at the east end of the cell. This detail was obtained as a result of additional borings (Core – 1 through Core – 4) performed in the area to depths of up to 150 feet below ground surface (see Boring Location Map Drawing 1 in Attachment 2).

Bedrock properties - Bedrock joint shear strength testing (Samples 2 and 3 in Attachment 2) performed to evaluate the nature of the bedding joints located beneath area limestone layers as these joints tended to be saturated and as such created planes of weakness that tend to govern the lateral stability of the mass. The worst case saturated shear strength of the weathered shale obtained from these borings was assigned to a series of joints estimated at depth in the eastern rock slope. The anisotropic shear strengths for the more massive and blocky bedrock units (limestone, sandstone, and un-weathered shale) were estimated based on rock core samples so as to replicate vertical rock face spalling observed at the site.

Table 1. Material Properties

Material	Density	Cohesion (c)	ϕ	Reference
	pcf	psf	Degrees	
Impenetrable	Impenetrable			*Slope W™ 2004 default values*
Limestone	150	2000 (H) 250 (V)	15 (H) 9 (V)	Core samples and field observation
Sandstone	140			
Gray Shale (Sound)	145.5	5000 (H) 240 (V)	15 (H) 9 (V)	
Brown Shale (Sound)	139.3	13023	0	Ref[5]
Brown Shale (Weathered)	139.3	5000 (H) 240 (V)	15 (H) 9 (V)	Core samples and field observations
Shale Joint 1	145.5	240	11.5	
Shale Joint 1 (2)	145.5	200	14	Ref[6]
Shale Joint 1 (3) & (4)	145.5	180	17.5	
Compacted Clay Liner (CCL) (CL)	131	1600	22.9	Ref[7],[8]&[9]
Silty Clay	131	50	23.7	Ref [7]

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5 Alpha Omega Geotech, Inc. Unconfined Strength Data for Brown and Gray Shale, AES Project #4926.10 for American Environmental Landfill. 30 Sept 2011.

6 Alpha Omega Geotech, Inc. AEL Shale Interface Testing, AOG # 13-182T, Samples #1, 2 and 3.

7 Haung, Y.H., Stability Analysis of Earth Slopes, University of Kentucky, Van Nostrand Reinhold Co., New York, 1983, pp 305.

8 Stark, T.D., Choi, H., McCone, S., "Drained Shear Strength Parameters for Analysis of Landslides", Journal of Geotechnical and Geoenvironmental Engineering, ASCE, May 2005.

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Clay	131	240	23.7	Ref [7]
Granular Drainage Layer (SW)	143.6	0	37	Ref [7]
Weak Geosynthetic Layer (WGL) - Liner Floor	131	0	11	Ref [9]
WGL – Liner Side Slope (construction)	131	167	25 / 19 @ 2607psf	Ref [9]
WGL - Liner Side Slope (post closure)	131	0	17	Ref [10]
Stiff Silty Clay (CL) (native undisturbed subgrade)	131	240	23.7	Ref [7]
Municipal Solid Waste	65	500	35	Ref [11]
Intermediate Soil Cover (CL)	131	240	23.7	Ref [7]
Cover Vegetative Support Layer (CL)	131	240	28	Ref [7]
Vegetative Cover Soil (CL)	131	240	23.7	Ref [7]

Soil properties - As noted in our AES 2011 report, we used available boring log and testing data to estimate the strength and unit weight properties of the native or recompacted soil materials used to construct the waste containment envelope. The sources of these values are noted in the footnoted references in the above table. Site specific data (PSI (1994)) were used where possible. When insufficient site specific data were available, the design engineer used the most conservative values reported by Haung (1983). In the case of unit weight, the highest wet unit weight in the range was calculated to provide a conservative driving force. With strength parameters, (ϕ and c) the low end of the reported range was used to reduce the resisting forces along the critical slip surface. The pertinent portions of these references have been provided for informational purposes.

The final cover profile evaluated in this analysis is the permitted alternative cover which consists of 12 inches of vegetative layer underlain by a 24 inches thick vegetative support layer and at least 12 inches of intermediate cover.

Geosynthetic Interface Strength properties – SCS Aquaterra performed a literature evaluation to determine the weakest geo-synthetic layer (WGL) interface strength (adhesion or cohesion, designated as α or c below and internal or interface friction angle, ϕ or δ) of the permitted primary and cover liner geosynthetic sequences. The interface strengths of the primary liner and cover liner sequences were assigned based on an evaluation of the individual interface contact strengths as developed using soil strengths of adjoining layers from the references noted above for the pertinent ϕ and c (cohesion). Soil to geosynthetic and geosynthetic to geosynthetic contact strengths were developed using Koerner and Narejo (2005). The strengths of each contact are shown in the following table for each liner configuration. Two separate liner configurations were considered for the primary liner

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[10] Koerner, G.R. and Narejo, D., "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces", Geosynthetic Research Institute, GRI Report #30, Folsom, PA, April 2005.

[11] Eid, H.D., Stark, T.S., Evans, W.D. and Sherry, P.E., "Municipal Solid Waste Slope Failure. I: Waste and Foundation Soil Properties", Journal of Geotechnical and Geoenvironmental Engineering, May 2000, pg. 405.

STABILITY ANALYSIS OF EARTH SLOPES

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Table 3.1 Average Effective Shear Strength of Compacted Soils.

UNIFIED CLASSIFICATION	SOIL TYPE	PROCTOR COMPACTION MAXIMUM DRY DENSITY pcf	$\gamma_{w\,max}$ @ opt m.c.	PROCTOR COMPACTION OPTIMUM MOISTURE CONTENT %	AS COMPACTED COHESION c_o tsf	SATURATED COHESION c_{sat} tsf	FRICTION ANGLE $\bar{\phi}$ deg
GW	well graded clean gravels, gravel-sand mixture	>119	134.8	<13.3	*	*	>38
GP	poorly graded clean gravels, gravel sand mixture	>110	123.6	<12.4	*	*	>37
GM	silty gravels, poorly graded gravel-sand-silt	>114	130.5	<14.5	*	*	>34
GC	clayey gravels, poorly graded gravel-sand-clay	>115	131.9	<14.7	*	*	>31
SW	well graded clean sands, gravelly sands	119±5	143.6	13.3±2.5	0.41±0.04	*	38±1
SP	poorly graded clean sands, sand-gravel mixture	110±2	127.0	12.4±1.0	0.24±0.06	*	37±1
SM	silty sands, poorly graded sand-silt mixture	114±1		14.5±0.4	0.53±0.06	0.21±0.07	34±1
SM-SC	sand-silt-clay with slightly plastic fines	119±1		12.8±0.5	0.21±0.07	0.15±0.06	33±3
SC	clayey sands, poorly graded sand-clay mixture	115±1		14.7±0.4	0.78±0.16	0.12±0.06	31±3
ML	inorganic silts and clayed silts	103±1	124.7	19.2±0.7	0.70±0.10	0.09±*	32±2
ML-CL	mixtures of inorganic silts and clays	109±2	130.4	16.8±0.7	0.66±0.18	0.23±*	32±2
CL	inorganic clays of low to medium plasticity	108±1	131.1	17:3±3	0.91±0.11	0.14±0.02	28±2
OL	organic silts and silty clays of low plasticity	*		*	*	*	*
MH	inorganic clayey silts, elastic silts	82±4	120.0	36.3±3.2	0.76±0.31	0.21±0.09	25±3
CH	inorganic clays of high plasticity	94±2	121.6	25.5±1.2	1.07±0.35	0.12±0.06	19±5
OH	organic clays and silty clays	*		*	*	*	*

*denotes insufficient data, > is greater than, < is less than
(After Bureau of Reclamation, 1973; 1 pcf=157.1 N/m³, 1 tsf=95.8 kPa)

JEH, calc'd

Ref # 6

COPY

JFH.

Drained Shear Strength Parameters for Analysis of Landslides

Timothy D. Stark[1]; Hangseok Choi[2]; and Sean McCone[3]

Abstract: This paper presents recommendations for selecting the type and magnitude of drained shear strength parameters for analysis of landslides. In particular, the importance, existence, and use of the cohesion shear strength parameter is reviewed. For slope stability analyses, it is recommended that the shear strength be modeled using a stress dependent failure envelope or a friction angle that corresponds to the average effective normal stress acting on the slip surface passing through that particular material instead of using a combination of cohesion and friction angle to represent soil shear strength. Other recommendations for stability analyses include using an effective stress cohesion of zero for residual and fully softened strength situations. To facilitate selection of shear strength parameters for landslide analyses, empirical relationships for the drained residual and fully softened strengths are updated from the previous empirical relationships presented by Stark and Eid. Finally, the paper presents torsional ring shear test results that indicate that pre-existing shear surfaces exhibit self-healing that results in increased shear resistance. The magnitude of healing appears to increase with increasing soil plasticity, and this increase could have implications for the size, timing, and cost of landslide remediation.

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CE Database subject headings: Soil mechanics; Landslides; Overconsolidated clays; Shear strength; Slope stability; Remedial action.

Introduction

The main input for a stability analysis of a landslide are slope geometry, location of the failure surface, magnitude of pore-water pressures, unit weight of materials involved, and shear strength of the materials that intersect the failure surface. The use of a topographic survey should provide insight to the slope geometry, use of field instrumentation, e.g., slope inclinometers, and field observations can facilitate location of the failure surface for a postfailure analysis, and laboratory testing can quantify the unit weight of the materials involved. As a result, the magnitude of the pore-water pressures and the material shear strength usually present the largest uncertainty in the analysis of landslides. The magnitude of pore-water pressures is a site-specific and time-specific inquiry, and thus it is difficult to quantify or generalize about pore-water pressure conditions. Therefore, this paper focuses on the representation of material shear strength in landslide stability analyses even though the other input parameters listed above also are extremely important.

A drained or undrained shear strength may be applicable for the materials that intersect the failure surface depending on the hydraulic conductivity of the materials and rate of loading involved. This paper focuses on the drained or effective stress shear strength parameters, and thus it is assumed that the hydraulic conductivity of the soils involved is sufficient to dissipate all of the pore-water pressures prior to instability and/or the loading is slow enough that nonhydrostatic pore-water pressures do not develop. The paper focus is further narrowed to include only cohesive soils because landslides are usually more frequent in cohesive rather than granular materials.

Recommendations for Stability Analyses of Landslides

Drained Shear Strengths

The two drained shear strengths considered herein are the residual and fully softened shear strengths. The residual shear strength of cohesive soils is applicable to new and existing slopes that contain a pre-existing shear surface. A pre-existing shear surface, and thus a residual shear strength condition, is present in old landslides or soliflucted slopes, bedding shears in folded strata, in sheared joints or faults, and after an embankment failure (Skempton 1985). Other situations where a strength at or near residual has been mobilized include the shear stresses and displacements induced in the foundation of a dam by the annual raising and lowering of the reservoir (Stark and Duncan 1991), shear stresses and displacements induced in a slope by blasting (Stark et al. 2000), and the behavior of colluvial slopes (D'Appolonia et al. 1967; Fleming and Johnson 1994; Eid et al. 2000). A drained failure condition usually prevails during reactivation of a pre-existing shear surface that has attained a residual strength condition (Terzaghi et al. 1996). This is attributed to the thin nature of

prior slide movement
use residual shear strength

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Note. Discussion open until October 1, 2005. Separate discussions must be submitted for individual papers. To extend the closing date by one month, a written request must be filed with the ASCE Managing Editor. The manuscript for this paper was submitted for review and possible publication on June 19, 2003; approved on August 6, 2004. This paper is part of the *Journal of Geotechnical and Geoenvironmental Engineering*, Vol. 131, No. 5, May 1, 2005. ©ASCE, ISSN 1090-0241/2005/5-1–XXXX/$25.00.

the shear zone and the clay particles being oriented parallel to the direction of shear and thus having little tendency for volume change and development of excessive pore-water pressures. Therefore, an effective stress stability analysis is usually applicable for a residual strength condition and thus drained shear strength parameters should be used. The results of torsional ring shear tests on 66 clays, mudstones, claystones, and shales (Table 1) confirm that the drained residual failure envelope is stress dependent.

The drained fully softened shear strength of cohesive soils is an important parameter in evaluating the stability of slopes that have not undergone previous sliding (first-time slides). After studying case histories involving soil slopes in brown London clay, Skempton (1977) concludes that slopes that have not undergone previous sliding can be designed using a fully softened shear strength. Investigations by Skempton et al. (1969) and Skempton (1977) indicate that softening of an overconsolidated clay reduces the effective stress cohesion component of the Mohr–Coulomb shear strength parameters but does not cause orientation of clay particles or a reduction in the friction angle (Skempton 1970). Consequently, Skempton (1977) suggests that the long-term shear strength available in an overconsolidated clay that has not undergone previous sliding corresponds to the fully softened condition. More recently, Stark and Eid (1997) show that the mobilized strength in first-time slides can be less than the fully softened strength. This conclusion is reinforced by Mesri and Shahein (2003) that show slopes in nonhomogeneous stiff clay and clay shales exhibit a residual strength along at least a portion of the slip surface for first-time slides.

not any prior movement
Criterion] fully softened)
shear strength

The fully softened condition corresponds to the condition after which the overconsolidated clay has absorbed as much water as it desires and has reached equilibrium at a particular site. Skempton (1970) concludes that the fully softened shear strength is numerically equal to the drained peak strength of a normally consolidated specimen. Torsional ring shear test results on 36 clays, mudstones, claystones, and shales (Table 2) confirm that the drained fully softened failure envelope is also stress dependent.

Use of Cohesion in Stability Analyses

A topic of frequent discussion in review of stability analyses of landslides and litigation associated with landslides is the use of a nonzero value for the effective stress cohesion parameter (c') from a Mohr–Coulomb strength diagram. The significance of using a nonzero value is discussed first and then recommendations for the value of cohesion that should be used for the residual and fully softened strength conditions are presented.

The factor of safety (F) in a limit equilibrium analysis is defined as the ratio of the shear strength divided by the shear stress required for equilibrium of the slope. Using moment equilibrium, the factor of safety derived for the ordinary method of slices analysis can be represented by the following expression:

$$F=\frac{\sum_{i=1}^{n}[(c'+\sigma_n'\tan\phi')L]_i}{\sum_{i=1}^{n}[W\sin\alpha]_i}=\frac{\sum_{i=1}^{n}[c'L+(W\cos\alpha-uL)\tan\phi']_i}{\sum_{i=1}^{n}[W\sin\alpha]_i} \tag{1}$$

where c'=effective stress cohesion; σ_n'=effective normal stress acting on the base of the vertical slice=$(W\cos\alpha/L-u)$; W=weight of the vertical slice; α= inclination of the base of the vertical slice; u=pore-water pressure acting on the base of the vertical slice; L=length of base of the vertical slice; ϕ'=effective stress friction angle; and Σ=summation of the calculation for the number of vertical slices (n) used to model the slope. Even though the ordinary method of slices has been found to yield erroneous results of factor of safety for the condition of high pore-water pressure (Duncan and Wright 1979), the ordinary method of slices is only being used to demonstrate the importance of the value of cohesion on the factor of safety because of its simplicity.

From Eq. (1) it can be seen that the cohesion parameter is multiplied directly by the base length of the vertical slice being considered, whereas the friction component is a function of the effective normal stress acting on the base of the vertical slice, the tangent of the friction angle, and the base length. The same cohesion value is applied to the base of each vertical slice that intersects this material regardless of the location of the vertical slice in the slide mass. In summary, any value of cohesion is applied directly to the entire length of the failure surface in the particular material and thus can have a large impact on the calculated factor of safety. This usually results in a substantial increase in the factor of safety with small increases in the value of cohesion especially for long failure surfaces through the material that is assigned the value of cohesion.

For the residual strength condition it is recommended that the value of cohesion be set equal to zero in stability analyses. By definition the residual strength condition results from the reorientation of the platy clay particles parallel to the direction of shear, which results in increased face-to-face interaction of the particles (Skempton 1985). The resulting shear strength is low because it is difficult for the face-to-face particles to establish contact or bonding between them (Terzaghi et al. 1996). The establishment of a residual strength condition also results in an increased water content at or near the pre-existing failure surface (Skempton 1985). In summary, the particle contact and bonding that leads to a value of cohesion greater than zero has been reduced or eliminated by the shear displacement required to reach a residual strength condition. This results in only a frictional shear resistance that is represented by a residual friction angle and the effective normal stress acting on the shear surface. Because the residual strength is controlled by the frictional resistance of face-to-face particles, the residual strength is a function of clay mineralogy. The empirical correlations presented subsequently are a function of clay mineralogy, i.e., liquid limit, and the quantity of this clay mineral, i.e., clay-size faction. In summary, it is recommended that the value of effective stress cohesion be zero in stability analyses involving a residual strength condition.

Determining whether the value of effective stress cohesion should be equal to zero is more problematic for the fully softened condition than the residual strength condition. Skempton (1977) concludes that overconsolidated clays undergo a softening process that results in the fully softened strength being mobilized, and not the shear strength of the intact or unsoftened overconsolidated clay, in slopes that have not undergone previous sliding (first-time slides). This softening process reduces the effective stress cohesion component of the Mohr–Coulomb shear strength parameters but does not cause orientation of clay particles or a reduction in the friction angle (Skempton 1970). Because Skempton (1970) concludes that the fully softened shear strength corresponds to the drained peak strength of a normally consolidated specimen, this suggests that the value of effective stress cohesion should be set to zero, i.e., the value of cohesion measured in shear tests on normally consolidated clay (Holtz and Kovacs 1981;

Table 1. Soil Samples Used in Residual Shear Strength Testing

Soil number	Clay, mudstone, shale, and claystone samples	Clay, mudstone, shale, and claystone locations	Liquid limit (%)	Plastic limit (%)	Clay-size fraction (%)	Activity (PI/clay-size fraction)
1	Glacial till[a]	Urbana, Ill.	24	16	18	0.44
2	Loess[a]	Vicksburg, Miss.	28	18	10	1.00
3	Bootlegger Cove clay[a]	Anchorage, Ala.	35	18	44	0.39
4	Duck Creek shale[b]	Fulton, Ill.	37	25	19	0.63
5	Chinle (red) shale[b]	Holbrook, Ariz.	39	20	43	0.44
6	Colluvium (B-2)[a]	Vallejo, Calif.	41	22	28	0.68
7	Slide debris (B-4)[a]	Vallejo, Calif.	42	23	27	0.70
8	Silty clay (B-104)[a]	Gary, Ind.	42	18	48	0.50
9	Shear surface[a]	Brillant, Ohio.	44	19	39	0.64
10	Colorado shale[b]	Montana, Mont.	46	25	73	0.29
11	Panoche mudstone	San Francisco, Calif.	47	27	41	0.49
12	Mudstone (B-2)	Vallejo, Calif.	47	27	41	0.49
13	Four Fathom shale[b]	Durham, England	50	24	33	0.79
14	Shear surface (LD-17)[a]	Orange County, Calif.	50	29	25	0.84
15	Mancos shale	Price, Utah	52	20	63	0.51
16	Panoche shale	San Francisco, Calif.	53	29	50	0.48
17	Colluvium	Marietta, Ohio.	54	25	48	0.60
18	Shear surface[a]	Los Angeles, Calif.	55	24	17	1.82
19	Silty clay (sample 2)[a]	Esperanza Dam, Ecuador	55	40	18	0.83
20	Illinois Valley shale	Peru, Ill.	56	24	45	0.71
21	Shear surface (LD-11)[a]	Orange County, Calif.	58	35	23	1.00
22	Yellowish brown fat clay[a]	Whittier, Calif.	58	23	37	0.95
23	Comanche shale[b]	Proctor Dam, Tex.	62	32	68	0.44
24	Silty clay (sample 3)[a]	Esperanza Dam, Ecuador	64	41	21	1.10
25	Shear surface (LD-1)[a]	Orange County, Calif.	65	32	22	1.50
26	Bearpaw shale[b]	Billings, Mont.	68	24	51	0.86
27	Slide debris (B-3)	Vallejo, Calif.	69	22	56	0.84
28	Shear surface (LD-8)[a]	Orange County, Calif.	69	34	30	1.17
29	Orinda claystone	Contra Costa County, Calif.	73	25	27	1.78
30	Claystone	Big Bear, Calif.	75	22	54	0.98
31	Shear surface (LD-15)[a]	Orange County, Calif.	75	37	48	0.79
32	Bay mud[a]	San Francisco, Calif.	76	41	16	2.19
33	Patapsco shale[b]	Washington, D.C.	77	25	59	0.88
34	Monterey claystone (depth 17.4 m)[a]	Carmel, Calif.	77	26	58	0.88
35	Shear surface[a]	Los Angeles, Calif.	79	32	41	1.15
36	Shear surface (depth 28.7 m)	Los Angeles, Calif.	82	34	50	0.96
37	Pierre shale[b]	Limon, Colo.	82	30	42	1.24
38	Black clay and olive brown clay[a]	Whittier, Calif.	82	26	57	0.98
39	Shear surface[a]	Madisette, Calif.	83	29	52	1.04
40	Clay gouge	Contra Costa County, Calif.	86	28	76	0.76
41	Shear surface[a]	Laguna Niguel, Calif.	86	40	40	1.15
42	Santiago claystone	San Diego, Calif.	89	44	57	0.79
43	Shear surface[a]	Oceanside, Ore.	90	37	43	1.23
44	Monterey claystone (depth 36.3 m)[a]	Carmel, Calif.	93	39	69	0.78
45	Lower Pepper shale	Waco Dam, Tex.	94	26	77	0.88
46	Shear surface (depth 19.8 m)	Los Angeles, Calif.	95	33	47	1.32
47	Shear surface[a]	Novato, Calif.	95	27	54	1.26
48	Altamira Bentonitic tuff	Portuguese Bend, Calif.	98	37	68	0.90
49	Brown London clay	Bradwell, England	101	35	66	1.02
50	Shear surface	Los Angeles, Calif.	104	32	58	1.24
51	Cucaracha shale[b]	Panama Canal, Panama	111	42	63	1.10
52	Otay Bentonitic shale[a]	San Diego, Calif.	112	53	73	0.81
53	Shear surface (depth 8.4 m)	San Diego, Calif.	118	36	81	1.01
54	Denver shale[b]	Denver, Colo.	121	37	67	1.25

Table 1. (*Continued.*)

Soil number	Clay, mudstone, shale, and claystone samples	Clay, mudstone, shale, and claystone locations	Liquid limit (%)	Plastic limit (%)	Clay-size fraction (%)	Activity (PI/clay-size fraction)
55	Otay Bentonitic claystone[a]	Chula Vista, Calif.	126	47	53	1.49
56	Bearpaw shale[b]	Saskatchewan, Canada	128	27	43	2.35
57	Pierre shale	Newcastle, Wyo.	137	30	54	1.98
58	Oahe Firm shale	Oahe Dam, S.D.	138	41	78	1.24
59	Claggett shale[b]	Benton, Mont.	157	31	71	1.78
60	Shear surface (depth 4.0 m)	San Diego, Calif.	161	43	84	1.40
61	Taylor shale[b]	San Antonio, Tex.	170	39	72	1.82
62	Pierre shale[b]	Reliance, S.D.	184	55	84	1.54
63	Bentonitic shale	Oahe Dam, S.D.	192	47	65	1.96
64	Panoche clay gouge	San Francisco, Calif.	219	56	72	2.26
65	Lea Park Bentonitic shale	Saskatchewan, Canada	253	48	65	3.15
66	Bearpaw shale[b]	Ft. Peck Dam, Mont.	288	44	88	2.77

[a] Samples not ball-milled.

[b] Index Properties from Mesri and Cepeda-Diaz (1986).

Terzaghi et al. 1996), for the analysis of first time slides in heavily overconsolidated clays. However, Mesri and Shahien (2003) use the back analysis of 107 first time slides in clay or shale to conclude that the fully softened strength is mobilized in homogeneous soft to stiff clay and where the shear surface cuts across bedding planes and laminations. Therefore, it is recommended that the effective stress cohesion be assigned a value of zero for homogeneous soft to stiff clay. If the slope is comprised on nonhomogeneous stiff clay or clay shale, at least a portion of the slip surface is at residual and thus a cohesion of zero should be sued for these materials (Mesri and Shahien 2003). In summary the value of cohesion should be zero unless back-analysis of local case histories suggest a value greater than zero (Mesri and Abdel-Ghaffar 1993).

Stress-Dependent Failure Envelope

The secant residual and fully softened friction angles for a cohesive soil can be estimated for a particular effective normal stress using the liquid limit, clay-size fraction, and interpolation between the empirical relationships presented subsequently. For stability analyses it is recommended that the secant friction angle corresponding to the average effective normal stress acting on the slip surface in that particular material or the entire failure envelope be used to estimate the residual and fully softened shear strengths. A number of slope stability software packages allow the entire failure envelope to be input using values of shear and normal stress to incorporate the stress dependency. The empirical correlations can be used to estimate the stress dependent residual and fully softened failure envelopes for inclusion in the software. For example, the stress dependent residual failure envelope can be obtained by plotting the shear stress corresponding to the secant residual friction angle at effective normal stresses of 100, 400, and 700 kPa. A smooth curve can be drawn through these three points and the origin to construct the stress dependent failure envelope.

Drained Residual Strength Empirical Correlation

A modified Bromhead ring shear apparatus (Stark and Eid 1993) was used for measuring the residual and fully softened strengths of the clays, mudstones, shales, and claystones listed in Tables 1 and 2. The original (Bromhead 1979) and modified Bromhead ring shear apparatus utilize an annular specimen with an inside diameter of 70 mm and an outside diameter of 100 mm. To avoid possible rate effects, a displacement rate of 0.018 mm/min was used for the residual and fully softened shear strength testing. The modified Bromhead ring shear apparatus allows a remolded specimen to be overconsolidated and precut, which simulates the field conditions that lead to the development of a residual strength condition in overconsolidated clays and clayshales. Details of the precutting and multistage shearing processes are presented in Stark and Eid (1993 and 1994) and ASTM (1999c).

The test procedure for measuring the fully softened shear strength is not included in ASTM (1999c) and is briefly reviewed here. For each soil, three remolded, normally consolidated specimens were sheared at effective normal stresses of 50, 100, and 400 kPa in the modified ring shear apparatus. These three tests are separate from the one multistage test used to estimate the residual failure envelope. The fully softened and residual shear strength could be obtained from one ring shear test on the same specimen at a particular normal stress, but this procedure has been found to be less efficient than using one multistage test to establish the residual strength failure envelope and three tests on different normally consolidated specimens that are terminated shortly after measuring the fully softened shear strength. The fully softened shear strength is usually mobilized before a shear displacement of 10 mm. The range of effective normal stresses was chosen to represent the normal stresses that are typically encountered in first time failures of slopes and embankments.

The specimen preparation procedure for the ring shear apparatus was adapted from that used by Mesri and Cepeda-Diaz (1986) for direct shear tests. Remolded shale, mudstone, and claystone specimens were obtained by air drying a representative sample of each material. As noted in Stark and Eid (1994), an undisturbed specimen is not required for measuring the residual strength because the peak shear strength is not of concern. The air-dried material is ball milled until the entire representative sample passes the United States Standard sieve Number 200. This facilitates the development of a residual strength condition and measurement of the corresponding Atterberg limits because the flocculated particles are broken down in the ball milling process.

Table 2. Soil Samples Used in Fully Softened Shear Strength Testing

Soil number	Clay, mudstone, shale, and claystone samples	Clay, mudstone, shale, and claystone locations	Liquid limit (%)	Plastic limit (%)	Clay-size fraction (%)	Activity (PI/clay-size fraction)
1	Glacial till[a]	Urbana, Ill.	24	16	18	0.44
2	Loess[a]	Vicksburg, Miss.	28	18	10	1.00
3	Duck Creek shale[b]	Fulton, Ill.	37	25	19	0.63
4	Slide debris[a]	San Francisco, Calif.	37	26	28	0.39
5	Colluvium[a]	Vallejo, Calif.	39	22	36	0.47
6	Slope-wash material	San Luis Dam, Calif.	42	24	34	0.53
7	Crab Orchard shale	Peoria, Ill.	44	24	32	0.63
8	Failure plane debris[a]	Brillant, Ohio	44	19	39	0.64
9	Colorado shale[b]	Montana, Mont.	46	25	73	0.29
10	Panoche mudstone	San Francisco, Calif.	47	27	41	0.49
11	Panoche shale	San Francisco, Calif.	53	29	50	0.48
12	Colluvium	Marietta, Ohio.	54	25	48	0.60
13	Slide plane material	Los Angeles, Calif.	55	24	27	1.15
14	Illinois Valley shale	Peru, Ill.	56	24	45	0.71
15	Comanche shale[b]	Proctor Dam, Tex.	62	32	68	0.44
16	Breccia material	Manta, Ecuador	64	41	25	0.92
17	Silty clay[a]	La Esperanza Dam, Ecuador	64	41	21	1.10
18	Claystone	Big Bear, Calif.	75	22	54	0.98
19	Siltstone/Claystone[a]	Orange County, Calif.	75	37	48	0.79
20	Bay mud[a]	San Francisco, Calif.	76	41	16	2.19
21	Patapsco shale[b]	Wasington, D.C.	77	25	59	0.88
22	Pierre shale[b]	Limon, Colo.	82	30	42	1.24
23	Shear surface (depth 19.8 m)	Los Angeles, Calif.	82	31	50	1.02
24	Lower Pepper shale	Waco Dam, Tex.	94	26	77	0.88
25	Serpentinite clay[a]	Marion County, Calif.	95	27	54	1.26
26	Brown London clay	Bradwell, England	101	35	66	1.00
27	Cucaracha shale[b]	Panama Canal	111	42	63	1.10
28	Denver shale[b]	Denver, Colo.	121	37	67	1.25
29	Bearpaw shale[b]	Saskatchewan, Canada	128	27	43	2.35
30	Pierre shale	Newcastle, Wyo.	137	30	54	1.98
31	Oahe Firm shale	Oahe Dam, S.D.	138	41	78	1.24
32	Taylor shale[b]	San Antonio, Tex.	170	39	72	1.82
33	Pierre shale[b]	Reliance, S.D.	184	55	84	1.54
34	Oahe Bentonitic shale	Oahe Dam, S.D.	192	47	65	2.23
35	Lea Park Bentonitic shale	Saskatchewan, Canada	253	48	65	3.15
36	Bearpaw shale[b]	Ft. Peck Dam, Mont.	288	44	88	2.77

[a] Samples not ball milled.

[b] Index properties from Mesri and Cepeda-Diaz (1986).

Field shear surface usually consist of small seams of clayey material surrounded by material with a coarser gradation [see Fig. 1(a)]. To simulate field conditions, only the clayey shear zone material should be tested and not the coarser surrounding material. During deposition or subsequent shearing, the coarse particles have been removed from the clayey layer and the strength of the clayey material controls the slope stability. Skempton (1985) illustrates this phenomenon with a sketch of the larger particles being moved or pushed from the shear surface. Thus, only the clayey shear zone material should be sampled and tested as shown in Fig. 1(b).

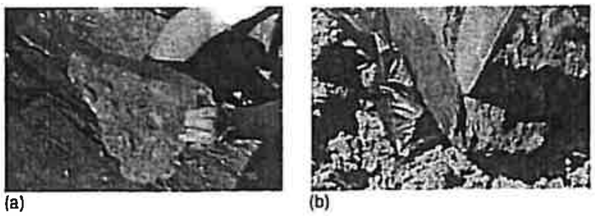


Fig. 1. Photograph of cohesive shear plane material

Remolded silt and clay specimens (see sample names in Tables 1 and 2 with one asterisk) are obtained by air drying a representative sample, crushing it with a mortar and pestle, and processing it through the Number 40 sieve, which is in agreement with ASTM procedures, e.g., (ASTM 1999a). Ball milling is not used for these materials because it would change the texture and gradation of the soil. In both cases, distilled water was added to the processed soil until a liquidity index of about 1.5 is obtained. The sample is then allowed to rehydrate for at least 1 week in a moist room. The liquid limit, plastic limit, and clay-size fraction of the

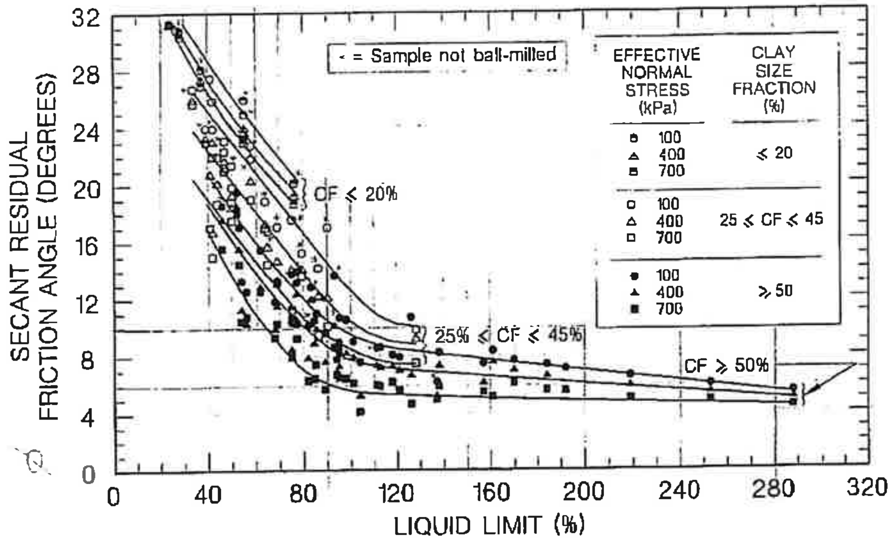


Fig. 2. Secant residual friction angle relationships with liquid limit, clay-size fraction, and effective normal stress

specimens are measured using the ball-milled or sieved soil samples that are used to create the test specimen.

Effect of Ball Milling on Empirical Correlations

The torsional ring shear data are used to create the empirical residual friction angle relationships shown in Fig. 2, which means that both ball-milled and nonball-milled materials are included in the empirical relationships. The asterisks in Fig. 2 indicate the data points that correspond to materials that were not ball milled. Each asterisk is placed as close as possible to the data point corresponding to the effective normal stress of 100 kPa in each clay-size fraction grouping. The ball-milled data in Fig. 2 were not weighted differently in drawing of the trend lines because in the field heavily overconsolidated clays, mudstones, claystones, and shales are disaggregated by shearing to achieve a residual strength condition and remolded silt and clay specimens are sufficiently disaggregated with the ASTM preparation procedure (ASTM 1999a). Ball milling simply facilitates the measurement of the residual strength of remolded overconsolidated clays, mudstones, claystones, and shales in the laboratory by expediting the disaggregation process. This results in smaller shear displacements, and thus time, required to achieve a residual strength condition in laboratory ring shear testing on remolded material. Remolded material is preferred as discussed subsequently because of the difficulties in obtaining, trimming, and orienting of shear surface specimens in direct shear or ring shear devices and the soil extrusion that can occur in tests o large shear displacement.

In summary, significant disaggregation of the clay particles occurs in heavily overconsolidated clays, mudstones, claystones, and shales during field shearing and laboratory testing must simulate this disaggregation or the measured shear strength will overestimate the field residual shear strength (Stark and Eid 1992). Skempton (1985) and Stark and Eid (1992) present case histories that verify the importance of disaggregating the clay particles in laboratory testing of remolded material in predicting the field residual strength.

Development of Empirical Correlation

Fig. 2 presents a revision of the empirical correlation between drained secant residual friction angle and soil index properties (liquid limit and clay-size fraction) at effective normal stresses of 100, 400, and 700 kPa presented by Stark and Eid (1994). It can be seen that the higher the liquid limit and clay-size fraction, the lower the secant residual friction angle. The liquid limit is used as an indicator of clay mineralogy, and thus particle size. As the particle size decreases, and thus the particle surface area increases, the liquid limit increases and the drained residual strength decreases. However, clay-size fraction remains an important predictive parameter of residual strength because it indicates the quantity of soil particles smaller than 0.002 mm.

Activity, defined as the plasticity index divided by the clay-size fraction, has been used in previous residual strength correlations, e.g., Skempton (1985). Both the liquid limit and activity provide an indication of clay mineralogy, and thus particle size and shape. Because liquid limit and activity provide an indication of clay mineralogy, a correlation was sought using both parameters. It was found that the residual friction angle correlation is better defined using the liquid limit instead of activity and the plastic limit does not have to be measured if only the liquid limit is used. As a result, the liquid limit is used to indicate clay mineralogy in the empirical relationships instead of activity.

The correlations in Fig. 2 separate the clay-size fraction into three groups: less than or equal to 20%, greater than or equal to 25% and less than or equal to 45%, and greater than or equal to 50%. These three groupings are similar to those presented by Lupini et al. (1981) and Skempton (1985), which are less than or equal to 25%, between 25 and 50%, and greater than or equal to 50%. The three clay-size fraction groupings were used by Lupini et al. (1981) to distinguish the boundaries between rolling shear, transitional shear, and sliding shear behaviors, respectively. The data in Fig. 2 confirm that the effects of particle reorientation are more pronounced in clays with a clay-size fraction of greater than or equal to 25% and thus the second clay-size fraction group in Fig. 2 starts at a clay-size fraction of 25%. The data do not demonstrate a distinct change from rolling shear to transitional shear and thus there is a gap in the clay-size groupings between less than or equal to 20% and greater than or equal to 25% in Fig. 2. This is in agreement with Skempton (1985) who concludes that the effects of particle reorientation are only observed in clays that have a clay-size fraction of 20–25% and thus Skempton (1985) also did not observe a distinct transition between rolling and transitional shear. The shear strength difference between rolling and transitional shear behavior on the secant residual friction angle is evident from Fig. 2 where the higher values and less stress dependency of the secant residual friction angle are measured for soils with a clay-size fraction less than or equal to 20%, i.e., rolling shear or no large impact of particle reorientation. A distinct transition from transitional to sliding shear behavior also was not observed and thus there is a gap in the clay-size groupings between greater than or equal to 45% and greater than 50%. Interpolation can be used to estimate the secant residual friction angle between the three clay-size groups in Fig. 2 for a particular effective normal stress.

New Empirical Correlation

The testing conducted since Stark and Eid (1994) increased the number of soils in the clay-size fraction group of less than or equal to 20% from four to six. Based on the new data, only the relationship for an effective normal stress of 100 kPa was revised. This relationship was shifted slightly upward (less than 1°), which increases the stress dependency of the secant residual friction angle for soils with a clay-size fraction less than or equal to 20%. The relationship for an effective normal stresses of 400 and 700 kPa were not changed from Stark and Eid (1994). Because the revisions are small (approximately 1°) the original relationships presented by Stark and Eid (1994) are not included for comparison purposes.

Fig. 2 also presents the ring shear data for the soils that exhibit a clay-size fraction greater than or equal to 25% and less than or equal to 45%. The new data suggest that the range of secant residual friction angle for effective normal stresses between 100 and 700 kPa should be increased. To accomplish this increase, the relationship for an effective normal stress of 100 kPa did not change significantly, i.e., 1° or less, but the 400 and 700 kPa normal stress relationships were each shifted downward by approximately 1°. Increasing the data set from 6 to 20 increased the soil variability in the database, which probably resulted in the increased range of residual friction angle in this clay-size fraction group. Moving the relationships for an effective normal stress of 400 and 700 kPa downward suggests that the residual strength for this clay-size fraction group is more stress dependent than originally observed by Stark and Eid (1994). For example, at a liquid limit of 60%, the secant residual friction angle in Fig. 2 decreases from approximately 21° at an effective normal stress of 100 kPa to about 15° at an effective normal stress of 700 kPa. In Stark and Eid (1994) the secant residual friction angle only decreased from approximately 20 to 18° at effective normal stresses of 100 and 700 kPa, respectively, for a liquid limit of 60%.

Fig. 2 presents the ring shear data for the soils from Table 1 that exhibit a clay-size fraction greater than or equal to 50%. The new data also suggest that the range of secant residual friction angle for effective normal stresses of 100 and 700 kPa also should be increased. To accomplish this increase in range of residual friction angle, the relationship for an effective normal stress of 700 kPa was shifted downward by approximately 2° for liquid limits less than 100%. For liquid limits greater than 100% the downward shift decreased from 2° to no change at a liquid limit of 288%. The largest increase in the range of secant residual friction angle occurred at a liquid limit of 80% where the secant residual friction angle in Fig. 2 decreases from approximately 12° at an effective normal stress of 100 kPa to about 7° at an effective normal stress of 700 kPa. This corresponds to a decrease in friction angle of almost 50%. In Stark and Eid (1994) the secant residual friction angle only decreased from approximately 12 to 8° at effective normal stresses of 100 and 700 kPa, respectively, for a liquid limit of 80%. However, the data suggest that at liquid limits greater than 200%, the stress dependency of the failure envelope starts to decrease.

In summary, the main difference between the empirical relationships shown in Fig. 2 and the relationships presented by Stark and Eid (1994) is the increase in the range or stress dependency of the secant residual friction angle for the two highest clay-size fraction groups.

Effect of Sample Preparation on Index Properties

An undisturbed specimen can be used for ring shear testing. However, obtaining an undisturbed shear surface specimen, determining the actual direction of field shearing, and trimming and properly aligning the usually nonhorizontal shear surface in the ring shear apparatus is difficult. As a result, the ring shear test method presented by Stark and Eid (1993) and incorporated in *ASTM D 6467* (ASTM 1999c) utilizes a remolded specimen. The ring shear test is performed by deforming a presheared, remolded specimen at a controlled displacement rate until a constant minimum drained shear resistance is measured on a single shear plane determined by the configuration of the apparatus. Preparation of a remolded specimen can influence the liquid limit and clay-size fraction measured for the material and thus plotting of the data in Fig. 2. To utilize Fig. 2 in practice, consistent values of liquid limit and clay-size fraction should be used and this section of the paper presents a procedure for obtaining consistent values of liquid limit and clay-size fraction to utilize Fig. 2 in practice even though the heavily overconsolidated clays, mudstone, claystones, and shales are not ball milled in practice.

Most heavily overconsolidated clays, mudstones claystones, and shales possess varying degrees of induration (Mesri and Cepeda-Diaz 1986). This induration involves diagenetic bonding between clay mineral particles by carbonates, silica, alumina, iron oxides, and other ionic complexes. The degree of induration (aggregation) that survives a particular sample preparation procedure will influence the measured index properties (LaGatta 1970; Townsend and Banks 1974). To simulate the field conditions under which the residual strength is mobilized and the laboratory conditions under which the empirical relationships in Fig. 2 were developed, the material should be disaggregated before measuring the liquid limit and clay-size fraction. Because liquid limit is used in the empirical relationships to infer clay mineralogy, ball milling is used to "free" or disaggregate the clay mineral particles (Mesri and Cepeda-Diaz 1986). The residual shear strength is not a function of sample preparation because the aggregated particles are broken down during the continuous shearing in one direction in the field and the laboratory. Therefore, to correlate with the residual strength, the index properties also must be measured using a disaggregated specimen. Because the liquid limit and clay-size fraction are used herein to infer clay mineralogy and quantity of particles smaller than 0.002 mm, respectively, the mudstone, claystone, and shale particles were disaggregated by

Table 3. Soil Samples Used in Liquid Limit (LL) and Clay-Size Faction (CF) Testing

Soil number	Clay, mudstone, shale, and claystone samples	Clay, mudstone, shale, and claystone locations	ASTM LL (%)	Ball-milled LL (%)	Ratio ball-milled/ ASTM LL	ASTM CF (%)	Ball-milled CF (%)	Ratio ball-milled/ ASTM CF
1	Batestown till	Batestown, Ill.	21	29	1.38	—	—	—
2	Duck Creek shale	Fulton, Ill.	29	37	1.28	19	31	1.63
3	Crab Orchard	Peoria, Ill.	36	44	1.22	19	32	1.68
4	Claystone	Big Bear, Calif.	48	75	1.56	40	54	1.35
5	Shear surface	Brillant, Ohio	44	—	—	28	39	1.39
6	Illinois Valley shale	Peru, Ill.	45	56	1.24	35	45	1.29
7	Shear surface	Novato, Calif.	95	—	—	54	61	1.13
8	Shear surface	Los Angeles, Calif.	55	62	1.13	17	27	1.59
9	Dike shale	Cairo, Egypt	52	91	1.75	47	58	1.23
10	Makattam shale	Cairo, Egypt	68	103	1.51	—	—	—
11	Shear surface (LD-8)	Orange County, Calif.	69	—	—	30	41	1.37
12	Shear surface (LD-15)	Orange County, Calif.	75	97	1.29	48	52	1.08
13	Shear surface (depth 8.4 m)	San Diego, Calif.	82	119	1.45	73	81	1.11
14	Pierre shale	New Castle, Wyo.	103	137	1.33	44	54	1.23
15	Panoche clay gouge	San Francisco, Calif.	125	219	1.75	—	72	—
16	Otay Bentonitic claystone	Chula Vista, Calif.	133	216	1.62	43	53	1.23
17	Bentonitic shale	San Diego, Calif.	141	239	1.70	—	—	—
18	Claystone	May City, Egypt	—	—	—	15	29	1.93

ball milling a representative air-dried sample until all particles passed U.S. standard sieve Number 200 (Mesri and Cepeda-Diaz 1986). Ball milling was used only for the heavily overconsolidated clays, mudstones, claystones, and shales because they possess substantial diagenetic bonding that are usually not destroyed using a mortar and pestle. A judgment decision is usually made on whether a material should be ball milled or not. This decision is made after examination of the chunks of claystone, mudstone, shale, or overconsolidated clay and determining whether the chunks can be sufficiently broken down with a mortar and pestle to disaggregate the clay particles.

The use of ball-milled material facilitated the understanding of the residual strength and development of the empirical relationships in Fig. 2 because the residual strength is a fundamental soil property. Ball milling results in a better estimate of the actual liquid limit (LL) than the ASTM standard test method (ASTM 1999a), because more of the diagenetic bonding and induration is eliminated which allows more particle surface area to be exposed and to hydrate than if the clay particles are not disaggregated. The residual strength is a fundamental property because the soil structure, stress history, particle interference, and diagenetic bonding have been removed by continuous shear displacement in one direction. As a result, the residual strength is controlled by the resistance of individual clay particles, oriented primarily face-to-face, sliding across one another. The shear resistance induced by sliding along individual clay particles is controlled by the fundamental characteristics of the clay particles, e.g., type of clay mineral(s) and the quantity or percentage of the clay mineral(s), and the index properties must reflect this disaggregation to obtain a meaningful correlation.

Ball milling usually results in a higher LL than that obtained using the ASTM standard test method (ASTM 1999a). The higher LL is caused by the ball milling causing more particle disaggregation than the ASTM standard method and thus more water adsorption. This difference between the liquid limit values has complicated the use of the empirical relationships presented by Stark and Eid (1994) because commercial laboratories primarily, if not exclusively, utilize the ASTM standard procedure (ASTM 1999a) to measure the LL. This occasionally results in: (1) nonagreement between commercial ring shear test results and the empirical relationships and (2) probably an overestimate of the residual friction angle because the ASTM standard procedure underestimates the value of LL and/or clay-size fraction. To overcome these difficulties, values of LL were measured using both sample preparation procedures to develop an adjustment factor for ASTM derived values of LL. Table 3 presents a comparison of LL values

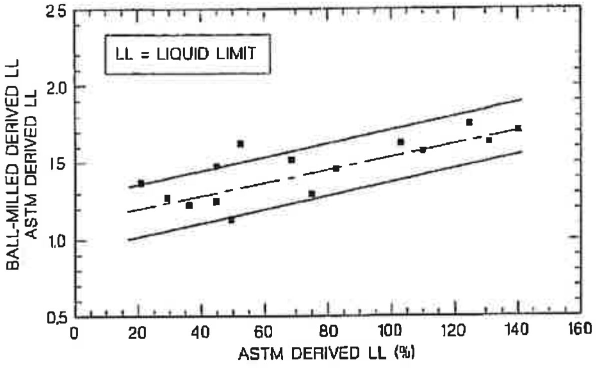


Fig. 3. Ratio of ball-milled and ASTM values of liquid limit

measured using both sample preparation procedures and the ratio of these values. Fig. 3 presents a relationship between the ASTM derived LL and the ratio of ball-milled to ASTM derived LL values. The middle relationship shown in Fig. 3 can be used with an ASTM derived value of LL to estimate the ratio of LL values obtained using the ball-milling and ASTM standard procedures. After multiplying the ASTM derived LL value by the ratio of the LL values, the resulting LL can be used in Fig. 2 to estimate the drained residual secant friction angle and/or failure envelope. This should reduce the need for commercial laboratories to ball mill claystones, shales, and mudstones and facilitate usage of the empirical relationships. The middle relationship can be expressed using the following equation and can be used to estimate the ratio of the liquid limit values:

$$\frac{\text{ball-milled derived LL}}{\text{ASTM derived LL}} = 0.003(\text{ASTM derived LL}) + 1.23 \qquad (2)$$

It can be seen from Fig. 3 that the liquid limit is affected by the sample preparation procedure. This is in agreement with the results reported by LaGatta (1970) for Cucaracha shale from the Panama Canal in which the liquid limit increased from 49 to 156% by crushing the shale for 6 min in a disk mill. It is anticipated that the higher the LL, the greater the bonding between clay particles, the more difficult disaggregation of the clay particles becomes, and the higher the difference between the ASTM and ball-milled values of liquid limit. Thus, high plasticity claystones, shales, and mudstones probably should be ball-milled.

An adjustment procedure for the clay-size fraction was also developed to facilitate usage of the empirical relationships. Fig. 4 presents a relationship between the ASTM derived values (ASTM 1999b) of clay-size fraction and the ratio of ball milled to ASTM clay-size fraction values. It can be seen that the ratio decreases as the ASTM derived value of clay-size fraction increases. It is anticipated that the decrease is caused by the ASTM value being in better agreement with the ball-milled value at higher values of clay-size fraction. This may be attributed to the dispersing agent, sodium hexametaphosphate, being more effective in high plasticity soils than low plasticity soils. The relationship in Fig. 4 can be used to estimate the ball-milled clay-size fraction using the ASTM derived value of clay-size fraction. This ball-milled clay-size fraction also should be used in Fig. 2 to estimate the residual failure envelope and/or friction angle. The relationship in Fig. 4 can be expressed using the following polynomial equation and can be used to estimate the ratio of the clay-size fraction (CF) values:

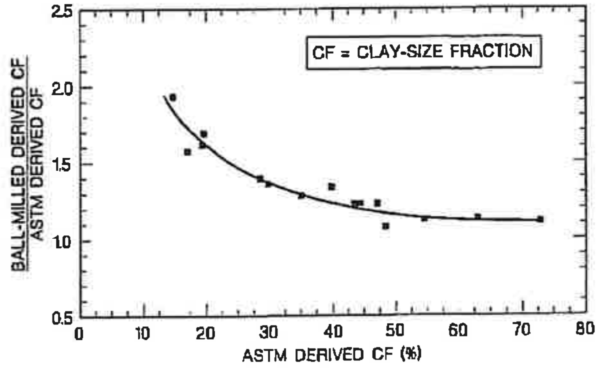


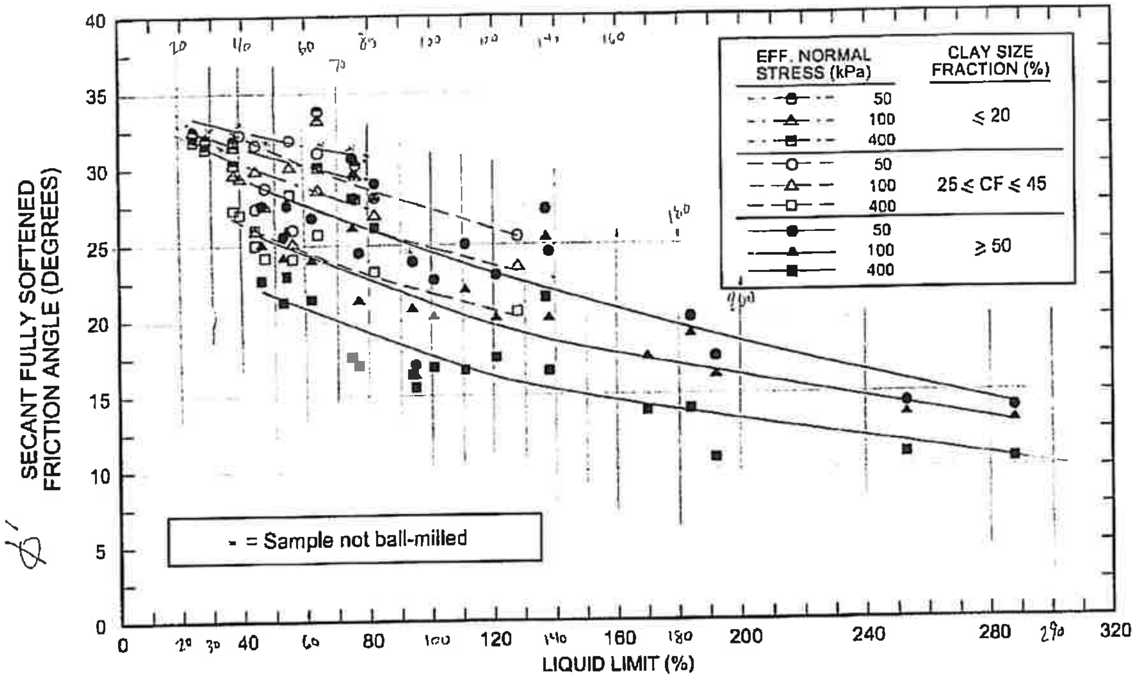
Fig. 4. Ratio of ball-milled and ASTM values of clay-size fraction

$$\frac{\text{ball-milled derived CF}}{\text{ASTM derived CF}} = 0.0003(\text{ASTM derived CF})^2 - 0.037(\text{ASTM derived CF}) + 2.254 \qquad (3)$$

In summary, the most important factor in deaggregating the material is the level to which the clay bonding is removed. Ball milling produces a greater amount of deaggregation than the ASTM sample preparation procedure (ASTM 1999a) and index properties that better represent the fundamental behavior of the material (Townsend and Banks 1974; Mesri and Cepeda-Diaz 1986). However, to facilitate use of the empirical relationships in practice, adjustment factors are presented to adjust the LL and clay-size fraction values derived from the ASTM standard test procedure (ASTM 1999a and 1999b, respectively).

Drained Fully Softened Strength Empirical Correlation

Stark and Eid (1997) show that the ring shear apparatus yields a secant fully softened friction angle that is approximately 2.5° less than that obtained from a drained isotropically consolidated triaxial compression test. This is attributed to the difference in mode of shear and stress state in the two tests. Because the stress state in a triaxial compression test is closer to the field mode of shear in first time slides, the ring shear secant fully softened friction angles measured herein are increased by 2.5° in the subsequent empirical correlation. The increase of the ring shear secant fully softened friction angle by 2.5° adds uncertainty to the correlation. As a result, the fully softened friction angle estimated from Fig. 5 should be compared with existing correlations, e.g., Bjerrum and Simons (1960), Terzaghi et al. (1996), NAVFAC (1982), and Mesri and Abdel-Ghaffar (1993), to verify the increase in ring shear friction angle of approximately 2.5°. However, the proposed fully softened relationship differs from existing fully softened friction angle correlations because the relationships are a function of liquid limit, clay-size fraction, and effective normal stress. In correlations presented by Bjerrum and Simons (1960), NAVFAC (1982), and Mesri and Abdel-Ghaffar (1993), there is considerable scatter in the fully softened friction angle ϕ' for the range of plasticity index of 10–100%. It is anticipated that this scatter is caused by omitting the effect of clay-size fraction and effective normal stress on the fully softened friction angle. For example, at a liquid limit of 120% the fully softened friction angle ranges from 17 to 28° (Fig. 5) for a clay-size fraction greater than or



No prior slide.

Fig. 5. Secant fully softened friction angle relationships with liquid limit, clay-size fraction, and effective normal stress

equal to 25%. This variation is explained when the data is separated by clay-size fraction and effective normal stress as shown in Fig. 5.

Fig. 5 presents the empirical relationships between drained secant fully softened friction angle (ϕ′) and liquid limit, clay-size fraction, and effective normal stresses of 50, 100, and 400 kPa for the soils represented in Table 2. For a clay-size fraction less than or equal to 20%, the original data set of four increased by one during this study. Based on the new data, the empirical relationship for an effective stress of 50 kPa presented by Stark and Eid (1997) was revised slightly upward (less than 0.5°). The other two relationships in this clay-size fraction range of ≤20% were not changed. However, there is still a lack of data in this clay-size fraction range to clearly define these relationships.

Fig. 5 also presents the ring shear data for the soils from Table 2 that exhibit a clay-size fraction greater than or equal to 25% and less than or equal to 45%. Increasing the data set from 6 to 11 soils resulted in an increase in the range of fully softened friction angle for effective normal stresses ranging from 50 to 400 kPa. For example, at a liquid limit of 40%, the secant fully softened friction angle in Fig. 5 decreases from approximately 32° at an effective normal stress of 50 kPa to about 26° at an effective normal stress of 400 kPa. In Stark and Eid (1997) the secant residual friction angle decreased from approximately 31 to 27° at effective normal stresses of 50 and 400 kPa, respectively, for a liquid limit of 40%.

Fig. 5 presents the ring shear data for the soils from Table 2 that exhibit a clay-size fraction greater than or equal to 50%. Increasing the data set from fourteen to twenty resulted in the largest change (approximately 2°) in the range of the fully softened friction angle. This change was accomplished by shifting the relationships for effective normal stresses of 100 and 400 kPa each downward approximately 1°. For example, at a liquid limit of 80%, the secant fully softened friction angle in Fig. 5 decreases from approximately 26°, at an effective normal stress of 50 kPa to about 18°, at an effective normal stress of 400 kPa. In Stark and Eid (1997), the secant fully softened friction angle decreased from approximately 25 to 19° at effective normal stresses of 50 and 400 kPa, respectively, for a liquid limit of 80%. The additional data also resulted in more scatter for the highest clay-size fraction group. This increase in scatter may be caused by differences in the particle aggregation resulting from the use of the ASTM sample preparation procedure discussed previously. The difference in sample preparation procedure is not evident for the residual strength condition because the particles have undergone significant deaggregation via shear displacement to reach a residual strength condition.

The empirical fully softened friction angle relationships presented in Fig. 5 can be used to estimate the secant fully softened friction angle using the liquid limit, clay-size fraction, and effective normal stress. If the liquid limit and clay-size fraction are measured using the ASTM Standard Test Methods, ASTM D 4318 (1999a) and ASTM D 422 (1999b), respectively, the values should be adjusted as discussed previously because some of the liquid limit and clay-size fraction values used to obtain Fig. 5 were measured using ball-milled material. The main difference between the relationships shown in Fig. 5 and the relationship presented by Stark and Eid (1997) is the increase in the range of fully softened friction angle (approximately 2°) for the clay-size fraction group of greater than or equal to 50%.

Numerical Difference Between Fully Softened and Residual Friction Angles

Fig. 6 presents the numerical difference between the residual and fully softened friction angles for the 36 soils. It is shown in Table 2 that the difference between the fully softened (ϕ′) and residual (ϕ'_r) friction angles is maximized for soils with a liquid limit

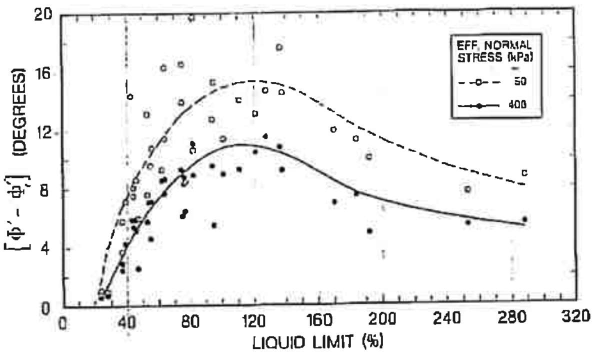


Fig. 6. Difference between secant fully softened and residual friction angles as function of liquid limit

between 80 and 140%. In these soils, a large shear displacement is required to convert initial edge-to-face particle interactions to face-to-face interactions and establish a residual strength condition. This particle reorientation leads to a low residual friction angle, and thus a large difference between ϕ' and ϕ'_r. For example, at a liquid limit of 120%, the difference between ϕ' and ϕ'_r is approximately 15 and 11° for effective normal stresses of 50 and 400 kPa, respectively. Fig. 6 also shows that the difference between ϕ' and ϕ'_r depends on the effective normal stress at which the two secant friction angles are estimated. Increasing the effective normal stress decreases the difference between ϕ' and ϕ'_r. This suggests that the fully softened failure envelope exhibits a larger stress dependency than the drained residual failure envelope. This may be caused by the effective normal stress being the only factor that affects initial particle orientation in the fully softened strength condition whereas, both effective normal stress and large shear displacement affect particle orientation in the drained residual strength condition.

For low plasticity soils (liquid limit less than 50), the relatively rotund or bulky particles and/or stiff clay plates result in large values of ϕ' and ϕ'_r. Consequently, the difference between ϕ' and ϕ'_r is smaller (6–8°) than for high plasticity soils (11–15° as discussed in the preceding paragraph). This is caused by the rotund particles and/or stiff clay plates establishing edge-to-face interaction during shear in the fully softened and residual cases and not face-to-face interaction. For very high plasticity soils (liquid limit greater than 140%), the flexible and platy particles of these soils can establish face-to-face interaction at low and high normal stresses in a remolded specimen without large shear displacement. This mechanism leads to a smaller difference between ϕ' and ϕ'_r than that of the soils with a LL between 80 and 140%.

Fig. 6 can be used to evaluate the practical significance of determining whether or not a pre-existing shear surface is present in a slope. In natural soils with a liquid limit between approximately 80 and 140%, it is important to determine whether the slope has a pre-existing shear surface because of the large difference (up to 16°) between the fully softened and residual friction angles. If a pre-existing shear surface is located, a residual friction angle should be utilized for slope design. It should be noted that the difference in ϕ' and ϕ'_r will be greater for shallow failure surfaces, i.e., lower effective normal stresses, than for deep failure surfaces.

In soils with a liquid limit less than 50%, there is a smaller difference (less than 8 and 6° at an effective vertical stress of 50 and 400 kPa, respectively) between the fully softened and residual friction angles. However, this difference between the fully softened and residual values may still adversely affect the slope design depending on the magnitude of effective normal stress acting on the failure surface in this material. In slopes where there is not a large difference between ϕ' and ϕ'_r and where some uncertainty exists on whether a pre-existing shear surface is present or not, it may be prudent to verify the slope design using an appropriate value of ϕ'_r. This could be accomplished by assigning an appropriate value of ϕ'_r to all materials and ensuring that the resulting factor of safety is greater than unity (Stark and Poeppel 1994).

Healing of Shear Surfaces

D'Appolonia et al. (1967) suggest that shear surfaces in cohesive soil, in particular colluvium, can undergo a "healing" causing the shear strength mobilized along a pre-existing failure surface to be greater than the residual value. However, they state that the mechanism for "healing" is not known. The importance of determining the existence and magnitude, if any, of healing is illustrated by a landslide near Seattle, Wash. Surface features indicate that this is an ancient landslide that was reactivated in 1990. The 1990 movement involved less than 2 ft of lateral movement. A consultant proposed that the cohesive colluvium responsible for the slide had gained strength, i.e., healed, during the inactive or dormant period prior to 1990. As a result, it was concluded that the slide is less stable now than before the 1990 movement because the shear strength increase due to healing was removed because of the less than 2 ft of lateral displacement. This small amount of movement did not significantly change the driving or resisting forces. In other words, the strength gain that occurred from the time that the ancient landslide occurred until 1990 is not available after the 1990 movement and thus the slope is less stable after 1990 than before 1990 because the slope geometry did not change significantly. This assertion has serious economical implications for this and other landslides because if the slope is less stable, insurance companies and others may be liable to return the slope to the premovement condition, i.e., the premovement factor of safety. This would involve increasing the shear strength of the soil involved, altering the geometry of the slope, installing a shear key, and/or draining the slope, all of which are expensive propositions.

Another reason for determining the existence and magnitude of healing is the remediation of landslides. If the pre-existing shear surface "heals" in a short period of time, i.e., prior to remediation, it might be possible to design the remedial measures using a shear strength greater than the residual value, which will reduce the cost of the remedial measures. Therefore, it is important to determine: (1) if the shear strength increases from the residual value with time; (2) if the strength increases with time, how long does it take to reach the maximum value; (3) if the strength increases with time, does the strength return to the residual value with additional movement and if so how much displacement; and (4) what is the maximum shear strength that could be obtained from healing and used for design purposes.

To address these questions, "healing" torsional ring shear tests have been conducted on low plasticity (Duck Creek shale, liquid limit of 37) and high plasticity (Otay bentonitic shale, liquid limit of 112) soil from Table 1. The ring shear tests were conducted using the procedure described in Stark and Eid (1993 and 1994) and ASTM (1999c) except that after the residual strength is achieved at the desired normal stress of 100 kPa, the test is

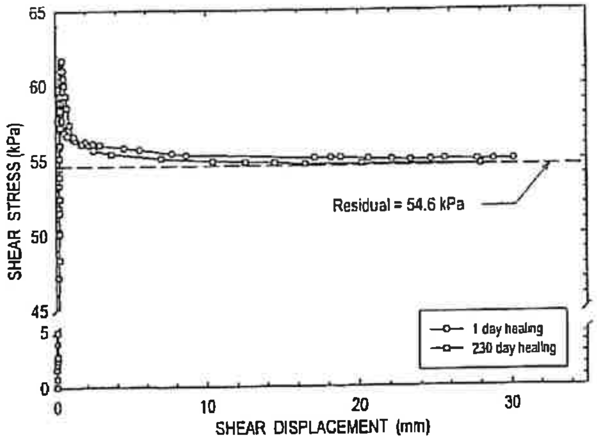


Fig. 7. Shear stress–shear displacement relationships from healing tests on Duck Creek shale

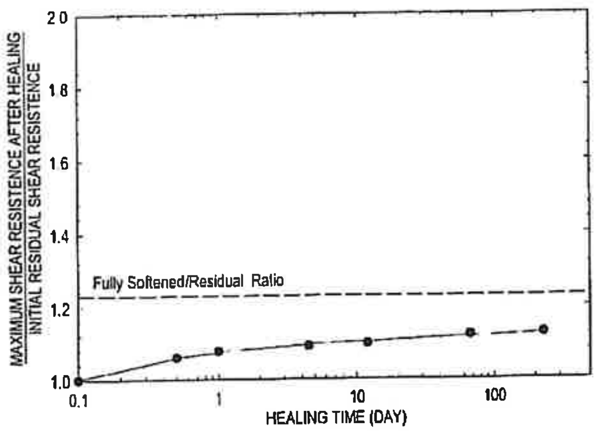


Fig. 8. Ratio of maximum shear resistance after healing to initial residual shear resistance for Duck Creek shale at effective stress of 100 kPa

stopped. The specimen is not removed from the specimen container and the normal stress of 100 kPa is maintained for the first healing period. In general, the healing periods follow an approximate geometric progression starting with a 1 day healing period. After 1 day of healing, shearing restarted until the initial residual strength condition is achieved. After the residual strength is achieved, the specimen is healed for the next healing period and then sheared again. For example, the 5 day healing period corresponds to a specimen that rests for 5 days after reaching a residual strength condition after the 1 day healing period. At the end of each healing period, the ring shear test is restarted without preshearing the specimen. Thus, when the test is reactivated the strength gain, if any, that occurred during the healing period is measured. After measuring the maximum healed shear strength and before another healing period is commenced, the ring shear test is continued until the residual strength initially measured is reached. To date, testing is limited to Duck Creek shale and Otay bentonitic shale at an effective normal stress of 100 kPa. Future testing is focusing on other soil plasticities and effective normal stresses. The shear displacement rate used for the initial and healing phases of the ring shear test is 0.018 mm/min, which is the same rate used for the residual and fully softened strength testing described in Tables 1 and 2.

Healing Tests on Low Plasticity Soil

Fig. 7 presents the shear stress–displacement relationships for the one and 230 day healing tests on the low plasticity Duck Creek Shale. The resulting shear stress–displacement relationships exhibit a shear resistance after healing that is greater than the initial residual shear stress of 54.6 kPa. The 1 day and 230 day tests yield healed shear stresses of 58.8 and 61.7 kPa, respectively. After healing and shearing, both values of shear resistance return to approximately the initial residual shear stress of 54.6 kPa. These small increases in shear resistance after healing are significant for the Duck Creek shale because the difference between the residual and fully softened strengths is small because of the low plasticity (liquid limit of 37) of the soil.

The importance of this small strength gain due to healing is reflected in Fig. 8, which presents the ratio of the maximum shear resistance measured after healing to the initial residual shear resistance. The dashed line in Fig. 8 represents the ratio of the fully softened strength to the residual strength. The fully softened strength is used for comparison purposes because this strength would be the upper limit if no sliding had occurred and thus represents the fully healed condition or maximum strength that could be expected due to healing because it corresponds to a no shear displacement condition. These preliminary data suggest that in low plasticity material, healing of a pre-existing shear surface does occur, albeit at a relatively slow rate, and the shear strength after healing may approach the fully softened strength.

It is important to note that the strength gain due to healing is lost if a small shear displacement is induced after healing (see Fig. 7). Therefore, it is recommended that the remedial measures utilize a factor of safety that ensures little, if any, additional shear displacement occurs under static and seismic conditions.

Healing Tests on High Plasticity Soil

Fig. 9 presents the shear stress–displacement relationships results of 1 and 230 day healing tests on the high plasticity Otay bentonitic shale. The resulting shear stress–displacement relationships

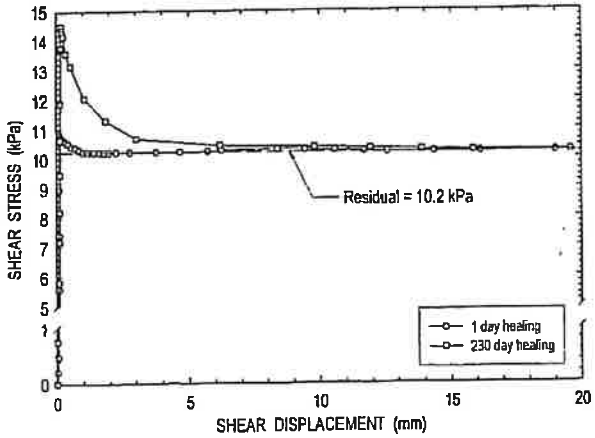


Fig. 9. Shear stress–shear displacement relationships from healing tests on Otay bentonitic shale

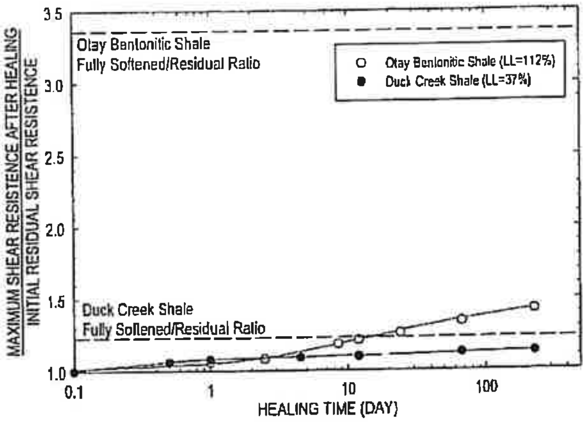


Fig. 10. Ratio of maximum shear resistance after healing to initial residual shear resistance for Duck Creek shale and Otay bentonitic shale at effective stress of 100 kPa

exhibit a shear resistance that is greater than the initial residual shear stress of about 10.2 kPa. The maximum shear resistance increases with increasing healing time. After mobilizing the healed shear resistance, the shear resistance decreases with increasing shear displacement until the residual strength condition is reached again at a shear stress of 10.2 kPa.

In summary, it also appears that the high plasticity material develops additional shear resistance with time and the percentage increase is greater than that observed for the low plasticity soil (Fig. 10). The mechanism(s) for this strength gain are not known but may be related to the interaction of face-to-face particles because this strength gain occurred after the establishment of a residual strength condition. These mechanisms of strength gain may include van der Waals attractions and thixotropy. Thixotropy is defined as an isothermal, reversible, time-dependent process occurring under conditions of constant composition and volume that results in material hardening (Mitchell 1993). It is anticipated that once shearing has been terminated, the soil structure is not in complete equilibrium even though a residual strength condition is achieved initially. This nonequilibrium condition may result from the tendency of clay minerals in close face-to-face contact to have high repulsion pressures and thus dispersion (Terzaghi et al. 1996). This nonequilibrium condition may lead to a readjustment or the creation of some particle bonding and thus strength gain to achieve equilibrium.

Even though there is a larger increase in shear resistance due to healing in the high plasticity material, the shear resistance after healing is considerably lower than the fully softened value. The difference between the fully softened and healed strength is significantly greater for the high plasticity than the low plasticity soil. Fig. 10 superimposes the results of seven healing tests conducted on Otay bentonitic shale on the results of the six healing tests performed on Duck Creek shale. It can be seen that the Otay bentonitic shale exhibits a significantly greater strength gain after 4 days of healing than does the Duck Creek shale. These results agree with the results of reversal direct shear tests conducted by Ramiah et al. (1973) that also show a strength gain after large shear displacement for both kaolinite and bentonite. Ramiah et al. (1973) show a greater strength gain for short time periods, less than four days, for high plasticity, e.g., bentonite, than lower plasticity, e.g., kaolinite soil. However, the strength gain shown in Fig. 9 is also lost if a small shear displacement is induced after healing.

In summary, these initial test results suggest that a failure surface which has achieved a residual strength condition may undergo a healing process and exhibit a shear strength greater than the residual value upon reshearing. This finding may have significant impact on landslides in high plasticity material because the strength gain due to healing may be greater than in low plasticity materials. Mitchell (1960) suggests that if strength gains are determined under a careful and controlled test procedure, no fundamental reason exists for preventing the application of thixotropic effects in design. To better define the potential for strength gain in clays of varying plasticity and over longer healing times, testing is continuing.

Conclusions

The following conclusions are based on the interpretation of torsional ring shear tests on clays, mudstones, shales, and claystones and the results of slope stability analyses.

1. In stability analyses, an effective stress cohesion equal to zero should be used in residual shear strength conditions (pre-existing shear surfaces, e.g., old landslides, shear zones, slickensided surfaces, or fault gouges) because the particle bonds, structure, and stress history have been reduced or removed and the clay particles are oriented parallel to the direction of shear. Therefore, the residual shear strength is controlled by the frictional resistance of the face-to-face contacts of the oriented particles and should be represented by only a residual friction angle or a stress dependent failure envelope that passes through the origin. In first-time slide situations it is recommended that the effective stress cohesion be assigned a zero.
2. Empirical relationships for the residual (Fig. 2) and fully softened (Fig. 5) shear strengths are presented herein that are a function of the liquid limit, clay-size fraction, and effective normal stress. The liquid limit provides an adequate indication of clay mineralogy and the clay-size fraction indicates the quantity of particles smaller than 0.002 mm. These relationships can be used to estimate the stress dependent failure envelope or a secant friction angle that corresponds to the average effective normal stress acting on the critical slip surface passing through this material. It is recommended that the stress dependent failure envelope or a secant friction angle corresponding to the average effective normal stress on the slip surface be used in a stability analysis to model the effective stress dependent behavior of the residual and fully softened shear strengths.
3. The liquid limit and clay-size fraction are sensitive to the sample preparation technique utilized. To facilitate use of the empirical relationships presented herein in practice, an adjustment factor for the value of liquid limit and clay-size fraction derived from the ASTM standard test methods is presented to account for the effectiveness of ball milling in deaggregating clay particles. The adjustment factors can be used to adjust the ASTM derived values of liquid limit and clay-size fraction to reflect the ball-milling sample preparation procedure so the ASTM derived values can be used with the empirical relationships in Figs. 2 and 5 to estimate the secant residual and fully softened friction angle, respectively. The adjustment should reduce the need for commercial labo-

ratories to ball mill heavily overconsolidated claystones, shales, and mudstones.

4. The numerical difference between the secant fully softened and the residual friction angles is a function of clay mineralogy and effective normal stress. Natural soils with a liquid limit between approximately 80 and 140% exhibit the largest difference in these friction angles (up to 16°). In these soils, the presence or absence of a pre-existing shear surface should be clarified during the subsurface investigation. In soils with a liquid limit less than 50%, there is a smaller difference (less than 8 and 6° at an effective vertical stress of 50 and 400 kPa, respectively) between the secant fully softened and residual friction angles. However, a difference of 8 or 6° between the fully softened and residual angles may still adversely affect the slope design/stability depending on the magnitude of effective normal stress acting on the failure surface in this material and the estimated factor of safety. As a result, it is prudent to verify the slope design by assigning a residual friction angle to materials that may mobilize a residual strength and ensure the factor of safety is greater than unity.
5. Preliminary results of healing ring shear tests indicate that preexisting shear surfaces may undergo healing or strength gain. The magnitude of healing appears to increase with increasing soil plasticity, and this increase could have important implications for the size, timing, and cost of landslide remediation. The strength gain with time may be more important in high plasticity soil because of the large difference in the fully softened and residual shear strength of these materials and thus the large potential for strength gain. However, the strength gain due to healing appears to be lost after small shear displacement.

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References

American Society for Testing and Materials (ASTM). (1999). "Standard test method for liquid limit, plastic limit, and plasticity index of soil." *(D 4318), 1999 annual book of ASTM standards*, Vol. 04.08, West Conshohocken, Pa, 526–538.

American Society for Testing and Materials (ASTM). (1999b). "Standard test method for particle-size analysis of soils." *(D 422) 1999 annual book of ASTM standards*, Vol. 04.08, West Conshohocken, Pa, 10–17.

American Society for Testing and Materials (ASTM). (1999c). "Standard test method for torsional ring shear test to determine drained residual shear strength of cohesive soils." *(D 6467) 1999 annual book of ASTM Standards*, Vol. 04.08, West Conshohocken, Pa, 832–836.

Bjerrum, L., and Simons, N. E. (1960). "Comparison of shear strength characteristics of normally consolidated clays." *Proc., Conf. on Shear Strength of Cohesive Clays*, ASCE, New York, 711–726.

Bromhead, E. N. (1979). "A simple ring shear apparatus." *Ground Eng.*, 12(5), 40–44.

D'Appolonia, E., Alperstein, R., and D'Appolonia, D. J. (1967). "Behavior of a colluvial slope." *J. Soil Mech. Found. Div.*, 93(4), 447–473.

Duncan, J. M., and Wright, S. G. (1979). "The accuracy of equilibrium methods of slope stability analysis." *Eng. Geol. (Amsterdam)*, 16, 5–17.

Eid, H. T., Stark, T. D., Evans, W. D., and Sherry, P. E. (2000). "Municipal solid waste slope failure. I: waste and foundation soil properties." *J. Geotech. Geoenviron. Eng.*, 126(5), 397–407.

Fleming, R. W., and Johnson, A. M. (1994). "Landslides in colluvium: Landslides of the Cincinnati, Ohio, area." *U.S. Geological Survey Bull. 2059-B*.

Holtz, R. D., and Kovacs, W. D. (1981). *An introduction to geotechnical engineering*, Prentice Hall, Englewood Cliffs, N.J.

La Gatta, D. P. (1970). "Residual strength of clays and clay-shale by rotation shear tests." Rep., Harvard Soil Mechanics Ser. No. *86*, Harvard Univ., Cambridge, Mass.

Lupini, J. F., Skinner, A. E., and Vaughan, P. R. (1981). "The drained residual strength of cohesive soils." *Geotechnique*, 31(2), 181–213.

Mesri, G., and Abdel-Ghaffar, M. E. M. (1993). "Cohesion intercept in effective stress-stability analysis." *J. Geotech. Eng.*, 119(8), 1229–1249.

Mesri, G., and Cepeda-Diaz, A. F. (1986). "Residual shear strength of clays and shales." *Geotechnique*, 36(2), 269–274.

Mesri, G., and Shahien, M. (2003). "Residual shear strength mobilized in first-time slope failures." *J. Geotech. Geoenviron. Eng.*, 129(1), 12–31.

Mitchell, J. K. (1960). "Fundamental aspects of thixotropy in soils." *J. Soil Mech. Found. Div.*, 86(3), 19–52.

Mitchell, J. K. (1993). *Fundamentals of soil behavior*, 2nd Ed., Wiley, New York.

Department of The Navy, Naval Facilities Engineering Command (NAVFAC). (1982). *Soil mechanics: Design manual*, NAVFAC, DM-7, Alexandria, Va.

Ramiah, B. K., Purushothamaraj, P., and Tavane, N. G. (1973). "Thixotropic effects on residual strength of remoulded clays." *Indian Geotechnical J.*, 3(3), 189–197.

Skempton, A. W. (1970). "First-time slides in over-consolidated clays." *Geotechnique*, 20(3), 320–324.

Skempton, A. W. (1977). "Slope stability of cuttings in brown London clay." *Proc., 9th Int. Conf. on Soil Mechanics and Foundation Engineering*, Vol. 3, Tokyo, 261–270.

Skempton, A. W. (1985). "Residual strength of clays in landslides, folded strata and the laboratory." *Geotechnique*, 35(1), 3–18.

Skempton, A. W., Schuster, R. L., and Petley, D. J. (1969). "Joints and fissures in the London clay at Wraysburg and Edgware." *Geotechnique*, 19(2), 205–217.

Stark, T. D., and Duncan, J. M. (1991). "Mechanisms of strength loss in stiff clays." *J. Geotech. Eng.*, 117(1), 139–154.

Stark, T. D., and Eid, H. T. (1992). "Comparison of field and laboratory residual shear strengths." *Proc., Stability and Performance of Slopes and Embankments II*, No. 31, Vol. 1, ASCE, New York, GSP 876–889.

Stark, T. D., and Eid, H. T. (1993). "Modified Bromhead ring shear apparatus." *Geotech. Test. J.*, 16(1), 100–107.

Stark, T. D., and Eid, H. T. (1994). "Drained residual strength of cohesive soils." *J. Geotech. Eng.*, 120(5), 856–871.

Stark, T. D., and Eid, H. T. (1997). "Slope stability analyses in stiff fissured clays." *J. Geotech. Geoenviron. Eng.*, 123(4), 335–343.

Stark, T. D., Eid, H. T., Evans, W. D., and Sherry, P. E. (2000). "Municipal solid waste slope failure II: stability analyses." *J. Geotech. Geoenviron. Eng.*, 126(5), 408–419.

Stark, T. D., and Poeppel, A. R. (1994). "Landfill liner interface strengths from torsional-ring-shear tests." *J. Geotech. Eng.*, 120(3), 597–615.

Terzaghi, K., Peck, R. B., and Mesri, G. (1996). *Soil mechanics in engineering practice*, 3rd Ed., Wiley, New York, 549–549.

Townsend, F. C., and Banks, D. C. (1974). "Preparation effects on clay shale classification indexes." *Proc., National Meeting on Water Resources Engineering*, ASCE, New York, 21–25.

AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
S-4	Bulk	-	CL	17.8	42	23	19	-0.26	-	-	-	107.7	18.2	-	-	-	-	-
S-5	Bulk	-	CL	9.4	42	23	19	-0.73	-	-	-	111.5	17.2	-	-	-	-	-

ABBREVIATIONS:
LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES:
T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME:	**AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK**		
PROJECT NUMBER:	**093-90018**		
SAMPLE ID:	**S-4**	**SAMPLE DEPTH:**	-
SAMPLE TYPE:	**Bulk**		

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

	PLASTIC LIMIT DETERMINATION			LIQUID LIMIT DETERMINATION		NATURAL MOISTURE
Number of Blows				22	22	
Weight of Wet Soil & Tare (gm)	20.69	20.14	20.32	23.59	22.76	198.09
Weight of Dry Soil & Tare (gm)	19.00	18.53	18.68	17.87	17.27	174.63
Weight of Tare (gm)	11.55	11.41	11.46	4.32	4.32	42.61
Weight of Water (gm)	1.69	1.61	1.64	5.72	5.49	23.46
Weight of Dry Soil (gm)	7.45	7.12	7.22	13.55	12.95	132.02
Water Content %	22.68	22.61	22.71	42.21	42.39	17.77

	TRIAL 1	TRIAL 2
BLOWS:	**22**	**22**
K VALUE:	**0.985**	**0.985**

PLASTIC LIMIT (PL): 23

LIQUID LIMIT (LL): 42

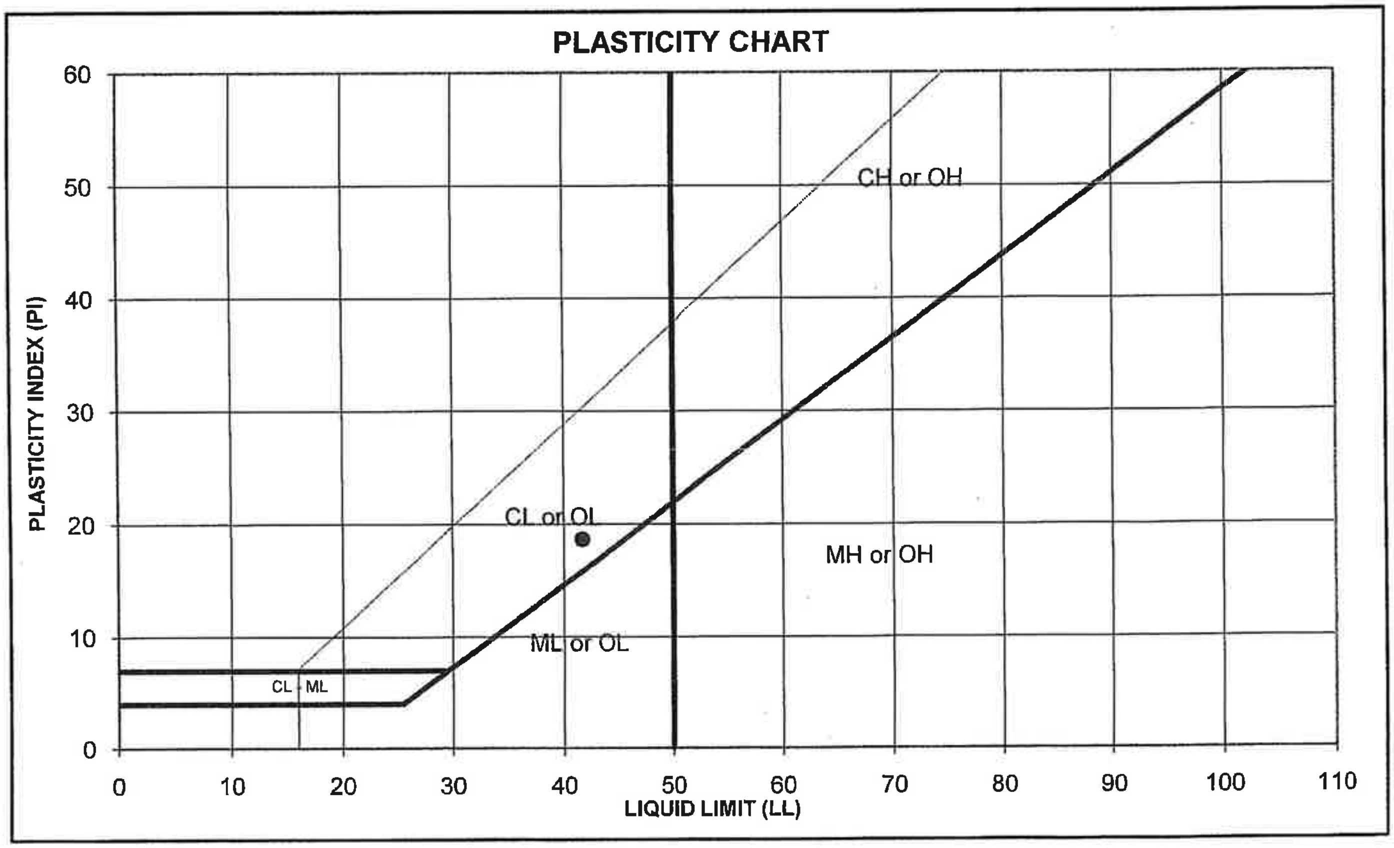
PLASTICITY INDEX (PI): 19

LIQUIDITY INDEX (LI): -0.26

NOTE:

DESCRIPTION Olive, SILTY CLAY, trace fine sand.

USCS (CL)

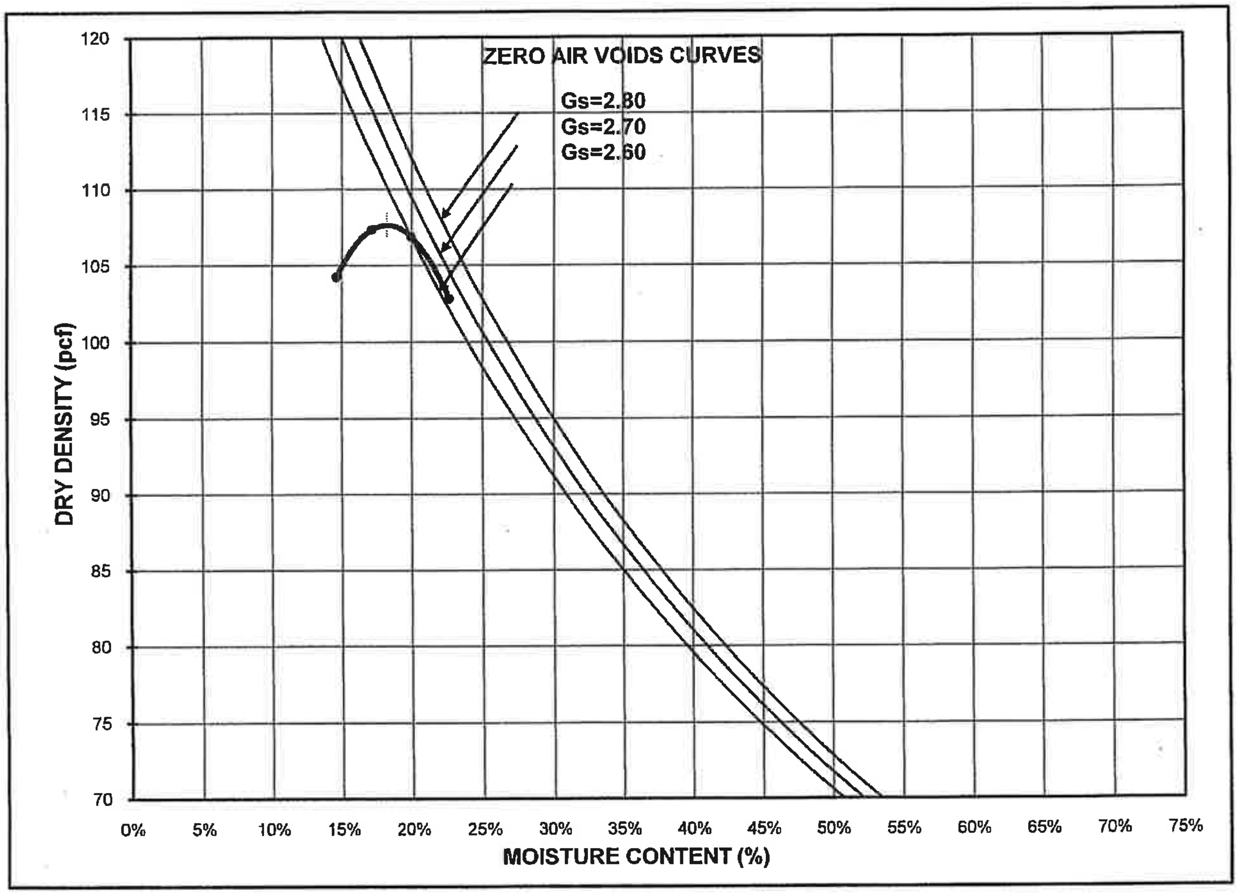


TECH	RF
DATE	3/2/09
CHECK	
REVIEW	

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK
PROJECT NUMBER: 093-90018
SAMPLE ID: S-4 - DEPTH: - SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	104.2	14.6%
2	107.3	17.1%
3	106.9	19.9%
4	102.8	22.7%

Maximum Dry Density (pcf)	107.7
Optimum Moisture (%)	18.2
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	17.8%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION Olive, SILTY CLAY, trace fine sand.

USCS (CL)

CHECK

REVIEW

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK
PROJECT NUMBER: 093-90018
SAMPLE ID: S-5 - **SAMPLE DEPTH:** -
SAMPLE TYPE: Bulk

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

	PLASTIC LIMIT DETERMINATION			**LIQUID LIMIT DETERMINATION**		**NATURAL MOISTURE**
Number of Blows				22	22	
Weight of Wet Soil & Tare (gm)	22.03	21.49	21.99	23.34	21.01	274.55
Weight of Dry Soil & Tare (gm)	20.09	19.62	20.01	17.72	15.97	255.41
Weight of Tare (gm)	11.72	11.69	11.38	4.37	4.28	52.21
Weight of Water (gm)	1.94	1.87	1.98	5.62	5.04	19.14
Weight of Dry Soil (gm)	8.37	7.93	8.63	13.35	11.69	203.20
Water Content %	23.18	23.58	22.94	42.10	43.11	9.42

	TRIAL 1	TRIAL 2
BLOWS:	**22**	**22**
K VALUE:	**0.985**	**0.985**

PLASTIC LIMIT (PL) 23

LIQUID LIMIT (LL) 42

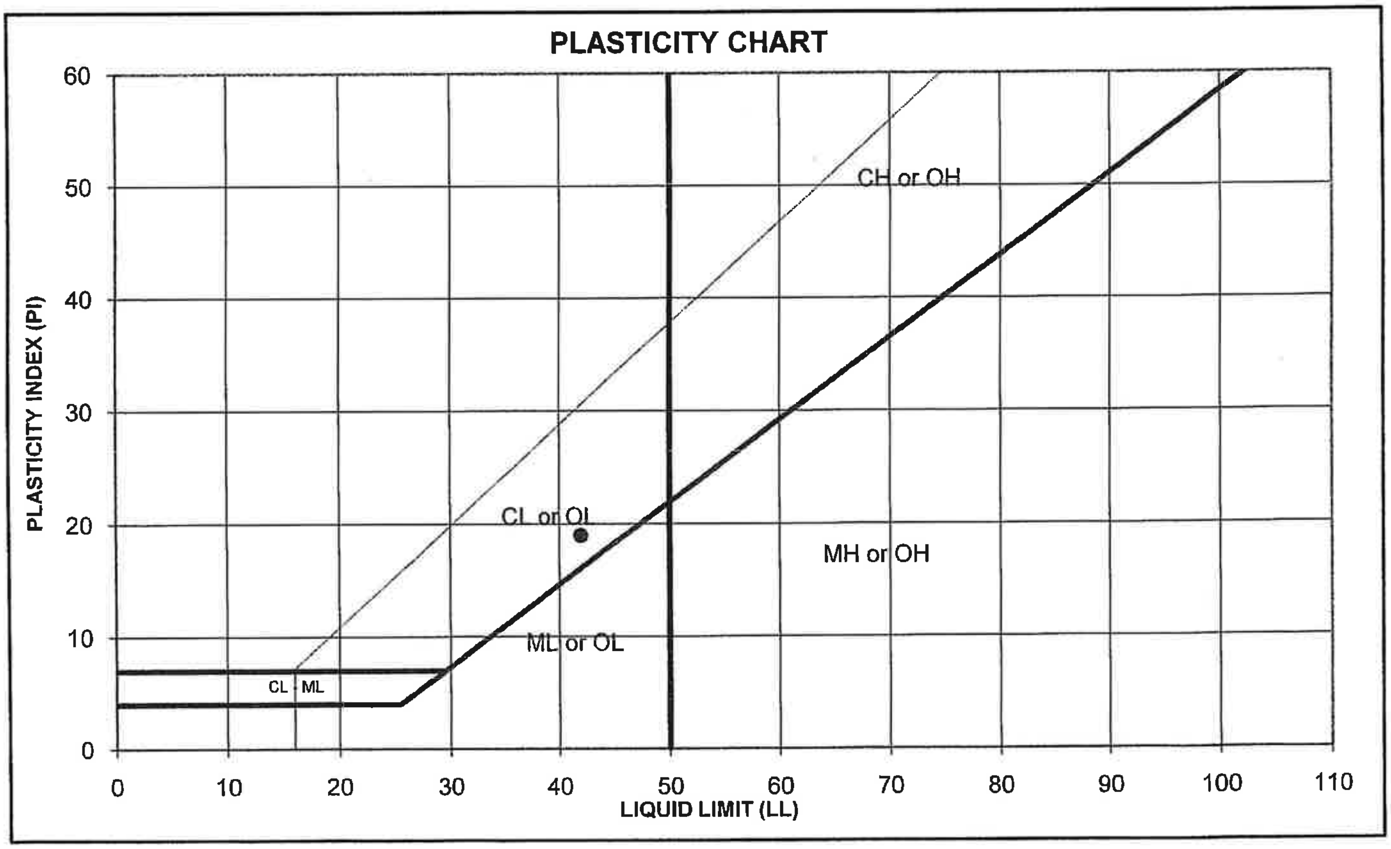
PLASTICITY INDEX (PI) 19

LIQUIDITY INDEX (LI) -0.73

NOTE:

DESCRIPTION Light Olive Brown, (Shale) SILTY CLAY, trace fine sand.

USCS (CL)



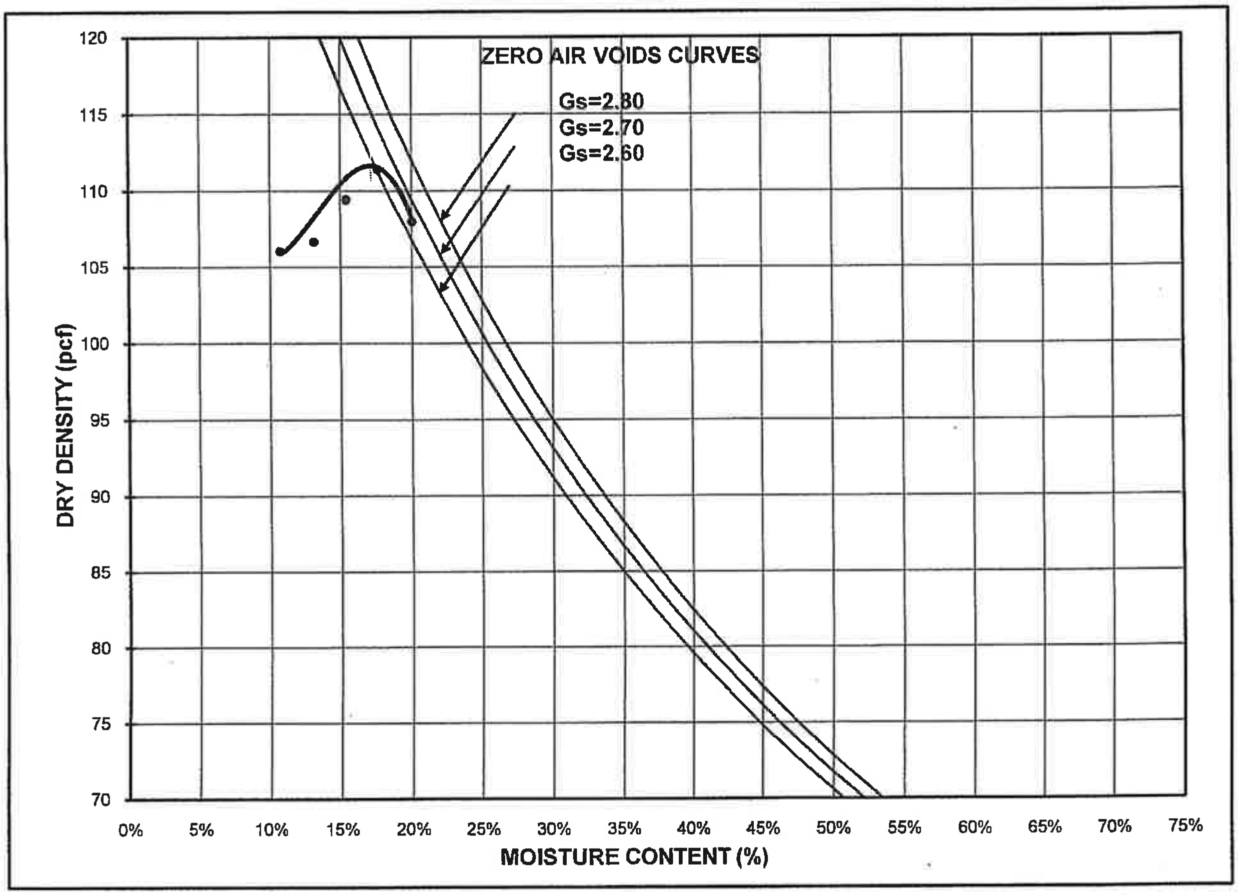
TECH	RF
DATE	3/2/09
CHECK	
REVIEW	

FEBRUARY 2008 **093-90018**

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: **AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK**
PROJECT NUMBER: **093-90018**
SAMPLE ID: **S-5** - DEPTH: **-** SAMPLE TYPE: **Bulk**



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	106.0	10.7%
2	106.6	13.1%
3	109.4	15.4%
4	111.4	17.6%
5	108.0	20.0%

Maximum Dry Density (pcf)	111.5
Optimum Moisture (%)	17.2
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	9.4%

NOTE: Material was crushed to pass throught the 3/8" sieve.

% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION Light Olive Brown, (Shale) SILTY CLAY, trace fine sand.

USCS CL

CHECK
REVIEW

FEBRUARY 2009

093-90018

AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classification	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		Gs	Unit Weight		Permeability (cm/sec)	Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %		Moisture %	Dry (lb/cuft)		
S-4	Bulk	-	CL	17.8	42	23	19	-0.26	-	-	-	107.7	18.2	-	-	-	-	-
S-5	Bulk	-	CL	9.4	42	23	19	-0.73	-	-	-	111.5	17.2	-	-	-	-	-
CL-1	Bulk	-	CL	7.3	37	22	15	-0.96	100.0	98.4	-	117.8	14.0	-	14.0	112.1	5.0E-08	-
CL-2	Bulk	-	CL	11.7	42	25	17	-0.81	100.0	98.4	-	110.5	17.7	-	17.6	104.6	5.1E-08	-

$\bar{x}$ 40.75% 98.4%

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

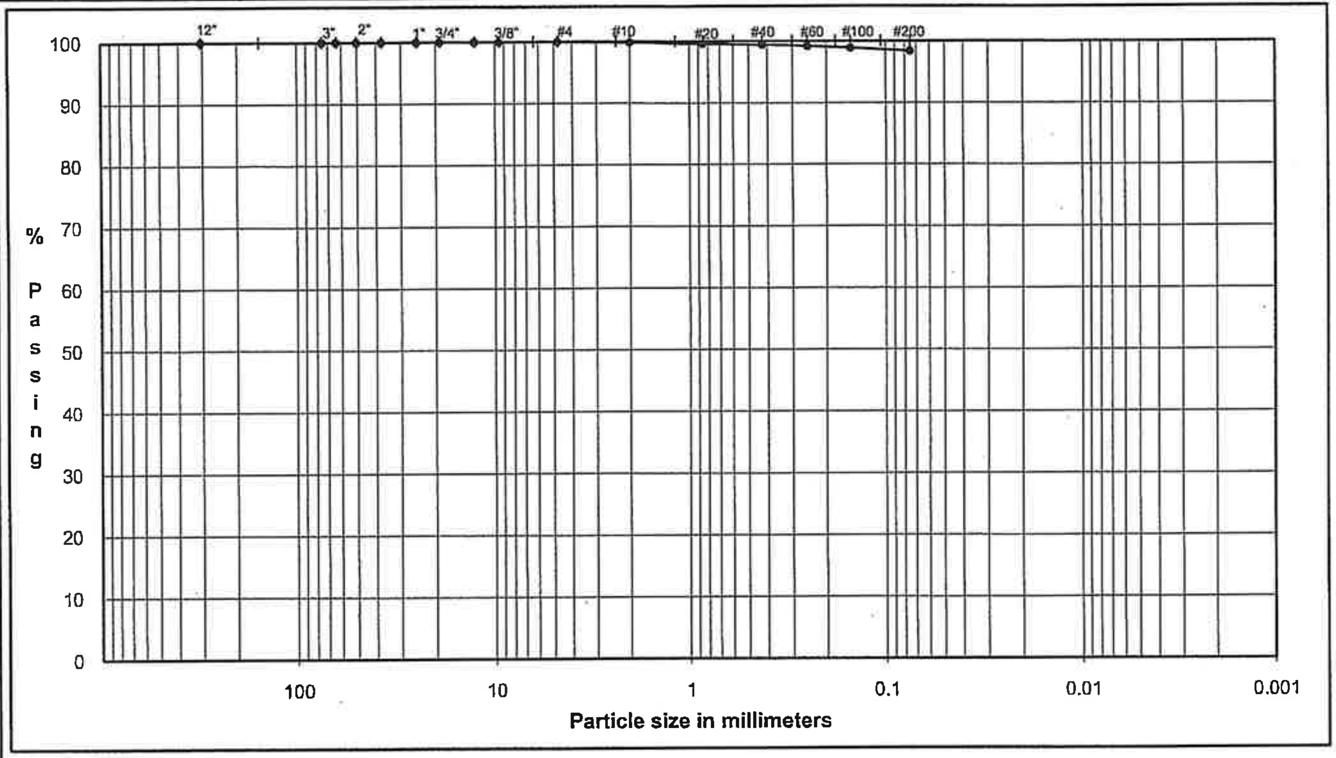
NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

MARCH 2009 093-90018

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

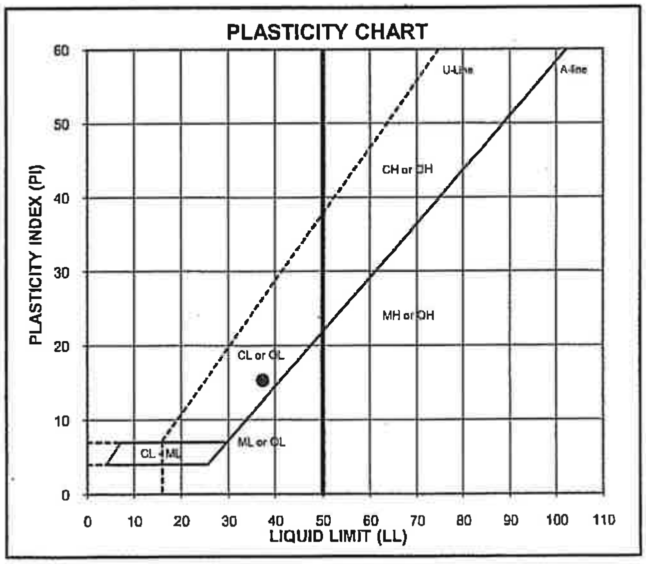
PROJECT NAME:	AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK		
SAMPLE ID:	CL-1	Depth:	-
TYPE:	Bulk		



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
2.5"	63.5	**100.0**	Coarse Gravel	**0.00**
2.0"	50.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**100.0**		
0.75"	19.0	**100.0**		
0.50"	12.7	**100.0**	Fine Gravel	**0.00**
0.375"	9.5	**100.0**		
#4	4.8	**100.0**		
#10	2.00	**99.9**	Coarse Sand	**0.15**
#20	0.85	**99.6**	Medium Sand	**0.42**
#40	0.43	**99.4**		
#60	0.25	**99.2**	Fine Sand	**1.02**
#100	0.15	**98.9**		
#200	0.075	**98.4**		
			Fines	**98.41**



ATTERBERG LIMITS

Method -B (Dry preparation)

M,	LL	PL	PI	LI
7.3	37	22	15	-0.96

DESCRIPTION: Gray, (Shale) SILTY CLAY, trace medium to fine sand.

USCS: CL

LL (oven-dried)
< 0.75 - ORGANIC (OL/OH)

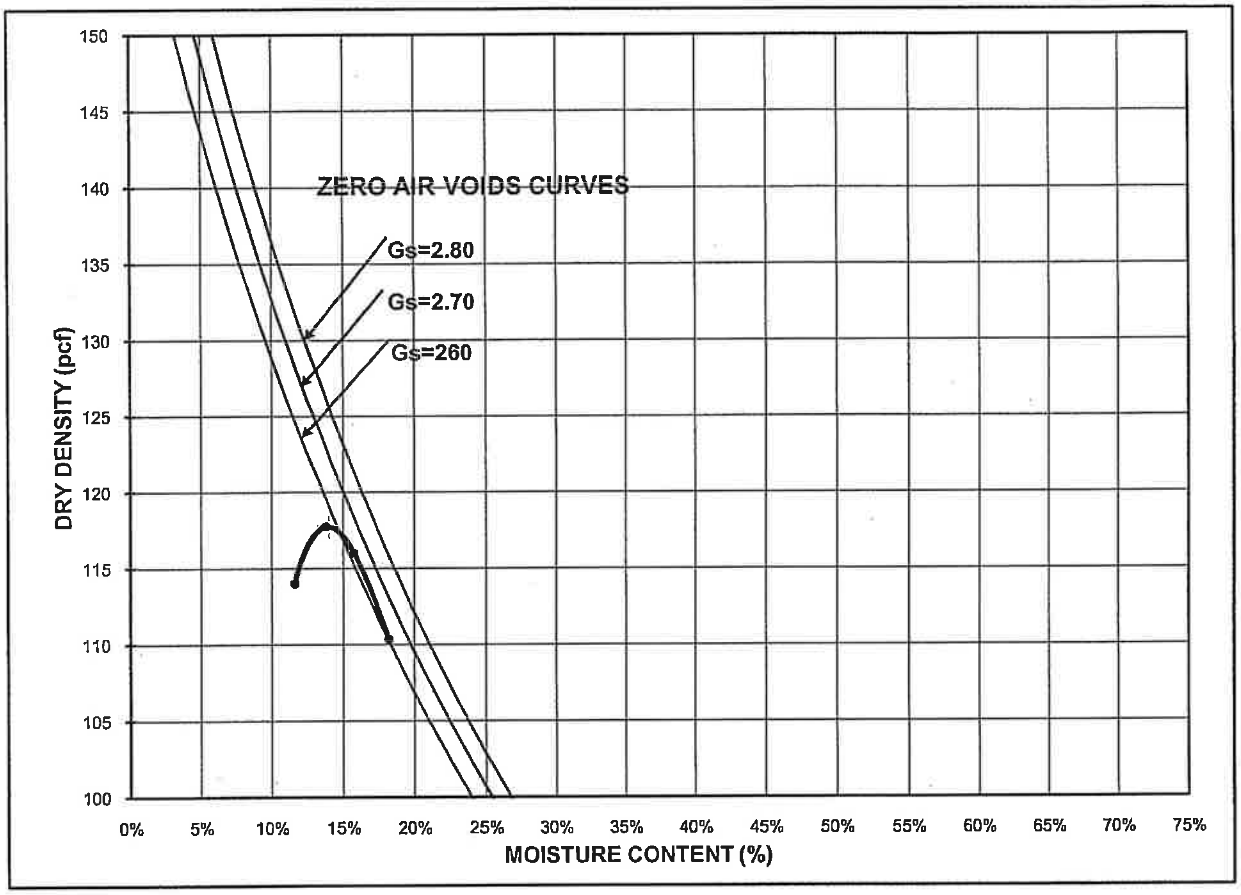
TECH	TJ
DATE	3/4/09
CHECK	
REVIEW	

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK
PROJECT NUMBER: 093-90018
SAMPLE ID: CL-1 - DEPTH: - SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	114.0	11.6%
2	117.7	13.8%
3	116.0	15.7%
4	110.3	18.2%

Maximum Dry Density (pcf)	117.8
Optimum Moisture (%)	14.0
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	

As-Received Moisture Content 7.3%

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION Gray, (Shale) SILTY CLAY, trace medium to fine sand.

USCS CL

CHECK AK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK		Board #	1
PROJECT NUMBER	093-90018		Flow Pump	2
SAMPLE ID	CL-1	-	Flow Pump Speed	10
SAMPLE TYPE	Bulk		Technician	TW

COMMENTS: The sample was remolded to 94.9% of the Maximum Dry Density and OPTM (using ASTM D 698).

Sample Data, Initial			
Height, inches	2.996	B-Value, f	1.00
Diameter, inches	2.790	Cell Pres.	95.0
Area, cm²	39.44	Bot. Pres.	80.0
Volume, cm^3	300.15	Top Pres.	80.0
Mass, g	614.97	Tot. B.P.	80.0
Moisture Content, %	14.03	Head, max.	84.41
Dry Density, pcf	112.12	Head, min.	84.41
Spec. Gravity(assumed)	2.700	Max. Grad.	11.02
Volume Solids, cm^3	199.74	Min. Grad.	11.02
Volume Voids, cm^3	100.41		
Void Ratio	0.50		
Saturation, %	75.4%		

Flow Pump Rate 2.25E-05 cm^3/sec

Sample Data, Final	
Height, inches	3.016
Diameter, inches	2.818
Area, cm²	40.24
Volume, cm^3	308.25
Mass, g	637.34
Moisture Content, %	18.18
Dry Density, pcf	109.17
Volume Solids, cm^3	199.74
Volume Voids, cm^3	108.51
Void Ratio	0.54
Saturation, %	90.3%

USCS CL

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	614.97	645.32
Wt Soil & Tare, f	g	539.31	547.35
Wt Tare	g	0.00	8.38
Wt Moisture Lost	g	75.66	97.97
Wt Dry Soil	g	539.31	538.97
Water Content	%	14.03%	18.18%

DESCRIPTION

Gray, (Shale) SILTY CLAY, trace medium to fine sand.

		TIME FUNCTIONS, SECONDS						dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
03/09/09	39881	10	20	21.1	0	0	0	0	1.20	84.41	11.02	5.0E-08
03/09/09	39881	10	25	21.1	5	5	300	300	1.20	84.41	11.02	5.0E-08
03/09/09	39881	10	30	21.1	5	10	300	600	1.20	84.41	11.02	5.0E-08
03/09/09	39881	10	35	21.1	5	15	300	900	1.20	84.41	11.02	5.0E-08 *
03/09/09	39881	10	40	21.1	5	20	300	1200	1.20	84.41	11.02	5.0E-08 *
03/09/09	39881	10	45	21.1	5	25	300	1500	1.20	84.41	11.02	5.0E-08 *
03/09/09	39881	10	50	21.1	5	30	300	1800	1.20	84.41	11.02	5.0E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 5.0E-08 cm/sec **

PERMEANT: Deaired Tap Water

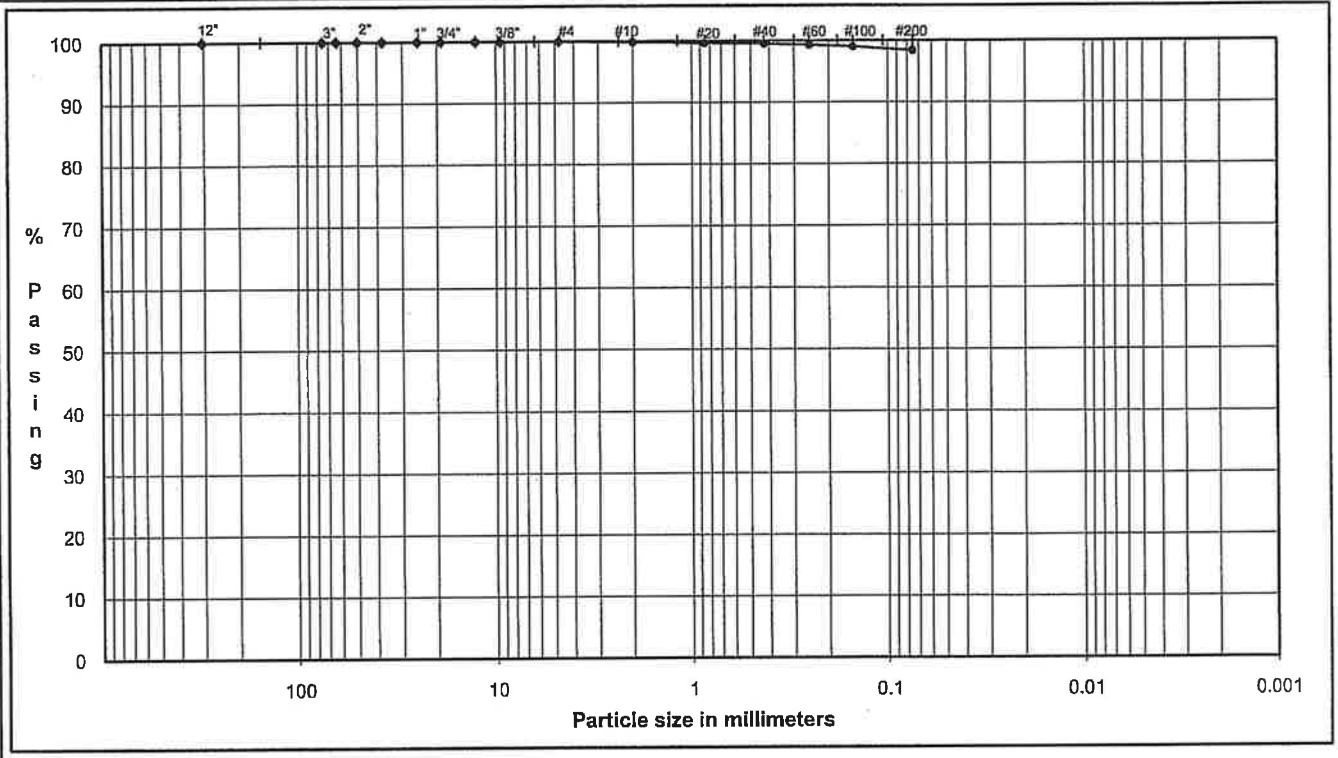
DATE	3/9/09
CHECK	AK
REVIEW	

MARCH 2009 093-90018

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

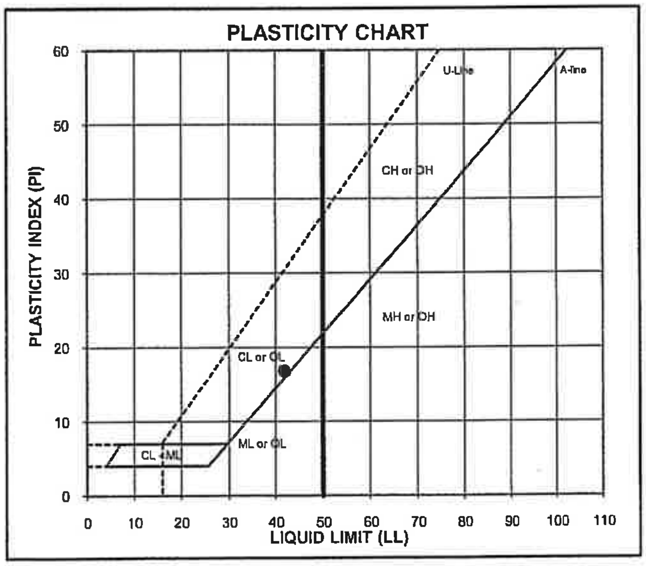
PROJECT NAME: AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK
SAMPLE ID: CL-2 Depth: -
TYPE: Bulk



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0	Cobbles	0.00
3.0"	75.0	100.0		
2.5"	63.5	100.0	Coarse Gravel	0.00
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0		
0.50"	12.7	100.0	Fine Gravel	0.00
0.375"	9.5	100.0		
#4	4.8	100.0		
#10	2.00	99.9	Coarse Sand	0.15
#20	0.85	99.7	Medium Sand	0.34
#40	0.43	99.5		
#60	0.25	99.3	Fine Sand	1.12
#100	0.15	99.0		
#200	0.075	98.4		
			Fines	98.39



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
11.7	42	25	17	-0.81

DESCRIPTION: Gray, SILTY CLAY, trace medium to fine sand.

USCS: CL

LL (oven-dried)
< 0.75 = ORGANIC (OL/OH)

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

TECH	TJ
DATE	3/4/09
CHECK	AK
REVIEW	

Golder Associates Inc.

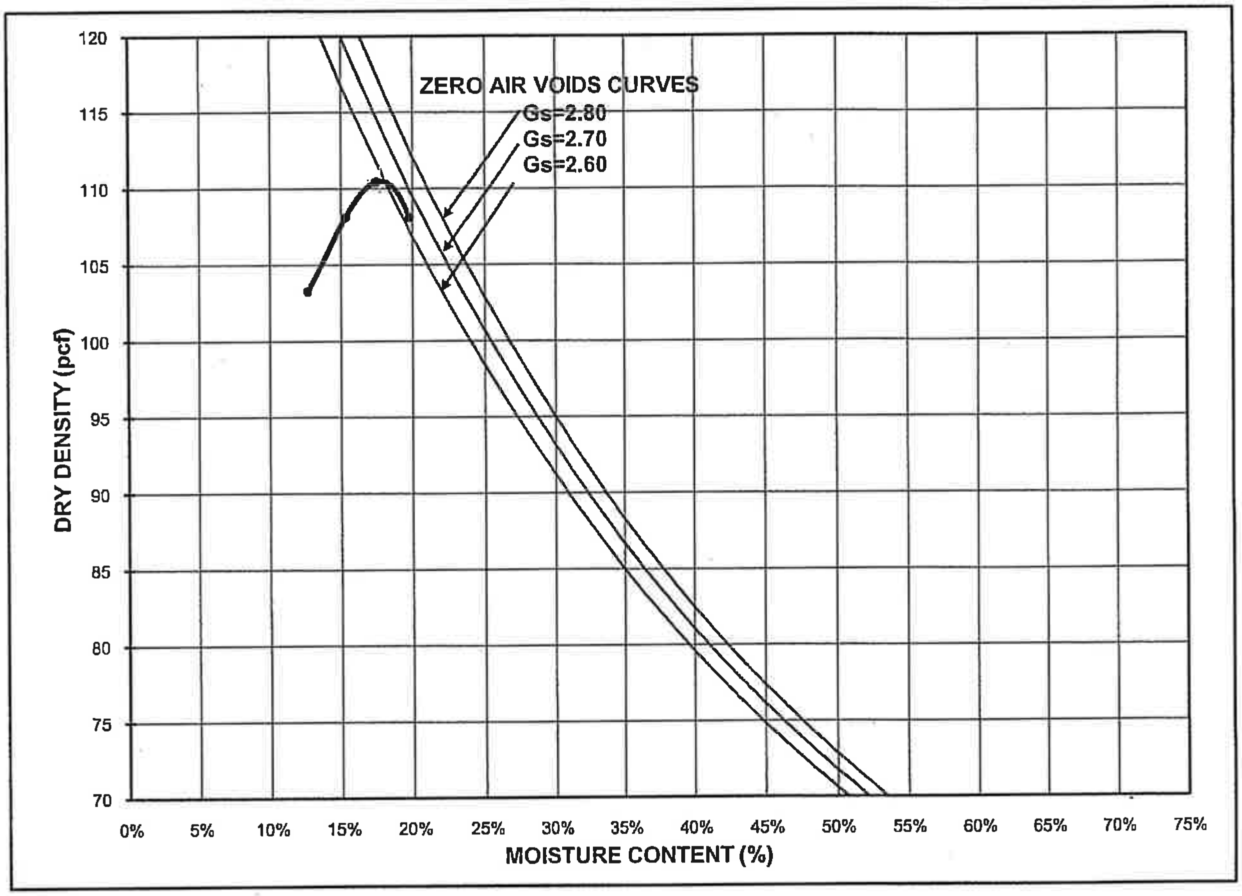
MARCH 2009

093-90018

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Wet Method

PROJECT NAME: AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK
PROJECT NUMBER: 093-90018
SAMPLE ID: CL-2 - DEPTH: - SAMPLE TYPE: Bulk



COMPACTION POINTS

Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	103.2	12.6%
2	108.1	15.3%
3	110.4	17.4%
4	108.1	19.7%
5	103.0	22.3%

Maximum Dry Density (pcf)	110.5
Optimum Moisture (%)	17.7
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	11.7%

NOTE: SAMPLE WAS CRUSHED AND PASSED THROUGH THE NO. 3/8" SIEVE BEFORE TESTING.

% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION Gray, SILTY CLAY, trace medium to fine sand.

USCS CL

CHECK AK
REVIEW

FLEXIBLE WALL PERMEABILITY
ASTM D 5084
METHOD D, CONSTANT RATE OF FLOW

PROJECT TITLE	AQUATERRA/AMERICAN ENVIRONMENTAL LF/OK	
PROJECT NUMBER	093-90018	
SAMPLE ID	CL-2	-
SAMPLE TYPE	Bulk	

Board #	1
Flow Pump	2
Flow Pump Speed	10
Technician	AK

COMMENTS: The sample was remolded to 94.7% of the Maximum Dry Density and OPTM - 0.1% (using ASTM D 698).

Sample Data, Initial			
Height, inches	3.011	B-Value, f	0.99
Diameter, inches	2.790	Cell Pres.	95.0
Area, cm²	39.44	Bot. Pres.	80.0
Volume, cm^3	301.65	Top Pres.	80.0
Mass, g	594.32	Tot. B.P.	80.0
Moisture Content, %	17.56	Head, max.	83.70
Dry Density, pcf	104.58	Head, min.	83.70
Spec. Gravity(assumed)	2.700	Max. Grad.	10.97
Volume Solids, cm^3	187.24	Min. Grad.	10.97
Volume Voids, cm^3	114.41		
Void Ratio	0.61		
Saturation, %	77.6%		

Flow Pump Rate 2.25E-05 cm^3/sec

Sample Data, Final	
Height, inches	3.004
Diameter, inches	2.784
Area, cm²	39.27
Volume, cm^3	299.66
Mass, g	612.22
Moisture Content, %	21.10
Dry Density, pcf	105.27
Volume Solids, cm^3	187.24
Volume Voids, cm^3	112.42
Void Ratio	0.60
Saturation, %	94.9%

USCS CL

WATER CONTENTS		Sample Initial	Sample Final
Wt Soil & Tare, i	g	594.32	620.71
Wt Soil & Tare, f	g	505.55	514.05
Wt Tare	g	0.00	8.52
Wt Moisture Lost	g	88.77	106.66
Wt Dry Soil	g	505.55	505.53
Water Content	%	17.56%	21.10%

DESCRIPTION

Gray, SILTY CLAY, trace medium to fine sand.

TIME FUNCTIONS, SECONDS								dP				
DATE	DAY	HOUR	MIN	TEMP (°C)	dt (min)	dt,acc (min)	dt (sec)	dt,acc (sec)	Reading (psi)	Head (cm)	Gradient	Permeability (cm/sec)
03/08/09	39880	14	0	20.9	0	0	0	0	1.19	83.70	10.97	5.1E-08
03/08/09	39880	14	5	20.9	5	5	300	300	1.19	83.70	10.97	5.1E-08
03/08/09	39880	14	10	20.9	5	10	300	600	1.19	83.70	10.97	5.1E-08
03/08/09	39880	14	15	20.9	5	15	300	900	1.19	83.70	10.97	5.1E-08 *
03/08/09	39880	14	20	20.9	5	20	300	1200	1.19	83.70	10.97	5.1E-08 *
03/08/09	39880	14	25	20.9	5	25	300	1500	1.19	83.70	10.97	5.1E-08 *
03/08/09	39880	14	30	20.9	5	30	300	1800	1.19	83.70	10.97	5.1E-08 *

*TRANSCRIBED FROM ORIGINAL DATA SHEETS

PERMEABILITY REPORTED AS ** 5.1E-08 cm/sec **

PERMEANT: Deaired Tap Water

DATE	3/8/09
CHECK	AK
REVIEW	

LABORATORY COMPACTION CHARACTERISTICS OF SOIL REPORT

Report Number: 04111202.0002
Service Date: 11/07/11
Report Date: 11/21/11 Revision 2 - sieve results

Terracon
10930 E. 56th St.
Tulsa, OK 74146
918-250-0461

Client

Aqua Terra Environmental Solutions
Attn: Joe Paul Edwards
4149 Highline Blvd
Suite 350
Oklahoma City, OK 73108

Project

Aquaterra Testing
10930 E 56th Street
Tulsa, OK

Project Number 04111202

Material Information

Source of Material:
Proposed Use:

Sample Information

Sample Date: 11/07/11 **Sample Time:** 805
Sampled By:
Sample Location:

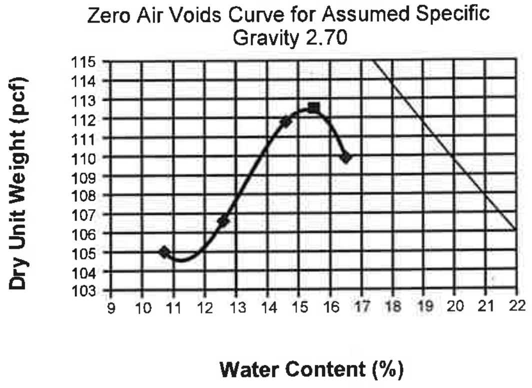
Sample Description: reddish silty sandy lean clay

Laboratory Test Data

Test Procedure: ASTM D698
Test Method: Method A
Sample Preparation: Dry
Rammer Type: Manual
Maximum Dry Unit Weight (pcf): **112.5**
Optimum Water Content (%): **15.5**

	Result	Specifications
Liquid Limit:	31	
Plastic Limit:	16	
Plasticity Index:	15	
In-Place Moisture (%):		
Passing #200 (%):	82.8	

USCS:


Zero Air Voids Curve for Assumed Specific Gravity 2.70

Comments:

Services:

Terracon Rep.:
Reported To:
Contractor:
Report Distribution:
(90) Aqua Terra Environmental Solutions

Reviewed By: ______________________

James E. Chandler
Project Manager III-Technical

Test Methods:

CCL BENEATH PROPOSED PHASE IVA - COMPACTED GRAY SHALE : MAX WASTE HEIGHT ≈ 86 FT.

Clay Fraction	100.0	Secant Fully Softened Friction Angle ϕ =	22.9	Ref: "Drained Shear Strength Parameters for Analysis of Landfills" GT/2003/023463 006505QGT - Stark e		NO PRIOR SLIDE
LL	55.1	Feet of Waste / Cover	86.0 ft	Effective Normal Stress	5590 psf	Must be between 1044.27 and 8354.16

		Clay Fraction (%)								
γ_{MSW}		≤20			25 ≤ cf ≤ 45			≥50		
65 pcf		Effective Normal Stress (σ)								
	20.8854	50 kPa	100 kPa	400 kPa						
		1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf
	Ft of MSW	16.07 ft	32.13 ft	128.53 ft	16.07 ft	32.13 ft	128.53 ft	16.07 ft	32.13 ft	128.53 ft
	LL	Secant Fully Softened Friction Angle (ϕ'_r) Degrees								

1	2	3	4	5	6	7	8	9	10	11	12
1	10										1
2	20	33.6	32.8	32.2							2
3	30	32.9	32	31.1							3
4	40	32.5	31.4	30.4	32.3	29.5	26.5	29.5	26.3	22.6	4
5	50	31.95	30.7	29.5	31.1	28.4	25.4	28.5	25.2	21.7	5
6	60	31.4	30.2	28.65	30.2	27.6	24.6	27.5	24.5	20.9	6
7	70	31	29.55	27.95	29.4	26.8	23.8	26.8	23.5	20.05	7
8	80	30.75	29.2	27.5	28.6	26.1	23	26.1	22.6	19.15	8
9	90				27.8	25.3	22.4	25.2	22	18.25	9
10	100				27.25	24.65	21.7	24.3	21.25	17.5	10
11	120				26	23.6	20.6	23	19.8	16.2	11
12	140				25	22.7	19.8	22	18.6	15.2	12
13	160							20.8	17.65	14.6	13
14	180							19.5	16.9	13.9	14
15	200							18.3	16.15	13.2	15
16	240							16.4	14.6	12.1	16
17	290							13.5	12.4	10.1	17
5	50	31.95	30.7	29.5	31.1	28.4	25.4	28.5	25.2	21.7	
	60	31.4	30.2	28.65	30.2	27.6	24.6	27.5	24.5	20.9	
	51%	0.55	0.5	0.85	0.9	0.8	0.8	1	0.7	0.8	
	55.1041875	**31.7**	**30.4**	**29.1**	**30.6**	**28.0**	**25.0**	**28.0**	**24.8**	**21.3**	

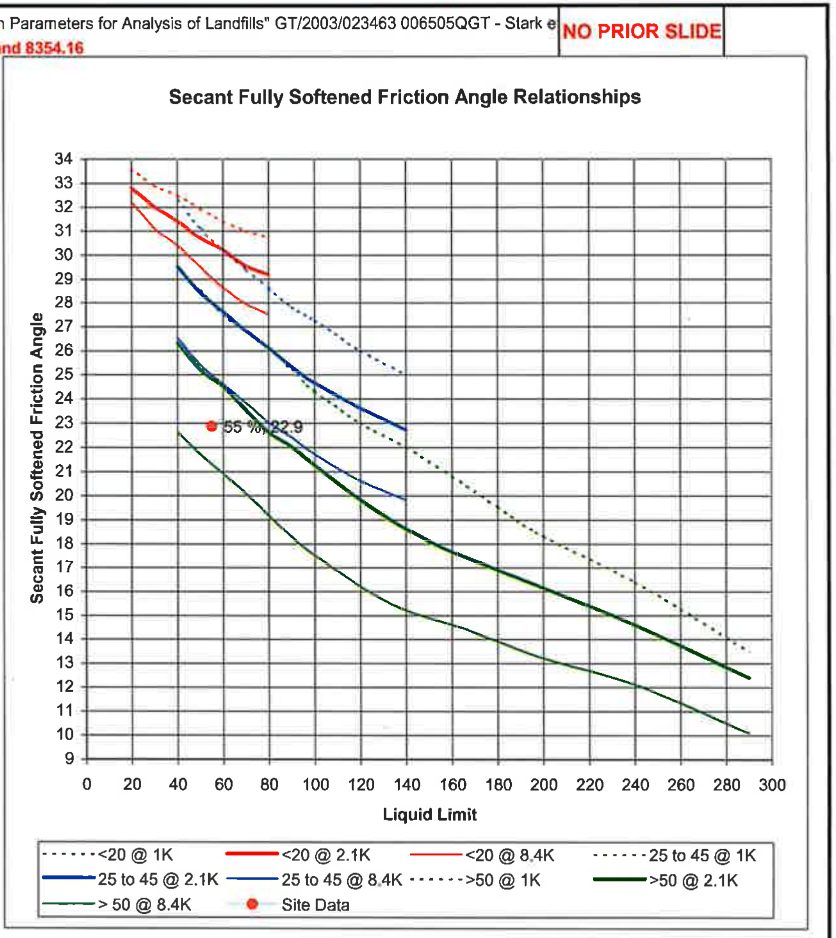
	5590 psf	1	2	3	1	2	3	1	2	3
		1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf
	55.1041875	31.66926969	30.44479063	29.06614406	30.64062313	27.991665	24.991665	27.98958125	24.84270688	21.291665
		1	2	3	1	2	3	1	2	3
		2			2			2		
		30.44	2088.54		27.99	2088.54		24.84	2088.54	
1	29.7	29.07	8354.16		24.99	8354.16		21.29	8354.16	
21	26.3	1.38	6265.62		3.00	6265.62		3.55	6265.62	
45	22.9	**29.7**	55.9%		**26.3**	55.9%		**22.9**	55.9%	
100	22.9	55 %								
		5590 psf	100	22.9	5590					

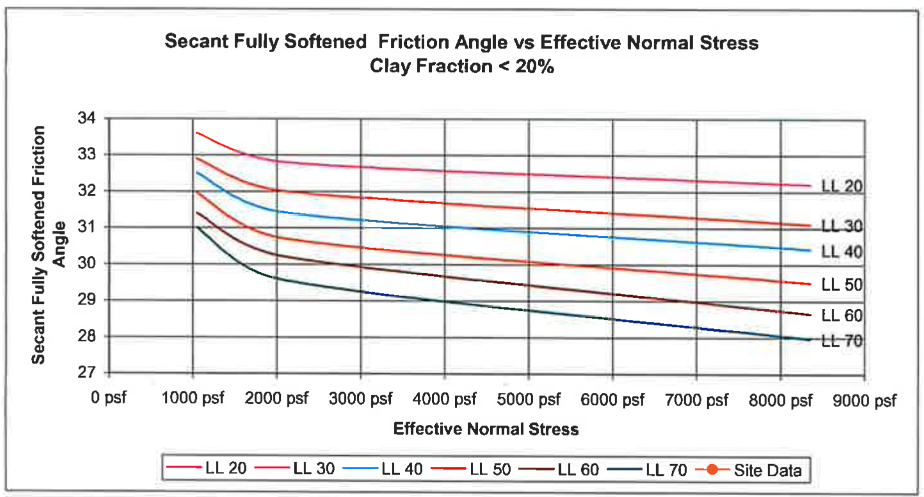
LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf	0	33.6	32.9	32.5	31.95	31.4	31										
2089 psf	0	32.8	32	31.4	30.7	30.2	29.55										
8354 psf	0	32.2	31.1	30.4	29.5	28.65	27.95										

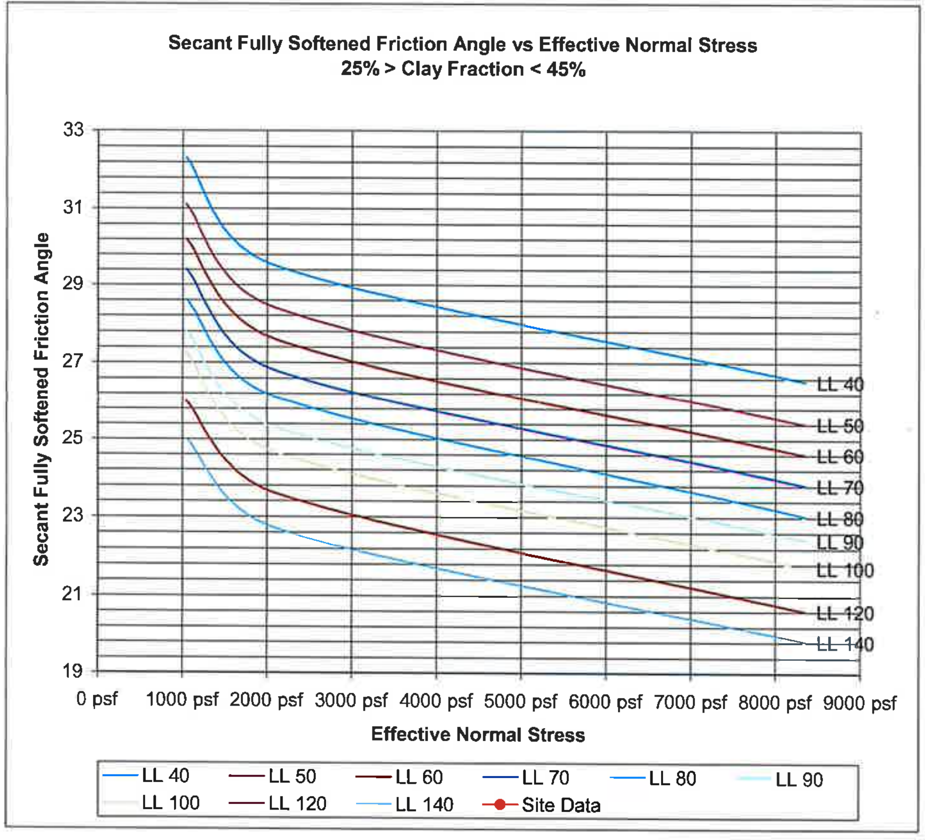
LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf		0	0	32.3	31.1	30.2	29.4	28.6	27.8	27.25	26	25	0				
2089 psf			0	29.5	28.4	27.6	26.8	26.1	25.3	24.65	23.6	22.7	0				
8354 psf			0	26.5	25.4	24.6	23.8	23	22.4	21.7	20.6	19.8	0				

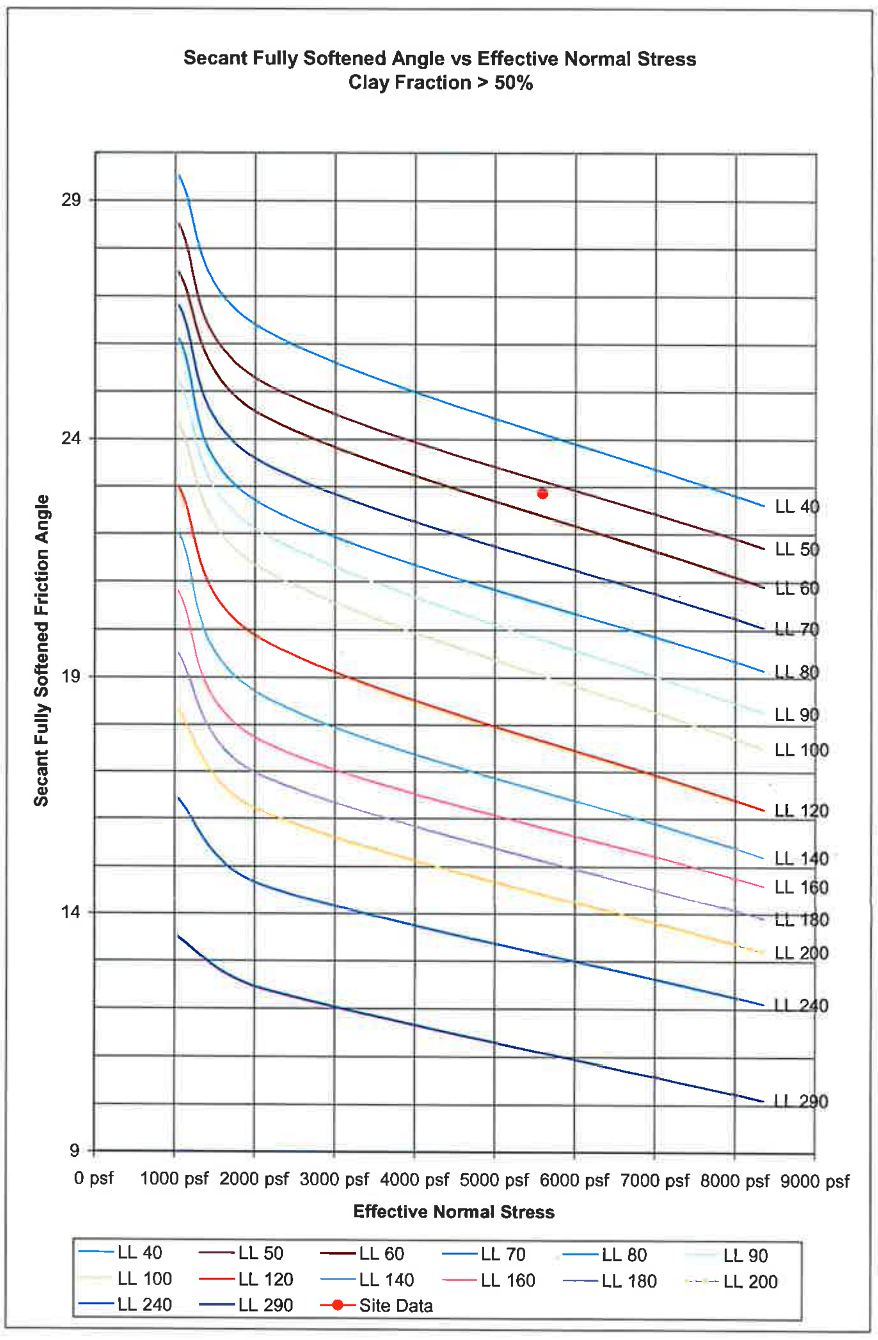
LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf			0	29.5	28.5	27.5	26.8	26.1	25.2	24.3	23	22	20.8	19.5	18.3	16.4	13.5
2089 psf			0	26.3	25.2	24.5	23.5	22.6	22	21.25	19.8	18.6	17.65	16.9	16.15	14.6	12.4
8354 psf			0	22.6	21.7	20.9	20.05	19.15	18.25	17.5	16.2	15.2	14.6	13.9	13.2	12.1	10.1

98.4	$CF=CF_{(ASTM)}$
100.0	$CF_{BM}=(0.0003CF^2-0.037CF+2.254)CF$
40.75	$LL=LL_{(ASTM)}$
55.1	$LL_{BM}=((0.003(LL)+1.23)L$









COVER CCL OVER PROPOSED PHASE IVA - COMPACTED GRAY SHALE: USED ϕ AT ≈ 1KSF σ CONFINING STRESS (CONSERVATIVE) JFH.

Clay Fraction	100.0	Secant Fully Softened Friction Angle ϕ =	28.0	Ref: "Drained Shear Strength Parameters for Analysis of Landfills" GT/2003/023463 006505QGT - Stark e
LL	55.1	Feet of Waste / Cover 16.1 ft	Effective Normal Stress 1045 psf	Must be between 1044.27 and 8354.16

NO PRIOR SLIDE

Clay Fraction (%)

γ_{MSW}		≤20			25 ≤ cf ≤ 45			≥50			
65 pcf		Effective Normal Stress (σ)									
	20.8854	50 kPa	100 kPa	400 kPa							
		1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf	
	Ft of MSW	16.07 ft	32.13 ft	128.53 ft	16.07 ft	32.13 ft	128.53 ft	16.07 ft	32.13 ft	128.53 ft	
	LL	Secant Fully Softened Friction Angle (ϕ'_r) Degrees									
1	2	3	4	5	6	7	8	9	10	11	12
1	10										1
2	20	33.6	32.8	32.2							2
3	30	32.9	32	31.1							3
4	40	32.5	31.4	30.4	32.3	29.5	26.5	29.5	26.3	22.6	4
5	50	31.95	30.7	29.5	31.1	28.4	25.4	28.5	25.2	21.7	5
6	60	31.4	30.2	28.65	30.2	27.6	24.6	27.5	24.5	20.9	6
7	70	31	29.55	27.95	29.4	26.8	23.8	26.8	23.5	20.05	7
8	80	30.75	29.2	27.5	28.6	26.1	23	26.1	22.6	19.15	8
9	90				27.8	25.3	22.4	25.2	22	18.25	9
10	100				27.25	24.65	21.7	24.3	21.25	17.5	10
11	120				26	23.6	20.6	23	19.8	16.2	11
12	140				25	22.7	19.8	22	18.6	15.2	12
13	160							20.8	17.65	14.6	13
14	180							19.5	16.9	13.9	14
15	200							18.3	16.15	13.2	15
16	240							16.4	14.6	12.1	16
17	290							13.5	12.4	10.1	17
5	50	31.95	30.7	29.5	31.1	28.4	25.4	28.5	25.2	21.7	
	60	31.4	30.2	28.65	30.2	27.6	24.6	27.5	24.5	20.9	
	51%	0.55	0.5	0.85	0.9	0.8	0.8	1	0.7	0.8	
	55.1041875	**31.7**	**30.4**	**29.1**	**30.6**	**28.0**	**25.0**	**28.0**	**24.8**	**21.3**	

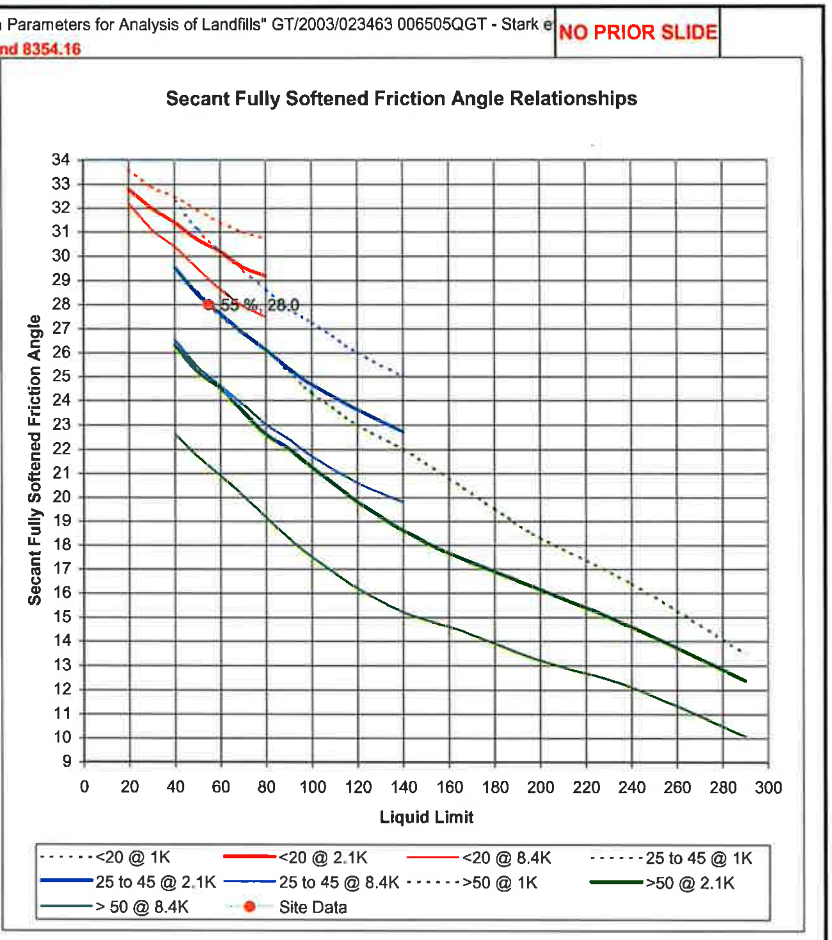
1045 psf	1	2	3	1	2	3	1	2	3
	1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	8354 psf
55.1041875	31.66926969	30.44479063	29.06614406	30.64062313	27.991665	24.991665	27.98958125	24.84270688	21.291665
	1	2	3	1	2	3	1	2	3
	1			1			1		
	31.67	1044.27		30.64	1044.27		27.99	1044.27	
	30.44	2088.54		27.99	2088.54		24.84	2088.54	
	1.22	1044.27		2.65	1044.27		3.15	1044.27	
	31.7	0.0%		**30.6**	0.0%		**28.0**	0.0%	

1	31.7
21	30.6
45	28.0
100	28.0

55 %

1045 psf

100	28.0	1044.55

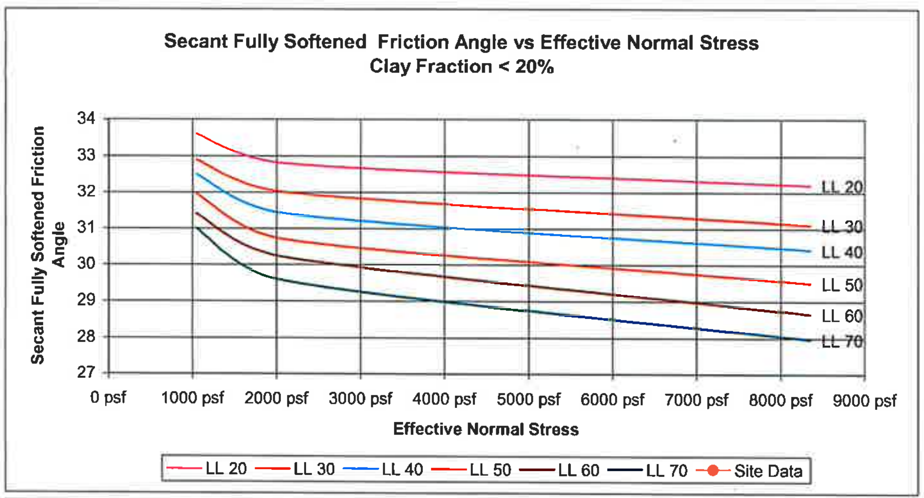

Secant Fully Softened Friction Angle Relationships

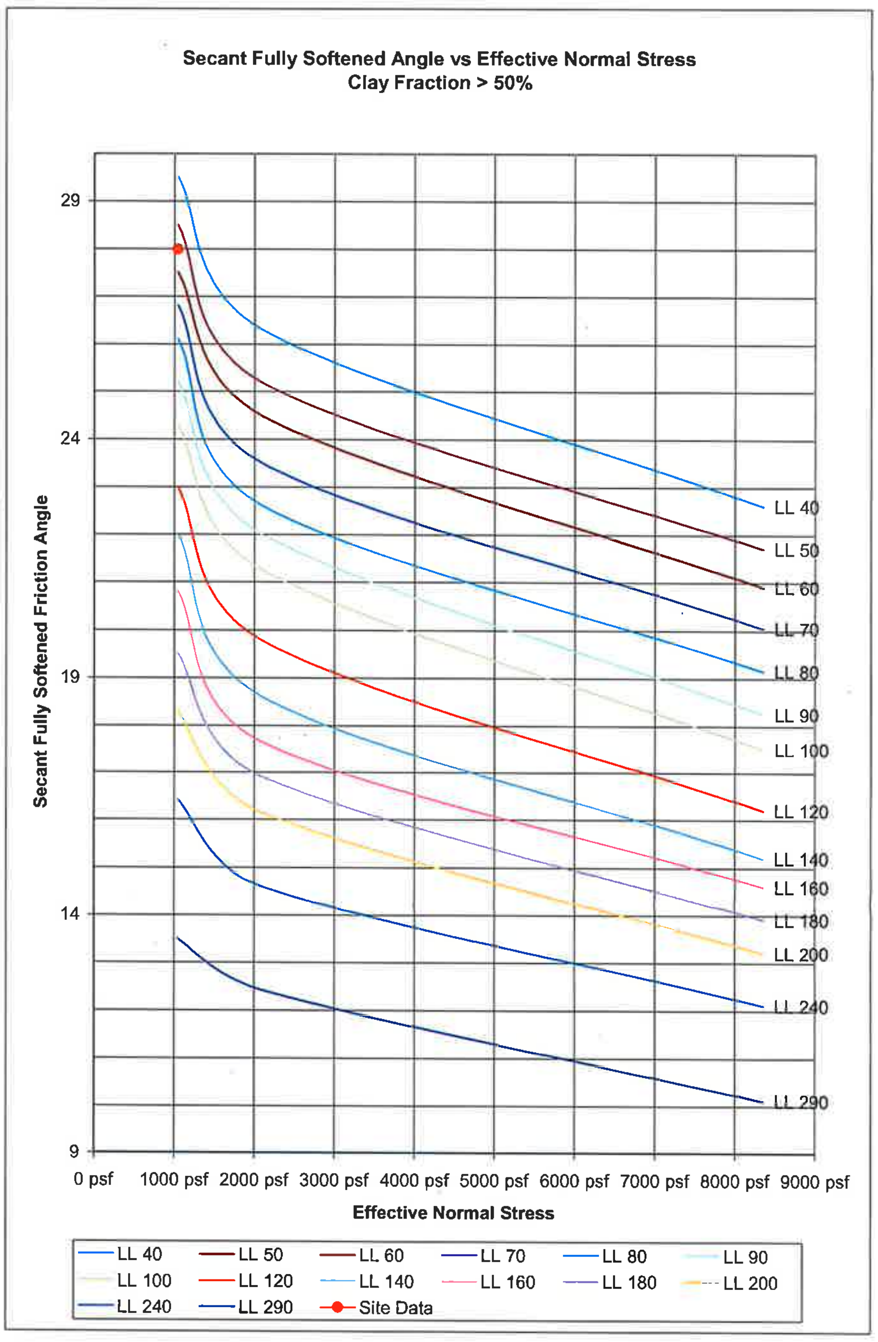
LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf	0	33.6	32.9	32.5	31.95	31.4	31										
2089 psf	0	32.8	32	31.4	30.7	30.2	29.55										
8354 psf	0	32.2	31.1	30.4	29.5	28.65	27.95										

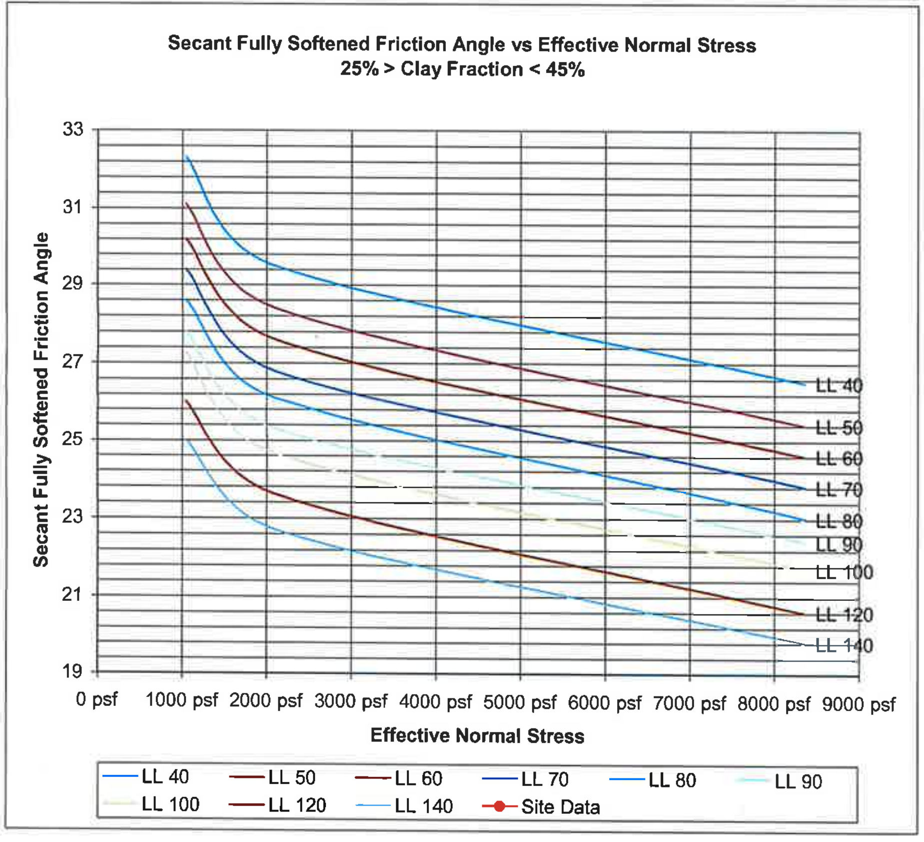
LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf		0	0	32.3	31.1	30.2	29.4	28.6	27.8	27.25	26	25	0				
2089 psf			0	29.5	28.4	27.6	26.8	26.1	25.3	24.65	23.6	22.7	0				
8354 psf			0	26.5	25.4	24.6	23.8	23	22.4	21.7	20.6	19.8	0				

LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf			0	29.5	28.5	27.5	26.8	26.1	25.2	24.3	23	22	20.8	19.5	18.3	16.4	13.5
2089 psf			0	26.3	25.2	24.5	23.5	22.6	22	21.25	19.8	18.6	17.65	16.9	16.15	14.6	12.4
8354 psf			0	22.6	21.7	20.9	20.05	19.15	18.25	17.5	16.2	15.2	14.6	13.9	13.2	12.1	10.1

98.4	CF=CF$_{(ASTM)}$
100.0	CF$_{BM}$=(0.0003CF^2-0.037CF+2.254)CF
40.75	LL=LL$_{(ASTM)}$
55.1	LL$_{BM}$=((0.003(LL)+1.23)L


Secant Fully Softened Friction Angle vs Effective Normal Stress
Clay Fraction < 20%


Secant Fully Softened Angle vs Effective Normal Stress
Clay Fraction > 50%

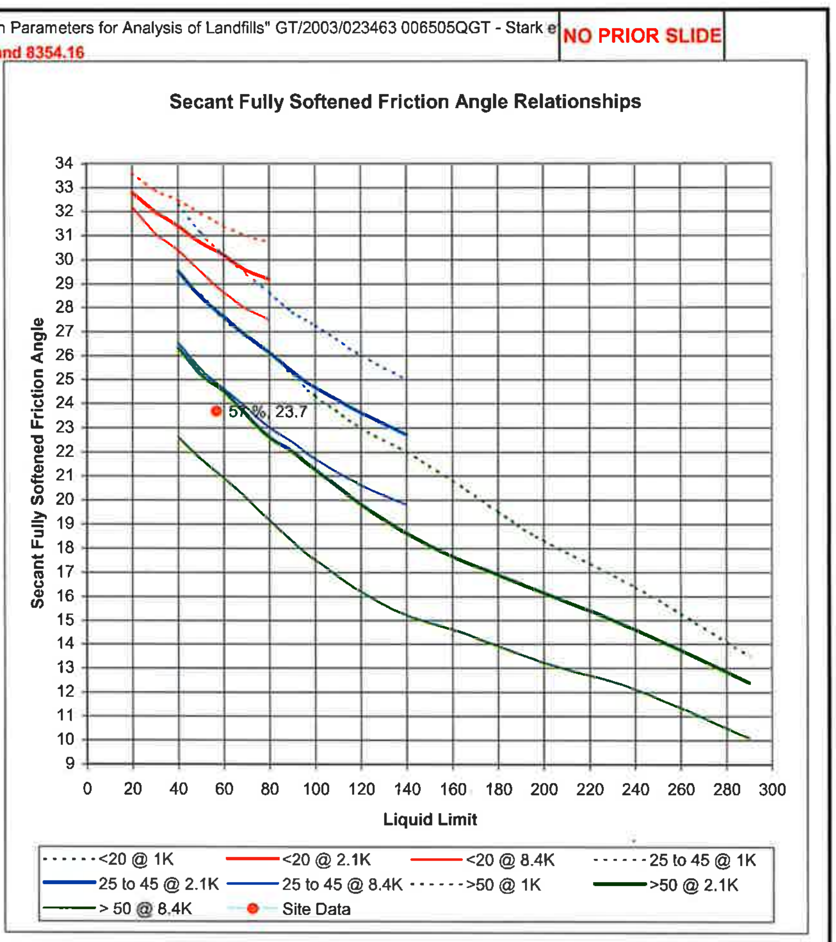

Secant Fully Softened Friction Angle vs Effective Normal Stress
25% > Clay Fraction < 45%

WEST TOE BERM ≈ 30 FT FILL HEIGHT : COMPACTED GRAY SHALE

Clay Fraction	**100.0**	**Secant Fully Softened Friction Angle ϕ =**	**23.7**	Ref: "Drained Shear Strength Parameters for Analysis of Landfills" GT/2003/023463 006505QGT - Stark e	**NO PRIOR SLIDE**
LL	**57.0**	Feet of Waste / Cover **30.0 ft**	Effective Normal Stress **3920 psf**	**Must be between 1044.27 and 8354.16**	

		Clay Fraction (%)									
γ_{MSW}		≤20			25 ≤ cf ≤ 45			≥50			
131 pcf		**Effective Normal Stress (σ)**									
20.8854		50 kPa	100 kPa	400 kPa							
		1044 psf	**2089 psf**	**8354 psf**	**1044 psf**	**2089 psf**	**8354 psf**	**1044 psf**	**2089 psf**	**8354 psf**	
Ft of MSW		7.99 ft	15.98 ft	63.93 ft	7.99 ft	15.98 ft	63.93 ft	7.99 ft	15.98 ft	63.93 ft	
LL		**Secant Fully Softened Friction Angle (ϕ'_r) Degrees**									
1	2	3	4	5	6	7	8	9	10	11	12
1	10										1
2	20	33.6	32.8	32.2							2
3	30	32.9	32	31.1							3
4	40	32.5	31.4	30.4	32.3	29.5	26.5	29.5	26.3	22.6	4
5	50	31.95	30.7	29.5	31.1	28.4	25.4	28.5	25.2	21.7	5
6	60	31.4	30.2	28.65	30.2	27.6	24.6	27.5	24.5	20.9	6
7	70	31	29.55	27.95	29.4	26.8	23.8	26.8	23.5	20.05	7
8	80	30.75	29.2	27.5	28.6	26.1	23	26.1	22.6	19.15	8
9	90				27.8	25.3	22.4	25.2	22	18.25	9
10	100				27.25	24.65	21.7	24.3	21.25	17.5	10
11	120				26	23.6	20.6	23	19.8	16.2	11
12	140				25	22.7	19.8	22	18.6	15.2	12
13	160							20.8	17.65	14.6	13
14	180							19.5	16.9	13.9	14
15	200							18.3	16.15	13.2	15
16	240							16.4	14.6	12.1	16
17	290							13.5	12.4	10.1	17
5	50	31.95	30.7	29.5	31.1	28.4	25.4	28.5	25.2	21.7	
	60	31.4	30.2	28.65	30.2	27.6	24.6	27.5	24.5	20.9	
	70%	0.55	0.5	0.85	0.9	0.8	0.8	1	0.7	0.8	
	56.952	**31.6**	**30.4**	**28.9**	**30.5**	**27.8**	**24.8**	**27.8**	**24.7**	**21.1**	

	3920 psf	1	2	3	1	2	3	1	2	3
		1044 psf	2089 psf	8354 psf	1044 psf	2089 psf	6354 psf	1044 psf	2089 psf	8354 psf
	56.952	31.56764	30.3524	28.90908	30.47432	27.84384	24.84384	27.8048	24.71336	21.14384
		1	2	3	1	2	3	1	2	3
		2			2			2		
		30.35	2088.54		27.84	2088.54		24.71	2088.54	
1	29.9	28.91	8354.16		24.84	8354.16		21.14	8354.16	
21	27.0	1.44	6265.62		3.00	6265.62		3.57	6265.62	
45	23.7	**29.9**	29.2%		**27.0**	29.2%		**23.7**	29.2%	
100	23.7	57 %								
		3920 psf	100	23.7	3920.34					

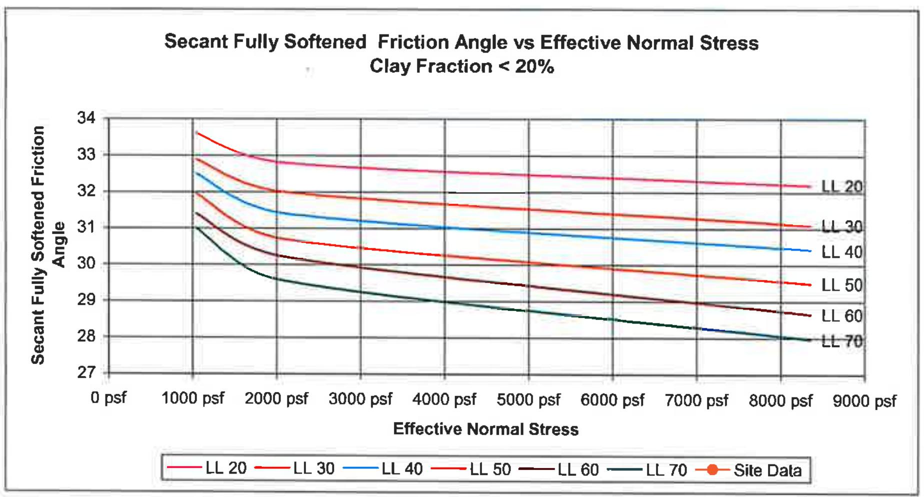


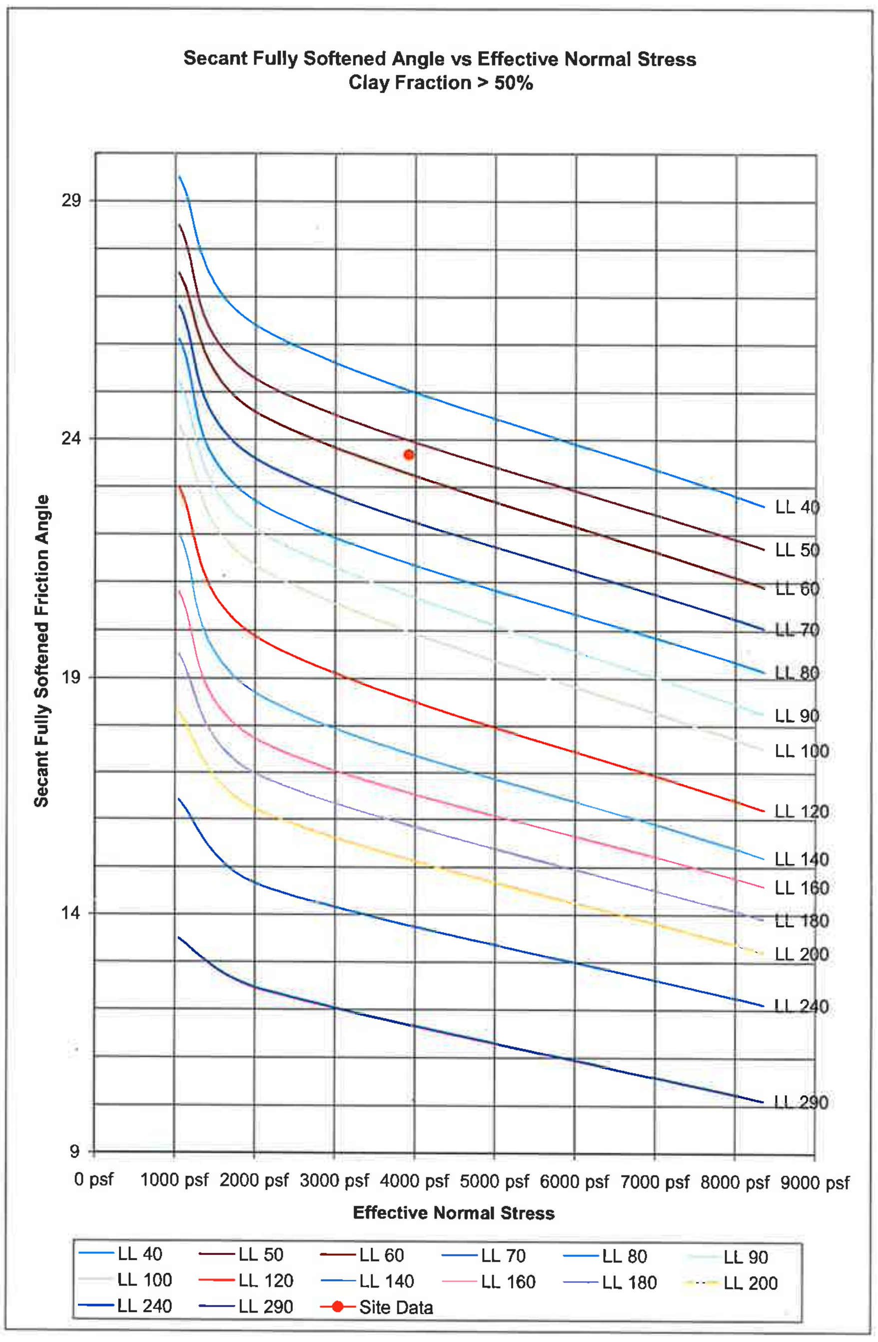
LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf	0	33.6	32.9	32.5	31.95	31.4	31										
2089 psf	0	32.8	32	31.4	30.7	30.2	29.55										
8354 psf	0	32.2	31.1	30.4	29.5	28.65	27.95										

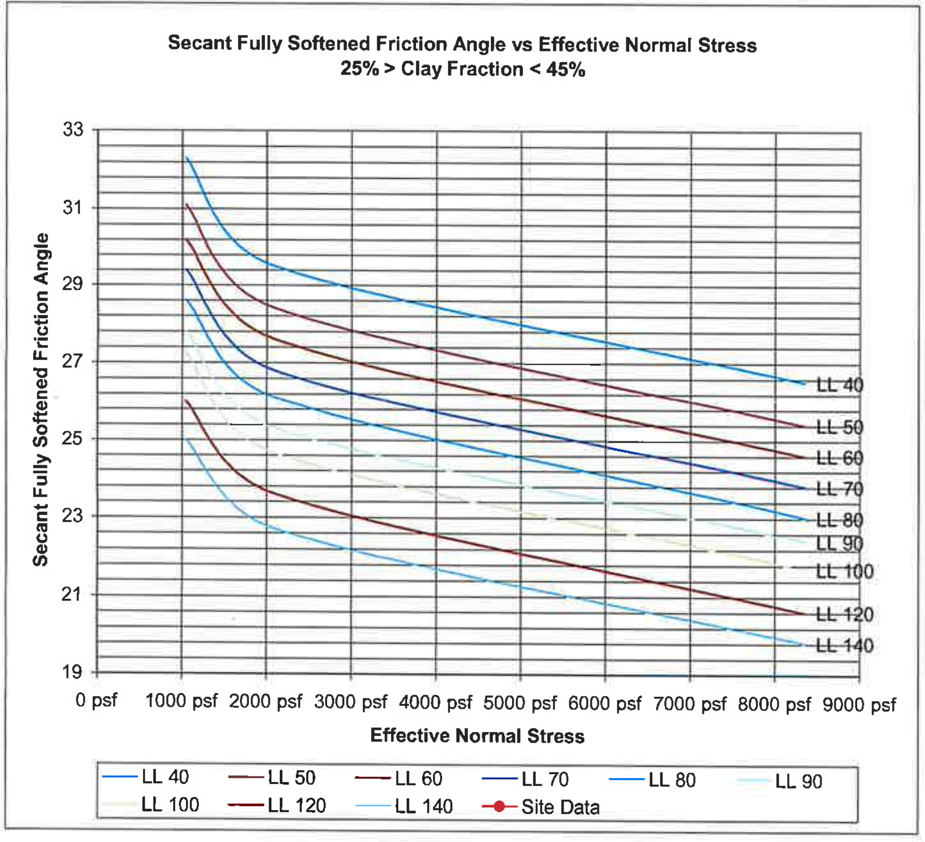
98.4	$CF=CF_{(ASTM)}$
100.0	$CF_{BM}=(0.0003CF^2-0.037CF+2.254)CF$
42	$LL=LL_{(ASTM)}$
57.0	$LL_{BM}=((0.003(LL)+1.23)L$

LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf		0	0	32.3	31.1	30.2	29.4	28.6	27.8	27.25	26	25	0				
2089 psf			0	29.5	28.4	27.6	26.8	26.1	25.3	24.65	23.6	22.7	0				
8354 psf			0	26.5	25.4	24.6	23.8	23	22.4	21.7	20.6	19.8	0				

LL	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200	240	290
1044 psf			0	29.5	28.5	27.5	26.8	26.1	25.2	24.3	23	22	20.8	19.5	18.3	16.4	13.5
2089 psf			0	26.3	25.2	24.5	23.5	22.6	22	21.25	19.8	18.6	17.65	16.9	16.15	14.6	12.4
8354 psf			0	22.6	21.7	20.9	20.05	19.15	18.25	17.5	16.2	15.2	14.6	13.9	13.2	12.1	10.1







SCS ENGINEERS

11219 Richardson Drive
North Little Rock, AR

LOG OF BORING NO.: **P-6**

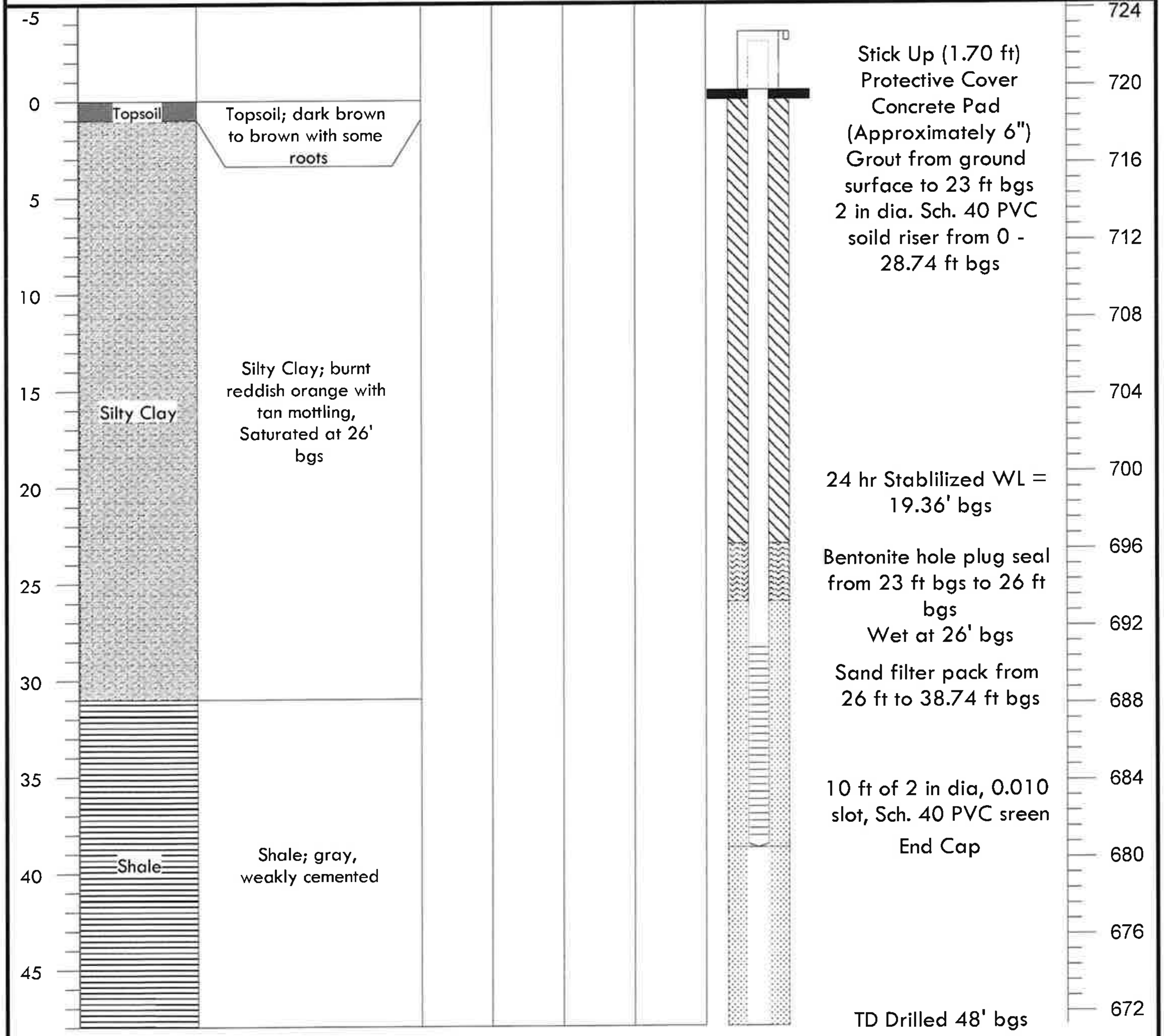
SHEET NUMBER: 1 of 1

CLIENT: AEL Landfill
PROJECT NAME: 203-Acre Expansion
PROJECT NUMBER: 27220345.00
PROJECT LOCATION: Sand Springs, Oklahoma
GEOLOGIST: Joe Wrath
START DATE:
FINISH DATE:

DRILLER: Timothy Swyden
DRILLING RIG: Dedrick 50 Turbo
DRILLING METHOD: Split Spoon/Core
DRILLING CONTRACTOR: Mohawk Drilling, Inc.
SAMPLING METHOD: Split Spoon/Core
BORING DIAMETER: 8.25"
WELL DIAMETER: 2"

SURFACE ELEVATION: 719.31 ft
TOC ELEVATION: 721.01 ft
WELL DEPTH COMPLETION: 48 fbgs
LOCATION:
EASTING: 2500001.93
NORTHING: 4276672.52
WATER LEVEL: 19.36 fbgs
STBLZD WATER ELEVATION: 699.95 ft
WATER LEVEL DATE: 7/15/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)



Topsoil; dark brown to brown with some roots

Silty Clay; burnt reddish orange with tan mottling, Saturated at 26' bgs

Shale; gray, weakly cemented

Stick Up (1.70 ft)
Protective Cover
Concrete Pad (Approximately 6")
Grout from ground surface to 23 ft bgs
2 in dia. Sch. 40 PVC soild riser from 0 - 28.74 ft bgs

24 hr Stablilized WL = 19.36' bgs

Bentonite hole plug seal from 23 ft bgs to 26 ft bgs
Wet at 26' bgs

Sand filter pack from 26 ft to 38.74 ft bgs

10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen
End Cap

TD Drilled 48' bgs

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

11219 Richardson Drive
North Little Rock, AR

LOG OF BORING NO.: **B-21**

SHEET NUMBER: 1 of 1

CLIENT: AEL Landfill	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 738.9 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 40 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499940.2 NORTHING: 429023.5
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 15.83 fbgs
START DATE: 7/6/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 723.07 ft
FINISH DATE: 7/6/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/7/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
-5									740
0	Topsoil	Topsoil; dark brown with rootlets	Cuttings	0					736
5			Cuttings	5					732
10	Silty Clay	Silty Clay; reddish brown to orange	Cuttings	10					728
15			Cuttings	15				Wet at 15' bgs 24 hr Stabilized WL = 15.83' bgs	724
20			Cuttings	20					720 716
25			Cuttings	25					712
30	Shale	Shale; tan transitions to dark gray at 32' bgs	Cuttings	30					708
35			Cuttings	35					704
40								TD Drilled 40' bgs	700

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS	LOG OF BORING NO.: **B-26**	SHEET NUMBER: 1 of 1
11219 Richardson Drive North Little Rock, AR	DRILLER: Jeremy Edgman	SURFACE ELEVATION: 758.7 ft
	DRILLING RIG: Atlas T3W	TOC ELEVATION: NA ft
CLIENT: AEL Landfill	DRILLING METHOD: Cuttings	WELL DEPTH COMPLETION: 59 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2499994.3 NORTHING: 429479.1
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Robert Fowler	SAMPLING METHOD: Cuttings	WATER LEVEL: 36.35 fbgs
START DATE: 7/6/2021	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 722.35 ft
FINISH DATE: 7/6/2021	WELL DIAMETER: NA	WATER LEVEL DATE: 7/7/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
-5									760
0	Topsoil	Topsoil; dark brown with rootlets	Cuttings	0					756
5	Silty Clay	Silty Clay; reddish brown to orange	Cuttings	5					752
10			Cuttings	10					748
15		Silty Clay; tan transitions to gray with some sandstone gravels at 20' bgs	Cuttings	15					744
20			Cuttings	20					740 736
25	Shale	Shale; gray, friable	Cuttings	25					732
30			Cuttings	30					728
35			Cuttings	35				24 hr Stabilized WL = 36.35	724 720
40			Cuttings	40					716
45			Cuttings	45					712
50			Cuttings	50					708
55			Cuttings	55				Wet at 55' bgs TD Drilled 59' bgs	704 700

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS

11219 Richardson Drive
North Little Rock, AR

LOG OF BORING NO.: **B-34**

SHEET NUMBER: 1 of 1

CLIENT: AEL Landfill
PROJECT NAME: 203-Acre Expansion
PROJECT NUMBER: 27220345.00
PROJECT LOCATION: Sand Springs, Oklahoma
GEOLOGIST: Robert Fowler
START DATE: 4/14/2021
FINISH DATE: 4/15/2021

DRILLER: Timothy Swyden
DRILLING RIG: Dedrick 50 Turbo
DRILLING METHOD: Split Spoon/Core
DRILLING CONTRACTOR: Mohawk Drilling, Inc.
SAMPLING METHOD: Split Spoon/Core
BORING DIAMETER: 8.25"
WELL DIAMETER: NA

SURFACE ELEVATION: 815.8 ft
TOC ELEVATION: NA ft
WELL DEPTH COMPLETION: 108 fbgs
LOCATION:
EASTING: 2500000
NORTHING: 430500
WATER LEVEL: 87 fbgs
STBLZD WATER ELEVATION: 728.8 ft
WATER LEVEL DATE: NA

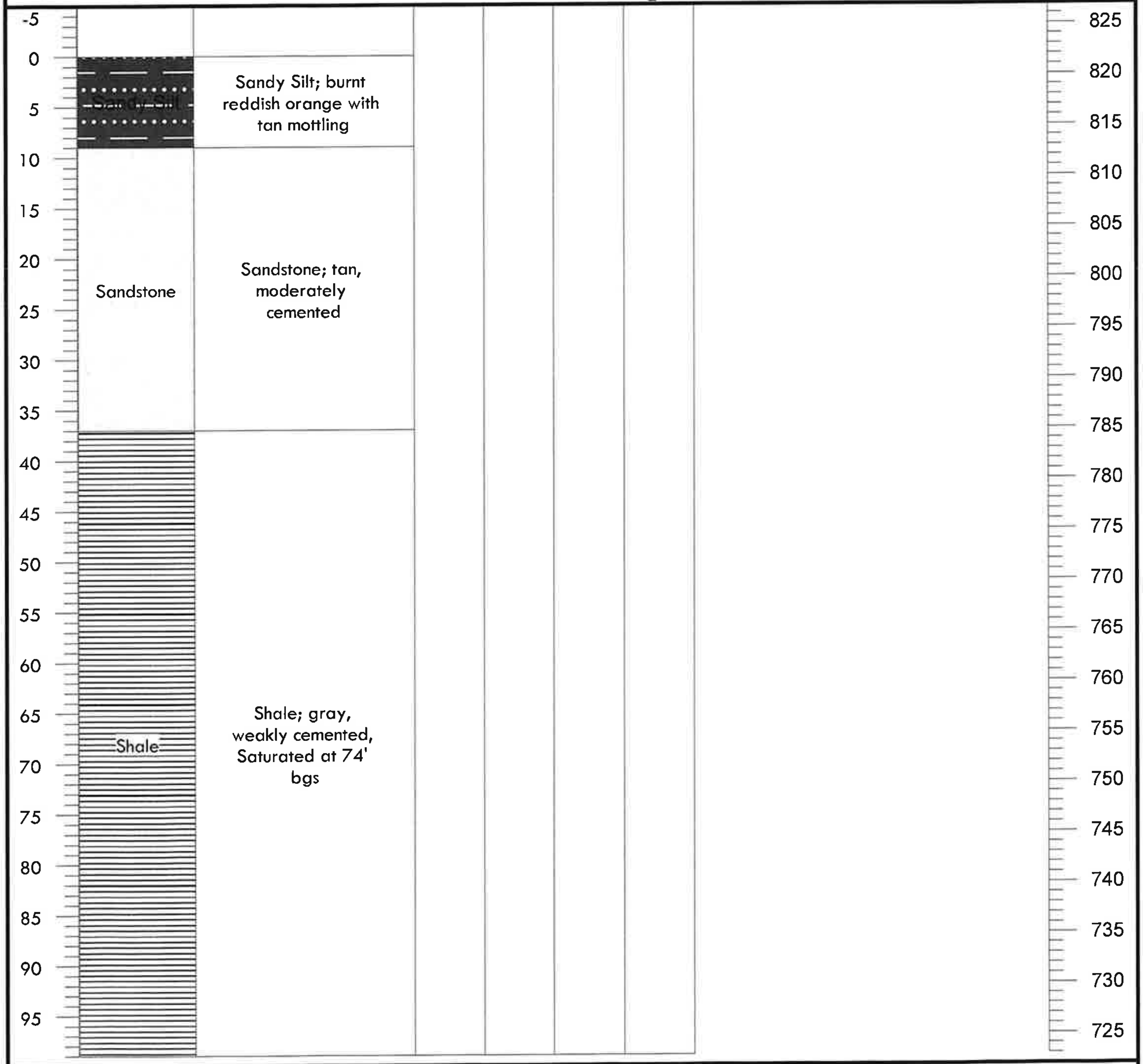
LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION
Shale	Shale; gray, thinly bedded, friable	SPT	0	3,7,9	18		
		SPT	5	8,11,6	18		
		SPT	10	9,16,15	18		
		SPT	15	6,7,6	18		
Silty Clay	Silty Clay; dark brown, orange mottling	SPT	20	6,7,7	18		
		SPT	25	5,5,5	18		
Clay	Clay; dark brown, with orange and gray mottling	SPT	30	6,18,17	18		
Shale	Shale; brown, thinly bedded, friable	SPT	35	16,27,29	18		
		SPT	40	30,50/5.5"	12		
Shale	Shale; gray, thinly bedded, friable	SPT	45	50/6"	6		
		SPT	50	50/4"	4		
		SPT	55	50/3.5"	3.5		
		SPT	60	50/3"	3		
		Core	60		36		
		Core	63		60		
	Limestone; gray, reacts with HCL	Core	68		60		
Shale	Shale; gray	Core	73		60		
Siltstone	Siltstone; gray, hard competant	Core	78		60		
Shale	Shale; gray, thinly bedded, friable	Core	83		60		
		Core	88		60		Wet at 87' bgs
Siltstone	Siltstone; gray, hard competant	Core	93		60		
		Core	98		48		
		Core	103		60		

TD Drilled 108' bgs

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

SCS ENGINEERS	LOG OF BORING NO.: **P-39**	SHEET NUMBER: 1 of 1
11219 Richardson Drive North Little Rock, AR	DRILLER: Timothy Swyden	SURFACE ELEVATION: 821.98 ft
	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 821.98 ft
CLIENT: AEL Landfill	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 99 fbgs
PROJECT NAME: 203-Acre Expansion	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2500000.48 NORTHING: 430955.82
PROJECT NUMBER: 27220345.00		
PROJECT LOCATION: Sand Springs, Oklahoma		
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 78 fbgs
START DATE:	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 743.98 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: NA

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)
	Sandy Silt	Sandy Silt; burnt reddish orange with tan mottling							
	Sandstone	Sandstone; tan, moderately cemented							
	Shale	Shale; gray, weakly cemented, Saturated at 74' bgs							



THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

LOG OF BORING NO. B-13

PAGE 1 OF 4

OWNER: American Environmental Landfill

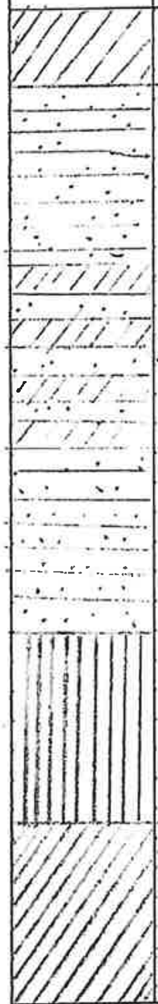
SITE: Subsurface Investigation

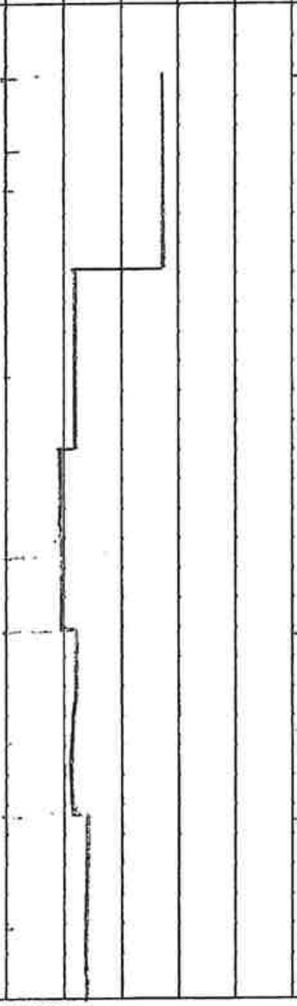
PROJECT: 00087.05

GRAPHIC LOG

DESCRIPTION

GROUND SURFACE ELEV. 749.44





Description	Depth (FT)	USCS Symbol
0-2 BROWN VERY SILTY CLAY; MOIST, LOW PLASTICITY		CL
2-17 ORANGE BROWN SANDSTONE DRY		SS
	5	
7-12 - w/ SILTY CLAY LAYERS		w/CL
	10	
	15	
17-22' ORANGE BROWN CLAYEY SILT W/ SAND, MOIST		ML
	20	
22-35' ORANGE BROWN VERY SILTY CLAY W/ SAND, VERY MOIST		CL
	25	

The Stratification Lines Represent the Approximate Boundary Lines Between Soil and Rock Types. The Transitions May be Gradual.

WATER LEVEL OBSERVATIONS	
wl	
wl	
wl	

ENVIRONMENTAL, INC.

BOREHOLE DIA :

WELL DIA:

BORING STARTED :

BORING COMPLETED :

RIG	FORMAN
APPROVED	JOB

C:\PROJECTS\borlog.doc

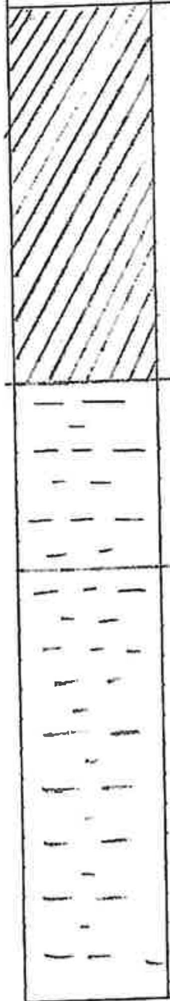
LOG OF BORING NO. B-13

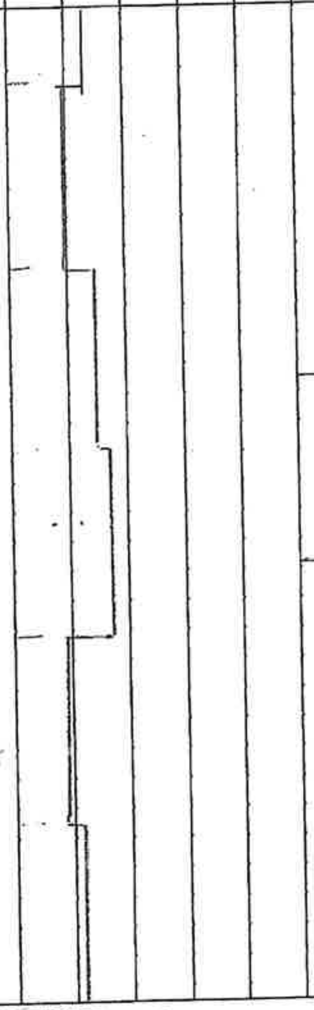
PAGE 2 OF 4

OWNER: American Environmental Landfill

SITE: Subsurface Investigation

PROJECT: 00087.05





GRAPHIC LOG	DESCRIPTION GROUND SURFACE ELEV.		DEPTH (FT)	USCS Symbol
			30	
	35-40' TAN SHALE		35	SH
	40-70' GRAY SHALE FRIABLE, DRY		40	SH
			45	
			50	

The Stratification Lines Represent the Approximate Boundary Lines Between Soil and Rock Types. The Transitions May be Gradual.

BOREHOLE DIA :

WELL DIA:

WATER LEVEL OBSERVATIONS	
wl	
wl	
wl	

ENVIRONMENTAL, INC.

BORING STARTED :

BORING COMPLETED :

RIG	FORMAN
APPROVED	JOB

LOG OF BORING NO. B-13

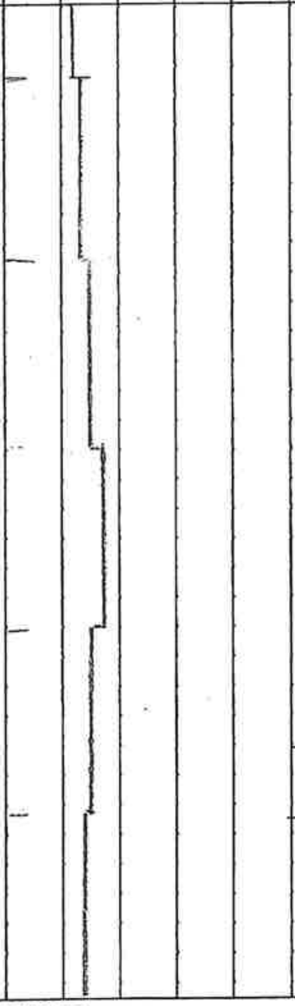
PAGE 3 OF 4

OWNER: American Environmental Landfill

SITE: Subsurface Investigation

PROJECT: 00087.05

DESCRIPTION GROUND SURFACE ELEV.	DEPTH (FT)	USCS Symbol
	55	
	60	
	65	
	70	
70-72 GRAY SHALE w/ SEVERAL 1" LIMESTONE LAYERS		SH & LS
72 - 90' GRAY SHALE		SH
	75	



The Stratification Lines Represent the Approximate Boundary Lines Between Soil and Rock Types. The Transitions May be Gradual.

WATER LEVEL OBSERVATIONS	
wl	
wl	
wl	

ENVIRONMENTAL, INC.

BOREHOLE DIA :

WELL DIA:

BORING STARTED :

BORING COMPLETED :

RIG	FORMAN
APPROVED	JOB

LOG OF BORING NO. B-13

PAGE 4 OF 4

OWNER: American Environmental Landfill

SITE: Subsurface Investigation

PROJECT: 00087.05

GRAPHIC LOG

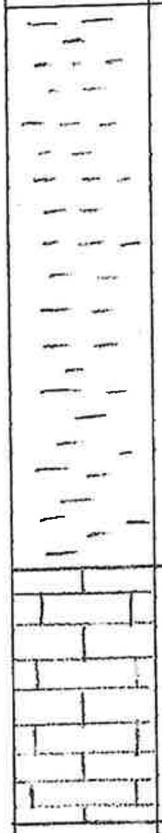
DESCRIPTION

GROUND SURFACE ELEV.

DEPTH (FT)

Drilling Rate

USCS Symbol



90– 97 LIMESTONE, LIGHT GRAY

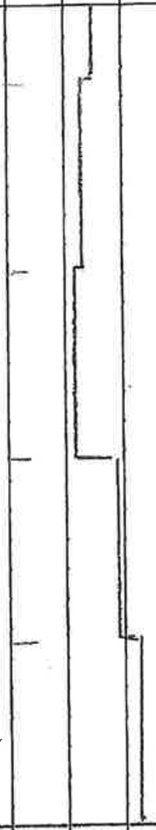
TD 97

80

85

90

95



The Stratification Lines Represent the Approximate Boundary Lines Between Soil and Rock Types. The Transitions May be Gradual.

BOREHOLE DIA: 5 7/8"

WELL DIA: NA

WATER LEVEL OBSERVATIONS

wl

wl

wl

ENVIRONMENTAL, INC.

BORING STARTED: 12/27/01

BORING COMPLETED: 12/27/01

RIG

FORMAN

APPROVED

JOB

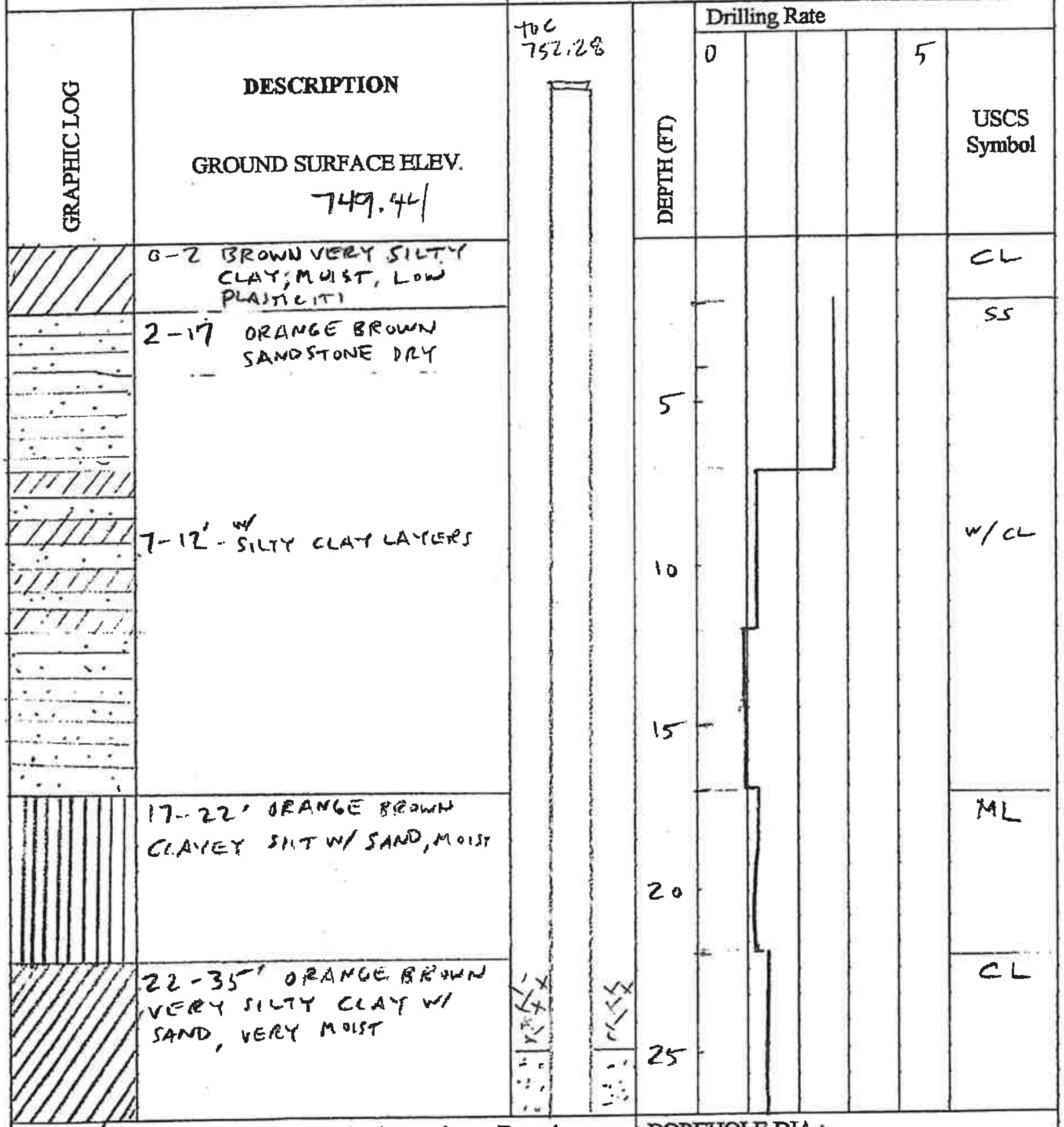
LOG OF BORING NO. MW-13

PAGE 1 OF 2

OWNER: American Environmental Landfill

SITE: Subsurface Investigation

PROJECT: 00087.05



DESCRIPTION GROUND SURFACE ELEV. 749.44	USCS Symbol
0-2 BROWN VERY SILTY CLAY; MOIST, LOW PLASTICITY	CL
2-17 ORANGE BROWN SANDSTONE DRY	SS
7-12' - w/ SILTY CLAY LAYERS	w/CL
17-22' ORANGE BROWN CLAYEY SILT W/ SAND, MOIST	ML
22-35' ORANGE BROWN VERY SILTY CLAY W/ SAND, VERY MOIST	CL

The Stratification Lines Represent the Approximate Boundary Lines Between Soil and Rock Types. The Transitions May be Gradual.

BOREHOLE DIA :

WELL DIA:

BORING STARTED :

BORING COMPLETED :

RIG	FORMAN
APPROVED	JOB

WATER LEVEL OBSERVATIONS

wl	
wl	
wl	

ENVIRONMENTAL, INC.

LOG OF BORING NO. MW- 13

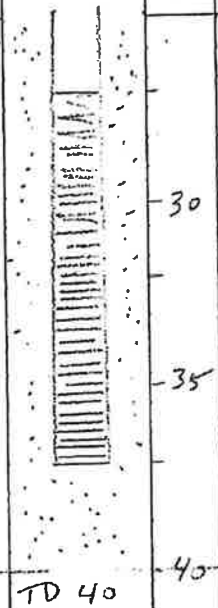
PAGE 2 OF 2

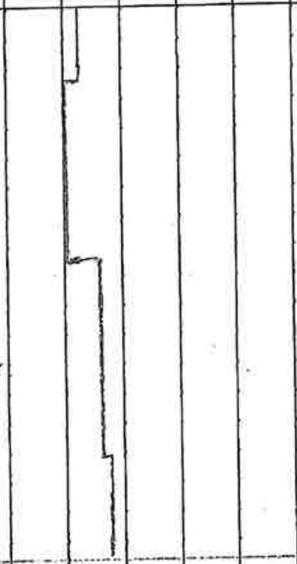
OWNER: American Environmental Landfill

SITE: Subsurface Investigation

PROJECT: 00087.05

GRAPHIC LOG	DESCRIPTION GROUND SURFACE ELEV.		DEPTH (FT)	Drilling Rate	USCS Symbol
	35-40' TAN SHALE	TD 40	30 35 40		SH





The Stratification Lines Represent the Approximate Boundary Lines Between Soil and Rock Types. The Transitions May be Gradual.

BOREHOLE DIA : 5 7/8"

WELL DIA: 2"

WATER LEVEL OBSERVATIONS	
wl	
wl	
wl	

ENVIRONMENTAL, INC.

BORING STARTED : 1/4/02

BORING COMPLETED : 1/4/02

RIG	FORMAN
APPROVED	JOB

AQUATERRA
Environmental Solutions, Inc.
11120 East 26th Street North, Wichita, 67226

LOG OF BORING NO.: **B-4B** SHEET NUMBER 1 of 3

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
PROJECT NUMBER:	04462.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	See Map
AES PROJECT NO:	04462.10
AES GEOLOGIST:	Kelly Hoyt
START DATE:	03/15/11
FINISH DATE	03/17/11
START TIME:	1645
FINISH TIME	1030

DRILLING CONTRACTOR:	Associated Env. Industries, Corp.
DRILLER:	Bill D.
DRILLING RIG:	Failing F-10
DRILLING METHOD:	HSA's / Air Rotary
SAMPLING METHOD:	Continuous Samper / Cuttings
BORING DIAMETER:	8.75" / 6"
WELL DIAMETER:	2-Inch
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	772.50 ✓
TOC ELEVATION:	775.02
WATER LEVEL:	49.16
WATER ELEVATION:	725.86
DATE:	5/12/2011

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	2	IN
WELL TOTAL DEPTH:	70	FT BGS
SCREEN LENGTH:	20	FT
RISER LENGTH:	50	FT
TOP OF SCREEN:	50	FT BGS
BOTTOM OF SCREEN:	70	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	45	FT BGS
TOP OF SEAL:	40	FT BGS
TYPE OF SEAL:	Bentonite Chips 3/8"	
TYPE OF FILTER PACK:	10-20 Silica Sand	

DRILLING TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I
HSA	0-5	5.0	1–5		
HSA	5-10	5.0	6–10		
HSA	10-15	4.7	11–15		
HSA	15-20	3.2	16–20		

SOIL DESCRIPTION AND DRILLING CONDITIONS

SILT sandy, moderate yellow brown 10YR 4/4, medium stiff, moist

768.5

CLAY sandy, moderate brown, 5YR 5/4 medium stiff, dry, (fine grain sand)

766.5

SILT sandy, moderate brown 5YR 5/4 very stiff, dry, (fine grain sand)

NOTES AND WELL CONSTRUCTION

LEGEND:

SS - Split Spoon	PID - Photoionization Detector	HA - Hand Auger
CS - 5 foot CME Sample	PP - Pocket Penetrometer	WB - Wash Bore
ST - Shelby Tube	HSA - Hollow Stem Augers	RB - Rock Bit
		NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
LOG OF BORING NO.:	**B-4B**
SHEET NUMBER	2 of 3
GEOLOGIST:	Kelly Hoyt
DATE:	03/17/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
HSA	20-25	5.0	21 22 23 24 25			SILT sandy, moderate brown 5YR 5/4 very stiff, dry, (fine grain sand) 757.5 SILT sandy, dark yellow orange 10YR 7/6 medium stiff, moist - damp -saturaed zone 23.5 - 24.5	3/16/11 1745 Stopped drilling with HSA's @25'
Air Rotary	25-30	NA	26 27 28 29 30				3/17/11 930 Begin air rotary drilling
Air Rotary	30-35	NA	31 32 33 34 35			742.5 SHALE, moderately weathered, moderate yellow brown	
Air Rotary	35-40	NA	36 37 38 39 40				
Air Rotary	40-45	NA	41 42 43 44 45			737.5 SHALE, dark gray, dry	

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA

ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

LOG OF BORING NO.: **B-4B**

SHEET NUMBER 3 of 3

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
GEOLOGIST:	Kelly Hoyt
DATE:	03/17/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I
Air Rotary	45-50	NA	46 47 48 49 50		
Air Rotary	50-55	NA	51 52 53 54 55		
Air Rotary	55-60	NA	56 57 58 59 60		
Air Rotary	60-65	NA	61 62 63 64 65		
Air Rotary	65-70	NA	66 67 68 69 70		

SOIL DESCRIPTION AND DRILLING CONDITIONS

SHALE, dark gray, dry

730.5

LIMESTONE, light gray

728.5

SHALE, dark gray, dry

724.5

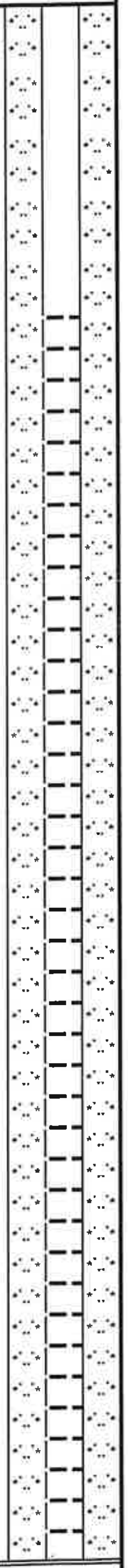
SHALE, medium brown, dry

714.5

SHALE, dark gray, dry

702.5 Boring Terminated

NOTES:



LEGEND:

SS - Split Spoon	PID - Photoionization Detector	HA - Hand Auger
CS - 5 foot CME Sample	PP - Pocket Penetrometer	WB - Wash Bore
ST - Shelby Tube	HSA - Hollow Stem Augers	RB - Rock Bit
		NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
11120 East 26th Street North, Wichita, 67226

LOG OF BORING NO.: **B-7A**

SHEET NUMBER 1 of 9

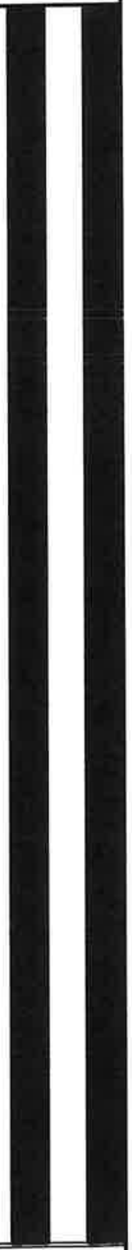
CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
PROJECT NUMBER:	04462.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	See Map
AES PROJECT NO:	04462.10
AES GEOLOGIST:	Kelly Hoyt
START DATE:	03/16/11
FINISH DATE:	04/12/11
START TIME:	1140
FINISH TIME:	1715

DRILLING CONTRACTOR:	Associated Env. Industries, Corp.
DRILLER:	Bill D.
DRILLING RIG:	Failing F-10
DRILLING METHOD:	HSA's / Air Rotary
SAMPLING METHOD:	Continuous Sampler / Cuttings
BORING DIAMETER:	8.75" / 6"
WELL DIAMETER:	2-Inch
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	898.40
TOC ELEVATION:	901.49
WATER LEVEL:	184.41
WATER ELEVATION:	717.08
DATE:	5/12/2011

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	2	IN
WELL TOTAL DEPTH:	212	FT BGS
SCREEN LENGTH:	40	FT
RISER LENGTH:	172	FT
TOP OF SCREEN:	172	FT BGS
BOTTOM OF SCREEN:	212	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	163	FT BGS
TOP OF SEAL:	157	FT BGS
TYPE OF SEAL:	Bentonite Chips 3/8"	
TYPE OF FILTER PACK:	10-20 Silica Sand	

DRILLING TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES AND WELL CONSTRUCTION
HSA	0-5	4.1	1 2 3 4 5	894.4		SILT, dk yellow brown, med stiff, moist CLAY silty, dark yellow brown 10YR 4/2 stiff, moist 895.4 SHALE, highly weathered, light olive gray 5Y 5/2 SANDSTONE, dark yellow orange 10YR 6/6 fine grain	
HSA	5-10	0.0	6 7 8 9 10				Hard slow drilling 6-18' Cuttings reduced to a powder
HSA	10-15	2.5	11 12 13 14 15				A few of the teeth on the auger have come up with the cuttings
HSA	15-20	2.7	16 17 18 19 20			880.4 SHALE, moderately weathered, medium dark gray N4, dry, friable	



LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

LOG OF BORING NO.:	**B-7A**
SHEET NUMBER	2 of 9
GEOLOGIST:	Kelly Hoyt
DATE:	04/12/11
PROJECT NUMBER:	04462.10
CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	CI	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
HSA	20-25	2.1	21 22 23 24 25			SHALE, moderately weathered, medium dark gray N4, dry, friable	
HSA	25-30	3.1	26 27 28 29 30				
HSA	30-35	2.4	31 32 33 34 35			SHALE, moderately weathered, light gray N7 dry friable	
HSA	35-40	2.7	36 37 38 39 40			SHALE, moderately weathered, medium dark gray N4, dry, friable	
HSA	40-45	3.1	41 42 43 44 45				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
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THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
LOG OF BORING NO.:	**B-7A**
SHEET NUMBER	3 of 9
GEOLOGIST:	Kelly Hoyt
DATE:	04/12/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
						SHALE, moderately weathered, medium dark gray N4, dry, friable	
HSA	45-50		46				
			47				
			48				
			49				3/16/11 1500 HSA drilling terminated @50'
			50			SHALE, dark gray, dry	
HSA	50-55		51				3/17/11 1355 Begin drilling with air rotary
			52				
			53				
			54				
			55				
HSA	55-60		56				
			57				
			58				
			59				
	1411		60				
HSA	1413 60-65		61				
			62				
			63				
			64				
			65				
HSA	65-70		66				
			67				
			68				
			69				
	1416		70				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
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THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA

ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

LOG OF BORING NO.: **B-7A**

SHEET NUMBER 4 of 9

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
GEOLOGIST:	Kelly Hoyt
DATE:	04/12/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	1418 70-75	NA	71 72 73 74 75			SHALE, dark gray, dry	
Air Rotary	75-80 1420	NA	76 77 78 79 80				
Air Rotary	1423 80-85	NA	81 82 83 84 85				84-90' drilling is harder more compentent shale
Air Rotary	85-90 1429	NA	86 87 88 89 90				
Air Rotary	1431 90-95	NA	91 92 93 94 95				

LEGEND:

SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
LOG OF BORING NO.:	**B-7A**
SHEET NUMBER	5 of 9
GEOLOGIST:	Kelly Hoyt
DATE:	04/12/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	*NOTES:*
Air Rotary	95-100 1436	NA	96 97 98 99 100			SHALE, dark gray, dry	
Air Rotary	1439 100-105	NA	101 102 103 104 105				
Air Rotary	105-110 1442	NA	106 107 108 109 110				
Air Rotary	1444 110-115	NA	111 112 113 114 115				
Air Rotary	115-120 1448	NA	116 117 118 119 120				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
RB - Rock Bit
NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA

ENVIRONMENTAL SOLUTIONS, INC.

7311 West 130th St, Overland Park, KS 66213

CLIENT:	American Environmental Landfill	LOG OF BORING NO.:	**B-7A**
PROJECT NAME:	Phase IV Additional Hydro Invest.	SHEET NUMBER	6 of 9
		GEOLOGIST:	Kelly Hoyt
		DATE:	04/12/11
		PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	1450 120 - 125	NA	121 122 123 124 125			SHALE, dark gray, dry	
Air Rotary	125 - 130 1454	NA	126 127 128 129 130				
Air Rotary	1456 130 - 135	NA	131 132 133 134 135				
Air Rotary	135 - 140 1500	NA	136 137 138 139 140				
Air Rotary	1502 140 -145	NA	141 142 143 144 145				

LEGEND:

SS - Split Spoon	*PID - Photoionization Detector*	*HA - Hand Auger*	***THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.***
CS - 5 foot CME Sample	*PP - Pocket Penetrometer*	*WB - Wash Bore*	
ST - Shelby Tube	*HSA - Hollow Stem Augers*	*RB - Rock Bit*	
		NX - Rock Core	

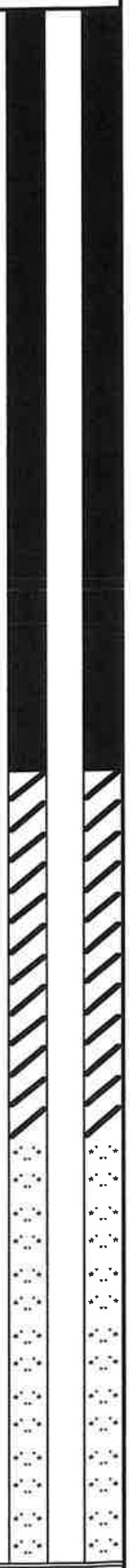
AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

LOG OF BORING NO.: **B-7A**

SHEET NUMBER 7 of 9

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
GEOLOGIST:	Kelly Hoyt
DATE:	04/12/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	145 -150 1506	NA	146 147 148 149 150			SHALE, dark gray, dry	
Air Rotary	1507 150 - 155	NA	151 152 153 154 155				
Air Rotary	155 - 160 1512	NA	156 157 158 159 160				
Air Rotary	1514 160 - 165	NA	161 162 163 164 165				
Air Rotary	165 - 170 1521	NA	166 167 168 169 170			731.4 LIMESTONE, light gray dry	



LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
WB - Wash Bore
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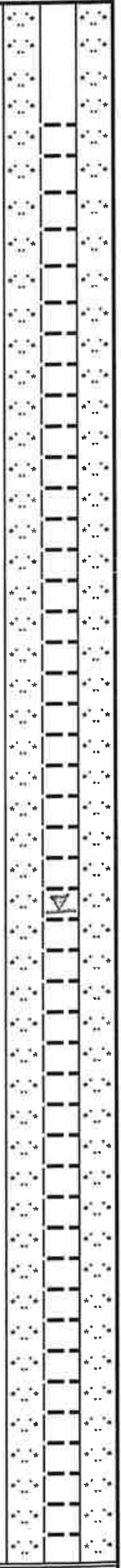
THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA **ENVIRONMENTAL SOLUTIONS, INC.** 7311 West 130th St, Overland Park, KS 66213		LOG OF BORING NO.: **B-7A**	SHEET NUMBER 8 of 9
CLIENT:	American Environmental Landfill	GEOLOGIST:	Kelly Hoyt
		DATE:	04/12/11
PROJECT NAME:	Phase IV Additional Hydro Invest.	PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	1523 170 - 175	NA	171			SHALE, dark gray, dry 728.4	
			172				
			173				
			174				
			175				
Air Rotary	175 - 180 1527	NA	176				
			177				
			178				
			179				
			180				
Air Rotary	1529 180 - 185	NA	181				
			182				
			183				
			184				
			185			MAY 2011 WATER LEVEL	717.08 184.4
Air Rotary	185 - 190 1533	NA	186				
			187				
			188				
			189				
			190				
Air Rotary	1535 190 - 195	NA	191				
			192				
			193				
			194				
			195				

LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
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THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA

ENVIRONMENTAL SOLUTIONS, INC.

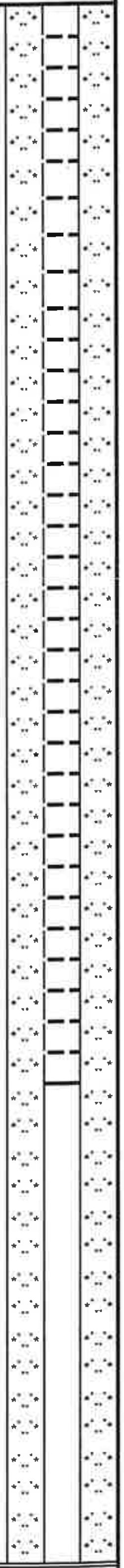
7311 West 130th St, Overland Park, KS 66213

LOG OF BORING NO.: **B-7A**

SHEET NUMBER 9 of 9

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
GEOLOGIST:	Kelly Hoyt
DATE:	04/12/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	195 - 200 1539	NA	196 197 198 199 200			SHALE, dark gray, dry	3/17/11 1545 Stopped drilling with air rotary @ 200'
Air Rotary	200 - 205	NA	201 202 203 204 205				4/12/11 1430 Begin drilling with air rotary
Air Rotary	205 - 210	NA	206 207 208 209 210				
Air Rotary	210 - 215	NA	211 212 213 214 215				
Air Rotary	215 - 220	NA	216 217 218 219 220			678.4 Boring Terminated	4/12/11 1515 Stop drilling with air rotary @ 220'



LEGEND:

SS - Split Spoon

CS - 5 foot CME Sample

ST - Shelby Tube

PID - Photoionization Detector

PP - Pocket Penetrometer

HSA - Hollow Stem Augers

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WB - Wash Bore

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THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
11120 East 26th Street North, Wichita, 67226

LOG OF BORING NO.: **B-11A**

SHEET NUMBER 1 of 5

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
PROJECT NUMBER:	04462.10
PROJECT LOCATION:	212 North 177 West Avenue Sand Springs, Oklahoma
BORING LOCATION:	See Map
AES PROJECT NO:	04462.10
AES GEOLOGIST:	Kelly Hoyt
START DATE 04/11/11	FINISH DATE: 05/02/11
START TIME: 1345	FINISH TIME: 1145

DRILLING CONTRACTOR:	Associated Env. Industries, Corp.
DRILLER:	Bill D.
DRILLING RIG:	Failing F-10
DRILLING METHOD:	Air Rotary
SAMPLING METHOD:	Cuttings
BORING DIAMETER:	14.75" / 6"
WELL DIAMETER:	10-Inch surface / 2-Inch
WELL COMPLETION:	Stick-up
SURFACE ELEVATION:	789.50 ✓
TOC ELEVATION:	792.66
WATER LEVEL:	68.64
WATER ELEVATION:	724.02 ✓
DATE:	6/6/2011

WELL CONSTRUCTION DETAILS

MATERIAL:	PVC	
DIAMETER:	2	IN
WELL TOTAL DEPTH:	100	FT BGS
SCREEN LENGTH:	40	FT
RISER LENGTH:	60	FT
TOP OF SCREEN:	60	FT BGS
BOTTOM OF SCREEN:	100	FT BGS
SCREEN SLOT:	0.010	IN
TOP OF FILTER PACK:	55	FT BGS
TOP OF SEAL:	39	FT BGS
TYPE OF SEAL:	Bentonite Chips 3/8"	
TYPE OF FILTER PACK:	10-20 Silica Sand	

DRILLING TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES AND WELL CONSTRUCTION
Air Rotary	0-5	NA	1 2 3 4 5	789.5		CLAY silty, olive brown 785.5 SHALE, olive brown	10" surface casing installed to 27'
Air Rotary	5-10	NA	6 7 8 9 10				
Air Rotary	10-15	NA	11 12 13 14 15			775.0 SHALE, moderate yellow brown	
Air Rotary	15-20	NA	16 17 18 19 20			SHALE, dark gray	

LEGEND:
SS - Split Spoon
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THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

LOG OF BORING NO.:	**B-11A**
SHEET NUMBER	2 of 5
CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
GEOLOGIST:	Kelly Hoyt
DATE:	05/02/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	20-25	NA	21 22 23 24 25			SHALE, dark gray	
Air Rotary	25-30	NA	26 27 28 29 30				
Air Rotary	30-35	NA	31 32 33 34 35				
Air Rotary	35-40	NA	36 37 38 39 40				
Air Rotary	40-45	NA	41 42 43 44 45				

LEGEND:

SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
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THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA

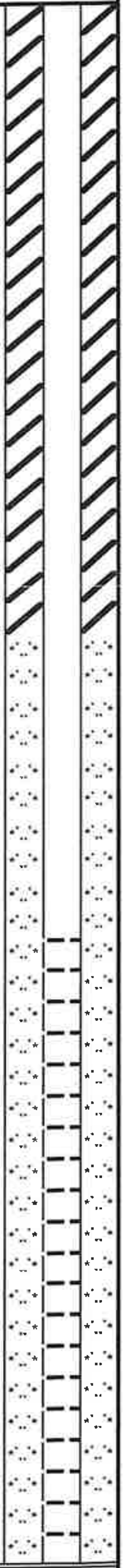
Environmental Solutions, Inc.
7311 West 130th St, Overland Park, KS 66213

LOG OF BORING NO.: **B-11A**

SHEET NUMBER 3 of 5

CLIENT: American Environmental Landfill
PROJECT NAME: Phase IV Additional Hydro Invest.
GEOLOGIST: Kelly Hoyt
DATE: 05/02/11
PROJECT NUMBER: 04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
HSA	45-50	NA	46 47 48 49 50			SHALE, dark gray	
HSA	50-55	NA	51 52 53 54 55				
HSA	55-60	NA	56 57 58 59 60				
HSA	60-65	NA	61 62 63 64 65			724.5	
HSA	65-67	NA	66 67			LIMESTONE, light gray	
Air Rotary	65-70		68 69 70			720 SHALE, dark gray	



LEGEND:
SS - Split Spoon
CS - 5 foot CME Sample
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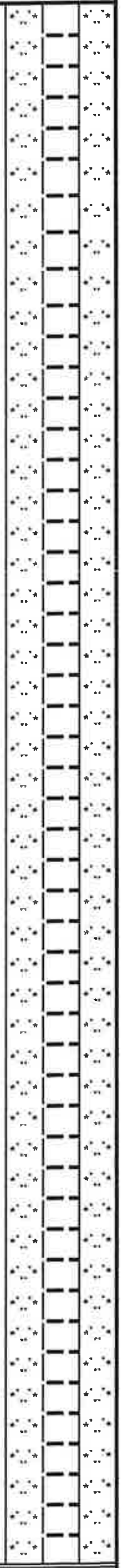
THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA

ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

CLIENT:	American Environmental Landfill	LOG OF BORING NO.:	**B-11A**
PROJECT NAME:	Phase IV Additional Hydro Invest.	SHEET NUMBER	4 of 5
		GEOLOGIST:	Kelly Hoyt
		DATE:	05/02/11
		PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I	SOIL DESCRIPTION AND DRILLING CONDITIONS	NOTES:
Air Rotary	70-75	NA	71 72 73 74 75			SHALE, dark gray	
Air Rotary	75-80	NA	76 77 78 79 80				
Air Rotary	80-85	NA	81 82 83 84 85				
Air Rotary	85-90	NA	86 87 88 89 90				
Air Rotary	90-95	NA	91 92 93 94 95			697.0 LIMESTONE, light gray	



LEGEND:

SS - Split Spoon
CS - 5 foot CME Sample
ST - Shelby Tube
PID - Photoionization Detector
PP - Pocket Penetrometer
HSA - Hollow Stem Augers
HA - Hand Auger
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THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

AQUATERRA
ENVIRONMENTAL SOLUTIONS, INC.
7311 West 130th St, Overland Park, KS 66213

CLIENT:	American Environmental Landfill
PROJECT NAME:	Phase IV Additional Hydro Invest.
LOG OF BORING NO.:	**B-11A**
SHEET NUMBER	5 of 5
GEOLOGIST:	Kelly Hoyt
DATE:	05/02/11
PROJECT NUMBER:	04462.10

SAMPLER TYPE	RUN	RECOVERY (FT)	DEPTH IN FEET	USCS CLASS	C I
Air Rotary	95-100	NA	96 97 98 99 100		
Air Rotary	100-105	NA	101 102 103 104 105		
Air Rotary	105-110	NA	106 107 108 109 110		
Air Rotary	110-115	NA	111 112 113 114 115		
Air Rotary	115-120	NA	116 117 118 119 120		

SOIL DESCRIPTION AND DRILLING CONDITIONS

LIMESTONE, light gray

693.5

SHALE, dark gray

691.5

LIMESTONE, light gray

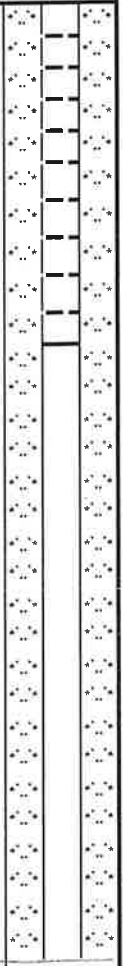
686.5

SHALE, dark gray

679.5

Boring Terminated

NOTES:



LEGEND:

SS - Split Spoon	PID - Photoionization Detector	HA - Hand Auger
CS - 5 foot CME Sample	PP - Pocket Penetrometer	WB - Wash Bore
ST - Shelby Tube	HSA - Hollow Stem Augers	RB - Rock Bit
		NX - Rock Core

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL.

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GRI GEI GII GSI GAI GCI

Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces

by

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Table 1 – Summary of Interface Shear Strength

Interface 1	Interface 2	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R^2	Fig. No.	δ (deg)	Ca (kPa)	Points	R^2
HDPE-S	Granular Soil	1a	21	0	162	0.93	1b	17	0	128	0.92
HDPE-S	Cohesive Soil										
	Saturated	1c	11	7	79	0.94	1d	11	0	59	0.95
	Unsaturated	1c	22	0	44	0.93	1d	18	0	32	0.93
HDPE-S	NW-NP GT	1e	11	0	149	0.93	1f	9	0	82	0.96
HDPE-S	Geonet	1g	11	0	196	0.90	1h	9	0	118	0.93
HDPE-S	Geocomposite	1i	15	0	36	0.97	1j	12	0	30	0.93
HDPE-T	Granular Soil	2a	34	0	251	0.98	2b	31	0	239	0.96
HDPE-T	Cohesive Soil										
	Saturated	2c	18	10	167	0.93	2d	16	0	150	0.90
	Unsaturated	2c	19	23	62	0.91	2d	22	0	35	
HDPE-T	NW-NP GT	2e	25	8	254	0.96	2f	17	0	217	0.95
HDPE-T	Geonet	2g	13	0	31	0.99	2h	10	0	27	0.99
HDPE-T	Geocomposite	2i	26	0	168	0.95	2j	15	0	164	0.94
LLDPE-S	Granular Soil	3a	27	0	6	1.00	3b	24	0	9	1.00
LLDPE-S	Cohesive Soil	3c	11	12.4	12	0.94	3d	12	3.7	9	0.93
LLDPE-S	NW-NP GT	3e	10	0	23	0.63	3f	9	0	23	0.49
LLDPE-S	Geonet	3g	11	0	9	0.99	3h	10	0	9	1.00
LLDPE-T	Granular Soil	4a	26	7.7	12	0.95	4b	25	5.2	12	0.95
LLDPE-T	Cohesive Soil	4c	21	5.8	12	1.00	4d	13	7.0	9	0.98
LLDPE-T	NW-NP GT	4e	26	8.1	9	1.00	4f	17	9.5	9	0.96
LLDPE-T	Geonet	4g	15	3.6	6	0.97	4h	11	0	6	0.98
PVC-S	Granular Soil	5a	26	0.4	6	0.99	5b	19	0	6	0.99
PVC-S	Cohesive Soil	5c	22	0.9	11	0.88	5d	15	0	9	0.95
PVC-S	NW-NP GT	5e	20	0	89	0.91	5f	16	0	83	0.74
PVC-S	NW-HB GT	5g	18	0	3	1.00	5h	12	0.1	3	1.00
PVC-S	Woven GT	5i	17	0	6	0.54	5j	7	0	6	0.93
PVC-S	Geonet	5k	18	0.1	3	1.00	5l	16	0.6	3	1.00

Interface 1	Interface 2	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R^2	Fig. No.	δ (deg)	Ca (kPa)	Points	R^2
PVC-F	NW-NP GT	6a	27	0.2	26	0.95	6b	23	0	26	0.95
PVC-F	NW-HB GT	6c	30	0	8	0.97	6d	27	0	8	0.90
PVC-F	Woven GT	6e	15	0	6	0.78	6f	10	0	6	0.76
PVC-F	Geonet	6g	25	0	11	1.00	6h	19	0	11	0.99
PVC-F	Geocomposite	6i	27	1.1	5	1.00	6j	22	4.7	6	1.00
CSPE-R	Granular Soil	7a	36	0	3	1.00	7b	16	0	3	1.00
CSPE-R	Cohesive Soil	7c	31	5.7	6	0.71	7d	18	0	6	0.99
CSPE-R	NW-NP GT	7e	14	0	6	0.97	7f	10	0	6	0.98
CSPE-R	NW-HB GT	7g	21	0	3	1.00	7h	10	0	3	1.00
CSPE-R	Woven GT	7i	11	0	6	0.92	7j	11	0	3	1.00
CSPE-R	Geonet	7k	28	0	9	0.87	7l	16	0	9	0.80
NW-NP GT	Granular Soil	8a	33	0	290	0.97	8b	33	0	117	0.96
NW-NP GT	Cohesive Soil	8c	30	5	79	0.96	8d	21	0	28	0.79
NW-HB GT	Granular Soil	9a	28	0	6	0.99	9b	16	0	6	0.91
NW-HB GT	Cohesive Soil	9c	29	0.9	15	0.71	9d	10	0	15	0.83
Woven GT	Granular Soil	10a	32	0	81	0.99	10b	29	0	28	0.98
Woven GT	Cohesive Soil	10c	29	0	34	0.94	10d	19	0	16	0.86
GCL Reinforced (internal))	N/A	11a	16	38	406	0.85	11b	6	12	182	0.91
GCL (NW-NP GT)	HDPE-T	12a	23	8	180	0.95	12b	13	0	157	0.90
GCL (W-SF GT)	HDPE-T	12c	18	11	196	0.96	12d	12	0	153	0.92
Geonet	NW-NP GT	13a	23	0	52	0.97	13b	16	0	32	0.97
Geocomposite (NW-NP GT)	Granular Soil	14a	27	14	14	0.86	14b	21	8	10	0.92

Determination of break points among three Mohr Coulomb Envelopes

1b - Primary Liner (Side Slope) w RCL

version jfh v5a

	Upper	Lower	Strength Type	δ	α	Tanδ
			Residual Strengths			
A	MSW	Gran Drain Layer	Residual	35.0 deg	520 psf	0.700
B	Gran Drain Layer	DST HDPE FML (60 Mil)		34.0 deg	0 psf	0.675
C	DST HDPE FML (60 Mil)	RCL		19.0 deg	480 psf	0.344

	σ	τ_A	τ_B	τ_C	τ_{MIN}
	0.0 psf	520.0 psf	000.0E+00 psf	480.4E+00 psf	000.0E+00 psf
1	-20234 psf	-13648.2 psf	-13.6E+03 psf	-6.5E+03 psf	-13.6E+03 psf
2	-111 psf	442.0 psf	-75.1E+00 psf	442.0E+00 psf	-75.1E+00 psf
3	1455 psf	1538.7 psf	981.3E+00 psf	981.3E+00 psf	981.3E+00 psf
4	10000 psf	7522.1 psf	6.7E+03 psf	3.9E+03 psf	3.9E+03 psf
5	10000 psf	7522.1 psf	6.7E+03 psf	3.9E+03 psf	3.9E+03 psf

Bilinear Envelope

	σ	$\tau_{Bilinear}$
1	-50000 psf	-34490 psf
2	0 psf	0 psf
3	625 psf	422 psf
4	1250 psf	843 psf
5	2500 psf	1341 psf
6	5000 psf	2202 psf
7	7500 psf	3063 psf
8	10000 psf	3924 psf

Break Even Points

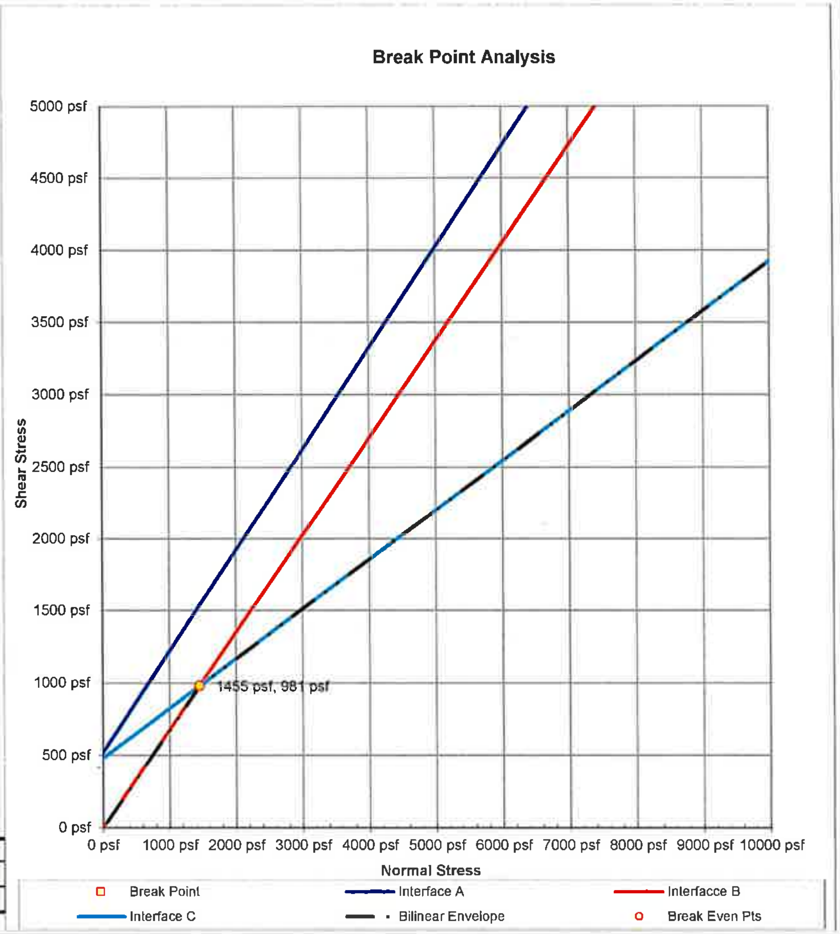
	Combo	σ_a	τ_a
1	A and B		
2	A and C		442.0
3	B and C	1454.9	981.3

Determination of secant* value on 'multi' linear case

Critical σ_a= ☐ α= ☐

Critical τ_a= δ_1=

*Secant value above the minimum adhesion (α_{min}) δ_2=



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ORIGINAL ARTICLE

Shear strength of municipal solid waste for stability analyses

Timothy D. Stark · Nejan Huvaj-Sarihan · Guocheng Li

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Abstract This paper investigates the shear strength of municipal solid waste (MSW) using the back analysis of failed waste slopes as well as field and laboratory test results. Shear strength of MSW is a function of many factors such as waste type, composition, compaction, daily cover, moisture conditions, age, decomposition, overburden pressure, etc. These factors together with non-standardized sampling methods, insufficient sample size to be representative of in situ conditions, and limited shear displacement or axial strain imposed during the laboratory shear testing have created considerable scatter in reported results. Based on the data presented herein, large shear displacements are required to mobilize the peak shear strength of MSW which can lead to displacement incompatibility between MSW and the underlying material(s) such as geosynthetic interfaces and foundation soils. The data presented herein are used to develop displacement compatible shear strength parameters for MSW. Recommendations are presented for modeling the displacement and stress dependent strength envelope in stability analyses.

Keywords Municipal solid waste · Shear strength · Slope stability · Landfill

Introduction

This paper investigates the shear strength of municipal solid waste (MSW). The recommendations presented herein build on previous results and recommendations presented by Eid et al. (2000) and others, such as Gerber (1991), Grisolia et al. (1991, 1995), Jessberger and Kockel (1991), Jessberger (1994), Gabr and Valero (1995), Kockel and Jessberger (1995), Edincliler et al. (1996), Jones et al. (1997), Pelkey (1997), Mazzucato et al. (1999), Thomas et al. (1999), Pelkey et al. (2001), Gabr et al. (2002), Vilar and Carvalho (2004) and Zekkos (2005). Table 1 presents a list of the references and data used herein.

Shear strength testing of MSW is difficult because of the heterogeneous composition of landfill materials, difficulty in sampling, specimen preparation, testing, and range of particle size, and time-dependent properties, such as the age of the MSW and decomposition state, unit weight, etc. Published laboratory and field shear test data and back-analysis of field case histories are used herein to develop a better understanding of MSW shear strength and present recommendations for MSW strength to be used in static and seismic slope stability analyses of landfills.

MSW laboratory test data

Because of the need for a strength envelope in static and seismic slope stability analyses, a basic Mohr–Coulomb approach is utilized herein and by the researchers cited previously to model the shear strength of MSW. The

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Table 1 Summary of MSW shear strength data

References	Testing method and sample size	Sample location	Waste constituents and properties	Displacement or strain at the shearing resistance considered
Landva and Clark (1990)	Laboratory direct shear device (434 × 287 mm)	Edmonton, Calgary, Mississauga, Waterloo in Canada	20–55% Paper products, 5–42% food waste, 4–20% garden waste, 6–15% metal, 2–15% plastic. Dry unit weight = 10–14 kN/m^3	No information
Richardson and Reynolds (1991)	Field direct shear device (150 × 150 mm)	Maine, USA	Dry unit weight = 16 kN/m^3 (Gerber 1991)	No information
Houston et al. (1995)	Field direct shear device (1.2 × 1.2 m)	Northwest Regional Landfill in Arizona	MSW, construction, and landscaping waste	Shear displacement of 2.5 cm
Withiam et al. (1995)	Field direct shear device (150 × 150 cm)	Dekorte Park Landfill in New Jersey	Glass, paper, cinders, plastic, metal and building debris. Dry unit weight = 10.8–12.8 kN/m^3	No information
Edincliler et al. (1996)	Laboratory direct shear device (30 cm diameter)	Southeastern Wisconsin Landfill	Fresh waste. Dry unit weight = 7.5–14.2 kN/m^3	Shear displacement of 2.5 cm
Siegel et al. (1990)	Laboratory direct shear device (13 cm diameter)	California Landfill	10–48-Year old waste. Dry unit weight = 9.6–17.3 kN/m^3	Shear displacement of 1.3 cm
Del Greco and Oggeri (1994) from Oweis and Khera (1998)	Laboratory direct shear device	No information	Baled MSW. Dry unit weight = 5–7 kN/m^3	No information
Kockel and Jessberger (1995); Jessberger and Kockel (1993)	Laboratory drained triaxial compression device (60 cm long × 30 cm diameter specimen)	Germany Landfill	1– 3-Year-old waste	10% Axial strain
Taylor (1995) from Van Impe (1998)	Laboratory simple shear device (no size)	No information	38% Paper, 18% plastics, 17% textiles; 3-month-old waste	10% Shear strain
Gabr and Valero (1995) from Van Impe (1998)	Laboratory direct shear device (6.4 cm diameter)	Pennsylvania Landfill	33% Ash, soil and rock, 23% textiles, 13% plastics, 10% metals, etc; 15–30 years old. Dry unit weight = 10–12.1 kN/m^3	Shear displacement of 6 mm
Kavazanjian et al. (1999)	Laboratory direct shear device (46 cm diameter)	California Landfill	11–35-Year-old	1.9% Shear strain
Mazzucato et al. (1999)	Field cylindrical direct shear device (80 cm diameter)	Italy Landfill	Total unit weight = 7 kN/m^3	Shear displacement of 2.5 cm
Thomas et al. (1999)	Field direct shear device (1 m × 1 m)	Torcy, France	20% Plastics, 21% paper, 11% textile. Total unit weight = 7.8–16 kN/m^3	Shear displacement of 2.5 cm
Pelkey et al. (2001); Pelkey (1997)	Laboratory direct shear and direct simple shear device (45 cm long × 30.5 cm wide)	Three Landfills in Canada	Shredded and un-shredded MSW; 2–5-year-old waste. Total unit weight 10–16 kN/m^3	Shear displacement 2.5 cm or 10% shear strain

Table 1 continued

References	Testing method and sample size	Sample location	Waste constituents and properties	Displacement or strain at the shearing resistance considered
Gabr et al. (2002)	Laboratory direct shear device (10 cm square)	Synthetically generated waste	No information	Maximum shear displacement of 1.2 cm
Machado et al. (2002)	Laboratory consolidated-drained triaxial compression device (30 and 40 cm long × 15 and 20 cm diameter specimen)	Sao Paulo, Brazil	55% Soil and organic paste, 17% plastics, 10% stone etc. 15 years old waste. Total unit weight = 10 kN/m^3	10% axial strain
Vilar and Carvalho (2004)	Laboratory consolidated-drained triaxial compression device (30 and 40 cm long × 15 and 20 cm diameter specimen)	Sao Paulo, Brazil	55% Soil and organic paste, 17% plastics, 10% stone, etc.; 15 years old waste. Total unit weight = 10–12 kN/m^3	10% Axial strain
Gomes et al. (2005)	Laboratory consolidated-drained triaxial compression device	Portugal	37% Plastics, 33% textile, 11% soil, and 10% metal. Total unit weight 11.5 kN/m^3	10% Axial strain
Itoh et al. (2005)	Laboratory consolidated-drained triaxial compression device (23 cm × 24 cm × 57.5 cm high specimen)	Tokyo Landfill	Maximum dry density 0.6–0.7 g/cm^3	10% Axial strain
Harris et al. (2006)	Laboratory direct simple shear device (15 cm diameter, 5 cm height)	Mohawk landfill, NY and Outer Loop landfill, KY	Shredded and processed MSW. 2–10-year-old waste. Total unit weight 11–17.5 kN/m^3	10% Shear strain
Isenberg (2003)	Laboratory direct simple shear device (15 cm × 15 cm × 5 cm)	Hiriya landfill, Israel	Decomposed waste. Unit weight 16 kN/m^3	No information
Grisolia et al. (1991) from Jessberger and Kockel (1993)	Laboratory triaxial device	No information	No information	10% Axial strain
Caicedo et al. (2002)	Field direct shear device (90 cm diameter)	Dona Juana landfill, Colombia	48% Organic matter, 45% paper, textile, and plastics, 7% soils, metals, and glass. Fresh MSW. Total unit weight 10 kN/m^3	No information

summary of shear strength data presented herein should be regarded as a generalization necessitated by the need for a strength envelope and should be used with considerable engineering judgment. There is an increasing need for estimating the shear strength of MSW because of an emphasis on stability analyses after a number of landfill slope failures. This need is greatest because the height of proposed landfills is increasing. The increasing height of landfills is to increase disposal capacity and can involve a new facility or a vertical expansion of an existing facility. This trend now includes proposed facilities that exceed an MSW depth of 180 m.

There is a wide range of effective stress shear strength parameters for MSW reported in the literature. Effective stress parameters are used in both static and seismic stability analyses because the high permeability of MSW usually does not allow generation of significant shear induced pore-pressures prior to or during slope instability unless aggressive leachate recirculation is being conducted. In general, if the MSW has a moisture content less than the field capacity of the MSW, shear induced pore pressure probably will not develop. Thus, effective stress stability analyses are usually performed to evaluate the stability of landfills.

Reported values of MSW effective stress friction angle (ϕ') range from 10 to 53° while effective stress cohesion (c') ranges from 0 to 67 kPa. This range is caused by the numerous factors that influence the test results including the inherent heterogeneous nature of waste, sample age, degree of decomposition, composition of the waste, specimen size, unit weight, pre-test processing, test method, and test conditions (Edincliler et al. 1996; Manassero et al. 1996; Van Impe 1998; Isenberg 2003). Large-scale laboratory direct shear tests (at least 30 cm × 30 cm dimensions) on MSW samples obtained from field borings, or excavations, and in situ direct shear tests (as large as 1 m × 1 m) on as-compacted MSW are common methods used to determine the shear strength of MSW (see Table 1). Of course, the representative nature of these samples is debatable but the testing provides some guidance on the shear strength of MSW. These limitations suggest that back-analysis of failed waste slopes should be used to guide the laboratory strength parameters.

Shear behavior of MSW

Effect of shear displacement/axial strain

The shear strength of MSW is shear displacement or axial strain dependent and tends to increase with increasing deformation (Eid et al. 2000). Review of existing laboratory data shows that most of the laboratory shear tests investigated are not continued to a sufficient displacement or strain to mobilize the peak strength of the MSW. Instead the shear test is terminated prior to mobilization of the peak shear resistance (Gerber 1991; Grisolia et al. 1991; Jessberger and Kockel 1991; Jessberger 1994; Gabr and Valero 1995; Kockel and Jessberger 1995; Edincliler et al. 1996; Jones et al. 1997; Mazzucato et al. 1999; Thomas et al. 1999; Bouzza and Wojnarowicz 2000; Pelkey et al. 2001; Gabr et al. 2002; Vilar and Carvalho 2004).

Figure 1 shows typical shear stress–displacement relationships from direct shear tests on MSW. The shear boxes used in these studies range from 15 to 100 cm long, 15 to 100 cm wide, and 22 to 30 cm deep. The tests were terminated at various shear displacements with the maximum shear displacement being about 250 mm. In most of the tests, the measured shear stress is still increasing when the direct shear test was terminated. From Fig. 1 a shearing displacement substantially greater than 150 mm is usually required to achieve the peak shear resistance of MSW. Pelkey et al. (2001) show the shear strength of MSW at different shear displacement levels and conclude that the peak shear strength of MSW is reached at a shear displacement of 100–220 mm (in a direct shear box that is 450 mm long and 305 mm wide with upper and lower shear boxes each 300 mm deep).

Stark et al. (2000) conclude that the shear strength of MSW increases with increasing strain or displacement. This leads to high strength values that are in good agreement with field observations of vertical scarps from landfill slope failures remaining near vertical for significant periods of time. Stark et al. (2000) conclude that the MSW acts

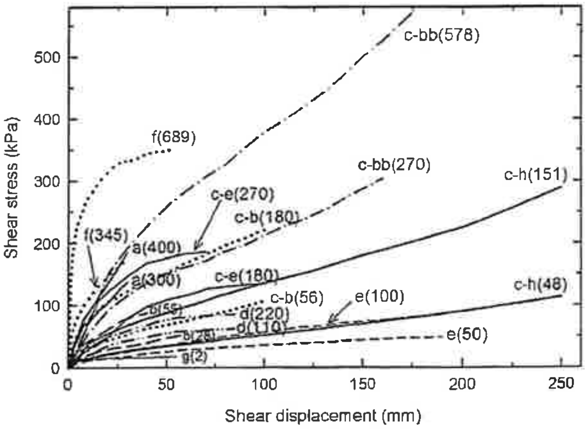


Fig. 1 Stress–displacement relationships from direct shear tests on MSW. *Letters* indicate different references and numbers in parenthesis are the testing normal stresses in kPa. [*a* Taylor 1995, *b* Edincliler et al. 1996, *c* Pelkey 1997 (*c*, *b* Blackfoot refuse, *c*, *bb* Blackfoot/Burbank refuse, *c–e* Edmonton shredded refuse, *c–h* Hantsport old refuse], *d* Mazzucato et al. 1999, *e* Thomas et al. 1999, *f* Harris et al. 2006, *g* Zekkos 2005)

as a reinforced mass and additional strain/displacement mobilizes the reinforcing effect of plastics, rope, fabrics, and other materials.

Figure 2 presents strength envelopes for MSW obtained from the direct shear data from the references summarized in Fig. 1 for various shear displacements. The data symbols used in Fig. 2 correspond to different levels of shear displacement. The lowest strength envelope corresponds to a shear displacement of 10 mm and the highest strength envelope corresponds to a shear displacement of 150 mm. This reaffirms increasing shear resistance with increasing shear displacement in direct shear tests, and shows the shear resistance can increase by a factor of two depending on the applied shear displacement.

Figure 2 also presents equations for the various strength envelopes that can be used to estimate the shear resistance of MSW for a given level of shear displacement. For example, if an estimated permanent seismic deformation of 100 mm is being considered, the shear resistance of MSW can be estimated using the strength envelope that corresponds to 100 mm of shear displacement in Fig. 2.

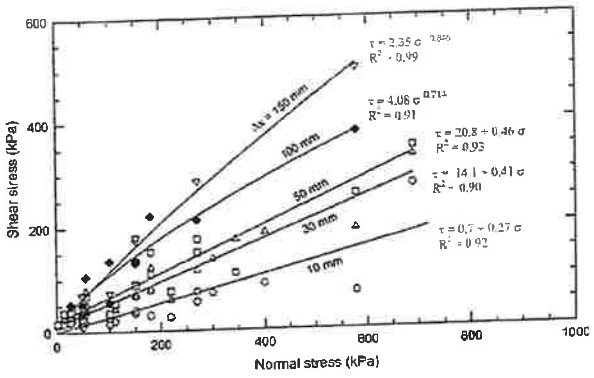


Fig. 2 Strength envelopes for MSW corresponding to 10, 30, 50, 100 and 150 mm of shear displacement (Δx) in direct shear tests

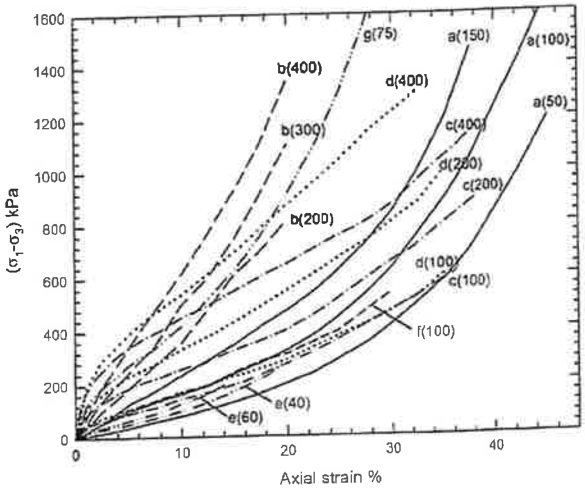


Fig. 3 Stress–strain relationships of MSW from triaxial compression tests. *Letters* indicate different references, and *numbers* in *parenthesis* are the consolidation pressures in kPa. (*a* Grisolia et al. 1991, *b* Jessberger and Kockel 1993, *c* Machado et al. 2002, *d* Vilar and Carvalho 2004, *e* Itoh et al. 2005, *f* Gomes et al. 2005, *g* Zekkos 2005)

Figure 3 shows typical deviator stress (σ_1–σ_3) versus axial strain relationships from isotropically consolidated-drained triaxial compression tests on MSW. The triaxial compression specimens range from 15 to 30 cm in diameter and 30 to 60 cm long. The tests were conducted to a maximum axial strain of 46% which corresponds to a vertical displacement of 21 cm based on an initial specimen height of 45 cm. As can be seen in Fig. 3, triaxial compression data on MSW consistently shows the deviator stress increasing continuously with axial strain, without reaching a well-defined peak value (Singh and Murphy 1990; Machado et al. 2002; Vilar and Carvalho 2004). This is in contrast to the direct shear data, which sometimes reaches a peak or ultimate value (see Fig. 1) prior to test termination. It is anticipated that this difference is caused by the difference in the mode of shear and magnitude of displacement applied in the direct shear and triaxial devices.

Figure 4 presents strength envelopes from isotropically consolidated triaxial compression tests on MSW obtained from the studies summarized in Fig. 3 for various levels of axial strain. The lowest strength envelope corresponds to

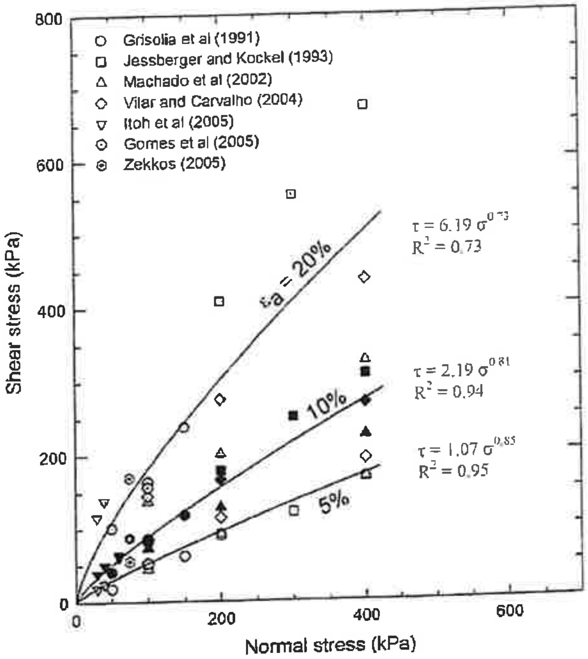


Fig. 4 Strength envelopes of MSW, corresponding to 5, 10 and 20% axial strain in triaxial compression tests. *White symbols* are for 5% axial strain, *black symbols* for 10% and *gray symbols* for 20%

an axial strain of 5% and the highest strength envelope corresponds to an axial strain of 20%. This also affirms increasing shear resistance with increasing axial strain in triaxial compression tests on MSW. Figure 4 also presents equations for the various strength envelopes that can be used to estimate the shear resistance of MSW for a given level of axial strain.

Grisolia et al. (1995) performed triaxial compression tests on MSW and report that even at axial strains in excess of 20–30%, the peak shear strength is not mobilized. They present their findings in the form of mobilized friction angle and cohesion as a function of axial strain. At an axial strain of 10%, the mobilized cohesion of 5 kPa and a friction angle of 10° are reported while a cohesion of 30 kPa and a friction angle of 20° is reported for an axial strain of 25%. Vilar and Carvalho (2004) described drained isotropically consolidated triaxial compression tests on 200 mm in diameter and 400 mm high specimens and report stress–strain relationships that are concave upwards. Thus, the peak strength is not achieved even at axial strains up to 30%. They also recommend that the resulting shear strength envelopes be based on the axial strain at which the particular deviator stress is obtained. Their triaxial data suggest that the frictional resistance of the MSW tends to be fully mobilized at axial strains of less than or equal to 20% while the cohesion intercept starts to be mobilized at axial strains of 10% or more. A limiting value of strain for mobilization of the cohesion intercept could not be discerned from the data (Vilar and Carvalho 2004). This may be beneficial for seismic analyses that predict a large amount of earthquake-induced permanent deformation because the cohesion intercept significantly influences the calculated factor of safety (FS) and yield acceleration (Stark and Choi 2004).

The shear displacement or axial strain dependency of MSW shear strength has created some confusion in the literature because the reported strength parameters correspond to different displacements or different axial strains. The reported MSW strength parameters usually correspond to the measured shear stress at the displacement or axial strain at test termination because the shear resistance is frequently still increasing. This is problematic because the range of displacement or axial strain that can be applied in shear devices varies considerably. This incompatibility probably results in some of the observed variability in the reported strength parameters. It is recommended that laboratories include a subscript to their strength parameters that indicates the displacement or axial strain at which the MSW strength parameters are determined. Others recognized the problem of reporting strength parameters for MSW when the failure point is not clearly defined or reached before the test is terminated. For example, Vilar and Carvalho (2004) and Harris et al. (2006) recommend that the Mohr–Coulomb criterion be related to some value of axial strain.

Isenberg (2003) emphasizes that waste shear strength and density are a function of site specific waste composition and operational techniques, such as waste type, composition, compaction, daily cover, moisture conditions, age, overburden pressure, etc. Isenberg (2003) reports peak shear strength parameters that range from $\phi' = 20–35°$ and $c' = 0–50$ kPa. These shear strength parameters are in agreement with the values proposed by Eid et al. (2000) of $\phi' = 35°$ and $c' = 0–25$ kPa. Milanov et al. (1997) report the most likely or reasonable shear strength parameters of MSW are $c' = 1–2$ kPa and $\phi' = 35–40°$.

Therefore, it is suggested that MSW shear strength parameters be reported with the displacement or axial strain level at test termination or where the shear strength parameters are being determined as will be presented herein.

Effect of normal stress

Increasing demand for vertically expanding existing landfills and the interest in mega-landfills, has created a need for characterizing the shear strength of MSW at high normal stresses. Therefore, the stress dependency of MSW shear strength parameters is discussed in this section. Figures 2 and 4 demonstrate the dependence of MSW shear strength on the magnitude of normal stress as well as shear displacement or axial strain.

The data and shear strength envelopes presented in Fig. 4 show clearly the stress-dependent nature of the Mohr–Coulomb strength envelope of MSW. The nonlinearity of the strength envelope can be evaluated in terms of the mobilized secant friction angle (as defined by Stark and Eid 1994), the value of which is decreasing with increasing normal stress. This indicates the importance of the stress-dependent nature of the MSW shear strength. Del Greco and Oggeri (1994) also suggested that the shear strength of MSW is stress dependent for normal stresses up to 110 kPa and recommended a stress dependent friction angle as early as 1994. There is little data at normal stresses greater than 500 kPa. A normal stress of 500 kPa corresponds to a waste depth of only 40 m based on a typical waste unit weight of 12.6 kN/m^3 (80 pcf). A waste depth of 40 m is considerably smaller than depths of 180 m, which are currently being proposed. Thus, it is prudent to be conservative at normal stresses greater than 500 kPa.

Figure 5 presents all of the laboratory data compiled during this study and described in Table 1. One important aspect of this data is the normal stress range up to 1,800 kPa, which corresponds to a waste height of about 145 m based on a typical waste unit weight of 12.6 kN/m^3. This height approaches the height currently being proposed for a landfill with a height of 180 m. Prior MSW strength relationships do not extend beyond 400 kPa and thus have

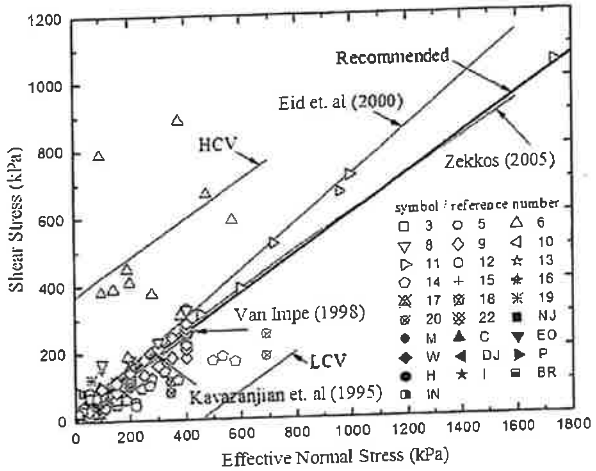


Fig. 5 Summary of measured and back-calculated MSW shear strength for effective normal stresses less than 1,800 kPa

limited applicability for mega-landfills and significant vertical expansions because MSW shear strength is normal stress dependent.

As expected, the data in Fig. 5 show considerable scatter but a trend of nonlinear increase in shear resistance with increasing normal stress is evident for normal stresses less than 1,000 kPa. Two bracketing trend lines are presented in Fig. 5 to facilitate the use of this data in evaluating the reliability of landfill slopes, which is discussed subsequently.

Reliability of landfill slopes

The probability of failure and reliability of the computed factor of safety (FS) of landfill slopes can be estimated using the method described by Duncan (2000). This procedure requires estimating the standard deviation in the quantities impacting the computed FS; one of which is MSW shear strength. Thus, the standard deviation of the MSW strength must be estimated to calculate the change in the FS due to the standard deviation in MSW strength. A Taylor series is used to estimate the standard deviation and variance in the FS based on the change in FS caused by the standard deviation in all of the parameters that influence the FS (Duncan 2000). The standard deviation in the factor of safety (σ_F) is estimated using the following Taylor series expression:

$$\sigma_F = \sqrt{\left(\frac{\Delta F_1}{2}\right)^2 + \left(\frac{\Delta F_2}{2}\right)^2 + \left(\frac{\Delta F_3}{2}\right)^2}$$

where ΔF is the change in factor of safety computed for the most likely value (MLV) +1 SD and the MLV −1 SD for the parameter in question. Thus, the change in factor of safety for the MSW strength envelope in Fig. 5 that correspond to the most likely strength envelope +1 and the most likely strength envelope −1 SD must be estimated.

The two trend lines in Fig. 5 can be used to estimate the highest (HCV) and lowest conceivable values (LCV) of the strength envelope for calculation of the SD of the MSW strength. The three-sigma rule is used to estimate the SD of a parameter because 99.7% of all values of a normally distributed parameter fall within three SDs of the value (Dai and Wang 1992). This assumes that the HCV and LCV correspond to values that are three SDs above and below, respectively, the average value (Duncan 2000). Figure 5 shows that the HCV and LCV strength envelopes encompass about 98% of the data shown for normal stresses less than 600 kPa and thus the trend lines are reasonable approximations of the HCV and LCV. Using the HCV and LCV in Fig. 5, the SD of strength can be calculated using the following expression:

$$\sigma = \frac{(\mathrm{HCV} - \mathrm{LCV})}{6}$$

The data presented herein can be used to estimate the reliability of landfill slopes instead of simply reporting a value of FS.

Recommended MSW shear strength parameters

Shear strength parameters at normal stresses less than 200 kPa

Figures 5 and 6 present all of the laboratory data compiled during this study and described in Table 1 for normal stresses less than 1,800 and 500 kPa, respectively,

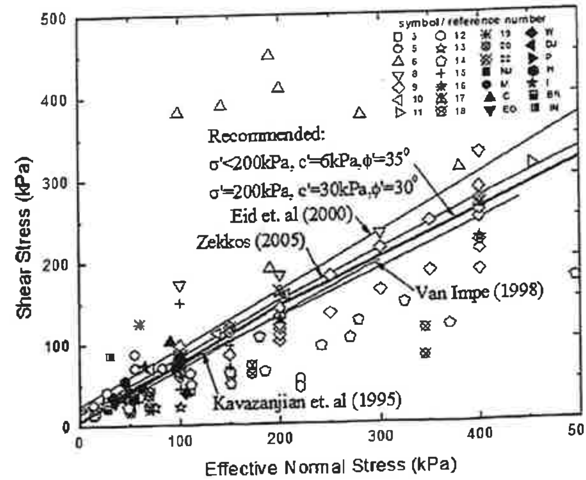


Fig. 6 Recommended strength envelope for effective normal stresses less than 500 kPa

which correspond to a shear displacement less than or equal to 25 mm or an axial or shear strain less than or equal to 10%. A shear displacement of 25 mm and an axial strain of 10% are used because these values are compatible with the stress–strain behavior of geosynthetic interface and foundation soil (Eid et al. 2000). Compatible shear displacement–shear stress relationships are illustrated in Fig. 6 of Eid et al. (2000), showing that the cohesive soil and MSW mobilize a peak strength at a shear displacement less than 2.5 mm and greater than 40 mm, respectively. Back-analysis of field case histories show that the mobilized resistance of MSW corresponds to the shear resistance at a displacement of about 25 mm. Eid et al. (2000) recommended MSW shear strength parameters of $c' = 25$ kPa and $\phi' = 35°$ which corresponds to a shear resistance of about 64 kPa for a normal stress of 55 kPa. Figure 6 of Eid et al. (2000) shows that a shear resistance of 64 kPa is mobilized in the direct shear test on MSW at a shear displacement of 20–25 mm. Because MSW exhibits a much higher peak strength and direct shear testing is usually conducted to at least 25 mm of shear displacement, a 25 mm is used to define the strength of MSW. A corresponding value of axial strain is about 10%.

Zekkos et al. (2007) recommends failure criterion based upon $K_o = 0.3$ and an additional 5% of axial strain in triaxial compression tests. The data presented by Zekkos et al. (2007) show a better regression coefficient when a failure criterion of $K_o = 0.3$ and an additional 10% of axial strain is used, which is in better agreement with Eid et al. (2000) and the axial strain of 10% recommended herein. Using an axial strain of 5% appears to be conservative for MSW based on vertical slopes in MSW that remain stable for long period of time.

Zekkos et al. (2007) use the variable K_o to define different points on the stress–strain relationship. The use of K_o is confusing because K_o is usually used to represent the coefficient of lateral earth pressure at rest, not a point after shearing has commenced in a triaxial compression test. The variable K is more representative and is the ratio of the major (σ_1) and minor (σ_3) principal stresses. In various ICD triaxial compression tests conducted by Zekkos (2005) the ratio of σ_1 to σ_3 of 0.3 occurred at an axial strain of 2–9%. Thus, the failure criterion of $K = 0.3$ and an additional axial strain of 5% corresponds to an axial strain of about 7–14%. The failure criterion of $K = 0.3$ and an additional axial strain of 10%, which exhibits a higher regression coefficient, corresponds to an axial strain of about 12–19%. The average of these criteria is an axial strain of 10% as recommended by Eid et al. (2000) and herein. A failure criterion of 10% axial strain in ICD triaxial compression tests is also less confusing. The amount of axial strain that occurs at a particular ratio of σ_1 to σ_3 is a function of confining pressure, waste composition, specimen preparation and compaction, and strain rate.

In summary, stress–strain compatible failure criteria for MSW appears to be a shear displacement of 25 mm or an axial strain of 10% in ICD triaxial compression tests.

Superimposed on data in Figs. 5 and 6 are several strength envelopes recommended by Kavazanjian et al. (1995), Van Impe (1998), Zekkos (2005) and Eid et al. (2000). Kavazanjian et al. (1995) suggest the following shear strength parameters for MSW: $c' = 24$ kPa and $\phi' = 0°$ for normal stress range of 0–30 kPa, $c' = 0$ and $\phi' = 33°$ for normal stress range of 30–300 kPa. Van Impe (1998) summarizes the shear strength of MSW data from laboratory tests as well as from back-analysis of case histories, suggesting a strength envelope defined by $c' = 20$ kPa and $\phi' = 0°$ for an effective normal stress range of 0–20 kPa. For the 20–60 kPa normal stress range, he recommends $c' = 0$ and $\phi' = 38°$ and for normal stresses greater than 60 kPa $c \geq 20$ kPa and $\phi' = 30°$. Thus, Van Impe (1998) recommends a tri-linear envelope to capture the stress dependent nature of MSW. Zekkos (2005) also recommends a stress-dependent strength envelope where friction angle decreases with confining stress.

Also shown in Figs. 5 and 6 is the linear strength envelope proposed by Eid et al. (2000) in terms of $c' = 25$ kPa and $\phi' = 35°$. Eid et al. (2000) selected a linear envelope because the data considered in their study is limited to normal stresses less than 350 kPa. This strength envelope plots above the strength envelopes of Van Impe (1998) and Kavazanjian et al. (1995). The Eid et al. (2000) envelope was chosen so that it plots above the lowest MSW shear strengths measured in laboratory tests because the mobilized strength, i.e., the presence of stable vertical or near vertical landfill slopes after a slope failure and back-analysis of landfill slope failures, is greater than the strength parameters of $c' = 25$ kPa and $\phi' = 35°$. Thus, the Eid et al. (2000) envelope is a lower bound on field data of MSW shear strength. Eid et al. (2000) concluded it would be too conservative to capture the lowest laboratory measured strengths at normal stresses less than 200 kPa because of limitations in MSW specimen preparation, testing equipment, and magnitude of applied shear displacement.

The authors do not believe that the recommended or MLV strength envelope should plot below all of the laboratory measured shear strengths at normal stresses less than 200 kPa as suggested by Kavazanjian et al. (1995). However, the recommended strength envelope should plot at or near the lower bound of the field or back-calculated shear strength values. Kavazanjian et al. (1995) base their strength envelope on the lower bound of the laboratory and back-calculated data, as they should because they use back-calculation of non-failed slopes to reinforce the laboratory data. The problem with back-calculating non-failed slopes is the FS is not known. In contrast, Eid et al. (2000) only back-calculated failed slopes in which sufficient information is available to perform a meaningful back-analysis. It will be shown subsequently a different rationale is used to develop a strength envelope for normal stresses greater than or equal to 200 kPa because of a lack of field case histories at these normal stresses.

Finally, it is recommended that the reliability of the computed FS be estimated using the methodology presented by Duncan (2000) so the recommended strength envelope in this study should be used as the MLV for normal stress less than 200 kPa.

Importance of MSW strength parameters at normal stresses less than 30 kPa

Kavazanjian et al. (1995) and Van Impe (1998) recommend different strength parameters for normal stresses less than 30 kPa. In a stability analysis a normal stress of 30 kPa on an inclined failure surface through the waste mass corresponds to a waste depth of about 4.8 m assuming a coefficient of lateral earth pressure of 0.5. An inclined failure surface through the waste is used because landfill slope failure usually involves a transitional slide along a weak underlying layer (Stark et al. 2000). If a coefficient of lateral earth pressure of 0.3 is used as recommended by Zekkos (2005), 30 kPa corresponds to a waste depth of 8 m. The lateral earth pressure coefficient is used because the stress normal to the inclined failure surface is desired. The depth of 4.8 m is calculated by dividing the normal stress of 30 kPa by a typical MSW unit weight (12.6 kN/m^3), and the lateral earth pressure coefficient.

Most landfills are much deeper than 4.8 m, especially mega-landfills, so the initial horizontal portion of the strength envelope only impacts an extremely small portion of the critical failure surface that passes through the MSW. A sensitivity analysis shows that varying the strength parameters in the upper 4.8 m of the critical failure surface that extends to the liner system in a deep landfill does not significantly impact the calculated FS for waste depths greater than about 15 m as compared to the strength parameters recommended by Eid et al. (2000). Thus, the refinement of the MSW failure at normal stresses less than 30 kPa does not appear to be warranted for landfills with a waste depth greater than about 15 m. However, refinement of the strength envelope at normal stresses greater than 300 kPa is important because the MSW shear strength parameters are known to be confining stress dependent.

Shear strength parameters at normal stresses greater than 200 kPa

The MSW strength data for normal stresses greater than about 200 kPa used by Eid et al. (2000) shows a nonlinear increase in shear strength with increasing normal stress as pointed out by discussers (see Stark et al. 2001). Thus, this paper provides recommendations for strength parameters for normal stresses greater than 200 kPa to overcome this limitation of the recommendation in Eid et al. (2000). Although some of the data in the higher normal stress range suggest that the strength envelope is linear (e.g. Kavazanjian et al. 1995), most of this data has a waste percentage of less than 30% (soil percentage of about 60–70%), which means that the materials tested probably should not be classified as waste. Recent data by Pelkey (1997), Pelkey et al. (2001) and Van Impe (1998) suggest that the slope of the shear strength envelope decreases as the normal stress increases.

125 psf

Figures 5 and 6 represents the bi-linear strength envelope that captures the stress dependency of MSW at effective normal stresses greater than 200 kPa. For normal stresses less than 200 kPa, $c' = 6$ kPa and $\phi' = 35°$ is recommended which is consistent with Eid et al. (2000) but utilizes a c' of six instead of 25 kPa. Even with the reduced c' value, the recommended strength envelope exceeds the strength envelopes proposed by Kavazanjian et al. (1995) and Van Impe (1998) for the applicable normal stresses.

~ 4,177 psf

For normal stresses greater than or equal to 200 kPa, the recommended strength envelope changes to $c' = 30$ kPa – 626.6psf and $\phi' = 30°$ to represent the stress dependency of MSW shear strength. A normal stress of 200 kPa on an inclined failure surface through the waste corresponds to a waste depth about 32 m assuming a coefficient of lateral earth pressure of 0.5 and a typical waste unit weight of 12.6 kN/m^3. ~ 80.2 pcf If the landfill has a waste depth of less than 32 m, the strength parameters of $c' = 6$ kPa and $\phi' = 35°$ can be used. If the landfill depth is greater than or equal to 32 m, the bilinear envelope should be used. To facilitate the use of the bi-linear envelope in stability analyses, the bilinear envelope can be approximated using the following expression:

$$\tau = 15 + 0.61\sigma'_n - 0.00002(\sigma'_n)^2$$

Alternatively, various points on this bilinear envelope, i.e. various pairs of shear and normal stress values, can be used in slope stability softwares to model the strength envelope directly.

Recommended strength envelope in this study is consistent with the recent recommendation by Zekkos (2005) reporting the strength envelope of MSW as:

JFH

$$\tau = c + \sigma'_n \cdot \tan \phi'$$

where $c = 15$ kPa. Considering the decrease in friction angle with increasing confining stress, Zekkos (2005) recommended the following equation for the shear strength of MSW, where P_o is 1 atm.:

$$\tau = 15 + \sigma'_n \cdot \tan\left[36 - 5 \cdot \log\left(\frac{\sigma'_n}{P_o}\right)\right]$$

Figure 5 shows good agreement between the recommended bilinear envelope and the envelope corresponding to the equation above. A bilinear strength envelope to model MSW is also suggested by Del Greco and Oggeri (1994), Pelkey et al. (2001), and Gabr et al. (2002).

The recommended strength parameters or equation developed herein above results in a strength envelope that plots below the Eid et al. (2000) strength envelope as shown in Fig. 5. This is because the recommended strength envelope plots at or near the lower bound of the new case histories analyzed herein, which provide the best estimate of mobilized MSW strength. These case histories are discussed subsequently.

Figure 5 also shows that the recommended strength envelope at normal stresses greater than 200 kPa plots at the lower bound of the laboratory measured shear strength values because there is a lack of field case histories that correspond to normal stresses significantly greater than 200 kPa. Thus, it is prudent to use a strength envelope near the lower bound of the laboratory measured shear strength values because field case histories are not available to confirm the laboratory measured shear strength values. As a result, the recommended strength envelope captures the one data point at a normal stress of about 1,750 kPa. Clearly, additional data is needed at higher normal stresses to confirm this recommended strength envelope.

The bilinear strength envelope shown in Fig. 5 still depicts MSW as a strong material. The high strength of MSW is confirmed by landfill slopes that can stand at steep angles for considerable time (Koelsch 1993). Examples of steep landfill slopes are reported by various researchers, e.g. 60-m-high nearly vertical scarp that resulted from the slope failure of a Cincinnati landfill which remained stable for 10 months until it was remediated (Stark et al. 2001), 21-m-high vertical excavation in MSW in Illinois which has remained stable over 10 years (Stark et al. 2001), 1H:3 V (about 71°) slope in the Umraniye dump site in Istanbul (Kocasoy and Curi 1995), a 75° slope excavated in Goettingen–Deiderode landfill in Germany (Koelsch 2005), stable 1.2H:1 V and 0.67H:1 V slopes in Hiriya landfill in Israel five years after a slope failure in 1997 (Isenberg 2003), and a vertical scarp after the Payatas landfill slope failure in Philippines in 2000 (Merry et al. 2005). Based on the observation of steep landfill slopes that remain stable, it is concluded that the focus of landfill stability analyses should be the materials that underlie the MSW, e.g., geosynthetic interfaces and weak foundation soils, and not the MSW unless there is a weak continuous layer in the waste mass.

Back-calculated MSW shear strength from failed waste slopes

Kavazanjian et al. (1995) back-analyzed unfailed landfill slopes to estimate the shear strength of MSW. The landfill slopes (Lopez Canyon, CA; OII Landfill, CA; Babylon, New York; Private Landfill, OH) had not failed or experienced movement, therefore they assumed a FS equal to 1.2 for the slope. Using a FS equal to 1.2 and assuming a c' of 5 kPa, they back-calculated the MSW friction angle. More recent data suggests a greater cohesion than 5 kPa which will reduce the back-calculated value of ϕ'.

Eid et al. (2000) analyzed four landfill slope failures to estimate the mobilized strength of MSW. Other case histories were considered for back-analyses but not included in that study because of significant uncertainties in some of the field conditions, such as slope geometry, leachate level, and subsurface information. These four case histories are included in Figs. 5 and 6 and reinforce the recommended bi-linear strength envelope.

Seven additional landfill slope failures were analyzed and Table 2 summarizes all of the case histories analyzed to date. The back-analyses of Warsaw, Poland; Istanbul, Turkey; Payatas, Philippines and Hiriya, Israel landfills are discussed in Huvaj-Sarihan and Stark (2008). Cruz das Almas-Brazil and Leuwigajah-Indonesia landfill slope failures were analyzed as part of this study.

One of these slope failures involves the Gnojna Grora Hill landfill, in Warsaw, Poland (Bouzza and Wojnarowicz 2000; Huvaj-Sarihan and Stark 2008). The unit weight of the waste material was 17 kN/m^3 (because the waste is mixed with demolition debris) and the natural water content of the waste is 28–80%. The groundwater/leachate level is 3–5 m below ground surface. No geosynthetic liner system was installed prior to waste placement and thus the waste is in contact with native materials and groundwater. Thus, the groundwater level corresponds to the leachate level. The slope did not experience a large slide but tension cracks developed in buildings on top of the landfill indicating the onset of sliding. Some of the observed building cracks may be caused by waste settlement rather than slope movement but tension cracks were observed indicating the onset of instability. Because the slope did experience extensive movement, the FS was assumed to be near unity for the back-analysis. To back-calculate an effective stress

Table 2 Summary of MSW landfill case histories used to back-calculate MSW shear strength

Label in Figs. 5 and 6	Reference	Maximum landfill height (m)	Average effective stress along failure surface in waste (kPa)	Average leachate level in terms of Pore Pressure ratio[a]	Back-calculated shear stress (kPa)
NJ	New Jersey site (Oweis and Khera 1998); Dvinoff and Munion 1986)	23	62	0.065	46
M	Maine site (Richardson and Reynolds 1991)	27	34	0.045	35
C	Cincinnati site (Eid et al. 2000)	84	90	0.078	103
EO	Eastern Ohio site (Stark et al. 1998)	24.5	35	0.021	29
W	Warsaw site, Poland (Bouzza and Wojnarowicz 2000)	26	106	0.44	40
DJ	Dona Juana, Columbia (Hendron et al. 1999, Gonzalez-Garcia and Espinoza-Silva 2003; Fernandez et al. 2005; Hendron 2006)	60	55	0.15–0.80	34
P	Payatas, Phillipines (Merry et al. 2005)	33	95	0.43	69.5
H	Hiriya landfill, Israel (Isenberg 2003)	60	32	0.65	46
IS	Istanbul landfill, Turkey (Kocasoy and Curi 1995)	45	65	0.50	72.5
BR	Cruz das Almas Landfill, Brazil (Gharabaghi et. al 2006)	40	28.9	0.30	20.3
IN	Leuwigajah dumpsite, Indonesia (Koelsch 2005)	70	31.2	0.21	86

[a] Pore pressure ratio, $r_u = u/\gamma h$

friction angle, the MSW was assumed to exhibit a c' of 0 kPa. The back-calculated ϕ' is 21°. The back calculated friction angle is reasonable considering the age of the waste. The landfill is estimated to be 300 years old (Bouzza and Wojnarowicz 2000). Therefore, the back-calculated shear strength of MSW is expected to be comparable to the shear strength of a cohesive soil. The average normal stress on the observed failure surface through the waste is 106 kPa.

Another landfill analyzed was located in Istanbul, Turkey. The dumpsite has been in operation since 1976. Composition of the waste material, after removal of the recyclable material by scavengers, is estimated to be about 70% food remains/organics, 10% papers, 6% textile, 3% plastics, 3% metals (Kocasoy and Curi 1995). Maximum MSW slope height was about 45 m, with steep front slopes of up to 45° or even more. The MSW was placed without any liner system. The waste is not compacted and is not covered with soil. The catastrophic slope failure occurred in 1993 and included up to 1,000,000 m^3 of waste. Pictures taken after the failure and the cross section used in slope stability analyses are shown in Huvaj-Sarihan and Stark (2008). Heavy rains, and excessive leachate level built up within the old decomposed waste were likely the triggering mechanism, together with recently placed demolition debris on top of the waste (Kocasoy and Curi 1995). An MSW unit weight of 11 kN/m^3 is assumed because no further information is available. The average normal and shear stresses on the observed failure surface through the waste is 65 and 72.5 kPa, respectively.

The Hiriya waste dump is located in Tel-Aviv, Israel, and was in use from 1952 to 1998 (Isenberg 2003). The landfill reaches a height of 60 m above the surrounding level ground, with the slopes of 45° or more. The landfill does not have an engineered bottom liner, final cover, or leachate and gas control systems. Side slopes of Hiriya landfill range from 1.3H:1 V to 1.6H:1 V. As a result of the steep slopes, the lack of drainage and erosion controls, the landfill has experienced small and large instability problems. In 1997 a major slope failure occurred following a period of heavy rain. Pictures taken after the failure and the cross section used in slope stability analyses are shown in Huvaj-Sarihan and Stark (2008). The average normal and shear stresses on the observed failure surface through the waste is 32 and 46 kPa, respectively.

The unit weight of MSW is an important parameter in engineering analyses of landfill performance, but significant uncertainty currently exists regarding its value (Zekkos 2005). There was not enough information to model the change in unit weight with depth in the back analysis of these landfill slope failures.

Conclusions

The following conclusions can be discerned concerning the shear strength of MSW:

1. Shear strength of MSW depends on many factors, such as, waste type, composition, compaction, daily cover material, moisture conditions, leachate management, age and overburden pressure and these factors should be considered in the design process.
2. Laboratory or in situ shear strength data should reflect the level of shear displacement or axial strain that corresponds to the reported shear strength value because MSW shear resistance usually increases with increasing displacement/strain. This trend is more pronounced in triaxial compression than direct shear testing results.
3. It is recommended that a shear displacement greater than 60 mm or an axial strain of greater than 20% be used in MSW shear testing to mobilize a shear resistance that may be representative of the peak shear strength of MSW.
4. The peak shear strength of MSW is high as evident from at or near vertical landfill slopes or scarps that remain stable for a considerable time. As a result, testing and stability evaluations should focus on the materials underlying the MSW, e.g., underlying geosynthetics and native soils, unless a weak, continuous layer of waste is present.
5. MSW shear strength is normal stress dependent. It is recommended that a bilinear strength envelope be used to represent the shear strength at high normal stresses. For normal stresses less than 200 kPa, shear strength parameters of $c' = 6$ kPa and $\phi' = 35°$ and for normal stresses greater than or equal to 200 kPa, $c' = 30$ kPa and $\phi' = 30°$ are recommended. The recommended bilinear envelope is based on shear strength data corresponding to a shear displacement of 25 mm or 10% axial strain and thus should be compatible with the shear behavior of underlying geosynthetic interfaces and foundation soil. However, considerable judgment should be used when implementing this strength envelope in a stability analysis because additional data is needed to refine this envelope.
6. Future research on the shear strength of MSW should include more laboratory testing and back-analyses of landfill failures to further refine the MSW shear strength parameters proposed herein.

References

Bouzza A, Wojnarowicz M (2000) Stability assessment of an old domestic waste slope in Warsaw Poland. In: Proceedings of slope stability 2000, sessions of Geo-Denver 2000, ASCE Geotech. Special publication no.101, p 48–57

Caicedo B, Giraldo E, Yamin L, Soler N (2002) The landslide of Dona Juana landfill in Bogota. A case study. In: Proceedings of the fourth international congress on environmental geotechnics (4th ICEG), Rio de Janeiro, Brazil, 11–15 August 2002, pp 171–175

Dai S-H, Wang M-O (1992) Reliability analysis in engineering applications. Van Nostrand Reinhold, New York

Del Greco O, Oggeri C (1994) Shear resistance tests on municipal solid wastes. In: Proceedings of 1st ICEG. BiTech Publishers, Edmonton

Duncan JM (2000) Factor of safety and reliability in geotechnical engineering. J Geotech Geoenviron Eng ASCE 126(4):307–316

Dvinoff AH, Munion DW (1986) Stability failure of a sanitary Landfill. In: Fang HY (ed) International symposium on environmental geotechnology, pp 26–34

Edincliler A, Benson CH, Edil TB (1996) Shear strength of municipal solid waste: interim report—year 1. Environmental geotechnics research report 96-2, prepared for WMX Technologies, Inc., February, 65 pp

Eid H, Stark TD, Evans WD, Sherry P (2000) Municipal solid waste slope failure i: waste and foundation soil properties. J Geotechn Geoenviron Eng ASCE 126(5):397–407

Fernandez G, Hendron D, Castro A (2005) Pore pressure induced slide in municipal solid waste Dona Juana Landfill—Bogota, Colombia. In: Proceedings of the 16th international conference on soil mechanics and geotechnical engineering, vol 4, pp 2253–2256, Osaka, Japan

Gabr MA, Valero SN (1995) Geotechnical properties of municipal solid waste. Geotech Test J ASTM 18(2):241–251

Gabr MA, Hossain MS, Barlaz MA (2002) Review of shear strength parameters of municipal solid waste with Leachate recirculation. In: Proceedings of 2nd intercontinental landfill research symposia, October 13–16, 2002 in Asheville, NC

Gerber R (1991) CWS slide investigation report. (reference from Edincliler et al. 1996)

Gharabaghi B, Singh MK, Inkratas C, Fleming IR, McBean E (2006) Comparison of slope stability in two Brazilian municipal Landfills. Waste Management (submitted)

Gomes C, Lopes ML, Lopes MG (2005) A study of MSW properties of a Portugese landfill. In: Proceedings of international workshop on hydro-physico-mechanics of landfills, LIRIGM, Grenoble 1 University, France, 21–22 March 2005

Gonzalez-Garcia AJ, Espinosa-Silva A (2003) Dona Juana sanitary landfill catastrophic failure in 1997. In: Proceedings of the 12th Panamerican conference on soil mechanics and geotechnical engineering, June 22–26, Cambridge vol 2, pp 1353–1360

Grisolia M, Napoleoni Q, Sirini P, Tancedi G (1991) Geotechnical behaviour of sanitary landfill based on laboratory and in-situ tests. In: Proceedings of 15th conference of geotechnics of Torino, Società Ingegneri e Architetti in Torino (in Italian)

Grisolia M, Napoleoni Q, Tancedi G (1995) The use of triaxial test for characterization of MSW. In: Proceedings of Sardinia '95—5th international waste management and landfill symposium, Cagliari, Italy, vol II, pp 761–768

Harris JM, Shafer AL, DeGroff W, Hater GR, Gabr M, Barlaz MA (2006) Shear strength of degraded reconstituted municipal solid waste. Geotech Test J ASTM 29(2):1–8

Hendron DM (2006) Large landslide risks in solid waste facilities–Geotechnical Fundamentals Count. Geo-Strata magazine of the Geo-Institue, March/April 2006, pp 28–30

Hendron DM, Fernandez G, Prommer PJ, Giroud JP, Orozco LF (1999) Investigation of the cause of the 27 September 1997 slope failure at the Doña Juana landfill. In: Proceedings of Sardinia '99—7th International waste management and landfill symposium, 4–8 October 1999, Cagliari, Italy

Houston WN, Houston SL, Liu JW, Elsayed A, Sanders CO (1995) In-situ testing methods for dynamic properties of MSW Landfills. In: Proceedings of specialty conference on earthquake design and performance of solid waste landfills, Geotechnical

Special Publication 54, ASCE, San Diego, CA, October, 1995, pp 73–82

Huvaj-Sarihan N, Stark TD (2008) Back analyses of landfill slope failures. In: Proceedings of 6th international case histories conference, 11–16 August 2008, Arlington, VA (accepted)

Isenberg RH (2003) Landfill and waste geotechnical stability. Presentation at US EPA Bioreactor Workshop, February 27–28, 2003, Arlington-VA

Itoh T, Towhata I, Kawano Y (2005) Mechanical properties of municipal waste deposits and ground improvement. In: Proceedings of the 16th international conference on soil mechanics and geotechnical engineering, Osaka, Japan, September, pp 2273–2276

Jessberger HL (1994) Geotechnical aspects of landfill design and construction. Part 2: material parameters and test methods. Geotechnical Engineering. Proc Instit Civil Eng 104:105–113

Jessberger HL, Kockel R (1991) Mechanical properties of waste materials. XV Ciclo di Conferenze de Geotecnica di Torino, Torino, Italy, November 19–22

Jessberger HL, Kockel R (1993) Determination and assessment of the mechanical properties of waste materials. In: Proceedings Sardinia 93, 4th international landfill symposium, S. Margherita di Pula, Cagliari, Italy, October 1993, pp 1383–1392

Jones R, Taylor D, Dixon N (1997) Shear strength of waste and its use in landfill stability analysis. In: Proceedings of the conference on geoenviromental engineering, University of Wales, Cardiff, pp 343–350

Kavazanjian E, Matasovic N, Bonaparte R, Schmertmann G (1995) Evaluation of MSW properties for seismic analysis. In: Proceedings of specialty conference, geoenvironment 2000, ASCE geotech special publication no.46, vol 2, pp 1126–1141

Kavazanjian E, Matasovic N, Bachus RC (1999) Large-diameter static and cyclic laboratory testing of municipal solid waste. In: Proceedings Sardinia 99, 7th international waste management and landfill symposium, 4–8 October 1999, Cagliari, Italy

Kocasoy G, Curi K (1995) The Umraniye-Hekimbasi open dump accident. Waste Manage Res 13:305–314

Kockel R, Jessberger H (1995) Stability evaluation of municipal solid waste slopes. In: Proceedings of the 11th ECSMFE (European Conference on Soil Mechanics and Foundation Engineering), vol 2, pp 267–272

Koelsch F (1993) The bearing behaviour of domestic waste and related consequences for stability. In: Proceedings of the 4th international landfill symposium, Sardinia '93, 11–15 October 1993, vol 2, pp 1393–1410, Cagliari, Italy

Koelsch F (2005) http://www.dr-koelsch.de/html/waste_mechanics.html

Landva AO, Clark JI (1990) Geotechnics of waste fill. Geotechnics of waste fills—theory and practice, ASTM STP 1070. In: Landva A, Knowles D (eds) American society for testing and materials. Philadelphia, Pennsylvania, pp 86–103

Machado SL, Carvalho MF, Vilar OM (2002) Constitutive model for municipal solid waste. J Geotech Geoenviron Eng ASCE 128(11):942–951

Manassero M, Van Impe WF, Bouazza A (1996) Waste disposal and containment. Environmental geotechnics. In: Proceedings of 2nd international congress on environmental geotechnics, Osaka, Japan, 5–8 November 1996, vol 3, pp 1425–1474

Mazzucato A, Simonini P, Colomo S (1999) Analysis of block slide in a MSW landfill. In: Proceedings Sardinia 99, 7th International Waste Management and Landfill Symposium, Cagliari, Italy

Merry SM, Kavazanjian E, Fritz WU (2005) Reconnaissance of the July 10, 2000, Payatas Landfill Failure. J Perform Constructed Facilities ASCE 19(2):100–107

Milanov V, Corade JM, Bruyat-Korda F, Falkenreck G (1997) Waste slope failure analysis at the Rabastens landfill site. Sardinia 97. In: Proceedings 6th international landfill symposium, vol 3, pp 551–557. Cagliari, Italy

Oweis IS, Khera RP (1998) Geotechnology of waste management, 2nd edn. PWS Kent, Boston, 472 p

Pelkey SG (1997) Geotechnical properties of municipal solid waste. M.Sc. thesis, University of New Brunswick

Pelkey SG, Valsangkar AJ, Landva A (2001) Shear displacement dependent strength of municipal solid waste and its major constituent. Geotech Test J ASTM 24(4):381–390

Richardson GN, Reynolds RD (1991) Geosynthetic considerations in a landfill on compressible clays. In: Proceedings of geosynthetics '91, vol 2, Vancouver, BC, Canada, Industrial Fabrics Association International, St Paul, MN

Siegel RA, Robertson RJ, Anderson DG (1990) Slope stability investigation at a landfill in Southern California. Geotechnics of waste fills—theory and practice, ASTM STP 1070. In: Landva A, Knowles D (eds) American society for testing and materials. Philadelphia, Pennsylvania, pp 259–284

Singh S, Murphy BJ (1990) Evaluation of the stability of sanitary landfills. Geotechnics of waste fills—theory and practice, ASTM STP 1070. In: Arvid L, David K (eds) American Society for Testing and Materials, Philadelphia, Pennsylvania, pp 240–258

Stark TD, Choi H (2004) Peak v. Residual interface strengths for landfill liner and cover design. Geosyn Int J Ind Fabrics Assoc Int (IFAI) 11(6):491–498

Stark TD, Eid HT (1994) Drained residual strength of cohesive soils. J Geotechn Eng ASCE 120(5):856–871

Stark TD, Eid HT, Evans WD, Sherry P (2000) Closure to "municipal solid waste landfill slope failure i: foundation and waste properties". J Geotech Geoenviron Eng ASCE 127(9):812–815

Stark TD, Eid HT, Evans WD, Sherry P (2001) Closure to "municipal solid waste landfill slope failure i: foundation and waste properties". J Geotechn Geoenviron Eng ASCE 127(9):812–815

Taylor DP (1995) Strength testing of domestic waste by plate bearing and shear box tests. MS dissertation. University of Derham School of Engineering

Thomas S, Aboura AA, Gourc JP, Gotteland P, Billard H, Delineau T, Gisbert T, Ouvry JF, Vuillemin M (1999) An in situ waste mechanical experimentation on a French Landfill. In: Proceedings Sardinia 99, seventh international waste management and landfill symposium, Cagliari, Italy

Van Impe WF (1998) Environmental geotechnics: ITC 5 Activities, state of art. In: Proceedings, 3rd international congress on environmental geotechnics, vol 4, pp 1163–1187, Lisbon, Portugal

Vilar OM, Carvalho MF (2004) Mechanical properties of municipal solid waste. Geotech Test J ASTM 32(6):1–12

Withiam JL, Bushell TD, Germann HW (1995) Prediction and performance of municipal landfill slope. In: Proceedings of specialty conference geoenvironment 2000, Geotechnical Special Publication 46, vol 2, pp 1005–1019. ASCE, New Orleans, LA

Zekkos (Zeccos) DP (2005) Evaluation of static and dynamic properties of municipal solid waste. Ph.D. thesis, Department of Civil and Environmental Engineering, University of California, Berkeley

Zekkos DP, Bray JD, Riemer MF, Kavazanjian E, Athanasopoulos GA (2007) Response of municipal solid-waste from Tri-Cities Landfill in triaxial compression. In: Proceedings Sardinia 2007, eleventh international waste management and landfill symposium. S. Margherita di Pula, Cagliari, Italy; 1–5 October 2007

Determination of break points among three Mohr Coulomb Envelopes

MSW Stark & Huvaj-Sarihan 2009

version jfh v3b1

	Upper	Lower	Strength Type	δ	α	Tanδ
			Peak Strengths			
A	Lower normal Stress	Higher normal stress	Peak	30.0 deg	639 psf	0.577
B	Higher normal stress			35.0 deg	125 psf	0.700

	σ	τ_A	τ_B	τ_{MIN}
	0.0 psf	638.5 psf	125.3E+00 psf	125.3E+00 psf
1	-1106 psf	0.0 psf	-649.1E+00 psf	-649.1E+00 psf
2	-179 psf	535.2 psf	000.0E+00 psf	000.0E+00 psf
3	4177 psf	3050.2 psf	3.1E+03 psf	3.1E+03 psf
4	10000 psf	6412.0 psf	7.1E+03 psf	6.4E+03 psf
5	10000 psf	6412.0 psf	7.1E+03 psf	6.4E+03 psf

Bilinear Envelope

	σ	$\tau_{Bilinear}$
1	-15000 psf	-10378 psf
2	0 psf	125 psf
3	625 psf	563 psf
4	1250 psf	1001 psf
5	2500 psf	1876 psf
6	5000 psf	3525 psf
7	7500 psf	4969 psf
8	10000 psf	6412 psf

Break Even Points

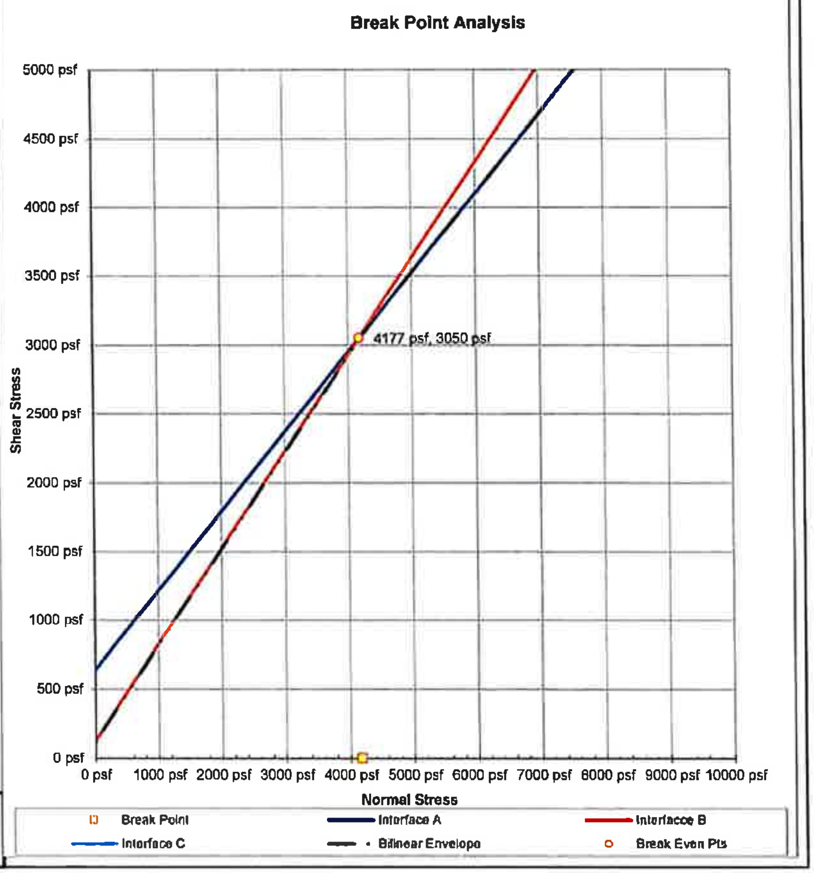
	Combo	σ_a	τ_a
1	A and C		
2	B and C		
3	A and B	4177.2	3050.2

Determination of secant value on 'multi' linear case

Critical σ_a= ☐

Critical τ_a=

δ_1=



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Technical Note

Peak versus residual interface strengths for landfill liner and cover design

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ABSTRACT: The rationale for using peak, residual, or a combination of these shear strengths for the analysis of geosynthetic-lined slopes and design recommendations for landfill liner and cover systems is presented herein. Landfill liner systems using geosynthetics that contain sideslopes are recommended to be designed using the methodology presented by Stark and Poeppel: (1) assign residual shear strengths to the sideslopes and peak shear strengths to the base of the liner system and satisfy a factor of safety greater than 1.5; and also (2) assign residual strengths to the sideslopes and base of the liner system and satisfy a factor of safety greater than unity. The authors recommend that the stability of landfill cover systems be analysed using peak shear strengths with a factor of safety greater than 1.5 because of the absence of large detrimental shear displacement along the weakest interface. If, for some reason, the slope angle of the cover system exceeds the friction angle of the weakest interface, or large displacements such as construction-induced displacements or seismically induced displacements are expected, a residual shear strength with a factor of safety greater than unity should be used for the cover design. In both liner and cover designs a peak composite failure envelope that describes the weakest interface should be used to represent the peak shear strength, and the residual failure that corresponds to the peak composite failure envelope should be used instead of the lowest residual failure envelope.

KEYWORDS: Geosynthetics, Interface shear resistance, Design, Direct shear test, Ring shear test, Shear strength, Slope stability

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1. INTRODUCTION

The main objectives of this manuscript are to clarify the recommendations for the design of geosynthetic-lined landfill liner slopes presented by Stark and Poeppel (1994) and to present new recommendations for the design of landfill cover systems. This discussion is limited to slope instability that might occur along a soil–geosynthetic or geosynthetic–geosynthetic interface. This discussion does not relate to possible slope instability that may develop in soils underlying a waste containment facility or through the waste materials.

The selection of the interface shear strength that should be used for design of the liner and cover system is important because it affects the disposal capacity of a waste containment facility. The usual design objective for waste containment facilities is to maximise storage capacity. Thus sideslopes are designed and constructed as steeply as possible, and the waste height and slope will be as high and steep as possible, respectively. Many researchers (e.g. Martin *et al.* 1984; Saxena and Wong 1984; Koerner *et al.* 1986; Williams and Houlihan 1987; Negussey *et al.* 1989; Bove 1990; Mitchell *et al.* 1990; O'Rourke *et al.* 1990; Takasumi *et al.* 1991; Yegian and Lahlaf 1992; Stark and Poeppel 1994; Stark *et al.* 1996; Dove and Frost 1999) have shown that the residual interface shear resistance can be as much as 50–60% lower than the peak interface shear resistance. Thus use of a residual strength in design results in substantially flatter slopes, smaller disposal capacity, and decreased revenue. However, a number of case histories (Seed *et al.* 1990; Seed and Boulanger 1991; Byrne *et al.* 1992; Stark 1999) show that an overestimate of the geosynthetic–geosynthetic interface shear resistance can lead to slope instability and substantial remediation costs.

2. DESIGN OF LANDFILL LINER SYSTEMS

2.1. General

Stark and Poeppel (1994) present a design approach that uses a combination of the peak and residual for the design of landfill liner systems. This recommendation is based on the interface testing for and back-analysis of the slope instability in the Kettleman Hills Hazardous Waste Facility. Stark and Poeppel (1994) conclude that two design scenarios should be considered in stability analyses of geosynthetic liner systems. This recommendation has been verified with other case histories (e.g. Stark *et al.* 1998, 2001).

The first design scenario uses the peak interface shear resistance along the base or bottom of the landfill liner system and the residual interface shear resistance along the sideslope(s) of the liner system and satisfying a 2-D factor of safety of at least 1.5 for the final slope configuration, at least 1.3 for interim slopes, and 1.1 to 1.3 depending on the design seismic event. The second scenario involves ensuring that the 2-D factor of safety exceeds unity when the appropriate (discussed subsequently) residual interface shear resistance is applied to the base and sideslopes of the liner system. The second design scenario is considered because the peak interface strength is usually mobilised at a small laboratory displacement (Stark *et al.* 1996). Because of the uncertainty of the relationship between laboratory shear displacements and field shear displacements, the effect of progressive failure, and possible shear displacement caused by earthquake shaking, this scenario should be carefully considered. In other words, if everything goes wrong, i.e. a residual interface strength is mobilised along the weakest interface, the slope should remain stable because the 2-D factor of safety is greater than unity. If the residual interface strength is measured in a direct shear apparatus, a factor of safety greater than unity, e.g. 1.1, should be considered to compensate for the limited continuous shear displacement applied in this apparatus (Stark and Poeppel 1994; Marr and Christopher 2003).

There are uncertainties surrounding the application of these design scenarios. The main uncertainties are related to determining the residual shear resistance that should be used for the sideslopes and whether or not this recommendation is applicable to the design of the cover system. This manuscript is focused on clarifying the authors' opinion with regard to the use and applicability of these design scenarios in the design of landfill geosynthetic-lined slopes. Thiel (2001) correctly limits this recommendation to the design of liner systems, which is reflected in the title of his paper. Stark and Poeppel (1994) consider only the liner system at the Kettleman Hills Facility and other liner systems and not a final cover system.

Stark and Poeppel (1994) conclude that a residual interface shear resistance is mobilised along the sideslopes of liner systems, and the critical interface on the sideslope can differ from the base of the liner. The residual strength can be mobilised for many reasons including waste settlement or creep that leads to shear displacements along specific interfaces (Long *et al.* 1995), waste placement activities (Yazdani *et al.* 1995), lateral movement or bulging of waste (Stark *et al.* 2000), construction activity of the liner system (McKelvey 1994), thermal expansion/contraction of the geosynthetics, stress transfer between the waste on the sideslope and the landfill base that is acting as a buttress (Stark and Poeppel 1994), strain or displacement incompatibility between the waste and geosynthetic interface of interest (Eid *et al.* 2000), and/or earthquake-induced displacements. These shear displacements may lead to mobilisation of a residual strength, which can result in progressive failure effects between the sideslope and at least a portion of the base of a bottom liner system (Byrne 1994; Stark and Poeppel 1994; Gilbert and Byrne 1996; Reddy *et al.* 1996; Filz *et al.* 2001). Additional evidence of these shear displacement mechanisms has been developed since 1994 and is presented in the following sections to reinforce the recommendations in Stark and Poeppel (1994).

2.2. Development of residual interface strength condition

A residual interface shear resistance will develop in the field only if detrimental shear displacement occurs along a geosynthetic interface in the liner system. The two important factors in the above statement are: (1) detrimental or damaging shear displacement, and (2) the interface along which this detrimental shear displacement will occur. Detrimental shear displacement means that the interface shear resistance is being reduced from the peak value because shear displacement is occurring.

The two main areas for slope instability in the cross-section shown in Figure 1 are a slide mass near the slope face, i.e. toe area, and the entire waste mass sliding along a failure surface that extends along the base of the landfill and up the sideslope. The stability of the slope face area is controlled by the interface in the base liner system exhibiting the lowest peak strength and the waste strength, and is independent of the sideslope.

The stability of the entire waste mass sliding along a failure surface that extends along the base of the landfill and up the sideslope is the focus of the design recommendation of using a residual interface strength on the sideslope. The driving force or force causing instability in this scenario is the triangle of waste above the sideslope of the landfill. The stability of this triangle of waste is controlled by the interface shear resistance mobilised along the sideslope and base of the landfill. The majority of the shear resistance in this failure mode is derived from the base of the landfill because the

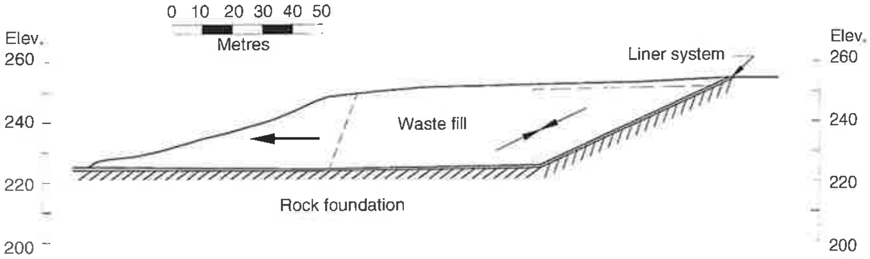

Figure 1. Schematic diagram illustrating mobilisation of buttressing effect of waste on the base of the landfill

normal stress is greatest along the base, and the failure surface is longer assuming that the same interfaces appear on the sideslope and the base of the landfill. The interface shear resistance along the base is given by $\sigma'_n \tan \delta_p$, where δ_p is the peak interface fiction angle of the weakest interface and σ'_n is the effective normal stress acting on this interface. Thus the practice of installing smooth HDPE geomembrane on the base and textured HDPE on the sideslope for value engineering and drainage layer stability purposes may have detrimental effects on stability because the smooth HDPE geomembrane will exhibit a smaller interface strength than textured HDPE.

Because of the low shear resistance exhibited by geosynthetic interfaces, the triangle of waste in Figure 1 must mobilise some shear resistance along the base of the landfill to prevent instability. The shear resistance of geosynthetic interfaces along the sideslope is low because of the low σ'_n and δ_p along the sideslope. This results in shear displacement along the weakest interface in the sideslope liner system, mobilising the passive resistance of the MSW along the base of the landfill. This stress transfer mechanism is especially relevant to MSW because of the compressible nature of MSW. If the base of the landfill were filled with an incompressible material, such as concrete, the shear displacement required to mobilise the shear resistance along the base of the landfill would be smaller. However, the compressible nature of MSW results in significant deformation being required to mobilise the shear resistance along the base of the landfill, especially at the sideslope/base transition. This stress transfer phenomenon has been duplicated using numerical methods by Byrne (1994), Gilbert and Byrne (1996), and Reddy *et al.* (1996).

Byrne (1994) was the first to use numerical methods to depict the behaviour of a liner system in response to waste placement to investigate the shear strength mobilised along the base and sideslope for the Kettleman Hills slope failure. Byrne (1994) uses the finite difference computer code FLAC (Cundall 1976) to recreate the filling process and shear strength mobilised in the base and sideslope of the liner system at the Kettleman Hills facility. The initial analysis involves placement of waste to a depth that is 3 m lower than the depth at failure. The second stage corresponds to the waste depth at failure of about 30 m. The results of the first stage of waste placement indicate a stable condition, but a residual strength condition is mobilised along the sideslope and a post-peak shear strength condition is mobilised along the initial portion (about 20%) of the base of the landfill in the vicinity of the sideslope. Over the remaining 80% of the landfill base, the induced shear stress is resisted by 60% of the peak shear strength.

After placement of the second stage of waste placement, i.e. waste depth at failure, failure along the liner system is imminent. A residual strength condition is mobilised along the sideslope, and the zone of post-peak shear strength along the base of the landfill now extends about 40% of the length of the base from the sideslope. Over the remaining 60% of the landfill base the shear stress is resisted by about 90% of the available peak shear strength. Placement of another 1 m of waste is sufficient to cause slope instability (Byrne 1994).

Subsequent finite element analyses of the Kettleman Hills slope failure (e.g. Reddy *et al.* 1996; Filz *et al.* 2001) indicate similar conclusions as those reached by Byrne (1994). These conclusions are that the shear resistances mobilised along the base and sideslope of the landfill are not equal, and the use of a peak smooth geomembrane–clay interface shear resistance along the entire failure surface does not predict the failure. More importantly, use of a peak smooth geomembrane–clay interface strength overpredicts the mobilised strength, and thus a combination of peak and residual strengths should be used in 2-D limit equilibrium methods.

Progressive failure occurs in slopes in which the driving force exceeds the mobilised strength of the weakest layer, e.g. the slope angle exceeds the friction angle of the weak layer (Mesri and Shahien 2003). If this occurs, the interface at the location where the driving force exceeds the interface friction angle becomes overstressed. If this local overstressing is great enough that the interface yields and shear displacement occurs, the shear stresses applied to this location are transferred to the interface element adjacent to this overstressing because the interface is undergoing a post-peak strength loss and cannot restrain the imposed shear stresses. If the existing shear stresses and the transferred shear stresses are great enough to cause the adjacent portion of the interface to yield, the overstressing will be transferred further. This process can continue until enough of the interface is overstressed that a slope failure occurs. If the shear strength of the weakest interface increases sufficiently, the initial overstressing can be arrested and slope failure is averted. Thus the fact that a limited portion of the interface achieves a post-peak condition does not mean the entire slope should be designed using residual interface strength. Byrne (1994) shows a residual strength condition developing along the entire sideslope and transferring stresses to the base of the landfill. Gilbert and Byrne (1996), Reddy *et al.* (1996) and Filz *et al.* (2001) also suggest the possibility of progressive failure occurring along a liner interface, and thus a residual or post-peak strength, respectively, may be applicable.

In summary, these analyses support the conclusion that a residual interface strength can be mobilised along a landfill sideslope while a peak interface strength is mobilised along the base.

2.3. Composite failure envelope design for bottom liner system

The interface along which detrimental shear displacement may occur is the interface that exhibits the lowest peak interface shear resistance in the bottom liner system regardless of the value of the residual interface shear resistance. For example, if the interface with the lowest peak interface shear resistance exhibits the highest residual interface shear resistance, the detrimental shear displacement may still occur along this interface but the resulting stability will be controlled by the residual interface shear resistance along this interface and not the lowest residual interface strength, e.g. a GCL. The reason for not mobilising the lowest residual interface shear resistance is that detrimental shear displacement will not occur along an interface with a higher peak strength before movement is initiated along the interface with the lowest peak interface strength. If detrimental shear displacement does not initiate along an interface, the shear resistance cannot drop to the residual value. In other words, there is no evidence that an interface can somehow end up at a residual strength condition if it is not subjected to detrimental shear displacement.

The failure envelope that corresponds to the lowest peak interface strength may correspond to the strength of one or more interfaces because geosynthetic interface strength is stress-dependent and non-linear (Stark and Poeppel 1994; Stark *et al.* 1996; Fox *et al.* 1998; Dove and Frost 1999). If more than one interface is used to develop the failure envelope for the interface with the lowest peak strength, the failure envelope is referred to as a composite failure envelope. The selection of a composite failure envelope for a multi-layer liner system is discussed at the end of the liner and cover system discussion.

The proper failure envelope for use in the design scenarios for bottom liner systems is reviewed in this section. This procedure is primarily for liner system design because of the large range in normal stress along the liner system. However, this procedure can be used for a cover system too. The range of normal stress is usually small in a cover system, i.e. 2.5–20.0 kPa, so the weakest peak interface strength usually does not change over this range in normal stress. However, if the weakest peak interface strength does change over this small normal stress range, a composite failure envelope should be developed for cover design purposes using the procedure described below.

The procedure for constructing a peak composite failure envelope uses the following three steps:

1. Determine the interface(s) or material(s) in the composite liner system that exhibit(s) the lowest peak strength for the full range of normal stresses encountered along the bottom liner system.
2. Determine the peak composite failure envelope for the weakest interface(s) or material(s) in the composite liner system for the full range of effective normal stresses encountered along the liner system.
3. Determine the residual composite failure envelope that corresponds to the peak composite failure envelope in Step 2.

The resulting peak and residual composite failure envelopes are used in the two design scenarios presented by Stark and Poeppel (1994) and discussed in Section 2.1. An example of developing a peak composite failure envelope is presented in Figures 2–5. Figure 2 presents the peak failure envelopes for the following interfaces measured using a torsional ring shear device (Stark and Poeppel 1994):

- nonwoven geotextile–smooth HDPE geomembrane (GM);
- clay–smooth GM; and
- geonet–smooth GM.

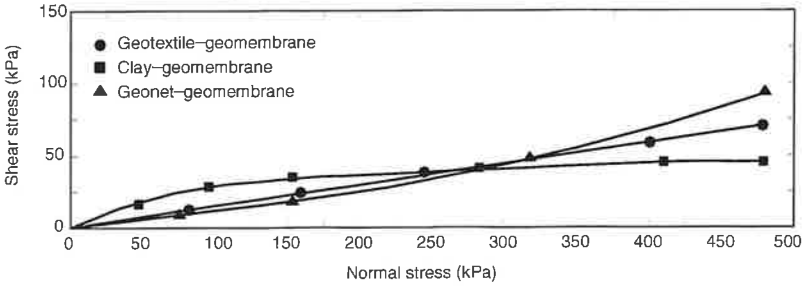

Figure 2. Peak failure envelopes for three components of the composite liner system at Kettleman Hills Waste Repository (Stark and Poeppel 1994)

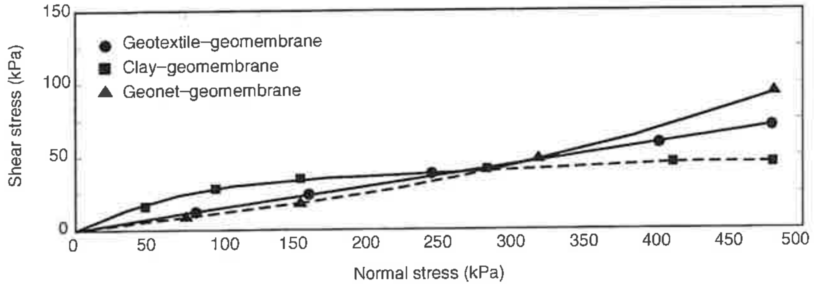

Figure 3. Peak composite failure envelope for three components of the composite base liner system at Kettleman Hills Waste Repository

For $\sigma'_n \leq 280$ kPa, the geonet–smooth GM interface exhibits the lowest peak shear strength and is the critical or weakest peak interface strength. However, the clay–smooth GM interface is critical for $\sigma'_n > 280$ kPa. Therefore a composite failure envelope, illustrated by the dashed line in Figure 3, should be used to represent the peak interface strength of the liner system. In other words, the peak composite failure envelope represents the weakest composite interface, and this shear displacement will occur along this composite interface before some other interfaces. Therefore this composite interface is the interface along which a residual strength condition could develop.

Figure 4 shows the individual residual strength failure envelopes for the same liner interfaces shown in Figure 2, and Figure 5 shows the design residual failure envelope (dashed) for the liner system. The design residual failure envelope corresponds to the peak composite failure envelope and does not simply represent the lowest residual composite failure envelope. The geotextile–smooth GM interface exhibits the lowest residual shear strength, but this residual envelope is not used for design because the peak strength of the geotextile–smooth GM interface will not be exceeded (see Figure 2) before the peak composite failure envelope is exceeded. Thus a residual strength condition will not be mobilised along the geotextile–smooth GM interface because detrimental shear displacement will occur on the geonet–GM and/or the clay–GM interface before it occurs on the geotextile–GM interface. Thus the residual composite failure envelope is between the highest and lowest residual failure envelopes.

In this example, there is not a large difference between the peak failure envelope of the geotextile–GM and geonet–GM interfaces at $\sigma'_n \leq 280$ kPa, so it may be prudent in this case to design for both of these interfaces at $\sigma'_n \leq 280$ kPa, which would involve checking to ensure the factor of safety is also greater than unity if the residual failure of the geotextile–GM interface is used for $\sigma'_n \leq 280$ kPa.

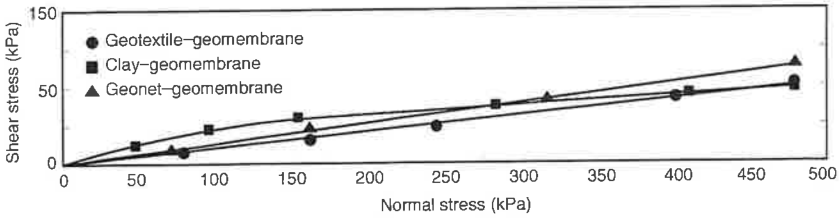

Figure 4. Residual failure envelopes for three components of the composite base liner system at Kettleman Hills Waste Repository (Stark and Poeppel 1994)

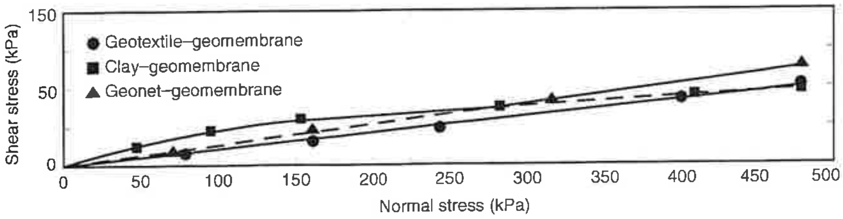

Figure 5. Design residual failure envelope for three components of the composite base liner system at Kettleman Hills Waste Repository

The proper selection of a composite failure envelope for design is especially important when a bottom liner system contains a reinforced GCL because of the high peak strength and low residual strength of hydrated bentonite (Stark and Eid 1996; Fox *et al.* 1998). With a reinforced GCL, other interfaces that exhibit a large post-peak strength loss, e.g. nonwoven geotextile–textured GM or double-sided drainage composite-textured GM, should also be evaluated to develop a representative composite failure envelope. The residual failure envelope for any hydrated GCL will plot well below the geotextile–smooth GM residual failure envelope in Figure 4 because it corresponds to the shear strength of hydrated bentonite. However, the peak strength envelope for an encapsulated unreinforced GCL and a reinforced GCL is likely to be significantly higher than that for many other typical interfaces in the liner system. If so, the GCL peak shear strength will not be exceeded, and the GCL will not reach a residual shear condition. Thus the GCL internal residual envelope should not be used for the sideslopes (design steps 1 and 2) or the base liner (design step 2). Use of the GCL internal residual failure envelope under these conditions would be unnecessarily conservative. This emphasises that the main design issue surrounding GCLs is not shear strength but hydraulic equivalence (Stark *et al.* 2004).

In summary, designers should not simply use the minimum residual failure envelope for design, but should determine which materials will reach a residual shear condition and then use the corresponding residual composite failure envelope for design. This is accomplished by first establishing the minimum peak composite failure envelope.

3. DESIGN OF LANDFILL COVER SYSTEMS

The proper methodology for selection of the design failure envelope for a cover system differs from the liner system design because of differences in the expected detrimental shear displacements. In particular, the design scenarios presented by Stark and Poeppel (1994) are not applicable to cover systems. Unpublished two- and three-dimensional back-analyses of cover failure studies by the first author show that peak interface strengths are mobilised throughout a cover system. This results for a number of reasons, including the presence of low shear stresses, low normal stresses (which limit detrimental, i.e. damage-inducing, shear displacements to a geosynthetic interface), smaller shear displacements required for stress transfer in soil cover than in MSW, and smaller settlements of the compacted soil veneer as compared with MSW. Although there is an opportunity for considerable construction-induced shear displacements to occur in cover systems, these displacements can be minimised by placing cover materials from bottom to the top of the sideslopes or by including tensile reinforcement (Koerner and Soong 1998). Therefore it is recommended that the stability of cover systems be analysed using the peak shear strength of the weakest interface, or if applicable the weakest composite interface, with a factor of safety greater than 1.5.

There are some situations where a residual interface shear resistance with a factor of safety greater than unity should be used in cover system design. If the slope angle of the final cover system is greater than a peak interface shear strength of the weakest interface, progressive failure can occur (Gilbert and Byrne 1996). As denoted previously, progressive failure occurs in slopes in which the driving force exceeds the mobilised strength of the weak layer, i.e. the slope angle exceeds the friction angle of the weak layer. Also, when large displacements such as construction-induced displacements or seismically induced displacements can be expected, the use of residual shear strength is recommended.

Thus, if the average slope angle of the cover system is greater than the lowest peak interface friction angle, a residual interface friction angle should be used for design. However, cover systems reinforced with tensile members can limit the progressive displacement on the weakest layer, and thus a residual interface shear strength will not fully mobilise. In such a case, the stability of a cover system can be analysed using the peak shear strength of the weakest interface with the factor of safety greater than 1.5.

4. RECOMMENDATIONS

The following recommendations can be discerned from information presented in this paper.

1. Detrimental, or damaging, shear displacement may occur within geosynthetic-lined landfill liner sideslopes owing to construction activities, thermal expansion/contraction, large displacements needed to mobilise the passive resistance of a waste buttresses on the base liner, strain or displacement incompatibility between the waste and geosynthetic interfaces, earthquake-induced displacement, lateral waste movement, waste placement procedures, or waste settlement. These shear displacements can lead to mobilisation of a post-peak strength and/or progressive failure effects between the sideslopes and base of a bottom liner system.
2. The failure envelope that corresponds to the lowest peak interface strength may correspond to one or more geosynthetic interfaces because geosynthetic interface strength is stress-dependent. If more than one interface is used to develop the failure envelope for the interface with the lowest peak strength, the envelope is referred to as a composite failure envelope. The procedure for constructing a peak composite failure envelope for multi-layer liner and cover systems uses the following three steps:
   (a) Determine the interface(s) or material(s) in the composite liner system exhibiting the lowest peak strength for the full range of normal stresses encountered along the bottom liner system.

   (b) Determine the peak composite failure envelope for the weakest interface(s) or material(s) in the composite liner system for the full range of effective normal stresses encountered along the liner system.
   (c) Determine the residual composite failure envelope that corresponds to the peak composite failure envelope in Step (b).
3. Utilising the peak and residual composite failure envelopes obtained above, the two design scenarios for the bottom liner systems with a sideslope presented by Stark and Poeppel (1994) can be used:
   (a) assign residual shear strengths to the sideslopes and peak shear strengths to the base of the liner system and satisfy a factor of safety greater than 1.5; and
   (b) assign residual strengths to the sideslopes and base of the liner system and satisfy a factor of safety greater than 1.0 or 1.1 if direct shear data are used.
4. The stability of geosynthetic cover systems can be analysed using the peak shear strength of the weakest interface, or if necessary the weakest composite interface, with the factor of safety greater than 1.5. The use of a peak interface strength is recommended for the cover system because of the lack of or limited amount of detrimental shear displacement along the weakest interface in a cover system compared with a liner sideslope. However, if the average slope angle of the cover system is greater than the lowest peak interface friction angle, or large displacements such as construction-induced displacements or seismically induced displacements are expected, a residual interface friction angle should be used for design.

REFERENCES

Bove, J. A. (1990). Direct shear friction testing for geosynthetics in waste containment. *Proceedings of ASTM Symposium on Geosynthetic Testing for Waste Containment Applications*, Special Technical Publication 1081, pp. 241–256.

Byrne, R. J. (1994). Design issues with strain softening interfaces in landfill liners. *Proceedings of Waste Tech'94 Conference*, National Solid Waste Management Association, San Francisco, CA, January, pp. 26.

Byrne, R. J., Kendall, J. & Brown, S. (1992). Cause and mechanism of failure, Kettleman Hills Landfill B-19, Unit IA. *Proceedings of ASCE Specialty Conference on Performance and Stability of Slopes and Embankments—II*, ASCE, New York, pp. 1188–1215.

Cundall, P. A. (1976). Explicit finite element difference methods in geomechanics. *Proceedings of ASCE Specialty Conference on Numerical Methods in Geomechanics*, ASCE, New York, Vol. 1, pp. 132–150.

Dove, J. E. & Frost, J. D. (1999). Peak friction behavior of smooth geomembrane-particle interfaces. *Journal of Geotechnical and Geoenvironmental Engineering, ASCE*, **125**, No. 7, 544–555.

Eid, H. T., Stark, T. D., Evans, W. D. & Sherry, P. (2000). Municipal solid waste landfill slope failure I: foundation and waste properties. *Journal of Geotechnical and Geoenvironmental Engineering, ASCE*, **126**, No. 5, 397–407.

Filz, G. M., Esterhuizen, J. J. B. & Duncan, J. M. (2001). Progressive failure of liner waste impoundments. *Journal of Geotechnical and Geoenvironmental Engineering, ASCE*, **127**, No. 10, 841–848.

Fox, P. J., Rowland, M. G. & Scheithe, J. R. (1998). Internal shear strength of three geosynthetic clay liners. *Journal of Geotechnical and Geoenvironmental Engineering, ASCE*, **124**, No. 10, 933–944.

Gilbert, R. B. & Byrne, R. J. (1996). Strain-softening behavior of waste containment system interfaces. *Geosynthetics International*, **3**, No. 2, 181–203.

Koerner, R. M., Martin, J. P. & Koerner, G. R. (1986). Shear strength parameters between geomembranes and cohesive soils. *Geotextiles and Geomembranes*, **4**, No. 1, 21–30.

Koerner, R. M. & Soong, T. Y. (1998). Analysis and design of veneer cover soils. *Proceedings of 6th International Conference on Geosynthetics*, Atlanta, GA, Vol. 1, pp. 1–23.

Long, J. H., Gilbert, R. B. & Daly, J. J. (1995). Effect of waste settlement on sloped lining systems. *Proceeding of Geosynthetics '95*, Nashville, TN, Vol. 2, pp. 729–744.

Martin, J. P., Koerner, R. M. & Whitty, J. E. (1984). Experimental friction evaluation of slippage between geomembranes, geotextiles, and soils. *Proceedings of International Conference on Geomembranes*, Denver, CO, pp. 191–196.

Marr, W. A. & Christopher, B. (2003). Recommended design strength for needlepunched geosynthetic clay liner products. *Geotechnical Fabrics Report*, IFAI, Vol. 16, October–November, pp. 18–23.

McKelvey, J. A. III (1994). Consideration of equipment loadings in geosynthetic lined slope designs. *Proceedings of 8th International Conference on Computer Methods and Advances in Geomechanics*, Rotterdam, Vol. 2, pp. 1371–1377.

Mesri, G. & Shahien, M. (2003). Residual shear strength mobilized in first-time slope failures. *Journal of Geotechnical and Geoenvironmental Engineering, ASCE*, **129**, No. 1, 12–31.

Mitchell, J. K., Seed, R. B. & Seed, H. B. (1990). Kettleman Hills waste landfill slope failure I: liner-system properties. *Journal of Geotechnical Engineering, ASCE*, **116**, No. 4, 647–668.

Negussey, D., Wijewickreme, W. K. D. & Vaid, Y. P. (1989). Geomembrane interface friction. *Canadian Geotechnical Journal*, **26**, No. 1, 165–169.

O'Rourke, T. D., Druschel, S. J. & Netravali, A. N. (1990). Shear strength characteristics of sand polymer interfaces. *Journal of Geotechnical Engineering, ASCE*, **116**, No. 3, 451–469.

Reddy, K. R., Kosgi, S. & Motan, S. (1996). Interface shear behavior of landfill composite liner systems: a finite element analysis. *Geosynthetics International*, **3**, No. 2, 247–275.

Saxena, S. K. & Wong, Y. T. (1984). Friction characteristics of a geomembrane. *Proceedings of International Conference on Geomembranes*, Denver, CO, pp. 187–190.

Seed, R. B. & Boulanger, R. W. (1991). Smooth HDPE-clay liner interface shear strengths: compaction effects. *Journal of Geotechnical Engineering, ASCE*, **117**, No. 4, 686–693.

Seed, R. B., Mitchell, J. K. & Seed, H. B. (1990). Kettleman Hills waste landfill slope failure II: stability analysis. *Journal of Geotechnical Engineering, ASCE*, **116**, No. 4, 669–689.

Stark, T. D. (1999). Stability of waste containment facilities. *Proceedings of Waste Tech '99*, National Solid Wastes Management Association, New Orleans, LA, pp. 1–24.

Stark, T. D. & Eid, H. T. (1996). Shear behavior of reinforced geosynthetic clay liners. *Geosynthetics International*, **3**, No. 6, 771–786.

Stark, T. D. & Poeppel, A. R. (1994) Landfill liner interface strengths from torsional ring shear tests. *Journal of Geotechnical Engineering, ASCE*, **120**, No. 3, 597–615.

Stark, T. D., Williamson, T. A. & Eid, H. T. (1996). HDPE geomembrane/geotextile interface shear strength. *Journal of Geotechnical Engineering, ASCE*, **122**, No. 3, 197–203.

Stark, T. D., Arellano, D., Evans, W. D., Wilson, V. & Gonda, J. (1998). Unreinforced geosynthetic clay liner case history. *Geosynthetics International*, **5**, No. 5, 521–544.

Stark, T. D., Eid, H. T., Evans, W. D. & Sherry, P. (2000). Municipal solid waste landfill slope failure II: stability analyses. *Journal of Geotechnical and Geoenvironmental Engineering, ASCE*, **126**, No. 5, 408–419.

Stark, T. D., Evans, W. D. & Wilson, V. (2001). Avoiding the slippery slope. *Waste Age*, Waste Systems and Technology, February, 42–45.

Stark, T. D., Choi, H. & Akhtarshard, R. (2004). Occurrence and effect of bentonite migration in geosynthetic clay liners. *Geosynthetics International*, **11**, No. 4, 296–310.

Takasumi, D. L., Green, K. R. & Holtz, R. D. (1991). Soil-geosynthetic interface strength characteristics: a review of state-of-the-art testing procedures. *Proceedings of Geosynthetics '91 Conference*, Atlanta, GA, Vol. 1, pp. 87–100.

Thiel, R. (2001). Peak versus residual strength for bottom liner stability analyses. *Proceedings of the 15th Annual Geosynthetics Research Institute Conference, Hot Topics in Geosynthetics II*, Houston, TX, Geosynthetics Institute, Folsom, PA, pp. 40–70.

Williams, N. D. & Houlihan, M. F. (1987). Evaluation of interface friction properties between geosynthetics and soils. *Proceeding of Geosynthetics '87 Conference*, New Orleans, LA, Vol. 2, pp. 616–627.

Yazdani, R., Campbell, J. L. & Koerner, G. R. (1995). Long-term in situ measurements of a high density polyethylene geomembrane in a municipal solid waste landfill. *Proceedings of Geosynthetics '95*, Nashville, TN, Vol. 3, pp. 893–905.

Yegian, M. K. & Lahlaf, A. M. (1992). Discussion of 'Kettleman Hills waste landfill slope failure I: liner-system properties'. *Journal of Geotechnical Engineering, ASCE*, **118**, No. 4, 643–645.

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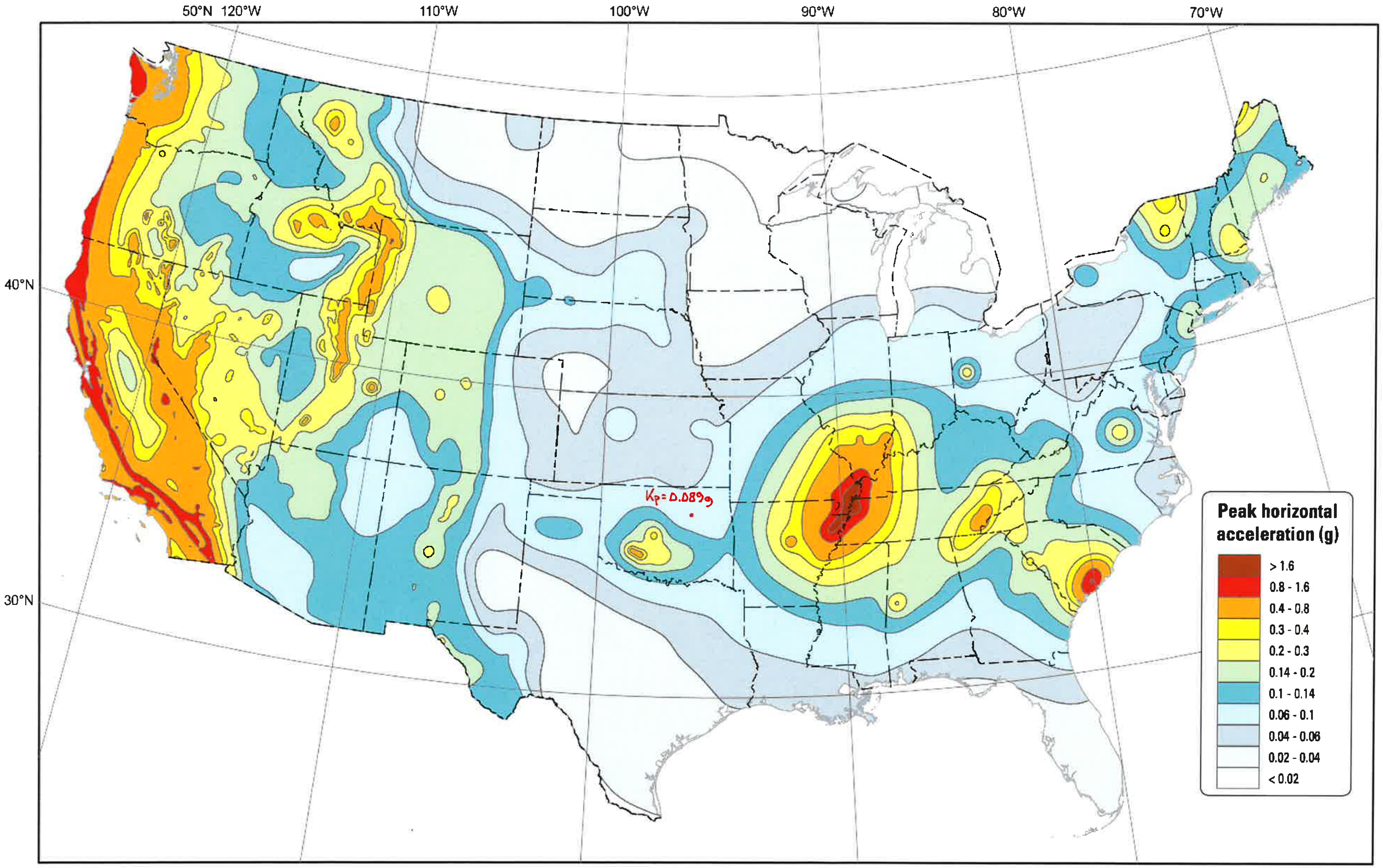
Attachment C

Seismic Evaluation and Supporting Information



K_p = 0.089g

2018 National Seismic Hazard Model for the conterminous United States

Peak horizontal acceleration
with a 2% probability of exceedance in 50 years
NEHRP site class B/C (V_{s30} = 760 m/s)

Input A_{max} on Rock beneath Site (.7g max) **0.0890 g**

A_{max} at base of landfill **0.089 g** *per Seed & Idriss , 1982)*

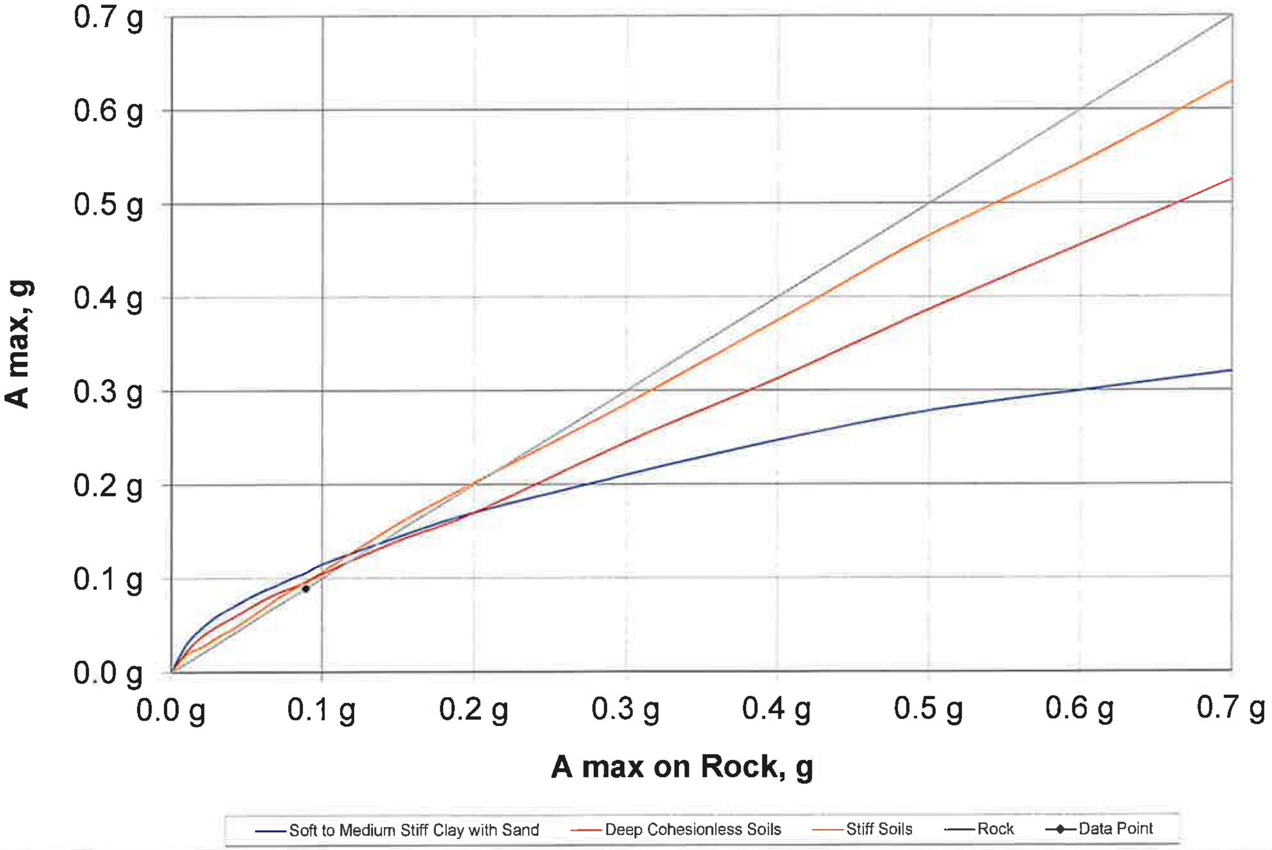
Select Type of Soil between Bedrock and Surface or Landfill Base (X)

0.089 g 0.089 g

	A Max on Bedrock Surface	Soft to Medium Stiff Clay with Sand	Deep Cohesionless Soils	Stiff Soils	Rock	
					x	
1	0.00 g	0.000 g	0.000 g	0.000 g	0.000 g	1
2	0.01 g	0.030 g	0.022 g	0.019 g	0.010 g	2
3	0.02 g	0.047 g	0.038 g	0.027 g	0.020 g	3
4	0.03 g	0.060 g	0.049 g	0.037 g	0.030 g	4
5	0.04 g	0.069 g	0.058 g	0.046 g	0.040 g	5
6	0.05 g	0.078 g	0.067 g	0.056 g	0.050 g	6
7	0.06 g	0.086 g	0.076 g	0.067 g	0.060 g	7
8	0.07 g	0.093 g	0.084 g	0.078 g	0.070 g	8
9	0.08 g	0.100 g	0.090 g	0.088 g	0.080 g	9
10	0.09 g	0.107 g	0.097 g	0.098 g	0.090 g	10
11	0.10 g	0.115 g	0.105 g	0.107 g	0.100 g	11
12	0.15 g	0.144 g	0.140 g	0.158 g	0.150 g	12
13	0.20 g	0.170 g	0.170 g	0.202 g	0.200 g	13
14	0.30 g	0.210 g	0.245 g	0.286 g	0.300 g	14
15	0.40 g	0.247 g	0.313 g	0.375 g	0.400 g	15
16	0.50 g	0.279 g	0.387 g	0.466 g	0.500 g	16
17	0.60 g	0.300 g	0.456 g	0.544 g	0.600 g	17
18	0.70 g	0.320 g	0.525 g	0.630 g	0.700 g	18
		0.100 g	0.090 g	0.088 g	0.080 g	9
		0.107 g	0.097 g	0.098 g	0.090 g	
	Interpolation	0.007	0.007	0.010	0.01	
		0.0063	0.0063	0.009	0.01	0.90
		0.106 g	0.096 g	0.097 g	0.089 g	check

Figure 1 - Estimation of A_{max} at Base of Landfill

Seed & Idriss, 1982



Attachment D

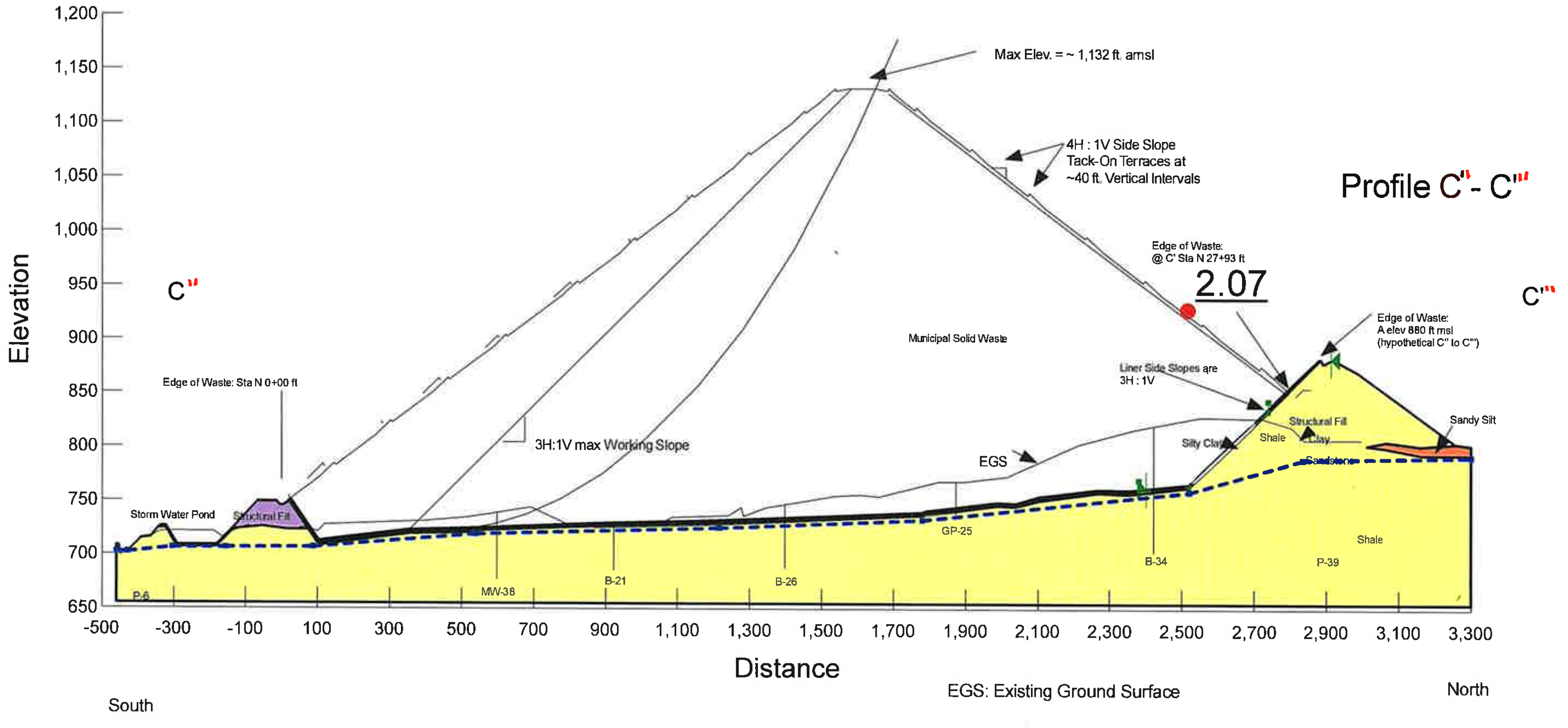
Slope W® Slope Stability Modeling Results

Slope Stability Analysis - Lateral Expansion (2023), American Environmental Landfill, Sand Springs, OK
Hartwell, John, 11/20/2023
AEL West LF Lat Exp 2023 rev2.gsz, Const DST for C'' to C''' (Forced to Side Slope Liner)
SLOPE/W, Morgenstern-Price

FOS: 2.07, Horz Seismic Coef.: 0

Volume: 391.87363 ft³, Weight: 55,291.132 lbf
Resisting Moment: 2,632,161.1 lbf·ft, Activating Moment: 1,274,705.6 lbf·ft
Resisting Force: 32,888.4 lbf, Activating Force: 15,908.009 lbf

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (psf)	Effective Friction Angle (°)
🟦	1 WGI 60 mil HDPE DSS Peak (Bottom)	129.9	0				11
🟦	2 WGI 60 Mil HDPE DSS Peak (Side Slope) Construction	129.9	0	33	27.98	1,364.9	
🟨	Bedrock						
🟧	Compacted Clay Liner (CCL) (CL)	127.5	1,600				22.9
🟪	Compacted Structural Fill (ML-CL)	129.9	1,600				23.7
🟦	Granular Drainage Layer (SW)	143.6	0				37
🟧	Sandy Silt (ML) (Native Undisturbed)	124.7	180				30
🟪	X WGI 60 mil HDPE DST Peak (Side Slope)	129.9	0	34	19	1,455	
🟥	X WGI 60 mil HDPE DST Residual (Side Slope)	129.9	0				22



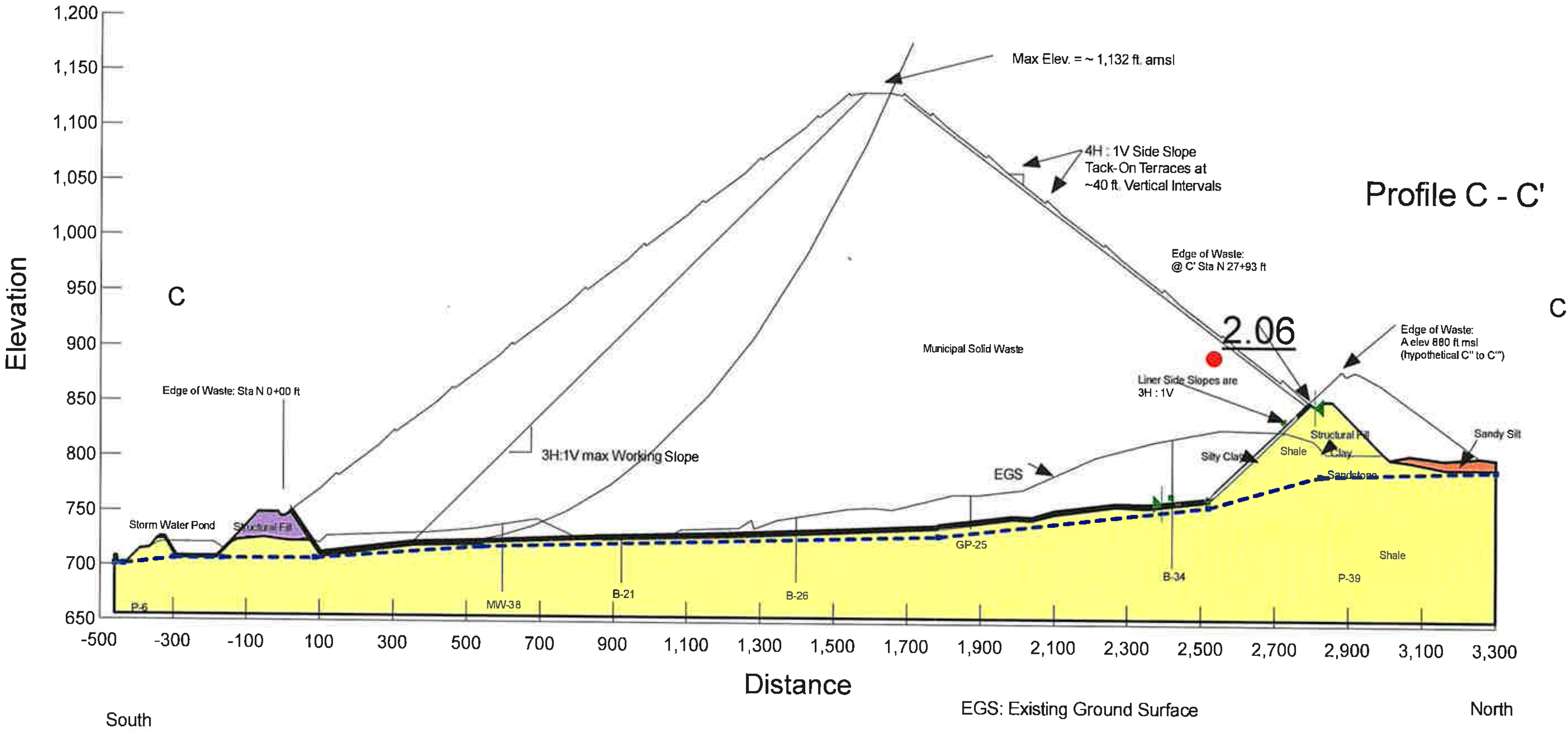
EGS: Existing Ground Surface

Slope Stability Analysis - Lateral Expansion (2023), American Environmental Landfill, Sand Springs, OK
Hartwell, John, 11/20/2023
AEL West LF Lat Exp 2023 rev2.gsz, Const DST(Forced to Side Slope Liner)
SLOPE/W, Morgenstern-Price

FOS: 2.06, Horz Seismic Coef.: 0

Volume: 547.38192 ft³, Weight: 77,211.99 lbf
Resisting Moment: 3,211,043.1 lbf·ft, Activating Moment: 1,560,134.1 lbf·ft
Resisting Force: 45,803.052 lbf, Activating Force: 22,265.371 lbf

Color	Name	Unit Weight (pcf)	Effective Cohesion (psf)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (psf)	Effective Friction Angle (°)
🟦	1 WGI 60 mil HDPE DSS Peak (Bottom)	129.9	0				11
🟦	2 WGI 60 Mil HDPE DSS Peak (Side Slope) Construction	129.9	0	33	27.98	1,364.9	
🟨	Bedrock						
🟧	Compacted Clay Liner (CCL) (CL)	127.5	1,600				22.9
🟪	Compacted Structural Fill (ML-CL)	129.9	1,600				23.7
🟦	Granular Drainage Layer (SW)	143.6	0				37
🟧	Sandy Silt (ML) (Native Undisturbed)	124.7	180				30
🟪	X WGI 60 mil HDPE DST Peak (Side Slope)	129.9	0	34	19	1,455	
🟥	X WGI 60 mil HDPE DST Residual (Side Slope)	129.9	0				22

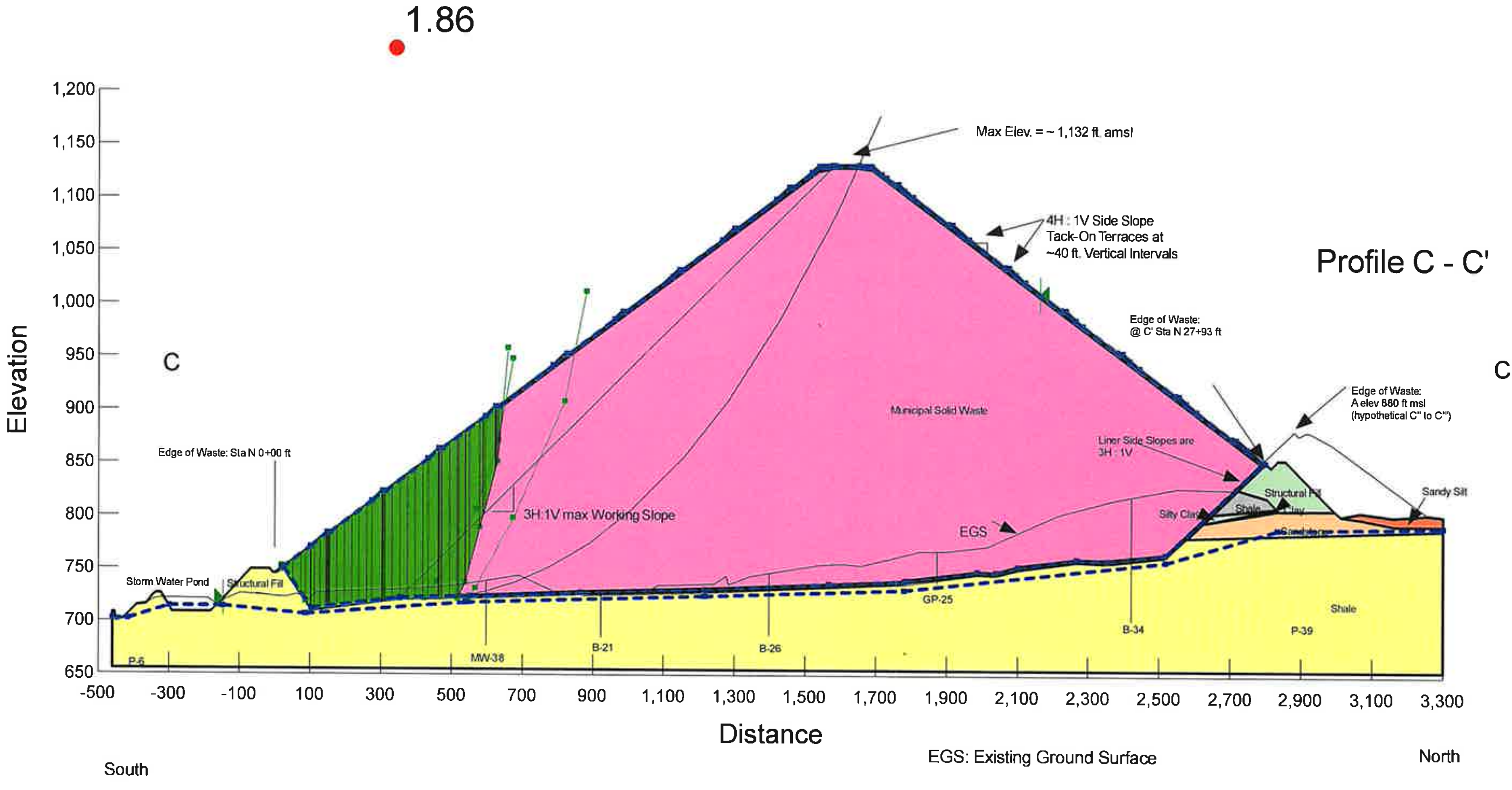


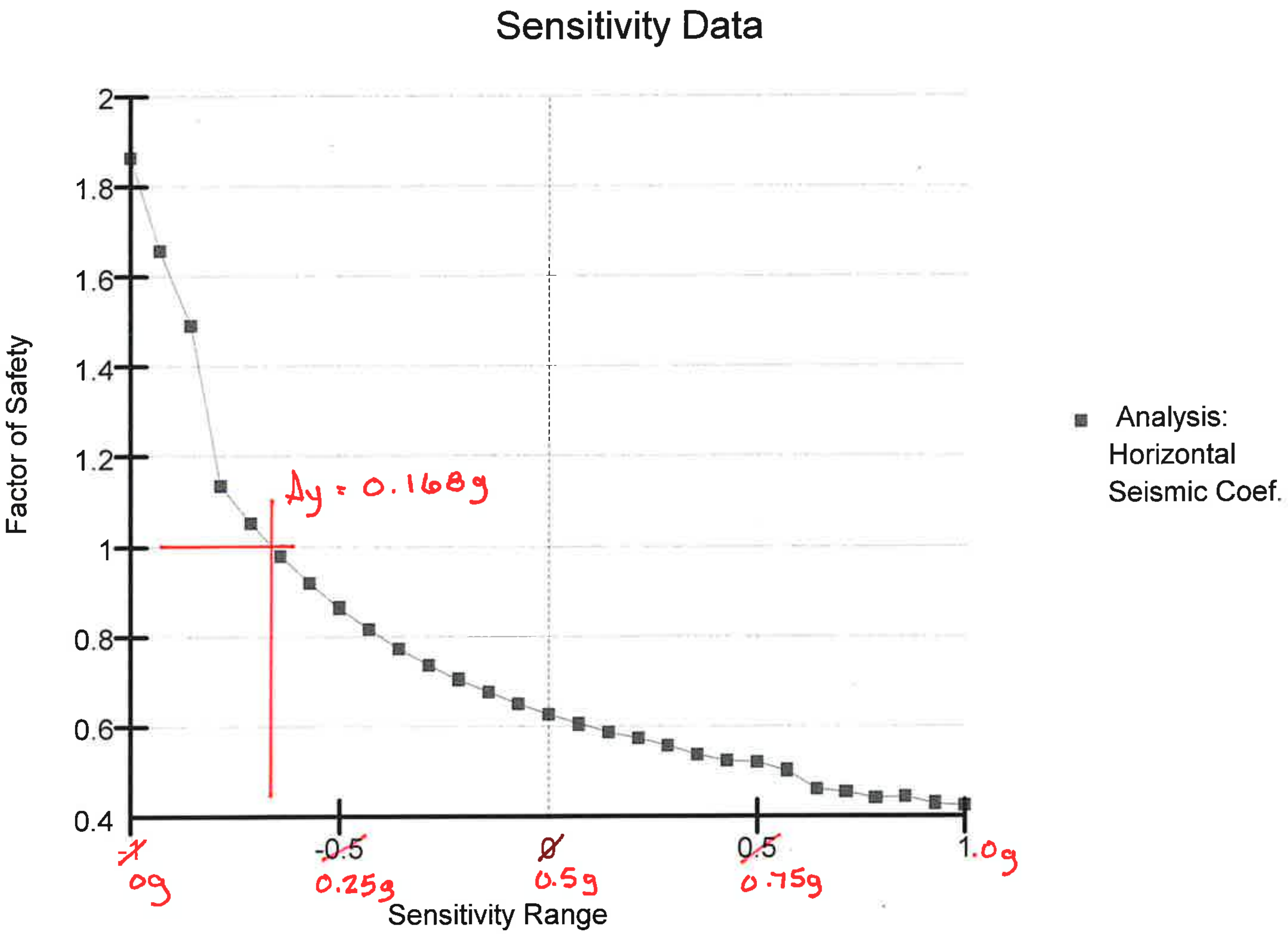
Slope Stability Analysis - Lateral Expansion (2023), American Environmental Landfill, Sand Springs, OK
Hartwell, John, 11/20/2023
AEL West LF Lat Exp 2023 rev2.gsz, Post Closure Global Static (Forced to WGI Primary Liner)
SLOPE/W, Morgenstern-Price

FOS: 1.86, Horz Seismic Coef.: 0

Volume: 58,349.479 ft³, Weight: 5,055,038 lbf
Resisting Moment: 4.324407e+08 lbf·ft, Activating Moment: 2.3224069e+08 lbf·ft
Resisting Force: 1,333,841.7 lbf, Activating Force: 716,780.05 lbf

Color	Name	Unit Weight (pcf)	C-Horizontal (psf)	C-Vertical (psf)	Phi-Horizontal (°)	Phi-Vertical (°)	Effective Cohesion (psf)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (psf)	Effective Friction Angle (°)	Piezomet Surface
🟦	1 WGI 60 mil HDPE DSS Peak (Bottom)	129.9					0				11	2
🟨	Bedrock											
🟥	Clay (CL) (Stiff: Native Undisturbed)	139.3					13,023				26	
🟧	Compacted Clay Liner (CCL) (CL)	127.5					1,600				22.9	2
🟧	Cover Recompacted Clay Barrier Layer (RCBL) (CL)	102					240				26	3
🟦	Granular Drainage Layer (SW)	143.6					0				37	2
⬜	Gray Shale	145.5	5,000	240	15	9						1
🟦	Intermediate Cover (CL)	127.5					240				23.7	3
🟪	MSW	85					125	35	30	4,177		
🟨	Sandstone	140	2,000	250	15	9						1
🟧	Sandy Silt (ML) (Native Undisturbed)	124.7					180				30	
🟩	Silty Clay (Native Undisturbed) (ML-CL)	129.9					50				23.7	
🟪	Vegatative Erosion Layer (CL)	104					240				23.7	3
🟥	X WGI 60 mil HDPE DST Residual (Side Slope)	129.9					0				22	2




Sensitivity Data
Factor of Safety
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
~~-1~~
0g
~~-0.5~~
0.25g
~~0~~
0.5g
~~0.5~~
0.75g
1.0g
Sensitivity Range
Ay = 0.168g
■ Analysis: Horizontal Seismic Coef.

```
0.0000                    1.86
0.0250                    1.66
0.0500                    1.49
0.0750                    Error 994: Cannot find intersection of factor of safety an
0.1000                    Error 994: Cannot find intersection of factor of safety an
0.1250                    1.13
0.1500                    1.05
0.1750                    0.98
0.2000                    0.92
0.2250                    0.86
0.2500                    0.82
0.2750                    0.77
0.3000                    0.74
0.3250                    0.70
0.3500                    0.68
0.3750                    0.65
0.4000                    0.63
0.4250                    0.60
0.4500                    0.59
0.4750                    0.57
0.0000                    0.56
0.5250                    0.54
0.5500                    0.52
0.5750                    0.52
0.6000                    0.50
0.6250                    Error 995: Slip surface factor of safety cannot be compute
0.6500                    Error 994: Cannot find intersection of factor of safety an
0.6750                    Error 994: Cannot find intersection of factor of safety an
0.7000                    0.46
0.7250                    0.45
0.7500                    Error 995: Slip surface factor of safety cannot be compute
0.7750                    0.44
0.8000                    Error 995: Slip surface factor of safety cannot be compute
0.8250                    0.44
0.8500                    Error 994: Cannot find intersection of factor of safety an
0.8750                    0.43
0.9000                    0.42
0.9250                    Error 994: Cannot find intersection of factor of safety an
0.9500                    Error 994: Cannot find intersection of factor of safety an
0.9750                    Error 994: Cannot find intersection of factor of safety an
1.0000                    Error 994: Cannot find intersection of factor of safety an
```

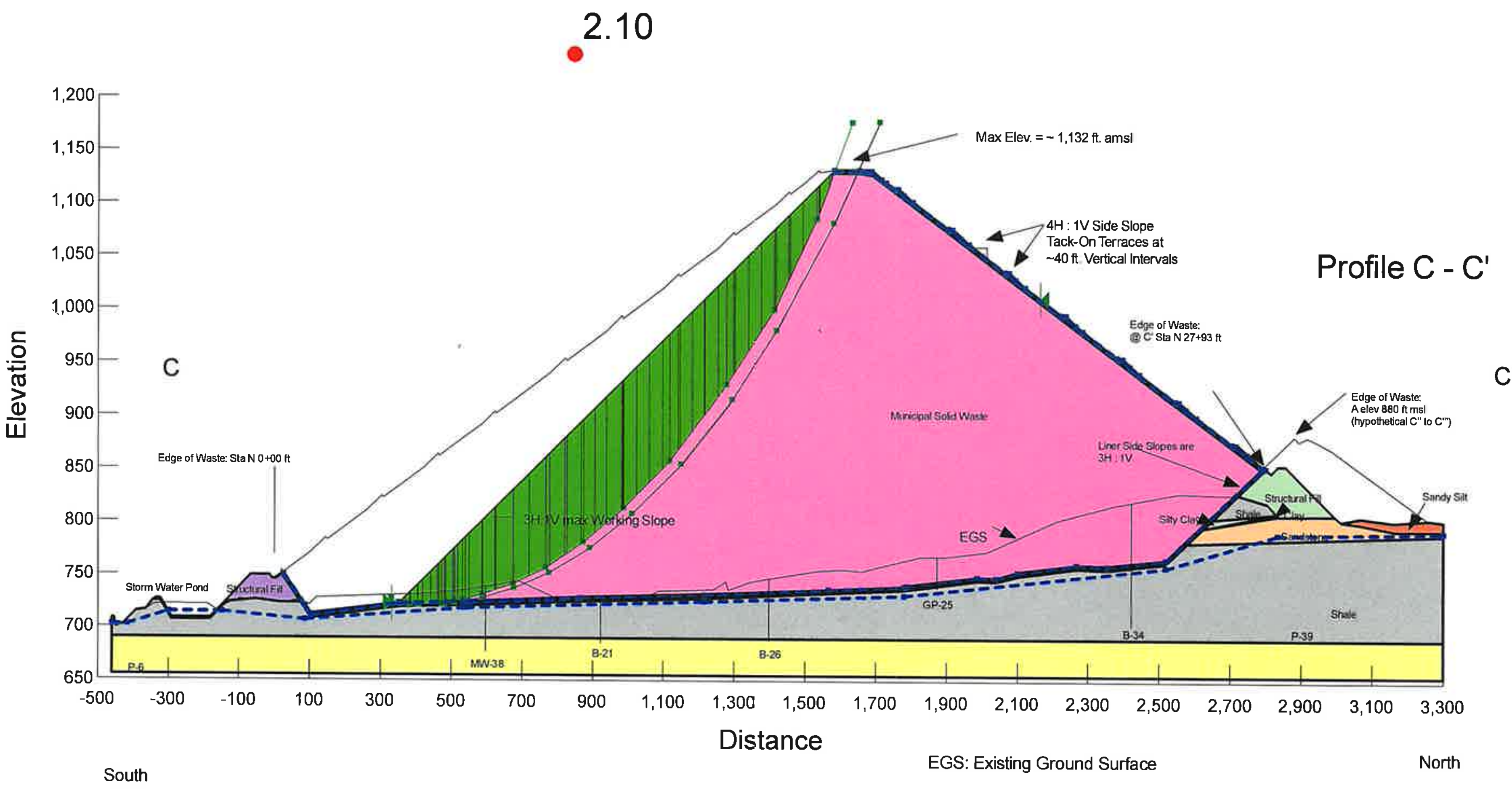
Ay = 0.168g

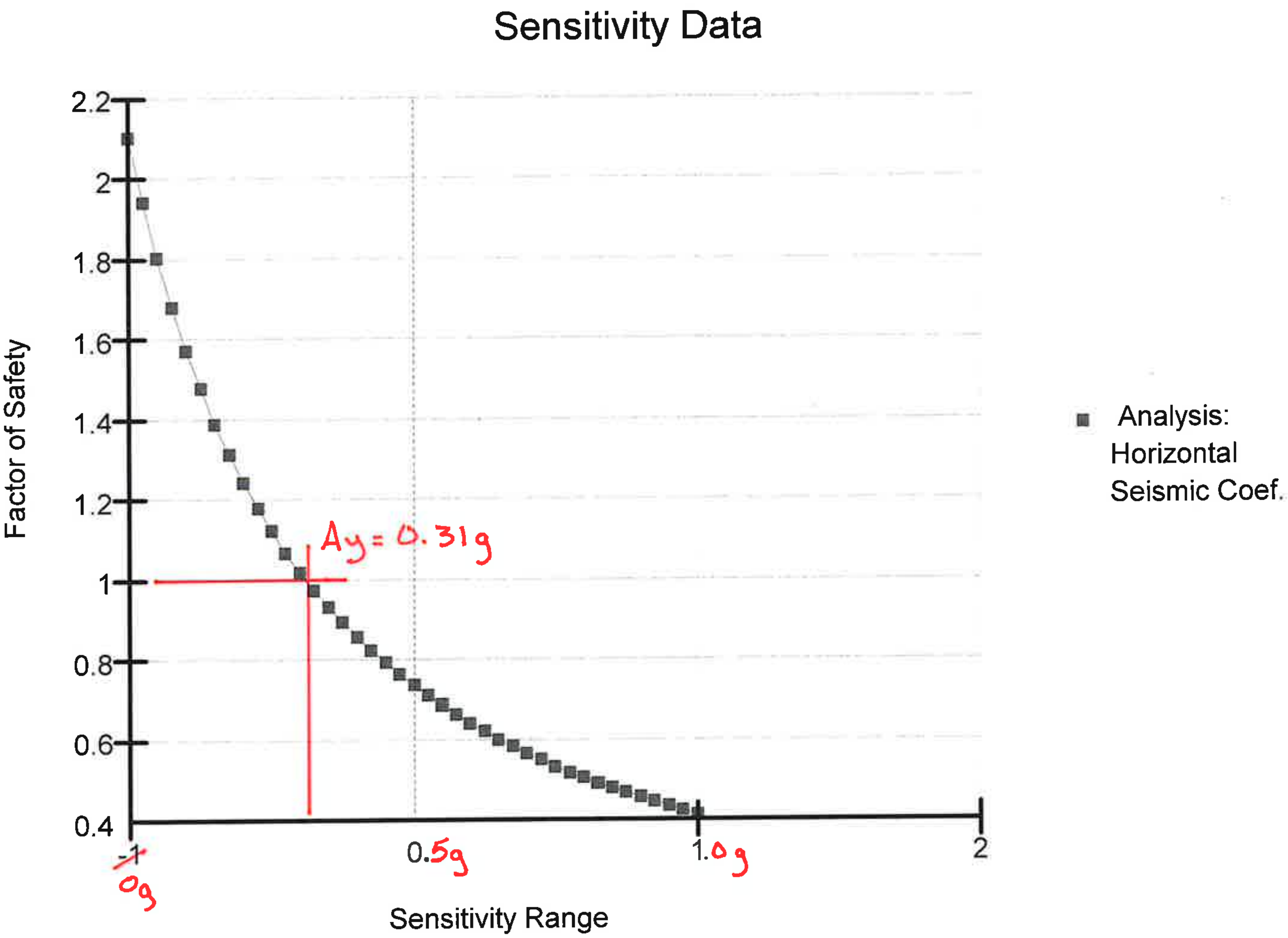
Slope Stability Analysis - Lateral Expansion (2023), American Environmental Landfill, Sand Springs, OK
Hartwell, John, 11/20/2023
AEL West LF Lat Exp 2023 rev2.gsz, Working Phase
SLOPE/W, Morgenstern-Price

FOS: 2.10, Horz Seismic Coef.: 0

Volume: 101,820.26 ft³, Weight: 8,670,595.8 lbf
Resisting Moment: 2.5254917e+09 lbf·ft, Activating Moment: 1.2013879e+09 lbf·ft
Resisting Force: 5,205,305.3 lbf, Activating Force: 2,477,374.4 lbf

Color	Name	Unit Weight (pcf)	C-Horizontal (psf)	C-Vertical (psf)	Phi-Horizontal (°)	Phi-Vertical (°)	Effective Cohesion (psf)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (psf)	Effective Friction Angle (°)	Piezon Surfac
🟦	1 WGI 60 mil HDPE DSS Peak (Bottom)	129.9					0				11	2
🟩	3 WGI 60 Mil HDPE DST Residual (Side Slope) Working and Post Closure	129.9					0				17	2
🟨	Bedrock											
🟧	Clay (CL) (Stiff: Native Undisturbed)	139.3					13,023				26	
🟧	Compacted Clay Liner (CCL) (CL)	127.5					1,600				22.9	
🟪	Compacted Structural Fill (ML-CL)	129.9					1,600				23.7	
🟧	Cover Recompacted Clay Barrier Layer (RCBL) (CL)	102					240				26	3
🟦	Granular Drainage Layer (SW)	143.6					0				37	2
⬜	Gray Shale	145.5	5,000	240	15	9						1
🟦	Intermediate Cover (CL)	127.5					240				23.7	
🟪	MSW	85					125	35	30	4,177		
🟨	Sandstone	140	2,000	250	15	9						1
🟧	Sandy Silt (ML) (Native Undisturbed)	124.7					180				30	
🟩	Silty Clay (Native Undisturbedl) (ML-CL)	129.9					50				23.7	
🟪	Vegatative Erosion Layer (CL)	104					240				23.7	3
🟥	X WGI 60 mil HDPE DST Residual (Side Slope)	129.9					0				22	2




Sensitivity Data
Factor of Safety
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
Ay = 0.31g
~~-1~~
0g
0.5g
1.0g
2
Sensitivity Range
Analysis: Horizontal Seismic Coef.

0.0000	2.10
0.0250	1.94
0.0500	1.80
0.0750	1.68
0.1000	1.57
0.1250	1.48
0.1500	1.39
0.1750	1.31
0.2000	1.24
0.2250	1.18
0.2500	1.12
0.2750	1.07
0.3000	1.02
0.3250	0.97
0.3500	0.93
0.3750	0.89
0.4000	0.86
0.4250	0.82
0.4500	0.79
0.4750	0.76
0.0000	0.74
0.5250	0.71
0.5500	0.69
0.5750	0.66
0.6000	0.64
0.6250	0.62
0.6500	0.60
0.6750	0.58
0.7000	0.57
0.7250	0.55
0.7500	0.53
0.7750	0.52
0.8000	0.50
0.8250	0.49
0.8500	0.48
0.8750	0.47
0.9000	0.45
0.9250	0.44
0.9500	0.43
0.9750	0.42
1.0000	0.41

Ay = 0.31g

Appendix D

Groundwater Monitoring Plan

Groundwater Monitoring Plan
American Environmental Landfill

American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

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6.0	Data Evaluation	2
7.0	Statistically Significant Increase	2
8.0	Monitoring Reports	1
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CERTIFICATION

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

Prepared by:

FLOYD E.
COTTER
17783

5/30/24

Floyd Cotter, PE
SCS Engineers

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1.0 INTRODUCTION

This Groundwater Monitoring Plan is intended to assist the operators of American Environmental Landfill, Inc. in conducting the sampling and analysis of groundwater at the American Environmental Landfill (AEL). The AEL is located near Sand Springs, Oklahoma in Sections 35 and 36, Township 20 North, Range 10 East, in Osage County, Oklahoma. The project site is on the Wekiwa Oklahoma 7.5 Minute USGS Quadrangle map. AEL is bordered by the Arkansas River to the South (Figure 1). The AEL operates under the Oklahoma Department of Environmental Quality (ODEQ) Permit Number 3557021.

The objective of the groundwater monitoring system is to assess potential changes in groundwater quality and determine if these changes are the result of an impact from the landfill. Groundwater data is evaluated by establishing sample locations and developing an appropriate statistical background level for the comparison of compliance data. Background data is collected from locations where the groundwater has not been impacted by the landfill or during times when the groundwater has not been impacted by the landfill. Once appropriate background concentrations have been established, compliance data are statistically evaluated with respect to the background data.

This Groundwater Monitoring Plan describes the hydrogeological setting, the monitoring network, background and monitoring parameters, sampling frequency, sampling procedures, and statistical methods. The procedures in this Groundwater Monitoring Plan were developed following ODEQ regulations and the US EPA's guidance for statistical analysis of groundwater monitoring data.

2.0 GROUNDWATER MONITORING

This Section presents the existing and proposed monitoring well networks, sampling schedule, and monitoring parameters for AEL.

2.1 GROUNDWATER MONITORING NETWORK

The groundwater monitoring system shall be installed and yield groundwater samples from the uppermost aquifer that represent the quality of background groundwater that has not been affected by the AEL and that represents the quality of groundwater that has passed underneath the AEL. The current groundwater monitoring system for the American Environmental Landfill consists of twelve (12) monitoring wells. Seven of these monitoring wells in the groundwater monitoring network monitor the existing landfill area (Phases I, II, III, V, and VI) and are designated as MW-1, MW-3, MW-5, MW-6, MW-8R, MW-15A, and MW-21A. Five (5) monitoring wells in the groundwater monitoring network monitor the Phase IV Expansion area designated as MW-1_IV, MW-31B, MW-34, MW-36, and MW-38. The existing monitoring well coordinates and elevations are presented in Table 1, and the historical groundwater elevations are presented in Table 2.

Groundwater monitoring wells were installed on land owned by the AEL at a distance of no more than 150 meters from the permitted waste boundary of the disposal area. There are three upgradient monitoring wells (MW-1, MW-8R, and MW-21A) and four downgradient monitoring wells (MW-3, MW-5, MW-6, and MW-15A) located in the Existing Landfill Phases I, II, III, V, and VI. There is one upgradient monitoring well (MW-1_IV) and four downgradient monitoring wells (MW-31B, MW-34, MW-36, and MW-38) located in the Phase IV Landfill Expansion Area. Because the lateral expansion will be contiguous with the Phase IV Expansion Area, one upgradient monitoring well (MW-1_IV), and two downgradient monitoring wells (MW-36 and MW-38) are proposed to be removed from the groundwater monitoring network and will be plugged and abandoned in accordance with the OWRB requirements stated in OAC 785:35. There are two proposed downgradient groundwater monitoring wells (MW-39 and MW-40) to be added to the groundwater monitoring network. Piezometer 1 (P-1) is proposed to be converted to MW-40. There is one proposed upgradient groundwater monitoring well (MW-41) to be added to the groundwater monitoring network. Figure 2 shows the location of all abandoned, existing, and proposed borings, piezometers, and detection wells. The proposed monitoring well coordinates and elevations are presented in Table 3. Boring logs and a typical well construction diagram for existing and proposed monitoring wells are included in Appendix A.

2.1.1 Monitoring Well Installation

The AEL will provide the ODEQ two weeks' written notice prior to any drilling. The monitoring wells will be installed in accordance with OAC 785:35 and registered online or by mail with the OWRB within 60 days after installation by a licensed monitoring well installation contractor.

2.1.2 Monitoring Well Development

Monitoring wells will be developed through the use of a surge block and pump or bailer. The surge block will be moved vigorously through the screened interval or the saturated portion if the screen extends above the water table in order to suspend sediment in the well and remove fines from the filter pack. The pump or bailer will then be used to remove the water from the monitoring well. The use of the surge block may require several iterations until the water runs clear. Once one well volume has been removed from the monitoring well, the pH, specific conductance, and temperature of the water will be measured and recorded. The monitoring well will be purged until the groundwater quality measurements stabilize between purged well volumes or the purged water is clear.

2.1.3 Monitoring Well Redevelopment

Monitoring wells will be redeveloped when 15% or more of the well screen is occluded or the turbidity appears to be increasing. Monitoring well redevelopment will follow the procedures listed above.

2.1.4 Monitoring Well Sealing and Abandonment

If any monitoring well or piezometer requires abandonment, the sealing and abandonment will be conducted in accordance with the OWRB as stated in the OAC 785:35. The two monitoring wells (MW-36 and MW-38) and any observation well including piezometers will be abandoned by an Oklahoma certified well driller following these procedures.

2.2 GROUNDWATER MONITORING PARAMETERS AND SAMPLING SCHEDULE

2.2.1 Background Monitoring

Background groundwater quality is required to be established at each monitoring well in accordance with OAC 252:515-9-31. One full year of quarterly sampling consisting of statistically independent data is required to be collected for each parameter or constituents listed in 252:515-9-31(d)(1). Background groundwater data should contain the natural variations in groundwater chemistry. Ideally, the background data should contain enough data points to conduct the selected statistical analysis and exhibit any seasonal, temporal, or spatial variability. The background groundwater quality data should be representative of the groundwater quality near the landfill but not impacted by the landfill.

If new wells are installed near an existing well that monitors the same formation with a similar screen depth, it may be possible to use the existing well's background data for the newly installed monitoring well. A confirmation sample should be collected from the newly installed monitoring well and compared to the previous monitoring well's background data. If the confirmation sample results are statistically similar to the previous monitoring well's background data, the monitoring well may be placed into routine detection monitoring. The ODEQ's approval for waiving the background sampling requirements should be obtained before proceeding with any replacement monitoring well installations.

2.2.2 Detection Monitoring

Groundwater samples for detection monitoring should be collected following the same sampling procedures used to collect the background groundwater quality samples. Samples are to be collected from the monitoring wells semi-annually. A report of the sampling results and results of the statistical analysis will be submitted to the ODEQ within 60 days of the sampling date.

2.2.3 Monitoring Constituents

The constituents for background and detection monitoring are listed in OAC 252:515-9-31(d) and include pH and specific conductance at each groundwater monitoring point. The background and detection monitoring parameters are listed in Table 4. These constituents shall be used unless alternative constituents are approved in accordance with OAC 252:515-9-72.

3.0 SAMPLING PROCEDURES

The following subsections summarize specific tasks involved in sampling of the groundwater monitoring system. Samples will be obtained from the facility's groundwater monitoring system by a sampling technician fully trained in the required sampling procedures.

3.1 WELL INSPECTION

Prior to performing any purging or sampling, each monitoring well will be inspected to assess the integrity of the well components. The condition of each well will be evaluated for any physical damage that may have been caused by the operation of site equipment or other vehicular traffic. The security of each well will be assessed in order to confirm that no outside source contaminants have been introduced to the well. All inspection information, as well as the date and time, general weather conditions, and sampling personnel identification, will be documented on the Field Sampling Sheet presented in Appendix B. The actual form utilized may vary in format but the information indicated will be recorded.

3.2 SAMPLE COLLECTION PROCEDURES

For sample collection, each monitoring well in the groundwater monitoring system will be sampled utilizing equipment and methodologies that minimize the potential for alteration or contamination of the sample and that are capable of obtaining a sample representative of the formation groundwater. Care will be taken to avoid placing clean sampling equipment on the ground or on any contaminated surface. Additionally, personnel who contact sampling equipment that may contact the interior of the monitoring well or the groundwater shall wear powderless latex (or equivalent) gloves. If contamination is known to exist at certain locations, non-contaminated wells will be sampled prior to those wells that are known to be contaminated.

3.3 EQUIPMENT DECONTAMINATION

All equipment that may contact the interior of the well or groundwater will be decontaminated in the field immediately prior to use, or in the office/lab and protected using aluminum foil and/or plastic bags. Decontamination procedures will be documented for each sampling event. The decontamination procedure will consist of the following steps:

- Wash with laboratory-grade soap (such as Alconox or Liquinox);
- Triple rinse with distilled or deionized water; and
- Air dry prior to use.

Personnel who contact sampling equipment subsequent to decontamination shall wear powderless latex (or equivalent) gloves. Gloves will be replaced immediately if they become contaminated or torn.

3.4 WATER LEVEL MEASUREMENTS

Prior to groundwater purging and sampling, water level measurements will be taken at each well location utilizing a dedicated or portable water level indicator, tape, or other suitable measuring device capable of achieving an accuracy of 0.01 feet. The measuring device will be used in accordance with the manufacturer's recommendations and/or directions. Prior to measuring, all equipment that may contact the groundwater will be decontaminated with distilled water. All wells will be measured for depth to water immediately prior to purging. Measurements of the depth to water from the top of the well casing will be to the nearest 0.01 foot, and the values will be recorded on the Field Sampling Sheets. Total well depths shall be obtained annually or if evidence of well tampering exists.

3.5 WELL PURGING

Immediately prior to sampling at each well location, the water within the well will be evacuated until measured water quality parameters indicate that formation water has entered the well or until a sufficient volume of water has been removed so that stagnant water has been purged from the well. The wells will be evacuated using the standard 3 to 5-well volume purging method or by low-flow (minimal drawdown) sampling methods. Low-flow sampling methods are preferred. If low-flow methods are used, all procedures will be in accordance with EPA/540/S-95/504, "Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures". This document has been included as Appendix C.

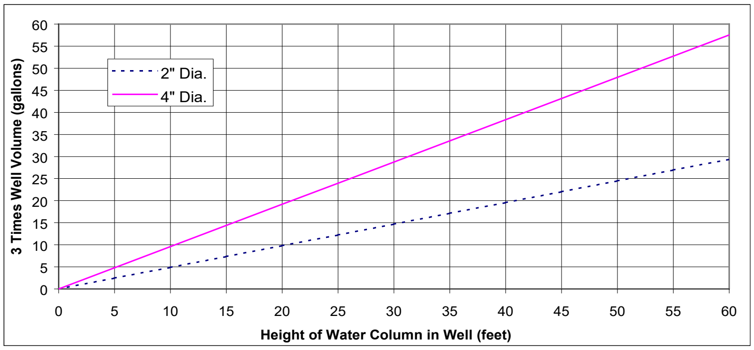
Procedures for low-flow sampling will include:

- Drawdown will be attempted to be kept to a minimum.
- Purging is complete when at least three parameters of the field-measured water quality parameters have stabilized for 3 successive readings.
- At least one volume of tubing & pump is purged before readings are counted. The volume of tubing & pump will be written on field datasheets along with cumulative volumes and times of parameter readings.
- At least 3 minutes minimum between parameter readings

During purging, representative samples of discharged water are to be periodically collected in clean containers or through a continuous flow cell and analyzed for field water quality parameters. Parameter results will be used to evaluate groundwater characteristics to aid in determining when the formation water is entering the well. At a minimum, the following parameters will be measured in the field: pH, specific conductance, turbidity, and temperature. Other field parameters such as dissolved oxygen (DO) and oxidation-reduction (redox) potential may be used to assist in evaluating purge effectiveness. Water quality parameters can be considered stable if three successive readings are within ±0.1 for pH, ±3% for conductivity, ±10 mv for redox potential, and ±10% for turbidity and DO. It should be noted that the turbidity reading is desired to stabilize at a value below 10 Nephelometric Turbidity Units (NTUs).

Purging may be considered complete when:

- Standard 3 to 5 well volume method - A minimum of three well volumes (based upon well construction records) have been evacuated from the well and two of the field measured parameters (pH, specific conductance and temperature) have stabilized, or to 5 well volumes, or until the well is pumped/bailed dry. If standard purge methods are used, then the well volume can be determined by using the inset chart. If three well volumes cannot be obtained due to the well being pumped or bailed dry, the well will be allowed to recover and then sampled. If sufficient water is not available for sampling within 24 hours of purging for slowly recovering wells, the well will be considered dry, and no sample will be collected.



- If low-flow (or minimal drawdown) techniques are used, purging activities will be accomplished using flow-control submersible bladder pumps. Purging rates will be monitored and depth-to-water measurements recorded so that evacuation rates do not induce a substantial lowering of the potentiometric head elevation within the well. Flow rates will vary for each well, but rates of approximately 0.1 to 0.5 L/min are typical. Purging of pump discharge lines is necessary prior to the collection of field parameter samples for field analysis using appropriate meters.

3.6 SAMPLE COLLECTION

Samples will be collected from each well using either a dedicated or disposable Teflon or polyethylene bailer or through the discharge of pumps used to evacuate the well. Samples will be collected at a rate that minimizes potential alteration of the sample due to agitation or oxidation. Pumping rates for the collection of samples for volatiles analysis (VOAs, etc.) will be approximately 0.1 L/min or less, to the extent practical based on the sampling equipment used. Pumping rates for the collection of other analyses may be increased but will be adjusted to a rate that also prevents chemical alteration.

If low-flow sampling methods are employed, the sampling rate is not to exceed the purging rate, with flow rates of approximately 0.1 to 0.5 L/min recommended (EPA/540/S-95/504). Sampling pumps are to be operated in a continuous manner so that they do not produce samples that are aerated in the return tube or upon discharge. Groundwater samples will be collected as soon as possible after well evacuation.

Samples will be collected and containerized in the order of the volatilization sensitivity of the parameter (i.e., volatile organics, organic compounds, inorganic species, and major cations and anions). The samples will be collected in appropriate containers with the appropriate sample preservative as described in subsequent sections.

3.7 SAMPLE PRESERVATION

Sample containers, preservation, handling, and analysis will meet the specifications described by "Test Methods for Evaluating Solid Waste Physical/Chemical Methods, third edition, Final Update IV, February 2007" or an equivalent substitute as approved by ODEQ. Sample containers will be supplied by the laboratory for each sampling event. The sample containers will be labeled to indicate the test parameters required. The appropriate preservatives will be added to each sample container based on the required analytical method.

3.8 CHAIN OF CUSTODY

Chain-of-custody procedures will allow for the possession and handling of samples to be traced from the time of collection through laboratory analysis. All sample containers will be labeled to avoid misidentification, have proper seals, and indicate the test parameters required. Chain-of-custody procedures will prevent potential tampering with samples collected. At the time each sample is collected, Chain-of-Custody will be completed and placed in the sample shipping container.

3.9 SAMPLE SHIPMENT

After collection and sample preservation, the labeled sample containers will be placed in an insulated shipping container using frozen ice packs or other suitable frozen material for temperature control. All samples included in the sample container will be packed in a manner that will minimize the potential for container breakage. An original Chain of Custody Form will be sealed in a water-resistant bag and placed with the appropriate sample bottle set. A copy will be maintained by the sampling personnel. Actual forms utilized may vary in format, but the information indicated is considered typical. The sample container will then be sealed with a custody seal for detection of unauthorized opening or potential tampering with sample containers and sent to the designated analytical laboratory. All shipments will be scheduled for next-day delivery. The temperature of the samples will be recorded when the sample container arrives at the analytical laboratory to assess that the appropriate sample temperature was maintained during shipment.

4.0 SAMPLE QUALITY CONTROL/QUALITY ASSURANCE

Quality control and quality assurance (QA/QC) samples will be collected to assist in maintaining the integrity of the data. The QA/QC samples are an integral part of maintaining the validity of the data and, therefore, are subject to the same handling and chain of custody protocols as the groundwater samples.

Groundwater samples will be collected in a manner so that chemical testing and evaluation of the samples will provide an accurate representation of the quality of the in-situ groundwater at the depth and location screened in the aquifer. This will require that all field equipment be calibrated prior to use and re-calibrated in the field before use, as necessary. Additionally, a number of factors must be considered that can affect the quality of the groundwater samples. These include the preparation of sample containers, sample collection, sample packaging and shipping, and laboratory analysis. As an aid in the detection and identification of errors, several types of field samples have been devised for quality assurance and quality control.

4.1 FIELD, TRIP, AND EQUIPMENT BLANKS

Trip and field blanks will be utilized during each round of sampling at the site. The trip blank will be provided by the analytical laboratory supplying the sample container. The trip blank, containing laboratory-grade deionized water will remain unopened and sent from and to the laboratory in the same manner as the site well samples. A field blank will be prepared in the field by pouring laboratory-grade deionized water into one of the clean sample containers opened in the field. The field blank will then be sealed and shipped in the same manner as the environmental samples. In the event that non-dedicated sampling equipment is utilized, a field equipment (rinsate) blank will be prepared by rinsing laboratory-grade deionized water over the sampling equipment immediately subsequent to decontamination and prior to sampling and capturing the rinse water in a sample container.

4.2 DUPLICATE SAMPLE

A duplicate sample will be collected from one well during each round of sampling at the site. The duplicate sample will be collected in the field using a matching set of sampling bottles and preservatives as the regular sample. Each duplicate sample will be collected by alternating filling between the regular sample bottles and the duplicate sample bottles, proceeding in the designated sampling order (i.e. VOAs first). Duplicate samples should not be physically different from regular samples in color, turbidity, or other physical characteristics.

5.0 LABORATORY QUALITY CONTROL

5.1 ANALYTICAL BLANKS AND SPIKES

The selected laboratory will use method quality control procedures that are equivalent to those described in “Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update IV, February 2007" or an equivalent substitute as approved by ODEQ. Duplicate samples, method blanks, instrument/reagent blanks, matrix spikes, blank/water reagent spikes and surrogate spikes are typical quality control checks performed throughout the analytical process. With the exception of instrument/reagent blanks and surrogate spikes, these checks are performed at a frequency of 5% or 10% (i.e., 1 in 20 samples, 1 in 10 samples). Instrument/reagent blanks and surrogate spikes are performed on a daily or per sample (where required by method) frequency. Each of the above applied Quality Control checks will be compared against the Acceptance Criterion for each QC check to maintain analytical quality.

The method blank is a blank solution that is treated as a sample for the parameter being measured, including all pretreatment/preparation procedures and is analyzed in the same manner as the well samples to assess analytical accuracy and the potential for sample contamination. Instrument/reagent blanks are prepared on a daily basis (where used) to detect contamination or interferences in the sample treatment solvents and chemicals to demonstrate that none of these applied chemicals systematically bias sample results.

Matrix spikes are well-samples fortified with known concentrations of analytes expected to be in the sample. The percent recovery of any spiked analyte is taken as a measure of the bias of the analytical method caused by the sample matrix. Blank/reagent water spikes are blank solutions fortified with known concentrations of analytes expected to be in samples. These spikes may (reagent water spikes) or may not (blank spike) be taken through the full analytical procedure prior to analysis. The percent recovery of any spiked analyte is taken as a measure of control on the analytical procedure. Surrogate spikes are utilized where a compound of a known amount that is not expected to be in the environmental sample is added to the sample. Volatile Organic Compound analysis uses this type of spike to measure method extraction efficiency. This spike is performed on every sample and QC sample where the analytical method requires it.

5.2 INSTRUMENT CALIBRATION

Applicable instruments are calibrated using calibration standards and method-specified calibration criteria. A solution containing various compounds of known concentrations is diluted and analyzed to establish calibration curves and is performed daily or per the method to monitor the accuracy and precision of the instrument. Instrument calibration is verified by analyzing a solution containing a known concentration of the pure compound(s) of interest and comparing it against the calibration curve. This standard compound is taken from the same stock as that used to develop the calibration curve. Calibration verification is done at a 5% frequency, or as the method requires, to check the stability of the calibration curve as well as the accuracy and precision of the system or analyst.

All standards and reagents used in laboratory procedures will be inventoried, labeled, logged and documented in accordance with Inorganics, Inorganics/Chemical Methods and Robotics, Semi-volatiles and Volatiles documentation procedures. All stock standards shall be purchased as certified primary solutions from reputable, commercial lab suppliers, and prepared from neat chemicals with certified purity. Stock standards shall be combined and/or diluted into secondary dilution standards, which are then diluted into working standards.

5.3 INSTRUMENT MAINTENANCE

Routine maintenance is performed and documented for all major instruments. In addition, any service agreements for laboratory equipment are renewed annually. The EPA's "Good Automated Laboratory Practices" (GALPs) shall be followed in the laboratory.

5.4 METHOD DETECTION LIMITS

Method Detection Limits (MDLs) will be updated annually per method and matrix. The MDL findings are produced annually.

6.0 DATA EVALUATION

This section outlines the proposed evaluation methodology that will be used for the detection of a release from the facility, utilizing PQLs (EQLS) as the reporting concentration limits for VOCs, and the Shewart-CUSUM control chart and/or Prediction Limits statistical comparisons. Data evaluation will be performed in accordance with the March 2009 Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance EPA 530/R-09-007 (Unified Guidance).

During background sample collection it will be necessary to examine the data for outliers, anomalies, and trends that might be an indication of a release. Outliers and anomalies are inconsistently large or small values that can occur due to sampling, laboratory, transportation or transcription errors, or even by chance alone. Significant trends indicate a source of systematic error or an actual contamination occurrence that must be evaluated and corrected before the detection monitoring program can be implemented. The inclusion of such values in the historical database used for statistical evaluation could cause misinterpretation of the data set and result in an artificial increase in the magnitude of statistical limits, which could result in an increase in the false negative rate (i.e., a decrease in the sensitivity of the statistical procedure).

To remove the possibility of historical outliers and trends creating false statistical limits, the data for each well and each constituent will be tested for the existence of outliers. Outliers in background data will be determined in accordance with Chapter 12 of the Unified Guidance. If a sample collected during background is found to be above the critical value for the sample of size (n-1), then the value is not used in the establishment of the statistical limit from the background data set. Outliers may be removed from consideration during the establishment of all statistical limits if some basis for a likely error or data discrepancy can be identified (Unified Guidance Section 5.2.3).

The statistical outlier and trend detection procedure will be performed for those wells that have had at least five (5) measurements for a given constituent. Once the background database is established, the outlier procedure described above may be applied and appropriate statistical limits set in accordance with the Unified Guidance.

6.1 STATISTICAL METHODOLOGY

For Detection Monitoring, this program will involve intra-well and inter-well analysis based on a comparison of well constituent concentrations to background data. Data evaluation will be performed in accordance with the Unified Guidance.

6.2 VOLATILE ORGANIC COMPOUNDS

PQLs asses if the quantitative value of the analyte is close to the measured value. Conversely, method detection limits (MDLs) indicate that the analyte is present in the sample with a specified degree of confidence. For analytes with estimated concentrations greater than the MDL but not the PQL, it can only be concluded that the true concentration is greater than zero; the actual concentration cannot be determined.

The use of laboratory-specific PQLs (or EQLs) already incorporates a measure of the statistical uncertainty that is associated with the measurement process. Any VOC detected and verified at a concentration above the PQL (or EQL) would be statistically significant, and therefore trigger assessment monitoring. These decision rules apply only in cases where the constituent has rarely, or never, been detected in the background. VOCs detected at concentrations between the MDL and

PQL will be reported but will not be considered statistically significant unless a verified concentration above the PQL is detected.

6.3 INORGANIC PARAMETERS

The statistical methodology for inorganic parameters in Detection Monitoring will include an intra-well and inter-well comparison of the detected constituent to the background data population for that constituent. The statistical limits for the background data set will be calculated using normal, lognormal, and nonparametric prediction limits depending on the distribution of the data set. A statistical program using combined Shewhart-CUSUM control charts and/or Prediction Interval Limits will be utilized in accordance with Unified Guidance Chapters 18-20.

For new monitoring wells, once four (4) rounds of background samples and one (1) detection event have been collected, an appropriate statistical method will be proposed to evaluate the data from these wells. Data evaluation will be performed in accordance with the Unified Guidance.

7.0 STATISTICALLY SIGNIFICANT INCREASE

If there is a verified statistically significant increase (SSI) over background levels for one or more constituents at any monitoring well, the AEL:

- Must notify the ODEQ in writing within 14 days of the determination and place a notice in the operating record indicating which constituents have shown statistically significant changes from background levels; and

- Must establish an assessment monitoring program as discussed in Section 7.1 within 90 days of the determination and have the assessment monitoring program approved by the ODEQ; or

- May, during the 90-day development of an assessment monitoring program, demonstrate that a source other than the facility caused the contamination or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration shall be submitted to the ODEQ for approval.

If a successful demonstration is approved by the ODEQ, detection monitoring shall continue. If, at the end of the 90-day period, a successful demonstration is not made, the assessment monitoring program must be initiated.

7.1 ASSESSMENT MONITORING

Assessment monitoring shall be conducted at a frequency specified by the ODEQ. Groundwater shall be sampled and analyzed for the groundwater quality constituents in Table 4 as well as the constituents listed in Appendix C of OAC 252:515. The list of monitored constituents may be reduced with approval from the ODEQ. A minimum of one sample from each downgradient well and a minimum of four independent samples from each well shall be collected and analyzed to establish the background for any detected constituents that are listed in Appendix C of OAC 252:515. The ODEQ may specify a subset of wells to be sampled and analyzed during assessment monitoring.

After obtaining the results from the initial assessment monitoring sampling event, the AEL must notify the ODEQ in writing within 14 days and place a notice in the operating record identifying the constituents that have been detected. Within 90 days and on at least a semi-annual basis thereafter, the AEL shall:

- Resample all wells;

- Conduct analyses for all constituents in the detection monitoring program and any other constituents specified by the ODEQ;

- Notify the ODEQ in writing and record the concentrations in the operation record; and

- Establish background concentrations for any constituents detected that are listed in Appendix C of OAC 252:515.

If the concentration of all assessment monitoring constituents is at or below background values for two consecutive sampling events using the approved statistical procedure, the AEL shall notify the ODEQ in writing and may return to detection monitoring upon approval by the ODEQ. If one or more assessment monitoring constituents are detected at statistically significant levels above the groundwater protection standard of OAC 252:515-9-96 in any sampling event, the AEL shall within 14 days of the finding:

- Notify the ODEQ in writing and place a notice in the operating record identifying the constituents that have exceeded the background levels;
- By certified mail with return receipt requested notify all persons who own the land or minerals or who reside on the land that directly overlies any part of the plume of contamination within one year time of travel if contaminants have migrated off-site;
- Submit for ODEQ a proposed plan and schedule for analyzing the environmental release from the facility and for developing appropriate corrective action;
- Submit to the ODEQ a copy of the notice sent to adjacent property owners along with a list of who was notified;
- Characterize the nature and extent of the release by installing additional monitoring wells as necessary; and
- Initiate an assessment of corrective action within 90 days.

7.2 CORRECTIVE MEASURES

If the assessment monitoring does not eliminate the landfill as the source of the SSI, then a corrective action program will be implemented following the described methods in OAC 252:515-9 Part 11 and Part 15.

8.0 MONITORING REPORTS

Groundwater monitoring reports will be submitted for newly installed monitoring wells, background sampling, and routine monitoring.

8.1 MONITORING WELL INSTALLATION

A report summarizing monitoring well installation activities with a location map, boring log, and monitoring well completion diagram will be submitted to the OWRB and ODEQ on forms prescribed by the OWRB. The report will include the well development details and survey coordinates and elevations. The monitoring well installation report will be submitted within 60 days of installation of the monitoring well or the last monitoring well of a group and may be submitted as part of the routine monitoring report.

8.2 BACKGROUND SAMPLING REPORT

A report summarizing the background sampling, statistical analysis, and results will be submitted to the ODEQ within 60 days of the last background sampling event. The report will include field data, monitoring well location maps, laboratory results, and statistical evaluations and summaries.

8.3 ROUTINE GROUNDWATER MONITORING REPORTS

A report summarizing the semi-annual sampling event will be submitted to the ODEQ within 60 days of the sampling date. The report will include field data, monitoring well location maps, groundwater flow summaries, laboratory results, and statistical evaluations and summaries.

9.0 REFERENCES

SCS Engineers, 2018, Hydrogeologic and Geotechnical Investigation.

U.S. EPA, 1989, Interim Final Guidance Document - Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities.

U.S. EPA, 1992, Addendum to Interim Final Guidance Document - Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities.

U.S. EPA, 1992, RCRA Ground-Water Monitoring, Draft Technical Guidance.

U.S. EPA, 2002, RCRA Waste Sampling, Draft Technical Guidance. Planning, Implementation, and Assessment. EPA530-D-02-002.

U.S. EPA, 2005, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.

TABLES AND FIGURES

Table 1. Existing Groundwater Monitoring System Summary

Monitoring Point	**Hydraulic Location**	**Monitoring Status**	**Northing**	**Easting**	**Surface Elevation (MSL)**	**Top of Casing Elevation (MSL)**	**Total Depth (ft)**
Existing Landfill							
MW-1	Up Gradient	Active/Detection	428081.39	2504346.62	800.8	802.6	54.27
MW-3	Down Gradient	Active/Detection	429375.11	2503946.83	765.3	764.8	34.52
MW-5	Down Gradient	Active/Detection	429388.42	2505535.40	777.2	779.8	51.68
MW-6	Down Gradient	Active/Detection	429382.24	2504611.52	776.7	777.3	46.15
MW-8R	Up Gradient	Active/Detection	427977.14	2505669.03	805.8	N/A	53.73
MW-15A	Down Gradient	Active/Detection	429406.63	2505330.21	766.7	770.3	N/A
MW-21A	Up Gradient	Active/Detection	429087.75	2503006.88	788.4	791.5	43.01
Phase IV Expansion Area	**Hydraulic Location**	**Monitoring Status**	**Northing**	**Easting**	**Surface Elevation (MSL)**	**Top of Casing Elevation (MSL)**	**Total Depth (ft)**
MW-1_IV	Up Gradient	Active/Detection	430004.48	2502704.30	768.0	770.6	54.27
MW-31B	Down Gradient	Active/Detection	427682.56	2501501.90	737.0	739.9	66
MW-34	Down Gradient	Active/Detection	427724.68	2502710.33	777.0	779.9	95.55
MW-36	Down Gradient	Active/Detection	427948.70	2500404.97	729.4	731.1	59.23
MW-38	Down Gradient	Active/Detection	428689.42	2500077.29	727.7	729.5	47.35

Table 2. Historical Groundwater Elevations

Monitoring Well	TOC (MSL)	Date													Highest Elevation (MSL)
		07-21	08-21	09-21	10-21	11-21	12-21	1-22	03-05-22	03-31-22	04-22	05-22	06-21	08-22	
MW-36	731.10	34.54	35.13	34.61	33.32	33.07	33.24	31.96	31.95	32.00	32.04	32.05	31.94	31.97	699.16
MW-38	729.50	10.47	11.02	11.86	12.44	12.21	11.76	11.49	11.35	11.32	11.47	11.20	10.48	11.58	719.03
P-1	744.53	33.76	34.19	34.60	34.50	34.42	33.97	34.22	34.10	34.17	34.30	34.30	33.85	34.65	710.77
P-4	760.73	48.75	48.57	48.75	48.54	48.43	48.28	48.71	48.78	49.16	49.10	48.43	49.61	50.12	712.45
P-6	721.01	19.44	20.36	20.69	20.11	19.86	19.56	19.80	19.57	19.45	19.37	19.02	18.60	19.33	702.41
P-9	781.88	56.53	56.34	56.50	56.43	56.40	56.41	56.48	56.64	56.65	56.67	56.71	56.72	56.85	725.54
P-12	789.16	45.61	104.7	102.9	101.0	98.99	96.29	94.85	92.95	90.63	89.05	86.56	83.00	79.80	743.55
P-15	776.55	86.49	85.55	85.22	84.93	84.70	84.50	84.32	84.00	83.89	83.75	83.60	83.34	83.10	693.45
P-19	791.87	79.82	66.28	66.22	65.92	65.97	65.87	65.98	65.77	65.77	65.70	65.58	65.48	65.92	726.39
P-23	817.77	95.53	94.43	93.83	93.17	91.59	92.12	89.95	87.90	87.06	86.40	85.32	84.08	82.17	735.60
P-27	809.37	79.91	34.71	32.18	31.00	30.51	30.22	29.67	28.65	27.40	26.25	24.68	23.35	26.59	786.02
P-30	824.13	89.53	90.21	90.52	90.69	90.85	90.78	91.04	90.95	91.05	90.95	90.98	90.81	91.03	734.60
P-37	849.01	84.79	85.63	85.97	86.11	88.95	86.16	86.28	86.20	86.38	86.31	86.10	85.28	85.86	764.22
P-39	825.52	55.37	54.71	54.41	55.06	54.58	53.43	55.93	55.51	55.16	55.66	56.05	55.24	56.19	772.09
P-42	844.46	93.06	95.60	96.42	96.67	96.69	96.47	96.43	96.30	96.34	96.29	96.22	96.18	96.77	751.40

Table 3. Proposed Groundwater Monitoring Network

Monitoring Well		MW-39	MW-40	MW-41
Boring Number		-	P-1	-
Hydraulic Location		Downgradient	Downgradient	Upgradient
Northing		427657.60'	427676.72'	430988.35'
Easting		2500732.38'	2497783.12'	2500961.83'
Surface Elevation (MSL)		726.00 ft	741.91 ft	872.03 ft
Total Depth (FT BGS)		45	70	138
Screen Elevation (MSL)	**Top**	691.0	700.9	744.0
	Bottom	681.0	690.9	734.0

Notes:
1. Existing Piezometer 1 (P-1) is proposed to be converted to MW-40. Location and elevation was provided by Professional Surveyors, Inc.
2. MW-39 and MW-41 locations and elevations are proposed.

Table 4. Background and Routine Monitoring Parameters

Constituent	Units	Constituent	Units
Oklahoma Groundwater Quality Constituents		**Oklahoma Appendix A Constituents**	
Calcium	mg/L	cis-1,2-Dichloroethene	ug/L
Carbonates	mg/L	trans-1,2-Dichloroethene	ug/L
Chemical Oxygen Demand	mg/L	1,2-Dichloropropane	ug/L
Chloride	mg/L	cis 1,3-Dichloropropene	ug/L
Magnesium	mg/L	trans 1,3-Dichloropropene	ug/L
Nitrate/Nitrite	mg/L	Ethylbenzene	ug/L
pH	S.U.	2-Hexanone	ug/L
Potassium	mg/L	Lead	ug/L
Sodium	mg/L	Bromomethane	mg/L
Specific Conductivity	umhos/cm	Chloromethane	ug/L
Sulfate	mg/L	Dibromomethane	ug/L
Oklahoma Appendix A Constituents	**Units**	Methylene chloride	ug/L
Acetone	ug/L	Methyl ethyl ketone	ug/L
Acrylonitrile	ug/L	Methyl iodide	ug/L
Antimony	mg/L	4-Methyl-2-pentanone	ug/L
Arsenic	mg/L	Nickel	mg/L
Barium	mg/L	Selenium	mg/L
Benzene	ug/L	Silver	mg/L
Beryllium	mg/L	Styrene	ug/L
Bromochloromethane	ug/L	1,1,1,2-Tetrachloroethane	ug/L

Bromodichloromethane	ug/L	1,1,2,2-Tetrachloroethane	ug/L
Bromoform; Tribromomethane	ug/L	Tetrachloroethene	ug/L
Cadmium	mg/L	Perchloroethylene	ug/L
Carbon disulfide	ug/L	Thallium	mg/L
Carbon tetrachloride	ug/L	Toluene	ug/L
Chlorobenzene	ug/L	1,1,1-Trichloroethane	ug/L
Chloroethane	ug/L	1,1,2-Trichloroethane	ug/L
Chloroform	ug/L	Trichloroethene	ug/L
Chromium	mg/L	Trichlorofluoromethane	ug/L
Cobalt	mg/L	1,2,3-Trichloropropane	ug/L
Copper	mg/L	Vanadium	mg/L
Dibromochloromethane	ug/L	Vinyl acetate	ug/L
1,2-Dibromo-3-chloropropane	ug/L	Vinyl chloride	ug/L
1,2-Dibromoethane	ug/L	Xylenes	ug/L
1,2-Dichlorobenzene	ug/L	Zinc	mg/L
1,4-Dichlorobenzene	ug/L	**Field Parameters**	**Units**
trans-1,4-Dichloro-2-butene	ug/L	Depth to water	ug/L
1,1-Dichloroethane	ug/L	Total well depth	feet
1,2-Dichloroethane	ug/L	Temperature	feet
1,1-Dichloroethene	ug/L	Specific conductivity	umhos/cm
		pH	S.U.

Figure 1. Site Location

LEGEND:

—·–·—·–	SOLID WASTE PERMIT BOUNDARY
—	PROPOSED EXPANSION AREA PERMIT BOUNDARY
○	6-MILE RADIUS

NOTE:

1. APPROXIMATE 6-MILE RADIUS TAKEN FROM GOOGLE EARTH

N

10000 0 10000 20000

SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY
△			
△			
△			
△			
△			
△			

SHEET TITLE
SITE LOCATION

PROJECT TITLE
GROUNDWATER MONITORING PLAN

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27220345.00
DSN. BY: TWL
DWN. BY: TWL
CHK. BY: CF
Q/A RVW BY: WJM
PROJ. MGR: WJM

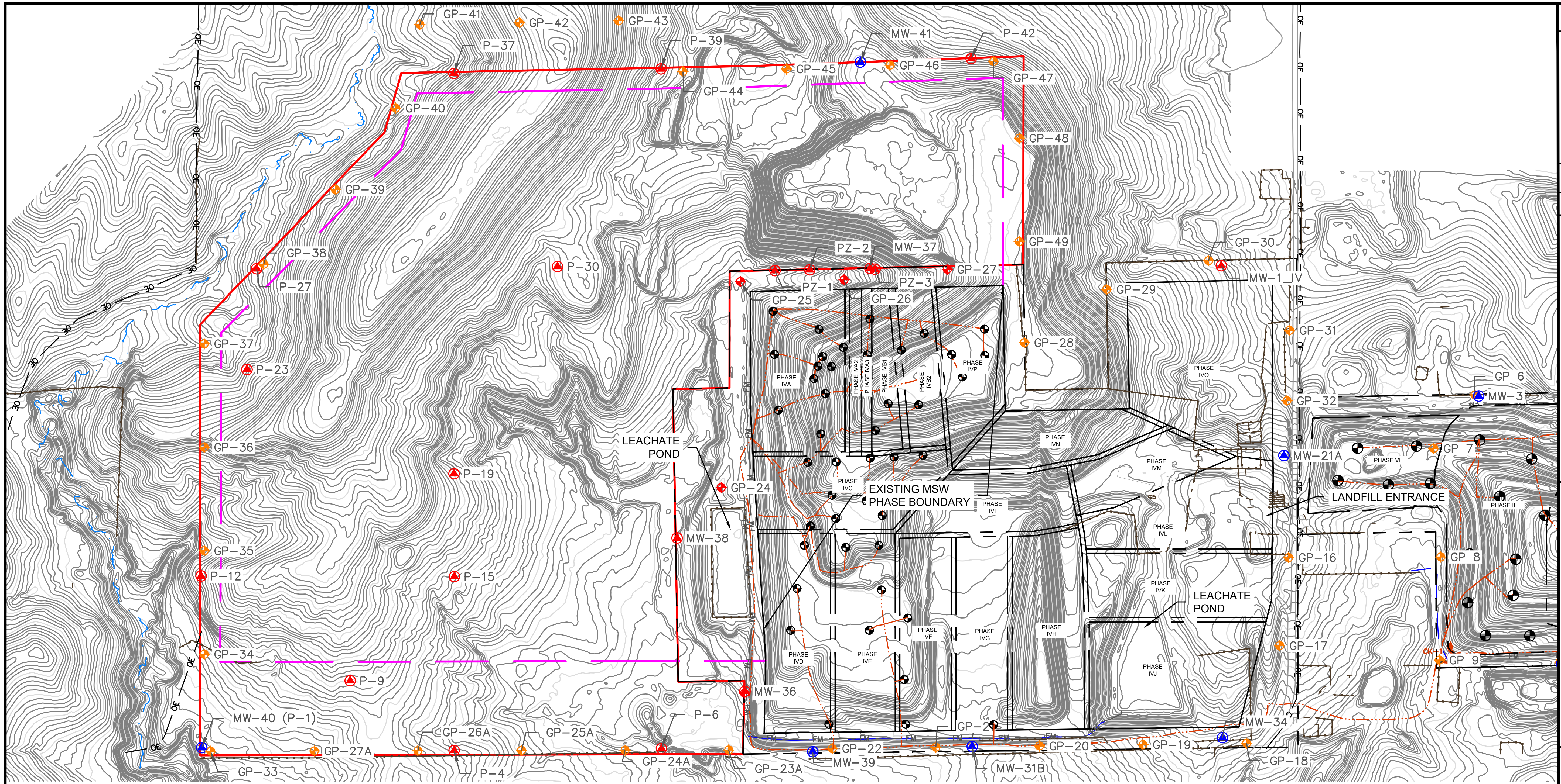
CADD FILE: GROUNDWATER MONITORING NETWORK.DWG

DATE: 12/8/23

SCALE: 1"=10,000'

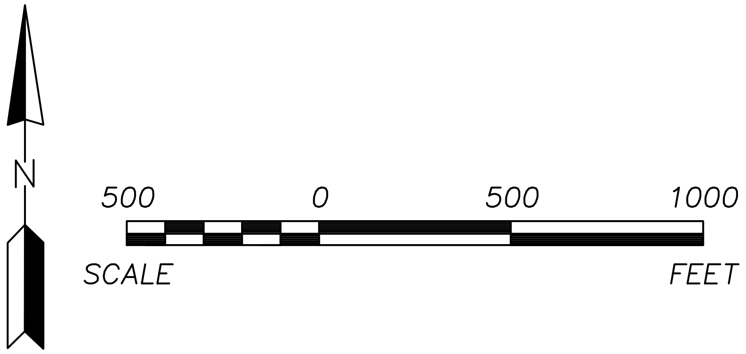
DRAWING NO.
1 of 2

Figure 2. Proposed Groundwater Monitoring System



LEGEND:

	EXISTING 2' MINOR CONTOUR
—1570—	EXISTING 10' MAJOR CONTOUR
—□—□—□—	EXISTING FENCE
— OE — OE —	EXISTING OVERHEAD ELECTRIC
	EXISTING UNPAVED ROAD
	EXISTING PAVED ROAD
— — — —	EXISTING BODY OF WATER
—— - —— -	SOLID WASTE PHASE BOUNDARY
—-·-·—	SOLID WASTE PERMIT BOUNDARY
— — — —	ELECTRICAL CONDUIT
— FM — FM —	LEACHATE FORCEMAIN
—··—··—	LANDFILL GAS COLLECTION SYSTEM PIPING
◐	EXTRACTION WELL
⊕	GAS PROBE
▲	MONITORING WELL
▲	MONITORING WELL ABANDONMENT
⊕	GAS PROBE ABANDONMENT
——	PROPOSED EXPANSION AREA PERMIT BOUNDARY
— — — —	PROPOSED LIMITS OF WASTE
—·—·—	EXISTING STREAM



REV.	DATE
DESCRIPTION	CK. BY

SHEET TITLE
PROPOSED EXPLOSIVE GAS MONITORING SYSTEM

PROJECT TITLE
GROUNDWATER MONITORING PLAN

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27220345.00	DWN. BY: TWL	Q/A RVW BY: WJM
DSN. BY: TWL	CHK. BY: CF	PROJ. MGR. WJM

CADD FILE:
GROUNDWATER MONITOIRNG NETWORK.DWG

DATE:
12/8/23

SCALE:
1"=500'

DRAWING NO.
2 of 2

Appendix A

Boring Logs and Well Construction Diagram

K:\AEL\Projects\2020\27220345.00 - Lateral Expansion Permitting\Task 8 - Application Submittal to ODEQ\App D GW Monitoring Plan\Typical Monitoring Well Construction.dwg Mar 14, 2023 - 4:02pm Layout Name: Typical Monitoring Well Construction By: 4810twl

(NOT TO SCALE)

░ SURFACE SEAL: CONCRETE OR CEMENT GROUT PLACED ABOVE THE ANNULAR SEAL FROM A DEPTH OF 2-FT TO GROUND SURFACE.

▨ ANNULAR SEAL: BENTONITE CHIPS, CEMENT/BENTONITE GROUT, OR BENTONITE GROUT (SEE NOTE 1) PLACED FROM FILTER PACK SEAL TO WITHIN 2-FT OF GROUND SURFACE

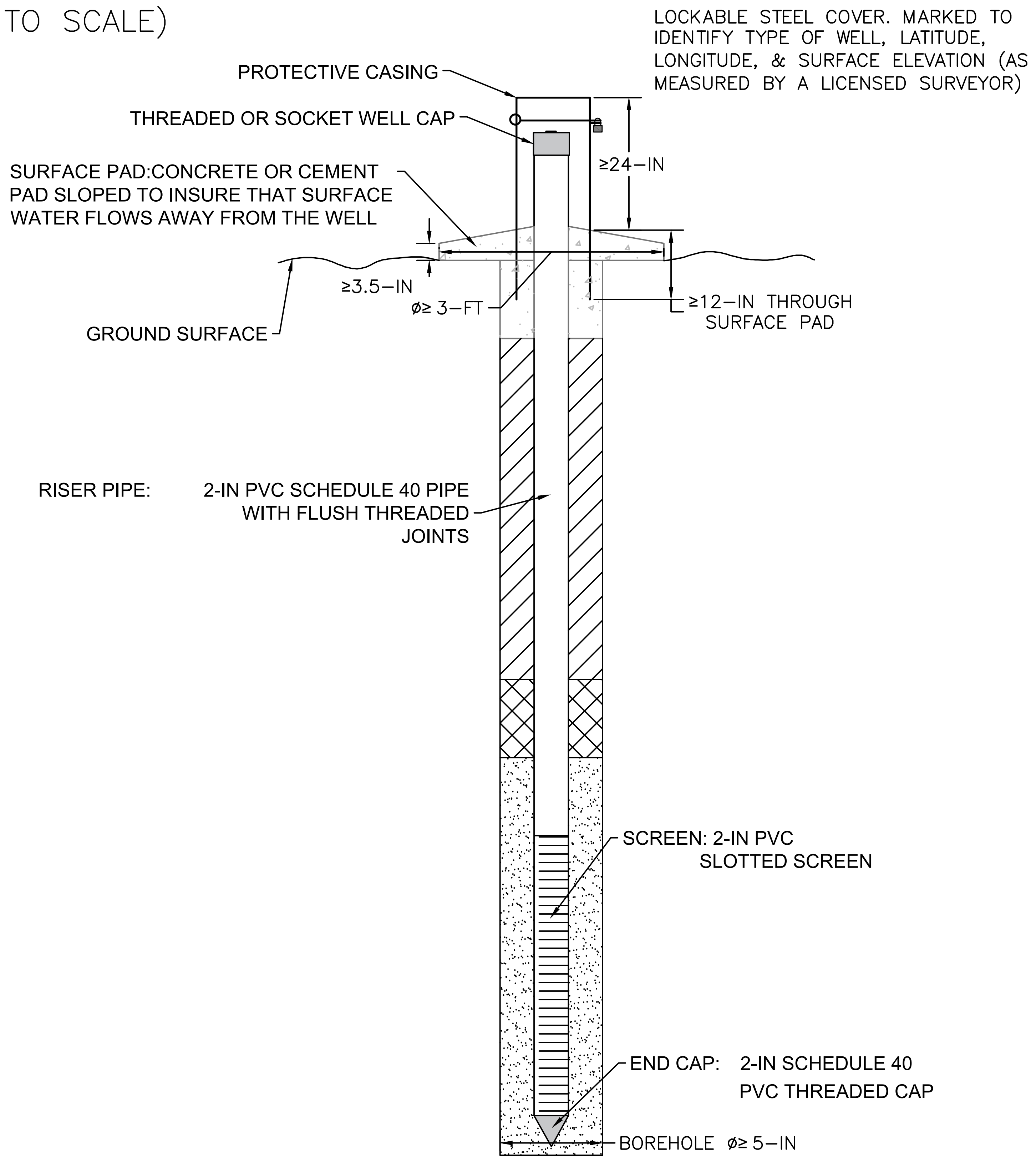
▩ FILTER PACK SEAL: AT LEAST 2-FT OF HYDRATED BENTONITE (0.25"-0.75" IN SIZE) PLACED ABOVE FILTER PACK.

⁘ FILTER PACK: SILICA SAND; PLACED FROM BOTTOM OF BOREHOLE TO 2-FT ABOVE THE TOP OF SCREEN.

NOTES:

1. ANNULAR SEAL: CEMENT GROUT MIX RATIO OF 94-LBS CEMENT TO A MAXIMUM OF 6-GAL WATER IS USED, AND MIXED TO THE CONSISTENCY RECOMMENDED BY THE CEMENT MANUFACTURER. MAXIMUM OF TWENTY PERCENT (20%) BENTONITE BY DRY WEIGHT MAY BE ADDED TO THE CEMENT GROUT TO FORM THE CEMENT/BENTONITE GROUT MIXTURE. THE BENTONITE IS PREHYDRATED TO THE MANUFACTURER'S RECOMMENDED CONSISTENCY. THE BENTONITE GROUT HAS AT LEAST TWENTY PERCENT (20%) BENTONITE BY DRY WEIGHT, AND IS MIXED ACCORDING TO THE MANUFACTURER'S RECOMMENDED CONSISTENCY.

2. WHEN THE PLACEMENT OF GROUT WILL EXCEED 20-FT, THE GROUT IS PLACED THROUGH A TREMIE PIPE AND FILLED OR PUMPED FROM THE BOTTOM UPWARD.



REV.	DATE	CK. BY
△	-	-
△	-	-
△	-	-
△	-	-
△	-	-
△	-	-

SHEET TITLE
TYPICAL MONITORING WELL CONSTRUCTION

PROJECT TITLE
GROUNDWATER MONITORING PLAN

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OKLAHOMA

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27219016.00
DWN. BY: TWL
Q/A RVW BY: WJM
DSN. BY: TWL
CHK. BY: WJM
PROJ. MGR WJM

CADD FILE: TYPICAL MONITORING WELL CONSTRUCTION.DWG

DATE: 3/14/23

DRAWING NO.
A-1

SCS ENGINEERS

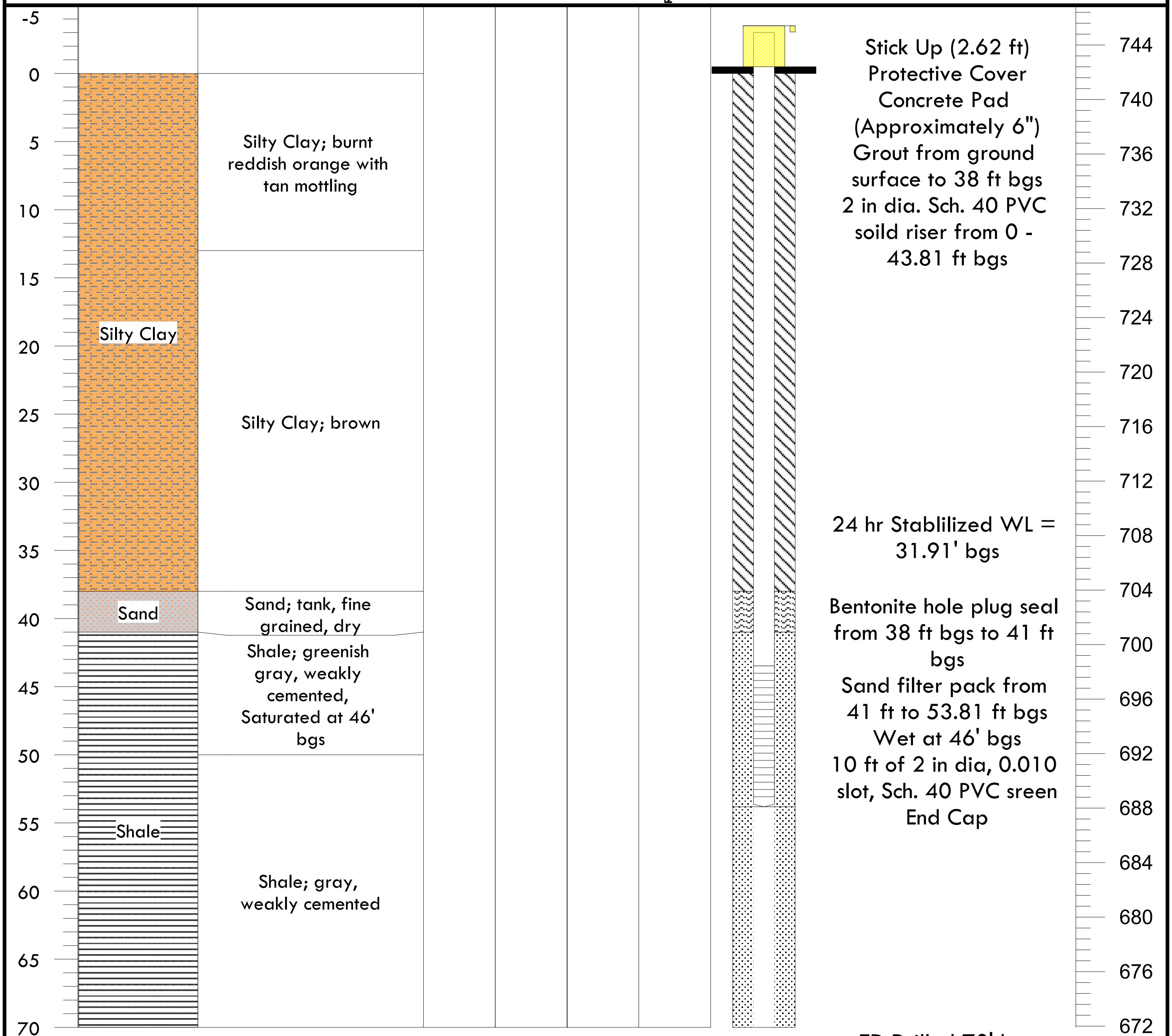
LOG OF BORING NO.: **P-1**

SHEET NUMBER: 1 of 1

11219 Richardson Drive
North Little Rock, AR

CLIENT: AEL Landfill	DRILLER: Timothy Swyden	SURFACE ELEVATION: 741.91 ft
PROJECT NAME: 203-Acre Expansion	DRILLING RIG: Dedrick 50 Turbo	TOC ELEVATION: 744.53 ft
PROJECT NUMBER: 27220345.00	DRILLING METHOD: Split Spoon/Core	WELL DEPTH COMPLETION: 70 fbgs
PROJECT LOCATION: Sand Springs, Oklahoma	DRILLING CONTRACTOR: Mohawk Drilling, Inc.	LOCATION: EASTING: 2497783.12 NORTHING: 427676.72
GEOLOGIST: Joe Wrath	SAMPLING METHOD: Split Spoon/Core	WATER LEVEL: 31.91 fbgs
START DATE: 12/16/2020	BORING DIAMETER: 8.25"	STBLZD WATER ELEVATION: 710 ft
FINISH DATE:	WELL DIAMETER: 2"	WATER LEVEL DATE: 7/19/2021

DEPTH (FT)	LITHOLOGY	LITHOLOGY DESCRIPTION	Sample Type	Sample Depth	Blow Counts	RECOVERY (%)	MONITORING WELL CONSTRUCTION	MONITORING WELL DESCRIPTION	ELEVATION (FT)



Silty Clay; burnt reddish orange with tan mottling

Silty Clay; brown

Sand; tank, fine grained, dry

Shale; greenish gray, weakly cemented, Saturated at 46' bgs

Shale; gray, weakly cemented

Stick Up (2.62 ft)
Protective Cover
Concrete Pad (Approximately 6")
Grout from ground surface to 38 ft bgs
2 in dia. Sch. 40 PVC soild riser from 0 - 43.81 ft bgs

24 hr Stablilized WL = 31.91' bgs

Bentonite hole plug seal from 38 ft bgs to 41 ft bgs
Sand filter pack from 41 ft to 53.81 ft bgs
Wet at 46' bgs
10 ft of 2 in dia, 0.010 slot, Sch. 40 PVC sreen
End Cap

TD Drilled 70' bgs

THE STRATIFICATION LINES REPRESENT APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: ACTUAL TRANSITIONS MAY BE GRADUAL

Appendix B

Example Form

Field Sampling Sheet

Project Name: ____________________ **Monitoring Point:** ____________
Project Location: ____________________
Project Number: ____________________ **Date (s):** ____________

Field Team Members

Name: ____________________ Affiliation: ____________________
Name: ____________________ Affiliation: ____________________

Weather Conditions

Temp: ________ ^{o}F Wind Direction: N S E W (circle two if needed)
Precipitation: None Light Heavy Sky: Cloudy Sunny Partly

Well Observations

Well Pad ____________________
Casing ____________________
Protective Casing ____________________
Reference Mark/Identification ____________________

Locks	Yes	No
Protective Casing		
Well		

Groundwater Level Measurements

Date/Time Measured: ____________
Static Water Level: ________ feet below TOC
Total Depth: ________ feet below TOC

Purging Activities

Purged By: ____________________ Purge Date: ____________
Purge Method: Bailer Dedicated Pump Non-Dedicated Pump (circle one)
Well Diameter: 1-inch 2-inch 3-inch 4-inch Other ________ (circle one)
Purge Volume Calculation: ____________________ Total Purge Volume: ________ gallons
Initial Parameter Readings: ________ pH ________ Spec. Cond. ________ Temp
Physical appearance of purge water: ____________________

Purge Time	Cumulative Purge Vol. (gallons)	Purge Rate (ml/m)	pH	Specific Conductivity (µS)	Temp (^{o}C)	Other	Other

---

Sampling Activities

Sampled By: ____________ Sample Date/Time: ____________________
Sample Method: Bailer Dedicated Pump Non-Dedicated Pump (circle one)
Sample Parameters: ________ pH ________ Spec. Cond. ________ Temp
Water Level: ________ feet below TOC

Observations/Comments: (i.e., equipment malfunctions, contamination sources, sampling difficulties; duplicate sample)

Form Completed By: ____________________ **Date:** ____________

Appendix C

Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures

United States
Environmental Protection
Agency

Office of
Research and
Development

Office of Solid Waste
and Emergency
Response

EPA/540/S-95/504
April 1996

Ground Water Issue

LOW-FLOW (MINIMAL DRAWDOWN) GROUND-WATER SAMPLING PROCEDURES

by Robert W. Puls[1] and Michael J. Barcelona[2]

Background

The Regional Superfund Ground Water Forum is a group of ground-water scientists, representing EPA's Regional Superfund Offices, organized to exchange information related to ground-water remediation at Superfund sites. One of the major concerns of the Forum is the sampling of ground water to support site assessment and remedial performance monitoring objectives. This paper is intended to provide background information on the development of low-flow sampling procedures and its application under a variety of hydrogeologic settings. It is hoped that the paper will support the production of standard operating procedures for use by EPA Regional personnel and other environmental professionals engaged in ground-water sampling.

For further information contact: Robert Puls, 405-436-8543, Subsurface Remediation and Protection Division, NRMRL, Ada, Oklahoma.

I. Introduction

The methods and objectives of ground-water sampling to assess water quality have evolved over time. Initially the emphasis was on the assessment of water quality of aquifers as sources of drinking water. Large water-bearing units were identified and sampled in keeping with that objective. These were highly productive aquifers that supplied drinking water via private wells or through public water supply systems. Gradually, with the increasing awareness of subsurface pollution of these water resources, the understanding of complex hydrogeochemical processes which govern the fate and transport of contaminants in the subsurface increased. This increase in understanding was also due to advances in a number of scientific disciplines and improvements in tools used for site characterization and ground-water sampling. Ground-water quality investigations where pollution was detected initially borrowed ideas, methods, and materials for site characterization from the water supply field and water analysis from public health practices. This included the materials and manner in which monitoring wells were installed and the way in which water was brought to the surface, treated, preserved and analyzed. The prevailing conceptual ideas included convenient generalizations of ground-water resources in terms of large and relatively homogeneous hydrologic *units*. With time it became apparent that conventional water supply generalizations of *homogeneity* did not adequately represent field data regarding pollution of these subsurface resources. The important role of *heterogeneity* became increasingly clear not only in geologic terms, but also in terms of complex physical,

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[1] ***National Risk Management Research Laboratory, U.S. EPA***
[2] ***University of Michigan***

Superfund Technology Support Center for Ground Water

**National Risk Management Research Laboratory
Subsurface Protection and Remediation Division
Robert S. Kerr Environmental Research Center
Ada, Oklahoma**

Technology Innovation Office
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chemical and biological subsurface processes. With greater appreciation of the role of heterogeneity, it became evident that subsurface pollution was ubiquitous and encompassed the unsaturated zone to the deep subsurface and included unconsolidated sediments, fractured rock, and *aquitards* or low-yielding or impermeable formations. Small-scale processes and heterogeneities were shown to be important in identifying contaminant distributions and in controlling water and contaminant flow paths.

It is beyond the scope of this paper to summarize all the advances in the field of ground-water quality investigations and remediation, but two particular issues have bearing on ground-water sampling today: aquifer heterogeneity and colloidal transport. Aquifer heterogeneities affect contaminant flow paths and include variations in geology, geochemistry, hydrology and microbiology. As methods and the tools available for subsurface investigations have become increasingly sophisticated and understanding of the subsurface environment has advanced, there is an awareness that in most cases a primary concern for site investigations is characterization of contaminant flow paths rather than entire aquifers. In fact, in many cases, plume thickness can be less than well screen lengths (e.g., 3-6 m) typically installed at hazardous waste sites to detect and monitor plume movement over time. Small-scale differences have increasingly been shown to be important and there is a general trend toward smaller diameter wells and shorter screens.

The hydrogeochemical significance of colloidal-size particles in subsurface systems has been realized during the past several years (Gschwend and Reynolds, 1987; McCarthy and Zachara, 1989; Puls, 1990; Ryan and Gschwend, 1990). This realization resulted from both field and laboratory studies that showed faster contaminant migration over greater distances and at higher concentrations than flow and transport model predictions would suggest (Buddemeier and Hunt, 1988; Enfield and Bengtsson, 1988; Penrose et al., 1990). Such models typically account for interaction between the mobile aqueous and immobile solid phases, but do not allow for a mobile, reactive solid phase. It is recognition of this third *phase* as a possible means of contaminant transport that has brought increasing attention to the manner in which samples are collected and processed for analysis (Puls et al., 1990; McCarthy and Degueldre, 1993; Backhus et al., 1993; U. S. EPA, 1995). If such a phase is present in sufficient mass, possesses high sorption reactivity, large surface area, and remains stable in suspension, it can serve as an important mechanism to facilitate contaminant transport in many types of subsurface systems.

Colloids are particles that are sufficiently small so that the surface free energy of the particle dominates the bulk free energy. Typically, in ground water, this includes particles with diameters between 1 and 1000 nm. The most commonly observed mobile particles include: secondary clay minerals; hydrous iron, aluminum, and manganese oxides; dissolved and particulate organic materials, and viruses and bacteria. These reactive particles have been shown to be mobile under a variety of conditions in both field studies and laboratory column experiments, and as such need to be included in monitoring programs where identification of the *total* mobile contaminant loading (dissolved + naturally suspended particles) at a site is an objective. To that end, sampling methodologies must be used which do not artificially bias *naturally* suspended particle concentrations.

Currently the most common ground-water purging and sampling methodology is to purge a well using bailers or high speed pumps to remove 3 to 5 casing volumes followed by sample collection. This method can cause adverse impacts on sample quality through collection of samples with high levels of turbidity. This results in the inclusion of otherwise immobile artifactual particles which produce an overestimation of certain analytes of interest (e.g., metals or hydrophobic organic compounds). Numerous documented problems associated with filtration (Danielsson, 1982; Laxen and Chandler, 1982; Horowitz et al., 1992) make this an undesirable method of rectifying the turbidity problem, and include the removal of potentially mobile (contaminant-associated) particles during filtration, thus artificially biasing contaminant concentrations low. Sampling-induced turbidity problems can often be mitigated by using low-flow purging and sampling techniques.

Current subsurface conceptual models have undergone considerable refinement due to the recent development and increased use of field screening tools. So-called hydraulic *push* technologies (e.g., cone penetrometer, Geoprobe®, QED HydroPunch®) enable relatively fast screening site characterization which can then be used to design and install a monitoring well network. Indeed, alternatives to conventional monitoring wells are now being considered for some hydrogeologic settings. The ultimate design of any monitoring system should however be based upon adequate site characterization and be consistent with established monitoring objectives.

If the sampling program objectives include accurate assessment of the magnitude and extent of subsurface contamination over time and/or accurate assessment of subsequent remedial performance, then some information regarding plume delineation in three-dimensional space is necessary prior to monitoring well network design and installation. This can be accomplished with a variety of different tools and equipment ranging from hand-operated augers to screening tools mentioned above and large drilling rigs. Detailed information on ground-water flow velocity, direction, and horizontal and vertical variability are essential baseline data requirements. Detailed soil and geologic data are required prior to and during the installation of sampling points. This includes historical as well as detailed soil and geologic logs which accumulate during the site investigation. The use of borehole geophysical techniques is also recommended. With this information (together with other site characterization data) and a clear understanding of sampling objectives, then appropriate location, screen length, well diameter, slot size, etc. for the monitoring well network can be decided. This is especially critical for new in situ remedial approaches or natural attenuation assessments at hazardous waste sites.

In general, the overall goal of any ground-water sampling program is to collect water samples with no alteration in water chemistry; analytical data thus obtained may be used for a variety of specific monitoring programs depending on the regulatory requirements. The sampling methodology described in this paper assumes that the monitoring goal is to sample monitoring wells for the presence of contaminants and it is applicable whether mobile colloids are a concern or not and whether the analytes of concern are metals (and metalloids) or organic compounds.

II. Monitoring Objectives and Design Considerations

The following issues are important to consider prior to the design and implementation of any ground-water monitoring program, including those which anticipate using low-flow purging and sampling procedures.

A. Data Quality Objectives (DQOs)

Monitoring objectives include four main types: detection, assessment, corrective-action evaluation and resource evaluation, along with *hybrid* variations such as site-assessments for property transfers and water availability investigations. Monitoring objectives may change as contamination or water quality problems are discovered. However, there are a number of common components of monitoring programs which should be recognized as important regardless of initial objectives. These components include:

1) Development of a conceptual model that incorporates elements of the regional geology to the local geologic framework. The conceptual model development also includes initial site characterization efforts to identify hydrostratigraphic units and likely flow-paths using a minimum number of borings and well completions;

2) Cost-effective and well documented collection of high quality data utilizing simple, accurate, and reproducible techniques; and

3) Refinement of the conceptual model based on supplementary data collection and analysis.

These fundamental components serve many types of monitoring programs and provide a basis for future efforts that evolve in complexity and level of spatial detail as purposes and objectives expand. High quality, reproducible data collection is a common goal regardless of program objectives.

High quality data collection implies data of sufficient accuracy, precision, and completeness (i.e., ratio of valid analytical results to the minimum sample number called for by the program design) to meet the program objectives. Accuracy depends on the correct choice of monitoring tools and procedures to minimize sample and subsurface disturbance from collection to analysis. Precision depends on the repeatability of sampling and analytical protocols. It can be assured or improved by replication of sample analyses including blanks, field/lab standards and reference standards.

B. Sample Representativeness

An important goal of any monitoring program is collection of data that is truly representative of conditions at the site. The term *representativeness* applies to chemical and hydrogeologic data collected via wells, borings, piezometers, geophysical and soil gas measurements, lysimeters, and temporary sampling points. It involves a recognition of the statistical variability of individual subsurface physical properties, and contaminant or major ion concentration levels, while explaining extreme values. Subsurface temporal and spatial variability are facts. Good professional practice seeks to maximize representativeness by using proven accurate and reproducible techniques to define limits on the distribution of measurements collected at a site. However, measures of representativeness are dynamic and are controlled by evolving site characterization and monitoring objectives. An evolutionary site characterization model, as shown in Figure 1, provides a systematic approach to the goal of consistent data collection.

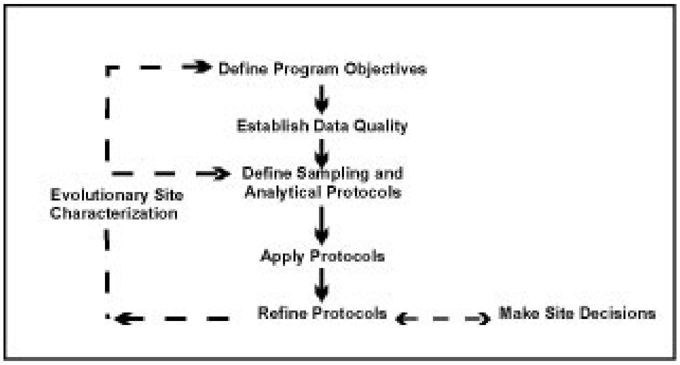

Figure 1. Evolutionary Site Characterization Model

The model emphasizes a recognition of the causes of the variability (e.g., use of inappropriate technology such as using bailers to purge wells; imprecise or operator-dependent methods) and the need to control avoidable errors.

1) Questions of Scale

A sampling plan designed to collect representative samples must take into account the potential scale of changes in site conditions through space and time as well as the chemical associations and behavior of the parameters that are targeted for investigation. In subsurface systems, physical (i.e., aquifer) and chemical properties over time or space are not statistically independent. In fact, samples taken in close proximity (i.e., within distances of a few meters) or within short time periods (i.e., more frequently than monthly) are highly auto-correlated. This means that designs employing high-sampling frequency (e.g., monthly) or dense spatial monitoring designs run the risk of redundant data collection and misleading inferences regarding trends in values that aren't statistically valid. In practice, contaminant detection and assessment monitoring programs rarely suffer these *over-sampling* concerns. In corrective-action evaluation programs, it is also possible that too little data may be collected over space or time. In these cases, false interpretation of the spatial extent of contamination or underestimation of temporal concentration variability may result.

2) Target Parameters

Parameter selection in monitoring program design is most often dictated by the regulatory status of the site. However, background water quality constituents, purging indicator parameters, and contaminants, all represent targets for data collection programs. The tools and procedures used in these programs should be equally rigorous and applicable to all categories of data, since all may be needed to determine or support regulatory action.

C. Sampling Point Design and Construction

Detailed site characterization is central to all decision-making purposes and the basis for this characterization resides in identification of the geologic framework and major hydro-stratigraphic units. Fundamental data for sample point location include: subsurface lithology, head-differences and background geochemical conditions. Each sampling point has a proper use or uses which should be documented at a level which is appropriate for the program's data quality objectives. Individual sampling points may not always be able to fulfill multiple monitoring objectives (e.g., detection, assessment, corrective action).

1) Compatibility with Monitoring Program and Data Quality Objectives

Specifics of sampling point location and design will be dictated by the complexity of subsurface lithology and variability in contaminant and/or geochemical conditions. It should be noted that, regardless of the ground-water sampling approach, few sampling points (e.g., wells, drive-points, screened augers) have zones of influence in excess of a few feet. Therefore, the spatial frequency of sampling points should be carefully selected and designed.

2) Flexibility of Sampling Point Design

In most cases *well-point* diameters in excess of 1 7/8 inches will permit the use of most types of submersible pumping devices for low-flow (minimal drawdown) sampling. It is suggested that *short* (e.g., less than 1.6 m) screens be incorporated into the monitoring design where possible so that comparable results from one device to another might be expected. *Short*, of course, is relative to the degree of vertical water quality variability expected at a site.

3) Equilibration of Sampling Point

Time should be allowed for equilibration of the well or sampling point with the formation after installation. Placement of well or sampling points in the subsurface produces some disturbance of ambient conditions. Drilling techniques (e.g., auger, rotary, etc.) are generally considered to cause more disturbance than *direct-push* technologies. In either case, there may be a period (i.e., days to months) during which water quality near the point may be distinctly different from that in the formation. Proper development of the sampling point and adjacent formation to remove fines created during emplacement will shorten this water quality *recovery* period.

III. Definition of Low-Flow Purging and Sampling

It is generally accepted that water in the well casing is non-representative of the formation water and needs to be purged prior to collection of ground-water samples. However, the water in the screened interval may indeed be representative of the formation, depending upon well construction and site hydrogeology. Wells are purged to some extent for the following reasons: the presence of the air interface at the top of the water column resulting in an oxygen concentration gradient with depth, loss of volatiles up the water column, leaching from or sorption to the casing or filter pack, chemical changes due to clay seals or backfill, and surface infiltration.

Low-flow purging, whether using portable or dedicated systems, should be done using pump-intake located in the middle or slightly above the middle of the screened interval. Placement of the pump too close to the bottom of the well will cause increased entrainment of solids which have collected in the well over time. These particles are present as a result of well development, prior purging and sampling events, and natural colloidal transport and deposition. Therefore, placement of the pump in the middle or toward the top of the screened interval is suggested. Placement of the pump at the top of the water column for sampling is only recommended in unconfined aquifers, screened across the water table, where this is the desired sampling point. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval.

A. Low-Flow Purging and Sampling

Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen. It does not necessarily refer to the flow rate of water discharged at the surface which can be affected by flow regulators or restrictions. Water level drawdown provides the best indication of the stress imparted by a given flow-rate for a given hydrological situation. The objective is to pump in a manner that minimizes stress (drawdown) to the system to the extent practical taking into account established site sampling objectives. Typically, flow rates on the order of 0.1 - 0.5 L/min are used, however this is dependent on site-specific hydrogeology. Some extremely coarse-textured formations have been successfully sampled in this manner at flow rates to 1 L/min. The effectiveness of using low-flow purging is intimately linked with proper screen location, screen length, and well construction and development techniques. The reestablishment of natural flow paths in both the vertical and horizontal directions is important for correct interpretation of the data. For high resolution sampling needs, screens less than 1 m should be used. Most of the need for purging has been found to be due to passing the sampling device through the overlying casing water which causes mixing of these stagnant waters and the dynamic waters within the screened interval. Additionally, there is disturbance to suspended sediment collected in the bottom of the casing and the displacement of water out into the formation immediately adjacent to the well screen. These disturbances and impacts can be avoided using dedicated sampling equipment, which precludes the need to insert the sampling device prior to purging and sampling.

Isolation of the screened interval water from the overlying stagnant casing water may be accomplished using low-flow minimal drawdown techniques. If the pump intake is located within the screened interval, most of the water pumped will be drawn in directly from the formation with little mixing of casing water or disturbance to the sampling zone. However, if the wells are not constructed and developed properly, zones other than those intended may be sampled. At some sites where geologic heterogeneities are sufficiently different within the screened interval, higher conductivity zones may be preferentially sampled. This is another reason to use shorter screened intervals, especially where high spatial resolution is a sampling objective.

B. Water Quality Indicator Parameters

It is recommended that water quality indicator parameters be used to determine purging needs prior to sample collection in each well. Stabilization of parameters such as pH, specific conductance, dissolved oxygen, oxidation-reduction potential, temperature and turbidity should be used to determine when formation water is accessed during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by oxidation-reduction potential, dissolved oxygen and turbidity. Temperature and pH, while commonly used as purging indicators, are actually quite insensitive in distinguishing between formation water and stagnant casing water; nevertheless, these are important parameters for data interpretation purposes and should also be measured. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. Instruments are available which utilize in-line flow cells to continuously measure the above parameters.

It is important to establish specific well stabilization criteria and then consistently follow the same methods thereafter, particularly with respect to drawdown, flow rate and sampling device. Generally, the time or purge volume required for parameter stabilization is independent of well depth or well volumes. Dependent variables are well diameter, sampling device, hydrogeochemistry, pump flow rate, and whether the devices are used in a portable or dedicated manner. If the sampling device is already in place (i.e., dedicated sampling systems), then the time and purge volume needed for stabilization is much shorter. Other advantages of dedicated equipment include less purge water for waste disposal, much less decontamination of equipment, less time spent in preparation of sampling as well as time in the field, and more consistency in the sampling approach which probably will translate into less variability in sampling results. The use of dedicated equipment is strongly recommended at wells which will undergo routine sampling over time.

If parameter stabilization criteria are too stringent, then minor oscillations in indicator parameters may cause purging operations to become unnecessarily protracted. It should also be noted that turbidity is a very conservative parameter in terms of stabilization. Turbidity is always the last parameter to stabilize. Excessive purge times are invariably related to the establishment of too stringent turbidity stabilization criteria. It should be noted that natural turbidity levels in ground water may exceed 10 nephelometric turbidity units (NTU).

C. Advantages and Disadvantages of Low-Flow (Minimum Drawdown) Purging

In general, the advantages of low-flow purging include:

- samples which are representative of the *mobile* load of contaminants present (dissolved and colloid-associated);
- minimal disturbance of the sampling point thereby minimizing sampling artifacts;
- less operator variability, greater operator control;

- reduced stress on the formation (minimal drawdown);
- less mixing of stagnant casing water with formation water;
- reduced need for filtration and, therefore, less time required for sampling;
- smaller purging volume which decreases waste disposal costs and sampling time;
- better sample consistency; reduced artificial sample variability.

Some disadvantages of low-flow purging are:

- higher initial capital costs,
- greater set-up time in the field,
- need to transport additional equipment to and from the site,
- increased training needs,
- resistance to change on the part of sampling practitioners,
- concern that new data will indicate a *change in conditions* and trigger an *action*.

IV. Low-Flow (Minimal Drawdown) Sampling Protocols

The following ground-water sampling procedure has evolved over many years of experience in ground-water sampling for organic and inorganic compound determinations and as such summarizes the authors' (and others) experiences to date (Barcelona et al., 1984, 1994; Barcelona and Helfrich, 1986; Puls and Barcelona, 1989; Puls et. al. 1990, 1992; Puls and Powell, 1992; Puls and Paul, 1995). High-quality chemical data collection is essential in ground-water monitoring and site characterization. The primary limitations to the collection of *representative* ground-water samples include: mixing of the stagnant casing and *fresh* screen waters during insertion of the sampling device or ground-water level measurement device; disturbance and resuspension of settled solids at the bottom of the well when using high pumping rates or raising and lowering a pump or bailer; introduction of atmospheric gases or degassing from the water during sample handling and transfer, or inappropriate use of vacuum sampling device, etc.

A. Sampling Recommendations

Water samples should not be taken immediately following well development. Sufficient time should be allowed for the ground-water flow regime in the vicinity of the monitoring well to stabilize and to approach chemical equilibrium with the well construction materials. This lag time will depend on site conditions and methods of installation but often exceeds one week.

Well purging is nearly always necessary to obtain samples of water flowing through the geologic formations in the screened interval. Rather than using a general but arbitrary guideline of purging three casing volumes prior to sampling, it is recommended that an in-line water quality measurement device (e.g., flow-through cell) be used to establish the stabilization time for several parameters (e.g. , pH, specific conductance, redox, dissolved oxygen, turbidity) on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

The following are recommendations to be considered before, during and after sampling:

- use low-flow rates (<0.5 L/min), during both purging and sampling to maintain minimal drawdown in the well;
- maximize tubing wall thickness, minimize tubing length;
- place the sampling device intake at the desired sampling point;
- minimize disturbances of the stagnant water column above the screened interval during water level measurement and sampling device insertion;
- make proper adjustments to stabilize the flow rate as soon as possible;
- monitor water quality indicators during purging;
- collect unfiltered samples to estimate contaminant loading and transport potential in the subsurface system.

B. Equipment Calibration

Prior to sampling, all sampling device and monitoring equipment should be calibrated according to manufacturer's recommendations and the site Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Calibration of pH should be performed with at least two buffers which bracket the expected range. Dissolved oxygen calibration must be corrected for local barometric pressure readings and elevation.

C. Water Level Measurement and Monitoring

It is recommended that a device be used which will least disturb the water surface in the casing. Well depth should be obtained from the well logs. Measuring to the bottom of the well casing will only cause resuspension of settled solids from the formation and require longer purging times for turbidity equilibration. Measure well depth after sampling is completed. The water level measurement should be taken from a permanent reference point which is surveyed relative to ground elevation.

D. Pump Type

The use of low-flow (e.g., 0.1-0.5 L/min) pumps is suggested for purging and sampling all types of analytes. All pumps have some limitation and these should be investigated with respect to application at a particular site. Bailers are inappropriate devices for low-flow sampling.

1) General Considerations

There are no unusual requirements for ground-water sampling devices when using low-flow, minimal drawdown techniques. The major concern is that the device give consistent results and minimal disturbance of the sample across a range of *low* flow rates (i.e., < 0.5 L/min). Clearly, pumping rates that cause minimal to no drawdown in one well could easily cause *significant* drawdown in another well finished in a less transmissive formation. In this sense, the pump should not cause undue pressure or temperature changes or physical disturbance on the water sample over a reasonable sampling range. Consistency in operation is critical to meet accuracy and precision goals.

2) Advantages and Disadvantages of Sampling Devices

A variety of sampling devices are available for low-flow (minimal drawdown) purging and sampling and include peristaltic pumps, bladder pumps, electrical submersible pumps, and gas-driven pumps. Devices which lend themselves to both dedication and consistent operation at definable low-flow rates are preferred. It is desirable that the pump be easily adjustable and operate reliably at these lower flow rates. The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and some volatiles loss. Gas-driven pumps should be of a type that does not allow the gas to be in direct contact with the sampled fluid.

Clearly, bailers and other *grab* type samplers are ill-suited for low-flow sampling since they will cause repeated disturbance and mixing of *stagnant* water in the casing and the *dynamic* water in the screened interval. Similarly, the use of inertial lift foot-valve type samplers may cause too much disturbance at the point of sampling. Use of these devices also tends to introduce uncontrolled and unacceptable operator variability.

Summaries of advantages and disadvantages of various sampling devices are listed in Herzog et al. (1991), U. S. EPA (1992), Parker (1994) and Thurnblad (1994).

E. Pump Installation

Dedicated sampling devices (left in the well) capable of pumping and sampling are preferred over <u>any</u> other type of device. Any portable sampling device should be slowly and carefully lowered to the middle of the screened interval or slightly above the middle (e.g., 1-1.5 m below the top of a 3 m screen). This is to minimize excessive mixing of the stagnant water in the casing above the screen with the screened interval zone water, and to minimize resuspension of solids which will have collected at the bottom of the well. These two disturbance effects have been shown to directly affect the time required for purging. There also appears to be a direct correlation between size of portable sampling devices relative to the well bore and resulting purge volumes and times. The key is to minimize disturbance of water and solids in the well casing.

F. Filtration

Decisions to filter samples should be dictated by sampling objectives rather than as a *fix* for poor sampling practices, and field-filtering of certain constituents should not be the default. Consideration should be given as to what the application of field-filtration is trying to accomplish. For assessment of truly dissolved (as opposed to operationally *dissolved* [i.e., samples filtered with 0.45 µm filters]) concentrations of major ions and trace metals, 0.1 µm filters are recommended although 0.45 µm filters are normally used for most regulatory programs. Alkalinity samples must also be filtered if significant particulate calcium carbonate is suspected, since this material is likely to impact alkalinity titration results (although filtration itself may alter the CO_2 composition of the sample and, therefore, affect the results).

Although filtration may be appropriate, filtration of a sample may cause a number of unintended changes to occur (e.g. oxidation, aeration) possibly leading to filtration-induced artifacts during sample analysis and uncertainty in the results. Some of these unintended changes may be unavoidable but the factors leading to them must be recognized. Deleterious effects can be minimized by consistent application of certain filtration guidelines. Guidelines should address selection of filter type, media, pore size, etc. in order to identify and minimize potential sources of uncertainty when filtering samples.

In-line filtration is recommended because it provides better consistency through less sample handling, and minimizes sample exposure to the atmosphere. In-line filters are available in both disposable (barrel filters) and non-disposable (in-line filter holder, flat membrane filters) formats and various filter pore sizes (0.1-5.0 µm). Disposable filter cartridges have the advantage of greater sediment handling capacity when compared to traditional membrane filters. Filters must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing, pass through a minimum of 1 L of ground water following purging and prior to sampling. Once filtration has begun, a filter cake may develop as particles larger than the pore size accumulate on the filter membrane. The result is that the effective pore diameter of the membrane is reduced and particles smaller than the stated pore size are excluded from the filtrate. Possible corrective measures include prefiltering (with larger pore size filters), minimizing particle loads to begin with, and reducing sample volume.

G. Monitoring of Water Level and Water Quality Indicator Parameters

Check water level periodically to monitor drawdown in the well as a guide to flow rate adjustment. The goal is minimal drawdown (<0.1 m) during purging. This goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience. In-line water quality indicator parameters should be continuously monitored during purging. The water quality indicator parameters monitored can include pH, redox potential, conductivity, dissolved oxygen (DO) and turbidity. The last three parameters are often most sensitive. Pumping rate, drawdown, and the time or volume required to obtain stabilization of parameter readings can be used as a future guide to purge the well. Measurements should be taken every three to five minutes if the above suggested rates are used. Stabilization is achieved after all parameters have stabilized for three successive readings. In lieu of measuring all five parameters, a minimum subset would include pH, conductivity, and turbidity or DO. Three successive readings should be within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox potential, and ± 10% for turbidity and DO. Stabilized purge indicator parameter trends are generally obvious and follow either an exponential or asymptotic change to stable values during purging. Dissolved oxygen and turbidity usually require the longest time for stabilization. The above stabilization guidelines are provided for rough estimates based on experience.

H. Sampling, Sample Containers, Preservation and Decontamination

Upon parameter stabilization, sampling can be initiated. If an in-line device is used to monitor water quality parameters, it should be disconnected or bypassed during sample collection. Sampling flow rate may remain at established purge rate or may be adjusted slightly to minimize aeration, bubble formation, turbulent filling of sample bottles, or loss of volatiles due to extended residence time in tubing. Typically, flow rates less than 0.5 L/min are appropriate. The same device should be used for sampling as was used for purging. Sampling should occur in a progression from least to most contaminated well, if this is known. Generally, volatile (e.g., solvents and fuel constituents) and gas sensitive (e.g., Fe^{2+}, CH_4, H_2S/HS^-, alkalinity) parameters should be sampled first. The sequence in which samples for most inorganic parameters are collected is immaterial unless filtered (dissolved) samples are desired. Filtering should be done last and in-line filters should be used as discussed above. During both well purging and sampling, proper protective clothing and equipment must be used based upon the type and level of contaminants present.

The appropriate sample container will be prepared in advance of actual sample collection for the analytes of interest and include sample preservative where necessary. Water samples should be collected directly into this container from the pump tubing.

Immediately after a sample bottle has been filled, it must be preserved as specified in the site (QAPP). Sample preservation requirements are based on the analyses being performed (use site QAPP, FSP, RCRA guidance document [U. S. EPA, 1992] or EPA SW-846 [U. S. EPA, 1982]). It may be advisable to add preservatives to sample bottles in a controlled setting prior to entering the field in order to reduce the chances of improperly preserving sample bottles or introducing field contaminants into a sample bottle while adding the preservatives.

The preservatives should be transferred from the chemical bottle to the sample container using a disposable polyethylene pipet and the disposable pipet should be used only once and then discarded.

After a sample container has been filled with ground water, a Teflon™ (or tin)-lined cap is screwed on tightly to prevent the container from leaking. A sample label is filled out as specified in the FSP. The samples should be stored inverted at 4°C.

Specific decontamination protocols for sampling devices are dependent to some extent on the type of device used and the type of contaminants encountered. Refer to the site QAPP and FSP for specific requirements.

I. Blanks

The following blanks should be collected:

(1) field blank: one field blank should be collected from each source water (distilled/deionized water) used for sampling equipment decontamination or for assisting well development procedures.

(2) equipment blank: one equipment blank should be taken prior to the commencement of field work, from each set of sampling equipment to be used for that day. Refer to site QAPP or FSP for specific requirements.

(3) trip blank: a trip blank is required to accompany each volatile sample shipment. These blanks are prepared in the laboratory by filling a 40-mL volatile organic analysis (VOA) bottle with distilled/deionized water.

V. Low-Permeability Formations and Fractured Rock

The overall sampling program goals or sampling objectives will drive how the sampling points are located, installed, and choice of sampling device. Likewise, site-specific hydrogeologic factors will affect these decisions. Sites with very low permeability formations or fractures causing discrete flow channels may require a unique monitoring approach. Unlike water supply wells, wells installed for ground-water quality assessment and restoration programs are often installed in low water-yielding settings (e.g., clays, silts). Alternative types of sampling points and sampling methods are often needed in these types of environments, because low-permeability settings may require extremely low-flow purging (<0.1 L/min) and may be technology-limited. Where devices are not readily available to pump at such low flow rates, the primary consideration is to avoid dewatering of the well screen. This may require repeated recovery of the water during purging while leaving the pump in place within the well screen.

Use of low-flow techniques may be impractical in these settings, depending upon the water recharge rates. The sampler and the end-user of data collected from such wells need to understand the limitations of the data collected; i.e., a strong potential for underestimation of actual contaminant concentrations for volatile organics, potential false negatives for filtered metals and potential false positives for unfiltered metals. It is suggested that comparisons be made between samples recovered using low-flow purging techniques and samples recovered using passive sampling techniques (i.e., two sets of samples). Passive sample collection would essentially entail acquisition of the sample with no or very little purging using a dedicated sampling system installed within the screened interval or a passive sample collection device.

A. Low-Permeability Formations (<0.1 L/min recharge)

1. Low-Flow Purging and Sampling with Pumps

a. "portable or non-dedicated mode" - Lower the pump (one capable of pumping at <0.1 L/min) to mid-screen or slightly above and set in place for minimum of 48 hours (to lessen purge volume requirements). After 48 hours, use procedures listed in Part IV above regarding monitoring water quality parameters for stabilization, etc., but do not dewater the screen. If excessive drawdown and slow recovery is a problem, then alternate approaches such as those listed below may be better.

b. "dedicated mode" - Set the pump as above at least a week prior to sampling; that is, operate in a dedicated pump mode. With this approach significant reductions in purge volume should be realized. Water quality parameters should stabilize quite rapidly due to less disturbance of the sampling zone.

2. Passive Sample Collection

Passive sampling collection requires insertion of the device into the screened interval for a sufficient time period to allow flow and sample equilibration before extraction for analysis. Conceptually, the extraction of water from low yielding formations seems more akin to the collection of water from the unsaturated zone and passive sampling techniques may be more appropriate in terms of obtaining "representative" samples. Satisfying usual sample volume requirements is typically a problem with this approach and some latitude will be needed on the part of regulatory entities to achieve sampling objectives.

B. Fractured Rock

In fractured rock formations, a low-flow to zero purging approach using pumps in conjunction with packers to isolate the sampling zone in the borehole is suggested. Passive multi-layer sampling devices may also provide the most "representative" samples. It is imperative in these settings to identify flow paths or water-producing fractures prior to sampling using tools such as borehole flowmeters and/or other geophysical tools.

After identification of water-bearing fractures, install packer(s) and pump assembly for sample collection using low-flow sampling in "dedicated mode" or use a passive sampling device which can isolate the identified water-bearing fractures.

VI. Documentation

The usual practices for documenting the sampling event should be used for low-flow purging and sampling techniques. This should include, at a minimum: information on the conduct of purging operations (flow-rate, drawdown, water-quality parameter values, volumes extracted and times for measurements), field instrument calibration data, water sampling forms and chain of custody forms. See Figures 2 and 3 and "Ground Water Sampling Workshop -- A Workshop Summary" (U. S. EPA, 1995) for example forms and other documentation suggestions and information. This information coupled with laboratory analytical data and validation data are needed to judge the "useability" of the sampling data.

VII. Notice

The U.S. Environmental Protection Agency through its Office of Research and Development funded and managed the research described herein as part of its in-house research program and under Contract No. 68-C4-0031 to Dynamac Corporation. It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

VIII. References

Backhus, D,A., J.N. Ryan, D.M. Groher, J.K. McFarlane, and P.M. Gschwend. 1993. Sampling Colloids and Colloid-Associated Contaminants in Ground Water. *Ground Water*, 31(3):466-479.

Barcelona, M.J., J.A. Helfrich, E.E. Garske, and J.P. Gibb. 1984. A laboratory evaluation of groundwater sampling mechanisms. *Ground Water Monitoring Review*, 4(2):32-41.

Barcelona, M.J. and J.A. Helfrich. 1986. Well construction and purging effects on ground-water samples. *Environ. Sci. Technol.,* 20(11):1179-1184.

Barcelona, M.J., H.A. Wehrmann, and M.D. Varljen. 1994. Reproducible well purging procedures and VOC stabilization criteria for ground-water sampling. *Ground Water*, 32(1):12-22.

Buddemeier, R.W. and J.R. Hunt. 1988. Transport of Colloidal Contaminants in Ground Water: Radionuclide Migration at the Nevada Test Site. *Applied Geochemistry*, 3: 535-548.

Danielsson, L.G. 1982. On the Use of Filters for Distinguishing Between Dissolved and Particulate Fractions in Natural Waters. *Water Research*, 16:179.

Enfield, C.G. and G. Bengtsson. 1988. Macromolecular Transport of Hydrophobic Contaminants in Aqueous Environments. *Ground Water,* 26(1): 64-70.

Gschwend, P.M. and M.D. Reynolds. 1987. Monodisperse Ferrous Phosphate Colloids in an Anoxic Groundwater Plume, *J. of Contaminant Hydrol.,* 1: 309-327.

Herzog, B., J. Pennino, and G. Nielsen. 1991. Ground-Water Sampling. In **Practical Handbook of Ground-Water Monitoring** (D.M. Nielsen, ed.). Lewis Publ., Chelsea, MI, pp. 449-499.

Horowitz, A.J., K.A. Elrick, and M.R. Colberg. 1992. The effect of membrane filtration artifacts on dissolved trace element concentrations. *Water Res.,* 26(6):753-763.

Laxen, D.P.H. and I.M. Chandler. 1982. Comparison of Filtration Techniques for Size Distribution in Freshwaters. *Analytical Chemistry*, 54(8):1350.

McCarthy, J.F. and J.M. Zachara. 1989. Subsurface Transport of Contaminants, *Environ. Sci. Technol.*, 5(23):496-502.

McCarthy, J.F. and C. Degueldre. 1993. Sampling and Characterization of Colloids and Ground Water for Studying Their Role in Contaminant Transport. In: Environmental Particles (J. Buffle and H.P. van Leeuwen, eds.), Lewis Publ., Chelsea, MI, pp. 247-315.

Parker, L.V. 1994. The Effects of Ground Water Sampling Devices on Water Quality: A Literature Review. *Ground Water Monitoring and Remediation*, 14(2):130-141.

Penrose, W.R., W.L. Polzer, E.H. Essington, D.M. Nelson, and K.A. Orlandini. 1990. Mobility of Plutonium and Americium through a Shallow Aquifer in a Semiarid Region, *Environ. Sci. Technol.*, 24:228-234.

Puls, R.W. and M.J. Barcelona. 1989. Filtration of Ground Water Samples for Metals Analyses. *Hazardous Waste and Hazardous Materials,* 6(4):385-393.

Puls, R.W., J.H. Eychaner, and R.M. Powell. 1990. Colloidal-Facilitated Transport of Inorganic Contaminants in Ground Water: Part I. Sampling Considerations. EPA/600/M-90/023, NTIS PB 91-168419.

Puls, R.W. 1990. Colloidal Considerations in Groundwater Sampling and Contaminant Transport Predictions. *Nuclear Safety*, 31(1):58-65.

Puls, R.W. and R.M. Powell. 1992. Acquisition of Representative Ground Water Quality Samples for Metals. *Ground Water Monitoring Review,* 12(3):167-176.

Puls, R.W., D.A. Clark, B.Bledsoe, R.M. Powell, and C.J. Paul. 1992. Metals in Ground Water: Sampling Artifacts and Reproducibility. *Hazardous Waste and Hazardous Materials*, 9(2): 149-162.

Puls, R.W. and C.J. Paul. 1995. Low-Flow Purging and Sampling of Ground-Water Monitoring Wells with Dedicated Systems. *Ground Water Monitoring and Remediation,* 15(1):116-123.

Ryan, J.N. and P.M. Gschwend. 1990. Colloid Mobilization in Two Atlantic Coastal Plain Aquifers. *Water Resour. Res.*, 26: 307-322.

Thurnblad, T. 1994. Ground Water Sampling Guidance: Development of Sampling Plans, Sampling Protocols, and Sampling Reports. Minnesota Pollution Control Agency.

U. S. EPA. 1992. RCRA Ground-Water Monitoring: Draft Technical Guidance. Office of Solid Waste, Washington, DC EPA/530/R-93/001, NTIS PB 93-139350.

U. S. EPA. 1995. Ground Water Sampling Workshop -- A Workshop Summary, Dallas, TX, November 30 - December 2, 1993. EPA/600/R-94/205, NTIS PB 95-193249, 126 pp.

U. S. EPA. 1982. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA SW-846. Office of Solid Waste and Emergency Response, Washington, D.C.

Figure 2. **Ground Water Sampling Log**

Project ________________ **Site** ________________ **Well No.** ______________ **Date** ___________________________

Well Depth _____________ **Screen Length** ___________ **Well Diameter** __________ **Casing Type** _____________

Sampling Device ________________ **Tubing type** _______________________ **Water Level** ___________________

Measuring Point ____________________ **Other Infor** ____

____

Sampling Personnel ____

Time	pH	Temp	Cond.	Dis.O_2	Turb.	[ ]Conc			Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi\ r^3$

Figure 3. **Ground Water Sampling Log** (with automatic data logging for most water quality parameters)

Project ________________ **Site** ________________ **Well No.** ______________ **Date** __________________________
Well Depth _____________ **Screen Length** ___________ **Well Diameter** __________ **Casing Type** ____________
Sampling Device ________________ **Tubing type** ______________________ **Water Level** __________________
Measuring Point ____________________ **Other Infor** ____
____
Sampling Personnel ____

Time	Pump Rate	Turbidity	Alkalinity	[ ] Conc	Notes

Type of Samples Collected

____

Information: 2 in = 617 ml/ft, 4 in = 2470 ml/ft: $Vol_{cyl} = \pi r^2 h$, $Vol_{sphere} = 4/3\pi\ r^3$

Appendix E

Explosive Gas Monitoring Plan

Explosive Gas Monitoring Plan
American Environmental Landfill

American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

INDEX AND CERTIFICATION PAGE

REPORT INDEX

CERTIFICATION

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

Prepared by:

FLOYD E.
COTTER

5/30/24

Floyd Cotter, PE
SCS Engineers

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Tables

1.0 INTRODUCTION

1.1 SITE LOCATION

The American Environmental Landfill (AEL) is an active municipal solid waste landfill owned and operated by American Environmental Landfill, Inc. The AEL is located near Sand Springs, Oklahoma in Sections 35 and 36, Township 20 North, Range 10 East in Osage County, Oklahoma. The project site is on the Wekiwa Oklahoma 7.5 Minute USGS Quadrangle map. AEL is bordered by the Arkansas River to the South (Figure 1). The AEL operates under the Oklahoma Department of Environmental Quality (ODEQ) Permit Number 3557021.

1.2 FACILITY BACKGROUND

The AEL was issued Permit No. 3557021 by the Oklahoma Department of Environmental Quality (ODEQ). ODEQ authorized the permit for the AEL to operate as a Subtitle D facility. The existing permit boundary contains approximately 222 acres. The proposed horizontal expansion consists of approximately 203 acres and will increase the permit boundary to 425 acres. The AEL consists of two existing landfill areas. Existing Phases I, II, III, V, and VI consist of approximately 58.76 acres of Subtitle D composite liner area. Phase IV Landfill Expansion area located west of the Existing Phases I, II, III, IV, and V consists of approximately 64.0 acres of Subtitle D composite liner area.

1.3 SITE GEOLOGY

Information regarding the site geology and the site hydrogeology can be found in the *Hydrogeologic and Geotechnical Investigation*, prepared by SCS Engineers and dated August 2023.

1.4 PURPOSE

This plan is intended to provide guidance for explosive gas monitoring at the AEL to avoid adverse gas-related environmental impacts and potential hazards to public health and safety. The plan has been prepared in general accordance with the Oklahoma Administrative Code (OAC) 252:515-15-3(a).

2.0 EXPLOSIVE GAS OVERVIEW

The decomposition of encapsulated solid waste within a landfill is known to produce landfill gas (LFG), typically consisting of approximately 50% methane (CH4) and 50% carbon dioxide (CO2). Trace amounts of non-methane organic compounds (NMOCs), oxygen, hydrogen sulfide, and reactive organic gases are also present (*Engineering and Design Landfill off-Gas Collection and Treatment Systems*, U.S. Army Corps of Engineers, 1995).

As LFG is generated, the pressure within the landfill builds until an equilibrium is reached between the quantity of LFG being generated and the quantity leaving the landfill. The increased pressure within the landfill provides the main source of energy for LFG migration along pressure gradients through preferential pathways.

LFG can present several problems or hazards, including the potential for explosion or fire, odor, toxic trace gases, vegetation stress, and asphyxiation. Of these, the main hazard associated with LFG is the potential for fire or explosion. Explosive gas monitoring is performed to protect lives and property from the hazards associated with LFG migration.

3.0 REGULATORY FRAMEWORK

OAC 252:515-15 requires that the AEL submit an Explosive Gas Monitoring Plan to be approved by the ODEQ. The plan should detail how the landfill plans to maintain compliance with the methane concentration limit set in OAC 252:515-15-2.

Per OAC 252:515-15-2, the concentration of methane gas generated by the facility shall not exceed twenty-five percent (25%) of the lower explosive limit (LEL) for methane in all structures within the permit boundary (excluding gas control or recovery system components) or exceed the LEL for methane at the permit boundary. The LEL is defined as the lowest percent by volume of a mixture of explosive gases in the air that will propagate a flame at 25°C and atmospheric pressure. The LEL for methane is 5% by volume in air. The allowable percentages of LEL and the equivalent explosive gas level concentrations are listed in the following table:

Table 1. Maximum Allowable Explosive Gas Concentrations

Location	Maximum Allowable % of LEL	Equivalent Methane Concentration in Air (% vol)
Facility Structures	25	1.25
Property Boundary	100	5.0

At the AEL, routine sampling of gas monitoring probes is conducted on a quarterly basis in accordance with OAC 252:515-15-3(c). The monitoring frequency may increase if deemed necessary by the AEL or ODEQ.

4.0 EXPLOSIVE GAS MONITORING

An explosive gas monitoring program has been implemented in order to comply with ODEQ regulations. The routine monitoring program includes monitoring of the gas monitoring probes and the structures within the permit boundary. The following sections outline the explosive gas monitoring program, including the gas monitoring probe network, monitoring equipment, monitoring procedures, the monitoring of structures, gas monitoring probe inspection and maintenance, and recordkeeping.

4.1 EXPLOSIVE GAS MONITORING PROBE NETWORK

The existing explosive gas monitoring system at the AEL consists of 33 gas monitoring probes; a summary is located in Table 2. Upon approval of the proposed horizontal expansion, twenty-eight existing gas monitoring probes (GP-1, GP-2, GP-3, GP-4, GP-5, GP-6, GP-7, GP-8, GP-9, GP-10, GP-11, GP-12, GP-13, GP-13a, GP-14, GP-15, GP-16, GP-17, GP-18, GP-19, GP-20, GP-21, GP-22, GP-28, GP-29, GP-30, GP-31, and GP-32) will remain in place, five existing gas probes will be decommissioned (GP-23, GP-24, GP-25, GP-26, and GP-27), and twenty-one additional gas probes (GP-23A, GP-24A, GP-25A, GP-26A, GP-27A, GP-33, GP-34, GP-35, GP-36, GP-37, GP-38, GP-39, GP-40, GP-41, GP-42, GP-43, GP-44, GP-45, GP-46, GP-47, GP-48 and GP-49) will be installed to the deepest placement of waste (708.31 msl), ranging in depth from 14.8-feet to 154.7-feet below ground surface (bgs). Gas monitoring probes will be installed and decommissioned in accordance with the Oklahoma Water Resources Board (OWRB) requirements detailed in OAC 785:35. Within 90 days of installation, as-built drawings of new probes shall be submitted to the ODEQ to demonstrate the probes were installed in accordance with OAC 252:515-15-4. New gas monitoring probes shall be constructed in general accordance with the permit detail drawings and the information provided in Table 2.

For the proposed gas monitoring probe network, all gas monitoring probes are located within the permit boundary of the AEL except gas probes GP-41 through GP-43. Gas monitoring probes 41-43 are proposed to be located north of the North Stormwater Detention Structure. Because the stormwater detention structure is continuous with the perimeter road, the location of monitoring probes or wells in this area would pose a safety issue. Therefore, locating these gas probes north of the stormwater detention structure is necessary. Gas monitoring probes GP-1, GP-2, GP-3, GP-4, GP-5, GP-6, GP-8, GP-9, GP-10, GP-11, GP-12, GP-13, GP-13a, and GP-15 are existing gas monitoring probes located along the entire permit boundary of the Existing Phases I, II, III, V, and VI. GP-16, GP-17, GP-18, GP-19, GP-20, GP-21, GP-22, GP-23, GP-24, GP-25, GP-26, GP-27, GP-28, GP-29, GP-30, GP-31, and GP-32 are existing gas monitoring probes located along the entire permit boundary of Phase IV Expansion Area. GP-14 is shared between the western edge of the Existing Phase VI and the eastern edge of the Phase IV Expansion Area. GP-23A, GP-24A, GP-25A, GP-26A, GP-27A, GP-33, GP-34, GP-35, GP-36, GP-37, GP-38, GP-39, GP-40, GP-41, GP-42, GP-43, GP-44, GP-45, GP-46, GP-47, GP-48, and GP-49 are proposed gas monitoring probes located along the northern, western, eastern, and southern boundaries of the proposed expansion area. A summary of the proposed gas monitoring probe network can be found in Table 3. The locations of existing and proposed gas monitoring probes are shown in Figure 2.

4.2 MONITORING EQUIPMENT

A Landtec GEM-5000 is used to measure the concentration of methane in the gas monitoring probes and structures within the permit boundary. The instrument is capable of sampling in an oxygen-deficient atmosphere. This type of instrument employs a meter calibrated to methane and is capable of measuring oxygen, methane, carbon dioxide, and balance gas. The instrument is operated and calibrated according to the manufacturer's instructions. Equivalent equipment may be used in place of the Landtec GEM-5000 and will be used in accordance with the manufacturer's recommendations.

4.3 MONITORING PROCEDURES

Sampling of the gas monitoring probes and structures within the permit boundary are conducted in accordance with ODEQ regulations. A properly calibrated Landtec GEM-5000 (or equivalent) is used during quarterly monitoring events to sample each perimeter gas probe and structures within the permit boundary. The equipment is connected to the sampling port and a sample is continuously collected until the composition of the gas sample stabilizes. Once the gas composition stabilizes, the reading will be recorded. AEL records the methane concentration at each gas monitoring probe and structure within the permit boundary and files the results within the site's operating record.

4.4 GAS MONITORING PROBE INSPECTION AND MAINTENANCE

During each explosive gas monitoring event, the integrity of the gas monitoring probes will be evaluated. Each gas monitoring probe will be inspected for the following:

- Probe number is clearly labeled and permanently affixed to the outer casing
- Latitude, longitude, and surface elevation is permanently affixed to the outer casing
- Protective casing is intact, straight, and not excessively corroded
- Concrete pad is intact and free of sediment
- Functional padlock
- Inner casing is intact and properly capped

If damage or excessive wear to a gas monitoring probe is observed during routine inspection and maintenance, an attempt will be made to mitigate or repair that probe in a timely fashion. If necessary, the damaged gas monitoring probe will be decommissioned and replaced with a new monitoring probe. Gas monitoring probes will be decommissioned in accordance with OWRB requirements detailed in OAC 785:35.

4.5 RECORDKEEPING

Results of quarterly sampling events shall be maintained in the site's operating record. If gas levels exceed the regulatory limits, the AEL shall implement the steps outlined in Section 5.0.

5.0 CONTINGENCY PLAN

If methane gas levels exceed regulatory limits, the AEL will implement a contingency plan to control off-site migration or to prevent continued migration into on-site structures. This will be conducted in accordance with OAC 252:515-15-5.

5.1 IMMEDIATE ACTIONS

Upon initial detection of methane gas concentrations exceeding the regulatory limit in the soil at the property boundary, the ODEQ will be notified immediately and the AEL staff will immediately take the necessary steps to protect public health and safety.

Upon completion of the required activities and no later than seven days from initial detection, a report describing the steps taken to protect public health and safety will be submitted to the ODEQ.

5.2 CORRECTIVE ACTION

After the immediate safety issues have been addressed as described above, the AEL personnel will begin focusing on corrective action to address a long-term remedy to control methane migration. This action will be taken in accordance with ODEQ consultation, rules, and regulations. Within 30 days of detection, a remediation plan describing the nature and extent of the problem and the proposed remedy will be submitted to the ODEQ.

The approved remediation plan shall be implemented within 60 days of the initial detection. An alternate schedule for corrective actions may be acceptable if approved by the ODEQ.

6.0 GENERAL COMMENTS AND CONCLUSIONS

SCS Engineers obtained general site information and information on the explosive gas monitoring system through files made available by the AEL.

TABLES AND FIGURES

Table 2. Existing Gas Monitoring Well Network Summary

Monitoring Well ID	Northing	Easting	Surface Elevation (ft MSL)	Monitoring Well ID	Northing	Easting	Surface Elevation (ft MSL)
GP-1	428331.68	2505735.44	805.7	GP-17	428168.25	2502935.52	799.6
GP-2	428880.64	2505673.92	802.0	GP-18	427697.55	2502826.60	772.4
GP-3	429383.90	2505545.66	777.8	GP-19	427690.55	2502326.70	765.8
GP-4	429434.46	2504990.69	777.0	GP-20	427684.05	2501824.94	740.2
GP-5	429390.27	2504588.76	776.2	GP-21	427677.51	2501326.21	734.3
GP-6	429380.83	2503928.48	765.2	GP-22	427664.27	2500827.16	726.5
GP-8	428597.87	2503763.94	776.8	GP-23	427939.21	2500402.37	728.9
GP-9	428099.71	2503757.46	780.0	GP-24	428937.93	2500286.55	745.2
GP-10	428089.90	2504338.53	800.9	GP-25	429930.40	2500399.00	754.3
GP-11	428095.78	2504840.35	806.0	GP-26	429988.60	2500883.00	783.5
GP-12	428099.37	2505350.59	824.8	GP-27	429982.72	2501389.48	889.8
GP-13	429373.70	2503723.00	768.4	GP-28	429622.92	2501751.77	898.2
GP-13a	429356.50	2503378.00	766.3	GP-29	429902.58	2502166.80	802.3
GP-14	429013.80	2503016.00	792.9	GP-30	430020.23	2502639.48	770.0
GP-15	428708.70	2503282.00	788.0	GP-31	429685.45	2503015.20	754.0
GP-16	428593.17	2502983.93	809.8	GP-32	429363.37	2502996.91	765.4

Table 3. Proposed Gas Monitoring Probe Network Summary

Monitoring Probe ID	Northing	Easting	Surface Elevation (MSL)	Top of Casing Elevation (MSL)	Total Depth (FT)	Screen	
						Top (MSL)	Bottom (MSL)
GP-23A	427665.50	2500326.68	719.8	722.8	14.8	714.8	705
GP-24A	427664.30	2499826.68	724.3	727.3	16.3	719.3	708
GP-25A	427663.09	2499326.68	738.8	741.8	26.5	733.8	712
GP-26A	427661.89	2498826.69	765.2	768.2	46.0	760.2	719
GP-27A	427660.69	2498326.69	752.1	755.1	43.1	747.1	709
GP-33	427659.49	2497826.69	743.6	746.6	38.6	738.6	705
GP-34	428127.73	2497795.00	757.2	760.2	22.8	752.2	734
GP-35	428627.73	2497795.00	774.4	777.4	29.3	769.4	745
GP-36	429127.73	2497795.00	820.1	823.1	73.3	815.1	747
GP-37	429627.73	2497795.00	789.2	792.2	31.0	784.2	758
GP-38	430012.25	2498082.56	810.5	813.5	18.8	805.5	792
GP-39	430373.37	2498428.38	834.8	837.8	56.5	829.8	778
GP-40	430766.12	2498719.15	823.0	826.0	49.6	818.0	773
GP-41	431169.54	2498835.98	837.3	840.3	62.3	842.3	775
GP-42	431178.88	2499315.89	897.0	900.0	122.0	892.0	775
GP-43	431188.21	2499795.80	861.8	864.8	86.8	856.9	775
GP-44	430943.10	2500105.80	850.5	853.5	75.9	845.5	775
GP-45	430955.46	2500605.63	837.8	840.8	71.1	832.8	767
GP-46	430973.52	2501105.31	869.8	872.8	109.4	864.8	760
GP-47	430991.58	2501604.98	842.0	845.0	87.0	837.0	755
GP-48	430621.35	2501729.59	896.7	899.7	145.7	891.7	751
GP-49	430121.35	2501728.85	897.7	900.7	154.7	892.7	743

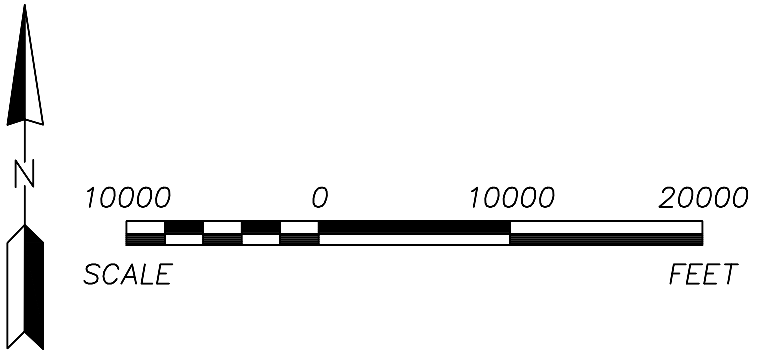
Figure 1. Site Location

LEGEND:

—·—·—·—	SOLID WASTE PERMIT BOUNDARY
🟥 ——	PROPOSED EXPANSION AREA PERMIT BOUNDARY
○	6-MILE RADIUS

NOTE:

1. APPROXIMATE 6-MILE RADIUS TAKEN FROM GOOGLE EARTH



SHEET TITLE

SITE LOCATION

PROJECT TITLE

EXPLOSIVE GAS MONITORING PLAN

CLIENT

AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

REV.	DATE	DESCRIPTION	CK. BY
△			
△			
△			
△			
△			
△			

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27220345.00	DWN. BY: TWL	Q/A RVW BY: WJM
DSN. BY: TWL	CHK. BY: CF	PROJ. MGR. WJM

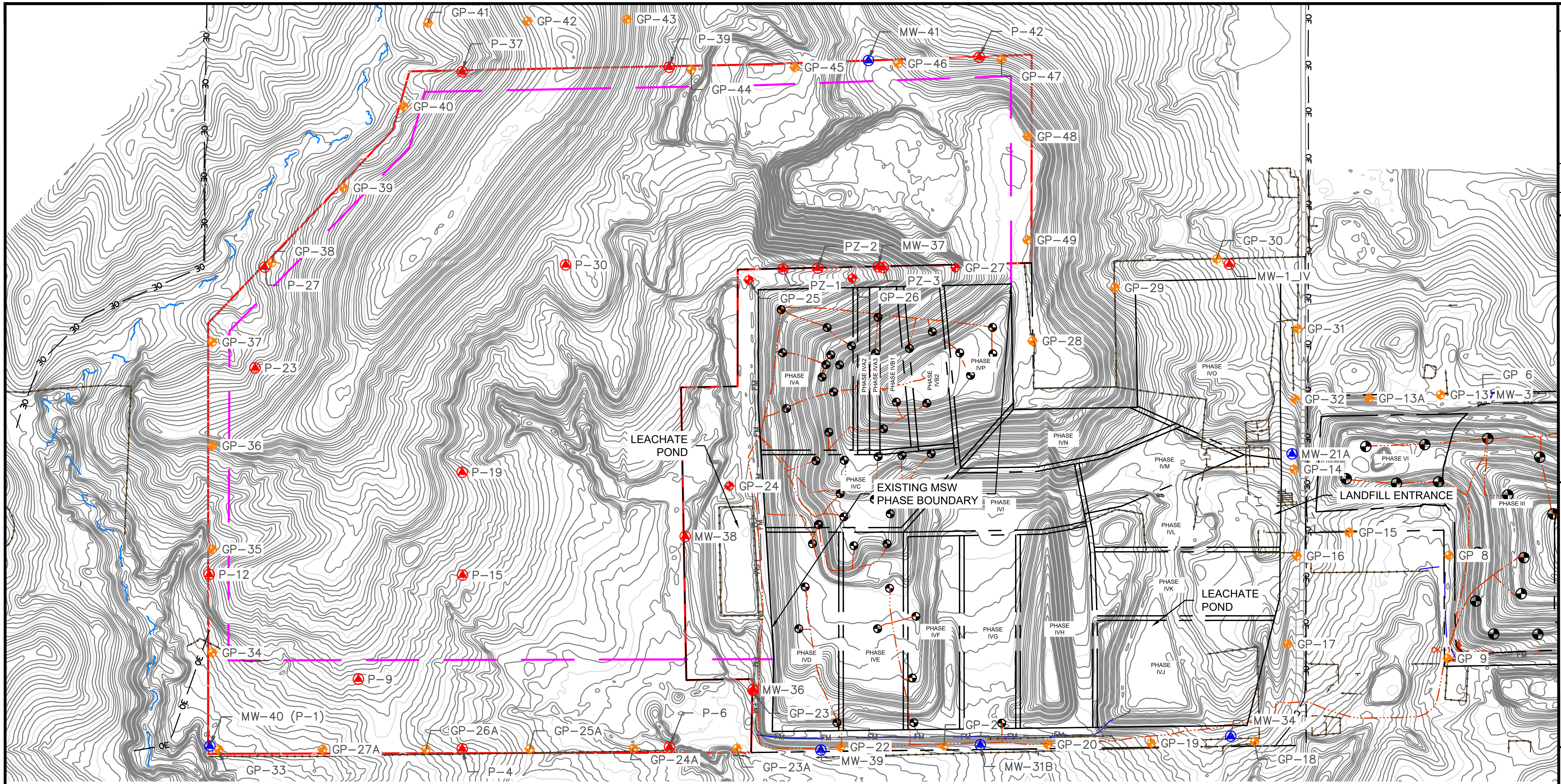
CADD FILE: EXPLOSIVE GAS MONITORING NETWORK.DWG

DATE: 12/11/23

SCALE: 1"=10,000'

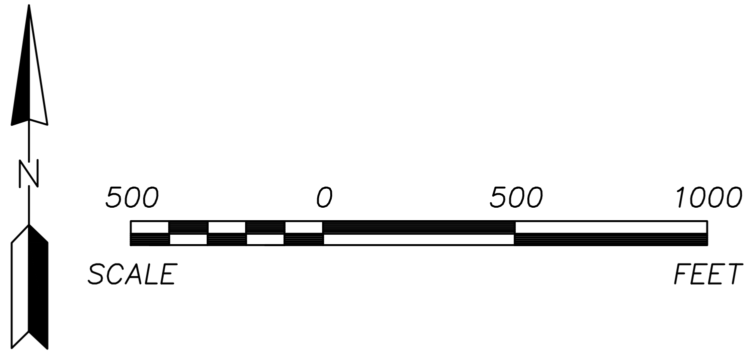
DRAWING NO. 1 of 2

Figure 2. Proposed Explosive Gas Monitoring System



LEGEND:

	EXISTING 2' MINOR CONTOUR		LANDFILL GAS COLLECTION SYSTEM PIPING
1570	EXISTING 10' MAJOR CONTOUR		EXTRACTION WELL
	EXISTING FENCE		GAS PROBE
OE — OE	EXISTING OVERHEAD ELECTRIC		MONITORING WELL
	EXISTING UNPAVED ROAD		MONITORING WELL ABANDONMENT
	EXISTING PAVED ROAD		GAS PROBE ABANDONMENT
	EXISTING BODY OF WATER		PROPOSED EXPANSION AREA PERMIT BOUNDARY
	SOLID WASTE PHASE BOUNDARY		PROPOSED LIMITS OF WASTE
	SOLID WASTE PERMIT BOUNDARY		EXISTING STREAM
	ELECTRICAL CONDUIT		
FM — FM	LEACHATE FORCEMAIN		



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SHEET TITLE
PROPOSED EXPLOSIVE GAS MONITORING SYSTEM

PROJECT TITLE
EXPLOSIVE GAS MONITORING PLAN

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

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PROJ. NO. 27220345.00	DWN. BY: TWL	Q/A RVW BY: WJM
DSN. BY: TWL	CHK. BY: CF	PROJ. MGR WJM

CADD FILE:
EXPLOSIVE GAS MONITORING NETWORK.DWG

DATE:
12/11/23

SCALE:
1"=500'

DRAWING NO.
2 of 2

Appendix F

Surface Water System Design Report

Stormwater Design System Report
American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

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CERTIFICATION

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

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FLOYD E.
COTTER
17783

5/30/24

Floyd Cotter, PE
SCS Engineers

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1.0 INTRODUCTION

The American Environmental Landfill (AEL) permit boundary contains approximately 222 acres. Approximately 150 acres have been developed for municipal solid waste disposal. The lateral expansion consists of approximately 203 acres and proposes to increase the permit boundary to 425 acres.

The following stormwater design incorporates the additional stormwater runoff created by the expansion and the necessary stormwater management components for a 25-year, 24-hour storm event. The stormwater structures are proposed to route stormwater from the landfill surface to either an outfall or a stormwater detention structure.

There are two stormwater detention structures proposed for the AEL. A North Stormwater Detention Structure and a South Stormwater Detention Structure are proposed to allow for the discharge of stormwater to impaired waterbodies. These stormwater detention structures allow for a settling period, to achieve the quality of stormwater as set by the 2022 OKR05 General Permit, by discharging stormwater through a perforated riser. The stormwater detention structures are designed to discharge typical stormwater events (25-year, 24-hour storm event) through a perforated riser. Secondary discharge structures associated with the stormwater detention ponds were designed to discharge stormwater from a 100-year, 24-hour storm event while maintaining minimum freeboard requirements.

2.0 METHODS

2.1 STORMWATER CONTROL STRUCTURES

The SCS TR-55 Hydrology Method, the SCS TR-55 Time of Concentration Method, and Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2020 were used to model the surface water flow for the landfill. Manning's Roughness Coefficients for TR-55 calculations were obtained from the database associated with the software.

A 25-year, 24-hour storm event was utilized to calculate peak flow for terraces, letdown channels, and perimeter channels. Stormwater control structures have been designed with approximate slopes of 1.0 percent, 25 percent, and 1.0 percent for terraces, letdown channels, and perimeter channels, respectively. Based on the subsurface investigation, borrow areas of the AEL consist of multiple Hydrologic Soil Groups. To produce a conservative result, the soils used for stormwater control structures, intermediate and final cover were assumed to be in the D group in fair condition (CN=84).

Worst-case scenario sub-basins were identified for terrace and letdown sizing by identifying the largest area draining to an individual stormwater structure. Therefore, all terraces and letdowns are sized the same. The perimeter channels were sized individually based on the area draining to each structure.

2.2 STORMWATER QUALITY STRUCTURES

A 100-year, 24-hour storm event was utilized to calculate peak flow into the stormwater detention structures via the perimeter channels. The South Detention structure is proposed to be constructed prior to landfill development. Therefore, the expansion area and its resulting final cover were analyzed at two different scenarios. Scenario 1 assumes that the South Detention Structure was constructed before stormwater control structures were established in the expansion area (current condition) while Scenario 2 analyses the resulting watershed when stormwater control structures are established. To produce a conservative result, the soils encountered as part of the expansion area's current condition were assumed to be in the C group in fair condition (CN=79). Once landfill development is complete, the analysis was repeated assuming all cover soil will be in the D group in fair condition (CN=84).

Worst-case scenario sub-basins were identified for sizing of stormwater detention structures and their respective discharge structures. Therefore, the South Detention Structure is sized based on the drainage area at the current condition while the North Detention Structure is sized based on the final cover conditions at the landfill.

Per OWRB, 785:25-3-1, *Dams which are or will be 25-feet or more in height from the natural bed of the stream or watercourse at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier if it is not across a stream channel or watercourse, to the top of the dam; or Dams which have or will have an impounding capacity of 50-acre-feet or more are subject to the OWRB's jurisdiction.*

The North Stormwater Detention Structure's dam is 19 feet in height and has an impounding capacity of 44.4 Acre-feet. Therefore, the North Stormwater Detention Structure is not regulated by the OWRB. The North Stormwater Detention Structure's spillway is capable of discharging 108% of the 100-year, 24-hour storm event while maintaining 1-foot freeboard.

The South Stormwater Detention Structure's dam is 17 feet in height and has an impounding capacity of 105.2 Acre-feet. Therefore, the South Stormwater Detention Structure is regulated by the OWRB.

The South Stormwater Detention Structure is classified as a small (< 50 feet in height and <10,000 Acre-feet in storage), high hazard (impacted roadway sees 1,500 or more vehicles per day) dam. Therefore, per OWRB 785:25 Appendix B, Minimum Spillway Performance Standards, the spillway for the South Detention Structure was designed to discharge 50% of the probable maximum flood as set by the *Regional Probable Maximum Precipitation Study for Oklahoma, Arkansas, Louisiana, and Mississippi (Applied Weather Associates, 2019)* while maintaining a minimum 1-foot freeboard. The probable maximum precipitation for the AEL consists of a 6-hour storm producing 27.4 inches and a 24-hour storm producing 32.6 inches resulting in a peak discharge of 4,224 cfs.

3.0 RESULTS

3.1 STORMWATER CONTROL

Peak flows for the worst-case terrace, worst-case letdown, and perimeter channels were calculated using Hydraflow Hydrograph Extension for AutoCAD Civil 3D 2020 to reflect the most critical condition for each type of structure. Velocities and normal depths were determined based on the calculated peak flows. Profiles for the terrace, letdown, and perimeter channels were generated showing that the surface water structures are adequately sized to handle a 25-year, 24-hour storm event. Results are included in Table 1.

3.2 STORMWATER QUALITY

Peak flows for the worst-case detention structure were calculated using Hydraflow Hydrograph Extension for AutoCAD Civil 3D 2020 to reflect the most critical condition for each structure. Profiles for the North and South Stormwater Detention Structures were generated showing that the stormwater detention structures are adequately sized to handle a 100-year, 24-hour storm event while maintaining minimum freeboard requirements. A profile for the South Stormwater Detention Structure's spillway was generated showing that the spillway is adequately sized to handle 50% of the PMF while maintaining minimum freeboard requirements.

The watershed plan and layout of the stormwater structures, including grading of the perimeter channels, are shown on drawings 12 and 13 of the Permit Drawings. Modeling outputs from the Hydraflow Hydrograph Extension software are presented in Appendix A and results are included in Table 1.

4.0 CONCLUSION

The stormwater control and stormwater quality structures have been adequately sized, in accordance with the ODEQ and OWRB rules and regulations, using Hydraflow Hydrograph Extension for AutoCAD Civil 3D 2020, NOAA Atlas 14 Point Precipitation Frequency Estimates, and the *Regional Probable Maximum Precipitation Study for Oklahoma, Arkansas, Louisiana, and Mississippi (Applied Weather Associates, 2019).* A summary of the stormwater control structures are provided in Table 1, and a summary of the stormwater quality control structures are provided in Table 2.

Table 1. Stormwater Control Structure Summary

Stormwater Control Structure	25-yr 24-hr Peak Discharge (cfs)	Slope (%)	Bottom Width (ft)	Total Depth (ft)	Velocity (ft/s)	Flow Depth (ft)
Worst-Case Terrace	23.21	1	0	3.5	0.79	3.12
Worst-Case Letdown	360.74	25	8	2	28.32	1.22
Channel 1	640.31	1	9	3.5	9.85	3.39
Channel 2	14.16	3.62	0	3	1.15	2.03
Channel 3	128.16	6	10	3	2.34	2.92

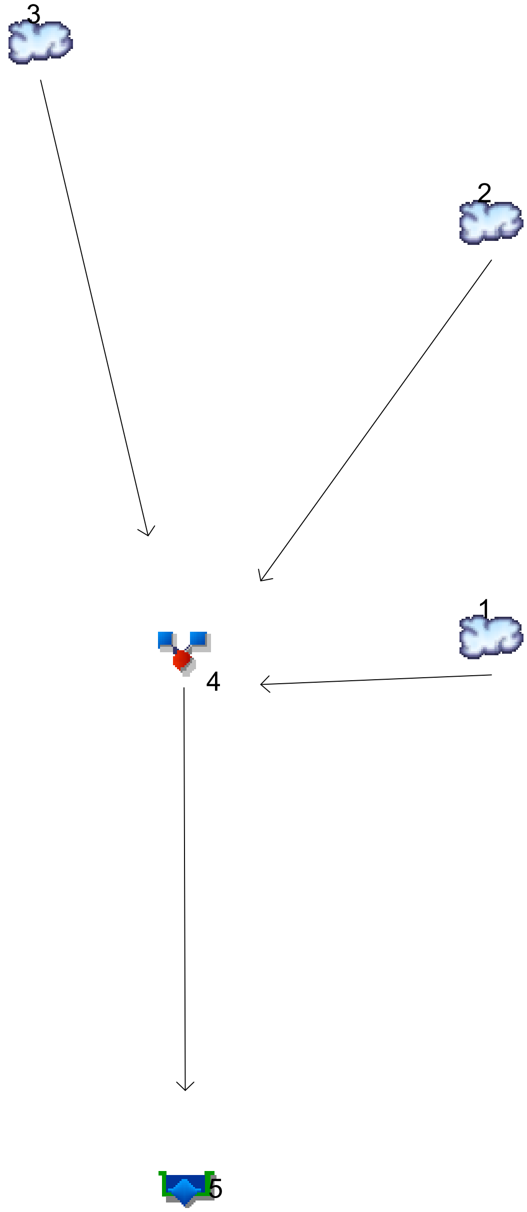
Table 2. Stormwater Quality Structure Summary

Stormwater Quality Structure	100-yr 24-hr Peak Inflow (cfs)	Dam Elevation (ft)	Elevation at Toe of Dam (ft)	Dam Height (ft)	Impounding Capacity (ac-ft)	Max Elevation (ft)	100-yr 24-hr Peak Discharge (cfs)
North Stormwater Detention Structure	791.87	840	821	19	44.4	836.90	92.36
South Stormwater Detention Structure	1,013.30	725	708	17	105.2	723.26	377.96

Appendix A

Model Results

Watershed Model Schematic



Legend

Hyd.	**Origin**	**Description**
1	SCS Runoff	Existing Landfill South
2	SCS Runoff	Existing Landfill North
3	SCS Runoff	Expansion Area
4	Combine	Combined Watershed
5	Reservoir	South Pond

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	-------	-------	-------	-------	78.64	-------	109.01	Existing Landfill South
2	SCS Runoff	------	-------	-------	-------	-------	-------	189.54	-------	263.73	Existing Landfill North
3	SCS Runoff	------	-------	-------	-------	-------	-------	521.88	-------	749.39	Expansion Area
4	Combine	1, 2, 3	-------	-------	-------	-------	-------	711.83	-------	1013.30	Combined Watershed
5	Reservoir	4	-------	-------	-------	-------	-------	75.87	-------	286.97	South Pond

Hydrograph Summary Report

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	78.64	2	724	250,946	------	------	------	Existing Landfill South
2	SCS Runoff	189.54	2	738	987,260	------	------	------	Existing Landfill North
3	SCS Runoff	521.88	2	746	3,213,498	------	------	------	Expansion Area
4	Combine	711.83	2	744	4,451,703	1, 2, 3	------	------	Combined Watershed
5	Reservoir	75.87	2	852	3,288,990	4	721.43	2,957,913	South Pond

Watershed Analysis (2023 EG South Pond).gpw | Return Period: 25 Year | Tuesday, 04 / 25 / 2023

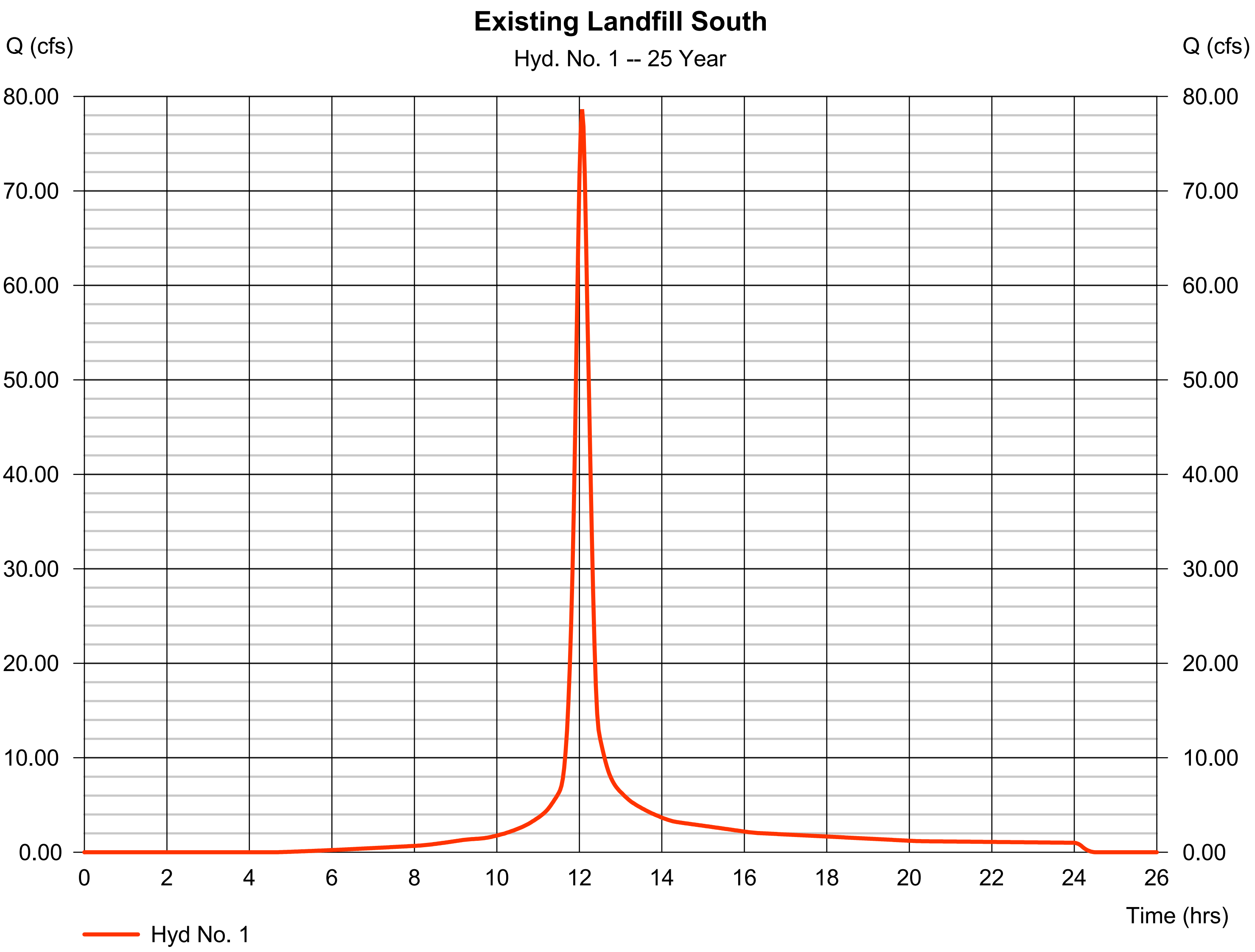
Hydrograph Report

Hyd. No. 1

Existing Landfill South

Hydrograph type = SCS Runoff
Storm frequency = 25 yrs
Time interval = 2 min
Drainage area = 13.550 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 6.96 in
Storm duration = 24 hrs

Peak discharge = 78.64 cfs
Time to peak = 12.07 hrs
Hyd. volume = 250,946 cuft
Curve number = 84
Hydraulic length = 0 ft
Time of conc. (Tc) = 18.50 min
Distribution = Type II
Shape factor = 484



TR55 Tc Worksheet

Hyd. No. 1

Existing Landfill South

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	90.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.86		0.00		0.00		
Land slope (%)	=	33.00		0.00		0.00		
Travel Time (min)	**=**	**2.67**	**+**	**0.00**	**+**	**0.00**	**=**	**2.67**
Shallow Concentrated Flow								
Flow length (ft)	=	1360.00		0.00		0.00		
Watercourse slope (%)	=	1.00		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61			0.00		0.00		
Travel Time (min)	**=**	**14.05**	**+**	**0.00**	**+**	**0.00**	**=**	**14.05**
Channel Flow								
X sectional flow area (sqft)	=	68.25		0.00		0.00		
Wetted perimeter (ft)	=	31.14		0.00		0.00		
Channel slope (%)	=	1.00		0.00		0.00		
Manning's n-value	=	0.026		0.015		0.015		
Velocity (ft/s)	=9.69							
				0.00				
						0.00		
Flow length (ft)	({0})1020.0			0.0		0.0		
Travel Time (min)	**=**	**1.75**	**+**	**0.00**	**+**	**0.00**	**=**	**1.75**

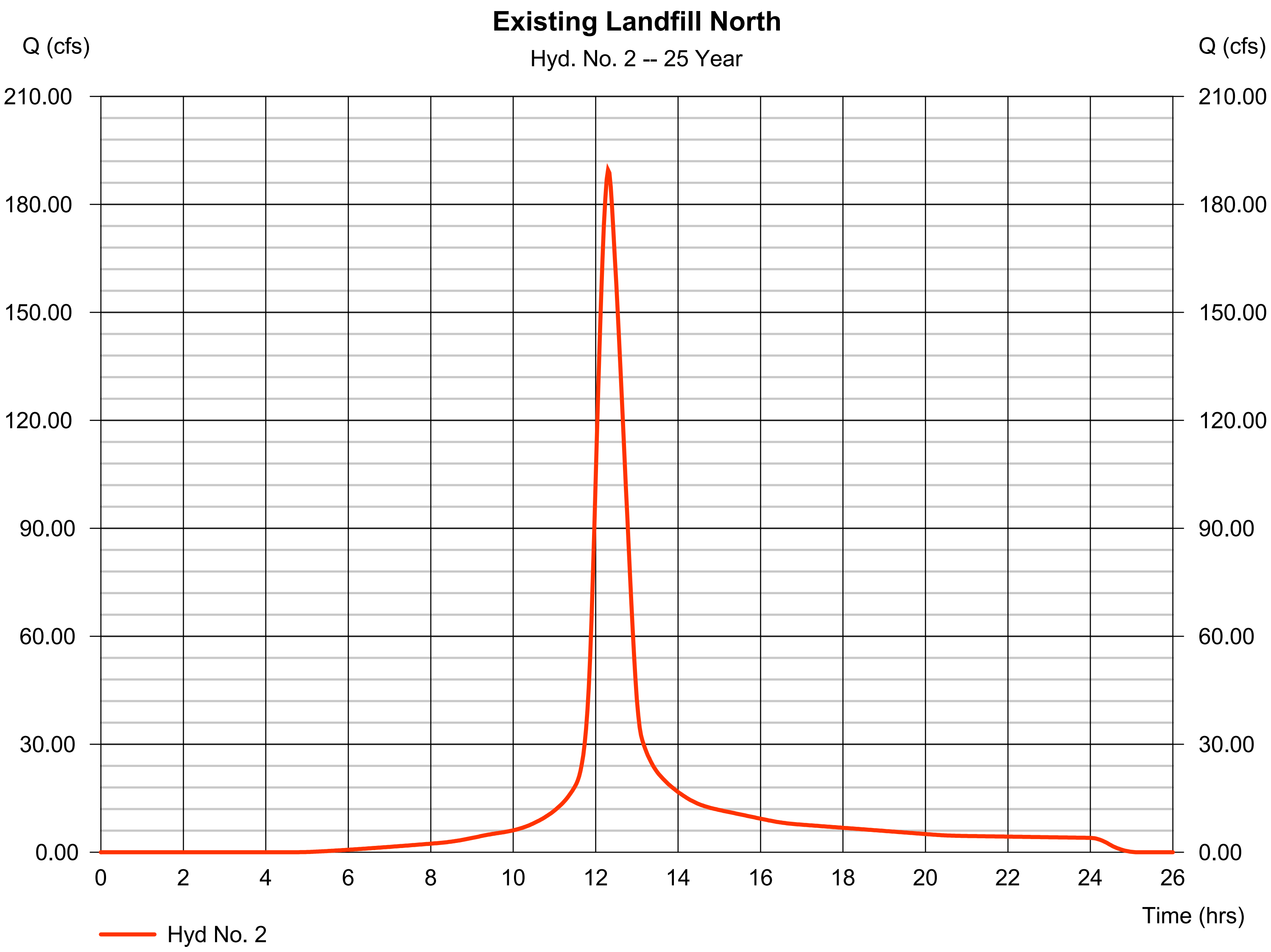
Total Travel Time, Tc .... 18.50 min

Hydrograph Report

Hyd. No. 2

Existing Landfill North

Hydrograph type	= SCS Runoff	Peak discharge	= 189.54 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 987,260 cuft
Drainage area	= 52.800 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 43.30 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 2

Existing Landfill North

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	300.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.86		0.00		0.00		
Land slope (%)	=	4.00		0.00		0.00		
Travel Time (min)	**=**	**16.28**	**+**	**0.00**	**+**	**0.00**	**=**	**16.28**
Shallow Concentrated Flow								
Flow length (ft)	=	2482.00		757.88		0.00		
Watercourse slope (%)	=	1.00		24.91		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.61			10.15		0.00		
Travel Time (min)	**=**	**25.64**	**+**	**1.24**	**+**	**0.00**	**=**	**26.88**
Channel Flow								
X sectional flow area (sqft)	=	24.00		0.00		0.00		
Wetted perimeter (ft)	=	16.94		0.00		0.00		
Channel slope (%)	=	25.00		0.00		0.00		
Manning's n-value	=	0.015		0.015		0.015		
Velocity (ft/s)	=62.72							
				0.00				
						0.00		
Flow length (ft)	({0})450.0			0.0		0.0		
Travel Time (min)	**=**	**0.12**	**+**	**0.00**	**+**	**0.00**	**=**	**0.12**

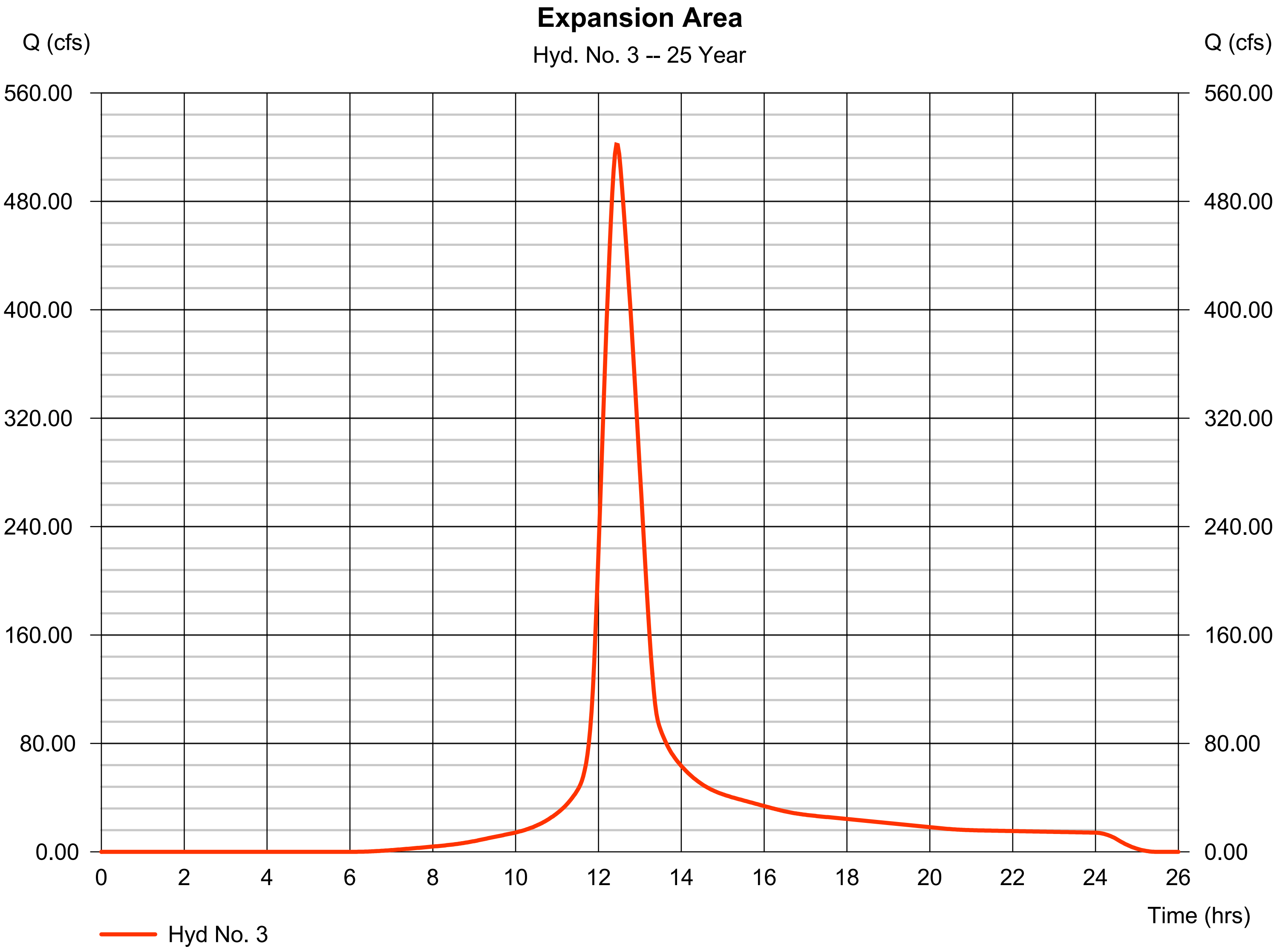
Total Travel Time, Tc .... 43.30 min

Hydrograph Report

Hyd. No. 3

Expansion Area

Hydrograph type	= SCS Runoff	Peak discharge	= 521.88 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 3,213,498 cuft
Drainage area	= 196.100 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 57.20 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 3

Expansion Area

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.400		0.011		0.011		
Flow length (ft)	=	300.0		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.86		0.00		0.00		
Land slope (%)	=	2.80		0.00		0.00		
Travel Time (min)	**=**	**41.16**	**+**	**0.00**	**+**	**0.00**	**=**	**41.16**
Shallow Concentrated Flow								
Flow length (ft)	=	2660.00		0.00		0.00		
Watercourse slope (%)	=	4.67		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	3.49		0.00		0.00		
Travel Time (min)	**=**	**12.72**	**+**	**0.00**	**+**	**0.00**	**=**	**12.72**
Channel Flow								
X sectional flow area (sqft)	=	112.00		0.00		0.00		
Wetted perimeter (ft)	=	62.65		0.00		0.00		
Channel slope (%)	=	1.66		0.00		0.00		
Manning's n-value	=	0.026		0.026		0.015		
Velocity (ft/s)	=	10.90						
				0.00				
						0.00		
Flow length (ft)		({0})2153.0		0.0		0.0		
Travel Time (min)	**=**	**3.29**	**+**	**0.00**	**+**	**0.00**	**=**	**3.29**

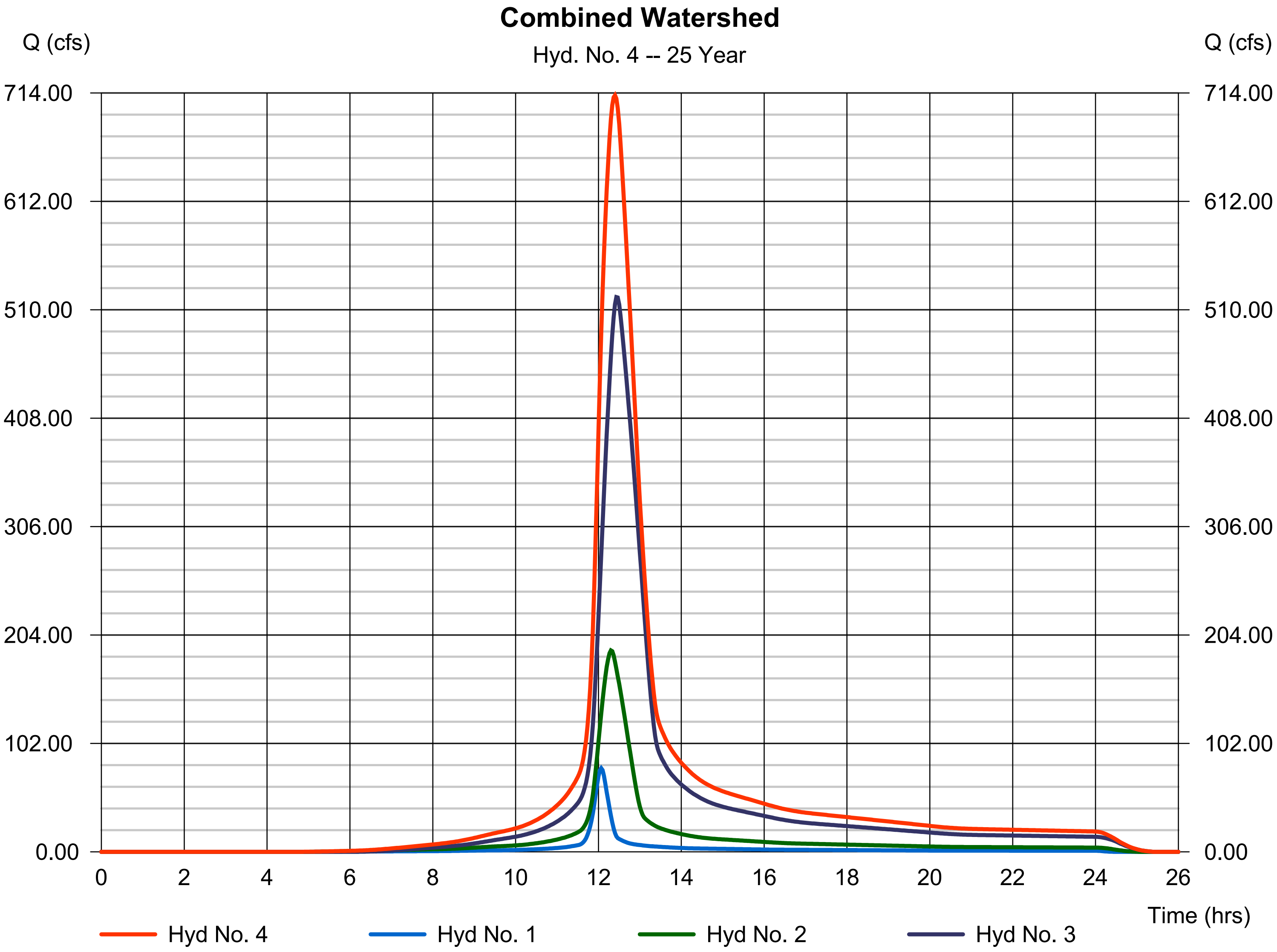
Total Travel Time, Tc .... 57.20 min

Hydrograph Report

Hyd. No. 4

Combined Watershed

Hydrograph type	= Combine	Peak discharge	= 711.83 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 4,451,703 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 262.450 ac



Hydrograph Report

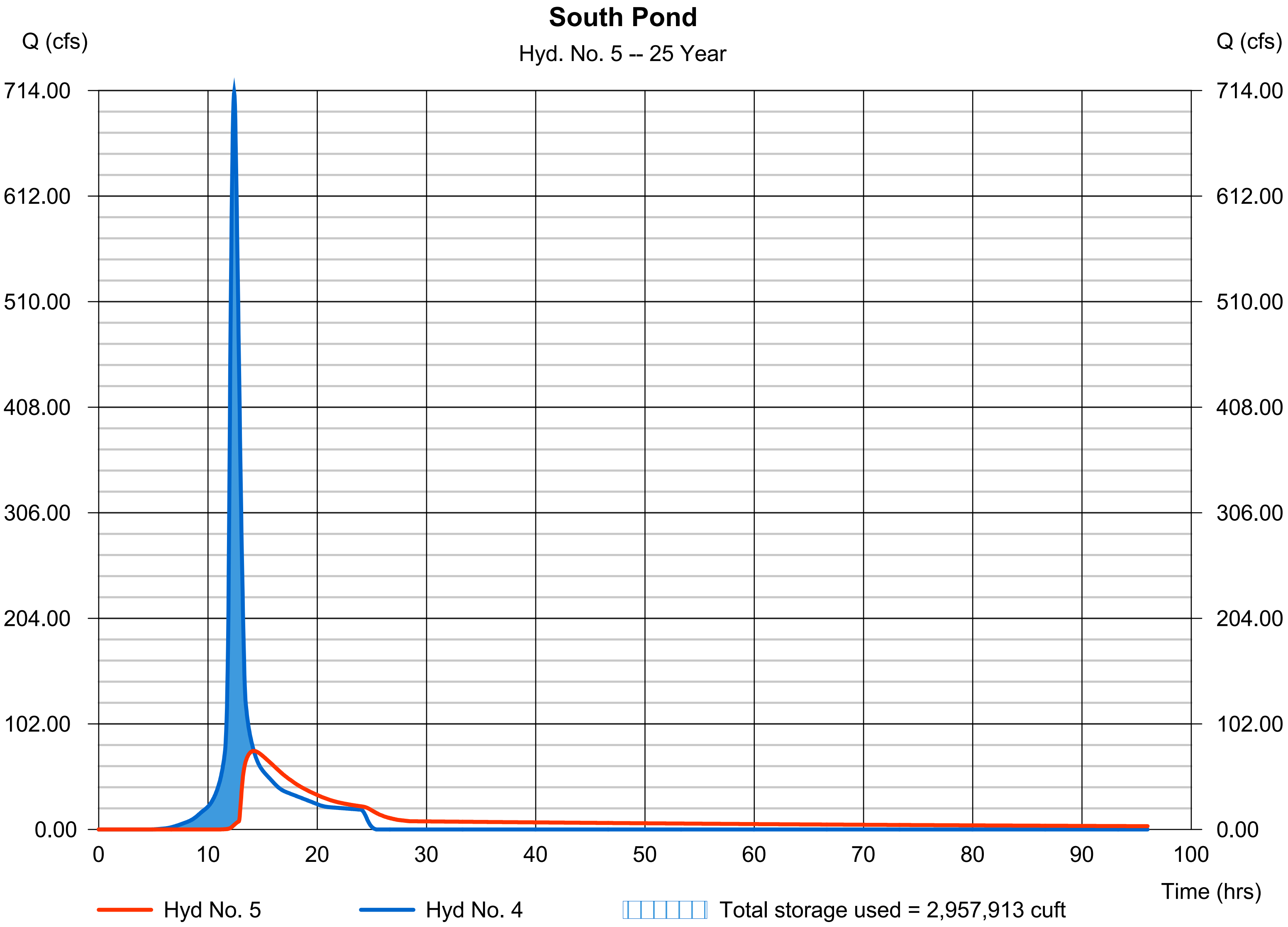
Hyd. No. 5

South Pond

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyd. No. = 4 - Combined Watershed
Reservoir name = South Pond

Peak discharge = 75.87 cfs
Time to peak = 14.20 hrs
Hyd. volume = 3,288,990 cuft
Max. Elevation = 721.43 ft
Max. Storage = 2,957,913 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	109.01	2	724	353,397	------	------	------	Existing Landfill South
2	SCS Runoff	263.73	2	738	1,390,314	------	------	------	Existing Landfill North
3	SCS Runoff	749.39	2	746	4,640,911	------	------	------	Expansion Area
4	Combine	1013.30	2	744	6,384,621	1, 2, 3	------	------	Combined Watershed
5	Reservoir	286.97	2	792	5,214,785	4	723.26	3,741,958	South Pond

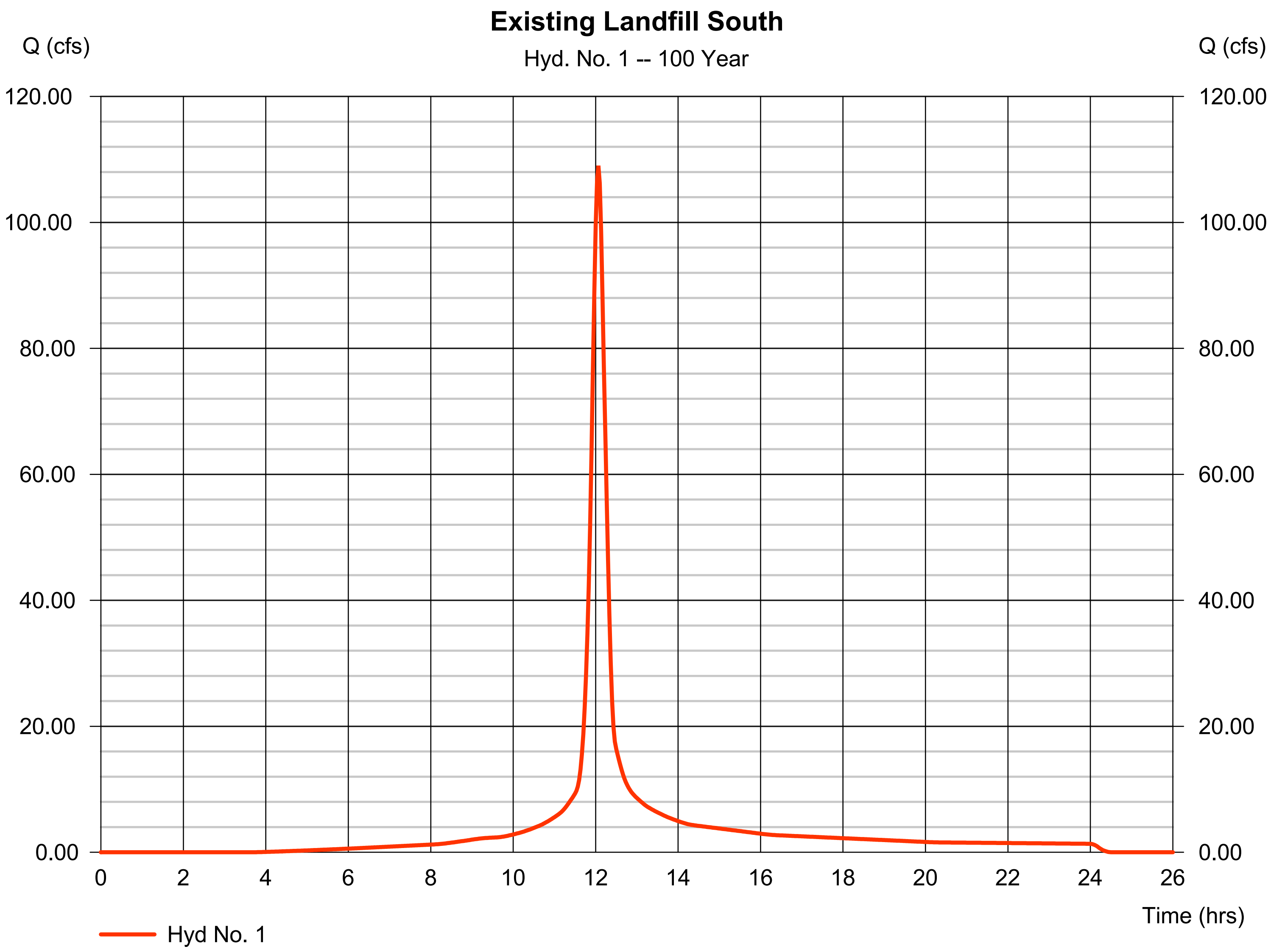
Hydrograph Report

Hyd. No. 1

Existing Landfill South

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 13.550 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 9.13 in
Storm duration = 24 hrs

Peak discharge = 109.01 cfs
Time to peak = 12.07 hrs
Hyd. volume = 353,397 cuft
Curve number = 84
Hydraulic length = 0 ft
Time of conc. (Tc) = 18.50 min
Distribution = Type II
Shape factor = 484

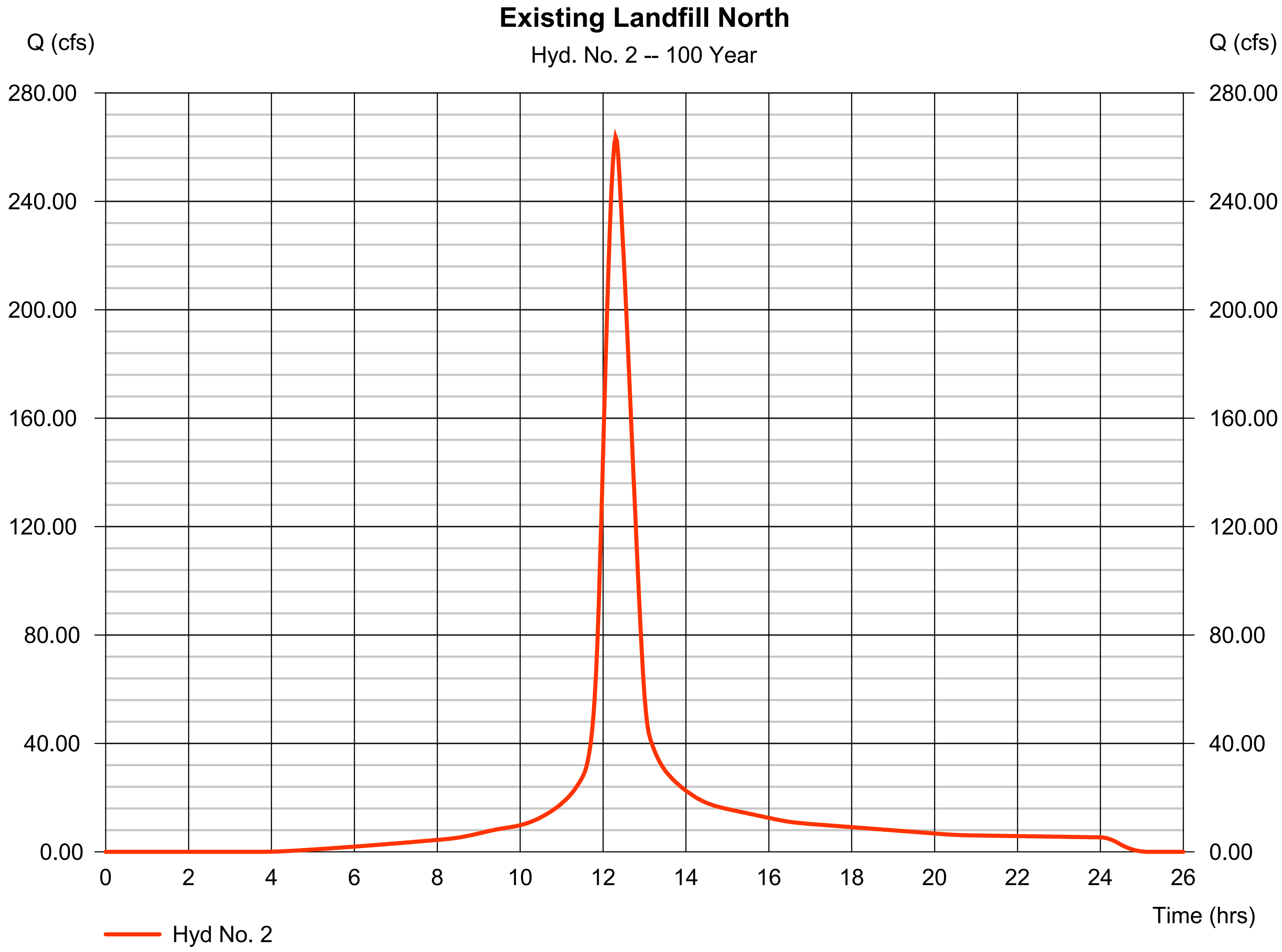


Hydrograph Report

Hyd. No. 2

Existing Landfill North

Hydrograph type	= SCS Runoff	Peak discharge	= 263.73 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.30 hrs
Time interval	= 2 min	Hyd. volume	= 1,390,314 cuft
Drainage area	= 52.800 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 43.30 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

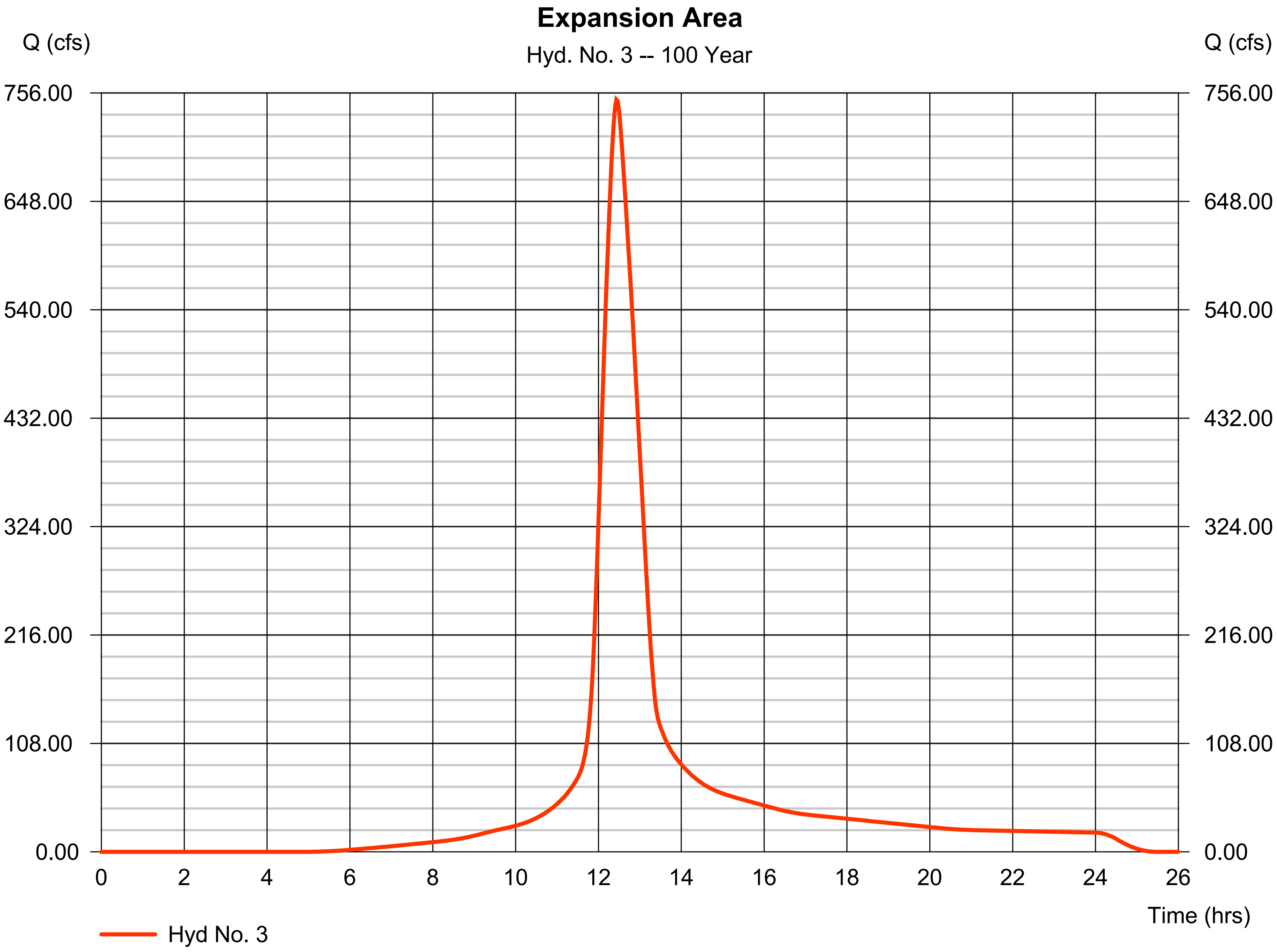


Hydrograph Report

Hyd. No. 3

Expansion Area

Hydrograph type	= SCS Runoff	Peak discharge	= 749.39 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.43 hrs
Time interval	= 2 min	Hyd. volume	= 4,640,911 cuft
Drainage area	= 196.100 ac	Curve number	= 79
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 57.20 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

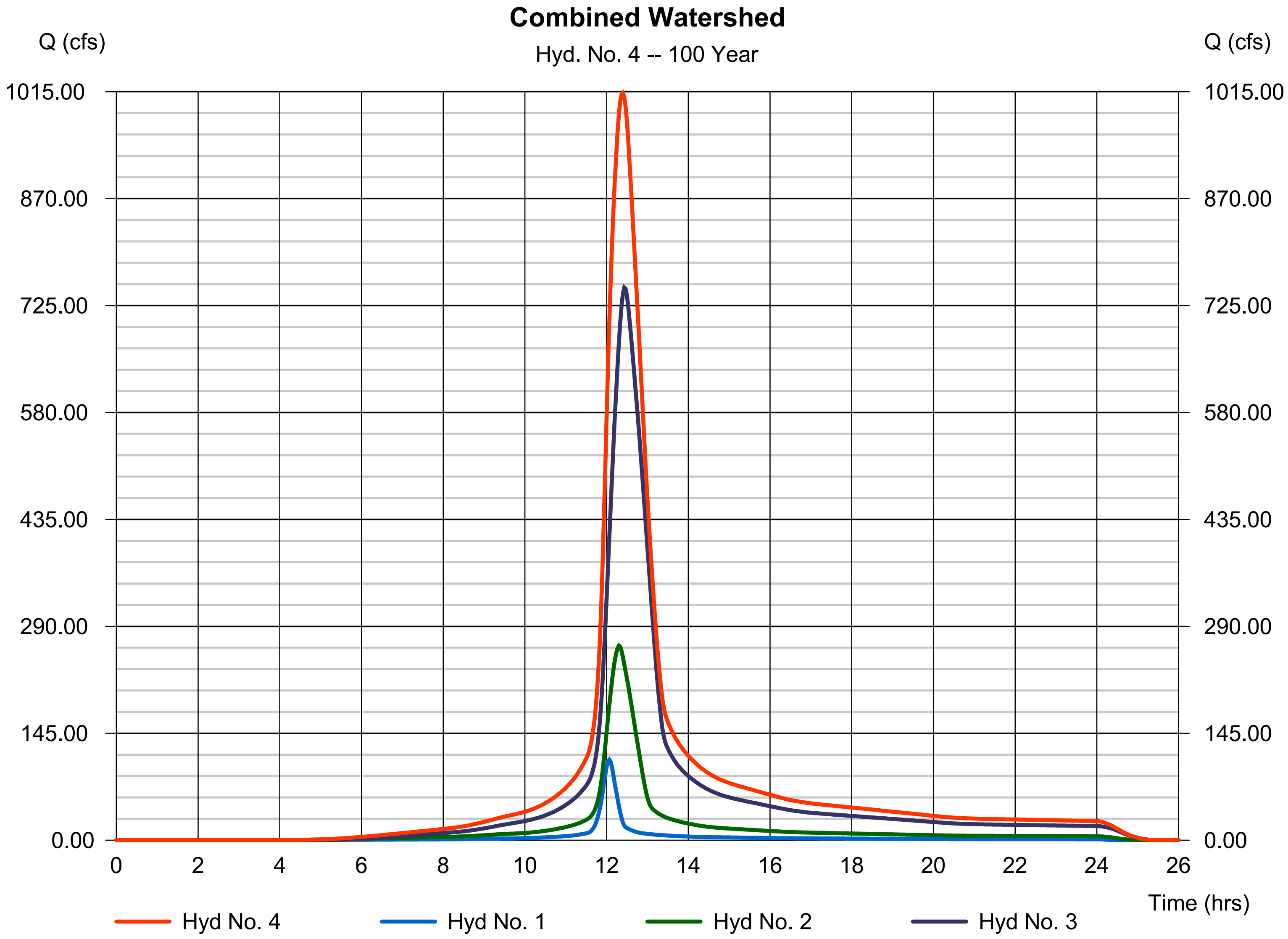


Hydrograph Report

Hyd. No. 4

Combined Watershed

Hydrograph type	= Combine	Peak discharge	= 1013.30 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.40 hrs
Time interval	= 2 min	Hyd. volume	= 6,384,621 cuft
Inflow hyds.	= 1, 2, 3	Contrib. drain. area	= 262.450 ac



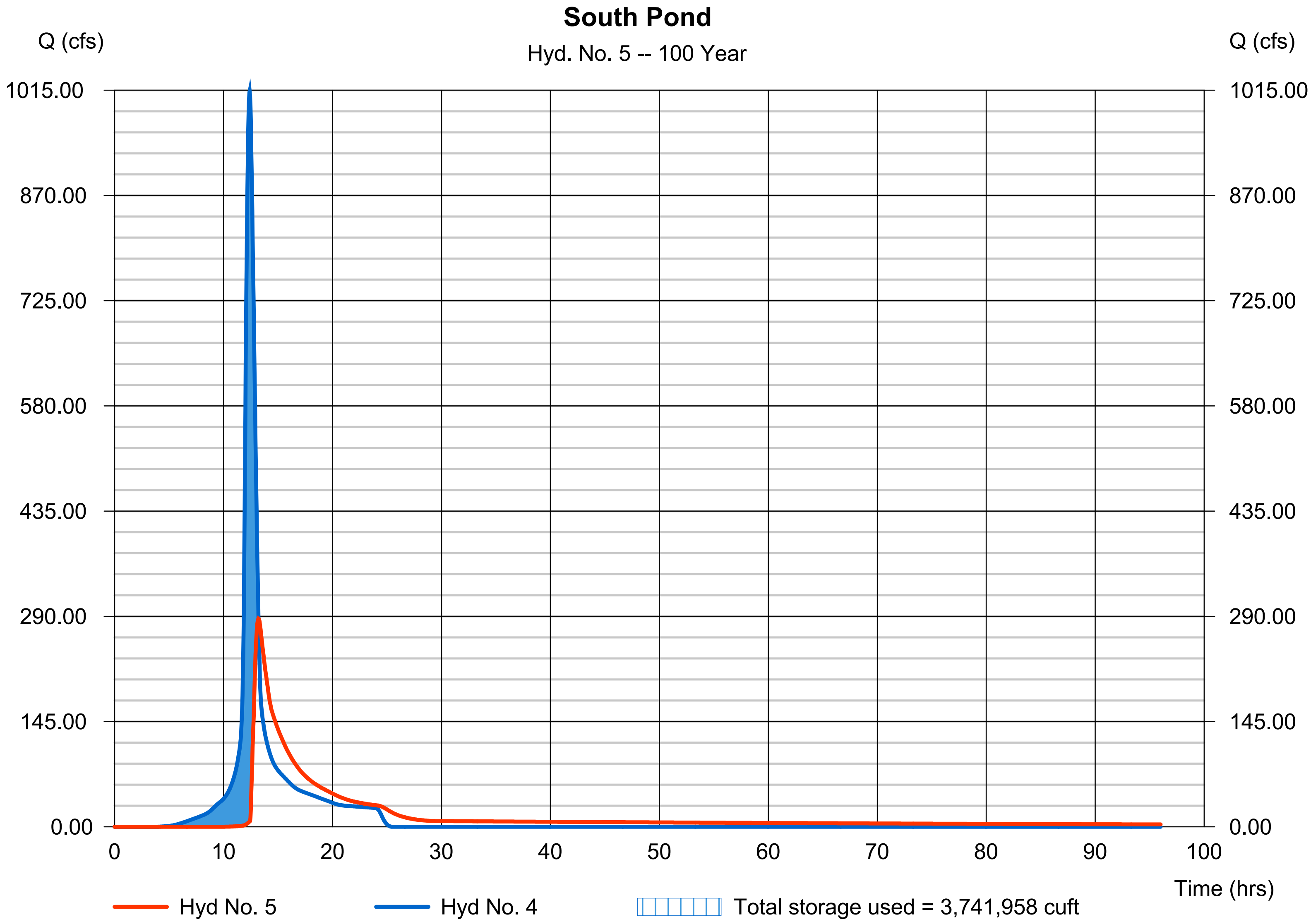
Hydrograph Report

Hyd. No. 5

South Pond

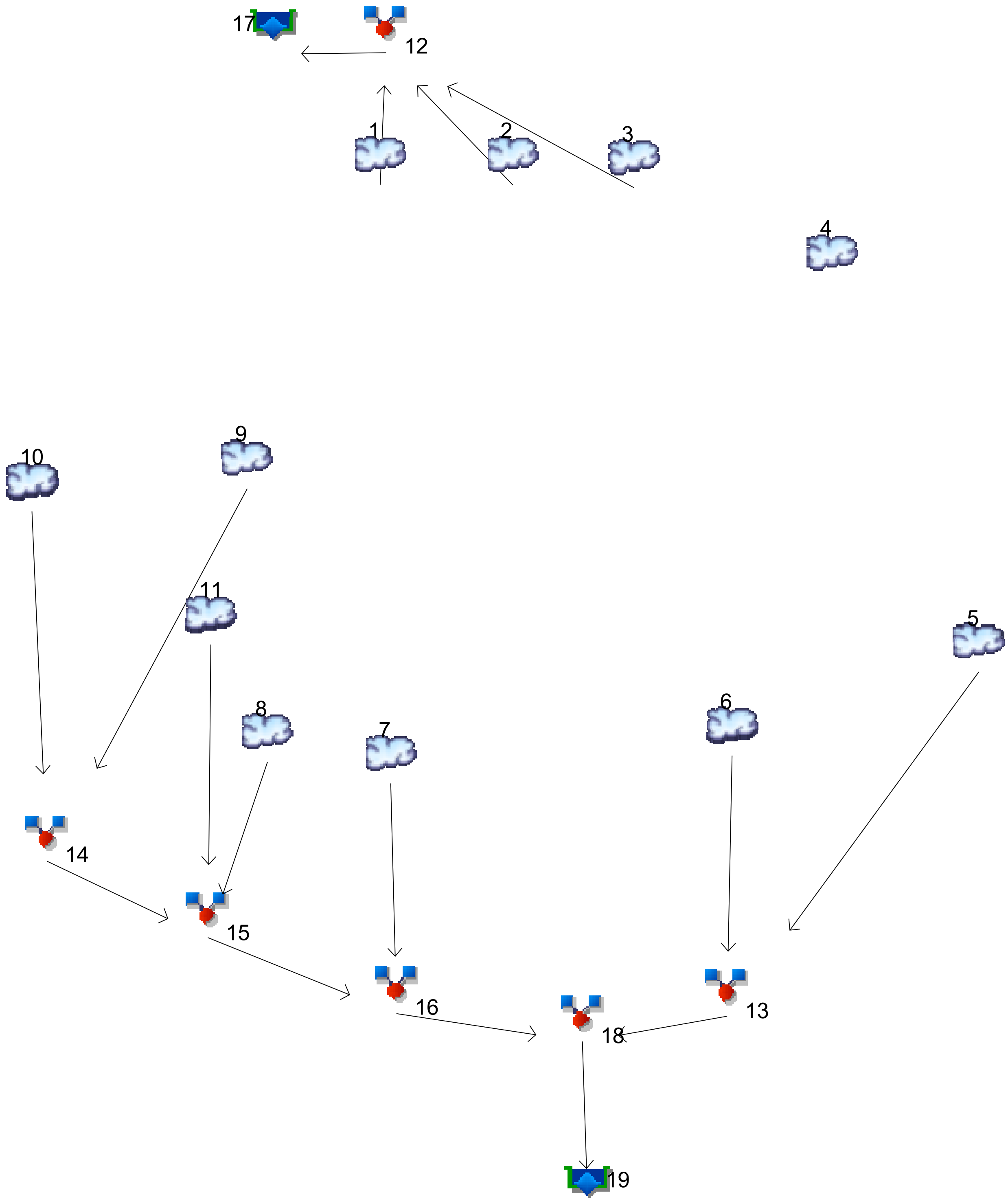
Hydrograph type	= Reservoir	Peak discharge	= 286.97 cfs
Storm frequency	= 100 yrs	Time to peak	= 13.20 hrs
Time interval	= 2 min	Hyd. volume	= 5,214,785 cuft
Inflow hyd. No.	= 4 - Combined Watershed	Max. Elevation	= 723.26 ft
Reservoir name	= South Pond	Max. Storage	= 3,741,958 cuft

Storage Indication method used.



Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020



Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)								Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	-------	-------	-------	-------	223.44	-------	309.29	Basin 1
2	SCS Runoff	------	-------	-------	-------	-------	-------	187.98	-------	260.20	Basin 2
3	SCS Runoff	------	-------	-------	-------	-------	-------	164.19	-------	227.60	Basin 3
4	SCS Runoff	------	-------	-------	-------	-------	-------	128.16	-------	177.40	Basin 4
5	SCS Runoff	------	-------	-------	-------	-------	-------	170.87	-------	237.13	Basin 5
6	SCS Runoff	------	-------	-------	-------	-------	-------	227.74	-------	315.70	Basin 6
7	SCS Runoff	------	-------	-------	-------	-------	-------	360.74	-------	501.74	Basin 7
8	SCS Runoff	------	-------	-------	-------	-------	-------	127.61	-------	176.27	Basin 8
9	SCS Runoff	------	-------	-------	-------	-------	-------	220.44	-------	304.51	Basin 9
10	SCS Runoff	------	-------	-------	-------	-------	-------	60.25	-------	83.23	Basin 10
11	SCS Runoff	------	-------	-------	-------	-------	-------	33.37	-------	46.09	Basin 11
12	Combine	1, 2, 3,	-------	-------	-------	-------	-------	571.36	-------	791.87	Combine North Watershed
13	Combine	5, 6,	-------	-------	-------	-------	-------	394.61	-------	547.88	Southeast Culvert
14	Combine	9, 10,	-------	-------	-------	-------	-------	280.69	-------	387.74	Southwest Culvert
15	Combine	8, 11, 14	-------	-------	-------	-------	-------	441.67	-------	610.11	Conjunction
16	Combine	7, 15	-------	-------	-------	-------	-------	640.31	-------	889.50	South Culvert
17	Reservoir	12	-------	-------	-------	-------	-------	16.84	-------	92.36	North Pond
18	Combine	13, 16,	-------	-------	-------	-------	-------	990.21	-------	1378.36	Combine South Watershed
19	Reservoir	18	-------	-------	-------	-------	-------	104.20	-------	377.96	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

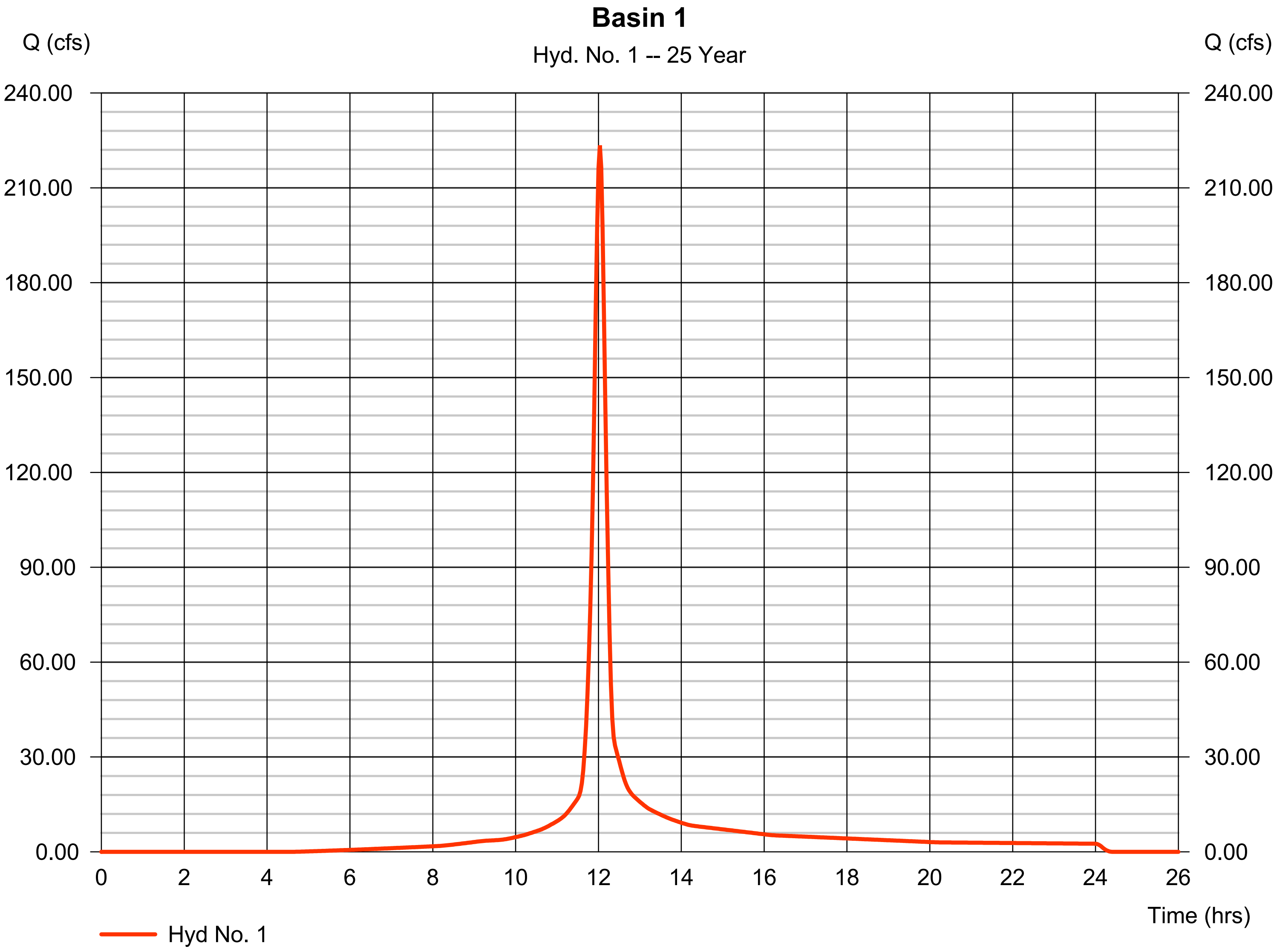
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	223.44	2	722	642,830	------	------	------	Basin 1
2	SCS Runoff	187.98	2	722	540,808	------	------	------	Basin 2
3	SCS Runoff	164.19	2	724	523,932	------	------	------	Basin 3
4	SCS Runoff	128.16	2	722	368,725	------	------	------	Basin 4
5	SCS Runoff	170.87	2	726	599,830	------	------	------	Basin 5
6	SCS Runoff	227.74	2	724	726,726	------	------	------	Basin 6
7	SCS Runoff	360.74	2	736	1,766,997	------	------	------	Basin 7
8	SCS Runoff	127.61	2	718	302,432	------	------	------	Basin 8
9	SCS Runoff	220.44	2	718	522,450	------	------	------	Basin 9
10	SCS Runoff	60.25	2	718	142,789	------	------	------	Basin 10
11	SCS Runoff	33.37	2	718	79,081	------	------	------	Basin 11
12	Combine	571.36	2	722	1,707,570	1, 2, 3,	------	------	Combine North Watershed
13	Combine	394.61	2	724	1,326,556	5, 6,	------	------	Southeast Culvert
14	Combine	280.69	2	718	665,240	9, 10,	------	------	Southwest Culvert
15	Combine	441.67	2	718	1,046,752	8, 11, 14	------	------	Conjunction
16	Combine	640.31	2	720	2,813,747	7, 15	------	------	South Culvert
17	Reservoir	16.84	2	930	1,426,208	12	835.39	1,260,748	North Pond
18	Combine	990.21	2	720	4,140,305	13, 16,	------	------	Combine South Watershed
19	Reservoir	104.20	2	788	3,225,121	18	721.82	2,636,732	<no description>

Hydrograph Report

Hyd. No. 1

Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 223.44 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 642,830 cuft
Drainage area	= 35.600 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.80 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 1

Basin 1

Description	A		B		C		Totals
Sheet Flow							
Manning's n-value	= 0.150		0.150		0.011		
Flow length (ft)	= 72.9		90.0		0.0		
Two-year 24-hr precip. (in)	= 3.86		3.86		0.00		
Land slope (%)	= 4.00		25.00		0.00		
Travel Time (min)	**= 5.25**	**+**	**2.99**	**+**	**0.00**	**=**	**8.24**
Shallow Concentrated Flow							
Flow length (ft)	= 579.63		0.00		0.00		
Watercourse slope (%)	= 1.10		0.00		0.00		
Surface description	= Unpaved		Paved		Paved		
Average velocity (ft/s)	=1.69		0.00		0.00		
Travel Time (min)	**= 5.71**	**+**	**0.00**	**+**	**0.00**	**=**	**5.71**
Channel Flow							
X sectional flow area (sqft)	= 7.01		0.00		0.00		
Wetted perimeter (ft)	= 11.31		0.00		0.00		
Channel slope (%)	= 25.00		0.00		0.00		
Manning's n-value	= 0.025		0.015		0.015		
Velocity (ft/s)	=21.64						
			0.00				
					0.00		
Flow length (ft)	({0})1075.1		0.0		0.0		
Travel Time (min)	**= 0.83**	**+**	**0.00**	**+**	**0.00**	**=**	**0.83**

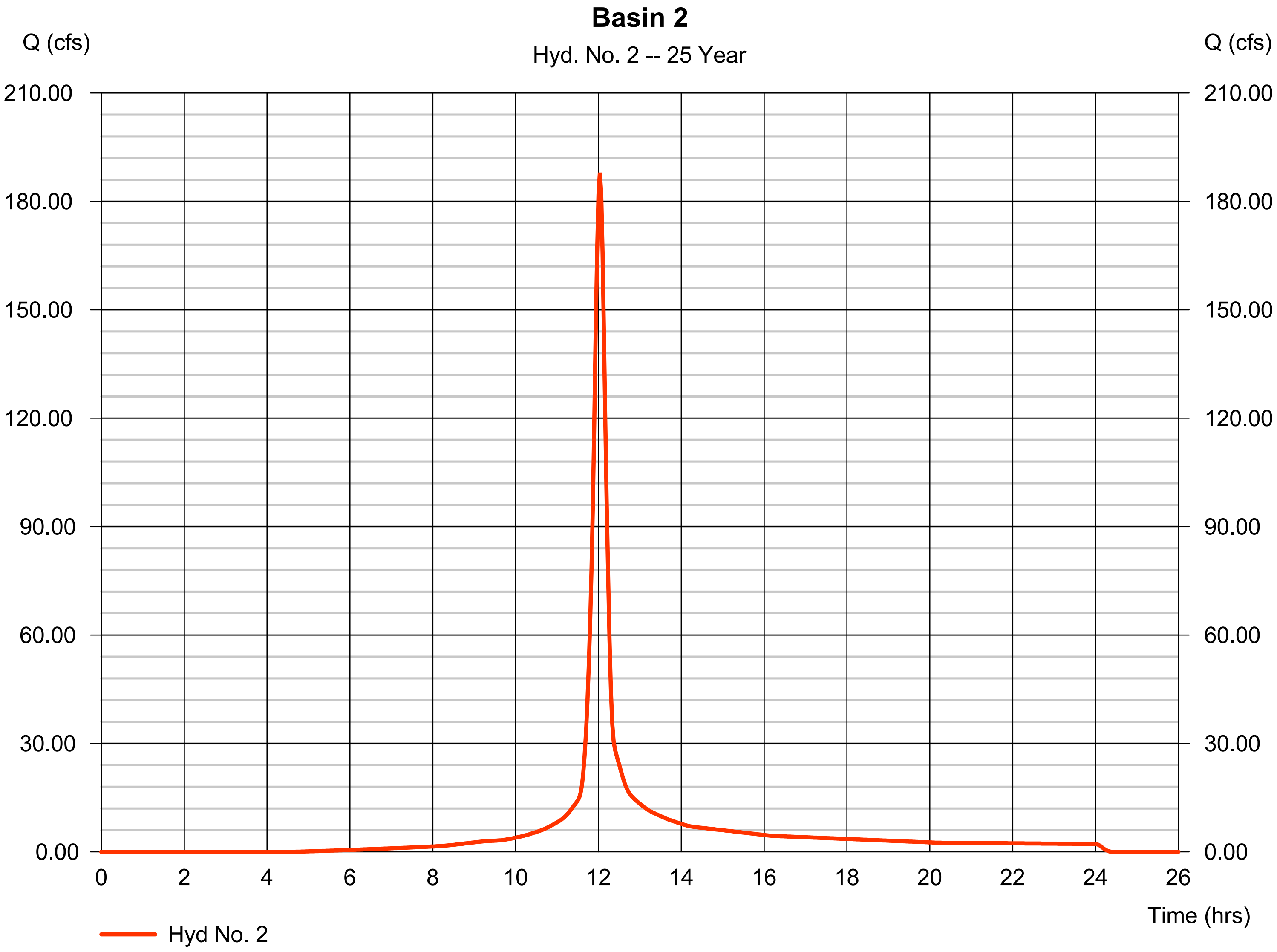
Total Travel Time, Tc .... 14.80 min

Hydrograph Report

Hyd. No. 2

Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 187.98 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 540,808 cuft
Drainage area	= 29.950 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.80 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 2

Basin 2

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.150		0.011		
Flow length (ft)	=	78.0		23.5		0.0		
Two-year 24-hr precip. (in)	=	3.86		3.86		0.00		
Land slope (%)	=	4.00		25.00		0.00		
Travel Time (min)	**=**	**5.54**	**+**	**1.02**	**+**	**0.00**	**=**	**6.56**
Shallow Concentrated Flow								
Flow length (ft)	=	463.80		0.00		0.00		
Watercourse slope (%)	=	1.10		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)	=	1.69		0.00		0.00		
Travel Time (min)	**=**	**4.57**	**+**	**0.00**	**+**	**0.00**	**=**	**4.57**
Channel Flow								
X sectional flow area (sqft)	=	9.17		36.34		0.00		
Wetted perimeter (ft)	=	12.16		23.48		0.00		
Channel slope (%)	=	25.00		1.50		0.00		
Manning's n-value	=	0.025		0.025		0.015		
Velocity (ft/s)	=	24.67		9.78		0.00		
Flow length (ft)		({0})1080.9		1150.5		0.0		
Travel Time (min)	**=**	**0.73**	**+**	**1.96**	**+**	**0.00**	**=**	**2.69**

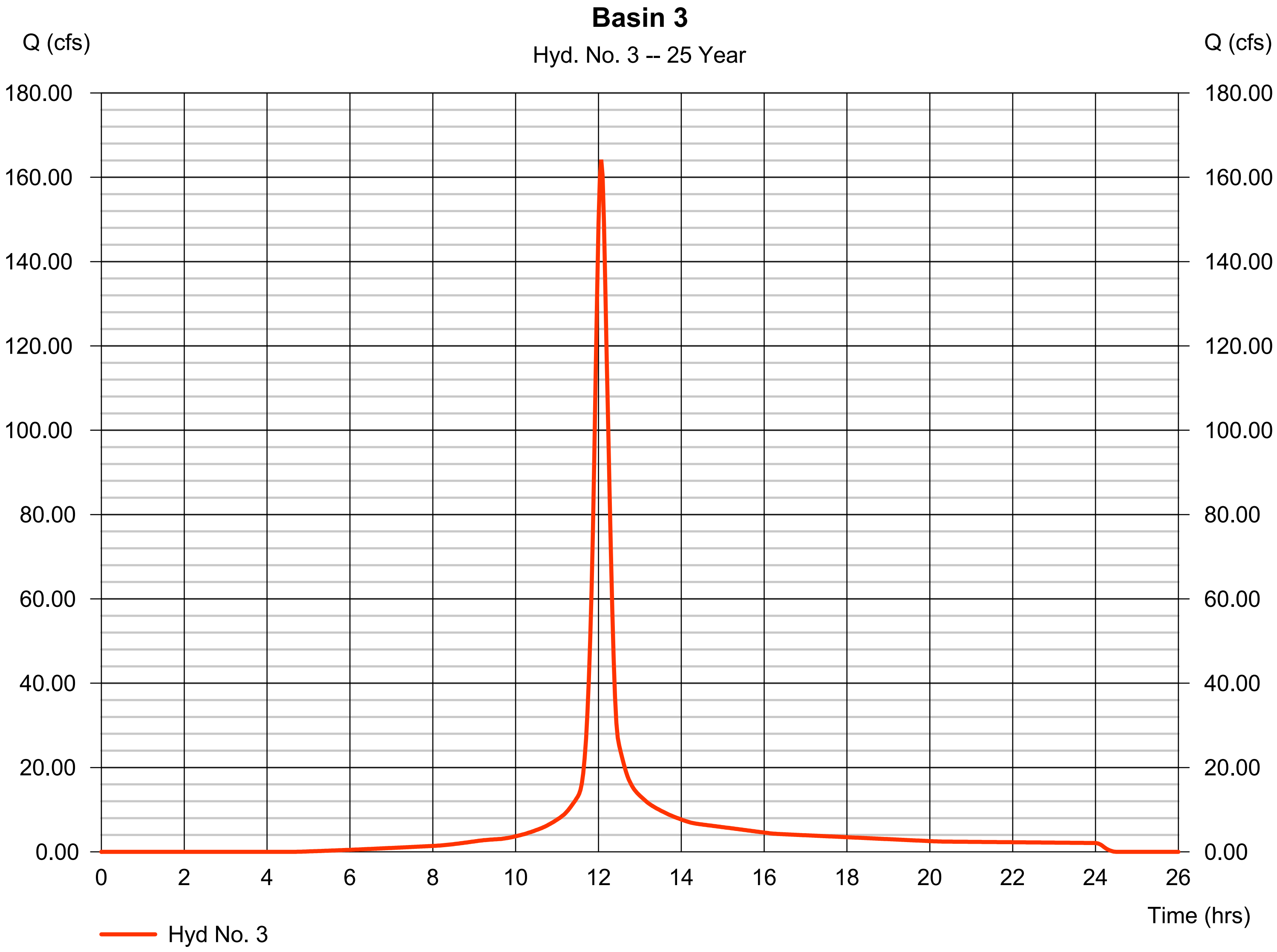
Total Travel Time, Tc .... 13.80 min

Hydrograph Report

Hyd. No. 3

Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 164.19 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 523,932 cuft
Drainage area	= 28.290 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.00 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 3

Basin 3

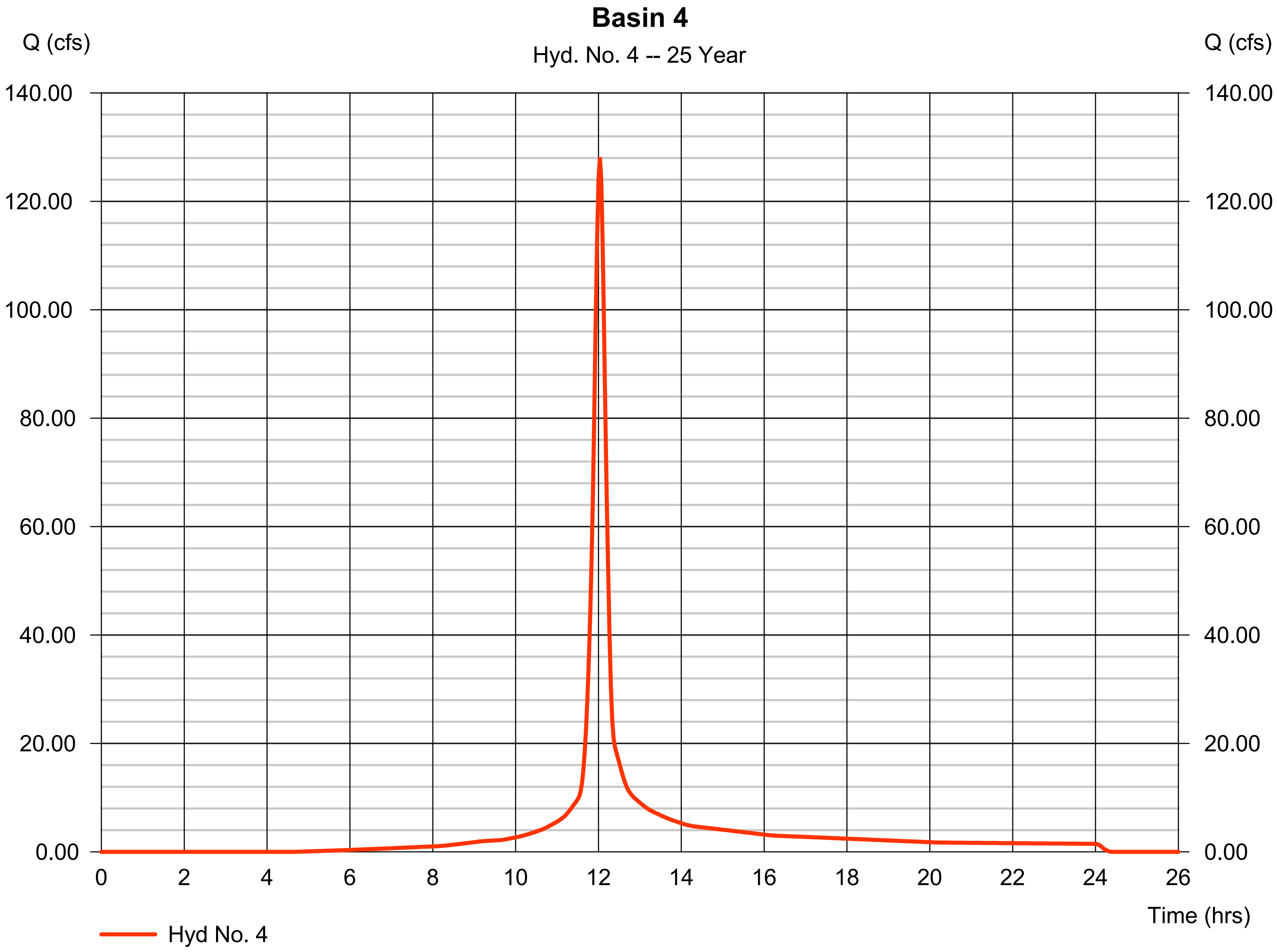
Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.150	0.011	
Flow length (ft)	= 100.0	180.4	0.0	
Two-year 24-hr precip. (in)	= 3.86	3.86	0.00	
Land slope (%)	= 4.00	25.00	0.00	
Travel Time (min)	**= 6.76**	**+ 5.21**	**+ 0.00**	**= 11.97**
Shallow Concentrated Flow				
Flow length (ft)	= 260.06	0.00	0.00	
Watercourse slope (%)	= 1.10	0.00	0.00	
Surface description	= Unpaved	Unpaved	Paved	
Average velocity (ft/s)	=1.69	0.00	0.00	
Travel Time (min)	**= 2.56**	**+ 0.00**	**+ 0.00**	**= 2.56**
Channel Flow				
X sectional flow area (sqft)	= 7.79	19.36	0.00	
Wetted perimeter (ft)	= 11.62	18.17	0.00	
Channel slope (%)	= 25.00	1.90	0.00	
Manning's n-value	= 0.025	0.025	0.015	
Velocity (ft/s)	=22.80	8.57	0.00	
Flow length (ft)	({0})770.3	2026.0	0.0	
Travel Time (min)	**= 0.56**	**+ 3.94**	**+ 0.00**	**= 4.50**
Total Travel Time, Tc				**19.00 min**

Hydrograph Report

Hyd. No. 4

Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 128.16 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 368,725 cuft
Drainage area	= 20.420 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.10 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 4

Basin 4

Description	**A**	**B**	**C**	**Totals**
Sheet Flow				
Manning's n-value	= 0.011	0.011	0.011	
Flow length (ft)	= 0.0	0.0	0.0	
Two-year 24-hr precip. (in)	= 0.00	0.00	0.00	
Land slope (%)	= 0.00	0.00	0.00	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Shallow Concentrated Flow				
Flow length (ft)	= 1257.56	591.23	0.00	
Watercourse slope (%)	= 1.60	23.36	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=2.04	9.83	0.00	
Travel Time (min)	**= 10.27**	**+ 1.00**	**+ 0.00**	**= 11.27**
Channel Flow				
X sectional flow area (sqft)	= 5.42	11.12	0.00	
Wetted perimeter (ft)	= 10.64	15.57	0.00	
Channel slope (%)	= 20.00	6.00	0.00	
Manning's n-value	= 0.025	0.025	0.015	
Velocity (ft/s)	=16.96	11.65	0.00	
Flow length (ft)	({0})213.1	2498.4	0.0	
Travel Time (min)	**= 0.21**	**+ 3.57**	**+ 0.00**	**= 3.78**

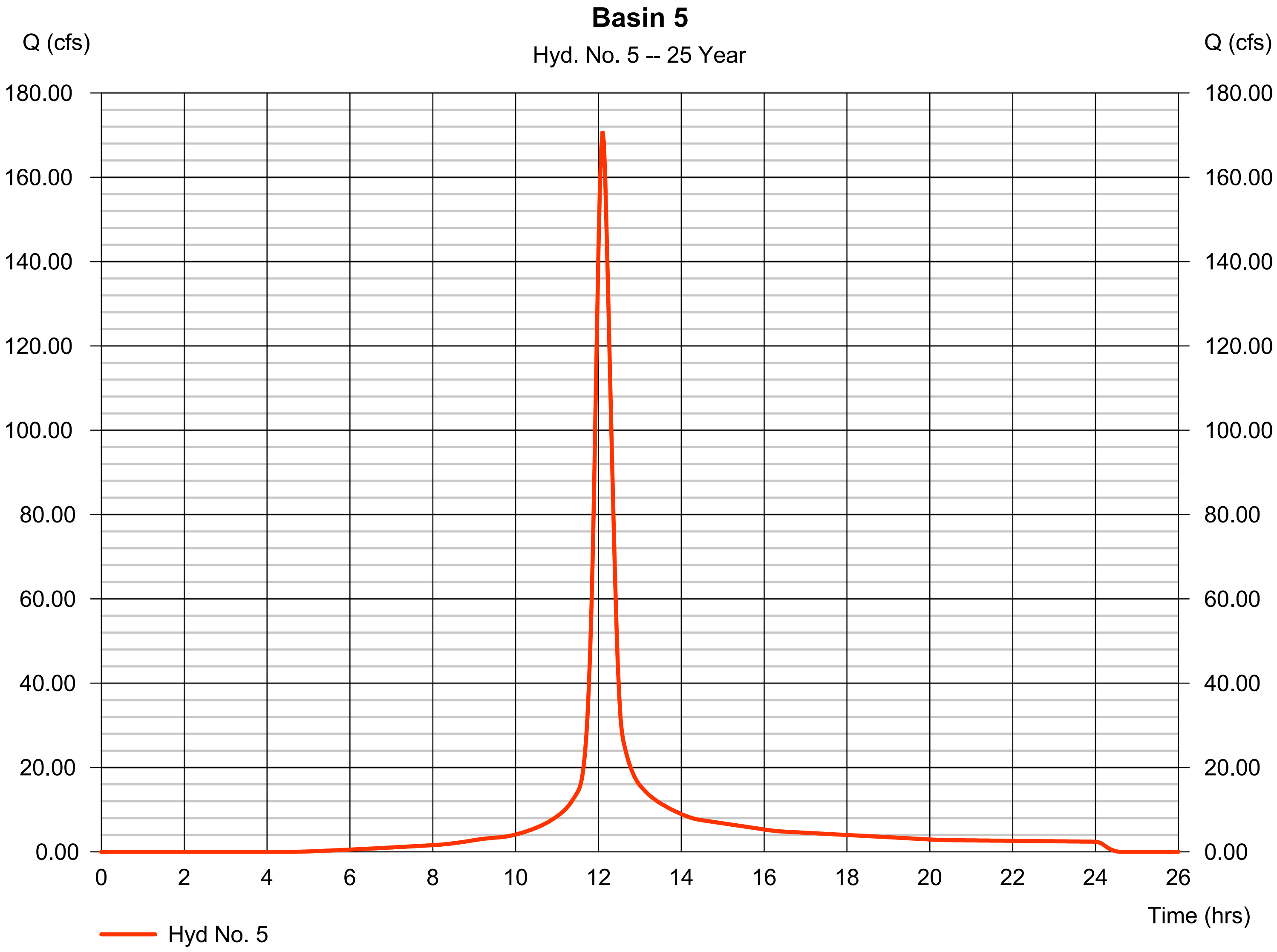
Total Travel Time, Tc .... 15.10 min

Hydrograph Report

Hyd. No. 5

Basin 5

Hydrograph type	= SCS Runoff	Peak discharge	= 170.87 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 599,830 cuft
Drainage area	= 31.820 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.70 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 5

Basin 5

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.150		0.011		
Flow length (ft)	=	136.1		66.4		0.0		
Two-year 24-hr precip. (in)	=	3.86		3.86		0.00		
Land slope (%)	=	4.00		25.00		0.00		
Travel Time (min)	**=**	**8.65**	**+**	**2.34**	**+**	**0.00**	**=**	**10.99**
Shallow Concentrated Flow								
Flow length (ft)	=	1188.35		0.00		0.00		
Watercourse slope (%)	=	3.35		0.00		0.00		
Surface description	=	Unpaved		Paved		Unpaved		
Average velocity (ft/s)	=	2.95		0.00		0.00		
Travel Time (min)	**=**	**6.71**	**+**	**0.00**	**+**	**0.00**	**=**	**6.71**
Channel Flow								
X sectional flow area (sqft)	=	7.80		16.77		0.00		
Wetted perimeter (ft)	=	11.62		17.22		0.00		
Channel slope (%)	=	24.30		3.10		0.00		
Manning's n-value	=	0.025		0.025		0.015		
Velocity (ft/s)	=	22.49		10.31		0.00		
Flow length (ft)		({0})555.8		1628.8		0.0		
Travel Time (min)	**=**	**0.41**	**+**	**2.63**	**+**	**0.00**	**=**	**3.05**

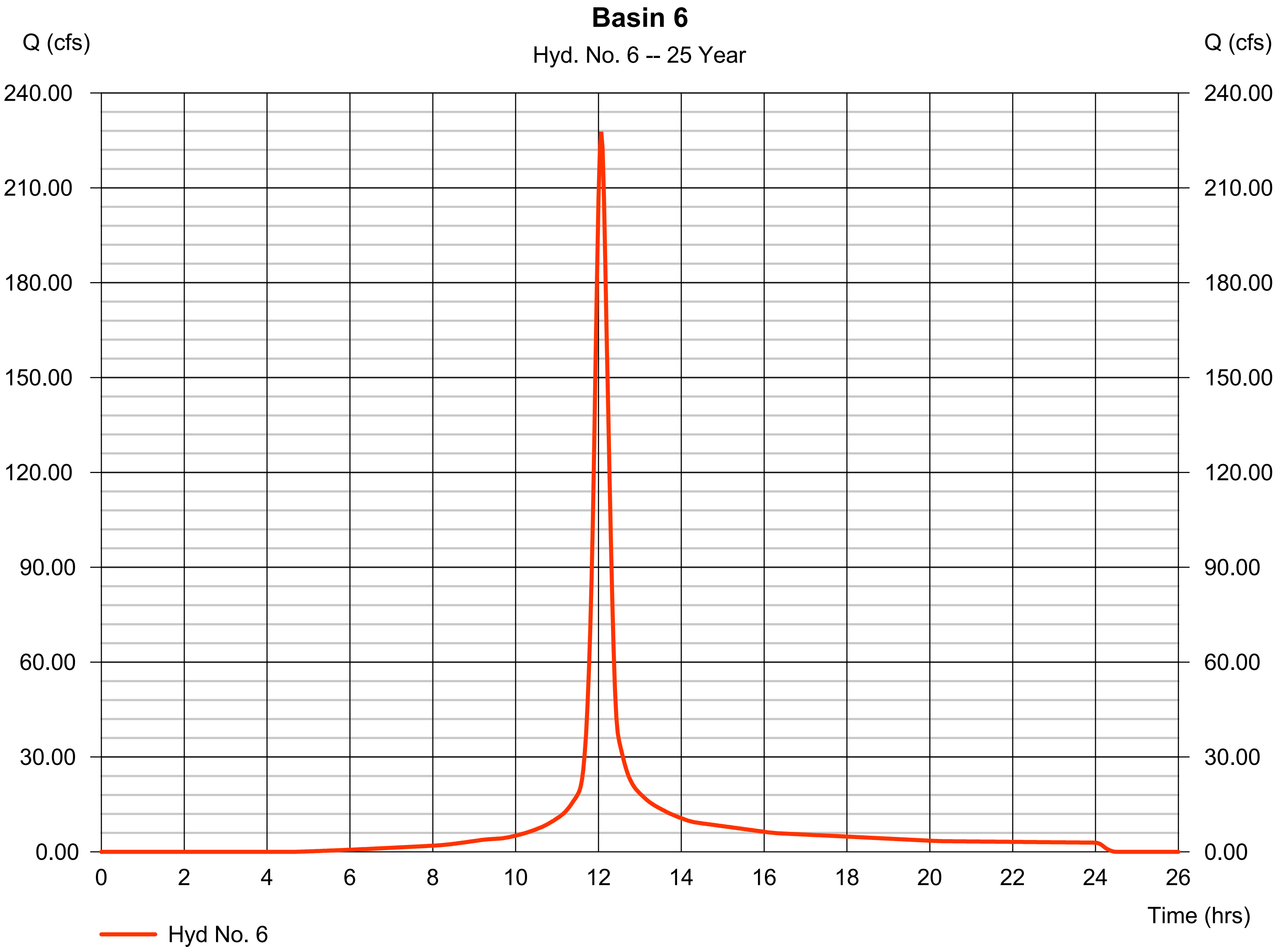
Total Travel Time, Tc .... 20.70 min

Hydrograph Report

Hyd. No. 6

Basin 6

Hydrograph type	= SCS Runoff	Peak discharge	= 227.74 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 726,726 cuft
Drainage area	= 39.240 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.20 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 6

Basin 6

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 214.4	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.86	0.00	0.00	
Land slope (%)	= 25.00	0.00	0.00	
Travel Time (min)	**= 5.98**	**+ 0.00**	**+ 0.00**	**= 5.98**
Shallow Concentrated Flow				
Flow length (ft)	= 544.00	1401.49	0.00	
Watercourse slope (%)	= 1.10	24.97	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=1.69	10.16	0.00	
Travel Time (min)	**= 5.36**	**+ 2.30**	**+ 0.00**	**= 7.66**
Channel Flow				
X sectional flow area (sqft)	= 9.88	30.42	0.00	
Wetted perimeter (ft)	= 12.43	21.78	0.00	
Channel slope (%)	= 25.00	1.00	0.00	
Manning's n-value	= 0.025	0.025	0.015	
Velocity (ft/s)	=25.55	7.46	0.00	
Flow length (ft)	({0})873.1	1326.2	0.0	
Travel Time (min)	**= 0.57**	**+ 2.96**	**+ 0.00**	**= 3.53**

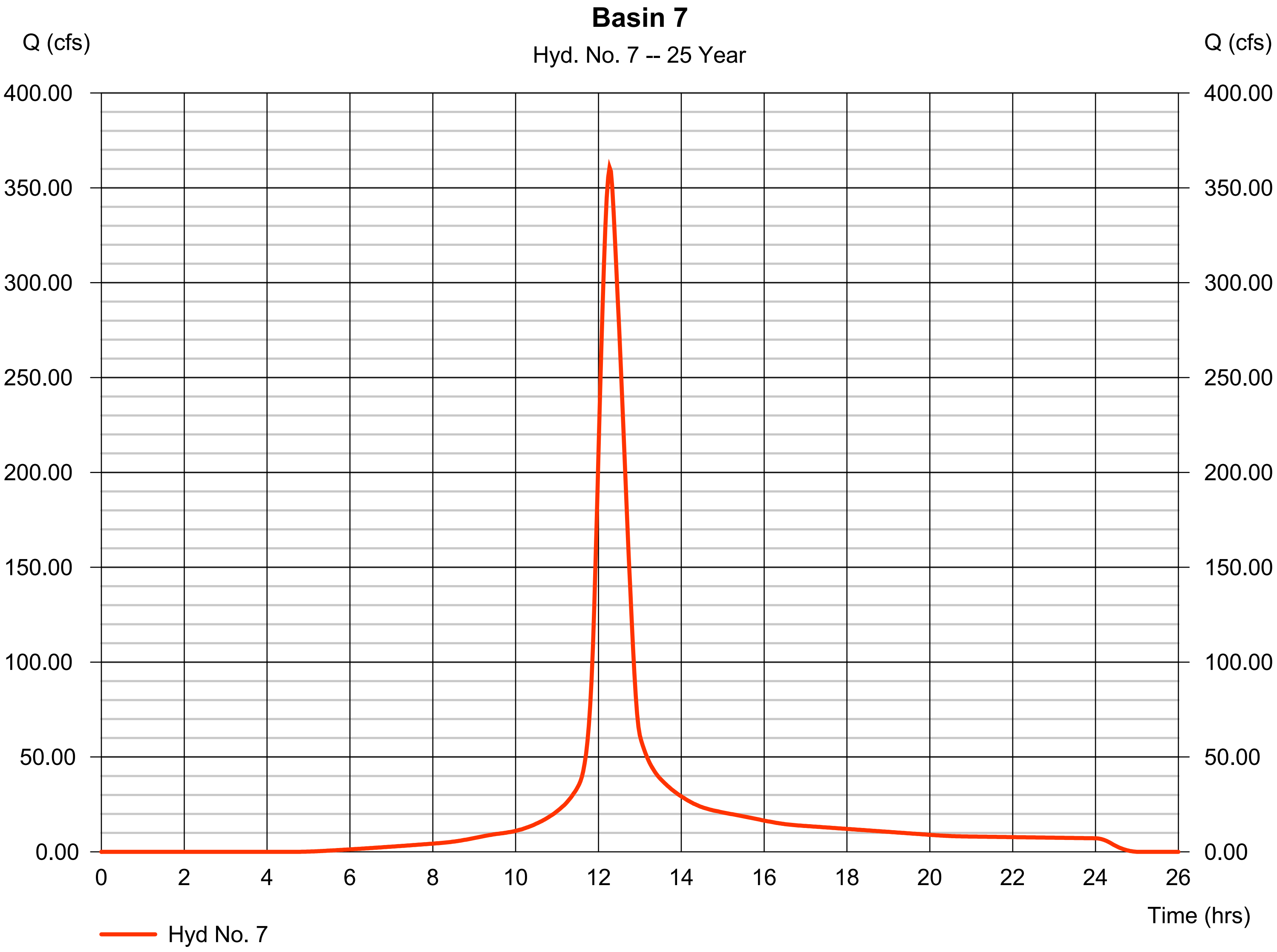
Total Travel Time, Tc .... 17.20 min

Hydrograph Report

Hyd. No. 7

Basin 7

Hydrograph type	= SCS Runoff	Peak discharge	= 360.74 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.27 hrs
Time interval	= 2 min	Hyd. volume	= 1,766,997 cuft
Drainage area	= 95.410 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 38.30 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 7

Basin 7

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 93.3	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.86	0.00	0.00	
Land slope (%)	= 25.00	0.00	0.00	
Travel Time (min)	**= 3.07 +**	**0.00 +**	**0.00 =**	**3.07**
Shallow Concentrated Flow				
Flow length (ft)	= 1414.99	1458.02	2981.00	
Watercourse slope (%)	= 1.10	18.40	2.97	
Surface description	= Unpaved	Paved	Unpaved	
Average velocity (ft/s)	=1.69	8.72	2.78	
Travel Time (min)	**= 13.94 +**	**2.79 +**	**17.87 =**	**34.59**
Channel Flow				
X sectional flow area (sqft)	= 12.74	0.00	0.00	
Wetted perimeter (ft)	= 13.46	0.00	0.00	
Channel slope (%)	= 25.00	0.00	0.00	
Manning's n-value	= 0.025	0.025	0.015	
Velocity (ft/s)	=28.72			
		0.00		
			0.00	
Flow length (ft)	({0})1047.5	0.0	0.0	
Travel Time (min)	**= 0.61 +**	**0.00 +**	**0.00 =**	**0.61**

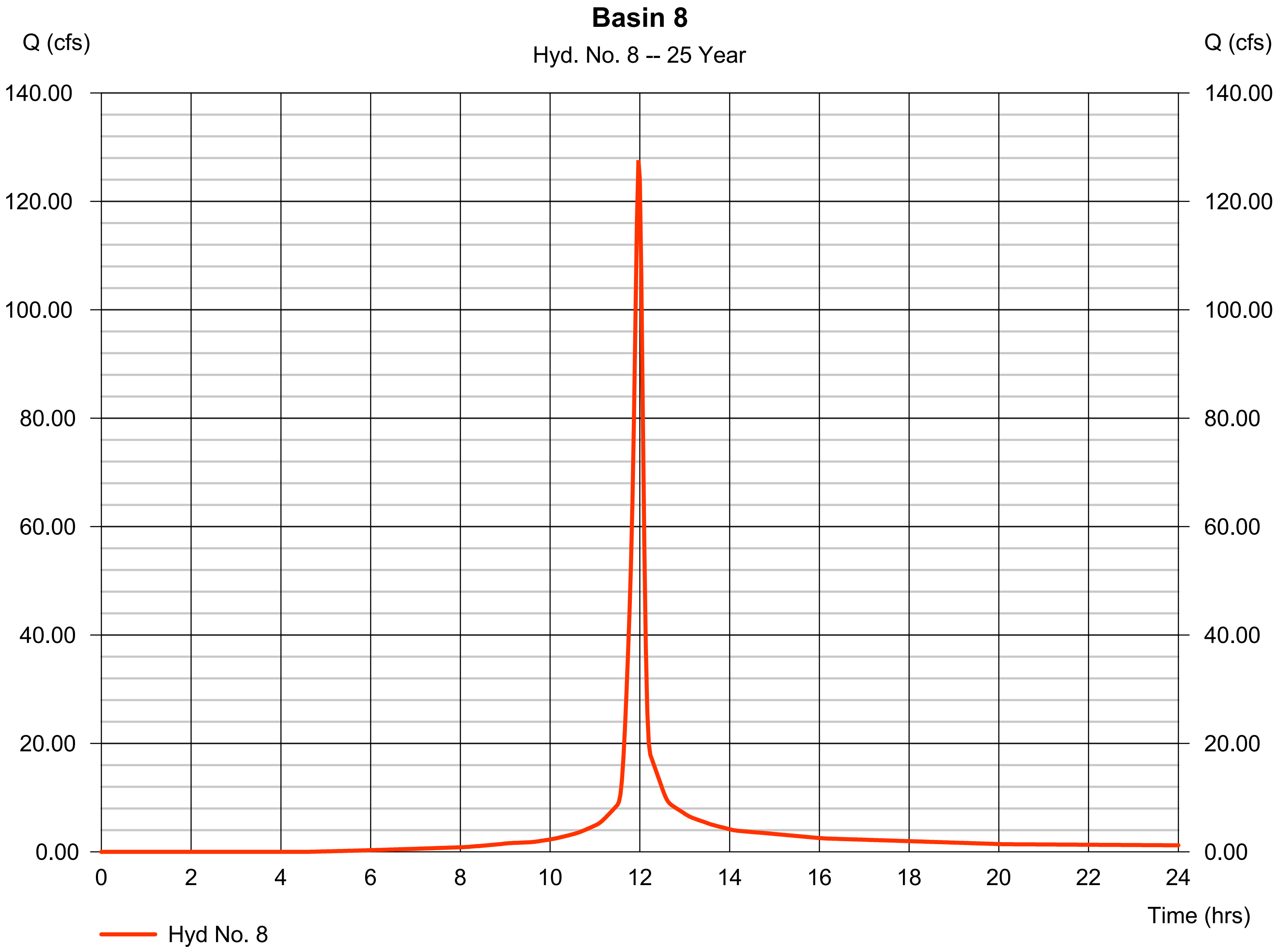
Total Travel Time, Tc .... 38.30 min

Hydrograph Report

Hyd. No. 8

Basin 8

Hydrograph type	= SCS Runoff	Peak discharge	= 127.61 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 302,432 cuft
Drainage area	= 16.330 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.60 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 8

Basin 8

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 118.4	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.86	0.00	0.00	
Land slope (%)	= 25.00	0.00	0.00	
Travel Time (min)	**= 3.72 +**	**0.00 +**	**0.00 =**	**3.72**
Shallow Concentrated Flow				
Flow length (ft)	= 124.27	0.00	0.00	
Watercourse slope (%)	= 1.10	0.00	0.00	
Surface description	= Unpaved	Paved	Paved	
Average velocity (ft/s)	=1.69	0.00	0.00	
Travel Time (min)	**= 1.22 +**	**0.00 +**	**0.00 =**	**1.22**
Channel Flow				
X sectional flow area (sqft)	= 7.02	0.00	0.00	
Wetted perimeter (ft)	= 11.31	0.00	0.00	
Channel slope (%)	= 19.00	0.00	0.00	
Manning's n-value	= 0.025	0.015	0.015	
Velocity (ft/s)	=18.87	0.00	0.00	
Flow length (ft)	({0})1872.8	0.0	0.0	
Travel Time (min)	**= 1.65 +**	**0.00 +**	**0.00 =**	**1.65**

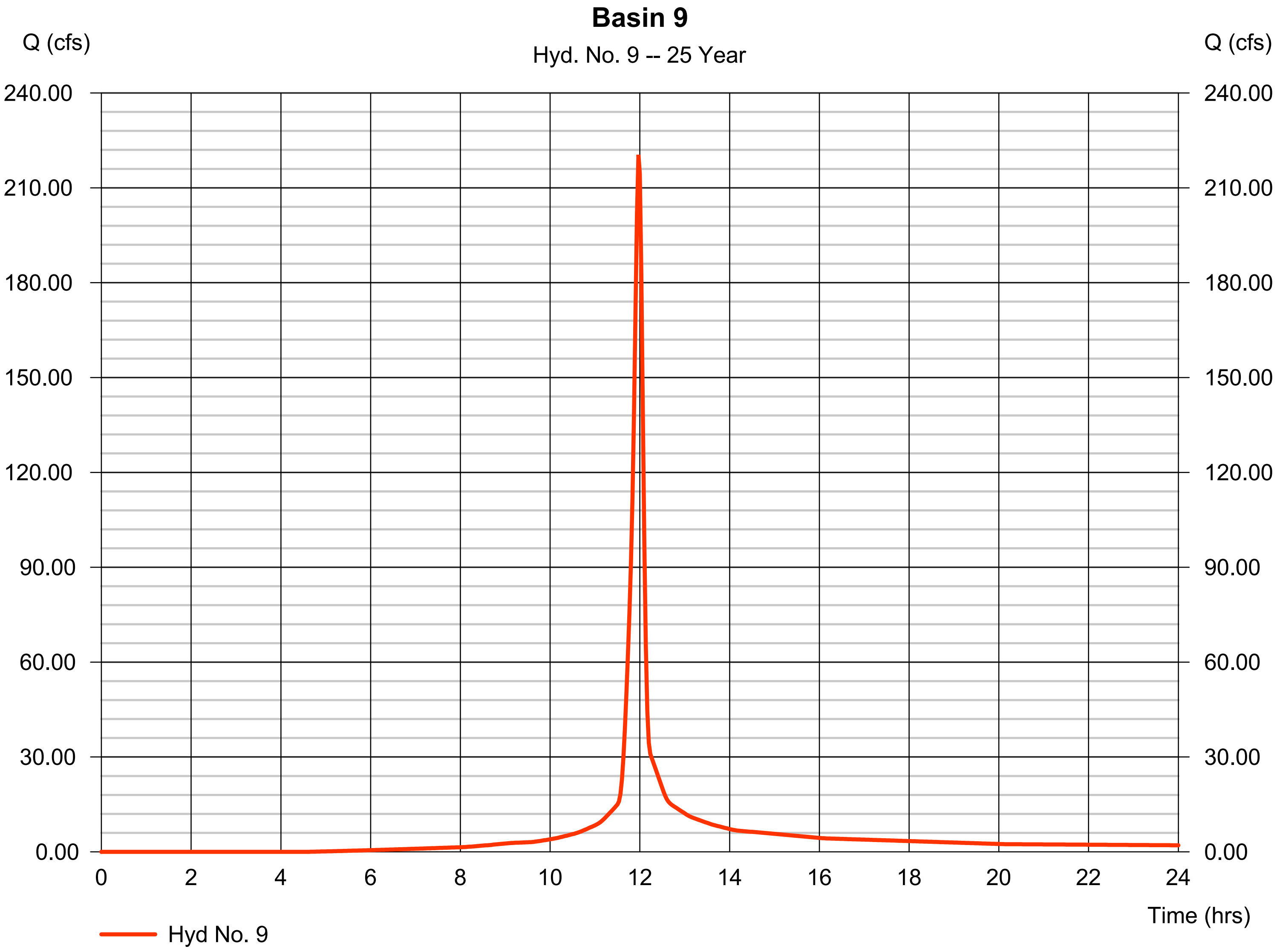
Total Travel Time, Tc .... 6.60 min

Hydrograph Report

Hyd. No. 9

Basin 9

Hydrograph type	= SCS Runoff	Peak discharge	= 220.44 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 522,450 cuft
Drainage area	= 28.210 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.50 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 9

Basin 9

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	177.8		0.0		0.0		
Two-year 24-hr precip. (in)	=	3.86		0.00		0.00		
Land slope (%)	=	25.00		0.00		0.00		
Travel Time (min)	**=**	**5.15**	**+**	**0.00**	**+**	**0.00**	**=**	**5.15**
Shallow Concentrated Flow								
Flow length (ft)	=	258.11		0.00		0.00		
Watercourse slope (%)	=	1.10		0.00		0.00		
Surface description	=	Unpaved		Paved		Paved		
Average velocity (ft/s)		=1.69		0.00		0.00		
Travel Time (min)	**=**	**2.54**	**+**	**0.00**	**+**	**0.00**	**=**	**2.54**
Channel Flow								
X sectional flow area (sqft)	=	9.17		0.00		0.00		
Wetted perimeter (ft)	=	12.16		0.00		0.00		
Channel slope (%)	=	23.25		0.00		0.00		
Manning's n-value	=	0.025		0.015		0.015		
Velocity (ft/s)		=23.79						
				0.00				
						0.00		
Flow length (ft)		({0})1182.7		0.0		0.0		
Travel Time (min)	**=**	**0.83**	**+**	**0.00**	**+**	**0.00**	**=**	**0.83**

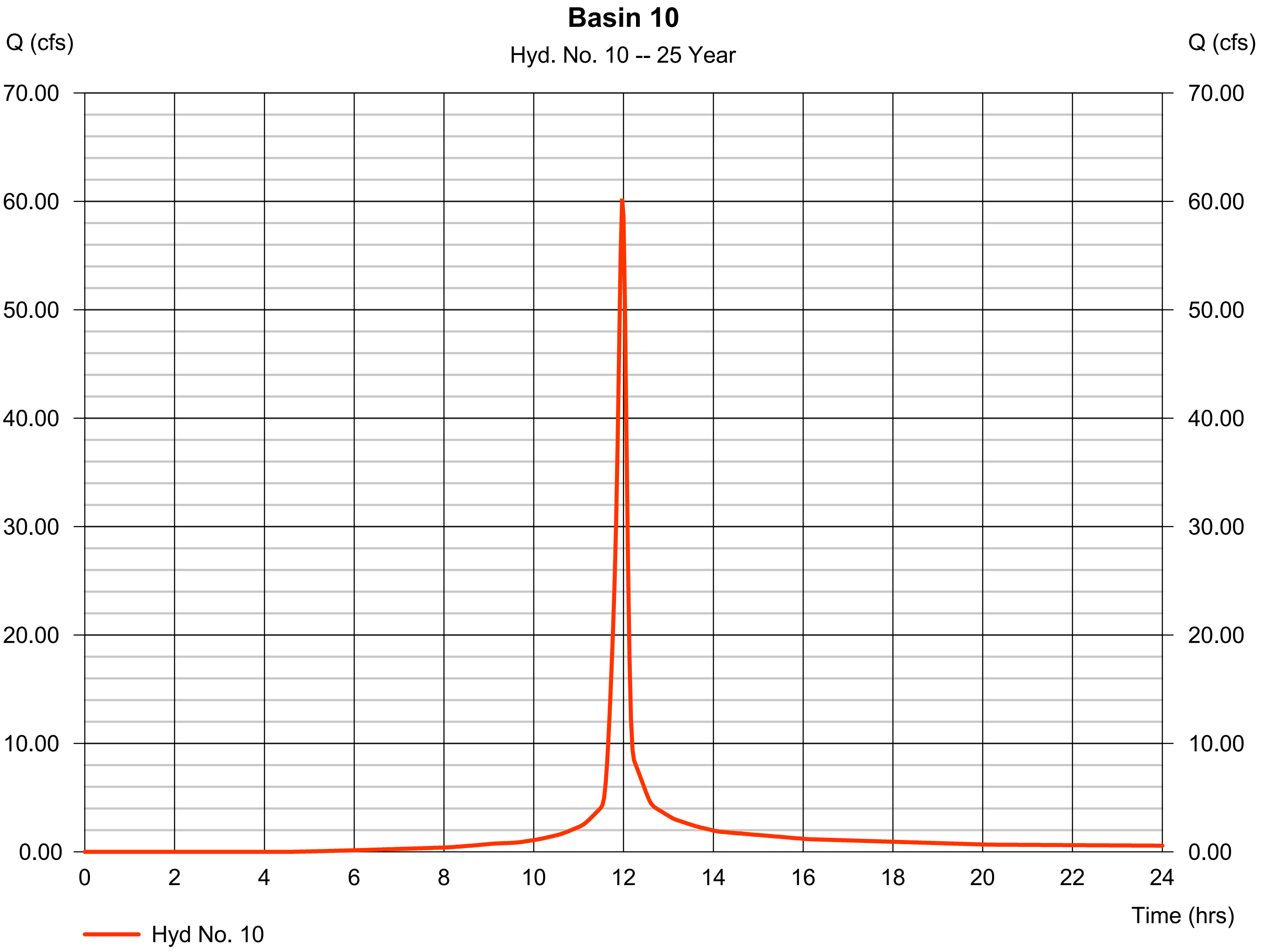
Total Travel Time, Tc .... 8.50 min

Hydrograph Report

Hyd. No. 10

Basin 10

Hydrograph type	= SCS Runoff	Peak discharge	= 60.25 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 142,789 cuft
Drainage area	= 7.710 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.20 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 10

Basin 10

Description		A		B		C		Totals
Sheet Flow								
Manning's n-value	=	0.150		0.011		0.011		
Flow length (ft)	=	123.6		42.0		0.0		
Two-year 24-hr precip. (in)	=	3.86		3.86		0.00		
Land slope (%)	=	33.00		8.00		0.00		
Travel Time (min)	**=**	**3.44**	**+**	**0.32**	**+**	**0.00**	**=**	**3.76**
Shallow Concentrated Flow								
Flow length (ft)	=	0.00		0.00		0.00		
Watercourse slope (%)	=	0.00		0.00		0.00		
Surface description	=	Paved		Paved		Paved		
Average velocity (ft/s)	=0.00			0.00		0.00		
Travel Time (min)	**=**	**0.00**	**+**	**0.00**	**+**	**0.00**	**=**	**0.00**
Channel Flow								
X sectional flow area (sqft)	=	32.56		0.00		0.00		
Wetted perimeter (ft)	=	22.41		0.00		0.00		
Channel slope (%)	=	1.53		0.00		0.00		
Manning's n-value	=	0.025		0.015		0.015		
Velocity (ft/s)	=9.47							
				0.00				
						0.00		
Flow length (ft)	({0})3077.6			0.0		0.0		
Travel Time (min)	**=**	**5.42**	**+**	**0.00**	**+**	**0.00**	**=**	**5.42**

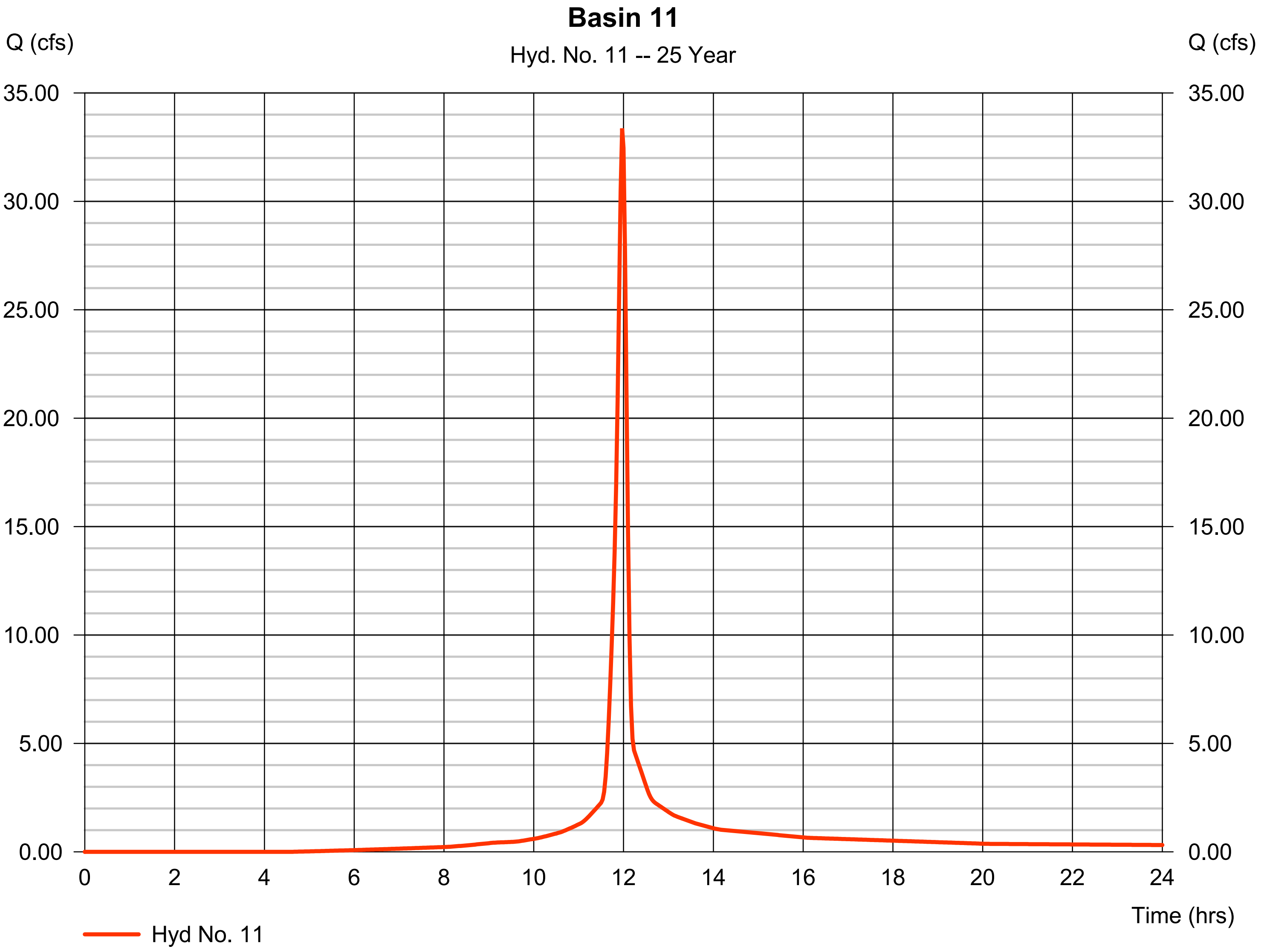
Total Travel Time, Tc .... 9.20 min

Hydrograph Report

Hyd. No. 11

Basin 11

Hydrograph type	= SCS Runoff	Peak discharge	= 33.37 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 79,081 cuft
Drainage area	= 4.270 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.50 min
Total precip.	= 6.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



TR55 Tc Worksheet

Hyd. No. 11

Basin 11

Description	A	B	C	Totals
Sheet Flow				
Manning's n-value	= 0.150	0.011	0.011	
Flow length (ft)	= 167.1	0.0	0.0	
Two-year 24-hr precip. (in)	= 3.86	0.00	0.00	
Land slope (%)	= 25.00	0.00	0.00	
Travel Time (min)	**= 4.90**	**+ 0.00**	**+ 0.00**	**= 4.90**
Shallow Concentrated Flow				
Flow length (ft)	= 0.00	0.00	0.00	
Watercourse slope (%)	= 0.00	0.00	0.00	
Surface description	= Paved	Paved	Paved	
Average velocity (ft/s)	=0.00	0.00	0.00	
Travel Time (min)	**= 0.00**	**+ 0.00**	**+ 0.00**	**= 0.00**
Channel Flow				
X sectional flow area (sqft)	= 7.02	0.00	0.00	
Wetted perimeter (ft)	= 9.68	0.00	0.00	
Channel slope (%)	= 3.00	0.00	0.00	
Manning's n-value	= 0.025	0.015	0.015	
Velocity (ft/s)	=8.33	0.00	0.00	
Flow length (ft)	({0})1288.7	0.0	0.0	
Travel Time (min)	**= 2.58**	**+ 0.00**	**+ 0.00**	**= 2.58**

Total Travel Time, Tc .... 7.50 min

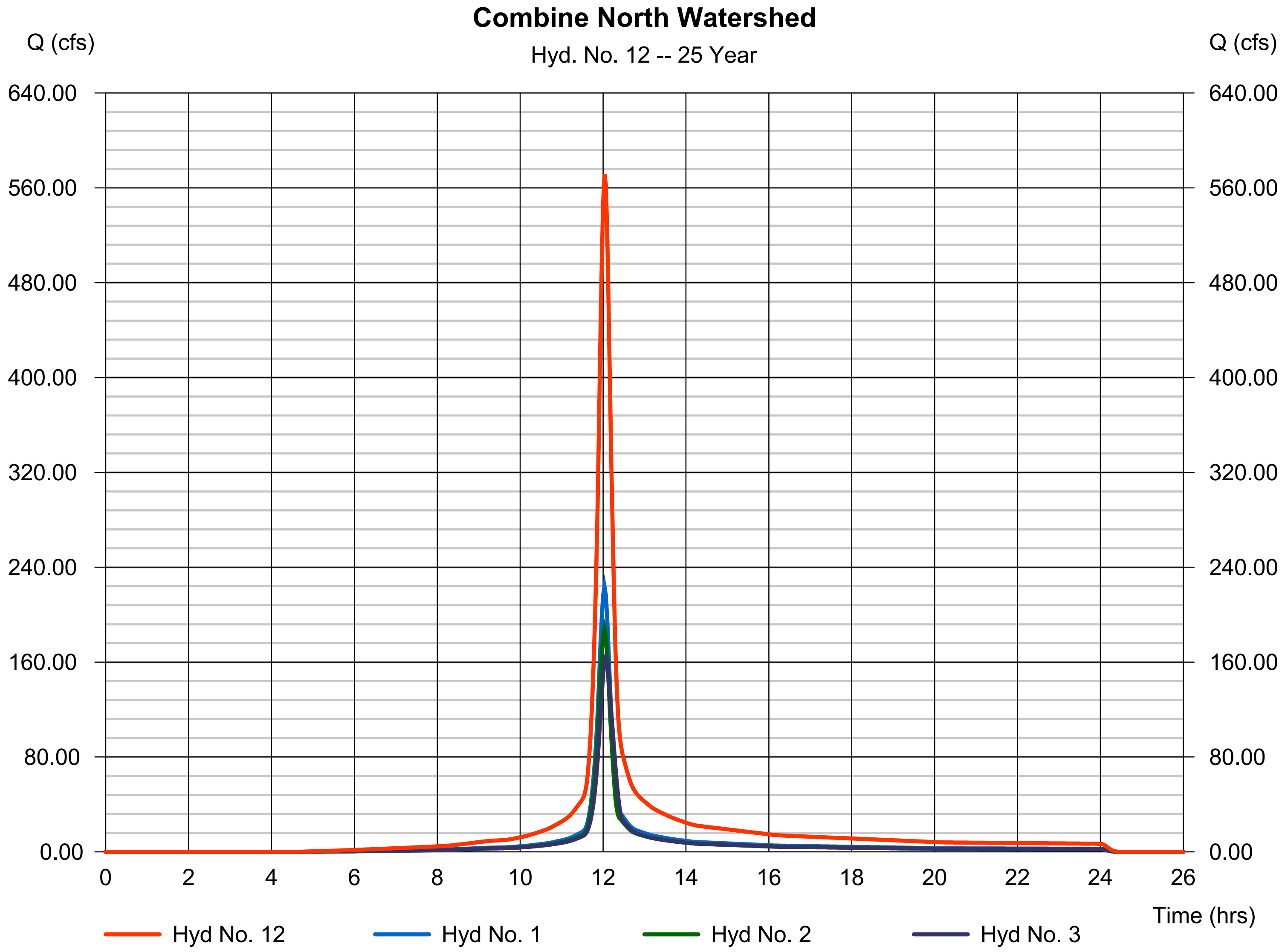
Hydrograph Report

Hyd. No. 12

Combine North Watershed

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyds. = 1, 2, 3

Peak discharge = 571.36 cfs
Time to peak = 12.03 hrs
Hyd. volume = 1,707,570 cuft
Contrib. drain. area = 93.840 ac



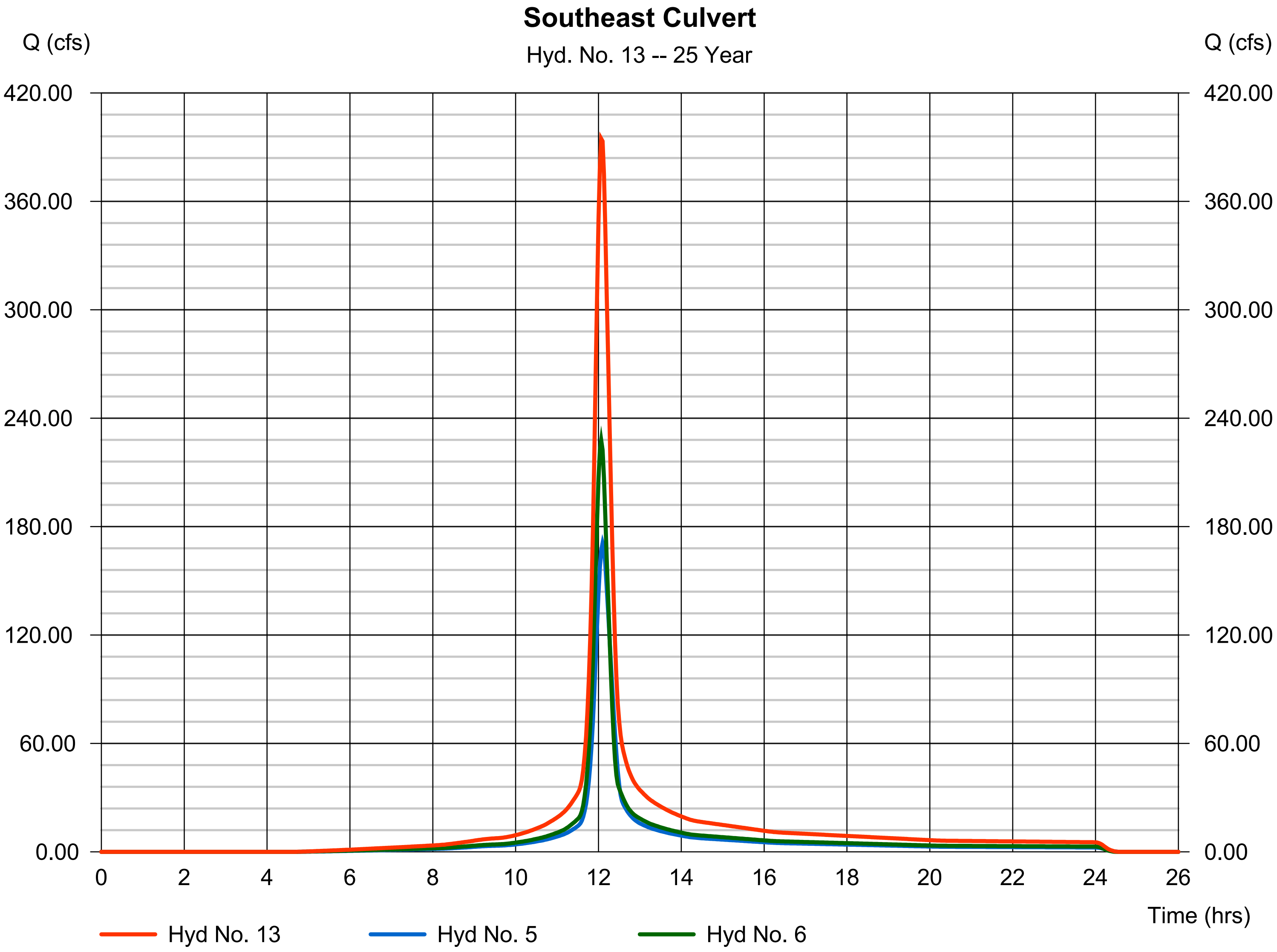
Hydrograph Report

Hyd. No. 13

Southeast Culvert

Hydrograph type = Combine
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyds. = 5, 6

Peak discharge = 394.61 cfs
Time to peak = 12.07 hrs
Hyd. volume = 1,326,556 cuft
Contrib. drain. area = 71.060 ac

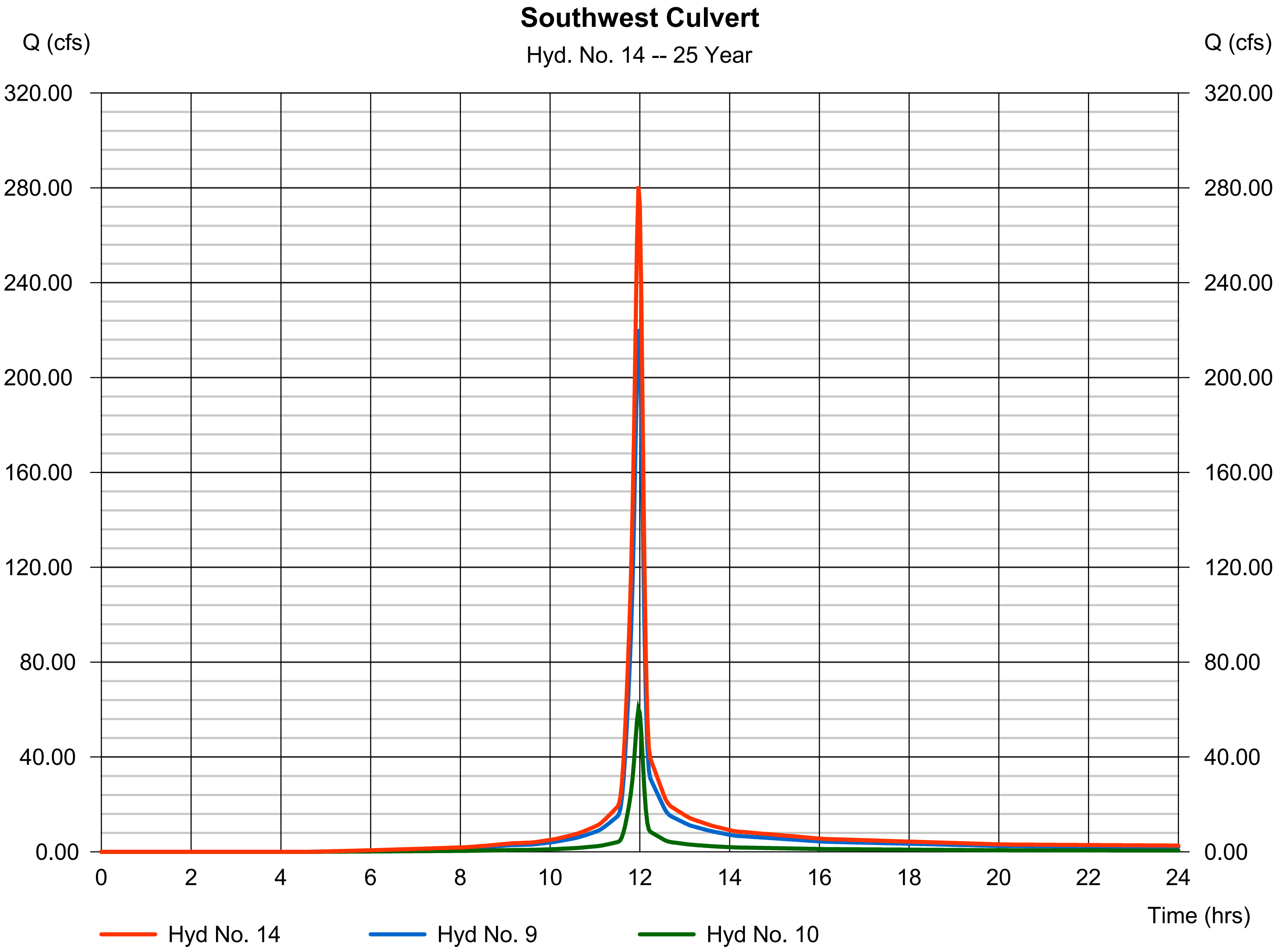


Hydrograph Report

Hyd. No. 14

Southwest Culvert

Hydrograph type	= Combine	Peak discharge	= 280.69 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 665,240 cuft
Inflow hyds.	= 9, 10	Contrib. drain. area	= 35.920 ac

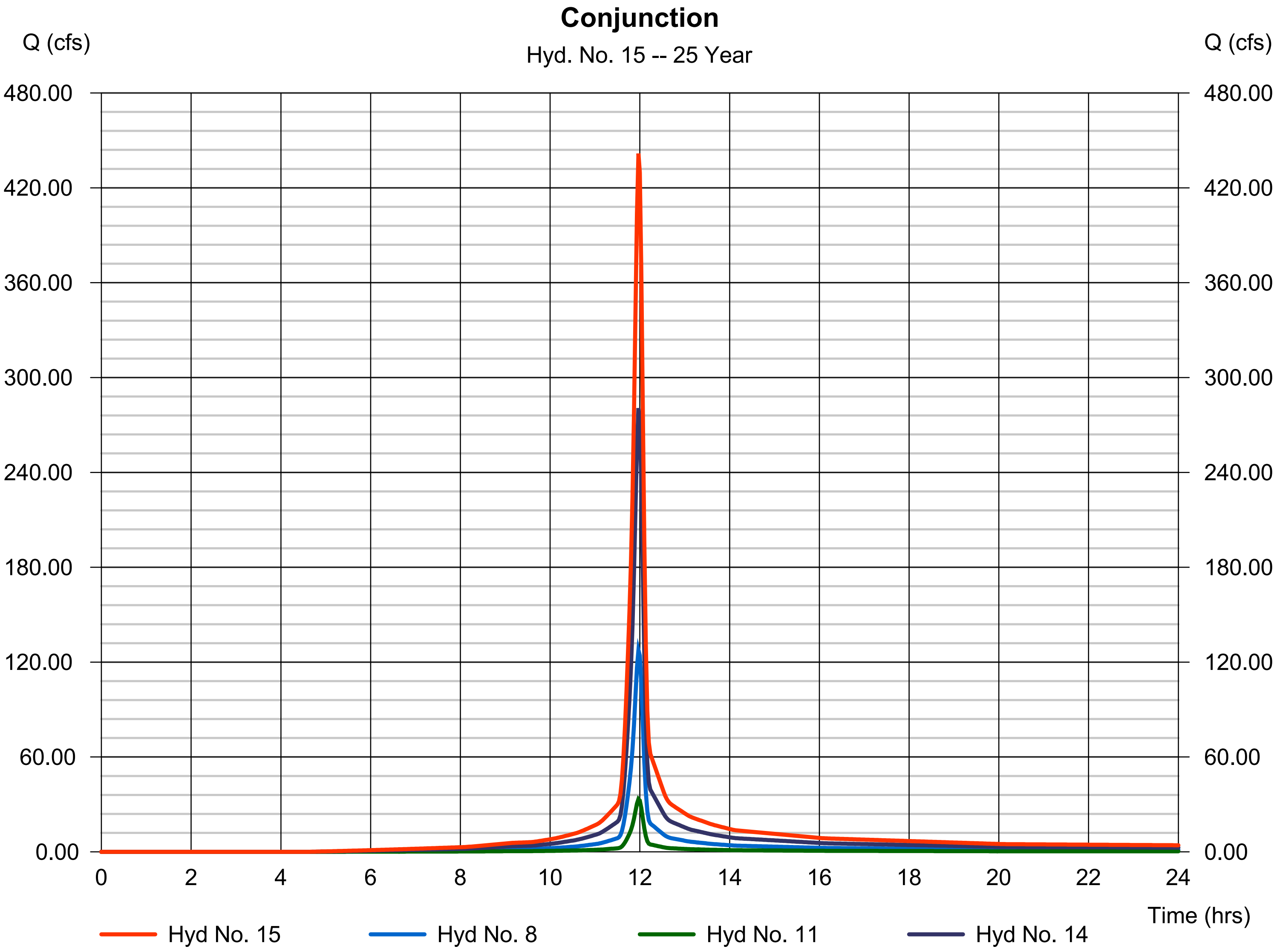


Hydrograph Report

Hyd. No. 15

Conjunction

Hydrograph type	= Combine	Peak discharge	= 441.67 cfs
Storm frequency	= 25 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 1,046,752 cuft
Inflow hyds.	= 8, 11, 14	Contrib. drain. area	= 20.600 ac

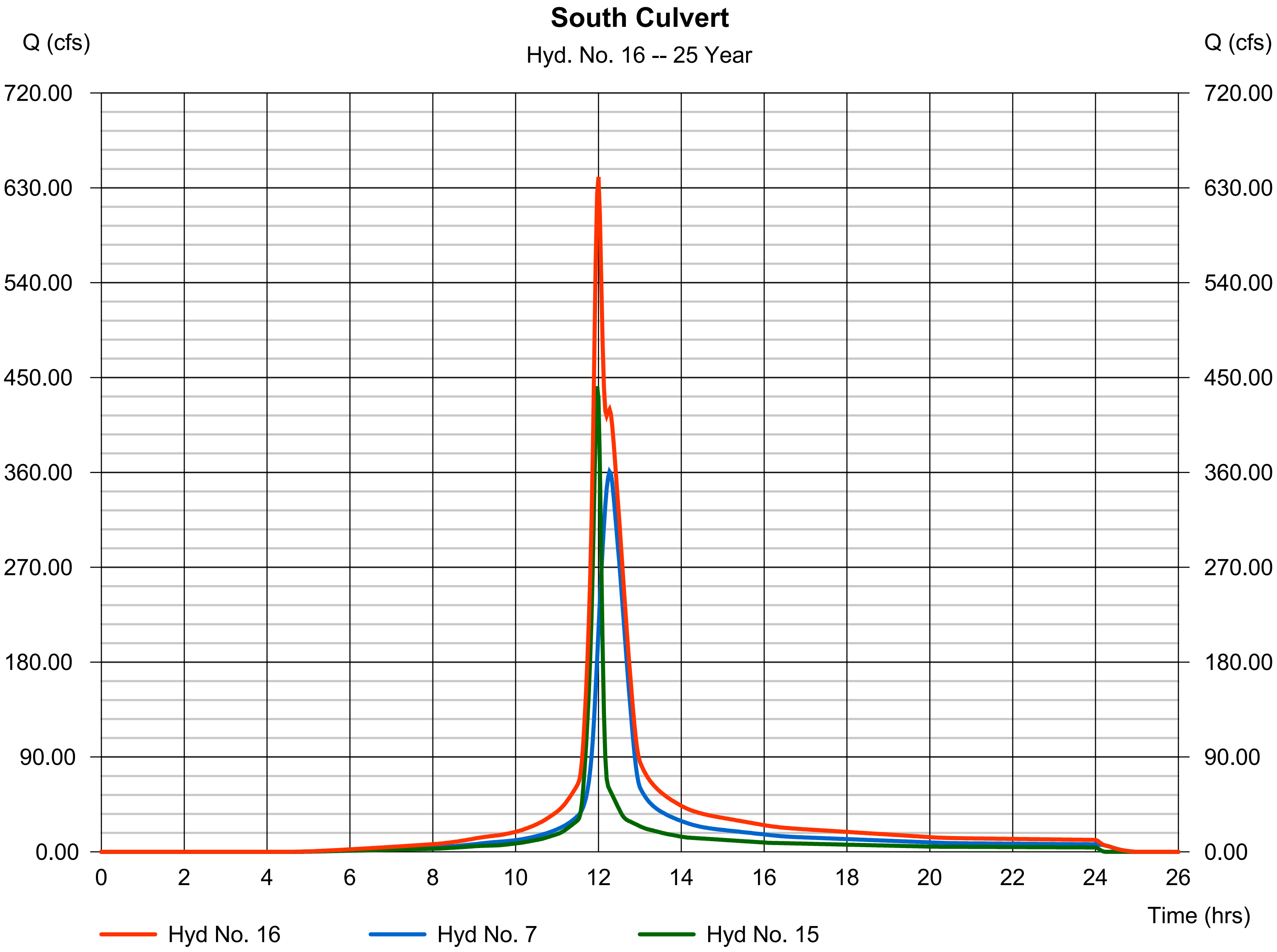


Hydrograph Report

Hyd. No. 16

South Culvert

Hydrograph type	= Combine	Peak discharge	= 640.31 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 2,813,747 cuft
Inflow hyds.	= 7, 15	Contrib. drain. area	= 95.410 ac



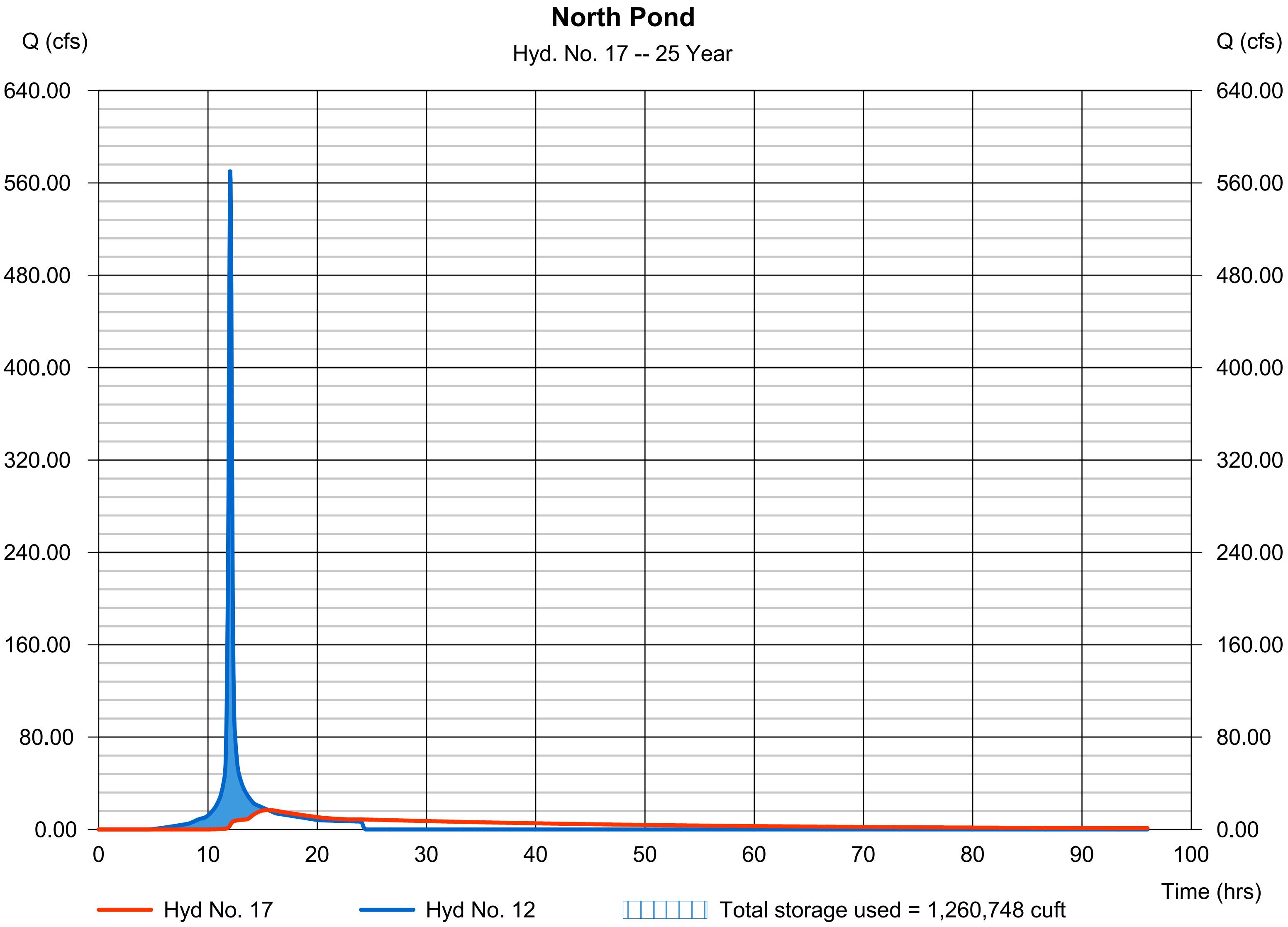
Hydrograph Report

Hyd. No. 17

North Pond

Hydrograph type	= Reservoir	Peak discharge	= 16.84 cfs
Storm frequency	= 25 yrs	Time to peak	= 15.50 hrs
Time interval	= 2 min	Hyd. volume	= 1,426,208 cuft
Inflow hyd. No.	= 12 - Combine North Watershed	Max. Elevation	= 835.39 ft
Reservoir name	= North Pond	Max. Storage	= 1,260,748 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - North Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 822.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	822.00	58,136	0	0
1.00	823.00	63,242	60,665	60,665
2.00	824.00	68,421	65,808	126,473
3.00	825.00	73,666	71,020	197,493
4.00	826.00	78,975	76,297	273,790
5.00	827.00	84,348	81,639	355,429
6.00	828.00	89,786	87,045	442,473
7.00	829.00	95,294	92,517	534,991
8.00	830.00	100,874	98,061	633,051
9.00	831.00	106,525	103,676	736,727
10.00	832.00	112,244	109,361	846,088
11.00	833.00	118,030	115,113	961,201
12.00	834.00	123,884	120,933	1,082,134
13.00	835.00	129,805	126,820	1,208,954
14.00	836.00	135,793	132,775	1,341,729
15.00	837.00	141,849	138,796	1,480,525
16.00	838.00	147,943	144,871	1,625,396
17.00	839.00	154,073	150,982	1,776,378
18.00	840.00	160,242	157,132	1,933,510

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 24.00	Inactive	0.00	6.00
Span (in)	= 24.00	0.00	0.00	6.00
No. Barrels	= 1	1	0	4
Invert El. (ft)	= 823.00	840.00	0.00	823.00
Length (ft)	= 100.00	175.00	0.00	10.00
Slope (%)	= 1.70	5.00	0.00	n/a
N-Value	= .013	.023	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	Yes

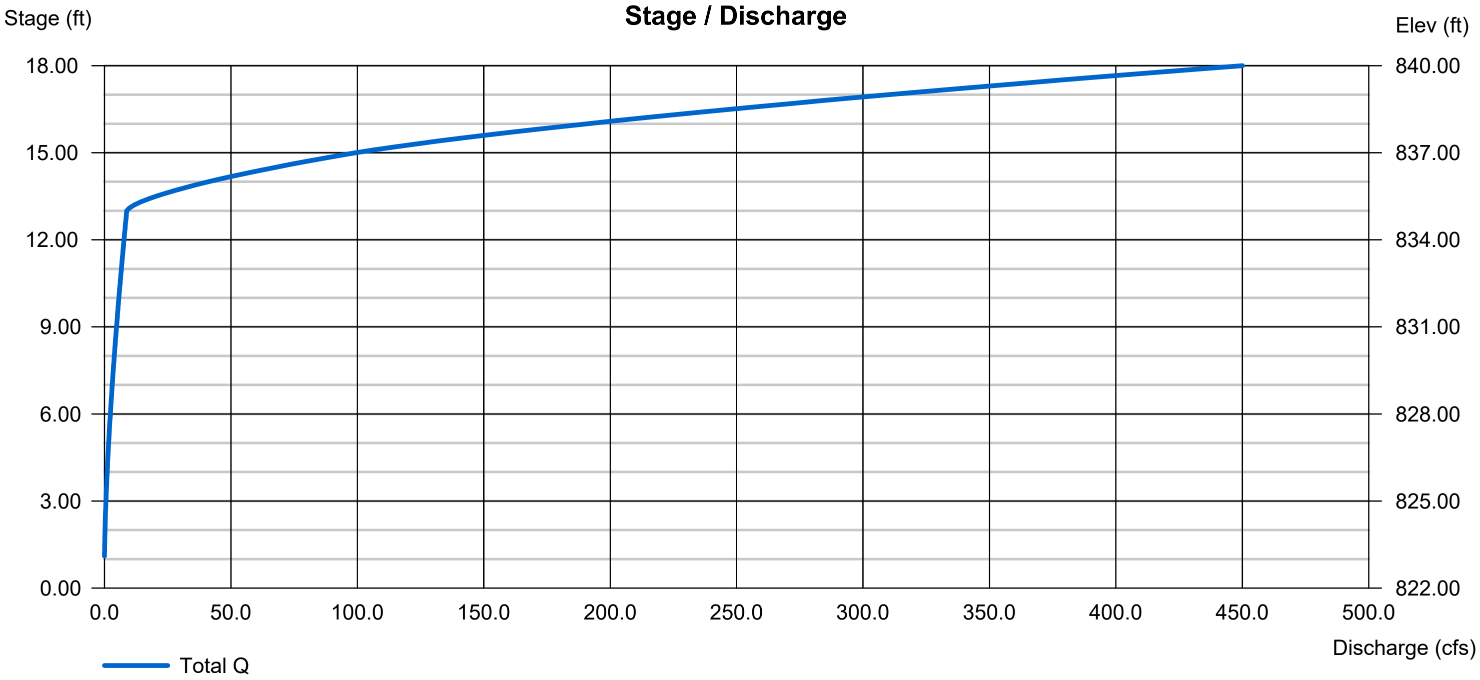
Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 5.00	12.00	0.00	0.00
Crest El. (ft)	= 837.00	835.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Ciplti	Broad	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Discharge

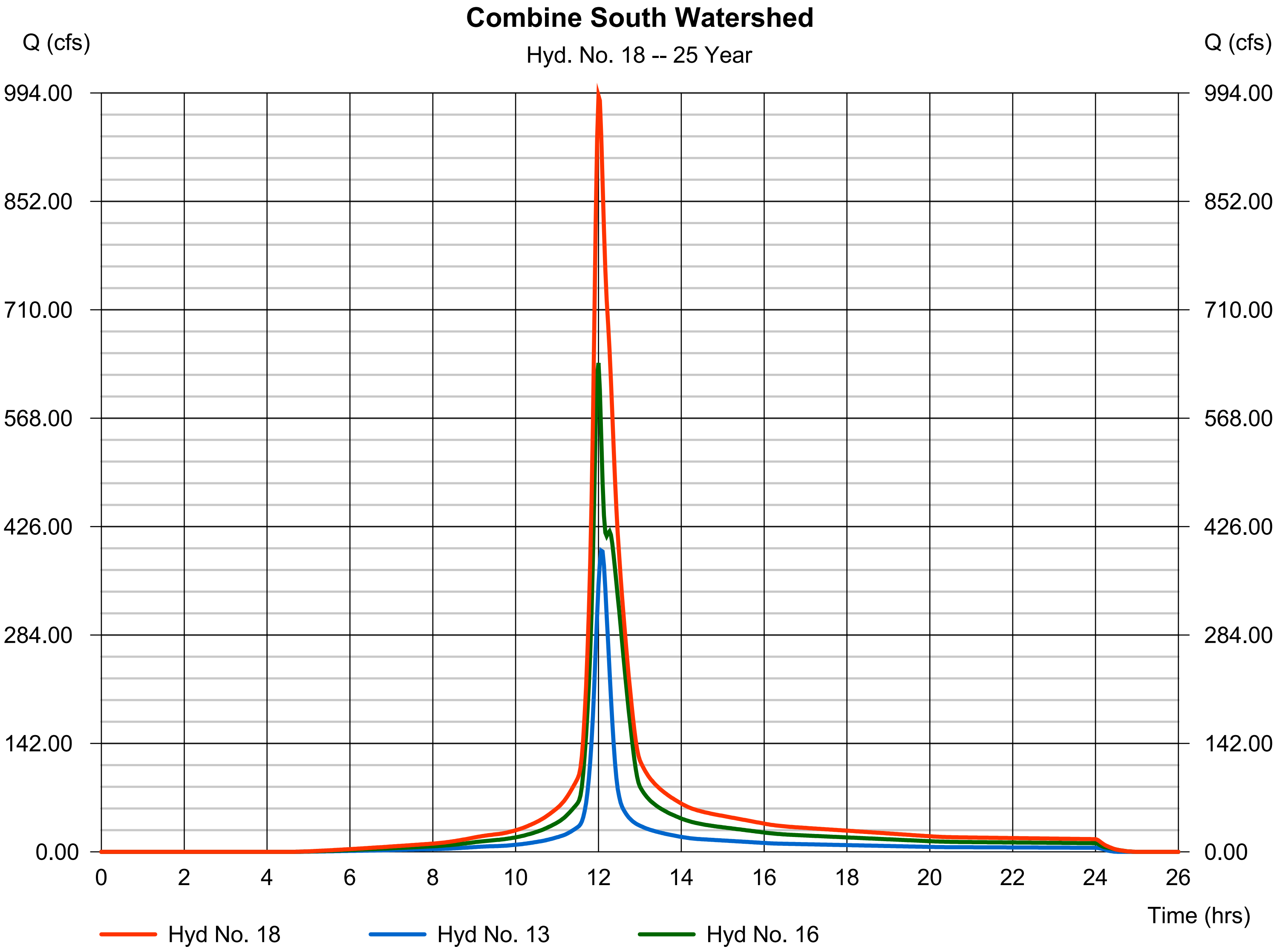


Hydrograph Report

Hyd. No. 18

Combine South Watershed

Hydrograph type	= Combine	Peak discharge	= 990.21 cfs
Storm frequency	= 25 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 4,140,305 cuft
Inflow hyds.	= 13, 16	Contrib. drain. area	= 0.000 ac



Hydrograph Report

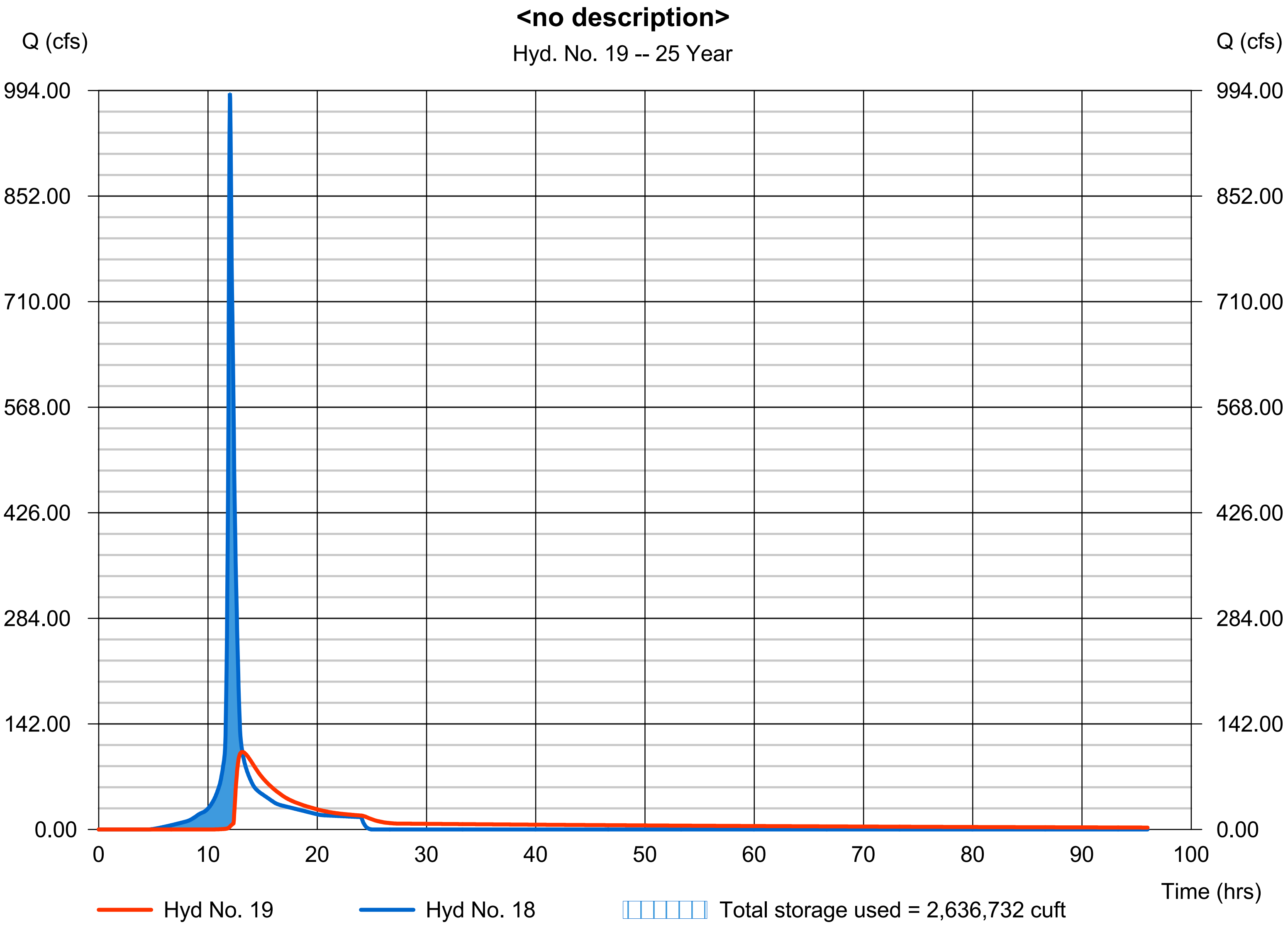
Hyd. No. 19

<no description>

Hydrograph type = Reservoir
Storm frequency = 25 yrs
Time interval = 2 min
Inflow hyd. No. = 18 - Combine South Watershed
Reservoir name = South Pond

Peak discharge = 104.20 cfs
Time to peak = 13.13 hrs
Hyd. volume = 3,225,121 cuft
Max. Elevation = 721.82 ft
Max. Storage = 2,636,732 cuft

Storage Indication method used.



Pond Report

Pond No. 2 - South Pond

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 708.00 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	708.00	89,937	0	0
1.00	709.00	104,573	97,153	97,153
2.00	710.00	117,327	110,878	208,031
3.00	711.00	130,746	123,964	331,995
4.00	712.00	144,768	137,684	469,679
5.00	713.00	159,045	151,836	621,514
6.00	714.00	173,523	166,215	787,729
7.00	715.00	188,202	180,795	968,524
8.00	716.00	203,082	195,576	1,164,100
9.00	717.00	218,162	210,555	1,374,655
10.00	718.00	233,443	225,737	1,600,392
11.00	719.00	248,942	241,127	1,841,519
12.00	720.00	265,406	257,104	2,098,623
13.00	721.00	295,020	280,054	2,378,677
14.00	722.00	337,687	316,082	2,694,759
15.00	723.00	367,007	352,210	3,046,969
16.00	724.00	381,899	374,391	3,421,360
17.00	725.00	396,829	389,302	3,810,662

Culvert / Orifice Structures

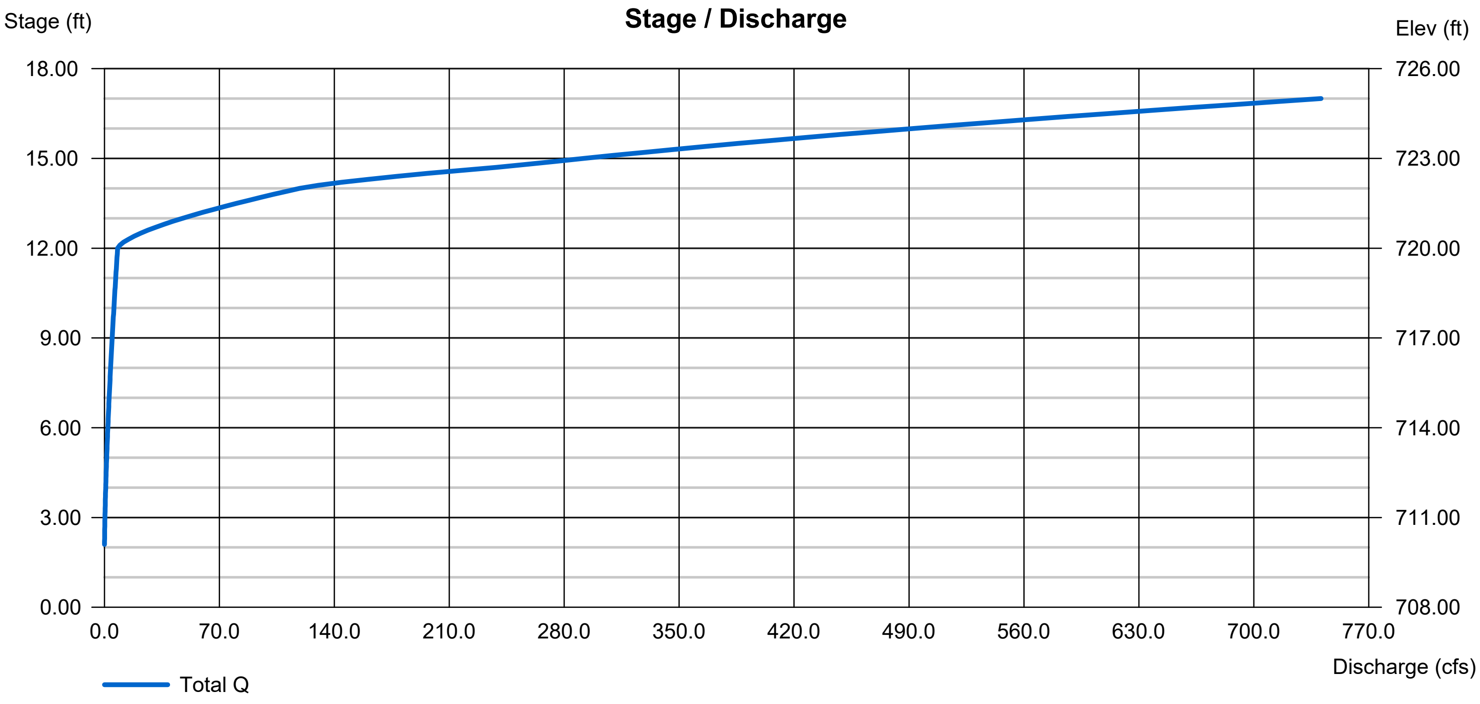
	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 48.00	Inactive	0.00	6.00
Span (in)	= 48.00	0.00	0.00	6.00
No. Barrels	= 1	1	0	4
Invert El. (ft)	= 709.00	0.00	0.00	710.00
Length (ft)	= 180.00	0.00	0.00	10.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.023	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	Yes

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 30.00	15.50	0.00	0.00
Crest El. (ft)	= 722.00	720.00	0.00	0.00
Weir Coeff.	= 3.33	2.60	3.33	3.33
Weir Type	= Ciplti	Broad	---	---
Multi-Stage	= No	Yes	No	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020

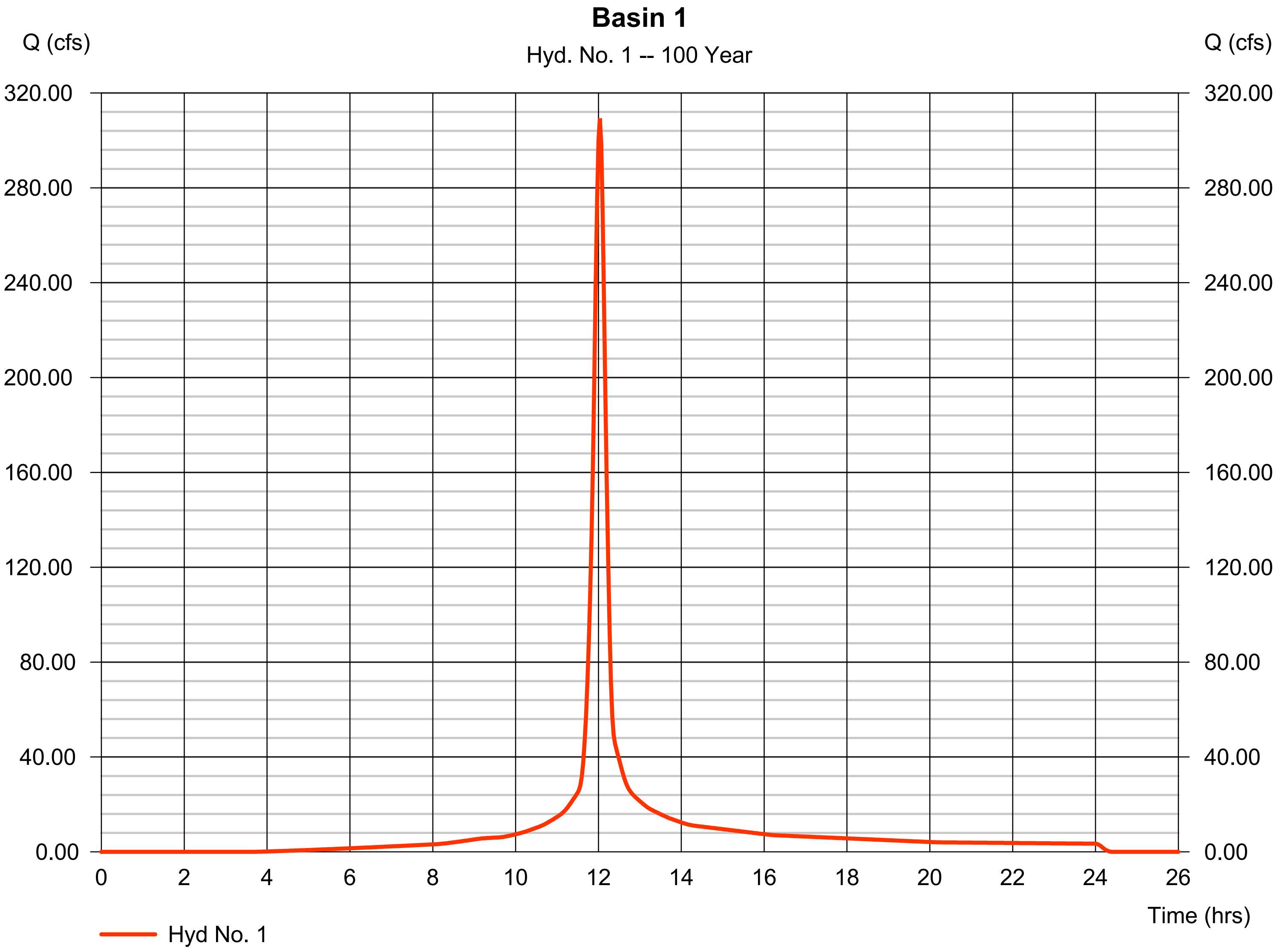
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	309.29	2	722	905,270	------	------	------	Basin 1
2	SCS Runoff	260.20	2	722	761,596	------	------	------	Basin 2
3	SCS Runoff	227.60	2	724	737,830	------	------	------	Basin 3
4	SCS Runoff	177.40	2	722	519,258	------	------	------	Basin 4
5	SCS Runoff	237.13	2	726	844,715	------	------	------	Basin 5
6	SCS Runoff	315.70	2	724	1,023,416	------	------	------	Basin 6
7	SCS Runoff	501.74	2	736	2,488,381	------	------	------	Basin 7
8	SCS Runoff	176.27	2	718	425,902	------	------	------	Basin 8
9	SCS Runoff	304.51	2	718	735,744	------	------	------	Basin 9
10	SCS Runoff	83.23	2	718	201,084	------	------	------	Basin 10
11	SCS Runoff	46.09	2	718	111,366	------	------	------	Basin 11
12	Combine	791.87	2	722	2,404,695	1, 2, 3,	------	------	Combine North Watershed
13	Combine	547.88	2	724	1,868,130	5, 6,	------	------	Southeast Culvert
14	Combine	387.74	2	718	936,828	9, 10,	------	------	Southwest Culvert
15	Combine	610.11	2	718	1,474,095	8, 11, 14	------	------	Conjunction
16	Combine	889.50	2	720	3,962,479	7, 15	------	------	South Culvert
17	Reservoir	92.36	2	754	2,120,476	12	836.90	1,466,014	North Pond
18	Combine	1378.36	2	720	5,830,608	13, 16,	------	------	Combine South Watershed
19	Reservoir	377.96	2	760	4,910,614	18	723.46	3,218,992	<no description>

Hydrograph Report

Hyd. No. 1

Basin 1

Hydrograph type	= SCS Runoff	Peak discharge	= 309.29 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 905,270 cuft
Drainage area	= 35.600 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 14.80 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

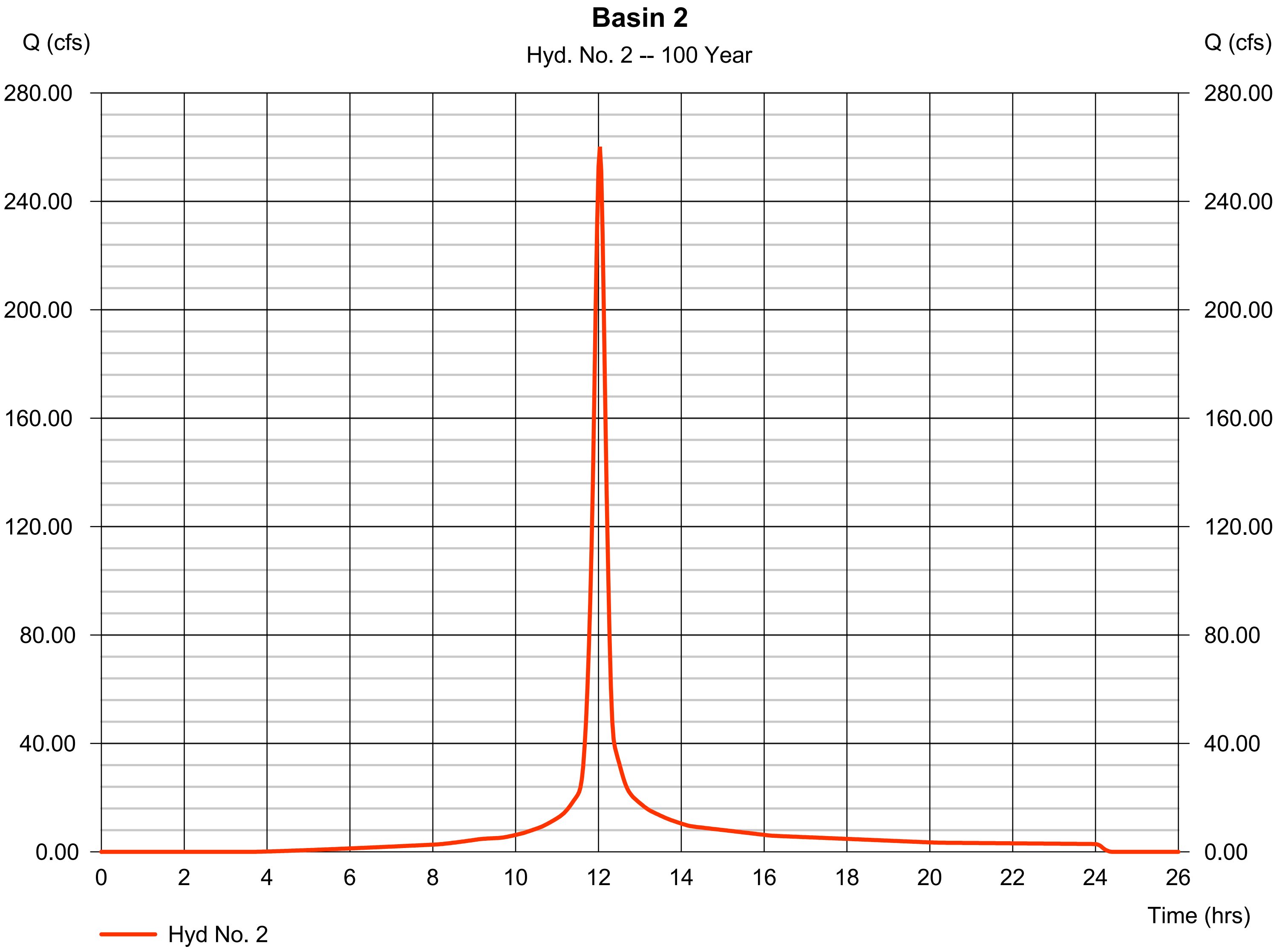


Hydrograph Report

Hyd. No. 2

Basin 2

Hydrograph type	= SCS Runoff	Peak discharge	= 260.20 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 761,596 cuft
Drainage area	= 29.950 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 13.80 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

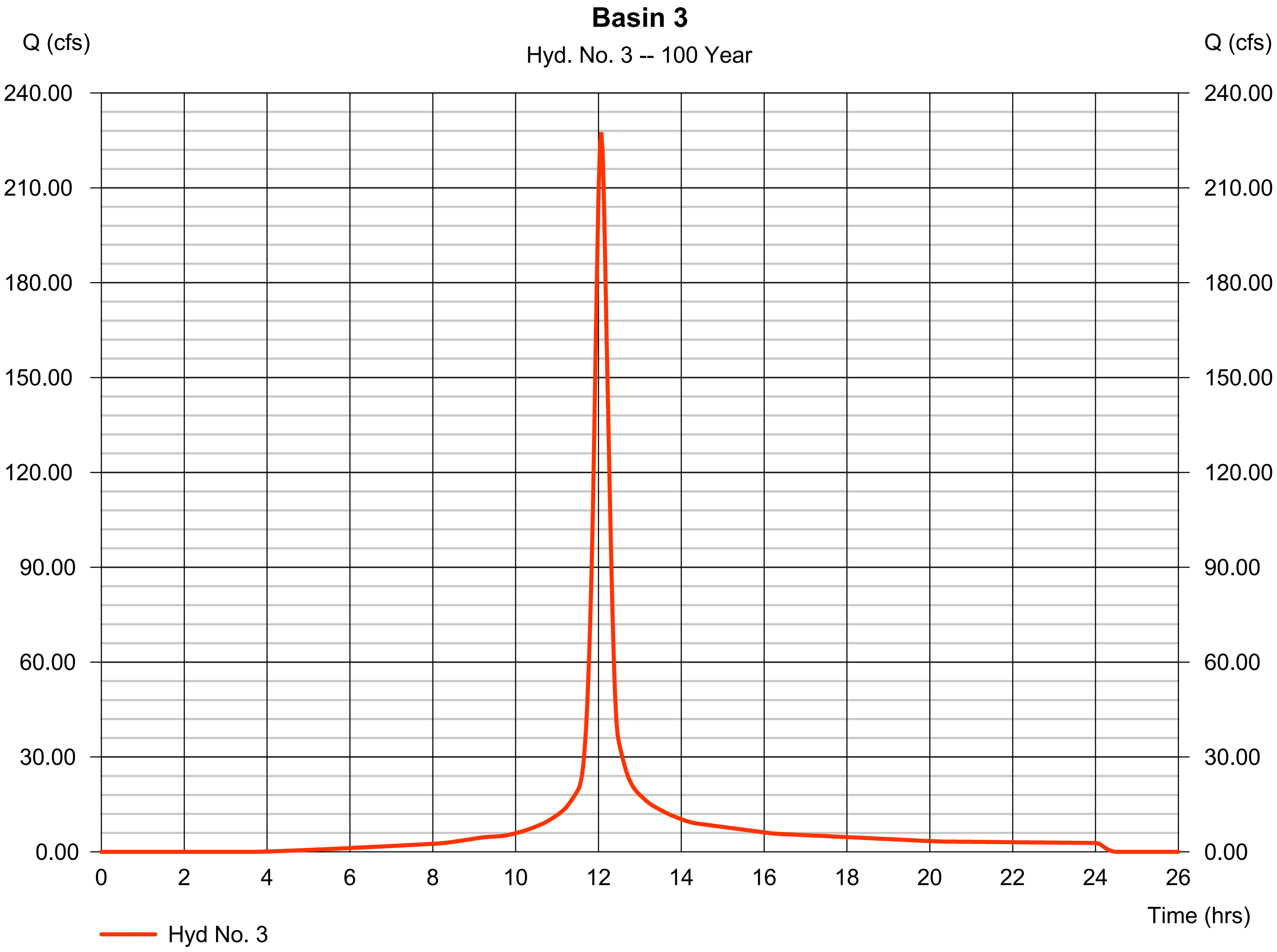


Hydrograph Report

Hyd. No. 3

Basin 3

Hydrograph type	= SCS Runoff	Peak discharge	= 227.60 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 737,830 cuft
Drainage area	= 28.290 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 19.00 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

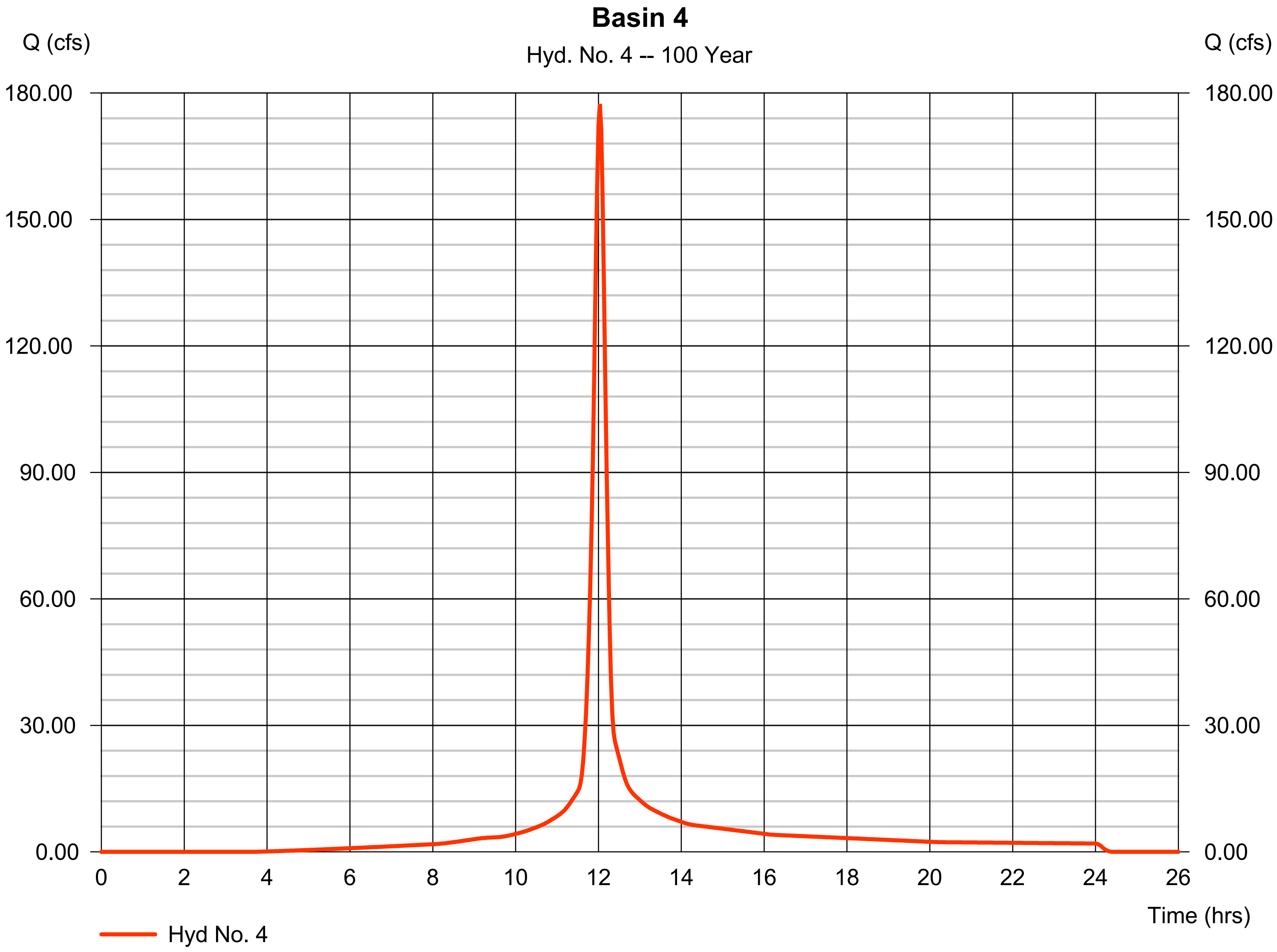


Hydrograph Report

Hyd. No. 4

Basin 4

Hydrograph type	= SCS Runoff	Peak discharge	= 177.40 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.03 hrs
Time interval	= 2 min	Hyd. volume	= 519,258 cuft
Drainage area	= 20.420 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 15.10 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

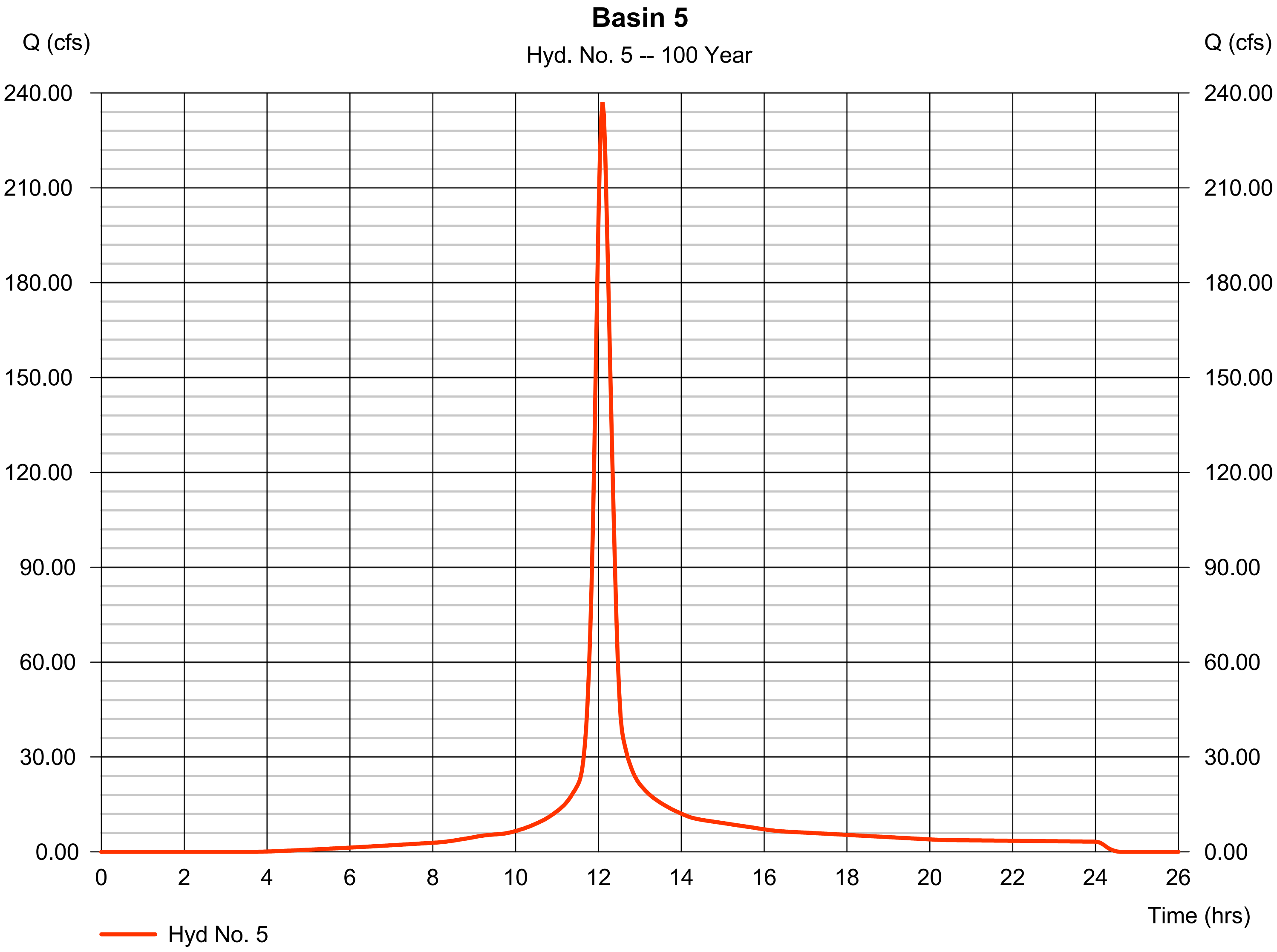


Hydrograph Report

Hyd. No. 5

Basin 5

Hydrograph type	= SCS Runoff	Peak discharge	= 237.13 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.10 hrs
Time interval	= 2 min	Hyd. volume	= 844,715 cuft
Drainage area	= 31.820 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 20.70 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

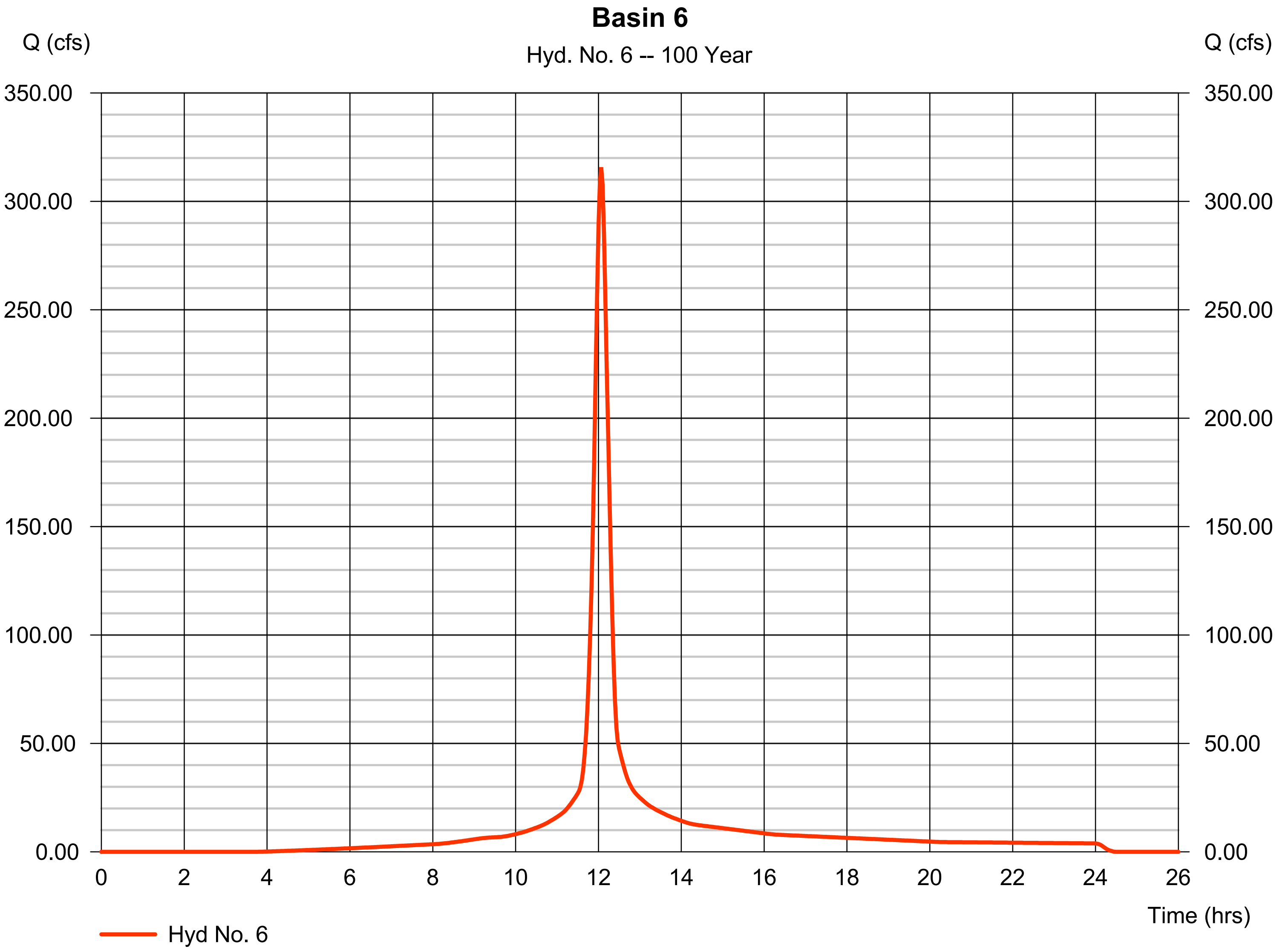


Hydrograph Report

Hyd. No. 6

Basin 6

Hydrograph type	= SCS Runoff	Peak discharge	= 315.70 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.07 hrs
Time interval	= 2 min	Hyd. volume	= 1,023,416 cuft
Drainage area	= 39.240 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 17.20 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



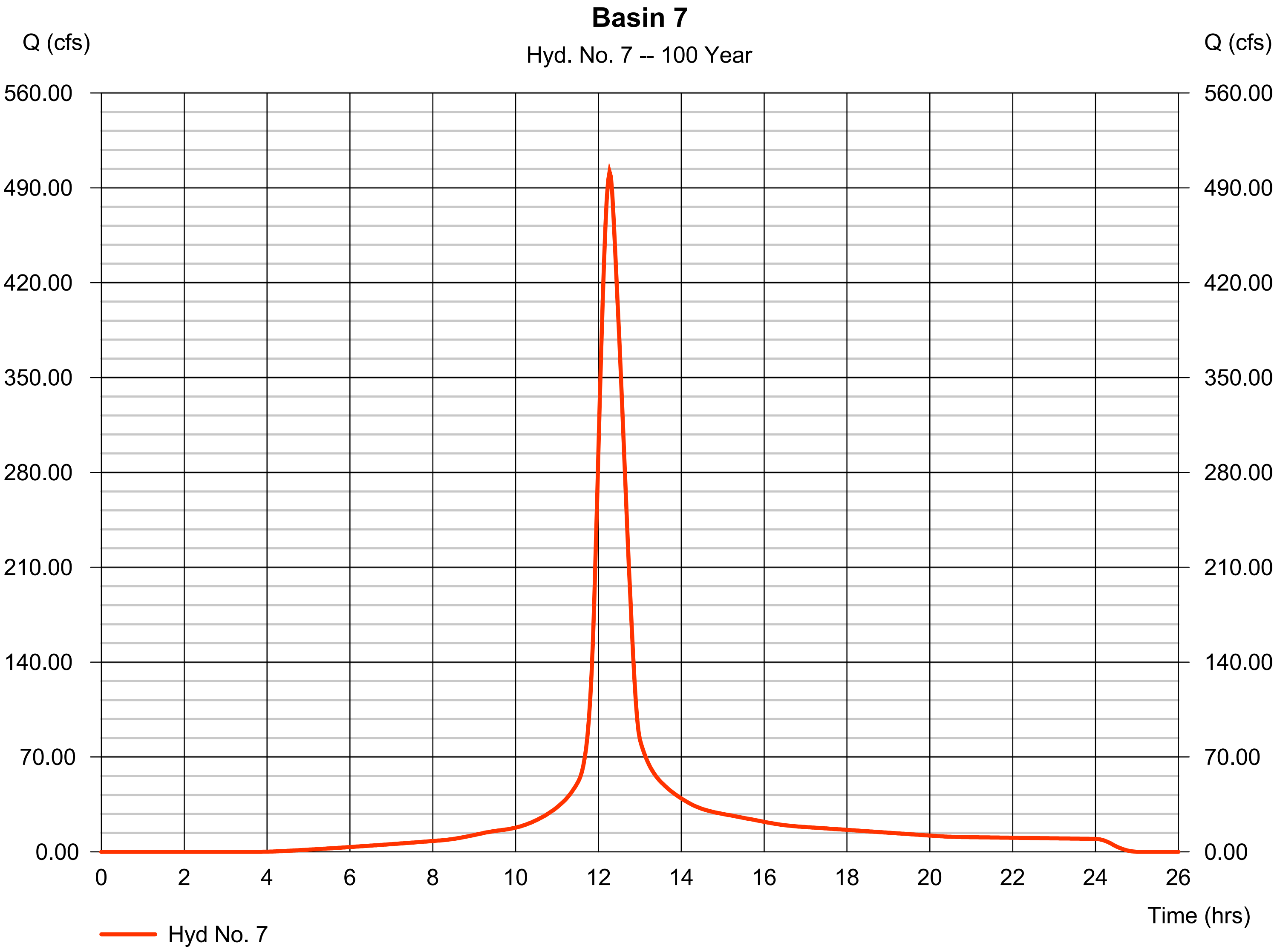
Hydrograph Report

Hyd. No. 7

Basin 7

Hydrograph type = SCS Runoff
Storm frequency = 100 yrs
Time interval = 2 min
Drainage area = 95.410 ac
Basin Slope = 0.0 %
Tc method = TR55
Total precip. = 9.13 in
Storm duration = 24 hrs

Peak discharge = 501.74 cfs
Time to peak = 12.27 hrs
Hyd. volume = 2,488,381 cuft
Curve number = 84
Hydraulic length = 0 ft
Time of conc. (Tc) = 38.30 min
Distribution = Type II
Shape factor = 484

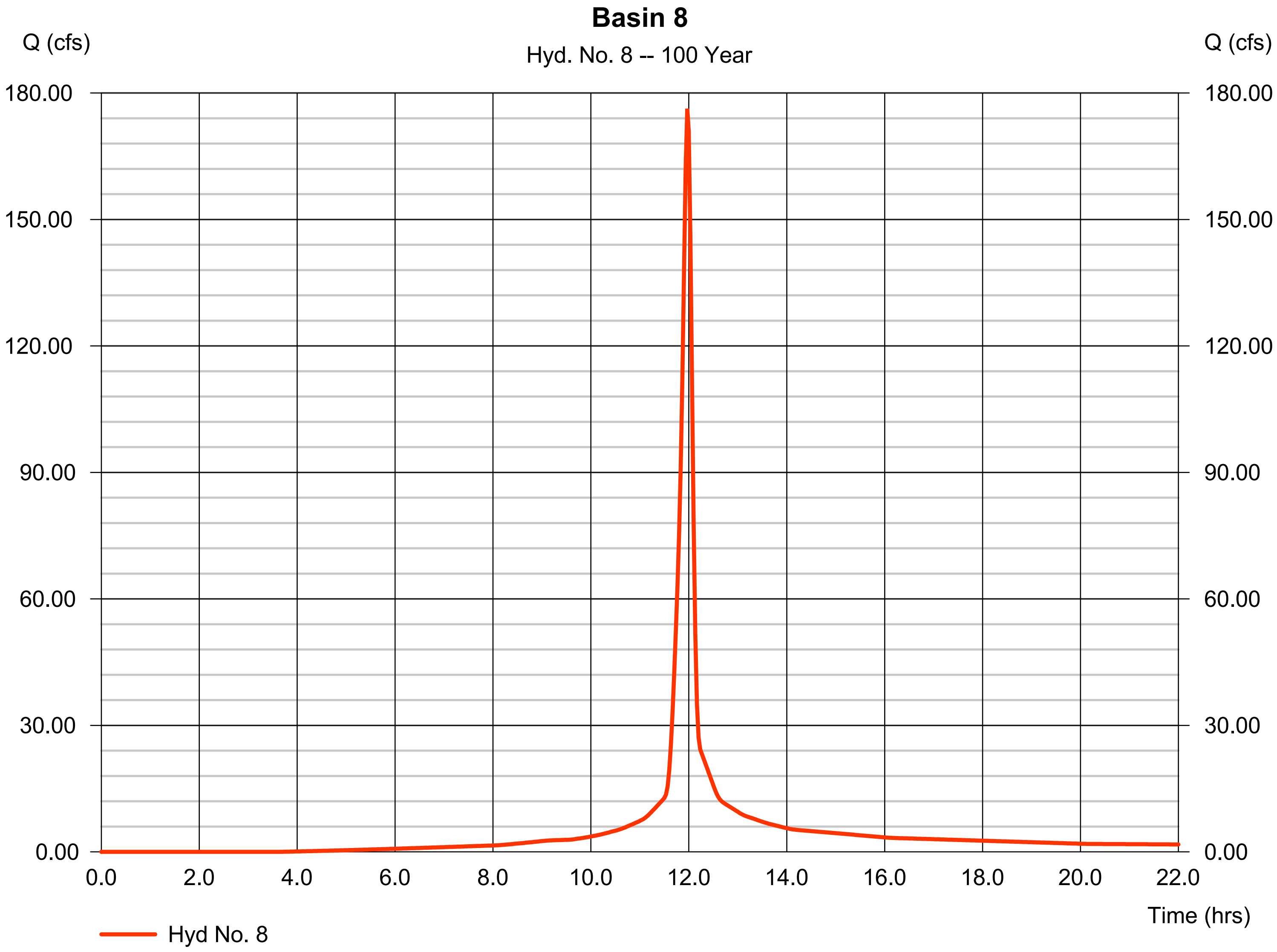


Hydrograph Report

Hyd. No. 8

Basin 8

Hydrograph type	= SCS Runoff	Peak discharge	= 176.27 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 425,902 cuft
Drainage area	= 16.330 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 6.60 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

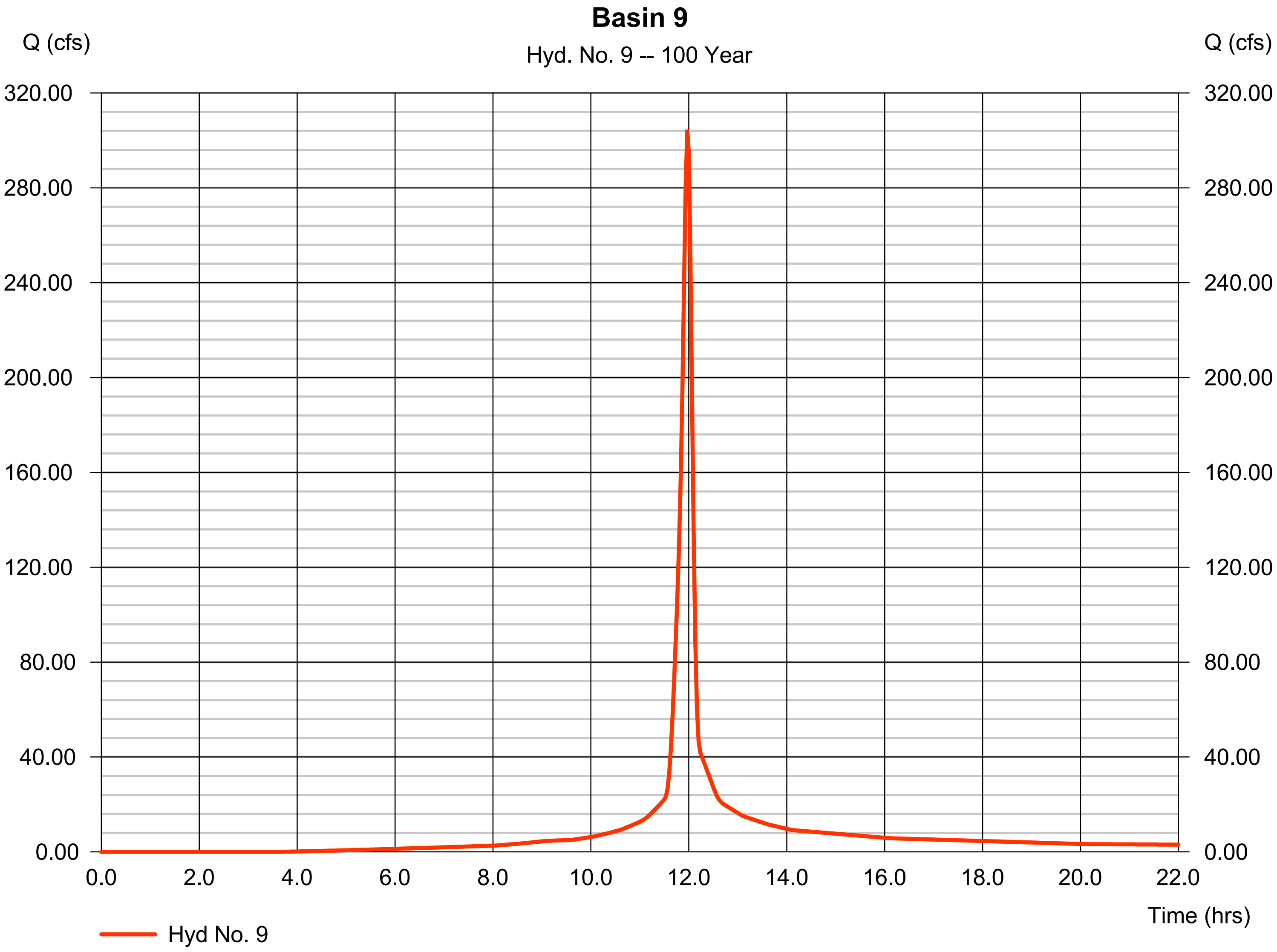


Hydrograph Report

Hyd. No. 9

Basin 9

Hydrograph type	= SCS Runoff	Peak discharge	= 304.51 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 735,744 cuft
Drainage area	= 28.210 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 8.50 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

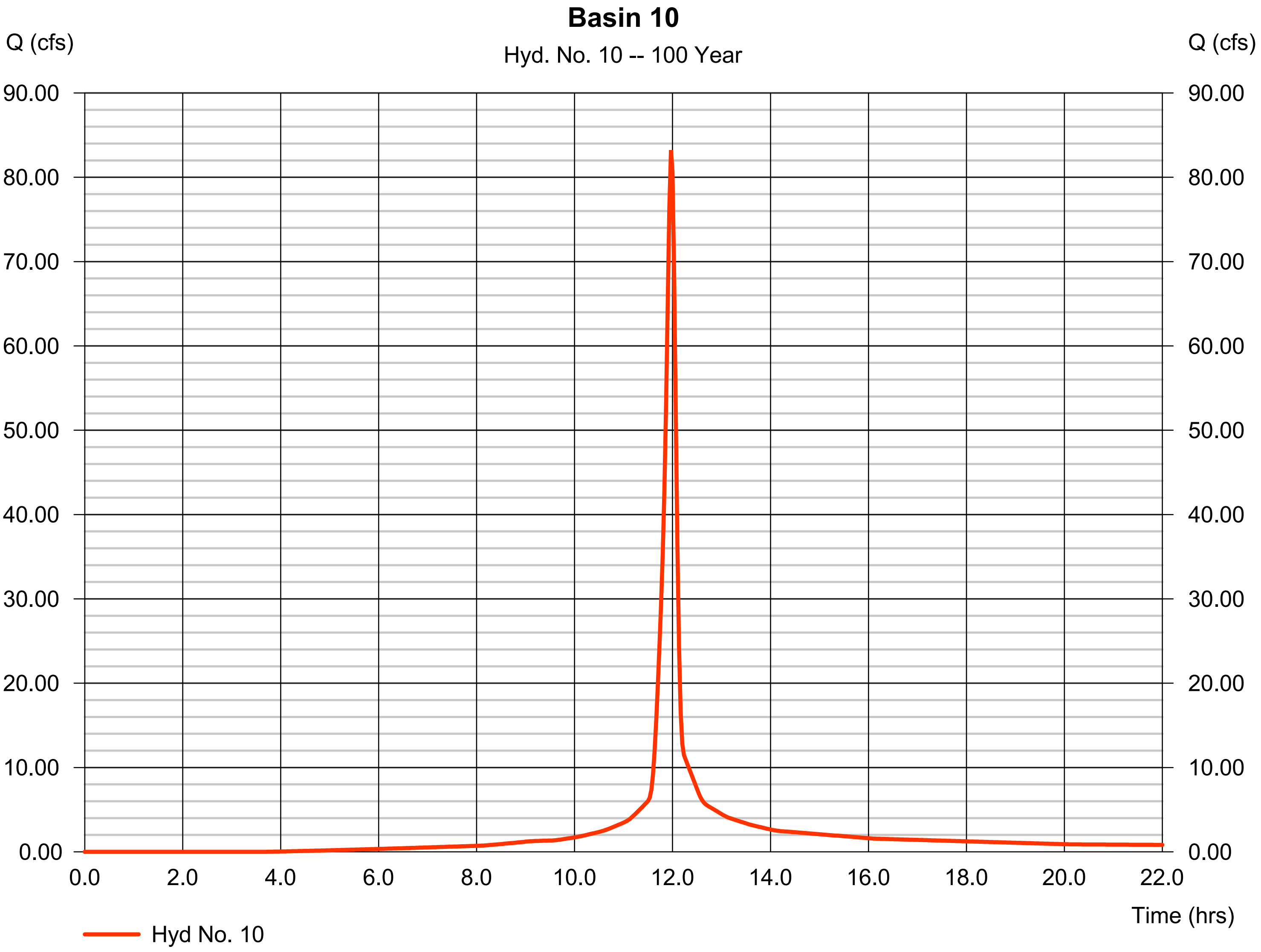


Hydrograph Report

Hyd. No. 10

Basin 10

Hydrograph type	= SCS Runoff	Peak discharge	= 83.23 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 201,084 cuft
Drainage area	= 7.710 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 9.20 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

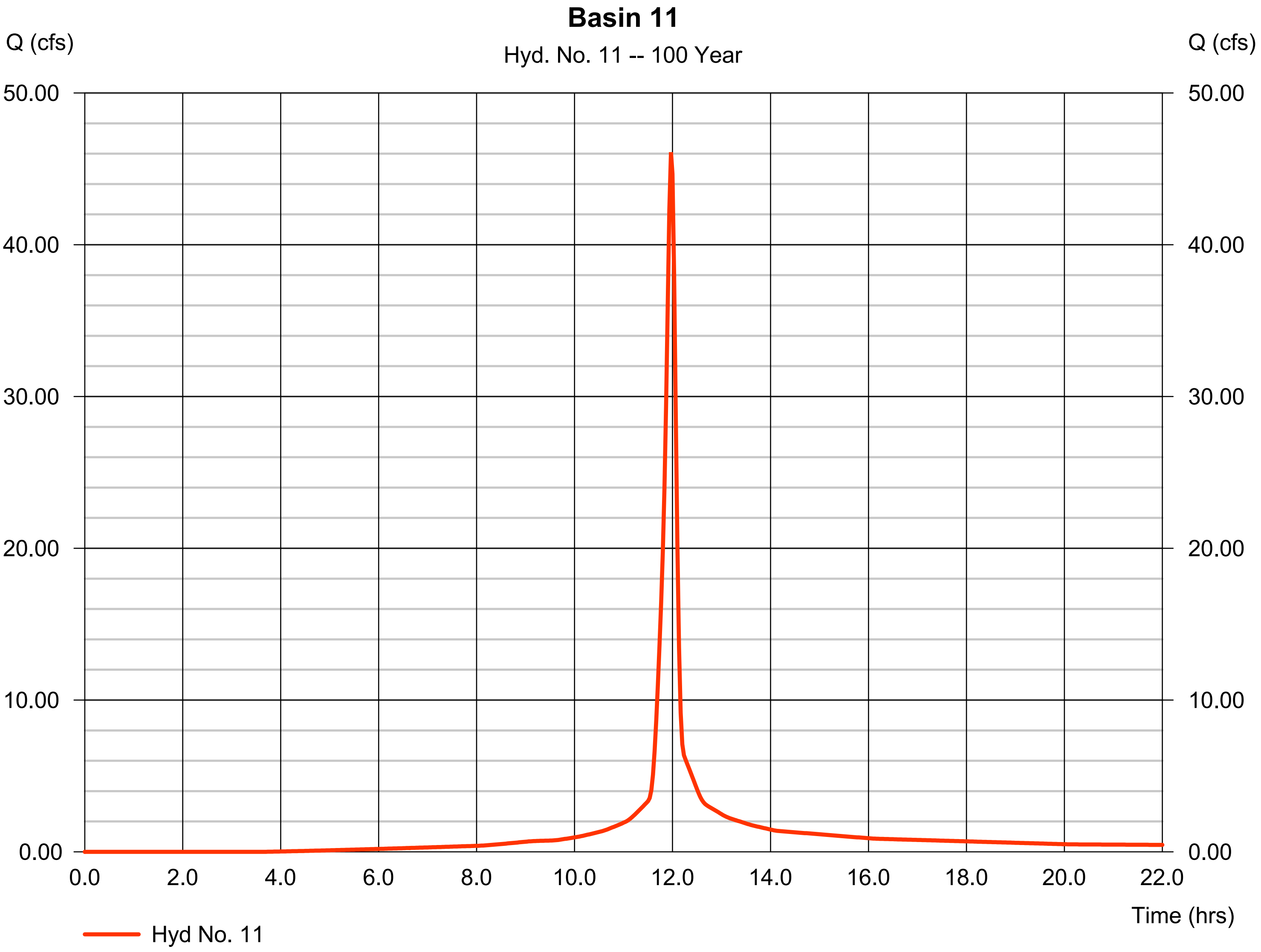


Hydrograph Report

Hyd. No. 11

Basin 11

Hydrograph type	= SCS Runoff	Peak discharge	= 46.09 cfs
Storm frequency	= 100 yrs	Time to peak	= 11.97 hrs
Time interval	= 2 min	Hyd. volume	= 111,366 cuft
Drainage area	= 4.270 ac	Curve number	= 84
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= TR55	Time of conc. (Tc)	= 7.50 min
Total precip.	= 9.13 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484



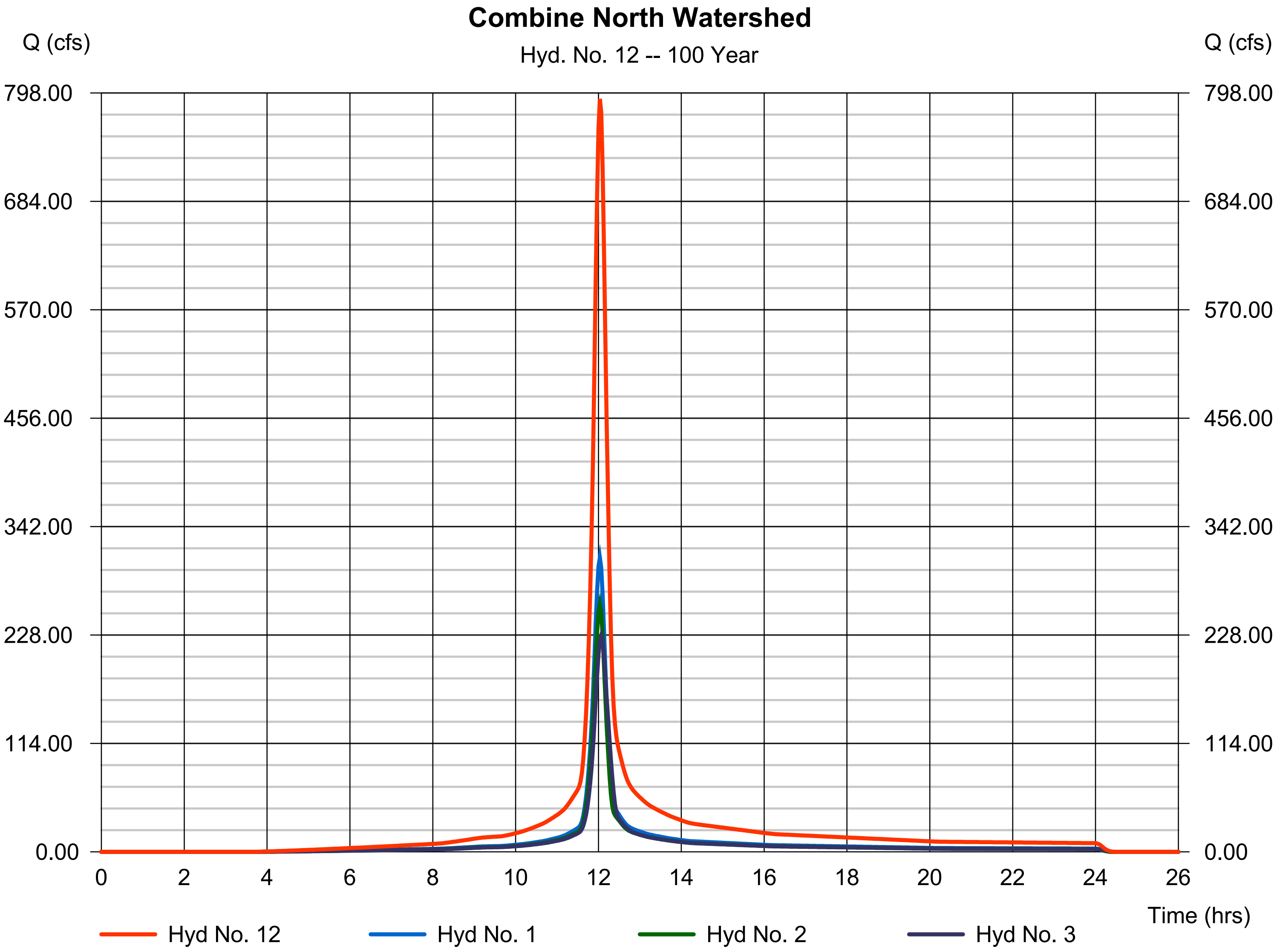
Hydrograph Report

Hyd. No. 12

Combine North Watershed

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 1, 2, 3

Peak discharge = 791.87 cfs
Time to peak = 12.03 hrs
Hyd. volume = 2,404,695 cuft
Contrib. drain. area = 93.840 ac



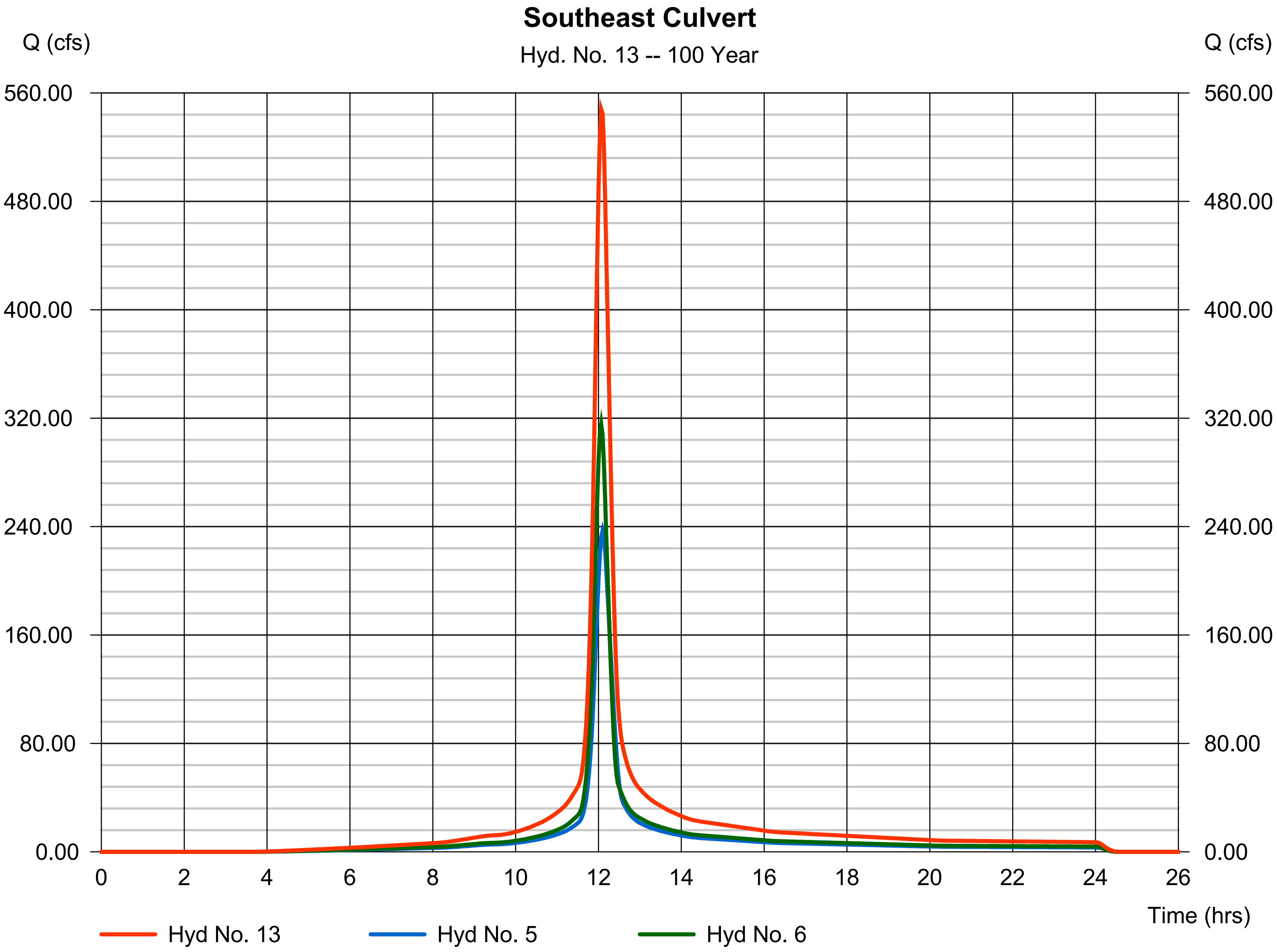
Hydrograph Report

Hyd. No. 13

Southeast Culvert

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 5, 6

Peak discharge = 547.88 cfs
Time to peak = 12.07 hrs
Hyd. volume = 1,868,130 cuft
Contrib. drain. area = 71.060 ac



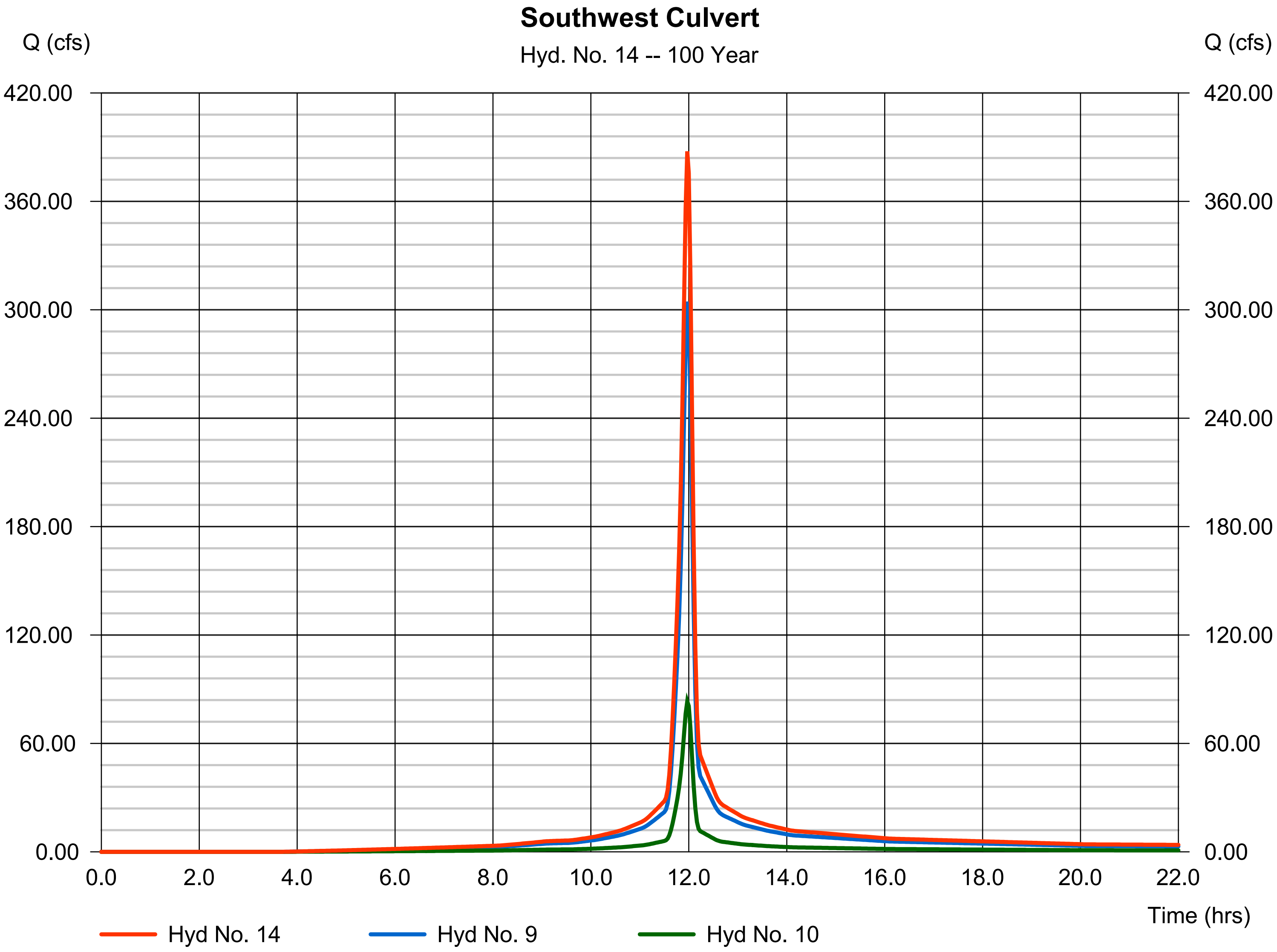
Hydrograph Report

Hyd. No. 14

Southwest Culvert

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 9, 10

Peak discharge = 387.74 cfs
Time to peak = 11.97 hrs
Hyd. volume = 936,828 cuft
Contrib. drain. area = 35.920 ac



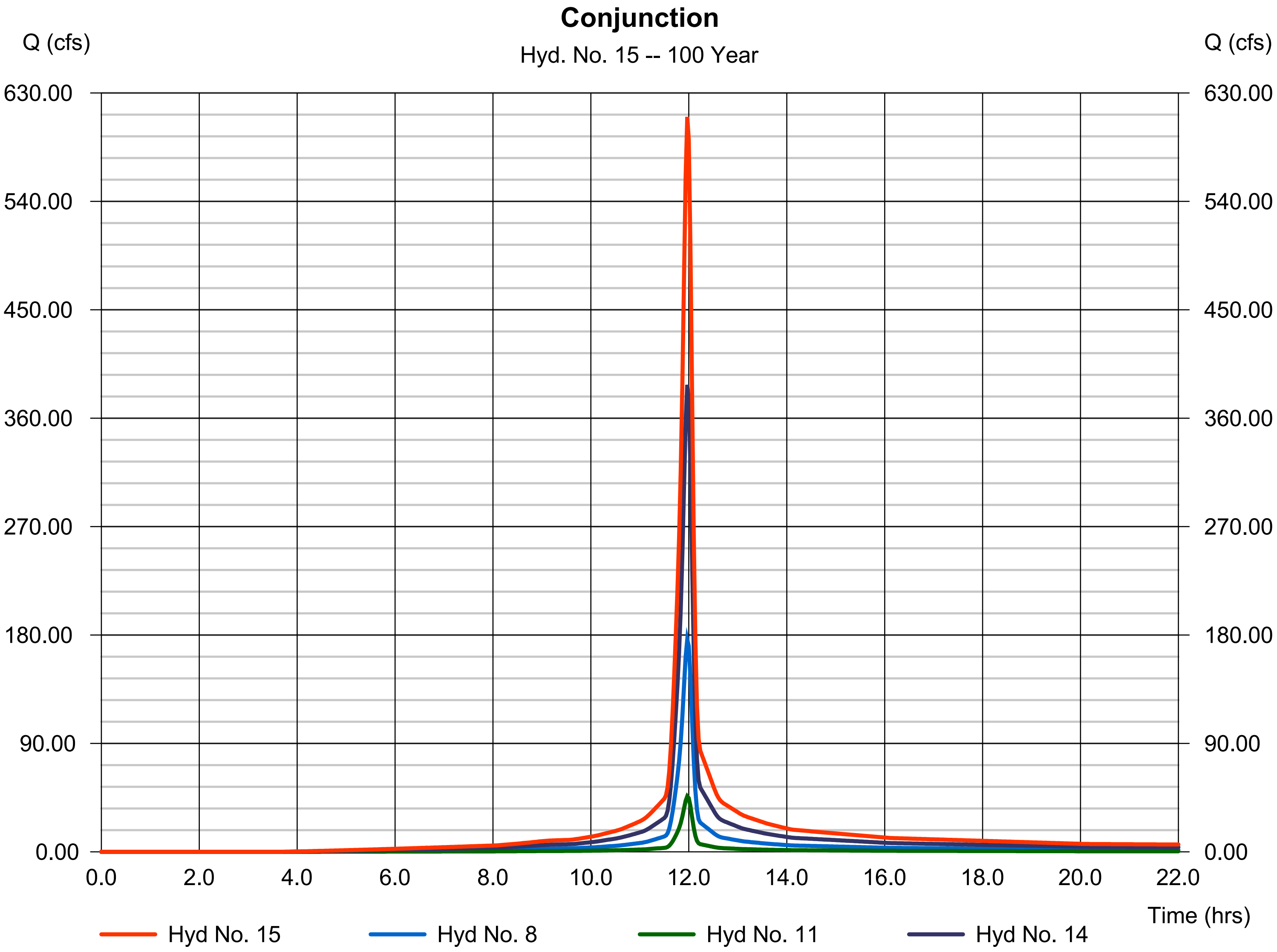
Hydrograph Report

Hyd. No. 15

Conjunction

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 8, 11, 14

Peak discharge = 610.11 cfs
Time to peak = 11.97 hrs
Hyd. volume = 1,474,095 cuft
Contrib. drain. area = 20.600 ac

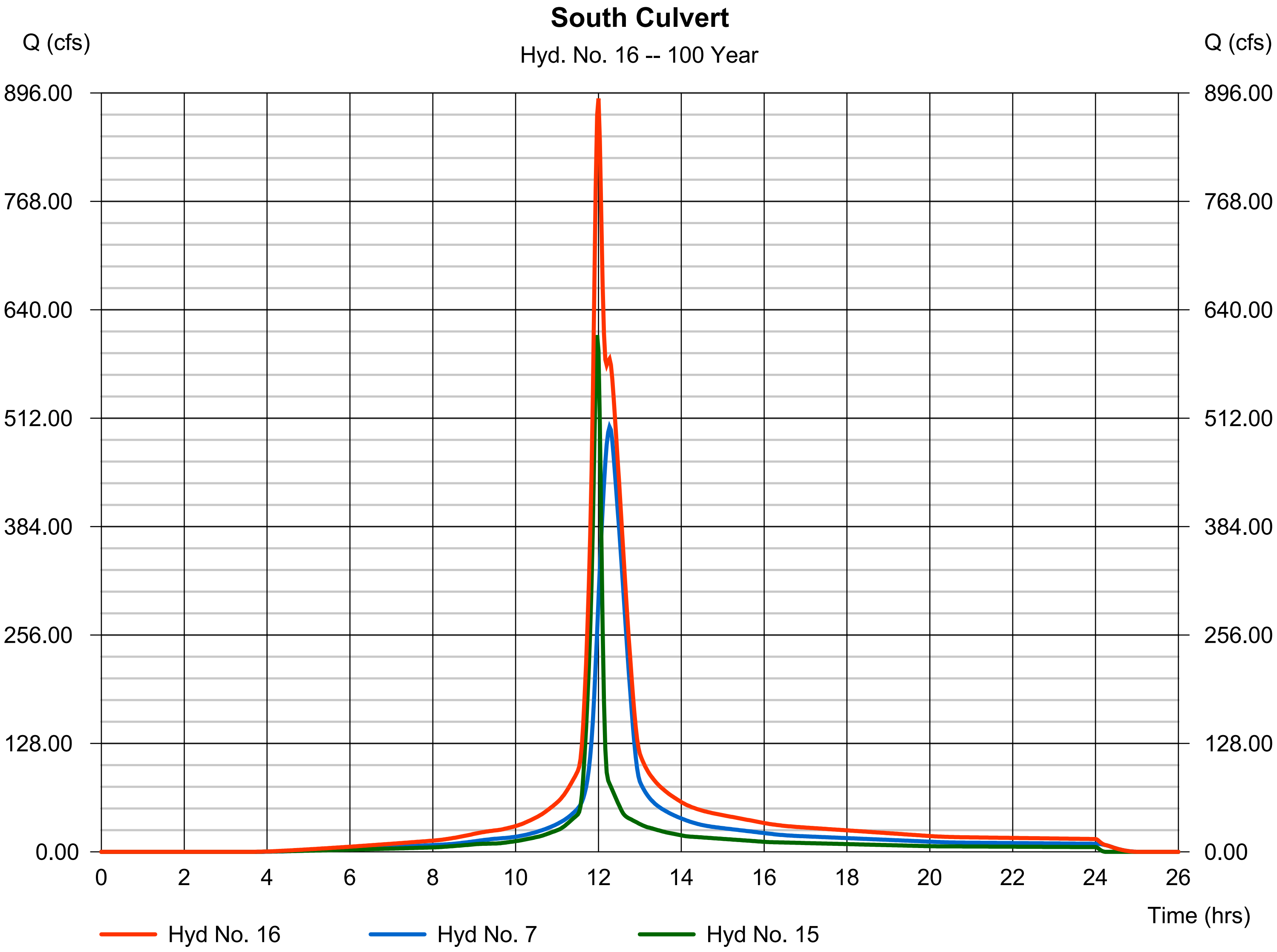


Hydrograph Report

Hyd. No. 16

South Culvert

Hydrograph type	= Combine	Peak discharge	= 889.50 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 3,962,479 cuft
Inflow hyds.	= 7, 15	Contrib. drain. area	= 95.410 ac



Hydrograph Report

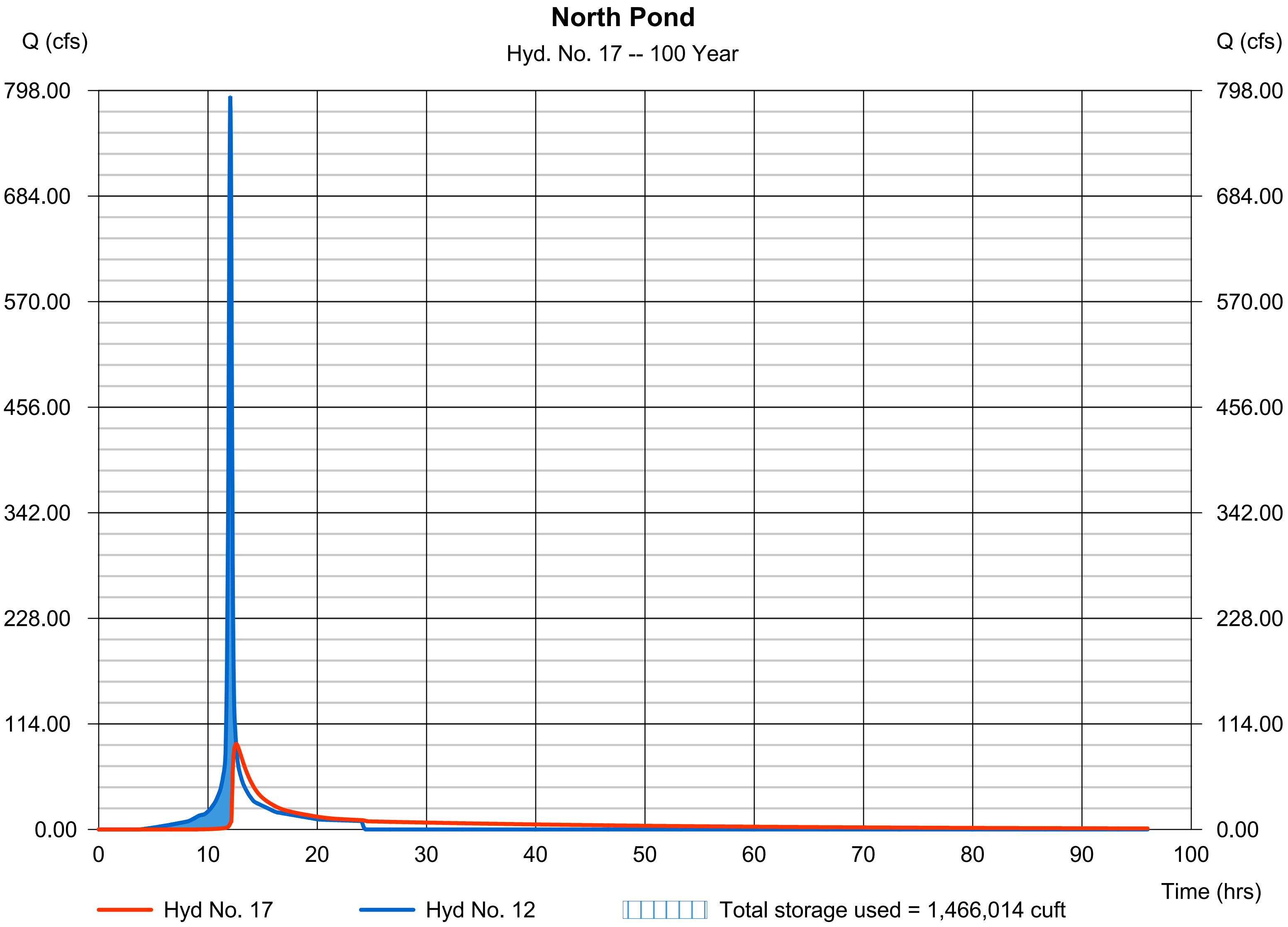
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Thursday, 06 / 1 / 2023

Hyd. No. 17

North Pond

Hydrograph type	= Reservoir	Peak discharge	= 92.36 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.57 hrs
Time interval	= 2 min	Hyd. volume	= 2,120,476 cuft
Inflow hyd. No.	= 12 - Combine North Watershed	Max. Elevation	= 836.90 ft
Reservoir name	= North Pond	Max. Storage	= 1,466,014 cuft

Storage Indication method used.

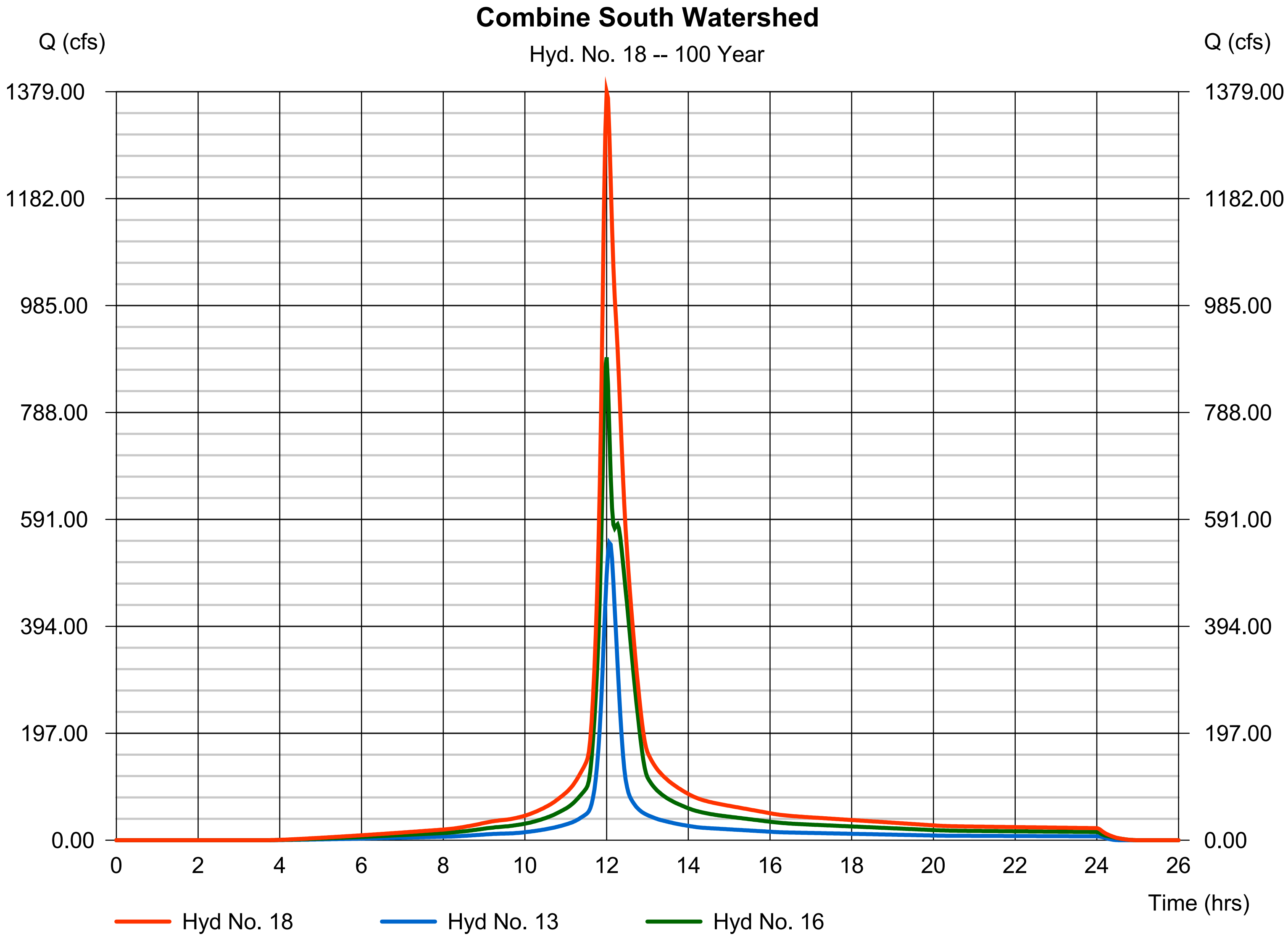


Hydrograph Report

Hyd. No. 18

Combine South Watershed

Hydrograph type	= Combine	Peak discharge	= 1378.36 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.00 hrs
Time interval	= 2 min	Hyd. volume	= 5,830,608 cuft
Inflow hyds.	= 13, 16	Contrib. drain. area	= 0.000 ac



Hydrograph Report

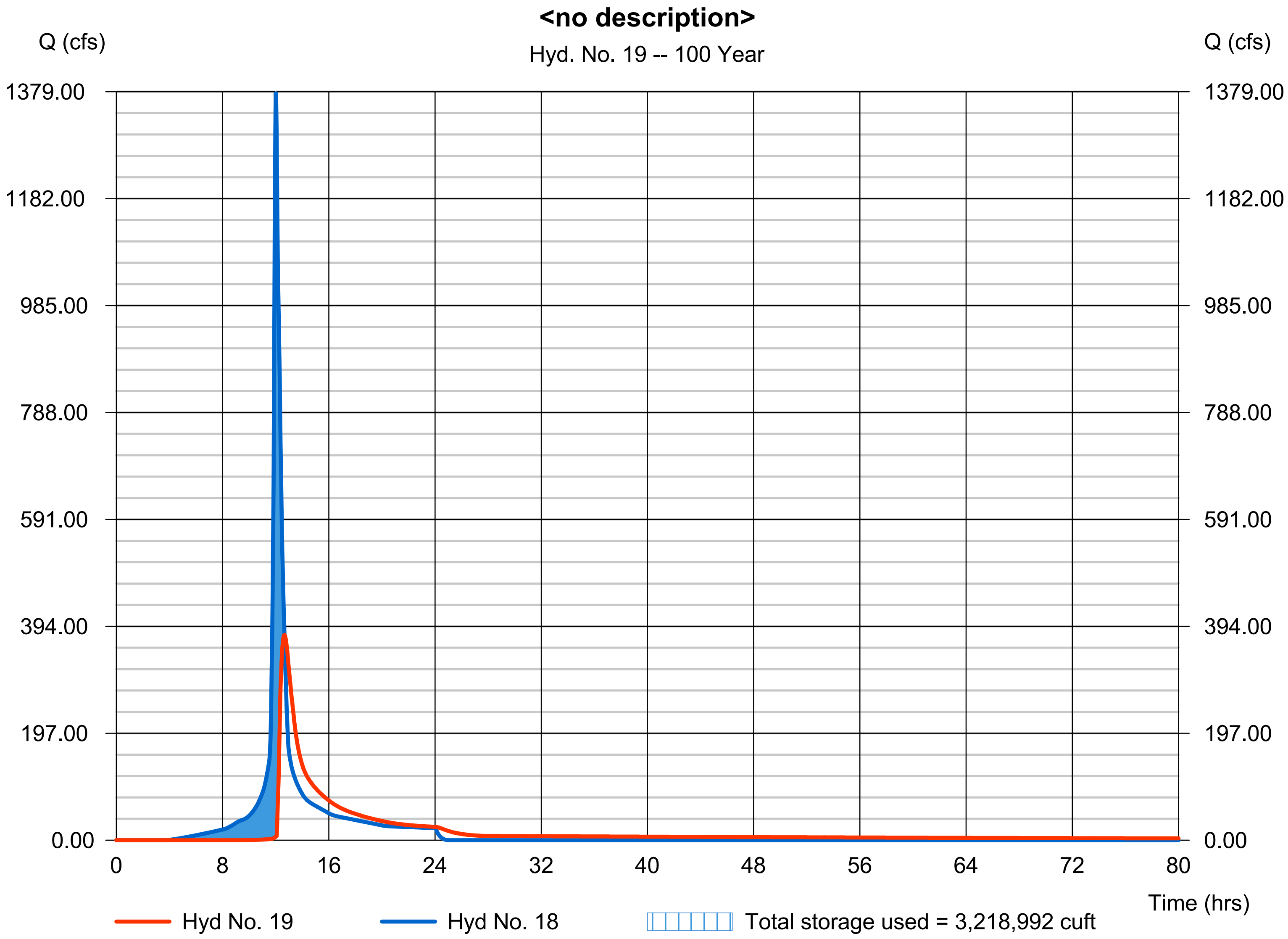
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020 Thursday, 06 / 1 / 2023

Hyd. No. 19

<no description>

Hydrograph type	= Reservoir	Peak discharge	= 377.96 cfs
Storm frequency	= 100 yrs	Time to peak	= 12.67 hrs
Time interval	= 2 min	Hyd. volume	= 4,910,614 cuft
Inflow hyd. No.	= 18 - Combine South Watershed	Max. Elevation	= 723.46 ft
Reservoir name	= South Pond	Max. Storage	= 3,218,992 cuft

Storage Indication method used.

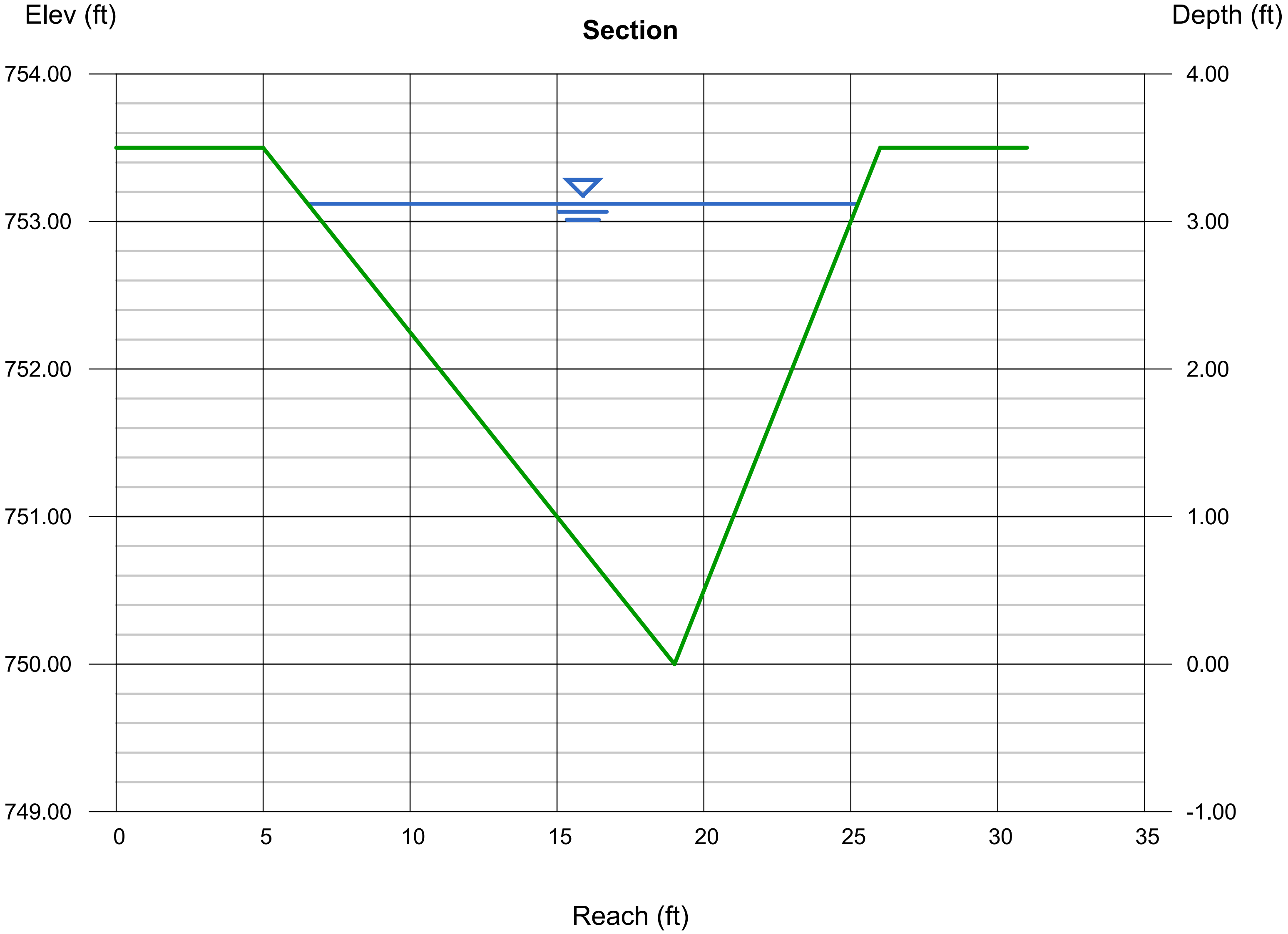


Channel Report

Worst Case Terrace

Triangular	
Side Slopes (z:1)	= 4.00, 2.00
Total Depth (ft)	= 3.50
Invert Elev (ft)	= 750.00
Slope (%)	= 1.00
N-Value	= 0.240
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 23.21

Highlighted	
Depth (ft)	= 3.12
Q (cfs)	= 23.21
Area (sqft)	= 29.20
Velocity (ft/s)	= 0.79
Wetted Perim (ft)	= 19.84
Crit Depth, Yc (ft)	= 1.31
Top Width (ft)	= 18.72
EGL (ft)	= 3.13



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

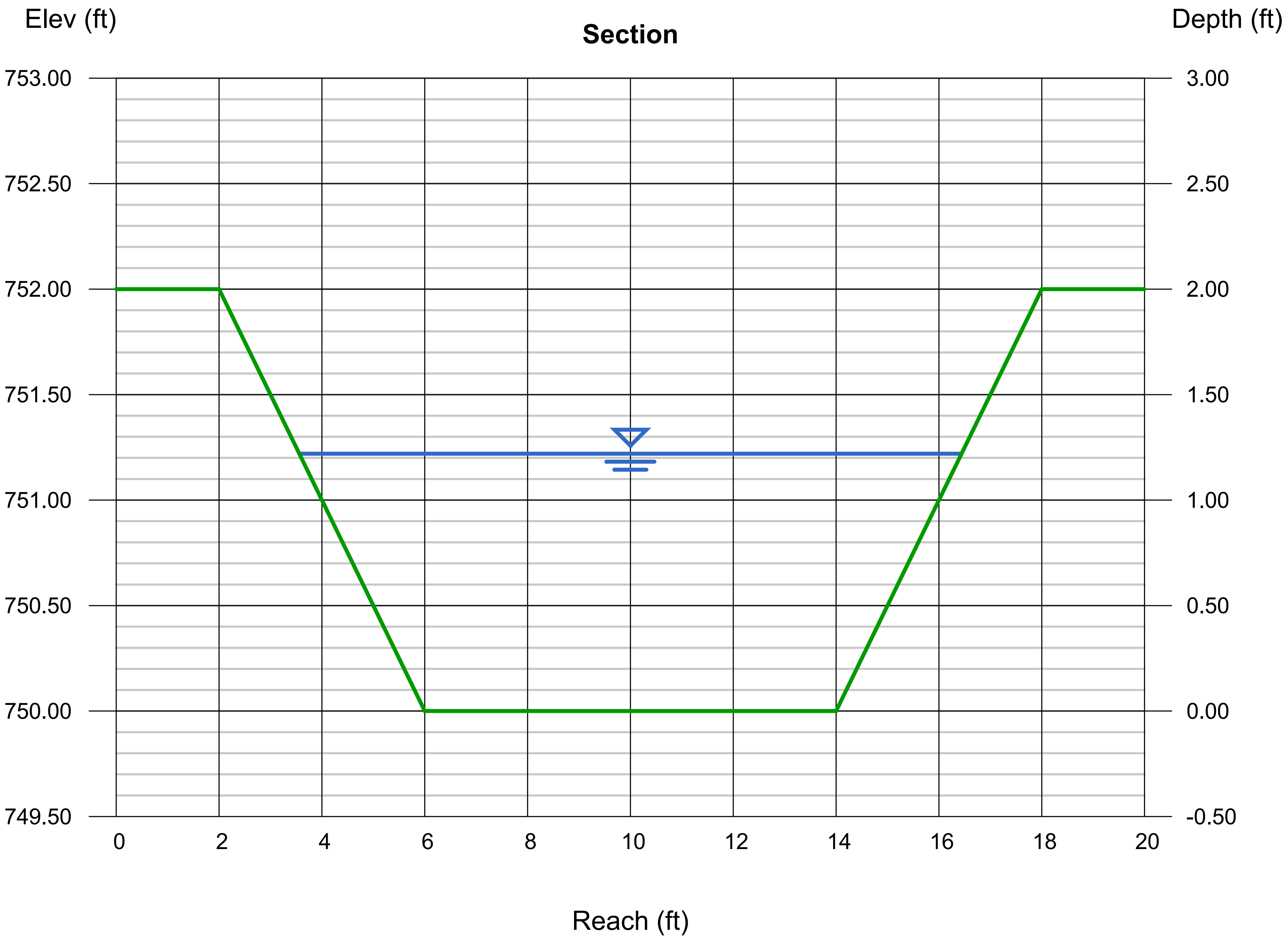
Tuesday, May 30 2023

Letdown Structure

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 8.00	Depth (ft)	= 1.22
Side Slopes (z:1)	= 2.00, 2.00	Q (cfs)	= 360.74
Total Depth (ft)	= 2.00	Area (sqft)	= 12.74
Invert Elev (ft)	= 750.00	Velocity (ft/s)	= 28.32
Slope (%)	= 25.00	Wetted Perim (ft)	= 13.46
N-Value	= 0.025	Crit Depth, Yc (ft)	= 2.00
		Top Width (ft)	= 12.88
		EGL (ft)	= 13.69

Calculations

Compute by:	Known Q
Known Q (cfs)	= 360.74



Channel Report

Channel 1

Trapezoidal

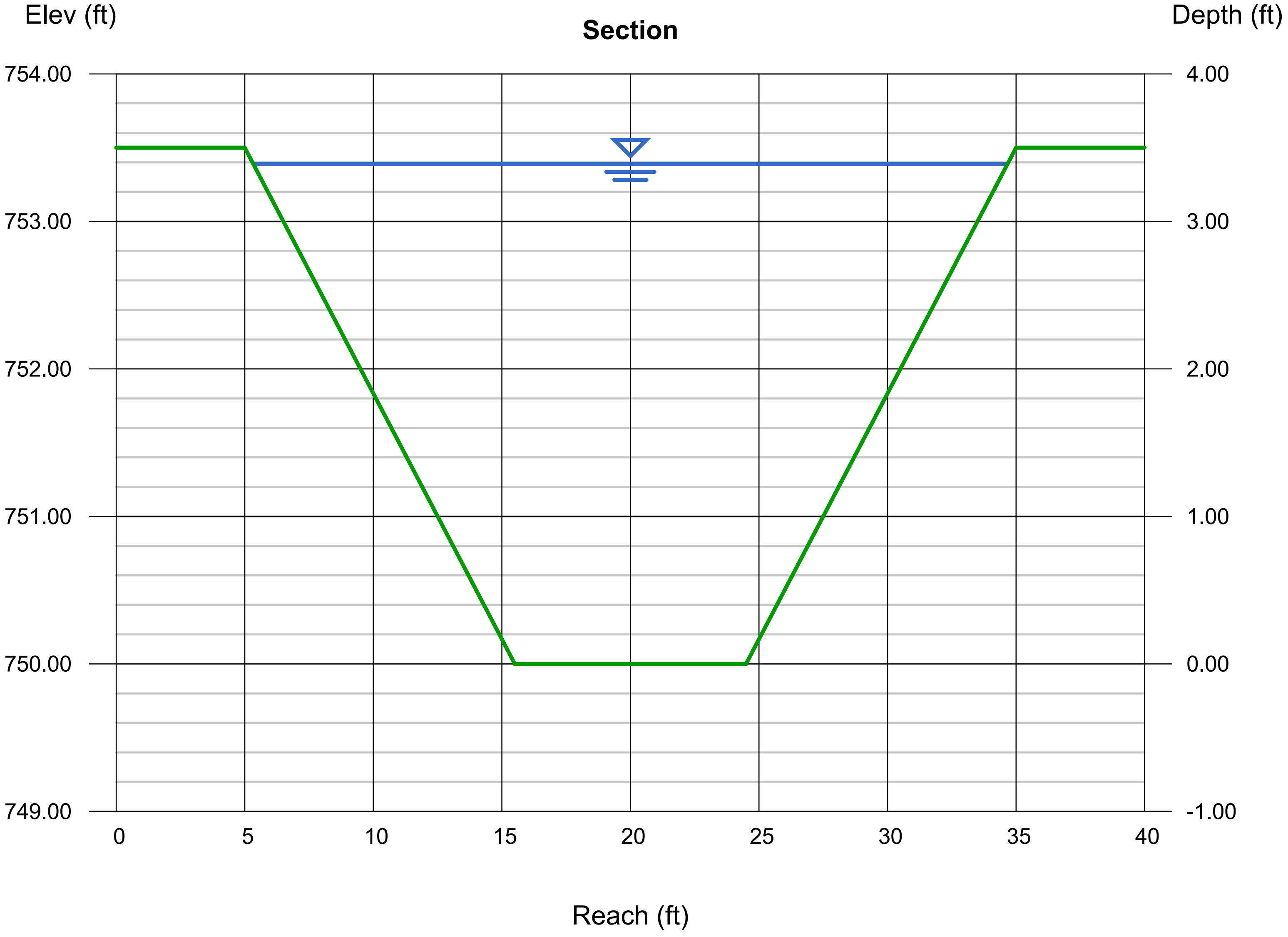
Bottom Width (ft) = 9.00
Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 3.50
Invert Elev (ft) = 750.00
Slope (%) = 1.00
N-Value = 0.025

Calculations

Compute by: Known Q
Known Q (cfs) = 640.31

Highlighted

Depth (ft) = 3.39
Q (cfs) = 640.31
Area (sqft) = 64.99
Velocity (ft/s) = 9.85
Wetted Perim (ft) = 30.44
Crit Depth, Yc (ft) = 3.50
Top Width (ft) = 29.34
EGL (ft) = 4.90

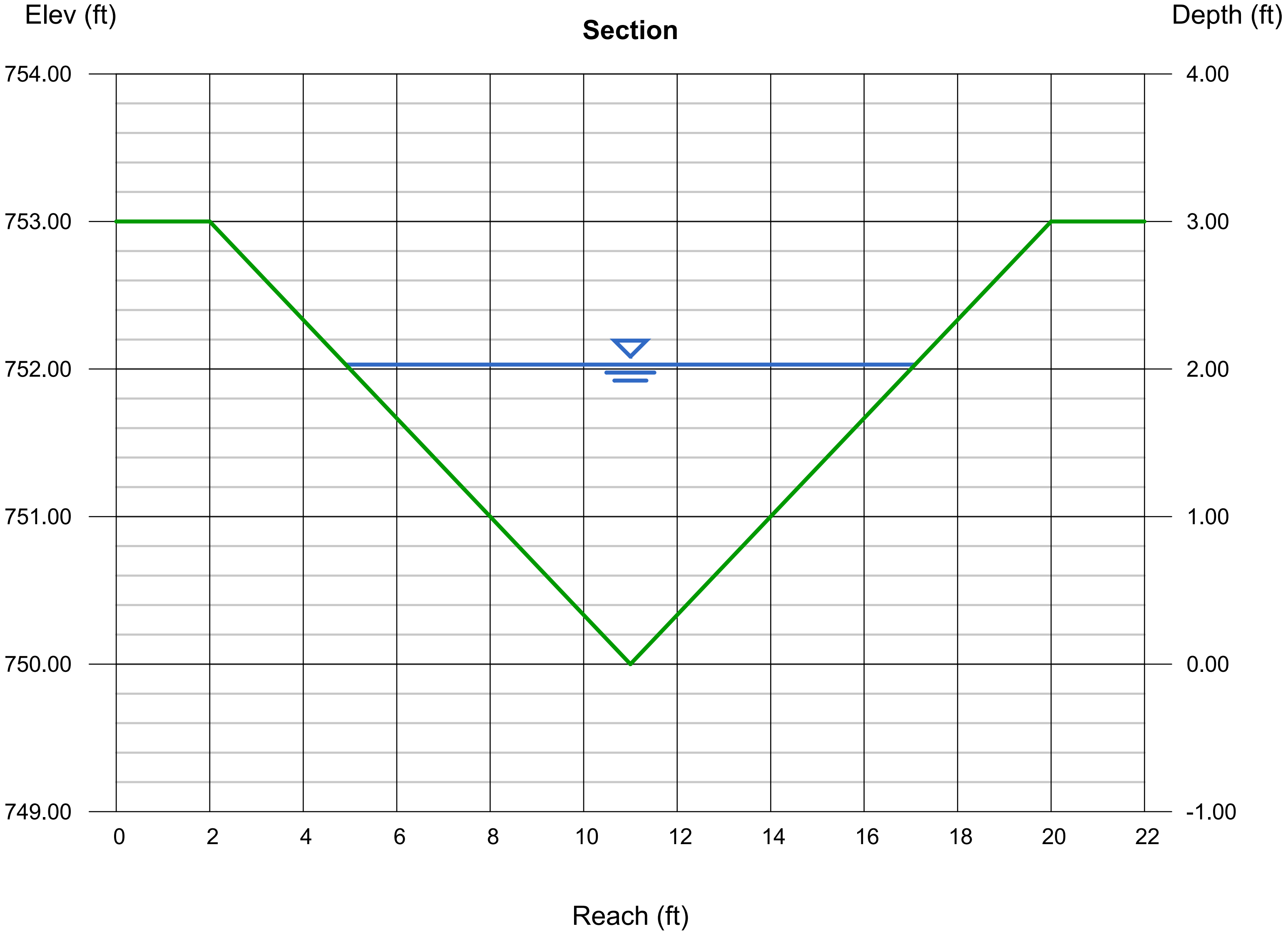


Channel Report

Channel 2

Triangular	
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 750.00
Slope (%)	= 3.62
N-Value	= 0.240
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 14.16

Highlighted	
Depth (ft)	= 2.03
Q (cfs)	= 14.16
Area (sqft)	= 12.36
Velocity (ft/s)	= 1.15
Wetted Perim (ft)	= 12.84
Crit Depth, Yc (ft)	= 1.07
Top Width (ft)	= 12.18
EGL (ft)	= 2.05



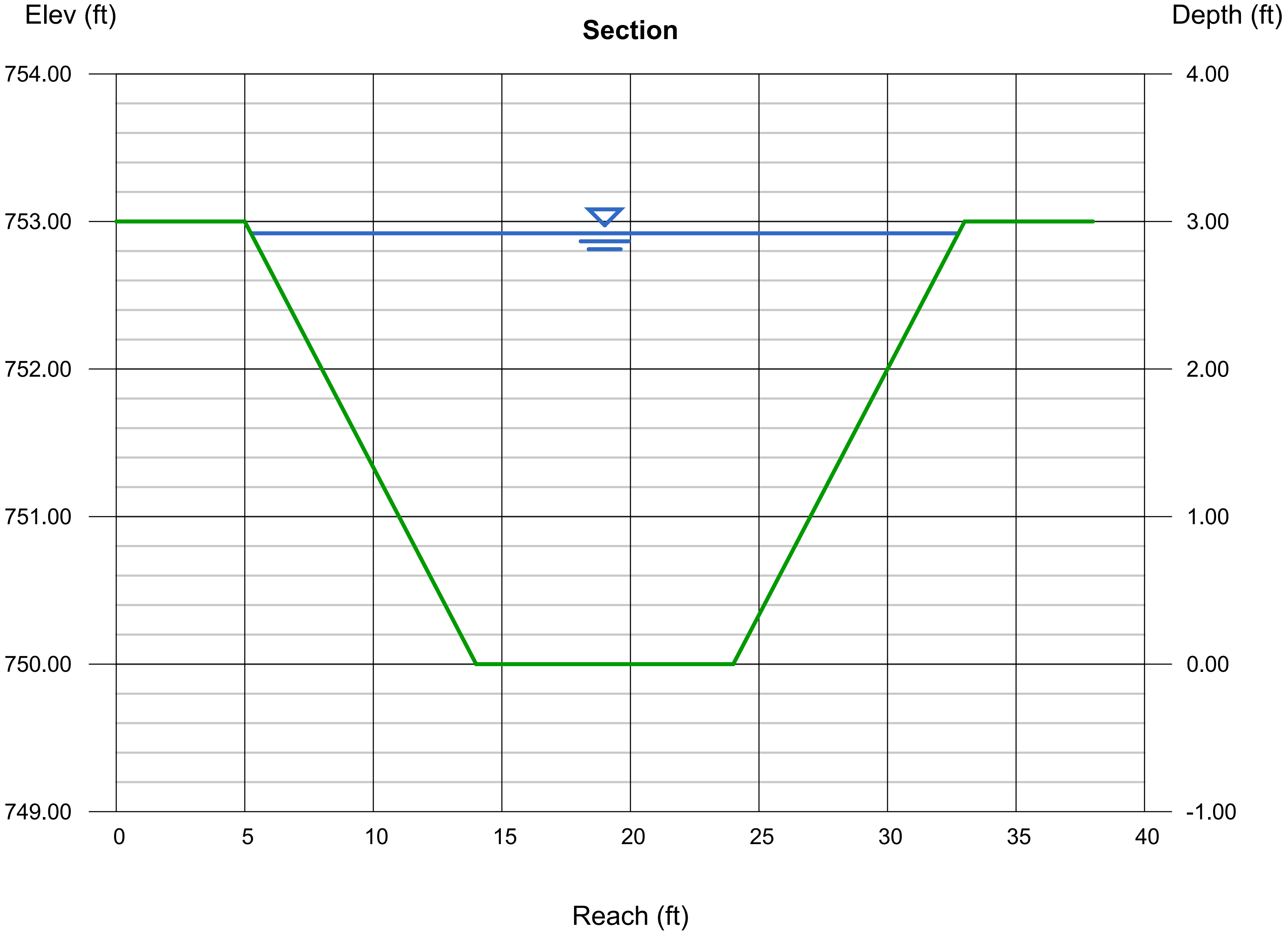
Channel Report

Channel 3

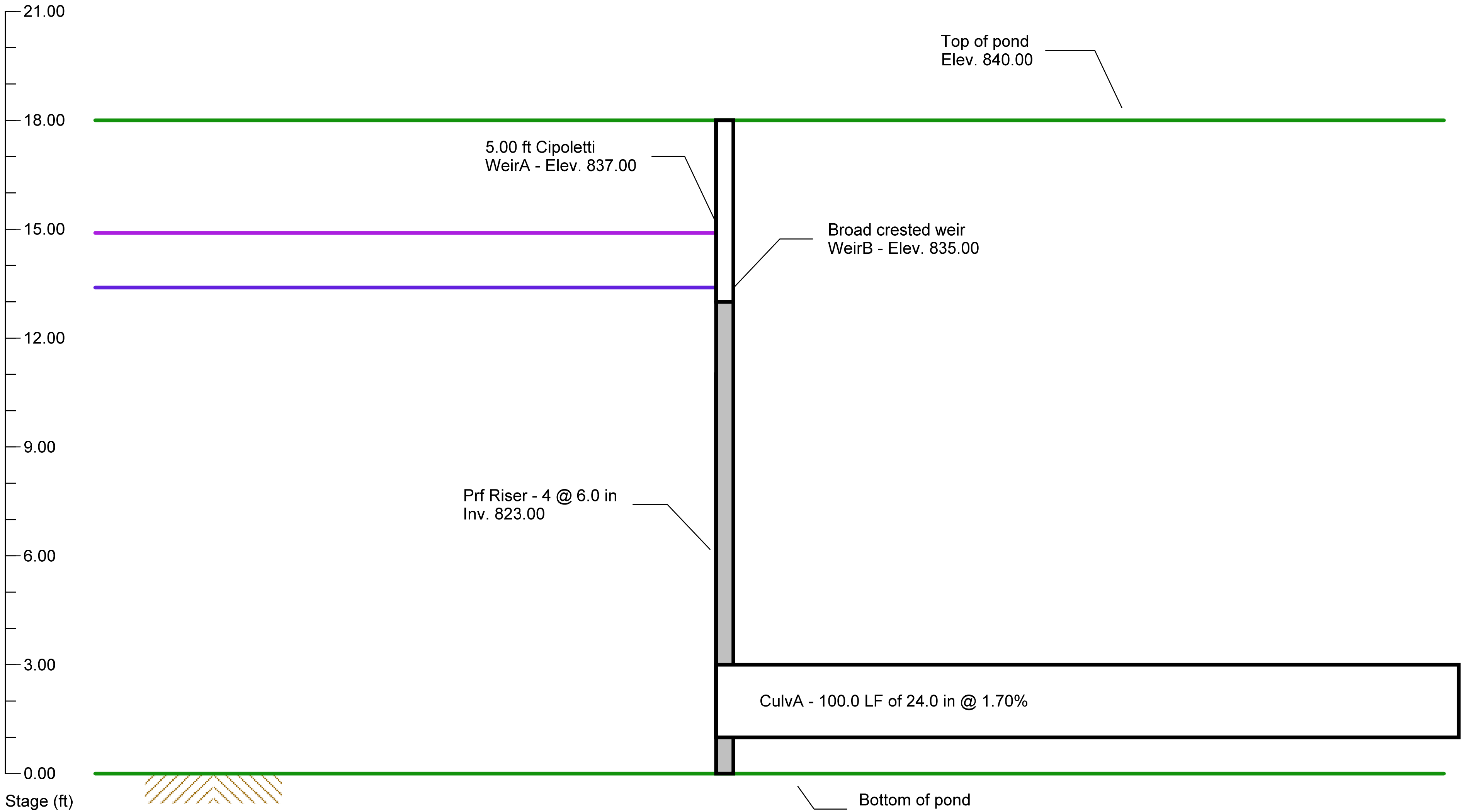
Trapezoidal
Bottom Width (ft) = 10.00
Side Slopes (z:1) = 3.00, 3.00
Total Depth (ft) = 3.00
Invert Elev (ft) = 750.00
Slope (%) = 6.00
N-Value = 0.240

Calculations
Compute by: Known Q
Known Q (cfs) = 128.16

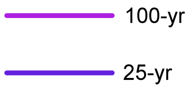
Highlighted
Depth (ft) = 2.92
Q (cfs) = 128.16
Area (sqft) = 54.78
Velocity (ft/s) = 2.34
Wetted Perim (ft) = 28.47
Crit Depth, Yc (ft) = 1.48
Top Width (ft) = 27.52
EGL (ft) = 3.01



Pond No. 1 - North Pond



Section
NTS

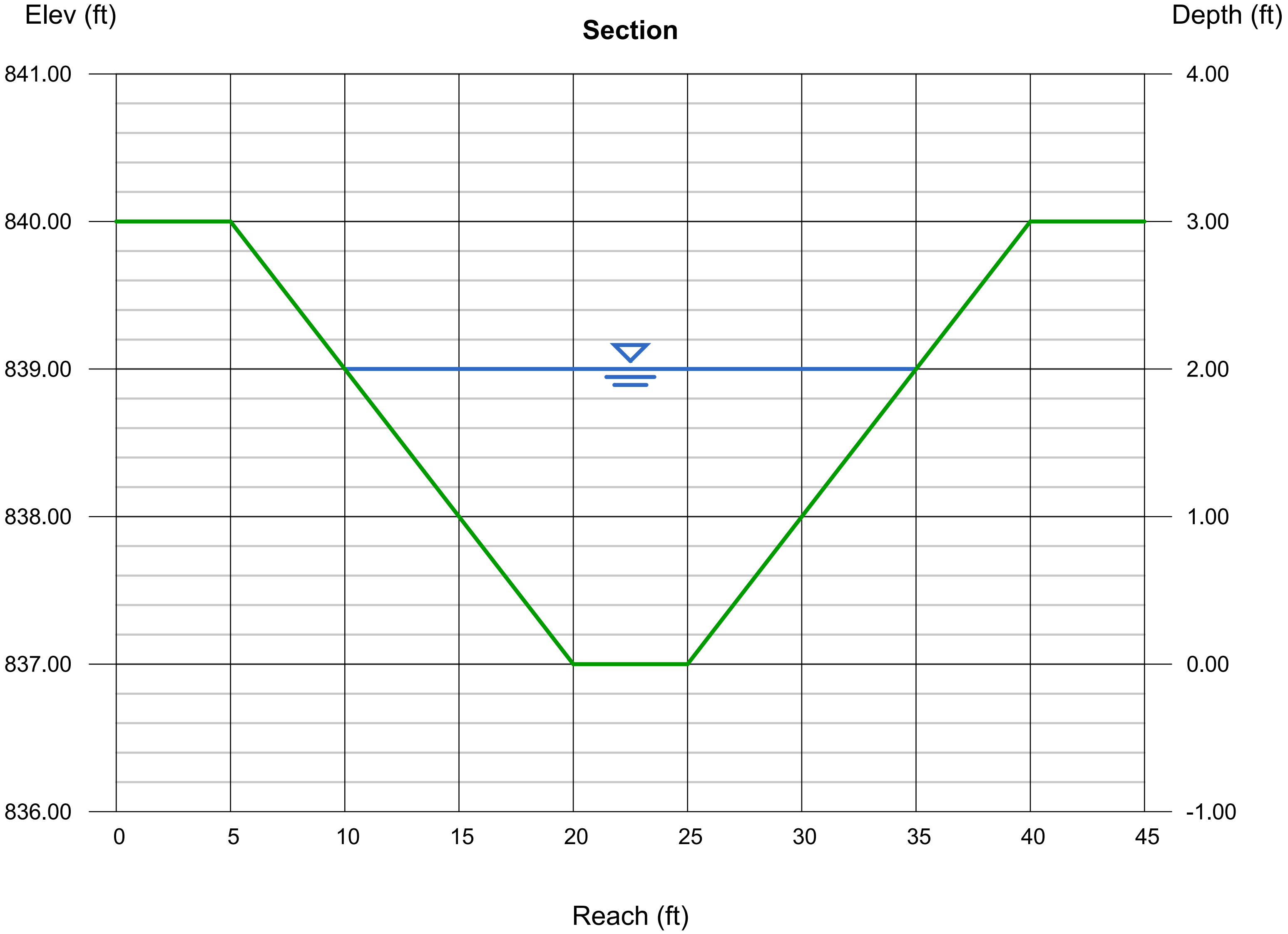


Inflow hydrograph = 12. Combine - Combine North Watershed

Channel Report

North Retention Structure Emergency Spillway

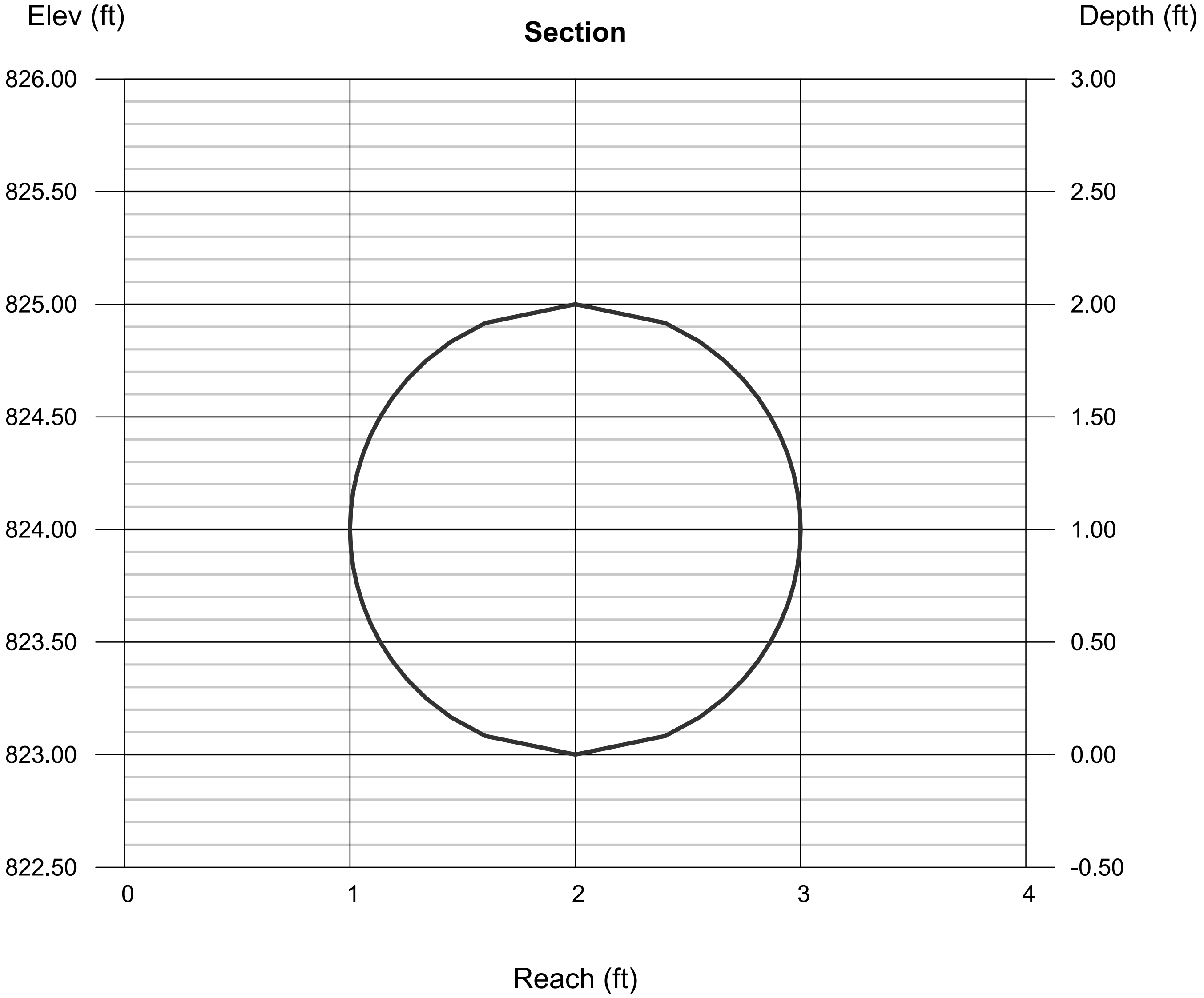
Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 5.00	Depth (ft)	= 2.00
Side Slopes (z:1)	= 5.00, 5.00	Q (cfs)	= 856.92
Total Depth (ft)	= 3.00	Area (sqft)	= 30.00
Invert Elev (ft)	= 837.00	Velocity (ft/s)	= 28.56
Slope (%)	= 5.00	Wetted Perim (ft)	= 25.40
N-Value	= 0.013	Crit Depth, Yc (ft)	= 3.00
		Top Width (ft)	= 25.00
Calculations		EGL (ft)	= 14.69
Compute by:	Known Depth		
Known Depth (ft)	= 2.00		



Channel Report

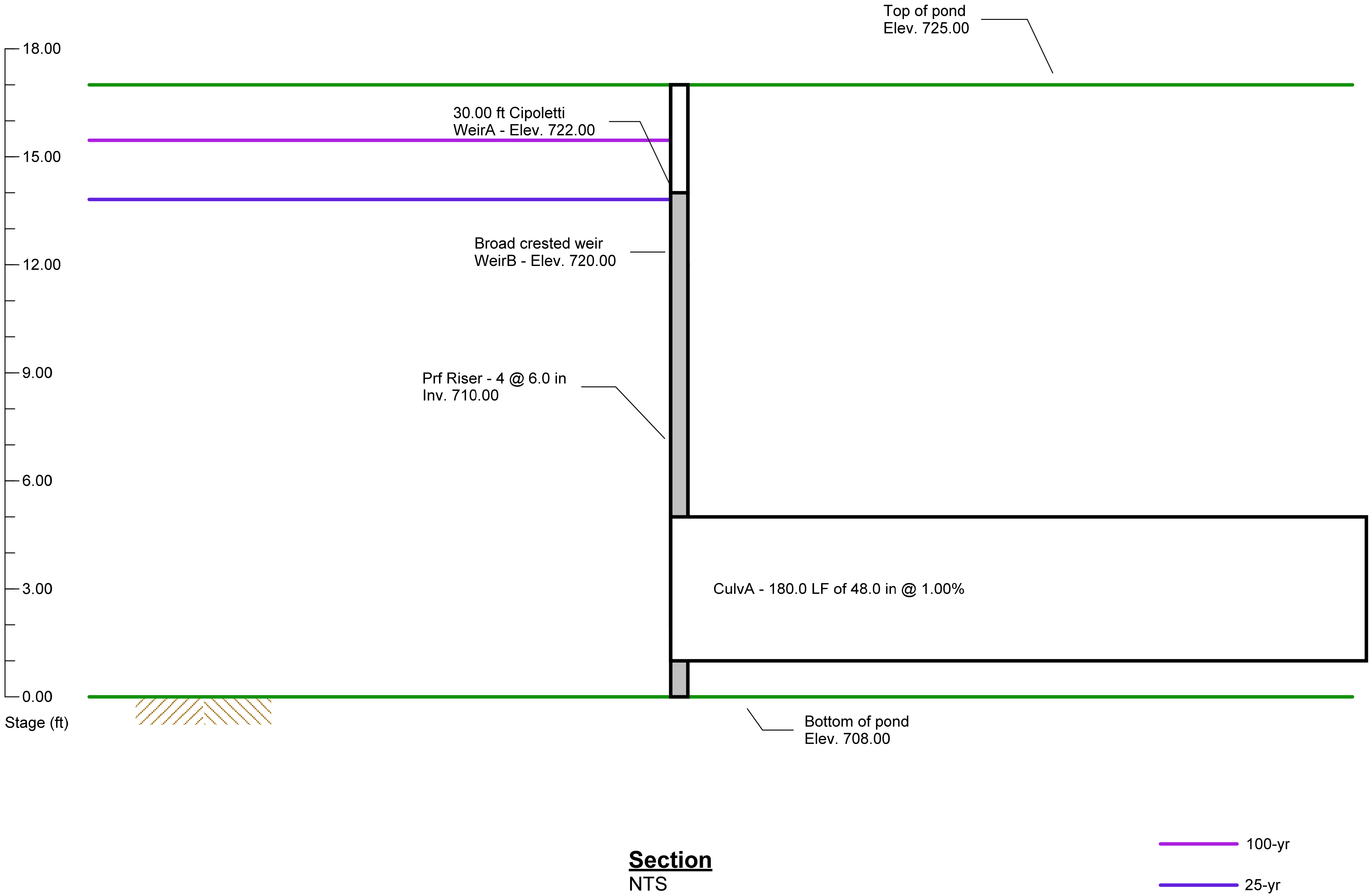
North Retention Structure Outlet

Circular		**Highlighted**	
Diameter (ft)	= 2.00	Depth (ft)	= 2.00
		Q (cfs)	= 29.49
		Area (sqft)	= 3.14
Invert Elev (ft)	= 823.00	Velocity (ft/s)	= 9.39
Slope (%)	= 1.70	Wetted Perim (ft)	= 6.28
N-Value	= 0.013	Crit Depth, Yc (ft)	= 1.86
		Top Width (ft)	= 0.00
Calculations		EGL (ft)	= 3.37
Compute by:	Known Depth		
Known Depth (ft)	= 2.00		



Pond No. 2 - South Pond

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2020



Section
NTS

Inflow hydrograph = 18. Combine - Combine South Watershed

Project: Watershed Analysis (Developed Landfill).gpw	Thursday, 06 / 1 / 2023

Channel Report

South Retention Structure Emergency Spillway

Trapezoidal

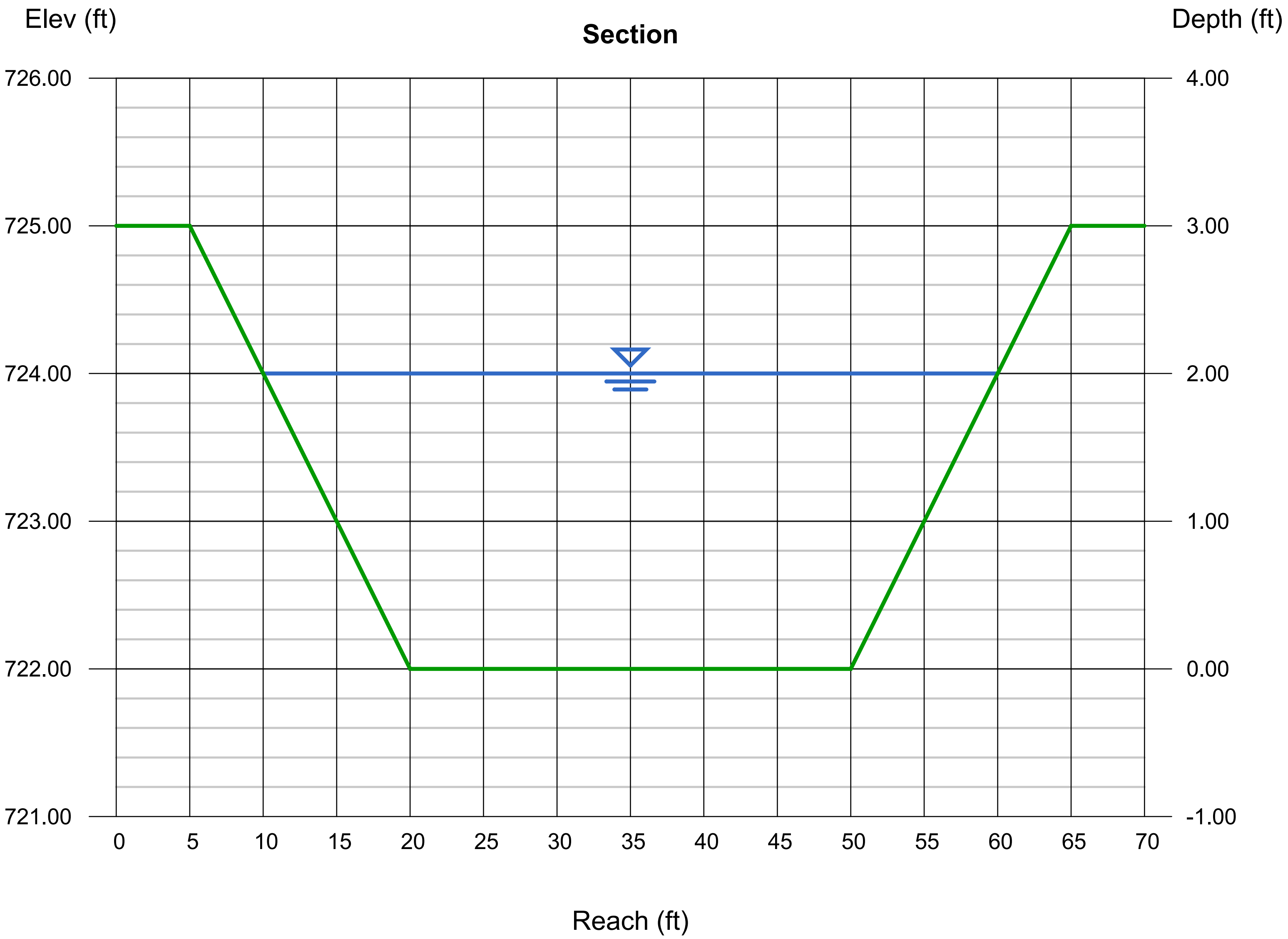
Bottom Width (ft) = 30.00
Side Slopes (z:1) = 5.00, 5.00
Total Depth (ft) = 3.00
Invert Elev (ft) = 722.00
Slope (%) = 5.00
N-Value = 0.013

Calculations

Compute by: Known Depth
Known Depth (ft) = 2.00

Highlighted

Depth (ft) = 2.00
Q (cfs) = 2,783
Area (sqft) = 80.00
Velocity (ft/s) = 34.79
Wetted Perim (ft) = 50.40
Crit Depth, Yc (ft) = 3.00
Top Width (ft) = 50.00
EGL (ft) = 20.81



Channel Report

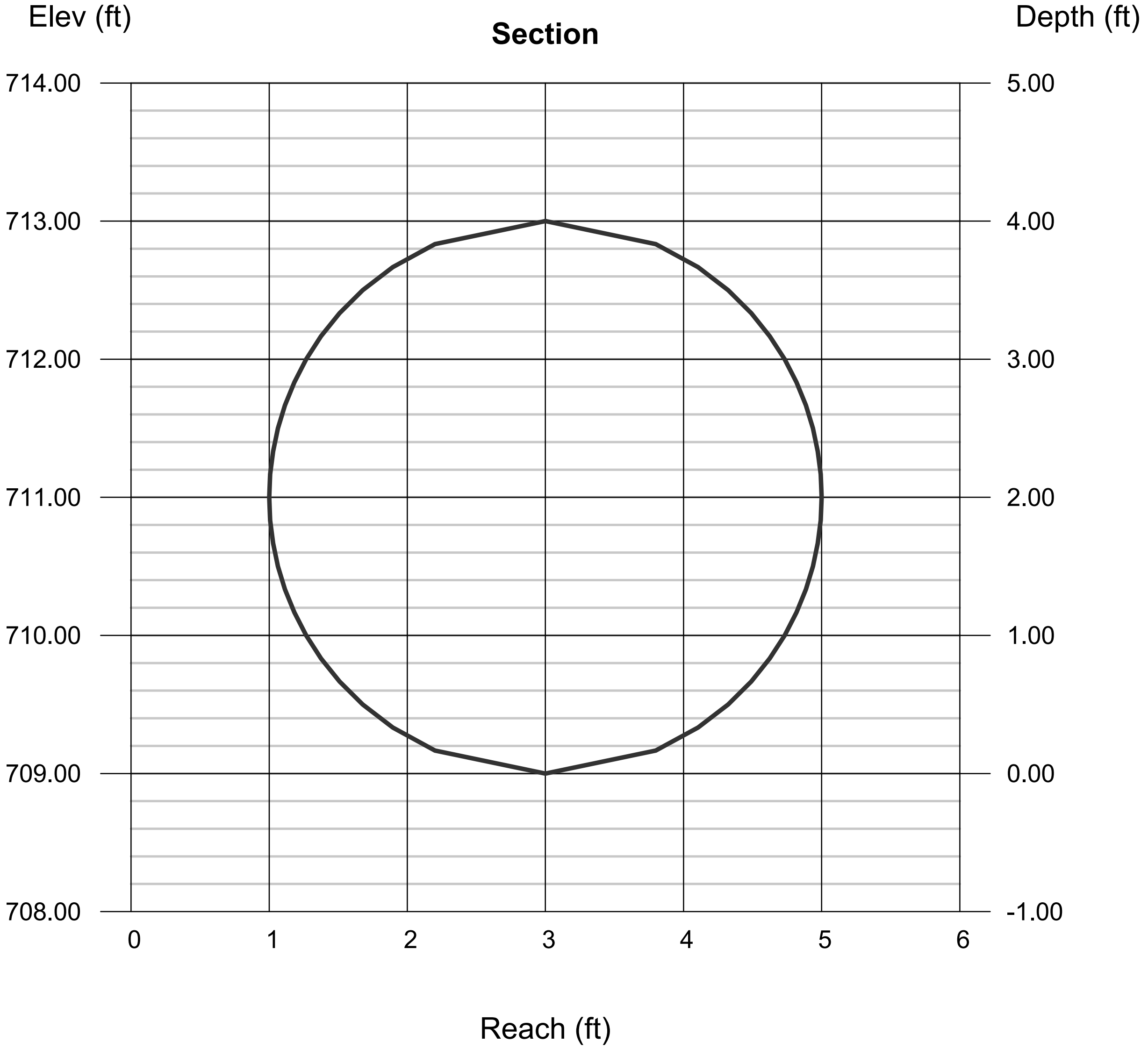
South Retention Structure Outlet

Circular
Diameter (ft) = 4.00

Invert Elev (ft) = 709.00
Slope (%) = 1.00
N-Value = 0.013

Calculations
Compute by: Known Depth
Known Depth (ft) = 4.00

Highlighted
Depth (ft) = 4.00
Q (cfs) = 143.64
Area (sqft) = 12.57
Velocity (ft/s) = 11.43
Wetted Perim (ft) = 12.57
Crit Depth, Yc (ft) = 3.55
Top Width (ft) = 0.00
EGL (ft) = 6.03



Appendix G

Quality Assurance/Quality Control Plan for Liner and Leachate Collection System Installation and Testing

Quality Assurance/Quality Control Plan for Liner and Leachate Collection System Installation and Testing American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

Index and Certification Page

Report Index

CERTIFICATION

This Quality Assurance / Quality Control Plan has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the plan discussed, and it has been prepared in accordance with good engineering practice including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

Submitted By:

FLOYD E. COTTER
17783

5/30/24

Floyd Cotter, PE
SCS Engineers

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Section Page

Tables

Appendices

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Quality Assurance/Quality Control (QA/QC Plan) is to describe the quality assurance procedures to be used during construction of the liner and leachate collection components at the American Environmental Landfill (AEL) in accordance with OAC 252:515 as promulgated by the Oklahoma Department of Environmental Quality (ODEQ) and the EPA Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities (EPA/600/R-93182, September 1993). The primary goals of the quality assurance program are to:

- Determine if proper construction techniques, materials, and procedures are used
- Determine if the intent of the construction documents and project design reports are met
- Identify construction problems and provide a mechanism for resolution

Upon completion of construction, information generated through the quality assurance program will be used to prepare a Liner Installation and Testing (LIT) Report.

This QA/QC Plan replaces the previous plan approved by ODEQ.

1.2 DOCUMENT FORMAT

The QA/QC Plan is a revision to previous plans prepared for AEL and is presented in seven sections. Section 1 is the introduction and presents the document format, definitions, and terms used throughout the document. Section 2 presents general requirements of the quality assurance program and organization. Sections 3 through 6 present special requirements for specific work items of the construction, including procedures such as materials verification, test standards, testing frequencies, conformance and construction testing, sample numbering and processing, and monitoring for each work item. Section 7 presents methods of documentation and record-keeping. All parties involved in the construction should be thoroughly familiar with this document, the construction drawings, and the construction specifications.

1.3 DEFINITIONS

Whenever the terms listed below are used, the intent and meaning will be interpreted as indicated.

ASTM

American Society for Testing and Materials.

Construction Drawings

The official plans, profiles, typical cross sections, elevations, and details, as well as their amendments and supplemental drawings, show the locations, character, dimensions, and details of the work to be performed. Construction drawings are also referred to as the "plans."

Construction Quality Assurance (CQA)

A planned and systematic series of observations and tests designed to provide adequate confidence that materials and services meet contractual and regulatory requirements.

Construction Quality Assurance Consultant (CQA Consultant)

The Consulting firm responsible for the implementation of the CQA program.

Construction Quality Assurance Monitor (CQA Monitor)

Site representative(s) of the POR responsible for documenting field observations and tests.

Construction Quality Assurance Professional of Record (POR)

The POR is an authorized representative of the owner and has responsibility for construction quality assurance reporting and confirming that the facility was constructed in general accordance with construction drawings and specifications approved by the permitting agency. The POR is identified as the "Engineer" in the project specifications. The POR must be registered as a Professional Engineer in the State of Oklahoma. The POR may also be known in applicable regulations and guidelines as the CQA Engineer, Resident Project Representative, Geotechnical Professional (GP), or the Geotechnical Quality Control/Quality Assurance Professional (GQCP).

Construction Specifications

The qualitative requirements for products, materials, and workmanship upon which the construction is based. Construction specifications are also referred to as "specifications."

Contract Documents

The official set of documents issued by the owner, includes bidding requirements, contract forms, contract conditions, construction specifications or drawings, addenda, and contract modifications.

Contractor

The person or persons, firm, partnership, corporation, or any combination, private, municipal, or public, which, as an independent contractor, has entered into a contract with the owner.

Design Engineer

The individuals or firms responsible for the design and preparation of the contract documents.

Earthwork

A construction activity involving the use of soil materials as defined in the construction specifications and Section 3 of this Plan.

Excavation

Excavation of materials from areas identified on the construction drawings.

Geomembrane

An essentially impermeable synthetic membrane, also referred to as a flexible membrane liner (FML), used as a solid or liquid barrier.

Nonconformance

A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate. Examples of nonconformance include, but are not limited to, physical defects, test failures, and inadequate documentation.

Panel

A unit area of the geomembrane that will be seamed in the field or in the fabricator's plant.

Procedure

A document that specifies or describes how an activity is to be performed.

Project Documents

Contractor submittals, construction drawings, record drawings, specifications, shop drawings, construction quality control and quality assurance plans, safety plan, and project schedule.

Project Manager

Owner's representative with overall project responsibility.

Quality Assurance

A planned and systematic pattern of procedures and documentation designed to provide adequate confidence that materials or services meet contractual and regulatory requirements, and that these materials will perform satisfactorily in service.

Quality Control

Those actions that provide a means of measuring and regulating the characteristics of a material or service to comply with the requirements of the construction documents. Quality control will be performed by the contractor, manufacturers, suppliers, and subcontractors.

Record Drawings

Drawings recording the constructed dimensions, details, and coordinates of the project (also referred to as "as built").

Surveyor

The individual or firm responsible for grade staking to establish required elevations to construct the project in accordance with the drawings and specifications.

Testing

Verification that materials meet specified requirements by subjecting that material to a set of physical, chemical, environmental, or operating conditions.

Testing Laboratory

A laboratory capable of conducting the tests required by this QA/QC Plan and the specifications. Testing may be done by the same laboratory or by a separate soil testing laboratory and a geosynthetic testing laboratory.

USCS

Unified Soil Classification System (ASTM D2487)

2.0 GENERAL REQUIREMENTS

2.1 NOTIFCAITON OF CONSTRUCTION

The ODEQ shall be notified at least two weeks before liner construction begins. The notification shall:

- Define the area to be constructed
- Include the names of the contractors and the QA and QC officials
- Include results of the pre-construction tests

2.2 MEETINGS

To facilitate construction and clearly define construction goals and activities, close coordination between the owner, design engineer, CQA personnel, and contractor is essential. To meet this objective, preconstruction and progress meetings will be held.

2.2.1 Preconstruction Meeting

A preconstruction meeting shall be held at the site prior to commencing construction and will be attended by the owner, POR, contractor, and design engineer. The ODEQ shall be notified at least 48 hours in advance of the meeting. The purpose of the preconstruction meeting will be to:

- Identify key personnel
- Review the construction drawings, specifications, CQA program, work area security, safety procedures, and related issues
- Define lines of communication and authority
- Establish reporting and documentation procedures
- Review testing equipment and procedures
- Establish testing protocols and procedures for correcting and documenting construction or nonconformance
- Conduct a site inspection to discuss work areas, stockpile areas, laydown areas, access roads, haul roads, and related items
- Review the project schedule

2.2.2 Progress Meetings

Informal progress meetings are recommended before the start of work and throughout the project. At a minimum, this meeting will be attended by the owner and/or representative and contractor. During liner installation, the progress meetings will be attended by the CQA Monitor and contractor. The purpose of progress meetings is to:

- Discuss progress, problems, resolutions, and schedule
- Review test data
- Discuss the contractor's personnel and equipment assignments
- Review previous activities and accomplishments
- Resolve any outstanding problems or disputes

2.2.3 Additional Meetings

As required, special meetings will be held to discuss problems or nonconformance. Persons attending will be determined on an as-needed basis. If the problem requires a design modification and subsequent change order, the design engineer should also be present.

2.3 RESPONSIBILITY OF CONSTRUCTION PERSONNEL

2.3.1 Responsibilities of the Project Manager

The project manager is the primary owner representative for the project. The project manager defines the overall project scope and has the authority to make changes to that scope if needed (with proper regulatory coordination).

2.3.2 Responsibilities of the Operations Supervisor

The operations supervisor will be on-site full-time as the owner representative for the project.

2.3.3 Responsibilities of the POR

The POR acts as an auditor to verify and document the proper and complete implementation of the quality assurance program. The POR will be responsible for documenting the construction and preparing the LIT Report. The LIT Report will include a statement by the POR as to whether the construction was performed in general conformance with the contract drawings, specifications, and design intent. The POR, in cooperation with the design engineer, must approve all design changes and clarifications to design questions.

2.3.4 Responsibilities of the CQA Monitor

The CQA Monitor represents the POR and Owner by observing and testing the contractor's work activities. The CQA Monitor documents the activities of the contractor in sufficient detail and with continuity to provide a high level of confidence that the work product follows the intent of the construction documents. The CQA Monitor also performs tests, when appropriate, to provide a high level of confidence that the characteristics of the materials and services meet the requirements of the construction documents.

Whenever a CQA Monitor performs visual observations or tests, he/she is responsible for the timely preparation and processing of all required documentation and reports. Accurate and concise reports must be prepared for all monitoring activities and each test performed. Section 7 of this document describes documentation requirements.

2.3.5 Responsibilities of the Contractor

The responsibilities of the contractor include scheduling, performing the work within the timeframe and budget agreed to in the contract and performing the work in accordance with the plans and specifications. The contractor is also responsible for coordinating with any subcontractors. The contractor is expected to cooperate with the CQA Monitor to achieve a quality product.

2.3.6 Responsibilities of the Surveyor

The surveyor will work at the direction of the contractor and/or the owner to provide grade staking for establishing required elevations to construct the project in accordance with the design intent.

2.4 CONTROL OF DOCUMENTS, RECORDS, AND FORMS

2.4.1 Project Control of Construction Documents

Construction documents, including specifications, drawings, and change orders, are controlled by the design engineer. The POR maintains one or more copies of the most current set of construction documents for use by the CQA Monitor. Upon issuance of new copies or revisions, it is the responsibility of the owner to notify the contractor and CQA staff of the revisions, provide revised construction documents, and order the recall of all unrevised copies of the construction documents.

2.4.2 Project Control of As-Built Information

As-built information is controlled by the CQA Monitor and surveyor. During the progress of the work, the POR and design engineer obtain as-built information provided by the contractor, CQA Monitor, surveyor, or others. At the completion of the project, this information is presented to the CQA consultant for use in preparing record drawings of the construction. Final as-built drawings are included with the LIT Report.

2.4.3 Project Control of Forms

Daily report forms, test report forms, and other project forms are controlled by the CQA Monitor, who maintains a master of each form. Upon issuance of a new form, the CQA Monitor must recall and remove all superseded copies along with the master.

2.4.4 Processing Daily Reports

Each CQA Monitor writes a daily record of work progress. The daily reports are reviewed by the POR, who maintains a complete file of daily reports.

2.4.5 Processing Test Reports

A test report must be completed by the CQA Monitor whenever testing is performed. The test reports must be peer-reviewed. The review includes a check for mathematical accuracy, conformance to test requirements, conformance to specifications, and a check for clarity, legibility, traceability, and completeness. The review must be evidenced by the signature of the reviewer. Copies of all test reports are transmitted weekly to the POR, and the original is maintained by the CQA Monitor.

2.4.6 Processing Project Records

Project records are completed as needed. Use of the project records is limited to the scope for which they are intended. The record must be completed by filling in all the blanks provided on the form and followed by the signature of the individual completing the form. All project records must be maintained by the CQA Monitor.

2.5 DOCUMENTATION AND CONTROL OF NONCONFORMANCE

2.5.1 Observation of Nonconformance

Whenever a nonconformance is discovered or observed in the construction process, product, job-related materials, documentation, or elsewhere, the CQA Monitor must notify the contractor and POR as soon as possible.

2.5.2 Determining Extent of Nonconformance

Whenever a nonconformance is discovered or observed in the construction process, product, job-related materials, documentation, or elsewhere, the CQA Monitor will determine the extent of the nonconformance. The extent of the deficiency may be determined by additional sampling, testing, observations, review of records, or any other means deemed appropriate.

2.5.3 Documenting Nonconformance

All nonconformance must be documented in writing on the daily records, logs, and elsewhere, as appropriate. The documentation must occur immediately upon determining the extent of the nonconformance. For any nonconformance that is considered serious or complex in nature, or that requires an engineering evaluation, a nonconformance report will be initiated and issued to the project manager, design engineer, POR, and contractor.

2.5.4 Corrective Measures

For a simple or routine nonconformance, corrective measures will be determined by specification direction, or if none exists, the CQA Monitor, POR, and contractor will discuss standard construction methods to correct the deficiency. For nonconformance requiring a nonconformance report, the design engineer must determine corrective measures. A copy of the nonconformance report, with the corrective measure determination, is forwarded to the POR and contractor for implementation of the corrective action.

2.5.5 Verification of Corrective Measures

Upon notification by the contractor that corrective measures are complete, the CQA Monitor verifies its completion. The verification must be accomplished by observations or retesting and photographs. Written documentation of the corrective measures must be made by the CQA Monitor on daily reports, logs and forms, and the nonconformance report. Verification of corrective measures is reviewed by the POR.

3.0 CONSTRUCTION QUALITY ASSURANCE FOR EARTHWORK

3.1 INTRODUCTION

The overall goal of the earthwork quality assurance program is to facilitate proper construction techniques and procedures are used and that the project is built in accord with the project construction drawings and specifications. Another function of the quality assurance program is to identify problems that may occur during construction and to verify that these problems are avoided or corrected before construction is completed.

Construction must be conducted consistent with the project construction drawings and specifications. To monitor conformance, a quality assurance testing program will be implemented that includes:

- A review of the contractor's quality control submittals
- Material evaluation
- Construction testing
- Construction observation

Activities will be conducted in accordance with this manual, and the project construction drawings and specifications.

3.2 EARTHWORK CONSTRUCTION

3.2.1 Subgrade

The prepared subgrade must conform to the Excavation Plan of the construction drawings. Prior to beginning liner construction, the liner subgrade area will be proof-rolled with heavy, rubber-tired construction equipment to detect unstable areas. Unstable areas will be undercut to firm material and refilled with suitable compacted earth fill. If the subgrade is achieved through excavation, the upper 6 inches of the subgrade will be compacted to a minimum of 90 percent of the maximum dry density as determined by the Standard Proctor (ASTM D 698), unless the subgrade is part of the perimeter berm. Perimeter berm soils shall be compacted to 95 percent of the maximum dry density at a moisture content varying from one percentage point below optimum to three percentage points above optimum.

The CQA Monitor will visually examine the subgrade preparation to evaluate its suitability as a foundation for the compacted soil liner. The CQA Monitor may find that physical testing is necessary to evaluate the prepared subgrade.

The subgrade shall be surveyed on a 100-foot grid to provide verification of liner thickness with a minimum of two reference points.

The CQA Monitor will approve the prepared subgrade prior to the placement of the soil liner or general fill. Approval will be based on a review of test information, if applicable, and CQA monitoring of the subgrade preparation.

3.2.2 General Fill

General fill material placed below the soil liner will be placed in uniform lifts that do not exceed 9 inches in loose thickness and are compacted to at least 95 percent of standard Proctor (ASTM D 698) at a moisture content ranging from one percentage point below optimum to three percentage points above optimum. The top 6 inches of compacted fill material underlying the soil liner will have a maximum particle size of 1-inch diameter.

3.2.3 Soil Liner

The soil liner will consist of a minimum 24-inch thick compacted soil layer (measured perpendicular to the subgrade surface layer). The hydraulic conductivity of the compacted soil liner shall not exceed 1x10-7 centimeters per second (cm/sec). The requirements for the soil liner material shall be as follows (minor deviations may be allowed at the discretion of the POR so long as the hydraulic conductivity requirement is met).

Table 1. Soil Liner Material Requirements

Plasticity Index	> 10
Liquid Limit	> 24
Percent Passing #200 Sieve	> 30
Percent Retained on #4 Sieve	< 20

The soil liner material will consist of relatively homogeneous cohesive materials, which are free of debris, rock greater than 1 inch in diameter, plant materials, frozen materials, foreign objects, organics, and other deleterious materials. The soil liner material should be placed in maximum 9-inch loose lifts to produce a compacted lift thickness of approximately 6 inches. The material will be compacted to a minimum of 95 percent of the maximum dry density as determined by standard Proctor (ASTM D 698), or 90 percent of the maximum dry density as determined by the modified Proctor (ASTM 1557) at a moisture content equal to or greater than the optimum moisture content.

Water shall be applied as necessary to the material and worked evenly into the material with the compaction equipment. Water used for the soil liner must be clean and not contaminated by waste or any objectionable material. Stormwater collected on-site may be utilized if it has not come into contact with solid waste.

The soil liner must be compacted with a heavy, footed roller. The lift thickness shall be controlled so that there is total penetration through the loose lift under compaction into the top of the previously compacted lift; therefore, the lift thickness must not be greater than the length of the foot. Adequate cleaning devices must be in place and maintained on the compaction roller so that the feet do not become clogged with clayey soils to the point that they cannot achieve full penetration. The footed roller is necessary to create bonding between soil particles, to reduce the individual clod size, and to achieve a blending of the soil matrix through its kneading action. Multiple passes are recommended for a vehicle with front and rear drums.

Soil liner construction should not be conducted in adverse weather conditions (heavy rain, freezing temperatures, etc.). The CQA Monitor shall determine if adverse weather conditions exist, that would adversely affect the soil liner causing an inadequate level of confidence in the work, and therefore, has the responsibility and authority to cease any construction activities affected by the adverse weather.

The finished surface of the soil liner must be finely graded by rolling with a smooth, steel-wheeled roller to obtain a uniform and smooth surface. The surface of the soil liner shall then be observed by the CQA Monitor for gravel, rock pieces, ruts, and deleterious materials that might impact the integrity of the overlying geomembrane. All voids created by removing gravel, rock pieces, or other deleterious materials will be backfilled with liner material to the density specifications outlined for soil liner construction and tested at the discretion of the CQA Monitor.

The top of the soil liner shall be surveyed on a 100-foot grid with a minimum of two reference points to provide verification of liner thickness.

The soil liner shall be prevented from losing moisture prior to placement of the geomembrane. Preserving the moisture content of the soil liner will be dependent on the earthwork contractor's means and methods and is subject to POR approval. The POR shall provide daily certification that the liner is of uniform grade with no ruts, meets the minimum moisture content requirements, and the surface is free of debris, rock greater than 1 inch in diameter, plant materials, frozen materials, foreign objects, and other deleterious materials.

3.2.4 Leachate Collection Layer

The leachate collection layer shall consist of a 12-inch drainage layer with a hydraulic conductivity greater than or equal to 1x10-3 cm/sec. Before the drainage layer soil is placed over the geotextile, all destructive and nondestructive testing must be completed on the underlying geomembrane and approved by the POR.

During placement of the drainage layer, a minimum of 36 inches of sand should be maintained between the haul trucks and the installed geosynthetics. The drainage layer soil layer will be placed using low-ground pressure equipment and shall be placed in a manner that will prevent abrasion of the underlying geosynthetics by pushing the material across the geosynthetics. A minimum of 12 inches of sand should be maintained between the spreading equipment and the installed geosynthetics. Under no circumstances shall the construction equipment come in direct contact with the installed geosynthetics.

The thickness of the drainage layer shall be verified with surveying procedures. Thickness shall be determined using the same 100-foot grid used for the liner thickness verification with a minimum of two reference points. The test results for the drainage layer will be included in the LIT Report.

During construction, the CQA Monitor will:

- Verify that grade control construction staking is performed prior to work
- Verify that underlying geosynthetics installations are not damaged during placement operations
- Mark damaged geosynthetics and verify that damage is repaired

- Monitor haul road thickness over geosynthetics installations and verify that equipment hauling and materials placement meet equipment specifications

- Verify corrective action measures as determined by the verification survey (The POR will coordinate with the project surveyor to perform a thickness verification survey of the drainage layer materials upon completion of placement operations)

3.2.5 Protective Cover Layer

The protective cover layer shall consist of either a 5-foot layer of uncompacted select waste or an additional 12-inch drainage layer with a hydraulic conductivity greater than or equal to $1x10^{-3}$ cm/sec.

If select waste is utilized as a protective cover layer, the select waste will contain no construction and demolition (C&D) waste, lumber, rock larger than 2-inch diameter, loads containing structural or scrap metal, fencing material, utility poles, large bulky items, or any other material that may puncture the liner. AEL will provide on-site personnel to remove any nonconforming waste while placing the first 5-foot lift of waste. The select waste will be placed or rolled into position on the drainage layer; the select waste will not be dumped or pushed across the top of the drainage layer. The select waste will be placed in one lift with a dozer and left uncompacted. Within 10 days of the completion of the first 5-foot lift of select waste, a signed letter from the landfill operator or other AEL representative that no nonconforming waste was placed in the first lift will be sent to the ODEQ.

If an additional 12-inch drainage layer is utilized as a protective cover layer, a minimum of 36 inches of sand should be maintained between the haul trucks and the installed geosynthetics. The protective cover layer will be placed using low-ground pressure equipment and shall be placed in a manner that will prevent abrasion of the underlying geosynthetics by pushing the material across the geosynthetics. A minimum of 12 inches of sand should be maintained between the spreading equipment and the installed geosynthetics. Under no circumstances shall the construction equipment come in direct contact with the installed geosynthetics.

The thickness of the drainage/protective cover layer shall be verified with surveying procedures. Thickness shall be determined using the same 100-foot grid used for the liner thickness verification with a minimum of two reference points. The test results for the drainage layer will be included in the LIT Report.

During construction, the CQA Monitor will:

- Verify that grade control construction staking is performed prior to work

- Verify that underlying geosynthetics installations are not damaged during placement operations

- Mark damaged geosynthetics and verify that damage is repaired

- Monitor haul road thickness over geosynthetics installations and verify that equipment hauling and materials placement meet equipment specifications

- Verify corrective action measures as determined by the verification survey (The POR will coordinate with the project surveyor to perform a thickness verification survey of the drainage layer materials upon completion of placement operations)

3.3 MATERIAL EVALUATION

3.3.1 Testing

Prior to the start of construction, sources will be identified for each material and samples tested to determine whether the materials meet project specifications. Samples will be obtained in accordance with applicable ASTM standards. Record samples and results of the testing will be maintained and stored at the project site. The frequency of material evaluation testing is shown in Table 3.

3.3.2 Materials Submittals

Material submittals may be used by the CQA Monitor to establish the acceptability of materials. When sample submittals are required, they will be made available to the CQA Monitor. Acceptance and proper review of submittals are the responsibility of the POR.

3.4 CONSTRUCTION TESTING

3.4.1 Test Procedures

The CQA Monitor must perform the various field and laboratory tests in accordance with the applicable standard, as specified in the construction documents or this manual. In most instances, the applicable procedure is an ASTM standard. Where called for in this manual or the construction documents, the applicable ASTM Standards are included in Table 2 below.

Construction testing is conducted during construction activities. During the progress of the work, additional procedures may be needed for other testing or sampling. If such procedures do not exist, or if they exist and need to be modified, written procedures must be developed by the POR.

Table 2. Applicable ASTM Standards

Standard	Test Description
ASTM D698	Laboratory compaction characteristics of soil using standard effort
ASTM D1557	Laboratory compaction characteristics of soil using modified effort
ASTM D422	Particle size analysis of soils
ASTM D6938	In-Place Density and Water Content of Soil and Soil Aggregate by Nuclear Methods (shallow depth)
ASTM D2937	Density of soil and soil aggregate in place by drive cylinder methods
ASTM D1556	Density and unit weight of soil in place by the sand-cone method
ASTM D2216	Laboratory determination of water (moisture) content of soil and rock by the oven drying method
ASTM D4643	Determination of water (moisture) content of soil by the microwave oven method
ASTM D2434	Permeability of porous granular soils
ASTM D5084	Hydraulic conductivity of saturated porous materials
ASTM D4318	Liquid limits, plastic limit, and plasticity index of soils (Atterberg limits)
ASTM D1140	Amount of material in soils finer than the No. 200 sieve
ASTM C136	Sieve analysis of fine and coarse aggregate
ASTM D2487	Soil classification
ASTM D1587	Thin-walled Shelby tube sampling
ASTM D3042	Insoluble residue in carbonate aggregates

3.4.2 Test Frequencies

Table 3 establishes the test frequencies for earthwork construction quality assurance per OAC 252:515-11. The test frequencies listed establish a minimum number of required tests. Additional testing must be conducted whenever work or materials are suspect, marginal, or of poor quality. Additional testing may also be performed to provide additional data for engineering evaluation. Any retests performed as a result of a failing test do not contribute to the total number of tests performed in satisfying the minimum test frequency.

Examples of conditions that may warrant additional tests include the following:

- Compactors slip while compacting
- Excessive pumping or cracking of fill
- Lift thickness greater than specified
- Dirt-clogged rollers used to compact the fill
- Improperly ballasted compactor
- Adverse weather
- Equipment breakdown
- Work conducted in difficult areas
- High frequency of failed tests

Table 3. Minimum Earthwork Construction Testing Frequencies

Test (ASTM No.)	**Subgrade/General Fill**	**Soil Liner**	**Leachate Collection (Sand)**	**Leachate Collection (Aggregate)**
Moisture Density Relationship (D698 or D1557)	1/10,000 cy per material type	1/10,000 cy per material type	NA	NA
Moisture/Density of Soil In-Place (D6938)	3 per acre per 6-inch lift	3 per acre per 6-inch lift	NA	NA
Moisture Content Oven Drying (D2216 or D4643)	N/A	1/10 in-place moisture density tests	NA	NA
Visual Classification (D2487 and D2488)	N/A	Continual during placement	Continual during placement	Continual during placement
Liquid Limit, Plastic Limit Determinations (D4318)	1/10,000 cy per material type	1/10,000 cy per material type	NA	NA
Gradation (D422 or D1140)	1/10,000 cy per material type	1/10,000 cy per material type	1/100,000 sf per material type	1/5,000 cy
Hydraulic Conductivity (D2434 or D5084)	N/A	2 per acre for top 12 inches of floor liner; 1 per acre for top 12 inches of sidewall liner	1/100,000 sf per material type	1/5,000 cy
Carbonate Content (D3042)	N/A	N/A	NA	1/5,000 cy
Thickness Verification	100-foot square grid with a minimum of 2 reference points	100-foot square grid with a minimum of 2 reference points	100-foot square grid with a minimum of 2 reference points	NA

3.5 MONITORING REQUIREMENTS

Earthwork components of the construction are summarized in Section 3.2. Each component has specific construction requirements that must be monitored. The following sections list monitoring requirements for each type of earthwork.

3.5.1 Excavation to Design Grade

- Verify that stripping is complete and spoils are placed in designated stockpiles
- Verify that construction staking is performed before work
- Review survey with design engineer

3.5.2 Selective Soil Stockpiling

- Visually monitor excavation to identify soil types
- Confirm soil types by sampling and visual classification
- Notify contractor of visual classification and identify stockpile that should receive excavated soil
- Monitor excavation, visually classify soil, and recommend stockpile location to contractor

3.5.3 General Fill Placement

- Verify subgrade is scarified and re-compacted to design requirements
- Verify removal and stockpiling of oversized material
- Verify that source of material is suitable for general fill
- Verify lift thickness
- Test compaction and moisture content at required frequencies
- Sample and perform classification testing at required frequencies
- Verify that completed grades meet slope requirements
- Verify that final grading meets tolerance requirements

3.5.4 Soil Liner Placement

- Verify subgrade is scarified and re-compacted to design requirements
- Verify removal and stockpiling of oversized material
- Verify that source of material is suitable for soil liner

- Verify lift thickness
- Test compaction and moisture content at required frequencies
- Sample and perform classification testing at required frequencies
- Obtain Shelby tube samples at required frequencies
- Verify that completed grades meet slope requirements
- Verify that final grading meets tolerance requirements

3.5.5 Leachate Collection Layer Placement

- Obtain samples of leachate collection material for testing
- Review material submittals
- Perform sampling and gradation, permeability, and calcium carbonate content (aggregate only) testing of material prior to installation at the frequencies established in this manual
- Verify that underlying geomembrane installations are complete before material installation
- Verify thickness of material placed by direct field measurements of in-place material
- Monitor placement of material and mark any geomembrane damaged during material installation
- Verify that damage is repaired

3.5.6 Drainage Aggregate Placement

- Obtain samples of drainage aggregate material for testing
- Review material submittals
- Perform sampling and gradation, permeability, and calcium carbonate content testing of material prior to installation, at the frequencies established in this manual
- Verify that underlying geomembrane installations are complete before material installation
- Monitor placement of material and mark any geomembrane damaged during material installation. Verify that damage is repaired

3.6 CONSTRUCTION SURVEYS

Elevations shall be determined by the Surveyor on a minimum 100-foot grid at the following locations:

- Top of subgrade
- Top of soil liner
- Top of leachate collection layer (if 5-foot uncompacted select waste is used as protective cover)
- Top of drainage/protective cover layer (if an additional 12-inch drainage layer is used as protective cover)
- Invert elevations of the collection pipes to the nearest 0.01 foot at least every 25 feet along each collection pipe, at changes in grade, and at all connections to structures

The tolerances applicable in setting survey stakes will be as set forth in the specifications.

4.0 CONSTRUCTION QUALITY ASSURANCE FOR GEOSYNTHETICS

4.1 INTRODUCTION

This section describes CQA procedures for the installation of the geosynthetic components at the AEL. The overall goal of the geosynthetics quality assurance program is to facilitate that proper construction techniques and procedures are used and that the project is built in accordance with the project construction drawings and specifications. Another function of the quality assurance program is to identify problems that may occur during construction and to verify that these problems are avoided or corrected before construction is complete. The program includes the following:

- A review of the contractor's quality control submittals
- Material evaluation (conformance testing)
- Construction testing
- Construction observation

Conformance testing refers to material testing that takes place before material installation. Construction testing includes activities that occur during installation. Activities will be conducted in accordance with this manual, and the project construction drawings and specifications.

4.2 GEOMEMBRANE

4.2.1 Delivery

Upon delivery of the geomembrane, the CQA Monitor will verify that:

- The geomembrane is delivered in rolls and not folded (Folded geomembrane is not acceptable because the highly crystalline structure of the geomembrane will be damaged if it is folded. Any evidence of folding or other shipping damage is cause for rejection of the material)
- Equipment used to unload and store the rolls does not damage the geomembrane
- The geomembrane is stored in an acceptable location and in accordance with the specifications
- The geomembrane is protected from puncture, dirt, grease, mud, mechanical abrasions, excessive heat, or other damage
- All manufacturing documentation required by the specifications has been received (Geomembrane that does not have proper manufacturer's documentation must be stored at a separate location until all documentation has been received, reviewed, and accepted)

4.2.2 Submittal Review

Prior to installation of the geomembrane portion of the liner, the geomembrane installer shall submit to the POR or his/her representative the manufacturer's quality control testing results for the geomembrane to be installed. These results shall be reviewed to verify that the geomembrane conforms to the project specifications. The GRI-prescribed tests for geomembranes are referenced so as to consistently include ASTM requirements and associated additions and revisions. Current GRI-prescribed test methods for HDPE geomembranes (GM13) are located in Appendix A.

4.2.3 Quality Assurance Conformance Testing

After delivery or at the manufacturer's plant, the CQA Monitor shall obtain geomembrane samples at a frequency of one per 100,000 square feet and every resin lot.

4.2.3.1 Sampling Procedure

Samples will be taken either at the manufacturing plant by the testing laboratory before rolls are shipped or at the site by the CQA Monitor after rolls are shipped. In either case, the sampling procedures are the same.

Specimens should be taken across the entire roll width and should not include the first 1 foot. Five, 1-foot by 1-foot specimens should be taken from the roll. Specimen locations should be evenly spaced across the roll width and be limited to the first 5 feet of geomembrane (i.e., taken near the end of the roll). The five specimens constitute one sample. The sampler should mark the roll identification number on each specimen. The five specimens from any one sample should be taped together or otherwise packaged so that they do not become separated before arriving at the testing laboratory. A test request sheet should be included with each shipment. Samples should be shipped so that they arrive at the laboratory within 24 hours after sampling. In addition, a minimum 1-foot by 5-foot specimen from each sample should be retained by the testing laboratory at least until the project is completed. Any roll that cannot be identified shall be rejected by the CQA Monitor.

4.2.3.2 Test

For each of the properties listed by GRI test methods, the material shall meet current industry standards and project specifications for the geomembrane material type and thickness (e.g., 60 mil HDPE, textured). The POR may request additional testing at his/her discretion. The owner should be notified of submittals that have not been made at the required time. Submittal should be consistent with the specifications requirements and any deficiencies should be reported to the owner. The tests to be conducted by the laboratory are included in Table 4.

Table 4. 60 mil HDPE Geomembrane Testing Frequencies

Test	**Type of Test**	**Test Method (ASTM)**	**Frequency of Testing**
Resin	Specific Gravity/Density	D1505 / D792	Per 200,000 lbs and every resin lot
	Melt Flow Index	D1238	Per 200,000 lbs and every resin lot
Manufacturer's Quality Control	Thickness	D5199 (Smooth) or D5994 (Textured)	Per roll of Geomembrane
	Specific Gravity/Density	D1505 / D792	Per 200,000 lbs
	Tensile Properties	D6693	Per 20,000 lbs
	Tear Resistance	D1004	Per 45,000 lbs
	Puncture Strength	D4833	Per 45,000 lbs
	Stress Crack Resistance	D5397	Per GRI GM10
	Carbon Black Content	D1603	Per 20,000 lbs
	Carbon Black Dispersion	D5596	Per 45,000 lbs
	Oxidation Induction Time	D3895 or D5885	Per 200,000 lbs
	Oven Aging	D5721	For each formulation
	UV Resistance	D7238	For each formulation
Conformance Testing by Third-Party Independent Laboratory	Thickness	D5199 (Smooth) or D5994 (Textured)	Per 100,000 ft^2 and every resin lot
	Specific Gravity/Density	D1505 / D792	Per 100,000 ft^2 and every resin lot
	Carbon Black Content	D1603	Per 100,000 ft^2 and every resin lot
	Carbon Black Dispersion	D5596	Per 100,000 ft^2 and every resin lot
	Tensile Properties	D638/GRI GM13	Per 100,000 ft^2 and every resin lot
	Puncture Strength	D4833	Per 100,000 ft^2 and every resin lot
	Tear Resistance	D1004	Per 100,000 ft^2 and every resin lot
Destructive Seam and Field Testing	Shear and Peel	D6392	1/500 linear feet of seam
Nondestructive Seam Field Testing	Air Pressure	D5820	All dual-track hot wedge weld seams
	Vacuum	D5641	All non-air pressure tested seams when possible
	Other		As necessary with concurrence with ODEQ

4.2.4 Panel Placement

At the conclusion of soil liner construction, the geomembrane shall be installed by a third-party geosynthetics contractor. Prior to installation of the geomembrane, the ODEQ shall be notified at least 48 hours before installation.

The subgrade (top of clay liner beneath geomembrane) shall be free of debris, roots, and angular or sharp rocks. The subgrade (top of clay liner beneath geomembrane) shall be of such compaction so as to provide a firm, unyielding foundation sufficient for deployment vehicles to move about the construction area without rutting and pumping. The geomembrane installer will complete a Subgrade Acceptance Form for inclusion in the construction documentation report.

During placement, the CQA Monitor must maintain up-to-date logs documenting panel and roll numbers, seam numbers, test locations and results, repair locations and results, and nondestructive testing information. The CQA Monitor will review the contractor-prepared as-built (record) drawings, using the logs as reference.

Geomembrane panels shall be deployed and immediately assigned a number according to a panel numbering system. Panels shall be placed down the slope and not across it. Panels shall be physically identified in the field with a grease pencil (or equivalent) for reference during seaming and testing operations and project as-built records. Destructive and nondestructive test locations, as well as repair locations, shall be appropriately identified for documentation purposes. Panels will be deployed with a rubber-tired front loader and a special roller bar to assist with unrolling the geomembrane panels at specified locations. Care shall be used in the deployment of geomembrane panels such that traffic is minimized and equipment does not damage the geomembrane or supporting subgrade surface. Sandbags or other approved loading shall be used as necessary to prevent the uplift of panels by the wind or migration of stormwater beneath the panels. Panels shall not be deployed in areas of standing water or on frozen subgrade. Damage done to panels during deployment shall be noted and repaired by patching and/or spot welding as approved by the POR. No more panels shall be deployed than can be seamed during that day. Steps shall be taken to prevent water from migrating under the geomembrane during and after deployment. Overlapping of the panels or completion of seaming for those panels deployed prior to the end of the work day shall be used as appropriate to minimize the potential for such occurrence. Additionally, temporary or permanent berms shall be constructed where necessary to redirect surface water away from the construction area.

During panel placement, the CQA Monitor should:

- Record panel numbers and dimensions on a panel/seam log
- Observe the geomembrane surface as it is deployed and record all panel defects and repair of the defects (All repairs must be made in accordance with the specifications)
- Verify that equipment used does not damage the geomembrane during handling or equipment transit by contact with hydrocarbons, or by other means
- Verify that the soil liner beneath the geomembrane has not been damaged since previous acceptance
- Verify there are no stones, construction debris, or other items beneath the geomembrane that could cause damage to the geomembrane

- Verify that the geomembrane is not dragged across an unprotected surface (If the geomembrane is dragged across an unprotected surface, the geomembrane must be inspected for scratches and repaired or rejected, if necessary)

- Record weather conditions, including temperature, wind, and humidity. The geomembrane must not be deployed in the presence of excess moisture (fog, dew, mist, etc.). In addition, the geomembrane should only be seamed when the ambient air temperature is between 40°F and 104°F unless trial weld tests for the seaming demonstrate adequate results at other temperatures. The geomembrane should not be deployed during excessive winds that can lift and move the geomembrane panels. The CQA Monitor shall determine if adverse weather conditions exist, that would adversely affect the deployment and seaming of the FML, causing an inadequate level of confidence in the work, and therefore, has the responsibility and authority to cease any construction activities affected by the adverse weather.

- Verify that people working on the geomembrane do not smoke, wear shoes that could damage the liner, or engage in activities that could damage the liner

- Verify that the method used to deploy the geomembrane minimizes wrinkles or fish-mouths so that the geomembrane is anchored and ballasted to prevent movement by the wind (The contractor is responsible for any damage resulting to or from windblown geomembrane)

- Verify that no more panels are deployed than can be seamed on the same day

- Verify that no base T-seam is closer than 5 feet to the toe of the slope

- Verify that field seams are minimized in corners and odd-shaped geometric locations

- Verify that field seaming will be performed by a hot shoe fusion welder, an extrusion welder, or an alternative method approved by the ODEQ and POR prior to use in the field

The CQA Monitor must inform both the contractor and the POR if any of the above conditions are not met.

4.2.5 Geomembrane Anchor Trench

Anchor trenches shall be excavated by the Owner or the project earthwork contractor to the lines and widths depicted on the approved permit or design plans prior to geomembrane placement. Sharp bends and edges in the anchor trench shall be minimized to avoid potential stresses to the geomembrane. The geomembrane should be placed in the anchor trench to the dimensions shown on the construction drawings. Excess material must be removed before the anchor trench is backfilled. The geomembrane anchor trench is left open until panels are seamed together. Expansion and contraction of the geomembrane should be accounted for in the liner placement. The anchor trench should be filled at sundown or in the morning when temperatures are coolest to reduce bridging of the geomembrane.

4.2.6 Trail Welds

Prior to seaming the geomembrane panels, trial welds made by the welding equipment to be used during that day's work shall be made and tested. The trial welds shall be made by the same machine/operator combination and under the same conditions as will be encountered during actual seaming operations. Trial welds shall be made at the beginning of each work day, at approximately 5-hour intervals thereafter, and whenever a new welding machine/operator combination begins work. The trial weld sample must be 3 feet long and 12 inches wide, with the seam centered lengthwise. The CQA Monitor must observe all welding operations, quantitatively test each trial weld for peel and shear, and record the results. The trial weld must meet specified requirements for peel and shear and the break must be ductile or a film-tearing bond (FTB) for a wedge weld. If at any time the CQA Monitor believes that an operator or welding apparatus is not functioning properly, a trial weld test must be performed. If there are wide changes in temperature, humidity, or wind speed, the trial weld test should be repeated. The trial weld test sample must be allowed to cool to ambient temperature before testing.

Testing shall include shear and peel tests on ten separate samples (five for shear, five for peel), using the specifications outlined by the GRI. The GRI-prescribed standard specifications for geomembranes are referenced so as to consistently include ASTM requirements and associated additions and revisions. Current GRI-prescribed standard specifications for HDPE geomembranes (GM19a) are located in Appendix A.

Should trial welds fail, adjustments shall be made to the welder, as necessary, and new specimens shall be cut and tested. If repeat tests also fail, the subject welding machine shall not be used for seaming until deficiencies are corrected and passing trial welds are achieved. All trial welds shall be documented by the CQA Monitor on a Trial Weld Record.

4.2.7 Field Seaming

The CQA Monitor shall observe panel welding. The welding area shall be generally clean and free of moisture, dirt, and debris. Fish-mouths and wrinkles at seam overlaps that cannot be welded shall be cut out and patched with an extrusion welded patch. A seam number shall be assigned to each seam that reflects the two panels being joined together and written on the panels at both ends of the seam for field identification purposes. The CQA Monitor shall measure the seams and record the measurements on a Seam Record. Additional information to be documented may include date and time of seaming, the welder's initials, machine number, machine speed, and set temperature.

During geomembrane welding operations, the CQA Monitor must verify the following:

- The contractor has the number of welding apparatuses and spare parts necessary to perform the work
- Equipment used for welding will not damage the geomembrane
- The extrusion welder is purged before beginning a weld until all the heat-degraded extrudate is removed (extrusion welding only)
- Seam grinding has been completed less than one-hour before seam welding, and the upper sheet is beveled (extrusion welding only)
- Grind marks do not extend more than ¼-inch from the edge of the weld

- The ambient temperature is between 40°F and 104° F

- The ends of old welds, more than five minutes old, are ground to expose new material before restarting a weld (extrusion welding only)

- The contact surfaces of the sheets are clean, free of dust, grease, dirt, debris, and moisture before welding

- The weld is free of dust, rocks, and other debris

- The seams are overlapped a minimum of 3 inches for extrusion and 4 inches for hot wedge welding, or in accordance with the manufacturer's recommendations, whichever is more stringent

- No solvents or adhesives are present in the seam area

- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing

- The panels are welded in accordance with the plans and specifications

- There is no free moisture in the weld area

4.2.8 Construction Testing

Construction testing is performed on seams welded at the construction site. These tests include quality control and quality assurance testing performed by the contractor.

4.2.8.1 Nondestructive Seam Testing

The purpose of nondestructive testing is to detect discontinuities or holes in the seam, and it indicates whether a seam is continuous and non-leaking. All seams that are welded during the installation of the geomembrane shall be nondestructively tested by the Geomembrane Contractor and overseen by the CQA Monitor to check the integrity of the seams. Nondestructive tests shall be conducted using the air pressure test or the vacuum test.

HDPE Liner Air Pressure Test

Air pressure testing will be completed on seams that have been welded with a fusion welder (wedge welder) using an air pump capable of sustaining 25 to 30 pounds per square inch (psi) of pressure. The following procedures shall be followed by the Geomembrane Contractor:

- Seal one end of the seam channel to be tested

- Insert a sharp, hollow needle or other approved pressure feed device with a pressure gauge into the sealed end of the seam

- Energize the air pump to verify the unobstructed passage of air through the seam channel. Should the verification fail, locate the obstruction and test the seam on both sides of the obstruction

- Seal the other end of the seam channel

- Energize the air pump to a pressure of between 25 and 30 psi, close valve, and allow 2 minutes for the injected air to reach equilibrium in the channel prior to recording the initial pressure reading

- Sustain pressure for 5 minutes and record the final pressure reading

- Should the air pressure decrease by more than 2 psi during the 5-minute test period or the initial pressure not stabilize, locate the faulty area of the seam, make repairs, and retest

- If the air pressure test passes, the air channel should be cut at the opposite end of the gauge to deflate the seam channel

- Record appropriate test information on the Nondestructive Test Record and record the nondestructive test locations

HDPE Vacuum Test

Vacuum testing will be completed on HDPE seams that have been welded with an extrusion welder or when the geometry of a seam makes it impossible or impractical to test using the air pressure test. The following procedures shall be followed by the Geomembrane Contractor:

- Trim excess overlap from the seam edges

- Wet the area to be tested with a soap and water solution

- Place the vacuum box assembly over the wetted area and apply sufficient pressure to “seat” the box on the test area

- Create a vacuum of 3 to 5 psi to the box, using the pressure gauge on the box to observe pressure readings

- Once a tight seal is acquired, observe the area for approximately 10 seconds looking for the presence of recurring soap bubbles on the seam

- Should leaks (bubbles) be observed, mark the location of each leak, repair the marked areas, and retest as appropriate

- Should no leaks be detected, release the pressure on the vacuum box and move the box to the next adjacent test location maintaining a minimum 3-inch overlap, if applicable

- Record appropriate test information on the Nondestructive Test Record and record the nondestructive test locations

Should specific locations exist where nondestructive testing is not possible or practical, seams shall be tested according to a method agreed upon by the POR and the ODEQ.

During nondestructive testing, the CQA Monitor shall perform the following:

- Review technical specifications regarding test procedures
- Verify that equipment operators are fully-trained and qualified to perform their work
- Verify that test equipment meets project specifications
- Verify that the entire length of each seam is tested in accord with the specifications
- Observe all continuity testing and record results
- Verify that all testing is completed in accordance with the project specifications
- Identify the failed areas by marking them with a waterproof marker compatible with the geomembrane, and inform the contractor of the areas that require repair
- Verify that all repairs are completed and tested according to project specifications
- Record all completed and tested repairs

4.2.8.2 Destructive Seam Testing

Destructive seam tests will be performed independently by the installer and CQA consultant at intervals stated in the project specifications. However, the CQA Monitor must perform additional tests if there is suspicion that a seam does not meet specification requirements. Reasons for performing additional tests may include, but are not limited to:

- Wrinkling in seam area
- Excess crystalline
- Suspect seaming equipment or techniques
- Weld contamination
- Insufficient overlap
- Adverse weather conditions
- Possibility of moisture, dust, dirt, debris, and other foreign material in the seam
- Failing tests

There are two types of destructive testing required for the geomembrane installation: peel adhesion (peel) and bonded seam strength (shear). The purpose of peel and shear tests is to evaluate seam strength and long-term performance. Shear strength measures the continuity of tensile strength through the seam and into the parent material. Peel strength determines weld quality. Test welds must be allowed to cool naturally to ambient temperature before testing. Destructive testing must be performed concurrently with seaming operations, not at the completion of the entire installation.

Destructive test samples shall be collected at a frequency of one per 500 feet of seam length per machine as seaming progresses in an effort to detect possible problems in a timely manner. A minimum of one destructive test sample should be collected from an extrusion weld if extrusion welding is used. The following procedures shall be followed by the Geomembrane Contractor:

- The CQA Monitor shall randomly select a seam location to be sampled and tested. All destructive sample locations shall be marked on the geomembrane liner
- The Geomembrane Contractor shall cut three samples at the selected location: one each for the Geomembrane Contractor, Independent Third-Party Laboratory, and the Owner's archives
- Each sample shall be a minimum of 12 inches wide by 18 inches long (or according to minimum laboratory requirements) with the seam centered lengthwise
- The Geomembrane Contractor shall perform field tests prior to the next day's seaming
- The Geomembrane Contractor shall field test ten 1-inch wide test specimens (five for peel and five for shear strength) using the specifications outlined by the GRI (Current GM19a Standard Specifications are referenced in Appendix A)
- The Owner or CQA Monitor shall coordinate with an independent third-party laboratory to perform the same test procedures on the laboratory samples
- The GRI-prescribed standard specifications for geomembranes are referenced so as to consistently include ASTM requirements and associated additions and revisions. Current GRI-prescribed standard specifications for HDPE geomembranes (GM19a) are located in Appendix A. For HDPE, GRI GM19a should be utilized to assess the seam test results. If the results of the testing show a sample does not conform to the requirements, retesting should be addressed by the procedures outlined below. Such criteria shall apply to both the field tests and the third-party laboratory tests. Should environmental conditions during testing detrimentally affect field test results, the laboratory tests shall govern
- The CQA Monitor shall document pertinent destructive test information on a Destructive Test Record and record the destructive test locations. Pertinent information to be logged for each sample includes seam number, destructive test number, welder, date, time
- If possible, the independent third-party laboratory should provide test results within 24 hours to the CQA monitor (Certified test results are to be provided within five days)
- The CQA Monitor must immediately notify the contractor in the event of a failed test result (The geomembrane shall not be covered, except as necessary to provide wind protection, until passing results are received from the testing laboratory)

4.2.8.3 Procedure for Destructive Test Failure

- Two additional destructive samples shall be collected, one on each side of the failed test location at least 10 feet from its location

- The same testing procedures as described above shall apply to determine whether the additional samples pass or fail

- If the additional tests pass, the portion of the seam between two passing test locations shall either be reconstructed or cap stripped

- If either of the additional tests fails, the process shall be repeated until a seam length is bounded by two passing tests (The seam between the two passing test locations shall either be reconstructed or cap stripped)

- All repaired or replaced seams shall be nondestructively tested to verify their integrity. Repairs shall be noted on a Repair Record and the locations of repairs shall be recorded

4.2.9 Repairs

Any portion of the geomembrane that is flawed or fails a nondestructive or destructive test, or portions where destructive tests were cut or nondestructive tests left cuts or holes, must be repaired in accordance with the specifications. The CQA Monitor must locate and record all repairs. Repair techniques include the following:

- Patching – used to repair large holes, tears, large panel defects, undispersed raw materials, contamination by foreign matter, and destructive sample locations

- Extrusion – used to repair small defects in the panels and seams. In general, this procedure should be used for defects less than ½-inch in the largest dimension

- Capping – used to repair failed welds or to cover seams where welds or bonded sections cannot be nondestructively tested (also used to cap T-seams where wedge-welding is used)

- Removal – used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles, fish-mouths, intersections, etc.) from the installed geomembrane. Areas of removal must be patched or capped

Repair procedures include the following:

- Abrade geomembrane surfaces to be repaired (extrusion welds only) no more than 1-hour before the repair

- Clean and dry all surfaces at the time of repair

- Verify acceptance of the repair procedures, materials, and techniques by the CQA Monitor in advance of the specific repair

- Extend patches or caps at least 6 inches beyond the edge of the defect, and round all corners of the material to be patched and patches to a radius of at least 3 inches. Bevel the top edges of patches before extrusion welding

4.2.10 Wrinkles

During the placement of materials over the geomembrane, temperature changes or creep may cause wrinkles to develop in the geomembrane. Any wrinkles that can fold over must be allowed to contract by liner temperature reduction. In no case can the material be placed over the geomembrane, which could result in the geomembrane folding. Panels that are being seamed together should be at approximately the same temperature and have approximately the same amount of wrinkling. The CQA Monitor must monitor the geomembrane for wrinkles and notify the contractor if wrinkles are being covered with material. The CQA Monitor is then responsible for documenting corrective action to remove the wrinkles.

4.2.11 Geomembrane Acceptance

The contractor retains all ownership and responsibility for the geomembrane until acceptance by the Owner. In the event the contractor is responsible for placing materials over the geomembrane, the contractor retains all ownership and responsibility for the geomembrane until all required documentation is complete and the cover material is placed. After panels are placed, seamed, tested successfully, and repairs made, the completed installation is walked by the Owner's and contractor's representatives. Any damage or defect found during this inspection is repaired properly by the installer. The installation is not accepted until it meets the requirements of both representatives. In addition, the geomembrane is accepted by the POR only when the following has been completed:

- The installation is finished
- All seams have been inspected and verified to be acceptable
- All required laboratory and field tests have been completed and reviewed
- All required contractor-supplied documentation has been received and reviewed
- All record drawings have been received and reviewed by the CQA Monitor (The record drawings show the true panel dimensions, and the locations of seams, trenches, and repairs)

4.3 GEOTEXTILE

The geotextile will be placed between the geomembrane and the leachate collection layer. The geotextile material shall be equivalent to the geotextile description included in Appendix B.

4.3.1 Delivery

During delivery, the CQA monitor must observe the following:

- Equipment used to unload the rolls will not damage the geotextile
- Rolls are wrapped in impermeable and opaque protection covers

- All documentation required by the specifications has been received and reviewed for compliance with the specifications

- Each roll is marked or tagged with the manufacturer's name, project identification, lot number, roll number, and roll dimensions

- Materials are stored in a location that will protect the rolls from precipitation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions

- Damaged rolls are rejected and removed from the site or stored at a location separate from accepted rolls

4.3.2 Testing and Certification

Prior to installation of the geotextile, the geotextile manufacturer shall provide the Owner and/or POR the GRI-prescribed test results for the geotextile material to be installed. These results shall be reviewed to verify that the geotextile conforms to the project specifications. The GRI-prescribed tests for geotextiles are referenced so as to consistently include ASTM requirements and associated additions and revisions. Current GRI-prescribed test methods for geotextile cushions (GT12a) and geotextile filters (GT13a) are located in Appendix A.

For each of the properties listed by GRI test methods, the material shall meet current industry standards for the geotextile material type (e.g., woven, non-woven) and unit weight. The POR may request additional testing at his/her discretion.

4.3.3 Geotextile Installation

Prior to geotextile installation, the CQA Monitor must observe the following:

- The supporting surface does not contain stones that could damage the geotextile or the underlying geosynthetics

- There are no excessively soft areas that could result in damage to the geotextile or the underlying geosynthetics

During geotextile placement, the CQA Monitor must observe the following:

- The geotextile as it is deployed. Record all defects and disposition of the defects

- That equipment used does not damage the geotextile

- That people working on the geotextile do not smoke, wear shoes that could damage the geotextile, or engage in other activities that could damage the geotextile

- That the geotextile is securely anchored as required in the construction drawings and specifications

- That the seams are overlapped and that the panels are being joined in accordance with the specifications

4.3.4 Geotextile Repairs

Repair procedures include:

- Patching - used to repair large holes, tears, large defects, and destructive sample locations
- Removal - used to replace areas with large defects where the preceding method is not appropriate

4.4 EQUIPMENT ON GEOSYNTHETIC MATERIAL

Construction equipment on the composite liner system will be minimized to reduce the potential for liner puncture. The CQA Monitor will verify that small equipment such as generators are placed on scrap liner material (rub sheet) above geosynthetic materials in the composite liner system. Aggregate drainage layers, drainage layer, and/or general fill that are placed on the geosynthetics will be placed using low-ground pressure equipment. The CQA Monitor will verify that the geosynthetics are not displaced while the soil layers are being placed.

Unless otherwise specified by the POR, all lifts of the leachate collection layer and/or general fill that is placed on the geosynthetics shall conform to the following guidelines presented in Table 5 below.

Table 5. Equipment Requirements for Leachate Collection Layer Construction

Equipment Ground Pressure (psi)	Minimum Lift Thickness (inches)
< 5	10
5 - 8	18
8 - 16	24
> 16	36

5.0 CONSTRUCTION QUALITY ASSURANCE FOR PIPING

5.1 HDPE PIPING

This section describes CQA procedures for the installation of the HDPE pipe for the leachate collection system. Proper installation of pipes is essential for systems to operate as intended.

5.1.1 Delivery

During delivery, the CQA Monitor must verify the following:

- Upon delivery, the pipe and fittings are in compliance with the requirements of the specifications
- Stacking or insertion of other construction materials onto or into the pipe and fittings is prohibited (The CQA Monitor will periodically examine the storage area to observe that the pipe and fittings are undamaged and have been protected)
- Upon transporting pipe and fittings from the storage location to the construction site, the contractor uses pliable straps, slings, or rope to lift the pipe
- The contractor lifts pipe greater than 20 feet in length with at least two support points
- Equipment used to unload the pipe does not damage the pipe
- The pipe is stacked consistent with the manufacturer's recommendations
- All documentation required by the specifications has been received
- Each section is marked according to specification requirements, including pipe manufacturer, SDR size, ASTM designation, and date of manufacturer

Any damaged pipe must be rejected and removed from the site, or stored at a location separate from the accepted pipe designated by the Owner. All pipe that does not have proper manufacturer's documentation must also be stored at a separate location until all documentation has been received and approved.

5.1.2 Conformance Testing

The pipe manufacturer will provide the Owner and the POR with a quality control certificate for each lot or batch of pipe provided. The quality control certificate will be signed by a responsible party employed by the pipe manufacturer, such as the production manager.

Prior to the installation of pipe, the pipe manufacturer will provide the following to the CQA Monitor:

- Property data sheet including all specified properties measured using test methods indicated in the specifications, or equivalent
- A certification that property values given in the properties sheet are minimum values and are guaranteed by the pipe manufacturer

The CQA Monitor will observe that:

- The property values certified by the pipe manufacturer meet all of the specifications
- The measurements of properties by the pipe manufacturer are properly documented and the test methods used are acceptable

5.1.3 Installation

Prior to pipe installation, the CQA Monitor must observe the following:

- All lines and grades have been verified by the surveyor
- The pipe trenches are swept clean of any deleterious material that may damage the pipe or geomembrane or may clog the pipe
- Pipe perforations are the correct size and are properly spaced according to the specifications. Perforations shall be factory-machined

During pipe and fitting installation, the CQA Monitor must:

- Observe that pipes and fittings are not broken, cracked, or otherwise damaged or unsatisfactory (For fusion welded pipe, the pipe installer will provide for a fusion surface area that is clean and free of moisture, dust, dirt, debris of any kind, or other foreign material)
- Observe that the pipe and fittings are being constructed in accordance with specifications and accepted practices
- Observe that the people and equipment utilized to install the pipe do not damage the pipe or any other component of the liner system

Surveying shall include invert elevations to the nearest 0.01 feet at least every 25 feet along each collection pipe, at changes in grade, and at all connections to structures.

6.0 CONSTRUCTION QUALITY ASSURANCE FOR DRAINAGE AGGREGATE

6.1 DRAINAGE AGGREGATE

The drainage aggregate will consist of materials that comply with the specifications and have a hydraulic conductivity greater than or equal to 1.0x10-2 cm/sec. The granular drainage material should be tested by the supplier for gradation (ASTM D422), hydraulic conductivity (ASTM D2434), and calcium carbonate content (ASTM D3042) at the supply source at a minimum of 1 test per 5,000 cubic yards or per lined area. The material shall be free of organics, foreign objects, and other deleterious materials. The physical characteristics of the material shall be evaluated through visual observation and laboratory testing before construction and visual observations during construction. The material may be tested during construction at the discretion of the CQA Monitor.

6.1.1 Installation

The drainage aggregate will be placed on top of the geotextile that overlies the geomembrane using low-ground pressure equipment as outlined in Section 4.4. The drainage aggregate shall be placed by spreading a minimum of 12 inches of material in front of the spreading equipment. Under no circumstances shall the construction equipment come in direct contact with the installed geosynthetics.

During construction, the CQA Monitor will:

- Verify that underlying geosynthetic installations are not damaged during placement operations, or mark damaged geosynthetics and verify that damage is repaired
- Monitor haul road thickness over geosynthetics installations and verify that equipment hauling and materials placement meet equipment specifications

7.0 DOCUMENTATION

The quality assurance program depends on thorough monitoring and documentation of all construction activities during liner and leachate collection system installation. Therefore, the POR and CQA Monitor will document that all quality assurance requirements are addressed and satisfied. Documentation consists of daily record-keeping, testing, and installation reports, nonconformance reports (if necessary), progress reports, design and specification revisions, and a LIT Report as required by OAC 252:515-11-6.

7.1 DAILY RECORD KEEPING

At a minimum, daily records consist of construction progress, daily construction reports, observation and test data sheets, and, as needed, nonconformance/corrective measure reports. All forms are copied to the POR for review.

7.1.1 Daily Record of Construction Progress

The daily field report will summarize ongoing construction and discussions with the contractor and will be prepared by the CQA Monitor. At a minimum, the report will include the following:

- Date, project name, project number, and location
- A unique number for cross-referencing and document control
- Weather data
- A description of all ongoing construction for the day in the area of the CQA Monitor's responsibility
- An inventory of equipment used by the contractor
- Items of discussion and names of parties involved in discussions
- A brief description of tests and observations, identified as passing or failing, or, in the event of failure, a retest
- Areas of nonconformance/corrective actions, if any (nonconformance/corrective action form to be attached)
- Summary of materials received and quality documentation
- Follow-up information on previously reported problems or deficiencies
- Record of any site visitors
- Signature of CQA Monitor

7.1.2 Observation and Test Data Sheets

Observation and test data sheets should include the following information as appropriate for the form being used:

- Date, project name, and location
- A unique number for cross-referencing and document control
- Weather data, as applicable
- A reduced-scale site plan showing sample and test locations
- Test equipment calibrations, if applicable
- A summary of test results identified as passing, failing, or, in the event of a failed test, retest
- Completed calculations
- Signature of the CQA Monitor

7.1.3 Nonconformance Reports

In the event of a nonconformance event, a nonconformance verification report form is included with the daily report. Procedures for implementing and resolving any nonconformance to the specification are outlined in Section 2.4 of this QA/QC Plan.

7.2 PHOTOGRAPHS

Construction activities will be photographed. Photographs will be taken to document any significant problems encountered, corrective actions, and construction progress. The photographs are identified by number, location, time, date, and photographer. The photographer should document the subject of the photograph, either on the back of the picture or in a photograph log.

7.3 DESIGN AND SPECIFICATION CHANGES

Design and specification changes may be required during construction and are only made with a written agreement of the design engineer, owner, and contractor. These changes are made by a change order to the contract. The regulatory agencies are notified by the POR of any significant changes. When change orders are issued, they are prepared by the owner with technical input from the design engineer and POR. The owner distributes change orders to the required parties for signature and execution.

7.4 LINER INSTALLATION AND TESTING REPORT

At the completion of the project, the POR will submit a LIT Report documenting the construction of the composite liner system and leachate collections system to the ODEQ for approval. The POR will provide an engineer’s certification that the liner and leachate collection system were constructed in accordance with the approved construction drawings and specifications. QA/QC documentation will be included in the LIT Report. Waste shall not be placed on a new liner system until the ODEQ provides written authorization to commence disposal.

The LIT Report shall be submitted to the ODEQ at the conclusion of the composite liner and leachate collection system construction. The LIT Report shall be placed in the site operating record.

At a minimum, the LIT Report contains:

- A summary of major construction activities
- A summary of conformance test results
- A summary of laboratory and field test results
- Sampling and testing location drawings
- A summary of repairs and their locations
- A description of significant construction problems and the resolution of these problems
- A list of changes from the construction drawings and specifications and the justification for these changes
- As built record drawings
- Invert elevations to the nearest 0.01 foot at least every 25 feet along each leachate collection pipe, grade changes, and at all connections to structures
- Results of the initial leachate collection pipe cleanout
- A statement of compliance with the construction documents and design intent signed and sealed by a professional engineer registered in the State of Oklahoma

APPENDIX A

GRI PRESCRIBED TESTING

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Revision Schedule on page 7

GRI Guide GM10*

Standard Guide for

"The Stress Crack Resistance of HDPE Geomembrane Sheet"

This guide was developed by the Geosynthetic Research Institute (GRI) with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new guides on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this guide either at this time or in the future.

1. Scope

1.1 This guide covers polyethylene in the resin density range of 0.932 g/cc or greater, which results in a geomembrane with minimum density of 0.940 g/cc when mixed with carbon black and additives. This compounded material is commonly referred to in the geomembrane industry as high density polyethylene (HDPE) and this terminology will be used accordingly in this guide.

1.2 This guide uses data obtained from the Notched Constant Tensile Load (NCTL) test, per ASTM D5397 Test Method, to generate a behavioral curve. It then prescribes the procedure to be used to obtain the transition time (T_t) from this curve and furthermore sets a minimum value for "T_t". The guide is oriented toward test specimens taken from fabricated sheets of the geomembrane under consideration. The guide also recommends the frequency of such testing.

1.3 This guide also addresses data obtained from the Single Point-Notched Constant Tensile Load (SP-NCTL) test, per the Appendix of the ASTM D 5397 Test Method. It prescribes the number and orientation of test specimens and sets a value for minimum acceptable

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*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This guide will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

times without failure. The guide is oriented toward test specimens taken from fabricated geomembrane sheets. It also recommends the frequency of such testing.

1.4 For textured or structured geomembranes the test specimens must be taken within the smooth (nontextured) surfaces along the edges of the sheet.

1.5 In the context of quality systems and management, this guide is focused on manufacturing quality control (MQC).

Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product(s) represent the stated objective and properties set forth in this guide.

2. Referenced Documents

2.1 ASTM Standards

D6693 - Test Method for Tensile Properties of Plastics
D883 - Definitions of Terms Relating to Plastics
D1822 - Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Materials
D5397 - Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
D5397 Appendix - The Single Point Notch Constant Tension Load Test

3. Classification

3.1 This guide covers the stress crack resistance of HDPE geomembranes. According to ASTM D 883, stress crack is defined as "an external or internal crack in a plastic caused by tensile stresses less than its short-time mechanical strength."

3.2 This guide focuses on those geomembranes produced from virgin polyethylene in the density range of 0.932 g/cc or greater. When formulated with typical amounts of carbon black and additives, the resulting minimum density is 0.940 g/cc. This compounded material is commonly referred to as HDPE in the geomembrane industry.

3.3 While stress cracking in plastics is a fundamental resin property it should be recognized that it can be influenced by the thermal history of the sheet during the manufacturing process.

4. Sample Preparation

4.1 Test specimens to be used for the full NCTL test and the SP-NCTL test are taken directly from samples of the as-manufactured geomembrane sheet. They should be taken at uniform distances across the roll width with the exception of textured surfaces as discussed in section 1.4.

4.2 Test specimens can also be taken from a small scale laboratory extruder, however, the correlation of results to the as-manufactured sheet is unknown. If the results are used to estimate the quality of as-manufactured sheet, a correlation must be developed on a material and process specific basis.

Note 2: Since thermal history during processing is recognized as an important variable, test results obtained on sheet produced by small scale laboratory extruder could be different from test results obtained on sheets produced on full size commercial equipment.

5. Test Specimens and General Conditions

5.1 Geomembrane sheet thicknesses that are applicable for this guide are from 0.75 mm (30 mil) to 3.0 mm (120 mils).

Note 3: It should be noted that the failure time at any applied stress level is somewhat effected by the thickness of the geomembrane sheet. Generally, specimens of small thickness will result in a longer failure times than those of large thickness due to their density variation.

5.2 Dimensions of the individual dumbbell shaped test specimens shall be in accordance with ASTM D1822 for both the NCTL and SP-NCTL tests.

5.3 The thickness of the test specimens must be within 5% of the nominal thickness of the geomembrane sheet.

5.4 Per ASTM D5397 and its Appendix, the notch depths for both NCTL and SP-NCTL test specimens shall be such that a ligament of 80% of nominal sheet thickness remains after notching to sustain the applied loads.

5.5 The yield stress used for calculating the percent applied loads in Section 6.4 shall be obtained according to ASTM D6693.

Note 4: The applied stress to be imposed on the notched test specimens are percentages of the yield stress of the sheet per ASTM D6693 at 21°C ± 2°C. In contrast, the NCTL and SP-NCTL tests are tested at 50 ± 1°C.

5.6 Test specimens shall be immersed in a suitable bath containing a 10% Igepal (CO 630)/90% tap water solution, maintained at 50°C ± 1°C.

Note 5: In case of disputes between the parties involved, deionized water should be used instead of tap water.

Note 6: It is generally considered good practice to use deionized water so as to maintain the wetting agent solution for the maximum time possible.

Note 7: The solution should be changed every 1000 h or sooner.

5.7 The constant load test device shall be equipped with timers and other incidental items per ASTM D5397.

6. NCTL Tests per ASTM D5397

6.1 Data Required - Per ASTM D5397, data sets of percent yield stress (% σ_y) versus average failure time (F_t) shall be generated.

6.2 A minimum of thirty test specimens are die cut in one direction from the sample of the geomembrane sheet (3 replicates at 10 different loads). The longitudinal axis of the dumbbell shaped test specimens will generally be the cross machine direction of the geomembrane sheet.

6.3 The test specimens, in sets of three, are subjected to each applied stress. The applied stress levels should range from approximately 50% to 20% of the yield strength, in maximum increments of 5%.

6.4 Tests at the lowest stress level shall start first and incrementally increase through each stress interval to the highest stress level.

6.5 For this guide focused on manufacturing quality control (MQC) testing, the yield value used to calculate the applied loads shall be the manufacturer's mean value for the geomembrane resin/formulation under consideration.

Note 8: For manufacturing quality assurance (MQA) testing, the yield value will generally be from five tests per ASTM D6693 for the particular resin/formulation under consideration. Since this is a statistically small sample, the value will generally be different (higher or lower) than the manufacturer's mean value of yield stress. Communication between the parties involved is recommended to resolve possible differences.

6.6 The resulting test data shall be presented on a log-log plot of the percent yield stress versus average failure time of the three tests at each load, as shown in Figure 1. At least 3 points shall be located in the ductile region of the curve and at least 3 points shall be located in the brittle region of the curve. Adequate points shall be available to define the shape of the transition region of the curve.

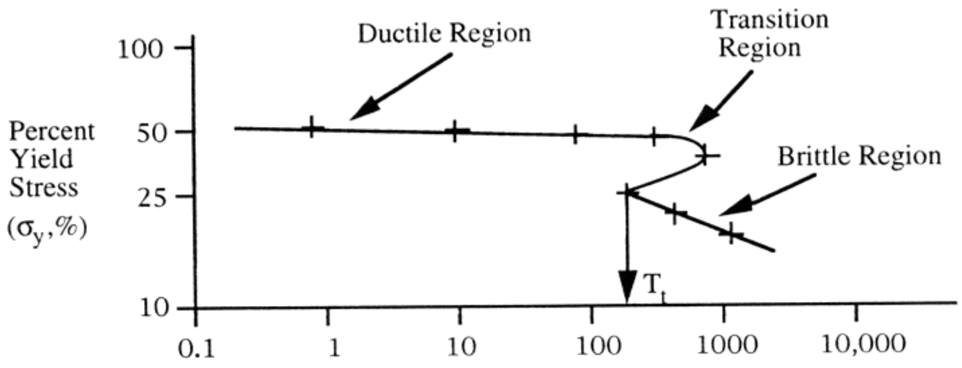

Figure 1 - Possible response of curves resulting from a complete NCTL test

6.7 The transition time (T_t) shall be identified as the time corresponding to the onset point of the brittle portion of the curve provided that such point has a lower failure time than any point in the transition region of the curve. If no such point has been determined, back extrapolation of the brittle curve shall be used to identify a smooth curve from the points located in the transition region.

6.8 The minimum value for the transition time for an acceptable HDPE geomembrane sheet using the above procedure shall be 250 hours.

Note 9: The original value of 100 hours[1] transition time value was deduced from a data base which included fourteen commercial virgin geomembranes and seven field exhumed geomembranes. The majority of the evaluated geomembranes had a thickness of 2.0 mm (0.080 in.). In light of recent upgrade of SCR to 500 hours this value is now increased to 250 hours.

6.9 For sheets with transition times well in excess of 250 hours the determination of the complete brittle portion of the curve can be extremely long. For example, if the test is ongoing and a linear ductile line is still in evidence after 1000 hours, a conclusion can be reached that the geomembrane sheet under consideration will possess a transition time greater than 250 hours. In some cases, the test can be concluded and a report written as to the satisfaction of this guide.

6.10 A full NCTL test shall be conducted on each resin/formulation used by the geomembrane manufacturer.

7. SP-NCTL Tests per ASTM D 5397-Appendix

7.1 SP-NCTL tests per the Appendix of ASTM D 5397 shall be performed on samples of geomembrane sheet for each two resin lots. For the purposes of this guide, a lot is defined as a railcar of pellets which is typically in the range of 70,000 Kg to 90,000 Kg (150,000

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[1] Hsuan, Y.G., Koerner, R.M., and Lord, A.E., (1993) "Stress-Cracking Resistance of High-Density Polyethylene Geomembranes" Journal of Geotechnical Engineering, ASCE, Vol. 119, No. 11, pp. 1840-1857.

to 200,000 lb.). Thus, the frequency of testing is every two (2) railroad cars of the above capacity (or equivalent).

Note 10: If multiple gauges of sheet are made from a given resin lot only the sheet with highest gauge thickness needs to be tested to comply with this guide.

7.2 Samples can also be taken from a small scale laboratory extruder, however, the correlation of results to the as-manufactured sheet must be developed on a material and process specific basis.

7.3 Test specimens are to be taken in the cross machine direction of the geomembrane sheet under consideration.

7.4 The constant load applied to the test specimen(s) shall be 30% of the yield stress per ASTM D6693. The yield stress value used in the test shall be the manufacturer's mean value for the geomembrane resin/formulation under consideration.

7.5 The criteria to be used for pass/fail decisions shall be set forth in Table 1.

Table 1 – Various SP-NCTL Test Criteria for Pass/Fail Decisions

Test Cycle	Yield Stress (based on ASTM D 6693)	Number of Test Specimens	Passing Criteria	If Noncompliance Occurs
A	the manufacturer’s mean value via MQC testing	5	4 out of 5 with $F_t > 500$ hr (noncomplying specimen with $F_t > 250$ hr)	retest using cycle B
B	the manufacturer’s mean value via MQC testing	5	4 out of 5 with $F_t > 500$ hr (noncomplying specimen with $F_t > 250$ hr)	reject railcar or perform full retest using cycle C
C	the manufacturer’s mean value via MQC testing	30	Onset of brittle portion of curve $T_t > 250$ hr	reject railcar

8. Certification

8.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the geomembrane was manufactured and tested in accordance with this guide together with a report of the test results shall be furnished.

9. Retest and Rejection

9.1 If the results of any test do not conform to the requirements of this guide, retesting to determine conformity may be performed as agreed upon between the parties involved.

Revision Schedule
for
The Stress Crack Resistance of HDPE Geomembrane Sheet

Original:	January 30, 1997
Revision 1 –	March 12, 1997: Adjusted details in Table 1.
Revision 2 –	June 18, 2003: Increased 200 to 300 hours per GM13 revision Increased noncomplying specifier from 100 to 150 hours Changed ASTM D638 to ASTM D6693
Revision 3 –	February 20, 2006: Decreased frequency of testing from 1 resin lot to 2 resin lots. See Section 7.1.
Revision 4 –	July 23, 2015: Increased SCR value from 300 to 500 hours per GM13. Increased noncomplying specifier from 150 to 250 hours. Added Note 7. The standard’s identification was changed from a specification to a guide which better reflects the content of the document.
Revision 5 –	March 24, 2021: Corrected numerical error in Section 6.9 from 100 to 250 hours.

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Revision 16: March 17, 2021
Revision schedule on pg. 11

GRI - GM13 Standard Specification*

Standard Specification for

"Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes" ^{SM}

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers high density polyethylene (HDPE) geomembranes with a formulated sheet density of 0.940 g/ml, or higher, in the thickness range of 0.75 mm (30 mils) to 3.0 mm (120 mils). Both smooth and textured geomembrane surfaces are included.

1.2 This specification sets forth a set of minimum, physical, mechanical and chemical properties that must be met, or exceeded by the geomembrane being manufactured. In a few cases a range is specified.

1.3 In the context of quality systems and management, this specification represents manufacturing quality control (MQC).

> Note 1: Manufacturing quality control represents those actions taken by a manufacturer to ensure that the product represents the stated objective and properties set forth in this specification.

1.4 This standard specification is intended to ensure good quality and performance of HDPE geomembranes in general applications, but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive

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values for test indicated, may be necessary under conditions of a particular application.

Note 2: For information on installation techniques, users of this standard are referred to the geosynthetics literature, which is abundant on the subject.

2. Referenced Documents

2.1 ASTM Standards

D 792	Specific Gravity (Relative Density) and Density of Plastics by Displacement
D 1004	Test Method for Initial Tear Resistance of Plastics Film and Sheeting
D 1238	Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
D 1505	Test Method for Density of Plastics by the Density-Gradient Technique
D 1603	Test Method for Carbon Black in Olefin Plastics
D 4218	Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
D 4833	Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
D 5199	Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
D 5397	Procedure to Perform a Single Point Notched Constant Tensile Load – (SP-NCTL) Test: Appendix
D 5596	Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
D 5721	Practice for Air-Oven Aging of Polyolefin Geomembranes
D 5885	Test method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry
D 5994	Test Method for Measuring the Core Thickness of Textured Geomembranes
D 6370	Standard Test Method for Rubber-Compositional Analysis by Thermogravimetry (TGA)
D 6693	Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
D 7238	Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
D 7466	Test Method for Measuring the Asperity Height of Textured Geomembranes
D 8117	Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by Differential Scanning Calorimetry

2.2 GRI Standards

GM10	Specification for the Stress Crack Resistance of Geomembrane Sheet

2.3 U. S. Environmental Protection Agency Technical Guidance Document "Quality Control Assurance and Quality Control for Waste Containment Facilities," EPA/600/R-93/182, September 1993, 305 pgs.

3. Definitions

Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications.
ref. EPA/600/R-93/182

Manufacturing Quality Assurance (MQA) - A planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. MQA includes manufacturing facility inspections, verifications, audits and evaluation of the raw materials (resins and additives) and geosynthetic products to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project.
ref. EPA/600/R-93/182

Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For HDPE polyethylene geomembranes, a formulation is defined as the exact percentages and types of resin(s), additives and carbon black.

Nominal - Representative value of a measurable property determined under a set of conditions, by which a product may be described. Abbreviated as nom. in Tables 1 and 2.

4. Material Classification and Formulation

4.1 This specification covers high density polyethylene geomembranes with a formulated sheet density of 0.940 g/ml, or higher. Density can be measured by ASTM D1505 or ASTM D792. If the latter, Method B is recommended.

4.2 The polyethylene resin from which the geomembrane is made will generally be in the density range of 0.932 g/ml or higher, and have a melt index value per ASTM D1238 of less than 1.0 g/10 min.

4.3 The resin shall be virgin material with no more than 10% rework. If rework is used, it must be a similar HDPE as the parent material.

4.4 No post consumer resin (PCR) of any type shall be added to the formulation.

5. Physical, Mechanical and Chemical Property Requirements

5.1 The geomembrane shall conform to the test property requirements prescribed in Tables 1 and 2. Table 1 is for smooth HDPE geomembranes and Table 2 is for single and double sided textured HDPE geomembranes. Each of the tables are given in English and SI (metric) units. The conversion from English to SI (metric) is soft.

Note 3: The tensile strength properties in this specification were originally based on ASTM D 638 which uses a laboratory testing temperature of 23°C ± 2°C. Since ASTM Committee D35 on Geosynthetics adopted ASTM D 6693 (in place of D 638), this GRI Specification followed accordingly. The difference is that D 6693 uses a testing temperature of 21°C ± 2°C. The numeric values of strength and elongation were not changed in this specification. If a dispute arises in this regard, the original temperature of 23°C ± 2°C should be utilized for testing purposes.

Note 4: There are several tests often included in other HDPE specifications which are omitted from this standard because they are outdated, irrelevant or generate information that is not necessary to evaluate on a routine MQC basis. The following tests have been purposely omitted:

- Volatile Loss
- Dimensional Stability
- Coeff. of Linear Expansion
- Resistance to Soil Burial
- Low Temperature Impact
- ESCR Test (D 1693)
- Wide Width Tensile
- Water Vapor Transmission
- Water Absorption
- Ozone Resistance
- Modulus of Elasticity
- Hydrostatic Resistance
- Tensile Impact
- Field Seam Strength
- Multi-Axial Burst
- Various Toxicity Tests

Note 5: There are several tests which are included in this standard (that are not customarily required in other HDPE specifications) because they are relevant and important in the context of current manufacturing processes. The following tests have been purposely added:

- Oxidative Induction Time
- Oven Aging
- Ultraviolet Resistance
- Asperity Height of Textured Sheet (see Note 6)

Note 6: The minimum average value of asperity height does not represent an expected value of interface shear strength. Shear strength associated with geomembranes is both site-specific and product-specific and should be determined by direct shear testing using ASTM D5321/ASTM D6243 as prescribed. This testing should be included in the particular site's CQA conformance testing protocol for the geosynthetic materials involved, or formally waived by the Design Engineer, with concurrence from the Owner prior to the deployment of the geosynthetic materials.

Note 7: There are other tests in this standard, focused on a particular property, which are updated to current standards. The following are in this category:

- Thickness of Textured Sheet
- Puncture Resistance
- Stress Crack Resistance
- Carbon Black Dispersion (In the viewing and subsequent quantitative interpretation of ASTM D 5596 only near spherical agglomerates shall be included in the assessment).

5.2 The values listed in the tables of this specification are to be interpreted according to the designated test method. In this respect they are neither minimum average roll values (MARV) nor maximum average roll values (MaxARV).

5.3 The properties of the HDPE geomembrane shall be tested at the minimum frequencies shown in Tables 1 and 2. If the specific manufacturer's quality control guide is more stringent and is certified accordingly, it must be followed in like manner.

Note 8: This specification is focused on manufacturing quality control (MQC). Conformance testing and manufacturing quality assurance (MQA) testing are at the discretion of the purchaser and/or quality assurance engineer, respectively.

6. Workmanship and Appearance

6.1 Smooth geomembrane shall have good appearance qualities. It shall be free from such defects that would affect the specified properties of the geomembrane.

6.2 Textured geomembrane shall generally have uniform texturing appearance. It shall be free from agglomerated texturing material and such defects that would affect the specified properties of the geomembrane.

6.3 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling

7.1 Sampling shall be in accordance with the specific test methods listed in Tables 1 and 2. If no sampling protocol is stipulated in the particular test method, then test specimens shall be taken evenly spaced across the entire roll width.

7.2 The number of tests shall be in accordance with the appropriate test methods listed in Tables 1 and 2.

7.3 The average of the test results should be calculated per the particular standard cited and compared to the minimum value listed in these tables, hence the values listed are the minimum average values and are designated as "min. ave."

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Packaging and Marketing

9.1 The geomembrane shall be rolled onto a substantial core or core segments and held firm by dedicated straps/slings, or other suitable means. The rolls must be adequate for safe transportation to the point of delivery, unless otherwise specified in the contract or order.

10. Certification

10.1 Upon request of the purchaser in the contract or order, a manufacturer's certification that the material was manufactured and tested in accordance with this specification, together with a report of the test results, shall be furnished at the time of shipment.

ENGLISH UNITS

Table 1(a) – High Density Polyethylene (HDPE) Geomembrane -Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness (min. ave.) - mils	D5199	nom.	nom.	nom.	nom.	nom.	nom.	nom.	per roll
- lowest individual of 10 values - %		-10	-10	-10	-10	-10	-10	-10	
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb
Tensile Properties *(1)* (min. ave.)	D 6693								20,000 lb
- yield strength - lb/in.	Type IV	63	84	105	126	168	210	252	
- break strength - lb/in.		114	152	190	228	304	380	456	
- yield elongation - %		12	12	12	12	12	12	12	
- break elongation - %		700	700	700	700	700	700	700	
Tear Resistance (min. ave.) - lb	D 1004	21	28	35	42	56	70	84	45,000 lb
Puncture Resistance (min. ave.) - lb	D 4833	54	72	90	108	144	180	216	45,000 lb
Stress Crack Resistance *(2)* - hr.	D5397 (App.)	500	500	500	500	500	500	500	per GRI-GM10
Carbon Black Content (range) - %	D 4218 *(3)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 lb
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(5)*									200,000 lb
(a) Standard OIT - min.	D 8117	100	100	100	100	100	100	100	
— or —									
(b) High Pressure OIT - min.	D 5885	400	400	400	400	400	400	400	
Oven Aging at 85°C *(5), (6)*	D 5721								
(a) Standard OIT (min. ave.) - % retained after 90 days	D 8117	55	55	55	55	55	55	55	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5885	80	80	80	80	80	80	80	
UV Resistance *(7)*	D 7238								
(a) Standard OIT (min. ave.)	D 8117	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	N.R. *(8)*	per each formulation
— or —									
(b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 5885	50	50	50	50	50	50	50	

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 in.

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

SI (METRIC) UNITS

Table 1(b) – High Density Polyethylene (HPDE) Geomembrane - Smooth

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness - (min. ave.) - mm • lowest individual of 10 values - %	D5199	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	nom. -10	per roll
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	90,000 kg
Tensile Properties *(1)* (min. ave.) • yield strength - kN/m • break strength - kN/m • yield elongation - % • break elongation - %	D 6693 Type IV	 11 20 12 700	 15 27 12 700	 18 33 12 700	 22 40 12 700	 29 53 12 700	 37 67 12 700	 44 80 12 700	9,000 kg
Tear Resistance (min. ave.) - N	D 1004	93	125	156	187	249	311	374	20,000 kg
Puncture Resistance (min. ave.) - N	D 4833	240	320	400	480	640	800	960	20,000 kg
Stress Crack Resistance *(2)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM-10
Carbon Black Content (range) - %	D 4218 *(3)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	9,000 kg
Carbon Black Dispersion	D 5596	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	note *(4)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(5)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	90,000 kg
Oven Aging at 85°C *(5), (6)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(7)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(9)*	D 7238 D 8117 D 5885	 N. R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	 N.R. *(8)* 50	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(3) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(4) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(9) UV resistance is based on percent retained value regardless of the original HP-OIT value.

ENGLISH UNITS

Table 2(a) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils	
Thickness mils (min. ave.) - mils • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	per roll
Asperity Height mils (min. ave.) - mils	D 7466	16	16	16	16	16	16	16	every 2nd roll *(1)*
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	200,000 lb
Tensile Properties (min. ave.) *(2)* • yield strength - lb/in. • break strength - lb/in. • yield elongation - % • break elongation - %	D 6693 Type IV	63 45 12 100	84 60 12 100	105 75 12 100	126 90 12 100	168 120 12 100	210 150 12 100	252 180 12 100	20,000 lb
Tear Resistance (min. ave.) - lb	D 1004	21	28	35	42	56	70	84	45,000 lb
Puncture Resistance (min. ave.) - lb	D 4833	45	60	75	90	120	150	180	45,000 lb
Stress Crack Resistance *(3)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM10
Carbon Black Content (range) - %	D 4218 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	20,000 lb
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	45,000 lb
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	D 8117 D 5885	100 400	100 400	100 400	100 400	100 400	100 400	100 400	200,000 lb
Oven Aging at 85°C *(6), (7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	55 80	55 80	55 80	55 80	55 80	55 80	55 80	per each formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	D 7238 D 8117 D 5885	N.R. *(9)* 50	N.R. *(9)* 50	N.R. *(9)* 50	N.R. *(9)* 50	N.R. *(9)* 50	N.R. *(9)* 50	N.R. *(9)* 50	per each formulation

(1) Alternate the measurement side for double sided textured sheet

(2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 1.3 inches
Break elongation is calculated using a gage length of 2.0 inches

(3) SP-NCTL per ASTM D5397 Appendix, is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 2(b) – High Density Polyethylene (HDPE) Geomembrane - Textured

Properties	Test Method	Test Value							Testing Frequency (minimum)
		0.75 mm	1.00 mm	1.25 mm	1.50 mm	2.00 mm	2.50 mm	3.00 mm	
Thickness (min. ave.) - mm • lowest individual for 8 out of 10 values - % • lowest individual for any of the 10 values - %	D 5994	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	nom. -5% -10 -15	per roll
Asperity Height mils (min. ave.) - mm	D 7466	0.40	0.40	0.40	0.40	0.40	0.40	0.40	every 2nd roll *(1)*
Formulated Density (min. ave.) - g/cc	D 1505/D 792	0.940	0.940	0.940	0.940	0.940	0.940	0.940	90,000 kg
Tensile Properties (min. ave.) *(2)* • yield strength - kN/m • break strength - kN/m • yield elongation - % • break elongation - %	D 6693 Type IV	 11 8 12 100	 15 10 12 100	 18 13 12 100	 22 16 12 100	 29 21 12 100	 37 26 12 100	 44 32 12 100	9,000 kg
Tear Resistance (min. ave.) - N	D 1004	93	125	156	187	249	311	374	20,000 kg
Puncture Resistance (min. ave.) - N	D 4833	200	267	333	400	534	667	800	20,000 kg
Stress Crack Resistance *(3)* - hr.	D 5397 (App.)	500	500	500	500	500	500	500	per GRI GM10
Carbon Black Content (range) - %	D 4218 *(4)*	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	2.0-3.0	9,000 kg
Carbon Black Dispersion	D 5596	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	note *(5)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(6)* (a) Standard OIT - min. — or — (b) High Pressure OIT - min.	 D 8117 D 5885	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	 100 400	90,000 kg
Oven Aging at 85°C *(6), (7)* (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 8117 D 5885	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	 55 80	per each formulation
UV Resistance *(8)* (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs *(10)*	D 7238 D 8117 D 5885	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	 N.R. *(9)* 50	per each formulation

(1) Alternate the measurement side for double sided textured sheet

(2) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
Yield elongation is calculated using a gage length of 33 mm
Break elongation is calculated using a gage length of 50 mm

(3) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheets made from the same formulation as being used for the textured sheet materials.
The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing.

(4) Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.

(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
9 in Categories 1 or 2 and 1 in Category 3

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.

(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Adoption and Revision Schedule
for
HDPE Specification per GRI-GM13

“Test Methods, Test Properties, Testing Frequency for
High Density Polyethylene (HDPE) Smooth and Textured Geomembranes”

Adopted: June 17, 1997

Revision 1: November 20, 1998; changed CB dispersion from allowing 2 views to be in Category 3 to requiring all 10 views to be in Category 1 or 2. Also reduced UV percent retained from 60% to 50%.

Revision 2: April 29, 1999: added to Note 5 after the listing of Carbon Black Dispersion the following: “(In the viewing and subsequent quantitative interpretation of ASTM D5596 only near spherical agglomerates shall be included in the assessment)” and to Note (4) in the property tables.

Revision 3: June 28, 2000: added a new Section 5.2 that the numeric table values are neither MARV or MaxARV. They are to be interpreted per the the designated test method.

Revision 4: December 13, 2000: added one Category 3 is allowed for carbon black dispersion. Also, unified terminology to “strength” and “elongation”.

Revision 5: May 15, 2003: Increased minimum acceptable stress crack resistance time from 200 hrs to 300 hrs.

Revision 6: June 23, 2003: Adopted ASTM D 6693, in place of ASTM D 638, for tensile strength testing. Also, added Note 2.

Revision 7: February 20, 2006: Added Note 6 on Asperity Height clarification with respect to shear strength.

Revision 8: Removed recommended warranty from specification.

Revision 9: June 1, 2009: Replaced GRI-GM12 test for asperity height of textured geomembranes with ASTM D 7466.

Revision 10 April 11, 2011: Added alternative carbon black content test methods

Revision 11 December 13, 2012: Replaced GRI-GM11 with the equivalent ASTM D 7238.

Revision 12 November 14, 2014: Increased minimum acceptable stress crack resistance time from 300 to 500 hours. Also, increased asperity height of textured sheet from 10 to 16 mils (0.25 to 0.40 mm).

Revision 13 November 4, 2015: Removed Footnote (1) on asperity height from tables.

Revision 14 January 6, 2016: Removed Trouser Tear from Note 5.

Revision 15: September 9, 2019: Editorial update to harmonize tables.

Revision 16: March 17, 2021: Updated Standard OIT Test from ASTM D3895 to D8117

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Revision 1 (Editorial): January 9, 2013

GRI GM14*

Standard Guide for

"Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes"

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This guide is focused on selecting the spacing interval for taking destructive seam samples of field deployed geomembranes as a particular job progresses based on an installers ongoing record of pass - or - fail testing.

> Note 1 - While subjective at this time, the guide is most applicable to large geomembrane seaming projects which require more than 100 destructive seam samples based upon the typical sampling strategy of 1 destructive sample per 150 m (500 ft).

1.2 This guide is essentially applicable to production seams. Caution should be exercised in using the guide for projects that involve complex geometries, multiple penetrations, or extreme weather conditions.

1.3 The primary target audiences for this guide are construction quality assurance (CQA) organizations, construction quality control (CQC) organizations, facility owner/operators and agency regulators having permitting authority.

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*This GRI standard is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version.

1.4 The outcome of using the guide rewards good seaming performance resulting from a record of passing destructive seam tests. It also penalizes poor seaming performance resulting from a record of excessively failing seam tests.

1.5 This guide does not address the actual seam testing procedures that are used for acceptance or failure of the geomembrane seam test specimens themselves. Depending on the type of geomembrane being deployed one should use ASTM D4437, D3083, D751 and D413 for testing details in this regard. The project-specific CQA plan should define the particular criteria used in acceptance or failure.

1.6 An alternative to this method of attributes is that of using control charts for determining the variable interval for taking destructive seam samples. See GRI-GM20 in this regard.

2. Referenced Documents

2.1 ASTM Standards:

D4437	Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes
D3083	Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining
D751	Method of Testing Coated Fabrics
D413	Test Methods for Rubber Property - Adhesion to Flexible Substrate

2.2 Other Standards
ANSI/ASQC Z1.4 [1993]
Sampling Procedures and Tables for Inspection by Attributes

2.3 GRI Standards

GM20	Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using Control Charts

3. Summary of Guide

3.1 Use of this guide requires the establishment of an anticipated geomembrane seam failure percentage (ranging from 1 to 8%) and an initial, or start-up, sampling interval.

Note 2 - The value of anticipated failure percentage is an important consideration. It dictates each decision as to a possible increase or decrease in interval spacing from the preceding value. The percentage itself comes from historical data of the construction quality assurance (CQA) organization or regulatory agency. It is related to a number of factors including criticality of installation, type of geomembrane, type of seaming method and local ambient conditions.

The actual value is admittedly subjective and should be made known in advance to the geomembrane installer before bidding the project. Use of an unrealistically low value of anticipated failure percentage, e.g., < 1.0%, will likely result in field difficulties insofar as decreased sampling intervals are concerned. Conversely, use of an unrealistically high value of anticipated failure percentage, e.g., > 8.0%, will likely result in very large sampling intervals and quite possibly sacrifice the overall quality of the seaming effort.

3.2 The guide then gives the procedure for establishing the initial number of samples needed for a possible modification to the start-up sampling interval. This is called the initial batch. Based upon the number of failed samples in the initial batch, the spacing is either increased (for good seaming), kept the same, or decreased (for poor seaming).

3.3 A second batch size is then determined and the process is continued. Depending on the project size, i.e., the total length of seaming, a number of decision cycles can occur until the project is finished.

3.4 It is seen that the number of samples required for the entire project is either fewer than the start-up frequency (for good seaming); the same as the start-up frequency (for matching the initial anticipated failure percentage); or more than the start-up frequency (for poor seaming).

4. Significance and Use

4.1 Construction quality assurance (CQA) and construction quality control (CQC) organizations, as well as owner/operators and agency regulators can use this guide to vary the sampling interval of geomembrane seam samples (i.e., the taking of field samples for destructive shear and peel testing) from an initial, or start-up, interval. This initial interval is often one destructive seam sample in every 150 m (500 ft) of seam length.

4.2 The guide leads to increasing the sampling interval for good seaming practice (hence fewer destructive samples) and to decreasing the sampling interval for poor seaming practice (hence additional destructive samples).

4.3 Use of the guide should provide an incentive for geomembrane installers to upgrade the quality and performance of their field seaming activities. In so doing, the cutting of fewer destructive samples will lead to overall better quality of the entire liner project, since the patching of previously taken destructive samples is invariably of poorer quality than the original seam itself.

Note 3 - It is generally accepted that field patching of areas where destructive samples had been taken using extrusion fillet seaming is less desirable than the original seam which was made by hot wedge welding.

4.4 Control charts are described in GRI-GM20 which can also be used by geomembrane installers and their construction quality control (CQC) personnel for improvement in overall job quality and identification of poorly performing seaming personnel and/or equipment.

5. Suggested Methodology

Using the concepts embodied in the method of attributes, the following procedure is based on adjustments to sequential sampling.

5.1 Typical Field Situation - In order to begin the process, a project-specific total seam length must be obtained from the installers panel (roll) layout plan. Also, an initial, or start-up, sampling interval must be decided upon. From this information the total number of samples that are required based on the start-up sampling interval can be obtained.

Example 1 - A given project has 54,000 m (180,000 ft) of field seaming. The start-up sampling frequency is 1 sample per 150 m (500 ft). Therefore, the total number of samples required if the start-up interval is kept constant will be:

$$\frac{54{,}000}{150} = 360\,\text{samples}$$

5.2 Determination of Initial Batch Size - Using the table shown below, the initial batch size from which to possibly modify the start-up sampling interval is obtained.

Table 1 - Batch Size Determination, after ANSI/ASQC Z1.4 [1993]

No. of Required Samples Based on Initial or Modified Sampling Interval	No. of Samples Needed (Batch Size) to Determine Subsequent Sampling Interval
2 - 8	2
9 - 15	3
16 - 25	5
26 - 50	8
51 - 90	13
91 - 150	20
151 - 280	32
281 - 500	50
501 - 1200	80
1201 - 3200	125

Example 1 (cont.) - For 360 samples, a batch size of 50 is necessary. As production seaming progresses, these 50 samples are tested (either as they are taken or in a batch) and the number of failures is determined.

5.3 Verification of Start-Up Sampling Interval - A sampling table is now used which separates the number of failures within this initial batch size into three categories: a relatively low number of failures (where the sampling interval can be increased), the anticipated number of failures (where the sampling interval is maintained), or a relatively high number of failures (where the sampling interval should be decreased). Table 2 provides this information which is based upon the operation characteristic (OC) curves of Appendix B.

> Example 1 (cont.) - Assuming an anticipated failure percentage of 2% (recall Note - 2), Table 2 results in the three categories shown below:
>
> - 0 or 1 failure out of 50; the sampling interval can be increased
> - 2 or 3 failures out of 50; the sampling frequency should remain at 1 sample per 150 m (500 ft)
> - 4 or more failures out of 50; the sampling interval should be decreased

Table 2 - Sampling Table Containing the Number of Failed Samples to be used for Interval Sampling Interval Modification, see Appendix A for details

No. of Required Samples Based on Initial or Modified Sampling Interval	No. of Samples Needed (Batch Size) to Determine Subsequent Sampling Interval	Anticipated Failure Percentage*							
		1%		2%		3%		4%	
		I	D	I	D	I	D	I	D
2 - 8	2	0	1	0	1	0	1	0	1
9 - 15	3	0	1	0	1	0	2	0	2
16 - 25	5	0	1	0	1	0	2	0	2
26 - 50	8	0	1	0	1	0	2	0	2
51 - 90	13	0	1	0	2	0	2	0	3
91 - 150	20	0	2	0	3	1	3	1	4
151 - 280	32	0	2	1	3	1	4	2	5
281 - 500	50	0	3	1	4	2	5	3	6
501 - 1200	80	1	4	2	6	3	7	5	9
1201 - 3200	125	2	5	4	7	5	9	7	11

No. of Required Samples Based on Initial or Modified Sampling Interval	No. of Samples Needed (Batch Size) to Determine Subsequent Sampling Interval	Anticipated Failure Percentage*							
		5%		6%		7%		8%	
		I	D	I	D	I	D	I	D
2 - 8	2	0	1	0	2	0	2	0	2
9 - 15	3	0	2	0	2	0	2	0	2
16 - 25	5	0	2	0	2	0	3	0	3
26 - 50	8	0	3	0	3	1	3	1	4
51 - 90	13	1	4	1	4	1	4	1	5
91 - 150	20	1	5	2	5	2	5	2	6
151 - 280	32	2	6	3	6	3	7	4	7
281 - 500	50	4	7	4	8	5	9	6	10
501 - 1200	80	6	10	7	11	8	12	9	14
1201 - 3200	125	9	13	10	15	12	17	13	19

No: *To be selected by CQA, owner or regulatory organizations

I = Increase the sampling interval if the number of failed samples found in the batch does not exceed the tabulated value.

D = Decrease the sampling interval if the number of failed samples found in the batch equals or exceeds the tabulated value.

5.4 Modification of Start-Up Sampling Interval - Depending upon the outcome of the previous section, the start-up sampling interval may be modified to a new value which will then require a new batch size to verify the modification. The process is then continued until the project is finished. Two examples will be provided using the above sampling table both with anticipated failure percentages of 2.0%: Example 2 illustrates good seaming, and Example 3 illustrates poor seaming.

> Example 2 - Using the same project seam length and start-up sampling frequency as in the previous example assume that the start-up batch of 50 samples in the previous example had 2-failures. The decision is then to continue at a 1 destructive sample in 150 m (500 ft) sampling interval. Thus the second batch size from Table 1 is again 50 samples, see Table 3. Table 3(a) is in S.I. units and Table 3(b) is in English units. Now assume in the second batch there are no failures. This allows the sampling interval to be increased, e.g., to 1 sample in 180 m (600 ft). From Table 1, the third batch size is then decreased to 32 samples. The process is continued in this manner until the project is concluded. For this hypothetical situation Table 3(a) illustrates that 265 samples (or 266 samples when using the English units in Table 3(b)) are necessary. Note that by using a constant interval of 1 sample in 150 m (500 ft), 360 samples would have been necessary. Also note that the maximum sampling interval was fixed at 310 m (1000 ft).

Note 4 - This example, and the following one, use a changing sampling interval of ± 20% from the previous value. That is, when good seaming allows for an increase in sampling interval; the progression being from 150, 180, 215, 260 to 310 m (500, 600, 720, 850 to 1000 ft), respectively. A maximum interval of 310 m (1000 ft) is recommended, but clearly this value is at the discretion of the organizations involved. Conversely, poor seaming requires a decrease in sampling interval; the progression being from 150, 120, 100, 80 to 65 m (500, 400, 320, 250 to 200 ft), respectively. A minimum interval of 65 m (200 ft) is recommended, but clearly this decision is also at the discretion of the organizations involved

Table 3(a) - Results of Example 2 (**in S.I. Units**) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Good" Quality Installer

Batch number	Sampling Interval (m)	No. of Remaining Samples Required	Batch size	Cumulative Distance (m)	Number of failures	Decision made
1	150	360	50	7500	2	Stay
2	150	310	50	15000	0	Increase
3	180	217	32	20760	0	Increase
4	215	155	32	27640	2	Stay
5	215	123	20	31940	1	Stay
6	215	103	20	36240	0	Increase
7	260	68	13	39620	1	Stay
8	260	55	13	43000	0	Increase
9	310	35	8	45480	0	Stay
10	310	27	8	47960	0	Stay
11	310	19	5	49510	0	Stay
12	310	14	3	50440	0	Stay
13	310	11	3	51370	0	Stay
14	310	8	2	51990	0	Stay
15	310	6	2	52610	0	Stay
16	310	4	2	53230	0	Stay
17	310	2	2	53850	0	Done

Total Number of tests per 54,000 m of seam project = 265

Table 3(b) - Results of Example 2 (**in English Units**) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Good" Quality Installer

Batch number	Sampling Interval (m)	No. of Remaining Samples Required	Batch size	Cumulative Distance (m)	Number of failures	Decision made
1	500	360	50	25000	2	Stay
2	500	310	50	50000	0	Increase
3	600	217	32	69200	0	Increase
4	720	154	32	92240	2	Stay
5	720	122	20	106640	1	Stay
6	720	102	20	121040	0	Increase
7	850	69	13	132090	1	Stay
8	850	56	13	143140	0	Increase
9	1000	37	8	151140	0	Stay
10	1000	29	8	159140	0	Stay
11	1000	21	5	164140	0	Stay
12	1000	16	5	169140	0	Stay
13	1000	11	3	172140	0	Stay
14	1000	8	2	174140	0	Stay
15	1000	6	2	176140	0	Stay
16	1000	4	2	178140	0	Stay
17	1000	2	1	179140	0	Done

Total Number of tests per 180,000 ft of seam project = 266

Example 3 - Using the same project seam length and start-up sampling frequency as Example 1, assume that the start-up batch of 50 samples had 3- failures. The decision is then to continue at a 1 destructive sample in 150 m (500 ft) sampling interval. Thus the second batch size is again 50 samples as it was with Example 2, see Table 4. Table 4(a) is in S.I. units and Table 4(b) is in English units. Now assume in the second batch there are 2-failures. The decision is to again continue at a 1 destructive sample in 150 m (500 ft) sampling interval. From Table 1, the third batch size is then decreased to 32 samples. The process is continued in this manner until the project is concluded. For this hypothetical situation Table 4 illustrates that 412 samples are necessary. Note that by a constant interval of 1 sample in 150 m (500 ft), 360 samples would have been necessary. Furthermore, a good seamer (as illustrated in Example 2) would only have had to take 265 samples.

Table 4(a) - Results of Example 3 (**in S.I. Units**) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Poor" Quality Installer

Batch number	Sampling Interval (m)	No. of Remaining Samples Required	Batch size	Cumulative Distance (m)	Number of failures	Decision made
1	150	360	50	7500	3	Stay
2	150	310	50	15000	2	Stay
3	150	260	32	19800	2	Stay
4	150	228	32	24600	3	Decrease
5	120	245	32	28440	3	Decrease
6	100	256	32	31640	1	Increase
7	120	186	32	35480	1	Increase
8	150	123	20	38480	2	Stay
9	150	103	20	41480	1	Stay
10	150	83	13	43430	2	Decrease
11	120	88	13	44990	2	Decrease
12	100	90	13	46290	1	Stay
13	100	77	13	47590	1	Stay
14	100	64	13	48890	1	Stay
15	100	51	13	50190	0	Increase
16	120	32	8	51150	1	Stay
17	120	24	5	51750	1	Decrease
18	100	23	5	52250	0	Increase
19	120	15	3	52610	0	Increase
20	150	9	2	52910	1	Decrease
21	120	9	2	53150	1	Decrease
22	100	11	3	53210	0	Increase
23	120	7	2	53390	0	Increase
24	150	5	2	53510	0	Increase
25	180	3	2	53750	0	Done

Total Number of tests per 54,000 m of seam project = 412

Table 4(b) - Results of Example 3 (**in English Units**) Illustrating the Variation of the Sampling Interval Based on a 2.0% Anticipated Failure Percentage With a "Poor" Quality Installer

Batch number	Sampling Interval (m)	No. of Remaining Samples Required	Batch size	Cumulative Distance (m)	Number of failures	Decision made
1	500	360	50	25000	3	Stay
2	500	310	50	50000	2	Stay
3	500	260	32	66000	2	Stay
4	500	228	32	82000	3	Decrease
5	400	245	32	94800	3	Decrease
6	320	266	32	105040	1	Increase
7	400	187	32	117840	1	Increase
8	500	124	20	127840	2	Stay
9	500	104	20	137840	1	Stay
10	500	84	13	144340	2	Decrease
11	400	89	13	149540	2	Decrease
12	320	95	13	153700	1	Stay
13	320	82	13	157860	1	Stay
14	320	69	13	162020	1	Stay
15	320	56	13	166180	0	Increase
16	400	35	8	169380	1	Stay
17	400	27	5	171380	1	Decrease
18	320	27	5	172980	0	Increase
19	400	18	3	174180	0	Increase
20	500	12	2	175180	1	Decrease
21	400	12	2	175980	1	Decrease
22	320	13	3	176140	0	Increase
23	400	10	2	176780	0	Increase
24	500	6	2	177140	0	Increase
25	600	5	2	177980	0	Done

Total Number of tests per 54,000 m of seam project = 412

5.5 Summary

This guide illustrates by means of hypothetical examples how a CQA and/or CQC organization can modify the sampling interval for taking destructive samples from a geomembrane seaming project. It is based on the method of attributes which is common to statistical control methods. The methodology uses sequential sampling to proceed from one decision to the next until the project is complete.

The result in using this guide for the above purpose is to reward good seaming performance by taking fewer destructive samples, and to penalize poor seaming performance by taking additional destructive samples. In the example illustrations, good seaming resulted in taking 265 samples (versus 360), or a decrease of 26% from the originally set constant interval of 1 sample per 150 m (500 ft). Conversely, poor seaming resulted in taking 412 samples (versus 360), or a 14% increase in the originally set constant interval of 1 sample per 150 m (500 ft.) of seam length.

GM 14 - Appendix A - The Selection of the "I" and "D" Values

In this appendix, the procedure used for selecting the "I" and "D" values listed in Table 2 is presented. The required background, e.g., the concept of sampling risk and the operating characteristics (OC) curves, are briefly discussed.

Sampling Risk

Sampling involves a degree of risk that the actual samples do not adequately reflect the conditions of the lot. For example, when using the sampling plan recommended in this guide, there are two common risks [see Juran and Gryna (1980) and Juran el. al (1974) for details]:

1. A good seaming practice might be penalized. This is generally referred as the installer's risk and denoted as the α risk.
2. A poor seaming practice might go undetected. This is generally referred as an owner/regulators risk and denoted as the β risk.

The effects (impacts) of the relative degree of these two risks are summarized in Table B1.

Table B1 - The Effects of the Relative Degree of α and β Risks.

Relative	Types of Risks	
Degree	Installers (α) Risk	Owner/Regulators (β) Risk
Low	Loose CQA control; low testing cost	Tight CQA control; high testing cost
High	Tight CQA control; high testing cost	Loose CQA control; low testing cost

Operating Characteristics (OC) Curves

Both of the risks can be quantified by sampling-plan-specific *operating characteristics* (OC) *curves*. The OC curve for a sampling plan is a graph which plots the probability that the sampling plan will accept a lot (i.e., the P_a value) versus the percent defective samples in that particular lot. Note that the term "sampling plan" used here corresponds to a batch of "*n*" destructive testing samples and the criteria for adjusting the sampling interval. Recall Table 2 in the main body of this guide. Figure B1 illustrates the concept of OC curves. In Figure B1, the dashed curve represents an "ideal" OC curve. Here it is desired to accept all lots having less or equal than 2% and reject all lots having greater than 2% failures. In reality, all sampling plans have risks that a "good" lot will be rejected or a "bad" lot will be accepted. This is illustrated by the solid S-shaped curve shown in Figure B1. It is seen that this particular sampling plan will have a 5% risk (100% - 95%) of rejecting a lot having only 1% defects (i.e., a "good" lot) and a 10% risk of accepting a lot having 5% defects (i.e., a "bad" lot).

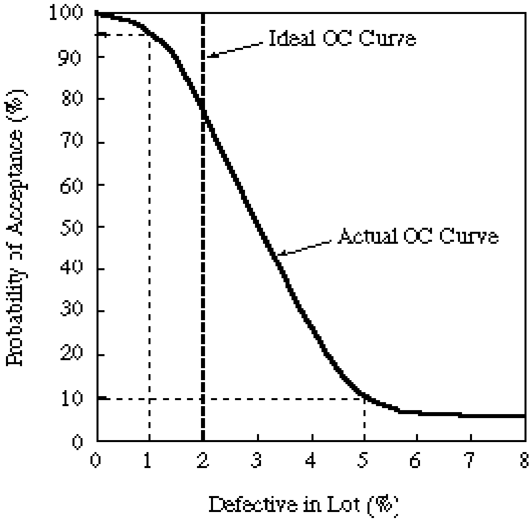

Figure B1 - Ideal and Actual Operating Characteristics Curves for a Sampling Plan

An OC curve can be developed by determining the probability of acceptance for several values of the percent defects. To do so, a statistical distribution of the acceptance probability has to be assumed first. There are three distributions which can be used: hypergeometric, binomial and Poisson distribution. The Poisson distribution is generally preferable due to the ease of calculation. It is used in this guide. The Poisson distribution function to be applied to an acceptance sampling plan is as follows:

$$P\begin{pmatrix} exactly\ "c"\, defects \\ in\ a\ batch\ of\ size\ "n" \end{pmatrix} = \frac{e^{-np}(np)^c}{c!} \qquad \text{(B1)}$$

Most statistics books provide Poisson distribution tables which give the probability of "c" or less defects in a batch of size "n" from a lot having a fraction of defect "p".

The Selection of the "I" and "D" Values Listed in Table 2

As mentioned earlier, each of the sampling plans recommended in this guide consists of three variables: the batch size "n", the values of "I" and "D". Note that the values of "I" and "D" are specific values of "c" mentioned in Equation B1. The "I" value corresponds to the judgment criterion of rewarding good seaming practice, i.e., increasing the sampling interval if the number of failed samples does not exceed this particular value. The "D" value, on the other hand, corresponds to the judgment criterion of penalizing poor seaming practice, i.e., decreasing the sampling interval if the number of failed samples equals or exceeds this particular value.

The concept of the OC curves is used to determine the actual values of I's and D's for different sampling plans. The criteria used are as follows:

- For a batch of size "n", the "I" value should yield a 80~90% probability of rewarding good seaming practice, i.e., $80\% < P_a < 90\%$.

- For a batch of size "n", the "D" value should yield a risk of 0.5% or less of penalizing good seaming practice, i.e., $P_a \geq 99.5\%$. In other words, the probability for good seaming practice to be penalized is extremely small, i.e., less than 0.5%.

The above criteria is subjective. Nevertheless, it is felt to be adequate since the rights of both the installer and the owner/regulator are protected. Recognize that a sampling plan with tighter control (i.e., smaller values of "I" and "D") might seem to be more ideal at first glance, but it may result in a significant increase in the required number of destructive tests, i.e., it may be counter productive.

As an illustration, Figure B2 shows the graphic procedure of obtaining the "I" and "D" values for a batch of 50 samples (n=50) and an anticipated failure percentage of 4%. [In other words, it illustrates the procedure of obtaining one particular pair of numbers listed in Table 2, namely, "I" and "D" equal to 3 and 6, respectively.] Note that each OC curve shown in Figure B2 corresponds to a specific "c" value and is obtained via a Poisson distribution table.

Figure B2 can also used to determine the values of "I" and "D" for sampling plans with the same batch size (i.e., n = 50) but different anticipated failure percentage. The rest of the values listed in Table 2 can be verified in a similar manner using OC curves corresponding to different batch sizes.

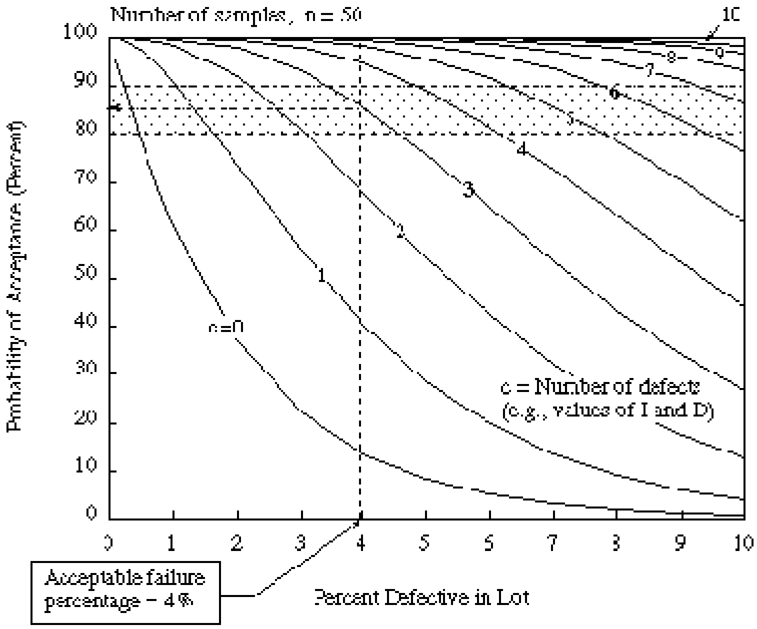

Figure B2 - The Determination of the Values of "I" and "D" for a Batch with 50 Samples and an Anticipated Failure Percentage of 4.0%.

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Revision schedule is on pg. 12

GRI -GM19a Standard Specification*

Standard Specification for

"Seam Strength and Related Properties of Thermally Bonded Homogeneous Polyolefin Geomembranes/Barriers" ^{SM}

This specification was developed by the Geosynthetic Research Institute (GRI), with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification addresses the required seam strength and related properties of thermally bonded homogeneous, i.e., nonreinforced, polyolefin geomembranes. Included herein are high density polyethylene (HDPE), linear low density polyethylene (LLDPE) and flexible polypropylene (fPP).

Note 1: See GRI Standard GM19b for reinforced geomembrane seams of all types including scrim reinforced LLDPE-R and fPP-R.

1.2 Numeric values of seam strength and related properties are specified in both shear and peel modes.

Note 2: This specification does not address the test method details or specific testing procedures. It refers to the relevant ASTM test methods where applicable.

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*This GRI standard specification is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 5-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version and it is kept current on the Institute's Website <<geosynthetic-institute.org>>.

1.3 The thermal bonding methods focused upon are hot wedge (single and dual track) and extrusion fillet.

Note 3: Other acceptable, but less frequently used, methods of seaming are hot air and ultrasonic methods. They are inferred as being a subcategory of hot wedge seaming.

1.4 This specification does not suggest a specific distance between destructive seam samples to be taken in the field, i.e., the sampling interval. Two separate GRI Standard Practices are focused on this issue, see GRI-GM14 and GRI-GM20.

1.5 This specification is only applicable to laboratory testing.

1.6 This specification does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards

D6392	Standard Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods
D7747	Standard Test Method for Determining Integrity of Seams Produced Using Thermo-Fusion Methods for Reinforced Geomembranes by the Strip Tensile Method

2.2 EPA Standards

EPA 600/2.88/052 (NTIS PB-89-129670)
Lining of Waste Containment and Other Containment Facilities

2.3 GRI Standards

GM13	Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
GM14	Guide for Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes
GM17	Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes
GM18	Test Properties and Testing Frequency for Flexible Polypropylene (fPP and fPP-R) Geomembranes
GM20	Guide for Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using Control Charts

GM25 Test Property and Testing Frequency for Scrim Reinforced Linear Low Density Polyethylene Geomembranes

3. Definition

3.1 Geomembrane, n – An essentially impermeable geosynthetic composed of one or more synthetic sheets used for the purpose of liquid, gas or solid containment.

Note 4: This specification addresses homogeneous, or nonreinforced, geomembranes. GRI-GM19b addresses scrim, or fabric, reinforced geomembranes.

3.2 Hot Wedge Seaming – A thermal technique which melts the two opposing geomembrane surfaces to be seamed by running a hot metal wedge or knife between them. Pressure is applied to the top or bottom geomembrane, or both, to form a continuous bond. Seams of this type can be made with dual bond tracks separated by a nonbonded gap. These seams are referred to as dual hot wedge seams or double-track seams.

3.3 Hot Air Seaming – This seaming technique introduces high-temperature air or gas between two geomembrane surfaces to facilitate localized surface melting. Pressure is applied to the top or bottom geomembrane, forcing together the two surfaces to form a continuous bond.

3.4 Ultrasonic Seaming - A thermal technique which melts the two opposing geomembrane surfaces to be seamed by running a ultrasonically vibrated metal wedge or knife between them. Pressure is applied to the top or bottom geomembrane, or both, to form a continuous bond. Some seams of this type are made with dual bond tracks separated by a nonbonded gap. These seams are referred to as dual-track seams or double-track seams.

3.5 Extrusion Fillet Seaming – This seaming technique involves extruding molten resin at the edge of an overlapped geomembrane on another to form a continuous bond. A depreciated method called “extrusion flat” seaming extrudes the molten resin between the two overlapped sheets. In all types of extrusion seaming the surfaces upon which the molten resin is applied must be suitably prepared, usually by a slight grinding or buffing.

4. Significance and Use

4.1 The various methods of field fabrication of seams in homogeneous, or nonreinforced, polyolefin geomembranes are covered in existing ASTM standards mentioned in the referenced document section. What is not covered in those documents is the numeric values of strength and related properties that the completed seam must meet, or exceed. This specification provides this information insofar as minimum, or maximum, property values are concerned when the field fabricated seams are sampled and laboratory tested in shear and peel. Separate GRI standards, GM14 and GM20, provide guidance as to the spacing that destructive samples should be taken in typical field installation projects.

5. Sample and Specimen Preparation

5.1 The spacings for taking field seam samples for destructive testing can be a fixed, or variable, interval or can be statistically related as provided in GRI-GM14 and GRI-GM20. These statistical processes describe a progression from the most restrictive interval of 1 per 500 feet (1 per 150 m) to the complete use and reliance of the electrical leak location survey (ELLS) method. Intermediate between these extremes are variations depending upon the installers experience and performance.

Note 5: The job-specific spacing is decided upon the design engineer or CQA organization.

5.2 The size of field seam samples is to be according to the referenced test method, e.g., ASTM D6392 or site-specific CQA plan.

5.3 The individual test specimens taken from the field seam samples are to be tested according to the referenced test method, i.e., ASTM D6392 for HDPE, LLDPE and fPP. The specimens are to be conditioned prior to testing according to these same test methods and evaluated accordingly.

6. Assessment of Seam Test Results

6.1 HDPE seams – For HDPE seams (both smooth and textured), the strength of all five out of five 1.0 inch (25 mm) wide strip specimens in <u>shear</u> should meet or exceed the values given in Tables 1(a) and 1(b). In addition, all five specimens should meet the shear percent elongation, calculated as follows, and exceed the values given in Tables 1(a) and 1(b):

$$E = \frac{L}{L_o}(100) \tag{1}$$

where

E = elongation (%)
L = extension at end of test (in. or mm)
L_o = original average length (usually 1.0 in. or 25 mm)

Note 6: The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

For HDPE seams (both smooth and textured), the strength of all five out of five 1.0 in. (25 mm) wide strip specimens tested in peel should meet or exceed the values given in Tables 1(a) and 1(b).

In addition, the peel separation (or incursion) should not exceed the values given in Tables 1(a) and 1(b) for all five out of five specimens. The value shall be based on the proportion of area of separated bond to the area of the original bonding as follows:

$$S = \frac{A}{A_o}(100) \tag{2}$$

where

S = separation (%)
A = average area of separation, or incursion (in^2 or mm^2)
A_0 = original bonding area (in^2 or mm^2)

Note 7: The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%
Extrusion Fillet: AD1, AD2 and AD-WLD

Note 8: Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

In this regard, five out of five specimens shall result in acceptable break patterns.

6.2 LLDPE seams – For LLDPE seams (both smooth and textured), the strength all five out of five 1.0 in. (25 mm) wide strip specimens in shear should meet or exceed the values given in Tables 2(a) through 2(d). Note that the unreinforced specimens are 1.0 in. (25 mm) wide strips. In addition, the shear percent elongation, calculated as follows, should exceed the values given in Tables 2(a) through 2(d). All five specimens should meet the shear elongation requirement.

$$E = \frac{L}{L_o}(100) \tag{1}$$

where

E = elongation (%)
L = extension at end of test (in. or mm)
L_o = original average length (usually 1.0 in. or 25 mm)

Note 6 (Repeated): The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

For LLDPE seams (smooth, textured and scrim reinforced), the strength of all five 1.0 in. (25 mm) wide strip specimens tested in <u>peel</u> should meet or exceed the values given in Tables 2(a) through 2(d).

In addition, the peel separation (or incursion) should not exceed the values given in Tables 2(a) through 2(d). All five out of five specimens shall meet the peel separation value. The value shall be based on the proportion of area of separated bond to the area of the original bonding as follows:

$$S = \frac{A}{A_o}(100) \tag{2}$$

where

S = separation (%)
A = average area of separation, or incursion (in.^{2} or mm^2)
A_0 = original bonding area (in.^{2} or mm^2)

Note 6 (Repeated): The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the <u>locus-of-break</u> patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%
Extrusion Fillet: AD1, AD2 and AD-WLD

Note 8 (Repeated): Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

In this regard, all five specimens shall result in acceptable break patterns.

6.3 fPP Seams – For fPP seams, the strength all five out of five specimens in shear should meet or exceed the values given in Tables 3(a) and 3(b). Note that the specimens are 1.0 in. (25 mm) wide strips. In addition, the shear percent elongation on the specimens, calculated as follows, should exceed the values given in Tables 3(a) and 3(b). All five out of five specimens should meet the shear elongation requirement.

$$\mathrm{E} = \frac{\mathrm{L}}{\mathrm{L_o}}(100) \qquad (1)$$

where
E = elongation (%)
L = extension at end of test (in. or mm)
$\mathrm{L_o}$ = original gauge length (usually 1.0 in. or 25 mm)

Note 4 (Repeated): The assumed gage length is considered to be the unseamed sheet material on either side of the welded area. It generally will be 1.0 in. (25 mm) from the edge of the seam to the grip face.

For fPP seams, the strength of all five out of five specimens in peel should meet or exceed the values given in Tables 3(a) and 3(b). Note that the unreinforced specimens are 1.0 in. (25 mm) wide strips. In addition, the peel percent separation (or incursion) should not exceed the values given in Tables 3(a) and 3(b). All five out of five specimens should meet the peel separation value. The values should be based on the proportion of area of separated bond to the area of the original bonding as follows.

$$S = \frac{A}{A_o}(100) \qquad (2)$$

where

S = separation in (%)
A = average area of separation, or incursion (in.^{2} or mm^2)
$\mathrm{A_o}$ = original bonding area (in.^{2} or mm^2)

Note 7 (Repeated): The area of peel separation can occur in a number of nonuniform patterns across the seam width. The estimated dimensions of this separated area is visual and must be done with care and concern. The area must not include squeeze-out which is part of the welding process.

Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code);

Hot Wedge: AD and AD-Brk > 25%
Extrusion Fillet: AD1, AD2 and AD-WLD

Note 8 (Repeated): Separation-in-plane (SIP) is a locus-of-break where the failure surface propagates within one of the seamed sheets during destructive testing (usually in the peel mode). It is not merely a surface skin effect producing a few ductile fibrils (sometimes called ductile drawdown). SIP is acceptable if the required strength, shear elongation and peel separation criteria are met.

In this regard, five out of five specimens shall result in acceptable break patterns.

7. Retest and Rejection

7.1 If the results of the testing of a sample do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the construction quality control or construction quality assurance plan for the particular site under construction.

8. Certification

8.1 Upon request of the construction quality assurance officer or certification engineer, an installer's certification that the geomembrane was installed and tested in accordance with this specification, together with a report of the test results, shall be furnished at the completion of the installation.

Table 1(a) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** High Density Polyethylene (HDPE) Geomembranes **(English Units)**

Geomembrane Nominal Thickness	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams(1)							
shear strength, lb/in.	57	80	100	120	160	200	240
shear elongation at break(2), %	50	50	50	50	50	50	50
peel strength, lb/in.	45	60	76	91	121	151	181
peel separation, %	25	25	25	25	25	25	25
Extrusion Fillet Seams							
shear strength, lb/in.	57	80	100	120	160	200	240
shear elongation at break(2), %	50	50	50	50	50	50	50
peel strength, lb/in.	39	52	65	78	104	130	156
peel separation, %	25	25	25	25	25	25	25

Notes for Tables 1(a) and 1(b):

1. Also for hot air and ultrasonic seaming methods
2. Elongation measurements should be omitted for field testing

Table 1(b) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** High Density Polyethylene (HDPE) Geomembranes **(S.I. Units)**

Geomembrane Nominal Thickness	0.75 mm	1.0 mm	1.25 mm	1.5 mm	2.0 mm	2.5 mm	3.0 mm
Hot Wedge Seams(1)							
shear strength, N/25 mm.	250	350	438	525	701	876	1050
shear elongation at break(2), %	50	50	50	50	50	50	50
peel strength, N/25 mm	197	263	333	398	530	661	793
peel separation, %	25	25	25	25	25	25	25
Extrusion Fillet Seams							
shear strength, N/25 mm	250	350	438	525	701	876	1050
shear elongation at break(2), %	50	50	50	50	50	50	50
peel strength, N/25 mm	170	225	285	340	455	570	680
peel separation, %	25	25	25	25	25	25	25

Table 2(a) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** Linear Low Density Polyethylene (LLDPE) Geomembranes (English Units)

Geomembrane Nominal Thickness	20 mils	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams(1)								
shear strength, lb/in.	30	45	60	75	90	120	150	180
shear elongation(2), %	50	50	50	50	50	50	50	50
peel strength, lb/in.	25	38	50	63	75	100	125	150
peel separation, %	25	25	25	25	25	25	25	25
Extrusion Fillet Seams								
shear strength, lb/in.	30	45	60	75	90	120	150	180
shear elongation(2), %	50	50	50	50	50	50	50	50
peel strength, lb/in.	22	34	44	57	66	88	114	136
peel separation, %	25	25	25	25	25	25	25	25

Notes for Tables 2(a) and 2(b):

1. Also for hot air and ultrasonic seaming methods
2. Elongation measurements should be omitted for field testing

Table 2(b) – Seam Strength and Related Properties of Thermally Bonded **Smooth and Textured** Linear Low Density Polyethylene (LLDPE) Geomembranes (S.I. Units)

Geomembrane Nominal Thickness	0.50 mm	0.75 mm	1.0 mm	1.25 mm	1.5 mm	2.0 mm	2.5 mm	3.0 mm
Hot Wedge Seams(1)								
shear strength, N/25 mm	131	197	263	328	394	525	657	788
shear elongation(2), %	50	50	50	50	50	50	50	50
peel strength, N/25 mm	109	166	219	276	328	438	547	657
peel separation, %	25	25	25	25	25	25	25	25
Extrusion Fillet Seams								
shear strength, N/25 mm	131	197	263	328	394	525	657	788
shear elongation(2), %	50	50	50	50	50	50	50	50
peel strength, N/25 mm	95	150	190	250	290	385	500	595
peel separation, %	25	25	25	25	25	25	25	25

Table 3(a) – Seam Strength and Related Properties of Thermally Bonded **Nonreinforced** Flexible Polypropylene (fPP) Geomembranes (English Units)

Geomembrane Nominal Thickness	30 mil	40 mil
Hot Wedge Seams[1]		
shear strength, lb/in. (NR); lb (R)	25	30
shear elongation[2], %	50	50
peel strength, lb/in. (NR); lb (R)	20	25
peel separation, %	25	25
Extrusion Fillet Seams		
shear strength, lb/in. (NR); lb (R)	25	30
shear elongation[2], %	50	50
peel strength, lb/in. (NR); lb (R)	20	25
peel separation, %	25	25

1. Also for hot air and ultrasonic seaming methods
2. Elongation measurements should be omitted for field testing

Table 3(b) – Seam Strength and Related Properties of Thermally Bonded **Nonreinforced and Scrim Reinforced** Flexible Polypropylene (fPP) Geomembranes (S.I. Units)

Geomembrane Nominal Thickness	0.75 mm	1.0 mm
Hot Wedge Seams[1]		
shear strength, N/25 mm (NR); N (R)	110	130
shear elongation[2], %	50	50
peel strength, N/25 mm (NR); N (R)	85	110
peel separation, %	25	25
Extrusion Fillet Seams		
shear strength, N/25 mm (NR); N (R)	110	130
shear elongation[2], %	50	50
peel strength, N/25 mm (NR); N (R)	85	110
peel separation, %	25	25

1. Also for hot air and ultrasonic seaming methods
2. Elongation measurements should be omitted for field testing

Adoption and Revision Schedule
for
Seam Specification per GRI-GM19

"Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes"

Adopted: February 18, 2002

Revision 1: May 15, 2003; Increased selected shear and peel test requirements, per the following:

Material	Test	Seam Type	Current GM19	Proposed GM19	Difference
HDPE	Shear	Hot Wedge Extrusion	95% yield 95% yield	95% yield 95% yield	no change no change
	Peel	Hot Wedge Extrusion	62% yield 62% yield	72% yield 62% yield	16% increase no change
LLDPE	Shear	Hot Wedge Extrusion	1300 psi break 1300 psi break	1500 psi break 1500 psi break	15% increase 15% increase
	Peel	Hot Wedge Extrusion	1100 psi break 1100 psi break	1250 psi break 1100 psi break	14% increase no change

Revision 2: January 28, 2005; added Note 6 (in three locations) stating that incursion is measured on an area basis and not depth as in ASTM D6392.

Revision 3: June 4, 2010; Removed Note 6 on peel incursion since ASTM D6392 (2008) now uses area of incursion whereas previously they used linear length of incursion. Thus ASTM is now in agreement with GM19 in this regard.

Revision 4: November 15, 2010; Added Note 6 (in three locations) stating what separation-in-plane (SIP) is, and is not, and that it is acceptable if the required strength, shear elongation and peel separation criteria are met.

Revision 5: July 12, 2011; AD1 and AD2 breaks are now unacceptable even if strength is achieved.

Revision 6: October 3, 2011; Added LLDPE-R to the various geomembrane types, in particular, Tables 2(c) and 2(d) and made editorial changes.

Revision 7: November 3, 2013; clarified issues of 4 out of 5 passing strength and 5 out of 5 passing locus-of-break, shear elongation and peel separation.

Revision 8: February 12, 2015; upgraded standards and terminology

Revision 9:	July 28, 2017: eliminated reinforced LLDPE-R and fPP-R geomembranes in deference to GRI-GM19b which includes them and other scrim-reinforced geomembranes and barriers. Also now required are 5 out of 5 passing strength tests for all materials.
Revision 10:	March 18, 2021: Removed AD-WLD exception in multiple locations as a result of the point being mute due to Revision 9.

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Rev. 2: March 3, 2016
Revision Schedule: pg. 7

GRI -GT12(a)[∗] - ASTM Version Standard Specification

Standard Specification for

"Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials" ^{SM}

This specification was developed by the Geosynthetic Research Institute (GRI) with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers nonwoven geotextile test properties for subsequent use as protection (or cushioning) materials.

Note 1: The typical use will be as a protective covering or underlayment of a geomembrane against puncture or tear due to rock, stones, concrete or other hard surfaces and/or objects.

1.2 This specification sets forth a set of physical, mechanical and endurance properties that must be met, or exceeded by the geotextile being manufactured.

1.3 In the context of quality systems and management, this specification represents a manufacturing quality control (MQC) document.

Note 2: Manufacturing quality control represents those actions taken by a manufacturer to assure that a product represents the stated objective and properties set forth in the specification.

[∗] This GRI standard specification is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version and it is kept current on the Institute's Webpage <<geosynthetic-institute.org>>.

1.4 This standard specification is intended to assure good quality and performance of fabrics used as geotextile protection materials but is possibly not adequate for the complete specification in a specific situation. Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application.

1.5 This standard specification does not address installation practices or design guidance. Both of these items are addressed in the literature dealing with this particular application.

2. Referenced Documents

2.1 ASTM Standards

D 4354	Practice for Sampling of Geosynthetics for Testing
D 4533	Test Method for Trapezoidal Tearing Strength of Geotextiles
D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4759	Practice for Determining the Specification Conformance of Geosynthetics
D 4873	Guide for Identification, Storage and Handling of Geotextiles
D 5035	Test Method for Breaking Strength and Elongation of Textile Fabrics (2" Strip Method)
D 5261	Test Method for Measuring Mass per Unit Area of Geotextiles
D 6241	Test Method for Static Puncture Strength of Geotextiles and Geotextile Related Product Using a 50-mm Probe
D 7238	Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent Condensation Apparatus

2.2 AASHTO Specification

M288-05 Geotextile Specification for Highway Applications

3. Definitions

3.1 Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For nonwoven geotextiles, a formulation is defined as the exact percentages and types of resin(s), additives and/or carbon black.

3.2 Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications [ref. EPA/600/R-93/182].

Note 3: This particular specification for nonwoven protection geotextiles falls under the concept of MQC.

3.3 Minimum Average Roll Value (MARV) – For geosynthetics, a manufacturing quality control tool used to allow manufacturers to establish published values such that the user/purchaser will have a 97.7% confidence that the property in question will meet published values. For normally distributed data, "MARV" is calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property.

4. Material Classification and Formulation

4.1 This specification covers geotextiles used as protection (or cushioning) materials.

4.2 The type of resins are usually polypropylene, polyester or polyethylene, but other resins are also possible in this regard.

4.3 The type of geotextile style is designated as a nonwoven since research has shown these fabrics to be most effective in the typical applications toward which this specification is directed. While needle-punched nonwovens are usually used, heat bonded and resin dipped manufacturing styles (or others) can also be considered.

5. Specification Requirements

5.1 The geotextiles for use as protection (or cushioning) materials shall conform to Table 1. The table is given in English units and in SI (Metric) units. The conversion from English to SI units is "soft".

5.2 Since there are a number of geotextile puncture test methods available, Table 2 is provided. Either of these tests can be considered to be an alternative test replacing ASTM D4833 in Table 1. The decision to make such a replacement must be agreed upon by the parties involved. The table is given in English units and in SI (Metric) units. The conversion from English to SI units is "soft".

5.3 The required values for all properties in Tables 1 and 2 are to be minimum average roll values (MARV) except UV resistance which is a minimum value.

6. Workmanship and Appearance

6.1 The finished geotextile shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the geotextile, or its proper functioning.

6.2 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling, Testing, and Acceptance

7.1 Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling shall be in accordance with the most current modification of ASTM Standard D 4354, using the section titled, “Procedure for Sampling for Purchaser’s Specification Conformance Testing.” In the absence of purchaser’s testing, verification may be based on manufacturer’s certifications as a result of testing by the manufacturer of quality assurance samples obtained using the procedure for Sampling for Manufacturer’s Quality Assurance (MQA) Testing. A lot size shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

7.2 Testing shall be performed in accordance with the method referenced in this specification for the indicated application. The number of specimens to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV. Refer to ASTM D 4759 for more details regarding geotextile acceptance procedures.

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer’s quality manual.

9. Shipment and Storage

9.1 Geotextile labeling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style, and roll number. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer’s certificate.

9.2 Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

9.3 During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition that may damage the property values of the geotextile.

10. Certification

10.1 The contractor shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile.

10.2 The manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.

10.3 The manufacturer’s certificate shall state that the finished geotextile meets MARV requirements of the specification as evaluated under the manufacturer’s quality control program. A person having legal authority to bind the manufacturer shall attest to the certificate.

10.4 Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

USA Units

Table 1(a) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property[1]	Test Method ASTM	Unit	Mass/Unit Area (oz/yd^2)					
Mass per unit area	D5261	oz/yd^2	10	12	16	24	32	60
Grab tensile strength	D4632	lb	230	300	370	450	500	630
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	lb	95	115	145	200	215	290
Puncture (CBR) strength	D6241	lb	700	800	900	1100	1700	2400
UV resistance[2]	D7238	%	70	70	70	70	70	70

Notes:

(1) All values are MARV except UV resistance; it is a minimum value.
(2) Evaluation to be on 2.0 inch strip tensile specimens per ASTM D 5035 after 500 lt. hrs. exposure.

S.I. (Metric) Units

Table 1(b) – Required Properties, Test Methods and Values for Geotextiles Used as Geomembrane Protection (or Cushioning) Materials

Property[1]	Test Method ASTM	Unit	Mass/Unit Area (g/m^2)					
Mass per unit area	D5261	g/m^2	340	406	542	812	1080	2000
Grab tensile strength	D4632	kN	1.02	1.33	1.64	2.00	2.25	2.80
Grab tensile elongation	D4632	%	50	50	50	50	50	50
Trap. tear strength	D4533	kN	0.42	0.51	0.64	0.89	0.96	1.27
Puncture (CBR) strength	D6241	kN	3.11	3.56	4.00	4.90	7.56	10.60
UV resistance[2]	D7238	%	70	70	70	70	70	70

Notes:

(1) All values are MARV except UV resistance; it is a minimum value.
(2) Evaluation to be on 50 mm strip tensile specimens per ASTM D5035 after 500 lt. hrs. exposure.

Adoption and Revision Schedule

for

"Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials"

Original:	February 18, 2002
Revision 1:	December 18, 2012: Replaced ASTM D4355 with ASTM D7238
Revision 2:	March 3, 2016: Deleted ASTM D4833 Pin Puncture and ASTM D5495 Pyramid Puncture from the Standard

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Revision 4: June 20, 2017
Revision Schedule on pg. 9

GRI GT13(a) – ASTM Version Standard Spécification[*]

Standard Specification for

“Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate” ℠

This specification was developed by the Geosynthetic Research Institute (GRI) with the cooperation of the member organizations for general use by the public. It is completely optional in this regard and can be superseded by other existing or new specifications on the subject matter in whole or in part. Neither GRI, the Geosynthetic Institute, nor any of its related institutes, warrant or indemnifies any materials produced according to this specification either at this time or in the future.

1. Scope

1.1 This specification covers geotextile test methods properties for subsequent use as separation between subgrade soil and aggregate predominantly in pavement systems.

Note 1: While separation occurs in every geotextile application, this pavement-related specification focuses on subgrade soils being “firm” as indicated by CBR values in ASTM D1883 higher than 3.0 (soaked) or 8.0 (unsoaked).

1.2 This specification sets forth a set of physical, mechanical and endurance properties that must be met, or exceeded, by the geotextile being manufactured.

1.3 In the context of quality systems and management, this specification represents a manufacturing quality control (MQC) document. However, its general use is essentially as a recommended design document.

1.4 This specification is intended to assure both good quality and performance of fabrics used as geotextile separators but is possibly not adequate for the complete

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[*] This GRI standard specification is developed by the Geosynthetic Research Institute through consultation and review by the member organizations. This specification will be reviewed at least every 2-years, or on an as-required basis. In this regard it is subject to change at any time. The most recent revision date is the effective version and it is kept current on the Institute’s Website <<geosynthetic-institute.org>>.

specification in a specific situation. Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application.

1.5 This standard specification does not address installation practice. This item is addressed in the geosynthetics literature dealing with this particular application and under unique situations might require modifications, e.g., higher values and/or additional test properties.

2. Referenced Documents

2.1 ASTM Standards

D 1883	Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils
D 4354	Practice for Sampling of Geosynthetics for Testing
D 4533	Test Method for Trapezoidal Tearing Strength of Geotextiles
D 4632	Test Method for Grab Breaking Load and Elongation of Geotextiles
D 4759	Practice for Determining the Specification Conformance of Geosynthetics
D 4873	Guide for Identification, Storage and Handling of Geotextiles
D 5261	Test Method for Measuring Mass per Unit Area of Geotextiles
D 6241	Test Method for Static Puncture Strength of Geotextiles and Geotextile Related Product Using a 50-mm Probe
D 7238	Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus

2.2 AASHTO Specification

M288-05 Geotextile Specification for Highway Applications

3. Definitions

3.1 Formulation - The mixture of a unique combination of ingredients identified by type, properties and quantity. For geotextiles, a formulation is defined as the exact percentages and types of resin(s), additives and/or carbon black.

3.2 Manufacturing Quality Control (MQC) - A planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory originated. MQC is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications [ref. EPA/600/R-93/182].

3.3 Minimum Average Roll Value (MARV) – For geosynthetics, a manufacturing quality control tool used to allow manufacturers to establish published values such that the user/purchaser will have a 97.7% confidence that the property in question will meet published values. For normally distributed data, “MARV” is calculated as the typical value minus two (2) standard deviations from documented quality control test results for a defined population from one specific test method associated with one specific property.

3.4 Minimum Value – The lowest sample value from documented manufacturing quality control test results for a defined population from one test method associated with one specific property.

3.5 Maximum Value – The highest sample value from documented manufacturing quality control test results for a defined population from one test method associated with one specific property.

3.6 Separation – The placement of a flexible porous geosynthetic between dissimilar materials so the integrity and functioning of both materials can remain intact or be improved.

Note 2: For separation of stone base courses overlying soil subgrades this primary function simultaneously prevents the stone from intruding down into the soil and the soil from pumping up into the stone.

4. Material Classification and Formulation

4.1 This specification covers geotextiles used as separation materials.

4.2 The polymer types are mainly polypropylene, but also polyester or polyethylene. Other polymers are also possible in this regard.

4.3 The type of geotextile style is not designated. However a distinction can be made based on the elongation criteria of 50%.

Note 3: It is assumed that nonwoven fabrics break at elongations higher than 50%. Woven fabrics always break at elongations significantly lower than 50%.

5. Specification Requirements

5.1 The geotextiles for use as separator shall conform to Tables 1or 2. Table 1 is given in English units and Table 2 is in SI (Metric) units. The conversion from English to SI units is “soft”, i.e., rounded off to an approximate value. All test methods are based on ASTM Standards.

Note 4: The numeric relationships between this specification based on ASTM Test Methods and GRI –GT13(b) based on ISO Test Methods have been developed at the Geosynthetic Institute.

5.2 The required values for most properties in Tables 1 and 2 are to be minimum average roll values (MARV). The exceptions are AOS which is a maximum average roll value (MaxARV), and UV stability which is a minimum average value.

5.3 The required class is determined by the severity of installation conditions (i.e., size of equipment, condition of subgrade, thickness of covering lift, etc.). Table 3 gives guidance in this respect.

6. Workmanship and Appearance

6.1 The finished geotextile shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the geotextile, or its proper functioning.

6.2 General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

7. MQC Sampling, Testing, and Acceptance

7.1 Geotextiles shall be subject to sampling and testing to verify conformance with this specification. Sampling shall be in accordance with the most current modification of ASTM Standard D 4354, using the section titled, "Procedure for Sampling for Purchaser's Specification Conformance Testing." In the absence of purchaser's testing, verification may be based on manufacturer's certifications as a result of testing by the manufacturer of quality assurance samples obtained using the procedure for Sampling for Manufacturer's Quality Assurance (MQA) Testing. A lot size shall be considered to be the shipment quantity of the given product or a truckload of the given product, whichever is smaller.

7.2 Testing shall be performed in accordance with the method referenced in this specification for the indicated application. The number of specimens to test per sample is specified by each test method. Geotextile product acceptance shall be based on ASTM D4759. Product acceptance is determined by comparing the average test results of all specimens within a given sample to the specification MARV. Refer to ASTM D 4759 for more details regarding geotextile acceptance procedures.

8. MQC Retest and Rejection

8.1 If the results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done in accordance with the manufacturing protocol as set forth in the manufacturer's quality manual.

9. Shipment and Storage

9.1 Geotextile labeling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style, and roll number.

Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

9.2 Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage.

Note 5: The project specification shall be very explicit as to the maximum exposure time between the geotextile being removed from the wrapper and being backfilled with soil or covered with another geosynthetic.

9.3 During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition that may damage the property values of the geotextile.

10. Certification

10.1 The contractor shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or yarns, and other pertinent information to fully describe the geotextile.

10.2 The manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.

10.3 The manufacturer's certificate shall state that the finished geotextile meets the requirements of the specification as evaluated under the manufacturer's quality control program. A person having legal authority to bind the manufacturer shall attest to the certificate.

10.4 Either mislabeling or misrepresentation of materials shall be reason to reject those geotextile products.

English Units

Table 1(a) – Geotextile Properties Class 1 (High Survivability)

Property(1)	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	315	203
Trapezoid Tear Strength	D 4533	lb	112	79
CBR Puncture Strength	D 6241	lb	630	440
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability(2)	D 7238	% Str. Ret. @ 500 lt. hrs.	80	80

Table 1(b) – Geotextile Properties Class 2 (Moderate Survivability)

Property(1)	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	248	158
Trapezoid Tear Strength	D 4533	lb	90	56
CBR Puncture Strength	D 6241	lb	500	320
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability(2)	D 7238	% Str. Ret. @ 500 lt. hrs.	70	70

Table 1(c) – Geotextile Properties Class 3 (Low Survivability)

Property(1)	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	lb	180	113
Trapezoid Tear Strength	D 4533	lb	68	41
CBR Puncture Strength	D 6241	lb	380	230
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	in.	0.024	0.024
Ultraviolet Stability(2)	D 7238	% Str. Ret. @ 500 lt. hrs.	60	60

Notes:

(1) All values are minimum average roll values (MARV) except AOS which is a maximum average roll value (MaxARV) and UV stability which is a minimum average value.

(2) Evaluation to be on 50 mm strip tensile specimens after 500 hours exposure.

SI Metric Units

Table 2(a) – Geotextile Properties Class 1 (High Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	1400	900
Trapezoid Tear Strength	D 4533	N	500	350
CBR Puncture Strength	D 6241	N	2800	2000
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability[2]	D 7238	% Str. Ret. @ 500 lt. hrs.	80	80

Table 2(b) – Geotextile Properties Class 2 (Moderate Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	1100	700
Trapezoid Tear Strength	D 4533	N	400	250
CBR Puncture Strength	D 6241	N	2250	1400
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability[2]	D 7238	% Str. Ret. @ 500 lt. hrs.	70	70

Table 2(c) – Geotextile Properties Class 3 (Low Survivability)

Property[1]	ASTM Test	Unit	Elongation < 50%	Elongation ≥ 50%
Grab Tensile Strength	D 4632	N	800	500
Trapezoid Tear Strength	D 4533	N	300	180
CBR Puncture Strength	D 6241	N	1700	1000
Permittivity	D 4491	sec-1	0.02	0.02
Apparent Opening Size	D 4751	mm	0.60	0.60
Ultraviolet Stability[2]	D 7238	% Str. Ret. @ 500 lt. hrs.	60	60

Notes:

(1) All values are minimum average roll values (MARV) except AOS which is a maximum average roll value (MaxARV) and UV stability which is a minimum average value.

(2) Evaluation to be on 50 mm strip tensile specimens after 500 hours exposure.

Table 3 - Required Degree of Survivability as a Function of Subgrade Conditions, Construction Equipment and Lift Thickness
(Class 1, 2 and 3 Properties are Given in Table 1 and 2; Class 1 + Properties are Higher than Class 1 but Not Defined at this Time)

	Low ground-pressure equipment ≤ 25 kPa (3.6 psi)	Medium ground-pressure equipment > 25 to ≤ 50 kPa (>3.6 to ≤ 7.3 psi)	High ground-pressure equipment > 50 kPa (> 7.3 psi)
Subgrade has been cleared of all obstacles except grass, weeds, leaves, and fine wood debris. Surface is smooth and level so that any shallow depressions and humps do not exceed 450 mm (18 in.) in depth or height. All larger depressions are filled. Alternatively, a smooth working table may be placed.	Low (Class 3)	Moderate (Class 2)	High (Class 1)
Subgrade has been cleared of obstacles larger than small to moderate-sized tree limbs and rocks. Tree trunks and stumps should be removed or covered with a partial working table. Depressions and humps should not exceed 450 mm (18 in.) in depth or height. Larger depressions should be filled.	Moderate (Class 2)	High (Class 1)	Very High (Class 1+)
Minimal site preparation is required. Trees may be felled, delimbed, and left in place. Stumps should be cut to project not more than ± 150 mm (6 in.) above subgrade. Fabric may be draped directly over the tree trunks, stumps, large depressions and humps, holes, stream channels, and large boulders. Items should be removed only if placing the fabric and cover material over them will distort the finished road surface.	High (Class 1)	Very high (Class 1+)	Not recommended

*Recommendations are for 150 to 300 mm (6 to 12 in.) initial lift thickness. For other initial lift thicknesses:

300 to 450 mm (12 to 18 in.):	reduce survivability requirement one level;
450 to 600 mm (18 to 24 in.):	reduce survivability requirement two levels;
> 600 mm (24 in.):	reduce survivability requirement three levels

Note 1: While separation occurs in every geotextile application, this pavement-related specification focuses on subgrade soils being “firm” as indicated by CBR values higher than 3.0 (soaked) or 8.0 (unsoaked).

Source: Modified after Christopher, Holtz, and DiMaggio

Adoption and Revision Schedule

GRI-GT13(a) – ASTM Version

"Test Methods and Properties for Geotextiles Used as Separation Between Subgrade Soil and Aggregate"

Original: March 10, 2004

Revision 1: May 6, 2005: Editorial changes

Revision 2: August 29, 2008: Editorial changes

Revision 3: December 19, 2012: Changed ASTM D4355 to ASTM D7238 and editorial changes

Revision 4: June 20, 2017: Change UV stability from 50% retained to 80, 70, 60% retained (for high, moderate and low survivability, respectively) so as to be in agreement with the ISO version in GRI-GT13b.

Appendix H

Leachate Collection System Design Report

Leachate Collection System Design Report
American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

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INDEX AND CERTIFICATION PAGE

REPORT INDEX

CERTIFICATION

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

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1.0 INTRODUCTION

SCS Engineers, on behalf of American Environmental Landfill, Inc., is submitting the necessary documents to permit a lateral expansion to the existing American Environmental Landfill (AEL). The AEL is located near Sand Springs, Oklahoma in Sections 35 and 36, Township 20 North, Range 10 East in Osage County, Oklahoma. The project site is on the Wekiwa Oklahoma 7.5 Minute USGS Quadrangle map.

The existing AEL permit boundary contains approximately 222 acres. Approximately 150 acres have been developed for municipal solid waste disposal. This lateral expansion proposes to increase the permit boundary by approximately 203 acres. Because the lateral expansion is continuous with the existing permit, three existing leachate collection sumps (W1, W2, and W3) will be excavated and graded so that leachate generated from those existing areas will be routed to the adjacent sump drainage area (Cell 7).

Leachate from the proposed expansion will be conveyed from five identical sumps to the leachate storage pond via forcemain and stored until evaporated and/or recirculated over composite lined areas in accordance with the ODEQ-approved Leachate Recirculation Plan.

SCS Engineers used the Hydrologic Evaluation of Landfill Performance (HELP) model, Version 4.0 Beta (2018), to estimate the potential volume of generated leachate at AEL. The HELP model is a quasi-two-dimensional hydrologic model of water movement across, into, through, and out of landfills. The model uses climate, soil, and landfill design data to perform a solution technique that accounts for the effects of surface storage, runoff, infiltration, percolation, soil-moisture storage, evapotranspiration, and waste footprint drainage.

Leachate generation was evaluated for active, interim, and closed landfill conditions utilizing the worst-case scenario of a slope length of 250 feet at 0.5%.

The proposed leachate collection piping consists of 6" HDPE SDR 7.3 pipe manufactured by ISCO. The proposed pipe consists of three, 0.5-inch perforations per linear foot of pipe, drilled at an angle of 60° from the vertical alignment of pipe. The following table summarizes the proposed pipe dimensions.

Table 1. Proposed Pipe Dimensions

Nominal Pipe Diameter OD (in)	6
Outside Diameter D_o (in)	6.625
Inside Diameter D_i (in)	4.701
Pipe Thickness t (in)	0.908
Standard Dimension Ratio SDR = D_o/t	7.3

The following calculations demonstrate that the leachate collection system for the expansion area is adequately designed to handle and store the maximum volume of leachate generated at the AEL.

2.0 LEACHATE GENERATION CALCULATIONS

2.1 PURPOSE

The following calculations determine the leachate generation volumes of the AEL during active, interim, and closed conditions. The calculations verify that the five leachate sumps are adequately sized to handle peak leachate generation volumes from the proposed expansion.

2.2 CALCULATIONS

HELP model results for three scenarios were used (active, interim, and closed) to determine the average and peak leachate drainage collected. The daily average leachate collected was calculated by converting the annual average leachate drainage into a daily rate. A summary and the complete HELP model results are located in Appendix A and Appendix B, respectively.

Table 2. Summary of Modeled Leachate Collection

Scenario	Daily Leachate Drainage Collected (cf/acre/day)	Daily Leachate Drainage Collected (gal/acre/day)
Average Closed Condition	0.086	0.65
Peak Closed Condition	0.288	2.16
Average Interim Condition	0.446	3.34
Peak Interim Condition	0.799	5.98
Average Active Condition	0.682	5.10
Peak Active Condition	0.729	5.45

The table above shows the highest daily leachate drainage collected rate occurs under the peak interim condition and is equal to 5.98 gallons/acre/day.

The permit drawings illustrate the layout of the proposed expansion. The leachate generated from the proposed expansion will be routed into one of five sumps. The sump geometry is shown below.

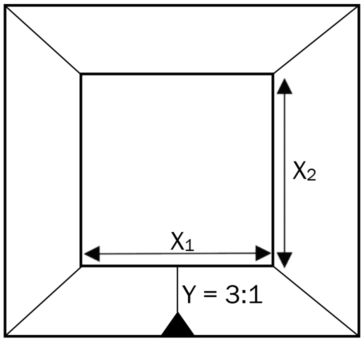
X_1 = Area Bottom of Sump

X_2 = Area of Top of Sump

Y = Slope of Sump Sides

h = Depth of Sump

Top View



Leachate Drainage Collection Sample Calculation

Acreage of largest cell (Cell 7) is 94.56 acres.

Calculate volume of one sump.

$$V = \frac{1}{3}[A_1 + A_2 + (A_1 \times A_2)^{0.5}]h$$

Where:

$X_1 = X_2 = 12$

$Y = 3\ h = 2$

$A_1 = X_1 \times X_2 = 12 \times 12 = 144\ ft^2$

$A_2 = (X_1 + 2hY) \times (X_2 + 2hY) = [12 + (2 \times 2 \times 3)] \times [12 + (2 \times 2 \times 3)] = 576\ ft^2$

$$V = \frac{1}{3}[144 + 576 + (144 \times 576)^{0.5}] \times 2 = 672\ ft^3 \times \frac{7.48\ gal}{1\ ft^3} = 5{,}027\ gal$$

Calculate Available Volume by accounting for the porosity (*n*) of the gravel bed. The average porosity of gravel beds ranges from 0.25% – 0.40%. A conservative value of 0.25% is used for this calculation.

$$Available\ Volume = n\mathrm{V} = 0.25\%\ \mathrm{x}\ 5{,}027\ gal = 1{,}256\ gal$$

Calculate daily flow for worst-case conditions.

$$V = 5.98\ gal/acre/day\ \times 94.56\ acres = 565.5\ gal/day$$

V = 1,256-gal > 565.5-gal **Sump is adequately sized.**

2.3 RESULTS

The largest daily calculated leachate drainage collected is 565.5 gallons, and the capacity of each sump is 1,256 gallons. Therefore, the sumps are adequately sized to handle the peak daily flow for closed conditions, which is the worst-case scenario.

3.0 LEACHATE COLLECTION PIPE FLOW CALCULATIONS

3.1 PURPOSE

The following calculations verify the designed leachate collection pipe is capable of handling leachate flow as it drains to the sumps located along the southern boundary of the lateral expansion area.

3.2 CALCULATIONS

The maximum leachate volume that will drain to the leachate collection pipe per acre was determined utilizing the HELP model to model average daily and peak daily scenarios. Results are summarized in Table 1.

A peak flow for the leachate collection pipe is calculated using Manning's Equation. This peak flow is compared to peak leachate drainage rates that will flow through the pipe based on acreages of the cells draining to each sump and leachate drainage rates taken from the HELP model.

Peak Flow Sample Calculation

$$Peak\ Flow = 565.5\frac{gal}{day} * \frac{1\ day}{24\ hrs} * \frac{1\ hr}{60\ min} = 0.40\ gpm$$

Pipe Flow Sample Calculation

Use Manning's Equation to calculate flow through one leachate collection pipe.

$$\mathrm{Q} = \left({}^{1.486}/_{n}\right) \times AR^{({}^{2}/_{3})} \times s^{({}^{1}/_{2})}$$

Where:

Q = Flow (cfs)

I.D. = Inner diameter = 4.701 in = 0.39 ft

$1/4\left(1-\frac{\sin\theta}{\theta}\right)d_o$

n = Manning's roughness coefficient (unitless) = 0.01

A = Cross-sectional flow areas of the solid pipe (ft^2) = $\pi r^2/2 = \pi(0.196)^2/2 = 0.06$

R = Hydraulic radius*(ft) = = $\left({}^{1}/_{4}\right)(1 - \sin(180)/180))X0.39) = 0.098$

S = Pipe slope (ft/ft) = 0.5% = 0.005

$$\mathrm{Q} = \left({}^{1.486}/_{0.01}\right) \times (0.06 \times 0.098)^{({}^{2}/_{3})} \times 0.005^{{}^{1}/_{2}} = 0.134\ cfs = 1.08\ gpm$$

*Assume that the 6" HDPE pipe is flowing half-full.

Q = 1.08 gpm > 0.40 gpm **Pipe is adequately sized.**

3.3 RESULTS

When flowing half-full, the 6-inch diameter SDR 7.3 HDPE pipes can handle 1.08 gpm of flow. The maximum calculated flow for the leachate pipe in the lateral expansion area is 0.40 gpm. Therefore, the leachate collection pipe designed in the lateral expansion is adequately sized.

4.0 DEAD AND LIVE LOAD PIPE CRUSHING CALCULATIONS

4.1 PURPOSE

The following calculations verify the permitted design of the leachate collection pipes for the lateral expansion under worst-case scenario conditions at a temperature of 100°F and a load time of 50 years meets allowable deflection values. The maximum allowable deflection is 7.5%.

For the purposes of live load calculations, a Cat 826H Compactor, weighing 90,207 pounds, was used to determine the maximum pipe deflection.

Because the expansion is continuous with the previously permitted Phase IV Expansion area, the existing leachate collection piping network was evaluated to demonstrate that the additional load does not exceed allowable pipe deflection calculations. Results are included in Appendix C.

4.2 PARAMETERS

The design is based on "Soil Engineering" 3rd Edition by RL Handy & Spangler and "Buried Pipe Design," located in Book 2, Chapter 7 of the Engineering Manual by Performance Pipe, a division of Chevron Phillips Chemical Company LP. Both are provided as (Appendix D).

The bedding constant is a function of the bedding angle and the corresponding K from Table 26-4 of *Soil Engineering*. The resulting bedding constant (K) is 0.083.

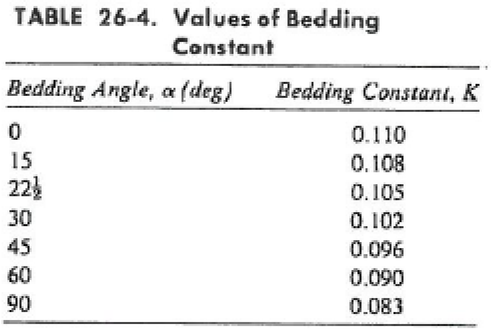
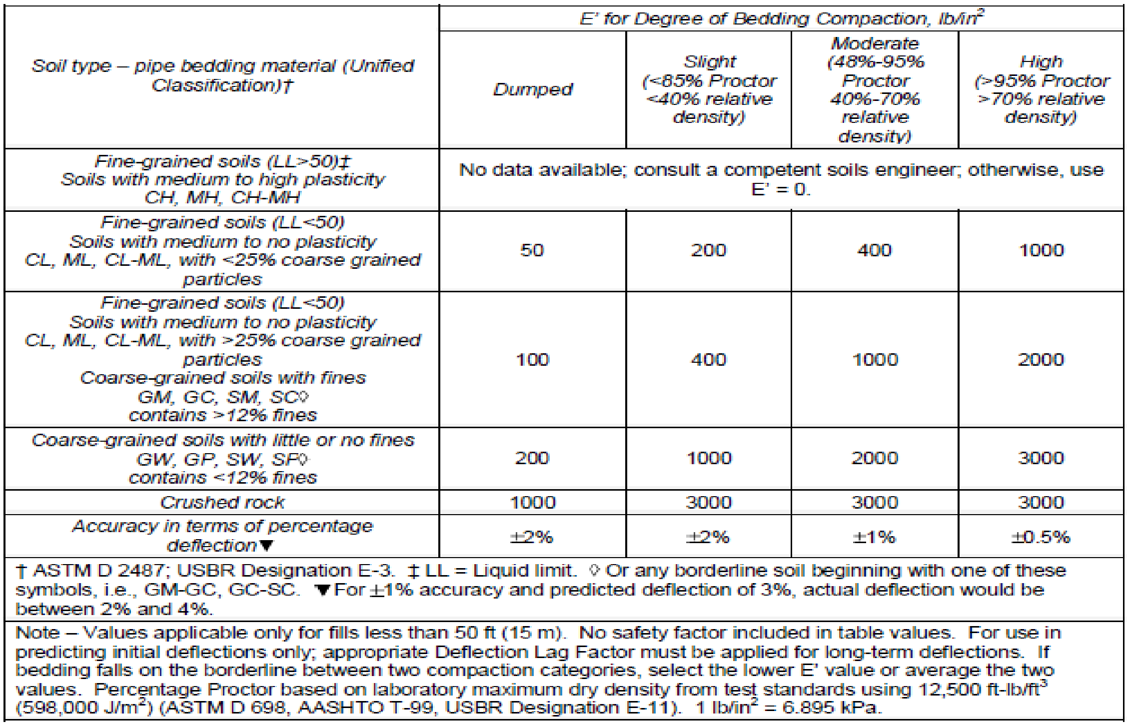


TABLE 26-4. Values of Bedding Constant

Bedding Angle, α (deg)	*Bedding Constant, K*
0	0.110
15	0.108
22½	0.105
30	0.102
45	0.096
60	0.090
90	0.083

The modulus of soil reaction (E') value is a function of the degree of bedding compaction and the pipe bedding material. The design uses an E' value equal to 3,000 psi because the bedding material is a slightly compacted crushed rock.



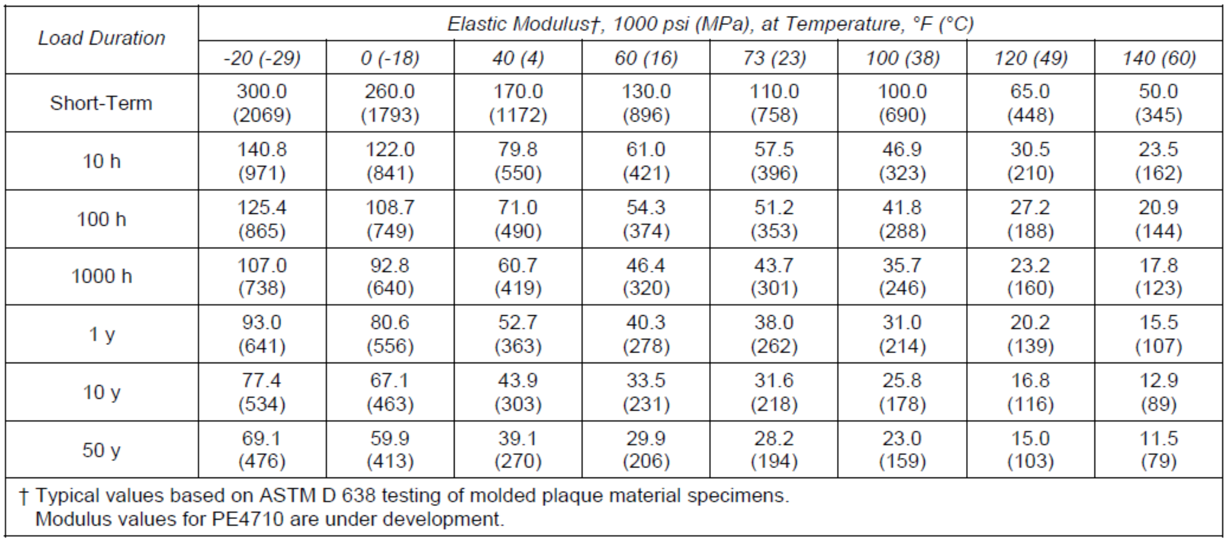
Soil type – pipe bedding material (Unified Classification)†	*E' for Degree of Bedding Compaction, lb/in^2*			
	Dumped	*Slight (<85% Proctor <40% relative density)*	*Moderate (48%-95% Proctor 40%-70% relative density)*	*High (>95% Proctor >70% relative density)*
Fine-grained soils (LL>50)‡ Soils with medium to high plasticity CH, MH, CH-MH	No data available; consult a competent soils engineer; otherwise, use E' = 0.			
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with <25% coarse grained particles	50	200	400	1000
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with >25% coarse grained particles Coarse-grained soils with fines GM, GC, SM, SC♢ contains >12% fines	100	400	1000	2000
Coarse-grained soils with little or no fines GW, GP, SW, SP♢ contains <12% fines	200	1000	2000	3000
Crushed rock	1000	3000	3000	3000
Accuracy in terms of percentage deflection▼	±2%	±2%	±1%	±0.5%

† ASTM D 2487; USBR Designation E-3. ‡ LL = Liquid limit. ♢ Or any borderline soil beginning with one of these symbols, i.e., GM-GC, GC-SC. ▼For ±1% accuracy and predicted deflection of 3%, actual deflection would be between 2% and 4%.

Note – Values applicable only for fills less than 50 ft (15 m). No safety factor included in table values. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections. If bedding falls on the borderline between two compaction categories, select the lower E' value or average the two values. Percentage Proctor based on laboratory maximum dry density from test standards using 12,500 ft-lb/ft^3 (598,000 J/m^2) (ASTM D 698, AASHTO T-99, USBR Designation E-11). 1 lb/in^2 = 6.895 kPa.

Source: Performance Pipe Design Manual, Book 2, Chapter 7, Table 7-7

The elastic modulus (E) is a function of both temperature and load time. A temperature of 100°F and a load time of 50 years were used to determine this value in the following table. An E value of 23,000 psi was chosen for this design.



Load Duration	*Elastic Modulus†, 1000 psi (MPa), at Temperature, °F (°C)*							
	-20 (-29)	*0 (-18)*	*40 (4)*	*60 (16)*	*73 (23)*	*100 (38)*	*120 (49)*	*140 (60)*
Short-Term	300.0 (2069)	260.0 (1793)	170.0 (1172)	130.0 (896)	110.0 (758)	100.0 (690)	65.0 (448)	50.0 (345)
10 h	140.8 (971)	122.0 (841)	79.8 (550)	61.0 (421)	57.5 (396)	46.9 (323)	30.5 (210)	23.5 (162)
100 h	125.4 (865)	108.7 (749)	71.0 (490)	54.3 (374)	51.2 (353)	41.8 (288)	27.2 (188)	20.9 (144)
1000 h	107.0 (738)	92.8 (640)	60.7 (419)	46.4 (320)	43.7 (301)	35.7 (246)	23.2 (160)	17.8 (123)
1 y	93.0 (641)	80.6 (556)	52.7 (363)	40.3 (278)	38.0 (262)	31.0 (214)	20.2 (139)	15.5 (107)
10 y	77.4 (534)	67.1 (463)	43.9 (303)	33.5 (231)	31.6 (218)	25.8 (178)	16.8 (116)	12.9 (89)
50 y	69.1 (476)	59.9 (413)	39.1 (270)	29.9 (206)	28.2 (194)	23.0 (159)	15.0 (103)	11.5 (79)

† Typical values based on ASTM D 638 testing of molded plaque material specimens.
Modulus values for PE4710 are under development.

Source: Performance Pipe Design Manual, Technical Note 814-TN, Table 1

The depth of fill and sequential final cover layers are provided in the following table.

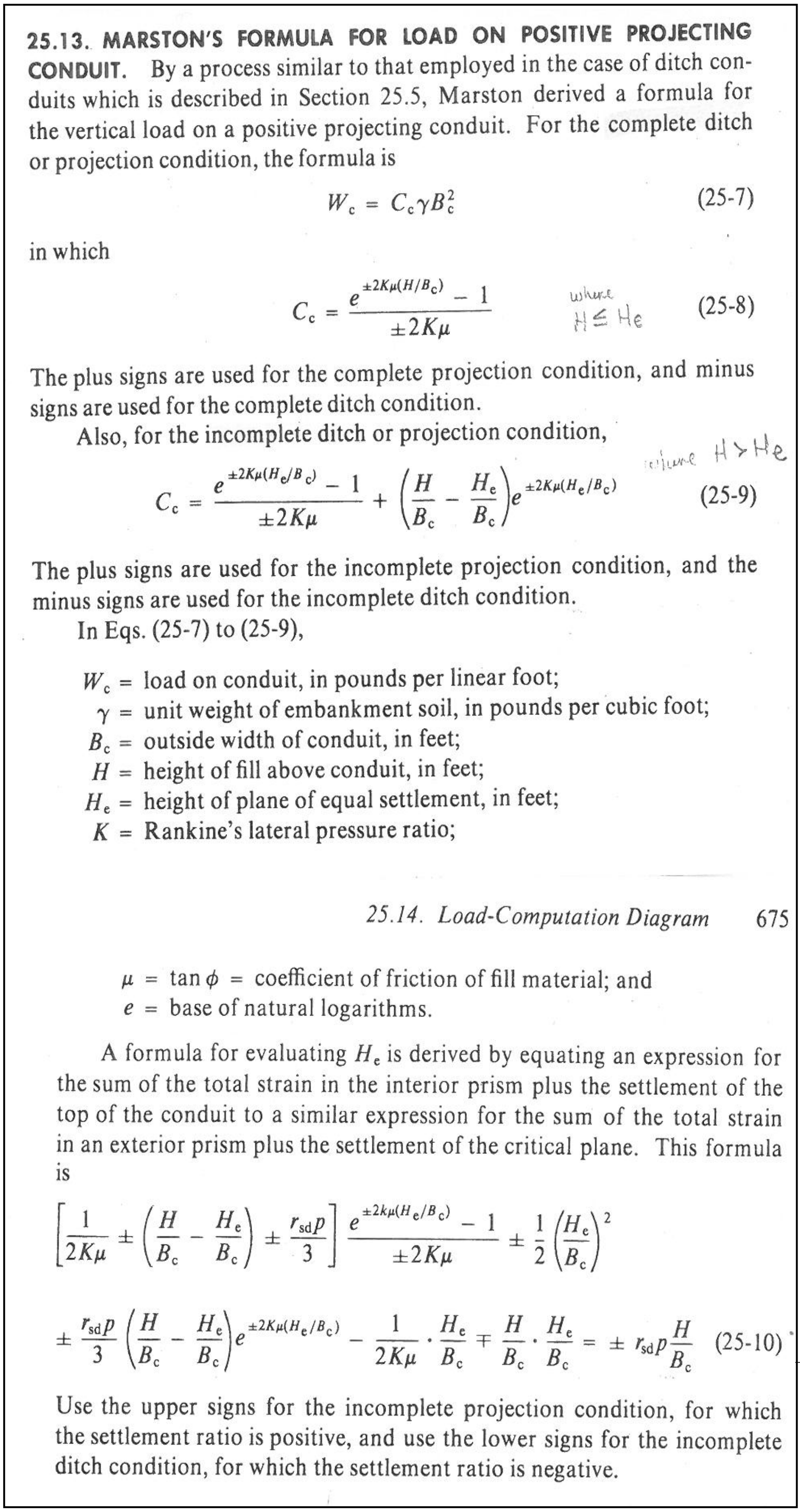
Table 3. Depth of Fill and Final Cover Characteristics

	Thickness (ft)	**Specific Weight (pcf)**
Leachate Collection Trench	1.5 (over top of pipe)	-
Waste and Daily Cover	397	85.7
Vegetative Support Layer	2	115
Vegetation Layer	1	100

4.3 CALCULATIONS

Calculations were performed using the Pipe Deflection Calculations Workbook developed by John Hartwell, P.E. PhD. Results are included in Appendix C.

The calculations use the Marston's Formula for Load on Positive Projecting Conduit to calculate the load applied to the leachate collection pipe.



25.13. MARSTON'S FORMULA FOR LOAD ON POSITIVE PROJECTING CONDUIT. By a process similar to that employed in the case of ditch conduits which is described in Section 25.5, Marston derived a formula for the vertical load on a positive projecting conduit. For the complete ditch or projection condition, the formula is

$$W_c = C_c \gamma B_c^2 \qquad (25\text{-}7)$$

in which

$$C_c = \frac{e^{\pm 2K\mu(H/B_c)} - 1}{\pm 2K\mu} \qquad (25\text{-}8)$$

where
$H \leq He$

The plus signs are used for the complete projection condition, and minus signs are used for the complete ditch condition.

Also, for the incomplete ditch or projection condition,

where $H > He$

$$C_c = \frac{e^{\pm 2K\mu(H_e/B_c)} - 1}{\pm 2K\mu} + \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2K\mu(H_e/B_c)} \qquad (25\text{-}9)$$

The plus signs are used for the incomplete projection condition, and the minus signs are used for the incomplete ditch condition.

In Eqs. (25-7) to (25-9),

W_c = load on conduit, in pounds per linear foot;
γ = unit weight of embankment soil, in pounds per cubic foot;
B_c = outside width of conduit, in feet;
H = height of fill above conduit, in feet;
H_e = height of plane of equal settlement, in feet;
K = Rankine's lateral pressure ratio;

25.14. Load-Computation Diagram 675

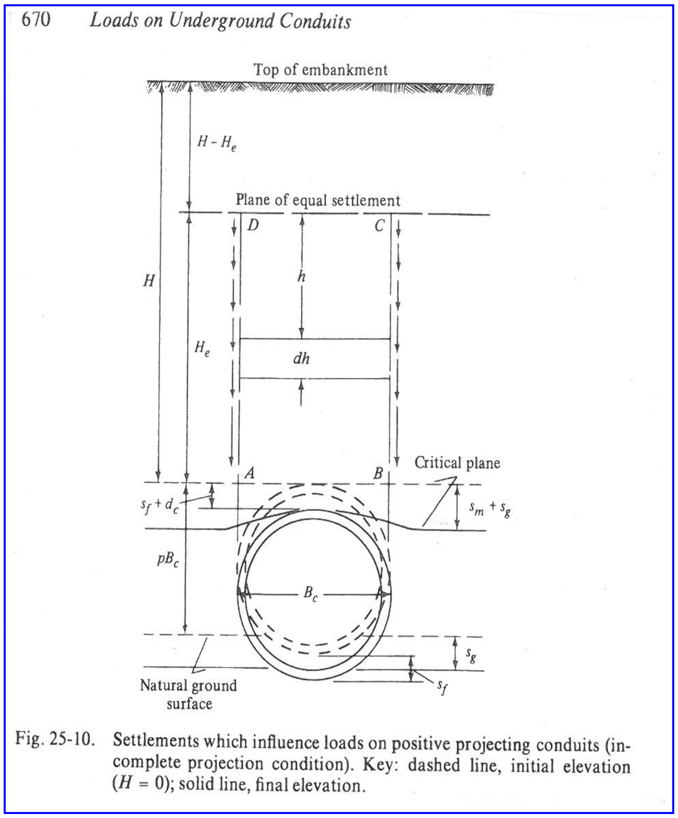
$\mu = \tan\phi$ = coefficient of friction of fill material; and
e = base of natural logarithms.

A formula for evaluating H_e is derived by equating an expression for the sum of the total strain in the interior prism plus the settlement of the top of the conduit to a similar expression for the sum of the total strain in an exterior prism plus the settlement of the critical plane. This formula is

$$\left[\frac{1}{2K\mu} \pm \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) \pm \frac{r_{sd}p}{3}\right] \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2K\mu} \pm \frac{1}{2}\left(\frac{H_e}{B_c}\right)^2$$

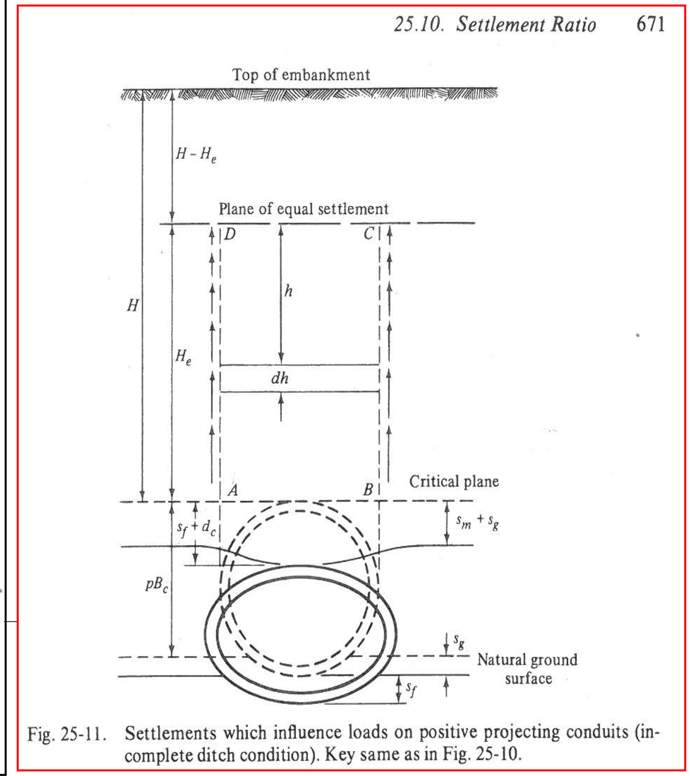
$$\pm \frac{r_{sd}p}{3}\left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2K\mu(H_e/B_c)} - \frac{1}{2K\mu} \cdot \frac{H_e}{B_c} \mp \frac{H}{B_c} \cdot \frac{H_e}{B_c} = \pm r_{sd}p\frac{H}{B_c} \qquad (25\text{-}10)$$

Use the upper signs for the incomplete projection condition, for which the settlement ratio is positive, and use the lower signs for the incomplete ditch condition, for which the settlement ratio is negative.



670 *Loads on Underground Conduits*

Fig. 25-10. Settlements which influence loads on positive projecting conduits (incomplete projection condition). Key: dashed line, initial elevation (H = 0); solid line, final elevation.



25.10. Settlement Ratio 671

Fig. 25-11. Settlements which influence loads on positive projecting conduits (incomplete ditch condition). Key same as in Fig. 25-10.

Once the load on a positive projecting pipe is calculated, the Vertical and Horizontal Pipe Deflection value is calculated using equation 26-7 found in *Soil Engineering* included in Appendix D.

Equation 26-7 Vertical and Horizontal Pipe Deflection = $Dx = (DKW_cr^3)/[(EI)+(0.061E'r^3)]$

Where:

D = Deflection Lag Factor

K = Bedding Constant

W_C = Load on Positive Pipe

r = Radius

E = Pipe Modulus of Elasticity

I = Moment of Inertia

E' = Soils Modulus of Elasticity

4.4 RESULTS

During initial filling activities, the 6-inch diameter SDR 7.3 HDPE pipes will see a calculated maximum deflection of 0.43% due to an applied live load.

Once filing activities are complete, the 6-inch diameter SDR 7.3 HDPE pipes will see a calculated maximum deflection of 5.8% due to an applied dead load.

The maximum allowable deflection for HDPE pipe is 7.5%. Therefore, the leachate collection pipe designed in the lateral expansion is adequately sized. Results are included in Appendix C.

5.0 CONCLUSION

Based on the calculations performed by SCS Engineers, the following piping and associated depth of the final cover are applicable.

- 6-inch SDR 7.3 HDPE piping shall be used to convey leachate from the cell drainage layer to the cell sump

- The depth of fill between the permitted final cover and the top of the leachate collection pipe shall be less than or equal to ~ 400 feet

- The existing 6-inch SDR 11 HDPE piping does not exceed the maximum allowable deflection

Appendix A

HELP Model Summary

American Environmental Landfill
Help Model Version 4.0

		Active (20-ft of Waste)	Interim (120-ft of Waste)	Closed 397-ft of Waste)
General Information	No. of Years	1	15	30
	Ground Cover	Poor	Good	Good
	SCS Runoff Curve Number	97.1	91.3	97.1
	Model Area (Ac)	1	1	1
	Runoff Area (%)	30	50	100
	Max Leaf Area Index	1	1	1
	Evaporative Zone Depth	10	10	10
Intermediate Cover	Thickness (inches)	6	6	12
	Porosity (vol/vol)	0.445	0.445	0.445
	Field Capacity (vol/vol)	0.393	0.393	0.393
	Wilting Point (vol/vol)	0.277	0.277	0.277
	Initial Soil water Content (vol/vol)	0.3567	0.2736	0.2736
	Saturated Hydraulic Conductivity (cm/sec)	1.90E-06	1.90E-06	1.90E-06
Waste	Thickness (inches)	240	960	4764
	Porosity (vol/vol)	0.672	0.671	0.671
	Field Capacity (vol/vol)	0.292	0.292	0.292
	Wilting Point (vol/vol)	0.077	0.077	0.077
	Initial Soil water Content (vol/vol)	0.2888	0.2912	0.292
	Saturated Hydraulic Conductivity (cm/sec)	1.00E-03	1.00E-03	1.00E-03
Leachate Collection Layer	Thickness (inches)	12	12	12
	Porosity (vol/vol)	0.457	0.457	0.457
	Field Capacity (vol/vol)	0.131	0.131	0.131
	Wilting Point (vol/vol)	0.058	0.058	0.058
	Initial Soil water Content (vol/vol)	0.1742	0.1455	0.135
	Saturated Hydraulic Conductivity (cm/sec)	1.00E-03	1.00E-03	1.00E-03
	Slope (ft/ft)	0.5%	0.5%	0.5%
	Reach (ft)	250	250	250
Flexible Membrane Liner	Thickness (inches)	0.06	0.06	0.06
	Saturated Hydraulic Conductivity (cm/sec)	2.00E-13	2.00E-13	2.00E-13
	Pinhole Density (holes/ac)	0.5	0.5	0.5
	Installation Defects (holes/ac)	1	1	1
	Placement Quality	Good	Good	Good
Barrier Soil Liner	Thickness (inches)	24	24	24
	Porosity (vol/vol)	0.427	0.427	0.427
	Field Capacity (vol/vol)	0.418	0.418	0.418
	Wilting Point (vol/vol)	0.367	0.367	0.367
	Initial Soil water Content (vol/vol)	0.427	0.427	0.427
	Saturated Hydraulic Conductivity (cm/sec)	1.00E-07	1.00E-07	1.00E-07
Precipitation	Average Annual (in)	43.62	36.87	37.26
Runoff	Average Annual (in)	14.639	13.369	22.193
Evapotranspiration	Average Annual (in)	28.972	23.487	15.068
Lateral Drainage Collected	Average Annual (cf/ac/day)	249	162.6	31.4
	Peak Daily (cf/ac/day)	0.7291	0.7985	0.2881
Head on Liner	Average Annual (in)	1.6577	1.0817	0.2087
	Peak Daily (in)	2.6312	2.8386	1.1774
Percolation	Average Annual (cf/ac/day)	0.000501	0.000337	0.2664
	Peak Daily (cf/ac/day)	0.0053	0.0058	0.0023

Appendix B

HELP Model Results

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: AEL Lateral Expansion **Simulated On:** 11/29/2022 8:42

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness = 6 inches
Porosity = 0.445 vol/vol
Field Capacity = 0.393 vol/vol
Wilting Point = 0.277 vol/vol
Initial Soil Water Content = 0.3567 vol/vol
Effective Sat. Hyd. Conductivity = 1.90E-06 cm/sec
Note: 100% of drainage collected from Layer 3 is recirculated into this layer.

Layer 2

Type 1 - Vertical Percolation Layer (Waste)
Municipal Solid Waste (MSW) (900 pcy)
Material Texture Number 18

Thickness = 240 inches
Porosity = 0.671 vol/vol
Field Capacity = 0.292 vol/vol
Wilting Point = 0.077 vol/vol
Initial Soil Water Content = 0.2888 vol/vol
Effective Sat. Hyd. Conductivity = 1.00E-03 cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
LFS Loamy Fine Sand
Material Texture Number 5

Thickness = 12 inches
Porosity = 0.457 vol/vol
Field Capacity = 0.131 vol/vol
Wilting Point = 0.058 vol/vol
Initial Soil Water Content = 0.1742 vol/vol
Effective Sat. Hyd. Conductivity = 1.00E-03 cm/sec
Slope = 0.5 %
Drainage Length = 250 ft
Note: 100% of drainage collected from this layer is recirculated into Layer 1.

Layer 4

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness	=	0.06	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	0.5	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness	=	24	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	97.1	
Fraction of Area Allowing Runoff	=	30	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	10	inches
Initial Water in Evaporative Zone	=	2.531	inches
Upper Limit of Evaporative Storage	=	5.354	inches
Lower Limit of Evaporative Storage	=	1.97	inches
Initial Snow Water	=	0	inches
Initial Water in Layer Materials	=	83.781	inches
Total Initial Water	=	83.781	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	36.15	Degrees

Maximum Leaf Area Index = 1
Start of Growing Season (Julian Date) = 74 days
End of Growing Season (Julian Date) = 319 days
Average Wind Speed = 10 mph
Average 1st Quarter Relative Humidity = 63 %
Average 2nd Quarter Relative Humidity = 66 %
Average 3rd Quarter Relative Humidity = 69 %
Average 4th Quarter Relative Humidity = 63 %

Note: Evapotranspiration data was obtained for Sand Springs, Oklahoma

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.360443	1.630784	3.351263	4.428939	4.601378	4.538602
3.993826	2.841239	3.475277	2.797522	2.323377	1.91907

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
44	49	51.8	67	77.1	85.5
91.2	88.2	80.8	71.7	57.6	45.3

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2

Daily Output for Year 1

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 8:42

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.00	0.000	0.039	0.2493	1.5900	0.0002	1.32E-06
2	*		0.00	0.000	0.040	0.2452	1.5894	0.0002	1.32E-06
3	*		0.00	0.000	0.000	0.2453	1.5889	0.0002	1.32E-06
4	*		0.00	0.000	0.000	0.2453	1.5883	0.0002	1.32E-06
5	*		0.00	0.000	0.000	0.2453	1.5877	0.0002	1.32E-06
6	*		0.00	0.000	0.000	0.2453	1.5872	0.0002	1.32E-06
7			0.11	0.000	0.082	0.2477	1.5866	0.0002	1.32E-06
8			0.08	0.000	0.120	0.2437	1.5861	0.0002	1.32E-06
9			0.28	0.034	0.120	0.2519	1.5855	0.0002	1.32E-06
10			0.10	0.000	0.107	0.2563	1.5850	0.0002	1.32E-06
11			0.03	0.000	0.110	0.2488	1.5844	0.0002	1.32E-06
12			0.03	0.000	0.078	0.2444	1.5839	0.0002	1.32E-06
13			0.00	0.000	0.116	0.2329	1.5833	0.0002	1.32E-06
14			0.00	0.000	0.111	0.2218	1.5827	0.0002	1.32E-06
15			0.00	0.000	0.118	0.2100	1.5822	0.0002	1.31E-06
16			0.00	0.000	0.118	0.1982	1.5816	0.0002	1.31E-06
17			0.00	0.000	0.006	0.1976	1.5811	0.0002	1.31E-06
18			0.03	0.000	0.016	0.1995	1.5805	0.0002	1.31E-06
19	*		0.16	0.000	0.051	0.2015	1.5800	0.0002	1.31E-06
20			0.03	0.000	0.082	0.2048	1.5794	0.0002	1.31E-06
21			0.00	0.000	0.026	0.2023	1.5789	0.0002	1.31E-06
22			0.00	0.000	0.028	0.1995	1.5783	0.0002	1.31E-06
23			0.02	0.000	0.018	0.1995	1.5778	0.0002	1.31E-06
24			0.10	0.000	0.010	0.2090	1.5772	0.0002	1.31E-06

25		0.00	0.000	0.013	0.2077	1.5767	0.0002	1.31E-06
26		0.00	0.000	0.016	0.2061	1.5761	0.0002	1.31E-06
27	*	0.00	0.000	0.017	0.2044	1.5756	0.0002	1.31E-06
28		0.00	0.000	0.016	0.2028	1.5750	0.0002	1.31E-06
29		0.00	0.000	0.015	0.2013	1.5745	0.0002	1.31E-06
30		0.00	0.000	0.015	0.1998	1.5739	0.0002	1.31E-06
31	*	0.00	0.000	0.000	0.1998	1.5734	0.0002	1.31E-06
32	*	0.00	0.000	0.000	0.1999	1.5728	0.0002	1.31E-06
33	*	0.00	0.000	0.000	0.1999	1.5723	0.0002	1.31E-06
34	*	0.00	0.000	0.000	0.1999	1.5717	0.0002	1.31E-06
35	*	0.00	0.000	0.000	0.1999	1.5712	0.0002	1.31E-06
36	*	0.00	0.000	0.000	0.1999	1.5706	0.0002	1.31E-06
37	*	0.00	0.000	0.000	0.1999	1.5701	0.0002	1.31E-06
38	*	0.00	0.000	0.000	0.2000	1.5695	0.0002	1.31E-06
39	*	0.00	0.000	0.015	0.1985	1.5690	0.0002	1.30E-06
40	*	0.00	0.000	0.012	0.1974	1.5684	0.0002	1.30E-06
41		0.00	0.000	0.004	0.1970	1.5679	0.0002	1.30E-06
42	*	0.00	0.000	0.000	0.1970	1.5673	0.0002	1.30E-06
43		0.00	0.000	0.000	0.1970	1.5668	0.0002	1.30E-06
44		0.00	0.000	0.000	0.1970	1.5662	0.0002	1.30E-06
45		0.14	0.001	0.012	0.2098	1.5657	0.0002	1.30E-06
46		0.00	0.000	0.010	0.2092	1.5651	0.0002	1.30E-06
47		0.00	0.000	0.010	0.2082	1.5646	0.0002	1.30E-06
48		0.00	0.000	0.011	0.2071	1.5640	0.0002	1.30E-06
49		0.00	0.000	0.010	0.2061	1.5635	0.0002	1.30E-06
50		0.00	0.000	0.010	0.2051	1.5629	0.0002	1.30E-06
51	*	0.00	0.000	0.010	0.2042	1.5624	0.0002	1.30E-06
52		0.00	0.000	0.010	0.2032	1.5618	0.0002	1.30E-06
53		0.02	0.000	0.014	0.2034	1.5613	0.0002	1.30E-06
54		0.00	0.000	0.011	0.2026	1.5607	0.0002	1.30E-06
55		0.06	0.000	0.014	0.2071	1.5602	0.0002	1.30E-06
56		0.00	0.000	0.011	0.2060	1.5596	0.0002	1.30E-06

57		0.00	0.000	0.011	0.2050	1.5591	0.0002	1.30E-06
58		0.00	0.000	0.009	0.2041	1.5586	0.0002	1.30E-06
59	*	0.00	0.000	0.000	0.2041	1.5580	0.0002	1.30E-06
60	*	0.00	0.000	0.008	0.2033	1.5575	0.0002	1.30E-06
61	*	0.00	0.000	0.008	0.2025	1.5569	0.0002	1.30E-06
62	*	0.00	0.000	0.008	0.2017	1.5564	0.0002	1.30E-06
63	*	0.00	0.000	0.013	0.2009	1.5558	0.0002	1.29E-06
64	*	0.04	0.000	0.045	0.2001	1.5553	0.0002	1.29E-06
65		0.00	0.000	0.008	0.1994	1.5547	0.0002	1.29E-06
66		0.00	0.000	0.008	0.1986	1.5542	0.0002	1.29E-06
67		1.67	0.665	0.016	0.2145	1.5537	0.0002	1.29E-06
68		0.00	0.129	0.285	0.2262	1.5531	0.0002	1.29E-06
69		0.00	0.000	0.266	0.2298	1.5526	0.0002	1.29E-06
70		0.00	0.000	0.069	0.2229	1.5520	0.0002	1.29E-06
71		0.38	0.049	0.134	0.2366	1.5515	0.0002	1.29E-06
72		1.05	0.413	0.087	0.2482	1.5509	0.0002	1.29E-06
73		0.00	0.075	0.133	0.2599	1.5504	0.0002	1.29E-06
74	*	0.00	0.006	0.037	0.2715	1.5499	0.0002	1.29E-06
75		0.00	0.000	0.079	0.2651	1.5493	0.0002	1.29E-06
76		0.03	0.000	0.109	0.2569	1.5488	0.0002	1.29E-06
77		1.82	0.766	0.072	0.2698	1.5482	0.0002	1.29E-06
78		0.67	0.469	0.116	0.2814	1.5477	0.0002	1.29E-06
79		0.00	0.171	0.135	0.2930	1.5471	0.0002	1.29E-06
80		0.00	0.059	0.085	0.3047	1.5466	0.0002	1.29E-06
81		0.39	0.102	0.248	0.3163	1.5461	0.0002	1.29E-06
82		0.43	0.132	0.142	0.3279	1.5455	0.0002	1.29E-06
83	*	0.00	0.000	0.087	0.3293	1.5450	0.0002	1.29E-06
84	*	0.23	0.000	0.039	0.3313	1.5444	0.0002	1.29E-06
85		0.00	0.007	0.111	0.3370	1.5439	0.0002	1.29E-06
86		0.48	0.144	0.071	0.3492	1.5434	0.0002	1.29E-06
87		0.00	0.000	0.240	0.3401	1.5428	0.0002	1.28E-06
88		0.00	0.000	0.104	0.3296	1.5423	0.0002	1.28E-06

89	*	0.01	0.000	0.065	0.3238	1.5417	0.0002	1.28E-06
90		0.12	0.000	0.103	0.3248	1.5447	0.0002	1.29E-06
91		0.00	0.000	0.211	0.3037	1.5688	0.0002	1.30E-06
92		0.00	0.000	0.099	0.2938	1.5682	0.0002	1.30E-06
93	*	0.25	0.000	0.043	0.2958	1.5677	0.0002	1.30E-06
94		0.00	0.000	0.095	0.3051	1.5671	0.0002	1.30E-06
95		0.10	0.000	0.115	0.3038	1.5666	0.0002	1.30E-06
96		0.19	0.013	0.198	0.2990	1.5660	0.0002	1.30E-06
97		0.87	0.295	0.112	0.3107	1.5655	0.0002	1.30E-06
98		0.02	0.030	0.170	0.3223	1.5649	0.0002	1.30E-06
99		0.00	0.000	0.190	0.3103	1.5644	0.0002	1.30E-06
100		0.00	0.000	0.267	0.2837	1.5638	0.0002	1.30E-06
101		0.30	0.033	0.270	0.2773	1.5633	0.0002	1.30E-06
102		0.00	0.000	0.181	0.2651	1.5627	0.0002	1.30E-06
103	*	0.10	0.000	0.093	0.2663	1.5622	0.0002	1.30E-06
104		0.00	0.000	0.189	0.2474	1.5617	0.0002	1.30E-06
105		0.00	0.000	0.112	0.2362	1.5611	0.0002	1.30E-06
106		0.00	0.000	0.080	0.2282	1.5606	0.0002	1.30E-06
107		0.00	0.000	0.059	0.2216	1.5600	0.0002	1.30E-06
108		0.00	0.000	0.046	0.2170	1.5831	0.0002	1.32E-06
109		0.00	0.000	0.038	0.2102	1.6287	0.0002	1.35E-06
110		0.00	0.000	0.034	0.2068	1.6735	0.0002	1.38E-06
111		0.46	0.099	0.036	0.2229	1.6741	0.0002	1.38E-06
112		0.27	0.069	0.113	0.2345	1.6746	0.0002	1.39E-06
113		0.00	0.000	0.206	0.2282	1.6740	0.0002	1.38E-06
114		0.00	0.000	0.167	0.2082	1.7135	0.0002	1.41E-06
115		0.00	0.000	0.106	0.1977	1.7714	0.0002	1.46E-06
116		0.00	0.000	0.007	0.1970	1.7708	0.0002	1.46E-06
117		0.00	0.000	0.000	0.1970	1.7702	0.0002	1.46E-06
118		0.00	0.000	0.000	0.1970	1.7696	0.0002	1.46E-06
119	*	0.00	0.000	0.000	0.1970	1.7690	0.0002	1.46E-06
120		0.00	0.000	0.000	0.1970	1.7683	0.0002	1.46E-06

121	0.00	0.000	0.000	0.1970	1.7677	0.0002	1.46E-06
122	0.00	0.000	0.000	0.1970	1.7671	0.0002	1.46E-06
123	0.22	0.024	0.016	0.2094	1.7665	0.0002	1.46E-06
124	0.00	0.000	0.063	0.2084	1.7659	0.0002	1.45E-06
125	0.00	0.000	0.018	0.2066	1.7652	0.0002	1.45E-06
126	0.00	0.000	0.016	0.2051	1.7646	0.0002	1.45E-06
127	0.00	0.000	0.015	0.2036	1.7640	0.0002	1.45E-06
128	0.00	0.000	0.015	0.2021	1.7634	0.0002	1.45E-06
129	0.00	0.000	0.015	0.2006	1.7628	0.0002	1.45E-06
130	0.41	0.081	0.024	0.2163	1.7621	0.0002	1.45E-06
131	0.00	0.000	0.167	0.2144	1.7615	0.0002	1.45E-06
132	0.04	0.000	0.020	0.2167	1.7609	0.0002	1.45E-06
133	0.00	0.000	0.071	0.2096	1.7603	0.0002	1.45E-06
134	0.47	0.110	0.022	0.2241	1.7597	0.0002	1.45E-06
135	0.67	0.256	0.092	0.2357	1.7591	0.0002	1.45E-06
136	0.84	0.343	0.304	0.2474	1.7584	0.0002	1.45E-06
137	0.00	0.058	0.160	0.2590	1.7578	0.0002	1.45E-06
138	0.00	0.000	0.114	0.2611	1.7572	0.0002	1.45E-06
139	0.00	0.000	0.221	0.2390	1.7566	0.0002	1.45E-06
140	0.00	0.000	0.154	0.2236	1.7560	0.0002	1.45E-06
141	0.00	0.000	0.171	0.2065	1.7554	0.0002	1.45E-06
142	0.38	0.043	0.239	0.2105	1.7548	0.0002	1.45E-06
143	0.00	0.000	0.141	0.2025	1.7541	0.0002	1.45E-06
144	0.00	0.000	0.034	0.1991	1.7535	0.0002	1.45E-06
145	0.00	0.000	0.018	0.1973	1.7529	0.0002	1.44E-06
146	0.00	0.000	0.003	0.1970	1.7523	0.0002	1.44E-06
147	0.00	0.000	0.000	0.1970	1.7517	0.0002	1.44E-06
148	0.33	0.051	0.044	0.2107	1.7511	0.0002	1.44E-06
149	0.00	0.000	0.109	0.2092	1.7505	0.0002	1.44E-06
150	0.00	0.000	0.022	0.2070	1.7498	0.0002	1.44E-06
151	0.03	0.000	0.027	0.2075	1.7492	0.0002	1.44E-06
152	0.20	0.023	0.025	0.2183	1.7486	0.0002	1.44E-06

153	0.04	0.000	0.158	0.2112	1.7480	0.0002	1.44E-06
154	0.00	0.000	0.019	0.2092	1.7474	0.0002	1.44E-06
155	0.00	0.000	0.021	0.2071	1.7468	0.0002	1.44E-06
156	0.00	0.000	0.018	0.2053	1.7462	0.0002	1.44E-06
157	0.00	0.000	0.019	0.2035	1.7456	0.0002	1.44E-06
158	0.00	0.000	0.019	0.2016	1.7449	0.0002	1.44E-06
159	0.00	0.000	0.021	0.1995	1.7443	0.0002	1.44E-06
160	0.00	0.000	0.022	0.1973	1.7437	0.0002	1.44E-06
161	0.00	0.000	0.003	0.1970	1.7431	0.0002	1.44E-06
162	0.54	0.133	0.026	0.2130	1.7425	0.0002	1.44E-06
163	0.00	0.000	0.295	0.2052	1.7419	0.0002	1.44E-06
164	0.00	0.000	0.015	0.2037	1.7413	0.0002	1.44E-06
165	1.29	0.480	0.027	0.2188	1.7407	0.0002	1.44E-06
166	0.00	0.047	0.359	0.2305	1.7401	0.0002	1.44E-06
167	0.00	0.000	0.294	0.2121	1.7395	0.0002	1.43E-06
168	0.00	0.000	0.123	0.1998	1.7389	0.0002	1.43E-06
169	0.06	0.000	0.045	0.2014	1.7383	0.0002	1.43E-06
170	0.90	0.273	0.150	0.2132	1.7377	0.0002	1.43E-06
171	0.00	0.015	0.192	0.2249	1.7371	0.0002	1.43E-06
172	0.00	0.000	0.095	0.2190	1.7365	0.0002	1.43E-06
173	0.00	0.000	0.191	0.1999	1.7358	0.0002	1.43E-06
174	0.00	0.000	0.029	0.1974	1.7352	0.0002	1.43E-06
175	0.39	0.047	0.138	0.2108	1.7346	0.0002	1.43E-06
176	0.00	0.000	0.124	0.2051	1.7340	0.0002	1.43E-06
177	0.00	0.000	0.044	0.2007	1.7334	0.0002	1.43E-06
178	0.76	0.225	0.054	0.2164	1.7328	0.0002	1.43E-06
179	0.02	0.000	0.246	0.2269	1.7322	0.0002	1.43E-06
180	0.00	0.000	0.115	0.2154	1.7316	0.0002	1.43E-06
181	0.05	0.000	0.141	0.2064	1.7310	0.0002	1.43E-06
182	0.04	0.000	0.086	0.2016	1.7304	0.0002	1.43E-06
183	0.06	0.000	0.024	0.2052	1.7298	0.0002	1.43E-06
184	0.00	0.000	0.052	0.2000	1.7292	0.0002	1.43E-06

185	1.74	0.683	0.072	0.2150	1.7286	0.0002	1.43E-06
186	0.66	0.335	0.428	0.2266	1.7280	0.0002	1.43E-06
187	0.15	0.069	0.420	0.2383	1.7274	0.0002	1.43E-06
188	0.01	0.000	0.341	0.2206	1.7269	0.0002	1.43E-06
189	0.69	0.115	0.352	0.2335	1.7267	0.0002	1.42E-06
190	0.00	0.000	0.278	0.2147	1.7260	0.0002	1.42E-06
191	0.00	0.000	0.161	0.1987	1.7254	0.0002	1.42E-06
192	0.00	0.000	0.008	0.1978	1.7248	0.0002	1.42E-06
193	0.24	0.028	0.072	0.2058	1.7242	0.0002	1.42E-06
194	0.00	0.000	0.115	0.2003	1.7236	0.0002	1.42E-06
195	0.00	0.000	0.026	0.1977	1.7230	0.0002	1.42E-06
196	0.00	0.000	0.007	0.1970	1.7224	0.0002	1.42E-06
197	0.00	0.000	0.000	0.1970	1.7218	0.0002	1.42E-06
198	0.00	0.000	0.000	0.1970	1.7212	0.0002	1.42E-06
199	0.00	0.000	0.000	0.1970	1.7206	0.0002	1.42E-06
200	0.00	0.000	0.000	0.1970	1.7200	0.0002	1.42E-06
201	0.00	0.000	0.000	0.1970	1.7194	0.0002	1.42E-06
202	0.00	0.000	0.000	0.1970	1.7188	0.0002	1.42E-06
203	0.00	0.000	0.000	0.1970	1.7182	0.0002	1.42E-06
204	0.00	0.000	0.000	0.1970	1.7176	0.0002	1.42E-06
205	0.00	0.000	0.000	0.1970	1.7170	0.0002	1.42E-06
206	0.00	0.000	0.000	0.1970	1.7164	0.0002	1.42E-06
207	0.00	0.000	0.000	0.1970	1.7158	0.0002	1.42E-06
208	0.26	0.036	0.028	0.2096	1.7152	0.0002	1.42E-06
209	0.98	0.349	0.100	0.2210	1.7146	0.0002	1.42E-06
210	0.00	0.031	0.267	0.2326	1.7140	0.0002	1.42E-06
211	0.00	0.000	0.226	0.2173	1.7134	0.0002	1.41E-06
212	0.50	0.057	0.262	0.2304	1.7128	0.0002	1.41E-06
213	0.20	0.025	0.116	0.2366	1.7122	0.0002	1.41E-06
214	0.00	0.000	0.115	0.2299	1.7116	0.0002	1.41E-06
215	0.00	0.000	0.207	0.2093	1.7110	0.0002	1.41E-06
216	0.00	0.000	0.097	0.1996	1.7104	0.0002	1.41E-06

217	0.03	0.000	0.032	0.1992	1.7098	0.0002	1.41E-06
218	0.17	0.009	0.078	0.2057	1.7092	0.0002	1.41E-06
219	0.00	0.000	0.055	0.2021	1.7086	0.0002	1.41E-06
220	0.00	0.000	0.038	0.1984	1.7080	0.0002	1.41E-06
221	0.00	0.000	0.011	0.1973	1.7074	0.0002	1.41E-06
222	0.12	0.000	0.013	0.2083	1.7068	0.0002	1.41E-06
223	0.01	0.000	0.020	0.2069	1.7062	0.0002	1.41E-06
224	0.00	0.000	0.021	0.2048	1.7056	0.0002	1.41E-06
225	0.00	0.000	0.022	0.2026	1.7050	0.0002	1.41E-06
226	0.00	0.000	0.022	0.2005	1.7044	0.0002	1.41E-06
227	0.00	0.000	0.022	0.1983	1.7038	0.0002	1.41E-06
228	0.00	0.000	0.011	0.1973	1.7032	0.0002	1.41E-06
229	0.00	0.000	0.003	0.1970	1.7026	0.0002	1.41E-06
230	0.00	0.000	0.000	0.1970	1.7020	0.0002	1.41E-06
231	0.00	0.000	0.000	0.1970	1.7014	0.0002	1.41E-06
232	0.00	0.000	0.000	0.1970	1.7008	0.0002	1.41E-06
233	0.00	0.000	0.000	0.1970	1.7002	0.0002	1.40E-06
234	0.00	0.000	0.000	0.1970	1.6997	0.0002	1.40E-06
235	0.00	0.000	0.000	0.1970	1.6991	0.0002	1.40E-06
236	0.07	0.000	0.010	0.2033	1.6985	0.0002	1.40E-06
237	0.00	0.000	0.016	0.2018	1.6979	0.0002	1.40E-06
238	0.00	0.000	0.021	0.1996	1.6973	0.0002	1.40E-06
239	0.00	0.000	0.009	0.1987	1.6967	0.0002	1.40E-06
240	0.00	0.000	0.009	0.1979	1.6961	0.0002	1.40E-06
241	0.00	0.000	0.005	0.1974	1.6955	0.0002	1.40E-06
242	0.00	0.000	0.003	0.1971	1.6949	0.0002	1.40E-06
243	0.00	0.000	0.001	0.1970	1.6943	0.0002	1.40E-06
244	0.23	0.027	0.016	0.2097	1.6937	0.0002	1.40E-06
245	0.00	0.000	0.072	0.2082	1.6931	0.0002	1.40E-06
246	0.00	0.000	0.022	0.2060	1.6925	0.0002	1.40E-06
247	0.00	0.000	0.022	0.2039	1.6919	0.0002	1.40E-06
248	0.00	0.000	0.018	0.2022	1.6913	0.0002	1.40E-06

249	0.07	0.000	0.028	0.2068	1.6907	0.0002	1.40E-06
250	0.14	0.002	0.027	0.2170	1.6902	0.0002	1.40E-06
251	0.44	0.114	0.030	0.2281	1.6896	0.0002	1.40E-06
252	1.50	0.610	0.289	0.2397	1.6890	0.0002	1.40E-06
253	0.99	0.542	0.185	0.2514	1.6884	0.0002	1.40E-06
254	0.00	0.110	0.338	0.2630	1.6878	0.0002	1.40E-06
255	0.35	0.066	0.445	0.2683	1.6872	0.0002	1.39E-06
256	0.51	0.149	0.146	0.2800	1.6866	0.0002	1.39E-06
257	0.00	0.000	0.138	0.2802	1.6860	0.0002	1.39E-06
258	0.00	0.000	0.089	0.2713	1.6854	0.0002	1.39E-06
259	0.00	0.000	0.167	0.2547	1.6848	0.0002	1.39E-06
260	0.00	0.000	0.176	0.2372	1.6842	0.0002	1.39E-06
261	1.04	0.295	0.255	0.2519	1.6836	0.0002	1.39E-06
262	0.69	0.233	0.322	0.2636	1.6831	0.0002	1.39E-06
263	0.00	0.008	0.215	0.2752	1.6825	0.0002	1.39E-06
264	0.00	0.000	0.294	0.2478	1.6819	0.0002	1.39E-06
265	0.00	0.000	0.151	0.2327	1.6813	0.0002	1.39E-06
266	0.00	0.000	0.110	0.2219	1.6807	0.0002	1.39E-06
267	1.21	0.420	0.093	0.2375	1.6801	0.0002	1.39E-06
268	0.24	0.144	0.200	0.2492	1.6795	0.0002	1.39E-06
269	0.00	0.002	0.204	0.2608	1.6789	0.0002	1.39E-06
270	0.00	0.000	0.311	0.2302	1.6783	0.0002	1.39E-06
271	0.00	0.000	0.199	0.2102	1.6778	0.0002	1.39E-06
272	0.00	0.000	0.126	0.1976	1.6781	0.0002	1.39E-06
273	0.17	0.007	0.043	0.2080	1.6778	0.0002	1.39E-06
274	0.03	0.000	0.099	0.2028	1.6772	0.0002	1.39E-06
275	0.87	0.251	0.159	0.2158	1.6766	0.0002	1.39E-06
276	0.15	0.048	0.205	0.2274	1.6760	0.0002	1.39E-06
277	0.00	0.000	0.177	0.2209	1.6754	0.0002	1.39E-06
278	1.42	0.505	0.231	0.2338	1.6749	0.0002	1.39E-06
279	0.00	0.066	0.222	0.2455	1.6743	0.0002	1.39E-06
280	0.00	0.000	0.179	0.2429	1.6737	0.0002	1.38E-06

281		0.00	0.000	0.075	0.2355	1.6731	0.0002	1.38E-06
282		0.00	0.000	0.086	0.2269	1.6725	0.0002	1.38E-06
283		0.00	0.000	0.109	0.2160	1.6719	0.0002	1.38E-06
284		0.00	0.000	0.128	0.2033	1.6713	0.0002	1.38E-06
285		0.15	0.000	0.093	0.2089	1.6708	0.0002	1.38E-06
286		0.00	0.000	0.084	0.2005	1.6702	0.0002	1.38E-06
287		0.00	0.000	0.026	0.1979	1.6696	0.0002	1.38E-06
288		0.00	0.000	0.009	0.1971	1.6690	0.0002	1.38E-06
289		0.00	0.000	0.001	0.1970	1.6684	0.0002	1.38E-06
290		1.26	0.455	0.054	0.2131	1.6678	0.0002	1.38E-06
291		0.20	0.153	0.172	0.2248	1.6672	0.0002	1.38E-06
292		0.00	0.009	0.206	0.2364	1.6667	0.0002	1.38E-06
293		0.00	0.000	0.177	0.2209	1.6661	0.0002	1.38E-06
294		0.00	0.000	0.110	0.2099	1.6655	0.0002	1.38E-06
295		0.00	0.000	0.067	0.2033	1.6649	0.0002	1.38E-06
296		0.00	0.000	0.053	0.1980	1.6643	0.0002	1.38E-06
297	*	0.00	0.000	0.005	0.1974	1.6639	0.0002	1.38E-06
298		0.00	0.000	0.002	0.1972	1.6637	0.0002	1.38E-06
299	*	0.00	0.000	0.002	0.1970	1.6632	0.0002	1.38E-06
300	*	0.00	0.000	0.000	0.1970	1.6626	0.0002	1.38E-06
301	*	0.14	0.000	0.022	0.1990	1.6620	0.0002	1.38E-06
302	*	0.04	0.000	0.000	0.2010	1.6614	0.0002	1.38E-06
303		0.90	0.364	0.000	0.2137	1.6608	0.0002	1.37E-06
304		0.79	0.404	0.085	0.2254	1.6602	0.0002	1.37E-06
305		0.01	0.156	0.082	0.2370	1.6597	0.0002	1.37E-06
306		0.10	0.076	0.100	0.2486	1.6591	0.0002	1.37E-06
307		0.00	0.000	0.157	0.2506	1.6585	0.0002	1.37E-06
308		0.00	0.000	0.176	0.2330	1.6579	0.0002	1.37E-06
309		0.00	0.000	0.093	0.2237	1.6573	0.0002	1.37E-06
310		0.00	0.000	0.092	0.2145	1.6568	0.0002	1.37E-06
311		0.00	0.000	0.107	0.2038	1.6562	0.0002	1.37E-06
312		0.00	0.000	0.061	0.1977	1.6556	0.0002	1.37E-06

313		0.00	0.000	0.005	0.1972	1.6550	0.0002	1.37E-06
314		0.00	0.000	0.002	0.1970	1.6544	0.0002	1.37E-06
315		0.24	0.031	0.033	0.2084	1.6539	0.0002	1.37E-06
316		0.05	0.000	0.088	0.2112	1.6533	0.0002	1.37E-06
317		1.01	0.354	0.046	0.2237	1.6527	0.0002	1.37E-06
318		0.00	0.045	0.215	0.2354	1.6521	0.0002	1.37E-06
319		0.10	0.000	0.137	0.2417	1.6515	0.0002	1.37E-06
320		0.53	0.147	0.072	0.2549	1.6510	0.0002	1.37E-06
321		0.00	0.000	0.130	0.2595	1.6504	0.0002	1.37E-06
322		0.00	0.000	0.065	0.2531	1.6498	0.0002	1.37E-06
323		0.00	0.000	0.091	0.2440	1.6492	0.0002	1.37E-06
324		0.00	0.000	0.084	0.2355	1.6487	0.0002	1.37E-06
325		0.00	0.000	0.095	0.2260	1.6481	0.0002	1.37E-06
326		0.00	0.000	0.169	0.2092	1.6475	0.0002	1.36E-06
327		0.00	0.000	0.102	0.1990	1.6469	0.0002	1.36E-06
328		0.00	0.000	0.010	0.1980	1.6464	0.0002	1.36E-06
329		0.00	0.000	0.010	0.1970	1.6458	0.0002	1.36E-06
330		0.00	0.000	0.000	0.1970	1.6452	0.0002	1.36E-06
331		0.80	0.241	0.044	0.2133	1.6446	0.0002	1.36E-06
332		0.00	0.012	0.193	0.2250	1.6441	0.0002	1.36E-06
333		0.00	0.000	0.107	0.2170	1.6435	0.0002	1.36E-06
334		0.00	0.000	0.073	0.2098	1.6429	0.0002	1.36E-06
335		0.00	0.000	0.048	0.2050	1.6423	0.0002	1.36E-06
336		0.00	0.000	0.052	0.1998	1.6418	0.0002	1.36E-06
337		0.00	0.000	0.027	0.1972	1.6412	0.0002	1.36E-06
338		0.00	0.000	0.001	0.1971	1.6406	0.0002	1.36E-06
339		0.00	0.000	0.001	0.1970	1.6400	0.0002	1.36E-06
340	*	0.20	0.000	0.036	0.1990	1.6395	0.0002	1.36E-06
341		0.00	0.000	0.053	0.2079	1.6389	0.0002	1.36E-06
342		0.00	0.000	0.031	0.2048	1.6383	0.0002	1.36E-06
343		0.00	0.000	0.057	0.1991	1.6377	0.0002	1.36E-06
344		0.01	0.000	0.023	0.1975	1.6372	0.0002	1.36E-06

345		0.01	0.000	0.014	0.1970	1.6366	0.0002	1.36E-06
346		0.16	0.004	0.025	0.2089	1.6360	0.0002	1.36E-06
347		0.00	0.000	0.025	0.2073	1.6355	0.0002	1.36E-06
348		0.00	0.000	0.022	0.2051	1.6349	0.0002	1.36E-06
349		0.00	0.000	0.020	0.2031	1.6343	0.0002	1.35E-06
350		0.00	0.000	0.019	0.2013	1.6337	0.0002	1.35E-06
351		0.00	0.000	0.017	0.1996	1.6332	0.0002	1.35E-06
352	*	0.49	0.000	0.023	0.2015	1.6326	0.0002	1.35E-06
353		0.88	0.504	0.000	0.2156	1.6320	0.0002	1.35E-06
354	*	0.00	0.000	0.031	0.2156	1.6315	0.0002	1.35E-06
355	*	0.00	0.000	0.015	0.2157	1.6309	0.0002	1.35E-06
356	*	0.01	0.137	0.043	0.2295	1.6303	0.0002	1.35E-06
357		0.00	0.040	0.071	0.2411	1.6297	0.0002	1.35E-06
358		0.00	0.000	0.126	0.2378	1.6292	0.0002	1.35E-06
359		0.00	0.000	0.068	0.2310	1.6286	0.0002	1.35E-06
360	*	0.21	0.000	0.040	0.2330	1.6280	0.0002	1.35E-06
361		0.00	0.000	0.077	0.2402	1.6275	0.0002	1.35E-06
362	*	0.00	0.000	0.040	0.2362	1.6269	0.0002	1.35E-06
363		0.66	0.189	0.095	0.2496	1.6263	0.0002	1.35E-06
364		0.00	0.012	0.083	0.2613	1.6257	0.0002	1.35E-06
365		0.00	0.000	0.112	0.2528	1.6252	0.0002	1.35E-06

* = Frozen (air or soil)

Annual Totals for Year 1

	inches	cubic feet	percent
Precipitation	43.62	158,339.0	100.00
Runoff	14.639	53,138.5	33.56
Evapotranspiration	28.972	105,169.8	66.42
Recirculation into Layer 1	0.0686	249.0	0.16
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0686	249.0	0.16
Percolation/Leakage through Layer 5	0.000501	1.8185	0.00
Average Head on Top of Layer 4	1.6577	---	---
Change in Water Storage	0.0079	28.8	0.02
Soil Water at Start of Year	83.7814	304,126.3	192.07
Soil Water at End of Year	83.7893	304,155.1	192.09
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0686	-249.0	-0.16

Average Annual Totals Summary

Title: AEL Lateral Expansion
Simulated on: 11/29/2022 8:42

	Average Annual Totals for Years 1 - 1*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	43.62	[0]	158,339.0	100.00
Runoff	14.639	[0]	53,138.5	33.56
Evapotranspiration	28.972	[0]	105,169.8	66.42
Subprofile1				
Recirculation into Layer 1	0.0686	[0]	249.0	0.16
Lateral drainage collected from Layer 3	0.0000	[0]	0.0000	0.00
Drainage recirculated from Layer 3	0.0686	[0]	249.0	0.16
Percolation/leakage through Layer 5	0.000501	[0]	1.8185	0.00
Average Head on Top of Layer 4	1.6577		---	---
Water storage				
Change in water storage	0.0079		28.8	0.02

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: AEL Lateral Expansion

Simulated on: 11/29/2022 8:42

	Peak Values for Years 1 - 1*		
	(inches)		(cubic feet)
Precipitation	1.82		6,601.4
Runoff	0.766		2,779.8
Subprofile1			
Drainage Recirculated into Layer 1	0.0002		0.7291
Drainage collected from Layer 3	0.0000		0.0000
Drainage recirculated from Layer 3	0.0002		0.7291
Percolation/leakage through Layer 5	0.000001		0.0053
Average head on Layer 4	1.7714		---
Maximum head on Layer 4	2.6312		---
Location of maximum head in Layer 3	64.32	(feet from drain)	
Other Parameters			
Snow water	0.6786		2,463.4
Maximum vegetation soil water	0.3492	(vol/vol)	
Minimum vegetation soil water	0.1970	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: AEL Lateral Expansion
Simulated on: 11/29/2022 8:42
Simulation period: 1 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	2.1370	0.3562
2	69.3027	0.2888
3	2.1017	0.1751
4	0.0000	0.0000
5	10.2480	0.4270
Snow water	0.0000	---

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: AEL Lateral Expansion **Simulated On:** 11/29/2022 9:52

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness = 6 inches
Porosity = 0.445 vol/vol
Field Capacity = 0.393 vol/vol
Wilting Point = 0.277 vol/vol
Initial Soil Water Content = 0.2736 vol/vol
Effective Sat. Hyd. Conductivity = 1.90E-06 cm/sec

Note: 100% of drainage collected from Layer 3 is recirculated into this layer.

Layer 2

Type 1 - Vertical Percolation Layer (Waste)
Municipal Solid Waste (MSW) (900 pcy)
Material Texture Number 18

Thickness = 960 inches
Porosity = 0.671 vol/vol
Field Capacity = 0.292 vol/vol
Wilting Point = 0.077 vol/vol
Initial Soil Water Content = 0.2912 vol/vol
Effective Sat. Hyd. Conductivity = 1.00E-03 cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
LFS Loamy Fine Sand
Material Texture Number 5

Thickness = 12 inches
Porosity = 0.457 vol/vol
Field Capacity = 0.131 vol/vol
Wilting Point = 0.058 vol/vol
Initial Soil Water Content = 0.1455 vol/vol
Effective Sat. Hyd. Conductivity = 1.00E-03 cm/sec
Slope = 0.5 %
Drainage Length = 250 ft

Note: 100% of drainage collected from this layer is recirculated into Layer 1.

Layer 4

Type 4 - Flexible Membrane Liner

HDPE Membrane

Material Texture Number 35

Thickness	=	0.06	inches
Effective Sat. Hyd. Conductivity	=	2.00E-13	cm/sec
FML Pinhole Density	=	0.5	Holes/Acre
FML Installation Defects	=	1	Holes/Acre
FML Placement Quality	=	3	Good

Layer 5

Type 3 - Barrier Soil Liner

Liner Soil (High)

Material Texture Number 16

Thickness	=	24	inches
Porosity	=	0.427	vol/vol
Field Capacity	=	0.418	vol/vol
Wilting Point	=	0.367	vol/vol
Initial Soil Water Content	=	0.427	vol/vol
Effective Sat. Hyd. Conductivity	=	1.00E-07	cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number	=	91.3	
Fraction of Area Allowing Runoff	=	50	%
Area projected on a horizontal plane	=	1	acres
Evaporative Zone Depth	=	10	inches
Initial Water in Evaporative Zone	=	2.029	inches
Upper Limit of Evaporative Storage	=	5.354	inches
Lower Limit of Evaporative Storage	=	1.97	inches
Initial Snow Water	=	0.336473	inches
Initial Water in Layer Materials	=	293.176	inches
Total Initial Water	=	293.512	inches
Total Subsurface Inflow	=	0	inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude	=	36.15	Degrees

Maximum Leaf Area Index = 1
Start of Growing Season (Julian Date) = 74 days
End of Growing Season (Julian Date) = 319 days
Average Wind Speed = 10 mph
Average 1st Quarter Relative Humidity = 63 %
Average 2nd Quarter Relative Humidity = 66 %
Average 3rd Quarter Relative Humidity = 69 %
Average 4th Quarter Relative Humidity = 63 %

Note: Evapotranspiration data was obtained for Sand Springs, Oklahoma

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.468211	1.918381	3.381085	4.035513	4.605293	4.860243
3.293734	2.881958	3.652511	3.642077	2.361213	1.992999

Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
43.4	43.7	56.7	66.7	78.1	87.7
90.7	89.2	81.7	70.8	57.2	48.8

Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2

Daily Output for Year 1

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.048	0.113	0.2157	0.5348	0.0001	4.87E-07
2			0.00	0.000	0.055	0.2150	0.5346	0.0001	4.87E-07
3			0.00	0.000	0.010	0.2140	0.5344	0.0001	4.86E-07
4			0.00	0.000	0.010	0.2131	0.5342	0.0001	4.86E-07
5			0.00	0.000	0.010	0.2121	0.5340	0.0001	4.86E-07
6			0.00	0.000	0.009	0.2112	0.5338	0.0001	4.86E-07
7			0.00	0.000	0.009	0.2103	0.5336	0.0001	4.86E-07
8			0.00	0.000	0.009	0.2094	0.5335	0.0001	4.86E-07
9			0.00	0.000	0.009	0.2085	0.5333	0.0001	4.85E-07
10			0.00	0.000	0.009	0.2076	0.5331	0.0001	4.85E-07
11			0.00	0.000	0.009	0.2068	0.5329	0.0001	4.85E-07
12			0.00	0.000	0.008	0.2059	0.5327	0.0001	4.85E-07
13	*		0.00	0.000	0.008	0.2051	0.5325	0.0001	4.85E-07
14	*		0.00	0.000	0.000	0.2051	0.5323	0.0001	4.85E-07
15	*		0.00	0.000	0.000	0.2051	0.5321	0.0001	4.84E-07
16	*		0.00	0.000	0.000	0.2051	0.5320	0.0001	4.84E-07
17	*		0.00	0.000	0.008	0.2043	0.5318	0.0001	4.84E-07
18			0.00	0.000	0.008	0.2035	0.5316	0.0001	4.84E-07
19			0.00	0.000	0.008	0.2027	0.5314	0.0001	4.84E-07
20			0.00	0.000	0.008	0.2019	0.5312	0.0001	4.84E-07
21			0.00	0.000	0.008	0.2012	0.5310	0.0001	4.84E-07
22			0.00	0.000	0.008	0.2004	0.5308	0.0001	4.83E-07
23			0.00	0.000	0.006	0.1998	0.5307	0.0001	4.83E-07
24			0.00	0.000	0.009	0.1989	0.5305	0.0001	4.83E-07

25		0.00	0.000	0.009	0.1980	0.5303	0.0001	4.83E-07
26		0.00	0.000	0.009	0.1971	0.5301	0.0001	4.83E-07
27		0.00	0.000	0.001	0.1970	0.5299	0.0001	4.83E-07
28		0.01	0.000	0.006	0.1977	0.5297	0.0001	4.82E-07
29		0.00	0.000	0.001	0.1976	0.5295	0.0001	4.82E-07
30		0.00	0.000	0.005	0.1975	0.5294	0.0001	4.82E-07
31		0.00	0.000	0.001	0.1974	0.5292	0.0001	4.82E-07
32		0.00	0.000	0.002	0.1973	0.5290	0.0001	4.82E-07
33		0.00	0.000	0.002	0.1971	0.5288	0.0001	4.82E-07
34		0.00	0.000	0.001	0.1970	0.5286	0.0001	4.82E-07
35		0.00	0.000	0.000	0.1970	0.5284	0.0001	4.81E-07
36		0.00	0.000	0.000	0.1970	0.5282	0.0001	4.81E-07
37		0.32	0.080	0.016	0.2116	0.5281	0.0001	4.81E-07
38		0.00	0.000	0.084	0.2112	0.5279	0.0001	4.81E-07
39		0.00	0.000	0.006	0.2106	0.5277	0.0001	4.81E-07
40		0.02	0.000	0.012	0.2114	0.5275	0.0001	4.81E-07
41		0.00	0.000	0.006	0.2108	0.5273	0.0001	4.80E-07
42		0.00	0.000	0.008	0.2100	0.5271	0.0001	4.80E-07
43		0.00	0.000	0.007	0.2094	0.5269	0.0001	4.80E-07
44	*	0.02	0.000	0.030	0.2087	0.5268	0.0001	4.80E-07
45	*	0.00	0.000	0.000	0.2087	0.5266	0.0001	4.80E-07
46	*	0.00	0.000	0.000	0.2087	0.5264	0.0001	4.80E-07
47	*	0.00	0.000	0.000	0.2088	0.5262	0.0001	4.80E-07
48	*	0.00	0.000	0.000	0.2088	0.5260	0.0001	4.79E-07
49	*	0.13	0.000	0.028	0.2107	0.5258	0.0001	4.79E-07
50	*	0.07	0.000	0.000	0.2127	0.5257	0.0001	4.79E-07
51		0.37	0.146	0.085	0.2254	0.5255	0.0001	4.79E-07
52		0.07	0.003	0.091	0.2371	0.5253	0.0001	4.79E-07
53		0.53	0.123	0.187	0.2487	0.5251	0.0001	4.79E-07
54		0.00	0.000	0.105	0.2486	0.5250	0.0001	4.79E-07
55		0.00	0.000	0.064	0.2422	0.5248	0.0001	4.78E-07
56		0.00	0.000	0.113	0.2309	0.5246	0.0001	4.78E-07

57	*	0.00	0.000	0.047	0.2262	0.5245	0.0001	4.78E-07
58	*	0.00	0.000	0.000	0.2262	0.5243	0.0001	4.78E-07
59		0.26	0.045	0.080	0.2353	0.5241	0.0001	4.78E-07
60		0.00	0.000	0.200	0.2197	0.5239	0.0001	4.78E-07
61		0.00	0.000	0.074	0.2123	0.5237	0.0001	4.77E-07
62		0.00	0.000	0.133	0.1990	0.5238	0.0001	4.78E-07
63		0.00	0.000	0.015	0.1976	0.5238	0.0001	4.78E-07
64		0.00	0.000	0.006	0.1970	0.5237	0.0001	4.77E-07
65		0.00	0.000	0.000	0.1970	0.5235	0.0001	4.77E-07
66		0.31	0.066	0.044	0.2107	0.5233	0.0001	4.77E-07
67		0.28	0.061	0.105	0.2223	0.5231	0.0001	4.77E-07
68		0.00	0.000	0.114	0.2171	0.5229	0.0001	4.77E-07
69	*	0.17	0.000	0.088	0.2191	0.5227	0.0001	4.77E-07
70		0.12	0.000	0.087	0.2293	0.5226	0.0001	4.77E-07
71		0.00	0.000	0.098	0.2195	0.5224	0.0001	4.76E-07
72		0.00	0.000	0.176	0.2019	0.5222	0.0001	4.76E-07
73		0.10	0.000	0.055	0.2068	0.5220	0.0001	4.76E-07
74		0.53	0.164	0.064	0.2202	0.5218	0.0001	4.76E-07
75		0.00	0.000	0.172	0.2194	0.5217	0.0001	4.76E-07
76		0.00	0.000	0.083	0.2111	0.5215	0.0001	4.76E-07
77		0.06	0.000	0.102	0.2064	0.5213	0.0001	4.75E-07
78		0.29	0.047	0.064	0.2191	0.5211	0.0001	4.75E-07
79		0.00	0.000	0.126	0.2111	0.5209	0.0001	4.75E-07
80	*	0.36	0.000	0.038	0.2131	0.5207	0.0001	4.75E-07
81		0.02	0.069	0.063	0.2259	0.5206	0.0001	4.75E-07
82		0.00	0.000	0.146	0.2182	0.5204	0.0001	4.75E-07
83		0.15	0.001	0.134	0.2198	0.5202	0.0001	4.75E-07
84		0.10	0.000	0.158	0.2137	0.5200	0.0001	4.74E-07
85		0.00	0.000	0.088	0.2049	0.5198	0.0001	4.74E-07
86		0.00	0.000	0.039	0.2010	0.5196	0.0001	4.74E-07
87		0.03	0.000	0.035	0.2001	0.5195	0.0001	4.74E-07
88		0.00	0.000	0.016	0.1984	0.5193	0.0001	4.74E-07

89	0.00	0.000	0.006	0.1978	0.5191	0.0001	4.74E-07
90	0.00	0.000	0.005	0.1973	0.5189	0.0001	4.73E-07
91	0.04	0.000	0.010	0.2000	0.5187	0.0001	4.73E-07
92	0.07	0.000	0.009	0.2060	0.5186	0.0001	4.73E-07
93	0.00	0.000	0.011	0.2050	0.5184	0.0001	4.73E-07
94	0.00	0.000	0.014	0.2035	0.5182	0.0001	4.73E-07
95	0.00	0.000	0.015	0.2021	0.5180	0.0001	4.73E-07
96	0.00	0.000	0.014	0.2007	0.5178	0.0001	4.73E-07
97	0.04	0.000	0.020	0.2025	0.5176	0.0001	4.72E-07
98	0.00	0.000	0.013	0.2012	0.5175	0.0001	4.72E-07
99	0.00	0.000	0.011	0.2001	0.5173	0.0001	4.72E-07
100	0.00	0.000	0.011	0.1990	0.5171	0.0001	4.72E-07
101	0.05	0.000	0.010	0.2027	0.5169	0.0001	4.72E-07
102	0.00	0.000	0.008	0.2019	0.5167	0.0001	4.72E-07
103	0.14	0.001	0.014	0.2139	0.5166	0.0001	4.72E-07
104	0.00	0.000	0.008	0.2132	0.5164	0.0001	4.71E-07
105	0.08	0.000	0.017	0.2193	0.5162	0.0001	4.71E-07
106	0.29	0.069	0.022	0.2326	0.5160	0.0001	4.71E-07
107	0.10	0.000	0.087	0.2402	0.5158	0.0001	4.71E-07
108	0.00	0.000	0.011	0.2391	0.5157	0.0001	4.71E-07
109	0.00	0.000	0.013	0.2378	0.5155	0.0001	4.71E-07
110	0.00	0.000	0.012	0.2366	0.5153	0.0001	4.70E-07
111	0.03	0.000	0.018	0.2381	0.5151	0.0001	4.70E-07
112	0.00	0.000	0.012	0.2369	0.5149	0.0001	4.70E-07
113	0.00	0.000	0.014	0.2355	0.5148	0.0001	4.70E-07
114	0.01	0.000	0.018	0.2349	0.5146	0.0001	4.70E-07
115	0.17	0.016	0.019	0.2470	0.5145	0.0001	4.70E-07
116	0.00	0.000	0.113	0.2372	0.5144	0.0001	4.70E-07
117	0.00	0.000	0.014	0.2359	0.5143	0.0001	4.70E-07
118	0.04	0.000	0.021	0.2377	0.5141	0.0001	4.69E-07
119	0.00	0.000	0.016	0.2362	0.5139	0.0001	4.69E-07
120	0.00	0.000	0.013	0.2348	0.5137	0.0001	4.69E-07

121	0.25	0.047	0.022	0.2484	0.5135	0.0001	4.69E-07
122	0.08	0.000	0.283	0.2332	0.5134	0.0001	4.69E-07
123	0.00	0.000	0.016	0.2316	0.5132	0.0001	4.69E-07
124	0.00	0.000	0.019	0.2300	0.5130	0.0001	4.69E-07
125	0.19	0.023	0.019	0.2428	0.5128	0.0001	4.68E-07
126	0.00	0.000	0.235	0.2216	0.5127	0.0001	4.68E-07
127	0.30	0.071	0.021	0.2353	0.5125	0.0001	4.68E-07
128	1.41	0.730	0.123	0.2469	0.5123	0.0001	4.68E-07
129	0.07	0.159	0.151	0.2586	0.5121	0.0001	4.68E-07
130	0.43	0.147	0.207	0.2702	0.5120	0.0001	4.68E-07
131	0.33	0.079	0.194	0.2818	0.5118	0.0001	4.68E-07
132	0.73	0.355	0.128	0.2934	0.5116	0.0001	4.67E-07
133	1.11	0.703	0.098	0.3051	0.5114	0.0001	4.67E-07
134	0.43	0.279	0.200	0.3167	0.5113	0.0001	4.67E-07
135	0.00	0.000	0.332	0.3047	0.5111	0.0001	4.67E-07
136	0.00	0.000	0.145	0.2902	0.5109	0.0001	4.67E-07
137	0.06	0.000	0.157	0.2808	0.5107	0.0001	4.67E-07
138	0.01	0.000	0.144	0.2675	0.5105	0.0001	4.66E-07
139	0.74	0.219	0.171	0.2822	0.5104	0.0001	4.66E-07
140	0.01	0.000	0.309	0.2728	0.5102	0.0001	4.66E-07
141	0.00	0.000	0.221	0.2507	0.5100	0.0001	4.66E-07
142	0.00	0.000	0.143	0.2364	0.5098	0.0001	4.66E-07
143	0.00	0.000	0.124	0.2240	0.5096	0.0001	4.66E-07
144	0.00	0.000	0.168	0.2072	0.5095	0.0001	4.66E-07
145	0.01	0.000	0.068	0.1983	0.5549	0.0001	5.03E-07
146	0.18	0.018	0.045	0.2083	0.5940	0.0001	5.36E-07
147	0.00	0.000	0.050	0.2054	0.5938	0.0001	5.36E-07
148	0.34	0.071	0.055	0.2201	0.5936	0.0001	5.35E-07
149	0.28	0.030	0.247	0.2242	0.5934	0.0001	5.35E-07
150	0.13	0.000	0.144	0.2256	0.5932	0.0001	5.35E-07
151	0.26	0.028	0.208	0.2255	0.5930	0.0001	5.35E-07
152	0.00	0.000	0.199	0.2085	0.5928	0.0001	5.35E-07

153	0.00	0.000	0.071	0.2014	0.5925	0.0001	5.35E-07
154	0.00	0.000	0.033	0.1981	0.5923	0.0001	5.34E-07
155	0.00	0.000	0.006	0.1975	0.5921	0.0001	5.34E-07
156	0.00	0.000	0.003	0.1973	0.5919	0.0001	5.34E-07
157	0.00	0.000	0.003	0.1970	0.5917	0.0001	5.34E-07
158	0.00	0.000	0.000	0.1970	0.5915	0.0001	5.34E-07
159	0.00	0.000	0.000	0.1970	0.5913	0.0001	5.34E-07
160	0.30	0.063	0.036	0.2102	0.5911	0.0001	5.33E-07
161	0.02	0.000	0.084	0.2106	0.5909	0.0001	5.33E-07
162	0.00	0.000	0.020	0.2086	0.5907	0.0001	5.33E-07
163	0.00	0.000	0.017	0.2069	0.5905	0.0001	5.33E-07
164	0.00	0.000	0.020	0.2049	0.5903	0.0001	5.33E-07
165	0.32	0.070	0.030	0.2196	0.5901	0.0001	5.33E-07
166	0.00	0.000	0.160	0.2107	0.5899	0.0001	5.32E-07
167	0.12	0.000	0.029	0.2202	0.5896	0.0001	5.32E-07
168	0.00	0.000	0.024	0.2178	0.5894	0.0001	5.32E-07
169	0.03	0.000	0.026	0.2179	0.5892	0.0001	5.32E-07
170	0.00	0.000	0.019	0.2160	0.5890	0.0001	5.32E-07
171	0.70	0.279	0.030	0.2293	0.5888	0.0001	5.31E-07
172	0.04	0.000	0.365	0.2234	0.5886	0.0001	5.31E-07
173	1.56	0.660	0.342	0.2352	0.5884	0.0001	5.31E-07
174	0.51	0.325	0.198	0.2469	0.5882	0.0001	5.31E-07
175	1.21	0.717	0.213	0.2585	0.5880	0.0001	5.31E-07
176	0.05	0.002	0.408	0.2701	0.5878	0.0001	5.31E-07
177	0.01	0.000	0.143	0.2566	0.5876	0.0001	5.30E-07
178	0.22	0.027	0.279	0.2450	0.5874	0.0001	5.30E-07
179	0.15	0.008	0.132	0.2478	0.5872	0.0001	5.30E-07
180	0.00	0.000	0.202	0.2284	0.5870	0.0001	5.30E-07
181	0.00	0.000	0.260	0.2024	0.5868	0.0001	5.30E-07
182	0.00	0.000	0.043	0.1981	0.5866	0.0001	5.30E-07
183	0.00	0.000	0.011	0.1970	0.5863	0.0001	5.29E-07
184	0.00	0.000	0.000	0.1970	0.5861	0.0001	5.29E-07

185	0.00	0.000	0.000	0.1970	0.5859	0.0001	5.29E-07
186	0.00	0.000	0.000	0.1970	0.5857	0.0001	5.29E-07
187	0.00	0.000	0.000	0.1970	0.5855	0.0001	5.29E-07
188	0.11	0.000	0.011	0.2071	0.5853	0.0001	5.29E-07
189	0.00	0.000	0.016	0.2055	0.5851	0.0001	5.28E-07
190	0.00	0.000	0.021	0.2034	0.5849	0.0001	5.28E-07
191	0.00	0.000	0.024	0.2010	0.5847	0.0001	5.28E-07
192	0.00	0.000	0.021	0.1990	0.5845	0.0001	5.28E-07
193	0.00	0.000	0.017	0.1973	0.5843	0.0001	5.28E-07
194	0.00	0.000	0.003	0.1970	0.5841	0.0001	5.28E-07
195	1.07	0.468	0.033	0.2128	0.5839	0.0001	5.27E-07
196	0.03	0.061	0.207	0.2244	0.5837	0.0001	5.27E-07
197	0.00	0.000	0.196	0.2110	0.5835	0.0001	5.27E-07
198	0.00	0.000	0.119	0.1991	0.5833	0.0001	5.27E-07
199	0.00	0.000	0.021	0.1970	0.5831	0.0001	5.27E-07
200	0.11	0.000	0.019	0.2066	0.5829	0.0001	5.27E-07
201	0.36	0.078	0.073	0.2193	0.5827	0.0001	5.26E-07
202	0.04	0.000	0.114	0.2199	0.5825	0.0001	5.26E-07
203	0.00	0.000	0.098	0.2100	0.5823	0.0001	5.26E-07
204	0.13	0.000	0.110	0.2119	0.5820	0.0001	5.26E-07
205	0.04	0.000	0.058	0.2101	0.5818	0.0001	5.26E-07
206	0.00	0.000	0.027	0.2074	0.5816	0.0001	5.26E-07
207	0.00	0.000	0.035	0.2040	0.5814	0.0001	5.25E-07
208	2.09	1.110	0.047	0.2187	0.5812	0.0001	5.25E-07
209	0.00	0.197	0.279	0.2304	0.5810	0.0001	5.25E-07
210	0.00	0.000	0.215	0.2286	0.5808	0.0001	5.25E-07
211	0.00	0.000	0.220	0.2066	0.5806	0.0001	5.25E-07
212	0.00	0.000	0.086	0.1979	0.5804	0.0001	5.25E-07
213	0.00	0.000	0.005	0.1974	0.5802	0.0001	5.24E-07
214	0.00	0.000	0.002	0.1972	0.5800	0.0001	5.24E-07
215	0.00	0.000	0.002	0.1970	0.5798	0.0001	5.24E-07
216	0.28	0.050	0.060	0.2092	0.5796	0.0001	5.24E-07

217	0.00	0.000	0.074	0.2069	0.5794	0.0001	5.24E-07
218	0.00	0.000	0.036	0.2033	0.5792	0.0001	5.24E-07
219	0.00	0.000	0.038	0.1995	0.5790	0.0001	5.23E-07
220	0.00	0.000	0.017	0.1979	0.5788	0.0001	5.23E-07
221	0.00	0.000	0.009	0.1970	0.5786	0.0001	5.23E-07
222	0.44	0.122	0.044	0.2124	0.5784	0.0001	5.23E-07
223	0.00	0.000	0.141	0.2105	0.5782	0.0001	5.23E-07
224	0.00	0.000	0.023	0.2082	0.5780	0.0001	5.23E-07
225	0.01	0.000	0.033	0.2055	0.5778	0.0001	5.22E-07
226	0.00	0.000	0.026	0.2029	0.5776	0.0001	5.22E-07
227	0.00	0.000	0.034	0.1995	0.5774	0.0001	5.22E-07
228	0.00	0.000	0.019	0.1976	0.5772	0.0001	5.22E-07
229	0.06	0.000	0.019	0.2012	0.5770	0.0001	5.22E-07
230	0.07	0.000	0.015	0.2065	0.5768	0.0001	5.22E-07
231	0.00	0.000	0.018	0.2047	0.5766	0.0001	5.21E-07
232	0.00	0.000	0.024	0.2023	0.5764	0.0001	5.21E-07
233	0.00	0.000	0.026	0.1997	0.5762	0.0001	5.21E-07
234	0.00	0.000	0.017	0.1979	0.5760	0.0001	5.21E-07
235	0.00	0.000	0.008	0.1971	0.5758	0.0001	5.21E-07
236	0.00	0.000	0.001	0.1970	0.5756	0.0001	5.21E-07
237	0.00	0.000	0.000	0.1970	0.5754	0.0001	5.20E-07
238	0.09	0.000	0.011	0.2046	0.5752	0.0001	5.20E-07
239	0.00	0.000	0.016	0.2031	0.5750	0.0001	5.20E-07
240	0.01	0.000	0.020	0.2018	0.5747	0.0001	5.20E-07
241	0.00	0.000	0.023	0.1995	0.5745	0.0001	5.20E-07
242	0.00	0.000	0.011	0.1984	0.5743	0.0001	5.20E-07
243	0.00	0.000	0.009	0.1975	0.5741	0.0001	5.19E-07
244	0.00	0.000	0.004	0.1971	0.5739	0.0001	5.19E-07
245	0.00	0.000	0.001	0.1970	0.5737	0.0001	5.19E-07
246	0.00	0.000	0.000	0.1970	0.5735	0.0001	5.19E-07
247	0.00	0.000	0.000	0.1970	0.5733	0.0001	5.19E-07
248	0.00	0.000	0.000	0.1970	0.5731	0.0001	5.19E-07

249		0.00	0.000	0.000	0.1970	0.5729	0.0001	5.18E-07
250		0.00	0.000	0.000	0.1970	0.5727	0.0001	5.18E-07
251		0.00	0.000	0.000	0.1970	0.5725	0.0001	5.18E-07
252		0.00	0.000	0.000	0.1970	0.5723	0.0001	5.18E-07
253		0.00	0.000	0.000	0.1970	0.5721	0.0001	5.18E-07
254		0.00	0.000	0.000	0.1970	0.5719	0.0001	5.18E-07
255		0.00	0.000	0.000	0.1970	0.5717	0.0001	5.17E-07
256		0.09	0.000	0.011	0.2052	0.5715	0.0001	5.17E-07
257		0.00	0.000	0.007	0.2045	0.5713	0.0001	5.17E-07
258		0.04	0.000	0.018	0.2063	0.5711	0.0001	5.17E-07
259		0.00	0.000	0.010	0.2052	0.5709	0.0001	5.17E-07
260		0.00	0.000	0.009	0.2043	0.5707	0.0001	5.17E-07
261		0.00	0.000	0.011	0.2032	0.5705	0.0001	5.16E-07
262		0.79	0.321	0.028	0.2171	0.5703	0.0001	5.16E-07
263		0.00	0.000	0.313	0.2162	0.5701	0.0001	5.16E-07
264		0.00	0.000	0.095	0.2067	0.5699	0.0001	5.16E-07
265		0.00	0.000	0.059	0.2008	0.5697	0.0001	5.16E-07
266		0.00	0.000	0.038	0.1970	0.5695	0.0001	5.16E-07
267	*	0.00	0.000	0.000	0.1970	0.5693	0.0001	5.15E-07
268	*	0.01	0.000	0.015	0.1970	0.5691	0.0001	5.15E-07
269	*	0.12	0.000	0.086	0.1990	0.5689	0.0001	5.15E-07
270		0.26	0.033	0.116	0.2081	0.5687	0.0001	5.15E-07
271		0.00	0.000	0.110	0.2004	0.5685	0.0001	5.15E-07
272		0.00	0.000	0.025	0.1979	0.5683	0.0001	5.15E-07
273		0.00	0.000	0.009	0.1971	0.5681	0.0001	5.14E-07
274		0.00	0.000	0.001	0.1970	0.5679	0.0001	5.14E-07
275		0.00	0.000	0.000	0.1970	0.5677	0.0001	5.14E-07
276		0.00	0.000	0.000	0.1970	0.5675	0.0001	5.14E-07
277		0.00	0.000	0.000	0.1970	0.5673	0.0001	5.14E-07
278		0.42	0.112	0.038	0.2131	0.5671	0.0001	5.14E-07
279		0.05	0.000	0.169	0.2121	0.5669	0.0001	5.13E-07
280		0.52	0.178	0.038	0.2250	0.5667	0.0001	5.13E-07

281		0.00	0.000	0.138	0.2289	0.5665	0.0001	5.13E-07
282	*	0.01	0.000	0.040	0.2257	0.5663	0.0001	5.13E-07
283		0.07	0.000	0.060	0.2271	0.5661	0.0001	5.13E-07
284		0.00	0.000	0.090	0.2181	0.5660	0.0001	5.13E-07
285		0.00	0.000	0.143	0.2038	0.5658	0.0001	5.12E-07
286		0.00	0.000	0.054	0.1984	0.5656	0.0001	5.12E-07
287		0.00	0.000	0.007	0.1977	0.5654	0.0001	5.12E-07
288		0.00	0.000	0.004	0.1974	0.5652	0.0001	5.12E-07
289		0.00	0.000	0.004	0.1970	0.5650	0.0001	5.12E-07
290		0.00	0.000	0.000	0.1970	0.5648	0.0001	5.12E-07
291		0.00	0.000	0.000	0.1970	0.5646	0.0001	5.11E-07
292		0.00	0.000	0.000	0.1970	0.5644	0.0001	5.11E-07
293		0.00	0.000	0.000	0.1970	0.5642	0.0001	5.11E-07
294		0.00	0.000	0.000	0.1970	0.5640	0.0001	5.11E-07
295		0.00	0.000	0.000	0.1970	0.5638	0.0001	5.11E-07
296		0.00	0.000	0.000	0.1970	0.5636	0.0001	5.11E-07
297		0.38	0.098	0.032	0.2128	0.5634	0.0001	5.10E-07
298		0.53	0.225	0.066	0.2244	0.5632	0.0001	5.10E-07
299		0.00	0.000	0.177	0.2290	0.5630	0.0001	5.10E-07
300		0.00	0.000	0.078	0.2214	0.5628	0.0001	5.10E-07
301		0.00	0.000	0.111	0.2103	0.5626	0.0001	5.10E-07
302		0.00	0.000	0.114	0.1989	0.5624	0.0001	5.10E-07
303		0.00	0.000	0.015	0.1974	0.5622	0.0001	5.09E-07
304		0.00	0.000	0.002	0.1972	0.5620	0.0001	5.09E-07
305		0.00	0.000	0.002	0.1970	0.5618	0.0001	5.09E-07
306	*	0.00	0.000	0.000	0.1970	0.5616	0.0001	5.09E-07
307		0.72	0.257	0.048	0.2133	0.5614	0.0001	5.09E-07
308	*	0.00	0.000	0.030	0.2133	0.5612	0.0001	5.09E-07
309	*	1.01	0.000	0.021	0.2248	0.5610	0.0001	5.08E-07
310		0.38	0.468	0.000	0.2371	0.5608	0.0001	5.08E-07
311		0.08	0.472	0.001	0.2487	0.5606	0.0001	5.08E-07
312		0.00	0.037	0.180	0.2603	0.5604	0.0001	5.08E-07

313		0.00	0.000	0.081	0.2560	0.5602	0.0001	5.08E-07
314		0.01	0.000	0.129	0.2443	0.5600	0.0001	5.08E-07
315		0.07	0.000	0.121	0.2390	0.5598	0.0001	5.08E-07
316		0.07	0.000	0.093	0.2362	0.5596	0.0001	5.07E-07
317		0.12	0.000	0.091	0.2389	0.5594	0.0001	5.07E-07
318		0.00	0.000	0.064	0.2325	0.5594	0.0001	5.07E-07
319		0.00	0.000	0.131	0.2194	0.5593	0.0001	5.07E-07
320		0.09	0.000	0.063	0.2218	0.5591	0.0001	5.07E-07
321		0.00	0.000	0.087	0.2131	0.5589	0.0001	5.07E-07
322		0.00	0.000	0.094	0.2037	0.5588	0.0001	5.07E-07
323		0.00	0.000	0.060	0.1977	0.5586	0.0001	5.06E-07
324	*	0.00	0.000	0.006	0.1972	0.5587	0.0001	5.07E-07
325		0.29	0.051	0.067	0.2098	0.5587	0.0001	5.07E-07
326		0.49	0.142	0.140	0.2214	0.5585	0.0001	5.06E-07
327		0.00	0.000	0.118	0.2237	0.5583	0.0001	5.06E-07
328		0.01	0.000	0.041	0.2206	0.5596	0.0001	5.07E-07
329	*	0.00	0.000	0.001	0.2206	0.5603	0.0001	5.08E-07
330		0.03	0.000	0.065	0.2168	0.5601	0.0001	5.08E-07
331		0.00	0.000	0.066	0.2103	0.5599	0.0001	5.08E-07
332		0.03	0.000	0.062	0.2072	0.5597	0.0001	5.07E-07
333		0.17	0.011	0.057	0.2160	0.5595	0.0001	5.07E-07
334		0.00	0.000	0.049	0.2122	0.5593	0.0001	5.07E-07
335	*	0.00	0.000	0.000	0.2123	0.5591	0.0001	5.07E-07
336	*	0.00	0.000	0.028	0.2094	0.5589	0.0001	5.07E-07
337		0.00	0.000	0.057	0.2037	0.5587	0.0001	5.07E-07
338		0.00	0.000	0.053	0.1984	0.5585	0.0001	5.06E-07
339		0.00	0.000	0.014	0.1970	0.5583	0.0001	5.06E-07
340		0.00	0.000	0.000	0.1970	0.5581	0.0001	5.06E-07
341		0.00	0.000	0.000	0.1970	0.5579	0.0001	5.06E-07
342		0.00	0.000	0.000	0.1970	0.5577	0.0001	5.06E-07
343		0.00	0.000	0.000	0.1970	0.5575	0.0001	5.06E-07
344		0.00	0.000	0.000	0.1970	0.5574	0.0001	5.05E-07

345		0.00	0.000	0.000	0.1970	0.5572	0.0001	5.05E-07
346		0.00	0.000	0.000	0.1970	0.5570	0.0001	5.05E-07
347		0.00	0.000	0.000	0.1970	0.5568	0.0001	5.05E-07
348		0.00	0.000	0.000	0.1970	0.5566	0.0001	5.05E-07
349		0.00	0.000	0.000	0.1970	0.5564	0.0001	5.05E-07
350		0.00	0.000	0.000	0.1970	0.5562	0.0001	5.04E-07
351	*	0.00	0.000	0.000	0.1970	0.5560	0.0001	5.04E-07
352		0.00	0.000	0.000	0.1970	0.5558	0.0001	5.04E-07
353		0.00	0.000	0.000	0.1970	0.5556	0.0001	5.04E-07
354		0.00	0.000	0.000	0.1970	0.5554	0.0001	5.04E-07
355		0.00	0.000	0.000	0.1970	0.5552	0.0001	5.04E-07
356		0.00	0.000	0.000	0.1970	0.5550	0.0001	5.04E-07
357		0.00	0.000	0.000	0.1970	0.5548	0.0001	5.03E-07
358		0.00	0.000	0.000	0.1970	0.5546	0.0001	5.03E-07
359		0.00	0.000	0.000	0.1970	0.5544	0.0001	5.03E-07
360	*	0.00	0.000	0.000	0.1970	0.5542	0.0001	5.03E-07
361	*	0.00	0.000	0.000	0.1970	0.5540	0.0001	5.03E-07
362	*	0.00	0.000	0.000	0.1970	0.5538	0.0001	5.03E-07
363	*	0.20	0.000	0.030	0.1990	0.5537	0.0001	5.02E-07
364	*	0.30	0.000	0.028	0.2010	0.5535	0.0001	5.02E-07
365	*	0.00	0.000	0.040	0.2029	0.5533	0.0001	5.02E-07

* = Frozen (air or soil)

Annual Totals for Year 1			
	inches	cubic feet	percent
Precipitation	30.28	109,914.3	100.00
Runoff	10.539	38,258.0	34.81
Evapotranspiration	19.734	71,634.0	65.17
Recirculation into Layer 1	0.0229	83.0	0.08
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0229	83.0	0.08
Percolation/Leakage through Layer 5	0.000183	0.6642	0.00
Average Head on Top of Layer 4	0.5524	---	---
Change in Water Storage	0.0060	21.7	0.02
Soil Water at Start of Year	293.1757	1,064,227.9	968.23
Soil Water at End of Year	293.1817	1,064,249.6	968.25
Snow Water at Start of Year	0.3365	1,221.4	1.11
Snow Water at End of Year	0.3365	1,221.4	1.11
Annual Water Budget Balance	-0.0229	-83.0	-0.08

Daily Output for Year 2

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.093	0.023	0.2157	0.5531	0.0001	5.02E-07
2			0.00	0.000	0.070	0.2180	0.5529	0.0001	5.02E-07
3			0.00	0.000	0.010	0.2170	0.5527	0.0001	5.02E-07
4			0.00	0.000	0.010	0.2160	0.5525	0.0001	5.01E-07
5	*		0.00	0.000	0.000	0.2160	0.5523	0.0001	5.01E-07
6	*		0.00	0.000	0.000	0.2160	0.5521	0.0001	5.01E-07
7	*		0.00	0.000	0.000	0.2160	0.5519	0.0001	5.01E-07
8	*		0.00	0.000	0.000	0.2160	0.5517	0.0001	5.01E-07
9	*		0.68	0.000	0.030	0.2180	0.5515	0.0001	5.01E-07
10	*		0.03	0.000	0.027	0.2200	0.5513	0.0001	5.00E-07
11	*		0.06	0.000	0.000	0.2219	0.5511	0.0001	5.00E-07
12	*		0.00	0.000	0.020	0.2239	0.5509	0.0001	5.00E-07
13	*		0.00	0.000	0.035	0.2259	0.5507	0.0001	5.00E-07
14			0.00	0.200	0.037	0.2386	0.5506	0.0001	5.00E-07
15			0.00	0.000	0.101	0.2477	0.5504	0.0001	5.00E-07
16			0.00	0.000	0.054	0.2423	0.5502	0.0001	4.99E-07
17			0.00	0.000	0.055	0.2368	0.5500	0.0001	4.99E-07
18	*		0.00	0.000	0.000	0.2368	0.5498	0.0001	4.99E-07
19			0.00	0.000	0.068	0.2300	0.5496	0.0001	4.99E-07
20			0.00	0.000	0.081	0.2219	0.5494	0.0001	4.99E-07
21			0.00	0.000	0.096	0.2123	0.5492	0.0001	4.99E-07
22			0.00	0.000	0.145	0.1978	0.5490	0.0001	4.99E-07
23			0.00	0.000	0.004	0.1974	0.5488	0.0001	4.98E-07
24	*		0.00	0.000	0.000	0.1974	0.5486	0.0001	4.98E-07

25	*	*	0.00	0.000	0.000	0.1974	0.5484	0.0001	4.98E-07
26		*	0.05	0.000	0.009	0.2014	0.5482	0.0001	4.98E-07
27		*	0.00	0.000	0.000	0.2014	0.5481	0.0001	4.98E-07
28		*	0.01	0.000	0.004	0.2015	0.5479	0.0001	4.98E-07
29			0.09	0.000	0.018	0.2088	0.5477	0.0001	4.97E-07
30			0.00	0.000	0.020	0.2069	0.5475	0.0001	4.97E-07
31			0.09	0.000	0.031	0.2123	0.5473	0.0001	4.97E-07
32			0.00	0.000	0.017	0.2106	0.5471	0.0001	4.97E-07
33	*		0.00	0.000	0.020	0.2086	0.5469	0.0001	4.97E-07
34	*		0.01	0.000	0.033	0.2067	0.5467	0.0001	4.97E-07
35	*		0.00	0.000	0.000	0.2067	0.5465	0.0001	4.96E-07
36	*		0.00	0.000	0.000	0.2067	0.5463	0.0001	4.96E-07
37	*		0.00	0.000	0.000	0.2067	0.5461	0.0001	4.96E-07
38			0.00	0.000	0.017	0.2050	0.5459	0.0001	4.96E-07
39	*		0.00	0.000	0.000	0.2050	0.5458	0.0001	4.96E-07
40			0.00	0.000	0.016	0.2034	0.5456	0.0001	4.96E-07
41			0.00	0.000	0.015	0.2019	0.5454	0.0001	4.96E-07
42			0.49	0.153	0.030	0.2175	0.5452	0.0001	4.95E-07
43			1.30	0.686	0.114	0.2292	0.5450	0.0001	4.95E-07
44			0.00	0.139	0.146	0.2408	0.5448	0.0001	4.95E-07
45			0.00	0.000	0.151	0.2396	0.5446	0.0001	4.95E-07
46			0.32	0.034	0.135	0.2514	0.5444	0.0001	4.95E-07
47			0.00	0.000	0.114	0.2438	0.5443	0.0001	4.95E-07
48			0.15	0.005	0.114	0.2465	0.5441	0.0001	4.94E-07
49			0.00	0.000	0.249	0.2222	0.5439	0.0001	4.94E-07
50			0.00	0.000	0.125	0.2097	0.5437	0.0001	4.94E-07
51	*		0.01	0.000	0.057	0.2052	0.5435	0.0001	4.94E-07
52	*		0.00	0.000	0.000	0.2052	0.5433	0.0001	4.94E-07
53	*		0.00	0.000	0.060	0.1992	0.5431	0.0001	4.94E-07
54	*		0.00	0.000	0.000	0.1992	0.5429	0.0001	4.93E-07
55	*		0.00	0.000	0.000	0.1993	0.5428	0.0001	4.93E-07
56			0.54	0.123	0.131	0.2155	0.5426	0.0001	4.93E-07

57		0.00	0.000	0.120	0.2158	0.5424	0.0001	4.93E-07
58		0.00	0.000	0.060	0.2098	0.5422	0.0001	4.93E-07
59	*	0.00	0.000	0.000	0.2098	0.5420	0.0001	4.93E-07
60		0.00	0.000	0.079	0.2018	0.5431	0.0001	4.94E-07
61	*	0.00	0.000	0.000	0.2018	0.5437	0.0001	4.94E-07
62	*	0.00	0.000	0.000	0.2018	0.5435	0.0001	4.94E-07
63	*	0.18	0.000	0.054	0.2038	0.5433	0.0001	4.94E-07
64		0.31	0.087	0.105	0.2178	0.5431	0.0001	4.94E-07
65	*	0.04	0.000	0.087	0.2214	0.5429	0.0001	4.93E-07
66		0.00	0.000	0.075	0.2139	0.5427	0.0001	4.93E-07
67		0.00	0.000	0.036	0.2103	0.5425	0.0001	4.93E-07
68	*	0.00	0.000	0.057	0.2046	0.5423	0.0001	4.93E-07
69		0.01	0.000	0.051	0.2000	0.5421	0.0001	4.93E-07
70		0.00	0.000	0.030	0.1970	0.5420	0.0001	4.93E-07
71	*	0.00	0.000	0.001	0.1970	0.5418	0.0001	4.93E-07
72	*	0.08	0.000	0.047	0.1990	0.5416	0.0001	4.92E-07
73	*	0.59	0.000	0.000	0.2010	0.5414	0.0001	4.92E-07
74		0.82	0.706	0.000	0.2137	0.5412	0.0001	4.92E-07
75		0.00	0.074	0.309	0.2253	0.5410	0.0001	4.92E-07
76		0.00	0.000	0.114	0.2213	0.5408	0.0001	4.92E-07
77		0.57	0.154	0.133	0.2348	0.5406	0.0001	4.92E-07
78	*	0.31	0.000	0.037	0.2377	0.5404	0.0001	4.91E-07
79		0.00	0.059	0.076	0.2510	0.5402	0.0001	4.91E-07
80		0.01	0.000	0.119	0.2523	0.5401	0.0001	4.91E-07
81		0.00	0.000	0.077	0.2446	0.5399	0.0001	4.91E-07
82		0.00	0.000	0.107	0.2339	0.5397	0.0001	4.91E-07
83		0.05	0.000	0.210	0.2182	0.5395	0.0001	4.91E-07
84		0.17	0.013	0.146	0.2183	0.5393	0.0001	4.90E-07
85		0.38	0.042	0.192	0.2299	0.5391	0.0001	4.90E-07
86		0.00	0.000	0.228	0.2113	0.5389	0.0001	4.90E-07
87		0.00	0.000	0.111	0.2002	0.5392	0.0001	4.90E-07
88		0.00	0.000	0.028	0.1974	0.5392	0.0001	4.90E-07

89		0.01	0.000	0.009	0.1972	0.5391	0.0001	4.90E-07
90		0.71	0.243	0.067	0.2135	0.5389	0.0001	4.90E-07
91		0.00	0.000	0.178	0.2190	0.5387	0.0001	4.90E-07
92		0.00	0.000	0.056	0.2134	0.5385	0.0001	4.90E-07
93		0.00	0.000	0.112	0.2023	0.5383	0.0001	4.90E-07
94		0.00	0.000	0.037	0.1985	0.5381	0.0001	4.89E-07
95		0.00	0.000	0.015	0.1971	0.5379	0.0001	4.89E-07
96		0.00	0.000	0.000	0.1970	0.5377	0.0001	4.89E-07
97		0.00	0.000	0.000	0.1970	0.5375	0.0001	4.89E-07
98		0.54	0.163	0.053	0.2133	0.5374	0.0001	4.89E-07
99	*	0.05	0.011	0.033	0.2249	0.5372	0.0001	4.89E-07
100	*	0.00	0.000	0.054	0.2249	0.5370	0.0001	4.89E-07
101	*	0.00	0.000	0.000	0.2249	0.5368	0.0001	4.88E-07
102	*	0.00	0.000	0.066	0.2183	0.5366	0.0001	4.88E-07
103	*	0.03	0.000	0.092	0.2119	0.5364	0.0001	4.88E-07
104	*	0.00	0.000	0.005	0.2119	0.5362	0.0001	4.88E-07
105		0.00	0.000	0.060	0.2059	0.5360	0.0001	4.88E-07
106		0.00	0.000	0.071	0.1989	0.5359	0.0001	4.88E-07
107		0.00	0.000	0.017	0.1972	0.5357	0.0001	4.87E-07
108		0.00	0.000	0.001	0.1971	0.5355	0.0001	4.87E-07
109		0.00	0.000	0.001	0.1970	0.5353	0.0001	4.87E-07
110		0.00	0.000	0.000	0.1970	0.5351	0.0001	4.87E-07
111		0.00	0.000	0.000	0.1970	0.5349	0.0001	4.87E-07
112		0.13	0.000	0.011	0.2088	0.5347	0.0001	4.87E-07
113		0.00	0.000	0.012	0.2076	0.5345	0.0001	4.86E-07
114		0.00	0.000	0.014	0.2063	0.5344	0.0001	4.86E-07
115		0.00	0.000	0.016	0.2047	0.5342	0.0001	4.86E-07
116		0.00	0.000	0.016	0.2031	0.5340	0.0001	4.86E-07
117		0.57	0.193	0.031	0.2184	0.5338	0.0001	4.86E-07
118		0.00	0.000	0.214	0.2161	0.5336	0.0001	4.86E-07
119		0.00	0.000	0.118	0.2044	0.5334	0.0001	4.86E-07
120		0.00	0.000	0.057	0.1990	0.5332	0.0001	4.85E-07

121	0.61	0.190	0.067	0.2152	0.5330	0.0001	4.85E-07
122	0.00	0.000	0.278	0.2061	0.5329	0.0001	4.85E-07
123	0.00	0.000	0.031	0.2030	0.5327	0.0001	4.85E-07
124	0.00	0.000	0.023	0.2007	0.5325	0.0001	4.85E-07
125	0.00	0.000	0.028	0.1979	0.5323	0.0001	4.85E-07
126	0.00	0.000	0.009	0.1970	0.5321	0.0001	4.84E-07
127	0.01	0.000	0.009	0.1974	0.5319	0.0001	4.84E-07
128	0.12	0.000	0.011	0.2084	0.5317	0.0001	4.84E-07
129	0.09	0.000	0.019	0.2159	0.5316	0.0001	4.84E-07
130	0.87	0.380	0.032	0.2289	0.5314	0.0001	4.84E-07
131	1.50	0.759	0.477	0.2405	0.5312	0.0001	4.84E-07
132	0.05	0.000	0.423	0.2515	0.5310	0.0001	4.84E-07
133	0.00	0.000	0.164	0.2350	0.5308	0.0001	4.83E-07
134	0.00	0.000	0.307	0.2043	0.5306	0.0001	4.83E-07
135	0.50	0.041	0.292	0.2169	0.5304	0.0001	4.83E-07
136	0.00	0.000	0.207	0.2003	0.5302	0.0001	4.83E-07
137	0.00	0.000	0.021	0.1982	0.5301	0.0001	4.83E-07
138	0.25	0.049	0.046	0.2084	0.5299	0.0001	4.83E-07
139	0.03	0.000	0.077	0.2083	0.5297	0.0001	4.82E-07
140	0.30	0.062	0.047	0.2213	0.5295	0.0001	4.82E-07
141	0.37	0.061	0.192	0.2330	0.5293	0.0001	4.82E-07
142	0.01	0.000	0.299	0.2098	0.5291	0.0001	4.82E-07
143	0.00	0.000	0.113	0.1985	0.5289	0.0001	4.82E-07
144	0.00	0.000	0.012	0.1973	0.5288	0.0001	4.82E-07
145	0.00	0.000	0.001	0.1971	0.5286	0.0001	4.82E-07
146	0.00	0.000	0.001	0.1970	0.5284	0.0001	4.81E-07
147	0.00	0.000	0.000	0.1970	0.5282	0.0001	4.81E-07
148	0.00	0.000	0.000	0.1970	0.5280	0.0001	4.81E-07
149	0.12	0.000	0.012	0.2081	0.5278	0.0001	4.81E-07
150	0.00	0.000	0.012	0.2069	0.5277	0.0001	4.81E-07
151	0.36	0.095	0.036	0.2208	0.5275	0.0001	4.81E-07
152	0.05	0.000	0.117	0.2230	0.5273	0.0001	4.80E-07

153	0.99	0.459	0.034	0.2359	0.5271	0.0001	4.80E-07
154	0.00	0.000	0.268	0.2461	0.5269	0.0001	4.80E-07
155	0.06	0.000	0.082	0.2437	0.5267	0.0001	4.80E-07
156	0.00	0.000	0.181	0.2258	0.5265	0.0001	4.80E-07
157	0.00	0.000	0.167	0.2091	0.5264	0.0001	4.80E-07
158	0.17	0.005	0.163	0.2086	0.5262	0.0001	4.80E-07
159	0.01	0.000	0.087	0.2010	0.5262	0.0001	4.80E-07
160	0.17	0.008	0.082	0.2078	0.5267	0.0001	4.80E-07
161	0.46	0.066	0.225	0.2192	0.5265	0.0001	4.80E-07
162	0.03	0.000	0.100	0.2187	0.5292	0.0001	4.82E-07
163	0.10	0.000	0.062	0.2222	0.5308	0.0001	4.83E-07
164	0.00	0.000	0.096	0.2126	0.5306	0.0001	4.83E-07
165	0.11	0.000	0.137	0.2103	0.5304	0.0001	4.83E-07
166	0.03	0.000	0.103	0.2033	0.5302	0.0001	4.83E-07
167	0.09	0.000	0.044	0.2080	0.5300	0.0001	4.83E-07
168	0.02	0.000	0.041	0.2059	0.5299	0.0001	4.83E-07
169	0.68	0.251	0.056	0.2189	0.5297	0.0001	4.82E-07
170	0.00	0.000	0.194	0.2236	0.5295	0.0001	4.82E-07
171	0.00	0.000	0.118	0.2118	0.5293	0.0001	4.82E-07
172	0.10	0.000	0.108	0.2110	0.5291	0.0001	4.82E-07
173	0.27	0.032	0.152	0.2161	0.5289	0.0001	4.82E-07
174	0.48	0.022	0.483	0.2152	0.5287	0.0001	4.82E-07
175	0.07	0.000	0.195	0.2043	0.5286	0.0001	4.82E-07
176	0.20	0.026	0.096	0.2098	0.5284	0.0001	4.81E-07
177	0.00	0.000	0.129	0.1995	0.5282	0.0001	4.81E-07
178	0.00	0.000	0.019	0.1976	0.5280	0.0001	4.81E-07
179	1.54	0.739	0.056	0.2137	0.5278	0.0001	4.81E-07
180	0.00	0.000	0.470	0.2247	0.5276	0.0001	4.81E-07
181	0.00	0.000	0.096	0.2151	0.5274	0.0001	4.81E-07
182	0.00	0.000	0.109	0.2043	0.5273	0.0001	4.80E-07
183	0.00	0.000	0.058	0.1984	0.5271	0.0001	4.80E-07
184	0.04	0.000	0.035	0.1986	0.5269	0.0001	4.80E-07

185	0.00	0.000	0.009	0.1977	0.5267	0.0001	4.80E-07
186	0.00	0.000	0.005	0.1972	0.5265	0.0001	4.80E-07
187	0.00	0.000	0.001	0.1970	0.5263	0.0001	4.80E-07
188	0.00	0.000	0.000	0.1970	0.5262	0.0001	4.80E-07
189	0.00	0.000	0.000	0.1970	0.5260	0.0001	4.79E-07
190	0.00	0.000	0.000	0.1970	0.5258	0.0001	4.79E-07
191	0.00	0.000	0.001	0.1970	0.5256	0.0001	4.79E-07
192	0.00	0.000	0.000	0.1970	0.5254	0.0001	4.79E-07
193	0.00	0.000	0.000	0.1970	0.5252	0.0001	4.79E-07
194	0.05	0.000	0.011	0.2009	0.5250	0.0001	4.79E-07
195	0.00	0.000	0.002	0.2007	0.5249	0.0001	4.78E-07
196	0.00	0.000	0.011	0.1996	0.5247	0.0001	4.78E-07
197	0.00	0.000	0.007	0.1988	0.5245	0.0001	4.78E-07
198	0.00	0.000	0.005	0.1983	0.5243	0.0001	4.78E-07
199	0.00	0.000	0.004	0.1979	0.5241	0.0001	4.78E-07
200	0.00	0.000	0.004	0.1975	0.5239	0.0001	4.78E-07
201	0.00	0.000	0.004	0.1971	0.5238	0.0001	4.78E-07
202	0.00	0.000	0.001	0.1970	0.5236	0.0001	4.77E-07
203	0.00	0.000	0.000	0.1970	0.5234	0.0001	4.77E-07
204	0.00	0.000	0.002	0.1970	0.5232	0.0001	4.77E-07
205	0.32	0.076	0.026	0.2113	0.5230	0.0001	4.77E-07
206	0.02	0.000	0.092	0.2119	0.5228	0.0001	4.77E-07
207	0.00	0.000	0.015	0.2104	0.5227	0.0001	4.77E-07
208	0.00	0.000	0.013	0.2091	0.5225	0.0001	4.76E-07
209	0.04	0.000	0.021	0.2107	0.5223	0.0001	4.76E-07
210	0.00	0.000	0.012	0.2095	0.5221	0.0001	4.76E-07
211	0.00	0.000	0.009	0.2087	0.5219	0.0001	4.76E-07
212	0.02	0.000	0.019	0.2083	0.5217	0.0001	4.76E-07
213	0.01	0.000	0.017	0.2077	0.5216	0.0001	4.76E-07
214	0.00	0.000	0.012	0.2064	0.5214	0.0001	4.76E-07
215	0.00	0.000	0.012	0.2053	0.5212	0.0001	4.75E-07
216	0.00	0.000	0.011	0.2041	0.5210	0.0001	4.75E-07

217	0.00	0.000	0.011	0.2030	0.5208	0.0001	4.75E-07
218	0.68	0.259	0.027	0.2176	0.5207	0.0001	4.75E-07
219	0.00	0.000	0.211	0.2217	0.5205	0.0001	4.75E-07
220	0.00	0.000	0.087	0.2131	0.5203	0.0001	4.75E-07
221	0.00	0.000	0.131	0.2001	0.5201	0.0001	4.74E-07
222	0.27	0.047	0.120	0.2055	0.5199	0.0001	4.74E-07
223	0.00	0.000	0.073	0.2029	0.5197	0.0001	4.74E-07
224	0.00	0.000	0.032	0.1997	0.5196	0.0001	4.74E-07
225	0.00	0.000	0.024	0.1973	0.5194	0.0001	4.74E-07
226	0.37	0.089	0.046	0.2123	0.5192	0.0001	4.74E-07
227	0.00	0.000	0.201	0.2011	0.5190	0.0001	4.74E-07
228	0.00	0.000	0.028	0.1986	0.5188	0.0001	4.73E-07
229	0.00	0.000	0.016	0.1970	0.5186	0.0001	4.73E-07
230	0.00	0.000	0.000	0.1970	0.5185	0.0001	4.73E-07
231	0.00	0.000	0.000	0.1970	0.5183	0.0001	4.73E-07
232	0.00	0.000	0.000	0.1970	0.5181	0.0001	4.73E-07
233	0.00	0.000	0.000	0.1970	0.5179	0.0001	4.73E-07
234	0.00	0.000	0.000	0.1970	0.5177	0.0001	4.72E-07
235	0.01	0.000	0.006	0.1970	0.5176	0.0001	4.72E-07
236	0.00	0.000	0.000	0.1970	0.5174	0.0001	4.72E-07
237	0.00	0.000	0.000	0.1970	0.5172	0.0001	4.72E-07
238	0.13	0.000	0.012	0.2087	0.5170	0.0001	4.72E-07
239	0.00	0.000	0.010	0.2076	0.5168	0.0001	4.72E-07
240	0.00	0.000	0.010	0.2066	0.5167	0.0001	4.72E-07
241	0.00	0.000	0.013	0.2053	0.5165	0.0001	4.71E-07
242	0.98	0.425	0.029	0.2197	0.5163	0.0001	4.71E-07
243	0.00	0.000	0.339	0.2241	0.5161	0.0001	4.71E-07
244	0.00	0.000	0.191	0.2050	0.5159	0.0001	4.71E-07
245	0.00	0.000	0.073	0.1977	0.5157	0.0001	4.71E-07
246	0.00	0.000	0.007	0.1970	0.5156	0.0001	4.71E-07
247	0.00	0.000	0.000	0.1970	0.5154	0.0001	4.71E-07
248	0.00	0.000	0.000	0.1970	0.5152	0.0001	4.70E-07

249		0.00	0.000	0.000	0.1970	0.5150	0.0001	4.70E-07
250		0.06	0.000	0.013	0.2012	0.5148	0.0001	4.70E-07
251		0.13	0.000	0.025	0.2118	0.5147	0.0001	4.70E-07
252		0.00	0.000	0.014	0.2104	0.5145	0.0001	4.70E-07
253		0.00	0.000	0.017	0.2087	0.5143	0.0001	4.70E-07
254		0.00	0.000	0.019	0.2068	0.5141	0.0001	4.69E-07
255		0.00	0.000	0.018	0.2050	0.5139	0.0001	4.69E-07
256		0.07	0.000	0.027	0.2090	0.5138	0.0001	4.69E-07
257		0.00	0.000	0.018	0.2073	0.5136	0.0001	4.69E-07
258		1.03	0.454	0.032	0.2210	0.5134	0.0001	4.69E-07
259		0.00	0.042	0.202	0.2326	0.5132	0.0001	4.69E-07
260		0.00	0.000	0.158	0.2211	0.5130	0.0001	4.69E-07
261		0.00	0.000	0.086	0.2125	0.5129	0.0001	4.68E-07
262	*	0.04	0.000	0.092	0.2076	0.5127	0.0001	4.68E-07
263		0.00	0.000	0.101	0.1975	0.5125	0.0001	4.68E-07
264		0.00	0.000	0.003	0.1972	0.5123	0.0001	4.68E-07
265		0.18	0.012	0.078	0.2054	0.5123	0.0001	4.68E-07
266		0.30	0.041	0.114	0.2169	0.5122	0.0001	4.68E-07
267		0.09	0.000	0.101	0.2200	0.5120	0.0001	4.68E-07
268		0.43	0.066	0.170	0.2333	0.5118	0.0001	4.68E-07
269		0.00	0.000	0.148	0.2249	0.5117	0.0001	4.67E-07
270		0.00	0.000	0.102	0.2147	0.5115	0.0001	4.67E-07
271		0.05	0.000	0.174	0.2019	0.5113	0.0001	4.67E-07
272		0.00	0.000	0.031	0.1988	0.5111	0.0001	4.67E-07
273		0.03	0.000	0.032	0.1984	0.5109	0.0001	4.67E-07
274		0.00	0.000	0.010	0.1975	0.5108	0.0001	4.67E-07
275		0.00	0.000	0.004	0.1971	0.5106	0.0001	4.67E-07
276		0.00	0.000	0.001	0.1970	0.5104	0.0001	4.66E-07
277		0.00	0.000	0.000	0.1970	0.5102	0.0001	4.66E-07
278		0.00	0.000	0.000	0.1970	0.5100	0.0001	4.66E-07
279		0.00	0.000	0.000	0.1970	0.5099	0.0001	4.66E-07
280		0.66	0.232	0.036	0.2133	0.5097	0.0001	4.66E-07

281		0.00	0.000	0.163	0.2196	0.5095	0.0001	4.66E-07
282		0.00	0.000	0.059	0.2142	0.5093	0.0001	4.65E-07
283		0.12	0.000	0.085	0.2179	0.5092	0.0001	4.65E-07
284		0.00	0.000	0.062	0.2120	0.5090	0.0001	4.65E-07
285		0.00	0.000	0.073	0.2047	0.5088	0.0001	4.65E-07
286		0.00	0.000	0.067	0.1980	0.5086	0.0001	4.65E-07
287		0.00	0.000	0.010	0.1970	0.5084	0.0001	4.65E-07
288		0.00	0.000	0.000	0.1970	0.5083	0.0001	4.65E-07
289		0.00	0.000	0.000	0.1970	0.5081	0.0001	4.64E-07
290		0.00	0.000	0.000	0.1970	0.5079	0.0001	4.64E-07
291		0.27	0.052	0.040	0.2096	0.5077	0.0001	4.64E-07
292		0.68	0.269	0.090	0.2212	0.5075	0.0001	4.64E-07
293		0.00	0.000	0.146	0.2324	0.5074	0.0001	4.64E-07
294		0.00	0.000	0.049	0.2275	0.5072	0.0001	4.64E-07
295		0.00	0.000	0.048	0.2228	0.5070	0.0001	4.64E-07
296		0.00	0.000	0.097	0.2131	0.5068	0.0001	4.63E-07
297		0.00	0.000	0.063	0.2069	0.5067	0.0001	4.63E-07
298		0.00	0.000	0.084	0.1984	0.5065	0.0001	4.63E-07
299		3.14	1.784	0.097	0.2147	0.5063	0.0001	4.63E-07
300	*	0.00	0.000	0.031	0.2147	0.5061	0.0001	4.63E-07
301	*	0.00	0.000	0.015	0.2148	0.5059	0.0001	4.63E-07
302		0.49	0.177	0.000	0.2287	0.5058	0.0001	4.62E-07
303	*	0.06	0.588	0.000	0.2403	0.5056	0.0001	4.62E-07
304	*	0.00	0.204	0.008	0.2520	0.5054	0.0001	4.62E-07
305	*	0.21	0.005	0.021	0.2636	0.5052	0.0001	4.62E-07
306	*	0.04	0.000	0.035	0.2656	0.5051	0.0001	4.62E-07
307	*	0.01	0.000	0.036	0.2676	0.5049	0.0001	4.62E-07
308	*	0.02	0.000	0.000	0.2696	0.5047	0.0001	4.62E-07
309	*	0.00	0.000	0.020	0.2716	0.5045	0.0001	4.61E-07
310	*	1.15	0.000	0.000	0.2736	0.5044	0.0001	4.61E-07
311		0.64	1.206	0.000	0.2864	0.5042	0.0001	4.61E-07
312		0.06	0.248	0.098	0.2980	0.5040	0.0001	4.61E-07

313			0.00	0.032	0.069	0.3096	0.5038	0.0001	4.61E-07
314	*		0.00	0.000	0.032	0.3096	0.5036	0.0001	4.61E-07
315			0.32	0.060	0.074	0.3227	0.5035	0.0001	4.61E-07
316			0.00	0.000	0.171	0.3108	0.5033	0.0001	4.60E-07
317			0.00	0.000	0.112	0.2996	0.5031	0.0001	4.60E-07
318			0.00	0.000	0.048	0.2948	0.5029	0.0001	4.60E-07
319			0.00	0.000	0.057	0.2890	0.5028	0.0001	4.60E-07
320	*		0.00	0.000	0.000	0.2890	0.5026	0.0001	4.60E-07
321	*		0.00	0.000	0.000	0.2890	0.5024	0.0001	4.60E-07
322	*		0.00	0.000	0.000	0.2890	0.5022	0.0001	4.60E-07
323	*	*	0.00	0.000	0.000	0.2890	0.5021	0.0001	4.59E-07
324	*	*	0.00	0.000	0.000	0.2891	0.5019	0.0001	4.59E-07
325	*	*	0.00	0.000	0.000	0.2891	0.5017	0.0001	4.59E-07
326	*	*	0.00	0.000	0.000	0.2891	0.5015	0.0001	4.59E-07
327	*	*	0.00	0.000	0.000	0.2891	0.5014	0.0001	4.59E-07
328		*	0.00	0.000	0.000	0.2891	0.5012	0.0001	4.59E-07
329		*	0.00	0.000	0.000	0.2891	0.5010	0.0001	4.59E-07
330		*	0.00	0.000	0.000	0.2891	0.5008	0.0001	4.58E-07
331			0.00	0.000	0.044	0.2847	0.5007	0.0001	4.58E-07
332	*		0.00	0.000	0.000	0.2847	0.5005	0.0001	4.58E-07
333	*	*	0.00	0.000	0.000	0.2847	0.5003	0.0001	4.58E-07
334	*	*	0.00	0.000	0.000	0.2847	0.5001	0.0001	4.58E-07
335	*	*	0.00	0.000	0.000	0.2848	0.5000	0.0001	4.58E-07
336	*	*	0.00	0.000	0.000	0.2848	0.4998	0.0001	4.57E-07
337	*	*	0.00	0.000	0.000	0.2848	0.4996	0.0001	4.57E-07
338	*	*	0.00	0.000	0.000	0.2848	0.4994	0.0001	4.57E-07
339	*	*	0.00	0.000	0.000	0.2848	0.4993	0.0001	4.57E-07
340	*	*	0.00	0.000	0.000	0.2848	0.4991	0.0001	4.57E-07
341		*	0.00	0.000	0.000	0.2848	0.4989	0.0001	4.57E-07
342		*	0.56	0.314	0.008	0.2892	0.4987	0.0001	4.57E-07
343		*	0.12	0.115	0.083	0.2892	0.4986	0.0001	4.56E-07
344			0.02	0.000	0.102	0.2921	0.4984	0.0001	4.56E-07

345		0.20	0.024	0.093	0.2978	0.4982	0.0001	4.56E-07
346		0.05	0.000	0.084	0.2967	0.4984	0.0001	4.56E-07
347		0.00	0.000	0.132	0.2835	0.4992	0.0001	4.57E-07
348		0.00	0.000	0.097	0.2739	0.4990	0.0001	4.57E-07
349		0.00	0.000	0.085	0.2654	0.4989	0.0001	4.57E-07
350		0.00	0.000	0.165	0.2489	0.4987	0.0001	4.57E-07
351		0.00	0.000	0.147	0.2342	0.4985	0.0001	4.56E-07
352		0.00	0.000	0.136	0.2206	0.4983	0.0001	4.56E-07
353		0.00	0.000	0.065	0.2140	0.4982	0.0001	4.56E-07
354		0.00	0.000	0.058	0.2082	0.5024	0.0001	4.60E-07
355		0.00	0.000	0.045	0.1993	0.5536	0.0001	5.02E-07
356		0.00	0.000	0.023	0.1970	0.6389	0.0001	5.73E-07
357		0.00	0.000	0.000	0.1970	0.6387	0.0001	5.73E-07
358		0.00	0.000	0.000	0.1970	0.6385	0.0001	5.72E-07
359		0.00	0.000	0.000	0.1970	0.6383	0.0001	5.72E-07
360		0.00	0.000	0.000	0.1970	0.6381	0.0001	5.72E-07
361		0.00	0.000	0.000	0.1970	0.6378	0.0001	5.72E-07
362		0.00	0.000	0.000	0.1970	0.6376	0.0001	5.72E-07
363	*	0.00	0.000	0.000	0.1970	0.6374	0.0001	5.71E-07
364	*	0.29	0.000	0.034	0.1990	0.6372	0.0001	5.71E-07
365	*	0.00	0.000	0.030	0.2010	0.6369	0.0001	5.71E-07

* = Frozen (air or soil)

Annual Totals for Year 2

	inches	cubic feet	percent
Precipitation	34.66	125,803.4	100.00
Runoff	13.245	48,078.1	38.22
Evapotranspiration	21.552	78,233.7	62.19
Recirculation into Layer 1	0.0219	79.4	0.06
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0219	79.4	0.06
Percolation/Leakage through Layer 5	0.000176	0.6380	0.00
Average Head on Top of Layer 4	0.5286	---	---
Change in Water Storage	-0.1402	-509.0	-0.40
Soil Water at Start of Year	293.1817	1,064,249.6	845.96
Soil Water at End of Year	293.1891	1,064,276.5	845.98
Snow Water at Start of Year	0.3365	1,221.4	0.97
Snow Water at End of Year	0.1888	685.4	0.54
Annual Water Budget Balance	-0.0219	-79.4	-0.06

Daily Output for Year 3

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status* Air	Freezing Status* Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.003	0.056	0.2137	0.6367	0.0001	5.71E-07
2			0.00	0.000	0.012	0.2128	0.6365	0.0001	5.71E-07
3			0.00	0.000	0.013	0.2115	0.6363	0.0001	5.71E-07
4	*		0.00	0.000	0.013	0.2102	0.6360	0.0001	5.70E-07
5			0.00	0.000	0.012	0.2089	0.6358	0.0001	5.70E-07
6			0.00	0.000	0.012	0.2077	0.6356	0.0001	5.70E-07
7			0.00	0.000	0.012	0.2066	0.6354	0.0001	5.70E-07
8			0.06	0.000	0.018	0.2107	0.6351	0.0001	5.70E-07
9			0.15	0.011	0.018	0.2221	0.6349	0.0001	5.69E-07
10			0.07	0.000	0.031	0.2268	0.6347	0.0001	5.69E-07
11			0.00	0.000	0.013	0.2255	0.6345	0.0001	5.69E-07
12			0.00	0.000	0.011	0.2244	0.6343	0.0001	5.69E-07
13			0.00	0.000	0.010	0.2234	0.6340	0.0001	5.69E-07
14			0.00	0.000	0.010	0.2225	0.6338	0.0001	5.69E-07
15			0.00	0.000	0.010	0.2215	0.6336	0.0001	5.68E-07
16			0.00	0.000	0.009	0.2206	0.6334	0.0001	5.68E-07
17			0.00	0.000	0.009	0.2197	0.6331	0.0001	5.68E-07
18			0.00	0.000	0.009	0.2188	0.6329	0.0001	5.68E-07
19			0.00	0.000	0.009	0.2179	0.6327	0.0001	5.68E-07
20			0.00	0.000	0.009	0.2170	0.6325	0.0001	5.67E-07
21			0.00	0.000	0.009	0.2162	0.6323	0.0001	5.67E-07
22			0.00	0.000	0.008	0.2153	0.6320	0.0001	5.67E-07
23			0.00	0.000	0.008	0.2145	0.6318	0.0001	5.67E-07
24			0.00	0.000	0.008	0.2137	0.6316	0.0001	5.67E-07

25		0.00	0.000	0.008	0.2129	0.6314	0.0001	5.67E-07
26		0.00	0.000	0.008	0.2121	0.6312	0.0001	5.66E-07
27		0.00	0.000	0.008	0.2113	0.6309	0.0001	5.66E-07
28	*	0.00	0.000	0.000	0.2113	0.6307	0.0001	5.66E-07
29	*	0.00	0.000	0.000	0.2113	0.6305	0.0001	5.66E-07
30		0.17	0.019	0.015	0.2235	0.6303	0.0001	5.66E-07
31		0.02	0.000	0.034	0.2241	0.6300	0.0001	5.65E-07
32		0.04	0.000	0.016	0.2262	0.6298	0.0001	5.65E-07
33		0.00	0.000	0.009	0.2253	0.6296	0.0001	5.65E-07
34	*	0.76	0.000	0.038	0.2273	0.6294	0.0001	5.65E-07
35		0.00	0.196	0.006	0.2400	0.6292	0.0001	5.65E-07
36		0.00	0.071	0.113	0.2517	0.6289	0.0001	5.65E-07
37	*	0.00	0.000	0.065	0.2517	0.6287	0.0001	5.64E-07
38		0.00	0.000	0.000	0.2517	0.6285	0.0001	5.64E-07
39	*	0.00	0.000	0.004	0.2517	0.6283	0.0001	5.64E-07
40	*	0.00	0.000	0.000	0.2517	0.6281	0.0001	5.64E-07
41		0.00	0.000	0.049	0.2467	0.6278	0.0001	5.64E-07
42		0.00	0.000	0.086	0.2381	0.6276	0.0001	5.63E-07
43		0.00	0.000	0.150	0.2231	0.6274	0.0001	5.63E-07
44		0.00	0.000	0.067	0.2165	0.6272	0.0001	5.63E-07
45		0.19	0.019	0.099	0.2215	0.6270	0.0001	5.63E-07
46		0.06	0.000	0.069	0.2221	0.6269	0.0001	5.63E-07
47	*	0.00	0.000	0.000	0.2221	0.6268	0.0001	5.63E-07
48	*	0.00	0.000	0.000	0.2221	0.6266	0.0001	5.63E-07
49		0.00	0.000	0.105	0.2116	0.6264	0.0001	5.62E-07
50	*	0.14	0.000	0.038	0.2136	0.6262	0.0001	5.62E-07
51	*	0.00	0.000	0.033	0.2156	0.6260	0.0001	5.62E-07
52	*	0.00	0.000	0.024	0.2156	0.6257	0.0001	5.62E-07
53	*	0.00	0.000	0.040	0.2116	0.6255	0.0001	5.62E-07
54		0.00	0.000	0.088	0.2028	0.6253	0.0001	5.62E-07
55		0.11	0.000	0.048	0.2094	0.6251	0.0001	5.61E-07
56		0.28	0.034	0.110	0.2192	0.6249	0.0001	5.61E-07

57		0.00	0.000	0.070	0.2156	0.6257	0.0001	5.62E-07
58	*	0.00	0.000	0.034	0.2122	0.6261	0.0001	5.62E-07
59		0.00	0.000	0.087	0.2035	0.6259	0.0001	5.62E-07
60		0.00	0.000	0.052	0.1984	0.6256	0.0001	5.62E-07
61		0.10	0.000	0.025	0.2059	0.6254	0.0001	5.62E-07
62		0.66	0.241	0.051	0.2191	0.6252	0.0001	5.61E-07
63		0.54	0.243	0.177	0.2307	0.6250	0.0001	5.61E-07
64		0.28	0.120	0.159	0.2424	0.6248	0.0001	5.61E-07
65		0.23	0.029	0.304	0.2414	0.6245	0.0001	5.61E-07
66		0.25	0.023	0.348	0.2300	0.6243	0.0001	5.61E-07
67		0.37	0.022	0.426	0.2224	0.6241	0.0001	5.61E-07
68		1.04	0.393	0.237	0.2340	0.6239	0.0001	5.60E-07
69		0.00	0.000	0.329	0.2326	0.6237	0.0001	5.60E-07
70		0.00	0.000	0.207	0.2120	0.6234	0.0001	5.60E-07
71		0.16	0.005	0.194	0.2076	0.6232	0.0001	5.60E-07
72		0.06	0.000	0.082	0.2058	0.6230	0.0001	5.60E-07
73		0.25	0.036	0.063	0.2174	0.6228	0.0001	5.59E-07
74		0.11	0.000	0.062	0.2258	0.6282	0.0001	5.64E-07
75	*	0.00	0.000	0.000	0.2258	0.6314	0.0001	5.67E-07
76	*	0.00	0.000	0.072	0.2186	0.6312	0.0001	5.66E-07
77		0.03	0.000	0.080	0.2131	0.6310	0.0001	5.66E-07
78		0.19	0.024	0.097	0.2181	0.6308	0.0001	5.66E-07
79		0.06	0.000	0.112	0.2150	0.6305	0.0001	5.66E-07
80		0.29	0.044	0.077	0.2277	0.6303	0.0001	5.66E-07
81	*	0.01	0.000	0.049	0.2277	0.6301	0.0001	5.65E-07
82	*	0.00	0.000	0.041	0.2237	0.6299	0.0001	5.65E-07
83		0.05	0.000	0.132	0.2157	0.6297	0.0001	5.65E-07
84		0.18	0.021	0.090	0.2209	0.6294	0.0001	5.65E-07
85		0.01	0.000	0.108	0.2136	0.6292	0.0001	5.65E-07
86	*	0.04	0.000	0.043	0.2136	0.6290	0.0001	5.65E-07
87		0.00	0.000	0.079	0.2057	0.6288	0.0001	5.64E-07
88		0.05	0.000	0.089	0.2021	0.6286	0.0001	5.64E-07

89		1.52	0.740	0.088	0.2147	0.6283	0.0001	5.64E-07
90	*	0.09	0.225	0.000	0.2263	0.6281	0.0001	5.64E-07
91	*	0.52	0.000	0.025	0.2290	0.6279	0.0001	5.64E-07
92	*	0.34	0.000	0.016	0.2310	0.6277	0.0001	5.63E-07
93	*	0.00	0.000	0.032	0.2330	0.6275	0.0001	5.63E-07
94		0.00	0.000	0.052	0.2350	0.6272	0.0001	5.63E-07
95		0.16	0.568	0.000	0.2477	0.6270	0.0001	5.63E-07
96		0.00	0.102	0.114	0.2594	0.6268	0.0001	5.63E-07
97		0.00	0.000	0.216	0.2482	0.6270	0.0001	5.63E-07
98		0.00	0.000	0.197	0.2288	0.6271	0.0001	5.63E-07
99		0.19	0.015	0.192	0.2255	0.6269	0.0001	5.63E-07
100		0.00	0.000	0.179	0.2091	0.6267	0.0001	5.63E-07
101		0.00	0.000	0.085	0.2006	0.6264	0.0001	5.62E-07
102		0.33	0.046	0.171	0.2069	0.6262	0.0001	5.62E-07
103		0.08	0.000	0.110	0.2081	0.6260	0.0001	5.62E-07
104		0.00	0.000	0.089	0.1992	0.6258	0.0001	5.62E-07
105		0.00	0.000	0.017	0.1975	0.6256	0.0001	5.62E-07
106		0.00	0.000	0.005	0.1970	0.6253	0.0001	5.62E-07
107		0.84	0.323	0.052	0.2133	0.6251	0.0001	5.61E-07
108		0.04	0.028	0.173	0.2249	0.6249	0.0001	5.61E-07
109		0.30	0.063	0.086	0.2365	0.6247	0.0001	5.61E-07
110		0.00	0.000	0.119	0.2310	0.6245	0.0001	5.61E-07
111		0.00	0.000	0.111	0.2199	0.6242	0.0001	5.61E-07
112		0.04	0.000	0.218	0.2021	0.6240	0.0001	5.60E-07
113		0.40	0.037	0.315	0.2035	0.6238	0.0001	5.60E-07
114		0.10	0.000	0.094	0.2080	0.6236	0.0001	5.60E-07
115		0.50	0.032	0.306	0.2214	0.6234	0.0001	5.60E-07
116		0.45	0.075	0.221	0.2330	0.6232	0.0001	5.60E-07
117		0.50	0.135	0.202	0.2446	0.6229	0.0001	5.60E-07
118		0.00	0.000	0.295	0.2272	0.6245	0.0001	5.61E-07
119		0.00	0.000	0.194	0.2078	0.6254	0.0001	5.62E-07
120		0.00	0.000	0.098	0.1980	0.6252	0.0001	5.61E-07

121	0.00	0.000	0.008	0.1972	0.6250	0.0001	5.61E-07
122	2.29	1.225	0.066	0.2134	0.6247	0.0001	5.61E-07
123	0.00	0.231	0.260	0.2251	0.6245	0.0001	5.61E-07
124	0.40	0.084	0.355	0.2367	0.6243	0.0001	5.61E-07
125	0.03	0.000	0.268	0.2211	0.6256	0.0001	5.62E-07
126	0.17	0.006	0.262	0.2108	0.6263	0.0001	5.62E-07
127	0.00	0.000	0.101	0.2013	0.6261	0.0001	5.62E-07
128	0.00	0.000	0.030	0.1983	0.6258	0.0001	5.62E-07
129	0.00	0.000	0.012	0.1971	0.6256	0.0001	5.62E-07
130	0.00	0.000	0.001	0.1970	0.6254	0.0001	5.62E-07
131	1.53	0.739	0.052	0.2133	0.6252	0.0001	5.61E-07
132	0.20	0.281	0.098	0.2249	0.6250	0.0001	5.61E-07
133	0.02	0.056	0.074	0.2365	0.6247	0.0001	5.61E-07
134	1.76	0.926	0.226	0.2482	0.6245	0.0001	5.61E-07
135	0.04	0.119	0.236	0.2598	0.6243	0.0001	5.61E-07
136	0.00	0.000	0.216	0.2501	0.6241	0.0001	5.61E-07
137	0.03	0.000	0.100	0.2428	0.6239	0.0001	5.60E-07
138	0.04	0.000	0.142	0.2324	0.6237	0.0001	5.60E-07
139	0.10	0.000	0.239	0.2183	0.6234	0.0001	5.60E-07
140	0.84	0.273	0.210	0.2300	0.6232	0.0001	5.60E-07
141	0.01	0.015	0.105	0.2417	0.6230	0.0001	5.60E-07
142	0.00	0.000	0.175	0.2257	0.6228	0.0001	5.59E-07
143	0.00	0.000	0.137	0.2120	0.6226	0.0001	5.59E-07
144	0.00	0.000	0.132	0.1987	0.6223	0.0001	5.59E-07
145	0.21	0.027	0.076	0.2063	0.6228	0.0001	5.59E-07
146	0.00	0.000	0.094	0.1996	0.6244	0.0001	5.61E-07
147	0.00	0.000	0.022	0.1973	0.6242	0.0001	5.61E-07
148	0.18	0.018	0.036	0.2083	0.6240	0.0001	5.60E-07
149	0.00	0.000	0.038	0.2064	0.6238	0.0001	5.60E-07
150	0.00	0.000	0.027	0.2037	0.6236	0.0001	5.60E-07
151	0.00	0.000	0.026	0.2010	0.6233	0.0001	5.60E-07
152	0.14	0.000	0.032	0.2116	0.6231	0.0001	5.60E-07

153	0.11	0.000	0.027	0.2196	0.6229	0.0001	5.60E-07
154	0.13	0.000	0.020	0.2311	0.6227	0.0001	5.59E-07
155	0.00	0.000	0.183	0.2128	0.6225	0.0001	5.59E-07
156	0.00	0.000	0.022	0.2106	0.6222	0.0001	5.59E-07
157	0.00	0.000	0.025	0.2081	0.6220	0.0001	5.59E-07
158	0.00	0.000	0.022	0.2060	0.6218	0.0001	5.59E-07
159	0.20	0.029	0.028	0.2171	0.6216	0.0001	5.58E-07
160	0.00	0.000	0.050	0.2149	0.6214	0.0001	5.58E-07
161	0.00	0.000	0.023	0.2127	0.6212	0.0001	5.58E-07
162	0.00	0.000	0.018	0.2109	0.6209	0.0001	5.58E-07
163	0.00	0.000	0.015	0.2094	0.6207	0.0001	5.58E-07
164	0.02	0.000	0.021	0.2093	0.6205	0.0001	5.58E-07
165	0.19	0.021	0.027	0.2214	0.6203	0.0001	5.57E-07
166	0.09	0.000	0.047	0.2280	0.6201	0.0001	5.57E-07
167	0.02	0.000	0.237	0.2066	0.6199	0.0001	5.57E-07
168	1.10	0.488	0.028	0.2225	0.6196	0.0001	5.57E-07
169	0.00	0.000	0.428	0.2223	0.6194	0.0001	5.57E-07
170	0.00	0.000	0.197	0.2028	0.6192	0.0001	5.57E-07
171	0.01	0.000	0.060	0.1979	0.6190	0.0001	5.56E-07
172	0.54	0.112	0.157	0.2134	0.6188	0.0001	5.56E-07
173	0.10	0.000	0.137	0.2212	0.6186	0.0001	5.56E-07
174	0.00	0.000	0.149	0.2063	0.6183	0.0001	5.56E-07
175	0.00	0.000	0.069	0.1994	0.6181	0.0001	5.56E-07
176	0.00	0.000	0.024	0.1970	0.6179	0.0001	5.55E-07
177	0.00	0.000	0.000	0.1970	0.6177	0.0001	5.55E-07
178	0.18	0.019	0.030	0.2086	0.6175	0.0001	5.55E-07
179	1.12	0.521	0.068	0.2199	0.6173	0.0001	5.55E-07
180	0.00	0.007	0.310	0.2315	0.6170	0.0001	5.55E-07
181	0.20	0.030	0.133	0.2329	0.6168	0.0001	5.55E-07
182	0.38	0.051	0.188	0.2445	0.6166	0.0001	5.54E-07
183	0.04	0.000	0.219	0.2318	0.6164	0.0001	5.54E-07
184	0.00	0.000	0.236	0.2083	0.6162	0.0001	5.54E-07

185	0.00	0.000	0.095	0.1988	0.6160	0.0001	5.54E-07
186	0.00	0.000	0.014	0.1974	0.6158	0.0001	5.54E-07
187	0.00	0.000	0.004	0.1970	0.6155	0.0001	5.54E-07
188	1.23	0.551	0.058	0.2128	0.6153	0.0001	5.53E-07
189	0.01	0.000	0.408	0.2192	0.6151	0.0001	5.53E-07
190	0.00	0.000	0.096	0.2096	0.6149	0.0001	5.53E-07
191	0.00	0.000	0.110	0.1986	0.6147	0.0001	5.53E-07
192	0.00	0.000	0.016	0.1970	0.6145	0.0001	5.53E-07
193	0.00	0.000	0.000	0.1970	0.6142	0.0001	5.52E-07
194	0.06	0.000	0.014	0.2017	0.6140	0.0001	5.52E-07
195	0.13	0.000	0.029	0.2122	0.6138	0.0001	5.52E-07
196	0.05	0.000	0.030	0.2139	0.6136	0.0001	5.52E-07
197	0.00	0.000	0.027	0.2112	0.6134	0.0001	5.52E-07
198	0.00	0.000	0.032	0.2081	0.6132	0.0001	5.52E-07
199	0.00	0.000	0.027	0.2053	0.6130	0.0001	5.51E-07
200	0.00	0.000	0.031	0.2022	0.6127	0.0001	5.51E-07
201	0.07	0.000	0.035	0.2060	0.6125	0.0001	5.51E-07
202	0.07	0.000	0.042	0.2089	0.6123	0.0001	5.51E-07
203	0.37	0.109	0.036	0.2204	0.6121	0.0001	5.51E-07
204	0.02	0.000	0.259	0.2079	0.6119	0.0001	5.50E-07
205	0.00	0.000	0.022	0.2057	0.6117	0.0001	5.50E-07
206	0.00	0.000	0.026	0.2030	0.6115	0.0001	5.50E-07
207	0.84	0.335	0.042	0.2181	0.6112	0.0001	5.50E-07
208	0.03	0.030	0.167	0.2297	0.6110	0.0001	5.50E-07
209	0.42	0.095	0.146	0.2413	0.6108	0.0001	5.50E-07
210	0.00	0.000	0.297	0.2207	0.6106	0.0001	5.49E-07
211	0.00	0.000	0.192	0.2015	0.6104	0.0001	5.49E-07
212	1.25	0.510	0.162	0.2171	0.6102	0.0001	5.49E-07
213	0.00	0.040	0.223	0.2287	0.6100	0.0001	5.49E-07
214	0.25	0.024	0.281	0.2249	0.6097	0.0001	5.49E-07
215	0.00	0.000	0.175	0.2098	0.6095	0.0001	5.49E-07
216	0.00	0.000	0.103	0.1995	0.6093	0.0001	5.48E-07

217	0.00	0.000	0.024	0.1970	0.6091	0.0001	5.48E-07
218	0.00	0.000	0.000	0.1970	0.6089	0.0001	5.48E-07
219	0.00	0.000	0.000	0.1970	0.6087	0.0001	5.48E-07
220	0.00	0.000	0.000	0.1970	0.6085	0.0001	5.48E-07
221	0.37	0.085	0.052	0.2115	0.6083	0.0001	5.48E-07
222	0.00	0.000	0.102	0.2098	0.6080	0.0001	5.47E-07
223	0.00	0.000	0.031	0.2066	0.6078	0.0001	5.47E-07
224	0.00	0.000	0.029	0.2038	0.6076	0.0001	5.47E-07
225	0.00	0.000	0.028	0.2010	0.6074	0.0001	5.47E-07
226	0.00	0.000	0.020	0.1990	0.6072	0.0001	5.47E-07
227	0.00	0.000	0.016	0.1975	0.6070	0.0001	5.46E-07
228	0.00	0.000	0.005	0.1970	0.6068	0.0001	5.46E-07
229	0.00	0.000	0.000	0.1970	0.6066	0.0001	5.46E-07
230	0.00	0.000	0.000	0.1970	0.6063	0.0001	5.46E-07
231	0.00	0.000	0.000	0.1970	0.6061	0.0001	5.46E-07
232	0.00	0.000	0.000	0.1970	0.6059	0.0001	5.46E-07
233	0.30	0.068	0.035	0.2102	0.6057	0.0001	5.45E-07
234	0.27	0.063	0.097	0.2216	0.6055	0.0001	5.45E-07
235	0.00	0.000	0.166	0.2113	0.6053	0.0001	5.45E-07
236	0.00	0.000	0.023	0.2089	0.6051	0.0001	5.45E-07
237	0.00	0.000	0.021	0.2068	0.6049	0.0001	5.45E-07
238	0.00	0.000	0.020	0.2048	0.6046	0.0001	5.45E-07
239	0.00	0.000	0.022	0.2026	0.6044	0.0001	5.44E-07
240	1.82	0.934	0.031	0.2182	0.6042	0.0001	5.44E-07
241	0.00	0.138	0.305	0.2299	0.6040	0.0001	5.44E-07
242	0.00	0.000	0.224	0.2213	0.6038	0.0001	5.44E-07
243	0.11	0.000	0.140	0.2188	0.6036	0.0001	5.44E-07
244	0.00	0.000	0.150	0.2038	0.6034	0.0001	5.43E-07
245	0.00	0.000	0.051	0.1988	0.6032	0.0001	5.43E-07
246	0.43	0.070	0.162	0.2116	0.6029	0.0001	5.43E-07
247	0.25	0.025	0.266	0.2116	0.6027	0.0001	5.43E-07
248	0.06	0.000	0.087	0.2117	0.6025	0.0001	5.43E-07

249	0.14	0.000	0.079	0.2183	0.6023	0.0001	5.43E-07
250	0.25	0.033	0.115	0.2253	0.6021	0.0001	5.42E-07
251	0.12	0.000	0.092	0.2315	0.6019	0.0001	5.42E-07
252	0.01	0.000	0.168	0.2158	0.6017	0.0001	5.42E-07
253	0.00	0.000	0.147	0.2012	0.6015	0.0001	5.42E-07
254	0.00	0.000	0.034	0.1978	0.6013	0.0001	5.42E-07
255	0.00	0.000	0.004	0.1974	0.6010	0.0001	5.42E-07
256	0.00	0.000	0.002	0.1972	0.6008	0.0001	5.41E-07
257	0.43	0.110	0.060	0.2124	0.6006	0.0001	5.41E-07
258	0.00	0.000	0.134	0.2100	0.6004	0.0001	5.41E-07
259	0.36	0.085	0.054	0.2232	0.6002	0.0001	5.41E-07
260	0.06	0.000	0.126	0.2256	0.6000	0.0001	5.41E-07
261	0.00	0.000	0.069	0.2191	0.5998	0.0001	5.41E-07
262	0.41	0.092	0.083	0.2334	0.5996	0.0001	5.40E-07
263	0.03	0.000	0.124	0.2335	0.5994	0.0001	5.40E-07
264	0.00	0.000	0.123	0.2212	0.5992	0.0001	5.40E-07
265	0.00	0.000	0.103	0.2110	0.5989	0.0001	5.40E-07
266	0.00	0.000	0.113	0.1996	0.5987	0.0001	5.40E-07
267	0.03	0.000	0.038	0.1987	0.5985	0.0001	5.39E-07
268	0.01	0.000	0.014	0.1981	0.5983	0.0001	5.39E-07
269	1.08	0.463	0.061	0.2133	0.5981	0.0001	5.39E-07
270	0.09	0.075	0.228	0.2249	0.5979	0.0001	5.39E-07
271	0.15	0.011	0.122	0.2334	0.5977	0.0001	5.39E-07
272	0.00	0.000	0.246	0.2100	0.5975	0.0001	5.39E-07
273	0.00	0.000	0.101	0.1999	0.5973	0.0001	5.38E-07
274	0.00	0.000	0.018	0.1981	0.5971	0.0001	5.38E-07
275	0.06	0.000	0.028	0.2009	0.5968	0.0001	5.38E-07
276	0.41	0.108	0.073	0.2132	0.5966	0.0001	5.38E-07
277	0.09	0.000	0.188	0.2139	0.5974	0.0001	5.39E-07
278	0.00	0.000	0.128	0.2017	0.5978	0.0001	5.39E-07
279	0.79	0.246	0.156	0.2175	0.5976	0.0001	5.39E-07
280	0.00	0.000	0.289	0.2115	0.5974	0.0001	5.39E-07

281		0.00	0.000	0.119	0.1996	0.5972	0.0001	5.38E-07
282		0.00	0.000	0.024	0.1971	0.5970	0.0001	5.38E-07
283		0.00	0.000	0.001	0.1970	0.5968	0.0001	5.38E-07
284		0.14	0.000	0.018	0.2089	0.5966	0.0001	5.38E-07
285		0.00	0.000	0.019	0.2069	0.5964	0.0001	5.38E-07
286		0.00	0.000	0.023	0.2046	0.5962	0.0001	5.38E-07
287		0.00	0.000	0.023	0.2023	0.5960	0.0001	5.37E-07
288		0.00	0.000	0.021	0.2003	0.5958	0.0001	5.37E-07
289		0.00	0.000	0.019	0.1984	0.5955	0.0001	5.37E-07
290		0.00	0.000	0.009	0.1975	0.5953	0.0001	5.37E-07
291		0.00	0.000	0.005	0.1970	0.5951	0.0001	5.37E-07
292		0.00	0.000	0.000	0.1970	0.5949	0.0001	5.37E-07
293		0.00	0.000	0.000	0.1970	0.5947	0.0001	5.36E-07
294		0.00	0.000	0.000	0.1970	0.5945	0.0001	5.36E-07
295		0.00	0.000	0.000	0.1970	0.5943	0.0001	5.36E-07
296		0.29	0.064	0.029	0.2106	0.5941	0.0001	5.36E-07
297		0.00	0.000	0.072	0.2098	0.5939	0.0001	5.36E-07
298		0.00	0.000	0.013	0.2086	0.5937	0.0001	5.35E-07
299		0.00	0.000	0.012	0.2074	0.5935	0.0001	5.35E-07
300		0.00	0.000	0.011	0.2063	0.5933	0.0001	5.35E-07
301		0.00	0.000	0.011	0.2052	0.5931	0.0001	5.35E-07
302		0.00	0.000	0.011	0.2041	0.5928	0.0001	5.35E-07
303		0.00	0.000	0.010	0.2030	0.5926	0.0001	5.35E-07
304		0.00	0.000	0.010	0.2020	0.5924	0.0001	5.34E-07
305		0.00	0.000	0.010	0.2010	0.5922	0.0001	5.34E-07
306		0.00	0.000	0.010	0.2001	0.5920	0.0001	5.34E-07
307		0.00	0.000	0.010	0.1991	0.5918	0.0001	5.34E-07
308		0.00	0.000	0.008	0.1983	0.5916	0.0001	5.34E-07
309		0.00	0.000	0.010	0.1973	0.5914	0.0001	5.34E-07
310	*	0.00	0.000	0.003	0.1970	0.5912	0.0001	5.33E-07
311		0.00	0.000	0.001	0.1970	0.5910	0.0001	5.33E-07
312		0.00	0.000	0.000	0.1970	0.5908	0.0001	5.33E-07

313		0.00	0.000	0.000	0.1970	0.5906	0.0001	5.33E-07
314		0.00	0.000	0.000	0.1970	0.5904	0.0001	5.33E-07
315		0.20	0.029	0.015	0.2100	0.5902	0.0001	5.33E-07
316		0.01	0.000	0.042	0.2101	0.5899	0.0001	5.32E-07
317		0.00	0.000	0.008	0.2093	0.5897	0.0001	5.32E-07
318		0.00	0.000	0.008	0.2085	0.5895	0.0001	5.32E-07
319		0.17	0.014	0.018	0.2205	0.5893	0.0001	5.32E-07
320		0.00	0.000	0.020	0.2198	0.5891	0.0001	5.32E-07
321		0.00	0.000	0.008	0.2191	0.5889	0.0001	5.32E-07
322		0.00	0.000	0.008	0.2183	0.5887	0.0001	5.31E-07
323		0.00	0.000	0.007	0.2176	0.5885	0.0001	5.31E-07
324	*	0.01	0.000	0.006	0.2176	0.5883	0.0001	5.31E-07
325	*	0.00	0.000	0.000	0.2176	0.5881	0.0001	5.31E-07
326	*	0.00	0.000	0.000	0.2176	0.5879	0.0001	5.31E-07
327		0.04	0.000	0.016	0.2202	0.5877	0.0001	5.31E-07
328		0.57	0.217	0.020	0.2329	0.5875	0.0001	5.30E-07
329		0.00	0.000	0.143	0.2397	0.5873	0.0001	5.30E-07
330		0.00	0.000	0.056	0.2341	0.5871	0.0001	5.30E-07
331		0.00	0.000	0.090	0.2252	0.5869	0.0001	5.30E-07
332		0.00	0.000	0.040	0.2211	0.5867	0.0001	5.30E-07
333	*	0.00	0.000	0.035	0.2176	0.5865	0.0001	5.30E-07
334		0.00	0.000	0.068	0.2109	0.5863	0.0001	5.29E-07
335		0.00	0.000	0.038	0.2071	0.5861	0.0001	5.29E-07
336		0.00	0.000	0.063	0.2007	0.5859	0.0001	5.29E-07
337		0.37	0.077	0.069	0.2152	0.5856	0.0001	5.29E-07
338		0.00	0.000	0.099	0.2130	0.5854	0.0001	5.29E-07
339		0.00	0.000	0.069	0.2060	0.5852	0.0001	5.29E-07
340		0.09	0.000	0.054	0.2097	0.5850	0.0001	5.28E-07
341		0.23	0.035	0.076	0.2180	0.5848	0.0001	5.28E-07
342		0.00	0.000	0.078	0.2137	0.5846	0.0001	5.28E-07
343		0.08	0.000	0.090	0.2126	0.5844	0.0001	5.28E-07
344		0.18	0.013	0.078	0.2201	0.5842	0.0001	5.28E-07

345		0.31	0.048	0.115	0.2317	0.5840	0.0001	5.28E-07
346		0.00	0.000	0.057	0.2308	0.5838	0.0001	5.27E-07
347	*	0.00	0.000	0.000	0.2308	0.5836	0.0001	5.27E-07
348		0.00	0.000	0.044	0.2265	0.5834	0.0001	5.27E-07
349		0.00	0.000	0.052	0.2213	0.5832	0.0001	5.27E-07
350		0.00	0.000	0.062	0.2151	0.5830	0.0001	5.27E-07
351	*	0.13	0.000	0.045	0.2171	0.5828	0.0001	5.27E-07
352		0.00	0.000	0.071	0.2168	0.5826	0.0001	5.26E-07
353		0.00	0.000	0.043	0.2125	0.5824	0.0001	5.26E-07
354		0.12	0.000	0.063	0.2184	0.5822	0.0001	5.26E-07
355	*	0.02	0.000	0.023	0.2184	0.5820	0.0001	5.26E-07
356	*	0.00	0.000	0.000	0.2184	0.5818	0.0001	5.26E-07
357	*	0.00	0.000	0.000	0.2185	0.5816	0.0001	5.25E-07
358	*	0.00	0.000	0.030	0.2154	0.5814	0.0001	5.25E-07
359		0.00	0.000	0.050	0.2105	0.5812	0.0001	5.25E-07
360	*	0.00	0.000	0.000	0.2105	0.5810	0.0001	5.25E-07
361		0.00	0.000	0.045	0.2060	0.5808	0.0001	5.25E-07
362		0.00	0.000	0.047	0.2013	0.5814	0.0001	5.25E-07
363	*	0.59	0.000	0.030	0.2033	0.5818	0.0001	5.26E-07
364	*	0.28	0.000	0.030	0.2053	0.5816	0.0001	5.25E-07
365	*	0.00	0.000	0.028	0.2072	0.5814	0.0001	5.25E-07

* = Frozen (air or soil)

Annual Totals for Year 3			
	inches	cubic feet	percent
Precipitation	42.65	154,830.0	100.00
Runoff	14.020	50,893.5	32.87
Evapotranspiration	28.059	101,853.0	65.78
Recirculation into Layer 1	0.0253	91.9	0.06
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0253	91.9	0.06
Percolation/Leakage through Layer 5	0.000201	0.7295	0.00
Average Head on Top of Layer 4	0.6121	---	---
Change in Water Storage	0.5738	2,082.7	1.35
Soil Water at Start of Year	293.1891	1,064,276.5	687.38
Soil Water at End of Year	293.2337	1,064,438.3	687.49
Snow Water at Start of Year	0.1888	685.4	0.44
Snow Water at End of Year	0.7180	2,606.3	1.68
Annual Water Budget Balance	-0.0253	-92.0	-0.06

Daily Output for Year 4

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.00	0.000	0.039	0.2092	0.5812	0.0001	5.25E-07
2			0.00	0.269	0.000	0.2219	0.5810	0.0001	5.25E-07
3			0.00	0.013	0.120	0.2336	0.5808	0.0001	5.25E-07
4			0.00	0.000	0.070	0.2279	0.5805	0.0001	5.25E-07
5			0.00	0.000	0.077	0.2202	0.5804	0.0001	5.24E-07
6			0.00	0.000	0.064	0.2138	0.5802	0.0001	5.24E-07
7	*		0.00	0.000	0.037	0.2101	0.5801	0.0001	5.24E-07
8			0.00	0.000	0.061	0.2040	0.5801	0.0001	5.24E-07
9			0.00	0.000	0.044	0.1996	0.5799	0.0001	5.24E-07
10			0.00	0.000	0.025	0.1971	0.5797	0.0001	5.24E-07
11			0.00	0.000	0.001	0.1971	0.5795	0.0001	5.24E-07
12			0.00	0.000	0.001	0.1970	0.5793	0.0001	5.24E-07
13			0.00	0.000	0.000	0.1970	0.5791	0.0001	5.23E-07
14	*		0.00	0.000	0.000	0.1970	0.5789	0.0001	5.23E-07
15	*		0.00	0.000	0.000	0.1970	0.5787	0.0001	5.23E-07
16			0.00	0.000	0.000	0.1970	0.5785	0.0001	5.23E-07
17			0.00	0.000	0.000	0.1970	0.5783	0.0001	5.23E-07
18			0.00	0.000	0.000	0.1970	0.5781	0.0001	5.23E-07
19			0.00	0.000	0.000	0.1970	0.5779	0.0001	5.22E-07
20			0.00	0.000	0.000	0.1970	0.5777	0.0001	5.22E-07
21			0.00	0.000	0.000	0.1970	0.5775	0.0001	5.22E-07
22			0.00	0.000	0.000	0.1970	0.5773	0.0001	5.22E-07
23			0.00	0.000	0.000	0.1970	0.5771	0.0001	5.22E-07
24			0.00	0.000	0.000	0.1970	0.5769	0.0001	5.22E-07

25		0.72	0.266	0.032	0.2133	0.5767	0.0001	5.21E-07
26		0.00	0.001	0.139	0.2249	0.5765	0.0001	5.21E-07
27		0.00	0.000	0.038	0.2212	0.5763	0.0001	5.21E-07
28		0.00	0.000	0.049	0.2164	0.5761	0.0001	5.21E-07
29		0.00	0.000	0.056	0.2107	0.5759	0.0001	5.21E-07
30		0.00	0.000	0.065	0.2043	0.5757	0.0001	5.21E-07
31		0.00	0.000	0.056	0.1986	0.5755	0.0001	5.20E-07
32		0.00	0.000	0.015	0.1971	0.5753	0.0001	5.20E-07
33		0.19	0.020	0.034	0.2085	0.5751	0.0001	5.20E-07
34		0.21	0.037	0.056	0.2186	0.5749	0.0001	5.20E-07
35		0.05	0.000	0.077	0.2199	0.5747	0.0001	5.20E-07
36		0.09	0.000	0.071	0.2216	0.5744	0.0001	5.20E-07
37		0.23	0.035	0.078	0.2296	0.5742	0.0001	5.19E-07
38		0.00	0.000	0.097	0.2234	0.5740	0.0001	5.19E-07
39		0.00	0.000	0.056	0.2178	0.5738	0.0001	5.19E-07
40	*	0.00	0.000	0.043	0.2136	0.5736	0.0001	5.19E-07
41		0.00	0.000	0.053	0.2083	0.5734	0.0001	5.19E-07
42		0.00	0.000	0.038	0.2045	0.5732	0.0001	5.19E-07
43		0.07	0.000	0.046	0.2065	0.5730	0.0001	5.18E-07
44		0.07	0.000	0.043	0.2088	0.5728	0.0001	5.18E-07
45		0.20	0.024	0.038	0.2200	0.5726	0.0001	5.18E-07
46		0.09	0.000	0.119	0.2192	0.5724	0.0001	5.18E-07
47		0.18	0.019	0.029	0.2307	0.5722	0.0001	5.18E-07
48		0.00	0.000	0.099	0.2227	0.5720	0.0001	5.18E-07
49		0.03	0.000	0.027	0.2230	0.5718	0.0001	5.17E-07
50		0.00	0.000	0.021	0.2209	0.5716	0.0001	5.17E-07
51		0.00	0.000	0.019	0.2190	0.5714	0.0001	5.17E-07
52		0.05	0.000	0.024	0.2215	0.5712	0.0001	5.17E-07
53		0.09	0.000	0.025	0.2284	0.5710	0.0001	5.17E-07
54		0.70	0.282	0.030	0.2413	0.5708	0.0001	5.17E-07
55		0.00	0.023	0.093	0.2529	0.5706	0.0001	5.16E-07
56		0.00	0.000	0.093	0.2459	0.5704	0.0001	5.16E-07

57		0.67	0.232	0.105	0.2595	0.5702	0.0001	5.16E-07
58		0.68	0.325	0.191	0.2711	0.5700	0.0001	5.16E-07
59		0.41	0.216	0.145	0.2828	0.5698	0.0001	5.16E-07
60		0.00	0.000	0.170	0.2836	0.5696	0.0001	5.16E-07
61		0.00	0.000	0.077	0.2759	0.5694	0.0001	5.15E-07
62		0.00	0.000	0.105	0.2654	0.5692	0.0001	5.15E-07
63		0.00	0.000	0.123	0.2531	0.5690	0.0001	5.15E-07
64		0.00	0.000	0.073	0.2458	0.5688	0.0001	5.15E-07
65	*	0.00	0.000	0.000	0.2459	0.5686	0.0001	5.15E-07
66	*	0.00	0.000	0.000	0.2459	0.5684	0.0001	5.15E-07
67	*	0.02	0.000	0.025	0.2459	0.5682	0.0001	5.14E-07
68	*	0.16	0.000	0.030	0.2478	0.5680	0.0001	5.14E-07
69	*	0.00	0.000	0.065	0.2498	0.5678	0.0001	5.14E-07
70		0.00	0.000	0.155	0.2371	0.5676	0.0001	5.14E-07
71		0.00	0.000	0.174	0.2198	0.5674	0.0001	5.14E-07
72		0.01	0.000	0.107	0.2101	0.5672	0.0001	5.14E-07
73	*	1.14	0.000	0.030	0.2121	0.5670	0.0001	5.13E-07
74		0.27	0.221	0.000	0.2264	0.5668	0.0001	5.13E-07
75		0.20	0.260	0.000	0.2381	0.5666	0.0001	5.13E-07
76		0.71	0.843	0.000	0.2497	0.5664	0.0001	5.13E-07
77		0.04	0.136	0.229	0.2613	0.5663	0.0001	5.13E-07
78		0.07	0.000	0.142	0.2680	0.5661	0.0001	5.13E-07
79		0.01	0.000	0.117	0.2571	0.5659	0.0001	5.12E-07
80		0.37	0.071	0.078	0.2720	0.5657	0.0001	5.12E-07
81		0.00	0.000	0.143	0.2652	0.5655	0.0001	5.12E-07
82		0.00	0.000	0.102	0.2550	0.5653	0.0001	5.12E-07
83		0.00	0.000	0.060	0.2490	0.5651	0.0001	5.12E-07
84		0.05	0.000	0.223	0.2313	0.5649	0.0001	5.12E-07
85		0.00	0.000	0.187	0.2126	0.5647	0.0001	5.12E-07
86		0.00	0.000	0.136	0.1989	0.5645	0.0001	5.11E-07
87		0.00	0.000	0.015	0.1974	0.5676	0.0001	5.14E-07
88		0.28	0.051	0.068	0.2089	0.5674	0.0001	5.14E-07

89		1.08	0.354	0.375	0.2206	0.5672	0.0001	5.14E-07
90		0.01	0.000	0.294	0.2200	0.5704	0.0001	5.16E-07
91		0.00	0.000	0.125	0.2075	0.5722	0.0001	5.18E-07
92		0.00	0.000	0.089	0.1986	0.5720	0.0001	5.18E-07
93		0.09	0.000	0.042	0.2033	0.5718	0.0001	5.17E-07
94		0.01	0.000	0.059	0.1985	0.5716	0.0001	5.17E-07
95		0.72	0.211	0.150	0.2147	0.5714	0.0001	5.17E-07
96		1.74	0.975	0.128	0.2264	0.5712	0.0001	5.17E-07
97		0.00	0.236	0.131	0.2380	0.5710	0.0001	5.17E-07
98		0.08	0.060	0.084	0.2496	0.5708	0.0001	5.17E-07
99		0.02	0.000	0.116	0.2455	0.5706	0.0001	5.16E-07
100		0.01	0.000	0.086	0.2381	0.5704	0.0001	5.16E-07
101		0.00	0.000	0.183	0.2198	0.5702	0.0001	5.16E-07
102		0.01	0.000	0.118	0.2091	0.5700	0.0001	5.16E-07
103		0.00	0.000	0.099	0.1992	0.5698	0.0001	5.16E-07
104		0.09	0.000	0.034	0.2048	0.5696	0.0001	5.16E-07
105		0.00	0.000	0.052	0.1996	0.5694	0.0001	5.15E-07
106		0.00	0.000	0.019	0.1977	0.5692	0.0001	5.15E-07
107	*	0.00	0.000	0.006	0.1971	0.5690	0.0001	5.15E-07
108		0.00	0.000	0.001	0.1970	0.5688	0.0001	5.15E-07
109		1.45	0.691	0.043	0.2133	0.5686	0.0001	5.15E-07
110		0.00	0.170	0.097	0.2249	0.5684	0.0001	5.15E-07
111		0.01	0.000	0.088	0.2339	0.5682	0.0001	5.14E-07
112		0.14	0.000	0.144	0.2330	0.5680	0.0001	5.14E-07
113		0.22	0.035	0.080	0.2403	0.5678	0.0001	5.14E-07
114		0.02	0.000	0.233	0.2220	0.5676	0.0001	5.14E-07
115		0.00	0.000	0.090	0.2130	0.5674	0.0001	5.14E-07
116		0.00	0.000	0.123	0.2007	0.5672	0.0001	5.14E-07
117		0.00	0.000	0.032	0.1976	0.5670	0.0001	5.13E-07
118		0.06	0.000	0.023	0.2012	0.5668	0.0001	5.13E-07
119		0.00	0.000	0.008	0.2004	0.5666	0.0001	5.13E-07
120		0.00	0.000	0.015	0.1989	0.5664	0.0001	5.13E-07

121	0.00	0.000	0.008	0.1981	0.5662	0.0001	5.13E-07
122	0.00	0.000	0.008	0.1973	0.5660	0.0001	5.13E-07
123	0.05	0.000	0.014	0.2014	0.5658	0.0001	5.12E-07
124	0.59	0.213	0.038	0.2138	0.5656	0.0001	5.12E-07
125	0.00	0.000	0.137	0.2211	0.5654	0.0001	5.12E-07
126	0.00	0.000	0.042	0.2169	0.5652	0.0001	5.12E-07
127	0.07	0.000	0.056	0.2186	0.5650	0.0001	5.12E-07
128	0.04	0.000	0.158	0.2065	0.5648	0.0001	5.12E-07
129	0.56	0.048	0.338	0.2195	0.5646	0.0001	5.11E-07
130	0.06	0.000	0.163	0.2133	0.5644	0.0001	5.11E-07
131	1.95	0.968	0.193	0.2263	0.5642	0.0001	5.11E-07
132	0.28	0.308	0.210	0.2379	0.5640	0.0001	5.11E-07
133	1.43	0.756	0.358	0.2495	0.5638	0.0001	5.11E-07
134	0.01	0.000	0.395	0.2611	0.5636	0.0001	5.11E-07
135	0.00	0.000	0.205	0.2406	0.5634	0.0001	5.10E-07
136	0.00	0.000	0.228	0.2178	0.5632	0.0001	5.10E-07
137	0.00	0.000	0.189	0.1989	0.5630	0.0001	5.10E-07
138	0.00	0.000	0.010	0.1980	0.5628	0.0001	5.10E-07
139	0.00	0.000	0.010	0.1970	0.5626	0.0001	5.10E-07
140	0.00	0.000	0.000	0.1970	0.5624	0.0001	5.10E-07
141	0.19	0.020	0.027	0.2090	0.5622	0.0001	5.09E-07
142	0.00	0.000	0.036	0.2074	0.5620	0.0001	5.09E-07
143	0.00	0.000	0.023	0.2052	0.5618	0.0001	5.09E-07
144	0.24	0.043	0.032	0.2173	0.5616	0.0001	5.09E-07
145	0.14	0.002	0.094	0.2255	0.5614	0.0001	5.09E-07
146	0.02	0.000	0.122	0.2150	0.5612	0.0001	5.09E-07
147	0.64	0.170	0.153	0.2303	0.5611	0.0001	5.09E-07
148	0.00	0.000	0.185	0.2281	0.5609	0.0001	5.08E-07
149	0.00	0.000	0.225	0.2056	0.5607	0.0001	5.08E-07
150	0.00	0.000	0.075	0.1981	0.5605	0.0001	5.08E-07
151	0.00	0.000	0.010	0.1975	0.5603	0.0001	5.08E-07
152	0.02	0.000	0.016	0.1984	0.5601	0.0001	5.08E-07

153	0.28	0.045	0.051	0.2117	0.5599	0.0001	5.08E-07
154	0.00	0.000	0.061	0.2101	0.5599	0.0001	5.08E-07
155	0.00	0.000	0.024	0.2077	0.5599	0.0001	5.08E-07
156	0.00	0.000	0.022	0.2055	0.5597	0.0001	5.07E-07
157	0.00	0.000	0.019	0.2036	0.5595	0.0001	5.07E-07
158	0.00	0.000	0.019	0.2016	0.5593	0.0001	5.07E-07
159	0.00	0.000	0.019	0.1997	0.5591	0.0001	5.07E-07
160	0.10	0.000	0.027	0.2069	0.5589	0.0001	5.07E-07
161	0.02	0.000	0.028	0.2059	0.5587	0.0001	5.07E-07
162	0.00	0.000	0.015	0.2044	0.5585	0.0001	5.06E-07
163	0.00	0.000	0.013	0.2031	0.5583	0.0001	5.06E-07
164	0.00	0.000	0.015	0.2017	0.5581	0.0001	5.06E-07
165	0.00	0.000	0.015	0.2002	0.5579	0.0001	5.06E-07
166	0.03	0.000	0.023	0.2010	0.5577	0.0001	5.06E-07
167	0.00	0.000	0.010	0.2000	0.5575	0.0001	5.06E-07
168	0.00	0.000	0.008	0.1991	0.5573	0.0001	5.05E-07
169	0.00	0.000	0.004	0.1987	0.5572	0.0001	5.05E-07
170	0.00	0.000	0.004	0.1983	0.5570	0.0001	5.05E-07
171	0.00	0.000	0.003	0.1980	0.5568	0.0001	5.05E-07
172	0.00	0.000	0.004	0.1976	0.5566	0.0001	5.05E-07
173	0.01	0.000	0.010	0.1978	0.5564	0.0001	5.05E-07
174	0.00	0.000	0.002	0.1975	0.5562	0.0001	5.04E-07
175	0.78	0.306	0.026	0.2133	0.5560	0.0001	5.04E-07
176	0.00	0.000	0.215	0.2208	0.5558	0.0001	5.04E-07
177	0.00	0.000	0.122	0.2087	0.5556	0.0001	5.04E-07
178	0.00	0.000	0.097	0.1990	0.5554	0.0001	5.04E-07
179	0.00	0.000	0.020	0.1970	0.5552	0.0001	5.04E-07
180	0.00	0.000	0.000	0.1970	0.5550	0.0001	5.03E-07
181	0.00	0.000	0.000	0.1970	0.5548	0.0001	5.03E-07
182	0.07	0.000	0.014	0.2026	0.5546	0.0001	5.03E-07
183	0.06	0.000	0.027	0.2061	0.5544	0.0001	5.03E-07
184	0.00	0.000	0.022	0.2039	0.5542	0.0001	5.03E-07

185	0.46	0.140	0.040	0.2181	0.5540	0.0001	5.03E-07
186	0.02	0.000	0.127	0.2210	0.5538	0.0001	5.03E-07
187	0.06	0.000	0.070	0.2196	0.5536	0.0001	5.02E-07
188	0.53	0.089	0.234	0.2318	0.5535	0.0001	5.02E-07
189	0.00	0.000	0.221	0.2181	0.5533	0.0001	5.02E-07
190	0.00	0.000	0.156	0.2025	0.5531	0.0001	5.02E-07
191	0.00	0.000	0.049	0.1976	0.5529	0.0001	5.02E-07
192	0.00	0.000	0.003	0.1973	0.5527	0.0001	5.02E-07
193	0.00	0.000	0.001	0.1971	0.5525	0.0001	5.01E-07
194	0.00	0.000	0.001	0.1970	0.5523	0.0001	5.01E-07
195	0.00	0.000	0.000	0.1970	0.5521	0.0001	5.01E-07
196	0.00	0.000	0.000	0.1970	0.5519	0.0001	5.01E-07
197	0.05	0.000	0.013	0.2007	0.5517	0.0001	5.01E-07
198	1.03	0.460	0.041	0.2129	0.5515	0.0001	5.01E-07
199	0.04	0.089	0.150	0.2245	0.5513	0.0001	5.00E-07
200	0.00	0.000	0.119	0.2216	0.5511	0.0001	5.00E-07
201	0.00	0.000	0.097	0.2119	0.5509	0.0001	5.00E-07
202	0.26	0.033	0.206	0.2108	0.5507	0.0001	5.00E-07
203	0.96	0.358	0.213	0.2225	0.5506	0.0001	5.00E-07
204	0.00	0.000	0.252	0.2281	0.5504	0.0001	5.00E-07
205	0.00	0.000	0.205	0.2076	0.5502	0.0001	4.99E-07
206	0.01	0.000	0.088	0.1999	0.5500	0.0001	4.99E-07
207	0.00	0.000	0.027	0.1972	0.5498	0.0001	4.99E-07
208	0.00	0.000	0.002	0.1970	0.5496	0.0001	4.99E-07
209	0.00	0.000	0.000	0.1970	0.5494	0.0001	4.99E-07
210	0.62	0.203	0.060	0.2129	0.5492	0.0001	4.99E-07
211	0.80	0.382	0.147	0.2245	0.5490	0.0001	4.99E-07
212	0.00	0.000	0.290	0.2309	0.5488	0.0001	4.98E-07
213	0.00	0.000	0.114	0.2195	0.5486	0.0001	4.98E-07
214	0.00	0.000	0.172	0.2023	0.5484	0.0001	4.98E-07
215	0.00	0.000	0.040	0.1983	0.5482	0.0001	4.98E-07
216	0.00	0.000	0.008	0.1975	0.5480	0.0001	4.98E-07

217	0.00	0.000	0.003	0.1972	0.5479	0.0001	4.98E-07
218	0.00	0.000	0.002	0.1970	0.5477	0.0001	4.97E-07
219	0.00	0.000	0.000	0.1970	0.5475	0.0001	4.97E-07
220	0.00	0.000	0.000	0.1970	0.5473	0.0001	4.97E-07
221	0.00	0.000	0.000	0.1970	0.5471	0.0001	4.97E-07
222	0.00	0.000	0.000	0.1970	0.5469	0.0001	4.97E-07
223	0.00	0.000	0.000	0.1970	0.5467	0.0001	4.97E-07
224	0.00	0.000	0.000	0.1970	0.5465	0.0001	4.96E-07
225	0.00	0.000	0.000	0.1970	0.5463	0.0001	4.96E-07
226	0.00	0.000	0.000	0.1970	0.5461	0.0001	4.96E-07
227	0.90	0.369	0.035	0.2131	0.5459	0.0001	4.96E-07
228	0.25	0.065	0.344	0.2247	0.5457	0.0001	4.96E-07
229	0.00	0.000	0.124	0.2188	0.5456	0.0001	4.96E-07
230	0.00	0.000	0.083	0.2105	0.5454	0.0001	4.95E-07
231	0.00	0.000	0.080	0.2025	0.5452	0.0001	4.95E-07
232	0.18	0.000	0.140	0.2062	0.5450	0.0001	4.95E-07
233	1.20	0.519	0.143	0.2178	0.5448	0.0001	4.95E-07
234	0.00	0.070	0.167	0.2294	0.5446	0.0001	4.95E-07
235	0.00	0.000	0.178	0.2186	0.5444	0.0001	4.95E-07
236	0.14	0.000	0.105	0.2224	0.5442	0.0001	4.95E-07
237	0.00	0.000	0.164	0.2059	0.5440	0.0001	4.94E-07
238	0.41	0.061	0.147	0.2196	0.5438	0.0001	4.94E-07
239	0.00	0.000	0.214	0.2044	0.5436	0.0001	4.94E-07
240	0.39	0.057	0.140	0.2177	0.5438	0.0001	4.94E-07
241	0.17	0.012	0.231	0.2153	0.5438	0.0001	4.94E-07
242	0.22	0.026	0.182	0.2156	0.5436	0.0001	4.94E-07
243	0.02	0.000	0.162	0.2037	0.5434	0.0001	4.94E-07
244	0.00	0.000	0.050	0.1987	0.5432	0.0001	4.94E-07
245	0.00	0.000	0.017	0.1970	0.5431	0.0001	4.94E-07
246	0.42	0.098	0.074	0.2125	0.5429	0.0001	4.93E-07
247	0.13	0.002	0.110	0.2241	0.5427	0.0001	4.93E-07
248	0.44	0.125	0.085	0.2355	0.5425	0.0001	4.93E-07

249	0.18	0.054	0.079	0.2471	0.5423	0.0001	4.93E-07
250	0.00	0.000	0.181	0.2344	0.5421	0.0001	4.93E-07
251	0.00	0.000	0.122	0.2222	0.5419	0.0001	4.93E-07
252	0.00	0.000	0.226	0.1996	0.5417	0.0001	4.92E-07
253	0.00	0.000	0.013	0.1983	0.5415	0.0001	4.92E-07
254	0.00	0.000	0.007	0.1977	0.5413	0.0001	4.92E-07
255	0.00	0.000	0.007	0.1970	0.5412	0.0001	4.92E-07
256	0.00	0.000	0.000	0.1970	0.5410	0.0001	4.92E-07
257	0.60	0.196	0.055	0.2128	0.5408	0.0001	4.92E-07
258	0.75	0.351	0.144	0.2245	0.5406	0.0001	4.92E-07
259	0.13	0.108	0.132	0.2361	0.5404	0.0001	4.91E-07
260	0.03	0.000	0.122	0.2381	0.5402	0.0001	4.91E-07
261	0.00	0.000	0.049	0.2332	0.5400	0.0001	4.91E-07
262	0.00	0.000	0.098	0.2234	0.5398	0.0001	4.91E-07
263	0.00	0.000	0.143	0.2091	0.5396	0.0001	4.91E-07
264	0.00	0.000	0.070	0.2021	0.5394	0.0001	4.91E-07
265	0.34	0.043	0.235	0.2034	0.5393	0.0001	4.90E-07
266	0.00	0.000	0.066	0.2012	0.5391	0.0001	4.90E-07
267	0.00	0.000	0.032	0.1980	0.5389	0.0001	4.90E-07
268	0.00	0.000	0.008	0.1972	0.5387	0.0001	4.90E-07
269	0.05	0.000	0.028	0.1990	0.5385	0.0001	4.90E-07
270	0.00	0.000	0.007	0.1983	0.5383	0.0001	4.90E-07
271	1.58	0.763	0.071	0.2139	0.5381	0.0001	4.89E-07
272	0.00	0.135	0.205	0.2256	0.5379	0.0001	4.89E-07
273	0.00	0.000	0.170	0.2221	0.5377	0.0001	4.89E-07
274	0.00	0.000	0.087	0.2135	0.5376	0.0001	4.89E-07
275	0.00	0.000	0.088	0.2047	0.5374	0.0001	4.89E-07
276	0.00	0.000	0.059	0.1988	0.5372	0.0001	4.89E-07
277	0.00	0.000	0.016	0.1971	0.5370	0.0001	4.89E-07
278	0.00	0.000	0.001	0.1971	0.5368	0.0001	4.88E-07
279	0.00	0.000	0.001	0.1970	0.5366	0.0001	4.88E-07
280	0.18	0.016	0.037	0.2084	0.5364	0.0001	4.88E-07

281		0.00	0.000	0.041	0.2059	0.5362	0.0001	4.88E-07
282	*	0.00	0.000	0.028	0.2031	0.5361	0.0001	4.88E-07
283		0.00	0.000	0.027	0.2004	0.5359	0.0001	4.88E-07
284		0.00	0.000	0.021	0.1984	0.5357	0.0001	4.87E-07
285		0.24	0.048	0.035	0.2096	0.5355	0.0001	4.87E-07
286		0.00	0.000	0.099	0.2046	0.5353	0.0001	4.87E-07
287		0.00	0.000	0.020	0.2025	0.5351	0.0001	4.87E-07
288		0.00	0.000	0.020	0.2006	0.5349	0.0001	4.87E-07
289		0.00	0.000	0.014	0.1992	0.5347	0.0001	4.87E-07
290		0.09	0.000	0.030	0.2050	0.5346	0.0001	4.86E-07
291	*	0.00	0.000	0.014	0.2036	0.5344	0.0001	4.86E-07
292	*	0.00	0.000	0.010	0.2026	0.5342	0.0001	4.86E-07
293		0.00	0.000	0.013	0.2013	0.5340	0.0001	4.86E-07
294		0.00	0.000	0.013	0.2000	0.5338	0.0001	4.86E-07
295		0.00	0.000	0.013	0.1987	0.5336	0.0001	4.86E-07
296		0.00	0.000	0.008	0.1979	0.5334	0.0001	4.86E-07
297	*	1.89	0.000	0.000	0.1998	0.5332	0.0001	4.85E-07
298		0.04	0.218	0.000	0.2136	0.5331	0.0001	4.85E-07
299		0.00	0.315	0.000	0.2252	0.5329	0.0001	4.85E-07
300	*	0.00	0.062	0.000	0.2368	0.5327	0.0001	4.85E-07
301	*	0.42	0.000	0.033	0.2389	0.5325	0.0001	4.85E-07
302		0.11	0.287	0.000	0.2516	0.5323	0.0001	4.85E-07
303		0.01	0.549	0.000	0.2632	0.5321	0.0001	4.84E-07
304		0.00	0.069	0.106	0.2748	0.5319	0.0001	4.84E-07
305	*	0.00	0.000	0.043	0.2748	0.5317	0.0001	4.84E-07
306		0.00	0.000	0.000	0.2748	0.5316	0.0001	4.84E-07
307		1.04	0.539	0.000	0.2879	0.5314	0.0001	4.84E-07
308		0.00	0.000	0.000	0.2879	0.5312	0.0001	4.84E-07
309		0.00	0.000	0.000	0.2879	0.5310	0.0001	4.84E-07
310		0.00	0.000	0.000	0.2880	0.5308	0.0001	4.83E-07
311		0.00	0.000	0.000	0.2880	0.5306	0.0001	4.83E-07
312		0.00	0.000	0.000	0.2880	0.5304	0.0001	4.83E-07

313		0.00	0.000	0.000	0.2880	0.5303	0.0001	4.83E-07
314		0.00	0.000	0.000	0.2880	0.5301	0.0001	4.83E-07
315		0.21	0.039	0.000	0.3016	0.5299	0.0001	4.83E-07
316		0.09	0.000	0.000	0.3102	0.5297	0.0001	4.82E-07
317		0.00	0.000	0.000	0.3102	0.5295	0.0001	4.82E-07
318		0.00	0.000	0.000	0.3102	0.5293	0.0001	4.82E-07
319		0.00	0.000	0.000	0.3102	0.5291	0.0001	4.82E-07
320		0.00	0.000	0.000	0.3102	0.5290	0.0001	4.82E-07
321		0.00	0.000	0.000	0.3102	0.5288	0.0001	4.82E-07
322		0.00	0.000	0.000	0.3102	0.5286	0.0001	4.82E-07
323		0.01	0.000	0.000	0.3110	0.5284	0.0001	4.81E-07
324	*	1.40	0.144	0.000	0.3240	0.5282	0.0001	4.81E-07
325	*	0.00	0.004	0.026	0.3357	0.5280	0.0001	4.81E-07
326		0.00	0.874	0.000	0.3473	0.5278	0.0001	4.81E-07
327		0.00	0.061	0.187	0.3589	0.5277	0.0001	4.81E-07
328		0.00	0.000	0.134	0.3516	0.5275	0.0001	4.81E-07
329		0.00	0.000	0.149	0.3367	0.5273	0.0001	4.80E-07
330		0.00	0.000	0.065	0.3267	0.5553	0.0001	5.04E-07
331		0.00	0.000	0.120	0.3106	0.6794	0.0001	6.06E-07
332		0.00	0.000	0.129	0.2976	0.7606	0.0001	6.72E-07
333		0.06	0.000	0.130	0.2904	0.7603	0.0001	6.72E-07
334		0.00	0.000	0.099	0.2805	0.7601	0.0001	6.71E-07
335		0.00	0.000	0.099	0.2706	0.7598	0.0001	6.71E-07
336		0.00	0.000	0.103	0.2603	0.7595	0.0001	6.71E-07
337		0.00	0.000	0.058	0.2545	0.7593	0.0001	6.71E-07
338		0.00	0.000	0.045	0.2500	0.7590	0.0001	6.70E-07
339		0.00	0.000	0.038	0.2463	0.7587	0.0001	6.70E-07
340		0.14	0.000	0.041	0.2561	0.7585	0.0001	6.70E-07
341		0.00	0.000	0.030	0.2531	0.7582	0.0001	6.70E-07
342		0.19	0.023	0.034	0.2646	0.7579	0.0001	6.70E-07
343		0.00	0.000	0.048	0.2620	0.7577	0.0001	6.69E-07
344	*	0.00	0.000	0.024	0.2596	0.7574	0.0001	6.69E-07

345		0.00	0.000	0.023	0.2574	0.7571	0.0001	6.69E-07
346		0.01	0.000	0.026	0.2555	0.7569	0.0001	6.69E-07
347		0.01	0.000	0.025	0.2538	0.7566	0.0001	6.69E-07
348		0.00	0.000	0.020	0.2518	0.7563	0.0001	6.68E-07
349		0.45	0.140	0.025	0.2660	0.7561	0.0001	6.68E-07
350		0.00	0.000	0.152	0.2648	0.7558	0.0001	6.68E-07
351		0.00	0.000	0.115	0.2534	0.7555	0.0001	6.68E-07
352		0.00	0.000	0.059	0.2475	0.7553	0.0001	6.67E-07
353	*	0.00	0.000	0.000	0.2475	0.7550	0.0001	6.67E-07
354		0.01	0.000	0.076	0.2400	0.7594	0.0001	6.71E-07
355		0.23	0.042	0.064	0.2480	0.7733	0.0001	6.82E-07
356		0.00	0.000	0.162	0.2360	0.7730	0.0001	6.82E-07
357		0.00	0.000	0.043	0.2318	0.7727	0.0001	6.82E-07
358	*	0.00	0.000	0.000	0.2318	0.7725	0.0001	6.81E-07
359	*	0.25	0.000	0.013	0.2338	0.7722	0.0001	6.81E-07
360	*	0.00	0.000	0.010	0.2357	0.7719	0.0001	6.81E-07
361		0.00	0.000	0.047	0.2377	0.7717	0.0001	6.81E-07
362		0.02	0.000	0.086	0.2428	0.7714	0.0001	6.80E-07
363		0.10	0.000	0.121	0.2408	0.7711	0.0001	6.80E-07
364		0.00	0.000	0.092	0.2296	0.8091	0.0001	7.11E-07
365	*	0.00	0.000	0.053	0.2244	0.8314	0.0001	7.29E-07

* = Frozen (air or soil)

Annual Totals for Year 4

	inches	cubic feet	percent
Precipitation	42.01	152,505.5	100.00
Runoff	17.195	62,419.2	40.93
Evapotranspiration	25.282	91,774.1	60.18
Recirculation into Layer 1	0.0239	86.8	0.06
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0239	86.8	0.06
Percolation/Leakage through Layer 5	0.000191	0.6921	0.00
Average Head on Top of Layer 4	0.5764	---	---
Change in Water Storage	-0.4652	-1,688.6	-1.11
Soil Water at Start of Year	293.2337	1,064,438.3	697.97
Soil Water at End of Year	293.4865	1,065,356.1	698.57
Snow Water at Start of Year	0.7180	2,606.3	1.71
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0239	-86.7	-0.06

Daily Output for Year 5

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.000	0.2244	0.8308	0.0001	7.28E-07
2	*		0.00	0.000	0.049	0.2182	0.8494	0.0001	7.43E-07
3			0.00	0.000	0.045	0.2138	0.8679	0.0001	7.58E-07
4			0.00	0.000	0.036	0.2102	0.8676	0.0001	7.58E-07
5	*		0.00	0.000	0.000	0.2102	0.8673	0.0001	7.58E-07
6			0.00	0.000	0.033	0.2061	0.8767	0.0001	7.65E-07
7			0.00	0.000	0.030	0.2031	0.8926	0.0001	7.78E-07
8			0.00	0.000	0.028	0.2003	0.8923	0.0001	7.78E-07
9	*		0.00	0.000	0.000	0.2003	0.8920	0.0001	7.77E-07
10	*		0.00	0.000	0.019	0.1970	0.9171	0.0001	7.97E-07
11			0.00	0.000	0.000	0.1970	0.9345	0.0001	8.11E-07
12			0.00	0.000	0.000	0.1970	0.9341	0.0001	8.11E-07
13	*		0.00	0.000	0.000	0.1970	0.9338	0.0001	8.11E-07
14			0.00	0.000	0.000	0.1970	0.9335	0.0001	8.10E-07
15			0.00	0.000	0.000	0.1970	0.9332	0.0001	8.10E-07
16			0.00	0.000	0.000	0.1970	0.9328	0.0001	8.10E-07
17			0.00	0.000	0.000	0.1970	0.9325	0.0001	8.10E-07
18	*		0.00	0.000	0.000	0.1970	0.9322	0.0001	8.09E-07
19			0.00	0.000	0.000	0.1970	0.9318	0.0001	8.09E-07
20	*		0.00	0.000	0.000	0.1970	0.9315	0.0001	8.09E-07
21	*		0.00	0.000	0.000	0.1970	0.9312	0.0001	8.09E-07
22	*		0.00	0.000	0.000	0.1970	0.9309	0.0001	8.08E-07
23			0.00	0.000	0.000	0.1970	0.9305	0.0001	8.08E-07
24	*		0.00	0.000	0.000	0.1970	0.9302	0.0001	8.08E-07

25	*	0.00	0.000	0.000	0.1970	0.9299	0.0001	8.08E-07
26	*	0.00	0.000	0.000	0.1970	0.9296	0.0001	8.07E-07
27		0.00	0.000	0.000	0.1970	0.9293	0.0001	8.07E-07
28		0.00	0.000	0.000	0.1970	0.9289	0.0001	8.07E-07
29		0.00	0.000	0.000	0.1970	0.9286	0.0001	8.07E-07
30	*	0.00	0.000	0.000	0.1970	0.9283	0.0001	8.06E-07
31		0.00	0.000	0.000	0.1970	0.9280	0.0001	8.06E-07
32	*	0.02	0.000	0.018	0.1970	0.9276	0.0001	8.06E-07
33		0.48	0.147	0.018	0.2133	0.9273	0.0001	8.05E-07
34		0.00	0.000	0.111	0.2170	0.9270	0.0001	8.05E-07
35		0.00	0.000	0.007	0.2163	0.9267	0.0001	8.05E-07
36		0.00	0.000	0.009	0.2153	0.9263	0.0001	8.05E-07
37		0.00	0.000	0.009	0.2144	0.9260	0.0001	8.04E-07
38		0.00	0.000	0.009	0.2136	0.9257	0.0001	8.04E-07
39		0.00	0.000	0.009	0.2127	0.9254	0.0001	8.04E-07
40		0.00	0.000	0.008	0.2119	0.9250	0.0001	8.04E-07
41		0.00	0.000	0.008	0.2111	0.9247	0.0001	8.03E-07
42		0.00	0.000	0.008	0.2103	0.9244	0.0001	8.03E-07
43		0.00	0.000	0.008	0.2095	0.9241	0.0001	8.03E-07
44		0.27	0.053	0.016	0.2241	0.9237	0.0001	8.03E-07
45		0.00	0.000	0.061	0.2233	0.9234	0.0001	8.02E-07
46		0.00	0.000	0.008	0.2226	0.9231	0.0001	8.02E-07
47	*	0.00	0.000	0.000	0.2226	0.9228	0.0001	8.02E-07
48		0.00	0.000	0.008	0.2218	0.9224	0.0001	8.02E-07
49		0.00	0.000	0.008	0.2211	0.9221	0.0001	8.01E-07
50		0.00	0.000	0.007	0.2203	0.9218	0.0001	8.01E-07
51	*	0.00	0.000	0.000	0.2203	0.9215	0.0001	8.01E-07
52	*	0.00	0.000	0.000	0.2204	0.9212	0.0001	8.01E-07
53	*	0.35	0.000	0.028	0.2223	0.9208	0.0001	8.00E-07
54	*	0.00	0.000	0.031	0.2243	0.9205	0.0001	8.00E-07
55	*	0.00	0.000	0.030	0.2263	0.9202	0.0001	8.00E-07
56	*	0.00	0.000	0.031	0.2283	0.9199	0.0001	8.00E-07

57	*	0.00	0.000	0.013	0.2303	0.9195	0.0001	7.99E-07
58	*	0.12	0.000	0.008	0.2322	0.9192	0.0001	7.99E-07
59	*	0.02	0.000	0.000	0.2342	0.9189	0.0001	7.99E-07
60	*	0.00	0.000	0.074	0.2362	0.9186	0.0001	7.99E-07
61	*	0.38	0.000	0.026	0.2382	0.9183	0.0001	7.98E-07
62		0.00	0.071	0.034	0.2509	0.9179	0.0001	7.98E-07
63		0.00	0.000	0.114	0.2619	0.9176	0.0001	7.98E-07
64		0.00	0.000	0.133	0.2486	0.9173	0.0001	7.97E-07
65		0.00	0.000	0.151	0.2335	0.9170	0.0001	7.97E-07
66		0.39	0.049	0.158	0.2469	0.9166	0.0001	7.97E-07
67		0.00	0.000	0.168	0.2355	0.9163	0.0001	7.97E-07
68		0.00	0.000	0.100	0.2255	0.9160	0.0001	7.96E-07
69		0.00	0.000	0.149	0.2106	0.9157	0.0001	7.96E-07
70		0.00	0.000	0.122	0.1984	0.9156	0.0001	7.96E-07
71		0.00	0.000	0.007	0.1977	0.9159	0.0001	7.96E-07
72		0.00	0.000	0.007	0.1970	0.9156	0.0001	7.96E-07
73		0.00	0.000	0.000	0.1970	0.9153	0.0001	7.96E-07
74		0.00	0.000	0.000	0.1970	0.9149	0.0001	7.96E-07
75		0.00	0.000	0.000	0.1970	0.9146	0.0001	7.95E-07
76		0.00	0.000	0.000	0.1970	0.9143	0.0001	7.95E-07
77		0.00	0.000	0.003	0.1970	0.9140	0.0001	7.95E-07
78		0.01	0.000	0.005	0.1970	0.9137	0.0001	7.95E-07
79		0.00	0.000	0.000	0.1970	0.9133	0.0001	7.94E-07
80		0.00	0.000	0.000	0.1970	0.9130	0.0001	7.94E-07
81		0.00	0.000	0.000	0.1970	0.9127	0.0001	7.94E-07
82		0.25	0.052	0.015	0.2097	0.9124	0.0001	7.94E-07
83	*	0.64	0.000	0.033	0.2119	0.9121	0.0001	7.93E-07
84		0.00	0.000	0.055	0.2140	0.9117	0.0001	7.93E-07
85		0.00	0.177	0.086	0.2267	0.9114	0.0001	7.93E-07
86		0.00	0.000	0.175	0.2265	0.9111	0.0001	7.93E-07
87		0.00	0.000	0.071	0.2195	0.9108	0.0001	7.92E-07
88		0.00	0.000	0.110	0.2085	0.9105	0.0001	7.92E-07

89		0.00	0.000	0.070	0.2015	0.9101	0.0001	7.92E-07
90		0.00	0.000	0.033	0.1981	0.9098	0.0001	7.92E-07
91		0.00	0.000	0.006	0.1976	0.9095	0.0001	7.91E-07
92		0.00	0.000	0.003	0.1973	0.9092	0.0001	7.91E-07
93		0.06	0.000	0.010	0.2021	0.9089	0.0001	7.91E-07
94		0.62	0.226	0.035	0.2158	0.9086	0.0001	7.91E-07
95		0.00	0.000	0.135	0.2244	0.9082	0.0001	7.90E-07
96		0.00	0.000	0.080	0.2164	0.9079	0.0001	7.90E-07
97		0.00	0.000	0.119	0.2045	0.9076	0.0001	7.90E-07
98		0.00	0.000	0.068	0.1977	0.9073	0.0001	7.90E-07
99		0.01	0.000	0.015	0.1973	0.9070	0.0001	7.89E-07
100	*	1.41	0.000	0.042	0.1993	0.9066	0.0001	7.89E-07
101		0.00	0.318	0.000	0.2136	0.9063	0.0001	7.89E-07
102		0.08	0.393	0.120	0.2252	0.9060	0.0001	7.88E-07
103		0.00	0.000	0.249	0.2344	0.9057	0.0001	7.88E-07
104		0.00	0.000	0.095	0.2250	0.9054	0.0001	7.88E-07
105		0.00	0.000	0.090	0.2160	0.9051	0.0001	7.88E-07
106		0.51	0.140	0.080	0.2310	0.9047	0.0001	7.87E-07
107		0.00	0.000	0.148	0.2301	0.9044	0.0001	7.87E-07
108		0.00	0.000	0.266	0.2036	0.9041	0.0001	7.87E-07
109		0.00	0.000	0.057	0.1979	0.9038	0.0001	7.87E-07
110		0.00	0.000	0.010	0.1973	0.9035	0.0001	7.86E-07
111		0.00	0.000	0.003	0.1970	0.9032	0.0001	7.86E-07
112		0.00	0.000	0.000	0.1970	0.9028	0.0001	7.86E-07
113		0.01	0.000	0.008	0.1973	0.9025	0.0001	7.86E-07
114		0.02	0.000	0.008	0.1986	0.9022	0.0001	7.85E-07
115		0.02	0.000	0.008	0.1997	0.9019	0.0001	7.85E-07
116		0.45	0.138	0.035	0.2133	0.9016	0.0001	7.85E-07
117		0.01	0.000	0.145	0.2139	0.9013	0.0001	7.85E-07
118	*	0.00	0.000	0.000	0.2139	0.9009	0.0001	7.84E-07
119		0.00	0.000	0.075	0.2064	0.9006	0.0001	7.84E-07
120		0.49	0.096	0.146	0.2216	0.9003	0.0001	7.84E-07

121	0.06	0.000	0.234	0.2142	0.9000	0.0001	7.84E-07
122	0.30	0.028	0.236	0.2149	0.8997	0.0001	7.83E-07
123	0.00	0.000	0.128	0.2049	0.8994	0.0001	7.83E-07
124	0.00	0.000	0.050	0.2000	0.8991	0.0001	7.83E-07
125	0.19	0.024	0.053	0.2090	0.8987	0.0001	7.83E-07
126	0.20	0.037	0.051	0.2188	0.8984	0.0001	7.82E-07
127	0.00	0.000	0.103	0.2122	0.8981	0.0001	7.82E-07
128	0.01	0.000	0.032	0.2104	0.8978	0.0001	7.82E-07
129	1.06	0.474	0.039	0.2238	0.8975	0.0001	7.82E-07
130	0.06	0.121	0.121	0.2354	0.8972	0.0001	7.81E-07
131	0.00	0.000	0.129	0.2346	0.8969	0.0001	7.81E-07
132	0.00	0.000	0.157	0.2189	0.8965	0.0001	7.81E-07
133	0.00	0.000	0.207	0.1982	0.8962	0.0001	7.81E-07
134	0.03	0.000	0.021	0.1989	0.8959	0.0001	7.80E-07
135	0.00	0.000	0.010	0.1979	0.8956	0.0001	7.80E-07
136	0.00	0.000	0.007	0.1972	0.8953	0.0001	7.80E-07
137	0.00	0.000	0.001	0.1970	0.8950	0.0001	7.80E-07
138	0.00	0.000	0.000	0.1970	0.8947	0.0001	7.79E-07
139	0.00	0.000	0.000	0.1970	0.8943	0.0001	7.79E-07
140	0.00	0.000	0.000	0.1970	0.8940	0.0001	7.79E-07
141	0.00	0.000	0.000	0.1970	0.8937	0.0001	7.79E-07
142	0.00	0.000	0.000	0.1970	0.8934	0.0001	7.78E-07
143	0.00	0.000	0.000	0.1970	0.8931	0.0001	7.78E-07
144	0.00	0.000	0.000	0.1970	0.8928	0.0001	7.78E-07
145	0.00	0.000	0.000	0.1970	0.8925	0.0001	7.78E-07
146	0.00	0.000	0.000	0.1970	0.8921	0.0001	7.77E-07
147	0.00	0.000	0.000	0.1970	0.8918	0.0001	7.77E-07
148	0.00	0.000	0.000	0.1970	0.8915	0.0001	7.77E-07
149	0.05	0.000	0.007	0.2013	0.8912	0.0001	7.77E-07
150	0.08	0.000	0.012	0.2086	0.8909	0.0001	7.76E-07
151	0.10	0.000	0.013	0.2175	0.8906	0.0001	7.76E-07
152	0.29	0.067	0.023	0.2303	0.8903	0.0001	7.76E-07

153	1.93	1.110	0.090	0.2419	0.8900	0.0001	7.76E-07
154	0.01	0.222	0.130	0.2535	0.8897	0.0001	7.75E-07
155	0.00	0.000	0.215	0.2543	0.8893	0.0001	7.75E-07
156	0.00	0.000	0.354	0.2189	0.8890	0.0001	7.75E-07
157	0.00	0.000	0.186	0.2003	0.8887	0.0001	7.75E-07
158	0.00	0.000	0.025	0.1978	0.8884	0.0001	7.74E-07
159	0.00	0.000	0.006	0.1972	0.8883	0.0001	7.74E-07
160	0.06	0.000	0.012	0.2021	0.8880	0.0001	7.74E-07
161	0.00	0.000	0.020	0.2001	0.8877	0.0001	7.74E-07
162	0.72	0.269	0.043	0.2147	0.8874	0.0001	7.74E-07
163	0.00	0.000	0.288	0.2117	0.8871	0.0001	7.73E-07
164	0.00	0.000	0.104	0.2013	0.8868	0.0001	7.73E-07
165	0.39	0.057	0.147	0.2146	0.8865	0.0001	7.73E-07
166	0.22	0.034	0.158	0.2198	0.8862	0.0001	7.73E-07
167	0.24	0.024	0.242	0.2187	0.8859	0.0001	7.72E-07
168	0.76	0.130	0.444	0.2302	0.8855	0.0001	7.72E-07
169	0.38	0.074	0.217	0.2419	0.8852	0.0001	7.72E-07
170	0.93	0.415	0.176	0.2535	0.8849	0.0001	7.72E-07
171	0.17	0.087	0.170	0.2651	0.8846	0.0001	7.71E-07
172	1.47	0.846	0.148	0.2767	0.8843	0.0001	7.71E-07
173	0.00	0.046	0.240	0.2884	0.8840	0.0001	7.71E-07
174	0.00	0.000	0.384	0.2546	0.8837	0.0001	7.71E-07
175	0.03	0.000	0.286	0.2294	0.8834	0.0001	7.70E-07
176	0.00	0.000	0.283	0.2011	0.8831	0.0001	7.70E-07
177	1.34	0.569	0.149	0.2170	0.8828	0.0001	7.70E-07
178	0.00	0.012	0.318	0.2286	0.8825	0.0001	7.70E-07
179	0.00	0.000	0.186	0.2109	0.8852	0.0001	7.72E-07
180	0.00	0.000	0.117	0.1992	0.8939	0.0001	7.79E-07
181	0.00	0.000	0.021	0.1971	0.8936	0.0001	7.79E-07
182	0.19	0.017	0.066	0.2056	0.8932	0.0001	7.78E-07
183	0.33	0.074	0.083	0.2170	0.8929	0.0001	7.78E-07
184	0.01	0.000	0.181	0.2073	0.8926	0.0001	7.78E-07

185	0.00	0.000	0.034	0.2039	0.8923	0.0001	7.78E-07
186	0.07	0.000	0.041	0.2066	0.8920	0.0001	7.77E-07
187	0.02	0.000	0.034	0.2049	0.8917	0.0001	7.77E-07
188	0.00	0.000	0.030	0.2019	0.8914	0.0001	7.77E-07
189	0.06	0.000	0.028	0.2051	0.8911	0.0001	7.77E-07
190	0.08	0.000	0.024	0.2111	0.8908	0.0001	7.76E-07
191	0.01	0.000	0.018	0.2102	0.8904	0.0001	7.76E-07
192	0.00	0.000	0.017	0.2085	0.8901	0.0001	7.76E-07
193	0.00	0.000	0.018	0.2068	0.8898	0.0001	7.76E-07
194	0.00	0.000	0.018	0.2049	0.8895	0.0001	7.75E-07
195	0.00	0.000	0.016	0.2034	0.8892	0.0001	7.75E-07
196	0.00	0.000	0.017	0.2018	0.8889	0.0001	7.75E-07
197	0.11	0.000	0.020	0.2105	0.8886	0.0001	7.75E-07
198	0.24	0.043	0.027	0.2232	0.8883	0.0001	7.74E-07
199	0.24	0.028	0.207	0.2257	0.8880	0.0001	7.74E-07
200	0.00	0.000	0.105	0.2183	0.8876	0.0001	7.74E-07
201	0.00	0.000	0.100	0.2082	0.8873	0.0001	7.74E-07
202	0.17	0.011	0.057	0.2170	0.8870	0.0001	7.73E-07
203	0.00	0.000	0.052	0.2129	0.8867	0.0001	7.73E-07
204	0.00	0.000	0.037	0.2092	0.8864	0.0001	7.73E-07
205	1.82	0.933	0.044	0.2234	0.8861	0.0001	7.73E-07
206	0.09	0.166	0.337	0.2351	0.8858	0.0001	7.72E-07
207	0.02	0.000	0.149	0.2388	0.8855	0.0001	7.72E-07
208	0.00	0.000	0.093	0.2295	0.8852	0.0001	7.72E-07
209	0.00	0.000	0.128	0.2167	0.8848	0.0001	7.72E-07
210	0.00	0.000	0.166	0.2001	0.8845	0.0001	7.71E-07
211	0.00	0.000	0.027	0.1975	0.8842	0.0001	7.71E-07
212	0.52	0.106	0.150	0.2134	0.8839	0.0001	7.71E-07
213	0.33	0.025	0.372	0.2142	0.8852	0.0001	7.72E-07
214	0.00	0.000	0.135	0.2033	0.8859	0.0001	7.72E-07
215	0.00	0.000	0.046	0.1987	0.8855	0.0001	7.72E-07
216	0.00	0.000	0.016	0.1971	0.8852	0.0001	7.72E-07

217	0.00	0.000	0.001	0.1970	0.8849	0.0001	7.72E-07
218	0.00	0.000	0.000	0.1970	0.8846	0.0001	7.71E-07
219	0.31	0.068	0.042	0.2106	0.8843	0.0001	7.71E-07
220	0.00	0.000	0.085	0.2089	0.8840	0.0001	7.71E-07
221	0.00	0.000	0.026	0.2064	0.8837	0.0001	7.71E-07
222	0.00	0.000	0.024	0.2040	0.8834	0.0001	7.70E-07
223	0.00	0.000	0.023	0.2017	0.8831	0.0001	7.70E-07
224	0.00	0.000	0.022	0.1995	0.8828	0.0001	7.70E-07
225	0.00	0.000	0.018	0.1977	0.8825	0.0001	7.70E-07
226	0.00	0.000	0.007	0.1970	0.8821	0.0001	7.69E-07
227	0.00	0.000	0.000	0.1970	0.8818	0.0001	7.69E-07
228	0.00	0.000	0.000	0.1970	0.8815	0.0001	7.69E-07
229	0.13	0.000	0.008	0.2090	0.8812	0.0001	7.69E-07
230	0.00	0.000	0.010	0.2080	0.8809	0.0001	7.68E-07
231	0.00	0.000	0.011	0.2069	0.8806	0.0001	7.68E-07
232	0.00	0.000	0.014	0.2055	0.8803	0.0001	7.68E-07
233	0.00	0.000	0.015	0.2040	0.8800	0.0001	7.68E-07
234	0.00	0.000	0.017	0.2023	0.8797	0.0001	7.67E-07
235	0.00	0.000	0.019	0.2004	0.8794	0.0001	7.67E-07
236	0.00	0.000	0.017	0.1986	0.8791	0.0001	7.67E-07
237	0.00	0.000	0.013	0.1974	0.8788	0.0001	7.67E-07
238	0.00	0.000	0.004	0.1970	0.8784	0.0001	7.66E-07
239	0.00	0.000	0.000	0.1970	0.8781	0.0001	7.66E-07
240	0.00	0.000	0.000	0.1970	0.8778	0.0001	7.66E-07
241	0.00	0.000	0.000	0.1970	0.8775	0.0001	7.66E-07
242	0.00	0.000	0.000	0.1970	0.8772	0.0001	7.66E-07
243	0.00	0.000	0.000	0.1970	0.8769	0.0001	7.65E-07
244	0.03	0.000	0.007	0.1991	0.8766	0.0001	7.65E-07
245	0.23	0.038	0.021	0.2128	0.8763	0.0001	7.65E-07
246	0.52	0.193	0.058	0.2242	0.8760	0.0001	7.65E-07
247	0.73	0.310	0.230	0.2359	0.8757	0.0001	7.64E-07
248	0.00	0.000	0.298	0.2325	0.8754	0.0001	7.64E-07

249	0.00	0.000	0.150	0.2175	0.8751	0.0001	7.64E-07
250	0.00	0.000	0.173	0.2003	0.8748	0.0001	7.64E-07
251	0.01	0.000	0.029	0.1984	0.8745	0.0001	7.63E-07
252	1.69	0.771	0.186	0.2144	0.8741	0.0001	7.63E-07
253	0.09	0.195	0.154	0.2261	0.8738	0.0001	7.63E-07
254	0.84	0.338	0.315	0.2377	0.8735	0.0001	7.63E-07
255	0.10	0.000	0.258	0.2484	0.8732	0.0001	7.62E-07
256	0.00	0.000	0.141	0.2343	0.8729	0.0001	7.62E-07
257	0.00	0.000	0.122	0.2221	0.8726	0.0001	7.62E-07
258	0.04	0.000	0.110	0.2156	0.8723	0.0001	7.62E-07
259	0.00	0.000	0.091	0.2065	0.8720	0.0001	7.61E-07
260	0.00	0.000	0.083	0.1982	0.8717	0.0001	7.61E-07
261	0.00	0.000	0.012	0.1974	0.8714	0.0001	7.61E-07
262	0.06	0.000	0.015	0.2016	0.8711	0.0001	7.61E-07
263	0.05	0.000	0.023	0.2043	0.8708	0.0001	7.60E-07
264	0.00	0.000	0.020	0.2024	0.8705	0.0001	7.60E-07
265	0.00	0.000	0.023	0.2001	0.8702	0.0001	7.60E-07
266	0.36	0.086	0.037	0.2150	0.8699	0.0001	7.60E-07
267	0.01	0.000	0.105	0.2137	0.8696	0.0001	7.59E-07
268	0.00	0.000	0.119	0.2018	0.8693	0.0001	7.59E-07
269	0.00	0.000	0.038	0.1980	0.8690	0.0001	7.59E-07
270	0.00	0.000	0.010	0.1970	0.8687	0.0001	7.59E-07
271	0.00	0.000	0.000	0.1970	0.8683	0.0001	7.58E-07
272	0.18	0.019	0.022	0.2091	0.8680	0.0001	7.58E-07
273	0.02	0.000	0.039	0.2086	0.8677	0.0001	7.58E-07
274	0.00	0.000	0.020	0.2066	0.8674	0.0001	7.58E-07
275	0.00	0.000	0.019	0.2047	0.8671	0.0001	7.57E-07
276	1.32	0.625	0.032	0.2196	0.8668	0.0001	7.57E-07
277	0.00	0.164	0.073	0.2313	0.8665	0.0001	7.57E-07
278	0.00	0.000	0.076	0.2400	0.8662	0.0001	7.57E-07
279	0.00	0.000	0.124	0.2277	0.8659	0.0001	7.56E-07
280	0.00	0.000	0.080	0.2197	0.8656	0.0001	7.56E-07

281		0.24	0.043	0.118	0.2232	0.8653	0.0001	7.56E-07
282		0.00	0.000	0.194	0.2082	0.8651	0.0001	7.56E-07
283		0.00	0.000	0.089	0.1992	0.8647	0.0001	7.56E-07
284		0.00	0.000	0.022	0.1971	0.8644	0.0001	7.55E-07
285		0.00	0.000	0.001	0.1970	0.8641	0.0001	7.55E-07
286		0.00	0.000	0.000	0.1970	0.8638	0.0001	7.55E-07
287		0.00	0.000	0.000	0.1970	0.8635	0.0001	7.55E-07
288		0.00	0.000	0.000	0.1970	0.8632	0.0001	7.54E-07
289		0.00	0.000	0.000	0.1970	0.8629	0.0001	7.54E-07
290		0.00	0.000	0.000	0.1970	0.8626	0.0001	7.54E-07
291		0.00	0.000	0.000	0.1970	0.8623	0.0001	7.54E-07
292		0.00	0.000	0.000	0.1970	0.8620	0.0001	7.53E-07
293		0.38	0.095	0.032	0.2126	0.8617	0.0001	7.53E-07
294		0.00	0.000	0.105	0.2116	0.8614	0.0001	7.53E-07
295		0.00	0.000	0.015	0.2101	0.8611	0.0001	7.53E-07
296		0.00	0.000	0.015	0.2086	0.8608	0.0001	7.52E-07
297		0.00	0.000	0.014	0.2072	0.8605	0.0001	7.52E-07
298		0.12	0.000	0.020	0.2172	0.8602	0.0001	7.52E-07
299		0.16	0.012	0.022	0.2281	0.8599	0.0001	7.52E-07
300		0.20	0.038	0.035	0.2384	0.8596	0.0001	7.51E-07
301		0.22	0.033	0.158	0.2423	0.8593	0.0001	7.51E-07
302		0.25	0.036	0.108	0.2530	0.8590	0.0001	7.51E-07
303		1.56	0.893	0.107	0.2647	0.8587	0.0001	7.51E-07
304		0.97	0.698	0.132	0.2763	0.8584	0.0001	7.50E-07
305		0.07	0.159	0.144	0.2879	0.8581	0.0001	7.50E-07
306		0.00	0.000	0.220	0.2818	0.8578	0.0001	7.50E-07
307		0.00	0.000	0.081	0.2737	0.8575	0.0001	7.50E-07
308		0.14	0.004	0.077	0.2795	0.8572	0.0001	7.50E-07
309	*	0.68	0.000	0.030	0.2814	0.8569	0.0001	7.49E-07
310	*	0.07	0.000	0.018	0.2834	0.8566	0.0001	7.49E-07
311	*	0.00	0.000	0.012	0.2854	0.8563	0.0001	7.49E-07
312	*	0.00	0.000	0.030	0.2874	0.8560	0.0001	7.49E-07

313		0.00	0.250	0.000	0.3002	0.8557	0.0001	7.48E-07
314		0.00	0.000	0.117	0.3092	0.8554	0.0001	7.48E-07
315		0.00	0.000	0.120	0.2972	0.8551	0.0001	7.48E-07
316		0.00	0.000	0.077	0.2896	0.8548	0.0001	7.48E-07
317		0.00	0.000	0.114	0.2782	0.8545	0.0001	7.47E-07
318		0.00	0.000	0.140	0.2642	0.8542	0.0001	7.47E-07
319		0.00	0.000	0.154	0.2489	0.8539	0.0001	7.47E-07
320		0.12	0.000	0.246	0.2360	0.8536	0.0001	7.47E-07
321		0.03	0.000	0.144	0.2249	0.8533	0.0001	7.46E-07
322		0.01	0.000	0.057	0.2206	0.8530	0.0001	7.46E-07
323		0.61	0.214	0.050	0.2339	0.8527	0.0001	7.46E-07
324		0.00	0.000	0.104	0.2451	0.8524	0.0001	7.46E-07
325		0.00	0.000	0.123	0.2328	0.8521	0.0001	7.45E-07
326		0.00	0.000	0.073	0.2255	0.8518	0.0001	7.45E-07
327		0.00	0.000	0.059	0.2195	0.8515	0.0001	7.45E-07
328		0.00	0.000	0.075	0.2120	0.8512	0.0001	7.45E-07
329		0.00	0.000	0.070	0.2040	0.8699	0.0001	7.60E-07
330		0.00	0.000	0.069	0.1971	0.8810	0.0001	7.69E-07
331		0.00	0.000	0.001	0.1971	0.8807	0.0001	7.68E-07
332		0.00	0.000	0.001	0.1970	0.8804	0.0001	7.68E-07
333	*	0.00	0.000	0.000	0.1970	0.8801	0.0001	7.68E-07
334		0.00	0.000	0.000	0.1970	0.8798	0.0001	7.68E-07
335		0.00	0.000	0.000	0.1970	0.8794	0.0001	7.67E-07
336		0.00	0.000	0.000	0.1970	0.8791	0.0001	7.67E-07
337		0.00	0.000	0.000	0.1970	0.8788	0.0001	7.67E-07
338		0.00	0.000	0.000	0.1970	0.8785	0.0001	7.67E-07
339		0.00	0.000	0.000	0.1970	0.8782	0.0001	7.66E-07
340		0.00	0.000	0.000	0.1970	0.8779	0.0001	7.66E-07
341		0.00	0.000	0.000	0.1970	0.8776	0.0001	7.66E-07
342		0.00	0.000	0.000	0.1970	0.8773	0.0001	7.66E-07
343		0.00	0.000	0.000	0.1970	0.8770	0.0001	7.65E-07
344		0.07	0.000	0.007	0.2032	0.8767	0.0001	7.65E-07

345		0.00	0.000	0.008	0.2024	0.8764	0.0001	7.65E-07
346		0.00	0.000	0.009	0.2015	0.8761	0.0001	7.65E-07
347		0.15	0.009	0.015	0.2131	0.8758	0.0001	7.64E-07
348		0.00	0.000	0.017	0.2123	0.8754	0.0001	7.64E-07
349		0.01	0.000	0.015	0.2115	0.8751	0.0001	7.64E-07
350		0.00	0.000	0.011	0.2104	0.8748	0.0001	7.64E-07
351		0.00	0.000	0.010	0.2094	0.8745	0.0001	7.63E-07
352		0.38	0.107	0.021	0.2238	0.8742	0.0001	7.63E-07
353		0.00	0.000	0.117	0.2228	0.8739	0.0001	7.63E-07
354		0.02	0.000	0.015	0.2229	0.8736	0.0001	7.63E-07
355		0.18	0.024	0.015	0.2350	0.8733	0.0001	7.62E-07
356		0.00	0.000	0.051	0.2323	0.8730	0.0001	7.62E-07
357	*	0.00	0.000	0.009	0.2314	0.8727	0.0001	7.62E-07
358	*	0.00	0.000	0.009	0.2305	0.8724	0.0001	7.62E-07
359	*	0.00	0.000	0.000	0.2305	0.8721	0.0001	7.61E-07
360	*	0.48	0.000	0.016	0.2324	0.8718	0.0001	7.61E-07
361		0.34	0.349	0.000	0.2452	0.8715	0.0001	7.61E-07
362		0.15	0.142	0.061	0.2568	0.8712	0.0001	7.61E-07
363		0.03	0.000	0.129	0.2611	0.8709	0.0001	7.60E-07
364		1.29	0.688	0.056	0.2739	0.8706	0.0001	7.60E-07
365		0.00	0.089	0.121	0.2855	0.8702	0.0001	7.60E-07

* = Frozen (air or soil)

Annual Totals for Year 5			
	inches	cubic feet	percent
Precipitation	37.67	136,729.3	100.00
Runoff	14.595	52,979.3	38.75
Evapotranspiration	22.359	81,162.5	59.36
Recirculation into Layer 1	0.0368	133.6	0.10
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0368	133.6	0.10
Percolation/Leakage through Layer 5	0.000283	1.0273	0.00
Average Head on Top of Layer 4	0.8896	---	---
Change in Water Storage	0.7125	2,586.4	1.89
Soil Water at Start of Year	293.4865	1,065,356.1	779.17
Soil Water at End of Year	294.1105	1,067,621.2	780.83
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0885	321.3	0.23
Annual Water Budget Balance	-0.0368	-133.6	-0.10

Daily Output for Year 6

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

						Evap. Zone			
Day	Freezing Status*		Rain	Runoff	ET	Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.136	0.2807	0.8699	0.0001	7.60E-07
2			0.00	0.000	0.082	0.2726	0.8696	0.0001	7.59E-07
3			0.17	0.013	0.097	0.2771	0.8693	0.0001	7.59E-07
4			0.24	0.036	0.084	0.2873	0.8690	0.0001	7.59E-07
5			0.59	0.248	0.083	0.2989	0.8687	0.0001	7.59E-07
6	*		0.10	0.015	0.026	0.3106	0.8684	0.0001	7.58E-07
7	*		0.02	0.000	0.040	0.3128	0.8681	0.0001	7.58E-07
8			0.00	0.000	0.079	0.3124	0.8678	0.0001	7.58E-07
9			0.00	0.000	0.092	0.3032	0.8675	0.0001	7.58E-07
10			0.24	0.035	0.076	0.3128	0.8672	0.0001	7.58E-07
11	*		0.34	0.000	0.030	0.3150	0.8669	0.0001	7.57E-07
12	*		0.23	0.000	0.037	0.3171	0.8666	0.0001	7.57E-07
13	*		0.01	0.000	0.000	0.3192	0.8663	0.0001	7.57E-07
14			0.07	0.222	0.013	0.3319	0.8660	0.0001	7.57E-07
15	*		0.01	0.007	0.061	0.3435	0.8657	0.0001	7.56E-07
16			0.00	0.000	0.074	0.3368	0.8654	0.0001	7.56E-07
17			0.00	0.000	0.053	0.3315	0.8651	0.0001	7.56E-07
18			0.00	0.000	0.090	0.3226	0.8648	0.0001	7.56E-07
19			0.10	0.000	0.093	0.3238	0.8645	0.0001	7.55E-07
20			0.00	0.000	0.091	0.3139	0.8700	0.0001	7.60E-07
21			0.00	0.000	0.061	0.3072	0.8963	0.0001	7.81E-07
22			0.00	0.000	0.094	0.2973	0.9060	0.0001	7.89E-07
23			0.00	0.000	0.076	0.2897	0.9203	0.0001	8.00E-07
24			0.25	0.048	0.112	0.2940	0.9200	0.0001	8.00E-07

25		0.05	0.000	0.114	0.2924	0.9197	0.0001	7.99E-07
26		0.05	0.000	0.107	0.2867	0.9193	0.0001	7.99E-07
27		0.62	0.214	0.063	0.2996	0.9190	0.0001	7.99E-07
28		0.41	0.203	0.100	0.3112	0.9187	0.0001	7.99E-07
29		0.00	0.005	0.075	0.3229	0.9184	0.0001	7.98E-07
30		0.00	0.000	0.093	0.3136	0.9305	0.0001	8.08E-07
31		0.00	0.000	0.070	0.3066	0.9343	0.0001	8.11E-07
32		0.00	0.000	0.089	0.2977	0.9339	0.0001	8.11E-07
33		0.50	0.130	0.095	0.3127	0.9336	0.0001	8.10E-07
34		0.24	0.063	0.125	0.3226	0.9526	0.0001	8.26E-07
35		0.74	0.329	0.122	0.3339	0.9931	0.0001	8.58E-07
36		0.00	0.000	0.137	0.3435	0.9958	0.0001	8.60E-07
37		0.00	0.000	0.077	0.3351	0.9955	0.0001	8.60E-07
38		0.92	0.413	0.084	0.3488	1.0127	0.0001	8.73E-07
39		0.06	0.074	0.086	0.3604	1.0124	0.0001	8.73E-07
40		0.06	0.000	0.123	0.3605	1.0243	0.0001	8.82E-07
41		0.05	0.000	0.067	0.3579	1.0473	0.0001	9.00E-07
42		0.00	0.000	0.061	0.3471	1.1051	0.0001	9.46E-07
43		0.10	0.000	0.105	0.3412	1.2327	0.0001	1.05E-06
44		0.00	0.000	0.219	0.3151	1.3684	0.0002	1.15E-06
45		0.00	0.000	0.193	0.2929	1.4957	0.0002	1.25E-06
46		0.00	0.000	0.085	0.2844	1.5977	0.0002	1.33E-06
47		0.00	0.000	0.124	0.2721	1.5972	0.0002	1.33E-06
48		0.00	0.000	0.134	0.2587	1.5966	0.0002	1.33E-06
49		0.00	0.000	0.112	0.2475	1.5961	0.0002	1.33E-06
50	*	0.19	0.000	0.045	0.2495	1.5955	0.0002	1.33E-06
51		0.35	0.126	0.077	0.2638	1.5949	0.0002	1.32E-06
52		0.02	0.000	0.148	0.2636	1.5944	0.0002	1.32E-06
53	*	0.00	0.000	0.081	0.2556	1.5938	0.0002	1.32E-06
54	*	0.23	0.000	0.039	0.2575	1.5933	0.0002	1.32E-06
55		0.00	0.000	0.137	0.2609	1.5927	0.0002	1.32E-06
56	*	0.02	0.000	0.055	0.2569	1.5922	0.0002	1.32E-06

57	*	0.00	0.000	0.079	0.2490	1.5916	0.0002	1.32E-06
58		0.00	0.000	0.090	0.2400	1.5910	0.0002	1.32E-06
59		0.00	0.000	0.119	0.2281	1.5905	0.0002	1.32E-06
60	*	0.05	0.000	0.052	0.2282	1.5899	0.0002	1.32E-06
61		0.00	0.000	0.053	0.2204	1.6337	0.0002	1.35E-06
62		0.05	0.000	0.048	0.2210	1.6630	0.0002	1.38E-06
63		0.00	0.000	0.038	0.2172	1.6624	0.0002	1.38E-06
64		0.04	0.000	0.036	0.2161	1.6865	0.0002	1.39E-06
65		1.01	0.449	0.033	0.2290	1.7105	0.0002	1.41E-06
66		0.00	0.035	0.212	0.2406	1.7099	0.0002	1.41E-06
67		0.00	0.000	0.275	0.2139	1.7093	0.0002	1.41E-06
68		0.00	0.000	0.084	0.2055	1.7494	0.0002	1.44E-06
69		0.00	0.000	0.065	0.1990	1.7929	0.0002	1.48E-06
70		0.00	0.000	0.019	0.1971	1.7922	0.0002	1.47E-06
71		0.00	0.000	0.001	0.1971	1.7916	0.0002	1.47E-06
72		0.00	0.000	0.001	0.1970	1.7910	0.0002	1.47E-06
73		0.00	0.000	0.000	0.1970	1.7903	0.0002	1.47E-06
74		0.00	0.000	0.000	0.1970	1.7897	0.0002	1.47E-06
75	*	0.09	0.000	0.049	0.1990	1.7891	0.0002	1.47E-06
76	*	0.07	0.000	0.050	0.2010	1.7885	0.0002	1.47E-06
77	*	0.10	0.000	0.059	0.2030	1.7878	0.0002	1.47E-06
78	*	0.50	0.000	0.000	0.2050	1.7872	0.0002	1.47E-06
79		0.31	0.321	0.085	0.2177	1.7866	0.0002	1.47E-06
80		0.82	0.435	0.169	0.2294	1.7860	0.0002	1.47E-06
81		0.10	0.083	0.207	0.2410	1.7853	0.0002	1.47E-06
82		0.00	0.000	0.248	0.2246	1.7847	0.0002	1.47E-06
83		0.00	0.000	0.107	0.2139	1.7841	0.0002	1.47E-06
84		0.27	0.047	0.111	0.2201	1.7835	0.0002	1.47E-06
85	*	0.18	0.000	0.047	0.2226	1.7828	0.0002	1.47E-06
86		0.10	0.000	0.181	0.2295	1.7822	0.0002	1.47E-06
87		0.00	0.000	0.112	0.2183	1.7816	0.0002	1.47E-06
88		0.00	0.000	0.062	0.2121	1.7810	0.0002	1.47E-06

89	*	0.00	0.000	0.000	0.2121	1.7803	0.0002	1.47E-06
90	*	0.00	0.000	0.002	0.2121	1.7797	0.0002	1.47E-06
91	*	0.00	0.000	0.039	0.2082	1.7795	0.0002	1.46E-06
92	*	0.85	0.000	0.026	0.2102	1.7800	0.0002	1.47E-06
93		0.08	0.372	0.035	0.2237	1.7794	0.0002	1.46E-06
94		0.18	0.120	0.169	0.2354	1.7788	0.0002	1.46E-06
95	*	0.00	0.000	0.065	0.2354	1.7782	0.0002	1.46E-06
96	*	0.00	0.000	0.053	0.2354	1.7775	0.0002	1.46E-06
97		0.00	0.000	0.000	0.2354	1.7769	0.0002	1.46E-06
98		0.21	0.041	0.000	0.2487	1.7763	0.0002	1.46E-06
99		0.33	0.112	0.000	0.2603	1.7757	0.0002	1.46E-06
100		0.00	0.000	0.000	0.2603	1.7750	0.0002	1.46E-06
101		0.00	0.000	0.000	0.2603	1.7744	0.0002	1.46E-06
102		0.02	0.000	0.000	0.2622	1.7738	0.0002	1.46E-06
103		0.00	0.000	0.000	0.2623	1.7732	0.0002	1.46E-06
104	*	0.00	0.000	0.112	0.2623	1.7726	0.0002	1.46E-06
105	*	0.00	0.000	0.036	0.2623	1.7719	0.0002	1.46E-06
106		0.04	0.000	0.132	0.2534	1.7713	0.0002	1.46E-06
107		0.00	0.000	0.146	0.2388	1.7707	0.0002	1.46E-06
108		0.00	0.000	0.247	0.2141	1.7703	0.0002	1.46E-06
109		0.00	0.000	0.143	0.1998	1.7699	0.0002	1.46E-06
110		0.00	0.000	0.016	0.1982	1.7693	0.0002	1.46E-06
111		0.21	0.036	0.040	0.2084	1.7687	0.0002	1.46E-06
112		0.00	0.000	0.055	0.2066	1.7681	0.0002	1.46E-06
113		0.00	0.000	0.025	0.2041	1.7675	0.0002	1.46E-06
114		0.02	0.000	0.026	0.2032	1.7668	0.0002	1.46E-06
115		0.00	0.000	0.021	0.2012	1.7662	0.0002	1.45E-06
116		0.00	0.000	0.019	0.1992	1.7656	0.0002	1.45E-06
117		0.22	0.041	0.022	0.2111	1.7650	0.0002	1.45E-06
118		0.00	0.000	0.055	0.2098	1.7644	0.0002	1.45E-06
119		0.00	0.000	0.016	0.2082	1.7638	0.0002	1.45E-06
120		0.23	0.041	0.022	0.2210	1.7631	0.0002	1.45E-06

121	0.05	0.000	0.057	0.2246	1.7625	0.0002	1.45E-06
122	0.42	0.135	0.024	0.2374	1.7619	0.0002	1.45E-06
123	0.36	0.058	0.268	0.2490	1.7613	0.0002	1.45E-06
124	0.00	0.000	0.279	0.2266	1.7607	0.0002	1.45E-06
125	0.00	0.000	0.272	0.1994	1.7601	0.0002	1.45E-06
126	0.00	0.000	0.012	0.1982	1.7595	0.0002	1.45E-06
127	0.00	0.000	0.008	0.1976	1.7589	0.0002	1.45E-06
128	0.00	0.000	0.006	0.1970	1.7583	0.0002	1.45E-06
129	0.00	0.000	0.000	0.1970	1.7577	0.0002	1.45E-06
130	0.00	0.000	0.000	0.1970	1.7570	0.0002	1.45E-06
131	0.21	0.034	0.017	0.2094	1.7564	0.0002	1.45E-06
132	0.21	0.037	0.065	0.2200	1.7558	0.0002	1.45E-06
133	0.00	0.000	0.049	0.2189	1.7552	0.0002	1.45E-06
134	0.05	0.000	0.021	0.2221	1.7546	0.0002	1.45E-06
135	0.01	0.000	0.024	0.2210	1.7540	0.0002	1.45E-06
136	0.20	0.030	0.019	0.2327	1.7534	0.0002	1.45E-06
137	0.43	0.059	0.233	0.2444	1.7527	0.0002	1.44E-06
138	1.92	1.008	0.342	0.2560	1.7521	0.0002	1.44E-06
139	0.00	0.109	0.175	0.2677	1.7515	0.0002	1.44E-06
140	0.00	0.000	0.142	0.2644	1.7509	0.0002	1.44E-06
141	0.43	0.074	0.169	0.2776	1.7503	0.0002	1.44E-06
142	0.08	0.000	0.104	0.2807	1.7497	0.0002	1.44E-06
143	0.04	0.000	0.097	0.2748	1.7491	0.0002	1.44E-06
144	0.22	0.031	0.182	0.2726	1.7484	0.0002	1.44E-06
145	0.00	0.000	0.273	0.2487	1.7478	0.0002	1.44E-06
146	0.16	0.002	0.224	0.2421	1.7472	0.0002	1.44E-06
147	1.23	0.447	0.332	0.2534	1.7466	0.0002	1.44E-06
148	0.07	0.000	0.412	0.2529	1.7460	0.0002	1.44E-06
149	1.27	0.564	0.186	0.2658	1.7454	0.0002	1.44E-06
150	0.64	0.328	0.317	0.2775	1.7448	0.0002	1.44E-06
151	0.10	0.000	0.386	0.2757	1.7442	0.0002	1.44E-06
152	0.86	0.218	0.434	0.2885	1.7436	0.0002	1.44E-06

153	0.34	0.067	0.196	0.3002	1.7429	0.0002	1.44E-06
154	0.00	0.000	0.263	0.2777	1.7423	0.0002	1.44E-06
155	0.00	0.000	0.141	0.2636	1.7417	0.0002	1.44E-06
156	0.55	0.075	0.270	0.2772	1.7411	0.0002	1.44E-06
157	0.07	0.000	0.363	0.2550	1.7405	0.0002	1.44E-06
158	2.04	0.916	0.433	0.2671	1.7399	0.0002	1.43E-06
159	0.00	0.000	0.513	0.2731	1.7393	0.0002	1.43E-06
160	0.00	0.000	0.413	0.2318	1.7392	0.0002	1.43E-06
161	0.31	0.038	0.358	0.2198	1.7401	0.0002	1.44E-06
162	0.30	0.024	0.385	0.2103	1.7395	0.0002	1.43E-06
163	0.16	0.004	0.217	0.2058	1.7389	0.0002	1.43E-06
164	0.01	0.000	0.061	0.2012	1.7383	0.0002	1.43E-06
165	0.00	0.000	0.029	0.1983	1.7377	0.0002	1.43E-06
166	0.00	0.000	0.011	0.1972	1.7371	0.0002	1.43E-06
167	0.00	0.000	0.001	0.1971	1.7365	0.0002	1.43E-06
168	0.01	0.000	0.006	0.1970	1.7359	0.0002	1.43E-06
169	0.00	0.000	0.000	0.1970	1.7352	0.0002	1.43E-06
170	0.00	0.000	0.000	0.1970	1.7346	0.0002	1.43E-06
171	0.00	0.000	0.000	0.1970	1.7340	0.0002	1.43E-06
172	0.00	0.000	0.000	0.1970	1.7334	0.0002	1.43E-06
173	1.40	0.667	0.029	0.2132	1.7328	0.0002	1.43E-06
174	0.00	0.128	0.170	0.2249	1.7322	0.0002	1.43E-06
175	0.46	0.033	0.432	0.2345	1.7316	0.0002	1.43E-06
176	0.12	0.000	0.128	0.2363	1.7310	0.0002	1.43E-06
177	0.51	0.119	0.158	0.2490	1.7304	0.0002	1.43E-06
178	0.11	0.000	0.161	0.2541	1.7298	0.0002	1.43E-06
179	0.00	0.000	0.280	0.2261	1.7292	0.0002	1.43E-06
180	2.62	1.338	0.312	0.2416	1.7286	0.0002	1.43E-06
181	0.04	0.290	0.156	0.2532	1.7280	0.0002	1.43E-06
182	0.00	0.000	0.238	0.2589	1.7274	0.0002	1.43E-06
183	0.00	0.000	0.226	0.2363	1.7268	0.0002	1.43E-06
184	0.00	0.000	0.282	0.2081	1.7262	0.0002	1.42E-06

185	0.30	0.047	0.157	0.2132	1.7256	0.0002	1.42E-06
186	0.00	0.000	0.151	0.2028	1.7249	0.0002	1.42E-06
187	0.00	0.000	0.040	0.1988	1.7243	0.0002	1.42E-06
188	0.12	0.000	0.032	0.2080	1.7237	0.0002	1.42E-06
189	0.00	0.000	0.026	0.2054	1.7231	0.0002	1.42E-06
190	1.00	0.424	0.052	0.2195	1.7225	0.0002	1.42E-06
191	0.00	0.014	0.235	0.2311	1.7219	0.0002	1.42E-06
192	0.00	0.000	0.254	0.2071	1.7213	0.0002	1.42E-06
193	0.00	0.000	0.086	0.1986	1.7207	0.0002	1.42E-06
194	0.00	0.000	0.011	0.1978	1.7201	0.0002	1.42E-06
195	0.00	0.000	0.004	0.1974	1.7195	0.0002	1.42E-06
196	0.00	0.000	0.004	0.1970	1.7189	0.0002	1.42E-06
197	0.00	0.000	0.000	0.1970	1.7183	0.0002	1.42E-06
198	0.07	0.000	0.008	0.2029	1.7177	0.0002	1.42E-06
199	0.00	0.000	0.018	0.2012	1.7171	0.0002	1.42E-06
200	0.00	0.000	0.023	0.1989	1.7165	0.0002	1.42E-06
201	0.00	0.000	0.009	0.1980	1.7159	0.0002	1.42E-06
202	0.00	0.000	0.007	0.1973	1.7153	0.0002	1.42E-06
203	0.00	0.000	0.002	0.1971	1.7147	0.0002	1.42E-06
204	0.00	0.000	0.001	0.1970	1.7141	0.0002	1.42E-06
205	1.53	0.749	0.029	0.2131	1.7135	0.0002	1.41E-06
206	0.22	0.264	0.166	0.2247	1.7129	0.0002	1.41E-06
207	0.43	0.217	0.148	0.2364	1.7123	0.0002	1.41E-06
208	1.61	0.932	0.168	0.2480	1.7117	0.0002	1.41E-06
209	0.13	0.238	0.150	0.2596	1.7111	0.0002	1.41E-06
210	0.08	0.028	0.149	0.2713	1.7105	0.0002	1.41E-06
211	0.00	0.000	0.152	0.2589	1.7099	0.0002	1.41E-06
212	0.00	0.000	0.157	0.2433	1.7093	0.0002	1.41E-06
213	0.00	0.000	0.227	0.2205	1.7087	0.0002	1.41E-06
214	0.18	0.013	0.136	0.2220	1.7081	0.0002	1.41E-06
215	0.03	0.000	0.224	0.2045	1.7075	0.0002	1.41E-06
216	0.00	0.000	0.046	0.1999	1.7069	0.0002	1.41E-06

217	0.00	0.000	0.024	0.1976	1.7063	0.0002	1.41E-06
218	0.00	0.000	0.004	0.1972	1.7057	0.0002	1.41E-06
219	0.00	0.000	0.002	0.1970	1.7051	0.0002	1.41E-06
220	0.00	0.000	0.000	0.1970	1.7045	0.0002	1.41E-06
221	0.00	0.000	0.000	0.1970	1.7039	0.0002	1.41E-06
222	0.00	0.000	0.000	0.1970	1.7033	0.0002	1.41E-06
223	0.00	0.000	0.000	0.1970	1.7027	0.0002	1.41E-06
224	0.00	0.000	0.000	0.1970	1.7021	0.0002	1.41E-06
225	0.20	0.027	0.018	0.2093	1.7015	0.0002	1.41E-06
226	0.92	0.408	0.056	0.2208	1.7009	0.0002	1.41E-06
227	0.00	0.000	0.255	0.2319	1.7003	0.0002	1.40E-06
228	0.68	0.175	0.252	0.2435	1.6998	0.0002	1.40E-06
229	0.00	0.000	0.245	0.2327	1.6992	0.0002	1.40E-06
230	0.00	0.000	0.195	0.2132	1.6986	0.0002	1.40E-06
231	0.00	0.000	0.138	0.1995	1.6980	0.0002	1.40E-06
232	0.00	0.000	0.013	0.1982	1.6974	0.0002	1.40E-06
233	0.00	0.000	0.006	0.1976	1.6968	0.0002	1.40E-06
234	0.00	0.000	0.006	0.1970	1.6962	0.0002	1.40E-06
235	0.00	0.000	0.000	0.1970	1.6956	0.0002	1.40E-06
236	0.84	0.327	0.048	0.2129	1.6950	0.0002	1.40E-06
237	0.00	0.000	0.301	0.2133	1.6944	0.0002	1.40E-06
238	0.14	0.003	0.061	0.2210	1.6938	0.0002	1.40E-06
239	0.00	0.000	0.102	0.2111	1.6932	0.0002	1.40E-06
240	0.79	0.229	0.212	0.2252	1.6926	0.0002	1.40E-06
241	0.00	0.000	0.156	0.2308	1.6920	0.0002	1.40E-06
242	0.28	0.033	0.128	0.2398	1.6914	0.0002	1.40E-06
243	0.00	0.000	0.166	0.2266	1.6908	0.0002	1.40E-06
244	0.00	0.000	0.166	0.2101	1.6903	0.0002	1.40E-06
245	0.00	0.000	0.116	0.1985	1.6897	0.0002	1.40E-06
246	0.00	0.000	0.008	0.1976	1.6891	0.0002	1.40E-06
247	0.00	0.000	0.004	0.1973	1.6885	0.0002	1.40E-06
248	0.27	0.050	0.064	0.2081	1.6879	0.0002	1.40E-06

249	0.00	0.000	0.075	0.2057	1.6873	0.0002	1.40E-06
250	0.18	0.023	0.033	0.2160	1.6867	0.0002	1.39E-06
251	0.79	0.163	0.405	0.2275	1.6861	0.0002	1.39E-06
252	0.00	0.000	0.237	0.2172	1.6855	0.0002	1.39E-06
253	0.23	0.026	0.266	0.2078	1.6849	0.0002	1.39E-06
254	0.36	0.025	0.360	0.2059	1.6843	0.0002	1.39E-06
255	0.06	0.000	0.078	0.2066	1.6838	0.0002	1.39E-06
256	0.01	0.000	0.071	0.2006	1.6832	0.0002	1.39E-06
257	0.00	0.000	0.026	0.1981	1.6826	0.0002	1.39E-06
258	0.00	0.000	0.009	0.1972	1.6820	0.0002	1.39E-06
259	0.00	0.000	0.001	0.1971	1.6814	0.0002	1.39E-06
260	0.13	0.000	0.010	0.2087	1.6808	0.0002	1.39E-06
261	0.00	0.000	0.016	0.2072	1.6802	0.0002	1.39E-06
262	0.00	0.000	0.021	0.2051	1.6796	0.0002	1.39E-06
263	0.00	0.000	0.022	0.2029	1.6791	0.0002	1.39E-06
264	0.00	0.000	0.023	0.2007	1.6785	0.0002	1.39E-06
265	0.00	0.000	0.022	0.1985	1.6779	0.0002	1.39E-06
266	0.03	0.000	0.019	0.1994	1.6773	0.0002	1.39E-06
267	1.39	0.672	0.032	0.2132	1.6767	0.0002	1.39E-06
268	0.02	0.114	0.227	0.2248	1.6761	0.0002	1.39E-06
269	0.00	0.000	0.153	0.2209	1.6755	0.0002	1.39E-06
270	0.01	0.000	0.146	0.2077	1.6749	0.0002	1.39E-06
271	0.04	0.000	0.074	0.2046	1.6744	0.0002	1.39E-06
272	0.01	0.000	0.064	0.1995	1.6738	0.0002	1.38E-06
273	0.07	0.000	0.041	0.2024	1.6732	0.0002	1.38E-06
274	0.83	0.270	0.184	0.2160	1.6726	0.0002	1.38E-06
275	0.01	0.000	0.156	0.2263	1.6720	0.0002	1.38E-06
276	0.08	0.000	0.099	0.2243	1.6714	0.0002	1.38E-06
277	0.31	0.032	0.169	0.2325	1.6708	0.0002	1.38E-06
278	0.30	0.026	0.326	0.2276	1.6703	0.0002	1.38E-06
279	0.17	0.018	0.176	0.2264	1.6697	0.0002	1.38E-06
280	0.09	0.000	0.094	0.2276	1.6691	0.0002	1.38E-06

281	0.00	0.000	0.096	0.2180	1.6685	0.0002	1.38E-06
282	0.00	0.000	0.096	0.2084	1.6679	0.0002	1.38E-06
283	0.07	0.000	0.101	0.2057	1.6673	0.0002	1.38E-06
284	0.00	0.000	0.069	0.1988	1.6668	0.0002	1.38E-06
285	0.05	0.000	0.034	0.2002	1.6662	0.0002	1.38E-06
286	0.95	0.380	0.098	0.2137	1.6656	0.0002	1.38E-06
287	0.00	0.077	0.074	0.2253	1.6650	0.0002	1.38E-06
288	0.12	0.002	0.081	0.2370	1.6644	0.0002	1.38E-06
289	0.00	0.000	0.078	0.2293	1.6639	0.0002	1.38E-06
290	0.00	0.000	0.078	0.2216	1.6633	0.0002	1.38E-06
291	0.00	0.000	0.123	0.2092	1.6627	0.0002	1.38E-06
292	0.00	0.000	0.107	0.1986	1.6621	0.0002	1.38E-06
293	0.00	0.000	0.014	0.1972	1.6615	0.0002	1.38E-06
294	0.14	0.000	0.033	0.2084	1.6609	0.0002	1.38E-06
295	0.46	0.060	0.222	0.2205	1.6604	0.0002	1.37E-06
296	0.27	0.033	0.192	0.2277	1.6602	0.0002	1.37E-06
297	0.00	0.000	0.149	0.2161	1.6599	0.0002	1.37E-06
298	0.00	0.000	0.119	0.2043	1.6593	0.0002	1.37E-06
299	0.00	0.000	0.057	0.1985	1.6587	0.0002	1.37E-06
300	0.00	0.000	0.014	0.1972	1.6582	0.0002	1.37E-06
301	0.00	0.000	0.001	0.1971	1.6576	0.0002	1.37E-06
302	0.00	0.000	0.001	0.1970	1.6570	0.0002	1.37E-06
303	0.00	0.000	0.000	0.1970	1.6564	0.0002	1.37E-06
304	0.00	0.000	0.000	0.1970	1.6558	0.0002	1.37E-06
305	0.00	0.000	0.000	0.1970	1.6553	0.0002	1.37E-06
306	0.00	0.000	0.000	0.1970	1.6547	0.0002	1.37E-06
307	0.00	0.000	0.000	0.1970	1.6541	0.0002	1.37E-06
308	0.00	0.000	0.000	0.1970	1.6535	0.0002	1.37E-06
309	0.00	0.000	0.000	0.1970	1.6529	0.0002	1.37E-06
310	0.00	0.000	0.000	0.1970	1.6524	0.0002	1.37E-06
311	0.00	0.000	0.000	0.1970	1.6518	0.0002	1.37E-06
312	0.00	0.000	0.000	0.1970	1.6512	0.0002	1.37E-06

313		0.00	0.000	0.000	0.1970	1.6506	0.0002	1.37E-06
314		0.00	0.000	0.000	0.1970	1.6500	0.0002	1.37E-06
315		0.00	0.000	0.000	0.1970	1.6495	0.0002	1.37E-06
316		0.19	0.023	0.013	0.2098	1.6489	0.0002	1.37E-06
317		0.22	0.043	0.046	0.2215	1.6483	0.0002	1.37E-06
318		0.00	0.000	0.050	0.2208	1.6477	0.0002	1.36E-06
319		0.00	0.000	0.011	0.2197	1.6472	0.0002	1.36E-06
320		0.00	0.000	0.011	0.2187	1.6466	0.0002	1.36E-06
321		0.00	0.000	0.010	0.2177	1.6460	0.0002	1.36E-06
322		0.00	0.000	0.010	0.2167	1.6454	0.0002	1.36E-06
323		0.00	0.000	0.010	0.2157	1.6448	0.0002	1.36E-06
324		0.00	0.000	0.010	0.2148	1.6443	0.0002	1.36E-06
325	*	0.31	0.000	0.036	0.2168	1.6437	0.0002	1.36E-06
326		0.00	0.041	0.046	0.2295	1.6431	0.0002	1.36E-06
327		0.00	0.000	0.051	0.2285	1.6425	0.0002	1.36E-06
328		0.12	0.000	0.014	0.2394	1.6420	0.0002	1.36E-06
329	*	0.21	0.000	0.031	0.2414	1.6414	0.0002	1.36E-06
330		0.01	0.000	0.052	0.2525	1.6408	0.0002	1.36E-06
331		0.00	0.000	0.052	0.2473	1.6402	0.0002	1.36E-06
332		0.00	0.000	0.011	0.2462	1.6397	0.0002	1.36E-06
333		0.00	0.000	0.011	0.2451	1.6391	0.0002	1.36E-06
334		0.00	0.000	0.011	0.2441	1.6385	0.0002	1.36E-06
335		0.00	0.000	0.010	0.2430	1.6380	0.0002	1.36E-06
336	*	0.00	0.000	0.010	0.2420	1.6374	0.0002	1.36E-06
337	*	0.00	0.000	0.014	0.2410	1.6368	0.0002	1.36E-06
338		0.05	0.000	0.015	0.2445	1.6362	0.0002	1.36E-06
339	*	0.15	0.000	0.048	0.2465	1.6357	0.0002	1.36E-06
340	*	0.04	0.000	0.048	0.2485	1.6351	0.0002	1.36E-06
341	*	0.01	0.000	0.042	0.2505	1.6345	0.0002	1.35E-06
342	*	0.12	0.000	0.029	0.2525	1.6340	0.0002	1.35E-06
343	*	0.21	0.000	0.000	0.2545	1.6334	0.0002	1.35E-06
344	*	0.00	0.000	0.037	0.2565	1.6328	0.0002	1.35E-06

345	*	1.02	0.000	0.032	0.2584	1.6322	0.0002	1.35E-06
346		0.00	0.597	0.000	0.2712	1.6317	0.0002	1.35E-06
347		0.00	0.127	0.091	0.2828	1.6311	0.0002	1.35E-06
348		0.00	0.000	0.155	0.2795	1.6305	0.0002	1.35E-06
349		0.09	0.000	0.086	0.2804	1.6299	0.0002	1.35E-06
350		0.02	0.000	0.112	0.2717	1.6294	0.0002	1.35E-06
351		0.98	0.423	0.118	0.2846	1.6288	0.0002	1.35E-06
352		0.00	0.000	0.238	0.2922	1.6282	0.0002	1.35E-06
353		0.00	0.000	0.084	0.2839	1.6277	0.0002	1.35E-06
354		0.00	0.000	0.090	0.2749	1.6271	0.0002	1.35E-06
355	*	0.00	0.000	0.046	0.2703	1.6265	0.0002	1.35E-06
356	*	0.36	0.000	0.017	0.2723	1.6260	0.0002	1.35E-06
357	*	0.00	0.000	0.021	0.2743	1.6254	0.0002	1.35E-06
358		0.00	0.056	0.043	0.2870	1.6248	0.0002	1.35E-06
359		0.00	0.000	0.141	0.2785	1.6243	0.0002	1.35E-06
360		0.00	0.000	0.060	0.2725	1.6239	0.0002	1.35E-06
361		0.00	0.000	0.051	0.2674	1.6237	0.0002	1.35E-06
362		0.00	0.000	0.087	0.2587	1.6238	0.0002	1.35E-06
363		0.00	0.000	0.069	0.2518	1.6242	0.0002	1.35E-06
364		0.00	0.000	0.076	0.2442	1.6240	0.0002	1.35E-06
365	*	0.03	0.000	0.047	0.2424	1.6235	0.0002	1.35E-06

* = Frozen (air or soil)

Annual Totals for Year 6

	inches	cubic feet	percent
Precipitation	52.28	189,782.8	100.00
Runoff	18.555	67,355.8	35.49
Evapotranspiration	34.000	123,418.7	65.03
Recirculation into Layer 1	0.0665	241.5	0.13
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0665	241.5	0.13
Percolation/Leakage through Layer 5	0.000487	1.7662	0.00
Average Head on Top of Layer 4	1.6077	---	---
Change in Water Storage	-0.2738	-993.8	-0.52
Soil Water at Start of Year	294.1105	1,067,621.2	562.55
Soil Water at End of Year	293.9253	1,066,948.7	562.19
Snow Water at Start of Year	0.0885	321.3	0.17
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0664	-241.2	-0.13

Daily Output for Year 7

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.063	0.2362	1.6229	0.0002	1.35E-06
2			0.00	0.000	0.087	0.2275	1.6223	0.0002	1.35E-06
3			0.00	0.000	0.074	0.2202	1.6223	0.0002	1.35E-06
4			0.00	0.000	0.058	0.2143	1.6219	0.0002	1.35E-06
5	*		0.00	0.000	0.000	0.2143	1.6213	0.0002	1.34E-06
6	*		0.00	0.000	0.044	0.2099	1.6207	0.0002	1.34E-06
7	*		0.01	0.000	0.006	0.2100	1.6202	0.0002	1.34E-06
8			0.00	0.000	0.058	0.2042	1.6196	0.0002	1.34E-06
9			0.00	0.000	0.045	0.1994	1.6190	0.0002	1.34E-06
10	*		0.00	0.000	0.000	0.1995	1.6266	0.0002	1.35E-06
11	*		0.00	0.000	0.000	0.1995	1.6260	0.0002	1.35E-06
12	*		0.09	0.000	0.037	0.2015	1.6255	0.0002	1.35E-06
13	*		0.08	0.000	0.000	0.2035	1.6249	0.0002	1.35E-06
14	*		0.01	0.000	0.025	0.2054	1.6243	0.0002	1.35E-06
15	*		0.02	0.000	0.028	0.2074	1.6238	0.0002	1.35E-06
16			0.33	0.098	0.041	0.2202	1.6232	0.0002	1.35E-06
17			0.15	0.032	0.069	0.2318	1.6226	0.0002	1.35E-06
18	*		0.16	0.000	0.036	0.2342	1.6221	0.0002	1.35E-06
19	*		0.00	0.000	0.040	0.2366	1.6215	0.0002	1.34E-06
20	*	*	0.00	0.000	0.016	0.2366	1.6209	0.0002	1.34E-06
21	*	*	0.10	0.000	0.020	0.2367	1.6204	0.0002	1.34E-06
22	*	*	0.00	0.000	0.016	0.2367	1.6198	0.0002	1.34E-06
23	*	*	0.00	0.000	0.032	0.2367	1.6192	0.0002	1.34E-06
24	*	*	0.00	0.000	0.034	0.2367	1.6186	0.0002	1.34E-06

25		*	0.00	0.000	0.050	0.2367	1.6181	0.0002	1.34E-06
26		*	0.00	0.000	0.000	0.2367	1.6175	0.0002	1.34E-06
27		*	0.00	0.000	0.000	0.2368	1.6169	0.0002	1.34E-06
28			0.00	0.000	0.105	0.2263	1.6164	0.0002	1.34E-06
29			0.00	0.000	0.163	0.2101	1.6158	0.0002	1.34E-06
30			0.00	0.000	0.113	0.1988	1.6152	0.0002	1.34E-06
31			0.00	0.000	0.009	0.1979	1.6147	0.0002	1.34E-06
32			0.00	0.000	0.005	0.1975	1.6141	0.0002	1.34E-06
33			0.00	0.000	0.005	0.1970	1.6136	0.0002	1.34E-06
34			0.00	0.000	0.000	0.1970	1.6130	0.0002	1.34E-06
35			0.09	0.000	0.007	0.2053	1.6124	0.0002	1.34E-06
36			0.57	0.205	0.034	0.2185	1.6119	0.0002	1.34E-06
37			0.08	0.016	0.137	0.2301	1.6113	0.0002	1.34E-06
38			0.00	0.000	0.182	0.2135	1.6107	0.0002	1.34E-06
39			0.00	0.000	0.093	0.2042	1.6102	0.0002	1.34E-06
40			0.00	0.000	0.048	0.1995	1.6096	0.0002	1.34E-06
41			0.00	0.000	0.024	0.1971	1.6091	0.0002	1.34E-06
42			0.00	0.000	0.001	0.1970	1.6085	0.0002	1.34E-06
43			0.00	0.000	0.000	0.1970	1.6079	0.0002	1.33E-06
44			0.00	0.000	0.000	0.1970	1.6074	0.0002	1.33E-06
45			0.00	0.000	0.000	0.1970	1.6068	0.0002	1.33E-06
46			0.00	0.000	0.000	0.1970	1.6062	0.0002	1.33E-06
47			0.00	0.000	0.000	0.1970	1.6057	0.0002	1.33E-06
48	*		0.00	0.000	0.000	0.1970	1.6051	0.0002	1.33E-06
49	*		0.00	0.000	0.000	0.1971	1.6046	0.0002	1.33E-06
50	*		0.00	0.000	0.000	0.1971	1.6040	0.0002	1.33E-06
51	*		0.00	0.000	0.000	0.1971	1.6034	0.0002	1.33E-06
52			0.00	0.000	0.001	0.1970	1.6029	0.0002	1.33E-06
53			0.00	0.000	0.000	0.1970	1.6023	0.0002	1.33E-06
54			0.03	0.000	0.006	0.1993	1.6018	0.0002	1.33E-06
55			0.00	0.000	0.002	0.1991	1.6012	0.0002	1.33E-06
56	*		0.00	0.000	0.004	0.1987	1.6006	0.0002	1.33E-06

57		0.00	0.000	0.004	0.1983	1.6001	0.0002	1.33E-06
58		0.00	0.000	0.004	0.1980	1.5995	0.0002	1.33E-06
59		0.10	0.000	0.008	0.2077	1.5990	0.0002	1.33E-06
60		0.54	0.196	0.022	0.2209	1.5984	0.0002	1.33E-06
61		0.00	0.000	0.204	0.2201	1.5978	0.0002	1.33E-06
62		0.09	0.000	0.053	0.2237	1.5973	0.0002	1.33E-06
63		0.17	0.010	0.079	0.2305	1.5967	0.0002	1.33E-06
64	*	0.01	0.000	0.061	0.2263	1.5962	0.0002	1.33E-06
65	*	0.00	0.000	0.032	0.2231	1.5956	0.0002	1.33E-06
66		0.00	0.000	0.058	0.2173	1.5950	0.0002	1.32E-06
67		0.00	0.000	0.095	0.2079	1.5945	0.0002	1.32E-06
68	*	0.00	0.000	0.000	0.2079	1.5939	0.0002	1.32E-06
69		0.00	0.000	0.048	0.2031	1.5934	0.0002	1.32E-06
70		0.00	0.000	0.027	0.2005	1.5928	0.0002	1.32E-06
71		0.00	0.000	0.033	0.1972	1.5923	0.0002	1.32E-06
72		0.07	0.000	0.009	0.2030	1.5917	0.0002	1.32E-06
73		0.00	0.000	0.013	0.2017	1.5912	0.0002	1.32E-06
74		0.02	0.000	0.022	0.2017	1.5906	0.0002	1.32E-06
75	*	0.00	0.000	0.012	0.2005	1.5900	0.0002	1.32E-06
76		0.00	0.000	0.012	0.1993	1.5895	0.0002	1.32E-06
77		0.00	0.000	0.005	0.1988	1.5889	0.0002	1.32E-06
78		0.00	0.000	0.005	0.1983	1.5884	0.0002	1.32E-06
79		0.00	0.000	0.004	0.1980	1.5878	0.0002	1.32E-06
80		0.79	0.311	0.024	0.2135	1.5873	0.0002	1.32E-06
81		0.26	0.118	0.200	0.2251	1.5867	0.0002	1.32E-06
82		0.00	0.000	0.230	0.2139	1.5861	0.0002	1.32E-06
83		0.00	0.000	0.084	0.2055	1.5856	0.0002	1.32E-06
84		0.00	0.000	0.066	0.1989	1.5850	0.0002	1.32E-06
85		0.00	0.000	0.018	0.1971	1.5845	0.0002	1.32E-06
86		0.00	0.000	0.001	0.1971	1.5839	0.0002	1.32E-06
87		0.00	0.000	0.001	0.1970	1.5834	0.0002	1.32E-06
88		0.18	0.019	0.023	0.2089	1.5828	0.0002	1.32E-06

89		0.00	0.000	0.035	0.2073	1.5823	0.0002	1.32E-06
90		0.00	0.000	0.023	0.2051	1.5817	0.0002	1.31E-06
91		0.19	0.028	0.023	0.2161	1.5812	0.0002	1.31E-06
92		0.00	0.000	0.042	0.2147	1.5806	0.0002	1.31E-06
93		0.01	0.000	0.021	0.2134	1.5801	0.0002	1.31E-06
94		0.00	0.000	0.016	0.2118	1.5795	0.0002	1.31E-06
95		0.00	0.000	0.016	0.2102	1.5789	0.0002	1.31E-06
96		0.00	0.000	0.015	0.2087	1.5784	0.0002	1.31E-06
97		0.00	0.000	0.014	0.2073	1.5778	0.0002	1.31E-06
98		0.03	0.000	0.018	0.2087	1.5773	0.0002	1.31E-06
99		0.00	0.000	0.014	0.2073	1.5767	0.0002	1.31E-06
100		0.00	0.000	0.015	0.2058	1.5762	0.0002	1.31E-06
101		0.00	0.000	0.015	0.2043	1.5756	0.0002	1.31E-06
102		0.00	0.000	0.012	0.2031	1.5751	0.0002	1.31E-06
103		0.08	0.000	0.017	0.2090	1.5745	0.0002	1.31E-06
104		0.00	0.000	0.010	0.2080	1.5740	0.0002	1.31E-06
105		0.00	0.000	0.008	0.2072	1.5734	0.0002	1.31E-06
106		0.00	0.000	0.010	0.2062	1.5729	0.0002	1.31E-06
107		0.00	0.000	0.011	0.2051	1.5723	0.0002	1.31E-06
108		0.00	0.000	0.011	0.2040	1.5718	0.0002	1.31E-06
109		0.00	0.000	0.011	0.2030	1.5712	0.0002	1.31E-06
110		0.00	0.000	0.010	0.2019	1.5707	0.0002	1.31E-06
111		0.00	0.000	0.010	0.2010	1.5701	0.0002	1.31E-06
112		0.02	0.000	0.014	0.2012	1.5696	0.0002	1.31E-06
113	*	0.06	0.000	0.068	0.2002	1.5690	0.0002	1.30E-06
114	*	0.62	0.000	0.035	0.2022	1.5685	0.0002	1.30E-06
115	*	0.15	0.000	0.049	0.2042	1.5679	0.0002	1.30E-06
116		0.23	0.392	0.000	0.2170	1.5674	0.0002	1.30E-06
117		0.00	0.000	0.294	0.2238	1.5668	0.0002	1.30E-06
118		0.00	0.000	0.127	0.2111	1.5663	0.0002	1.30E-06
119		0.00	0.000	0.117	0.1995	1.5658	0.0002	1.30E-06
120	*	0.00	0.000	0.023	0.1971	1.5652	0.0002	1.30E-06

121	0.00	0.000	0.001	0.1971	1.5647	0.0002	1.30E-06
122	0.00	0.000	0.001	0.1970	1.5641	0.0002	1.30E-06
123	0.00	0.000	0.000	0.1970	1.5636	0.0002	1.30E-06
124	0.25	0.051	0.033	0.2089	1.5630	0.0002	1.30E-06
125	0.00	0.000	0.068	0.2072	1.5625	0.0002	1.30E-06
126	1.51	0.736	0.040	0.2219	1.5619	0.0002	1.30E-06
127	0.60	0.333	0.423	0.2336	1.5614	0.0002	1.30E-06
128	0.00	0.000	0.351	0.2300	1.5608	0.0002	1.30E-06
129	0.00	0.000	0.279	0.2021	1.5603	0.0002	1.30E-06
130	0.00	0.000	0.038	0.1983	1.5597	0.0002	1.30E-06
131	0.32	0.043	0.194	0.2028	1.5592	0.0002	1.30E-06
132	0.19	0.031	0.103	0.2100	1.5587	0.0002	1.30E-06
133	0.09	0.000	0.106	0.2118	1.5581	0.0002	1.30E-06
134	0.00	0.000	0.092	0.2026	1.5576	0.0002	1.30E-06
135	0.00	0.000	0.042	0.1984	1.5570	0.0002	1.30E-06
136	0.00	0.000	0.014	0.1970	1.5565	0.0002	1.30E-06
137	0.00	0.000	0.000	0.1970	1.5559	0.0002	1.29E-06
138	0.00	0.000	0.000	0.1970	1.5554	0.0002	1.29E-06
139	0.16	0.010	0.020	0.2092	1.5548	0.0002	1.29E-06
140	0.00	0.000	0.024	0.2079	1.5543	0.0002	1.29E-06
141	0.63	0.227	0.035	0.2222	1.5537	0.0002	1.29E-06
142	0.00	0.000	0.189	0.2255	1.5532	0.0002	1.29E-06
143	0.39	0.028	0.268	0.2321	1.5527	0.0002	1.29E-06
144	0.00	0.000	0.124	0.2225	1.5521	0.0002	1.29E-06
145	0.21	0.022	0.201	0.2192	1.5516	0.0002	1.29E-06
146	0.19	0.024	0.183	0.2176	1.5510	0.0002	1.29E-06
147	0.06	0.000	0.095	0.2164	1.5505	0.0002	1.29E-06
148	1.51	0.756	0.065	0.2289	1.5499	0.0002	1.29E-06
149	0.01	0.140	0.179	0.2406	1.5494	0.0002	1.29E-06
150	0.07	0.000	0.269	0.2346	1.5489	0.0002	1.29E-06
151	0.02	0.000	0.227	0.2140	1.5483	0.0002	1.29E-06
152	0.09	0.000	0.163	0.2064	1.5478	0.0002	1.29E-06

153	0.10	0.000	0.080	0.2085	1.5472	0.0002	1.29E-06
154	0.06	0.000	0.081	0.2063	1.5467	0.0002	1.29E-06
155	0.21	0.032	0.099	0.2113	1.5461	0.0002	1.29E-06
156	0.02	0.000	0.074	0.2095	1.5456	0.0002	1.29E-06
157	0.67	0.248	0.056	0.2222	1.5451	0.0002	1.29E-06
158	0.06	0.000	0.364	0.2160	1.5445	0.0002	1.29E-06
159	0.24	0.021	0.256	0.2098	1.5440	0.0002	1.29E-06
160	0.02	0.000	0.137	0.1999	1.5434	0.0002	1.29E-06
161	0.63	0.161	0.151	0.2158	1.5429	0.0002	1.28E-06
162	0.20	0.030	0.267	0.2191	1.5424	0.0002	1.28E-06
163	0.00	0.000	0.133	0.2087	1.5418	0.0002	1.28E-06
164	0.00	0.000	0.090	0.1997	1.5413	0.0002	1.28E-06
165	0.00	0.000	0.025	0.1972	1.5407	0.0002	1.28E-06
166	0.00	0.000	0.001	0.1971	1.5402	0.0002	1.28E-06
167	0.51	0.147	0.054	0.2131	1.5397	0.0002	1.28E-06
168	0.83	0.366	0.157	0.2248	1.5391	0.0002	1.28E-06
169	0.00	0.000	0.327	0.2255	1.5386	0.0002	1.28E-06
170	0.00	0.000	0.097	0.2157	1.5381	0.0002	1.28E-06
171	0.88	0.201	0.367	0.2301	1.5379	0.0002	1.28E-06
172	0.00	0.000	0.244	0.2229	1.5374	0.0002	1.28E-06
173	0.00	0.000	0.111	0.2118	1.5369	0.0002	1.28E-06
174	0.00	0.000	0.129	0.1990	1.5363	0.0002	1.28E-06
175	0.00	0.000	0.017	0.1973	1.5358	0.0002	1.28E-06
176	0.00	0.000	0.002	0.1972	1.5352	0.0002	1.28E-06
177	0.00	0.000	0.002	0.1970	1.5347	0.0002	1.28E-06
178	0.42	0.105	0.055	0.2130	1.5342	0.0002	1.28E-06
179	0.30	0.027	0.327	0.2152	1.5336	0.0002	1.28E-06
180	0.45	0.084	0.198	0.2268	1.5331	0.0002	1.28E-06
181	0.00	0.000	0.209	0.2142	1.5325	0.0002	1.28E-06
182	0.00	0.000	0.136	0.2006	1.5320	0.0002	1.28E-06
183	0.00	0.000	0.027	0.1979	1.5315	0.0002	1.28E-06
184	0.00	0.000	0.005	0.1975	1.5309	0.0002	1.28E-06

185	0.13	0.000	0.018	0.2092	1.5304	0.0002	1.28E-06
186	0.14	0.003	0.029	0.2198	1.5299	0.0002	1.27E-06
187	0.03	0.000	0.024	0.2210	1.5293	0.0002	1.27E-06
188	0.00	0.000	0.024	0.2185	1.5288	0.0002	1.27E-06
189	0.00	0.000	0.022	0.2163	1.5283	0.0002	1.27E-06
190	0.00	0.000	0.023	0.2141	1.5277	0.0002	1.27E-06
191	0.00	0.000	0.022	0.2119	1.5272	0.0002	1.27E-06
192	0.00	0.000	0.022	0.2097	1.5267	0.0002	1.27E-06
193	0.00	0.000	0.022	0.2075	1.5261	0.0002	1.27E-06
194	0.61	0.213	0.035	0.2222	1.5256	0.0002	1.27E-06
195	0.42	0.166	0.180	0.2338	1.5251	0.0002	1.27E-06
196	0.28	0.032	0.325	0.2391	1.5245	0.0002	1.27E-06
197	0.00	0.000	0.233	0.2190	1.5240	0.0002	1.27E-06
198	0.01	0.000	0.114	0.2081	1.5235	0.0002	1.27E-06
199	0.00	0.000	0.101	0.1980	1.5229	0.0002	1.27E-06
200	0.20	0.026	0.075	0.2058	1.5224	0.0002	1.27E-06
201	0.00	0.000	0.055	0.2029	1.5219	0.0002	1.27E-06
202	0.00	0.000	0.037	0.1992	1.5213	0.0002	1.27E-06
203	0.00	0.000	0.016	0.1976	1.5208	0.0002	1.27E-06
204	0.00	0.000	0.006	0.1970	1.5203	0.0002	1.27E-06
205	0.00	0.000	0.000	0.1970	1.5197	0.0002	1.27E-06
206	0.00	0.000	0.000	0.1970	1.5192	0.0002	1.27E-06
207	0.00	0.000	0.000	0.1970	1.5187	0.0002	1.27E-06
208	0.00	0.000	0.000	0.1970	1.5181	0.0002	1.27E-06
209	0.00	0.000	0.000	0.1970	1.5176	0.0002	1.27E-06
210	0.00	0.000	0.000	0.1970	1.5171	0.0002	1.27E-06
211	0.13	0.000	0.010	0.2091	1.5165	0.0002	1.26E-06
212	0.07	0.000	0.018	0.2139	1.5160	0.0002	1.26E-06
213	0.00	0.000	0.016	0.2123	1.5155	0.0002	1.26E-06
214	0.00	0.000	0.017	0.2107	1.5150	0.0002	1.26E-06
215	0.00	0.000	0.023	0.2084	1.5144	0.0002	1.26E-06
216	1.28	0.604	0.029	0.2224	1.5139	0.0002	1.26E-06

217	0.81	0.380	0.484	0.2341	1.5134	0.0002	1.26E-06
218	0.30	0.031	0.513	0.2389	1.5128	0.0002	1.26E-06
219	0.18	0.009	0.377	0.2208	1.5123	0.0002	1.26E-06
220	1.51	0.709	0.182	0.2319	1.5118	0.0002	1.26E-06
221	0.00	0.034	0.338	0.2435	1.5112	0.0002	1.26E-06
222	0.00	0.000	0.336	0.2133	1.5107	0.0002	1.26E-06
223	0.26	0.043	0.145	0.2164	1.5102	0.0002	1.26E-06
224	0.00	0.000	0.150	0.2056	1.5097	0.0002	1.26E-06
225	0.00	0.000	0.067	0.1989	1.5091	0.0002	1.26E-06
226	0.00	0.000	0.019	0.1970	1.5086	0.0002	1.26E-06
227	0.00	0.000	0.000	0.1970	1.5081	0.0002	1.26E-06
228	0.00	0.000	0.000	0.1970	1.5075	0.0002	1.26E-06
229	0.00	0.000	0.000	0.1970	1.5070	0.0002	1.26E-06
230	0.00	0.000	0.000	0.1970	1.5065	0.0002	1.26E-06
231	0.00	0.000	0.000	0.1970	1.5060	0.0002	1.26E-06
232	0.00	0.000	0.000	0.1970	1.5054	0.0002	1.26E-06
233	0.00	0.000	0.000	0.1970	1.5049	0.0002	1.26E-06
234	0.05	0.000	0.010	0.2009	1.5044	0.0002	1.26E-06
235	0.02	0.000	0.009	0.2019	1.5038	0.0002	1.26E-06
236	0.00	0.000	0.013	0.2006	1.5033	0.0002	1.25E-06
237	0.00	0.000	0.014	0.1992	1.5028	0.0002	1.25E-06
238	0.00	0.000	0.006	0.1987	1.5023	0.0002	1.25E-06
239	0.00	0.000	0.005	0.1981	1.5017	0.0002	1.25E-06
240	0.00	0.000	0.004	0.1977	1.5012	0.0002	1.25E-06
241	0.00	0.000	0.004	0.1973	1.5007	0.0002	1.25E-06
242	0.00	0.000	0.003	0.1971	1.5002	0.0002	1.25E-06
243	0.00	0.000	0.001	0.1970	1.4996	0.0002	1.25E-06
244	0.00	0.000	0.000	0.1970	1.4991	0.0002	1.25E-06
245	0.00	0.000	0.003	0.1970	1.4986	0.0002	1.25E-06
246	0.44	0.129	0.024	0.2132	1.4981	0.0002	1.25E-06
247	0.02	0.000	0.124	0.2161	1.4975	0.0002	1.25E-06
248	0.51	0.178	0.023	0.2294	1.4970	0.0002	1.25E-06

249	0.07	0.000	0.209	0.2329	1.4965	0.0002	1.25E-06
250	0.00	0.000	0.112	0.2217	1.4960	0.0002	1.25E-06
251	0.00	0.000	0.113	0.2104	1.4955	0.0002	1.25E-06
252	0.00	0.000	0.090	0.2014	1.4949	0.0002	1.25E-06
253	0.00	0.000	0.041	0.1973	1.4944	0.0002	1.25E-06
254	0.00	0.000	0.002	0.1972	1.4939	0.0002	1.25E-06
255	0.00	0.000	0.002	0.1970	1.4934	0.0002	1.25E-06
256	0.00	0.000	0.000	0.1970	1.4928	0.0002	1.25E-06
257	0.24	0.050	0.020	0.2093	1.4923	0.0002	1.25E-06
258	0.00	0.000	0.062	0.2082	1.4918	0.0002	1.25E-06
259	0.00	0.000	0.017	0.2065	1.4913	0.0002	1.25E-06
260	0.00	0.000	0.017	0.2049	1.4907	0.0002	1.25E-06
261	0.00	0.000	0.016	0.2033	1.4902	0.0002	1.24E-06
262	0.00	0.000	0.015	0.2018	1.4897	0.0002	1.24E-06
263	0.00	0.000	0.014	0.2004	1.4892	0.0002	1.24E-06
264	0.00	0.000	0.014	0.1990	1.4887	0.0002	1.24E-06
265	0.04	0.000	0.020	0.2010	1.4881	0.0002	1.24E-06
266	0.01	0.000	0.013	0.2003	1.4876	0.0002	1.24E-06
267	0.14	0.001	0.015	0.2127	1.4871	0.0002	1.24E-06
268	0.00	0.000	0.009	0.2119	1.4866	0.0002	1.24E-06
269	0.00	0.000	0.012	0.2108	1.4861	0.0002	1.24E-06
270	0.00	0.000	0.011	0.2097	1.4855	0.0002	1.24E-06
271	0.00	0.000	0.011	0.2086	1.4850	0.0002	1.24E-06
272	0.00	0.000	0.011	0.2076	1.4845	0.0002	1.24E-06
273	0.00	0.000	0.010	0.2066	1.4840	0.0002	1.24E-06
274	0.00	0.000	0.010	0.2056	1.4835	0.0002	1.24E-06
275	0.00	0.000	0.013	0.2047	1.4829	0.0002	1.24E-06
276	0.03	0.000	0.017	0.2062	1.4824	0.0002	1.24E-06
277	0.00	0.000	0.009	0.2053	1.4819	0.0002	1.24E-06
278	0.00	0.000	0.011	0.2042	1.4814	0.0002	1.24E-06
279	2.27	1.249	0.020	0.2183	1.4809	0.0002	1.24E-06
280	0.00	0.207	0.333	0.2300	1.4803	0.0002	1.24E-06

281		0.00	0.000	0.278	0.2229	1.4798	0.0002	1.24E-06
282		0.00	0.000	0.082	0.2147	1.4793	0.0002	1.24E-06
283		0.52	0.116	0.144	0.2294	1.4788	0.0002	1.24E-06
284		1.28	0.662	0.114	0.2411	1.4783	0.0002	1.24E-06
285		0.00	0.111	0.161	0.2527	1.4777	0.0002	1.24E-06
286		0.00	0.000	0.063	0.2575	1.4772	0.0002	1.23E-06
287		0.00	0.000	0.082	0.2493	1.4767	0.0002	1.23E-06
288		0.00	0.000	0.092	0.2401	1.4763	0.0002	1.23E-06
289		0.00	0.000	0.110	0.2291	1.4757	0.0002	1.23E-06
290		0.00	0.000	0.080	0.2211	1.4752	0.0002	1.23E-06
291		0.00	0.000	0.146	0.2065	1.4747	0.0002	1.23E-06
292		0.00	0.000	0.080	0.1986	1.4742	0.0002	1.23E-06
293		0.00	0.000	0.008	0.1978	1.4738	0.0002	1.23E-06
294		0.00	0.000	0.008	0.1970	1.4732	0.0002	1.23E-06
295	*	0.00	0.000	0.000	0.1970	1.4727	0.0002	1.23E-06
296	*	0.30	0.000	0.042	0.1990	1.4722	0.0002	1.23E-06
297		0.00	0.020	0.070	0.2123	1.4717	0.0002	1.23E-06
298		0.62	0.231	0.065	0.2239	1.4712	0.0002	1.23E-06
299		0.00	0.000	0.181	0.2282	1.4707	0.0002	1.23E-06
300		0.00	0.000	0.062	0.2221	1.4702	0.0002	1.23E-06
301		0.00	0.000	0.037	0.2184	1.4697	0.0002	1.23E-06
302	*	0.00	0.000	0.000	0.2184	1.4692	0.0002	1.23E-06
303		0.00	0.000	0.055	0.2129	1.4686	0.0002	1.23E-06
304		0.00	0.000	0.052	0.2077	1.4681	0.0002	1.23E-06
305	*	0.20	0.000	0.034	0.2097	1.4676	0.0002	1.23E-06
306	*	0.00	0.000	0.057	0.2117	1.4671	0.0002	1.23E-06
307		0.08	0.000	0.054	0.2211	1.4666	0.0002	1.23E-06
308		0.16	0.009	0.089	0.2267	1.4661	0.0002	1.23E-06
309		0.75	0.299	0.093	0.2383	1.4656	0.0002	1.23E-06
310		0.01	0.022	0.103	0.2499	1.4650	0.0002	1.23E-06
311		0.00	0.000	0.089	0.2433	1.4645	0.0002	1.22E-06
312	*	0.18	0.000	0.042	0.2453	1.4640	0.0002	1.22E-06

313	*	0.36	0.000	0.028	0.2473	1.4635	0.0002	1.22E-06
314	*	1.60	0.000	0.000	0.2493	1.4630	0.0002	1.22E-06
315		0.00	0.088	0.000	0.2620	1.4625	0.0002	1.22E-06
316		0.00	0.719	0.000	0.2736	1.4620	0.0002	1.22E-06
317		0.00	0.529	0.000	0.2853	1.4615	0.0002	1.22E-06
318		0.00	0.012	0.174	0.2969	1.4609	0.0002	1.22E-06
319		0.00	0.000	0.074	0.2907	1.4604	0.0002	1.22E-06
320		0.00	0.000	0.060	0.2846	1.4599	0.0002	1.22E-06
321		0.00	0.000	0.076	0.2770	1.4594	0.0002	1.22E-06
322		0.00	0.000	0.094	0.2677	1.4589	0.0002	1.22E-06
323		0.00	0.000	0.076	0.2601	1.4584	0.0002	1.22E-06
324	*	0.00	0.000	0.050	0.2551	1.4579	0.0002	1.22E-06
325	*	0.00	0.000	0.045	0.2506	1.4574	0.0002	1.22E-06
326	*	0.00	0.000	0.000	0.2506	1.4569	0.0002	1.22E-06
327	*	0.00	0.000	0.000	0.2506	1.4563	0.0002	1.22E-06
328	*	0.00	0.000	0.000	0.2506	1.4558	0.0002	1.22E-06
329	*	0.00	0.000	0.000	0.2506	1.4553	0.0002	1.22E-06
330	*	0.00	0.000	0.046	0.2461	1.4548	0.0002	1.22E-06
331	*	0.00	0.000	0.041	0.2420	1.4543	0.0002	1.22E-06
332	*	0.00	0.000	0.041	0.2379	1.4538	0.0002	1.22E-06
333	*	0.00	0.000	0.000	0.2379	1.4533	0.0002	1.22E-06
334	*	0.00	0.000	0.000	0.2379	1.4528	0.0002	1.22E-06
335		0.00	0.000	0.069	0.2311	1.4523	0.0002	1.22E-06
336		0.00	0.000	0.077	0.2233	1.4518	0.0002	1.22E-06
337		0.00	0.000	0.109	0.2124	1.4512	0.0002	1.21E-06
338		0.00	0.000	0.058	0.2066	1.4507	0.0002	1.21E-06
339		0.00	0.000	0.045	0.2020	1.4502	0.0002	1.21E-06
340	*	0.00	0.000	0.038	0.1983	1.4543	0.0002	1.22E-06
341	*	0.00	0.000	0.000	0.1983	1.4538	0.0002	1.22E-06
342	*	0.00	0.000	0.007	0.1970	1.4652	0.0002	1.23E-06
343	*	0.00	0.000	0.000	0.1970	1.4719	0.0002	1.23E-06
344	*	0.00	0.000	0.000	0.1970	1.4713	0.0002	1.23E-06

345			0.23	0.042	0.018	0.2095	1.4708	0.0002	1.23E-06
346			0.00	0.000	0.055	0.2085	1.4703	0.0002	1.23E-06
347	*		0.02	0.000	0.025	0.2085	1.4698	0.0002	1.23E-06
348	*		0.00	0.000	0.000	0.2085	1.4693	0.0002	1.23E-06
349	*	*	0.25	0.000	0.007	0.2085	1.4688	0.0002	1.23E-06
350	*	*	0.36	0.000	0.013	0.2085	1.4683	0.0002	1.23E-06
351		*	0.46	0.670	0.000	0.2116	1.4677	0.0002	1.23E-06
352	*	*	0.00	0.000	0.023	0.2116	1.4672	0.0002	1.23E-06
353	*	*	0.00	0.000	0.024	0.2116	1.4667	0.0002	1.23E-06
354	*	*	0.00	0.000	0.038	0.2116	1.4662	0.0002	1.23E-06
355	*	*	0.00	0.000	0.021	0.2117	1.4657	0.0002	1.23E-06
356	*	*	0.00	0.000	0.011	0.2117	1.4652	0.0002	1.23E-06
357	*	*	0.00	0.000	0.017	0.2117	1.4647	0.0002	1.22E-06
358	*	*	0.00	0.000	0.006	0.2117	1.4641	0.0002	1.22E-06
359	*	*	0.00	0.000	0.035	0.2117	1.4636	0.0002	1.22E-06
360		*	0.00	0.000	0.056	0.2117	1.4631	0.0002	1.22E-06
361		*	0.00	0.000	0.057	0.2118	1.4626	0.0002	1.22E-06
362	*	*	0.00	0.000	0.044	0.2118	1.4621	0.0002	1.22E-06
363		*	0.00	0.000	0.021	0.2118	1.4616	0.0002	1.22E-06
364	*	*	0.00	0.000	0.000	0.2118	1.4611	0.0002	1.22E-06
365	*	*	0.00	0.000	0.000	0.2118	1.4606	0.0002	1.22E-06

* = Frozen (air or soil)

Annual Totals for Year 7			
	inches	cubic feet	percent
Precipitation	34.85	126,491.9	100.00
Runoff	12.842	46,614.7	36.85
Evapotranspiration	22.363	81,179.1	64.18
Recirculation into Layer 1	0.0635	230.4	0.18
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0635	230.4	0.18
Percolation/Leakage through Layer 5	0.000466	1.6931	0.00
Average Head on Top of Layer 4	1.5337	---	---
Change in Water Storage	-0.3591	-1,303.4	-1.03
Soil Water at Start of Year	293.9253	1,066,948.7	843.49
Soil Water at End of Year	293.5662	1,065,645.3	842.46
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0635	-230.5	-0.18

Daily Output for Year 8

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1		*	0.00	0.000	0.000	0.2118	1.4600	0.0002	1.22E-06
2		*	0.00	0.000	0.000	0.2119	1.4595	0.0002	1.22E-06
3		*	0.00	0.000	0.000	0.2119	1.4590	0.0002	1.22E-06
4			0.00	0.000	0.035	0.2084	1.4585	0.0002	1.22E-06
5			0.00	0.000	0.064	0.2020	1.4580	0.0002	1.22E-06
6			0.00	0.000	0.039	0.1981	1.4575	0.0002	1.22E-06
7	*		0.00	0.000	0.000	0.1981	1.4570	0.0002	1.22E-06
8			0.00	0.000	0.011	0.1970	1.4565	0.0002	1.22E-06
9			0.00	0.000	0.000	0.1970	1.4560	0.0002	1.22E-06
10			0.00	0.000	0.000	0.1970	1.4555	0.0002	1.22E-06
11			0.00	0.000	0.000	0.1970	1.4550	0.0002	1.22E-06
12			0.00	0.000	0.000	0.1970	1.4544	0.0002	1.22E-06
13			0.00	0.000	0.000	0.1970	1.4539	0.0002	1.22E-06
14			0.00	0.000	0.000	0.1970	1.4534	0.0002	1.22E-06
15			0.00	0.000	0.000	0.1970	1.4529	0.0002	1.22E-06
16			0.00	0.000	0.000	0.1970	1.4524	0.0002	1.22E-06
17			0.61	0.206	0.036	0.2133	1.4519	0.0002	1.22E-06
18			0.00	0.000	0.134	0.2202	1.4514	0.0002	1.21E-06
19			0.00	0.000	0.042	0.2160	1.4509	0.0002	1.21E-06
20			0.00	0.000	0.098	0.2062	1.4504	0.0002	1.21E-06
21			0.00	0.000	0.073	0.1989	1.4499	0.0002	1.21E-06
22			0.00	0.000	0.018	0.1971	1.4494	0.0002	1.21E-06
23	*		0.00	0.000	0.000	0.1971	1.4489	0.0002	1.21E-06
24	*		0.00	0.000	0.000	0.1972	1.4483	0.0002	1.21E-06

25		0.00	0.000	0.001	0.1971	1.4478	0.0002	1.21E-06
26		0.00	0.000	0.002	0.1970	1.4473	0.0002	1.21E-06
27	*	0.19	0.000	0.029	0.1990	1.4468	0.0002	1.21E-06
28	*	0.00	0.000	0.016	0.2010	1.4463	0.0002	1.21E-06
29	*	0.00	0.000	0.013	0.2030	1.4458	0.0002	1.21E-06
30	*	0.00	0.000	0.029	0.2050	1.4453	0.0002	1.21E-06
31	*	0.00	0.000	0.019	0.2050	1.4448	0.0002	1.21E-06
32	*	0.00	0.000	0.000	0.2050	1.4443	0.0002	1.21E-06
33		0.00	0.000	0.017	0.2034	1.4438	0.0002	1.21E-06
34		1.29	0.606	0.039	0.2179	1.4433	0.0002	1.21E-06
35		0.44	0.333	0.159	0.2296	1.4428	0.0002	1.21E-06
36		0.10	0.084	0.151	0.2412	1.4423	0.0002	1.21E-06
37		0.00	0.000	0.134	0.2367	1.4418	0.0002	1.21E-06
38		0.49	0.129	0.088	0.2516	1.4413	0.0002	1.21E-06
39		0.00	0.000	0.087	0.2549	1.4408	0.0002	1.21E-06
40		0.00	0.000	0.082	0.2467	1.4403	0.0002	1.21E-06
41	*	0.00	0.000	0.041	0.2427	1.4398	0.0002	1.21E-06
42	*	0.00	0.000	0.000	0.2427	1.4393	0.0002	1.21E-06
43		0.00	0.000	0.087	0.2340	1.4388	0.0002	1.21E-06
44		0.00	0.000	0.099	0.2242	1.4383	0.0002	1.20E-06
45		0.00	0.000	0.183	0.2059	1.4378	0.0002	1.20E-06
46		0.00	0.000	0.078	0.1982	1.4373	0.0002	1.20E-06
47		0.00	0.000	0.007	0.1975	1.4367	0.0002	1.20E-06
48		0.00	0.000	0.005	0.1970	1.4362	0.0002	1.20E-06
49		0.00	0.000	0.000	0.1970	1.4357	0.0002	1.20E-06
50		0.00	0.000	0.000	0.1970	1.4352	0.0002	1.20E-06
51	*	0.00	0.000	0.000	0.1970	1.4347	0.0002	1.20E-06
52	*	0.00	0.000	0.000	0.1970	1.4342	0.0002	1.20E-06
53	*	0.00	0.000	0.000	0.1970	1.4337	0.0002	1.20E-06
54	*	0.00	0.000	0.000	0.1971	1.4332	0.0002	1.20E-06
55	*	0.00	0.000	0.000	0.1971	1.4327	0.0002	1.20E-06
56		0.00	0.000	0.001	0.1970	1.4322	0.0002	1.20E-06

57	*	0.00	0.000	0.000	0.1970	1.4317	0.0002	1.20E-06
58		0.00	0.000	0.000	0.1970	1.4312	0.0002	1.20E-06
59		0.00	0.000	0.000	0.1970	1.4308	0.0002	1.20E-06
60	*	0.00	0.000	0.000	0.1970	1.4303	0.0002	1.20E-06
61	*	0.00	0.000	0.000	0.1970	1.4298	0.0002	1.20E-06
62		0.43	0.118	0.028	0.2133	1.4292	0.0002	1.20E-06
63		0.20	0.038	0.135	0.2242	1.4287	0.0002	1.20E-06
64		0.12	0.000	0.075	0.2329	1.4282	0.0002	1.20E-06
65		0.00	0.000	0.083	0.2246	1.4277	0.0002	1.20E-06
66		0.00	0.000	0.081	0.2165	1.4272	0.0002	1.20E-06
67		0.13	0.000	0.095	0.2197	1.4267	0.0002	1.20E-06
68		0.01	0.000	0.056	0.2147	1.4262	0.0002	1.20E-06
69		0.00	0.000	0.038	0.2110	1.4257	0.0002	1.20E-06
70		0.00	0.000	0.032	0.2078	1.4252	0.0002	1.19E-06
71	*	0.00	0.000	0.000	0.2078	1.4247	0.0002	1.19E-06
72		0.00	0.000	0.027	0.2051	1.4243	0.0002	1.19E-06
73		0.00	0.000	0.021	0.2030	1.4238	0.0002	1.19E-06
74		0.00	0.000	0.019	0.2011	1.4233	0.0002	1.19E-06
75		0.00	0.000	0.016	0.1995	1.4228	0.0002	1.19E-06
76		0.00	0.000	0.016	0.1979	1.4223	0.0002	1.19E-06
77		0.00	0.000	0.009	0.1970	1.4218	0.0002	1.19E-06
78		0.00	0.000	0.000	0.1970	1.4213	0.0002	1.19E-06
79		0.00	0.000	0.000	0.1970	1.4208	0.0002	1.19E-06
80		0.00	0.000	0.000	0.1970	1.4203	0.0002	1.19E-06
81		0.08	0.000	0.008	0.2039	1.4198	0.0002	1.19E-06
82		0.13	0.000	0.014	0.2152	1.4193	0.0002	1.19E-06
83	*	0.00	0.000	0.008	0.2144	1.4188	0.0002	1.19E-06
84	*	0.00	0.000	0.004	0.2144	1.4183	0.0002	1.19E-06
85		0.00	0.000	0.012	0.2133	1.4178	0.0002	1.19E-06
86		0.00	0.000	0.011	0.2121	1.4173	0.0002	1.19E-06
87	*	0.00	0.000	0.000	0.2121	1.4168	0.0002	1.19E-06
88		0.18	0.018	0.017	0.2246	1.4163	0.0002	1.19E-06

89	0.00	0.000	0.031	0.2233	1.4158	0.0002	1.19E-06
90	0.00	0.000	0.013	0.2221	1.4153	0.0002	1.19E-06
91	0.37	0.106	0.022	0.2353	1.4148	0.0002	1.19E-06
92	0.19	0.027	0.211	0.2383	1.4143	0.0002	1.19E-06
93	0.00	0.000	0.170	0.2239	1.4138	0.0002	1.19E-06
94	0.00	0.000	0.116	0.2123	1.4133	0.0002	1.19E-06
95	1.07	0.455	0.065	0.2279	1.4128	0.0002	1.19E-06
96	0.28	0.179	0.201	0.2395	1.4123	0.0002	1.18E-06
97	0.00	0.000	0.223	0.2352	1.4118	0.0002	1.18E-06
98	0.00	0.000	0.169	0.2183	1.4113	0.0002	1.18E-06
99	0.06	0.000	0.136	0.2106	1.4108	0.0002	1.18E-06
100	0.12	0.000	0.073	0.2149	1.4103	0.0002	1.18E-06
101	0.50	0.092	0.187	0.2280	1.4099	0.0002	1.18E-06
102	0.72	0.273	0.191	0.2397	1.4094	0.0002	1.18E-06
103	0.97	0.453	0.292	0.2513	1.4089	0.0002	1.18E-06
104	0.64	0.277	0.375	0.2629	1.4084	0.0002	1.18E-06
105	0.00	0.000	0.226	0.2613	1.4079	0.0002	1.18E-06
106	0.00	0.000	0.261	0.2352	1.4074	0.0002	1.18E-06
107	0.00	0.000	0.141	0.2212	1.4069	0.0002	1.18E-06
108	0.00	0.000	0.093	0.2120	1.4064	0.0002	1.18E-06
109	1.13	0.480	0.082	0.2282	1.4059	0.0002	1.18E-06
110	0.22	0.146	0.225	0.2399	1.4054	0.0002	1.18E-06
111	0.00	0.000	0.231	0.2316	1.4049	0.0002	1.18E-06
112	0.00	0.000	0.302	0.2013	1.4047	0.0002	1.18E-06
113	0.00	0.000	0.027	0.1986	1.4052	0.0002	1.18E-06
114	0.00	0.000	0.016	0.1970	1.4048	0.0002	1.18E-06
115	0.16	0.005	0.040	0.2077	1.4043	0.0002	1.18E-06
116	1.00	0.439	0.071	0.2193	1.4038	0.0002	1.18E-06
117	0.80	0.469	0.177	0.2309	1.4033	0.0002	1.18E-06
118	0.15	0.097	0.264	0.2426	1.4028	0.0002	1.18E-06
119	0.00	0.000	0.205	0.2317	1.4023	0.0002	1.18E-06
120	1.30	0.509	0.303	0.2456	1.4018	0.0002	1.18E-06

121	0.00	0.000	0.302	0.2501	1.4013	0.0002	1.18E-06
122	0.00	0.000	0.188	0.2314	1.4008	0.0002	1.18E-06
123	0.00	0.000	0.100	0.2214	1.4003	0.0002	1.18E-06
124	0.00	0.000	0.143	0.2072	1.3998	0.0002	1.18E-06
125	0.00	0.000	0.089	0.1983	1.3994	0.0002	1.17E-06
126	0.00	0.000	0.006	0.1976	1.3989	0.0002	1.17E-06
127	0.17	0.010	0.068	0.2061	1.3984	0.0002	1.17E-06
128	0.00	0.000	0.037	0.2035	1.3979	0.0002	1.17E-06
129	0.00	0.000	0.031	0.2004	1.3974	0.0002	1.17E-06
130	0.00	0.000	0.024	0.1980	1.3969	0.0002	1.17E-06
131	0.00	0.000	0.008	0.1972	1.3964	0.0002	1.17E-06
132	1.25	0.573	0.039	0.2133	1.3959	0.0002	1.17E-06
133	0.22	0.194	0.194	0.2249	1.3954	0.0002	1.17E-06
134	0.00	0.000	0.253	0.2190	1.3950	0.0002	1.17E-06
135	0.00	0.000	0.191	0.1999	1.3945	0.0002	1.17E-06
136	0.00	0.000	0.026	0.1974	1.3940	0.0002	1.17E-06
137	0.00	0.000	0.006	0.1972	1.3935	0.0002	1.17E-06
138	0.14	0.000	0.026	0.2089	1.3930	0.0002	1.17E-06
139	0.00	0.000	0.021	0.2068	1.3925	0.0002	1.17E-06
140	0.00	0.000	0.025	0.2043	1.3920	0.0002	1.17E-06
141	0.00	0.000	0.024	0.2020	1.3915	0.0002	1.17E-06
142	0.16	0.013	0.029	0.2127	1.3910	0.0002	1.17E-06
143	0.02	0.000	0.037	0.2127	1.3906	0.0002	1.17E-06
144	0.00	0.000	0.020	0.2107	1.3901	0.0002	1.17E-06
145	0.00	0.000	0.017	0.2090	1.3896	0.0002	1.17E-06
146	0.00	0.000	0.018	0.2073	1.3891	0.0002	1.17E-06
147	0.00	0.000	0.016	0.2057	1.3886	0.0002	1.17E-06
148	0.00	0.000	0.018	0.2039	1.3881	0.0002	1.17E-06
149	0.00	0.000	0.017	0.2022	1.3876	0.0002	1.17E-06
150	0.00	0.000	0.017	0.2006	1.3872	0.0002	1.17E-06
151	0.02	0.000	0.021	0.2002	1.3867	0.0002	1.16E-06
152	0.89	0.371	0.028	0.2149	1.3862	0.0002	1.16E-06

153	1.53	0.791	0.369	0.2266	1.3857	0.0002	1.16E-06
154	1.38	0.855	0.378	0.2382	1.3852	0.0002	1.16E-06
155	0.64	0.401	0.387	0.2498	1.3847	0.0002	1.16E-06
156	0.00	0.000	0.394	0.2467	1.3842	0.0002	1.16E-06
157	0.13	0.000	0.196	0.2404	1.3838	0.0002	1.16E-06
158	0.06	0.000	0.162	0.2302	1.3833	0.0002	1.16E-06
159	0.04	0.000	0.161	0.2178	1.3828	0.0002	1.16E-06
160	1.18	0.496	0.144	0.2303	1.3823	0.0002	1.16E-06
161	0.00	0.000	0.421	0.2293	1.3818	0.0002	1.16E-06
162	0.05	0.000	0.240	0.2102	1.3814	0.0002	1.16E-06
163	0.00	0.000	0.093	0.2010	1.3810	0.0002	1.16E-06
164	0.00	0.000	0.032	0.1977	1.3812	0.0002	1.16E-06
165	0.00	0.000	0.005	0.1972	1.3823	0.0002	1.16E-06
166	0.00	0.000	0.002	0.1970	1.3818	0.0002	1.16E-06
167	0.00	0.000	0.000	0.1970	1.3813	0.0002	1.16E-06
168	0.00	0.000	0.000	0.1970	1.3808	0.0002	1.16E-06
169	0.00	0.000	0.000	0.1970	1.3803	0.0002	1.16E-06
170	1.05	0.452	0.044	0.2130	1.3798	0.0002	1.16E-06
171	0.00	0.000	0.428	0.2100	1.3794	0.0002	1.16E-06
172	0.00	0.000	0.107	0.1993	1.3789	0.0002	1.16E-06
173	0.00	0.000	0.023	0.1970	1.3784	0.0002	1.16E-06
174	0.00	0.000	0.000	0.1970	1.3779	0.0002	1.16E-06
175	0.00	0.000	0.000	0.1970	1.3774	0.0002	1.16E-06
176	0.00	0.000	0.000	0.1970	1.3769	0.0002	1.16E-06
177	0.00	0.000	0.000	0.1970	1.3765	0.0002	1.16E-06
178	0.00	0.000	0.000	0.1970	1.3760	0.0002	1.16E-06
179	0.34	0.080	0.037	0.2115	1.3755	0.0002	1.16E-06
180	0.00	0.000	0.095	0.2101	1.3750	0.0002	1.16E-06
181	0.00	0.000	0.023	0.2078	1.3745	0.0002	1.16E-06
182	0.00	0.000	0.020	0.2058	1.3741	0.0002	1.16E-06
183	0.01	0.000	0.023	0.2044	1.3736	0.0002	1.15E-06
184	0.00	0.000	0.018	0.2027	1.3731	0.0002	1.15E-06

185	0.00	0.000	0.018	0.2009	1.3726	0.0002	1.15E-06
186	0.00	0.000	0.016	0.1992	1.3721	0.0002	1.15E-06
187	0.00	0.000	0.015	0.1977	1.3717	0.0002	1.15E-06
188	0.00	0.000	0.007	0.1970	1.3712	0.0002	1.15E-06
189	0.00	0.000	0.000	0.1970	1.3707	0.0002	1.15E-06
190	0.00	0.000	0.000	0.1970	1.3702	0.0002	1.15E-06
191	0.00	0.000	0.000	0.1970	1.3697	0.0002	1.15E-06
192	0.00	0.000	0.000	0.1970	1.3693	0.0002	1.15E-06
193	0.70	0.259	0.025	0.2132	1.3688	0.0002	1.15E-06
194	1.31	0.598	0.379	0.2248	1.3683	0.0002	1.15E-06
195	0.00	0.052	0.247	0.2365	1.3678	0.0002	1.15E-06
196	0.00	0.000	0.140	0.2276	1.3673	0.0002	1.15E-06
197	0.01	0.000	0.124	0.2160	1.3669	0.0002	1.15E-06
198	0.00	0.000	0.147	0.2013	1.3664	0.0002	1.15E-06
199	0.15	0.000	0.074	0.2088	1.3659	0.0002	1.15E-06
200	0.40	0.062	0.155	0.2210	1.3654	0.0002	1.15E-06
201	0.10	0.000	0.109	0.2260	1.3650	0.0002	1.15E-06
202	0.00	0.000	0.138	0.2121	1.3645	0.0002	1.15E-06
203	0.00	0.000	0.122	0.2000	1.3640	0.0002	1.15E-06
204	0.96	0.343	0.159	0.2153	1.3635	0.0002	1.15E-06
205	0.00	0.000	0.356	0.2101	1.3630	0.0002	1.15E-06
206	0.00	0.000	0.107	0.1994	1.3626	0.0002	1.15E-06
207	0.00	0.000	0.024	0.1970	1.3621	0.0002	1.15E-06
208	0.26	0.047	0.081	0.2053	1.3616	0.0002	1.15E-06
209	0.06	0.000	0.084	0.2074	1.3611	0.0002	1.15E-06
210	0.05	0.000	0.041	0.2082	1.3607	0.0002	1.14E-06
211	0.00	0.000	0.026	0.2057	1.3602	0.0002	1.14E-06
212	0.00	0.000	0.028	0.2029	1.3597	0.0002	1.14E-06
213	0.00	0.000	0.025	0.2004	1.3592	0.0002	1.14E-06
214	0.02	0.000	0.033	0.1995	1.3587	0.0002	1.14E-06
215	0.32	0.070	0.043	0.2130	1.3583	0.0002	1.14E-06
216	0.12	0.000	0.190	0.2127	1.3578	0.0002	1.14E-06

217	0.00	0.000	0.016	0.2111	1.3573	0.0002	1.14E-06
218	0.00	0.000	0.021	0.2090	1.3568	0.0002	1.14E-06
219	0.00	0.000	0.024	0.2066	1.3564	0.0002	1.14E-06
220	0.00	0.000	0.024	0.2042	1.3559	0.0002	1.14E-06
221	0.30	0.064	0.032	0.2188	1.3554	0.0002	1.14E-06
222	0.00	0.000	0.207	0.2045	1.3549	0.0002	1.14E-06
223	0.00	0.000	0.020	0.2025	1.3545	0.0002	1.14E-06
224	0.00	0.000	0.028	0.1998	1.3540	0.0002	1.14E-06
225	0.00	0.000	0.023	0.1975	1.3535	0.0002	1.14E-06
226	0.00	0.000	0.004	0.1970	1.3531	0.0002	1.14E-06
227	0.00	0.000	0.000	0.1970	1.3526	0.0002	1.14E-06
228	0.00	0.000	0.000	0.1970	1.3521	0.0002	1.14E-06
229	0.11	0.000	0.011	0.2074	1.3517	0.0002	1.14E-06
230	0.00	0.000	0.010	0.2064	1.3512	0.0002	1.14E-06
231	0.17	0.013	0.021	0.2187	1.3507	0.0002	1.14E-06
232	0.01	0.000	0.027	0.2181	1.3502	0.0002	1.14E-06
233	0.00	0.000	0.016	0.2165	1.3498	0.0002	1.14E-06
234	0.00	0.000	0.017	0.2148	1.3493	0.0002	1.14E-06
235	0.00	0.000	0.015	0.2134	1.3488	0.0002	1.14E-06
236	0.00	0.000	0.016	0.2119	1.3483	0.0002	1.14E-06
237	0.35	0.086	0.030	0.2262	1.3479	0.0002	1.13E-06
238	0.52	0.121	0.262	0.2379	1.3474	0.0002	1.13E-06
239	0.24	0.033	0.251	0.2410	1.3469	0.0002	1.13E-06
240	0.02	0.000	0.090	0.2369	1.3465	0.0002	1.13E-06
241	0.00	0.000	0.068	0.2303	1.3460	0.0002	1.13E-06
242	0.00	0.000	0.139	0.2164	1.3455	0.0002	1.13E-06
243	0.00	0.000	0.090	0.2074	1.3450	0.0002	1.13E-06
244	0.00	0.000	0.083	0.1991	1.3446	0.0002	1.13E-06
245	0.00	0.000	0.017	0.1974	1.3441	0.0002	1.13E-06
246	0.07	0.000	0.020	0.2023	1.3436	0.0002	1.13E-06
247	0.00	0.000	0.039	0.1985	1.3432	0.0002	1.13E-06
248	0.00	0.000	0.011	0.1974	1.3427	0.0002	1.13E-06

249	0.00	0.000	0.004	0.1971	1.3422	0.0002	1.13E-06
250	0.00	0.000	0.000	0.1970	1.3417	0.0002	1.13E-06
251	0.00	0.000	0.000	0.1970	1.3413	0.0002	1.13E-06
252	0.00	0.000	0.000	0.1970	1.3408	0.0002	1.13E-06
253	0.00	0.000	0.000	0.1970	1.3403	0.0002	1.13E-06
254	0.00	0.000	0.000	0.1970	1.3399	0.0002	1.13E-06
255	0.00	0.000	0.000	0.1970	1.3394	0.0002	1.13E-06
256	0.00	0.000	0.000	0.1970	1.3389	0.0002	1.13E-06
257	0.00	0.000	0.000	0.1970	1.3385	0.0002	1.13E-06
258	0.00	0.000	0.000	0.1970	1.3380	0.0002	1.13E-06
259	0.00	0.000	0.000	0.1970	1.3375	0.0002	1.13E-06
260	0.00	0.000	0.000	0.1970	1.3370	0.0002	1.13E-06
261	0.00	0.000	0.000	0.1970	1.3366	0.0002	1.13E-06
262	0.01	0.000	0.007	0.1970	1.3361	0.0002	1.13E-06
263	0.00	0.000	0.000	0.1970	1.3356	0.0002	1.13E-06
264	0.00	0.000	0.000	0.1970	1.3352	0.0002	1.13E-06
265	0.51	0.159	0.027	0.2132	1.3347	0.0002	1.12E-06
266	0.14	0.041	0.098	0.2248	1.3342	0.0002	1.12E-06
267	0.00	0.000	0.057	0.2233	1.3338	0.0002	1.12E-06
268	0.00	0.000	0.013	0.2220	1.3333	0.0002	1.12E-06
269	0.00	0.000	0.013	0.2207	1.3329	0.0002	1.12E-06
270	0.00	0.000	0.014	0.2193	1.3324	0.0002	1.12E-06
271	0.06	0.000	0.022	0.2233	1.3319	0.0002	1.12E-06
272	0.00	0.000	0.017	0.2217	1.3315	0.0002	1.12E-06
273	0.00	0.000	0.013	0.2204	1.3310	0.0002	1.12E-06
274	0.00	0.000	0.011	0.2193	1.3305	0.0002	1.12E-06
275	0.00	0.000	0.012	0.2181	1.3301	0.0002	1.12E-06
276	0.00	0.000	0.011	0.2171	1.3296	0.0002	1.12E-06
277	0.00	0.000	0.011	0.2160	1.3291	0.0002	1.12E-06
278	0.33	0.083	0.024	0.2306	1.3287	0.0002	1.12E-06
279	0.24	0.067	0.074	0.2422	1.3282	0.0002	1.12E-06
280	0.00	0.000	0.081	0.2408	1.3277	0.0002	1.12E-06

281		0.00	0.000	0.058	0.2350	1.3273	0.0002	1.12E-06
282		0.00	0.000	0.117	0.2233	1.3268	0.0002	1.12E-06
283		0.00	0.000	0.059	0.2173	1.3263	0.0002	1.12E-06
284		0.00	0.000	0.054	0.2119	1.3259	0.0002	1.12E-06
285		0.00	0.000	0.096	0.2023	1.3254	0.0002	1.12E-06
286		0.00	0.000	0.049	0.1975	1.3249	0.0002	1.12E-06
287	*	0.00	0.000	0.003	0.1972	1.3245	0.0002	1.12E-06
288		0.00	0.000	0.002	0.1970	1.3240	0.0002	1.12E-06
289		0.00	0.000	0.000	0.1970	1.3236	0.0002	1.12E-06
290		0.00	0.000	0.000	0.1970	1.3231	0.0002	1.12E-06
291		3.66	2.179	0.040	0.2132	1.3226	0.0001	1.12E-06
292		0.66	0.845	0.144	0.2249	1.3222	0.0001	1.12E-06
293		0.00	0.281	0.154	0.2365	1.3217	0.0001	1.11E-06
294		0.00	0.029	0.107	0.2481	1.3212	0.0001	1.11E-06
295		0.00	0.000	0.103	0.2407	1.3208	0.0001	1.11E-06
296		0.00	0.000	0.061	0.2346	1.3203	0.0001	1.11E-06
297	*	0.00	0.000	0.000	0.2346	1.3198	0.0001	1.11E-06
298	*	0.00	0.000	0.000	0.2346	1.3194	0.0001	1.11E-06
299	*	0.00	0.000	0.000	0.2346	1.3189	0.0001	1.11E-06
300	*	0.00	0.000	0.000	0.2347	1.3185	0.0001	1.11E-06
301		0.04	0.000	0.072	0.2310	1.3180	0.0001	1.11E-06
302		0.00	0.000	0.090	0.2221	1.3175	0.0001	1.11E-06
303		0.00	0.000	0.055	0.2166	1.3171	0.0001	1.11E-06
304		0.05	0.000	0.145	0.2069	1.3166	0.0001	1.11E-06
305		0.08	0.000	0.078	0.2068	1.3162	0.0001	1.11E-06
306		0.32	0.051	0.088	0.2198	1.3157	0.0001	1.11E-06
307		0.48	0.148	0.119	0.2314	1.3152	0.0001	1.11E-06
308		0.01	0.000	0.088	0.2383	1.3148	0.0001	1.11E-06
309		0.00	0.000	0.066	0.2317	1.3148	0.0001	1.11E-06
310	*	0.00	0.000	0.048	0.2269	1.3146	0.0001	1.11E-06
311	*	0.00	0.000	0.000	0.2269	1.3141	0.0001	1.11E-06
312	*	0.00	0.000	0.000	0.2269	1.3137	0.0001	1.11E-06

313	*		0.11	0.000	0.027	0.2289	1.3132	0.0001	1.11E-06
314	*		0.00	0.000	0.034	0.2309	1.3128	0.0001	1.11E-06
315	*		0.00	0.000	0.007	0.2309	1.3123	0.0001	1.11E-06
316	*		0.00	0.000	0.000	0.2309	1.3118	0.0001	1.11E-06
317	*		0.09	0.000	0.031	0.2329	1.3114	0.0001	1.11E-06
318	*		0.00	0.000	0.017	0.2349	1.3109	0.0001	1.11E-06
319			0.02	0.000	0.060	0.2313	1.3105	0.0001	1.11E-06
320	*		0.02	0.000	0.015	0.2313	1.3100	0.0001	1.11E-06
321	*	*	0.00	0.000	0.000	0.2313	1.3095	0.0001	1.11E-06
322	*	*	0.00	0.000	0.000	0.2313	1.3091	0.0001	1.10E-06
323		*	0.00	0.000	0.000	0.2313	1.3086	0.0001	1.10E-06
324	*	*	0.00	0.000	0.000	0.2313	1.3082	0.0001	1.10E-06
325	*	*	0.72	0.000	0.041	0.2313	1.3077	0.0001	1.10E-06
326		*	0.00	0.407	0.033	0.2331	1.3072	0.0001	1.10E-06
327		*	0.00	0.000	0.142	0.2410	1.3068	0.0001	1.10E-06
328		*	0.00	0.000	0.000	0.2411	1.3063	0.0001	1.10E-06
329	*	*	0.00	0.000	0.003	0.2411	1.3059	0.0001	1.10E-06
330	*	*	0.05	0.000	0.021	0.2411	1.3054	0.0001	1.10E-06
331	*	*	0.07	0.000	0.000	0.2411	1.3050	0.0001	1.10E-06
332		*	0.00	0.004	0.068	0.2439	1.3045	0.0001	1.10E-06
333	*	*	0.00	0.000	0.000	0.2439	1.3040	0.0001	1.10E-06
334		*	0.00	0.000	0.000	0.2439	1.3036	0.0001	1.10E-06
335	*	*	0.00	0.000	0.000	0.2439	1.3031	0.0001	1.10E-06
336		*	0.00	0.000	0.000	0.2439	1.3027	0.0001	1.10E-06
337		*	0.00	0.000	0.000	0.2440	1.3022	0.0001	1.10E-06
338		*	0.00	0.000	0.000	0.2440	1.3018	0.0001	1.10E-06
339			0.00	0.000	0.058	0.2382	1.3013	0.0001	1.10E-06
340			0.00	0.000	0.102	0.2280	1.3008	0.0001	1.10E-06
341			0.00	0.000	0.071	0.2209	1.3004	0.0001	1.10E-06
342			0.00	0.000	0.049	0.2161	1.3000	0.0001	1.10E-06
343	*		0.00	0.000	0.000	0.2161	1.2995	0.0001	1.10E-06
344	*		0.00	0.000	0.000	0.2161	1.2991	0.0001	1.10E-06

345	*	0.00	0.000	0.039	0.2122	1.2986	0.0001	1.10E-06
346	*	0.10	0.000	0.025	0.2142	1.2982	0.0001	1.10E-06
347	*	0.12	0.000	0.000	0.2162	1.2977	0.0001	1.10E-06
348	*	0.69	0.000	0.022	0.2182	1.2973	0.0001	1.10E-06
349		0.17	0.000	0.000	0.2307	1.2968	0.0001	1.10E-06
350		0.02	0.405	0.000	0.2425	1.2963	0.0001	1.10E-06
351		0.00	0.052	0.128	0.2542	1.2959	0.0001	1.09E-06
352		0.01	0.000	0.129	0.2474	1.2954	0.0001	1.09E-06
353		0.06	0.000	0.049	0.2484	1.2950	0.0001	1.09E-06
354		0.07	0.000	0.048	0.2511	1.2945	0.0001	1.09E-06
355		0.00	0.000	0.083	0.2428	1.2941	0.0001	1.09E-06
356		0.00	0.000	0.064	0.2365	1.2936	0.0001	1.09E-06
357		0.00	0.000	0.068	0.2297	1.2932	0.0001	1.09E-06
358		0.08	0.000	0.115	0.2267	1.2927	0.0001	1.09E-06
359		0.00	0.000	0.079	0.2189	1.2923	0.0001	1.09E-06
360	*	0.01	0.000	0.050	0.2151	1.2918	0.0001	1.09E-06
361		0.19	0.025	0.057	0.2230	1.2914	0.0001	1.09E-06
362		0.00	0.000	0.087	0.2168	1.2909	0.0001	1.09E-06
363		0.00	0.000	0.056	0.2112	1.2905	0.0001	1.09E-06
364		0.00	0.000	0.074	0.2039	1.2900	0.0001	1.09E-06
365	*	0.00	0.000	0.036	0.2002	1.2896	0.0001	1.09E-06

* = Frozen (air or soil)

Annual Totals for Year 8

	inches	cubic feet	percent
Precipitation	38.77	140,734.9	100.00
Runoff	16.296	59,153.7	42.03
Evapotranspiration	22.645	82,202.9	58.41
Recirculation into Layer 1	0.0570	206.8	0.15
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0570	206.8	0.15
Percolation/Leakage through Layer 5	0.000422	1.5336	0.00
Average Head on Top of Layer 4	1.3729	---	---
Change in Water Storage	-0.1717	-623.1	-0.44
Soil Water at Start of Year	293.5662	1,065,645.3	757.20
Soil Water at End of Year	293.3945	1,065,022.2	756.76
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0570	-206.9	-0.15

Daily Output for Year 9

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.032	0.1971	1.2886	0.0001	1.09E-06
2			0.00	0.000	0.001	0.1971	1.2882	0.0001	1.09E-06
3			0.00	0.000	0.001	0.1970	1.2878	0.0001	1.09E-06
4			0.00	0.000	0.001	0.1970	1.2873	0.0001	1.09E-06
5			1.07	0.453	0.053	0.2133	1.2869	0.0001	1.09E-06
6			0.00	0.101	0.079	0.2250	1.2864	0.0001	1.09E-06
7	*		0.00	0.000	0.035	0.2250	1.2860	0.0001	1.09E-06
8	*		0.00	0.000	0.022	0.2250	1.2855	0.0001	1.09E-06
9	*		0.00	0.000	0.041	0.2256	1.2851	0.0001	1.09E-06
10	*		0.00	0.000	0.004	0.2256	1.2846	0.0001	1.09E-06
11	*		0.00	0.000	0.000	0.2257	1.2842	0.0001	1.09E-06
12			0.00	0.000	0.065	0.2192	1.2837	0.0001	1.09E-06
13			0.00	0.000	0.074	0.2118	1.2833	0.0001	1.08E-06
14			0.00	0.000	0.090	0.2028	1.2829	0.0001	1.08E-06
15			0.00	0.000	0.047	0.1981	1.2824	0.0001	1.08E-06
16			0.00	0.000	0.006	0.1976	1.2820	0.0001	1.08E-06
17	*		0.00	0.000	0.003	0.1973	1.2815	0.0001	1.08E-06
18			0.23	0.042	0.036	0.2084	1.2811	0.0001	1.08E-06
19			0.11	0.000	0.089	0.2144	1.2806	0.0001	1.08E-06
20			0.01	0.000	0.036	0.2114	1.2802	0.0001	1.08E-06
21			0.00	0.000	0.056	0.2059	1.2797	0.0001	1.08E-06
22			0.00	0.000	0.066	0.1993	1.2793	0.0001	1.08E-06
23			0.00	0.000	0.021	0.1972	1.2788	0.0001	1.08E-06
24			0.00	0.000	0.002	0.1970	1.2784	0.0001	1.08E-06

25		0.00	0.000	0.000	0.1970	1.2779	0.0001	1.08E-06
26	*	0.00	0.000	0.000	0.1970	1.2775	0.0001	1.08E-06
27	*	0.00	0.000	0.000	0.1970	1.2770	0.0001	1.08E-06
28	*	0.00	0.000	0.000	0.1970	1.2766	0.0001	1.08E-06
29	*	0.00	0.000	0.000	0.1970	1.2761	0.0001	1.08E-06
30	*	0.00	0.000	0.000	0.1970	1.2757	0.0001	1.08E-06
31	*	0.00	0.000	0.000	0.1971	1.2752	0.0001	1.08E-06
32	*	0.00	0.000	0.000	0.1971	1.2748	0.0001	1.08E-06
33		0.00	0.000	0.001	0.1970	1.2744	0.0001	1.08E-06
34		0.00	0.000	0.000	0.1970	1.2739	0.0001	1.08E-06
35		0.00	0.000	0.000	0.1970	1.2735	0.0001	1.08E-06
36	*	0.03	0.000	0.034	0.1970	1.2730	0.0001	1.08E-06
37	*	0.18	0.000	0.050	0.1990	1.2726	0.0001	1.08E-06
38		0.00	0.000	0.046	0.2060	1.2721	0.0001	1.08E-06
39		0.14	0.000	0.019	0.2177	1.2717	0.0001	1.08E-06
40	*	0.11	0.000	0.067	0.2197	1.2712	0.0001	1.08E-06
41		0.00	0.000	0.042	0.2181	1.2708	0.0001	1.08E-06
42	*	0.00	0.000	0.018	0.2167	1.2703	0.0001	1.07E-06
43		0.12	0.000	0.022	0.2265	1.2699	0.0001	1.07E-06
44		0.29	0.067	0.028	0.2396	1.2694	0.0001	1.07E-06
45		0.17	0.023	0.087	0.2502	1.2690	0.0001	1.07E-06
46		0.43	0.128	0.099	0.2619	1.2686	0.0001	1.07E-06
47		0.00	0.000	0.157	0.2567	1.2681	0.0001	1.07E-06
48		0.00	0.000	0.067	0.2501	1.2677	0.0001	1.07E-06
49	*	0.00	0.000	0.000	0.2501	1.2672	0.0001	1.07E-06
50		0.00	0.000	0.069	0.2432	1.2668	0.0001	1.07E-06
51		0.00	0.000	0.142	0.2290	1.2663	0.0001	1.07E-06
52		0.00	0.000	0.147	0.2143	1.2659	0.0001	1.07E-06
53		0.00	0.000	0.057	0.2090	1.2655	0.0001	1.07E-06
54	*	0.00	0.000	0.000	0.2091	1.2650	0.0001	1.07E-06
55	*	0.00	0.000	0.000	0.2091	1.2646	0.0001	1.07E-06
56		0.00	0.000	0.076	0.2015	1.2641	0.0001	1.07E-06

57		0.00	0.000	0.026	0.1990	1.2637	0.0001	1.07E-06
58		0.00	0.000	0.011	0.1979	1.2632	0.0001	1.07E-06
59		0.00	0.000	0.009	0.1970	1.2628	0.0001	1.07E-06
60		0.00	0.000	0.000	0.1970	1.2624	0.0001	1.07E-06
61		0.00	0.000	0.000	0.1970	1.2619	0.0001	1.07E-06
62		0.00	0.000	0.000	0.1970	1.2615	0.0001	1.07E-06
63		0.00	0.000	0.000	0.1970	1.2610	0.0001	1.07E-06
64		0.71	0.262	0.032	0.2133	1.2606	0.0001	1.07E-06
65		0.00	0.000	0.246	0.2140	1.2601	0.0001	1.07E-06
66		0.00	0.000	0.120	0.2023	1.2597	0.0001	1.07E-06
67		0.00	0.000	0.042	0.1981	1.2593	0.0001	1.07E-06
68		0.00	0.000	0.011	0.1970	1.2588	0.0001	1.07E-06
69		0.00	0.000	0.000	0.1970	1.2584	0.0001	1.07E-06
70		0.00	0.000	0.000	0.1970	1.2579	0.0001	1.07E-06
71		0.72	0.262	0.046	0.2133	1.2575	0.0001	1.06E-06
72		0.00	0.000	0.175	0.2210	1.2571	0.0001	1.06E-06
73		0.00	0.000	0.109	0.2101	1.2566	0.0001	1.06E-06
74		0.00	0.000	0.105	0.1996	1.2562	0.0001	1.06E-06
75	*	0.00	0.000	0.025	0.1971	1.2557	0.0001	1.06E-06
76		0.00	0.000	0.001	0.1971	1.2553	0.0001	1.06E-06
77		0.11	0.000	0.012	0.2064	1.2549	0.0001	1.06E-06
78		0.03	0.000	0.024	0.2071	1.2544	0.0001	1.06E-06
79	*	1.98	0.000	0.000	0.2091	1.2540	0.0001	1.06E-06
80	*	0.00	0.000	0.024	0.2111	1.2535	0.0001	1.06E-06
81		0.00	0.770	0.000	0.2239	1.2531	0.0001	1.06E-06
82		0.00	0.494	0.014	0.2355	1.2527	0.0001	1.06E-06
83		0.09	0.051	0.263	0.2471	1.2522	0.0001	1.06E-06
84		0.01	0.000	0.181	0.2351	1.2518	0.0001	1.06E-06
85		0.07	0.000	0.254	0.2169	1.2513	0.0001	1.06E-06
86		0.00	0.000	0.166	0.2003	1.2509	0.0001	1.06E-06
87		0.00	0.000	0.023	0.1980	1.2505	0.0001	1.06E-06
88		0.00	0.000	0.008	0.1971	1.2513	0.0001	1.06E-06

89		0.00	0.000	0.001	0.1970	1.2516	0.0001	1.06E-06
90		0.00	0.000	0.000	0.1970	1.2512	0.0001	1.06E-06
91		0.00	0.000	0.000	0.1970	1.2507	0.0001	1.06E-06
92		0.00	0.000	0.000	0.1970	1.2503	0.0001	1.06E-06
93		0.11	0.000	0.011	0.2072	1.2498	0.0001	1.06E-06
94		0.00	0.000	0.012	0.2060	1.2494	0.0001	1.06E-06
95	*	0.00	0.000	0.014	0.2046	1.2490	0.0001	1.06E-06
96		0.00	0.000	0.016	0.2030	1.2485	0.0001	1.06E-06
97		0.00	0.000	0.019	0.2016	1.2481	0.0001	1.06E-06
98		0.00	0.000	0.015	0.2001	1.2477	0.0001	1.06E-06
99		0.00	0.000	0.014	0.1987	1.2472	0.0001	1.06E-06
100		0.12	0.000	0.020	0.2086	1.2468	0.0001	1.06E-06
101		0.64	0.243	0.028	0.2216	1.2464	0.0001	1.06E-06
102		0.00	0.000	0.265	0.2188	1.2459	0.0001	1.06E-06
103		0.00	0.000	0.121	0.2067	1.2455	0.0001	1.06E-06
104		0.06	0.000	0.088	0.2039	1.2450	0.0001	1.06E-06
105		0.00	0.000	0.045	0.1994	1.2446	0.0001	1.05E-06
106		0.00	0.000	0.012	0.1982	1.2442	0.0001	1.05E-06
107		1.54	0.751	0.047	0.2139	1.2437	0.0001	1.05E-06
108		0.01	0.009	0.463	0.2255	1.2433	0.0001	1.05E-06
109		0.53	0.071	0.296	0.2370	1.2429	0.0001	1.05E-06
110		0.00	0.000	0.192	0.2235	1.2424	0.0001	1.05E-06
111		0.00	0.000	0.095	0.2140	1.2420	0.0001	1.05E-06
112		0.02	0.000	0.063	0.2098	1.2416	0.0001	1.05E-06
113	*	0.00	0.000	0.000	0.2098	1.2411	0.0001	1.05E-06
114	*	0.00	0.000	0.087	0.2011	1.2407	0.0001	1.05E-06
115		0.00	0.000	0.031	0.1981	1.2403	0.0001	1.05E-06
116		0.00	0.000	0.008	0.1973	1.2401	0.0001	1.05E-06
117		0.00	0.000	0.003	0.1970	1.2397	0.0001	1.05E-06
118		0.00	0.000	0.000	0.1970	1.2393	0.0001	1.05E-06
119		0.13	0.000	0.013	0.2090	1.2388	0.0001	1.05E-06
120		0.00	0.000	0.016	0.2074	1.2384	0.0001	1.05E-06

121	0.00	0.000	0.019	0.2055	1.2380	0.0001	1.05E-06
122	0.00	0.000	0.021	0.2035	1.2375	0.0001	1.05E-06
123	0.00	0.000	0.019	0.2015	1.2371	0.0001	1.05E-06
124	0.00	0.000	0.018	0.1998	1.2367	0.0001	1.05E-06
125	0.00	0.000	0.017	0.1981	1.2362	0.0001	1.05E-06
126	0.00	0.000	0.008	0.1973	1.2358	0.0001	1.05E-06
127	0.00	0.000	0.003	0.1970	1.2354	0.0001	1.05E-06
128	0.00	0.000	0.000	0.1970	1.2349	0.0001	1.05E-06
129	0.00	0.000	0.000	0.1970	1.2345	0.0001	1.05E-06
130	0.00	0.000	0.000	0.1970	1.2341	0.0001	1.05E-06
131	0.22	0.039	0.017	0.2098	1.2336	0.0001	1.05E-06
132	0.00	0.000	0.046	0.2090	1.2332	0.0001	1.05E-06
133	0.00	0.000	0.012	0.2078	1.2328	0.0001	1.05E-06
134	0.04	0.000	0.021	0.2094	1.2323	0.0001	1.05E-06
135	0.04	0.000	0.020	0.2113	1.2319	0.0001	1.05E-06
136	0.24	0.041	0.025	0.2247	1.2315	0.0001	1.04E-06
137	0.92	0.435	0.067	0.2362	1.2310	0.0001	1.04E-06
138	0.00	0.000	0.283	0.2425	1.2306	0.0001	1.04E-06
139	0.00	0.000	0.156	0.2268	1.2302	0.0001	1.04E-06
140	0.00	0.000	0.269	0.1999	1.2297	0.0001	1.04E-06
141	0.00	0.000	0.022	0.1977	1.2293	0.0001	1.04E-06
142	0.00	0.000	0.004	0.1974	1.2289	0.0001	1.04E-06
143	0.00	0.000	0.004	0.1970	1.2285	0.0001	1.04E-06
144	0.00	0.000	0.000	0.1970	1.2280	0.0001	1.04E-06
145	0.00	0.000	0.000	0.1970	1.2276	0.0001	1.04E-06
146	0.00	0.000	0.000	0.1970	1.2272	0.0001	1.04E-06
147	0.00	0.000	0.000	0.1970	1.2267	0.0001	1.04E-06
148	0.00	0.000	0.000	0.1970	1.2263	0.0001	1.04E-06
149	0.02	0.000	0.010	0.1977	1.2259	0.0001	1.04E-06
150	0.00	0.000	0.002	0.1975	1.2254	0.0001	1.04E-06
151	0.58	0.194	0.032	0.2135	1.2250	0.0001	1.04E-06
152	0.00	0.000	0.202	0.2125	1.2246	0.0001	1.04E-06

153	0.02	0.000	0.024	0.2120	1.2242	0.0001	1.04E-06
154	0.00	0.000	0.016	0.2104	1.2237	0.0001	1.04E-06
155	0.00	0.000	0.017	0.2087	1.2233	0.0001	1.04E-06
156	0.10	0.000	0.023	0.2168	1.2229	0.0001	1.04E-06
157	0.00	0.000	0.011	0.2157	1.2224	0.0001	1.04E-06
158	1.47	0.746	0.028	0.2288	1.2220	0.0001	1.04E-06
159	0.00	0.117	0.209	0.2404	1.2216	0.0001	1.04E-06
160	0.88	0.397	0.194	0.2521	1.2212	0.0001	1.04E-06
161	0.00	0.000	0.279	0.2536	1.2207	0.0001	1.04E-06
162	0.00	0.000	0.094	0.2443	1.2203	0.0001	1.04E-06
163	0.00	0.000	0.095	0.2348	1.2199	0.0001	1.04E-06
164	0.10	0.000	0.116	0.2329	1.2194	0.0001	1.04E-06
165	0.00	0.000	0.261	0.2069	1.2190	0.0001	1.04E-06
166	0.00	0.000	0.084	0.1986	1.2186	0.0001	1.03E-06
167	0.02	0.000	0.034	0.1977	1.2182	0.0001	1.03E-06
168	0.01	0.000	0.014	0.1975	1.2195	0.0001	1.04E-06
169	0.00	0.000	0.003	0.1972	1.2202	0.0001	1.04E-06
170	0.02	0.000	0.013	0.1976	1.2197	0.0001	1.04E-06
171	0.00	0.000	0.004	0.1973	1.2193	0.0001	1.04E-06
172	0.00	0.000	0.002	0.1971	1.2189	0.0001	1.03E-06
173	0.00	0.000	0.001	0.1970	1.2185	0.0001	1.03E-06
174	0.00	0.000	0.000	0.1970	1.2180	0.0001	1.03E-06
175	0.00	0.000	0.000	0.1970	1.2176	0.0001	1.03E-06
176	0.00	0.000	0.000	0.1970	1.2172	0.0001	1.03E-06
177	0.90	0.369	0.033	0.2131	1.2167	0.0001	1.03E-06
178	0.00	0.000	0.250	0.2220	1.2163	0.0001	1.03E-06
179	0.00	0.000	0.096	0.2124	1.2159	0.0001	1.03E-06
180	0.16	0.006	0.144	0.2125	1.2155	0.0001	1.03E-06
181	0.13	0.000	0.189	0.2067	1.2150	0.0001	1.03E-06
182	0.08	0.000	0.080	0.2072	1.2146	0.0001	1.03E-06
183	0.04	0.000	0.038	0.2073	1.2142	0.0001	1.03E-06
184	0.09	0.000	0.035	0.2130	1.2138	0.0001	1.03E-06

185	0.00	0.000	0.020	0.2110	1.2133	0.0001	1.03E-06
186	0.00	0.000	0.026	0.2085	1.2129	0.0001	1.03E-06
187	0.16	0.012	0.031	0.2191	1.2125	0.0001	1.03E-06
188	0.00	0.000	0.030	0.2173	1.2121	0.0001	1.03E-06
189	0.00	0.000	0.021	0.2152	1.2116	0.0001	1.03E-06
190	0.22	0.035	0.027	0.2272	1.2112	0.0001	1.03E-06
191	0.00	0.000	0.200	0.2111	1.2108	0.0001	1.03E-06
192	0.00	0.000	0.023	0.2088	1.2104	0.0001	1.03E-06
193	0.47	0.140	0.034	0.2249	1.2099	0.0001	1.03E-06
194	0.00	0.000	0.285	0.2104	1.2095	0.0001	1.03E-06
195	0.00	0.000	0.022	0.2082	1.2091	0.0001	1.03E-06
196	0.04	0.000	0.030	0.2090	1.2087	0.0001	1.03E-06
197	0.37	0.105	0.033	0.2222	1.2082	0.0001	1.03E-06
198	0.27	0.028	0.318	0.2221	1.2078	0.0001	1.03E-06
199	0.00	0.000	0.189	0.2061	1.2074	0.0001	1.03E-06
200	0.00	0.000	0.067	0.1994	1.2070	0.0001	1.03E-06
201	0.01	0.000	0.032	0.1971	1.2066	0.0001	1.03E-06
202	0.00	0.000	0.001	0.1970	1.2061	0.0001	1.02E-06
203	0.00	0.000	0.000	0.1970	1.2057	0.0001	1.02E-06
204	0.04	0.000	0.013	0.1998	1.2053	0.0001	1.02E-06
205	0.00	0.000	0.003	0.1995	1.2049	0.0001	1.02E-06
206	0.00	0.000	0.008	0.1987	1.2044	0.0001	1.02E-06
207	0.07	0.000	0.016	0.2043	1.2040	0.0001	1.02E-06
208	0.13	0.000	0.024	0.2148	1.2036	0.0001	1.02E-06
209	0.03	0.000	0.022	0.2152	1.2032	0.0001	1.02E-06
210	0.00	0.000	0.020	0.2132	1.2028	0.0001	1.02E-06
211	0.00	0.000	0.021	0.2111	1.2023	0.0001	1.02E-06
212	0.00	0.000	0.020	0.2091	1.2019	0.0001	1.02E-06
213	0.73	0.285	0.035	0.2229	1.2015	0.0001	1.02E-06
214	0.47	0.129	0.378	0.2346	1.2011	0.0001	1.02E-06
215	0.13	0.001	0.160	0.2438	1.2007	0.0001	1.02E-06
216	0.83	0.281	0.263	0.2550	1.2002	0.0001	1.02E-06

217	0.00	0.000	0.323	0.2406	1.1998	0.0001	1.02E-06
218	0.03	0.000	0.205	0.2231	1.1994	0.0001	1.02E-06
219	0.00	0.000	0.222	0.2009	1.1990	0.0001	1.02E-06
220	0.00	0.000	0.029	0.1980	1.1986	0.0001	1.02E-06
221	0.00	0.000	0.009	0.1971	1.1981	0.0001	1.02E-06
222	0.00	0.000	0.001	0.1970	1.1977	0.0001	1.02E-06
223	0.14	0.000	0.019	0.2090	1.1973	0.0001	1.02E-06
224	0.43	0.133	0.046	0.2211	1.1969	0.0001	1.02E-06
225	0.00	0.000	0.229	0.2119	1.1965	0.0001	1.02E-06
226	0.00	0.000	0.133	0.1986	1.1960	0.0001	1.02E-06
227	0.00	0.000	0.016	0.1970	1.1956	0.0001	1.02E-06
228	0.00	0.000	0.000	0.1970	1.1952	0.0001	1.02E-06
229	0.00	0.000	0.000	0.1970	1.1948	0.0001	1.02E-06
230	0.00	0.000	0.000	0.1970	1.1944	0.0001	1.02E-06
231	0.00	0.000	0.000	0.1970	1.1939	0.0001	1.02E-06
232	0.00	0.000	0.000	0.1970	1.1935	0.0001	1.02E-06
233	0.01	0.000	0.010	0.1974	1.1931	0.0001	1.01E-06
234	0.00	0.000	0.002	0.1972	1.1927	0.0001	1.01E-06
235	0.00	0.000	0.001	0.1971	1.1923	0.0001	1.01E-06
236	0.00	0.000	0.001	0.1970	1.1919	0.0001	1.01E-06
237	0.00	0.000	0.000	0.1970	1.1914	0.0001	1.01E-06
238	0.00	0.000	0.000	0.1970	1.1910	0.0001	1.01E-06
239	0.10	0.000	0.012	0.2063	1.1906	0.0001	1.01E-06
240	0.00	0.000	0.010	0.2053	1.1902	0.0001	1.01E-06
241	0.00	0.000	0.017	0.2039	1.1898	0.0001	1.01E-06
242	0.01	0.000	0.023	0.2024	1.1894	0.0001	1.01E-06
243	0.00	0.000	0.015	0.2009	1.1889	0.0001	1.01E-06
244	0.00	0.000	0.019	0.1990	1.1885	0.0001	1.01E-06
245	0.14	0.003	0.027	0.2100	1.1881	0.0001	1.01E-06
246	0.00	0.000	0.014	0.2088	1.1877	0.0001	1.01E-06
247	0.00	0.000	0.016	0.2072	1.1873	0.0001	1.01E-06
248	0.44	0.136	0.032	0.2213	1.1869	0.0001	1.01E-06

249	0.22	0.040	0.165	0.2326	1.1864	0.0001	1.01E-06
250	0.10	0.000	0.067	0.2396	1.1860	0.0001	1.01E-06
251	0.42	0.137	0.031	0.2521	1.1856	0.0001	1.01E-06
252	0.11	0.000	0.180	0.2577	1.1852	0.0001	1.01E-06
253	0.00	0.000	0.232	0.2345	1.1848	0.0001	1.01E-06
254	0.00	0.000	0.298	0.2048	1.1844	0.0001	1.01E-06
255	0.89	0.304	0.156	0.2206	1.1840	0.0001	1.01E-06
256	0.00	0.009	0.140	0.2322	1.1835	0.0001	1.01E-06
257	0.00	0.000	0.205	0.2126	1.1831	0.0001	1.01E-06
258	0.00	0.000	0.126	0.2000	1.1827	0.0001	1.01E-06
259	0.00	0.000	0.030	0.1970	1.1823	0.0001	1.01E-06
260	0.00	0.000	0.000	0.1970	1.1819	0.0001	1.01E-06
261	0.00	0.000	0.000	0.1970	1.1815	0.0001	1.01E-06
262	0.00	0.000	0.000	0.1970	1.1811	0.0001	1.01E-06
263	0.21	0.031	0.027	0.2090	1.1806	0.0001	1.01E-06
264	0.00	0.000	0.046	0.2075	1.1802	0.0001	1.00E-06
265	0.00	0.000	0.021	0.2054	1.1798	0.0001	1.00E-06
266	0.00	0.000	0.020	0.2034	1.1794	0.0001	1.00E-06
267	0.00	0.000	0.018	0.2016	1.1790	0.0001	1.00E-06
268	0.16	0.011	0.027	0.2129	1.1786	0.0001	1.00E-06
269	0.50	0.174	0.045	0.2244	1.1782	0.0001	1.00E-06
270	1.14	0.532	0.280	0.2360	1.1777	0.0001	1.00E-06
271	0.27	0.164	0.215	0.2476	1.1773	0.0001	1.00E-06
272	0.11	0.000	0.306	0.2445	1.1769	0.0001	1.00E-06
273	0.00	0.000	0.099	0.2346	1.1765	0.0001	1.00E-06
274	0.00	0.000	0.205	0.2142	1.1761	0.0001	1.00E-06
275	0.00	0.000	0.112	0.2030	1.1757	0.0001	1.00E-06
276	0.00	0.000	0.057	0.1973	1.1753	0.0001	1.00E-06
277	0.00	0.000	0.002	0.1971	1.1749	0.0001	1.00E-06
278	0.18	0.017	0.047	0.2075	1.1744	0.0001	1.00E-06
279	0.04	0.000	0.063	0.2068	1.1740	0.0001	1.00E-06
280	0.02	0.000	0.048	0.2044	1.1736	0.0001	1.00E-06

281		0.04	0.000	0.039	0.2047	1.1732	0.0001	9.99E-07
282		0.31	0.065	0.048	0.2180	1.1728	0.0001	9.99E-07
283		0.00	0.000	0.155	0.2090	1.1724	0.0001	9.99E-07
284		0.00	0.000	0.023	0.2068	1.1720	0.0001	9.98E-07
285		0.00	0.000	0.021	0.2047	1.1716	0.0001	9.98E-07
286		0.11	0.000	0.029	0.2126	1.1712	0.0001	9.98E-07
287		0.00	0.000	0.116	0.2011	1.1708	0.0001	9.97E-07
288		0.00	0.000	0.023	0.1988	1.1703	0.0001	9.97E-07
289		0.00	0.000	0.017	0.1971	1.1699	0.0001	9.97E-07
290		0.16	0.009	0.020	0.2096	1.1695	0.0001	9.96E-07
291		0.00	0.000	0.018	0.2087	1.1691	0.0001	9.96E-07
292		0.00	0.000	0.014	0.2073	1.1687	0.0001	9.96E-07
293		0.01	0.000	0.019	0.2063	1.1683	0.0001	9.95E-07
294		0.00	0.000	0.013	0.2050	1.1679	0.0001	9.95E-07
295		0.00	0.000	0.013	0.2038	1.1675	0.0001	9.95E-07
296		0.00	0.000	0.012	0.2026	1.1671	0.0001	9.95E-07
297		1.46	0.706	0.027	0.2181	1.1667	0.0001	9.94E-07
298		1.23	0.798	0.215	0.2297	1.1663	0.0001	9.94E-07
299		0.02	0.226	0.125	0.2413	1.1659	0.0001	9.94E-07
300	*	1.29	0.007	0.023	0.2530	1.1655	0.0001	9.93E-07
301	*	0.00	0.000	0.025	0.2550	1.1650	0.0001	9.93E-07
302	*	0.00	0.000	0.033	0.2570	1.1646	0.0001	9.93E-07
303		0.00	0.128	0.001	0.2697	1.1642	0.0001	9.92E-07
304		0.00	0.554	0.014	0.2814	1.1638	0.0001	9.92E-07
305		0.00	0.017	0.180	0.2930	1.1634	0.0001	9.92E-07
306		0.00	0.000	0.086	0.2861	1.1630	0.0001	9.91E-07
307	*	0.00	0.000	0.036	0.2826	1.1626	0.0001	9.91E-07
308	*	0.00	0.000	0.000	0.2826	1.1622	0.0001	9.91E-07
309		0.00	0.000	0.072	0.2754	1.1618	0.0001	9.90E-07
310		0.00	0.000	0.106	0.2648	1.1614	0.0001	9.90E-07
311		0.00	0.000	0.228	0.2421	1.1610	0.0001	9.90E-07
312		0.30	0.050	0.092	0.2528	1.1606	0.0001	9.89E-07

313		0.00	0.000	0.178	0.2399	1.1602	0.0001	9.89E-07
314		0.00	0.000	0.200	0.2198	1.1619	0.0001	9.90E-07
315		0.00	0.000	0.188	0.2011	1.1622	0.0001	9.91E-07
316		0.11	0.000	0.045	0.2057	1.1960	0.0001	1.02E-06
317		0.11	0.000	0.035	0.2133	1.2162	0.0001	1.03E-06
318		0.15	0.002	0.029	0.2250	1.2158	0.0001	1.03E-06
319		0.03	0.000	0.037	0.2244	1.2153	0.0001	1.03E-06
320		0.01	0.000	0.029	0.2227	1.2149	0.0001	1.03E-06
321		0.00	0.000	0.020	0.2207	1.2145	0.0001	1.03E-06
322		0.00	0.000	0.019	0.2188	1.2140	0.0001	1.03E-06
323		0.00	0.000	0.017	0.2171	1.2136	0.0001	1.03E-06
324		0.00	0.000	0.016	0.2155	1.2132	0.0001	1.03E-06
325		0.00	0.000	0.015	0.2140	1.2128	0.0001	1.03E-06
326		0.00	0.000	0.015	0.2125	1.2123	0.0001	1.03E-06
327		0.00	0.000	0.014	0.2112	1.2119	0.0001	1.03E-06
328		0.00	0.000	0.013	0.2098	1.2115	0.0001	1.03E-06
329		0.00	0.000	0.013	0.2086	1.2111	0.0001	1.03E-06
330		0.00	0.000	0.012	0.2073	1.2107	0.0001	1.03E-06
331		0.00	0.000	0.011	0.2062	1.2102	0.0001	1.03E-06
332		0.30	0.069	0.027	0.2201	1.2098	0.0001	1.03E-06
333		0.01	0.000	0.087	0.2189	1.2094	0.0001	1.03E-06
334		0.52	0.174	0.026	0.2334	1.2090	0.0001	1.03E-06
335		0.19	0.056	0.134	0.2450	1.2085	0.0001	1.03E-06
336		0.00	0.000	0.124	0.2382	1.2081	0.0001	1.03E-06
337		0.19	0.019	0.068	0.2466	1.2077	0.0001	1.03E-06
338		0.00	0.000	0.128	0.2357	1.2073	0.0001	1.03E-06
339		0.00	0.000	0.098	0.2259	1.2068	0.0001	1.03E-06
340		0.00	0.000	0.045	0.2213	1.2064	0.0001	1.03E-06
341		0.00	0.000	0.037	0.2177	1.2060	0.0001	1.02E-06
342		0.00	0.000	0.054	0.2122	1.2056	0.0001	1.02E-06
343		0.00	0.000	0.046	0.2076	1.2052	0.0001	1.02E-06
344	*	0.00	0.000	0.000	0.2076	1.2047	0.0001	1.02E-06

345	*	0.00	0.000	0.000	0.2077	1.2043	0.0001	1.02E-06
346		0.00	0.000	0.049	0.2027	1.2039	0.0001	1.02E-06
347		0.00	0.000	0.031	0.1998	1.2035	0.0001	1.02E-06
348		0.11	0.000	0.039	0.2072	1.2030	0.0001	1.02E-06
349	*	0.02	0.000	0.023	0.2072	1.2026	0.0001	1.02E-06
350	*	0.00	0.000	0.022	0.2050	1.2023	0.0001	1.02E-06
351		0.00	0.000	0.039	0.2016	1.2020	0.0001	1.02E-06
352		0.01	0.000	0.043	0.1979	1.2016	0.0001	1.02E-06
353		0.00	0.000	0.009	0.1970	1.2011	0.0001	1.02E-06
354		0.00	0.000	0.000	0.1970	1.2007	0.0001	1.02E-06
355		0.00	0.000	0.000	0.1970	1.2003	0.0001	1.02E-06
356		0.00	0.000	0.000	0.1970	1.1999	0.0001	1.02E-06
357	*	0.00	0.000	0.000	0.1970	1.1995	0.0001	1.02E-06
358	*	0.00	0.000	0.000	0.1970	1.1990	0.0001	1.02E-06
359	*	0.00	0.000	0.000	0.1970	1.1986	0.0001	1.02E-06
360	*	0.00	0.000	0.000	0.1970	1.1982	0.0001	1.02E-06
361	*	0.00	0.000	0.000	0.1970	1.1978	0.0001	1.02E-06
362	*	0.00	0.000	0.000	0.1970	1.1974	0.0001	1.02E-06
363	*	0.00	0.000	0.000	0.1970	1.1969	0.0001	1.02E-06
364		0.00	0.000	0.000	0.1970	1.1965	0.0001	1.02E-06
365		0.00	0.000	0.000	0.1970	1.1961	0.0001	1.02E-06

* = Frozen (air or soil)

Annual Totals for Year 9

	inches	cubic feet	percent
Precipitation	32.25	117,064.9	100.00
Runoff	11.656	42,309.8	36.14
Evapotranspiration	20.656	74,981.0	64.05
Recirculation into Layer 1	0.0505	183.4	0.16
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0505	183.4	0.16
Percolation/Leakage through Layer 5	0.000378	1.3732	0.00
Average Head on Top of Layer 4	1.2209	---	---
Change in Water Storage	-0.0626	-227.3	-0.19
Soil Water at Start of Year	293.3945	1,065,022.2	909.77
Soil Water at End of Year	293.3319	1,064,794.9	909.58
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0505	-183.4	-0.16

Daily Output for Year 10

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.000	0.1970	1.1957	0.0001	1.02E-06
2			0.00	0.000	0.000	0.1970	1.1953	0.0001	1.02E-06
3			0.00	0.000	0.000	0.1970	1.1949	0.0001	1.02E-06
4			0.00	0.000	0.000	0.1970	1.1944	0.0001	1.02E-06
5			0.00	0.000	0.000	0.1970	1.1940	0.0001	1.02E-06
6			0.00	0.000	0.000	0.1970	1.1936	0.0001	1.02E-06
7			0.00	0.000	0.000	0.1970	1.1932	0.0001	1.01E-06
8			0.00	0.000	0.000	0.1970	1.1928	0.0001	1.01E-06
9			0.00	0.000	0.000	0.1970	1.1923	0.0001	1.01E-06
10			0.00	0.000	0.000	0.1970	1.1919	0.0001	1.01E-06
11			0.00	0.000	0.000	0.1970	1.1915	0.0001	1.01E-06
12			0.00	0.000	0.000	0.1970	1.1911	0.0001	1.01E-06
13			0.00	0.000	0.000	0.1970	1.1907	0.0001	1.01E-06
14			0.00	0.000	0.000	0.1970	1.1903	0.0001	1.01E-06
15			0.06	0.000	0.011	0.2023	1.1898	0.0001	1.01E-06
16			0.01	0.000	0.011	0.2019	1.1894	0.0001	1.01E-06
17			0.42	0.131	0.023	0.2158	1.1890	0.0001	1.01E-06
18			0.01	0.000	0.147	0.2155	1.1886	0.0001	1.01E-06
19			0.00	0.000	0.010	0.2146	1.1882	0.0001	1.01E-06
20			0.00	0.000	0.009	0.2138	1.1878	0.0001	1.01E-06
21			0.00	0.000	0.008	0.2129	1.1873	0.0001	1.01E-06
22			0.00	0.000	0.008	0.2121	1.1869	0.0001	1.01E-06
23			0.00	0.000	0.008	0.2113	1.1865	0.0001	1.01E-06
24	*		0.00	0.000	0.008	0.2105	1.1861	0.0001	1.01E-06

25			0.00	0.000	0.008	0.2097	1.1857	0.0001	1.01E-06
26			0.00	0.000	0.008	0.2089	1.1853	0.0001	1.01E-06
27			0.00	0.000	0.008	0.2082	1.1848	0.0001	1.01E-06
28			0.00	0.000	0.008	0.2074	1.1844	0.0001	1.01E-06
29			0.00	0.000	0.008	0.2067	1.1840	0.0001	1.01E-06
30			0.00	0.000	0.007	0.2059	1.1836	0.0001	1.01E-06
31	*		0.00	0.000	0.000	0.2060	1.1832	0.0001	1.01E-06
32	*		0.00	0.000	0.000	0.2060	1.1828	0.0001	1.01E-06
33	*		0.00	0.000	0.000	0.2060	1.1824	0.0001	1.01E-06
34	*		0.00	0.000	0.000	0.2060	1.1819	0.0001	1.01E-06
35	*		0.00	0.000	0.000	0.2060	1.1815	0.0001	1.01E-06
36			0.00	0.000	0.008	0.2053	1.1811	0.0001	1.01E-06
37			0.00	0.000	0.007	0.2045	1.1807	0.0001	1.01E-06
38			0.00	0.000	0.007	0.2038	1.1803	0.0001	1.00E-06
39	*		0.00	0.000	0.007	0.2031	1.1799	0.0001	1.00E-06
40	*		0.00	0.000	0.000	0.2031	1.1795	0.0001	1.00E-06
41	*		0.03	0.000	0.013	0.2049	1.1790	0.0001	1.00E-06
42	*		0.00	0.000	0.000	0.2049	1.1786	0.0001	1.00E-06
43	*		0.00	0.000	0.000	0.2049	1.1782	0.0001	1.00E-06
44	*		0.00	0.000	0.007	0.2042	1.1778	0.0001	1.00E-06
45	*		0.00	0.000	0.000	0.2042	1.1774	0.0001	1.00E-06
46	*		0.17	0.000	0.018	0.2062	1.1770	0.0001	1.00E-06
47	*		0.24	0.000	0.000	0.2082	1.1766	0.0001	1.00E-06
48	*		0.12	0.000	0.000	0.2102	1.1762	0.0001	1.00E-06
49			0.13	0.080	0.000	0.2229	1.1757	0.0001	1.00E-06
50			0.00	0.126	0.012	0.2346	1.1753	0.0001	1.00E-06
51			0.00	0.000	0.094	0.2377	1.1749	0.0001	1.00E-06
52			0.01	0.000	0.077	0.2311	1.1745	0.0001	1.00E-06
53			0.49	0.147	0.059	0.2455	1.1741	0.0001	1.00E-06
54			0.24	0.078	0.115	0.2572	1.1737	0.0001	1.00E-06
55	*		0.54	0.000	0.028	0.2594	1.1733	0.0001	9.99E-07
56	*	*	0.06	0.000	0.032	0.2594	1.1729	0.0001	9.99E-07

57	*	*	0.00	0.000	0.018	0.2594	1.1725	0.0001	9.99E-07
58	*	*	0.00	0.000	0.024	0.2595	1.1720	0.0001	9.98E-07
59		*	0.00	0.007	0.033	0.2666	1.1716	0.0001	9.98E-07
60	*	*	0.22	0.000	0.025	0.2666	1.1712	0.0001	9.98E-07
61	*	*	0.09	0.000	0.017	0.2666	1.1708	0.0001	9.97E-07
62	*	*	0.00	0.000	0.010	0.2666	1.1704	0.0001	9.97E-07
63	*	*	0.00	0.000	0.028	0.2667	1.1700	0.0001	9.97E-07
64		*	0.00	0.435	0.056	0.2667	1.1696	0.0001	9.96E-07
65		*	0.00	0.000	0.095	0.2750	1.1692	0.0001	9.96E-07
66		*	0.00	0.000	0.000	0.2750	1.1688	0.0001	9.96E-07
67	*	*	0.00	0.000	0.000	0.2751	1.1684	0.0001	9.95E-07
68		*	0.00	0.000	0.000	0.2751	1.1679	0.0001	9.95E-07
69			0.00	0.000	0.059	0.2691	1.1675	0.0001	9.95E-07
70			0.00	0.000	0.099	0.2593	1.1671	0.0001	9.95E-07
71			0.00	0.000	0.086	0.2507	1.1667	0.0001	9.94E-07
72	*		0.00	0.000	0.045	0.2463	1.1663	0.0001	9.94E-07
73			0.00	0.000	0.161	0.2302	1.1659	0.0001	9.94E-07
74			0.00	0.000	0.095	0.2207	1.1655	0.0001	9.93E-07
75			0.00	0.000	0.136	0.2072	1.1651	0.0001	9.93E-07
76			0.02	0.000	0.104	0.1989	1.1647	0.0001	9.93E-07
77			0.00	0.000	0.015	0.1974	1.1651	0.0001	9.93E-07
78	*		0.00	0.000	0.004	0.1970	1.1651	0.0001	9.93E-07
79			0.00	0.000	0.000	0.1970	1.1647	0.0001	9.93E-07
80			0.00	0.000	0.000	0.1970	1.1643	0.0001	9.92E-07
81			0.00	0.000	0.000	0.1970	1.1639	0.0001	9.92E-07
82			1.33	0.619	0.037	0.2133	1.1635	0.0001	9.92E-07
83			0.16	0.179	0.199	0.2249	1.1631	0.0001	9.91E-07
84			0.15	0.013	0.196	0.2359	1.1627	0.0001	9.91E-07
85			0.00	0.000	0.087	0.2285	1.1623	0.0001	9.91E-07
86			0.00	0.000	0.060	0.2225	1.1619	0.0001	9.90E-07
87			0.00	0.000	0.114	0.2111	1.1614	0.0001	9.90E-07
88			0.47	0.086	0.143	0.2268	1.1610	0.0001	9.90E-07

89		0.00	0.000	0.136	0.2218	1.1606	0.0001	9.89E-07
90		0.00	0.000	0.062	0.2156	1.1602	0.0001	9.89E-07
91	*	0.00	0.000	0.000	0.2157	1.1598	0.0001	9.89E-07
92	*	0.00	0.000	0.000	0.2157	1.1594	0.0001	9.89E-07
93		0.00	0.000	0.110	0.2047	1.1590	0.0001	9.88E-07
94		0.00	0.000	0.047	0.2000	1.1586	0.0001	9.88E-07
95		0.00	0.000	0.026	0.1974	1.1582	0.0001	9.88E-07
96		0.00	0.000	0.002	0.1972	1.1578	0.0001	9.87E-07
97		0.85	0.322	0.068	0.2135	1.1574	0.0001	9.87E-07
98		0.00	0.005	0.172	0.2251	1.1570	0.0001	9.87E-07
99		0.00	0.000	0.081	0.2175	1.1566	0.0001	9.86E-07
100		0.00	0.000	0.107	0.2068	1.1562	0.0001	9.86E-07
101		0.00	0.000	0.084	0.1985	1.1558	0.0001	9.86E-07
102		0.00	0.000	0.010	0.1975	1.1554	0.0001	9.85E-07
103		0.35	0.047	0.149	0.2079	1.1550	0.0001	9.85E-07
104		0.00	0.000	0.123	0.2004	1.1546	0.0001	9.85E-07
105		0.00	0.000	0.025	0.1979	1.1542	0.0001	9.84E-07
106		0.41	0.098	0.056	0.2136	1.1537	0.0001	9.84E-07
107		0.06	0.000	0.234	0.2056	1.1533	0.0001	9.84E-07
108		0.23	0.026	0.193	0.2043	1.1529	0.0001	9.83E-07
109		0.79	0.273	0.177	0.2158	1.1525	0.0001	9.83E-07
110		0.00	0.000	0.376	0.2032	1.1521	0.0001	9.83E-07
111		0.00	0.000	0.046	0.1986	1.1517	0.0001	9.82E-07
112		0.00	0.000	0.016	0.1970	1.1513	0.0001	9.82E-07
113		0.00	0.000	0.000	0.1970	1.1509	0.0001	9.82E-07
114		0.00	0.000	0.000	0.1970	1.1505	0.0001	9.82E-07
115		0.00	0.000	0.000	0.1970	1.1501	0.0001	9.81E-07
116		0.00	0.000	0.000	0.1970	1.1497	0.0001	9.81E-07
117		0.00	0.000	0.000	0.1970	1.1493	0.0001	9.81E-07
118		0.00	0.000	0.000	0.1970	1.1489	0.0001	9.80E-07
119		0.00	0.000	0.000	0.1970	1.1485	0.0001	9.80E-07
120	*	0.00	0.000	0.000	0.1970	1.1481	0.0001	9.80E-07

121	0.00	0.000	0.000	0.1970	1.1477	0.0001	9.79E-07
122	0.22	0.037	0.019	0.2097	1.1473	0.0001	9.79E-07
123	0.00	0.000	0.047	0.2088	1.1469	0.0001	9.79E-07
124	0.25	0.039	0.030	0.2225	1.1465	0.0001	9.78E-07
125	0.00	0.000	0.053	0.2211	1.1461	0.0001	9.78E-07
126	0.00	0.000	0.013	0.2198	1.1457	0.0001	9.78E-07
127	0.00	0.000	0.013	0.2185	1.1453	0.0001	9.77E-07
128	0.00	0.000	0.012	0.2173	1.1449	0.0001	9.77E-07
129	0.00	0.000	0.012	0.2161	1.1445	0.0001	9.77E-07
130	0.00	0.000	0.012	0.2149	1.1441	0.0001	9.77E-07
131	0.00	0.000	0.011	0.2138	1.1437	0.0001	9.76E-07
132	0.00	0.000	0.012	0.2127	1.1433	0.0001	9.76E-07
133	0.00	0.000	0.012	0.2115	1.1429	0.0001	9.76E-07
134	0.05	0.000	0.022	0.2147	1.1425	0.0001	9.75E-07
135	0.00	0.000	0.014	0.2134	1.1421	0.0001	9.75E-07
136	0.00	0.000	0.014	0.2120	1.1417	0.0001	9.75E-07
137	0.05	0.000	0.023	0.2151	1.1413	0.0001	9.74E-07
138	1.70	0.884	0.026	0.2277	1.1409	0.0001	9.74E-07
139	0.03	0.190	0.200	0.2393	1.1405	0.0001	9.74E-07
140	0.00	0.000	0.204	0.2379	1.1401	0.0001	9.73E-07
141	0.32	0.032	0.159	0.2472	1.1397	0.0001	9.73E-07
142	0.00	0.000	0.156	0.2349	1.1393	0.0001	9.73E-07
143	0.00	0.000	0.314	0.2039	1.1389	0.0001	9.72E-07
144	0.00	0.000	0.063	0.1976	1.1385	0.0001	9.72E-07
145	0.00	0.000	0.003	0.1973	1.1381	0.0001	9.72E-07
146	0.00	0.000	0.003	0.1970	1.1377	0.0001	9.72E-07
147	0.00	0.000	0.000	0.1970	1.1373	0.0001	9.71E-07
148	0.00	0.000	0.000	0.1970	1.1369	0.0001	9.71E-07
149	0.00	0.000	0.000	0.1970	1.1365	0.0001	9.71E-07
150	0.00	0.000	0.000	0.1970	1.1361	0.0001	9.70E-07
151	0.00	0.000	0.000	0.1970	1.1357	0.0001	9.70E-07
152	0.00	0.000	0.000	0.1970	1.1353	0.0001	9.70E-07

153	0.00	0.000	0.000	0.1970	1.1349	0.0001	9.69E-07
154	0.00	0.000	0.000	0.1970	1.1345	0.0001	9.69E-07
155	0.33	0.076	0.033	0.2113	1.1341	0.0001	9.69E-07
156	0.06	0.000	0.096	0.2150	1.1337	0.0001	9.68E-07
157	1.33	0.662	0.032	0.2276	1.1333	0.0001	9.68E-07
158	0.19	0.094	0.405	0.2392	1.1329	0.0001	9.68E-07
159	0.32	0.027	0.400	0.2355	1.1325	0.0001	9.67E-07
160	0.05	0.000	0.198	0.2236	1.1321	0.0001	9.67E-07
161	0.06	0.000	0.217	0.2078	1.1317	0.0001	9.67E-07
162	0.48	0.025	0.335	0.2172	1.1314	0.0001	9.67E-07
163	0.02	0.000	0.174	0.2044	1.1310	0.0001	9.66E-07
164	0.00	0.000	0.054	0.1989	1.1307	0.0001	9.66E-07
165	0.00	0.000	0.016	0.1973	1.1308	0.0001	9.66E-07
166	0.00	0.000	0.003	0.1970	1.1304	0.0001	9.66E-07
167	0.00	0.000	0.000	0.1970	1.1300	0.0001	9.65E-07
168	0.00	0.000	0.000	0.1970	1.1296	0.0001	9.65E-07
169	0.00	0.000	0.000	0.1970	1.1292	0.0001	9.65E-07
170	0.00	0.000	0.000	0.1970	1.1288	0.0001	9.65E-07
171	0.00	0.000	0.000	0.1970	1.1284	0.0001	9.64E-07
172	0.00	0.000	0.000	0.1970	1.1280	0.0001	9.64E-07
173	0.11	0.000	0.012	0.2070	1.1276	0.0001	9.64E-07
174	0.00	0.000	0.010	0.2060	1.1272	0.0001	9.63E-07
175	0.00	0.000	0.013	0.2046	1.1268	0.0001	9.63E-07
176	0.00	0.000	0.016	0.2031	1.1264	0.0001	9.63E-07
177	0.00	0.000	0.016	0.2016	1.1260	0.0001	9.62E-07
178	0.00	0.000	0.015	0.2001	1.1256	0.0001	9.62E-07
179	1.09	0.482	0.031	0.2156	1.1252	0.0001	9.62E-07
180	0.14	0.033	0.375	0.2272	1.1249	0.0001	9.61E-07
181	0.26	0.032	0.191	0.2308	1.1245	0.0001	9.61E-07
182	0.05	0.000	0.241	0.2148	1.1241	0.0001	9.61E-07
183	0.00	0.000	0.121	0.2027	1.1237	0.0001	9.61E-07
184	0.00	0.000	0.040	0.1987	1.1233	0.0001	9.60E-07

185	0.00	0.000	0.015	0.1973	1.1229	0.0001	9.60E-07
186	0.55	0.161	0.073	0.2131	1.1225	0.0001	9.60E-07
187	0.15	0.005	0.246	0.2187	1.1221	0.0001	9.59E-07
188	0.00	0.000	0.138	0.2054	1.1217	0.0001	9.59E-07
189	0.00	0.000	0.063	0.1991	1.1213	0.0001	9.59E-07
190	0.00	0.000	0.021	0.1970	1.1209	0.0001	9.58E-07
191	0.09	0.000	0.014	0.2048	1.1205	0.0001	9.58E-07
192	0.00	0.000	0.017	0.2031	1.1201	0.0001	9.58E-07
193	0.00	0.000	0.021	0.2010	1.1197	0.0001	9.57E-07
194	0.00	0.000	0.023	0.1987	1.1194	0.0001	9.57E-07
195	0.00	0.000	0.009	0.1978	1.1190	0.0001	9.57E-07
196	0.00	0.000	0.007	0.1972	1.1186	0.0001	9.57E-07
197	0.00	0.000	0.002	0.1970	1.1182	0.0001	9.56E-07
198	0.00	0.000	0.000	0.1970	1.1178	0.0001	9.56E-07
199	0.00	0.000	0.000	0.1970	1.1174	0.0001	9.56E-07
200	0.08	0.000	0.012	0.2037	1.1170	0.0001	9.55E-07
201	0.12	0.000	0.020	0.2134	1.1166	0.0001	9.55E-07
202	0.00	0.000	0.009	0.2125	1.1162	0.0001	9.55E-07
203	0.08	0.000	0.024	0.2176	1.1158	0.0001	9.54E-07
204	0.01	0.000	0.020	0.2168	1.1154	0.0001	9.54E-07
205	0.03	0.000	0.023	0.2175	1.1151	0.0001	9.54E-07
206	0.10	0.000	0.026	0.2253	1.1147	0.0001	9.53E-07
207	0.00	0.000	0.018	0.2238	1.1143	0.0001	9.53E-07
208	0.21	0.028	0.023	0.2365	1.1139	0.0001	9.53E-07
209	2.34	1.399	0.060	0.2476	1.1135	0.0001	9.53E-07
210	0.02	0.196	0.309	0.2593	1.1131	0.0001	9.52E-07
211	0.03	0.000	0.388	0.2431	1.1127	0.0001	9.52E-07
212	0.41	0.030	0.319	0.2467	1.1123	0.0001	9.52E-07
213	0.04	0.000	0.303	0.2232	1.1119	0.0001	9.51E-07
214	0.00	0.000	0.113	0.2119	1.1115	0.0001	9.51E-07
215	0.00	0.000	0.124	0.1995	1.1111	0.0001	9.51E-07
216	0.00	0.000	0.017	0.1978	1.1108	0.0001	9.50E-07

217	0.00	0.000	0.008	0.1970	1.1104	0.0001	9.50E-07
218	0.00	0.000	0.000	0.1970	1.1100	0.0001	9.50E-07
219	0.00	0.000	0.000	0.1970	1.1096	0.0001	9.49E-07
220	0.00	0.000	0.000	0.1970	1.1092	0.0001	9.49E-07
221	0.00	0.000	0.000	0.1970	1.1088	0.0001	9.49E-07
222	0.00	0.000	0.000	0.1970	1.1084	0.0001	9.49E-07
223	0.00	0.000	0.000	0.1970	1.1080	0.0001	9.48E-07
224	0.00	0.000	0.000	0.1970	1.1077	0.0001	9.48E-07
225	0.03	0.000	0.012	0.1984	1.1073	0.0001	9.48E-07
226	0.08	0.000	0.012	0.2054	1.1069	0.0001	9.47E-07
227	0.18	0.018	0.021	0.2176	1.1065	0.0001	9.47E-07
228	0.00	0.000	0.028	0.2166	1.1061	0.0001	9.47E-07
229	0.61	0.232	0.031	0.2297	1.1057	0.0001	9.46E-07
230	0.00	0.000	0.223	0.2294	1.1053	0.0001	9.46E-07
231	0.54	0.130	0.163	0.2424	1.1049	0.0001	9.46E-07
232	0.03	0.000	0.334	0.2241	1.1045	0.0001	9.46E-07
233	0.27	0.039	0.139	0.2299	1.1042	0.0001	9.45E-07
234	0.00	0.000	0.326	0.2011	1.1038	0.0001	9.45E-07
235	0.00	0.000	0.035	0.1977	1.1034	0.0001	9.45E-07
236	0.00	0.000	0.004	0.1973	1.1030	0.0001	9.44E-07
237	0.00	0.000	0.006	0.1970	1.1026	0.0001	9.44E-07
238	0.00	0.000	0.000	0.1970	1.1022	0.0001	9.44E-07
239	0.00	0.000	0.000	0.1970	1.1018	0.0001	9.43E-07
240	0.00	0.000	0.000	0.1970	1.1015	0.0001	9.43E-07
241	0.00	0.000	0.000	0.1970	1.1011	0.0001	9.43E-07
242	0.00	0.000	0.000	0.1970	1.1007	0.0001	9.42E-07
243	0.00	0.000	0.000	0.1970	1.1003	0.0001	9.42E-07
244	0.16	0.005	0.021	0.2096	1.0999	0.0001	9.42E-07
245	0.00	0.000	0.015	0.2086	1.0995	0.0001	9.42E-07
246	0.00	0.000	0.015	0.2071	1.0991	0.0001	9.41E-07
247	0.37	0.094	0.031	0.2218	1.0988	0.0001	9.41E-07
248	0.86	0.387	0.124	0.2334	1.0984	0.0001	9.41E-07

249		0.00	0.049	0.112	0.2450	1.0980	0.0001	9.40E-07
250		0.00	0.000	0.090	0.2409	1.0976	0.0001	9.40E-07
251		0.00	0.000	0.065	0.2344	1.0972	0.0001	9.40E-07
252		0.00	0.000	0.195	0.2149	1.0968	0.0001	9.39E-07
253		0.08	0.000	0.166	0.2061	1.0965	0.0001	9.39E-07
254		0.56	0.149	0.122	0.2199	1.0961	0.0001	9.39E-07
255		1.00	0.374	0.352	0.2315	1.0957	0.0001	9.39E-07
256		1.55	0.940	0.148	0.2431	1.0953	0.0001	9.38E-07
257		0.00	0.103	0.326	0.2548	1.0949	0.0001	9.38E-07
258		0.00	0.000	0.217	0.2434	1.0945	0.0001	9.38E-07
259		0.00	0.000	0.095	0.2338	1.0945	0.0001	9.38E-07
260		0.00	0.000	0.063	0.2276	1.0944	0.0001	9.38E-07
261		0.00	0.000	0.111	0.2165	1.0940	0.0001	9.37E-07
262		0.00	0.000	0.068	0.2098	1.0936	0.0001	9.37E-07
263	*	0.00	0.000	0.043	0.2054	1.0932	0.0001	9.37E-07
264	*	0.92	0.000	0.033	0.2074	1.0928	0.0001	9.36E-07
265		0.00	0.370	0.000	0.2218	1.0925	0.0001	9.36E-07
266		0.53	0.346	0.083	0.2334	1.0921	0.0001	9.36E-07
267		0.56	0.344	0.113	0.2450	1.0917	0.0001	9.35E-07
268		0.00	0.026	0.157	0.2567	1.0913	0.0001	9.35E-07
269		0.00	0.000	0.150	0.2443	1.0909	0.0001	9.35E-07
270		0.00	0.000	0.108	0.2335	1.0906	0.0001	9.35E-07
271		0.00	0.000	0.108	0.2227	1.0902	0.0001	9.34E-07
272		0.00	0.000	0.127	0.2101	1.0898	0.0001	9.34E-07
273		0.00	0.000	0.119	0.1982	1.0894	0.0001	9.34E-07
274		0.00	0.000	0.006	0.1976	1.0890	0.0001	9.33E-07
275		0.00	0.000	0.006	0.1970	1.0886	0.0001	9.33E-07
276		0.00	0.000	0.000	0.1970	1.0883	0.0001	9.33E-07
277		0.00	0.000	0.000	0.1970	1.0879	0.0001	9.32E-07
278		0.00	0.000	0.000	0.1970	1.0875	0.0001	9.32E-07
279		0.00	0.000	0.000	0.1970	1.0871	0.0001	9.32E-07
280		0.00	0.000	0.000	0.1970	1.0867	0.0001	9.32E-07

281	*	0.01	0.000	0.013	0.1970	1.0864	0.0001	9.31E-07
282		0.00	0.000	0.000	0.1970	1.0860	0.0001	9.31E-07
283	*	0.00	0.000	0.000	0.1970	1.0856	0.0001	9.31E-07
284		0.00	0.000	0.000	0.1970	1.0852	0.0001	9.30E-07
285		1.62	0.806	0.031	0.2133	1.0848	0.0001	9.30E-07
286		0.00	0.193	0.121	0.2249	1.0845	0.0001	9.30E-07
287	*	0.00	0.000	0.062	0.2250	1.0841	0.0001	9.29E-07
288		0.00	0.000	0.058	0.2250	1.0837	0.0001	9.29E-07
289		0.00	0.000	0.000	0.2250	1.0833	0.0001	9.29E-07
290	*	0.00	0.000	0.076	0.2247	1.0829	0.0001	9.29E-07
291		0.00	0.000	0.032	0.2215	1.0826	0.0001	9.28E-07
292		0.00	0.000	0.066	0.2149	1.0822	0.0001	9.28E-07
293		0.00	0.000	0.077	0.2072	1.0818	0.0001	9.28E-07
294		0.00	0.000	0.083	0.1989	1.0814	0.0001	9.27E-07
295		0.00	0.000	0.018	0.1972	1.0810	0.0001	9.27E-07
296		0.00	0.000	0.001	0.1971	1.0807	0.0001	9.27E-07
297		0.00	0.000	0.001	0.1970	1.0803	0.0001	9.26E-07
298		0.13	0.000	0.016	0.2084	1.0799	0.0001	9.26E-07
299		0.30	0.042	0.088	0.2212	1.0795	0.0001	9.26E-07
300		0.00	0.000	0.052	0.2204	1.0791	0.0001	9.26E-07
301		0.10	0.000	0.070	0.2237	1.0788	0.0001	9.25E-07
302		0.00	0.000	0.081	0.2156	1.0784	0.0001	9.25E-07
303		0.00	0.000	0.057	0.2099	1.0780	0.0001	9.25E-07
304		0.00	0.000	0.075	0.2024	1.0776	0.0001	9.24E-07
305		0.70	0.216	0.120	0.2183	1.0773	0.0001	9.24E-07
306		0.00	0.000	0.182	0.2208	1.0769	0.0001	9.24E-07
307		0.00	0.000	0.110	0.2098	1.0765	0.0001	9.23E-07
308		0.00	0.000	0.102	0.1996	1.0761	0.0001	9.23E-07
309		0.58	0.124	0.170	0.2159	1.0758	0.0001	9.23E-07
310		0.23	0.037	0.163	0.2275	1.0754	0.0001	9.23E-07
311		0.01	0.000	0.122	0.2200	1.0750	0.0001	9.22E-07
312		0.05	0.000	0.106	0.2142	1.0746	0.0001	9.22E-07

313		0.01	0.000	0.106	0.2051	1.0743	0.0001	9.22E-07
314		0.00	0.000	0.062	0.1989	1.0739	0.0001	9.21E-07
315		0.00	0.000	0.015	0.1974	1.0735	0.0001	9.21E-07
316		0.00	0.000	0.003	0.1971	1.0731	0.0001	9.21E-07
317		0.00	0.000	0.001	0.1970	1.0728	0.0001	9.21E-07
318		0.00	0.000	0.000	0.1970	1.0724	0.0001	9.20E-07
319		0.00	0.000	0.000	0.1970	1.0720	0.0001	9.20E-07
320		0.53	0.164	0.041	0.2133	1.0716	0.0001	9.20E-07
321		0.00	0.000	0.109	0.2188	1.0713	0.0001	9.19E-07
322		0.00	0.000	0.036	0.2152	1.0709	0.0001	9.19E-07
323		0.00	0.000	0.067	0.2085	1.0705	0.0001	9.19E-07
324		0.00	0.000	0.085	0.2001	1.0701	0.0001	9.18E-07
325		0.00	0.000	0.031	0.1970	1.0698	0.0001	9.18E-07
326		0.00	0.000	0.000	0.1970	1.0694	0.0001	9.18E-07
327		0.00	0.000	0.002	0.1970	1.0690	0.0001	9.18E-07
328		0.00	0.000	0.000	0.1970	1.0686	0.0001	9.17E-07
329		0.00	0.000	0.000	0.1970	1.0683	0.0001	9.17E-07
330		0.00	0.000	0.000	0.1970	1.0679	0.0001	9.17E-07
331		0.00	0.000	0.000	0.1970	1.0675	0.0001	9.16E-07
332		0.00	0.000	0.000	0.1970	1.0671	0.0001	9.16E-07
333		0.00	0.000	0.000	0.1970	1.0668	0.0001	9.16E-07
334		0.00	0.000	0.000	0.1970	1.0664	0.0001	9.16E-07
335		0.07	0.000	0.012	0.2023	1.0660	0.0001	9.15E-07
336		0.08	0.000	0.019	0.2082	1.0656	0.0001	9.15E-07
337	*	0.02	0.000	0.019	0.2082	1.0653	0.0001	9.15E-07
338	*	0.00	0.000	0.000	0.2082	1.0649	0.0001	9.14E-07
339	*	0.56	0.000	0.008	0.2102	1.0645	0.0001	9.14E-07
340	*	2.58	0.000	0.000	0.2122	1.0641	0.0001	9.14E-07
341	*	0.00	0.000	0.012	0.2142	1.0638	0.0001	9.13E-07
342	*	0.00	0.000	0.029	0.2161	1.0634	0.0001	9.13E-07
343		0.00	0.716	0.000	0.2289	1.0630	0.0001	9.13E-07
344		0.07	1.334	0.000	0.2405	1.0627	0.0001	9.13E-07

345	0.17	0.325	0.188	0.2522	1.0623	0.0001	9.12E-07
346	0.11	0.084	0.152	0.2638	1.0619	0.0001	9.12E-07
347	0.08	0.000	0.075	0.2730	1.0615	0.0001	9.12E-07
348	0.29	0.047	0.095	0.2847	1.0612	0.0001	9.11E-07
349	0.06	0.000	0.141	0.2803	1.0608	0.0001	9.11E-07
350	0.02	0.000	0.159	0.2667	1.0604	0.0001	9.11E-07
351	0.01	0.000	0.070	0.2603	1.0600	0.0001	9.11E-07
352	0.00	0.000	0.076	0.2528	1.0597	0.0001	9.10E-07
353	0.00	0.000	0.096	0.2432	1.0593	0.0001	9.10E-07
354	0.04	0.000	0.175	0.2293	1.0589	0.0001	9.10E-07
355	0.35	0.062	0.076	0.2444	1.0586	0.0001	9.09E-07
356	0.03	0.000	0.078	0.2456	1.0582	0.0001	9.09E-07
357	0.01	0.000	0.108	0.2360	1.0578	0.0001	9.09E-07
358	0.23	0.035	0.101	0.2423	1.0575	0.0001	9.08E-07
359	0.39	0.097	0.119	0.2540	1.0571	0.0001	9.08E-07
360	0.00	0.000	0.092	0.2545	1.0567	0.0001	9.08E-07
361	0.00	0.000	0.101	0.2444	1.0563	0.0001	9.08E-07
362	0.06	0.000	0.064	0.2441	1.0560	0.0001	9.07E-07
363	0.06	0.000	0.059	0.2439	1.0556	0.0001	9.07E-07
364	0.00	0.000	0.066	0.2373	1.0552	0.0001	9.07E-07
365	0.00	0.000	0.067	0.2307	1.0549	0.0001	9.06E-07

* = Frozen (air or soil)

Annual Totals for Year 10			
	inches	cubic feet	percent
Precipitation	36.96	134,154.8	100.00
Runoff	14.988	54,407.4	40.56
Evapotranspiration	21.678	78,691.9	58.66
Recirculation into Layer 1	0.0465	168.9	0.13
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0465	168.9	0.13
Percolation/Leakage through Layer 5	0.000351	1.2730	0.00
Average Head on Top of Layer 4	1.1241	---	---
Change in Water Storage	0.2904	1,054.3	0.79
Soil Water at Start of Year	293.3319	1,064,794.9	793.71
Soil Water at End of Year	293.6224	1,065,849.2	794.49
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0465	-168.9	-0.13

Daily Output for Year 11

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.01	0.000	0.010	0.2307	1.0545	0.0001	9.06E-07
2			0.05	0.000	0.081	0.2275	1.0541	0.0001	9.06E-07
3	*		0.00	0.000	0.037	0.2238	1.0538	0.0001	9.06E-07
4			0.00	0.000	0.053	0.2185	1.0534	0.0001	9.05E-07
5			0.00	0.000	0.105	0.2081	1.0530	0.0001	9.05E-07
6			0.00	0.000	0.069	0.2012	1.0526	0.0001	9.05E-07
7			0.00	0.000	0.028	0.1985	1.0523	0.0001	9.04E-07
8			0.00	0.000	0.015	0.1970	1.0519	0.0001	9.04E-07
9			0.00	0.000	0.000	0.1970	1.0515	0.0001	9.04E-07
10	*		0.00	0.000	0.000	0.1970	1.0512	0.0001	9.04E-07
11			0.00	0.000	0.000	0.1970	1.0508	0.0001	9.03E-07
12			0.00	0.000	0.000	0.1970	1.0504	0.0001	9.03E-07
13			0.00	0.000	0.000	0.1970	1.0501	0.0001	9.03E-07
14			0.00	0.000	0.000	0.1970	1.0497	0.0001	9.02E-07
15			0.00	0.000	0.000	0.1970	1.0493	0.0001	9.02E-07
16	*		0.00	0.000	0.000	0.1970	1.0490	0.0001	9.02E-07
17	*		0.00	0.000	0.000	0.1970	1.0486	0.0001	9.02E-07
18			0.00	0.000	0.000	0.1970	1.0482	0.0001	9.01E-07
19			0.00	0.000	0.000	0.1970	1.0479	0.0001	9.01E-07
20			0.00	0.000	0.000	0.1970	1.0475	0.0001	9.01E-07
21	*		0.00	0.000	0.000	0.1970	1.0471	0.0001	9.00E-07
22			0.00	0.000	0.000	0.1970	1.0468	0.0001	9.00E-07
23			0.00	0.000	0.000	0.1970	1.0464	0.0001	9.00E-07
24			0.00	0.000	0.000	0.1970	1.0460	0.0001	8.99E-07

25		0.00	0.000	0.000	0.1970	1.0457	0.0001	8.99E-07
26		0.00	0.000	0.000	0.1970	1.0453	0.0001	8.99E-07
27		0.00	0.000	0.000	0.1970	1.0449	0.0001	8.99E-07
28		0.00	0.000	0.000	0.1970	1.0446	0.0001	8.98E-07
29		0.00	0.000	0.000	0.1970	1.0442	0.0001	8.98E-07
30		0.00	0.000	0.000	0.1970	1.0438	0.0001	8.98E-07
31		0.00	0.000	0.000	0.1970	1.0435	0.0001	8.97E-07
32		0.00	0.000	0.000	0.1970	1.0431	0.0001	8.97E-07
33	*	0.00	0.000	0.000	0.1970	1.0427	0.0001	8.97E-07
34	*	0.00	0.000	0.000	0.1970	1.0424	0.0001	8.97E-07
35	*	0.00	0.000	0.000	0.1970	1.0420	0.0001	8.96E-07
36	*	0.00	0.000	0.000	0.1970	1.0416	0.0001	8.96E-07
37	*	0.00	0.000	0.000	0.1970	1.0413	0.0001	8.96E-07
38	*	0.00	0.000	0.000	0.1970	1.0409	0.0001	8.95E-07
39		0.16	0.007	0.016	0.2099	1.0405	0.0001	8.95E-07
40		0.00	0.000	0.013	0.2093	1.0402	0.0001	8.95E-07
41		0.00	0.000	0.009	0.2084	1.0398	0.0001	8.95E-07
42		0.00	0.000	0.009	0.2075	1.0394	0.0001	8.94E-07
43		0.00	0.000	0.009	0.2067	1.0391	0.0001	8.94E-07
44		0.00	0.000	0.009	0.2058	1.0387	0.0001	8.94E-07
45		0.00	0.000	0.009	0.2050	1.0384	0.0001	8.93E-07
46	*	0.00	0.000	0.008	0.2041	1.0380	0.0001	8.93E-07
47	*	0.00	0.000	0.000	0.2041	1.0376	0.0001	8.93E-07
48	*	0.00	0.000	0.008	0.2033	1.0373	0.0001	8.93E-07
49	*	0.12	0.000	0.034	0.2053	1.0369	0.0001	8.92E-07
50	*	0.00	0.000	0.045	0.2073	1.0365	0.0001	8.92E-07
51		0.00	0.000	0.009	0.2064	1.0362	0.0001	8.92E-07
52		0.00	0.000	0.010	0.2055	1.0358	0.0001	8.91E-07
53	*	0.00	0.000	0.000	0.2055	1.0355	0.0001	8.91E-07
54	*	0.00	0.000	0.010	0.2045	1.0351	0.0001	8.91E-07
55	*	0.00	0.000	0.008	0.2038	1.0347	0.0001	8.91E-07
56		0.00	0.000	0.008	0.2030	1.0344	0.0001	8.90E-07

57		0.00	0.000	0.008	0.2023	1.0342	0.0001	8.90E-07
58		0.00	0.000	0.007	0.2015	1.0338	0.0001	8.90E-07
59		0.00	0.000	0.007	0.2008	1.0334	0.0001	8.90E-07
60		0.00	0.000	0.007	0.2001	1.0331	0.0001	8.89E-07
61		0.00	0.000	0.007	0.1994	1.0327	0.0001	8.89E-07
62		0.97	0.418	0.021	0.2152	1.0323	0.0001	8.89E-07
63		0.14	0.130	0.144	0.2268	1.0320	0.0001	8.88E-07
64		0.05	0.000	0.144	0.2303	1.0316	0.0001	8.88E-07
65		0.00	0.000	0.048	0.2256	1.0313	0.0001	8.88E-07
66	*	0.00	0.000	0.050	0.2206	1.0309	0.0001	8.88E-07
67	*	0.00	0.000	0.000	0.2206	1.0305	0.0001	8.87E-07
68		0.00	0.000	0.087	0.2120	1.0302	0.0001	8.87E-07
69		0.39	0.052	0.150	0.2259	1.0298	0.0001	8.87E-07
70		0.00	0.000	0.132	0.2179	1.0295	0.0001	8.86E-07
71		0.00	0.000	0.092	0.2087	1.0291	0.0001	8.86E-07
72		0.00	0.000	0.058	0.2029	1.0287	0.0001	8.86E-07
73		0.00	0.000	0.047	0.1982	1.0284	0.0001	8.86E-07
74		0.00	0.000	0.012	0.1970	1.0280	0.0001	8.85E-07
75		1.08	0.382	0.214	0.2133	1.0277	0.0001	8.85E-07
76		0.27	0.140	0.200	0.2249	1.0273	0.0001	8.85E-07
77		0.00	0.000	0.100	0.2289	1.0269	0.0001	8.84E-07
78		0.00	0.000	0.044	0.2245	1.0266	0.0001	8.84E-07
79		0.00	0.000	0.097	0.2148	1.0262	0.0001	8.84E-07
80		0.61	0.171	0.125	0.2297	1.0259	0.0001	8.84E-07
81		0.00	0.000	0.296	0.2168	1.0255	0.0001	8.83E-07
82		0.00	0.000	0.065	0.2104	1.0251	0.0001	8.83E-07
83		0.49	0.047	0.267	0.2235	1.0248	0.0001	8.83E-07
84		0.00	0.000	0.185	0.2097	1.0244	0.0001	8.82E-07
85		0.13	0.000	0.061	0.2166	1.0241	0.0001	8.82E-07
86		0.83	0.283	0.161	0.2293	1.0237	0.0001	8.82E-07
87		0.16	0.071	0.156	0.2410	1.0233	0.0001	8.82E-07
88		0.00	0.000	0.308	0.2172	1.0231	0.0001	8.81E-07

89		0.00	0.000	0.105	0.2068	1.0229	0.0001	8.81E-07
90		0.00	0.000	0.086	0.1982	1.0225	0.0001	8.81E-07
91		0.00	0.000	0.006	0.1976	1.0222	0.0001	8.81E-07
92		0.34	0.047	0.151	0.2067	1.0220	0.0001	8.80E-07
93		0.19	0.027	0.085	0.2161	1.0216	0.0001	8.80E-07
94		0.06	0.000	0.098	0.2147	1.0212	0.0001	8.80E-07
95	*	0.30	0.000	0.037	0.2166	1.0209	0.0001	8.80E-07
96	*	0.00	0.000	0.027	0.2186	1.0205	0.0001	8.79E-07
97	*	0.02	0.000	0.037	0.2206	1.0202	0.0001	8.79E-07
98	*	0.53	0.000	0.000	0.2226	1.0198	0.0001	8.79E-07
99		0.01	0.231	0.110	0.2353	1.0194	0.0001	8.79E-07
100		0.66	0.274	0.235	0.2470	1.0191	0.0001	8.78E-07
101		0.00	0.017	0.091	0.2586	1.0187	0.0001	8.78E-07
102		0.32	0.076	0.081	0.2702	1.0184	0.0001	8.78E-07
103		0.24	0.042	0.128	0.2804	1.0180	0.0001	8.77E-07
104		0.26	0.048	0.161	0.2860	1.0177	0.0001	8.77E-07
105		0.00	0.000	0.240	0.2653	1.0173	0.0001	8.77E-07
106		0.00	0.000	0.281	0.2373	1.0169	0.0001	8.77E-07
107		0.00	0.000	0.262	0.2111	1.0166	0.0001	8.76E-07
108		0.75	0.223	0.152	0.2273	1.0162	0.0001	8.76E-07
109		0.32	0.028	0.476	0.2273	1.0159	0.0001	8.76E-07
110		0.00	0.000	0.217	0.2084	1.0155	0.0001	8.75E-07
111		0.00	0.000	0.079	0.2005	1.0152	0.0001	8.75E-07
112		0.00	0.000	0.027	0.1978	1.0148	0.0001	8.75E-07
113		0.00	0.000	0.004	0.1974	1.0145	0.0001	8.75E-07
114		0.00	0.000	0.006	0.1972	1.0141	0.0001	8.74E-07
115		0.92	0.366	0.056	0.2134	1.0137	0.0001	8.74E-07
116		0.00	0.000	0.390	0.2077	1.0146	0.0001	8.75E-07
117		0.00	0.000	0.080	0.1997	1.0150	0.0001	8.75E-07
118		0.00	0.000	0.027	0.1970	1.0147	0.0001	8.75E-07
119		0.00	0.000	0.000	0.1970	1.0143	0.0001	8.74E-07
120		0.01	0.000	0.008	0.1970	1.0140	0.0001	8.74E-07

121		0.22	0.035	0.026	0.2091	1.0136	0.0001	8.74E-07
122		0.06	0.000	0.060	0.2126	1.0133	0.0001	8.74E-07
123		0.03	0.000	0.027	0.2132	1.0129	0.0001	8.73E-07
124	*	0.00	0.000	0.013	0.2118	1.0126	0.0001	8.73E-07
125		0.00	0.000	0.016	0.2102	1.0122	0.0001	8.73E-07
126		0.00	0.000	0.017	0.2085	1.0119	0.0001	8.73E-07
127		0.00	0.000	0.016	0.2069	1.0115	0.0001	8.72E-07
128		0.00	0.000	0.016	0.2053	1.0111	0.0001	8.72E-07
129		0.00	0.000	0.015	0.2038	1.0108	0.0001	8.72E-07
130		0.00	0.000	0.015	0.2023	1.0104	0.0001	8.71E-07
131		0.00	0.000	0.015	0.2008	1.0101	0.0001	8.71E-07
132		0.00	0.000	0.014	0.1994	1.0097	0.0001	8.71E-07
133		0.20	0.026	0.025	0.2113	1.0094	0.0001	8.71E-07
134		0.06	0.000	0.052	0.2145	1.0090	0.0001	8.70E-07
135		0.00	0.000	0.015	0.2130	1.0087	0.0001	8.70E-07
136		0.00	0.000	0.014	0.2116	1.0083	0.0001	8.70E-07
137		0.00	0.000	0.013	0.2103	1.0080	0.0001	8.69E-07
138		0.06	0.000	0.023	0.2144	1.0076	0.0001	8.69E-07
139		0.86	0.370	0.029	0.2279	1.0073	0.0001	8.69E-07
140		0.00	0.006	0.200	0.2396	1.0069	0.0001	8.69E-07
141		0.06	0.000	0.265	0.2195	1.0065	0.0001	8.68E-07
142		0.00	0.000	0.213	0.1983	1.0062	0.0001	8.68E-07
143		0.00	0.000	0.007	0.1976	1.0058	0.0001	8.68E-07
144		0.00	0.000	0.003	0.1973	1.0055	0.0001	8.67E-07
145		0.00	0.000	0.003	0.1970	1.0051	0.0001	8.67E-07
146		0.02	0.000	0.013	0.1976	1.0048	0.0001	8.67E-07
147		0.63	0.214	0.045	0.2132	1.0044	0.0001	8.67E-07
148		0.00	0.000	0.190	0.2152	1.0041	0.0001	8.66E-07
149		0.00	0.000	0.071	0.2081	1.0037	0.0001	8.66E-07
150		0.11	0.000	0.076	0.2112	1.0034	0.0001	8.66E-07
151		0.49	0.069	0.218	0.2243	1.0030	0.0001	8.66E-07
152		0.00	0.000	0.181	0.2130	1.0027	0.0001	8.65E-07

153	0.00	0.000	0.110	0.2020	1.0023	0.0001	8.65E-07
154	0.00	0.000	0.047	0.1973	1.0020	0.0001	8.65E-07
155	0.00	0.000	0.002	0.1972	1.0016	0.0001	8.64E-07
156	0.00	0.000	0.001	0.1971	1.0013	0.0001	8.64E-07
157	0.32	0.066	0.050	0.2106	1.0009	0.0001	8.64E-07
158	0.11	0.000	0.092	0.2192	1.0006	0.0001	8.64E-07
159	0.00	0.000	0.116	0.2076	1.0002	0.0001	8.63E-07
160	0.01	0.000	0.029	0.2054	0.9999	0.0001	8.63E-07
161	0.15	0.002	0.031	0.2165	0.9995	0.0001	8.63E-07
162	0.50	0.173	0.043	0.2277	0.9992	0.0001	8.62E-07
163	0.40	0.114	0.234	0.2394	0.9988	0.0001	8.62E-07
164	0.25	0.031	0.290	0.2407	0.9985	0.0001	8.62E-07
165	0.01	0.000	0.260	0.2185	0.9981	0.0001	8.62E-07
166	0.00	0.000	0.186	0.1999	0.9978	0.0001	8.61E-07
167	0.19	0.017	0.092	0.2064	0.9974	0.0001	8.61E-07
168	0.00	0.000	0.085	0.1996	0.9971	0.0001	8.61E-07
169	0.00	0.000	0.022	0.1974	0.9967	0.0001	8.61E-07
170	0.00	0.000	0.004	0.1970	0.9964	0.0001	8.60E-07
171	0.03	0.000	0.015	0.1984	0.9960	0.0001	8.60E-07
172	0.00	0.000	0.004	0.1980	0.9957	0.0001	8.60E-07
173	0.00	0.000	0.007	0.1973	0.9953	0.0001	8.59E-07
174	0.00	0.000	0.002	0.1971	0.9950	0.0001	8.59E-07
175	0.00	0.000	0.001	0.1970	0.9946	0.0001	8.59E-07
176	0.02	0.000	0.012	0.1979	0.9943	0.0001	8.59E-07
177	0.00	0.000	0.003	0.1976	0.9939	0.0001	8.58E-07
178	0.05	0.000	0.016	0.2010	0.9936	0.0001	8.58E-07
179	0.00	0.000	0.003	0.2007	0.9933	0.0001	8.58E-07
180	0.76	0.303	0.035	0.2144	0.9929	0.0001	8.58E-07
181	0.22	0.105	0.178	0.2260	0.9926	0.0001	8.57E-07
182	0.94	0.292	0.445	0.2377	0.9922	0.0001	8.57E-07
183	0.00	0.000	0.266	0.2305	0.9919	0.0001	8.57E-07
184	0.00	0.000	0.244	0.2062	0.9915	0.0001	8.56E-07

185	0.00	0.000	0.082	0.1980	0.9912	0.0001	8.56E-07
186	0.67	0.200	0.120	0.2139	0.9908	0.0001	8.56E-07
187	0.00	0.000	0.243	0.2090	0.9905	0.0001	8.56E-07
188	0.00	0.000	0.083	0.2007	0.9901	0.0001	8.55E-07
189	0.00	0.000	0.033	0.1974	0.9898	0.0001	8.55E-07
190	0.00	0.000	0.004	0.1970	0.9894	0.0001	8.55E-07
191	0.09	0.000	0.017	0.2039	0.9891	0.0001	8.55E-07
192	0.00	0.000	0.021	0.2018	0.9887	0.0001	8.54E-07
193	0.00	0.000	0.027	0.1991	0.9884	0.0001	8.54E-07
194	0.00	0.000	0.011	0.1980	0.9880	0.0001	8.54E-07
195	0.00	0.000	0.008	0.1972	0.9877	0.0001	8.53E-07
196	0.00	0.000	0.002	0.1970	0.9874	0.0001	8.53E-07
197	0.02	0.000	0.013	0.1977	0.9870	0.0001	8.53E-07
198	0.95	0.399	0.040	0.2130	0.9867	0.0001	8.53E-07
199	0.01	0.000	0.351	0.2151	0.9863	0.0001	8.52E-07
200	0.00	0.000	0.117	0.2035	0.9860	0.0001	8.52E-07
201	0.37	0.045	0.200	0.2113	0.9856	0.0001	8.52E-07
202	0.95	0.338	0.255	0.2229	0.9853	0.0001	8.51E-07
203	0.00	0.000	0.249	0.2271	0.9849	0.0001	8.51E-07
204	0.00	0.000	0.125	0.2146	0.9846	0.0001	8.51E-07
205	0.00	0.000	0.141	0.2005	0.9842	0.0001	8.51E-07
206	0.00	0.000	0.027	0.1978	0.9839	0.0001	8.50E-07
207	0.00	0.000	0.004	0.1974	0.9836	0.0001	8.50E-07
208	0.00	0.000	0.002	0.1972	0.9832	0.0001	8.50E-07
209	0.00	0.000	0.002	0.1970	0.9829	0.0001	8.50E-07
210	0.00	0.000	0.000	0.1970	0.9825	0.0001	8.49E-07
211	0.00	0.000	0.000	0.1970	0.9822	0.0001	8.49E-07
212	0.00	0.000	0.000	0.1970	0.9818	0.0001	8.49E-07
213	0.00	0.000	0.000	0.1970	0.9815	0.0001	8.48E-07
214	0.07	0.000	0.015	0.2028	0.9811	0.0001	8.48E-07
215	0.00	0.000	0.015	0.2012	0.9808	0.0001	8.48E-07
216	0.00	0.000	0.023	0.1990	0.9805	0.0001	8.48E-07

217	0.00	0.000	0.009	0.1981	0.9801	0.0001	8.47E-07
218	0.00	0.000	0.007	0.1975	0.9798	0.0001	8.47E-07
219	0.05	0.000	0.016	0.2009	0.9794	0.0001	8.47E-07
220	0.00	0.000	0.003	0.2006	0.9791	0.0001	8.47E-07
221	0.01	0.000	0.017	0.1999	0.9787	0.0001	8.46E-07
222	0.00	0.000	0.007	0.1992	0.9784	0.0001	8.46E-07
223	0.03	0.000	0.017	0.2007	0.9781	0.0001	8.46E-07
224	0.03	0.000	0.014	0.2023	0.9777	0.0001	8.45E-07
225	0.00	0.000	0.012	0.2011	0.9774	0.0001	8.45E-07
226	0.07	0.000	0.025	0.2058	0.9770	0.0001	8.45E-07
227	0.00	0.000	0.016	0.2042	0.9767	0.0001	8.45E-07
228	0.00	0.000	0.015	0.2027	0.9763	0.0001	8.44E-07
229	0.00	0.000	0.017	0.2010	0.9760	0.0001	8.44E-07
230	0.00	0.000	0.018	0.1992	0.9757	0.0001	8.44E-07
231	0.05	0.000	0.029	0.2016	0.9753	0.0001	8.44E-07
232	0.00	0.000	0.012	0.2004	0.9750	0.0001	8.43E-07
233	0.00	0.000	0.012	0.1992	0.9746	0.0001	8.43E-07
234	0.00	0.000	0.006	0.1986	0.9743	0.0001	8.43E-07
235	0.00	0.000	0.006	0.1980	0.9739	0.0001	8.43E-07
236	0.00	0.000	0.004	0.1976	0.9736	0.0001	8.42E-07
237	0.00	0.000	0.004	0.1972	0.9733	0.0001	8.42E-07
238	0.40	0.107	0.033	0.2129	0.9729	0.0001	8.42E-07
239	0.00	0.000	0.117	0.2119	0.9726	0.0001	8.41E-07
240	0.45	0.140	0.030	0.2256	0.9722	0.0001	8.41E-07
241	0.00	0.000	0.162	0.2234	0.9719	0.0001	8.41E-07
242	0.00	0.000	0.102	0.2133	0.9716	0.0001	8.41E-07
243	0.00	0.000	0.128	0.2004	0.9712	0.0001	8.40E-07
244	0.00	0.000	0.027	0.1978	0.9709	0.0001	8.40E-07
245	0.00	0.000	0.006	0.1974	0.9705	0.0001	8.40E-07
246	0.01	0.000	0.015	0.1973	0.9702	0.0001	8.40E-07
247	0.00	0.000	0.003	0.1971	0.9699	0.0001	8.39E-07
248	0.00	0.000	0.000	0.1970	0.9695	0.0001	8.39E-07

249	0.49	0.142	0.045	0.2131	0.9692	0.0001	8.39E-07
250	1.19	0.582	0.153	0.2248	0.9688	0.0001	8.38E-07
251	0.00	0.000	0.396	0.2332	0.9685	0.0001	8.38E-07
252	0.95	0.349	0.218	0.2460	0.9682	0.0001	8.38E-07
253	0.08	0.044	0.133	0.2576	0.9678	0.0001	8.38E-07
254	0.01	0.000	0.279	0.2348	0.9675	0.0001	8.37E-07
255	0.00	0.000	0.206	0.2142	0.9672	0.0001	8.37E-07
256	0.00	0.000	0.145	0.1998	0.9668	0.0001	8.37E-07
257	0.00	0.000	0.020	0.1978	0.9665	0.0001	8.37E-07
258	0.00	0.000	0.006	0.1971	0.9679	0.0001	8.38E-07
259	0.00	0.000	0.001	0.1970	0.9686	0.0001	8.38E-07
260	0.00	0.000	0.000	0.1970	0.9683	0.0001	8.38E-07
261	0.00	0.000	0.000	0.1970	0.9679	0.0001	8.38E-07
262	0.13	0.000	0.015	0.2090	0.9676	0.0001	8.37E-07
263	0.00	0.000	0.013	0.2077	0.9672	0.0001	8.37E-07
264	0.00	0.000	0.016	0.2061	0.9669	0.0001	8.37E-07
265	0.00	0.000	0.018	0.2043	0.9666	0.0001	8.37E-07
266	0.69	0.257	0.037	0.2192	0.9662	0.0001	8.36E-07
267	0.00	0.000	0.149	0.2291	0.9659	0.0001	8.36E-07
268	0.00	0.000	0.045	0.2246	0.9656	0.0001	8.36E-07
269	0.00	0.000	0.064	0.2182	0.9652	0.0001	8.36E-07
270	0.00	0.000	0.085	0.2097	0.9649	0.0001	8.35E-07
271	0.00	0.000	0.092	0.2008	0.9645	0.0001	8.35E-07
272	0.40	0.076	0.110	0.2151	0.9642	0.0001	8.35E-07
273	0.09	0.000	0.133	0.2188	0.9639	0.0001	8.35E-07
274	0.00	0.000	0.065	0.2123	0.9635	0.0001	8.34E-07
275	0.00	0.000	0.125	0.1998	0.9632	0.0001	8.34E-07
276	0.01	0.000	0.034	0.1973	0.9628	0.0001	8.34E-07
277	0.00	0.000	0.002	0.1971	0.9625	0.0001	8.33E-07
278	0.00	0.000	0.001	0.1970	0.9622	0.0001	8.33E-07
279	0.00	0.000	0.000	0.1970	0.9618	0.0001	8.33E-07
280	0.00	0.000	0.000	0.1970	0.9615	0.0001	8.33E-07

281		0.00	0.000	0.000	0.1970	0.9612	0.0001	8.32E-07
282		0.00	0.000	0.000	0.1970	0.9608	0.0001	8.32E-07
283		0.14	0.000	0.020	0.2091	0.9605	0.0001	8.32E-07
284		0.00	0.000	0.011	0.2081	0.9602	0.0001	8.32E-07
285		0.00	0.000	0.012	0.2069	0.9598	0.0001	8.31E-07
286		0.00	0.000	0.015	0.2054	0.9595	0.0001	8.31E-07
287		0.00	0.000	0.015	0.2039	0.9591	0.0001	8.31E-07
288		0.00	0.000	0.014	0.2025	0.9588	0.0001	8.30E-07
289		0.00	0.000	0.013	0.2012	0.9585	0.0001	8.30E-07
290		0.00	0.000	0.013	0.1999	0.9581	0.0001	8.30E-07
291		0.00	0.000	0.012	0.1987	0.9578	0.0001	8.30E-07
292		0.00	0.000	0.010	0.1977	0.9575	0.0001	8.29E-07
293		0.00	0.000	0.006	0.1971	0.9571	0.0001	8.29E-07
294		0.00	0.000	0.001	0.1970	0.9568	0.0001	8.29E-07
295		0.00	0.000	0.000	0.1970	0.9565	0.0001	8.29E-07
296		0.07	0.000	0.014	0.2026	0.9561	0.0001	8.28E-07
297		0.01	0.000	0.011	0.2021	0.9558	0.0001	8.28E-07
298		1.20	0.560	0.028	0.2160	0.9555	0.0001	8.28E-07
299		0.58	0.384	0.182	0.2276	0.9551	0.0001	8.28E-07
300		0.00	0.000	0.393	0.2259	0.9548	0.0001	8.27E-07
301		0.00	0.000	0.104	0.2156	0.9544	0.0001	8.27E-07
302		0.00	0.000	0.056	0.2100	0.9541	0.0001	8.27E-07
303		0.00	0.000	0.064	0.2036	0.9538	0.0001	8.27E-07
304		0.00	0.000	0.058	0.1978	0.9534	0.0001	8.26E-07
305		0.00	0.000	0.004	0.1974	0.9531	0.0001	8.26E-07
306		0.34	0.070	0.062	0.2114	0.9528	0.0001	8.26E-07
307		0.46	0.147	0.119	0.2230	0.9524	0.0001	8.25E-07
308	*	0.11	0.000	0.057	0.2333	0.9521	0.0001	8.25E-07
309		0.00	0.000	0.128	0.2298	0.9518	0.0001	8.25E-07
310		0.28	0.036	0.078	0.2429	0.9514	0.0001	8.25E-07
311	*	0.12	0.000	0.032	0.2455	0.9511	0.0001	8.24E-07
312		0.00	0.000	0.084	0.2468	0.9508	0.0001	8.24E-07

313		0.00	0.000	0.080	0.2388	0.9521	0.0001	8.25E-07
314		0.00	0.000	0.084	0.2304	0.9528	0.0001	8.26E-07
315		0.00	0.000	0.094	0.2209	0.9525	0.0001	8.25E-07
316		0.01	0.000	0.067	0.2151	0.9521	0.0001	8.25E-07
317	*	0.00	0.000	0.037	0.2118	0.9518	0.0001	8.25E-07
318	*	0.08	0.000	0.055	0.2138	0.9515	0.0001	8.25E-07
319	*	0.00	0.000	0.009	0.2138	0.9511	0.0001	8.24E-07
320	*	0.00	0.000	0.045	0.2094	0.9508	0.0001	8.24E-07
321	*	0.00	0.000	0.000	0.2094	0.9505	0.0001	8.24E-07
322	*	0.00	0.000	0.005	0.2094	0.9501	0.0001	8.24E-07
323	*	0.00	0.000	0.000	0.2094	0.9498	0.0001	8.23E-07
324		0.00	0.000	0.048	0.2047	0.9495	0.0001	8.23E-07
325		0.10	0.000	0.077	0.2069	0.9491	0.0001	8.23E-07
326		0.01	0.000	0.059	0.2020	0.9488	0.0001	8.23E-07
327		0.00	0.000	0.036	0.1987	0.9501	0.0001	8.24E-07
328		0.00	0.000	0.014	0.1973	0.9508	0.0001	8.24E-07
329		0.08	0.000	0.022	0.2029	0.9504	0.0001	8.24E-07
330		0.94	0.391	0.063	0.2165	0.9501	0.0001	8.24E-07
331		0.00	0.084	0.066	0.2282	0.9498	0.0001	8.23E-07
332	*	0.00	0.000	0.045	0.2282	0.9494	0.0001	8.23E-07
333	*	0.00	0.000	0.040	0.2280	0.9491	0.0001	8.23E-07
334		0.00	0.000	0.036	0.2245	0.9488	0.0001	8.23E-07
335		0.00	0.000	0.079	0.2166	0.9484	0.0001	8.22E-07
336		0.00	0.000	0.147	0.2019	0.9481	0.0001	8.22E-07
337		0.00	0.000	0.043	0.1976	0.9478	0.0001	8.22E-07
338		0.16	0.004	0.055	0.2078	0.9474	0.0001	8.21E-07
339		0.06	0.000	0.075	0.2066	0.9471	0.0001	8.21E-07
340		0.00	0.000	0.071	0.1995	0.9468	0.0001	8.21E-07
341		0.00	0.000	0.019	0.1976	0.9464	0.0001	8.21E-07
342		0.00	0.000	0.005	0.1971	0.9461	0.0001	8.20E-07
343		0.00	0.000	0.001	0.1970	0.9458	0.0001	8.20E-07
344		0.66	0.223	0.057	0.2133	0.9455	0.0001	8.20E-07

345		0.55	0.260	0.140	0.2250	0.9451	0.0001	8.20E-07
346		0.00	0.002	0.135	0.2366	0.9448	0.0001	8.19E-07
347		0.00	0.000	0.068	0.2300	0.9445	0.0001	8.19E-07
348		0.00	0.000	0.054	0.2246	0.9441	0.0001	8.19E-07
349	*	0.00	0.000	0.033	0.2214	0.9438	0.0001	8.19E-07
350		0.00	0.000	0.059	0.2154	0.9435	0.0001	8.18E-07
351		0.00	0.000	0.047	0.2107	0.9431	0.0001	8.18E-07
352		0.00	0.000	0.049	0.2059	0.9428	0.0001	8.18E-07
353	*	0.00	0.000	0.033	0.2025	0.9425	0.0001	8.18E-07
354		0.00	0.000	0.046	0.1979	0.9421	0.0001	8.17E-07
355		0.00	0.000	0.009	0.1971	0.9418	0.0001	8.17E-07
356		0.07	0.000	0.018	0.2020	0.9415	0.0001	8.17E-07
357		0.21	0.029	0.034	0.2138	0.9412	0.0001	8.16E-07
358	*	0.00	0.000	0.029	0.2138	0.9408	0.0001	8.16E-07
359	*	0.09	0.000	0.014	0.2157	0.9405	0.0001	8.16E-07
360		0.00	0.000	0.060	0.2151	0.9402	0.0001	8.16E-07
361		0.00	0.000	0.028	0.2123	0.9398	0.0001	8.15E-07
362		0.00	0.000	0.049	0.2074	0.9395	0.0001	8.15E-07
363		0.00	0.000	0.048	0.2026	0.9392	0.0001	8.15E-07
364	*	0.09	0.000	0.036	0.2046	0.9388	0.0001	8.15E-07
365	*	0.00	0.000	0.000	0.2066	0.9385	0.0001	8.14E-07

* = Frozen (air or soil)

Annual Totals for Year 11			
	inches	cubic feet	percent
Precipitation	31.87	115,695.9	100.00
Runoff	9.774	35,478.9	30.67
Evapotranspiration	22.357	81,156.0	70.15
Recirculation into Layer 1	0.0411	149.2	0.13
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0411	149.2	0.13
Percolation/Leakage through Layer 5	0.000313	1.1365	0.00
Average Head on Top of Layer 4	0.9932	---	---
Change in Water Storage	-0.2590	-940.1	-0.81
Soil Water at Start of Year	293.6224	1,065,849.2	921.25
Soil Water at End of Year	293.3436	1,064,837.2	920.38
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0198	71.9	0.06
Annual Water Budget Balance	-0.0411	-149.3	-0.13

Daily Output for Year 12

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.075	0.2011	0.9382	0.0001	8.14E-07
2			0.00	0.000	0.025	0.1985	0.9379	0.0001	8.14E-07
3			0.00	0.000	0.014	0.1972	0.9375	0.0001	8.14E-07
4			0.21	0.028	0.042	0.2081	0.9372	0.0001	8.13E-07
5			0.09	0.000	0.088	0.2111	0.9369	0.0001	8.13E-07
6			0.02	0.000	0.046	0.2082	0.9365	0.0001	8.13E-07
7			0.99	0.416	0.064	0.2219	0.9362	0.0001	8.13E-07
8			0.09	0.134	0.080	0.2335	0.9359	0.0001	8.12E-07
9			0.13	0.034	0.083	0.2451	0.9356	0.0001	8.12E-07
10			0.00	0.000	0.080	0.2406	0.9352	0.0001	8.12E-07
11			0.00	0.000	0.086	0.2321	0.9349	0.0001	8.12E-07
12			0.00	0.000	0.054	0.2267	0.9346	0.0001	8.11E-07
13			0.00	0.000	0.065	0.2202	0.9343	0.0001	8.11E-07
14			0.10	0.000	0.065	0.2235	0.9339	0.0001	8.11E-07
15	*		0.02	0.000	0.024	0.2235	0.9336	0.0001	8.10E-07
16			0.22	0.035	0.051	0.2336	0.9333	0.0001	8.10E-07
17			0.00	0.000	0.065	0.2307	0.9329	0.0001	8.10E-07
18			0.00	0.000	0.050	0.2257	0.9326	0.0001	8.10E-07
19			0.00	0.000	0.054	0.2203	0.9323	0.0001	8.09E-07
20	*		0.00	0.000	0.047	0.2156	0.9320	0.0001	8.09E-07
21	*		0.00	0.000	0.038	0.2119	0.9316	0.0001	8.09E-07
22			0.00	0.000	0.042	0.2077	0.9313	0.0001	8.09E-07
23	*		0.00	0.000	0.000	0.2077	0.9310	0.0001	8.08E-07
24	*		0.01	0.000	0.014	0.2077	0.9307	0.0001	8.08E-07

25	*	0.10	0.000	0.055	0.2097	0.9303	0.0001	8.08E-07
26	*	0.00	0.000	0.027	0.2097	0.9300	0.0001	8.08E-07
27	*	0.00	0.000	0.034	0.2063	0.9297	0.0001	8.07E-07
28	*	0.00	0.000	0.039	0.2024	0.9294	0.0001	8.07E-07
29	*	0.11	0.000	0.038	0.2044	0.9290	0.0001	8.07E-07
30		0.01	0.000	0.088	0.2013	0.9287	0.0001	8.07E-07
31		0.02	0.000	0.047	0.1987	0.9284	0.0001	8.06E-07
32		0.32	0.052	0.067	0.2134	0.9281	0.0001	8.06E-07
33		0.00	0.000	0.086	0.2100	0.9279	0.0001	8.06E-07
34		0.00	0.000	0.063	0.2037	0.9277	0.0001	8.06E-07
35		0.00	0.000	0.037	0.2001	0.9274	0.0001	8.06E-07
36		0.00	0.000	0.024	0.1977	0.9271	0.0001	8.05E-07
37		0.00	0.000	0.007	0.1970	0.9267	0.0001	8.05E-07
38		0.00	0.000	0.000	0.1970	0.9264	0.0001	8.05E-07
39		0.20	0.024	0.036	0.2085	0.9261	0.0001	8.05E-07
40		0.00	0.000	0.043	0.2066	0.9258	0.0001	8.04E-07
41		0.00	0.000	0.025	0.2041	0.9254	0.0001	8.04E-07
42		0.00	0.000	0.022	0.2019	0.9251	0.0001	8.04E-07
43	*	0.00	0.000	0.000	0.2019	0.9248	0.0001	8.03E-07
44		0.00	0.000	0.020	0.1999	0.9245	0.0001	8.03E-07
45	*	0.00	0.000	0.016	0.1982	0.9242	0.0001	8.03E-07
46		0.00	0.000	0.010	0.1973	0.9238	0.0001	8.03E-07
47		0.23	0.041	0.025	0.2096	0.9235	0.0001	8.02E-07
48		0.00	0.000	0.051	0.2086	0.9232	0.0001	8.02E-07
49	*	0.01	0.000	0.015	0.2086	0.9229	0.0001	8.02E-07
50	*	0.00	0.000	0.000	0.2087	0.9225	0.0001	8.02E-07
51	*	0.00	0.000	0.000	0.2087	0.9222	0.0001	8.01E-07
52	*	0.00	0.000	0.015	0.2072	0.9219	0.0001	8.01E-07
53		0.00	0.000	0.014	0.2058	0.9216	0.0001	8.01E-07
54	*	0.00	0.000	0.013	0.2045	0.9212	0.0001	8.01E-07
55		0.07	0.000	0.025	0.2090	0.9209	0.0001	8.00E-07
56		0.28	0.065	0.030	0.2214	0.9206	0.0001	8.00E-07

57			0.19	0.030	0.111	0.2301	0.9203	0.0001	8.00E-07
58	*		0.00	0.000	0.030	0.2301	0.9200	0.0001	8.00E-07
59	*		0.00	0.000	0.027	0.2274	0.9196	0.0001	7.99E-07
60	*		0.00	0.000	0.000	0.2274	0.9193	0.0001	7.99E-07
61	*		0.00	0.000	0.000	0.2275	0.9190	0.0001	7.99E-07
62	*		0.00	0.000	0.000	0.2275	0.9187	0.0001	7.99E-07
63	*		0.00	0.000	0.000	0.2275	0.9184	0.0001	7.98E-07
64	*		0.00	0.000	0.000	0.2275	0.9180	0.0001	7.98E-07
65	*	*	0.00	0.000	0.000	0.2275	0.9177	0.0001	7.98E-07
66	*	*	0.00	0.000	0.000	0.2275	0.9174	0.0001	7.98E-07
67	*	*	0.19	0.000	0.069	0.2275	0.9171	0.0001	7.97E-07
68	*	*	0.00	0.000	0.043	0.2275	0.9168	0.0001	7.97E-07
69		*	0.00	0.000	0.078	0.2275	0.9164	0.0001	7.97E-07
70		*	0.00	0.000	0.000	0.2275	0.9161	0.0001	7.97E-07
71		*	0.01	0.000	0.006	0.2278	0.9158	0.0001	7.96E-07
72			0.00	0.000	0.152	0.2126	0.9155	0.0001	7.96E-07
73			0.00	0.000	0.104	0.2022	0.9152	0.0001	7.96E-07
74	*		0.40	0.000	0.038	0.2041	0.9148	0.0001	7.96E-07
75	*	*	0.01	0.000	0.041	0.2042	0.9145	0.0001	7.95E-07
76	*	*	0.00	0.000	0.045	0.2042	0.9142	0.0001	7.95E-07
77		*	0.00	0.086	0.071	0.2085	0.9139	0.0001	7.95E-07
78		*	0.00	0.000	0.065	0.2085	0.9136	0.0001	7.95E-07
79		*	0.01	0.000	0.007	0.2089	0.9132	0.0001	7.94E-07
80			0.00	0.000	0.077	0.2017	0.9129	0.0001	7.94E-07
81			0.31	0.042	0.107	0.2138	0.9126	0.0001	7.94E-07
82			0.23	0.035	0.129	0.2213	0.9123	0.0001	7.93E-07
83			0.00	0.000	0.097	0.2154	0.9120	0.0001	7.93E-07
84			0.00	0.000	0.043	0.2112	0.9116	0.0001	7.93E-07
85			0.35	0.067	0.078	0.2249	0.9113	0.0001	7.93E-07
86	*		0.53	0.000	0.041	0.2272	0.9110	0.0001	7.92E-07
87	*		0.00	0.000	0.041	0.2294	0.9107	0.0001	7.92E-07
88	*		0.00	0.000	0.045	0.2316	0.9104	0.0001	7.92E-07

89	0.00	0.000	0.048	0.2338	0.9100	0.0001	7.92E-07
90	0.00	0.011	0.185	0.2466	0.9097	0.0001	7.91E-07
91	0.00	0.000	0.069	0.2408	0.9094	0.0001	7.91E-07
92	0.00	0.000	0.094	0.2314	0.9091	0.0001	7.91E-07
93	0.03	0.000	0.088	0.2252	0.9088	0.0001	7.91E-07
94	0.26	0.034	0.110	0.2329	0.9084	0.0001	7.90E-07
95	0.00	0.000	0.223	0.2141	0.9081	0.0001	7.90E-07
96	0.01	0.000	0.088	0.2061	0.9078	0.0001	7.90E-07
97	0.44	0.086	0.111	0.2214	0.9075	0.0001	7.90E-07
98	0.20	0.027	0.235	0.2207	0.9072	0.0001	7.89E-07
99	0.00	0.000	0.151	0.2083	0.9069	0.0001	7.89E-07
100	0.00	0.000	0.086	0.1997	0.9065	0.0001	7.89E-07
101	0.00	0.000	0.027	0.1972	0.9062	0.0001	7.89E-07
102	0.87	0.301	0.131	0.2135	0.9059	0.0001	7.88E-07
103	0.17	0.079	0.172	0.2252	0.9056	0.0001	7.88E-07
104	0.41	0.065	0.250	0.2368	0.9053	0.0001	7.88E-07
105	0.00	0.000	0.150	0.2280	0.9049	0.0001	7.88E-07
106	0.00	0.000	0.109	0.2171	0.9046	0.0001	7.87E-07
107	0.02	0.000	0.167	0.2021	0.9043	0.0001	7.87E-07
108	0.69	0.197	0.141	0.2184	0.9040	0.0001	7.87E-07
109	0.44	0.131	0.249	0.2300	0.9037	0.0001	7.87E-07
110	0.27	0.080	0.129	0.2416	0.9034	0.0001	7.86E-07
111	0.00	0.000	0.181	0.2316	0.9030	0.0001	7.86E-07
112	0.00	0.000	0.168	0.2147	0.9027	0.0001	7.86E-07
113	0.00	0.000	0.078	0.2069	0.9024	0.0001	7.86E-07
114	0.00	0.000	0.092	0.1977	0.9021	0.0001	7.85E-07
115	0.00	0.000	0.004	0.1974	0.9018	0.0001	7.85E-07
116	0.00	0.000	0.004	0.1970	0.9015	0.0001	7.85E-07
117	0.00	0.000	0.000	0.1970	0.9011	0.0001	7.85E-07
118	0.00	0.000	0.000	0.1970	0.9008	0.0001	7.84E-07
119	0.21	0.029	0.029	0.2091	0.9005	0.0001	7.84E-07
120	0.40	0.121	0.075	0.2206	0.9002	0.0001	7.84E-07

121		0.00	0.000	0.233	0.2094	0.8999	0.0001	7.84E-07
122		0.09	0.000	0.033	0.2151	0.8996	0.0001	7.83E-07
123		0.11	0.000	0.111	0.2145	0.8993	0.0001	7.83E-07
124		0.14	0.000	0.037	0.2253	0.8989	0.0001	7.83E-07
125		0.00	0.000	0.125	0.2129	0.8986	0.0001	7.83E-07
126		0.00	0.000	0.019	0.2110	0.8983	0.0001	7.82E-07
127		0.00	0.000	0.017	0.2093	0.8980	0.0001	7.82E-07
128	*	0.00	0.000	0.016	0.2077	0.8977	0.0001	7.82E-07
129		0.00	0.000	0.015	0.2062	0.8974	0.0001	7.82E-07
130		0.00	0.000	0.012	0.2050	0.8971	0.0001	7.81E-07
131		0.00	0.000	0.017	0.2033	0.8967	0.0001	7.81E-07
132		0.00	0.000	0.017	0.2016	0.8964	0.0001	7.81E-07
133		0.00	0.000	0.017	0.2000	0.8961	0.0001	7.81E-07
134		0.62	0.215	0.033	0.2160	0.8958	0.0001	7.80E-07
135		0.13	0.000	0.284	0.2219	0.8955	0.0001	7.80E-07
136		0.30	0.030	0.183	0.2272	0.8952	0.0001	7.80E-07
137		0.08	0.000	0.134	0.2247	0.8949	0.0001	7.80E-07
138		0.00	0.000	0.144	0.2103	0.8945	0.0001	7.79E-07
139		0.00	0.000	0.107	0.1996	0.8942	0.0001	7.79E-07
140		0.00	0.000	0.025	0.1972	0.8939	0.0001	7.79E-07
141		0.45	0.110	0.073	0.2132	0.8936	0.0001	7.79E-07
142		0.00	0.000	0.168	0.2075	0.8933	0.0001	7.78E-07
143		0.00	0.000	0.033	0.2042	0.8930	0.0001	7.78E-07
144		0.04	0.000	0.040	0.2043	0.8927	0.0001	7.78E-07
145		0.29	0.057	0.049	0.2170	0.8924	0.0001	7.78E-07
146		0.02	0.000	0.186	0.2061	0.8920	0.0001	7.77E-07
147		0.02	0.000	0.032	0.2047	0.8917	0.0001	7.77E-07
148		0.00	0.000	0.025	0.2022	0.8914	0.0001	7.77E-07
149		0.00	0.000	0.022	0.2000	0.8911	0.0001	7.77E-07
150		0.00	0.000	0.024	0.1977	0.8908	0.0001	7.76E-07
151		0.00	0.000	0.006	0.1971	0.8905	0.0001	7.76E-07
152		0.11	0.000	0.015	0.2069	0.8902	0.0001	7.76E-07

153	0.06	0.000	0.023	0.2104	0.8899	0.0001	7.76E-07
154	0.10	0.000	0.025	0.2180	0.8895	0.0001	7.75E-07
155	0.05	0.000	0.024	0.2204	0.8892	0.0001	7.75E-07
156	0.15	0.003	0.027	0.2317	0.8889	0.0001	7.75E-07
157	0.00	0.000	0.107	0.2213	0.8886	0.0001	7.75E-07
158	0.00	0.000	0.014	0.2199	0.8883	0.0001	7.74E-07
159	0.00	0.000	0.016	0.2182	0.8880	0.0001	7.74E-07
160	0.00	0.000	0.014	0.2169	0.8877	0.0001	7.74E-07
161	0.00	0.000	0.014	0.2156	0.8874	0.0001	7.74E-07
162	0.00	0.000	0.015	0.2141	0.8871	0.0001	7.73E-07
163	0.00	0.000	0.014	0.2127	0.8867	0.0001	7.73E-07
164	0.00	0.000	0.013	0.2114	0.8864	0.0001	7.73E-07
165	0.00	0.000	0.012	0.2101	0.8861	0.0001	7.73E-07
166	1.04	0.456	0.032	0.2258	0.8858	0.0001	7.72E-07
167	0.00	0.000	0.361	0.2297	0.8855	0.0001	7.72E-07
168	0.00	0.000	0.215	0.2082	0.8852	0.0001	7.72E-07
169	0.00	0.000	0.090	0.1992	0.8849	0.0001	7.72E-07
170	0.09	0.000	0.056	0.2027	0.8846	0.0001	7.71E-07
171	0.06	0.000	0.056	0.2031	0.8843	0.0001	7.71E-07
172	0.70	0.256	0.075	0.2155	0.8840	0.0001	7.71E-07
173	0.00	0.000	0.190	0.2211	0.8836	0.0001	7.71E-07
174	0.00	0.000	0.157	0.2054	0.8835	0.0001	7.71E-07
175	0.00	0.000	0.063	0.1990	0.8834	0.0001	7.70E-07
176	0.00	0.000	0.019	0.1971	0.8830	0.0001	7.70E-07
177	0.00	0.000	0.001	0.1971	0.8827	0.0001	7.70E-07
178	0.00	0.000	0.001	0.1970	0.8824	0.0001	7.70E-07
179	0.19	0.020	0.032	0.2089	0.8821	0.0001	7.69E-07
180	0.12	0.000	0.049	0.2176	0.8818	0.0001	7.69E-07
181	0.00	0.000	0.016	0.2160	0.8815	0.0001	7.69E-07
182	0.00	0.000	0.024	0.2136	0.8812	0.0001	7.69E-07
183	0.00	0.000	0.022	0.2114	0.8809	0.0001	7.68E-07
184	0.00	0.000	0.022	0.2093	0.8806	0.0001	7.68E-07

185	0.00	0.000	0.022	0.2071	0.8803	0.0001	7.68E-07
186	0.00	0.000	0.019	0.2052	0.8800	0.0001	7.68E-07
187	0.00	0.000	0.021	0.2032	0.8796	0.0001	7.67E-07
188	0.00	0.000	0.018	0.2014	0.8793	0.0001	7.67E-07
189	0.00	0.000	0.017	0.1997	0.8790	0.0001	7.67E-07
190	0.00	0.000	0.020	0.1977	0.8787	0.0001	7.67E-07
191	0.00	0.000	0.007	0.1970	0.8784	0.0001	7.66E-07
192	0.41	0.108	0.034	0.2130	0.8781	0.0001	7.66E-07
193	0.00	0.000	0.202	0.2037	0.8778	0.0001	7.66E-07
194	0.00	0.000	0.016	0.2020	0.8775	0.0001	7.66E-07
195	0.00	0.000	0.018	0.2003	0.8772	0.0001	7.65E-07
196	0.00	0.000	0.017	0.1986	0.8769	0.0001	7.65E-07
197	0.00	0.000	0.016	0.1970	0.8766	0.0001	7.65E-07
198	0.04	0.000	0.014	0.1992	0.8763	0.0001	7.65E-07
199	0.00	0.000	0.002	0.1990	0.8760	0.0001	7.65E-07
200	0.05	0.000	0.018	0.2020	0.8756	0.0001	7.64E-07
201	0.00	0.000	0.010	0.2011	0.8753	0.0001	7.64E-07
202	0.00	0.000	0.011	0.2000	0.8750	0.0001	7.64E-07
203	0.00	0.000	0.013	0.1988	0.8747	0.0001	7.64E-07
204	0.00	0.000	0.005	0.1983	0.8744	0.0001	7.63E-07
205	0.00	0.000	0.005	0.1978	0.8741	0.0001	7.63E-07
206	0.00	0.000	0.004	0.1974	0.8738	0.0001	7.63E-07
207	0.00	0.000	0.003	0.1971	0.8735	0.0001	7.63E-07
208	0.00	0.000	0.001	0.1970	0.8732	0.0001	7.62E-07
209	0.00	0.000	0.000	0.1970	0.8729	0.0001	7.62E-07
210	0.00	0.000	0.000	0.1970	0.8726	0.0001	7.62E-07
211	0.00	0.000	0.000	0.1970	0.8723	0.0001	7.62E-07
212	0.00	0.000	0.000	0.1970	0.8720	0.0001	7.61E-07
213	0.00	0.000	0.000	0.1970	0.8717	0.0001	7.61E-07
214	0.15	0.000	0.024	0.2095	0.8714	0.0001	7.61E-07
215	0.00	0.000	0.009	0.2085	0.8711	0.0001	7.61E-07
216	0.00	0.000	0.013	0.2072	0.8708	0.0001	7.60E-07

217	0.00	0.000	0.014	0.2058	0.8704	0.0001	7.60E-07
218	0.08	0.000	0.031	0.2107	0.8701	0.0001	7.60E-07
219	0.00	0.000	0.012	0.2095	0.8698	0.0001	7.60E-07
220	0.00	0.000	0.009	0.2087	0.8695	0.0001	7.59E-07
221	0.00	0.000	0.015	0.2072	0.8692	0.0001	7.59E-07
222	0.00	0.000	0.015	0.2057	0.8689	0.0001	7.59E-07
223	0.04	0.000	0.025	0.2068	0.8686	0.0001	7.59E-07
224	0.00	0.000	0.020	0.2048	0.8683	0.0001	7.58E-07
225	0.00	0.000	0.016	0.2032	0.8680	0.0001	7.58E-07
226	0.13	0.000	0.029	0.2131	0.8677	0.0001	7.58E-07
227	0.21	0.038	0.026	0.2243	0.8674	0.0001	7.58E-07
228	0.00	0.000	0.052	0.2229	0.8671	0.0001	7.57E-07
229	0.03	0.000	0.024	0.2238	0.8668	0.0001	7.57E-07
230	0.26	0.054	0.029	0.2360	0.8665	0.0001	7.57E-07
231	0.00	0.000	0.140	0.2274	0.8662	0.0001	7.57E-07
232	0.18	0.011	0.112	0.2320	0.8659	0.0001	7.56E-07
233	0.00	0.000	0.216	0.2116	0.8656	0.0001	7.56E-07
234	0.14	0.000	0.083	0.2173	0.8653	0.0001	7.56E-07
235	0.81	0.320	0.078	0.2295	0.8650	0.0001	7.56E-07
236	0.03	0.000	0.291	0.2330	0.8647	0.0001	7.55E-07
237	0.00	0.000	0.182	0.2148	0.8648	0.0001	7.56E-07
238	0.00	0.000	0.154	0.1995	0.8647	0.0001	7.56E-07
239	0.00	0.000	0.024	0.1973	0.8644	0.0001	7.55E-07
240	0.00	0.000	0.002	0.1972	0.8641	0.0001	7.55E-07
241	0.00	0.000	0.002	0.1970	0.8638	0.0001	7.55E-07
242	0.90	0.347	0.080	0.2127	0.8635	0.0001	7.55E-07
243	0.00	0.000	0.349	0.2095	0.8632	0.0001	7.54E-07
244	0.00	0.000	0.101	0.1995	0.8629	0.0001	7.54E-07
245	0.00	0.000	0.025	0.1970	0.8626	0.0001	7.54E-07
246	0.20	0.020	0.083	0.2049	0.8623	0.0001	7.54E-07
247	0.03	0.000	0.060	0.2041	0.8620	0.0001	7.53E-07
248	0.01	0.000	0.047	0.2008	0.8617	0.0001	7.53E-07

249	0.46	0.136	0.058	0.2140	0.8614	0.0001	7.53E-07
250	0.09	0.000	0.178	0.2191	0.8611	0.0001	7.53E-07
251	0.00	0.000	0.066	0.2125	0.8608	0.0001	7.52E-07
252	0.00	0.000	0.080	0.2045	0.8605	0.0001	7.52E-07
253	0.00	0.000	0.071	0.1974	0.8602	0.0001	7.52E-07
254	0.00	0.000	0.003	0.1971	0.8599	0.0001	7.52E-07
255	0.00	0.000	0.000	0.1970	0.8596	0.0001	7.51E-07
256	0.00	0.000	0.000	0.1970	0.8593	0.0001	7.51E-07
257	0.00	0.000	0.000	0.1970	0.8590	0.0001	7.51E-07
258	0.00	0.000	0.000	0.1970	0.8587	0.0001	7.51E-07
259	0.00	0.000	0.000	0.1970	0.8584	0.0001	7.50E-07
260	0.00	0.000	0.000	0.1970	0.8581	0.0001	7.50E-07
261	0.31	0.067	0.040	0.2106	0.8578	0.0001	7.50E-07
262	0.00	0.000	0.077	0.2096	0.8575	0.0001	7.50E-07
263	0.00	0.000	0.016	0.2080	0.8572	0.0001	7.49E-07
264	0.60	0.209	0.036	0.2226	0.8569	0.0001	7.49E-07
265	0.02	0.000	0.121	0.2326	0.8566	0.0001	7.49E-07
266	0.00	0.000	0.083	0.2243	0.8563	0.0001	7.49E-07
267	0.00	0.000	0.113	0.2131	0.8560	0.0001	7.49E-07
268	0.00	0.000	0.140	0.1991	0.8557	0.0001	7.48E-07
269	0.00	0.000	0.015	0.1976	0.8554	0.0001	7.48E-07
270	0.00	0.000	0.003	0.1973	0.8551	0.0001	7.48E-07
271	0.00	0.000	0.003	0.1970	0.8548	0.0001	7.48E-07
272	0.00	0.000	0.000	0.1970	0.8545	0.0001	7.47E-07
273	0.00	0.000	0.000	0.1970	0.8542	0.0001	7.47E-07
274	0.00	0.000	0.000	0.1970	0.8539	0.0001	7.47E-07
275	0.00	0.000	0.000	0.1970	0.8536	0.0001	7.47E-07
276	0.00	0.000	0.000	0.1970	0.8533	0.0001	7.46E-07
277	0.00	0.000	0.000	0.1970	0.8530	0.0001	7.46E-07
278	0.05	0.000	0.016	0.2002	0.8527	0.0001	7.46E-07
279	0.00	0.000	0.002	0.2000	0.8524	0.0001	7.46E-07
280	0.00	0.000	0.008	0.1992	0.8521	0.0001	7.45E-07

281	0.00	0.000	0.004	0.1988	0.8518	0.0001	7.45E-07
282	0.00	0.000	0.004	0.1984	0.8515	0.0001	7.45E-07
283	0.00	0.000	0.003	0.1981	0.8512	0.0001	7.45E-07
284	0.00	0.000	0.003	0.1978	0.8509	0.0001	7.44E-07
285	0.00	0.000	0.003	0.1975	0.8506	0.0001	7.44E-07
286	0.00	0.000	0.003	0.1972	0.8503	0.0001	7.44E-07
287	0.00	0.000	0.001	0.1971	0.8500	0.0001	7.44E-07
288	0.09	0.000	0.016	0.2045	0.8497	0.0001	7.44E-07
289	0.04	0.000	0.020	0.2060	0.8494	0.0001	7.43E-07
290	0.13	0.000	0.022	0.2170	0.8491	0.0001	7.43E-07
291	0.01	0.000	0.012	0.2165	0.8488	0.0001	7.43E-07
292	0.07	0.000	0.024	0.2207	0.8485	0.0001	7.43E-07
293	0.04	0.000	0.025	0.2219	0.8482	0.0001	7.42E-07
294	0.00	0.000	0.010	0.2209	0.8479	0.0001	7.42E-07
295	0.00	0.000	0.009	0.2200	0.8476	0.0001	7.42E-07
296	0.00	0.000	0.009	0.2191	0.8473	0.0001	7.42E-07
297	0.00	0.000	0.009	0.2182	0.8470	0.0001	7.41E-07
298	0.00	0.000	0.009	0.2173	0.8468	0.0001	7.41E-07
299	0.00	0.000	0.009	0.2165	0.8465	0.0001	7.41E-07
300	0.00	0.000	0.008	0.2156	0.8462	0.0001	7.41E-07
301	0.00	0.000	0.008	0.2148	0.8459	0.0001	7.40E-07
302	0.00	0.000	0.008	0.2140	0.8456	0.0001	7.40E-07
303	0.00	0.000	0.008	0.2132	0.8453	0.0001	7.40E-07
304	0.01	0.000	0.016	0.2127	0.8450	0.0001	7.40E-07
305	0.00	0.000	0.008	0.2120	0.8447	0.0001	7.39E-07
306	0.00	0.000	0.008	0.2112	0.8444	0.0001	7.39E-07
307	0.04	0.000	0.022	0.2134	0.8441	0.0001	7.39E-07
308	0.63	0.243	0.026	0.2262	0.8438	0.0001	7.39E-07
309	2.66	1.629	0.169	0.2378	0.8435	0.0001	7.39E-07
310	0.02	0.398	0.086	0.2494	0.8432	0.0001	7.38E-07
311	0.01	0.063	0.170	0.2611	0.8429	0.0001	7.38E-07
312	0.03	0.000	0.214	0.2490	0.8426	0.0001	7.38E-07

313		0.00	0.000	0.188	0.2307	0.8423	0.0001	7.38E-07
314		0.00	0.000	0.129	0.2178	0.8420	0.0001	7.37E-07
315		0.00	0.000	0.165	0.2013	0.8417	0.0001	7.37E-07
316		0.00	0.000	0.031	0.1981	0.8414	0.0001	7.37E-07
317		0.00	0.000	0.010	0.1970	0.8446	0.0001	7.39E-07
318		0.00	0.000	0.000	0.1970	0.8465	0.0001	7.41E-07
319		0.00	0.000	0.000	0.1970	0.8462	0.0001	7.41E-07
320		0.00	0.000	0.000	0.1970	0.8459	0.0001	7.40E-07
321		0.00	0.000	0.000	0.1970	0.8456	0.0001	7.40E-07
322		0.01	0.000	0.007	0.1970	0.8453	0.0001	7.40E-07
323		0.00	0.000	0.003	0.1970	0.8450	0.0001	7.40E-07
324		0.00	0.000	0.000	0.1970	0.8447	0.0001	7.39E-07
325		0.00	0.000	0.000	0.1970	0.8444	0.0001	7.39E-07
326	*	0.00	0.000	0.000	0.1970	0.8441	0.0001	7.39E-07
327	*	0.12	0.000	0.056	0.1990	0.8438	0.0001	7.39E-07
328		0.67	0.291	0.000	0.2133	0.8435	0.0001	7.39E-07
329	*	0.19	0.059	0.006	0.2250	0.8432	0.0001	7.38E-07
330	*	0.81	0.000	0.037	0.2270	0.8429	0.0001	7.38E-07
331		0.05	0.164	0.000	0.2397	0.8426	0.0001	7.38E-07
332		0.07	0.306	0.000	0.2513	0.8423	0.0001	7.38E-07
333		0.01	0.157	0.047	0.2630	0.8420	0.0001	7.37E-07
334		0.37	0.105	0.197	0.2746	0.8417	0.0001	7.37E-07
335		0.00	0.000	0.165	0.2669	0.8414	0.0001	7.37E-07
336		0.02	0.000	0.111	0.2578	0.8411	0.0001	7.37E-07
337		0.08	0.000	0.106	0.2555	0.8408	0.0001	7.36E-07
338		0.02	0.000	0.103	0.2474	0.8405	0.0001	7.36E-07
339		0.00	0.000	0.114	0.2360	0.8402	0.0001	7.36E-07
340		0.00	0.000	0.056	0.2304	0.8400	0.0001	7.36E-07
341	*	0.00	0.000	0.036	0.2268	0.8397	0.0001	7.35E-07
342	*	0.00	0.000	0.000	0.2268	0.8394	0.0001	7.35E-07
343	*	0.00	0.000	0.004	0.2268	0.8391	0.0001	7.35E-07
344	*	0.00	0.000	0.037	0.2232	0.8388	0.0001	7.35E-07

345		0.00	0.000	0.068	0.2164	0.8385	0.0001	7.34E-07
346		0.00	0.000	0.131	0.2033	0.8382	0.0001	7.34E-07
347		0.00	0.000	0.053	0.1980	0.8379	0.0001	7.34E-07
348		0.00	0.000	0.010	0.1970	0.8376	0.0001	7.34E-07
349		0.00	0.000	0.000	0.1970	0.8373	0.0001	7.34E-07
350		0.00	0.000	0.000	0.1970	0.8370	0.0001	7.33E-07
351		0.16	0.005	0.028	0.2093	0.8367	0.0001	7.33E-07
352		0.00	0.000	0.017	0.2080	0.8364	0.0001	7.33E-07
353		0.00	0.000	0.019	0.2062	0.8361	0.0001	7.33E-07
354		0.15	0.009	0.031	0.2166	0.8358	0.0001	7.32E-07
355		0.36	0.103	0.047	0.2283	0.8355	0.0001	7.32E-07
356		0.00	0.000	0.108	0.2278	0.8353	0.0001	7.32E-07
357		0.00	0.000	0.067	0.2211	0.8350	0.0001	7.32E-07
358		0.00	0.000	0.076	0.2135	0.8347	0.0001	7.31E-07
359		0.00	0.000	0.067	0.2067	0.8344	0.0001	7.31E-07
360		0.00	0.000	0.048	0.2020	0.8341	0.0001	7.31E-07
361		0.00	0.000	0.041	0.1979	0.8338	0.0001	7.31E-07
362		0.00	0.000	0.008	0.1972	0.8335	0.0001	7.30E-07
363	*	0.00	0.000	0.003	0.1970	0.8332	0.0001	7.30E-07
364		0.00	0.000	0.000	0.1970	0.8329	0.0001	7.30E-07
365		0.00	0.000	0.000	0.1970	0.8326	0.0001	7.30E-07

* = Frozen (air or soil)

Annual Totals for Year 12			
	inches	cubic feet	percent
Precipitation	26.96	97,877.9	100.00
Runoff	8.240	29,910.9	30.56
Evapotranspiration	18.873	68,510.5	70.00
Recirculation into Layer 1	0.0366	132.9	0.14
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0366	132.9	0.14
Percolation/Leakage through Layer 5	0.000282	1.0222	0.00
Average Head on Top of Layer 4	0.8821	---	---
Change in Water Storage	-0.1500	-544.4	-0.56
Soil Water at Start of Year	293.3436	1,064,837.2	1087.92
Soil Water at End of Year	293.2134	1,064,364.7	1087.44
Snow Water at Start of Year	0.0198	71.9	0.07
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0366	-132.9	-0.14

Daily Output for Year 13

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.00	0.000	0.000	0.1970	0.8320	0.0001	7.29E-07
2	*		0.00	0.000	0.000	0.1970	0.8317	0.0001	7.29E-07
3	*		0.00	0.000	0.000	0.1970	0.8315	0.0001	7.29E-07
4			0.00	0.000	0.000	0.1970	0.8312	0.0001	7.29E-07
5	*		0.00	0.000	0.000	0.1970	0.8309	0.0001	7.28E-07
6			0.00	0.000	0.000	0.1970	0.8306	0.0001	7.28E-07
7			0.22	0.037	0.022	0.2097	0.8303	0.0001	7.28E-07
8			0.29	0.071	0.070	0.2214	0.8300	0.0001	7.28E-07
9			0.64	0.259	0.103	0.2330	0.8297	0.0001	7.27E-07
10			0.03	0.031	0.091	0.2446	0.8294	0.0001	7.27E-07
11			0.16	0.011	0.081	0.2531	0.8292	0.0001	7.27E-07
12			0.24	0.037	0.105	0.2609	0.8289	0.0001	7.27E-07
13			0.16	0.016	0.077	0.2700	0.8286	0.0001	7.27E-07
14			0.00	0.000	0.085	0.2630	0.8283	0.0001	7.26E-07
15			0.00	0.000	0.081	0.2549	0.8280	0.0001	7.26E-07
16			0.10	0.000	0.083	0.2561	0.8277	0.0001	7.26E-07
17			0.00	0.000	0.135	0.2429	0.8275	0.0001	7.26E-07
18			0.20	0.024	0.106	0.2476	0.8272	0.0001	7.25E-07
19			0.00	0.000	0.117	0.2383	0.8269	0.0001	7.25E-07
20			0.00	0.000	0.084	0.2299	0.8266	0.0001	7.25E-07
21			0.00	0.000	0.075	0.2224	0.8263	0.0001	7.25E-07
22	*		0.00	0.000	0.000	0.2224	0.8260	0.0001	7.24E-07
23	*		0.00	0.000	0.000	0.2224	0.8257	0.0001	7.24E-07
24			0.00	0.000	0.058	0.2167	0.8254	0.0001	7.24E-07

25			0.00	0.000	0.064	0.2103	0.8251	0.0001	7.24E-07
26			0.08	0.000	0.070	0.2114	0.8248	0.0001	7.24E-07
27	*		0.00	0.000	0.000	0.2114	0.8246	0.0001	7.23E-07
28	*		0.00	0.000	0.000	0.2114	0.8243	0.0001	7.23E-07
29	*		0.00	0.000	0.000	0.2115	0.8240	0.0001	7.23E-07
30			0.00	0.000	0.050	0.2065	0.8237	0.0001	7.23E-07
31	*		0.47	0.000	0.024	0.2084	0.8234	0.0001	7.22E-07
32	*		0.01	0.000	0.013	0.2104	0.8231	0.0001	7.22E-07
33	*		0.00	0.000	0.017	0.2124	0.8228	0.0001	7.22E-07
34	*		0.00	0.000	0.020	0.2144	0.8225	0.0001	7.22E-07
35	*		0.00	0.000	0.009	0.2164	0.8223	0.0001	7.21E-07
36	*		0.00	0.000	0.022	0.2183	0.8220	0.0001	7.21E-07
37	*		0.00	0.000	0.028	0.2203	0.8217	0.0001	7.21E-07
38	*		0.00	0.000	0.027	0.2223	0.8214	0.0001	7.21E-07
39	*		0.01	0.000	0.031	0.2243	0.8211	0.0001	7.21E-07
40	*		0.21	0.000	0.000	0.2262	0.8208	0.0001	7.20E-07
41			0.08	0.116	0.036	0.2390	0.8205	0.0001	7.20E-07
42			0.22	0.053	0.111	0.2506	0.8202	0.0001	7.20E-07
43	*		0.00	0.000	0.047	0.2506	0.8199	0.0001	7.20E-07
44	*	*	0.01	0.000	0.016	0.2506	0.8197	0.0001	7.19E-07
45	*	*	0.00	0.000	0.000	0.2507	0.8194	0.0001	7.19E-07
46	*	*	0.00	0.000	0.000	0.2507	0.8191	0.0001	7.19E-07
47		*	0.00	0.000	0.000	0.2507	0.8188	0.0001	7.19E-07
48		*	0.00	0.000	0.000	0.2507	0.8185	0.0001	7.18E-07
49		*	0.00	0.000	0.000	0.2507	0.8182	0.0001	7.18E-07
50			0.00	0.000	0.114	0.2393	0.8179	0.0001	7.18E-07
51			0.00	0.000	0.085	0.2307	0.8177	0.0001	7.18E-07
52			0.00	0.000	0.130	0.2178	0.8174	0.0001	7.18E-07
53			0.00	0.000	0.058	0.2119	0.8176	0.0001	7.18E-07
54			1.57	0.716	0.145	0.2282	0.8188	0.0001	7.19E-07
55			0.72	0.557	0.063	0.2398	0.8185	0.0001	7.18E-07
56			0.30	0.271	0.178	0.2515	0.8182	0.0001	7.18E-07

57		0.00	0.006	0.142	0.2631	0.8179	0.0001	7.18E-07
58		0.00	0.000	0.098	0.2539	0.8176	0.0001	7.18E-07
59		0.00	0.000	0.077	0.2462	0.8174	0.0001	7.18E-07
60		0.65	0.214	0.095	0.2607	0.8171	0.0001	7.17E-07
61		0.32	0.093	0.215	0.2723	0.8168	0.0001	7.17E-07
62		0.50	0.206	0.124	0.2839	0.8165	0.0001	7.17E-07
63		0.00	0.000	0.152	0.2834	0.8162	0.0001	7.17E-07
64		0.00	0.000	0.124	0.2710	0.8159	0.0001	7.16E-07
65		0.00	0.000	0.113	0.2597	0.8156	0.0001	7.16E-07
66		0.00	0.000	0.099	0.2499	0.8154	0.0001	7.16E-07
67	*	0.00	0.000	0.000	0.2499	0.8151	0.0001	7.16E-07
68		0.00	0.000	0.070	0.2432	0.8148	0.0001	7.15E-07
69	*	0.05	0.000	0.087	0.2395	0.8145	0.0001	7.15E-07
70		0.00	0.000	0.097	0.2299	0.8142	0.0001	7.15E-07
71	*	0.03	0.000	0.031	0.2299	0.8139	0.0001	7.15E-07
72		0.13	0.000	0.154	0.2277	0.8136	0.0001	7.15E-07
73		0.00	0.000	0.058	0.2219	0.8134	0.0001	7.14E-07
74		0.00	0.000	0.094	0.2125	0.8131	0.0001	7.14E-07
75		0.00	0.000	0.044	0.2081	0.8128	0.0001	7.14E-07
76		0.00	0.000	0.058	0.2023	0.8125	0.0001	7.14E-07
77		0.00	0.000	0.038	0.1986	0.8122	0.0001	7.13E-07
78		0.00	0.000	0.016	0.1970	0.8119	0.0001	7.13E-07
79		0.48	0.137	0.047	0.2133	0.8117	0.0001	7.13E-07
80		0.00	0.000	0.127	0.2144	0.8114	0.0001	7.13E-07
81		0.00	0.000	0.057	0.2086	0.8111	0.0001	7.12E-07
82		0.00	0.000	0.038	0.2049	0.8108	0.0001	7.12E-07
83		0.00	0.000	0.037	0.2012	0.8105	0.0001	7.12E-07
84		0.00	0.000	0.032	0.1980	0.8102	0.0001	7.12E-07
85		0.00	0.000	0.010	0.1970	0.8099	0.0001	7.12E-07
86		1.07	0.456	0.058	0.2133	0.8097	0.0001	7.11E-07
87		0.69	0.387	0.208	0.2249	0.8094	0.0001	7.11E-07
88		0.10	0.065	0.228	0.2365	0.8091	0.0001	7.11E-07

89		0.00	0.000	0.205	0.2225	0.8088	0.0001	7.11E-07
90		0.00	0.000	0.097	0.2128	0.8085	0.0001	7.10E-07
91		0.10	0.000	0.154	0.2078	0.8082	0.0001	7.10E-07
92		0.15	0.000	0.113	0.2119	0.8080	0.0001	7.10E-07
93		0.00	0.000	0.053	0.2067	0.8077	0.0001	7.10E-07
94	*	0.00	0.000	0.000	0.2067	0.8074	0.0001	7.10E-07
95	*	0.00	0.000	0.060	0.2006	0.8078	0.0001	7.10E-07
96	*	0.00	0.000	0.023	0.1984	0.8079	0.0001	7.10E-07
97	*	0.01	0.000	0.028	0.1970	0.8076	0.0001	7.10E-07
98		0.00	0.000	0.002	0.1970	0.8073	0.0001	7.09E-07
99		0.00	0.000	0.000	0.1970	0.8070	0.0001	7.09E-07
100		0.00	0.000	0.000	0.1970	0.8067	0.0001	7.09E-07
101		0.00	0.000	0.000	0.1970	0.8065	0.0001	7.09E-07
102		0.36	0.084	0.047	0.2118	0.8062	0.0001	7.09E-07
103		0.51	0.177	0.128	0.2235	0.8059	0.0001	7.08E-07
104		0.00	0.000	0.174	0.2237	0.8056	0.0001	7.08E-07
105	*	0.00	0.000	0.063	0.2174	0.8053	0.0001	7.08E-07
106		0.00	0.000	0.039	0.2134	0.8050	0.0001	7.08E-07
107		0.00	0.000	0.074	0.2060	0.8048	0.0001	7.07E-07
108		1.46	0.683	0.067	0.2223	0.8045	0.0001	7.07E-07
109		1.04	0.738	0.076	0.2339	0.8042	0.0001	7.07E-07
110		0.00	0.170	0.198	0.2455	0.8039	0.0001	7.07E-07
111		0.00	0.000	0.285	0.2340	0.8036	0.0001	7.06E-07
112		0.00	0.000	0.100	0.2240	0.8034	0.0001	7.06E-07
113		0.00	0.000	0.148	0.2093	0.8031	0.0001	7.06E-07
114		0.05	0.000	0.121	0.2023	0.8028	0.0001	7.06E-07
115		0.00	0.000	0.036	0.1987	0.8025	0.0001	7.06E-07
116		0.00	0.000	0.013	0.1974	0.8022	0.0001	7.05E-07
117		0.00	0.000	0.003	0.1971	0.8020	0.0001	7.05E-07
118		0.00	0.000	0.001	0.1970	0.8017	0.0001	7.05E-07
119	*	0.00	0.000	0.000	0.1970	0.8014	0.0001	7.05E-07
120	*	0.00	0.000	0.000	0.1970	0.8011	0.0001	7.04E-07

121	*	0.10	0.000	0.101	0.1970	0.8008	0.0001	7.04E-07
122		0.34	0.077	0.044	0.2114	0.8006	0.0001	7.04E-07
123		0.00	0.000	0.089	0.2102	0.8003	0.0001	7.04E-07
124		0.02	0.000	0.029	0.2095	0.8000	0.0001	7.04E-07
125		0.00	0.000	0.017	0.2078	0.7997	0.0001	7.03E-07
126		0.00	0.000	0.018	0.2060	0.7994	0.0001	7.03E-07
127		0.00	0.000	0.017	0.2043	0.7992	0.0001	7.03E-07
128		0.00	0.000	0.017	0.2027	0.7989	0.0001	7.03E-07
129		0.95	0.398	0.035	0.2180	0.7986	0.0001	7.02E-07
130		0.00	0.000	0.431	0.2110	0.7983	0.0001	7.02E-07
131		0.00	0.000	0.102	0.2008	0.7980	0.0001	7.02E-07
132		0.00	0.000	0.038	0.1970	0.7978	0.0001	7.02E-07
133		0.00	0.000	0.000	0.1970	0.7975	0.0001	7.02E-07
134		0.00	0.000	0.000	0.1970	0.7972	0.0001	7.01E-07
135		0.00	0.000	0.000	0.1970	0.7969	0.0001	7.01E-07
136		0.00	0.000	0.000	0.1970	0.7966	0.0001	7.01E-07
137		1.04	0.438	0.048	0.2132	0.7964	0.0001	7.01E-07
138		0.28	0.076	0.399	0.2249	0.7961	0.0001	7.00E-07
139		2.88	1.743	0.167	0.2365	0.7958	0.0001	7.00E-07
140		0.64	0.648	0.191	0.2481	0.7955	0.0001	7.00E-07
141		0.83	0.509	0.423	0.2597	0.7952	0.0001	7.00E-07
142		0.19	0.073	0.316	0.2714	0.7950	0.0001	7.00E-07
143		1.00	0.451	0.293	0.2830	0.7947	0.0001	6.99E-07
144		0.00	0.000	0.314	0.2730	0.7944	0.0001	6.99E-07
145		0.32	0.046	0.121	0.2841	0.7941	0.0001	6.99E-07
146		0.00	0.000	0.133	0.2754	0.7938	0.0001	6.99E-07
147		0.06	0.000	0.208	0.2608	0.7936	0.0001	6.98E-07
148		0.02	0.000	0.097	0.2529	0.7933	0.0001	6.98E-07
149		0.40	0.075	0.119	0.2663	0.7930	0.0001	6.98E-07
150		0.07	0.000	0.144	0.2667	0.7927	0.0001	6.98E-07
151		0.05	0.000	0.119	0.2596	0.7925	0.0001	6.97E-07
152		0.00	0.000	0.210	0.2386	0.7922	0.0001	6.97E-07

153	0.00	0.000	0.215	0.2171	0.7919	0.0001	6.97E-07
154	0.00	0.000	0.179	0.1992	0.7916	0.0001	6.97E-07
155	0.24	0.043	0.084	0.2061	0.8014	0.0001	7.05E-07
156	0.33	0.031	0.228	0.2147	0.8072	0.0001	7.09E-07
157	0.00	0.000	0.148	0.2030	0.8069	0.0001	7.09E-07
158	0.00	0.000	0.045	0.1986	0.8066	0.0001	7.09E-07
159	0.98	0.394	0.075	0.2147	0.8063	0.0001	7.09E-07
160	0.68	0.370	0.188	0.2263	0.8060	0.0001	7.08E-07
161	0.00	0.000	0.409	0.2210	0.8058	0.0001	7.08E-07
162	0.10	0.000	0.100	0.2206	0.8055	0.0001	7.08E-07
163	0.00	0.000	0.178	0.2028	0.8052	0.0001	7.08E-07
164	0.00	0.000	0.043	0.1985	0.8049	0.0001	7.08E-07
165	0.04	0.000	0.037	0.1985	0.8046	0.0001	7.07E-07
166	0.26	0.041	0.058	0.2100	0.8044	0.0001	7.07E-07
167	0.00	0.000	0.126	0.2015	0.8041	0.0001	7.07E-07
168	0.00	0.000	0.029	0.1987	0.8038	0.0001	7.07E-07
169	0.00	0.000	0.016	0.1971	0.8035	0.0001	7.06E-07
170	0.00	0.000	0.001	0.1970	0.8032	0.0001	7.06E-07
171	0.38	0.092	0.046	0.2123	0.8029	0.0001	7.06E-07
172	0.31	0.025	0.341	0.2136	0.8027	0.0001	7.06E-07
173	0.51	0.065	0.289	0.2251	0.8024	0.0001	7.05E-07
174	0.06	0.000	0.256	0.2120	0.8021	0.0001	7.05E-07
175	1.02	0.394	0.161	0.2245	0.8018	0.0001	7.05E-07
176	0.90	0.429	0.323	0.2362	0.8015	0.0001	7.05E-07
177	0.06	0.000	0.355	0.2444	0.8013	0.0001	7.05E-07
178	0.53	0.148	0.133	0.2575	0.8010	0.0001	7.04E-07
179	0.23	0.039	0.160	0.2691	0.8007	0.0001	7.04E-07
180	0.15	0.006	0.128	0.2739	0.8004	0.0001	7.04E-07
181	0.00	0.000	0.103	0.2642	0.8002	0.0001	7.04E-07
182	0.00	0.000	0.101	0.2542	0.7999	0.0001	7.03E-07
183	0.00	0.000	0.122	0.2420	0.7996	0.0001	7.03E-07
184	0.00	0.000	0.127	0.2292	0.7993	0.0001	7.03E-07

185	0.00	0.000	0.203	0.2089	0.7990	0.0001	7.03E-07
186	0.00	0.000	0.104	0.1986	0.7988	0.0001	7.03E-07
187	0.00	0.000	0.013	0.1970	0.8037	0.0001	7.07E-07
188	0.00	0.000	0.000	0.1970	0.8065	0.0001	7.09E-07
189	0.76	0.276	0.062	0.2131	0.8062	0.0001	7.09E-07
190	0.00	0.000	0.255	0.2138	0.8060	0.0001	7.08E-07
191	0.01	0.000	0.091	0.2054	0.8057	0.0001	7.08E-07
192	0.16	0.000	0.131	0.2087	0.8054	0.0001	7.08E-07
193	0.00	0.000	0.090	0.1997	0.8051	0.0001	7.08E-07
194	0.00	0.000	0.020	0.1977	0.8048	0.0001	7.07E-07
195	0.00	0.000	0.007	0.1970	0.8045	0.0001	7.07E-07
196	0.00	0.000	0.000	0.1970	0.8043	0.0001	7.07E-07
197	0.00	0.000	0.000	0.1970	0.8040	0.0001	7.07E-07
198	0.00	0.000	0.000	0.1970	0.8037	0.0001	7.07E-07
199	0.00	0.000	0.000	0.1970	0.8034	0.0001	7.06E-07
200	0.00	0.000	0.000	0.1970	0.8031	0.0001	7.06E-07
201	0.00	0.000	0.000	0.1970	0.8029	0.0001	7.06E-07
202	0.00	0.000	0.000	0.1970	0.8026	0.0001	7.06E-07
203	0.00	0.000	0.000	0.1970	0.8023	0.0001	7.05E-07
204	0.00	0.000	0.000	0.1970	0.8020	0.0001	7.05E-07
205	0.00	0.000	0.004	0.1970	0.8017	0.0001	7.05E-07
206	0.05	0.000	0.016	0.2001	0.8014	0.0001	7.05E-07
207	0.00	0.000	0.003	0.1998	0.8012	0.0001	7.05E-07
208	0.00	0.000	0.009	0.1989	0.8009	0.0001	7.04E-07
209	0.47	0.144	0.041	0.2129	0.8006	0.0001	7.04E-07
210	0.00	0.000	0.160	0.2117	0.8003	0.0001	7.04E-07
211	0.00	0.000	0.016	0.2102	0.8000	0.0001	7.04E-07
212	0.00	0.000	0.020	0.2082	0.7998	0.0001	7.03E-07
213	0.00	0.000	0.019	0.2063	0.7995	0.0001	7.03E-07
214	0.00	0.000	0.019	0.2044	0.7992	0.0001	7.03E-07
215	0.00	0.000	0.017	0.2027	0.7989	0.0001	7.03E-07
216	0.00	0.000	0.017	0.2010	0.7986	0.0001	7.02E-07

217	0.00	0.000	0.018	0.1992	0.7984	0.0001	7.02E-07
218	0.00	0.000	0.021	0.1971	0.7981	0.0001	7.02E-07
219	0.00	0.000	0.001	0.1970	0.7978	0.0001	7.02E-07
220	0.09	0.000	0.017	0.2047	0.7975	0.0001	7.02E-07
221	0.00	0.000	0.012	0.2036	0.7972	0.0001	7.01E-07
222	0.96	0.418	0.033	0.2171	0.7970	0.0001	7.01E-07
223	1.28	0.727	0.231	0.2287	0.7967	0.0001	7.01E-07
224	0.17	0.247	0.140	0.2404	0.7964	0.0001	7.01E-07
225	0.15	0.077	0.126	0.2520	0.7961	0.0001	7.00E-07
226	0.00	0.000	0.183	0.2413	0.7959	0.0001	7.00E-07
227	0.00	0.000	0.088	0.2325	0.7956	0.0001	7.00E-07
228	0.00	0.000	0.188	0.2137	0.7953	0.0001	7.00E-07
229	0.00	0.000	0.154	0.1983	0.7950	0.0001	7.00E-07
230	0.65	0.193	0.116	0.2141	0.7947	0.0001	6.99E-07
231	0.00	0.000	0.248	0.2081	0.7945	0.0001	6.99E-07
232	0.00	0.000	0.083	0.1998	0.7942	0.0001	6.99E-07
233	0.05	0.000	0.068	0.1978	0.7939	0.0001	6.99E-07
234	0.44	0.067	0.163	0.2121	0.7936	0.0001	6.98E-07
235	1.01	0.420	0.182	0.2237	0.7933	0.0001	6.98E-07
236	0.00	0.000	0.314	0.2282	0.7931	0.0001	6.98E-07
237	0.00	0.000	0.215	0.2067	0.7928	0.0001	6.98E-07
238	0.17	0.008	0.121	0.2097	0.7925	0.0001	6.98E-07
239	0.00	0.000	0.107	0.1998	0.7922	0.0001	6.97E-07
240	0.01	0.000	0.032	0.1978	0.7920	0.0001	6.97E-07
241	0.07	0.000	0.051	0.1992	0.7917	0.0001	6.97E-07
242	0.31	0.032	0.162	0.2080	0.7914	0.0001	6.97E-07
243	0.07	0.000	0.079	0.2101	0.7911	0.0001	6.96E-07
244	0.39	0.098	0.072	0.2219	0.7908	0.0001	6.96E-07
245	0.00	0.000	0.215	0.2102	0.7906	0.0001	6.96E-07
246	0.52	0.152	0.062	0.2257	0.7903	0.0001	6.96E-07
247	0.06	0.000	0.207	0.2266	0.7900	0.0001	6.96E-07
248	0.00	0.000	0.153	0.2114	0.7897	0.0001	6.95E-07

249	0.00	0.000	0.060	0.2054	0.7895	0.0001	6.95E-07
250	0.00	0.000	0.065	0.1989	0.7892	0.0001	6.95E-07
251	0.00	0.000	0.018	0.1971	0.7889	0.0001	6.95E-07
252	0.09	0.000	0.022	0.2039	0.7886	0.0001	6.94E-07
253	0.09	0.000	0.042	0.2083	0.7884	0.0001	6.94E-07
254	0.24	0.037	0.059	0.2188	0.7881	0.0001	6.94E-07
255	0.00	0.000	0.154	0.2071	0.7878	0.0001	6.94E-07
256	0.00	0.000	0.030	0.2042	0.7875	0.0001	6.94E-07
257	0.00	0.000	0.033	0.2008	0.7872	0.0001	6.93E-07
258	0.00	0.000	0.037	0.1971	0.7870	0.0001	6.93E-07
259	0.00	0.000	0.001	0.1970	0.7867	0.0001	6.93E-07
260	0.00	0.000	0.004	0.1970	0.7864	0.0001	6.93E-07
261	0.23	0.038	0.032	0.2092	0.7861	0.0001	6.92E-07
262	0.26	0.051	0.081	0.2204	0.7859	0.0001	6.92E-07
263	0.01	0.000	0.179	0.2090	0.7856	0.0001	6.92E-07
264	0.00	0.000	0.020	0.2070	0.7853	0.0001	6.92E-07
265	0.00	0.000	0.023	0.2047	0.7850	0.0001	6.92E-07
266	0.00	0.000	0.023	0.2024	0.7848	0.0001	6.91E-07
267	0.00	0.000	0.019	0.2005	0.7845	0.0001	6.91E-07
268	0.00	0.000	0.019	0.1986	0.7842	0.0001	6.91E-07
269	0.01	0.000	0.025	0.1971	0.7839	0.0001	6.91E-07
270	0.00	0.000	0.001	0.1970	0.7837	0.0001	6.90E-07
271	0.04	0.000	0.017	0.1991	0.7834	0.0001	6.90E-07
272	0.29	0.058	0.034	0.2132	0.7831	0.0001	6.90E-07
273	0.35	0.098	0.092	0.2246	0.7828	0.0001	6.90E-07
274	0.31	0.026	0.341	0.2258	0.7826	0.0001	6.90E-07
275	0.29	0.034	0.158	0.2349	0.7823	0.0001	6.89E-07
276	0.25	0.026	0.294	0.2288	0.7820	0.0001	6.89E-07
277	0.35	0.024	0.387	0.2228	0.7818	0.0001	6.89E-07
278	0.00	0.000	0.112	0.2144	0.7815	0.0001	6.89E-07
279	0.00	0.000	0.126	0.2019	0.7812	0.0001	6.88E-07
280	0.00	0.000	0.039	0.1980	0.7809	0.0001	6.88E-07

281		0.00	0.000	0.010	0.1970	0.7807	0.0001	6.88E-07
282		0.00	0.000	0.000	0.1970	0.7804	0.0001	6.88E-07
283		0.41	0.099	0.055	0.2129	0.7801	0.0001	6.88E-07
284		0.00	0.000	0.160	0.2069	0.7798	0.0001	6.87E-07
285		0.00	0.000	0.023	0.2046	0.7796	0.0001	6.87E-07
286		0.00	0.000	0.021	0.2025	0.7793	0.0001	6.87E-07
287		0.00	0.000	0.019	0.2006	0.7790	0.0001	6.87E-07
288		0.09	0.000	0.036	0.2060	0.7787	0.0001	6.86E-07
289		0.07	0.000	0.037	0.2095	0.7785	0.0001	6.86E-07
290		0.04	0.000	0.035	0.2104	0.7782	0.0001	6.86E-07
291		0.00	0.000	0.015	0.2089	0.7779	0.0001	6.86E-07
292		0.00	0.000	0.011	0.2079	0.7777	0.0001	6.86E-07
293		0.00	0.000	0.013	0.2065	0.7774	0.0001	6.85E-07
294		0.15	0.007	0.029	0.2174	0.7771	0.0001	6.85E-07
295		0.08	0.000	0.034	0.2226	0.7768	0.0001	6.85E-07
296		0.03	0.000	0.064	0.2191	0.7766	0.0001	6.85E-07
297		0.00	0.000	0.014	0.2179	0.7763	0.0001	6.84E-07
298		0.00	0.000	0.013	0.2166	0.7760	0.0001	6.84E-07
299	*	0.03	0.000	0.037	0.2155	0.7758	0.0001	6.84E-07
300	*	0.00	0.000	0.011	0.2144	0.7755	0.0001	6.84E-07
301		0.00	0.000	0.011	0.2133	0.7752	0.0001	6.84E-07
302		0.00	0.000	0.011	0.2123	0.7749	0.0001	6.83E-07
303		0.03	0.000	0.024	0.2126	0.7747	0.0001	6.83E-07
304		0.01	0.000	0.019	0.2119	0.7744	0.0001	6.83E-07
305		0.00	0.000	0.011	0.2109	0.7741	0.0001	6.83E-07
306		0.00	0.000	0.012	0.2097	0.7739	0.0001	6.82E-07
307	*	0.00	0.000	0.000	0.2097	0.7736	0.0001	6.82E-07
308	*	0.00	0.000	0.010	0.2087	0.7733	0.0001	6.82E-07
309		0.15	0.006	0.027	0.2197	0.7730	0.0001	6.82E-07
310		0.00	0.000	0.018	0.2186	0.7728	0.0001	6.82E-07
311	*	0.00	0.000	0.000	0.2186	0.7725	0.0001	6.81E-07
312	*	0.07	0.000	0.037	0.2206	0.7722	0.0001	6.81E-07

313	*	0.00	0.000	0.016	0.2206	0.7720	0.0001	6.81E-07
314	*	0.00	0.000	0.000	0.2206	0.7717	0.0001	6.81E-07
315		0.02	0.000	0.023	0.2205	0.7714	0.0001	6.81E-07
316		0.00	0.000	0.011	0.2195	0.7711	0.0001	6.80E-07
317		0.23	0.037	0.026	0.2322	0.7709	0.0001	6.80E-07
318		0.00	0.000	0.075	0.2284	0.7706	0.0001	6.80E-07
319		0.00	0.000	0.074	0.2210	0.7703	0.0001	6.80E-07
320		0.00	0.000	0.086	0.2124	0.7701	0.0001	6.79E-07
321		0.54	0.155	0.074	0.2276	0.7698	0.0001	6.79E-07
322		0.00	0.000	0.085	0.2345	0.7695	0.0001	6.79E-07
323		0.00	0.000	0.036	0.2309	0.7693	0.0001	6.79E-07
324		0.99	0.437	0.057	0.2446	0.7690	0.0001	6.79E-07
325		0.22	0.194	0.070	0.2562	0.7687	0.0001	6.78E-07
326	*	0.00	0.000	0.053	0.2562	0.7684	0.0001	6.78E-07
327		0.00	0.000	0.000	0.2563	0.7682	0.0001	6.78E-07
328		0.00	0.000	0.000	0.2563	0.7679	0.0001	6.78E-07
329		0.00	0.000	0.000	0.2563	0.7676	0.0001	6.77E-07
330		0.00	0.000	0.000	0.2563	0.7674	0.0001	6.77E-07
331	*	0.00	0.000	0.048	0.2563	0.7671	0.0001	6.77E-07
332		0.00	0.000	0.000	0.2563	0.7668	0.0001	6.77E-07
333		0.38	0.122	0.000	0.2698	0.7666	0.0001	6.77E-07
334		0.62	0.288	0.000	0.2815	0.7663	0.0001	6.76E-07
335		1.31	0.791	0.000	0.2931	0.7660	0.0001	6.76E-07
336		0.00	0.000	0.000	0.2931	0.7658	0.0001	6.76E-07
337	*	0.00	0.000	0.030	0.2931	0.7655	0.0001	6.76E-07
338		0.02	0.000	0.000	0.2951	0.7652	0.0001	6.76E-07
339	*	0.00	0.000	0.033	0.2951	0.7650	0.0001	6.75E-07
340	*	0.00	0.000	0.030	0.2951	0.7647	0.0001	6.75E-07
341	*	0.54	0.282	0.000	0.3083	0.7644	0.0001	6.75E-07
342	*	0.26	0.061	0.010	0.3199	0.7642	0.0001	6.75E-07
343		0.00	0.260	0.000	0.3316	0.7639	0.0001	6.74E-07
344	*	0.00	0.001	0.019	0.3432	0.7636	0.0001	6.74E-07

345			0.00	0.177	0.012	0.3548	0.7633	0.0001	6.74E-07
346			0.00	0.000	0.094	0.3568	0.7631	0.0001	6.74E-07
347			0.00	0.000	0.044	0.3525	0.7628	0.0001	6.74E-07
348			0.07	0.000	0.051	0.3512	0.7843	0.0001	6.91E-07
349	*		0.00	0.000	0.033	0.3437	0.8989	0.0001	7.83E-07
350	*		0.00	0.000	0.000	0.3389	1.0222	0.0001	8.81E-07
351	*		0.00	0.000	0.000	0.3348	1.1719	0.0001	9.98E-07
352	*		0.00	0.000	0.000	0.3316	1.3073	0.0001	1.10E-06
353	*		0.00	0.000	0.000	0.3287	1.3984	0.0002	1.17E-06
354	*		0.00	0.000	0.000	0.3264	1.4835	0.0002	1.24E-06
355	*		0.00	0.000	0.000	0.3243	1.5522	0.0002	1.29E-06
356	*		0.00	0.000	0.000	0.3224	1.6146	0.0002	1.34E-06
357			0.00	0.000	0.063	0.3144	1.6665	0.0002	1.38E-06
358	*		0.00	0.000	0.038	0.3094	1.7103	0.0002	1.41E-06
359			0.03	0.000	0.079	0.3033	1.7555	0.0002	1.45E-06
360			0.06	0.000	0.093	0.2991	1.7974	0.0002	1.48E-06
361			0.00	0.000	0.068	0.2918	1.8236	0.0002	1.50E-06
362			0.00	0.000	0.050	0.2866	1.8349	0.0002	1.51E-06
363			0.00	0.000	0.043	0.2823	1.8362	0.0002	1.51E-06
364	*		0.05	0.000	0.026	0.2843	1.8356	0.0002	1.51E-06
365	*	*	0.00	0.000	0.005	0.2843	1.8349	0.0002	1.51E-06

* = Frozen (air or soil)

Annual Totals for Year 13			
	inches	cubic feet	percent
Precipitation	46.59	169,134.1	100.00
Runoff	18.392	66,762.0	39.47
Evapotranspiration	27.002	98,016.7	57.95
Recirculation into Layer 1	0.0345	125.3	0.07
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0345	125.3	0.07
Percolation/Leakage through Layer 5	0.000266	0.9671	0.00
Average Head on Top of Layer 4	0.8339	---	---
Change in Water Storage	1.1994	4,354.0	2.57
Soil Water at Start of Year	293.2134	1,064,364.7	629.30
Soil Water at End of Year	294.4129	1,068,718.7	631.88
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0344	-124.9	-0.07

Daily Output for Year 14

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1		*	0.00	0.000	0.000	0.2843	1.8343	0.0002	1.51E-06
2	*	*	0.44	0.000	0.017	0.2843	1.8336	0.0002	1.51E-06
3	*	*	0.03	0.000	0.010	0.2843	1.8330	0.0002	1.51E-06
4		*	0.00	0.000	0.000	0.2844	1.8324	0.0002	1.50E-06
5	*	*	0.00	0.000	0.033	0.2844	1.8317	0.0002	1.50E-06
6		*	0.00	0.090	0.031	0.2892	1.8311	0.0002	1.50E-06
7		*	0.00	0.100	0.057	0.2893	1.8304	0.0002	1.50E-06
8	*	*	0.00	0.000	0.042	0.2893	1.8298	0.0002	1.50E-06
9		*	0.00	0.000	0.000	0.2893	1.8291	0.0002	1.50E-06
10		*	0.00	0.000	0.039	0.2893	1.8285	0.0002	1.50E-06
11			0.00	0.000	0.050	0.2837	1.8329	0.0002	1.51E-06
12			0.00	0.000	0.091	0.2741	1.8502	0.0002	1.52E-06
13			0.00	0.000	0.060	0.2681	1.8610	0.0002	1.53E-06
14			0.00	0.000	0.058	0.2623	1.8604	0.0002	1.53E-06
15	*		0.00	0.000	0.000	0.2624	1.8597	0.0002	1.53E-06
16	*	*	0.00	0.000	0.000	0.2624	1.8591	0.0002	1.53E-06
17	*	*	0.00	0.000	0.000	0.2624	1.8584	0.0002	1.52E-06
18	*	*	0.00	0.000	0.000	0.2624	1.8578	0.0002	1.52E-06
19		*	0.00	0.000	0.000	0.2624	1.8571	0.0002	1.52E-06
20	*	*	0.00	0.000	0.000	0.2625	1.8565	0.0002	1.52E-06
21	*	*	0.00	0.000	0.000	0.2625	1.8558	0.0002	1.52E-06
22	*	*	0.00	0.000	0.000	0.2625	1.8552	0.0002	1.52E-06
23	*	*	0.00	0.000	0.000	0.2625	1.8545	0.0002	1.52E-06
24	*	*	0.02	0.000	0.017	0.2626	1.8539	0.0002	1.52E-06

25		*	0.00	0.000	0.000	0.2626	1.8532	0.0002	1.52E-06
26		*	0.00	0.000	0.000	0.2626	1.8526	0.0002	1.52E-06
27	*	*	0.00	0.000	0.000	0.2626	1.8519	0.0002	1.52E-06
28	*	*	0.70	0.000	0.011	0.2626	1.8513	0.0002	1.52E-06
29	*	*	0.00	0.000	0.014	0.2627	1.8506	0.0002	1.52E-06
30		*	0.00	0.277	0.011	0.2673	1.8500	0.0002	1.52E-06
31		*	0.00	0.165	0.051	0.2673	1.8493	0.0002	1.52E-06
32	*	*	0.04	0.000	0.024	0.2758	1.8487	0.0002	1.52E-06
33	*	*	0.02	0.000	0.038	0.2758	1.8480	0.0002	1.52E-06
34	*	*	0.00	0.000	0.026	0.2758	1.8474	0.0002	1.52E-06
35	*	*	0.00	0.000	0.000	0.2758	1.8467	0.0002	1.52E-06
36	*	*	0.00	0.000	0.000	0.2759	1.8461	0.0002	1.52E-06
37	*	*	0.00	0.000	0.000	0.2759	1.8454	0.0002	1.51E-06
38	*	*	0.00	0.000	0.000	0.2759	1.8448	0.0002	1.51E-06
39		*	0.00	0.000	0.000	0.2759	1.8442	0.0002	1.51E-06
40		*	0.11	0.000	0.009	0.2855	1.8435	0.0002	1.51E-06
41		*	0.10	0.001	0.009	0.2947	1.8429	0.0002	1.51E-06
42			0.03	0.000	0.106	0.2871	1.8422	0.0002	1.51E-06
43			0.00	0.000	0.083	0.2788	1.8416	0.0002	1.51E-06
44	*		0.75	0.000	0.042	0.2808	1.8409	0.0002	1.51E-06
45	*	*	0.00	0.000	0.019	0.2809	1.8403	0.0002	1.51E-06
46	*	*	0.00	0.000	0.023	0.2809	1.8396	0.0002	1.51E-06
47		*	0.00	0.389	0.018	0.2820	1.8390	0.0002	1.51E-06
48		*	0.00	0.000	0.193	0.2858	1.8384	0.0002	1.51E-06
49		*	0.00	0.000	0.000	0.2858	1.8377	0.0002	1.51E-06
50	*	*	0.00	0.000	0.000	0.2858	1.8371	0.0002	1.51E-06
51		*	0.00	0.000	0.000	0.2859	1.8364	0.0002	1.51E-06
52			0.00	0.000	0.067	0.2792	1.8358	0.0002	1.51E-06
53			0.00	0.000	0.164	0.2625	1.8396	0.0002	1.51E-06
54			1.08	0.425	0.135	0.2779	1.8405	0.0002	1.51E-06
55			0.00	0.003	0.245	0.2895	1.8398	0.0002	1.51E-06
56			0.16	0.008	0.195	0.2842	1.8392	0.0002	1.51E-06

57		0.26	0.032	0.168	0.2874	1.8386	0.0002	1.51E-06
58		0.04	0.000	0.243	0.2704	1.8379	0.0002	1.51E-06
59		0.00	0.000	0.234	0.2471	1.8373	0.0002	1.51E-06
60		0.13	0.000	0.259	0.2344	1.8366	0.0002	1.51E-06
61		0.00	0.000	0.123	0.2222	1.8360	0.0002	1.51E-06
62		0.00	0.000	0.090	0.2132	1.8353	0.0002	1.51E-06
63		0.07	0.000	0.106	0.2096	1.8347	0.0002	1.51E-06
64	*	0.07	0.000	0.037	0.2116	1.8341	0.0002	1.51E-06
65		0.00	0.000	0.073	0.2025	1.8720	0.0002	1.53E-06
66		0.00	0.000	0.030	0.1994	1.9389	0.0002	1.59E-06
67		0.00	0.000	0.012	0.1982	1.9401	0.0002	1.59E-06
68		0.00	0.000	0.009	0.1974	1.9395	0.0002	1.59E-06
69		0.00	0.000	0.002	0.1971	1.9388	0.0002	1.59E-06
70		0.00	0.000	0.001	0.1970	1.9381	0.0002	1.58E-06
71		0.00	0.000	0.000	0.1970	1.9374	0.0002	1.58E-06
72		0.00	0.000	0.000	0.1970	1.9367	0.0002	1.58E-06
73		0.00	0.000	0.000	0.1970	1.9361	0.0002	1.58E-06
74		0.00	0.000	0.000	0.1970	1.9354	0.0002	1.58E-06
75		0.00	0.000	0.000	0.1970	1.9347	0.0002	1.58E-06
76		0.00	0.000	0.000	0.1970	1.9340	0.0002	1.58E-06
77		0.00	0.000	0.000	0.1970	1.9333	0.0002	1.58E-06
78		0.00	0.000	0.000	0.1970	1.9327	0.0002	1.58E-06
79		0.00	0.000	0.000	0.1970	1.9320	0.0002	1.58E-06
80	*	0.01	0.000	0.010	0.1970	1.9313	0.0002	1.58E-06
81	*	0.06	0.000	0.058	0.1970	1.9306	0.0002	1.58E-06
82	*	0.00	0.000	0.000	0.1970	1.9300	0.0002	1.58E-06
83		0.00	0.000	0.000	0.1970	1.9293	0.0002	1.58E-06
84	*	0.70	0.000	0.040	0.1990	1.9286	0.0002	1.58E-06
85		0.06	0.260	0.039	0.2134	1.9279	0.0002	1.58E-06
86		0.00	0.000	0.154	0.2233	1.9273	0.0002	1.58E-06
87		0.39	0.062	0.138	0.2366	1.9266	0.0002	1.58E-06
88	*	0.00	0.000	0.103	0.2326	1.9259	0.0002	1.58E-06

89	*	0.00	0.000	0.005	0.2327	1.9253	0.0002	1.57E-06
90	*	0.16	0.000	0.050	0.2347	1.9246	0.0002	1.57E-06
91	*	0.10	0.000	0.078	0.2366	1.9239	0.0002	1.57E-06
92	*	0.37	0.000	0.022	0.2386	1.9232	0.0002	1.57E-06
93	*	0.00	0.000	0.018	0.2406	1.9226	0.0002	1.57E-06
94		0.00	0.114	0.032	0.2534	1.9219	0.0002	1.57E-06
95		0.00	0.000	0.090	0.2555	1.9212	0.0002	1.57E-06
96		0.00	0.000	0.101	0.2455	1.9205	0.0002	1.57E-06
97		0.00	0.000	0.132	0.2322	1.9199	0.0002	1.57E-06
98	*	0.00	0.000	0.062	0.2260	1.9193	0.0002	1.57E-06
99		0.10	0.000	0.098	0.2261	1.9186	0.0002	1.57E-06
100		0.00	0.000	0.153	0.2108	1.9179	0.0002	1.57E-06
101		0.00	0.000	0.124	0.1984	1.9172	0.0002	1.57E-06
102		0.00	0.000	0.009	0.1976	1.9166	0.0002	1.57E-06
103		0.04	0.000	0.017	0.1995	1.9159	0.0002	1.57E-06
104		0.06	0.000	0.011	0.2046	1.9152	0.0002	1.57E-06
105		1.30	0.616	0.044	0.2184	1.9146	0.0002	1.57E-06
106		0.00	0.068	0.252	0.2300	1.9139	0.0002	1.57E-06
107		0.00	0.000	0.127	0.2241	1.9132	0.0002	1.57E-06
108		0.00	0.000	0.110	0.2132	1.9125	0.0002	1.57E-06
109		0.00	0.000	0.134	0.1998	1.9119	0.0002	1.56E-06
110		0.07	0.000	0.047	0.2019	1.9112	0.0002	1.56E-06
111		0.08	0.000	0.029	0.2070	1.9105	0.0002	1.56E-06
112		0.67	0.181	0.185	0.2203	1.9099	0.0002	1.56E-06
113		0.00	0.000	0.201	0.2174	1.9104	0.0002	1.56E-06
114		0.21	0.026	0.098	0.2231	1.9105	0.0002	1.56E-06
115		0.00	0.000	0.119	0.2138	1.9098	0.0002	1.56E-06
116		0.00	0.000	0.097	0.2042	1.9091	0.0002	1.56E-06
117		0.63	0.102	0.272	0.2202	1.9085	0.0002	1.56E-06
118		0.05	0.000	0.223	0.2129	1.9078	0.0002	1.56E-06
119		0.12	0.000	0.138	0.2108	1.9072	0.0002	1.56E-06
120		0.01	0.000	0.097	0.2024	1.9065	0.0002	1.56E-06

121	0.39	0.054	0.145	0.2164	1.9058	0.0002	1.56E-06
122	0.00	0.000	0.196	0.2023	1.9052	0.0002	1.56E-06
123	0.13	0.000	0.067	0.2084	1.9045	0.0002	1.56E-06
124	0.02	0.000	0.060	0.2047	1.9038	0.0002	1.56E-06
125	0.00	0.000	0.048	0.1999	1.9032	0.0002	1.56E-06
126	0.10	0.000	0.034	0.2063	1.9025	0.0002	1.56E-06
127	0.01	0.000	0.026	0.2043	1.9018	0.0002	1.56E-06
128	0.00	0.000	0.024	0.2019	1.9012	0.0002	1.56E-06
129	0.26	0.039	0.041	0.2156	1.9005	0.0002	1.56E-06
130	0.01	0.000	0.077	0.2128	1.8998	0.0002	1.56E-06
131	0.00	0.000	0.023	0.2105	1.8992	0.0002	1.56E-06
132	0.00	0.000	0.020	0.2086	1.8985	0.0002	1.55E-06
133	0.00	0.000	0.018	0.2068	1.8978	0.0002	1.55E-06
134	0.00	0.000	0.018	0.2051	1.8972	0.0002	1.55E-06
135	0.00	0.000	0.017	0.2034	1.8965	0.0002	1.55E-06
136	0.14	0.000	0.023	0.2148	1.8958	0.0002	1.55E-06
137	0.00	0.000	0.018	0.2130	1.8952	0.0002	1.55E-06
138	0.00	0.000	0.017	0.2113	1.8945	0.0002	1.55E-06
139	0.00	0.000	0.015	0.2098	1.8938	0.0002	1.55E-06
140	0.61	0.221	0.026	0.2244	1.8932	0.0002	1.55E-06
141	0.00	0.000	0.265	0.2197	1.8925	0.0002	1.55E-06
142	0.01	0.000	0.189	0.2016	1.8919	0.0002	1.55E-06
143	0.00	0.000	0.045	0.1972	1.8912	0.0002	1.55E-06
144	0.22	0.031	0.067	0.2057	1.8905	0.0002	1.55E-06
145	0.03	0.000	0.065	0.2055	1.8899	0.0002	1.55E-06
146	0.00	0.000	0.033	0.2023	1.8892	0.0002	1.55E-06
147	0.01	0.000	0.034	0.2004	1.8886	0.0002	1.55E-06
148	0.17	0.013	0.028	0.2122	1.8879	0.0002	1.55E-06
149	0.07	0.000	0.036	0.2169	1.8872	0.0002	1.55E-06
150	0.17	0.017	0.021	0.2290	1.8866	0.0002	1.55E-06
151	0.00	0.000	0.036	0.2271	1.8859	0.0002	1.55E-06
152	0.49	0.166	0.032	0.2402	1.8853	0.0002	1.54E-06

153	0.04	0.000	0.166	0.2435	1.8846	0.0002	1.54E-06
154	0.00	0.000	0.133	0.2302	1.8839	0.0002	1.54E-06
155	0.00	0.000	0.256	0.2047	1.8833	0.0002	1.54E-06
156	0.00	0.000	0.070	0.1977	1.8826	0.0002	1.54E-06
157	0.00	0.000	0.004	0.1974	1.8820	0.0002	1.54E-06
158	0.00	0.000	0.004	0.1970	1.8813	0.0002	1.54E-06
159	0.00	0.000	0.004	0.1970	1.8807	0.0002	1.54E-06
160	1.25	0.571	0.042	0.2132	1.8800	0.0002	1.54E-06
161	0.00	0.000	0.478	0.2133	1.8793	0.0002	1.54E-06
162	1.21	0.378	0.429	0.2273	1.8787	0.0002	1.54E-06
163	0.05	0.000	0.218	0.2371	1.8780	0.0002	1.54E-06
164	1.13	0.406	0.353	0.2498	1.8774	0.0002	1.54E-06
165	0.28	0.127	0.164	0.2614	1.8767	0.0002	1.54E-06
166	0.00	0.000	0.156	0.2582	1.8760	0.0002	1.54E-06
167	0.00	0.000	0.210	0.2372	1.8754	0.0002	1.54E-06
168	0.00	0.000	0.215	0.2157	1.8747	0.0002	1.54E-06
169	0.00	0.000	0.164	0.1994	1.8741	0.0002	1.54E-06
170	0.38	0.051	0.151	0.2125	1.8734	0.0002	1.54E-06
171	0.00	0.000	0.168	0.2008	1.8728	0.0002	1.54E-06
172	0.00	0.000	0.031	0.1977	1.8721	0.0002	1.53E-06
173	0.21	0.030	0.034	0.2088	1.8715	0.0002	1.53E-06
174	0.00	0.000	0.049	0.2070	1.8708	0.0002	1.53E-06
175	0.04	0.000	0.032	0.2083	1.8701	0.0002	1.53E-06
176	0.74	0.292	0.040	0.2217	1.8695	0.0002	1.53E-06
177	0.29	0.032	0.440	0.2276	1.8688	0.0002	1.53E-06
178	0.00	0.000	0.253	0.2055	1.8682	0.0002	1.53E-06
179	0.00	0.000	0.076	0.1980	1.8675	0.0002	1.53E-06
180	0.00	0.000	0.007	0.1972	1.8669	0.0002	1.53E-06
181	0.16	0.007	0.034	0.2085	1.8662	0.0002	1.53E-06
182	0.22	0.036	0.051	0.2184	1.8656	0.0002	1.53E-06
183	0.92	0.410	0.083	0.2299	1.8649	0.0002	1.53E-06
184	0.05	0.000	0.290	0.2409	1.8643	0.0002	1.53E-06

185	0.00	0.000	0.188	0.2221	1.8636	0.0002	1.53E-06
186	0.07	0.000	0.122	0.2173	1.8630	0.0002	1.53E-06
187	0.61	0.193	0.111	0.2295	1.8623	0.0002	1.53E-06
188	0.23	0.032	0.342	0.2307	1.8616	0.0002	1.53E-06
189	0.00	0.000	0.232	0.2108	1.8610	0.0002	1.53E-06
190	0.00	0.000	0.082	0.2026	1.8603	0.0002	1.53E-06
191	0.01	0.000	0.058	0.1983	1.8597	0.0002	1.53E-06
192	0.00	0.000	0.007	0.1977	1.8590	0.0002	1.53E-06
193	0.00	0.000	0.003	0.1973	1.8584	0.0002	1.52E-06
194	1.41	0.652	0.074	0.2129	1.8577	0.0002	1.52E-06
195	0.01	0.037	0.344	0.2246	1.8571	0.0002	1.52E-06
196	0.00	0.000	0.114	0.2169	1.8564	0.0002	1.52E-06
197	0.00	0.000	0.101	0.2069	1.8558	0.0002	1.52E-06
198	0.13	0.000	0.095	0.2102	1.8551	0.0002	1.52E-06
199	0.09	0.000	0.119	0.2077	1.8545	0.0002	1.52E-06
200	0.00	0.000	0.079	0.1998	1.8538	0.0002	1.52E-06
201	0.02	0.000	0.041	0.1980	1.8532	0.0002	1.52E-06
202	0.00	0.000	0.009	0.1972	1.8525	0.0002	1.52E-06
203	0.00	0.000	0.001	0.1971	1.8519	0.0002	1.52E-06
204	0.00	0.000	0.001	0.1970	1.8512	0.0002	1.52E-06
205	0.15	0.001	0.026	0.2090	1.8506	0.0002	1.52E-06
206	0.00	0.000	0.017	0.2074	1.8499	0.0002	1.52E-06
207	0.00	0.000	0.024	0.2050	1.8493	0.0002	1.52E-06
208	0.00	0.000	0.027	0.2028	1.8487	0.0002	1.52E-06
209	0.00	0.000	0.022	0.2006	1.8480	0.0002	1.52E-06
210	0.00	0.000	0.023	0.1984	1.8474	0.0002	1.52E-06
211	0.00	0.000	0.011	0.1973	1.8467	0.0002	1.52E-06
212	0.29	0.064	0.034	0.2105	1.8461	0.0002	1.52E-06
213	0.15	0.014	0.086	0.2210	1.8454	0.0002	1.51E-06
214	0.67	0.277	0.043	0.2324	1.8448	0.0002	1.51E-06
215	0.00	0.000	0.270	0.2306	1.8441	0.0002	1.51E-06
216	0.07	0.000	0.143	0.2233	1.8435	0.0002	1.51E-06

217	0.00	0.000	0.125	0.2113	1.8428	0.0002	1.51E-06
218	0.58	0.142	0.151	0.2263	1.8422	0.0002	1.51E-06
219	0.04	0.000	0.179	0.2268	1.8415	0.0002	1.51E-06
220	0.00	0.000	0.266	0.2002	1.8409	0.0002	1.51E-06
221	0.00	0.000	0.031	0.1971	1.8403	0.0002	1.51E-06
222	0.00	0.000	0.001	0.1971	1.8396	0.0002	1.51E-06
223	0.50	0.098	0.152	0.2126	1.8390	0.0002	1.51E-06
224	0.00	0.000	0.201	0.2023	1.8383	0.0002	1.51E-06
225	0.00	0.000	0.037	0.1986	1.8377	0.0002	1.51E-06
226	0.00	0.000	0.016	0.1970	1.8370	0.0002	1.51E-06
227	0.00	0.000	0.000	0.1970	1.8364	0.0002	1.51E-06
228	0.00	0.000	0.000	0.1970	1.8357	0.0002	1.51E-06
229	0.00	0.000	0.000	0.1970	1.8351	0.0002	1.51E-06
230	0.00	0.000	0.000	0.1970	1.8345	0.0002	1.51E-06
231	0.50	0.149	0.037	0.2131	1.8338	0.0002	1.51E-06
232	0.01	0.000	0.171	0.2118	1.8332	0.0002	1.51E-06
233	0.00	0.000	0.119	0.1999	1.8325	0.0002	1.51E-06
234	0.00	0.000	0.024	0.1975	1.8319	0.0002	1.50E-06
235	0.01	0.000	0.017	0.1971	1.8312	0.0002	1.50E-06
236	0.00	0.000	0.001	0.1971	1.8306	0.0002	1.50E-06
237	0.38	0.090	0.050	0.2120	1.8300	0.0002	1.50E-06
238	0.07	0.000	0.117	0.2162	1.8293	0.0002	1.50E-06
239	0.25	0.045	0.048	0.2275	1.8287	0.0002	1.50E-06
240	0.21	0.037	0.086	0.2366	1.8280	0.0002	1.50E-06
241	0.00	0.000	0.121	0.2283	1.8274	0.0002	1.50E-06
242	0.00	0.000	0.145	0.2138	1.8268	0.0002	1.50E-06
243	0.00	0.000	0.121	0.2017	1.8261	0.0002	1.50E-06
244	0.00	0.000	0.041	0.1976	1.8255	0.0002	1.50E-06
245	0.00	0.000	0.003	0.1973	1.8248	0.0002	1.50E-06
246	0.39	0.094	0.051	0.2124	1.8242	0.0002	1.50E-06
247	0.00	0.000	0.110	0.2108	1.8236	0.0002	1.50E-06
248	0.19	0.024	0.029	0.2224	1.8230	0.0002	1.50E-06

249	0.01	0.000	0.079	0.2174	1.8223	0.0002	1.50E-06
250	0.06	0.000	0.031	0.2200	1.8217	0.0002	1.50E-06
251	0.00	0.000	0.027	0.2173	1.8211	0.0002	1.50E-06
252	0.00	0.000	0.022	0.2151	1.8204	0.0002	1.50E-06
253	0.00	0.000	0.021	0.2131	1.8198	0.0002	1.50E-06
254	0.63	0.231	0.036	0.2271	1.8191	0.0002	1.49E-06
255	0.42	0.172	0.183	0.2387	1.8185	0.0002	1.49E-06
256	0.00	0.000	0.134	0.2424	1.8179	0.0002	1.49E-06
257	0.00	0.000	0.093	0.2332	1.8172	0.0002	1.49E-06
258	0.00	0.000	0.281	0.2051	1.8166	0.0002	1.49E-06
259	0.00	0.000	0.071	0.1980	1.8160	0.0002	1.49E-06
260	0.00	0.000	0.005	0.1975	1.8153	0.0002	1.49E-06
261	0.00	0.000	0.005	0.1970	1.8147	0.0002	1.49E-06
262	0.00	0.000	0.000	0.1970	1.8141	0.0002	1.49E-06
263	0.00	0.000	0.000	0.1970	1.8134	0.0002	1.49E-06
264	0.00	0.000	0.000	0.1970	1.8128	0.0002	1.49E-06
265	0.00	0.000	0.000	0.1970	1.8122	0.0002	1.49E-06
266	0.00	0.000	0.000	0.1970	1.8115	0.0002	1.49E-06
267	0.00	0.000	0.000	0.1970	1.8109	0.0002	1.49E-06
268	0.00	0.000	0.000	0.1970	1.8102	0.0002	1.49E-06
269	0.00	0.000	0.001	0.1970	1.8096	0.0002	1.49E-06
270	0.00	0.000	0.000	0.1970	1.8090	0.0002	1.49E-06
271	0.00	0.000	0.000	0.1970	1.8083	0.0002	1.49E-06
272	0.00	0.000	0.000	0.1970	1.8077	0.0002	1.49E-06
273	0.00	0.000	0.000	0.1970	1.8071	0.0002	1.49E-06
274	0.41	0.110	0.029	0.2132	1.8064	0.0002	1.49E-06
275	0.01	0.000	0.125	0.2130	1.8058	0.0002	1.48E-06
276	0.00	0.000	0.014	0.2117	1.8052	0.0002	1.48E-06
277	0.00	0.000	0.014	0.2103	1.8045	0.0002	1.48E-06
278	0.00	0.000	0.013	0.2090	1.8039	0.0002	1.48E-06
279	0.00	0.000	0.012	0.2078	1.8033	0.0002	1.48E-06
280	0.00	0.000	0.012	0.2067	1.8027	0.0002	1.48E-06

281		0.14	0.006	0.020	0.2179	1.8020	0.0002	1.48E-06
282		0.00	0.000	0.019	0.2166	1.8014	0.0002	1.48E-06
283	*	0.00	0.000	0.012	0.2154	1.8008	0.0002	1.48E-06
284		0.00	0.000	0.011	0.2143	1.8001	0.0002	1.48E-06
285		0.00	0.000	0.011	0.2133	1.7995	0.0002	1.48E-06
286		0.00	0.000	0.010	0.2123	1.7989	0.0002	1.48E-06
287		1.34	0.653	0.023	0.2264	1.7982	0.0002	1.48E-06
288		0.00	0.119	0.173	0.2380	1.7976	0.0002	1.48E-06
289		0.00	0.000	0.240	0.2259	1.7970	0.0002	1.48E-06
290		0.00	0.000	0.165	0.2094	1.7963	0.0002	1.48E-06
291		0.00	0.000	0.086	0.2008	1.7957	0.0002	1.48E-06
292		0.00	0.000	0.038	0.1971	1.7951	0.0002	1.48E-06
293		0.00	0.000	0.001	0.1970	1.7945	0.0002	1.48E-06
294		0.00	0.000	0.000	0.1970	1.7938	0.0002	1.48E-06
295		0.00	0.000	0.000	0.1970	1.7932	0.0002	1.48E-06
296		0.00	0.000	0.000	0.1970	1.7926	0.0002	1.47E-06
297		0.00	0.000	0.000	0.1970	1.7920	0.0002	1.47E-06
298		0.00	0.000	0.000	0.1970	1.7913	0.0002	1.47E-06
299		0.00	0.000	0.000	0.1970	1.7907	0.0002	1.47E-06
300		0.60	0.202	0.037	0.2133	1.7901	0.0002	1.47E-06
301		0.00	0.007	0.069	0.2249	1.7894	0.0002	1.47E-06
302		0.00	0.000	0.074	0.2183	1.7888	0.0002	1.47E-06
303		0.00	0.000	0.054	0.2129	1.7882	0.0002	1.47E-06
304		0.00	0.000	0.096	0.2033	1.7876	0.0002	1.47E-06
305		0.00	0.000	0.061	0.1973	1.7869	0.0002	1.47E-06
306	*	0.22	0.000	0.027	0.1993	1.7863	0.0002	1.47E-06
307	*	0.00	0.000	0.032	0.2013	1.7857	0.0002	1.47E-06
308		0.00	0.000	0.091	0.2048	1.7851	0.0002	1.47E-06
309		0.00	0.000	0.026	0.2022	1.7844	0.0002	1.47E-06
310		0.00	0.000	0.029	0.1993	1.7838	0.0002	1.47E-06
311		0.00	0.000	0.012	0.1982	1.7832	0.0002	1.47E-06
312		0.00	0.000	0.009	0.1973	1.7826	0.0002	1.47E-06

313		0.00	0.000	0.002	0.1971	1.7819	0.0002	1.47E-06
314		0.00	0.000	0.001	0.1970	1.7813	0.0002	1.47E-06
315		0.00	0.000	0.000	0.1970	1.7807	0.0002	1.47E-06
316		0.00	0.000	0.000	0.1970	1.7801	0.0002	1.47E-06
317		0.00	0.000	0.000	0.1970	1.7794	0.0002	1.46E-06
318		0.00	0.000	0.000	0.1970	1.7788	0.0002	1.46E-06
319		0.42	0.114	0.030	0.2133	1.7782	0.0002	1.46E-06
320		0.54	0.202	0.135	0.2249	1.7776	0.0002	1.46E-06
321		0.05	0.000	0.147	0.2351	1.7770	0.0002	1.46E-06
322		0.09	0.000	0.099	0.2338	1.7763	0.0002	1.46E-06
323		0.02	0.000	0.149	0.2209	1.7757	0.0002	1.46E-06
324		0.00	0.000	0.092	0.2117	1.7751	0.0002	1.46E-06
325		0.00	0.000	0.099	0.2018	1.7745	0.0002	1.46E-06
326		0.00	0.000	0.041	0.1977	1.7738	0.0002	1.46E-06
327		0.00	0.000	0.005	0.1972	1.7732	0.0002	1.46E-06
328		0.00	0.000	0.002	0.1970	1.7726	0.0002	1.46E-06
329		0.00	0.000	0.000	0.1970	1.7720	0.0002	1.46E-06
330		0.00	0.000	0.000	0.1970	1.7714	0.0002	1.46E-06
331		0.00	0.000	0.000	0.1970	1.7707	0.0002	1.46E-06
332		0.02	0.000	0.010	0.1983	1.7701	0.0002	1.46E-06
333		0.13	0.000	0.019	0.2091	1.7695	0.0002	1.46E-06
334		0.07	0.000	0.019	0.2147	1.7689	0.0002	1.46E-06
335		0.00	0.000	0.010	0.2137	1.7683	0.0002	1.46E-06
336		0.00	0.000	0.015	0.2122	1.7676	0.0002	1.46E-06
337	*	0.00	0.000	0.015	0.2108	1.7670	0.0002	1.46E-06
338	*	0.00	0.000	0.014	0.2094	1.7664	0.0002	1.46E-06
339		0.00	0.000	0.013	0.2081	1.7658	0.0002	1.45E-06
340	*	0.00	0.000	0.013	0.2068	1.7652	0.0002	1.45E-06
341	*	0.08	0.000	0.021	0.2088	1.7645	0.0002	1.45E-06
342	*	0.00	0.000	0.044	0.2085	1.7639	0.0002	1.45E-06
343	*	0.00	0.000	0.013	0.2073	1.7633	0.0002	1.45E-06
344	*	0.17	0.000	0.040	0.2093	1.7627	0.0002	1.45E-06

345	*	0.00	0.000	0.040	0.2112	1.7621	0.0002	1.45E-06
346	*	0.00	0.000	0.019	0.2132	1.7615	0.0002	1.45E-06
347		0.00	0.000	0.024	0.2119	1.7608	0.0002	1.45E-06
348	*	0.00	0.000	0.000	0.2119	1.7602	0.0002	1.45E-06
349	*	0.00	0.000	0.000	0.2119	1.7596	0.0002	1.45E-06
350	*	0.11	0.000	0.041	0.2139	1.7590	0.0002	1.45E-06
351		0.04	0.000	0.088	0.2140	1.7584	0.0002	1.45E-06
352		0.08	0.000	0.022	0.2199	1.7578	0.0002	1.45E-06
353		0.18	0.019	0.019	0.2324	1.7571	0.0002	1.45E-06
354		0.00	0.000	0.031	0.2313	1.7565	0.0002	1.45E-06
355		0.00	0.000	0.011	0.2303	1.7559	0.0002	1.45E-06
356		0.53	0.184	0.023	0.2451	1.7553	0.0002	1.45E-06
357		0.00	0.000	0.087	0.2541	1.7547	0.0002	1.45E-06
358		0.00	0.000	0.068	0.2473	1.7541	0.0002	1.45E-06
359		0.00	0.000	0.103	0.2370	1.7535	0.0002	1.45E-06
360		0.00	0.000	0.080	0.2291	1.7529	0.0002	1.44E-06
361		0.00	0.000	0.060	0.2231	1.7522	0.0002	1.44E-06
362		0.00	0.000	0.107	0.2124	1.7516	0.0002	1.44E-06
363		0.00	0.000	0.051	0.2073	1.7510	0.0002	1.44E-06
364	*	0.00	0.000	0.000	0.2073	1.7504	0.0002	1.44E-06
365		0.00	0.000	0.053	0.2020	1.7498	0.0002	1.44E-06

* = Frozen (air or soil)

Annual Totals for Year 14			
	inches	cubic feet	percent
Precipitation	32.50	117,973.8	100.00
Runoff	9.773	35,475.9	30.07
Evapotranspiration	23.577	85,583.5	72.54
Recirculation into Layer 1	0.0763	277.1	0.23
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0763	277.1	0.23
Percolation/Leakage through Layer 5	0.000553	2.0058	0.00
Average Head on Top of Layer 4	1.8443	---	---
Change in Water Storage	-0.8506	-3,087.6	-2.62
Soil Water at Start of Year	294.4129	1,068,718.7	905.89
Soil Water at End of Year	293.5623	1,065,631.1	903.28
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0763	-277.1	-0.23

Daily Output for Year 15

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 11/29/2022 9:52

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.040	0.1980	1.7492	0.0002	1.44E-06
2			0.48	0.136	0.046	0.2143	1.7486	0.0002	1.44E-06
3			0.00	0.000	0.158	0.2122	1.7479	0.0002	1.44E-06
4			0.00	0.000	0.076	0.2047	1.7473	0.0002	1.44E-06
5			0.00	0.000	0.059	0.1988	1.7467	0.0002	1.44E-06
6			0.00	0.000	0.018	0.1970	1.7461	0.0002	1.44E-06
7			0.00	0.000	0.000	0.1970	1.7455	0.0002	1.44E-06
8			0.02	0.000	0.011	0.1980	1.7449	0.0002	1.44E-06
9			0.04	0.000	0.011	0.2013	1.7443	0.0002	1.44E-06
10	*		0.17	0.000	0.050	0.2033	1.7437	0.0002	1.44E-06
11	*		0.36	0.000	0.018	0.2053	1.7431	0.0002	1.44E-06
12	*		0.01	0.000	0.009	0.2072	1.7424	0.0002	1.44E-06
13	*		0.03	0.000	0.023	0.2092	1.7418	0.0002	1.44E-06
14	*		0.00	0.000	0.009	0.2112	1.7412	0.0002	1.44E-06
15	*		0.00	0.000	0.006	0.2132	1.7406	0.0002	1.44E-06
16	*		0.00	0.000	0.018	0.2152	1.7400	0.0002	1.44E-06
17	*		0.00	0.000	0.010	0.2172	1.7394	0.0002	1.43E-06
18	*		0.00	0.000	0.000	0.2192	1.7388	0.0002	1.43E-06
19	*		0.06	0.000	0.000	0.2212	1.7382	0.0002	1.43E-06
20	*		0.00	0.000	0.031	0.2231	1.7376	0.0002	1.43E-06
21	*		0.00	0.000	0.031	0.2251	1.7370	0.0002	1.43E-06
22	*		0.00	0.000	0.022	0.2271	1.7364	0.0002	1.43E-06
23	*		0.34	0.000	0.006	0.2291	1.7357	0.0002	1.43E-06
24	*		0.00	0.000	0.000	0.2311	1.7351	0.0002	1.43E-06

25	*		0.00	0.000	0.033	0.2331	1.7345	0.0002	1.43E-06
26			0.00	0.009	0.028	0.2458	1.7339	0.0002	1.43E-06
27			0.00	0.000	0.049	0.2479	1.7333	0.0002	1.43E-06
28	*		0.00	0.000	0.032	0.2499	1.7327	0.0002	1.43E-06
29	*	*	0.00	0.000	0.015	0.2500	1.7321	0.0002	1.43E-06
30	*	*	0.31	0.000	0.000	0.2500	1.7315	0.0002	1.43E-06
31		*	0.00	0.236	0.028	0.2511	1.7309	0.0002	1.43E-06
32		*	0.00	0.000	0.100	0.2546	1.7303	0.0002	1.43E-06
33		*	0.00	0.000	0.000	0.2547	1.7297	0.0002	1.43E-06
34	*	*	0.00	0.000	0.000	0.2547	1.7291	0.0002	1.43E-06
35		*	0.00	0.000	0.000	0.2547	1.7285	0.0002	1.43E-06
36			0.00	0.000	0.079	0.2468	1.7279	0.0002	1.43E-06
37			0.00	0.000	0.116	0.2352	1.7273	0.0002	1.43E-06
38			0.00	0.000	0.094	0.2259	1.7266	0.0002	1.42E-06
39			0.00	0.000	0.098	0.2161	1.7260	0.0002	1.42E-06
40			0.00	0.000	0.155	0.2006	1.7254	0.0002	1.42E-06
41			0.00	0.000	0.028	0.1978	1.7248	0.0002	1.42E-06
42			0.00	0.000	0.005	0.1973	1.7242	0.0002	1.42E-06
43			0.00	0.000	0.003	0.1970	1.7236	0.0002	1.42E-06
44			0.03	0.000	0.011	0.1988	1.7230	0.0002	1.42E-06
45			0.00	0.000	0.003	0.1985	1.7224	0.0002	1.42E-06
46	*		0.19	0.000	0.041	0.2005	1.7218	0.0002	1.42E-06
47			0.00	0.000	0.091	0.2048	1.7212	0.0002	1.42E-06
48			0.00	0.000	0.013	0.2035	1.7206	0.0002	1.42E-06
49			0.00	0.000	0.015	0.2020	1.7200	0.0002	1.42E-06
50			0.41	0.117	0.034	0.2165	1.7194	0.0002	1.42E-06
51			0.00	0.000	0.147	0.2135	1.7188	0.0002	1.42E-06
52			0.00	0.000	0.018	0.2117	1.7182	0.0002	1.42E-06
53			0.00	0.000	0.015	0.2102	1.7176	0.0002	1.42E-06
54			0.03	0.000	0.022	0.2107	1.7170	0.0002	1.42E-06
55			0.00	0.000	0.015	0.2092	1.7164	0.0002	1.42E-06
56			0.00	0.000	0.016	0.2076	1.7158	0.0002	1.42E-06

57		0.00	0.000	0.014	0.2062	1.7152	0.0002	1.42E-06
58		0.00	0.000	0.013	0.2049	1.7146	0.0002	1.42E-06
59		0.00	0.000	0.012	0.2036	1.7140	0.0002	1.42E-06
60		0.00	0.000	0.012	0.2025	1.7134	0.0002	1.41E-06
61		0.00	0.000	0.011	0.2014	1.7128	0.0002	1.41E-06
62		0.00	0.000	0.011	0.2003	1.7122	0.0002	1.41E-06
63	*	0.00	0.000	0.011	0.1992	1.7116	0.0002	1.41E-06
64		0.00	0.000	0.010	0.1982	1.7110	0.0002	1.41E-06
65	*	0.00	0.000	0.009	0.1973	1.7104	0.0002	1.41E-06
66	*	0.00	0.000	0.000	0.1973	1.7098	0.0002	1.41E-06
67	*	0.00	0.000	0.000	0.1973	1.7092	0.0002	1.41E-06
68		0.00	0.000	0.003	0.1970	1.7086	0.0002	1.41E-06
69		0.00	0.000	0.000	0.1970	1.7080	0.0002	1.41E-06
70		0.00	0.000	0.000	0.1970	1.7074	0.0002	1.41E-06
71		0.00	0.000	0.000	0.1970	1.7068	0.0002	1.41E-06
72		0.00	0.000	0.000	0.1970	1.7062	0.0002	1.41E-06
73		0.00	0.000	0.000	0.1970	1.7056	0.0002	1.41E-06
74		0.00	0.000	0.000	0.1970	1.7050	0.0002	1.41E-06
75	*	0.00	0.000	0.000	0.1970	1.7044	0.0002	1.41E-06
76	*	0.00	0.000	0.000	0.1971	1.7038	0.0002	1.41E-06
77		0.00	0.000	0.001	0.1970	1.7032	0.0002	1.41E-06
78		0.00	0.000	0.000	0.1970	1.7026	0.0002	1.41E-06
79		0.00	0.000	0.002	0.1970	1.7020	0.0002	1.41E-06
80		0.00	0.000	0.000	0.1970	1.7014	0.0002	1.41E-06
81		0.00	0.000	0.000	0.1970	1.7008	0.0002	1.41E-06
82		0.00	0.000	0.000	0.1970	1.7003	0.0002	1.40E-06
83		0.00	0.000	0.000	0.1970	1.6997	0.0002	1.40E-06
84		0.15	0.002	0.013	0.2100	1.6991	0.0002	1.40E-06
85		0.14	0.005	0.015	0.2213	1.6985	0.0002	1.40E-06
86		0.01	0.000	0.014	0.2210	1.6979	0.0002	1.40E-06
87		0.00	0.000	0.008	0.2203	1.6973	0.0002	1.40E-06
88		0.00	0.000	0.008	0.2195	1.6967	0.0002	1.40E-06

89	*	0.00	0.000	0.007	0.2188	1.6961	0.0002	1.40E-06
90		0.00	0.000	0.007	0.2181	1.6955	0.0002	1.40E-06
91	*	0.00	0.000	0.007	0.2174	1.6949	0.0002	1.40E-06
92		0.00	0.000	0.007	0.2167	1.6943	0.0002	1.40E-06
93	*	1.02	0.000	0.044	0.2187	1.6937	0.0002	1.40E-06
94	*	0.17	0.000	0.028	0.2206	1.6931	0.0002	1.40E-06
95		0.04	0.067	0.000	0.2334	1.6925	0.0002	1.40E-06
96		0.06	0.462	0.035	0.2450	1.6919	0.0002	1.40E-06
97		0.00	0.000	0.311	0.2502	1.6913	0.0002	1.40E-06
98		0.86	0.371	0.107	0.2628	1.6907	0.0002	1.40E-06
99		0.01	0.000	0.149	0.2745	1.6902	0.0002	1.40E-06
100		0.00	0.000	0.287	0.2458	1.6896	0.0002	1.40E-06
101		0.00	0.000	0.133	0.2325	1.6890	0.0002	1.40E-06
102		0.00	0.000	0.273	0.2052	1.6884	0.0002	1.40E-06
103		0.00	0.000	0.070	0.1982	1.6878	0.0002	1.40E-06
104		0.00	0.000	0.008	0.1970	1.6956	0.0002	1.40E-06
105		0.00	0.000	0.000	0.1970	1.7000	0.0002	1.40E-06
106	*	0.00	0.000	0.000	0.1970	1.6994	0.0002	1.40E-06
107		0.00	0.000	0.000	0.1970	1.6989	0.0002	1.40E-06
108	*	0.00	0.000	0.000	0.1970	1.6983	0.0002	1.40E-06
109		0.00	0.000	0.000	0.1970	1.6977	0.0002	1.40E-06
110		0.00	0.000	0.000	0.1970	1.6971	0.0002	1.40E-06
111		0.00	0.000	0.000	0.1970	1.6965	0.0002	1.40E-06
112	*	0.00	0.000	0.000	0.1970	1.6959	0.0002	1.40E-06
113	*	0.00	0.000	0.000	0.1970	1.6953	0.0002	1.40E-06
114	*	0.00	0.000	0.000	0.1970	1.6947	0.0002	1.40E-06
115	*	0.45	0.000	0.042	0.1990	1.6941	0.0002	1.40E-06
116	*	0.02	0.000	0.000	0.2010	1.6935	0.0002	1.40E-06
117		0.07	0.162	0.009	0.2137	1.6929	0.0002	1.40E-06
118		0.00	0.000	0.171	0.2128	1.6923	0.0002	1.40E-06
119		0.00	0.000	0.014	0.2113	1.6917	0.0002	1.40E-06
120		0.43	0.127	0.028	0.2262	1.6912	0.0002	1.40E-06

121	0.08	0.000	0.251	0.2216	1.6906	0.0002	1.40E-06
122	0.92	0.225	0.401	0.2341	1.6900	0.0002	1.40E-06
123	0.00	0.000	0.158	0.2351	1.6894	0.0002	1.40E-06
124	0.00	0.000	0.112	0.2239	1.6888	0.0002	1.40E-06
125	0.00	0.000	0.216	0.2023	1.6882	0.0002	1.40E-06
126	0.00	0.000	0.045	0.1978	1.6876	0.0002	1.40E-06
127	0.00	0.000	0.004	0.1974	1.6870	0.0002	1.39E-06
128	0.00	0.000	0.004	0.1970	1.6864	0.0002	1.39E-06
129	0.05	0.000	0.012	0.2007	1.6859	0.0002	1.39E-06
130	0.00	0.000	0.003	0.2004	1.6853	0.0002	1.39E-06
131	0.47	0.144	0.042	0.2144	1.6847	0.0002	1.39E-06
132	0.03	0.000	0.165	0.2154	1.6841	0.0002	1.39E-06
133	0.05	0.000	0.027	0.2176	1.6835	0.0002	1.39E-06
134	0.00	0.000	0.021	0.2154	1.6829	0.0002	1.39E-06
135	0.00	0.000	0.017	0.2137	1.6823	0.0002	1.39E-06
136	0.00	0.000	0.016	0.2121	1.6817	0.0002	1.39E-06
137	0.15	0.005	0.024	0.2234	1.6811	0.0002	1.39E-06
138	0.00	0.000	0.023	0.2216	1.6805	0.0002	1.39E-06
139	0.00	0.000	0.017	0.2199	1.6800	0.0002	1.39E-06
140	0.02	0.000	0.021	0.2196	1.6794	0.0002	1.39E-06
141	0.00	0.000	0.015	0.2181	1.6788	0.0002	1.39E-06
142	0.18	0.017	0.022	0.2306	1.6782	0.0002	1.39E-06
143	0.24	0.047	0.043	0.2421	1.6776	0.0002	1.39E-06
144	0.28	0.030	0.277	0.2414	1.6770	0.0002	1.39E-06
145	0.15	0.011	0.092	0.2482	1.6764	0.0002	1.39E-06
146	0.95	0.431	0.146	0.2597	1.6758	0.0002	1.39E-06
147	0.29	0.055	0.347	0.2714	1.6753	0.0002	1.39E-06
148	0.26	0.035	0.326	0.2631	1.6747	0.0002	1.39E-06
149	0.00	0.000	0.262	0.2396	1.6741	0.0002	1.39E-06
150	0.92	0.345	0.142	0.2542	1.6735	0.0002	1.38E-06
151	0.04	0.044	0.129	0.2658	1.6729	0.0002	1.38E-06
152	0.09	0.000	0.218	0.2579	1.6723	0.0002	1.38E-06

153	2.31	1.355	0.108	0.2712	1.6718	0.0002	1.38E-06
154	0.03	0.189	0.250	0.2828	1.6712	0.0002	1.38E-06
155	0.36	0.156	0.159	0.2944	1.6706	0.0002	1.38E-06
156	0.00	0.000	0.163	0.2902	1.6700	0.0002	1.38E-06
157	0.00	0.000	0.184	0.2718	1.6694	0.0002	1.38E-06
158	0.00	0.000	0.264	0.2454	1.6688	0.0002	1.38E-06
159	0.57	0.046	0.349	0.2584	1.6682	0.0002	1.38E-06
160	0.00	0.000	0.286	0.2343	1.6677	0.0002	1.38E-06
161	0.00	0.000	0.237	0.2106	1.6671	0.0002	1.38E-06
162	0.00	0.000	0.112	0.1993	1.6676	0.0002	1.38E-06
163	0.00	0.000	0.023	0.1970	1.6701	0.0002	1.38E-06
164	0.00	0.000	0.000	0.1970	1.6695	0.0002	1.38E-06
165	0.00	0.000	0.000	0.1970	1.6690	0.0002	1.38E-06
166	0.00	0.000	0.000	0.1970	1.6684	0.0002	1.38E-06
167	1.87	0.957	0.041	0.2131	1.6678	0.0002	1.38E-06
168	0.00	0.151	0.288	0.2248	1.6672	0.0002	1.38E-06
169	0.00	0.000	0.222	0.2177	1.6666	0.0002	1.38E-06
170	0.00	0.000	0.166	0.2011	1.6660	0.0002	1.38E-06
171	0.00	0.000	0.035	0.1976	1.6655	0.0002	1.38E-06
172	0.00	0.000	0.004	0.1973	1.6649	0.0002	1.38E-06
173	0.61	0.169	0.109	0.2136	1.6643	0.0002	1.38E-06
174	0.11	0.000	0.235	0.2180	1.6637	0.0002	1.38E-06
175	0.00	0.000	0.125	0.2055	1.6631	0.0002	1.38E-06
176	0.00	0.000	0.063	0.1992	1.6625	0.0002	1.38E-06
177	0.00	0.000	0.022	0.1971	1.6620	0.0002	1.38E-06
178	0.00	0.000	0.001	0.1970	1.6614	0.0002	1.38E-06
179	0.00	0.000	0.000	0.1970	1.6608	0.0002	1.37E-06
180	1.37	0.640	0.050	0.2131	1.6602	0.0002	1.37E-06
181	0.00	0.025	0.355	0.2247	1.6596	0.0002	1.37E-06
182	0.00	0.000	0.178	0.2095	1.6591	0.0002	1.37E-06
183	0.17	0.003	0.141	0.2114	1.6585	0.0002	1.37E-06
184	0.00	0.000	0.123	0.1994	1.6579	0.0002	1.37E-06

185	0.00	0.000	0.017	0.1977	1.6573	0.0002	1.37E-06
186	0.00	0.000	0.006	0.1971	1.6567	0.0002	1.37E-06
187	0.01	0.000	0.013	0.1973	1.6562	0.0002	1.37E-06
188	0.12	0.000	0.013	0.2078	1.6556	0.0002	1.37E-06
189	0.14	0.000	0.027	0.2186	1.6550	0.0002	1.37E-06
190	0.62	0.235	0.043	0.2308	1.6544	0.0002	1.37E-06
191	0.00	0.000	0.274	0.2254	1.6538	0.0002	1.37E-06
192	0.01	0.000	0.187	0.2078	1.6533	0.0002	1.37E-06
193	1.15	0.405	0.254	0.2235	1.6527	0.0002	1.37E-06
194	0.00	0.000	0.219	0.2349	1.6521	0.0002	1.37E-06
195	0.00	0.000	0.230	0.2119	1.6515	0.0002	1.37E-06
196	0.55	0.061	0.284	0.2262	1.6509	0.0002	1.37E-06
197	0.21	0.035	0.134	0.2325	1.6504	0.0002	1.37E-06
198	0.00	0.000	0.253	0.2108	1.6498	0.0002	1.37E-06
199	0.04	0.000	0.147	0.1999	1.6492	0.0002	1.37E-06
200	0.07	0.000	0.051	0.2020	1.6488	0.0002	1.37E-06
201	0.33	0.032	0.157	0.2128	1.6487	0.0002	1.37E-06
202	0.57	0.084	0.319	0.2245	1.6481	0.0002	1.37E-06
203	0.00	0.000	0.167	0.2158	1.6475	0.0002	1.36E-06
204	0.00	0.000	0.093	0.2065	1.6469	0.0002	1.36E-06
205	0.00	0.000	0.071	0.1995	1.6464	0.0002	1.36E-06
206	0.12	0.000	0.040	0.2075	1.6458	0.0002	1.36E-06
207	0.00	0.000	0.026	0.2049	1.6452	0.0002	1.36E-06
208	0.00	0.000	0.035	0.2015	1.6446	0.0002	1.36E-06
209	0.00	0.000	0.027	0.1988	1.6441	0.0002	1.36E-06
210	0.00	0.000	0.012	0.1976	1.6435	0.0002	1.36E-06
211	0.00	0.000	0.006	0.1970	1.6429	0.0002	1.36E-06
212	0.00	0.000	0.000	0.1970	1.6423	0.0002	1.36E-06
213	0.00	0.000	0.000	0.1970	1.6418	0.0002	1.36E-06
214	0.00	0.000	0.000	0.1970	1.6412	0.0002	1.36E-06
215	0.00	0.000	0.000	0.1970	1.6406	0.0002	1.36E-06
216	0.00	0.000	0.000	0.1970	1.6400	0.0002	1.36E-06

217	0.00	0.000	0.000	0.1970	1.6395	0.0002	1.36E-06
218	0.00	0.000	0.000	0.1970	1.6389	0.0002	1.36E-06
219	0.00	0.000	0.000	0.1970	1.6383	0.0002	1.36E-06
220	0.54	0.173	0.030	0.2131	1.6377	0.0002	1.36E-06
221	0.00	0.000	0.231	0.2075	1.6372	0.0002	1.36E-06
222	0.00	0.000	0.019	0.2056	1.6366	0.0002	1.36E-06
223	0.00	0.000	0.020	0.2036	1.6360	0.0002	1.36E-06
224	0.00	0.000	0.017	0.2020	1.6354	0.0002	1.36E-06
225	0.00	0.000	0.025	0.1995	1.6349	0.0002	1.36E-06
226	0.00	0.000	0.025	0.1970	1.6343	0.0002	1.35E-06
227	0.00	0.000	0.000	0.1970	1.6337	0.0002	1.35E-06
228	0.00	0.000	0.000	0.1970	1.6332	0.0002	1.35E-06
229	0.00	0.000	0.000	0.1970	1.6326	0.0002	1.35E-06
230	0.00	0.000	0.000	0.1970	1.6320	0.0002	1.35E-06
231	0.00	0.000	0.000	0.1970	1.6314	0.0002	1.35E-06
232	0.00	0.000	0.000	0.1970	1.6309	0.0002	1.35E-06
233	0.50	0.156	0.029	0.2129	1.6303	0.0002	1.35E-06
234	0.00	0.000	0.181	0.2103	1.6297	0.0002	1.35E-06
235	0.00	0.000	0.109	0.1995	1.6292	0.0002	1.35E-06
236	0.00	0.000	0.025	0.1970	1.6286	0.0002	1.35E-06
237	0.00	0.000	0.000	0.1970	1.6280	0.0002	1.35E-06
238	0.57	0.174	0.061	0.2129	1.6274	0.0002	1.35E-06
239	0.13	0.000	0.227	0.2206	1.6269	0.0002	1.35E-06
240	0.00	0.000	0.050	0.2157	1.6263	0.0002	1.35E-06
241	0.00	0.000	0.132	0.2024	1.6257	0.0002	1.35E-06
242	0.55	0.116	0.158	0.2181	1.6252	0.0002	1.35E-06
243	0.00	0.000	0.182	0.2115	1.6246	0.0002	1.35E-06
244	0.00	0.000	0.100	0.2015	1.6240	0.0002	1.35E-06
245	0.00	0.000	0.037	0.1978	1.6235	0.0002	1.35E-06
246	0.13	0.000	0.025	0.2083	1.6229	0.0002	1.35E-06
247	0.20	0.026	0.034	0.2192	1.6223	0.0002	1.35E-06
248	0.00	0.000	0.047	0.2172	1.6218	0.0002	1.35E-06

249	1.19	0.562	0.052	0.2298	1.6212	0.0002	1.34E-06
250	0.00	0.064	0.203	0.2415	1.6206	0.0002	1.34E-06
251	0.61	0.222	0.149	0.2531	1.6201	0.0002	1.34E-06
252	0.00	0.000	0.192	0.2522	1.6195	0.0002	1.34E-06
253	0.00	0.000	0.200	0.2322	1.6189	0.0002	1.34E-06
254	0.00	0.000	0.275	0.2046	1.6184	0.0002	1.34E-06
255	0.01	0.000	0.071	0.1987	1.6178	0.0002	1.34E-06
256	0.00	0.000	0.009	0.1978	1.6172	0.0002	1.34E-06
257	0.00	0.000	0.008	0.1970	1.6167	0.0002	1.34E-06
258	0.13	0.000	0.016	0.2088	1.6161	0.0002	1.34E-06
259	0.11	0.000	0.033	0.2163	1.6155	0.0002	1.34E-06
260	0.29	0.056	0.050	0.2290	1.6150	0.0002	1.34E-06
261	0.20	0.034	0.125	0.2355	1.6144	0.0002	1.34E-06
262	0.00	0.000	0.074	0.2316	1.6138	0.0002	1.34E-06
263	0.00	0.000	0.063	0.2253	1.6133	0.0002	1.34E-06
264	0.00	0.000	0.121	0.2132	1.6127	0.0002	1.34E-06
265	0.00	0.000	0.056	0.2076	1.6121	0.0002	1.34E-06
266	0.01	0.000	0.051	0.2033	1.6116	0.0002	1.34E-06
267	0.01	0.000	0.044	0.1998	1.6110	0.0002	1.34E-06
268	0.00	0.000	0.027	0.1971	1.6104	0.0002	1.34E-06
269	0.00	0.000	0.001	0.1970	1.6099	0.0002	1.34E-06
270	0.00	0.000	0.000	0.1970	1.6093	0.0002	1.34E-06
271	0.00	0.000	0.000	0.1970	1.6087	0.0002	1.34E-06
272	0.06	0.000	0.013	0.2019	1.6082	0.0002	1.33E-06
273	0.00	0.000	0.012	0.2008	1.6076	0.0002	1.33E-06
274	0.04	0.000	0.025	0.2018	1.6071	0.0002	1.33E-06
275	0.13	0.000	0.024	0.2125	1.6065	0.0002	1.33E-06
276	0.10	0.000	0.023	0.2203	1.6059	0.0002	1.33E-06
277	0.00	0.000	0.010	0.2193	1.6054	0.0002	1.33E-06
278	0.00	0.000	0.014	0.2180	1.6048	0.0002	1.33E-06
279	0.00	0.000	0.015	0.2165	1.6042	0.0002	1.33E-06
280	0.00	0.000	0.014	0.2152	1.6037	0.0002	1.33E-06

281	0.00	0.000	0.013	0.2139	1.6031	0.0002	1.33E-06
282	0.03	0.000	0.022	0.2146	1.6026	0.0002	1.33E-06
283	0.00	0.000	0.013	0.2134	1.6020	0.0002	1.33E-06
284	0.00	0.000	0.014	0.2120	1.6014	0.0002	1.33E-06
285	0.00	0.000	0.013	0.2107	1.6009	0.0002	1.33E-06
286	0.00	0.000	0.011	0.2095	1.6003	0.0002	1.33E-06
287	0.07	0.000	0.022	0.2138	1.5998	0.0002	1.33E-06
288	0.00	0.000	0.012	0.2126	1.5992	0.0002	1.33E-06
289	0.77	0.314	0.026	0.2263	1.5986	0.0002	1.33E-06
290	0.29	0.116	0.233	0.2380	1.5981	0.0002	1.33E-06
291	0.03	0.000	0.193	0.2337	1.5975	0.0002	1.33E-06
292	0.00	0.000	0.060	0.2277	1.5970	0.0002	1.33E-06
293	0.00	0.000	0.073	0.2204	1.5964	0.0002	1.33E-06
294	0.00	0.000	0.059	0.2145	1.5958	0.0002	1.33E-06
295	0.00	0.000	0.051	0.2094	1.5953	0.0002	1.32E-06
296	0.00	0.000	0.050	0.2044	1.5947	0.0002	1.32E-06
297	0.00	0.000	0.067	0.1977	1.5942	0.0002	1.32E-06
298	0.00	0.000	0.006	0.1972	1.5936	0.0002	1.32E-06
299	0.00	0.000	0.002	0.1970	1.5930	0.0002	1.32E-06
300	0.00	0.000	0.000	0.1970	1.5925	0.0002	1.32E-06
301	0.00	0.000	0.000	0.1970	1.5919	0.0002	1.32E-06
302	0.00	0.000	0.000	0.1970	1.5914	0.0002	1.32E-06
303	0.00	0.000	0.000	0.1970	1.5908	0.0002	1.32E-06
304	0.00	0.000	0.000	0.1970	1.5903	0.0002	1.32E-06
305	0.00	0.000	0.000	0.1970	1.5897	0.0002	1.32E-06
306	0.00	0.000	0.000	0.1970	1.5891	0.0002	1.32E-06
307	0.00	0.000	0.000	0.1970	1.5886	0.0002	1.32E-06
308	0.43	0.115	0.034	0.2133	1.5880	0.0002	1.32E-06
309	0.00	0.000	0.126	0.2124	1.5875	0.0002	1.32E-06
310	0.00	0.000	0.014	0.2110	1.5869	0.0002	1.32E-06
311	0.00	0.000	0.013	0.2097	1.5864	0.0002	1.32E-06
312	0.00	0.000	0.013	0.2084	1.5858	0.0002	1.32E-06

313		0.00	0.000	0.012	0.2072	1.5853	0.0002	1.32E-06
314		0.00	0.000	0.012	0.2060	1.5847	0.0002	1.32E-06
315		0.00	0.000	0.012	0.2048	1.5841	0.0002	1.32E-06
316		0.00	0.000	0.011	0.2037	1.5836	0.0002	1.32E-06
317		0.00	0.000	0.011	0.2026	1.5830	0.0002	1.32E-06
318		0.00	0.000	0.011	0.2016	1.5825	0.0002	1.32E-06
319		0.35	0.085	0.026	0.2168	1.5819	0.0002	1.31E-06
320		0.19	0.032	0.122	0.2262	1.5814	0.0002	1.31E-06
321		0.12	0.000	0.114	0.2300	1.5808	0.0002	1.31E-06
322		0.00	0.000	0.046	0.2255	1.5803	0.0002	1.31E-06
323		0.00	0.000	0.050	0.2205	1.5797	0.0002	1.31E-06
324	*	0.24	0.000	0.028	0.2225	1.5792	0.0002	1.31E-06
325	*	0.00	0.000	0.018	0.2245	1.5786	0.0002	1.31E-06
326	*	0.09	0.000	0.000	0.2265	1.5780	0.0002	1.31E-06
327		0.00	0.026	0.048	0.2392	1.5775	0.0002	1.31E-06
328		0.00	0.000	0.117	0.2302	1.5769	0.0002	1.31E-06
329		0.14	0.000	0.097	0.2343	1.5764	0.0002	1.31E-06
330		0.19	0.021	0.110	0.2378	1.5758	0.0002	1.31E-06
331		0.00	0.000	0.109	0.2291	1.5753	0.0002	1.31E-06
332		0.00	0.000	0.043	0.2247	1.5748	0.0002	1.31E-06
333		0.45	0.126	0.059	0.2390	1.5742	0.0002	1.31E-06
334	*	0.00	0.000	0.027	0.2390	1.5737	0.0002	1.31E-06
335	*	0.00	0.000	0.010	0.2390	1.5731	0.0002	1.31E-06
336	*	0.00	0.000	0.007	0.2390	1.5726	0.0002	1.31E-06
337	*	0.02	0.000	0.025	0.2463	1.5720	0.0002	1.31E-06
338		0.10	0.000	0.067	0.2495	1.5715	0.0002	1.31E-06
339	*	0.04	0.000	0.035	0.2495	1.5709	0.0002	1.31E-06
340		0.69	0.267	0.078	0.2627	1.5704	0.0002	1.31E-06
341		0.00	0.000	0.103	0.2742	1.5698	0.0002	1.31E-06
342		0.00	0.000	0.087	0.2656	1.5693	0.0002	1.31E-06
343		0.00	0.000	0.067	0.2589	1.5687	0.0002	1.30E-06
344		0.07	0.000	0.071	0.2592	1.5682	0.0002	1.30E-06

345		0.02	0.000	0.087	0.2523	1.5676	0.0002	1.30E-06
346		0.00	0.000	0.049	0.2474	1.5671	0.0002	1.30E-06
347	*	0.00	0.000	0.000	0.2474	1.5665	0.0002	1.30E-06
348	*	0.00	0.000	0.000	0.2474	1.5660	0.0002	1.30E-06
349		0.00	0.000	0.076	0.2398	1.5654	0.0002	1.30E-06
350		0.00	0.000	0.063	0.2335	1.5649	0.0002	1.30E-06
351		0.00	0.000	0.097	0.2238	1.5649	0.0002	1.30E-06
352		0.00	0.000	0.045	0.2193	1.5643	0.0002	1.30E-06
353		0.00	0.000	0.045	0.2150	1.5638	0.0002	1.30E-06
354		0.00	0.000	0.055	0.2096	1.5632	0.0002	1.30E-06
355		0.00	0.000	0.046	0.2050	1.5627	0.0002	1.30E-06
356		0.00	0.000	0.048	0.2003	1.5621	0.0002	1.30E-06
357		0.00	0.000	0.017	0.1986	1.5616	0.0002	1.30E-06
358		0.03	0.000	0.029	0.1989	1.5610	0.0002	1.30E-06
359		0.00	0.000	0.003	0.1986	1.5605	0.0002	1.30E-06
360		0.00	0.000	0.006	0.1980	1.5599	0.0002	1.30E-06
361		0.00	0.000	0.005	0.1975	1.5594	0.0002	1.30E-06
362		0.00	0.000	0.004	0.1971	1.5588	0.0002	1.30E-06
363	*	0.41	0.000	0.023	0.1991	1.5583	0.0002	1.30E-06
364		0.02	0.110	0.023	0.2134	1.5577	0.0002	1.30E-06
365		0.08	0.000	0.072	0.2249	1.5572	0.0002	1.30E-06

* = Frozen (air or soil)

Annual Totals for Year 15			
	inches	cubic feet	percent
Precipitation	32.76	118,911.8	100.00
Runoff	10.423	37,834.3	31.82
Evapotranspiration	22.169	80,474.2	67.68
Recirculation into Layer 1	0.0685	248.5	0.21
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0685	248.5	0.21
Percolation/Leakage through Layer 5	0.000500	1.8148	0.00
Average Head on Top of Layer 4	1.6541	---	---
Change in Water Storage	0.1657	601.5	0.51
Soil Water at Start of Year	293.5623	1,065,631.1	896.15
Soil Water at End of Year	293.7280	1,066,232.6	896.66
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0685	-248.6	-0.21

Average Annual Totals Summary

Title: AEL Lateral Expansion
Simulated on: 11/29/2022 9:52

	Average Annual Totals for Years 1 - 15*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	36.87	[6.7]	133,840.4	100.00
Runoff	13.369	[3.295]	48,528.8	36.26
Evapotranspiration	23.487	[3.814]	85,258.1	63.70
Subprofile1				
Recirculation into Layer 1	0.0448	[0.0182]	162.6	0.12
Lateral drainage collected from Layer 3	0.0000	[0]	0.0000	0.00
Drainage recirculated from Layer 3	0.0448	[0.0182]	162.6	0.12
Percolation/leakage through Layer 5	0.000337	[0.000126]	1.2225	0.00
Average Head on Top of Layer 4	1.0817	[0.4395]	---	---
Water storage				
Change in water storage	0.0144	[0.512]	52.2	0.04

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: AEL Lateral Expansion
Simulated on: 11/29/2022 9:52

	Peak Values for Years 1 - 15*	
	(inches)	(cubic feet)
Precipitation	3.66	13,287.7
Runoff	2.179	7,911.5
Subprofile1		
Drainage Recirculated into Layer 1	0.0002	0.7985
Drainage collected from Layer 3	0.0000	0.0000
Drainage recirculated from Layer 3	0.0002	0.7985
Percolation/leakage through Layer 5	0.000002	0.0058
Average head on Layer 4	1.9401	---
Maximum head on Layer 4	2.8386	---
Location of maximum head in Layer 3	67.11 (feet from drain)	
Other Parameters		
Snow water	3.0963	11,239.6
Maximum vegetation soil water	0.3605 (vol/vol)	
Minimum vegetation soil water	0.1970 (vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: AEL Lateral Expansion
Simulated on: 11/29/2022 9:53
Simulation period: 15 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	1.8604	0.3101
2	279.5400	0.2912
3	2.0795	0.1733
4	0.0000	0.0000
5	10.2480	0.4270
Snow water	0.0000	---

HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE
HELP MODEL VERSION 4.0 BETA (2018)
DEVELOPED BY USEPA NATIONAL RISK MANAGEMENT RESEARCH LABORATORY

Title: AEL Lateral Expansion **Simulated On:** 6/29/2023 9:04

Layer 1

Type 1 - Vertical Percolation Layer (Cover Soil)
SiCL - Silty Clay Loam (Moderate)
Material Texture Number 26

Thickness = 12 inches
Porosity = 0.445 vol/vol
Field Capacity = 0.393 vol/vol
Wilting Point = 0.277 vol/vol
Initial Soil Water Content = 0.3066 vol/vol
Effective Sat. Hyd. Conductivity = 1.90E-06 cm/sec
Note: 100% of drainage collected from Layer 3 is recirculated into this layer.

Layer 2

Type 1 - Vertical Percolation Layer (Waste)
Municipal Solid Waste (MSW) (900 pcy)
Material Texture Number 18

Thickness = 4764 inches
Porosity = 0.671 vol/vol
Field Capacity = 0.292 vol/vol
Wilting Point = 0.077 vol/vol
Initial Soil Water Content = 0.292 vol/vol
Effective Sat. Hyd. Conductivity = 1.00E-03 cm/sec

Layer 3

Type 2 - Lateral Drainage Layer
LFS Loamy Fine Sand
Material Texture Number 5

Thickness = 12 inches
Porosity = 0.457 vol/vol
Field Capacity = 0.131 vol/vol
Wilting Point = 0.058 vol/vol
Initial Soil Water Content = 0.1316 vol/vol
Effective Sat. Hyd. Conductivity = 1.00E-03 cm/sec
Slope = 0.5 %
Drainage Length = 250 ft
Note: 100% of drainage collected from this layer is recirculated into Layer 1.

Layer 4

Type 4 - Flexible Membrane Liner
HDPE Membrane
Material Texture Number 35

Thickness = 0.06 inches
Effective Sat. Hyd. Conductivity = 2.00E-13 cm/sec
FML Pinhole Density = 0.5 Holes/Acre
FML Installation Defects = 1 Holes/Acre
FML Placement Quality = 3 Good

Layer 5

Type 3 - Barrier Soil Liner
Liner Soil (High)
Material Texture Number 16

Thickness = 24 inches
Porosity = 0.427 vol/vol
Field Capacity = 0.418 vol/vol
Wilting Point = 0.367 vol/vol
Initial Soil Water Content = 0.427 vol/vol
Effective Sat. Hyd. Conductivity = 1.00E-07 cm/sec

Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

SCS Runoff Curve Number = 97.1
Fraction of Area Allowing Runoff = 100 %
Area projected on a horizontal plane = 1 acres
Evaporative Zone Depth = 10 inches
Initial Water in Evaporative Zone = 2.894 inches
Upper Limit of Evaporative Storage = 4.45 inches
Lower Limit of Evaporative Storage = 2.77 inches
Initial Snow Water = 0 inches
Initial Water in Layer Materials = 1406.595 inches
Total Initial Water = 1406.595 inches
Total Subsurface Inflow = 0 inches/year

Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

Station Latitude = 36.15 Degrees

Maximum Leaf Area Index = 1
Start of Growing Season (Julian Date) = 74 days
End of Growing Season (Julian Date) = 319 days
Average Wind Speed = 10 mph
Average 1st Quarter Relative Humidity = 63 %
Average 2nd Quarter Relative Humidity = 66 %
Average 3rd Quarter Relative Humidity = 69 %
Average 4th Quarter Relative Humidity = 63 %

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Note: Evapotranspiration data was obtained for Sand Springs, Oklahoma

Normal Mean Monthly Precipitation (inches)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
1.360443	1.630784	3.351263	4.428939	4.601378	4.538602
3.993826	2.841239	3.475277	2.797522	2.323377	1.91907

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Note: Precipitation was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2

Normal Mean Monthly Temperature (Degrees Fahrenheit)

Jan/Jul	Feb/Aug	Mar/Sep	Apr/Oct	May/Nov	Jun/Dec
44	49	51.8	67	77.1	85.5
91.2	88.2	80.8	71.7	57.6	45.3

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Note: Temperature was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2
Solar radiation was simulated based on HELP V4 weather simulation for:
Lat/Long: 36.15/-96.2

Daily Output for Year 1

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.030	0.2863	0.0235	0.0000	3.23E-08
2	*		0.00	0.000	0.028	0.2835	0.0235	0.0000	3.23E-08
3	*		0.00	0.000	0.000	0.2835	0.0235	0.0000	3.23E-08
4	*		0.00	0.000	0.000	0.2835	0.0235	0.0000	3.23E-08
5	*		0.00	0.000	0.000	0.2835	0.0234	0.0000	3.23E-08
6	*		0.00	0.000	0.000	0.2835	0.0234	0.0000	3.23E-08
7			0.11	0.000	0.058	0.2882	0.0234	0.0000	3.23E-08
8			0.08	0.000	0.068	0.2894	0.0234	0.0000	3.23E-08
9			0.28	0.092	0.113	0.2972	0.0234	0.0000	3.23E-08
10			0.10	0.000	0.048	0.3028	0.0234	0.0000	3.23E-08
11			0.03	0.000	0.071	0.2991	0.0234	0.0000	3.23E-08
12			0.03	0.000	0.055	0.2970	0.0234	0.0000	3.22E-08
13			0.00	0.000	0.079	0.2891	0.0234	0.0000	3.22E-08
14			0.00	0.000	0.087	0.2804	0.0234	0.0000	3.22E-08
15			0.00	0.000	0.027	0.2777	0.0234	0.0000	3.22E-08
16			0.00	0.000	0.006	0.2771	0.0235	0.0000	3.23E-08
17			0.00	0.000	0.001	0.2770	0.0235	0.0000	3.24E-08
18			0.03	0.000	0.009	0.2796	0.0235	0.0000	3.23E-08
19	*		0.16	0.000	0.051	0.2816	0.0235	0.0000	3.23E-08
20			0.03	0.000	0.082	0.2848	0.0235	0.0000	3.23E-08
21			0.00	0.000	0.015	0.2834	0.0235	0.0000	3.23E-08
22			0.00	0.000	0.017	0.2817	0.0235	0.0000	3.23E-08
23			0.02	0.000	0.024	0.2810	0.0235	0.0000	3.23E-08
24			0.10	0.000	0.022	0.2893	0.0235	0.0000	3.23E-08

25		0.00	0.000	0.011	0.2882	0.0235	0.0000	3.23E-08
26		0.00	0.000	0.012	0.2870	0.0235	0.0000	3.23E-08
27	*	0.00	0.000	0.014	0.2857	0.0235	0.0000	3.23E-08
28		0.00	0.000	0.013	0.2843	0.0234	0.0000	3.23E-08
29		0.00	0.000	0.013	0.2830	0.0234	0.0000	3.23E-08
30		0.00	0.000	0.012	0.2818	0.0234	0.0000	3.23E-08
31	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.23E-08
32	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.23E-08
33	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.22E-08
34	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.22E-08
35	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.22E-08
36	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.22E-08
37	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.22E-08
38	*	0.00	0.000	0.000	0.2818	0.0234	0.0000	3.22E-08
39	*	0.00	0.000	0.012	0.2806	0.0234	0.0000	3.22E-08
40	*	0.00	0.000	0.011	0.2795	0.0234	0.0000	3.22E-08
41		0.00	0.000	0.011	0.2783	0.0234	0.0000	3.22E-08
42	*	0.00	0.000	0.010	0.2773	0.0234	0.0000	3.22E-08
43		0.00	0.000	0.002	0.2771	0.0234	0.0000	3.22E-08
44		0.00	0.000	0.000	0.2770	0.0233	0.0000	3.22E-08
45		0.14	0.003	0.012	0.2899	0.0233	0.0000	3.22E-08
46		0.00	0.000	0.006	0.2893	0.0233	0.0000	3.22E-08
47		0.00	0.000	0.009	0.2884	0.0233	0.0000	3.22E-08
48		0.00	0.000	0.009	0.2875	0.0233	0.0000	3.22E-08
49		0.00	0.000	0.009	0.2866	0.0233	0.0000	3.22E-08
50		0.00	0.000	0.009	0.2857	0.0233	0.0000	3.21E-08
51	*	0.00	0.000	0.009	0.2848	0.0233	0.0000	3.21E-08
52		0.00	0.000	0.008	0.2840	0.0233	0.0000	3.21E-08
53		0.02	0.000	0.014	0.2842	0.0233	0.0000	3.21E-08
54		0.00	0.000	0.010	0.2834	0.0233	0.0000	3.21E-08
55		0.06	0.000	0.014	0.2879	0.0233	0.0000	3.21E-08
56		0.00	0.000	0.009	0.2870	0.0233	0.0000	3.21E-08

57		0.00	0.000	0.010	0.2860	0.0233	0.0000	3.21E-08
58		0.00	0.000	0.008	0.2853	0.0233	0.0000	3.21E-08
59	*	0.00	0.000	0.000	0.2853	0.0233	0.0000	3.21E-08
60	*	0.00	0.000	0.007	0.2845	0.0232	0.0000	3.21E-08
61	*	0.00	0.000	0.007	0.2838	0.0232	0.0000	3.21E-08
62	*	0.00	0.000	0.007	0.2831	0.0232	0.0000	3.21E-08
63	*	0.00	0.000	0.012	0.2824	0.0232	0.0000	3.21E-08
64	*	0.04	0.000	0.044	0.2817	0.0232	0.0000	3.21E-08
65		0.00	0.000	0.007	0.2810	0.0232	0.0000	3.21E-08
66		0.00	0.000	0.007	0.2803	0.0232	0.0000	3.20E-08
67		1.67	1.499	0.016	0.2960	0.0232	0.0000	3.20E-08
68		0.00	0.000	0.111	0.2849	0.0232	0.0000	3.20E-08
69		0.00	0.000	0.007	0.2843	0.0232	0.0000	3.20E-08
70		0.00	0.000	0.008	0.2834	0.0232	0.0000	3.20E-08
71		0.38	0.215	0.015	0.2986	0.0232	0.0000	3.20E-08
72		1.05	0.855	0.082	0.3102	0.0232	0.0000	3.20E-08
73		0.00	0.000	0.087	0.3015	0.0232	0.0000	3.20E-08
74	*	0.00	0.000	0.000	0.3015	0.0232	0.0000	3.20E-08
75		0.00	0.000	0.057	0.2958	0.0232	0.0000	3.20E-08
76		0.03	0.000	0.081	0.2903	0.0231	0.0000	3.20E-08
77		1.82	1.612	0.072	0.3038	0.0231	0.0000	3.20E-08
78		0.67	0.442	0.111	0.3154	0.0231	0.0000	3.20E-08
79		0.00	0.000	0.100	0.3054	0.0231	0.0000	3.20E-08
80		0.00	0.000	0.058	0.2996	0.0231	0.0000	3.20E-08
81		0.39	0.129	0.231	0.3024	0.0231	0.0000	3.20E-08
82		0.43	0.179	0.135	0.3140	0.0231	0.0000	3.19E-08
83	*	0.00	0.000	0.000	0.3140	0.0231	0.0000	3.19E-08
84	*	0.23	0.000	0.039	0.3160	0.0231	0.0000	3.19E-08
85		0.00	0.005	0.111	0.3219	0.0231	0.0000	3.19E-08
86		0.48	0.294	0.070	0.3340	0.0231	0.0000	3.19E-08
87		0.00	0.000	0.181	0.3158	0.0231	0.0000	3.19E-08
88		0.00	0.000	0.084	0.3074	0.0231	0.0000	3.19E-08

89	*	0.01	0.000	0.053	0.3027	0.0231	0.0000	3.19E-08
90		0.12	0.000	0.091	0.3057	0.0230	0.0000	3.19E-08
91		0.00	0.000	0.184	0.2873	0.0230	0.0000	3.19E-08
92		0.00	0.000	0.083	0.2790	0.0230	0.0000	3.19E-08
93	*	0.25	0.000	0.043	0.2810	0.0230	0.0000	3.19E-08
94		0.00	0.001	0.095	0.2903	0.0230	0.0000	3.19E-08
95		0.10	0.000	0.043	0.2960	0.0237	0.0000	3.25E-08
96		0.19	0.038	0.087	0.3025	0.0243	0.0000	3.31E-08
97		0.87	0.645	0.105	0.3141	0.0243	0.0000	3.31E-08
98		0.02	0.000	0.110	0.3049	0.0248	0.0000	3.36E-08
99		0.00	0.000	0.112	0.2937	0.0250	0.0000	3.38E-08
100		0.00	0.000	0.107	0.2830	0.0250	0.0000	3.38E-08
101		0.30	0.127	0.060	0.2941	0.0250	0.0000	3.38E-08
102		0.00	0.000	0.117	0.2824	0.0250	0.0000	3.38E-08
103	*	0.10	0.000	0.093	0.2835	0.0250	0.0000	3.38E-08
104		0.00	0.000	0.034	0.2801	0.0250	0.0000	3.38E-08
105		0.00	0.000	0.019	0.2782	0.0250	0.0000	3.37E-08
106		0.00	0.000	0.009	0.2773	0.0249	0.0000	3.37E-08
107		0.00	0.000	0.003	0.2771	0.0249	0.0000	3.37E-08
108		0.00	0.000	0.000	0.2770	0.0249	0.0000	3.37E-08
109		0.00	0.000	0.000	0.2770	0.0249	0.0000	3.37E-08
110		0.00	0.000	0.000	0.2770	0.0249	0.0000	3.37E-08
111		0.46	0.280	0.027	0.2924	0.0249	0.0000	3.37E-08
112		0.27	0.094	0.097	0.3007	0.0249	0.0000	3.37E-08
113		0.00	0.000	0.079	0.2928	0.0249	0.0000	3.37E-08
114		0.00	0.000	0.112	0.2816	0.0249	0.0000	3.37E-08
115		0.00	0.000	0.034	0.2782	0.0249	0.0000	3.37E-08
116		0.00	0.000	0.009	0.2773	0.0249	0.0000	3.37E-08
117		0.00	0.000	0.002	0.2771	0.0249	0.0000	3.37E-08
118		0.00	0.000	0.001	0.2770	0.0249	0.0000	3.37E-08
119	*	0.00	0.000	0.000	0.2770	0.0249	0.0000	3.37E-08
120		0.00	0.000	0.000	0.2770	0.0249	0.0000	3.37E-08

121	0.00	0.000	0.000	0.2770	0.0249	0.0000	3.37E-08
122	0.00	0.000	0.000	0.2770	0.0248	0.0000	3.36E-08
123	0.22	0.075	0.016	0.2896	0.0248	0.0000	3.36E-08
124	0.00	0.000	0.009	0.2886	0.0248	0.0000	3.36E-08
125	0.00	0.000	0.015	0.2871	0.0248	0.0000	3.36E-08
126	0.00	0.000	0.014	0.2857	0.0248	0.0000	3.36E-08
127	0.00	0.000	0.013	0.2844	0.0248	0.0000	3.36E-08
128	0.00	0.000	0.013	0.2831	0.0248	0.0000	3.36E-08
129	0.00	0.000	0.013	0.2818	0.0248	0.0000	3.36E-08
130	0.41	0.228	0.023	0.2972	0.0248	0.0000	3.36E-08
131	0.00	0.000	0.015	0.2961	0.0248	0.0000	3.36E-08
132	0.04	0.000	0.019	0.2985	0.0248	0.0000	3.36E-08
133	0.00	0.000	0.013	0.2972	0.0248	0.0000	3.36E-08
134	0.47	0.313	0.021	0.3105	0.0248	0.0000	3.36E-08
135	0.67	0.466	0.087	0.3220	0.0248	0.0000	3.36E-08
136	0.84	0.564	0.286	0.3207	0.0248	0.0000	3.36E-08
137	0.00	0.000	0.108	0.3099	0.0247	0.0000	3.35E-08
138	0.00	0.000	0.086	0.3013	0.0247	0.0000	3.35E-08
139	0.00	0.000	0.205	0.2808	0.0247	0.0000	3.35E-08
140	0.00	0.000	0.033	0.2775	0.0248	0.0000	3.36E-08
141	0.00	0.000	0.004	0.2771	0.0249	0.0000	3.37E-08
142	0.38	0.195	0.050	0.2908	0.0249	0.0000	3.37E-08
143	0.00	0.000	0.069	0.2839	0.0249	0.0000	3.37E-08
144	0.00	0.000	0.025	0.2814	0.0249	0.0000	3.37E-08
145	0.00	0.000	0.022	0.2792	0.0249	0.0000	3.37E-08
146	0.00	0.000	0.019	0.2773	0.0249	0.0000	3.37E-08
147	0.00	0.000	0.001	0.2771	0.0249	0.0000	3.37E-08
148	0.33	0.160	0.032	0.2904	0.0249	0.0000	3.37E-08
149	0.00	0.000	0.060	0.2844	0.0248	0.0000	3.36E-08
150	0.00	0.000	0.017	0.2827	0.0248	0.0000	3.36E-08
151	0.03	0.000	0.024	0.2834	0.0248	0.0000	3.36E-08
152	0.20	0.063	0.025	0.2951	0.0248	0.0000	3.36E-08

153	0.04	0.000	0.135	0.2854	0.0248	0.0000	3.36E-08
154	0.00	0.000	0.018	0.2836	0.0248	0.0000	3.36E-08
155	0.00	0.000	0.017	0.2819	0.0248	0.0000	3.36E-08
156	0.00	0.000	0.018	0.2801	0.0248	0.0000	3.36E-08
157	0.00	0.000	0.018	0.2783	0.0248	0.0000	3.36E-08
158	0.00	0.000	0.006	0.2776	0.0248	0.0000	3.36E-08
159	0.00	0.000	0.004	0.2772	0.0249	0.0000	3.37E-08
160	0.00	0.000	0.001	0.2771	0.0250	0.0000	3.37E-08
161	0.00	0.000	0.000	0.2770	0.0249	0.0000	3.37E-08
162	0.54	0.350	0.025	0.2930	0.0249	0.0000	3.37E-08
163	0.00	0.000	0.115	0.2815	0.0249	0.0000	3.37E-08
164	0.00	0.000	0.013	0.2802	0.0249	0.0000	3.37E-08
165	1.29	1.106	0.028	0.2958	0.0249	0.0000	3.37E-08
166	0.00	0.000	0.139	0.2819	0.0249	0.0000	3.37E-08
167	0.00	0.000	0.017	0.2802	0.0249	0.0000	3.37E-08
168	0.00	0.000	0.012	0.2789	0.0249	0.0000	3.37E-08
169	0.06	0.000	0.019	0.2830	0.0249	0.0000	3.37E-08
170	0.90	0.744	0.027	0.2961	0.0249	0.0000	3.37E-08
171	0.00	0.000	0.075	0.2885	0.0249	0.0000	3.37E-08
172	0.00	0.000	0.083	0.2802	0.0250	0.0000	3.38E-08
173	0.00	0.000	0.023	0.2779	0.0254	0.0000	3.42E-08
174	0.00	0.000	0.010	0.2772	0.0254	0.0000	3.42E-08
175	0.39	0.189	0.064	0.2906	0.0254	0.0000	3.41E-08
176	0.00	0.000	0.020	0.2886	0.0254	0.0000	3.41E-08
177	0.00	0.000	0.028	0.2858	0.0253	0.0000	3.41E-08
178	0.76	0.576	0.040	0.3005	0.0253	0.0000	3.41E-08
179	0.02	0.000	0.116	0.2911	0.0253	0.0000	3.41E-08
180	0.00	0.000	0.120	0.2791	0.0253	0.0000	3.41E-08
181	0.05	0.000	0.035	0.2806	0.0253	0.0000	3.41E-08
182	0.04	0.000	0.014	0.2829	0.0253	0.0000	3.41E-08
183	0.06	0.000	0.027	0.2862	0.0253	0.0000	3.41E-08
184	0.00	0.000	0.022	0.2840	0.0255	0.0000	3.43E-08

185	1.74	1.553	0.044	0.2981	0.0255	0.0000	3.43E-08
186	0.66	0.308	0.376	0.2956	0.0255	0.0000	3.43E-08
187	0.15	0.001	0.194	0.2911	0.0255	0.0000	3.43E-08
188	0.01	0.000	0.122	0.2795	0.0255	0.0000	3.43E-08
189	0.69	0.398	0.147	0.2936	0.0255	0.0000	3.43E-08
190	0.00	0.000	0.122	0.2814	0.0255	0.0000	3.43E-08
191	0.00	0.000	0.024	0.2790	0.0256	0.0000	3.44E-08
192	0.00	0.000	0.011	0.2779	0.0257	0.0000	3.45E-08
193	0.24	0.095	0.033	0.2891	0.0257	0.0000	3.45E-08
194	0.00	0.000	0.018	0.2873	0.0257	0.0000	3.45E-08
195	0.00	0.000	0.026	0.2847	0.0257	0.0000	3.45E-08
196	0.00	0.000	0.025	0.2822	0.0257	0.0000	3.45E-08
197	0.00	0.000	0.027	0.2795	0.0257	0.0000	3.45E-08
198	0.00	0.000	0.020	0.2775	0.0257	0.0000	3.45E-08
199	0.00	0.000	0.003	0.2773	0.0257	0.0000	3.45E-08
200	0.00	0.000	0.001	0.2771	0.0257	0.0000	3.44E-08
201	0.00	0.000	0.001	0.2770	0.0257	0.0000	3.44E-08
202	0.00	0.000	0.000	0.2770	0.0257	0.0000	3.45E-08
203	0.00	0.000	0.000	0.2770	0.0259	0.0000	3.47E-08
204	0.00	0.000	0.000	0.2770	0.0259	0.0000	3.47E-08
205	0.00	0.000	0.000	0.2770	0.0259	0.0000	3.47E-08
206	0.00	0.000	0.000	0.2770	0.0259	0.0000	3.46E-08
207	0.00	0.000	0.000	0.2770	0.0259	0.0000	3.46E-08
208	0.26	0.119	0.018	0.2895	0.0259	0.0000	3.46E-08
209	0.98	0.837	0.026	0.3008	0.0259	0.0000	3.46E-08
210	0.00	0.000	0.105	0.2903	0.0258	0.0000	3.46E-08
211	0.00	0.000	0.018	0.2885	0.0258	0.0000	3.46E-08
212	0.50	0.324	0.030	0.3030	0.0258	0.0000	3.46E-08
213	0.20	0.068	0.088	0.3076	0.0258	0.0000	3.46E-08
214	0.00	0.000	0.090	0.2986	0.0258	0.0000	3.46E-08
215	0.00	0.000	0.188	0.2797	0.0258	0.0000	3.46E-08
216	0.00	0.000	0.020	0.2777	0.0258	0.0000	3.46E-08

217	0.03	0.000	0.023	0.2781	0.0260	0.0000	3.47E-08
218	0.17	0.033	0.039	0.2880	0.0261	0.0000	3.49E-08
219	0.00	0.000	0.025	0.2856	0.0261	0.0000	3.49E-08
220	0.00	0.000	0.032	0.2824	0.0261	0.0000	3.49E-08
221	0.00	0.000	0.032	0.2791	0.0261	0.0000	3.49E-08
222	0.12	0.000	0.027	0.2887	0.0261	0.0000	3.49E-08
223	0.01	0.000	0.022	0.2871	0.0261	0.0000	3.48E-08
224	0.00	0.000	0.021	0.2850	0.0261	0.0000	3.48E-08
225	0.00	0.000	0.021	0.2830	0.0261	0.0000	3.48E-08
226	0.00	0.000	0.020	0.2810	0.0261	0.0000	3.48E-08
227	0.00	0.000	0.021	0.2789	0.0261	0.0000	3.48E-08
228	0.00	0.000	0.015	0.2774	0.0260	0.0000	3.48E-08
229	0.00	0.000	0.003	0.2771	0.0260	0.0000	3.48E-08
230	0.00	0.000	0.001	0.2770	0.0260	0.0000	3.48E-08
231	0.00	0.000	0.000	0.2770	0.0260	0.0000	3.48E-08
232	0.00	0.000	0.000	0.2770	0.0260	0.0000	3.48E-08
233	0.00	0.000	0.000	0.2770	0.0260	0.0000	3.48E-08
234	0.00	0.000	0.000	0.2770	0.0260	0.0000	3.48E-08
235	0.00	0.000	0.000	0.2770	0.0260	0.0000	3.48E-08
236	0.07	0.000	0.012	0.2831	0.0260	0.0000	3.48E-08
237	0.00	0.000	0.016	0.2814	0.0260	0.0000	3.47E-08
238	0.00	0.000	0.024	0.2790	0.0260	0.0000	3.47E-08
239	0.00	0.000	0.008	0.2782	0.0260	0.0000	3.47E-08
240	0.00	0.000	0.006	0.2776	0.0260	0.0000	3.47E-08
241	0.00	0.000	0.004	0.2772	0.0259	0.0000	3.47E-08
242	0.00	0.000	0.002	0.2770	0.0259	0.0000	3.47E-08
243	0.00	0.000	0.000	0.2770	0.0259	0.0000	3.47E-08
244	0.23	0.082	0.018	0.2897	0.0259	0.0000	3.47E-08
245	0.00	0.000	0.015	0.2881	0.0259	0.0000	3.47E-08
246	0.00	0.000	0.023	0.2858	0.0259	0.0000	3.47E-08
247	0.00	0.000	0.022	0.2836	0.0259	0.0000	3.47E-08
248	0.00	0.000	0.018	0.2818	0.0259	0.0000	3.47E-08

249	0.07	0.000	0.031	0.2861	0.0259	0.0000	3.47E-08
250	0.14	0.007	0.030	0.2961	0.0259	0.0000	3.47E-08
251	0.44	0.299	0.026	0.3072	0.0259	0.0000	3.46E-08
252	1.50	1.127	0.276	0.3170	0.0259	0.0000	3.46E-08
253	0.99	0.712	0.172	0.3279	0.0259	0.0000	3.47E-08
254	0.00	0.000	0.214	0.3065	0.0259	0.0000	3.47E-08
255	0.35	0.116	0.418	0.2881	0.0259	0.0000	3.47E-08
256	0.51	0.264	0.128	0.2997	0.0259	0.0000	3.47E-08
257	0.00	0.000	0.108	0.2890	0.0259	0.0000	3.47E-08
258	0.00	0.000	0.069	0.2820	0.0259	0.0000	3.47E-08
259	0.00	0.000	0.039	0.2781	0.0259	0.0000	3.47E-08
260	0.00	0.000	0.005	0.2775	0.0259	0.0000	3.47E-08
261	1.04	0.810	0.075	0.2928	0.0259	0.0000	3.47E-08
262	0.69	0.310	0.302	0.3006	0.0259	0.0000	3.47E-08
263	0.00	0.000	0.085	0.2921	0.0259	0.0000	3.46E-08
264	0.00	0.000	0.121	0.2800	0.0259	0.0000	3.46E-08
265	0.00	0.000	0.025	0.2775	0.0259	0.0000	3.46E-08
266	0.00	0.000	0.004	0.2772	0.0259	0.0000	3.46E-08
267	1.21	0.996	0.055	0.2931	0.0258	0.0000	3.46E-08
268	0.24	0.079	0.113	0.2984	0.0258	0.0000	3.46E-08
269	0.00	0.000	0.082	0.2905	0.0258	0.0000	3.46E-08
270	0.00	0.000	0.111	0.2793	0.0258	0.0000	3.46E-08
271	0.00	0.000	0.015	0.2779	0.0258	0.0000	3.46E-08
272	0.00	0.000	0.004	0.2774	0.0258	0.0000	3.46E-08
273	0.17	0.022	0.032	0.2889	0.0258	0.0000	3.46E-08
274	0.03	0.000	0.030	0.2891	0.0258	0.0000	3.46E-08
275	0.87	0.701	0.047	0.3012	0.0258	0.0000	3.46E-08
276	0.15	0.011	0.096	0.3057	0.0258	0.0000	3.46E-08
277	0.00	0.000	0.109	0.2948	0.0258	0.0000	3.45E-08
278	1.42	1.062	0.226	0.3082	0.0258	0.0000	3.45E-08
279	0.00	0.000	0.136	0.2946	0.0258	0.0000	3.45E-08
280	0.00	0.000	0.099	0.2847	0.0257	0.0000	3.45E-08

281		0.00	0.000	0.048	0.2799	0.0257	0.0000	3.45E-08
282		0.00	0.000	0.017	0.2782	0.0257	0.0000	3.45E-08
283		0.00	0.000	0.007	0.2775	0.0257	0.0000	3.45E-08
284		0.00	0.000	0.004	0.2771	0.0257	0.0000	3.45E-08
285		0.15	0.002	0.028	0.2890	0.0257	0.0000	3.45E-08
286		0.00	0.000	0.017	0.2873	0.0257	0.0000	3.45E-08
287		0.00	0.000	0.022	0.2851	0.0257	0.0000	3.45E-08
288		0.00	0.000	0.021	0.2830	0.0257	0.0000	3.45E-08
289		0.00	0.000	0.020	0.2810	0.0257	0.0000	3.45E-08
290		1.26	1.072	0.035	0.2965	0.0257	0.0000	3.45E-08
291		0.20	0.065	0.078	0.3025	0.0257	0.0000	3.44E-08
292		0.00	0.000	0.075	0.2950	0.0257	0.0000	3.44E-08
293		0.00	0.000	0.131	0.2819	0.0257	0.0000	3.44E-08
294		0.00	0.000	0.037	0.2782	0.0256	0.0000	3.44E-08
295		0.00	0.000	0.009	0.2773	0.0256	0.0000	3.44E-08
296		0.00	0.000	0.002	0.2771	0.0256	0.0000	3.44E-08
297	*	0.00	0.000	0.001	0.2770	0.0256	0.0000	3.44E-08
298		0.00	0.000	0.000	0.2770	0.0256	0.0000	3.44E-08
299	*	0.00	0.000	0.000	0.2770	0.0256	0.0000	3.44E-08
300	*	0.00	0.000	0.000	0.2770	0.0256	0.0000	3.44E-08
301	*	0.14	0.000	0.022	0.2790	0.0256	0.0000	3.44E-08
302	*	0.04	0.000	0.000	0.2809	0.0256	0.0000	3.44E-08
303		0.90	0.885	0.000	0.2936	0.0256	0.0000	3.44E-08
304		0.79	0.597	0.076	0.3052	0.0256	0.0000	3.44E-08
305		0.01	0.000	0.046	0.3019	0.0256	0.0000	3.43E-08
306		0.10	0.000	0.063	0.3059	0.0256	0.0000	3.43E-08
307		0.00	0.000	0.100	0.2960	0.0256	0.0000	3.43E-08
308		0.00	0.000	0.125	0.2834	0.0255	0.0000	3.43E-08
309		0.00	0.000	0.039	0.2795	0.0255	0.0000	3.43E-08
310		0.00	0.000	0.016	0.2779	0.0255	0.0000	3.43E-08
311		0.00	0.000	0.006	0.2773	0.0255	0.0000	3.43E-08
312		0.00	0.000	0.003	0.2770	0.0255	0.0000	3.43E-08

313		0.00	0.000	0.000	0.2770	0.0255	0.0000	3.43E-08
314		0.00	0.000	0.000	0.2770	0.0255	0.0000	3.43E-08
315		0.24	0.096	0.024	0.2893	0.0255	0.0000	3.43E-08
316		0.05	0.000	0.022	0.2921	0.0255	0.0000	3.43E-08
317		1.01	0.847	0.036	0.3045	0.0255	0.0000	3.43E-08
318		0.00	0.000	0.080	0.2966	0.0255	0.0000	3.43E-08
319		0.10	0.000	0.091	0.2971	0.0255	0.0000	3.43E-08
320		0.53	0.323	0.071	0.3104	0.0255	0.0000	3.42E-08
321		0.00	0.000	0.086	0.3018	0.0255	0.0000	3.42E-08
322		0.00	0.000	0.056	0.2962	0.0254	0.0000	3.42E-08
323		0.00	0.000	0.072	0.2890	0.0254	0.0000	3.42E-08
324		0.00	0.000	0.056	0.2834	0.0254	0.0000	3.42E-08
325		0.00	0.000	0.047	0.2787	0.0254	0.0000	3.42E-08
326		0.00	0.000	0.014	0.2774	0.0254	0.0000	3.42E-08
327		0.00	0.000	0.002	0.2772	0.0254	0.0000	3.42E-08
328		0.00	0.000	0.002	0.2770	0.0254	0.0000	3.42E-08
329		0.00	0.000	0.000	0.2770	0.0254	0.0000	3.42E-08
330		0.00	0.000	0.000	0.2770	0.0254	0.0000	3.42E-08
331		0.80	0.594	0.039	0.2933	0.0254	0.0000	3.42E-08
332		0.00	0.000	0.067	0.2866	0.0254	0.0000	3.42E-08
333		0.00	0.000	0.019	0.2847	0.0254	0.0000	3.42E-08
334		0.00	0.000	0.017	0.2830	0.0254	0.0000	3.42E-08
335		0.00	0.000	0.016	0.2814	0.0254	0.0000	3.41E-08
336		0.00	0.000	0.015	0.2799	0.0254	0.0000	3.41E-08
337		0.00	0.000	0.014	0.2785	0.0253	0.0000	3.41E-08
338		0.00	0.000	0.008	0.2777	0.0253	0.0000	3.41E-08
339		0.00	0.000	0.004	0.2773	0.0253	0.0000	3.41E-08
340	*	0.20	0.000	0.036	0.2793	0.0253	0.0000	3.41E-08
341		0.00	0.000	0.053	0.2882	0.0253	0.0000	3.41E-08
342		0.00	0.000	0.010	0.2872	0.0253	0.0000	3.41E-08
343		0.00	0.000	0.009	0.2863	0.0254	0.0000	3.42E-08
344		0.01	0.000	0.015	0.2854	0.0258	0.0000	3.46E-08

345		0.01	0.000	0.017	0.2847	0.0258	0.0000	3.46E-08
346		0.16	0.017	0.019	0.2967	0.0258	0.0000	3.46E-08
347		0.00	0.000	0.009	0.2958	0.0258	0.0000	3.45E-08
348		0.00	0.000	0.011	0.2948	0.0258	0.0000	3.45E-08
349		0.00	0.000	0.010	0.2938	0.0258	0.0000	3.45E-08
350		0.00	0.000	0.010	0.2928	0.0257	0.0000	3.45E-08
351		0.00	0.000	0.009	0.2919	0.0257	0.0000	3.45E-08
352	*	0.49	0.000	0.023	0.2939	0.0257	0.0000	3.45E-08
353		0.88	1.195	0.000	0.3066	0.0257	0.0000	3.45E-08
354	*	0.00	0.000	0.000	0.3066	0.0257	0.0000	3.45E-08
355	*	0.00	0.000	0.000	0.3066	0.0257	0.0000	3.45E-08
356	*	0.01	0.000	0.028	0.3043	0.0257	0.0000	3.45E-08
357		0.00	0.000	0.038	0.3005	0.0257	0.0000	3.45E-08
358		0.00	0.000	0.078	0.2927	0.0257	0.0000	3.45E-08
359		0.00	0.000	0.072	0.2855	0.0257	0.0000	3.45E-08
360	*	0.21	0.000	0.040	0.2875	0.0257	0.0000	3.45E-08
361		0.00	0.000	0.077	0.2947	0.0257	0.0000	3.44E-08
362	*	0.00	0.000	0.039	0.2908	0.0257	0.0000	3.44E-08
363		0.66	0.420	0.093	0.3051	0.0257	0.0000	3.44E-08
364		0.00	0.000	0.059	0.2992	0.0257	0.0000	3.44E-08
365		0.00	0.000	0.081	0.2910	0.0256	0.0000	3.44E-08

* = Frozen (air or soil)

Annual Totals for Year 1

	inches	cubic feet	percent
Precipitation	43.62	158,339.0	100.00
Runoff	27.989	101,600.1	64.17
Evapotranspiration	15.613	56,676.7	35.79
Recirculation into Layer 1	0.0010	3.7404	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0010	3.7404	0.00
Percolation/Leakage through Layer 5	0.000012	0.0446	0.00
Average Head on Top of Layer 4	0.0249	---	---
Change in Water Storage	0.0171	62.1	0.04
Soil Water at Start of Year	1,406.5955	5,105,941.5	3224.69
Soil Water at End of Year	1,406.6126	5,106,003.6	3224.73
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0010	-3.7395	0.00

Daily Output for Year 2

Column key:	Head #1: drainage from Layer 4
	Drain #1: drainage from Layer 3
	Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.034	0.2876	0.0262	0.0000	3.49E-08
2			0.15	0.009	0.071	0.2944	0.0264	0.0000	3.52E-08
3			0.03	0.000	0.068	0.2907	0.0264	0.0000	3.52E-08
4	*		0.03	0.000	0.048	0.2889	0.0264	0.0000	3.52E-08
5			0.00	0.000	0.058	0.2831	0.0264	0.0000	3.52E-08
6			0.00	0.000	0.048	0.2783	0.0265	0.0000	3.52E-08
7			0.00	0.000	0.010	0.2773	0.0267	0.0000	3.54E-08
8			0.02	0.000	0.014	0.2777	0.0267	0.0000	3.54E-08
9	*		0.20	0.000	0.052	0.2797	0.0267	0.0000	3.54E-08
10			0.07	0.026	0.044	0.2932	0.0267	0.0000	3.54E-08
11	*		0.00	0.000	0.000	0.2932	0.0267	0.0000	3.54E-08
12			0.00	0.000	0.025	0.2907	0.0267	0.0000	3.54E-08
13			0.00	0.000	0.053	0.2854	0.0267	0.0000	3.54E-08
14			0.00	0.000	0.058	0.2796	0.0268	0.0000	3.55E-08
15			0.19	0.047	0.050	0.2891	0.0268	0.0000	3.55E-08
16			0.00	0.000	0.022	0.2869	0.0267	0.0000	3.55E-08
17	*		0.00	0.000	0.024	0.2845	0.0267	0.0000	3.55E-08
18			0.00	0.000	0.021	0.2825	0.0267	0.0000	3.55E-08
19	*		0.00	0.000	0.019	0.2806	0.0267	0.0000	3.55E-08
20			0.00	0.000	0.017	0.2789	0.0267	0.0000	3.55E-08
21			0.00	0.000	0.014	0.2775	0.0267	0.0000	3.55E-08
22			0.00	0.000	0.003	0.2773	0.0267	0.0000	3.54E-08
23			0.00	0.000	0.001	0.2771	0.0267	0.0000	3.54E-08
24	*		0.00	0.000	0.001	0.2770	0.0267	0.0000	3.54E-08

25			0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08
26	*		0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08
27	*		0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08
28	*		0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08
29	*		0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08
30			0.00	0.000	0.000	0.2770	0.0266	0.0000	3.54E-08
31	*		0.00	0.000	0.000	0.2770	0.0266	0.0000	3.54E-08
32	*		0.00	0.000	0.000	0.2770	0.0266	0.0000	3.54E-08
33	*		0.00	0.000	0.000	0.2770	0.0266	0.0000	3.54E-08
34			0.00	0.000	0.000	0.2770	0.0266	0.0000	3.54E-08
35	*		0.08	0.000	0.029	0.2790	0.0266	0.0000	3.54E-08
36	*		0.00	0.000	0.027	0.2790	0.0266	0.0000	3.53E-08
37	*		0.00	0.000	0.000	0.2790	0.0266	0.0000	3.53E-08
38	*		0.00	0.000	0.000	0.2790	0.0266	0.0000	3.53E-08
39	*	*	0.00	0.000	0.000	0.2790	0.0266	0.0000	3.53E-08
40	*	*	0.04	0.000	0.042	0.2790	0.0266	0.0000	3.53E-08
41		*	0.00	0.000	0.000	0.2790	0.0266	0.0000	3.53E-08
42		*	0.00	0.000	0.000	0.2790	0.0266	0.0000	3.53E-08
43			0.00	0.000	0.003	0.2787	0.0265	0.0000	3.53E-08
44			0.00	0.000	0.003	0.2784	0.0265	0.0000	3.53E-08
45	*		0.00	0.000	0.003	0.2781	0.0265	0.0000	3.53E-08
46	*	*	0.00	0.000	0.000	0.2781	0.0265	0.0000	3.53E-08
47	*	*	0.00	0.000	0.000	0.2781	0.0265	0.0000	3.53E-08
48	*	*	0.00	0.000	0.000	0.2781	0.0265	0.0000	3.53E-08
49	*	*	0.00	0.000	0.000	0.2781	0.0265	0.0000	3.52E-08
50		*	0.00	0.000	0.000	0.2781	0.0265	0.0000	3.52E-08
51		*	0.00	0.000	0.000	0.2781	0.0265	0.0000	3.52E-08
52			0.00	0.000	0.003	0.2779	0.0265	0.0000	3.52E-08
53			0.00	0.000	0.002	0.2776	0.0265	0.0000	3.52E-08
54			0.00	0.000	0.002	0.2774	0.0265	0.0000	3.52E-08
55			0.00	0.000	0.002	0.2772	0.0265	0.0000	3.52E-08
56			0.00	0.000	0.001	0.2770	0.0264	0.0000	3.52E-08

57		0.00	0.000	0.000	0.2770	0.0264	0.0000	3.52E-08
58		0.00	0.000	0.000	0.2770	0.0264	0.0000	3.52E-08
59		0.00	0.000	0.000	0.2770	0.0264	0.0000	3.52E-08
60	*	0.39	0.000	0.027	0.2790	0.0264	0.0000	3.52E-08
61	*	0.09	0.000	0.032	0.2809	0.0264	0.0000	3.52E-08
62		0.00	0.196	0.060	0.2936	0.0264	0.0000	3.52E-08
63		0.00	0.000	0.005	0.2931	0.0264	0.0000	3.52E-08
64		0.00	0.000	0.008	0.2923	0.0264	0.0000	3.51E-08
65		0.00	0.000	0.008	0.2915	0.0264	0.0000	3.51E-08
66		0.05	0.000	0.016	0.2946	0.0264	0.0000	3.51E-08
67		0.00	0.000	0.009	0.2938	0.0264	0.0000	3.51E-08
68		0.00	0.000	0.009	0.2929	0.0264	0.0000	3.51E-08
69		0.00	0.000	0.008	0.2921	0.0264	0.0000	3.51E-08
70		0.00	0.000	0.007	0.2914	0.0264	0.0000	3.51E-08
71	*	0.00	0.000	0.007	0.2906	0.0264	0.0000	3.51E-08
72		0.00	0.000	0.007	0.2899	0.0264	0.0000	3.51E-08
73		0.25	0.090	0.019	0.3037	0.0264	0.0000	3.51E-08
74	*	0.21	0.000	0.034	0.3057	0.0264	0.0000	3.51E-08
75	*	0.00	0.000	0.043	0.3076	0.0264	0.0000	3.51E-08
76	*	0.00	0.000	0.049	0.3096	0.0263	0.0000	3.51E-08
77		0.00	0.000	0.101	0.3021	0.0263	0.0000	3.51E-08
78	*	0.00	0.000	0.000	0.3021	0.0263	0.0000	3.51E-08
79	*	0.00	0.000	0.000	0.3021	0.0263	0.0000	3.51E-08
80		0.00	0.000	0.008	0.3013	0.0263	0.0000	3.51E-08
81	*	0.00	0.000	0.000	0.3013	0.0263	0.0000	3.51E-08
82	*	0.00	0.000	0.000	0.3013	0.0263	0.0000	3.51E-08
83		0.00	0.000	0.007	0.3005	0.0263	0.0000	3.51E-08
84		0.00	0.000	0.008	0.2997	0.0263	0.0000	3.50E-08
85		0.00	0.000	0.008	0.2989	0.0263	0.0000	3.50E-08
86		2.68	2.514	0.018	0.3134	0.0263	0.0000	3.50E-08
87		0.50	0.247	0.153	0.3233	0.0263	0.0000	3.50E-08
88		0.00	0.000	0.106	0.3127	0.0263	0.0000	3.50E-08

89		0.00	0.000	0.092	0.3035	0.0262	0.0000	3.50E-08
90		0.00	0.000	0.126	0.2909	0.0262	0.0000	3.50E-08
91	*	0.66	0.000	0.041	0.2928	0.0262	0.0000	3.50E-08
92		3.27	3.730	0.000	0.3071	0.0262	0.0000	3.50E-08
93		0.55	0.311	0.127	0.3187	0.0262	0.0000	3.50E-08
94		0.35	0.161	0.162	0.3217	0.0262	0.0000	3.50E-08
95		0.00	0.000	0.100	0.3117	0.0262	0.0000	3.50E-08
96		0.00	0.000	0.085	0.3031	0.0262	0.0000	3.50E-08
97		0.00	0.000	0.105	0.2927	0.0262	0.0000	3.49E-08
98		0.37	0.142	0.126	0.3025	0.0262	0.0000	3.49E-08
99		0.61	0.379	0.111	0.3142	0.0262	0.0000	3.49E-08
100		0.02	0.000	0.115	0.3044	0.0262	0.0000	3.49E-08
101		0.00	0.000	0.132	0.2912	0.0262	0.0000	3.49E-08
102		0.00	0.000	0.099	0.2813	0.0261	0.0000	3.49E-08
103	*	0.00	0.000	0.000	0.2813	0.0261	0.0000	3.49E-08
104	*	0.00	0.000	0.000	0.2813	0.0261	0.0000	3.49E-08
105	*	0.13	0.000	0.042	0.2833	0.0261	0.0000	3.49E-08
106	*	0.00	0.000	0.053	0.2849	0.0261	0.0000	3.49E-08
107	*	0.00	0.000	0.000	0.2849	0.0261	0.0000	3.49E-08
108	*	0.00	0.000	0.043	0.2805	0.0261	0.0000	3.49E-08
109	*	0.11	0.000	0.055	0.2825	0.0261	0.0000	3.49E-08
110	*	0.00	0.000	0.032	0.2825	0.0261	0.0000	3.49E-08
111		0.02	0.000	0.041	0.2808	0.0261	0.0000	3.48E-08
112		0.02	0.000	0.017	0.2809	0.0262	0.0000	3.49E-08
113		0.00	0.000	0.019	0.2790	0.0262	0.0000	3.50E-08
114		0.00	0.000	0.015	0.2775	0.0263	0.0000	3.50E-08
115		0.00	0.000	0.002	0.2772	0.0263	0.0000	3.50E-08
116		0.00	0.000	0.001	0.2771	0.0263	0.0000	3.50E-08
117		0.83	0.624	0.043	0.2934	0.0262	0.0000	3.50E-08
118		0.00	0.000	0.107	0.2827	0.0262	0.0000	3.50E-08
119		0.00	0.000	0.021	0.2806	0.0262	0.0000	3.50E-08
120		0.00	0.000	0.023	0.2783	0.0262	0.0000	3.50E-08

121		0.00	0.000	0.015	0.2772	0.0262	0.0000	3.50E-08
122		0.06	0.000	0.012	0.2822	0.0262	0.0000	3.50E-08
123		0.09	0.000	0.019	0.2898	0.0262	0.0000	3.50E-08
124		0.03	0.000	0.017	0.2912	0.0262	0.0000	3.50E-08
125		0.06	0.000	0.019	0.2953	0.0262	0.0000	3.49E-08
126	*	0.00	0.000	0.013	0.2940	0.0262	0.0000	3.49E-08
127		0.17	0.027	0.022	0.3063	0.0262	0.0000	3.49E-08
128		0.00	0.000	0.014	0.3049	0.0262	0.0000	3.49E-08
129		0.00	0.000	0.012	0.3037	0.0262	0.0000	3.49E-08
130		0.00	0.000	0.012	0.3025	0.0262	0.0000	3.50E-08
131		0.22	0.070	0.020	0.3151	0.0262	0.0000	3.50E-08
132		0.79	0.582	0.097	0.3267	0.0262	0.0000	3.50E-08
133		0.46	0.278	0.162	0.3287	0.0262	0.0000	3.49E-08
134	*	0.31	0.000	0.049	0.3307	0.0262	0.0000	3.49E-08
135		1.27	1.392	0.000	0.3434	0.0262	0.0000	3.49E-08
136		0.00	0.000	0.065	0.3369	0.0262	0.0000	3.49E-08
137		0.00	0.000	0.126	0.3246	0.0262	0.0000	3.49E-08
138		0.21	0.064	0.070	0.3321	0.0262	0.0000	3.49E-08
139		0.00	0.000	0.152	0.3169	0.0262	0.0000	3.49E-08
140		0.00	0.000	0.169	0.3001	0.0262	0.0000	3.49E-08
141		0.00	0.000	0.194	0.2806	0.0262	0.0000	3.49E-08
142		0.00	0.000	0.023	0.2784	0.0261	0.0000	3.49E-08
143		0.00	0.000	0.011	0.2772	0.0261	0.0000	3.49E-08
144		0.00	0.000	0.002	0.2770	0.0265	0.0000	3.53E-08
145		0.07	0.000	0.012	0.2833	0.0277	0.0000	3.64E-08
146		0.17	0.028	0.022	0.2954	0.0277	0.0000	3.64E-08
147		0.52	0.365	0.038	0.3069	0.0277	0.0000	3.64E-08
148		0.00	0.000	0.100	0.2969	0.0276	0.0000	3.64E-08
149		0.02	0.000	0.026	0.2965	0.0276	0.0000	3.63E-08
150		0.34	0.179	0.033	0.3095	0.0276	0.0000	3.63E-08
151		0.00	0.000	0.183	0.2912	0.0276	0.0000	3.63E-08
152		0.00	0.000	0.019	0.2892	0.0276	0.0000	3.63E-08

153	0.00	0.000	0.022	0.2871	0.0276	0.0000	3.63E-08
154	0.00	0.000	0.020	0.2851	0.0276	0.0000	3.63E-08
155	0.00	0.000	0.017	0.2833	0.0276	0.0000	3.63E-08
156	0.00	0.000	0.014	0.2819	0.0279	0.0000	3.66E-08
157	0.00	0.000	0.018	0.2801	0.0280	0.0000	3.67E-08
158	0.00	0.000	0.012	0.2792	0.0280	0.0000	3.67E-08
159	2.14	1.948	0.029	0.2951	0.0280	0.0000	3.67E-08
160	0.00	0.000	0.104	0.2847	0.0280	0.0000	3.67E-08
161	0.01	0.000	0.068	0.2794	0.0280	0.0000	3.67E-08
162	0.00	0.000	0.012	0.2781	0.0280	0.0000	3.66E-08
163	0.00	0.000	0.006	0.2776	0.0279	0.0000	3.66E-08
164	0.00	0.000	0.004	0.2771	0.0279	0.0000	3.66E-08
165	0.00	0.000	0.001	0.2770	0.0279	0.0000	3.66E-08
166	0.00	0.000	0.000	0.2770	0.0279	0.0000	3.66E-08
167	0.09	0.000	0.011	0.2848	0.0279	0.0000	3.66E-08
168	0.00	0.000	0.012	0.2836	0.0279	0.0000	3.66E-08
169	0.00	0.000	0.014	0.2821	0.0279	0.0000	3.66E-08
170	0.00	0.000	0.017	0.2804	0.0279	0.0000	3.66E-08
171	0.00	0.000	0.017	0.2788	0.0279	0.0000	3.66E-08
172	0.49	0.304	0.032	0.2939	0.0279	0.0000	3.66E-08
173	0.23	0.057	0.188	0.2920	0.0279	0.0000	3.66E-08
174	0.01	0.000	0.022	0.2913	0.0279	0.0000	3.66E-08
175	0.00	0.000	0.016	0.2897	0.0278	0.0000	3.66E-08
176	0.00	0.000	0.015	0.2882	0.0279	0.0000	3.66E-08
177	0.00	0.000	0.015	0.2867	0.0279	0.0000	3.66E-08
178	0.00	0.000	0.016	0.2851	0.0278	0.0000	3.66E-08
179	0.00	0.000	0.014	0.2837	0.0278	0.0000	3.65E-08
180	0.00	0.000	0.012	0.2825	0.0278	0.0000	3.65E-08
181	0.06	0.000	0.021	0.2861	0.0278	0.0000	3.65E-08
182	0.39	0.226	0.026	0.2999	0.0278	0.0000	3.65E-08
183	0.00	0.000	0.071	0.2928	0.0278	0.0000	3.65E-08
184	0.00	0.000	0.013	0.2914	0.0278	0.0000	3.65E-08

185	0.00	0.000	0.012	0.2902	0.0278	0.0000	3.65E-08
186	0.62	0.449	0.027	0.3044	0.0278	0.0000	3.65E-08
187	0.00	0.000	0.142	0.2902	0.0279	0.0000	3.66E-08
188	0.00	0.000	0.100	0.2806	0.0278	0.0000	3.65E-08
189	0.00	0.000	0.019	0.2788	0.0278	0.0000	3.65E-08
190	0.00	0.000	0.009	0.2779	0.0278	0.0000	3.65E-08
191	0.00	0.000	0.007	0.2772	0.0278	0.0000	3.65E-08
192	0.00	0.000	0.002	0.2770	0.0278	0.0000	3.65E-08
193	0.00	0.000	0.000	0.2770	0.0278	0.0000	3.65E-08
194	0.00	0.000	0.000	0.2770	0.0278	0.0000	3.65E-08
195	0.00	0.000	0.000	0.2770	0.0278	0.0000	3.65E-08
196	0.00	0.000	0.000	0.2770	0.0278	0.0000	3.65E-08
197	0.01	0.000	0.005	0.2770	0.0278	0.0000	3.65E-08
198	0.18	0.031	0.019	0.2896	0.0278	0.0000	3.65E-08
199	0.40	0.254	0.030	0.3011	0.0278	0.0000	3.65E-08
200	0.26	0.112	0.029	0.3126	0.0278	0.0000	3.65E-08
201	0.59	0.441	0.030	0.3241	0.0278	0.0000	3.65E-08
202	0.00	0.000	0.250	0.2991	0.0278	0.0000	3.65E-08
203	0.00	0.000	0.019	0.2972	0.0278	0.0000	3.65E-08
204	0.00	0.000	0.020	0.2951	0.0277	0.0000	3.64E-08
205	0.00	0.000	0.021	0.2930	0.0277	0.0000	3.64E-08
206	0.00	0.000	0.022	0.2908	0.0277	0.0000	3.64E-08
207	0.00	0.000	0.022	0.2887	0.0277	0.0000	3.64E-08
208	0.01	0.000	0.022	0.2871	0.0277	0.0000	3.64E-08
209	0.00	0.000	0.019	0.2851	0.0277	0.0000	3.64E-08
210	0.00	0.000	0.019	0.2832	0.0277	0.0000	3.64E-08
211	0.00	0.000	0.018	0.2814	0.0277	0.0000	3.64E-08
212	0.00	0.000	0.021	0.2794	0.0277	0.0000	3.64E-08
213	0.00	0.000	0.020	0.2774	0.0277	0.0000	3.64E-08
214	0.00	0.000	0.002	0.2772	0.0277	0.0000	3.64E-08
215	0.00	0.000	0.002	0.2770	0.0277	0.0000	3.64E-08
216	0.00	0.000	0.000	0.2770	0.0276	0.0000	3.64E-08

217	0.00	0.000	0.000	0.2770	0.0276	0.0000	3.63E-08
218	0.00	0.000	0.000	0.2770	0.0276	0.0000	3.63E-08
219	0.67	0.489	0.026	0.2929	0.0276	0.0000	3.63E-08
220	0.00	0.000	0.008	0.2921	0.0276	0.0000	3.63E-08
221	0.00	0.000	0.018	0.2906	0.0276	0.0000	3.63E-08
222	0.00	0.000	0.015	0.2891	0.0276	0.0000	3.63E-08
223	0.00	0.000	0.013	0.2878	0.0276	0.0000	3.63E-08
224	0.00	0.000	0.011	0.2867	0.0276	0.0000	3.63E-08
225	0.00	0.000	0.014	0.2853	0.0276	0.0000	3.63E-08
226	0.72	0.548	0.026	0.3000	0.0276	0.0000	3.63E-08
227	0.00	0.000	0.110	0.2890	0.0276	0.0000	3.63E-08
228	0.00	0.000	0.097	0.2793	0.0276	0.0000	3.63E-08
229	0.00	0.000	0.011	0.2781	0.0275	0.0000	3.63E-08
230	0.00	0.000	0.006	0.2776	0.0275	0.0000	3.63E-08
231	0.00	0.000	0.004	0.2771	0.0276	0.0000	3.63E-08
232	0.11	0.000	0.014	0.2863	0.0276	0.0000	3.63E-08
233	0.03	0.000	0.024	0.2868	0.0275	0.0000	3.63E-08
234	1.92	1.752	0.040	0.2994	0.0275	0.0000	3.62E-08
235	0.00	0.000	0.055	0.2938	0.0275	0.0000	3.62E-08
236	0.00	0.000	0.123	0.2815	0.0275	0.0000	3.62E-08
237	0.00	0.000	0.033	0.2782	0.0275	0.0000	3.62E-08
238	0.09	0.000	0.025	0.2845	0.0275	0.0000	3.62E-08
239	0.01	0.000	0.030	0.2825	0.0275	0.0000	3.62E-08
240	0.07	0.000	0.039	0.2854	0.0275	0.0000	3.62E-08
241	0.00	0.000	0.025	0.2830	0.0275	0.0000	3.62E-08
242	0.00	0.000	0.024	0.2805	0.0275	0.0000	3.62E-08
243	0.00	0.000	0.023	0.2782	0.0275	0.0000	3.62E-08
244	0.00	0.000	0.009	0.2774	0.0275	0.0000	3.62E-08
245	0.00	0.000	0.003	0.2771	0.0275	0.0000	3.62E-08
246	0.00	0.000	0.000	0.2770	0.0274	0.0000	3.62E-08
247	0.00	0.000	0.000	0.2770	0.0274	0.0000	3.62E-08
248	0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08

249	0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
250	0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
251	0.01	0.000	0.005	0.2770	0.0274	0.0000	3.61E-08
252	0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
253	0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
254	0.13	0.000	0.012	0.2890	0.0274	0.0000	3.61E-08
255	0.69	0.535	0.030	0.3013	0.0274	0.0000	3.61E-08
256	0.00	0.000	0.010	0.3003	0.0274	0.0000	3.61E-08
257	0.00	0.000	0.013	0.2989	0.0274	0.0000	3.61E-08
258	0.07	0.000	0.027	0.3028	0.0274	0.0000	3.61E-08
259	0.00	0.000	0.016	0.3012	0.0273	0.0000	3.61E-08
260	0.00	0.000	0.013	0.2999	0.0273	0.0000	3.61E-08
261	1.65	1.482	0.028	0.3136	0.0273	0.0000	3.60E-08
262	0.01	0.000	0.248	0.2897	0.0273	0.0000	3.60E-08
263	0.58	0.247	0.253	0.2980	0.0273	0.0000	3.60E-08
264	0.00	0.000	0.163	0.2817	0.0273	0.0000	3.60E-08
265	0.00	0.000	0.040	0.2778	0.0273	0.0000	3.60E-08
266	0.02	0.000	0.020	0.2780	0.0273	0.0000	3.60E-08
267	0.00	0.000	0.006	0.2774	0.0273	0.0000	3.60E-08
268	0.00	0.000	0.003	0.2771	0.0273	0.0000	3.60E-08
269	0.00	0.000	0.001	0.2771	0.0273	0.0000	3.60E-08
270	0.00	0.000	0.000	0.2770	0.0273	0.0000	3.60E-08
271	0.00	0.000	0.000	0.2770	0.0273	0.0000	3.60E-08
272	0.00	0.000	0.000	0.2770	0.0272	0.0000	3.60E-08
273	0.14	0.000	0.020	0.2891	0.0272	0.0000	3.60E-08
274	0.00	0.000	0.010	0.2882	0.0272	0.0000	3.60E-08
275	0.00	0.000	0.012	0.2870	0.0272	0.0000	3.59E-08
276	0.00	0.000	0.014	0.2856	0.0272	0.0000	3.59E-08
277	0.00	0.000	0.014	0.2842	0.0272	0.0000	3.59E-08
278	0.00	0.000	0.013	0.2829	0.0272	0.0000	3.59E-08
279	0.00	0.000	0.013	0.2816	0.0272	0.0000	3.59E-08
280	0.00	0.000	0.013	0.2803	0.0272	0.0000	3.59E-08

281		0.00	0.000	0.012	0.2791	0.0272	0.0000	3.59E-08
282		0.00	0.000	0.012	0.2780	0.0272	0.0000	3.59E-08
283		0.00	0.000	0.007	0.2772	0.0272	0.0000	3.59E-08
284		0.00	0.000	0.002	0.2771	0.0272	0.0000	3.59E-08
285		0.00	0.000	0.000	0.2770	0.0271	0.0000	3.59E-08
286		0.00	0.000	0.000	0.2770	0.0271	0.0000	3.59E-08
287		0.68	0.491	0.025	0.2933	0.0271	0.0000	3.59E-08
288		0.00	0.000	0.026	0.2906	0.0271	0.0000	3.59E-08
289		0.00	0.000	0.010	0.2896	0.0271	0.0000	3.58E-08
290		0.00	0.000	0.010	0.2887	0.0271	0.0000	3.58E-08
291		0.00	0.000	0.009	0.2878	0.0271	0.0000	3.58E-08
292		0.00	0.000	0.009	0.2869	0.0271	0.0000	3.58E-08
293		0.00	0.000	0.009	0.2860	0.0271	0.0000	3.58E-08
294		0.00	0.000	0.009	0.2851	0.0271	0.0000	3.58E-08
295		0.00	0.000	0.008	0.2842	0.0271	0.0000	3.58E-08
296		0.00	0.000	0.008	0.2834	0.0271	0.0000	3.58E-08
297		0.00	0.000	0.008	0.2826	0.0271	0.0000	3.58E-08
298	*	0.00	0.000	0.008	0.2818	0.0271	0.0000	3.58E-08
299		0.00	0.000	0.008	0.2810	0.0270	0.0000	3.58E-08
300		0.00	0.000	0.008	0.2802	0.0270	0.0000	3.58E-08
301		0.00	0.000	0.007	0.2795	0.0270	0.0000	3.58E-08
302		0.00	0.000	0.008	0.2787	0.0270	0.0000	3.58E-08
303		0.01	0.000	0.015	0.2781	0.0270	0.0000	3.58E-08
304	*	0.00	0.000	0.009	0.2772	0.0270	0.0000	3.57E-08
305		0.45	0.275	0.021	0.2927	0.0270	0.0000	3.57E-08
306		0.00	0.000	0.047	0.2880	0.0270	0.0000	3.57E-08
307		0.01	0.000	0.014	0.2876	0.0270	0.0000	3.58E-08
308		0.00	0.000	0.007	0.2869	0.0272	0.0000	3.59E-08
309		0.00	0.000	0.007	0.2862	0.0271	0.0000	3.59E-08
310		0.09	0.000	0.017	0.2933	0.0271	0.0000	3.59E-08
311		0.00	0.000	0.085	0.2849	0.0271	0.0000	3.59E-08
312		1.30	1.132	0.020	0.3001	0.0271	0.0000	3.59E-08

313	*	0.00	0.000	0.000	0.3001	0.0271	0.0000	3.58E-08
314		0.71	0.521	0.059	0.3135	0.0271	0.0000	3.58E-08
315	*	0.00	0.000	0.000	0.3135	0.0271	0.0000	3.58E-08
316	*	0.00	0.000	0.024	0.3112	0.0271	0.0000	3.58E-08
317	*	0.00	0.000	0.024	0.3088	0.0271	0.0000	3.58E-08
318		0.00	0.000	0.036	0.3051	0.0271	0.0000	3.58E-08
319		0.00	0.000	0.059	0.2992	0.0271	0.0000	3.58E-08
320	*	0.00	0.000	0.035	0.2957	0.0271	0.0000	3.58E-08
321		0.01	0.000	0.071	0.2897	0.0271	0.0000	3.58E-08
322		0.01	0.000	0.106	0.2798	0.0270	0.0000	3.58E-08
323		0.00	0.000	0.023	0.2775	0.0270	0.0000	3.58E-08
324		0.01	0.000	0.013	0.2771	0.0271	0.0000	3.59E-08
325		0.00	0.000	0.001	0.2770	0.0274	0.0000	3.62E-08
326		0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
327		0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
328		0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
329		0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
330		0.00	0.000	0.000	0.2770	0.0274	0.0000	3.61E-08
331		0.80	0.599	0.033	0.2933	0.0274	0.0000	3.61E-08
332		0.00	0.000	0.021	0.2912	0.0274	0.0000	3.61E-08
333		0.00	0.000	0.050	0.2862	0.0274	0.0000	3.61E-08
334		0.10	0.000	0.065	0.2899	0.0274	0.0000	3.61E-08
335		0.07	0.000	0.046	0.2927	0.0274	0.0000	3.61E-08
336	*	0.06	0.000	0.043	0.2942	0.0274	0.0000	3.61E-08
337	*	0.03	0.000	0.041	0.2927	0.0273	0.0000	3.61E-08
338		0.06	0.000	0.028	0.2962	0.0273	0.0000	3.61E-08
339		0.00	0.000	0.020	0.2941	0.0273	0.0000	3.61E-08
340		0.00	0.000	0.019	0.2922	0.0273	0.0000	3.60E-08
341	*	0.11	0.000	0.051	0.2942	0.0273	0.0000	3.60E-08
342	*	0.00	0.000	0.029	0.2952	0.0273	0.0000	3.60E-08
343		0.00	0.000	0.017	0.2935	0.0273	0.0000	3.60E-08
344		0.00	0.000	0.018	0.2917	0.0273	0.0000	3.60E-08

345		0.43	0.260	0.032	0.3058	0.0273	0.0000	3.60E-08
346		0.00	0.000	0.068	0.2990	0.0273	0.0000	3.60E-08
347		1.66	1.404	0.120	0.3128	0.0273	0.0000	3.60E-08
348		0.04	0.000	0.077	0.3088	0.0273	0.0000	3.60E-08
349		0.03	0.000	0.051	0.3063	0.0273	0.0000	3.60E-08
350	*	0.25	0.000	0.024	0.3083	0.0272	0.0000	3.60E-08
351		0.18	0.241	0.026	0.3210	0.0272	0.0000	3.60E-08
352		0.00	0.000	0.083	0.3127	0.0272	0.0000	3.60E-08
353		0.00	0.000	0.061	0.3066	0.0272	0.0000	3.59E-08
354		0.01	0.000	0.100	0.2972	0.0272	0.0000	3.59E-08
355		0.00	0.000	0.042	0.2930	0.0273	0.0000	3.60E-08
356		0.00	0.000	0.089	0.2841	0.0273	0.0000	3.60E-08
357		0.03	0.000	0.083	0.2788	0.0273	0.0000	3.60E-08
358		0.00	0.000	0.009	0.2779	0.0273	0.0000	3.60E-08
359		0.00	0.000	0.006	0.2772	0.0273	0.0000	3.60E-08
360		0.00	0.000	0.002	0.2771	0.0273	0.0000	3.60E-08
361		0.00	0.000	0.000	0.2770	0.0273	0.0000	3.60E-08
362		0.00	0.000	0.000	0.2770	0.0272	0.0000	3.60E-08
363		0.00	0.000	0.000	0.2770	0.0272	0.0000	3.60E-08
364		0.00	0.000	0.000	0.2770	0.0272	0.0000	3.60E-08
365		0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08

* = Frozen (air or soil)

Annual Totals for Year 2

	inches	cubic feet	percent
Precipitation	36.26	131,616.7	100.00
Runoff	25.259	91,689.6	69.66
Evapotranspiration	11.139	40,434.4	30.72
Recirculation into Layer 1	0.0011	4.0610	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0011	4.0610	0.00
Percolation/Leakage through Layer 5	0.000013	0.0474	0.00
Average Head on Top of Layer 4	0.0270	---	---
Change in Water Storage	-0.1398	-507.3	-0.39
Soil Water at Start of Year	1,406.6126	5,106,003.6	3879.45
Soil Water at End of Year	1,406.4728	5,105,496.3	3879.06
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0011	-4.0603	0.00

Daily Output for Year 3

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
2			0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
3			0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
4			0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
5			0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
6			0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
7			0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
8	*		0.00	0.000	0.000	0.2770	0.0272	0.0000	3.59E-08
9	*		0.10	0.000	0.024	0.2790	0.0272	0.0000	3.59E-08
10	*		0.28	0.000	0.000	0.2809	0.0271	0.0000	3.59E-08
11			0.00	0.129	0.061	0.2936	0.0271	0.0000	3.59E-08
12			0.00	0.000	0.007	0.2930	0.0271	0.0000	3.59E-08
13			0.00	0.000	0.010	0.2919	0.0271	0.0000	3.59E-08
14			0.00	0.000	0.010	0.2909	0.0271	0.0000	3.58E-08
15	*		0.00	0.000	0.010	0.2899	0.0271	0.0000	3.58E-08
16			0.00	0.000	0.010	0.2890	0.0271	0.0000	3.58E-08
17	*		0.00	0.000	0.000	0.2890	0.0271	0.0000	3.58E-08
18	*		0.00	0.000	0.000	0.2890	0.0271	0.0000	3.58E-08
19	*		0.01	0.000	0.010	0.2890	0.0271	0.0000	3.58E-08
20	*		0.00	0.000	0.000	0.2890	0.0271	0.0000	3.58E-08
21	*		0.00	0.000	0.000	0.2890	0.0271	0.0000	3.58E-08
22			0.00	0.000	0.009	0.2880	0.0271	0.0000	3.58E-08
23			0.00	0.000	0.009	0.2871	0.0270	0.0000	3.58E-08
24			0.00	0.000	0.009	0.2862	0.0270	0.0000	3.58E-08

25		0.00	0.000	0.009	0.2853	0.0270	0.0000	3.58E-08
26		0.00	0.000	0.009	0.2845	0.0270	0.0000	3.58E-08
27	*	0.00	0.000	0.000	0.2845	0.0270	0.0000	3.58E-08
28		0.00	0.000	0.008	0.2836	0.0270	0.0000	3.57E-08
29		0.03	0.000	0.018	0.2849	0.0270	0.0000	3.57E-08
30	*	0.17	0.000	0.039	0.2869	0.0270	0.0000	3.57E-08
31	*	0.00	0.000	0.039	0.2889	0.0270	0.0000	3.57E-08
32	*	0.00	0.000	0.049	0.2895	0.0270	0.0000	3.57E-08
33		0.00	0.000	0.008	0.2887	0.0270	0.0000	3.57E-08
34		0.00	0.000	0.010	0.2877	0.0270	0.0000	3.57E-08
35		0.00	0.000	0.010	0.2867	0.0270	0.0000	3.57E-08
36		0.00	0.000	0.008	0.2859	0.0270	0.0000	3.57E-08
37		0.00	0.000	0.008	0.2850	0.0269	0.0000	3.57E-08
38	*	0.00	0.000	0.008	0.2843	0.0269	0.0000	3.57E-08
39		0.00	0.000	0.008	0.2835	0.0269	0.0000	3.57E-08
40		0.55	0.374	0.021	0.2988	0.0269	0.0000	3.57E-08
41		0.00	0.000	0.007	0.2980	0.0269	0.0000	3.57E-08
42		0.00	0.000	0.008	0.2973	0.0269	0.0000	3.56E-08
43		0.00	0.000	0.007	0.2965	0.0269	0.0000	3.56E-08
44		0.00	0.000	0.007	0.2958	0.0269	0.0000	3.56E-08
45		0.00	0.000	0.007	0.2952	0.0269	0.0000	3.56E-08
46		0.00	0.000	0.007	0.2945	0.0269	0.0000	3.56E-08
47		0.00	0.000	0.007	0.2938	0.0269	0.0000	3.56E-08
48		0.00	0.000	0.007	0.2932	0.0269	0.0000	3.56E-08
49		0.00	0.000	0.007	0.2925	0.0269	0.0000	3.56E-08
50	*	0.18	0.000	0.042	0.2945	0.0269	0.0000	3.56E-08
51	*	0.00	0.000	0.070	0.2964	0.0268	0.0000	3.56E-08
52	*	0.00	0.000	0.032	0.2958	0.0268	0.0000	3.56E-08
53		0.00	0.000	0.008	0.2950	0.0268	0.0000	3.56E-08
54		0.39	0.227	0.019	0.3089	0.0268	0.0000	3.56E-08
55		0.21	0.070	0.118	0.3111	0.0268	0.0000	3.56E-08
56		0.00	0.000	0.114	0.2996	0.0268	0.0000	3.55E-08

57		0.00	0.000	0.054	0.2943	0.0268	0.0000	3.55E-08
58		0.00	0.000	0.036	0.2906	0.0268	0.0000	3.55E-08
59		0.00	0.000	0.025	0.2882	0.0268	0.0000	3.55E-08
60		0.17	0.024	0.037	0.2992	0.0268	0.0000	3.55E-08
61	*	0.04	0.000	0.039	0.2992	0.0268	0.0000	3.55E-08
62	*	0.02	0.000	0.021	0.2992	0.0268	0.0000	3.55E-08
63	*	0.04	0.000	0.053	0.2981	0.0268	0.0000	3.55E-08
64		0.25	0.095	0.037	0.3103	0.0267	0.0000	3.55E-08
65		0.00	0.000	0.137	0.2966	0.0267	0.0000	3.55E-08
66		0.00	0.000	0.019	0.2947	0.0267	0.0000	3.55E-08
67		0.00	0.000	0.017	0.2930	0.0267	0.0000	3.55E-08
68		0.08	0.000	0.025	0.2987	0.0267	0.0000	3.55E-08
69		0.00	0.000	0.019	0.2970	0.0267	0.0000	3.54E-08
70		0.00	0.000	0.017	0.2953	0.0267	0.0000	3.54E-08
71		0.00	0.000	0.017	0.2937	0.0267	0.0000	3.54E-08
72	*	0.16	0.000	0.093	0.2956	0.0267	0.0000	3.54E-08
73		0.00	0.000	0.058	0.2944	0.0267	0.0000	3.54E-08
74	*	0.00	0.000	0.015	0.2929	0.0267	0.0000	3.54E-08
75	*	0.01	0.000	0.022	0.2915	0.0267	0.0000	3.54E-08
76		0.00	0.000	0.012	0.2904	0.0267	0.0000	3.54E-08
77		0.00	0.000	0.011	0.2893	0.0266	0.0000	3.54E-08
78		0.00	0.000	0.011	0.2882	0.0266	0.0000	3.54E-08
79		1.29	1.115	0.025	0.3036	0.0266	0.0000	3.54E-08
80		1.17	0.827	0.223	0.3152	0.0266	0.0000	3.54E-08
81		0.03	0.000	0.094	0.3090	0.0266	0.0000	3.54E-08
82	*	0.98	0.000	0.031	0.3109	0.0266	0.0000	3.54E-08
83	*	0.00	0.000	0.026	0.3129	0.0266	0.0000	3.53E-08
84	*	0.00	0.000	0.035	0.3149	0.0266	0.0000	3.53E-08
85		0.00	0.000	0.056	0.3169	0.0266	0.0000	3.53E-08
86		0.00	0.507	0.119	0.3296	0.0266	0.0000	3.53E-08
87		0.00	0.000	0.152	0.3144	0.0266	0.0000	3.53E-08
88		0.00	0.000	0.089	0.3055	0.0266	0.0000	3.53E-08

89	*	0.00	0.000	0.000	0.3055	0.0266	0.0000	3.53E-08
90	*	0.00	0.000	0.000	0.3055	0.0265	0.0000	3.53E-08
91		0.00	0.000	0.092	0.2963	0.0265	0.0000	3.53E-08
92		0.00	0.000	0.112	0.2851	0.0265	0.0000	3.53E-08
93		0.00	0.000	0.070	0.2781	0.0265	0.0000	3.53E-08
94		0.34	0.146	0.064	0.2915	0.0265	0.0000	3.53E-08
95		0.00	0.000	0.102	0.2813	0.0265	0.0000	3.53E-08
96		0.00	0.000	0.029	0.2784	0.0265	0.0000	3.52E-08
97		0.00	0.000	0.011	0.2774	0.0265	0.0000	3.52E-08
98		0.13	0.000	0.015	0.2886	0.0265	0.0000	3.52E-08
99		0.13	0.000	0.022	0.2994	0.0265	0.0000	3.52E-08
100		0.17	0.036	0.021	0.3111	0.0265	0.0000	3.52E-08
101		0.04	0.000	0.180	0.2967	0.0265	0.0000	3.52E-08
102		0.01	0.000	0.028	0.2954	0.0265	0.0000	3.52E-08
103		0.00	0.000	0.021	0.2933	0.0264	0.0000	3.52E-08
104		0.00	0.000	0.018	0.2915	0.0264	0.0000	3.52E-08
105		0.00	0.000	0.015	0.2901	0.0264	0.0000	3.52E-08
106		0.00	0.000	0.014	0.2887	0.0264	0.0000	3.52E-08
107		0.00	0.000	0.013	0.2874	0.0264	0.0000	3.52E-08
108		0.00	0.000	0.013	0.2861	0.0264	0.0000	3.52E-08
109		0.00	0.000	0.013	0.2848	0.0264	0.0000	3.52E-08
110		0.00	0.000	0.012	0.2836	0.0264	0.0000	3.51E-08
111		0.00	0.000	0.014	0.2822	0.0264	0.0000	3.51E-08
112		0.00	0.000	0.014	0.2808	0.0264	0.0000	3.51E-08
113		0.00	0.000	0.008	0.2800	0.0264	0.0000	3.51E-08
114		0.35	0.184	0.026	0.2938	0.0264	0.0000	3.51E-08
115		0.01	0.000	0.020	0.2928	0.0264	0.0000	3.51E-08
116		0.60	0.430	0.025	0.3070	0.0263	0.0000	3.51E-08
117		0.32	0.138	0.138	0.3112	0.0263	0.0000	3.51E-08
118		0.00	0.000	0.171	0.2941	0.0263	0.0000	3.51E-08
119		0.32	0.099	0.234	0.2926	0.0263	0.0000	3.51E-08
120		0.00	0.000	0.112	0.2814	0.0263	0.0000	3.51E-08

121	0.00	0.000	0.023	0.2792	0.0263	0.0000	3.51E-08
122	0.00	0.000	0.011	0.2781	0.0263	0.0000	3.51E-08
123	0.00	0.000	0.005	0.2775	0.0263	0.0000	3.51E-08
124	0.00	0.000	0.004	0.2771	0.0263	0.0000	3.50E-08
125	0.00	0.000	0.001	0.2770	0.0265	0.0000	3.53E-08
126	0.00	0.000	0.000	0.2770	0.0273	0.0000	3.60E-08
127	0.00	0.000	0.000	0.2770	0.0273	0.0000	3.60E-08
128	0.00	0.000	0.000	0.2770	0.0273	0.0000	3.60E-08
129	0.00	0.000	0.003	0.2770	0.0273	0.0000	3.60E-08
130	0.20	0.054	0.019	0.2896	0.0273	0.0000	3.60E-08
131	0.04	0.000	0.019	0.2920	0.0272	0.0000	3.60E-08
132	0.00	0.000	0.011	0.2909	0.0272	0.0000	3.60E-08
133	0.01	0.000	0.018	0.2898	0.0272	0.0000	3.60E-08
134	0.01	0.000	0.020	0.2889	0.0272	0.0000	3.59E-08
135	0.00	0.000	0.014	0.2875	0.0272	0.0000	3.59E-08
136	0.00	0.000	0.015	0.2859	0.0272	0.0000	3.59E-08
137	0.00	0.000	0.014	0.2845	0.0272	0.0000	3.59E-08
138	0.00	0.000	0.012	0.2833	0.0272	0.0000	3.59E-08
139	1.49	1.315	0.028	0.2984	0.0272	0.0000	3.59E-08
140	0.00	0.000	0.076	0.2908	0.0272	0.0000	3.59E-08
141	0.00	0.000	0.012	0.2896	0.0272	0.0000	3.59E-08
142	0.00	0.000	0.013	0.2883	0.0272	0.0000	3.59E-08
143	0.00	0.000	0.012	0.2871	0.0272	0.0000	3.59E-08
144	0.06	0.000	0.022	0.2906	0.0272	0.0000	3.59E-08
145	0.02	0.000	0.022	0.2907	0.0272	0.0000	3.59E-08
146	0.28	0.126	0.026	0.3033	0.0272	0.0000	3.59E-08
147	0.00	0.000	0.127	0.2906	0.0271	0.0000	3.59E-08
148	0.28	0.113	0.026	0.3050	0.0272	0.0000	3.59E-08
149	0.00	0.000	0.191	0.2862	0.0272	0.0000	3.59E-08
150	0.00	0.000	0.015	0.2846	0.0272	0.0000	3.59E-08
151	0.51	0.329	0.026	0.3006	0.0272	0.0000	3.59E-08
152	0.11	0.000	0.122	0.2996	0.0272	0.0000	3.59E-08

153	0.60	0.287	0.274	0.3031	0.0272	0.0000	3.59E-08
154	1.43	1.137	0.178	0.3144	0.0272	0.0000	3.59E-08
155	0.01	0.000	0.209	0.2947	0.0272	0.0000	3.59E-08
156	0.00	0.000	0.138	0.2809	0.0272	0.0000	3.59E-08
157	0.00	0.000	0.031	0.2777	0.0271	0.0000	3.59E-08
158	0.00	0.000	0.006	0.2771	0.0271	0.0000	3.59E-08
159	0.13	0.000	0.016	0.2882	0.0271	0.0000	3.59E-08
160	0.02	0.000	0.027	0.2873	0.0271	0.0000	3.58E-08
161	0.94	0.764	0.046	0.3001	0.0271	0.0000	3.58E-08
162	0.03	0.000	0.181	0.2849	0.0271	0.0000	3.58E-08
163	0.00	0.000	0.023	0.2826	0.0271	0.0000	3.58E-08
164	0.00	0.000	0.024	0.2803	0.0271	0.0000	3.58E-08
165	0.00	0.000	0.020	0.2783	0.0271	0.0000	3.58E-08
166	0.00	0.000	0.007	0.2776	0.0271	0.0000	3.58E-08
167	0.00	0.000	0.005	0.2771	0.0271	0.0000	3.58E-08
168	0.00	0.000	0.001	0.2770	0.0271	0.0000	3.58E-08
169	0.00	0.000	0.000	0.2770	0.0270	0.0000	3.58E-08
170	0.00	0.000	0.000	0.2770	0.0270	0.0000	3.58E-08
171	0.00	0.000	0.000	0.2770	0.0270	0.0000	3.58E-08
172	0.00	0.000	0.000	0.2770	0.0270	0.0000	3.58E-08
173	0.00	0.000	0.004	0.2770	0.0270	0.0000	3.58E-08
174	0.00	0.000	0.000	0.2770	0.0270	0.0000	3.57E-08
175	0.00	0.000	0.000	0.2770	0.0270	0.0000	3.57E-08
176	0.04	0.000	0.012	0.2799	0.0270	0.0000	3.57E-08
177	0.00	0.000	0.002	0.2797	0.0270	0.0000	3.57E-08
178	0.00	0.000	0.006	0.2791	0.0270	0.0000	3.57E-08
179	0.00	0.000	0.003	0.2788	0.0270	0.0000	3.57E-08
180	0.28	0.115	0.026	0.2931	0.0270	0.0000	3.57E-08
181	0.16	0.032	0.019	0.3040	0.0270	0.0000	3.57E-08
182	0.05	0.000	0.019	0.3076	0.0270	0.0000	3.57E-08
183	0.00	0.000	0.013	0.3062	0.0269	0.0000	3.57E-08
184	0.00	0.000	0.011	0.3051	0.0269	0.0000	3.57E-08

185	0.00	0.000	0.016	0.3039	0.0269	0.0000	3.57E-08
186	0.00	0.000	0.011	0.3028	0.0269	0.0000	3.57E-08
187	0.00	0.000	0.014	0.3014	0.0269	0.0000	3.56E-08
188	0.00	0.000	0.012	0.3002	0.0269	0.0000	3.56E-08
189	0.23	0.077	0.026	0.3128	0.0269	0.0000	3.56E-08
190	0.32	0.120	0.275	0.3055	0.0269	0.0000	3.56E-08
191	0.16	0.012	0.184	0.3023	0.0269	0.0000	3.56E-08
192	0.18	0.046	0.093	0.3069	0.0269	0.0000	3.56E-08
193	0.00	0.000	0.045	0.3025	0.0269	0.0000	3.56E-08
194	0.00	0.000	0.035	0.2990	0.0269	0.0000	3.56E-08
195	0.02	0.000	0.036	0.2973	0.0269	0.0000	3.56E-08
196	0.66	0.490	0.045	0.3102	0.0268	0.0000	3.56E-08
197	0.36	0.137	0.293	0.3029	0.0268	0.0000	3.56E-08
198	0.73	0.394	0.294	0.3067	0.0268	0.0000	3.56E-08
199	0.08	0.000	0.176	0.2973	0.0268	0.0000	3.56E-08
200	0.00	0.000	0.134	0.2839	0.0268	0.0000	3.56E-08
201	0.00	0.000	0.052	0.2787	0.0268	0.0000	3.55E-08
202	0.00	0.000	0.013	0.2774	0.0268	0.0000	3.55E-08
203	0.23	0.085	0.034	0.2889	0.0268	0.0000	3.55E-08
204	0.09	0.000	0.031	0.2953	0.0268	0.0000	3.55E-08
205	0.00	0.000	0.016	0.2937	0.0268	0.0000	3.55E-08
206	0.00	0.000	0.025	0.2911	0.0268	0.0000	3.55E-08
207	0.00	0.000	0.027	0.2884	0.0268	0.0000	3.55E-08
208	0.00	0.000	0.021	0.2863	0.0268	0.0000	3.55E-08
209	0.00	0.000	0.023	0.2840	0.0267	0.0000	3.55E-08
210	0.00	0.000	0.020	0.2820	0.0267	0.0000	3.55E-08
211	0.00	0.000	0.018	0.2802	0.0267	0.0000	3.55E-08
212	0.00	0.000	0.017	0.2785	0.0267	0.0000	3.55E-08
213	0.00	0.000	0.013	0.2772	0.0267	0.0000	3.55E-08
214	0.00	0.000	0.001	0.2771	0.0267	0.0000	3.55E-08
215	0.00	0.000	0.001	0.2770	0.0267	0.0000	3.54E-08
216	0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08

217	0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08
218	0.00	0.000	0.000	0.2770	0.0267	0.0000	3.54E-08
219	0.02	0.000	0.013	0.2782	0.0267	0.0000	3.54E-08
220	0.00	0.000	0.002	0.2780	0.0267	0.0000	3.54E-08
221	0.00	0.000	0.004	0.2776	0.0267	0.0000	3.54E-08
222	0.00	0.000	0.004	0.2772	0.0266	0.0000	3.54E-08
223	0.00	0.000	0.001	0.2771	0.0266	0.0000	3.54E-08
224	0.00	0.000	0.001	0.2771	0.0266	0.0000	3.54E-08
225	1.29	1.100	0.031	0.2928	0.0266	0.0000	3.54E-08
226	0.16	0.012	0.099	0.2975	0.0266	0.0000	3.54E-08
227	0.15	0.007	0.098	0.3022	0.0266	0.0000	3.54E-08
228	0.00	0.000	0.063	0.2960	0.0266	0.0000	3.54E-08
229	0.00	0.000	0.041	0.2919	0.0266	0.0000	3.53E-08
230	0.00	0.000	0.035	0.2884	0.0266	0.0000	3.53E-08
231	0.48	0.279	0.052	0.3032	0.0266	0.0000	3.53E-08
232	0.00	0.000	0.092	0.2940	0.0266	0.0000	3.53E-08
233	0.00	0.000	0.030	0.2910	0.0266	0.0000	3.53E-08
234	0.00	0.000	0.027	0.2883	0.0266	0.0000	3.53E-08
235	0.00	0.000	0.022	0.2861	0.0266	0.0000	3.53E-08
236	0.00	0.000	0.024	0.2837	0.0265	0.0000	3.53E-08
237	0.00	0.000	0.023	0.2814	0.0265	0.0000	3.53E-08
238	0.00	0.000	0.024	0.2790	0.0265	0.0000	3.53E-08
239	0.00	0.000	0.011	0.2780	0.0265	0.0000	3.53E-08
240	0.68	0.481	0.042	0.2933	0.0265	0.0000	3.53E-08
241	0.00	0.000	0.100	0.2833	0.0265	0.0000	3.53E-08
242	0.00	0.000	0.018	0.2815	0.0265	0.0000	3.53E-08
243	0.00	0.000	0.019	0.2797	0.0265	0.0000	3.52E-08
244	0.00	0.000	0.021	0.2775	0.0265	0.0000	3.52E-08
245	0.00	0.000	0.003	0.2772	0.0265	0.0000	3.52E-08
246	0.38	0.204	0.032	0.2912	0.0265	0.0000	3.52E-08
247	0.00	0.000	0.070	0.2841	0.0265	0.0000	3.52E-08
248	0.00	0.000	0.056	0.2786	0.0265	0.0000	3.52E-08

249	0.44	0.176	0.149	0.2898	0.0264	0.0000	3.52E-08
250	0.06	0.000	0.118	0.2840	0.0264	0.0000	3.52E-08
251	0.25	0.087	0.071	0.2932	0.0264	0.0000	3.52E-08
252	0.86	0.424	0.358	0.3007	0.0264	0.0000	3.52E-08
253	0.00	0.000	0.158	0.2849	0.0264	0.0000	3.52E-08
254	0.00	0.000	0.040	0.2809	0.0264	0.0000	3.52E-08
255	0.00	0.000	0.020	0.2789	0.0264	0.0000	3.52E-08
256	0.00	0.000	0.010	0.2780	0.0265	0.0000	3.53E-08
257	0.00	0.000	0.007	0.2772	0.0265	0.0000	3.53E-08
258	0.00	0.000	0.002	0.2770	0.0265	0.0000	3.53E-08
259	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.53E-08
260	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.53E-08
261	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.53E-08
262	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.52E-08
263	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.52E-08
264	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.52E-08
265	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.52E-08
266	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.52E-08
267	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.52E-08
268	0.00	0.000	0.000	0.2770	0.0265	0.0000	3.52E-08
269	0.33	0.164	0.029	0.2905	0.0264	0.0000	3.52E-08
270	0.00	0.000	0.007	0.2899	0.0264	0.0000	3.52E-08
271	0.00	0.000	0.011	0.2888	0.0264	0.0000	3.52E-08
272	0.00	0.000	0.010	0.2878	0.0264	0.0000	3.52E-08
273	0.00	0.000	0.010	0.2868	0.0264	0.0000	3.52E-08
274	0.00	0.000	0.010	0.2858	0.0264	0.0000	3.52E-08
275	0.00	0.000	0.010	0.2849	0.0264	0.0000	3.52E-08
276	0.00	0.000	0.009	0.2839	0.0264	0.0000	3.51E-08
277	0.00	0.000	0.009	0.2830	0.0264	0.0000	3.51E-08
278	0.00	0.000	0.009	0.2821	0.0264	0.0000	3.51E-08
279	0.00	0.000	0.009	0.2812	0.0264	0.0000	3.51E-08
280	0.35	0.179	0.025	0.2957	0.0264	0.0000	3.51E-08

281	0.00	0.000	0.008	0.2949	0.0264	0.0000	3.51E-08
282	0.00	0.000	0.009	0.2940	0.0264	0.0000	3.51E-08
283	0.00	0.000	0.008	0.2932	0.0263	0.0000	3.51E-08
284	0.00	0.000	0.008	0.2924	0.0263	0.0000	3.51E-08
285	0.00	0.000	0.008	0.2916	0.0263	0.0000	3.51E-08
286	0.00	0.000	0.008	0.2908	0.0263	0.0000	3.51E-08
287	0.00	0.000	0.008	0.2901	0.0263	0.0000	3.51E-08
288	0.00	0.000	0.010	0.2893	0.0263	0.0000	3.51E-08
289	0.00	0.000	0.008	0.2886	0.0263	0.0000	3.51E-08
290	0.00	0.000	0.008	0.2878	0.0263	0.0000	3.51E-08
291	0.00	0.000	0.008	0.2870	0.0263	0.0000	3.50E-08
292	0.00	0.000	0.008	0.2862	0.0263	0.0000	3.50E-08
293	0.00	0.000	0.007	0.2854	0.0263	0.0000	3.50E-08
294	0.00	0.000	0.007	0.2847	0.0263	0.0000	3.50E-08
295	0.00	0.000	0.008	0.2839	0.0263	0.0000	3.50E-08
296	0.00	0.000	0.008	0.2831	0.0263	0.0000	3.50E-08
297	0.00	0.000	0.007	0.2824	0.0262	0.0000	3.50E-08
298	0.00	0.000	0.008	0.2816	0.0262	0.0000	3.50E-08
299	0.00	0.000	0.008	0.2808	0.0262	0.0000	3.50E-08
300	0.02	0.000	0.019	0.2813	0.0262	0.0000	3.50E-08
301	0.03	0.000	0.021	0.2826	0.0262	0.0000	3.50E-08
302	1.41	1.259	0.024	0.2952	0.0262	0.0000	3.50E-08
303	0.12	0.000	0.092	0.2978	0.0262	0.0000	3.50E-08
304	0.00	0.000	0.009	0.2969	0.0262	0.0000	3.50E-08
305	0.05	0.000	0.021	0.2993	0.0262	0.0000	3.50E-08
306	0.03	0.000	0.021	0.3005	0.0262	0.0000	3.49E-08
307	0.38	0.232	0.024	0.3130	0.0262	0.0000	3.49E-08
308	0.01	0.000	0.076	0.3060	0.0262	0.0000	3.49E-08
309	0.00	0.000	0.115	0.2946	0.0262	0.0000	3.49E-08
310	0.00	0.000	0.106	0.2840	0.0262	0.0000	3.49E-08
311	0.00	0.000	0.052	0.2788	0.0261	0.0000	3.49E-08
312	0.00	0.000	0.015	0.2773	0.0261	0.0000	3.49E-08

313		0.00	0.000	0.002	0.2770	0.0261	0.0000	3.49E-08
314		0.00	0.000	0.000	0.2770	0.0261	0.0000	3.49E-08
315		0.00	0.000	0.000	0.2770	0.0261	0.0000	3.49E-08
316		0.00	0.000	0.000	0.2770	0.0261	0.0000	3.49E-08
317		0.00	0.000	0.000	0.2770	0.0261	0.0000	3.49E-08
318		0.08	0.000	0.015	0.2833	0.0261	0.0000	3.49E-08
319		0.00	0.000	0.010	0.2823	0.0261	0.0000	3.48E-08
320		0.00	0.000	0.011	0.2812	0.0261	0.0000	3.48E-08
321	*	0.00	0.000	0.000	0.2812	0.0261	0.0000	3.48E-08
322	*	0.00	0.000	0.000	0.2812	0.0261	0.0000	3.48E-08
323		0.00	0.000	0.012	0.2800	0.0261	0.0000	3.48E-08
324		0.96	0.781	0.030	0.2948	0.0261	0.0000	3.48E-08
325		0.09	0.000	0.050	0.2988	0.0260	0.0000	3.48E-08
326		0.17	0.018	0.052	0.3089	0.0260	0.0000	3.48E-08
327		0.05	0.000	0.071	0.3066	0.0260	0.0000	3.48E-08
328		0.00	0.000	0.047	0.3019	0.0260	0.0000	3.48E-08
329		0.00	0.000	0.057	0.2963	0.0260	0.0000	3.48E-08
330		0.00	0.000	0.083	0.2879	0.0260	0.0000	3.48E-08
331		0.54	0.317	0.065	0.3034	0.0260	0.0000	3.48E-08
332		0.00	0.000	0.118	0.2916	0.0260	0.0000	3.48E-08
333		0.00	0.000	0.062	0.2854	0.0260	0.0000	3.48E-08
334		0.00	0.000	0.071	0.2783	0.0260	0.0000	3.48E-08
335		0.00	0.000	0.010	0.2773	0.0260	0.0000	3.48E-08
336		0.00	0.000	0.002	0.2772	0.0260	0.0000	3.48E-08
337		0.06	0.000	0.016	0.2820	0.0260	0.0000	3.47E-08
338		0.00	0.000	0.013	0.2806	0.0260	0.0000	3.47E-08
339		0.00	0.000	0.016	0.2790	0.0260	0.0000	3.47E-08
340	*	0.00	0.000	0.000	0.2790	0.0260	0.0000	3.47E-08
341	*	0.00	0.000	0.000	0.2790	0.0260	0.0000	3.47E-08
342		0.00	0.000	0.007	0.2784	0.0259	0.0000	3.47E-08
343	*	0.00	0.000	0.000	0.2784	0.0259	0.0000	3.47E-08
344		0.00	0.000	0.005	0.2779	0.0259	0.0000	3.47E-08

345		0.00	0.000	0.004	0.2775	0.0259	0.0000	3.47E-08
346	*	0.06	0.000	0.023	0.2795	0.0259	0.0000	3.47E-08
347		0.08	0.000	0.028	0.2861	0.0259	0.0000	3.47E-08
348	*	0.00	0.000	0.000	0.2861	0.0259	0.0000	3.47E-08
349		0.05	0.000	0.020	0.2891	0.0259	0.0000	3.47E-08
350		0.01	0.000	0.016	0.2884	0.0259	0.0000	3.47E-08
351		0.02	0.000	0.018	0.2886	0.0259	0.0000	3.46E-08
352		0.07	0.000	0.022	0.2937	0.0259	0.0000	3.46E-08
353		0.00	0.000	0.009	0.2930	0.0259	0.0000	3.46E-08
354		0.14	0.002	0.021	0.3048	0.0259	0.0000	3.46E-08
355		1.57	1.431	0.028	0.3165	0.0258	0.0000	3.46E-08
356		0.02	0.000	0.073	0.3110	0.0258	0.0000	3.46E-08
357		0.02	0.000	0.085	0.3046	0.0258	0.0000	3.46E-08
358		0.28	0.101	0.065	0.3160	0.0258	0.0000	3.46E-08
359		0.03	0.000	0.062	0.3128	0.0258	0.0000	3.46E-08
360		0.00	0.000	0.045	0.3084	0.0258	0.0000	3.46E-08
361	*	0.00	0.000	0.000	0.3084	0.0258	0.0000	3.46E-08
362	*	0.00	0.000	0.000	0.3084	0.0258	0.0000	3.46E-08
363		0.00	0.000	0.054	0.3030	0.0258	0.0000	3.46E-08
364		0.00	0.000	0.043	0.2987	0.0258	0.0000	3.46E-08
365	*	0.00	0.000	0.000	0.2987	0.0258	0.0000	3.45E-08

* = Frozen (air or soil)

Annual Totals for Year 3			
	inches	cubic feet	percent
Precipitation	30.17	109,519.4	100.00
Runoff	17.288	62,755.1	57.30
Evapotranspiration	12.666	45,978.5	41.98
Recirculation into Layer 1	0.0011	3.9983	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0011	3.9983	0.00
Percolation/Leakage through Layer 5	0.000013	0.0469	0.00
Average Head on Top of Layer 4	0.0266	---	---
Change in Water Storage	0.2165	785.8	0.72
Soil Water at Start of Year	1,406.4728	5,105,496.3	4661.73
Soil Water at End of Year	1,406.6893	5,106,282.0	4662.45
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0011	-3.9989	0.00

Daily Output for Year 4

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.052	0.2935	0.0258	0.0000	3.45E-08
2			0.00	0.000	0.058	0.2878	0.0258	0.0000	3.45E-08
3			0.00	0.000	0.044	0.2833	0.0258	0.0000	3.45E-08
4			0.00	0.000	0.038	0.2796	0.0257	0.0000	3.45E-08
5			0.00	0.000	0.023	0.2772	0.0257	0.0000	3.45E-08
6			0.02	0.000	0.014	0.2780	0.0257	0.0000	3.45E-08
7			0.05	0.000	0.014	0.2819	0.0257	0.0000	3.45E-08
8			0.11	0.000	0.022	0.2907	0.0257	0.0000	3.45E-08
9			0.00	0.000	0.010	0.2897	0.0257	0.0000	3.45E-08
10			0.38	0.209	0.034	0.3036	0.0257	0.0000	3.45E-08
11			0.00	0.000	0.053	0.2983	0.0257	0.0000	3.45E-08
12			0.33	0.163	0.033	0.3121	0.0257	0.0000	3.45E-08
13			0.02	0.000	0.105	0.3036	0.0257	0.0000	3.45E-08
14			0.17	0.029	0.065	0.3112	0.0257	0.0000	3.44E-08
15			0.00	0.000	0.113	0.2999	0.0257	0.0000	3.44E-08
16			0.00	0.000	0.125	0.2874	0.0257	0.0000	3.44E-08
17			0.00	0.000	0.086	0.2787	0.0257	0.0000	3.44E-08
18			0.00	0.000	0.015	0.2775	0.0259	0.0000	3.46E-08
19	*		0.00	0.000	0.000	0.2775	0.0261	0.0000	3.48E-08
20			0.00	0.000	0.003	0.2772	0.0261	0.0000	3.48E-08
21	*		0.00	0.000	0.000	0.2772	0.0261	0.0000	3.48E-08
22	*		0.00	0.000	0.000	0.2772	0.0261	0.0000	3.48E-08
23			0.00	0.000	0.001	0.2770	0.0260	0.0000	3.48E-08
24			0.00	0.000	0.000	0.2770	0.0260	0.0000	3.48E-08

25			0.07	0.000	0.014	0.2827	0.0260	0.0000	3.48E-08
26	*		0.00	0.000	0.000	0.2827	0.0260	0.0000	3.48E-08
27	*		0.00	0.000	0.000	0.2827	0.0260	0.0000	3.48E-08
28	*		0.18	0.000	0.011	0.2847	0.0260	0.0000	3.48E-08
29	*		0.40	0.000	0.019	0.2867	0.0260	0.0000	3.48E-08
30	*		0.00	0.000	0.025	0.2886	0.0260	0.0000	3.48E-08
31	*		0.00	0.000	0.014	0.2906	0.0260	0.0000	3.48E-08
32	*		0.00	0.000	0.019	0.2926	0.0260	0.0000	3.47E-08
33			0.00	0.218	0.042	0.3053	0.0260	0.0000	3.47E-08
34	*		0.05	0.000	0.048	0.3054	0.0260	0.0000	3.47E-08
35			0.35	0.167	0.037	0.3198	0.0260	0.0000	3.47E-08
36			0.62	0.376	0.149	0.3291	0.0260	0.0000	3.47E-08
37			0.94	0.743	0.085	0.3408	0.0259	0.0000	3.47E-08
38			0.00	0.000	0.103	0.3305	0.0259	0.0000	3.47E-08
39			0.00	0.000	0.054	0.3251	0.0259	0.0000	3.47E-08
40	*		0.00	0.000	0.000	0.3251	0.0259	0.0000	3.47E-08
41	*		0.00	0.000	0.000	0.3251	0.0259	0.0000	3.47E-08
42	*		0.00	0.000	0.000	0.3251	0.0259	0.0000	3.47E-08
43	*		0.00	0.000	0.000	0.3251	0.0259	0.0000	3.47E-08
44	*	*	0.00	0.000	0.000	0.3251	0.0259	0.0000	3.47E-08
45	*	*	0.57	0.000	0.004	0.3251	0.0259	0.0000	3.47E-08
46	*	*	0.00	0.000	0.014	0.3251	0.0259	0.0000	3.46E-08
47	*	*	0.33	0.000	0.022	0.3251	0.0259	0.0000	3.46E-08
48	*	*	0.32	0.000	0.011	0.3251	0.0259	0.0000	3.46E-08
49	*	*	0.00	0.000	0.026	0.3251	0.0259	0.0000	3.46E-08
50	*	*	0.00	0.000	0.029	0.3251	0.0258	0.0000	3.46E-08
51		*	0.00	1.081	0.000	0.3279	0.0258	0.0000	3.46E-08
52		*	0.00	0.000	0.000	0.3279	0.0258	0.0000	3.46E-08
53			0.00	0.000	0.113	0.3166	0.0258	0.0000	3.46E-08
54			0.00	0.000	0.111	0.3055	0.0258	0.0000	3.46E-08
55			0.00	0.000	0.114	0.2941	0.0258	0.0000	3.46E-08
56			0.00	0.000	0.128	0.2814	0.0258	0.0000	3.46E-08

57			0.00	0.000	0.038	0.2776	0.0258	0.0000	3.46E-08
58			0.00	0.000	0.005	0.2770	0.0264	0.0000	3.51E-08
59			0.00	0.000	0.000	0.2770	0.0285	0.0000	3.72E-08
60	*		0.36	0.000	0.040	0.2790	0.0285	0.0000	3.72E-08
61	*		0.15	0.000	0.043	0.2809	0.0285	0.0000	3.72E-08
62	*		0.00	0.000	0.022	0.2829	0.0285	0.0000	3.71E-08
63	*		0.00	0.000	0.015	0.2849	0.0285	0.0000	3.71E-08
64	*		0.01	0.000	0.009	0.2868	0.0285	0.0000	3.71E-08
65	*	*	0.00	0.000	0.027	0.2868	0.0284	0.0000	3.71E-08
66	*	*	0.00	0.000	0.017	0.2868	0.0284	0.0000	3.71E-08
67	*	*	0.00	0.000	0.034	0.2868	0.0284	0.0000	3.71E-08
68		*	1.20	1.404	0.000	0.2880	0.0284	0.0000	3.71E-08
69	*	*	0.00	0.000	0.000	0.2880	0.0284	0.0000	3.71E-08
70		*	0.36	0.348	0.012	0.2880	0.0284	0.0000	3.71E-08
71		*	0.07	0.000	0.012	0.2940	0.0284	0.0000	3.71E-08
72			0.01	0.000	0.045	0.2901	0.0284	0.0000	3.71E-08
73			0.41	0.159	0.116	0.3037	0.0284	0.0000	3.71E-08
74			0.00	0.000	0.034	0.3002	0.0284	0.0000	3.71E-08
75			0.00	0.000	0.069	0.2933	0.0284	0.0000	3.70E-08
76			0.00	0.000	0.099	0.2834	0.0284	0.0000	3.70E-08
77			0.00	0.000	0.048	0.2786	0.0283	0.0000	3.70E-08
78	*		0.00	0.000	0.012	0.2773	0.0283	0.0000	3.70E-08
79			0.00	0.000	0.003	0.2771	0.0283	0.0000	3.70E-08
80			0.00	0.000	0.000	0.2770	0.0283	0.0000	3.70E-08
81			0.10	0.000	0.016	0.2856	0.0283	0.0000	3.70E-08
82			0.23	0.078	0.029	0.2976	0.0283	0.0000	3.70E-08
83	*		0.00	0.000	0.022	0.2957	0.0283	0.0000	3.70E-08
84			0.08	0.000	0.068	0.2971	0.0283	0.0000	3.70E-08
85			0.00	0.000	0.069	0.2902	0.0283	0.0000	3.70E-08
86			0.30	0.099	0.140	0.2966	0.0283	0.0000	3.70E-08
87			0.09	0.000	0.134	0.2922	0.0283	0.0000	3.69E-08
88			0.03	0.000	0.049	0.2904	0.0283	0.0000	3.70E-08

89		0.10	0.000	0.044	0.2964	0.0285	0.0000	3.72E-08
90		0.02	0.000	0.039	0.2946	0.0285	0.0000	3.71E-08
91		0.02	0.000	0.037	0.2933	0.0285	0.0000	3.71E-08
92		0.89	0.726	0.040	0.3062	0.0285	0.0000	3.71E-08
93		0.31	0.144	0.075	0.3154	0.0284	0.0000	3.71E-08
94		0.67	0.389	0.223	0.3213	0.0284	0.0000	3.71E-08
95		0.00	0.000	0.127	0.3085	0.0284	0.0000	3.71E-08
96		0.00	0.000	0.159	0.2926	0.0286	0.0000	3.73E-08
97		0.00	0.000	0.137	0.2789	0.0287	0.0000	3.74E-08
98		0.00	0.000	0.011	0.2778	0.0287	0.0000	3.74E-08
99		0.00	0.000	0.004	0.2774	0.0287	0.0000	3.73E-08
100		0.02	0.000	0.018	0.2781	0.0287	0.0000	3.73E-08
101		0.89	0.687	0.047	0.2932	0.0287	0.0000	3.73E-08
102		0.19	0.059	0.039	0.3027	0.0287	0.0000	3.73E-08
103		1.63	1.364	0.151	0.3143	0.0286	0.0000	3.73E-08
104		0.00	0.000	0.099	0.3044	0.0286	0.0000	3.73E-08
105		0.00	0.000	0.105	0.2939	0.0286	0.0000	3.73E-08
106		0.00	0.000	0.152	0.2787	0.0286	0.0000	3.73E-08
107		0.00	0.000	0.009	0.2779	0.0286	0.0000	3.73E-08
108		0.00	0.000	0.006	0.2772	0.0286	0.0000	3.73E-08
109		0.00	0.000	0.004	0.2770	0.0307	0.0000	3.92E-08
110		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
111		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
112		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
113		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
114		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
115		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
116		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
117		0.11	0.000	0.014	0.2866	0.0318	0.0000	4.04E-08
118		0.13	0.000	0.020	0.2978	0.0318	0.0000	4.04E-08
119		0.03	0.000	0.019	0.2991	0.0318	0.0000	4.03E-08
120	*	0.00	0.000	0.012	0.2979	0.0318	0.0000	4.03E-08

121	*	1.03	0.000	0.043	0.2999	0.0318	0.0000	4.03E-08
122		4.75	5.591	0.000	0.3126	0.0318	0.0000	4.03E-08
123	*	0.00	0.000	0.078	0.3048	0.0318	0.0000	4.03E-08
124		0.00	0.000	0.100	0.2948	0.0318	0.0000	4.03E-08
125		0.00	0.000	0.149	0.2800	0.0318	0.0000	4.03E-08
126		0.12	0.000	0.049	0.2873	0.0318	0.0000	4.03E-08
127		0.31	0.108	0.068	0.3002	0.0318	0.0000	4.03E-08
128		0.20	0.072	0.032	0.3102	0.0317	0.0000	4.03E-08
129		0.14	0.006	0.175	0.3065	0.0317	0.0000	4.03E-08
130		0.53	0.360	0.048	0.3191	0.0317	0.0000	4.03E-08
131		0.11	0.002	0.263	0.3040	0.0317	0.0000	4.02E-08
132		0.04	0.000	0.236	0.2845	0.0317	0.0000	4.02E-08
133		0.01	0.000	0.068	0.2787	0.0317	0.0000	4.02E-08
134		0.00	0.000	0.013	0.2774	0.0317	0.0000	4.02E-08
135		0.20	0.050	0.033	0.2890	0.0318	0.0000	4.03E-08
136		0.32	0.161	0.048	0.3005	0.0318	0.0000	4.03E-08
137		0.00	0.000	0.014	0.2991	0.0317	0.0000	4.03E-08
138		0.00	0.000	0.020	0.2971	0.0317	0.0000	4.03E-08
139		0.50	0.315	0.040	0.3120	0.0317	0.0000	4.03E-08
140		0.00	0.000	0.204	0.2915	0.0317	0.0000	4.02E-08
141		0.00	0.000	0.023	0.2892	0.0317	0.0000	4.02E-08
142		0.07	0.000	0.037	0.2927	0.0317	0.0000	4.02E-08
143		0.72	0.565	0.038	0.3045	0.0317	0.0000	4.02E-08
144		0.00	0.000	0.141	0.2904	0.0317	0.0000	4.02E-08
145		0.00	0.000	0.108	0.2796	0.0317	0.0000	4.02E-08
146		0.11	0.000	0.043	0.2866	0.0317	0.0000	4.02E-08
147		0.10	0.000	0.039	0.2931	0.0317	0.0000	4.03E-08
148		0.00	0.000	0.020	0.2911	0.0320	0.0000	4.05E-08
149		0.00	0.000	0.027	0.2884	0.0320	0.0000	4.05E-08
150		0.02	0.000	0.033	0.2873	0.0320	0.0000	4.05E-08
151		0.09	0.000	0.035	0.2930	0.0320	0.0000	4.05E-08
152		0.00	0.000	0.019	0.2911	0.0320	0.0000	4.05E-08

153	0.00	0.000	0.019	0.2893	0.0320	0.0000	4.05E-08
154	0.01	0.000	0.026	0.2877	0.0320	0.0000	4.05E-08
155	0.00	0.000	0.020	0.2858	0.0319	0.0000	4.05E-08
156	0.00	0.000	0.017	0.2841	0.0319	0.0000	4.04E-08
157	0.00	0.000	0.018	0.2823	0.0319	0.0000	4.04E-08
158	0.00	0.000	0.017	0.2806	0.0319	0.0000	4.04E-08
159	0.00	0.000	0.015	0.2791	0.0319	0.0000	4.04E-08
160	0.00	0.000	0.011	0.2780	0.0319	0.0000	4.04E-08
161	0.00	0.000	0.011	0.2774	0.0319	0.0000	4.04E-08
162	0.00	0.000	0.003	0.2771	0.0319	0.0000	4.04E-08
163	0.00	0.000	0.001	0.2770	0.0319	0.0000	4.04E-08
164	0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
165	0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
166	0.00	0.000	0.000	0.2770	0.0318	0.0000	4.04E-08
167	0.15	0.006	0.021	0.2897	0.0318	0.0000	4.04E-08
168	0.11	0.000	0.020	0.2991	0.0318	0.0000	4.03E-08
169	0.00	0.000	0.009	0.2982	0.0318	0.0000	4.03E-08
170	0.00	0.000	0.016	0.2969	0.0318	0.0000	4.03E-08
171	0.00	0.000	0.012	0.2957	0.0318	0.0000	4.03E-08
172	0.00	0.000	0.012	0.2944	0.0318	0.0000	4.03E-08
173	0.00	0.000	0.013	0.2931	0.0318	0.0000	4.03E-08
174	0.00	0.000	0.011	0.2921	0.0318	0.0000	4.03E-08
175	1.57	1.399	0.028	0.3065	0.0318	0.0000	4.03E-08
176	0.15	0.009	0.092	0.3111	0.0318	0.0000	4.03E-08
177	0.00	0.000	0.225	0.2886	0.0317	0.0000	4.03E-08
178	0.00	0.000	0.088	0.2799	0.0317	0.0000	4.03E-08
179	0.07	0.000	0.039	0.2827	0.0317	0.0000	4.03E-08
180	0.00	0.000	0.025	0.2802	0.0317	0.0000	4.03E-08
181	0.00	0.000	0.015	0.2788	0.0317	0.0000	4.03E-08
182	0.00	0.000	0.009	0.2779	0.0317	0.0000	4.02E-08
183	0.00	0.000	0.007	0.2772	0.0318	0.0000	4.03E-08
184	0.00	0.000	0.002	0.2770	0.0319	0.0000	4.04E-08

185	0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
186	0.00	0.000	0.000	0.2770	0.0318	0.0000	4.04E-08
187	0.00	0.000	0.000	0.2770	0.0318	0.0000	4.04E-08
188	0.00	0.000	0.000	0.2770	0.0318	0.0000	4.03E-08
189	0.22	0.070	0.024	0.2895	0.0318	0.0000	4.03E-08
190	0.00	0.000	0.013	0.2882	0.0318	0.0000	4.03E-08
191	0.36	0.179	0.034	0.3024	0.0318	0.0000	4.03E-08
192	0.47	0.318	0.040	0.3132	0.0318	0.0000	4.03E-08
193	0.24	0.078	0.288	0.3009	0.0318	0.0000	4.03E-08
194	1.57	1.271	0.184	0.3121	0.0318	0.0000	4.03E-08
195	0.00	0.000	0.237	0.2884	0.0318	0.0000	4.03E-08
196	0.00	0.000	0.096	0.2788	0.0318	0.0000	4.03E-08
197	0.00	0.000	0.012	0.2776	0.0318	0.0000	4.03E-08
198	0.00	0.000	0.003	0.2772	0.0322	0.0000	4.07E-08
199	0.16	0.010	0.036	0.2887	0.0334	0.0000	4.19E-08
200	0.00	0.000	0.019	0.2868	0.0336	0.0000	4.20E-08
201	0.00	0.000	0.026	0.2841	0.0337	0.0000	4.22E-08
202	0.00	0.000	0.026	0.2815	0.0337	0.0000	4.21E-08
203	0.00	0.000	0.022	0.2793	0.0337	0.0000	4.21E-08
204	0.00	0.000	0.017	0.2776	0.0337	0.0000	4.21E-08
205	0.00	0.000	0.003	0.2773	0.0337	0.0000	4.21E-08
206	0.00	0.000	0.002	0.2771	0.0337	0.0000	4.21E-08
207	0.00	0.000	0.001	0.2770	0.0337	0.0000	4.21E-08
208	0.00	0.000	0.000	0.2770	0.0337	0.0000	4.22E-08
209	0.00	0.000	0.000	0.2770	0.0338	0.0000	4.22E-08
210	0.00	0.000	0.000	0.2770	0.0338	0.0000	4.22E-08
211	0.00	0.000	0.000	0.2770	0.0338	0.0000	4.22E-08
212	1.04	0.844	0.035	0.2928	0.0338	0.0000	4.22E-08
213	0.14	0.004	0.026	0.3035	0.0338	0.0000	4.22E-08
214	0.05	0.000	0.072	0.3015	0.0337	0.0000	4.22E-08
215	0.00	0.000	0.016	0.2999	0.0337	0.0000	4.22E-08
216	0.00	0.000	0.019	0.2981	0.0337	0.0000	4.21E-08

217	0.00	0.000	0.016	0.2965	0.0337	0.0000	4.21E-08
218	0.00	0.000	0.020	0.2945	0.0337	0.0000	4.21E-08
219	0.37	0.198	0.038	0.3081	0.0337	0.0000	4.21E-08
220	0.00	0.000	0.195	0.2886	0.0337	0.0000	4.21E-08
221	0.00	0.000	0.024	0.2862	0.0337	0.0000	4.21E-08
222	0.00	0.000	0.025	0.2836	0.0337	0.0000	4.21E-08
223	0.00	0.000	0.027	0.2809	0.0337	0.0000	4.21E-08
224	0.00	0.000	0.024	0.2785	0.0337	0.0000	4.21E-08
225	1.04	0.853	0.044	0.2932	0.0336	0.0000	4.21E-08
226	0.26	0.072	0.175	0.2942	0.0336	0.0000	4.21E-08
227	0.00	0.000	0.051	0.2891	0.0336	0.0000	4.21E-08
228	0.00	0.000	0.076	0.2815	0.0336	0.0000	4.21E-08
229	0.00	0.000	0.028	0.2787	0.0336	0.0000	4.20E-08
230	0.58	0.301	0.141	0.2926	0.0336	0.0000	4.20E-08
231	0.00	0.000	0.113	0.2814	0.0336	0.0000	4.20E-08
232	0.00	0.000	0.024	0.2791	0.0336	0.0000	4.20E-08
233	0.00	0.000	0.011	0.2780	0.0336	0.0000	4.20E-08
234	0.00	0.000	0.008	0.2772	0.0337	0.0000	4.21E-08
235	0.00	0.000	0.002	0.2771	0.0338	0.0000	4.22E-08
236	0.00	0.000	0.000	0.2770	0.0340	0.0000	4.24E-08
237	0.00	0.000	0.000	0.2770	0.0342	0.0000	4.26E-08
238	0.00	0.000	0.000	0.2770	0.0342	0.0000	4.26E-08
239	0.00	0.000	0.000	0.2770	0.0342	0.0000	4.26E-08
240	0.27	0.114	0.030	0.2891	0.0342	0.0000	4.26E-08
241	0.15	0.015	0.026	0.2998	0.0342	0.0000	4.26E-08
242	0.05	0.000	0.028	0.3016	0.0342	0.0000	4.26E-08
243	0.24	0.091	0.031	0.3135	0.0342	0.0000	4.26E-08
244	0.00	0.000	0.020	0.3115	0.0342	0.0000	4.25E-08
245	0.00	0.000	0.020	0.3096	0.0341	0.0000	4.25E-08
246	0.00	0.000	0.021	0.3075	0.0341	0.0000	4.25E-08
247	0.43	0.257	0.043	0.3202	0.0341	0.0000	4.25E-08
248	1.30	1.067	0.125	0.3312	0.0341	0.0000	4.25E-08

249		0.00	0.000	0.081	0.3231	0.0341	0.0000	4.25E-08
250		0.00	0.000	0.077	0.3154	0.0341	0.0000	4.25E-08
251		0.00	0.000	0.210	0.2944	0.0341	0.0000	4.25E-08
252		0.00	0.000	0.150	0.2794	0.0341	0.0000	4.25E-08
253		0.00	0.000	0.018	0.2776	0.0341	0.0000	4.25E-08
254		0.00	0.000	0.006	0.2770	0.0341	0.0000	4.25E-08
255		0.00	0.000	0.000	0.2770	0.0341	0.0000	4.25E-08
256		0.00	0.000	0.000	0.2770	0.0341	0.0000	4.25E-08
257		0.00	0.000	0.000	0.2770	0.0340	0.0000	4.24E-08
258		0.00	0.000	0.000	0.2770	0.0340	0.0000	4.24E-08
259		0.00	0.000	0.000	0.2770	0.0340	0.0000	4.24E-08
260		0.00	0.000	0.000	0.2770	0.0340	0.0000	4.24E-08
261		0.00	0.000	0.000	0.2770	0.0340	0.0000	4.24E-08
262		0.00	0.000	0.004	0.2770	0.0340	0.0000	4.24E-08
263		1.00	0.800	0.036	0.2932	0.0340	0.0000	4.24E-08
264		0.00	0.000	0.011	0.2921	0.0340	0.0000	4.24E-08
265		0.00	0.000	0.017	0.2904	0.0340	0.0000	4.24E-08
266		0.00	0.000	0.015	0.2890	0.0340	0.0000	4.24E-08
267		0.00	0.000	0.013	0.2877	0.0340	0.0000	4.24E-08
268		0.01	0.000	0.019	0.2868	0.0339	0.0000	4.23E-08
269		0.23	0.072	0.026	0.2994	0.0339	0.0000	4.23E-08
270		0.06	0.000	0.075	0.2978	0.0339	0.0000	4.23E-08
271		0.03	0.000	0.026	0.2985	0.0339	0.0000	4.23E-08
272	*	0.00	0.000	0.013	0.2972	0.0339	0.0000	4.23E-08
273		0.00	0.000	0.012	0.2961	0.0339	0.0000	4.24E-08
274		0.00	0.000	0.010	0.2950	0.0340	0.0000	4.24E-08
275		0.00	0.000	0.010	0.2940	0.0340	0.0000	4.24E-08
276		0.00	0.000	0.010	0.2930	0.0340	0.0000	4.24E-08
277		0.00	0.000	0.010	0.2921	0.0340	0.0000	4.24E-08
278		0.00	0.000	0.010	0.2911	0.0340	0.0000	4.24E-08
279		0.00	0.000	0.009	0.2901	0.0340	0.0000	4.24E-08
280		0.00	0.000	0.009	0.2893	0.0340	0.0000	4.24E-08

281		0.20	0.052	0.024	0.3013	0.0340	0.0000	4.24E-08
282		0.00	0.000	0.109	0.2904	0.0340	0.0000	4.24E-08
283		0.00	0.000	0.009	0.2895	0.0340	0.0000	4.24E-08
284		0.00	0.000	0.009	0.2886	0.0340	0.0000	4.24E-08
285		0.00	0.000	0.008	0.2878	0.0340	0.0000	4.24E-08
286		0.00	0.000	0.008	0.2870	0.0340	0.0000	4.24E-08
287		0.00	0.000	0.008	0.2862	0.0340	0.0000	4.24E-08
288		0.00	0.000	0.008	0.2854	0.0340	0.0000	4.24E-08
289	*	0.00	0.000	0.008	0.2847	0.0340	0.0000	4.24E-08
290		0.00	0.000	0.007	0.2839	0.0340	0.0000	4.24E-08
291		0.00	0.000	0.007	0.2832	0.0339	0.0000	4.24E-08
292		0.00	0.000	0.007	0.2825	0.0339	0.0000	4.23E-08
293		0.00	0.000	0.007	0.2818	0.0339	0.0000	4.23E-08
294		0.00	0.000	0.009	0.2809	0.0339	0.0000	4.23E-08
295		0.00	0.000	0.009	0.2801	0.0339	0.0000	4.23E-08
296		0.02	0.000	0.019	0.2799	0.0339	0.0000	4.23E-08
297		0.49	0.311	0.025	0.2955	0.0339	0.0000	4.23E-08
298		0.00	0.000	0.061	0.2894	0.0339	0.0000	4.23E-08
299		0.00	0.000	0.009	0.2885	0.0339	0.0000	4.23E-08
300	*	0.06	0.000	0.046	0.2904	0.0339	0.0000	4.23E-08
301		0.50	0.347	0.025	0.3033	0.0338	0.0000	4.23E-08
302		0.00	0.000	0.043	0.2990	0.0338	0.0000	4.23E-08
303	*	0.00	0.000	0.000	0.2990	0.0338	0.0000	4.22E-08
304	*	0.00	0.000	0.000	0.2990	0.0338	0.0000	4.22E-08
305	*	0.00	0.000	0.000	0.2990	0.0338	0.0000	4.22E-08
306	*	0.00	0.000	0.000	0.2990	0.0338	0.0000	4.22E-08
307	*	0.00	0.000	0.035	0.2955	0.0338	0.0000	4.22E-08
308		0.00	0.000	0.038	0.2917	0.0338	0.0000	4.22E-08
309		0.00	0.000	0.047	0.2871	0.0338	0.0000	4.22E-08
310		0.00	0.000	0.079	0.2792	0.0338	0.0000	4.22E-08
311		0.00	0.000	0.013	0.2779	0.0338	0.0000	4.22E-08
312		0.00	0.000	0.004	0.2774	0.0337	0.0000	4.22E-08

313		0.02	0.000	0.017	0.2775	0.0337	0.0000	4.22E-08
314		0.00	0.000	0.003	0.2771	0.0337	0.0000	4.21E-08
315		0.15	0.003	0.028	0.2895	0.0337	0.0000	4.21E-08
316		0.11	0.000	0.026	0.2978	0.0337	0.0000	4.21E-08
317	*	0.26	0.000	0.036	0.2998	0.0337	0.0000	4.21E-08
318	*	0.02	0.000	0.019	0.3018	0.0337	0.0000	4.21E-08
319	*	0.00	0.000	0.029	0.3037	0.0337	0.0000	4.21E-08
320		0.00	0.000	0.060	0.3057	0.0337	0.0000	4.21E-08
321	*	0.00	0.000	0.032	0.3077	0.0337	0.0000	4.21E-08
322	*	0.00	0.000	0.009	0.3077	0.0336	0.0000	4.21E-08
323	*	0.02	0.000	0.018	0.3077	0.0336	0.0000	4.21E-08
324		0.00	0.000	0.017	0.3060	0.0336	0.0000	4.20E-08
325		0.00	0.000	0.016	0.3044	0.0336	0.0000	4.20E-08
326		0.00	0.000	0.015	0.3029	0.0336	0.0000	4.20E-08
327		0.00	0.000	0.014	0.3015	0.0336	0.0000	4.20E-08
328	*	0.00	0.000	0.013	0.3001	0.0336	0.0000	4.20E-08
329	*	0.00	0.000	0.013	0.2988	0.0336	0.0000	4.20E-08
330		0.91	0.733	0.032	0.3137	0.0336	0.0000	4.20E-08
331		0.00	0.000	0.064	0.3073	0.0336	0.0000	4.20E-08
332		0.00	0.000	0.045	0.3029	0.0335	0.0000	4.20E-08
333	*	0.00	0.000	0.000	0.3029	0.0335	0.0000	4.20E-08
334		0.00	0.000	0.041	0.2988	0.0335	0.0000	4.20E-08
335	*	0.00	0.000	0.000	0.2988	0.0335	0.0000	4.19E-08
336	*	0.00	0.000	0.034	0.2954	0.0335	0.0000	4.19E-08
337		0.00	0.000	0.067	0.2887	0.0335	0.0000	4.19E-08
338		0.00	0.000	0.080	0.2808	0.0335	0.0000	4.19E-08
339		0.00	0.000	0.029	0.2779	0.0335	0.0000	4.19E-08
340		0.06	0.000	0.024	0.2819	0.0335	0.0000	4.19E-08
341		0.00	0.000	0.016	0.2802	0.0335	0.0000	4.19E-08
342		0.00	0.000	0.013	0.2789	0.0334	0.0000	4.19E-08
343		0.00	0.000	0.005	0.2784	0.0334	0.0000	4.19E-08
344		0.00	0.000	0.005	0.2779	0.0334	0.0000	4.19E-08

345		0.00	0.000	0.004	0.2774	0.0334	0.0000	4.19E-08
346	*	0.01	0.000	0.014	0.2774	0.0334	0.0000	4.19E-08
347	*	0.66	0.000	0.032	0.2794	0.0334	0.0000	4.18E-08
348		0.01	0.000	0.000	0.2905	0.0334	0.0000	4.18E-08
349		0.00	0.364	0.014	0.3029	0.0334	0.0000	4.18E-08
350	*	0.25	0.000	0.032	0.3049	0.0334	0.0000	4.18E-08
351		0.67	0.739	0.000	0.3176	0.0334	0.0000	4.18E-08
352		0.00	0.000	0.052	0.3124	0.0334	0.0000	4.18E-08
353		0.00	0.000	0.029	0.3095	0.0334	0.0000	4.18E-08
354	*	0.00	0.000	0.000	0.3095	0.0333	0.0000	4.18E-08
355		0.00	0.000	0.036	0.3060	0.0333	0.0000	4.18E-08
356	*	0.00	0.000	0.031	0.3029	0.0333	0.0000	4.18E-08
357		0.00	0.000	0.040	0.2988	0.0333	0.0000	4.18E-08
358		0.00	0.000	0.035	0.2954	0.0333	0.0000	4.17E-08
359		0.00	0.000	0.043	0.2911	0.0333	0.0000	4.17E-08
360		0.00	0.000	0.054	0.2857	0.0333	0.0000	4.17E-08
361		0.00	0.000	0.046	0.2811	0.0333	0.0000	4.17E-08
362		0.00	0.000	0.036	0.2775	0.0333	0.0000	4.17E-08
363		0.05	0.000	0.024	0.2805	0.0333	0.0000	4.17E-08
364		0.00	0.000	0.007	0.2798	0.0332	0.0000	4.17E-08
365		0.00	0.000	0.015	0.2783	0.0332	0.0000	4.17E-08

* = Frozen (air or soil)

Annual Totals for Year 4			
	inches	cubic feet	percent
Precipitation	39.57	143,629.9	100.00
Runoff	26.248	95,280.0	66.34
Evapotranspiration	13.521	49,079.9	34.17
Recirculation into Layer 1	0.0013	4.7151	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0013	4.7151	0.00
Percolation/Leakage through Layer 5	0.000015	0.0529	0.00
Average Head on Top of Layer 4	0.0313	---	---
Change in Water Storage	-0.2011	-730.0	-0.51
Soil Water at Start of Year	1,406.6893	5,106,282.0	3555.17
Soil Water at End of Year	1,406.4882	5,105,552.0	3554.66
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0013	-4.7120	0.00

Daily Output for Year 5

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.007	0.2776	0.0332	0.0000	4.17E-08
2			0.00	0.000	0.005	0.2772	0.0332	0.0000	4.17E-08
3			0.03	0.000	0.016	0.2790	0.0332	0.0000	4.16E-08
4			0.00	0.000	0.003	0.2787	0.0332	0.0000	4.16E-08
5	*		0.00	0.000	0.005	0.2782	0.0332	0.0000	4.16E-08
6			0.00	0.000	0.004	0.2778	0.0332	0.0000	4.16E-08
7			0.00	0.000	0.004	0.2774	0.0332	0.0000	4.16E-08
8			0.00	0.000	0.003	0.2771	0.0332	0.0000	4.16E-08
9			0.00	0.000	0.001	0.2770	0.0331	0.0000	4.16E-08
10			0.00	0.000	0.000	0.2770	0.0331	0.0000	4.16E-08
11			0.03	0.000	0.014	0.2790	0.0331	0.0000	4.16E-08
12			0.00	0.000	0.001	0.2789	0.0331	0.0000	4.16E-08
13			0.00	0.000	0.003	0.2785	0.0331	0.0000	4.16E-08
14			0.00	0.000	0.003	0.2783	0.0331	0.0000	4.16E-08
15			0.00	0.000	0.003	0.2780	0.0331	0.0000	4.15E-08
16			0.00	0.000	0.003	0.2777	0.0331	0.0000	4.15E-08
17			0.00	0.000	0.003	0.2774	0.0331	0.0000	4.15E-08
18			0.00	0.000	0.003	0.2772	0.0331	0.0000	4.15E-08
19			0.00	0.000	0.001	0.2770	0.0331	0.0000	4.15E-08
20	*		0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08
21			0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08
22			0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08
23			0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08
24	*		0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08

25		0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08
26		0.00	0.000	0.000	0.2770	0.0330	0.0000	4.14E-08
27	*	0.00	0.000	0.000	0.2770	0.0330	0.0000	4.14E-08
28	*	0.16	0.000	0.023	0.2790	0.0330	0.0000	4.14E-08
29		0.00	0.000	0.075	0.2828	0.0330	0.0000	4.14E-08
30		0.00	0.000	0.006	0.2823	0.0329	0.0000	4.14E-08
31		0.01	0.000	0.011	0.2820	0.0329	0.0000	4.14E-08
32		0.00	0.000	0.007	0.2812	0.0329	0.0000	4.14E-08
33		0.00	0.000	0.006	0.2806	0.0329	0.0000	4.14E-08
34	*	0.00	0.000	0.007	0.2798	0.0329	0.0000	4.14E-08
35	*	0.00	0.000	0.007	0.2791	0.0329	0.0000	4.14E-08
36		0.00	0.000	0.007	0.2784	0.0329	0.0000	4.14E-08
37		0.00	0.000	0.003	0.2782	0.0329	0.0000	4.14E-08
38		0.20	0.057	0.019	0.2903	0.0329	0.0000	4.13E-08
39	*	0.00	0.000	0.005	0.2898	0.0329	0.0000	4.13E-08
40		0.00	0.000	0.007	0.2891	0.0329	0.0000	4.13E-08
41		0.00	0.000	0.007	0.2884	0.0329	0.0000	4.13E-08
42		0.00	0.000	0.007	0.2877	0.0328	0.0000	4.13E-08
43		0.00	0.000	0.007	0.2870	0.0328	0.0000	4.13E-08
44		0.00	0.000	0.007	0.2863	0.0328	0.0000	4.13E-08
45		0.00	0.000	0.007	0.2857	0.0328	0.0000	4.13E-08
46		0.00	0.000	0.007	0.2850	0.0328	0.0000	4.13E-08
47		0.00	0.000	0.007	0.2843	0.0328	0.0000	4.13E-08
48		0.00	0.000	0.006	0.2837	0.0328	0.0000	4.13E-08
49		0.07	0.000	0.020	0.2884	0.0328	0.0000	4.13E-08
50		0.00	0.000	0.007	0.2877	0.0328	0.0000	4.12E-08
51		0.00	0.000	0.008	0.2869	0.0328	0.0000	4.12E-08
52		0.00	0.000	0.008	0.2862	0.0328	0.0000	4.12E-08
53		0.00	0.000	0.008	0.2854	0.0327	0.0000	4.12E-08
54		0.00	0.000	0.006	0.2848	0.0327	0.0000	4.12E-08
55		0.00	0.000	0.006	0.2842	0.0327	0.0000	4.12E-08
56		0.00	0.000	0.006	0.2836	0.0327	0.0000	4.12E-08

57		0.57	0.399	0.022	0.2987	0.0327	0.0000	4.12E-08
58		0.00	0.000	0.006	0.2981	0.0327	0.0000	4.12E-08
59		0.25	0.096	0.020	0.3114	0.0327	0.0000	4.12E-08
60		0.07	0.000	0.071	0.3114	0.0327	0.0000	4.12E-08
61		0.00	0.000	0.007	0.3107	0.0327	0.0000	4.11E-08
62		0.00	0.000	0.008	0.3099	0.0327	0.0000	4.11E-08
63		0.01	0.000	0.014	0.3094	0.0326	0.0000	4.11E-08
64		0.00	0.000	0.006	0.3089	0.0326	0.0000	4.11E-08
65		0.00	0.000	0.006	0.3083	0.0326	0.0000	4.11E-08
66		0.00	0.000	0.006	0.3077	0.0326	0.0000	4.11E-08
67		0.00	0.000	0.007	0.3071	0.0326	0.0000	4.11E-08
68		0.00	0.000	0.007	0.3064	0.0326	0.0000	4.11E-08
69	*	0.00	0.000	0.007	0.3057	0.0326	0.0000	4.11E-08
70		0.15	0.012	0.020	0.3176	0.0326	0.0000	4.11E-08
71		0.00	0.000	0.080	0.3096	0.0326	0.0000	4.11E-08
72		0.00	0.000	0.007	0.3089	0.0326	0.0000	4.11E-08
73		0.00	0.000	0.008	0.3082	0.0326	0.0000	4.10E-08
74		0.00	0.000	0.007	0.3075	0.0325	0.0000	4.10E-08
75		0.00	0.000	0.006	0.3068	0.0325	0.0000	4.10E-08
76		0.00	0.000	0.006	0.3062	0.0325	0.0000	4.10E-08
77		0.00	0.000	0.006	0.3056	0.0325	0.0000	4.10E-08
78		0.00	0.000	0.006	0.3049	0.0325	0.0000	4.10E-08
79		0.00	0.000	0.006	0.3043	0.0325	0.0000	4.10E-08
80		0.00	0.000	0.006	0.3037	0.0325	0.0000	4.10E-08
81		0.00	0.000	0.006	0.3030	0.0325	0.0000	4.10E-08
82		0.00	0.000	0.006	0.3024	0.0325	0.0000	4.10E-08
83		0.07	0.000	0.020	0.3074	0.0325	0.0000	4.10E-08
84		0.01	0.000	0.011	0.3069	0.0325	0.0000	4.09E-08
85		1.07	0.916	0.022	0.3204	0.0324	0.0000	4.09E-08
86		0.60	0.354	0.151	0.3300	0.0324	0.0000	4.09E-08
87		0.00	0.000	0.281	0.3019	0.0324	0.0000	4.09E-08
88		0.00	0.000	0.173	0.2846	0.0324	0.0000	4.09E-08

89		0.00	0.000	0.068	0.2778	0.0324	0.0000	4.09E-08
90		0.00	0.000	0.004	0.2774	0.0324	0.0000	4.09E-08
91		0.00	0.000	0.004	0.2770	0.0324	0.0000	4.09E-08
92		0.00	0.000	0.000	0.2770	0.0324	0.0000	4.09E-08
93		0.41	0.222	0.045	0.2914	0.0324	0.0000	4.09E-08
94		0.54	0.256	0.165	0.3030	0.0324	0.0000	4.09E-08
95		0.13	0.003	0.057	0.3105	0.0324	0.0000	4.09E-08
96		0.00	0.000	0.134	0.2971	0.0324	0.0000	4.09E-08
97		0.32	0.106	0.138	0.3050	0.0324	0.0000	4.09E-08
98	*	0.16	0.000	0.053	0.3069	0.0324	0.0000	4.09E-08
99		0.00	0.000	0.122	0.3031	0.0323	0.0000	4.08E-08
100		0.00	0.000	0.148	0.2883	0.0323	0.0000	4.08E-08
101		0.00	0.000	0.083	0.2800	0.0323	0.0000	4.08E-08
102		0.09	0.000	0.041	0.2846	0.0323	0.0000	4.08E-08
103		0.34	0.158	0.057	0.2973	0.0323	0.0000	4.08E-08
104		0.00	0.000	0.082	0.2892	0.0323	0.0000	4.08E-08
105		0.00	0.000	0.025	0.2866	0.0324	0.0000	4.09E-08
106		0.00	0.000	0.023	0.2844	0.0324	0.0000	4.09E-08
107		0.00	0.000	0.020	0.2825	0.0324	0.0000	4.09E-08
108		0.01	0.000	0.021	0.2809	0.0324	0.0000	4.09E-08
109		0.00	0.000	0.020	0.2789	0.0324	0.0000	4.09E-08
110		0.00	0.000	0.010	0.2779	0.0324	0.0000	4.09E-08
111		0.13	0.000	0.023	0.2882	0.0324	0.0000	4.09E-08
112		0.01	0.000	0.019	0.2875	0.0323	0.0000	4.08E-08
113		0.01	0.000	0.015	0.2866	0.0325	0.0000	4.10E-08
114		0.00	0.000	0.012	0.2854	0.0327	0.0000	4.12E-08
115		0.09	0.000	0.027	0.2920	0.0327	0.0000	4.11E-08
116		1.11	0.948	0.033	0.3053	0.0327	0.0000	4.11E-08
117		0.00	0.000	0.087	0.2966	0.0327	0.0000	4.11E-08
118		0.01	0.000	0.124	0.2856	0.0326	0.0000	4.11E-08
119		0.00	0.000	0.064	0.2792	0.0326	0.0000	4.11E-08
120		0.00	0.000	0.016	0.2775	0.0326	0.0000	4.11E-08

121	0.00	0.000	0.004	0.2771	0.0326	0.0000	4.11E-08
122	0.00	0.000	0.001	0.2770	0.0326	0.0000	4.11E-08
123	0.29	0.127	0.045	0.2891	0.0326	0.0000	4.11E-08
124	0.00	0.000	0.015	0.2877	0.0326	0.0000	4.11E-08
125	0.00	0.000	0.021	0.2856	0.0326	0.0000	4.11E-08
126	0.08	0.000	0.034	0.2899	0.0326	0.0000	4.11E-08
127	0.00	0.000	0.022	0.2879	0.0326	0.0000	4.10E-08
128	0.00	0.000	0.014	0.2865	0.0326	0.0000	4.10E-08
129	0.08	0.000	0.032	0.2910	0.0325	0.0000	4.10E-08
130	0.00	0.000	0.013	0.2898	0.0325	0.0000	4.10E-08
131	0.00	0.000	0.015	0.2883	0.0325	0.0000	4.10E-08
132	0.00	0.000	0.015	0.2868	0.0325	0.0000	4.10E-08
133	0.00	0.000	0.015	0.2853	0.0325	0.0000	4.10E-08
134	0.00	0.000	0.016	0.2837	0.0325	0.0000	4.10E-08
135	0.04	0.000	0.028	0.2846	0.0325	0.0000	4.10E-08
136	0.38	0.221	0.034	0.2975	0.0325	0.0000	4.10E-08
137	0.00	0.000	0.115	0.2859	0.0325	0.0000	4.10E-08
138	0.00	0.000	0.015	0.2845	0.0325	0.0000	4.09E-08
139	0.00	0.000	0.014	0.2830	0.0324	0.0000	4.09E-08
140	0.00	0.000	0.017	0.2814	0.0324	0.0000	4.09E-08
141	0.00	0.000	0.014	0.2800	0.0324	0.0000	4.09E-08
142	0.00	0.000	0.014	0.2785	0.0324	0.0000	4.09E-08
143	0.00	0.000	0.010	0.2775	0.0324	0.0000	4.09E-08
144	0.14	0.000	0.025	0.2893	0.0324	0.0000	4.09E-08
145	0.23	0.087	0.031	0.3010	0.0324	0.0000	4.09E-08
146	0.12	0.001	0.118	0.3012	0.0324	0.0000	4.09E-08
147	0.39	0.228	0.034	0.3139	0.0324	0.0000	4.09E-08
148	0.00	0.000	0.137	0.3002	0.0324	0.0000	4.09E-08
149	0.16	0.018	0.029	0.3114	0.0324	0.0000	4.08E-08
150	0.00	0.000	0.193	0.2921	0.0323	0.0000	4.08E-08
151	0.21	0.064	0.039	0.3032	0.0323	0.0000	4.08E-08
152	0.00	0.000	0.022	0.3011	0.0323	0.0000	4.08E-08

153	0.15	0.003	0.035	0.3125	0.0324	0.0000	4.09E-08
154	0.00	0.000	0.192	0.2934	0.0325	0.0000	4.10E-08
155	0.08	0.000	0.034	0.2979	0.0325	0.0000	4.10E-08
156	0.00	0.000	0.020	0.2959	0.0326	0.0000	4.11E-08
157	0.03	0.000	0.031	0.2963	0.0326	0.0000	4.11E-08
158	0.43	0.274	0.034	0.3083	0.0326	0.0000	4.11E-08
159	0.19	0.028	0.252	0.2998	0.0326	0.0000	4.11E-08
160	0.04	0.000	0.035	0.2999	0.0326	0.0000	4.11E-08
161	1.98	1.545	0.320	0.3113	0.0326	0.0000	4.10E-08
162	0.19	0.033	0.195	0.3071	0.0326	0.0000	4.11E-08
163	0.27	0.102	0.197	0.3045	0.0326	0.0000	4.10E-08
164	0.00	0.000	0.166	0.2879	0.0328	0.0000	4.13E-08
165	0.00	0.000	0.092	0.2787	0.0330	0.0000	4.15E-08
166	0.00	0.000	0.009	0.2778	0.0330	0.0000	4.15E-08
167	0.00	0.000	0.006	0.2772	0.0330	0.0000	4.15E-08
168	0.21	0.054	0.039	0.2887	0.0330	0.0000	4.15E-08
169	0.05	0.000	0.032	0.2906	0.0330	0.0000	4.15E-08
170	0.45	0.269	0.050	0.3033	0.0330	0.0000	4.14E-08
171	0.00	0.000	0.121	0.2912	0.0330	0.0000	4.14E-08
172	0.88	0.690	0.047	0.3056	0.0330	0.0000	4.14E-08
173	0.17	0.031	0.104	0.3095	0.0330	0.0000	4.14E-08
174	0.00	0.000	0.187	0.2909	0.0330	0.0000	4.14E-08
175	0.00	0.000	0.089	0.2820	0.0329	0.0000	4.14E-08
176	0.00	0.000	0.025	0.2795	0.0330	0.0000	4.14E-08
177	0.00	0.000	0.018	0.2776	0.0332	0.0000	4.16E-08
178	0.03	0.000	0.023	0.2786	0.0332	0.0000	4.17E-08
179	0.20	0.051	0.041	0.2895	0.0332	0.0000	4.17E-08
180	0.00	0.000	0.025	0.2875	0.0332	0.0000	4.16E-08
181	0.00	0.000	0.030	0.2845	0.0332	0.0000	4.16E-08
182	0.00	0.000	0.032	0.2813	0.0332	0.0000	4.16E-08
183	0.15	0.002	0.039	0.2922	0.0332	0.0000	4.16E-08
184	0.00	0.000	0.026	0.2895	0.0332	0.0000	4.16E-08

185	0.00	0.000	0.031	0.2864	0.0331	0.0000	4.16E-08
186	0.00	0.000	0.032	0.2832	0.0331	0.0000	4.16E-08
187	0.00	0.000	0.027	0.2805	0.0331	0.0000	4.16E-08
188	0.00	0.000	0.021	0.2785	0.0331	0.0000	4.16E-08
189	0.00	0.000	0.010	0.2775	0.0331	0.0000	4.16E-08
190	0.00	0.000	0.004	0.2771	0.0331	0.0000	4.16E-08
191	0.00	0.000	0.001	0.2770	0.0331	0.0000	4.15E-08
192	0.00	0.000	0.000	0.2770	0.0331	0.0000	4.15E-08
193	0.00	0.000	0.000	0.2770	0.0331	0.0000	4.15E-08
194	0.27	0.119	0.032	0.2892	0.0331	0.0000	4.15E-08
195	0.00	0.000	0.015	0.2876	0.0331	0.0000	4.15E-08
196	0.00	0.000	0.020	0.2857	0.0330	0.0000	4.15E-08
197	0.00	0.000	0.028	0.2828	0.0330	0.0000	4.15E-08
198	0.00	0.000	0.027	0.2801	0.0330	0.0000	4.15E-08
199	0.00	0.000	0.026	0.2776	0.0330	0.0000	4.15E-08
200	0.00	0.000	0.003	0.2773	0.0330	0.0000	4.15E-08
201	0.00	0.000	0.001	0.2771	0.0330	0.0000	4.15E-08
202	0.31	0.148	0.044	0.2893	0.0330	0.0000	4.14E-08
203	0.00	0.000	0.014	0.2879	0.0330	0.0000	4.14E-08
204	0.02	0.000	0.037	0.2863	0.0330	0.0000	4.14E-08
205	0.00	0.000	0.025	0.2837	0.0330	0.0000	4.14E-08
206	0.00	0.000	0.023	0.2815	0.0330	0.0000	4.14E-08
207	0.00	0.000	0.023	0.2792	0.0329	0.0000	4.14E-08
208	0.00	0.000	0.018	0.2774	0.0329	0.0000	4.14E-08
209	0.00	0.000	0.002	0.2772	0.0329	0.0000	4.14E-08
210	0.10	0.000	0.023	0.2850	0.0329	0.0000	4.14E-08
211	0.39	0.227	0.046	0.2964	0.0329	0.0000	4.14E-08
212	0.26	0.078	0.169	0.2976	0.0329	0.0000	4.14E-08
213	0.00	0.000	0.081	0.2895	0.0329	0.0000	4.13E-08
214	0.00	0.000	0.066	0.2829	0.0329	0.0000	4.13E-08
215	0.00	0.000	0.035	0.2793	0.0329	0.0000	4.13E-08
216	0.00	0.000	0.018	0.2776	0.0329	0.0000	4.13E-08

217	0.00	0.000	0.004	0.2772	0.0328	0.0000	4.13E-08
218	0.00	0.000	0.001	0.2770	0.0328	0.0000	4.13E-08
219	0.00	0.000	0.000	0.2770	0.0328	0.0000	4.13E-08
220	0.00	0.000	0.000	0.2770	0.0328	0.0000	4.13E-08
221	0.00	0.000	0.000	0.2770	0.0328	0.0000	4.13E-08
222	0.18	0.025	0.041	0.2886	0.0328	0.0000	4.13E-08
223	0.00	0.000	0.016	0.2869	0.0328	0.0000	4.13E-08
224	0.00	0.000	0.032	0.2837	0.0328	0.0000	4.12E-08
225	0.00	0.000	0.043	0.2795	0.0328	0.0000	4.12E-08
226	0.01	0.000	0.027	0.2776	0.0328	0.0000	4.12E-08
227	0.00	0.000	0.004	0.2771	0.0328	0.0000	4.12E-08
228	0.00	0.000	0.001	0.2770	0.0327	0.0000	4.12E-08
229	0.43	0.244	0.045	0.2911	0.0327	0.0000	4.12E-08
230	0.00	0.000	0.023	0.2888	0.0327	0.0000	4.12E-08
231	0.00	0.000	0.038	0.2850	0.0327	0.0000	4.12E-08
232	0.00	0.000	0.041	0.2810	0.0327	0.0000	4.12E-08
233	0.07	0.000	0.053	0.2826	0.0327	0.0000	4.12E-08
234	0.11	0.000	0.048	0.2887	0.0327	0.0000	4.12E-08
235	0.05	0.000	0.099	0.2839	0.0327	0.0000	4.12E-08
236	0.00	0.000	0.028	0.2811	0.0327	0.0000	4.11E-08
237	0.00	0.000	0.022	0.2789	0.0327	0.0000	4.11E-08
238	0.00	0.000	0.010	0.2779	0.0326	0.0000	4.11E-08
239	0.00	0.000	0.007	0.2772	0.0327	0.0000	4.11E-08
240	0.00	0.000	0.001	0.2771	0.0327	0.0000	4.12E-08
241	0.00	0.000	0.000	0.2770	0.0327	0.0000	4.12E-08
242	0.02	0.000	0.015	0.2772	0.0327	0.0000	4.12E-08
243	0.00	0.000	0.001	0.2771	0.0327	0.0000	4.12E-08
244	0.00	0.000	0.001	0.2770	0.0327	0.0000	4.12E-08
245	0.00	0.000	0.000	0.2770	0.0327	0.0000	4.12E-08
246	0.00	0.000	0.000	0.2770	0.0327	0.0000	4.11E-08
247	0.00	0.000	0.000	0.2770	0.0327	0.0000	4.11E-08
248	0.00	0.000	0.000	0.2770	0.0326	0.0000	4.11E-08

249	0.03	0.000	0.017	0.2780	0.0326	0.0000	4.11E-08
250	0.30	0.130	0.039	0.2914	0.0326	0.0000	4.11E-08
251	0.00	0.000	0.023	0.2891	0.0326	0.0000	4.11E-08
252	0.01	0.000	0.027	0.2874	0.0326	0.0000	4.11E-08
253	0.47	0.295	0.042	0.3010	0.0326	0.0000	4.11E-08
254	0.22	0.058	0.137	0.3030	0.0326	0.0000	4.11E-08
255	0.00	0.000	0.133	0.2897	0.0326	0.0000	4.11E-08
256	0.00	0.000	0.096	0.2801	0.0326	0.0000	4.11E-08
257	0.00	0.000	0.024	0.2778	0.0326	0.0000	4.10E-08
258	0.00	0.000	0.006	0.2772	0.0326	0.0000	4.10E-08
259	0.00	0.000	0.001	0.2771	0.0325	0.0000	4.10E-08
260	0.00	0.000	0.001	0.2770	0.0325	0.0000	4.10E-08
261	0.00	0.000	0.000	0.2770	0.0325	0.0000	4.10E-08
262	0.00	0.000	0.000	0.2770	0.0325	0.0000	4.10E-08
263	0.00	0.000	0.000	0.2770	0.0325	0.0000	4.10E-08
264	0.00	0.000	0.000	0.2770	0.0325	0.0000	4.10E-08
265	0.08	0.000	0.022	0.2825	0.0325	0.0000	4.10E-08
266	0.00	0.000	0.016	0.2809	0.0325	0.0000	4.10E-08
267	0.00	0.000	0.020	0.2789	0.0325	0.0000	4.10E-08
268	0.01	0.000	0.014	0.2782	0.0325	0.0000	4.10E-08
269	0.27	0.110	0.036	0.2910	0.0325	0.0000	4.09E-08
270	0.00	0.000	0.012	0.2898	0.0324	0.0000	4.09E-08
271	0.00	0.000	0.022	0.2876	0.0324	0.0000	4.09E-08
272	0.00	0.000	0.021	0.2855	0.0324	0.0000	4.09E-08
273	0.00	0.000	0.018	0.2837	0.0324	0.0000	4.09E-08
274	0.21	0.065	0.041	0.2943	0.0324	0.0000	4.09E-08
275	0.45	0.299	0.047	0.3047	0.0324	0.0000	4.09E-08
276	0.00	0.000	0.100	0.2948	0.0324	0.0000	4.09E-08
277	0.07	0.000	0.035	0.2979	0.0324	0.0000	4.09E-08
278	0.07	0.000	0.036	0.3012	0.0324	0.0000	4.09E-08
279	0.15	0.001	0.093	0.3067	0.0324	0.0000	4.09E-08
280	0.00	0.000	0.104	0.2963	0.0323	0.0000	4.08E-08

281		0.00	0.000	0.067	0.2896	0.0324	0.0000	4.09E-08
282	*	0.00	0.000	0.035	0.2861	0.0325	0.0000	4.10E-08
283	*	0.00	0.000	0.000	0.2861	0.0325	0.0000	4.10E-08
284	*	0.00	0.000	0.027	0.2834	0.0325	0.0000	4.10E-08
285		0.00	0.000	0.028	0.2806	0.0325	0.0000	4.09E-08
286		0.00	0.000	0.023	0.2783	0.0324	0.0000	4.09E-08
287		0.00	0.000	0.010	0.2773	0.0324	0.0000	4.09E-08
288		0.00	0.000	0.002	0.2771	0.0324	0.0000	4.09E-08
289		0.00	0.000	0.001	0.2770	0.0324	0.0000	4.09E-08
290		0.00	0.000	0.000	0.2770	0.0324	0.0000	4.09E-08
291		0.56	0.354	0.042	0.2931	0.0324	0.0000	4.09E-08
292		0.01	0.000	0.019	0.2925	0.0324	0.0000	4.09E-08
293		0.00	0.000	0.015	0.2910	0.0324	0.0000	4.09E-08
294		0.00	0.000	0.014	0.2896	0.0324	0.0000	4.09E-08
295		0.00	0.000	0.013	0.2882	0.0324	0.0000	4.09E-08
296		0.32	0.141	0.039	0.3027	0.0324	0.0000	4.08E-08
297		0.00	0.000	0.047	0.2980	0.0323	0.0000	4.08E-08
298		0.00	0.000	0.075	0.2905	0.0323	0.0000	4.08E-08
299		0.00	0.000	0.087	0.2818	0.0323	0.0000	4.08E-08
300		0.02	0.000	0.055	0.2782	0.0323	0.0000	4.08E-08
301		0.04	0.000	0.028	0.2793	0.0323	0.0000	4.08E-08
302		0.00	0.000	0.004	0.2789	0.0323	0.0000	4.08E-08
303		0.00	0.000	0.006	0.2783	0.0323	0.0000	4.08E-08
304		0.00	0.000	0.005	0.2778	0.0323	0.0000	4.08E-08
305		0.00	0.000	0.005	0.2773	0.0323	0.0000	4.08E-08
306		0.00	0.000	0.002	0.2771	0.0323	0.0000	4.08E-08
307		0.10	0.000	0.022	0.2848	0.0322	0.0000	4.07E-08
308		0.04	0.000	0.027	0.2866	0.0322	0.0000	4.07E-08
309		0.09	0.000	0.028	0.2927	0.0322	0.0000	4.07E-08
310		0.03	0.000	0.024	0.2933	0.0322	0.0000	4.07E-08
311		0.11	0.000	0.028	0.3017	0.0322	0.0000	4.07E-08
312		0.00	0.000	0.011	0.3006	0.0322	0.0000	4.07E-08

313		0.00	0.000	0.011	0.2994	0.0322	0.0000	4.07E-08
314		0.00	0.000	0.011	0.2983	0.0322	0.0000	4.07E-08
315		0.00	0.000	0.011	0.2972	0.0322	0.0000	4.07E-08
316		0.00	0.000	0.010	0.2962	0.0322	0.0000	4.07E-08
317		0.00	0.000	0.010	0.2952	0.0322	0.0000	4.07E-08
318		0.00	0.000	0.010	0.2942	0.0322	0.0000	4.07E-08
319		0.00	0.000	0.010	0.2932	0.0321	0.0000	4.06E-08
320	*	0.00	0.000	0.000	0.2932	0.0321	0.0000	4.06E-08
321		0.60	0.421	0.032	0.3078	0.0321	0.0000	4.06E-08
322		0.00	0.000	0.056	0.3022	0.0321	0.0000	4.06E-08
323		0.00	0.000	0.009	0.3013	0.0321	0.0000	4.06E-08
324		0.00	0.000	0.009	0.3004	0.0321	0.0000	4.06E-08
325		0.06	0.000	0.026	0.3041	0.0321	0.0000	4.06E-08
326		0.04	0.000	0.027	0.3058	0.0321	0.0000	4.06E-08
327		0.60	0.440	0.030	0.3183	0.0321	0.0000	4.06E-08
328		0.00	0.000	0.037	0.3146	0.0321	0.0000	4.06E-08
329		0.00	0.000	0.049	0.3097	0.0321	0.0000	4.06E-08
330	*	0.00	0.000	0.032	0.3065	0.0320	0.0000	4.06E-08
331		0.00	0.000	0.062	0.3004	0.0320	0.0000	4.05E-08
332		0.00	0.000	0.075	0.2929	0.0320	0.0000	4.05E-08
333		0.00	0.000	0.072	0.2857	0.0320	0.0000	4.05E-08
334		0.17	0.015	0.057	0.2955	0.0320	0.0000	4.05E-08
335		0.07	0.000	0.053	0.2970	0.0320	0.0000	4.05E-08
336		0.00	0.000	0.051	0.2918	0.0320	0.0000	4.05E-08
337		0.00	0.000	0.044	0.2875	0.0320	0.0000	4.05E-08
338		0.00	0.000	0.037	0.2838	0.0320	0.0000	4.05E-08
339		0.00	0.000	0.028	0.2810	0.0320	0.0000	4.05E-08
340		0.00	0.000	0.020	0.2790	0.0320	0.0000	4.05E-08
341		0.00	0.000	0.012	0.2778	0.0319	0.0000	4.05E-08
342		0.00	0.000	0.005	0.2773	0.0319	0.0000	4.04E-08
343	*	0.00	0.000	0.003	0.2770	0.0319	0.0000	4.04E-08
344	*	0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08

345	*		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
346	*		0.00	0.000	0.000	0.2770	0.0319	0.0000	4.04E-08
347	*		0.29	0.000	0.012	0.2790	0.0319	0.0000	4.04E-08
348	*		0.00	0.000	0.030	0.2809	0.0319	0.0000	4.04E-08
349	*		0.00	0.000	0.017	0.2829	0.0319	0.0000	4.04E-08
350	*		0.00	0.000	0.021	0.2849	0.0319	0.0000	4.04E-08
351	*		0.00	0.000	0.019	0.2868	0.0318	0.0000	4.04E-08
352	*		0.00	0.000	0.009	0.2888	0.0318	0.0000	4.04E-08
353	*		0.03	0.000	0.007	0.2908	0.0318	0.0000	4.04E-08
354	*		0.00	0.000	0.000	0.2928	0.0318	0.0000	4.03E-08
355	*		0.03	0.000	0.000	0.2947	0.0318	0.0000	4.03E-08
356	*		0.00	0.000	0.013	0.2967	0.0318	0.0000	4.03E-08
357	*		0.00	0.000	0.021	0.2967	0.0318	0.0000	4.03E-08
358			0.00	0.000	0.015	0.2952	0.0318	0.0000	4.03E-08
359	*	*	0.00	0.000	0.000	0.2952	0.0318	0.0000	4.03E-08
360	*	*	0.00	0.000	0.000	0.2952	0.0318	0.0000	4.03E-08
361	*	*	0.00	0.000	0.000	0.2952	0.0318	0.0000	4.03E-08
362	*	*	0.00	0.000	0.000	0.2952	0.0317	0.0000	4.03E-08
363	*	*	0.00	0.000	0.000	0.2952	0.0317	0.0000	4.03E-08
364	*	*	0.00	0.000	0.000	0.2952	0.0317	0.0000	4.03E-08
365	*	*	0.00	0.000	0.000	0.2952	0.0317	0.0000	4.02E-08

* = Frozen (air or soil)

Annual Totals for Year 5			
	inches	cubic feet	percent
Precipitation	22.07	80,122.3	100.00
Runoff	10.524	38,201.0	47.68
Evapotranspiration	11.381	41,311.4	51.56
Recirculation into Layer 1	0.0013	4.8933	0.01
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0013	4.8933	0.01
Percolation/Leakage through Layer 5	0.000015	0.0544	0.00
Average Head on Top of Layer 4	0.0326	---	---
Change in Water Storage	0.1680	609.9	0.76
Soil Water at Start of Year	1,406.4882	5,105,552.0	6372.20
Soil Water at End of Year	1,406.6562	5,106,161.9	6372.96
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0013	-4.8939	-0.01

Daily Output for Year 6

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
	Air	Soil							
1	*	*	0.00	0.000	0.000	0.2952	0.0317	0.0000	4.02E-08
2	*	*	0.00	0.000	0.000	0.2952	0.0317	0.0000	4.02E-08
3	*	*	0.00	0.000	0.000	0.2952	0.0317	0.0000	4.02E-08
4		*	0.10	0.000	0.018	0.3032	0.0317	0.0000	4.02E-08
5	*	*	0.00	0.000	0.000	0.3032	0.0317	0.0000	4.02E-08
6	*	*	0.00	0.000	0.000	0.3032	0.0317	0.0000	4.02E-08
7		*	0.00	0.000	0.000	0.3032	0.0317	0.0000	4.02E-08
8		*	0.05	0.000	0.017	0.3067	0.0316	0.0000	4.02E-08
9			0.00	0.000	0.015	0.3053	0.0316	0.0000	4.02E-08
10			0.00	0.000	0.013	0.3039	0.0316	0.0000	4.02E-08
11			0.00	0.000	0.013	0.3026	0.0316	0.0000	4.02E-08
12			0.00	0.000	0.012	0.3014	0.0316	0.0000	4.01E-08
13			0.02	0.000	0.025	0.3013	0.0316	0.0000	4.01E-08
14			0.00	0.000	0.011	0.3002	0.0316	0.0000	4.01E-08
15			0.00	0.000	0.014	0.2988	0.0316	0.0000	4.01E-08
16			0.09	0.000	0.031	0.3048	0.0316	0.0000	4.01E-08
17	*		0.14	0.000	0.021	0.3068	0.0316	0.0000	4.01E-08
18			0.00	0.000	0.075	0.3093	0.0316	0.0000	4.01E-08
19			0.02	0.000	0.025	0.3090	0.0315	0.0000	4.01E-08
20			0.17	0.021	0.032	0.3207	0.0315	0.0000	4.01E-08
21			0.00	0.000	0.053	0.3155	0.0315	0.0000	4.01E-08
22			0.00	0.000	0.012	0.3142	0.0315	0.0000	4.01E-08
23	*		0.00	0.000	0.000	0.3142	0.0315	0.0000	4.00E-08
24	*		0.00	0.000	0.000	0.3142	0.0315	0.0000	4.00E-08

25	*	0.00	0.000	0.000	0.3142	0.0315	0.0000	4.00E-08
26	*	0.53	0.000	0.029	0.3162	0.0315	0.0000	4.00E-08
27	*	0.00	0.000	0.013	0.3182	0.0315	0.0000	4.00E-08
28	*	0.00	0.000	0.026	0.3201	0.0315	0.0000	4.00E-08
29		0.00	0.002	0.033	0.3312	0.0315	0.0000	4.00E-08
30		0.00	0.069	0.064	0.3442	0.0314	0.0000	4.00E-08
31		0.57	0.417	0.094	0.3502	0.0314	0.0000	4.00E-08
32		0.00	0.000	0.097	0.3405	0.0314	0.0000	4.00E-08
33		0.00	0.000	0.110	0.3295	0.0314	0.0000	4.00E-08
34		0.00	0.000	0.113	0.3183	0.0314	0.0000	3.99E-08
35		0.12	0.000	0.213	0.3090	0.0314	0.0000	3.99E-08
36		0.00	0.000	0.118	0.2971	0.0314	0.0000	3.99E-08
37		0.00	0.000	0.051	0.2920	0.0314	0.0000	3.99E-08
38		0.00	0.000	0.040	0.2880	0.0314	0.0000	3.99E-08
39		0.23	0.078	0.051	0.2983	0.0314	0.0000	3.99E-08
40		0.00	0.000	0.030	0.2954	0.0314	0.0000	3.99E-08
41		0.00	0.000	0.027	0.2927	0.0313	0.0000	3.99E-08
42		0.00	0.000	0.025	0.2902	0.0313	0.0000	3.99E-08
43		0.00	0.000	0.023	0.2879	0.0313	0.0000	3.99E-08
44	*	0.00	0.000	0.000	0.2879	0.0313	0.0000	3.99E-08
45		0.00	0.000	0.022	0.2858	0.0313	0.0000	3.99E-08
46		0.00	0.000	0.020	0.2837	0.0313	0.0000	3.98E-08
47		0.00	0.000	0.019	0.2818	0.0313	0.0000	3.98E-08
48		0.00	0.000	0.015	0.2802	0.0313	0.0000	3.98E-08
49		0.00	0.000	0.018	0.2784	0.0313	0.0000	3.98E-08
50		0.00	0.000	0.011	0.2773	0.0313	0.0000	3.98E-08
51		0.16	0.005	0.028	0.2898	0.0312	0.0000	3.98E-08
52		0.00	0.000	0.007	0.2891	0.0312	0.0000	3.98E-08
53		0.00	0.000	0.011	0.2880	0.0312	0.0000	3.98E-08
54		0.33	0.154	0.033	0.3027	0.0312	0.0000	3.98E-08
55		0.01	0.000	0.033	0.3001	0.0312	0.0000	3.98E-08
56		0.00	0.000	0.010	0.2991	0.0312	0.0000	3.98E-08

57		0.00	0.000	0.010	0.2981	0.0312	0.0000	3.98E-08
58		0.00	0.000	0.010	0.2971	0.0312	0.0000	3.97E-08
59		0.00	0.000	0.009	0.2962	0.0312	0.0000	3.97E-08
60		0.00	0.000	0.009	0.2953	0.0312	0.0000	3.97E-08
61		0.00	0.000	0.009	0.2944	0.0312	0.0000	3.97E-08
62		0.00	0.000	0.009	0.2935	0.0312	0.0000	3.97E-08
63		0.00	0.000	0.009	0.2926	0.0311	0.0000	3.97E-08
64		0.00	0.000	0.008	0.2918	0.0311	0.0000	3.97E-08
65		0.00	0.000	0.010	0.2908	0.0311	0.0000	3.97E-08
66		0.00	0.000	0.010	0.2898	0.0311	0.0000	3.97E-08
67		0.00	0.000	0.010	0.2888	0.0311	0.0000	3.97E-08
68		0.05	0.000	0.026	0.2912	0.0311	0.0000	3.97E-08
69		0.00	0.000	0.010	0.2902	0.0311	0.0000	3.96E-08
70		0.00	0.000	0.009	0.2893	0.0311	0.0000	3.96E-08
71		0.00	0.000	0.009	0.2883	0.0311	0.0000	3.96E-08
72		0.00	0.000	0.010	0.2873	0.0311	0.0000	3.96E-08
73		0.00	0.000	0.010	0.2864	0.0311	0.0000	3.96E-08
74		0.00	0.000	0.008	0.2856	0.0310	0.0000	3.96E-08
75		0.00	0.000	0.008	0.2848	0.0310	0.0000	3.96E-08
76		0.00	0.000	0.007	0.2841	0.0310	0.0000	3.96E-08
77	*	0.00	0.000	0.000	0.2841	0.0310	0.0000	3.96E-08
78		0.09	0.000	0.025	0.2902	0.0310	0.0000	3.96E-08
79	*	0.04	0.000	0.044	0.2893	0.0310	0.0000	3.96E-08
80		0.11	0.000	0.026	0.2981	0.0310	0.0000	3.96E-08
81		0.01	0.000	0.015	0.2974	0.0310	0.0000	3.95E-08
82	*	0.05	0.000	0.058	0.2965	0.0310	0.0000	3.95E-08
83		0.03	0.000	0.023	0.2976	0.0310	0.0000	3.95E-08
84		0.00	0.000	0.008	0.2968	0.0311	0.0000	3.96E-08
85		0.00	0.000	0.007	0.2961	0.0311	0.0000	3.96E-08
86		0.00	0.000	0.007	0.2954	0.0311	0.0000	3.96E-08
87		0.00	0.000	0.006	0.2948	0.0311	0.0000	3.96E-08
88		0.00	0.000	0.006	0.2942	0.0311	0.0000	3.96E-08

89	0.00	0.000	0.006	0.2935	0.0310	0.0000	3.96E-08
90	0.00	0.000	0.006	0.2929	0.0310	0.0000	3.96E-08
91	0.11	0.000	0.024	0.3013	0.0310	0.0000	3.96E-08
92	0.00	0.000	0.007	0.3005	0.0310	0.0000	3.96E-08
93	0.03	0.000	0.020	0.3011	0.0310	0.0000	3.96E-08
94	0.00	0.000	0.007	0.3004	0.0310	0.0000	3.96E-08
95	0.00	0.000	0.006	0.2998	0.0310	0.0000	3.96E-08
96	0.05	0.000	0.023	0.3029	0.0310	0.0000	3.96E-08
97	0.73	0.569	0.027	0.3162	0.0310	0.0000	3.96E-08
98	3.07	2.735	0.221	0.3278	0.0310	0.0000	3.96E-08
99	0.02	0.000	0.074	0.3224	0.0310	0.0000	3.96E-08
100	0.02	0.000	0.187	0.3056	0.0310	0.0000	3.96E-08
101	0.04	0.000	0.241	0.2852	0.0310	0.0000	3.96E-08
102	0.01	0.000	0.073	0.2786	0.0310	0.0000	3.96E-08
103	0.00	0.000	0.010	0.2775	0.0312	0.0000	3.98E-08
104	0.00	0.000	0.004	0.2771	0.0321	0.0000	4.07E-08
105	0.00	0.000	0.001	0.2770	0.0330	0.0000	4.15E-08
106	0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08
107	0.00	0.000	0.000	0.2770	0.0330	0.0000	4.15E-08
108	0.00	0.000	0.000	0.2770	0.0330	0.0000	4.14E-08
109	0.00	0.000	0.000	0.2770	0.0330	0.0000	4.14E-08
110	0.00	0.000	0.000	0.2770	0.0330	0.0000	4.14E-08
111	0.01	0.000	0.009	0.2770	0.0330	0.0000	4.14E-08
112	0.01	0.000	0.005	0.2770	0.0330	0.0000	4.14E-08
113	0.00	0.000	0.000	0.2770	0.0329	0.0000	4.14E-08
114	0.00	0.000	0.000	0.2770	0.0329	0.0000	4.14E-08
115	0.00	0.000	0.000	0.2770	0.0329	0.0000	4.14E-08
116	0.17	0.013	0.025	0.2898	0.0329	0.0000	4.14E-08
117	0.79	0.635	0.035	0.3014	0.0329	0.0000	4.14E-08
118	0.23	0.083	0.077	0.3083	0.0329	0.0000	4.14E-08
119	0.96	0.766	0.083	0.3199	0.0329	0.0000	4.14E-08
120	0.05	0.000	0.077	0.3176	0.0329	0.0000	4.13E-08

121	0.08	0.000	0.148	0.3112	0.0329	0.0000	4.13E-08
122	0.02	0.000	0.103	0.3028	0.0329	0.0000	4.13E-08
123	0.47	0.167	0.357	0.2978	0.0328	0.0000	4.13E-08
124	0.00	0.000	0.182	0.2796	0.0328	0.0000	4.13E-08
125	0.03	0.000	0.047	0.2784	0.0328	0.0000	4.13E-08
126	0.15	0.000	0.040	0.2890	0.0338	0.0000	4.23E-08
127	0.04	0.000	0.034	0.2893	0.0350	0.0000	4.34E-08
128	0.00	0.000	0.025	0.2869	0.0350	0.0000	4.34E-08
129	0.01	0.000	0.028	0.2854	0.0350	0.0000	4.33E-08
130	0.18	0.031	0.038	0.2970	0.0350	0.0000	4.33E-08
131	0.03	0.000	0.029	0.2974	0.0350	0.0000	4.33E-08
132	0.00	0.000	0.018	0.2956	0.0350	0.0000	4.34E-08
133	0.00	0.000	0.016	0.2940	0.0351	0.0000	4.34E-08
134	0.00	0.000	0.016	0.2924	0.0351	0.0000	4.34E-08
135	0.02	0.000	0.026	0.2917	0.0351	0.0000	4.34E-08
136	0.00	0.000	0.015	0.2902	0.0351	0.0000	4.34E-08
137	0.00	0.000	0.016	0.2886	0.0351	0.0000	4.34E-08
138	0.00	0.000	0.014	0.2872	0.0351	0.0000	4.34E-08
139	0.29	0.114	0.037	0.3012	0.0351	0.0000	4.34E-08
140	0.00	0.000	0.013	0.2999	0.0350	0.0000	4.34E-08
141	0.00	0.000	0.013	0.2986	0.0350	0.0000	4.34E-08
142	0.28	0.115	0.035	0.3119	0.0350	0.0000	4.34E-08
143	0.66	0.411	0.135	0.3234	0.0350	0.0000	4.34E-08
144	0.00	0.000	0.139	0.3095	0.0350	0.0000	4.34E-08
145	0.00	0.000	0.168	0.2927	0.0350	0.0000	4.33E-08
146	0.00	0.000	0.106	0.2820	0.0350	0.0000	4.33E-08
147	0.00	0.000	0.046	0.2774	0.0350	0.0000	4.33E-08
148	0.00	0.000	0.002	0.2772	0.0350	0.0000	4.33E-08
149	0.00	0.000	0.002	0.2770	0.0350	0.0000	4.33E-08
150	0.00	0.000	0.000	0.2770	0.0349	0.0000	4.33E-08
151	0.00	0.000	0.002	0.2770	0.0349	0.0000	4.33E-08
152	0.00	0.000	0.000	0.2770	0.0349	0.0000	4.33E-08

153	0.00	0.000	0.000	0.2770	0.0349	0.0000	4.33E-08
154	0.00	0.000	0.000	0.2770	0.0349	0.0000	4.33E-08
155	0.00	0.000	0.000	0.2770	0.0349	0.0000	4.32E-08
156	0.00	0.000	0.000	0.2770	0.0349	0.0000	4.32E-08
157	0.67	0.471	0.039	0.2932	0.0349	0.0000	4.32E-08
158	0.00	0.000	0.010	0.2922	0.0349	0.0000	4.32E-08
159	0.00	0.000	0.015	0.2907	0.0349	0.0000	4.32E-08
160	0.00	0.000	0.014	0.2893	0.0348	0.0000	4.32E-08
161	0.00	0.000	0.013	0.2880	0.0348	0.0000	4.32E-08
162	0.00	0.000	0.013	0.2867	0.0348	0.0000	4.32E-08
163	0.00	0.000	0.012	0.2855	0.0348	0.0000	4.32E-08
164	0.00	0.000	0.012	0.2843	0.0348	0.0000	4.32E-08
165	0.04	0.000	0.030	0.2852	0.0348	0.0000	4.32E-08
166	0.97	0.803	0.034	0.2984	0.0348	0.0000	4.32E-08
167	1.16	0.859	0.182	0.3098	0.0348	0.0000	4.31E-08
168	0.21	0.059	0.132	0.3115	0.0348	0.0000	4.31E-08
169	0.01	0.000	0.241	0.2880	0.0348	0.0000	4.31E-08
170	0.51	0.202	0.293	0.2894	0.0348	0.0000	4.31E-08
171	0.00	0.000	0.093	0.2801	0.0348	0.0000	4.31E-08
172	0.00	0.000	0.023	0.2778	0.0347	0.0000	4.31E-08
173	0.00	0.000	0.006	0.2772	0.0347	0.0000	4.31E-08
174	0.00	0.000	0.001	0.2771	0.0349	0.0000	4.33E-08
175	0.00	0.000	0.001	0.2770	0.0354	0.0000	4.38E-08
176	0.00	0.000	0.000	0.2770	0.0355	0.0000	4.38E-08
177	0.00	0.000	0.002	0.2770	0.0356	0.0000	4.39E-08
178	0.20	0.049	0.031	0.2894	0.0356	0.0000	4.39E-08
179	0.00	0.000	0.011	0.2883	0.0356	0.0000	4.39E-08
180	0.00	0.000	0.018	0.2865	0.0355	0.0000	4.39E-08
181	0.00	0.000	0.017	0.2848	0.0355	0.0000	4.38E-08
182	0.85	0.658	0.040	0.2997	0.0355	0.0000	4.38E-08
183	0.02	0.000	0.059	0.2960	0.0355	0.0000	4.38E-08
184	0.00	0.000	0.136	0.2824	0.0355	0.0000	4.38E-08

185	0.00	0.000	0.050	0.2774	0.0355	0.0000	4.38E-08
186	0.00	0.000	0.002	0.2772	0.0355	0.0000	4.38E-08
187	0.00	0.000	0.002	0.2771	0.0355	0.0000	4.38E-08
188	0.00	0.000	0.000	0.2770	0.0360	0.0000	4.43E-08
189	0.12	0.000	0.022	0.2872	0.0363	0.0000	4.46E-08
190	1.50	1.320	0.047	0.3002	0.0363	0.0000	4.45E-08
191	0.00	0.000	0.072	0.2930	0.0363	0.0000	4.45E-08
192	0.00	0.000	0.127	0.2804	0.0363	0.0000	4.45E-08
193	0.00	0.000	0.026	0.2778	0.0363	0.0000	4.45E-08
194	0.00	0.000	0.004	0.2774	0.0362	0.0000	4.45E-08
195	0.02	0.000	0.017	0.2772	0.0362	0.0000	4.45E-08
196	0.00	0.000	0.002	0.2771	0.0362	0.0000	4.45E-08
197	0.00	0.000	0.000	0.2770	0.0362	0.0000	4.45E-08
198	0.00	0.000	0.000	0.2770	0.0362	0.0000	4.45E-08
199	0.00	0.000	0.000	0.2770	0.0362	0.0000	4.45E-08
200	0.00	0.000	0.000	0.2770	0.0362	0.0000	4.45E-08
201	0.00	0.000	0.000	0.2770	0.0362	0.0000	4.44E-08
202	0.00	0.000	0.000	0.2770	0.0362	0.0000	4.44E-08
203	0.00	0.000	0.000	0.2770	0.0362	0.0000	4.44E-08
204	0.00	0.000	0.000	0.2770	0.0361	0.0000	4.44E-08
205	2.12	1.915	0.040	0.2931	0.0361	0.0000	4.44E-08
206	0.98	0.744	0.119	0.3046	0.0361	0.0000	4.44E-08
207	0.41	0.178	0.222	0.3053	0.0361	0.0000	4.44E-08
208	0.00	0.000	0.175	0.2878	0.0361	0.0000	4.44E-08
209	0.00	0.000	0.064	0.2813	0.0361	0.0000	4.44E-08
210	0.03	0.000	0.056	0.2783	0.0361	0.0000	4.44E-08
211	0.01	0.000	0.017	0.2774	0.0361	0.0000	4.44E-08
212	0.00	0.000	0.003	0.2771	0.0361	0.0000	4.43E-08
213	0.00	0.000	0.001	0.2770	0.0363	0.0000	4.46E-08
214	0.00	0.000	0.000	0.2770	0.0366	0.0000	4.48E-08
215	0.00	0.000	0.000	0.2770	0.0366	0.0000	4.48E-08
216	0.00	0.000	0.000	0.2770	0.0365	0.0000	4.48E-08

217	0.00	0.000	0.000	0.2770	0.0365	0.0000	4.48E-08
218	0.00	0.000	0.000	0.2770	0.0365	0.0000	4.48E-08
219	0.00	0.000	0.000	0.2770	0.0365	0.0000	4.48E-08
220	0.00	0.000	0.003	0.2770	0.0365	0.0000	4.48E-08
221	0.07	0.000	0.020	0.2819	0.0365	0.0000	4.47E-08
222	0.00	0.000	0.010	0.2809	0.0365	0.0000	4.47E-08
223	0.03	0.000	0.028	0.2814	0.0365	0.0000	4.47E-08
224	0.00	0.000	0.010	0.2804	0.0365	0.0000	4.47E-08
225	0.52	0.343	0.037	0.2941	0.0365	0.0000	4.47E-08
226	0.00	0.000	0.008	0.2932	0.0364	0.0000	4.47E-08
227	0.00	0.000	0.014	0.2918	0.0364	0.0000	4.47E-08
228	0.00	0.000	0.013	0.2905	0.0364	0.0000	4.47E-08
229	0.47	0.290	0.038	0.3044	0.0364	0.0000	4.47E-08
230	0.00	0.000	0.058	0.2986	0.0364	0.0000	4.47E-08
231	0.00	0.000	0.013	0.2973	0.0364	0.0000	4.47E-08
232	0.00	0.000	0.011	0.2962	0.0364	0.0000	4.47E-08
233	0.00	0.000	0.011	0.2951	0.0364	0.0000	4.47E-08
234	0.00	0.000	0.011	0.2940	0.0364	0.0000	4.47E-08
235	0.00	0.000	0.013	0.2927	0.0364	0.0000	4.47E-08
236	1.02	0.845	0.036	0.3071	0.0364	0.0000	4.46E-08
237	0.65	0.331	0.260	0.3127	0.0364	0.0000	4.46E-08
238	0.10	0.000	0.188	0.3037	0.0364	0.0000	4.46E-08
239	0.00	0.000	0.193	0.2844	0.0364	0.0000	4.46E-08
240	0.00	0.000	0.060	0.2785	0.0364	0.0000	4.46E-08
241	0.08	0.000	0.042	0.2825	0.0364	0.0000	4.47E-08
242	0.12	0.000	0.045	0.2904	0.0364	0.0000	4.47E-08
243	0.00	0.000	0.019	0.2885	0.0364	0.0000	4.47E-08
244	0.00	0.000	0.023	0.2862	0.0364	0.0000	4.47E-08
245	0.00	0.000	0.022	0.2840	0.0364	0.0000	4.46E-08
246	0.00	0.000	0.019	0.2821	0.0364	0.0000	4.46E-08
247	0.02	0.000	0.029	0.2807	0.0364	0.0000	4.46E-08
248	0.00	0.000	0.020	0.2790	0.0364	0.0000	4.46E-08

249		0.00	0.000	0.013	0.2777	0.0363	0.0000	4.46E-08
250		0.00	0.000	0.006	0.2771	0.0363	0.0000	4.46E-08
251		0.00	0.000	0.001	0.2770	0.0363	0.0000	4.46E-08
252		0.40	0.217	0.039	0.2913	0.0363	0.0000	4.46E-08
253		0.55	0.399	0.038	0.3029	0.0364	0.0000	4.47E-08
254		0.00	0.000	0.068	0.2961	0.0364	0.0000	4.47E-08
255		0.00	0.000	0.086	0.2875	0.0364	0.0000	4.46E-08
256		0.00	0.000	0.040	0.2835	0.0364	0.0000	4.46E-08
257		0.00	0.000	0.038	0.2797	0.0364	0.0000	4.46E-08
258		1.55	1.318	0.073	0.2960	0.0364	0.0000	4.46E-08
259		1.11	0.912	0.080	0.3075	0.0363	0.0000	4.46E-08
260		0.00	0.000	0.093	0.2982	0.0363	0.0000	4.46E-08
261		0.00	0.000	0.148	0.2834	0.0363	0.0000	4.46E-08
262		0.00	0.000	0.052	0.2782	0.0363	0.0000	4.46E-08
263		0.00	0.000	0.009	0.2774	0.0363	0.0000	4.46E-08
264		0.06	0.000	0.029	0.2804	0.0363	0.0000	4.46E-08
265		0.00	0.000	0.005	0.2799	0.0365	0.0000	4.48E-08
266		0.00	0.000	0.012	0.2786	0.0367	0.0000	4.50E-08
267		0.00	0.000	0.006	0.2781	0.0367	0.0000	4.50E-08
268		0.00	0.000	0.006	0.2774	0.0367	0.0000	4.50E-08
269		0.00	0.000	0.003	0.2771	0.0367	0.0000	4.50E-08
270	*	0.00	0.000	0.001	0.2770	0.0367	0.0000	4.49E-08
271		0.10	0.000	0.021	0.2853	0.0367	0.0000	4.49E-08
272		0.33	0.158	0.042	0.2985	0.0367	0.0000	4.49E-08
273		0.00	0.000	0.009	0.2976	0.0367	0.0000	4.49E-08
274		0.02	0.000	0.026	0.2969	0.0367	0.0000	4.49E-08
275		0.00	0.000	0.013	0.2956	0.0367	0.0000	4.49E-08
276		0.00	0.000	0.013	0.2944	0.0366	0.0000	4.49E-08
277		0.00	0.000	0.012	0.2931	0.0366	0.0000	4.49E-08
278		0.00	0.000	0.012	0.2920	0.0366	0.0000	4.49E-08
279		0.95	0.767	0.036	0.3062	0.0366	0.0000	4.49E-08
280		0.00	0.000	0.153	0.2910	0.0366	0.0000	4.48E-08

281		0.00	0.000	0.117	0.2793	0.0366	0.0000	4.48E-08
282		0.00	0.000	0.012	0.2780	0.0366	0.0000	4.48E-08
283		0.00	0.000	0.008	0.2772	0.0366	0.0000	4.48E-08
284		0.00	0.000	0.002	0.2770	0.0366	0.0000	4.48E-08
285		0.00	0.000	0.000	0.2770	0.0367	0.0000	4.49E-08
286		0.00	0.000	0.000	0.2770	0.0368	0.0000	4.51E-08
287		1.00	0.788	0.047	0.2933	0.0368	0.0000	4.51E-08
288		0.00	0.000	0.057	0.2876	0.0368	0.0000	4.50E-08
289		0.00	0.000	0.017	0.2859	0.0368	0.0000	4.50E-08
290		2.98	2.780	0.043	0.3011	0.0368	0.0000	4.50E-08
291		0.00	0.000	0.078	0.2933	0.0368	0.0000	4.50E-08
292		0.45	0.233	0.082	0.3071	0.0368	0.0000	4.50E-08
293		0.04	0.000	0.059	0.3050	0.0368	0.0000	4.50E-08
294		0.00	0.000	0.073	0.2976	0.0368	0.0000	4.50E-08
295		0.00	0.000	0.043	0.2934	0.0367	0.0000	4.50E-08
296		0.00	0.000	0.054	0.2879	0.0367	0.0000	4.50E-08
297		0.51	0.287	0.069	0.3033	0.0367	0.0000	4.50E-08
298	*	0.05	0.000	0.065	0.3019	0.0367	0.0000	4.49E-08
299		0.27	0.098	0.068	0.3125	0.0367	0.0000	4.49E-08
300		0.01	0.000	0.062	0.3068	0.0367	0.0000	4.49E-08
301		0.00	0.000	0.044	0.3024	0.0367	0.0000	4.49E-08
302		0.00	0.000	0.059	0.2966	0.0367	0.0000	4.49E-08
303		0.10	0.000	0.099	0.2971	0.0367	0.0000	4.49E-08
304		0.00	0.000	0.081	0.2890	0.0367	0.0000	4.50E-08
305		0.00	0.000	0.086	0.2805	0.0367	0.0000	4.50E-08
306		0.00	0.000	0.027	0.2778	0.0367	0.0000	4.50E-08
307	*	0.00	0.000	0.006	0.2771	0.0370	0.0000	4.52E-08
308		0.00	0.000	0.001	0.2770	0.0373	0.0000	4.55E-08
309		0.79	0.526	0.106	0.2933	0.0373	0.0000	4.55E-08
310		0.53	0.322	0.092	0.3049	0.0373	0.0000	4.55E-08
311		0.00	0.000	0.056	0.2994	0.0373	0.0000	4.55E-08
312		0.06	0.000	0.058	0.2997	0.0373	0.0000	4.55E-08

313		0.00	0.000	0.076	0.2922	0.0373	0.0000	4.55E-08
314		0.00	0.000	0.071	0.2850	0.0373	0.0000	4.55E-08
315		0.00	0.000	0.059	0.2791	0.0373	0.0000	4.55E-08
316		0.00	0.000	0.011	0.2780	0.0373	0.0000	4.55E-08
317		0.11	0.000	0.032	0.2858	0.0372	0.0000	4.54E-08
318		0.17	0.009	0.039	0.2975	0.0372	0.0000	4.54E-08
319		0.02	0.000	0.035	0.2960	0.0372	0.0000	4.54E-08
320		0.00	0.000	0.073	0.2887	0.0372	0.0000	4.54E-08
321		0.00	0.000	0.068	0.2819	0.0372	0.0000	4.54E-08
322		0.31	0.131	0.062	0.2934	0.0372	0.0000	4.54E-08
323		0.27	0.091	0.115	0.2997	0.0372	0.0000	4.54E-08
324		0.45	0.239	0.096	0.3113	0.0372	0.0000	4.54E-08
325		0.05	0.000	0.130	0.3030	0.0372	0.0000	4.54E-08
326		0.89	0.667	0.090	0.3159	0.0371	0.0000	4.54E-08
327	*	0.71	0.000	0.034	0.3179	0.0371	0.0000	4.53E-08
328		0.05	0.307	0.000	0.3305	0.0371	0.0000	4.53E-08
329		0.45	0.613	0.000	0.3422	0.0371	0.0000	4.53E-08
330		0.18	0.044	0.049	0.3511	0.0371	0.0000	4.53E-08
331	*	0.11	0.000	0.029	0.3530	0.0371	0.0000	4.53E-08
332	*	0.00	0.000	0.028	0.3550	0.0371	0.0000	4.53E-08
333	*	0.00	0.000	0.016	0.3550	0.0371	0.0000	4.53E-08
334	*	0.00	0.000	0.000	0.3550	0.0371	0.0000	4.53E-08
335	*	0.00	0.000	0.000	0.3550	0.0370	0.0000	4.53E-08
336	*	0.00	0.000	0.000	0.3550	0.0370	0.0000	4.53E-08
337	*	0.00	0.000	0.000	0.3550	0.0370	0.0000	4.52E-08
338	*	0.00	0.000	0.000	0.3550	0.0370	0.0000	4.52E-08
339	*	0.00	0.000	0.000	0.3550	0.0370	0.0000	4.52E-08
340	*	0.00	0.000	0.000	0.3550	0.0370	0.0000	4.52E-08
341	*	0.00	0.000	0.000	0.3550	0.0370	0.0000	4.52E-08
342		0.00	0.000	0.045	0.3506	0.0370	0.0000	4.52E-08
343	*	0.17	0.000	0.039	0.3525	0.0370	0.0000	4.52E-08
344	*	0.00	0.000	0.037	0.3545	0.0369	0.0000	4.52E-08

345	*		0.00	0.000	0.032	0.3565	0.0369	0.0000	4.52E-08
346	*		0.00	0.000	0.002	0.3565	0.0369	0.0000	4.52E-08
347			0.00	0.000	0.036	0.3528	0.0369	0.0000	4.51E-08
348	*	*	0.00	0.000	0.000	0.3528	0.0369	0.0000	4.51E-08
349	*	*	0.00	0.000	0.000	0.3528	0.0369	0.0000	4.51E-08
350	*	*	0.00	0.000	0.000	0.3528	0.0369	0.0000	4.51E-08
351	*	*	0.00	0.000	0.000	0.3528	0.0369	0.0000	4.51E-08
352	*	*	0.00	0.000	0.000	0.3528	0.0369	0.0000	4.51E-08
353	*	*	0.00	0.000	0.000	0.3528	0.0369	0.0000	4.51E-08
354		*	0.00	0.000	0.000	0.3528	0.0368	0.0000	4.51E-08
355		*	0.00	0.000	0.002	0.3529	0.0368	0.0000	4.51E-08
356			0.03	0.000	0.081	0.3480	0.0368	0.0000	4.51E-08
357			0.00	0.000	0.136	0.3345	0.0368	0.0000	4.50E-08
358			0.00	0.000	0.086	0.3259	0.0368	0.0000	4.50E-08
359			0.34	0.147	0.142	0.3309	0.0368	0.0000	4.50E-08
360			0.00	0.000	0.056	0.3256	0.0368	0.0000	4.50E-08
361			0.00	0.000	0.040	0.3215	0.0368	0.0000	4.50E-08
362			0.00	0.000	0.068	0.3148	0.0368	0.0000	4.50E-08
363			0.00	0.000	0.075	0.3073	0.0367	0.0000	4.50E-08
364			0.00	0.000	0.060	0.3013	0.0367	0.0000	4.50E-08
365			0.00	0.000	0.053	0.2960	0.0367	0.0000	4.50E-08

* = Frozen (air or soil)

Annual Totals for Year 6

	inches	cubic feet	percent
Precipitation	40.57	147,278.8	100.00
Runoff	26.506	96,216.9	65.33
Evapotranspiration	14.057	51,027.5	34.65
Recirculation into Layer 1	0.0014	5.2027	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0014	5.2027	0.00
Percolation/Leakage through Layer 5	0.000016	0.0570	0.00
Average Head on Top of Layer 4	0.0346	---	---
Change in Water Storage	0.0095	34.4	0.02
Soil Water at Start of Year	1,406.6562	5,106,161.9	3467.00
Soil Water at End of Year	1,406.6657	5,106,196.3	3467.03
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0014	-5.2006	0.00

Daily Output for Year 7

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.032	0.2928	0.0367	0.0000	4.49E-08
2			0.00	0.000	0.040	0.2888	0.0367	0.0000	4.49E-08
3	*		0.00	0.000	0.035	0.2853	0.0367	0.0000	4.49E-08
4			0.00	0.000	0.035	0.2818	0.0367	0.0000	4.49E-08
5			0.06	0.000	0.049	0.2829	0.0367	0.0000	4.49E-08
6			0.00	0.000	0.022	0.2806	0.0367	0.0000	4.49E-08
7			0.62	0.434	0.044	0.2945	0.0366	0.0000	4.49E-08
8			0.79	0.610	0.067	0.3062	0.0366	0.0000	4.49E-08
9	*		0.10	0.000	0.036	0.3081	0.0366	0.0000	4.49E-08
10	*		0.10	0.000	0.020	0.3101	0.0366	0.0000	4.49E-08
11	*		0.00	0.000	0.044	0.3121	0.0366	0.0000	4.48E-08
12	*		0.00	0.000	0.045	0.3115	0.0366	0.0000	4.48E-08
13	*		0.00	0.000	0.025	0.3090	0.0366	0.0000	4.48E-08
14	*		0.00	0.000	0.023	0.3066	0.0366	0.0000	4.48E-08
15	*		0.00	0.000	0.000	0.3066	0.0366	0.0000	4.48E-08
16	*		0.04	0.000	0.038	0.3066	0.0366	0.0000	4.48E-08
17	*		0.03	0.000	0.025	0.3066	0.0365	0.0000	4.48E-08
18	*		0.11	0.000	0.024	0.3086	0.0365	0.0000	4.48E-08
19			0.00	0.000	0.071	0.3086	0.0365	0.0000	4.48E-08
20			0.00	0.000	0.046	0.3039	0.0365	0.0000	4.48E-08
21	*		0.00	0.000	0.000	0.3039	0.0365	0.0000	4.47E-08
22	*		0.18	0.000	0.042	0.3059	0.0365	0.0000	4.47E-08
23	*		0.00	0.000	0.000	0.3079	0.0365	0.0000	4.47E-08
24	*		0.82	0.000	0.022	0.3098	0.0365	0.0000	4.47E-08

25		0.00	0.639	0.000	0.3226	0.0365	0.0000	4.47E-08
26		0.01	0.002	0.098	0.3250	0.0364	0.0000	4.47E-08
27		0.05	0.000	0.104	0.3199	0.0364	0.0000	4.47E-08
28		0.20	0.047	0.103	0.3251	0.0364	0.0000	4.47E-08
29		0.04	0.000	0.105	0.3191	0.0364	0.0000	4.47E-08
30		0.19	0.037	0.111	0.3233	0.0364	0.0000	4.47E-08
31		0.00	0.000	0.090	0.3144	0.0364	0.0000	4.46E-08
32		0.00	0.000	0.069	0.3074	0.0370	0.0000	4.52E-08
33	*	0.00	0.000	0.040	0.3034	0.0376	0.0000	4.58E-08
34	*	0.00	0.000	0.000	0.3034	0.0376	0.0000	4.58E-08
35	*	0.00	0.000	0.000	0.3034	0.0376	0.0000	4.58E-08
36		0.00	0.000	0.050	0.2985	0.0376	0.0000	4.58E-08
37		0.00	0.000	0.030	0.2954	0.0376	0.0000	4.58E-08
38	*	0.00	0.000	0.043	0.2911	0.0376	0.0000	4.58E-08
39	*	0.00	0.000	0.000	0.2911	0.0376	0.0000	4.58E-08
40	*	0.05	0.000	0.033	0.2925	0.0376	0.0000	4.57E-08
41		0.05	0.000	0.085	0.2893	0.0376	0.0000	4.57E-08
42		0.14	0.000	0.056	0.2971	0.0375	0.0000	4.57E-08
43		0.00	0.000	0.088	0.2883	0.0375	0.0000	4.57E-08
44	*	0.00	0.000	0.040	0.2843	0.0375	0.0000	4.57E-08
45		0.00	0.000	0.056	0.2787	0.0375	0.0000	4.57E-08
46		0.00	0.000	0.013	0.2774	0.0375	0.0000	4.57E-08
47		0.00	0.000	0.003	0.2771	0.0375	0.0000	4.57E-08
48		0.00	0.000	0.003	0.2770	0.0375	0.0000	4.57E-08
49		0.12	0.000	0.021	0.2865	0.0376	0.0000	4.57E-08
50		0.09	0.000	0.031	0.2925	0.0376	0.0000	4.58E-08
51		0.01	0.000	0.018	0.2915	0.0376	0.0000	4.58E-08
52		0.00	0.000	0.017	0.2898	0.0376	0.0000	4.58E-08
53		0.00	0.000	0.016	0.2882	0.0376	0.0000	4.58E-08
54		0.00	0.000	0.015	0.2867	0.0376	0.0000	4.58E-08
55	*	0.00	0.000	0.014	0.2853	0.0376	0.0000	4.58E-08
56		0.00	0.000	0.013	0.2839	0.0376	0.0000	4.57E-08

57		0.01	0.000	0.018	0.2827	0.0376	0.0000	4.57E-08
58		0.00	0.000	0.012	0.2815	0.0375	0.0000	4.57E-08
59		0.02	0.000	0.024	0.2811	0.0375	0.0000	4.57E-08
60		0.21	0.064	0.030	0.2931	0.0375	0.0000	4.57E-08
61		0.26	0.112	0.035	0.3047	0.0375	0.0000	4.57E-08
62		0.33	0.135	0.170	0.3073	0.0375	0.0000	4.57E-08
63		0.35	0.158	0.107	0.3161	0.0375	0.0000	4.57E-08
64		0.24	0.089	0.172	0.3142	0.0375	0.0000	4.57E-08
65		0.29	0.114	0.232	0.3087	0.0375	0.0000	4.57E-08
66		0.00	0.000	0.080	0.3011	0.0375	0.0000	4.56E-08
67		0.00	0.000	0.108	0.2902	0.0374	0.0000	4.56E-08
68		0.00	0.000	0.039	0.2863	0.0374	0.0000	4.56E-08
69		0.00	0.000	0.035	0.2829	0.0378	0.0000	4.59E-08
70		0.00	0.000	0.029	0.2800	0.0381	0.0000	4.62E-08
71		0.30	0.130	0.049	0.2922	0.0381	0.0000	4.62E-08
72		0.00	0.000	0.025	0.2897	0.0381	0.0000	4.62E-08
73		0.00	0.000	0.024	0.2873	0.0381	0.0000	4.62E-08
74		0.00	0.000	0.016	0.2857	0.0381	0.0000	4.62E-08
75	*	0.00	0.000	0.015	0.2842	0.0380	0.0000	4.62E-08
76		0.13	0.000	0.032	0.2938	0.0380	0.0000	4.62E-08
77		0.09	0.000	0.035	0.2997	0.0380	0.0000	4.62E-08
78		0.05	0.000	0.026	0.3016	0.0380	0.0000	4.62E-08
79		0.00	0.000	0.013	0.3003	0.0380	0.0000	4.62E-08
80		0.00	0.000	0.012	0.2991	0.0380	0.0000	4.61E-08
81		0.00	0.000	0.012	0.2980	0.0380	0.0000	4.61E-08
82		0.12	0.000	0.029	0.3066	0.0380	0.0000	4.61E-08
83		0.09	0.000	0.105	0.3048	0.0380	0.0000	4.61E-08
84		0.03	0.000	0.029	0.3046	0.0379	0.0000	4.61E-08
85		0.00	0.000	0.017	0.3031	0.0379	0.0000	4.61E-08
86		0.00	0.000	0.011	0.3020	0.0379	0.0000	4.61E-08
87	*	0.02	0.000	0.019	0.3020	0.0379	0.0000	4.61E-08
88	*	0.00	0.000	0.010	0.3010	0.0379	0.0000	4.61E-08

89		0.00	0.000	0.010	0.3001	0.0379	0.0000	4.61E-08
90		0.00	0.000	0.010	0.2991	0.0379	0.0000	4.60E-08
91		0.07	0.000	0.027	0.3030	0.0379	0.0000	4.60E-08
92		0.02	0.000	0.022	0.3028	0.0379	0.0000	4.60E-08
93		0.00	0.000	0.011	0.3017	0.0379	0.0000	4.60E-08
94		0.00	0.000	0.011	0.3006	0.0378	0.0000	4.60E-08
95	*	0.00	0.000	0.000	0.3006	0.0378	0.0000	4.60E-08
96	*	0.00	0.000	0.009	0.2997	0.0378	0.0000	4.60E-08
97		0.18	0.026	0.027	0.3120	0.0378	0.0000	4.60E-08
98		0.00	0.000	0.074	0.3046	0.0378	0.0000	4.60E-08
99	*	0.25	0.000	0.033	0.3066	0.0378	0.0000	4.60E-08
100	*	1.38	0.000	0.027	0.3085	0.0378	0.0000	4.59E-08
101	*	0.00	0.000	0.054	0.3105	0.0378	0.0000	4.59E-08
102		0.00	0.000	0.051	0.3125	0.0378	0.0000	4.59E-08
103		0.00	0.412	0.000	0.3252	0.0377	0.0000	4.59E-08
104		0.00	0.599	0.133	0.3368	0.0377	0.0000	4.59E-08
105		0.00	0.000	0.173	0.3195	0.0377	0.0000	4.59E-08
106		0.63	0.315	0.231	0.3276	0.0377	0.0000	4.59E-08
107		0.00	0.000	0.106	0.3170	0.0377	0.0000	4.59E-08
108		0.00	0.000	0.059	0.3111	0.0377	0.0000	4.59E-08
109		1.15	0.928	0.082	0.3255	0.0377	0.0000	4.59E-08
110		0.26	0.110	0.121	0.3280	0.0377	0.0000	4.58E-08
111		0.00	0.000	0.124	0.3156	0.0377	0.0000	4.58E-08
112	*	0.01	0.000	0.045	0.3122	0.0376	0.0000	4.58E-08
113		0.00	0.000	0.066	0.3058	0.0376	0.0000	4.58E-08
114	*	0.00	0.000	0.091	0.2967	0.0379	0.0000	4.60E-08
115		0.00	0.000	0.100	0.2866	0.0385	0.0000	4.67E-08
116	*	0.00	0.000	0.000	0.2866	0.0385	0.0000	4.66E-08
117		0.00	0.000	0.078	0.2789	0.0385	0.0000	4.66E-08
118		0.45	0.181	0.150	0.2904	0.0385	0.0000	4.66E-08
119		0.73	0.424	0.194	0.3019	0.0385	0.0000	4.66E-08
120		2.18	1.974	0.092	0.3135	0.0385	0.0000	4.66E-08

121	0.00	0.000	0.152	0.2983	0.0385	0.0000	4.66E-08
122	0.00	0.000	0.079	0.2904	0.0385	0.0000	4.66E-08
123	0.04	0.000	0.139	0.2802	0.0385	0.0000	4.66E-08
124	0.00	0.000	0.024	0.2778	0.0384	0.0000	4.66E-08
125	0.00	0.000	0.006	0.2772	0.0384	0.0000	4.66E-08
126	0.99	0.753	0.074	0.2934	0.0384	0.0000	4.65E-08
127	0.47	0.182	0.202	0.3023	0.0384	0.0000	4.65E-08
128	0.00	0.000	0.074	0.2949	0.0384	0.0000	4.65E-08
129	0.00	0.000	0.080	0.2870	0.0384	0.0000	4.65E-08
130	0.00	0.000	0.080	0.2790	0.0384	0.0000	4.65E-08
131	0.00	0.000	0.013	0.2777	0.0384	0.0000	4.65E-08
132	0.00	0.000	0.005	0.2772	0.0383	0.0000	4.65E-08
133	0.13	0.000	0.025	0.2880	0.0383	0.0000	4.65E-08
134	0.00	0.000	0.015	0.2865	0.0383	0.0000	4.65E-08
135	0.00	0.000	0.018	0.2846	0.0383	0.0000	4.64E-08
136	0.19	0.043	0.037	0.2958	0.0383	0.0000	4.64E-08
137	0.01	0.000	0.021	0.2948	0.0383	0.0000	4.64E-08
138	0.01	0.000	0.028	0.2935	0.0383	0.0000	4.64E-08
139	0.07	0.000	0.036	0.2971	0.0383	0.0000	4.64E-08
140	0.50	0.343	0.042	0.3090	0.0383	0.0000	4.64E-08
141	0.18	0.018	0.179	0.3068	0.0383	0.0000	4.64E-08
142	0.11	0.000	0.104	0.3072	0.0382	0.0000	4.64E-08
143	0.12	0.001	0.198	0.2998	0.0382	0.0000	4.64E-08
144	0.00	0.000	0.089	0.2909	0.0382	0.0000	4.64E-08
145	0.00	0.000	0.044	0.2864	0.0382	0.0000	4.63E-08
146	0.24	0.088	0.052	0.2966	0.0383	0.0000	4.64E-08
147	0.03	0.000	0.046	0.2950	0.0383	0.0000	4.64E-08
148	0.01	0.000	0.041	0.2918	0.0383	0.0000	4.64E-08
149	0.49	0.299	0.052	0.3053	0.0383	0.0000	4.64E-08
150	0.05	0.000	0.131	0.2968	0.0383	0.0000	4.64E-08
151	0.00	0.000	0.022	0.2946	0.0383	0.0000	4.64E-08
152	0.00	0.000	0.022	0.2924	0.0383	0.0000	4.64E-08

153	0.00	0.000	0.020	0.2904	0.0383	0.0000	4.64E-08
154	0.00	0.000	0.020	0.2884	0.0383	0.0000	4.64E-08
155	0.00	0.000	0.017	0.2867	0.0382	0.0000	4.64E-08
156	0.63	0.435	0.041	0.3024	0.0382	0.0000	4.64E-08
157	0.00	0.000	0.197	0.2828	0.0382	0.0000	4.64E-08
158	0.00	0.000	0.024	0.2804	0.0382	0.0000	4.64E-08
159	0.07	0.000	0.044	0.2828	0.0382	0.0000	4.63E-08
160	0.45	0.275	0.042	0.2958	0.0382	0.0000	4.63E-08
161	0.14	0.001	0.078	0.3023	0.0382	0.0000	4.63E-08
162	0.00	0.000	0.119	0.2904	0.0382	0.0000	4.63E-08
163	0.00	0.000	0.088	0.2816	0.0382	0.0000	4.63E-08
164	0.00	0.000	0.032	0.2784	0.0381	0.0000	4.63E-08
165	0.06	0.000	0.030	0.2814	0.0381	0.0000	4.63E-08
166	0.08	0.000	0.028	0.2865	0.0381	0.0000	4.63E-08
167	0.00	0.000	0.019	0.2846	0.0381	0.0000	4.63E-08
168	0.00	0.000	0.021	0.2825	0.0381	0.0000	4.62E-08
169	0.00	0.000	0.024	0.2801	0.0381	0.0000	4.62E-08
170	0.01	0.000	0.031	0.2782	0.0381	0.0000	4.62E-08
171	0.00	0.000	0.005	0.2777	0.0381	0.0000	4.62E-08
172	0.00	0.000	0.006	0.2772	0.0381	0.0000	4.62E-08
173	0.00	0.000	0.001	0.2770	0.0380	0.0000	4.62E-08
174	0.00	0.000	0.000	0.2770	0.0380	0.0000	4.62E-08
175	1.43	1.225	0.042	0.2930	0.0380	0.0000	4.62E-08
176	0.00	0.000	0.104	0.2826	0.0380	0.0000	4.62E-08
177	0.00	0.000	0.020	0.2806	0.0380	0.0000	4.62E-08
178	0.00	0.000	0.023	0.2783	0.0380	0.0000	4.61E-08
179	0.08	0.000	0.032	0.2830	0.0380	0.0000	4.61E-08
180	0.03	0.000	0.025	0.2832	0.0380	0.0000	4.61E-08
181	0.00	0.000	0.015	0.2817	0.0380	0.0000	4.61E-08
182	0.00	0.000	0.012	0.2805	0.0379	0.0000	4.61E-08
183	0.00	0.000	0.016	0.2789	0.0379	0.0000	4.61E-08
184	0.00	0.000	0.006	0.2783	0.0379	0.0000	4.61E-08

185	0.00	0.000	0.005	0.2778	0.0379	0.0000	4.61E-08
186	0.00	0.000	0.004	0.2774	0.0379	0.0000	4.61E-08
187	0.15	0.000	0.028	0.2891	0.0379	0.0000	4.61E-08
188	0.15	0.000	0.033	0.3005	0.0379	0.0000	4.61E-08
189	0.04	0.000	0.144	0.2905	0.0379	0.0000	4.61E-08
190	0.00	0.000	0.018	0.2887	0.0379	0.0000	4.60E-08
191	1.05	0.867	0.037	0.3030	0.0379	0.0000	4.60E-08
192	0.00	0.000	0.167	0.2864	0.0379	0.0000	4.60E-08
193	0.00	0.000	0.073	0.2791	0.0379	0.0000	4.60E-08
194	0.00	0.000	0.018	0.2773	0.0378	0.0000	4.60E-08
195	0.00	0.000	0.002	0.2771	0.0378	0.0000	4.60E-08
196	0.00	0.000	0.001	0.2770	0.0379	0.0000	4.60E-08
197	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.60E-08
198	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.60E-08
199	0.00	0.000	0.000	0.2770	0.0378	0.0000	4.60E-08
200	0.00	0.000	0.000	0.2770	0.0378	0.0000	4.60E-08
201	1.45	1.239	0.047	0.2930	0.0378	0.0000	4.60E-08
202	0.00	0.000	0.114	0.2816	0.0378	0.0000	4.60E-08
203	0.21	0.051	0.048	0.2926	0.0378	0.0000	4.60E-08
204	0.34	0.099	0.261	0.2908	0.0378	0.0000	4.60E-08
205	0.07	0.000	0.139	0.2840	0.0378	0.0000	4.59E-08
206	0.00	0.000	0.038	0.2802	0.0378	0.0000	4.59E-08
207	0.14	0.000	0.052	0.2891	0.0378	0.0000	4.59E-08
208	0.00	0.000	0.030	0.2861	0.0377	0.0000	4.59E-08
209	0.00	0.000	0.026	0.2835	0.0377	0.0000	4.59E-08
210	0.07	0.000	0.049	0.2861	0.0378	0.0000	4.60E-08
211	0.08	0.000	0.045	0.2891	0.0379	0.0000	4.61E-08
212	0.00	0.000	0.023	0.2868	0.0379	0.0000	4.61E-08
213	0.00	0.000	0.023	0.2845	0.0379	0.0000	4.61E-08
214	0.00	0.000	0.024	0.2821	0.0379	0.0000	4.61E-08
215	0.00	0.000	0.025	0.2796	0.0380	0.0000	4.61E-08
216	0.00	0.000	0.020	0.2776	0.0379	0.0000	4.61E-08

217	0.00	0.000	0.005	0.2772	0.0379	0.0000	4.61E-08
218	0.00	0.000	0.001	0.2771	0.0379	0.0000	4.61E-08
219	0.00	0.000	0.001	0.2770	0.0379	0.0000	4.61E-08
220	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.61E-08
221	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.61E-08
222	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.60E-08
223	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.60E-08
224	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.60E-08
225	0.00	0.000	0.000	0.2770	0.0379	0.0000	4.60E-08
226	0.00	0.000	0.000	0.2770	0.0378	0.0000	4.60E-08
227	0.01	0.000	0.011	0.2770	0.0378	0.0000	4.60E-08
228	0.06	0.000	0.022	0.2805	0.0378	0.0000	4.60E-08
229	0.00	0.000	0.002	0.2802	0.0378	0.0000	4.60E-08
230	0.00	0.000	0.011	0.2792	0.0378	0.0000	4.60E-08
231	0.66	0.483	0.040	0.2931	0.0378	0.0000	4.60E-08
232	0.06	0.000	0.032	0.2955	0.0378	0.0000	4.59E-08
233	0.00	0.000	0.016	0.2939	0.0378	0.0000	4.59E-08
234	0.37	0.204	0.043	0.3066	0.0378	0.0000	4.59E-08
235	0.00	0.000	0.115	0.2954	0.0377	0.0000	4.59E-08
236	0.01	0.000	0.019	0.2941	0.0377	0.0000	4.59E-08
237	0.16	0.000	0.038	0.3059	0.0377	0.0000	4.59E-08
238	0.08	0.000	0.042	0.3098	0.0377	0.0000	4.59E-08
239	0.29	0.124	0.095	0.3173	0.0377	0.0000	4.59E-08
240	0.00	0.000	0.066	0.3107	0.0377	0.0000	4.59E-08
241	0.00	0.000	0.062	0.3047	0.0377	0.0000	4.59E-08
242	0.00	0.000	0.063	0.2983	0.0377	0.0000	4.59E-08
243	0.00	0.000	0.078	0.2906	0.0377	0.0000	4.59E-08
244	0.00	0.000	0.060	0.2846	0.0377	0.0000	4.58E-08
245	0.00	0.000	0.046	0.2799	0.0377	0.0000	4.58E-08
246	0.11	0.000	0.050	0.2858	0.0376	0.0000	4.58E-08
247	0.00	0.000	0.025	0.2833	0.0376	0.0000	4.58E-08
248	0.00	0.000	0.034	0.2800	0.0376	0.0000	4.58E-08

249		0.00	0.000	0.019	0.2780	0.0376	0.0000	4.58E-08
250		0.04	0.000	0.029	0.2792	0.0376	0.0000	4.58E-08
251		0.07	0.000	0.027	0.2835	0.0376	0.0000	4.58E-08
252		1.41	1.237	0.049	0.2958	0.0376	0.0000	4.58E-08
253		0.00	0.000	0.077	0.2881	0.0376	0.0000	4.58E-08
254		0.00	0.000	0.069	0.2812	0.0376	0.0000	4.57E-08
255		0.00	0.000	0.025	0.2787	0.0375	0.0000	4.57E-08
256		0.00	0.000	0.010	0.2777	0.0375	0.0000	4.57E-08
257		0.09	0.000	0.033	0.2830	0.0375	0.0000	4.57E-08
258		0.08	0.000	0.043	0.2872	0.0375	0.0000	4.57E-08
259		0.71	0.521	0.069	0.2997	0.0375	0.0000	4.57E-08
260		0.00	0.000	0.080	0.2917	0.0375	0.0000	4.57E-08
261		0.00	0.000	0.095	0.2822	0.0375	0.0000	4.57E-08
262		0.00	0.000	0.041	0.2781	0.0375	0.0000	4.57E-08
263		0.72	0.478	0.097	0.2925	0.0375	0.0000	4.57E-08
264		0.06	0.000	0.108	0.2873	0.0375	0.0000	4.57E-08
265		0.12	0.000	0.105	0.2892	0.0375	0.0000	4.57E-08
266		0.01	0.000	0.082	0.2823	0.0375	0.0000	4.56E-08
267		0.40	0.179	0.088	0.2960	0.0374	0.0000	4.56E-08
268		0.00	0.000	0.109	0.2851	0.0374	0.0000	4.56E-08
269		0.00	0.000	0.048	0.2803	0.0374	0.0000	4.56E-08
270		0.00	0.000	0.025	0.2778	0.0374	0.0000	4.56E-08
271		0.00	0.000	0.006	0.2771	0.0374	0.0000	4.56E-08
272		0.00	0.000	0.001	0.2770	0.0374	0.0000	4.56E-08
273		0.26	0.096	0.039	0.2891	0.0374	0.0000	4.56E-08
274		0.01	0.000	0.026	0.2872	0.0374	0.0000	4.56E-08
275	*	0.00	0.000	0.021	0.2851	0.0374	0.0000	4.56E-08
276		0.00	0.000	0.022	0.2829	0.0374	0.0000	4.55E-08
277		0.00	0.000	0.018	0.2811	0.0373	0.0000	4.55E-08
278		0.00	0.000	0.024	0.2787	0.0373	0.0000	4.55E-08
279		0.00	0.000	0.012	0.2774	0.0373	0.0000	4.55E-08
280		0.09	0.000	0.028	0.2836	0.0373	0.0000	4.55E-08

281	0.00	0.000	0.011	0.2826	0.0373	0.0000	4.55E-08
282	0.00	0.000	0.013	0.2812	0.0373	0.0000	4.55E-08
283	0.00	0.000	0.020	0.2792	0.0373	0.0000	4.55E-08
284	0.61	0.424	0.044	0.2938	0.0373	0.0000	4.55E-08
285	0.00	0.000	0.054	0.2884	0.0373	0.0000	4.55E-08
286	0.00	0.000	0.085	0.2799	0.0372	0.0000	4.55E-08
287	0.71	0.470	0.081	0.2958	0.0372	0.0000	4.54E-08
288	0.03	0.000	0.088	0.2896	0.0372	0.0000	4.54E-08
289	0.00	0.000	0.066	0.2831	0.0372	0.0000	4.54E-08
290	0.01	0.000	0.060	0.2783	0.0372	0.0000	4.54E-08
291	0.15	0.000	0.043	0.2890	0.0372	0.0000	4.54E-08
292	0.05	0.000	0.055	0.2888	0.0372	0.0000	4.54E-08
293	0.16	0.004	0.079	0.2969	0.0372	0.0000	4.54E-08
294	0.00	0.000	0.026	0.2942	0.0372	0.0000	4.54E-08
295	0.49	0.301	0.057	0.3077	0.0371	0.0000	4.54E-08
296	0.04	0.000	0.063	0.3050	0.0371	0.0000	4.53E-08
297	0.00	0.000	0.031	0.3020	0.0371	0.0000	4.53E-08
298	0.00	0.000	0.061	0.2959	0.0371	0.0000	4.54E-08
299	0.00	0.000	0.100	0.2859	0.0371	0.0000	4.53E-08
300	0.00	0.000	0.080	0.2779	0.0371	0.0000	4.53E-08
301	0.00	0.000	0.005	0.2775	0.0371	0.0000	4.53E-08
302	0.00	0.000	0.004	0.2771	0.0371	0.0000	4.53E-08
303	0.00	0.000	0.001	0.2770	0.0371	0.0000	4.53E-08
304	1.44	1.224	0.055	0.2932	0.0371	0.0000	4.53E-08
305	0.00	0.000	0.060	0.2872	0.0371	0.0000	4.53E-08
306	1.06	0.751	0.157	0.3026	0.0371	0.0000	4.53E-08
307	0.03	0.000	0.050	0.3010	0.0371	0.0000	4.53E-08
308	0.88	0.643	0.104	0.3140	0.0370	0.0000	4.53E-08
309	0.19	0.051	0.057	0.3226	0.0370	0.0000	4.52E-08
310	0.00	0.000	0.031	0.3196	0.0370	0.0000	4.52E-08
311	0.00	0.000	0.048	0.3147	0.0370	0.0000	4.52E-08
312	0.00	0.000	0.062	0.3086	0.0370	0.0000	4.53E-08

313		0.00	0.000	0.101	0.2985	0.0370	0.0000	4.52E-08
314		0.00	0.000	0.051	0.2933	0.0370	0.0000	4.52E-08
315		0.19	0.026	0.110	0.2987	0.0370	0.0000	4.52E-08
316		0.02	0.000	0.097	0.2906	0.0370	0.0000	4.52E-08
317		0.03	0.000	0.071	0.2868	0.0370	0.0000	4.52E-08
318		0.57	0.339	0.099	0.3003	0.0377	0.0000	4.59E-08
319		0.20	0.055	0.103	0.3049	0.0381	0.0000	4.63E-08
320		0.00	0.000	0.063	0.2986	0.0381	0.0000	4.62E-08
321		0.00	0.000	0.043	0.2943	0.0381	0.0000	4.62E-08
322		0.00	0.000	0.029	0.2915	0.0381	0.0000	4.62E-08
323		0.12	0.000	0.047	0.2990	0.0381	0.0000	4.62E-08
324		0.21	0.055	0.057	0.3088	0.0380	0.0000	4.62E-08
325	*	0.89	0.000	0.034	0.3108	0.0380	0.0000	4.62E-08
326	*	0.05	0.000	0.018	0.3127	0.0380	0.0000	4.62E-08
327	*	0.00	0.000	0.022	0.3147	0.0380	0.0000	4.62E-08
328	*	0.07	0.000	0.013	0.3167	0.0380	0.0000	4.62E-08
329	*	0.59	0.000	0.009	0.3186	0.0380	0.0000	4.61E-08
330		0.22	0.000	0.000	0.3210	0.0380	0.0000	4.61E-08
331	*	0.00	0.000	0.041	0.3230	0.0380	0.0000	4.61E-08
332		0.00	0.354	0.000	0.3357	0.0380	0.0000	4.61E-08
333	*	0.01	0.000	0.027	0.3377	0.0379	0.0000	4.61E-08
334		0.00	0.316	0.000	0.3504	0.0379	0.0000	4.61E-08
335		0.00	0.421	0.057	0.3620	0.0379	0.0000	4.61E-08
336		0.95	0.800	0.145	0.3624	0.0379	0.0000	4.61E-08
337		0.01	0.000	0.088	0.3543	0.0379	0.0000	4.61E-08
338		0.00	0.000	0.057	0.3486	0.0379	0.0000	4.61E-08
339		0.00	0.000	0.047	0.3439	0.0379	0.0000	4.60E-08
340		0.09	0.000	0.076	0.3452	0.0379	0.0000	4.60E-08
341		0.07	0.000	0.077	0.3442	0.0379	0.0000	4.60E-08
342		0.00	0.000	0.041	0.3401	0.0378	0.0000	4.60E-08
343		0.02	0.000	0.056	0.3362	0.0378	0.0000	4.60E-08
344		0.00	0.000	0.065	0.3297	0.0378	0.0000	4.60E-08

345		0.00	0.000	0.073	0.3224	0.0378	0.0000	4.60E-08
346		0.00	0.000	0.069	0.3156	0.0378	0.0000	4.60E-08
347		0.10	0.000	0.071	0.3185	0.0378	0.0000	4.60E-08
348	*	0.00	0.000	0.026	0.3159	0.0378	0.0000	4.60E-08
349	*	0.00	0.000	0.000	0.3159	0.0379	0.0000	4.60E-08
350	*	0.00	0.000	0.004	0.3159	0.0379	0.0000	4.60E-08
351	*	0.00	0.000	0.000	0.3159	0.0379	0.0000	4.60E-08
352		0.00	0.000	0.041	0.3118	0.0378	0.0000	4.60E-08
353		0.00	0.000	0.078	0.3040	0.0378	0.0000	4.60E-08
354		0.20	0.038	0.094	0.3105	0.0378	0.0000	4.60E-08
355		0.11	0.000	0.083	0.3134	0.0378	0.0000	4.60E-08
356		0.51	0.313	0.063	0.3266	0.0378	0.0000	4.60E-08
357		0.00	0.000	0.037	0.3230	0.0378	0.0000	4.60E-08
358		0.05	0.000	0.057	0.3226	0.0378	0.0000	4.59E-08
359		0.00	0.000	0.062	0.3167	0.0378	0.0000	4.59E-08
360		0.44	0.230	0.068	0.3311	0.0378	0.0000	4.59E-08
361		0.03	0.000	0.083	0.3261	0.0377	0.0000	4.59E-08
362		0.00	0.000	0.135	0.3126	0.0377	0.0000	4.59E-08
363		0.00	0.000	0.090	0.3036	0.0377	0.0000	4.59E-08
364		0.00	0.000	0.098	0.2937	0.0377	0.0000	4.59E-08
365		0.00	0.000	0.105	0.2832	0.0377	0.0000	4.59E-08

* = Frozen (air or soil)

Annual Totals for Year 7			
	inches	cubic feet	percent
Precipitation	41.54	150,782.1	100.00
Runoff	23.595	85,649.9	56.80
Evapotranspiration	18.070	65,594.7	43.50
Recirculation into Layer 1	0.0016	5.6598	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0016	5.6598	0.00
Percolation/Leakage through Layer 5	0.000017	0.0607	0.00
Average Head on Top of Layer 4	0.0377	---	---
Change in Water Storage	-0.1274	-462.5	-0.31
Soil Water at Start of Year	1,406.6657	5,106,196.3	3386.47
Soil Water at End of Year	1,406.5382	5,105,733.8	3386.17
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0016	-5.6594	0.00

Daily Output for Year 8

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.056	0.2776	0.0377	0.0000	4.59E-08
2			0.00	0.000	0.003	0.2773	0.0377	0.0000	4.59E-08
3			0.00	0.000	0.003	0.2770	0.0377	0.0000	4.58E-08
4			0.00	0.000	0.000	0.2770	0.0377	0.0000	4.58E-08
5			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
6			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
7			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
8			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
9			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
10			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
11			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
12			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
13			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.57E-08
14			0.00	0.000	0.000	0.2770	0.0376	0.0000	4.57E-08
15	*		0.00	0.000	0.000	0.2770	0.0375	0.0000	4.57E-08
16	*		0.00	0.000	0.000	0.2770	0.0375	0.0000	4.57E-08
17	*		0.00	0.000	0.000	0.2770	0.0375	0.0000	4.57E-08
18	*		0.22	0.000	0.028	0.2790	0.0375	0.0000	4.57E-08
19	*		0.00	0.000	0.021	0.2809	0.0375	0.0000	4.57E-08
20	*		0.09	0.000	0.011	0.2829	0.0375	0.0000	4.57E-08
21	*		0.00	0.000	0.000	0.2849	0.0375	0.0000	4.57E-08
22			0.03	0.022	0.056	0.2976	0.0375	0.0000	4.57E-08
23			0.00	0.000	0.007	0.2969	0.0375	0.0000	4.56E-08
24	*		0.00	0.000	0.011	0.2958	0.0374	0.0000	4.56E-08

25			0.00	0.000	0.010	0.2948	0.0374	0.0000	4.56E-08
26			0.35	0.179	0.037	0.3085	0.0374	0.0000	4.56E-08
27			0.19	0.053	0.031	0.3192	0.0374	0.0000	4.56E-08
28			0.00	0.000	0.026	0.3167	0.0374	0.0000	4.56E-08
29			0.00	0.000	0.041	0.3126	0.0374	0.0000	4.56E-08
30			0.00	0.000	0.108	0.3018	0.0374	0.0000	4.56E-08
31			0.00	0.000	0.040	0.2978	0.0374	0.0000	4.56E-08
32			0.00	0.000	0.045	0.2933	0.0374	0.0000	4.56E-08
33			0.00	0.000	0.026	0.2907	0.0374	0.0000	4.56E-08
34	*		0.00	0.000	0.029	0.2878	0.0374	0.0000	4.56E-08
35	*		0.00	0.000	0.000	0.2878	0.0375	0.0000	4.57E-08
36	*		0.00	0.000	0.000	0.2878	0.0375	0.0000	4.57E-08
37	*		0.00	0.000	0.000	0.2878	0.0375	0.0000	4.57E-08
38			0.00	0.000	0.025	0.2852	0.0375	0.0000	4.57E-08
39			0.00	0.000	0.025	0.2827	0.0375	0.0000	4.57E-08
40	*		0.00	0.000	0.000	0.2827	0.0375	0.0000	4.56E-08
41	*		0.00	0.000	0.000	0.2827	0.0374	0.0000	4.56E-08
42	*	*	0.00	0.000	0.000	0.2827	0.0374	0.0000	4.56E-08
43	*	*	0.00	0.000	0.000	0.2827	0.0374	0.0000	4.56E-08
44		*	0.00	0.000	0.000	0.2827	0.0374	0.0000	4.56E-08
45		*	0.00	0.000	0.000	0.2827	0.0374	0.0000	4.56E-08
46			0.25	0.088	0.045	0.2940	0.0374	0.0000	4.56E-08
47			0.01	0.000	0.031	0.2921	0.0374	0.0000	4.56E-08
48			0.00	0.000	0.022	0.2901	0.0374	0.0000	4.56E-08
49			0.00	0.000	0.019	0.2881	0.0374	0.0000	4.56E-08
50			0.00	0.000	0.019	0.2862	0.0373	0.0000	4.55E-08
51	*		0.00	0.000	0.000	0.2862	0.0373	0.0000	4.55E-08
52			0.00	0.000	0.018	0.2844	0.0373	0.0000	4.55E-08
53	*		0.12	0.000	0.061	0.2863	0.0373	0.0000	4.55E-08
54	*		0.00	0.000	0.045	0.2854	0.0373	0.0000	4.55E-08
55	*		0.00	0.000	0.000	0.2854	0.0373	0.0000	4.55E-08
56	*		0.00	0.000	0.000	0.2854	0.0373	0.0000	4.55E-08

57	*	0.00	0.000	0.014	0.2840	0.0373	0.0000	4.55E-08
58	*	0.00	0.000	0.012	0.2827	0.0373	0.0000	4.55E-08
59		0.79	0.603	0.038	0.2976	0.0372	0.0000	4.55E-08
60		0.00	0.000	0.044	0.2932	0.0372	0.0000	4.54E-08
61		0.00	0.000	0.095	0.2837	0.0372	0.0000	4.54E-08
62		0.00	0.000	0.042	0.2795	0.0372	0.0000	4.54E-08
63		0.00	0.000	0.013	0.2783	0.0372	0.0000	4.54E-08
64		0.00	0.000	0.009	0.2773	0.0372	0.0000	4.54E-08
65		0.00	0.000	0.002	0.2771	0.0372	0.0000	4.54E-08
66		0.00	0.000	0.001	0.2770	0.0375	0.0000	4.57E-08
67	*	0.00	0.000	0.000	0.2770	0.0378	0.0000	4.60E-08
68		0.00	0.000	0.000	0.2770	0.0378	0.0000	4.60E-08
69		0.00	0.000	0.000	0.2770	0.0378	0.0000	4.59E-08
70		0.27	0.111	0.031	0.2896	0.0378	0.0000	4.59E-08
71		0.62	0.463	0.044	0.3012	0.0378	0.0000	4.59E-08
72	*	0.10	0.000	0.061	0.3032	0.0377	0.0000	4.59E-08
73	*	0.34	0.000	0.018	0.3052	0.0377	0.0000	4.59E-08
74	*	0.11	0.000	0.011	0.3071	0.0377	0.0000	4.59E-08
75	*	1.30	0.000	0.000	0.3091	0.0377	0.0000	4.59E-08
76		0.00	0.028	0.034	0.3218	0.0377	0.0000	4.59E-08
77		0.00	0.179	0.013	0.3334	0.0377	0.0000	4.59E-08
78	*	0.82	0.000	0.028	0.3354	0.0377	0.0000	4.59E-08
79	*	0.22	0.000	0.018	0.3374	0.0377	0.0000	4.58E-08
80	*	0.00	0.000	0.014	0.3394	0.0377	0.0000	4.58E-08
81		0.00	0.000	0.000	0.3414	0.0376	0.0000	4.58E-08
82		0.00	1.955	0.000	0.3541	0.0376	0.0000	4.58E-08
83		0.00	0.000	0.119	0.3423	0.0376	0.0000	4.58E-08
84	*	0.00	0.000	0.073	0.3349	0.0376	0.0000	4.58E-08
85		0.00	0.000	0.086	0.3263	0.0376	0.0000	4.58E-08
86		0.00	0.000	0.045	0.3218	0.0376	0.0000	4.58E-08
87		0.00	0.000	0.079	0.3139	0.0376	0.0000	4.58E-08
88		0.00	0.000	0.147	0.2991	0.0376	0.0000	4.58E-08

89		0.00	0.000	0.126	0.2866	0.0376	0.0000	4.57E-08
90		0.00	0.000	0.052	0.2813	0.0375	0.0000	4.57E-08
91		0.00	0.000	0.037	0.2776	0.0376	0.0000	4.58E-08
92		0.49	0.279	0.057	0.2926	0.0377	0.0000	4.59E-08
93		0.66	0.390	0.153	0.3042	0.0378	0.0000	4.60E-08
94		0.06	0.000	0.067	0.3034	0.0380	0.0000	4.61E-08
95		0.11	0.000	0.096	0.3049	0.0380	0.0000	4.61E-08
96		0.02	0.000	0.173	0.2901	0.0380	0.0000	4.61E-08
97		0.00	0.000	0.091	0.2810	0.0380	0.0000	4.61E-08
98		0.00	0.000	0.033	0.2777	0.0379	0.0000	4.61E-08
99		0.00	0.000	0.005	0.2772	0.0382	0.0000	4.63E-08
100		0.00	0.000	0.001	0.2770	0.0384	0.0000	4.65E-08
101		0.00	0.000	0.000	0.2770	0.0384	0.0000	4.65E-08
102		0.00	0.000	0.000	0.2770	0.0384	0.0000	4.65E-08
103		0.00	0.000	0.000	0.2770	0.0384	0.0000	4.65E-08
104		0.32	0.143	0.046	0.2903	0.0384	0.0000	4.65E-08
105		0.28	0.120	0.044	0.3019	0.0383	0.0000	4.65E-08
106		0.00	0.000	0.043	0.2977	0.0383	0.0000	4.65E-08
107		0.00	0.000	0.014	0.2962	0.0383	0.0000	4.64E-08
108		0.26	0.096	0.039	0.3089	0.0383	0.0000	4.64E-08
109		0.74	0.482	0.138	0.3205	0.0383	0.0000	4.64E-08
110		0.07	0.000	0.156	0.3121	0.0383	0.0000	4.64E-08
111		0.05	0.000	0.205	0.2968	0.0383	0.0000	4.64E-08
112		0.00	0.000	0.106	0.2862	0.0383	0.0000	4.64E-08
113		0.00	0.000	0.046	0.2816	0.0384	0.0000	4.65E-08
114		0.00	0.000	0.033	0.2783	0.0385	0.0000	4.67E-08
115		0.00	0.000	0.010	0.2773	0.0385	0.0000	4.66E-08
116		0.00	0.000	0.003	0.2771	0.0385	0.0000	4.66E-08
117	*	0.14	0.000	0.108	0.2790	0.0385	0.0000	4.66E-08
118		0.00	0.000	0.015	0.2787	0.0385	0.0000	4.66E-08
119		0.00	0.000	0.005	0.2782	0.0385	0.0000	4.66E-08
120		0.28	0.113	0.044	0.2911	0.0385	0.0000	4.66E-08

121	0.00	0.000	0.010	0.2901	0.0385	0.0000	4.66E-08
122	0.00	0.000	0.014	0.2887	0.0385	0.0000	4.66E-08
123	0.00	0.000	0.014	0.2872	0.0384	0.0000	4.66E-08
124	0.00	0.000	0.013	0.2859	0.0384	0.0000	4.66E-08
125	0.06	0.000	0.033	0.2882	0.0384	0.0000	4.65E-08
126	0.03	0.000	0.029	0.2879	0.0384	0.0000	4.65E-08
127	0.00	0.000	0.013	0.2865	0.0384	0.0000	4.65E-08
128	0.00	0.000	0.010	0.2856	0.0384	0.0000	4.65E-08
129	0.00	0.000	0.011	0.2844	0.0384	0.0000	4.65E-08
130	0.00	0.000	0.012	0.2832	0.0384	0.0000	4.65E-08
131	0.19	0.046	0.033	0.2947	0.0384	0.0000	4.65E-08
132	0.31	0.153	0.039	0.3062	0.0383	0.0000	4.65E-08
133	0.22	0.062	0.149	0.3072	0.0383	0.0000	4.65E-08
134	0.01	0.000	0.069	0.3017	0.0383	0.0000	4.65E-08
135	0.00	0.000	0.089	0.2928	0.0383	0.0000	4.64E-08
136	0.00	0.000	0.046	0.2881	0.0383	0.0000	4.64E-08
137	0.00	0.000	0.037	0.2844	0.0383	0.0000	4.64E-08
138	1.60	1.378	0.058	0.3006	0.0383	0.0000	4.64E-08
139	0.00	0.000	0.148	0.2859	0.0383	0.0000	4.64E-08
140	0.00	0.000	0.054	0.2805	0.0384	0.0000	4.65E-08
141	2.67	2.357	0.154	0.2966	0.0384	0.0000	4.65E-08
142	0.14	0.000	0.122	0.2985	0.0384	0.0000	4.65E-08
143	0.00	0.000	0.087	0.2898	0.0383	0.0000	4.65E-08
144	0.88	0.548	0.188	0.3043	0.0383	0.0000	4.65E-08
145	0.00	0.000	0.198	0.2845	0.0386	0.0000	4.67E-08
146	0.00	0.000	0.059	0.2786	0.0390	0.0000	4.70E-08
147	0.00	0.000	0.013	0.2772	0.0389	0.0000	4.70E-08
148	0.00	0.000	0.002	0.2771	0.0389	0.0000	4.70E-08
149	0.03	0.000	0.021	0.2780	0.0389	0.0000	4.70E-08
150	0.00	0.000	0.003	0.2776	0.0389	0.0000	4.70E-08
151	0.00	0.000	0.005	0.2771	0.0389	0.0000	4.70E-08
152	0.00	0.000	0.001	0.2771	0.0389	0.0000	4.70E-08

153	0.08	0.000	0.024	0.2822	0.0389	0.0000	4.70E-08
154	0.00	0.000	0.011	0.2810	0.0389	0.0000	4.70E-08
155	0.00	0.000	0.016	0.2794	0.0389	0.0000	4.70E-08
156	0.00	0.000	0.010	0.2784	0.0388	0.0000	4.69E-08
157	0.00	0.000	0.005	0.2779	0.0388	0.0000	4.69E-08
158	0.24	0.088	0.031	0.2900	0.0388	0.0000	4.69E-08
159	0.00	0.000	0.010	0.2890	0.0388	0.0000	4.69E-08
160	0.00	0.000	0.015	0.2875	0.0388	0.0000	4.69E-08
161	0.00	0.000	0.015	0.2860	0.0388	0.0000	4.69E-08
162	1.09	0.900	0.042	0.3007	0.0388	0.0000	4.69E-08
163	0.09	0.000	0.159	0.2941	0.0388	0.0000	4.69E-08
164	0.00	0.000	0.100	0.2841	0.0388	0.0000	4.69E-08
165	0.00	0.000	0.050	0.2791	0.0387	0.0000	4.68E-08
166	0.00	0.000	0.011	0.2780	0.0387	0.0000	4.68E-08
167	0.00	0.000	0.008	0.2772	0.0387	0.0000	4.68E-08
168	0.00	0.000	0.002	0.2770	0.0387	0.0000	4.68E-08
169	0.00	0.000	0.000	0.2770	0.0387	0.0000	4.68E-08
170	0.00	0.000	0.000	0.2770	0.0387	0.0000	4.68E-08
171	0.63	0.414	0.050	0.2931	0.0387	0.0000	4.68E-08
172	0.00	0.000	0.012	0.2919	0.0387	0.0000	4.68E-08
173	0.00	0.000	0.020	0.2899	0.0387	0.0000	4.68E-08
174	0.00	0.000	0.019	0.2881	0.0386	0.0000	4.68E-08
175	0.00	0.000	0.018	0.2862	0.0386	0.0000	4.67E-08
176	0.00	0.000	0.018	0.2844	0.0386	0.0000	4.67E-08
177	3.49	3.300	0.043	0.2995	0.0386	0.0000	4.67E-08
178	0.04	0.000	0.150	0.2885	0.0386	0.0000	4.67E-08
179	0.40	0.129	0.270	0.2884	0.0386	0.0000	4.67E-08
180	0.49	0.235	0.142	0.2996	0.0386	0.0000	4.67E-08
181	1.95	1.691	0.146	0.3108	0.0386	0.0000	4.67E-08
182	1.48	1.246	0.121	0.3221	0.0386	0.0000	4.67E-08
183	0.00	0.000	0.122	0.3099	0.0385	0.0000	4.67E-08
184	0.00	0.000	0.260	0.2839	0.0385	0.0000	4.66E-08

185	0.00	0.000	0.060	0.2779	0.0385	0.0000	4.66E-08
186	0.04	0.000	0.038	0.2781	0.0385	0.0000	4.66E-08
187	0.00	0.000	0.007	0.2774	0.0385	0.0000	4.66E-08
188	0.26	0.104	0.042	0.2893	0.0385	0.0000	4.66E-08
189	0.00	0.000	0.019	0.2873	0.0385	0.0000	4.66E-08
190	0.00	0.000	0.029	0.2845	0.0385	0.0000	4.66E-08
191	0.00	0.000	0.023	0.2822	0.0385	0.0000	4.66E-08
192	0.57	0.368	0.052	0.2975	0.0384	0.0000	4.66E-08
193	0.00	0.000	0.081	0.2893	0.0384	0.0000	4.66E-08
194	0.00	0.000	0.021	0.2872	0.0384	0.0000	4.65E-08
195	0.00	0.000	0.025	0.2847	0.0384	0.0000	4.65E-08
196	0.04	0.000	0.043	0.2842	0.0384	0.0000	4.66E-08
197	0.00	0.000	0.023	0.2820	0.0384	0.0000	4.66E-08
198	0.00	0.000	0.029	0.2791	0.0384	0.0000	4.66E-08
199	0.00	0.000	0.009	0.2782	0.0384	0.0000	4.65E-08
200	0.00	0.000	0.007	0.2775	0.0386	0.0000	4.67E-08
201	0.00	0.000	0.004	0.2771	0.0387	0.0000	4.68E-08
202	0.00	0.000	0.001	0.2771	0.0387	0.0000	4.68E-08
203	0.00	0.000	0.000	0.2770	0.0387	0.0000	4.68E-08
204	0.00	0.000	0.000	0.2770	0.0387	0.0000	4.68E-08
205	0.00	0.000	0.000	0.2770	0.0387	0.0000	4.68E-08
206	0.00	0.000	0.000	0.2770	0.0387	0.0000	4.68E-08
207	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.68E-08
208	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
209	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
210	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
211	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
212	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
213	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
214	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
215	0.00	0.000	0.000	0.2770	0.0386	0.0000	4.67E-08
216	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.67E-08

217	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.67E-08
218	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.66E-08
219	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.66E-08
220	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.66E-08
221	0.00	0.000	0.002	0.2770	0.0385	0.0000	4.66E-08
222	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.66E-08
223	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.66E-08
224	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.66E-08
225	0.00	0.000	0.000	0.2770	0.0385	0.0000	4.66E-08
226	0.14	0.000	0.025	0.2887	0.0384	0.0000	4.66E-08
227	0.13	0.000	0.034	0.2983	0.0384	0.0000	4.66E-08
228	0.00	0.000	0.012	0.2971	0.0384	0.0000	4.65E-08
229	0.40	0.236	0.044	0.3095	0.0384	0.0000	4.65E-08
230	0.15	0.007	0.040	0.3196	0.0384	0.0000	4.65E-08
231	3.06	2.691	0.256	0.3305	0.0384	0.0000	4.65E-08
232	0.01	0.000	0.199	0.3119	0.0384	0.0000	4.65E-08
233	0.00	0.000	0.116	0.3003	0.0384	0.0000	4.65E-08
234	0.06	0.000	0.076	0.2983	0.0384	0.0000	4.65E-08
235	0.00	0.000	0.048	0.2935	0.0383	0.0000	4.65E-08
236	0.00	0.000	0.039	0.2896	0.0383	0.0000	4.65E-08
237	0.00	0.000	0.038	0.2858	0.0383	0.0000	4.65E-08
238	0.67	0.456	0.061	0.3008	0.0383	0.0000	4.64E-08
239	0.00	0.000	0.096	0.2911	0.0383	0.0000	4.64E-08
240	0.01	0.000	0.080	0.2840	0.0383	0.0000	4.64E-08
241	0.00	0.000	0.059	0.2781	0.0383	0.0000	4.64E-08
242	0.00	0.000	0.005	0.2775	0.0383	0.0000	4.64E-08
243	0.00	0.000	0.003	0.2773	0.0383	0.0000	4.64E-08
244	0.00	0.000	0.002	0.2771	0.0382	0.0000	4.64E-08
245	0.00	0.000	0.001	0.2770	0.0382	0.0000	4.64E-08
246	0.00	0.000	0.000	0.2770	0.0382	0.0000	4.64E-08
247	0.00	0.000	0.000	0.2770	0.0382	0.0000	4.64E-08
248	0.00	0.000	0.000	0.2770	0.0382	0.0000	4.63E-08

249	0.00	0.000	0.000	0.2770	0.0382	0.0000	4.63E-08
250	0.00	0.000	0.000	0.2770	0.0382	0.0000	4.63E-08
251	0.00	0.000	0.000	0.2770	0.0382	0.0000	4.63E-08
252	0.00	0.000	0.000	0.2770	0.0382	0.0000	4.63E-08
253	0.00	0.000	0.000	0.2770	0.0381	0.0000	4.63E-08
254	0.00	0.000	0.000	0.2770	0.0381	0.0000	4.63E-08
255	0.00	0.000	0.000	0.2770	0.0381	0.0000	4.63E-08
256	0.48	0.283	0.043	0.2921	0.0381	0.0000	4.63E-08
257	0.02	0.000	0.023	0.2922	0.0381	0.0000	4.63E-08
258	0.08	0.000	0.036	0.2967	0.0381	0.0000	4.62E-08
259	0.00	0.000	0.016	0.2952	0.0381	0.0000	4.62E-08
260	0.00	0.000	0.015	0.2936	0.0381	0.0000	4.62E-08
261	0.46	0.276	0.047	0.3074	0.0381	0.0000	4.62E-08
262	0.08	0.000	0.148	0.3002	0.0381	0.0000	4.62E-08
263	0.90	0.736	0.046	0.3123	0.0380	0.0000	4.62E-08
264	0.00	0.000	0.055	0.3068	0.0380	0.0000	4.62E-08
265	0.00	0.000	0.064	0.3004	0.0380	0.0000	4.62E-08
266	0.00	0.000	0.198	0.2807	0.0381	0.0000	4.62E-08
267	0.00	0.000	0.029	0.2778	0.0381	0.0000	4.62E-08
268	0.00	0.000	0.007	0.2771	0.0380	0.0000	4.62E-08
269	0.00	0.000	0.001	0.2770	0.0382	0.0000	4.64E-08
270	0.05	0.000	0.025	0.2799	0.0388	0.0000	4.69E-08
271	0.00	0.000	0.003	0.2796	0.0388	0.0000	4.69E-08
272	0.48	0.282	0.053	0.2937	0.0388	0.0000	4.69E-08
273	0.03	0.000	0.030	0.2942	0.0387	0.0000	4.69E-08
274	0.04	0.000	0.037	0.2945	0.0387	0.0000	4.68E-08
275	0.00	0.000	0.015	0.2930	0.0387	0.0000	4.68E-08
276	0.00	0.000	0.017	0.2913	0.0387	0.0000	4.68E-08
277	0.00	0.000	0.015	0.2898	0.0387	0.0000	4.68E-08
278	0.00	0.000	0.014	0.2884	0.0387	0.0000	4.68E-08
279	0.00	0.000	0.013	0.2871	0.0387	0.0000	4.68E-08
280	0.00	0.000	0.012	0.2859	0.0387	0.0000	4.68E-08

281		0.25	0.088	0.036	0.2982	0.0387	0.0000	4.68E-08
282		0.00	0.000	0.049	0.2933	0.0387	0.0000	4.68E-08
283		0.00	0.000	0.012	0.2921	0.0386	0.0000	4.67E-08
284		0.23	0.082	0.035	0.3038	0.0386	0.0000	4.67E-08
285		0.00	0.000	0.042	0.2995	0.0386	0.0000	4.67E-08
286		0.00	0.000	0.082	0.2914	0.0386	0.0000	4.67E-08
287		0.00	0.000	0.088	0.2826	0.0386	0.0000	4.67E-08
288		0.00	0.000	0.038	0.2787	0.0386	0.0000	4.67E-08
289		0.00	0.000	0.014	0.2774	0.0386	0.0000	4.67E-08
290		0.00	0.000	0.003	0.2771	0.0386	0.0000	4.67E-08
291		0.00	0.000	0.000	0.2770	0.0385	0.0000	4.67E-08
292		0.00	0.000	0.000	0.2770	0.0385	0.0000	4.67E-08
293		0.23	0.070	0.035	0.2895	0.0385	0.0000	4.66E-08
294		0.00	0.000	0.010	0.2885	0.0385	0.0000	4.66E-08
295		0.48	0.288	0.047	0.3030	0.0385	0.0000	4.66E-08
296		0.13	0.002	0.081	0.3076	0.0385	0.0000	4.66E-08
297		0.00	0.000	0.029	0.3048	0.0385	0.0000	4.66E-08
298		0.18	0.021	0.100	0.3109	0.0385	0.0000	4.66E-08
299		0.00	0.000	0.046	0.3063	0.0385	0.0000	4.66E-08
300		0.12	0.000	0.074	0.3109	0.0384	0.0000	4.66E-08
301	*	0.92	0.000	0.028	0.3129	0.0384	0.0000	4.66E-08
302	*	0.00	0.000	0.035	0.3149	0.0384	0.0000	4.65E-08
303	*	0.00	0.000	0.039	0.3168	0.0384	0.0000	4.65E-08
304	*	0.04	0.000	0.021	0.3188	0.0384	0.0000	4.65E-08
305	*	0.00	0.000	0.028	0.3208	0.0384	0.0000	4.65E-08
306	*	0.00	0.000	0.031	0.3227	0.0384	0.0000	4.65E-08
307	*	0.00	0.000	0.018	0.3247	0.0384	0.0000	4.65E-08
308	*	0.00	0.000	0.011	0.3267	0.0384	0.0000	4.65E-08
309	*	0.00	0.000	0.008	0.3286	0.0383	0.0000	4.65E-08
310	*	0.00	0.000	0.005	0.3306	0.0383	0.0000	4.65E-08
311	*	0.00	0.000	0.000	0.3326	0.0383	0.0000	4.65E-08
312	*	0.00	0.000	0.029	0.3345	0.0383	0.0000	4.64E-08

313			0.00	0.036	0.025	0.3473	0.0383	0.0000	4.64E-08
314			0.00	0.139	0.023	0.3589	0.0383	0.0000	4.64E-08
315			0.00	0.000	0.030	0.3559	0.0383	0.0000	4.64E-08
316			0.00	0.000	0.055	0.3504	0.0383	0.0000	4.64E-08
317			1.21	0.993	0.077	0.3642	0.0383	0.0000	4.64E-08
318			0.00	0.000	0.042	0.3600	0.0382	0.0000	4.64E-08
319			0.00	0.000	0.077	0.3524	0.0382	0.0000	4.64E-08
320			0.16	0.012	0.090	0.3583	0.0382	0.0000	4.64E-08
321			0.00	0.000	0.054	0.3530	0.0382	0.0000	4.63E-08
322	*		0.00	0.000	0.026	0.3504	0.0382	0.0000	4.63E-08
323			0.00	0.000	0.048	0.3456	0.0382	0.0000	4.63E-08
324			0.01	0.000	0.122	0.3348	0.0382	0.0000	4.63E-08
325			0.11	0.000	0.109	0.3354	0.0382	0.0000	4.63E-08
326			0.13	0.000	0.093	0.3392	0.0382	0.0000	4.63E-08
327			0.60	0.410	0.061	0.3521	0.0381	0.0000	4.63E-08
328	*		0.00	0.000	0.000	0.3521	0.0381	0.0000	4.63E-08
329	*		0.01	0.000	0.010	0.3521	0.0381	0.0000	4.63E-08
330	*	*	1.11	0.000	0.010	0.3521	0.0381	0.0000	4.63E-08
331	*	*	0.00	0.000	0.007	0.3521	0.0381	0.0000	4.62E-08
332		*	0.00	0.000	0.000	0.3521	0.0381	0.0000	4.62E-08
333	*	*	0.53	0.000	0.022	0.3521	0.0381	0.0000	4.62E-08
334	*	*	0.20	0.000	0.000	0.3521	0.0381	0.0000	4.62E-08
335		*	0.00	0.000	0.000	0.3521	0.0381	0.0000	4.62E-08
336		*	0.03	0.482	0.000	0.3536	0.0380	0.0000	4.62E-08
337		*	0.05	1.101	0.000	0.3536	0.0380	0.0000	4.62E-08
338		*	0.22	0.498	0.009	0.3536	0.0380	0.0000	4.62E-08
339	*	*	0.38	0.000	0.030	0.3536	0.0380	0.0000	4.62E-08
340		*	0.00	0.313	0.042	0.3536	0.0380	0.0000	4.62E-08
341			0.00	0.000	0.038	0.3498	0.0380	0.0000	4.61E-08
342			0.00	0.000	0.050	0.3449	0.0380	0.0000	4.61E-08
343			0.00	0.000	0.053	0.3400	0.0380	0.0000	4.61E-08
344			0.00	0.000	0.066	0.3334	0.0380	0.0000	4.61E-08

345		0.00	0.000	0.081	0.3254	0.0379	0.0000	4.61E-08
346		0.00	0.000	0.050	0.3204	0.0379	0.0000	4.61E-08
347	*	0.00	0.000	0.027	0.3177	0.0379	0.0000	4.61E-08
348	*	0.00	0.000	0.025	0.3152	0.0379	0.0000	4.61E-08
349	*	0.00	0.000	0.021	0.3131	0.0379	0.0000	4.61E-08
350	*	0.00	0.000	0.000	0.3131	0.0379	0.0000	4.60E-08
351	*	0.00	0.000	0.000	0.3131	0.0379	0.0000	4.60E-08
352	*	0.00	0.000	0.023	0.3108	0.0379	0.0000	4.60E-08
353	*	0.00	0.000	0.022	0.3087	0.0379	0.0000	4.60E-08
354	*	0.00	0.000	0.000	0.3087	0.0378	0.0000	4.60E-08
355		0.00	0.000	0.037	0.3050	0.0378	0.0000	4.60E-08
356		0.00	0.000	0.027	0.3023	0.0378	0.0000	4.60E-08
357	*	0.00	0.000	0.028	0.2995	0.0378	0.0000	4.60E-08
358		1.18	0.957	0.057	0.3158	0.0378	0.0000	4.60E-08
359		0.43	0.243	0.069	0.3274	0.0378	0.0000	4.60E-08
360		0.00	0.000	0.054	0.3220	0.0378	0.0000	4.59E-08
361		0.00	0.000	0.065	0.3156	0.0378	0.0000	4.59E-08
362		0.00	0.000	0.068	0.3088	0.0378	0.0000	4.59E-08
363		0.00	0.000	0.051	0.3037	0.0377	0.0000	4.59E-08
364		0.00	0.000	0.039	0.2999	0.0377	0.0000	4.59E-08
365		0.00	0.000	0.040	0.2958	0.0377	0.0000	4.59E-08

* = Frozen (air or soil)

Annual Totals for Year 8

	inches	cubic feet	percent
Precipitation	42.55	154,465.4	100.00
Runoff	29.024	105,357.3	68.21
Evapotranspiration	13.402	48,649.6	31.50
Recirculation into Layer 1	0.0016	5.7473	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0016	5.7473	0.00
Percolation/Leakage through Layer 5	0.000017	0.0615	0.00
Average Head on Top of Layer 4	0.0382	---	---
Change in Water Storage	0.1263	458.4	0.30
Soil Water at Start of Year	1,406.5382	5,105,733.8	3305.42
Soil Water at End of Year	1,406.6645	5,106,192.1	3305.72
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0016	-5.7473	0.00

Daily Output for Year 9

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.000	0.2958	0.0377	0.0000	4.59E-08
2	*		0.00	0.000	0.000	0.2958	0.0377	0.0000	4.59E-08
3	*		0.00	0.000	0.000	0.2958	0.0377	0.0000	4.59E-08
4	*		0.00	0.000	0.000	0.2958	0.0377	0.0000	4.58E-08
5			0.32	0.137	0.060	0.3085	0.0377	0.0000	4.58E-08
6	*		0.00	0.000	0.000	0.3085	0.0376	0.0000	4.58E-08
7			0.00	0.000	0.052	0.3033	0.0376	0.0000	4.58E-08
8			0.00	0.000	0.056	0.2977	0.0376	0.0000	4.58E-08
9			0.00	0.000	0.071	0.2906	0.0376	0.0000	4.58E-08
10			0.37	0.159	0.082	0.3038	0.0376	0.0000	4.58E-08
11			0.09	0.000	0.068	0.3060	0.0376	0.0000	4.58E-08
12			0.00	0.000	0.030	0.3030	0.0376	0.0000	4.58E-08
13			0.00	0.000	0.066	0.2964	0.0376	0.0000	4.57E-08
14			0.36	0.125	0.090	0.3106	0.0376	0.0000	4.57E-08
15			0.00	0.000	0.082	0.3024	0.0375	0.0000	4.57E-08
16			0.00	0.000	0.103	0.2921	0.0375	0.0000	4.57E-08
17			0.00	0.000	0.090	0.2831	0.0375	0.0000	4.57E-08
18			0.08	0.000	0.068	0.2841	0.0375	0.0000	4.57E-08
19	*		0.09	0.000	0.050	0.2861	0.0375	0.0000	4.57E-08
20			0.00	0.000	0.063	0.2819	0.0375	0.0000	4.57E-08
21			0.00	0.000	0.030	0.2788	0.0375	0.0000	4.57E-08
22			0.00	0.000	0.013	0.2776	0.0375	0.0000	4.57E-08
23	*		0.00	0.000	0.004	0.2772	0.0375	0.0000	4.56E-08
24			0.00	0.000	0.001	0.2771	0.0374	0.0000	4.56E-08

25		0.01	0.000	0.006	0.2770	0.0374	0.0000	4.56E-08
26		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
27		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
28		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
29		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
30		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
31		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
32		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
33		0.00	0.000	0.000	0.2770	0.0374	0.0000	4.56E-08
34		0.00	0.000	0.004	0.2770	0.0374	0.0000	4.56E-08
35		0.00	0.000	0.004	0.2770	0.0373	0.0000	4.55E-08
36	*	0.00	0.000	0.000	0.2770	0.0373	0.0000	4.55E-08
37	*	0.00	0.000	0.000	0.2770	0.0373	0.0000	4.55E-08
38		0.00	0.000	0.000	0.2770	0.0373	0.0000	4.55E-08
39		0.00	0.000	0.000	0.2770	0.0373	0.0000	4.55E-08
40		0.03	0.000	0.019	0.2783	0.0373	0.0000	4.55E-08
41		0.00	0.000	0.001	0.2782	0.0373	0.0000	4.55E-08
42		0.02	0.000	0.017	0.2788	0.0373	0.0000	4.55E-08
43		0.08	0.000	0.024	0.2843	0.0373	0.0000	4.55E-08
44		0.06	0.000	0.027	0.2875	0.0373	0.0000	4.55E-08
45		0.00	0.000	0.007	0.2868	0.0372	0.0000	4.54E-08
46	*	0.00	0.000	0.008	0.2860	0.0372	0.0000	4.54E-08
47		0.00	0.000	0.008	0.2852	0.0372	0.0000	4.54E-08
48		0.00	0.000	0.009	0.2843	0.0372	0.0000	4.54E-08
49		0.00	0.000	0.009	0.2834	0.0372	0.0000	4.54E-08
50		0.02	0.000	0.023	0.2834	0.0372	0.0000	4.54E-08
51	*	0.00	0.000	0.000	0.2834	0.0372	0.0000	4.54E-08
52		0.00	0.000	0.008	0.2826	0.0372	0.0000	4.54E-08
53		0.00	0.000	0.008	0.2817	0.0372	0.0000	4.54E-08
54		0.00	0.000	0.008	0.2809	0.0372	0.0000	4.54E-08
55		0.05	0.000	0.028	0.2826	0.0371	0.0000	4.53E-08
56		0.00	0.000	0.007	0.2819	0.0371	0.0000	4.53E-08

57		0.50	0.332	0.034	0.2956	0.0371	0.0000	4.53E-08
58		0.21	0.073	0.029	0.3068	0.0371	0.0000	4.53E-08
59		0.02	0.000	0.092	0.2998	0.0371	0.0000	4.53E-08
60		0.00	0.000	0.007	0.2991	0.0371	0.0000	4.53E-08
61		0.00	0.000	0.007	0.2983	0.0371	0.0000	4.53E-08
62		0.00	0.000	0.007	0.2976	0.0371	0.0000	4.53E-08
63	*	0.00	0.000	0.007	0.2969	0.0371	0.0000	4.53E-08
64	*	0.00	0.000	0.007	0.2962	0.0371	0.0000	4.53E-08
65		0.00	0.000	0.007	0.2955	0.0371	0.0000	4.53E-08
66		0.00	0.000	0.007	0.2948	0.0371	0.0000	4.53E-08
67		0.00	0.000	0.007	0.2942	0.0371	0.0000	4.53E-08
68		0.00	0.000	0.008	0.2934	0.0370	0.0000	4.53E-08
69		0.00	0.000	0.008	0.2926	0.0370	0.0000	4.52E-08
70		0.00	0.000	0.008	0.2918	0.0370	0.0000	4.52E-08
71		0.00	0.000	0.008	0.2910	0.0370	0.0000	4.52E-08
72		0.00	0.000	0.008	0.2902	0.0370	0.0000	4.52E-08
73		0.00	0.000	0.008	0.2894	0.0370	0.0000	4.52E-08
74		0.00	0.000	0.008	0.2887	0.0370	0.0000	4.52E-08
75		0.00	0.000	0.008	0.2879	0.0370	0.0000	4.52E-08
76		0.42	0.236	0.032	0.3030	0.0370	0.0000	4.52E-08
77		0.00	0.000	0.080	0.2950	0.0370	0.0000	4.52E-08
78		0.00	0.000	0.008	0.2942	0.0369	0.0000	4.52E-08
79		0.43	0.246	0.032	0.3096	0.0369	0.0000	4.52E-08
80		0.00	0.000	0.061	0.3036	0.0369	0.0000	4.51E-08
81	*	1.12	0.000	0.050	0.3056	0.0369	0.0000	4.51E-08
82	*	0.31	0.000	0.017	0.3076	0.0369	0.0000	4.51E-08
83	*	0.00	0.000	0.044	0.3095	0.0369	0.0000	4.51E-08
84		0.00	0.952	0.000	0.3223	0.0369	0.0000	4.51E-08
85		0.00	0.000	0.226	0.3181	0.0370	0.0000	4.52E-08
86		0.00	0.000	0.085	0.3096	0.0372	0.0000	4.54E-08
87		0.34	0.126	0.157	0.3148	0.0372	0.0000	4.54E-08
88		0.20	0.053	0.128	0.3171	0.0372	0.0000	4.54E-08

89		0.12	0.001	0.156	0.3130	0.0372	0.0000	4.54E-08
90		0.00	0.000	0.064	0.3066	0.0372	0.0000	4.54E-08
91		0.00	0.000	0.084	0.2981	0.0379	0.0000	4.60E-08
92	*	0.28	0.000	0.034	0.3001	0.0385	0.0000	4.66E-08
93	*	0.00	0.000	0.023	0.3021	0.0385	0.0000	4.66E-08
94	*	0.11	0.000	0.000	0.3041	0.0385	0.0000	4.66E-08
95		0.00	0.020	0.140	0.3152	0.0385	0.0000	4.66E-08
96		0.00	0.000	0.158	0.2994	0.0385	0.0000	4.66E-08
97		0.17	0.002	0.173	0.2988	0.0386	0.0000	4.67E-08
98		0.22	0.064	0.124	0.3020	0.0387	0.0000	4.68E-08
99		0.00	0.000	0.058	0.2962	0.0388	0.0000	4.69E-08
100		0.00	0.000	0.047	0.2915	0.0389	0.0000	4.70E-08
101		0.52	0.299	0.079	0.3059	0.0389	0.0000	4.70E-08
102	*	0.00	0.000	0.024	0.3034	0.0392	0.0000	4.73E-08
103	*	0.00	0.000	0.000	0.3034	0.0395	0.0000	4.75E-08
104	*	0.00	0.000	0.000	0.3034	0.0395	0.0000	4.75E-08
105	*	0.03	0.000	0.053	0.3008	0.0395	0.0000	4.75E-08
106		0.17	0.003	0.135	0.3037	0.0395	0.0000	4.75E-08
107		0.06	0.000	0.110	0.2986	0.0394	0.0000	4.75E-08
108		1.16	0.927	0.100	0.3118	0.0394	0.0000	4.75E-08
109		0.00	0.000	0.111	0.3007	0.0394	0.0000	4.75E-08
110		0.22	0.051	0.076	0.3096	0.0394	0.0000	4.75E-08
111		0.00	0.000	0.058	0.3039	0.0394	0.0000	4.75E-08
112		0.07	0.000	0.152	0.2953	0.0394	0.0000	4.74E-08
113		0.00	0.000	0.153	0.2800	0.0394	0.0000	4.74E-08
114		0.00	0.000	0.020	0.2780	0.0394	0.0000	4.74E-08
115		0.00	0.000	0.005	0.2774	0.0393	0.0000	4.74E-08
116		0.00	0.000	0.003	0.2771	0.0393	0.0000	4.74E-08
117		0.00	0.000	0.001	0.2770	0.0393	0.0000	4.74E-08
118	*	0.22	0.000	0.052	0.2790	0.0393	0.0000	4.74E-08
119		0.04	0.000	0.197	0.2787	0.0393	0.0000	4.74E-08
120		0.00	0.000	0.006	0.2781	0.0393	0.0000	4.74E-08

121	1.58	1.371	0.051	0.2935	0.0393	0.0000	4.73E-08
122	0.00	0.000	0.044	0.2895	0.0393	0.0000	4.73E-08
123	0.00	0.000	0.085	0.2810	0.0393	0.0000	4.73E-08
124	0.01	0.000	0.046	0.2774	0.0392	0.0000	4.73E-08
125	0.00	0.000	0.006	0.2771	0.0392	0.0000	4.73E-08
126	0.00	0.000	0.001	0.2770	0.0392	0.0000	4.73E-08
127	0.00	0.000	0.000	0.2770	0.0392	0.0000	4.73E-08
128	0.04	0.000	0.021	0.2785	0.0392	0.0000	4.73E-08
129	0.00	0.000	0.003	0.2782	0.0392	0.0000	4.73E-08
130	0.00	0.000	0.005	0.2776	0.0392	0.0000	4.73E-08
131	0.00	0.000	0.005	0.2772	0.0392	0.0000	4.72E-08
132	0.74	0.534	0.048	0.2934	0.0392	0.0000	4.72E-08
133	0.04	0.000	0.029	0.2943	0.0392	0.0000	4.72E-08
134	0.14	0.000	0.039	0.3040	0.0391	0.0000	4.72E-08
135	0.99	0.761	0.100	0.3169	0.0391	0.0000	4.72E-08
136	0.52	0.278	0.237	0.3177	0.0391	0.0000	4.72E-08
137	0.00	0.000	0.080	0.3097	0.0391	0.0000	4.72E-08
138	0.00	0.000	0.104	0.2993	0.0391	0.0000	4.72E-08
139	0.00	0.000	0.165	0.2828	0.0391	0.0000	4.72E-08
140	0.00	0.000	0.053	0.2775	0.0391	0.0000	4.72E-08
141	0.12	0.000	0.032	0.2865	0.0391	0.0000	4.71E-08
142	0.03	0.000	0.036	0.2858	0.0390	0.0000	4.71E-08
143	0.49	0.299	0.060	0.2987	0.0390	0.0000	4.71E-08
144	0.15	0.005	0.080	0.3056	0.0390	0.0000	4.71E-08
145	0.00	0.000	0.116	0.2939	0.0390	0.0000	4.71E-08
146	0.00	0.000	0.088	0.2851	0.0390	0.0000	4.71E-08
147	0.00	0.000	0.047	0.2803	0.0390	0.0000	4.71E-08
148	0.17	0.012	0.065	0.2899	0.0390	0.0000	4.71E-08
149	0.06	0.000	0.047	0.2915	0.0390	0.0000	4.71E-08
150	0.27	0.097	0.060	0.3028	0.0390	0.0000	4.70E-08
151	0.05	0.000	0.078	0.3003	0.0389	0.0000	4.70E-08
152	0.00	0.000	0.168	0.2835	0.0389	0.0000	4.70E-08

153	0.12	0.000	0.087	0.2865	0.0390	0.0000	4.71E-08
154	0.00	0.000	0.035	0.2830	0.0390	0.0000	4.71E-08
155	0.00	0.000	0.033	0.2797	0.0390	0.0000	4.71E-08
156	0.00	0.000	0.016	0.2781	0.0390	0.0000	4.70E-08
157	0.00	0.000	0.008	0.2773	0.0389	0.0000	4.70E-08
158	0.11	0.000	0.028	0.2859	0.0389	0.0000	4.70E-08
159	0.00	0.000	0.013	0.2846	0.0389	0.0000	4.70E-08
160	0.00	0.000	0.017	0.2829	0.0389	0.0000	4.70E-08
161	0.00	0.000	0.019	0.2810	0.0389	0.0000	4.70E-08
162	0.00	0.000	0.020	0.2791	0.0389	0.0000	4.70E-08
163	0.00	0.000	0.016	0.2775	0.0389	0.0000	4.70E-08
164	0.00	0.000	0.003	0.2771	0.0389	0.0000	4.70E-08
165	0.00	0.000	0.001	0.2770	0.0389	0.0000	4.70E-08
166	0.00	0.000	0.000	0.2770	0.0389	0.0000	4.70E-08
167	0.00	0.000	0.000	0.2770	0.0389	0.0000	4.69E-08
168	0.00	0.000	0.000	0.2770	0.0388	0.0000	4.69E-08
169	0.00	0.000	0.000	0.2770	0.0388	0.0000	4.69E-08
170	0.00	0.000	0.000	0.2770	0.0388	0.0000	4.69E-08
171	0.39	0.210	0.043	0.2909	0.0388	0.0000	4.69E-08
172	0.15	0.010	0.034	0.3017	0.0388	0.0000	4.69E-08
173	0.00	0.000	0.008	0.3009	0.0388	0.0000	4.69E-08
174	0.00	0.000	0.015	0.2994	0.0388	0.0000	4.69E-08
175	0.00	0.000	0.015	0.2979	0.0388	0.0000	4.69E-08
176	0.02	0.000	0.025	0.2974	0.0388	0.0000	4.69E-08
177	0.02	0.000	0.027	0.2969	0.0387	0.0000	4.68E-08
178	0.15	0.000	0.039	0.3077	0.0387	0.0000	4.68E-08
179	0.02	0.000	0.031	0.3069	0.0387	0.0000	4.68E-08
180	0.00	0.000	0.015	0.3055	0.0387	0.0000	4.68E-08
181	0.00	0.000	0.013	0.3043	0.0387	0.0000	4.68E-08
182	0.00	0.000	0.012	0.3031	0.0387	0.0000	4.68E-08
183	0.00	0.000	0.010	0.3021	0.0387	0.0000	4.68E-08
184	0.02	0.000	0.029	0.3014	0.0387	0.0000	4.68E-08

185	0.08	0.000	0.039	0.3055	0.0387	0.0000	4.68E-08
186	0.00	0.000	0.016	0.3038	0.0386	0.0000	4.68E-08
187	0.01	0.000	0.028	0.3024	0.0386	0.0000	4.67E-08
188	0.02	0.000	0.028	0.3012	0.0386	0.0000	4.67E-08
189	0.00	0.000	0.015	0.2996	0.0386	0.0000	4.67E-08
190	0.01	0.000	0.022	0.2985	0.0386	0.0000	4.67E-08
191	0.02	0.000	0.027	0.2973	0.0386	0.0000	4.67E-08
192	0.67	0.497	0.040	0.3109	0.0386	0.0000	4.67E-08
193	0.52	0.236	0.320	0.3075	0.0386	0.0000	4.67E-08
194	0.00	0.000	0.179	0.2897	0.0386	0.0000	4.67E-08
195	0.10	0.000	0.130	0.2869	0.0385	0.0000	4.67E-08
196	0.12	0.000	0.075	0.2911	0.0385	0.0000	4.67E-08
197	0.00	0.000	0.027	0.2884	0.0387	0.0000	4.68E-08
198	0.00	0.000	0.031	0.2853	0.0390	0.0000	4.70E-08
199	0.00	0.000	0.032	0.2821	0.0389	0.0000	4.70E-08
200	0.26	0.103	0.052	0.2929	0.0389	0.0000	4.70E-08
201	0.00	0.000	0.112	0.2817	0.0389	0.0000	4.70E-08
202	0.00	0.000	0.024	0.2793	0.0389	0.0000	4.70E-08
203	0.00	0.000	0.011	0.2781	0.0389	0.0000	4.70E-08
204	0.00	0.000	0.008	0.2773	0.0389	0.0000	4.70E-08
205	0.35	0.167	0.051	0.2902	0.0389	0.0000	4.70E-08
206	0.72	0.555	0.049	0.3015	0.0389	0.0000	4.70E-08
207	0.00	0.000	0.176	0.2838	0.0389	0.0000	4.70E-08
208	0.00	0.000	0.027	0.2812	0.0389	0.0000	4.70E-08
209	0.00	0.000	0.029	0.2783	0.0389	0.0000	4.70E-08
210	0.01	0.000	0.018	0.2772	0.0389	0.0000	4.70E-08
211	0.52	0.321	0.050	0.2923	0.0389	0.0000	4.70E-08
212	0.00	0.000	0.065	0.2858	0.0389	0.0000	4.70E-08
213	0.00	0.000	0.070	0.2788	0.0389	0.0000	4.69E-08
214	0.08	0.000	0.051	0.2815	0.0388	0.0000	4.69E-08
215	0.22	0.063	0.056	0.2913	0.0388	0.0000	4.69E-08
216	0.15	0.000	0.049	0.3008	0.0388	0.0000	4.69E-08

217	0.67	0.496	0.063	0.3123	0.0389	0.0000	4.70E-08
218	0.00	0.000	0.061	0.3062	0.0389	0.0000	4.70E-08
219	0.40	0.165	0.108	0.3191	0.0389	0.0000	4.70E-08
220	0.44	0.234	0.171	0.3228	0.0389	0.0000	4.70E-08
221	0.00	0.000	0.069	0.3163	0.0389	0.0000	4.70E-08
222	0.00	0.000	0.179	0.2984	0.0389	0.0000	4.70E-08
223	0.00	0.000	0.180	0.2804	0.0389	0.0000	4.70E-08
224	0.09	0.000	0.058	0.2835	0.0388	0.0000	4.69E-08
225	0.23	0.068	0.062	0.2940	0.0388	0.0000	4.69E-08
226	0.74	0.396	0.231	0.3048	0.0388	0.0000	4.69E-08
227	0.00	0.000	0.056	0.2992	0.0388	0.0000	4.69E-08
228	0.15	0.001	0.068	0.3073	0.0388	0.0000	4.69E-08
229	1.15	0.801	0.241	0.3180	0.0388	0.0000	4.69E-08
230	0.03	0.000	0.125	0.3083	0.0388	0.0000	4.69E-08
231	0.60	0.286	0.304	0.3094	0.0388	0.0000	4.69E-08
232	0.10	0.000	0.199	0.2998	0.0388	0.0000	4.69E-08
233	0.00	0.000	0.079	0.2918	0.0387	0.0000	4.68E-08
234	0.10	0.000	0.172	0.2844	0.0387	0.0000	4.68E-08
235	0.50	0.194	0.202	0.2952	0.0387	0.0000	4.68E-08
236	0.00	0.000	0.058	0.2893	0.0387	0.0000	4.68E-08
237	0.00	0.000	0.050	0.2843	0.0392	0.0000	4.73E-08
238	0.43	0.163	0.164	0.2945	0.0395	0.0000	4.76E-08
239	0.03	0.000	0.091	0.2880	0.0396	0.0000	4.77E-08
240	0.06	0.000	0.065	0.2874	0.0396	0.0000	4.76E-08
241	0.00	0.000	0.082	0.2796	0.0396	0.0000	4.76E-08
242	0.00	0.000	0.016	0.2781	0.0396	0.0000	4.77E-08
243	0.04	0.000	0.043	0.2780	0.0398	0.0000	4.79E-08
244	0.00	0.000	0.007	0.2773	0.0398	0.0000	4.79E-08
245	0.00	0.000	0.003	0.2771	0.0398	0.0000	4.78E-08
246	0.00	0.000	0.000	0.2770	0.0398	0.0000	4.78E-08
247	0.00	0.000	0.000	0.2770	0.0398	0.0000	4.78E-08
248	0.35	0.159	0.062	0.2898	0.0398	0.0000	4.78E-08

249	0.72	0.546	0.056	0.3011	0.0398	0.0000	4.78E-08
250	0.03	0.000	0.087	0.2953	0.0398	0.0000	4.78E-08
251	0.00	0.000	0.096	0.2857	0.0398	0.0000	4.78E-08
252	0.00	0.000	0.078	0.2779	0.0397	0.0000	4.78E-08
253	0.00	0.000	0.007	0.2772	0.0397	0.0000	4.78E-08
254	0.00	0.000	0.001	0.2770	0.0397	0.0000	4.77E-08
255	0.00	0.000	0.000	0.2770	0.0397	0.0000	4.77E-08
256	0.73	0.499	0.075	0.2922	0.0397	0.0000	4.77E-08
257	0.00	0.000	0.099	0.2823	0.0397	0.0000	4.77E-08
258	0.00	0.000	0.035	0.2789	0.0397	0.0000	4.77E-08
259	0.00	0.000	0.014	0.2774	0.0397	0.0000	4.77E-08
260	0.00	0.000	0.003	0.2771	0.0396	0.0000	4.77E-08
261	0.00	0.000	0.001	0.2770	0.0396	0.0000	4.77E-08
262	0.00	0.000	0.000	0.2770	0.0396	0.0000	4.77E-08
263	0.00	0.000	0.000	0.2770	0.0396	0.0000	4.77E-08
264	0.00	0.000	0.000	0.2770	0.0396	0.0000	4.76E-08
265	0.00	0.000	0.000	0.2770	0.0396	0.0000	4.76E-08
266	0.00	0.000	0.000	0.2770	0.0396	0.0000	4.76E-08
267	0.00	0.000	0.000	0.2770	0.0396	0.0000	4.76E-08
268	0.00	0.000	0.000	0.2770	0.0396	0.0000	4.76E-08
269	0.00	0.000	0.000	0.2770	0.0395	0.0000	4.76E-08
270	0.00	0.000	0.001	0.2770	0.0395	0.0000	4.76E-08
271	0.59	0.383	0.050	0.2927	0.0395	0.0000	4.76E-08
272	0.06	0.000	0.048	0.2936	0.0395	0.0000	4.76E-08
273	0.09	0.000	0.079	0.2942	0.0395	0.0000	4.76E-08
274	1.53	1.322	0.077	0.3072	0.0395	0.0000	4.75E-08
275	0.00	0.000	0.103	0.2969	0.0395	0.0000	4.75E-08
276	0.00	0.000	0.049	0.2920	0.0395	0.0000	4.75E-08
277	0.24	0.075	0.081	0.3005	0.0395	0.0000	4.75E-08
278	0.62	0.366	0.145	0.3110	0.0394	0.0000	4.75E-08
279	0.08	0.000	0.102	0.3089	0.0394	0.0000	4.75E-08
280	0.04	0.000	0.101	0.3031	0.0394	0.0000	4.75E-08

281		0.24	0.058	0.214	0.2998	0.0394	0.0000	4.75E-08
282		0.00	0.000	0.066	0.2933	0.0394	0.0000	4.75E-08
283		0.00	0.000	0.058	0.2874	0.0394	0.0000	4.74E-08
284		0.00	0.000	0.076	0.2798	0.0394	0.0000	4.74E-08
285		0.01	0.000	0.034	0.2775	0.0394	0.0000	4.74E-08
286	*	0.13	0.000	0.062	0.2795	0.0394	0.0000	4.74E-08
287		0.13	0.000	0.076	0.2894	0.0393	0.0000	4.74E-08
288		0.00	0.000	0.067	0.2827	0.0393	0.0000	4.74E-08
289		0.00	0.000	0.042	0.2785	0.0393	0.0000	4.74E-08
290		0.00	0.000	0.011	0.2774	0.0393	0.0000	4.74E-08
291		0.00	0.000	0.002	0.2772	0.0393	0.0000	4.74E-08
292		0.00	0.000	0.001	0.2770	0.0393	0.0000	4.73E-08
293		0.00	0.000	0.000	0.2770	0.0393	0.0000	4.73E-08
294		0.00	0.000	0.000	0.2770	0.0393	0.0000	4.73E-08
295		0.00	0.000	0.000	0.2770	0.0392	0.0000	4.73E-08
296		0.00	0.000	0.000	0.2770	0.0392	0.0000	4.73E-08
297		0.00	0.000	0.000	0.2770	0.0392	0.0000	4.73E-08
298		0.29	0.128	0.041	0.2895	0.0392	0.0000	4.73E-08
299		0.05	0.000	0.035	0.2905	0.0392	0.0000	4.73E-08
300		0.00	0.000	0.018	0.2887	0.0392	0.0000	4.73E-08
301		0.00	0.000	0.014	0.2873	0.0392	0.0000	4.73E-08
302		0.00	0.000	0.017	0.2857	0.0392	0.0000	4.72E-08
303		0.17	0.020	0.042	0.2964	0.0392	0.0000	4.72E-08
304		0.00	0.000	0.010	0.2954	0.0391	0.0000	4.72E-08
305		0.00	0.000	0.013	0.2941	0.0391	0.0000	4.72E-08
306		0.00	0.000	0.012	0.2929	0.0392	0.0000	4.72E-08
307		0.00	0.000	0.011	0.2918	0.0392	0.0000	4.73E-08
308		0.00	0.000	0.011	0.2906	0.0392	0.0000	4.72E-08
309		0.00	0.000	0.011	0.2895	0.0392	0.0000	4.72E-08
310		0.00	0.000	0.011	0.2884	0.0391	0.0000	4.72E-08
311		0.47	0.282	0.044	0.3030	0.0391	0.0000	4.72E-08
312		0.26	0.107	0.063	0.3117	0.0391	0.0000	4.72E-08

313	*	0.42	0.000	0.028	0.3136	0.0391	0.0000	4.72E-08
314		0.00	0.000	0.000	0.3247	0.0391	0.0000	4.72E-08
315	*	0.01	0.000	0.040	0.3266	0.0391	0.0000	4.72E-08
316		0.00	0.029	0.060	0.3394	0.0391	0.0000	4.72E-08
317		0.00	0.000	0.049	0.3345	0.0391	0.0000	4.71E-08
318		0.12	0.003	0.069	0.3393	0.0391	0.0000	4.71E-08
319		0.49	0.304	0.062	0.3516	0.0390	0.0000	4.71E-08
320		0.00	0.000	0.035	0.3481	0.0390	0.0000	4.71E-08
321	*	0.00	0.000	0.022	0.3460	0.0390	0.0000	4.71E-08
322	*	0.00	0.000	0.000	0.3460	0.0390	0.0000	4.71E-08
323		0.00	0.000	0.034	0.3425	0.0390	0.0000	4.71E-08
324		0.00	0.000	0.026	0.3399	0.0390	0.0000	4.71E-08
325	*	0.00	0.000	0.000	0.3399	0.0390	0.0000	4.71E-08
326	*	0.00	0.000	0.000	0.3399	0.0390	0.0000	4.71E-08
327		0.00	0.000	0.045	0.3354	0.0390	0.0000	4.70E-08
328		0.00	0.000	0.079	0.3275	0.0389	0.0000	4.70E-08
329		0.04	0.000	0.133	0.3185	0.0389	0.0000	4.70E-08
330		0.24	0.068	0.077	0.3278	0.0389	0.0000	4.70E-08
331		0.00	0.000	0.043	0.3234	0.0389	0.0000	4.70E-08
332		0.00	0.000	0.089	0.3145	0.0389	0.0000	4.70E-08
333		1.60	1.301	0.149	0.3291	0.0389	0.0000	4.70E-08
334		0.37	0.158	0.104	0.3394	0.0389	0.0000	4.70E-08
335		0.00	0.000	0.106	0.3287	0.0389	0.0000	4.70E-08
336		0.00	0.000	0.092	0.3195	0.0389	0.0000	4.69E-08
337		0.00	0.000	0.146	0.3049	0.0388	0.0000	4.69E-08
338		0.02	0.000	0.062	0.3003	0.0388	0.0000	4.69E-08
339		1.14	0.901	0.082	0.3161	0.0388	0.0000	4.69E-08
340		0.00	0.000	0.064	0.3097	0.0388	0.0000	4.69E-08
341		0.00	0.000	0.078	0.3019	0.0388	0.0000	4.69E-08
342		0.00	0.000	0.126	0.2894	0.0388	0.0000	4.69E-08
343		0.00	0.000	0.051	0.2842	0.0388	0.0000	4.69E-08
344		0.00	0.000	0.042	0.2800	0.0388	0.0000	4.69E-08

345		0.12	0.000	0.056	0.2862	0.0388	0.0000	4.69E-08
346	*	0.00	0.000	0.000	0.2862	0.0390	0.0000	4.71E-08
347	*	0.00	0.000	0.000	0.2862	0.0390	0.0000	4.70E-08
348	*	0.20	0.000	0.051	0.2881	0.0389	0.0000	4.70E-08
349	*	0.02	0.000	0.024	0.2901	0.0389	0.0000	4.70E-08
350	*	0.20	0.000	0.000	0.2921	0.0389	0.0000	4.70E-08
351	*	0.00	0.000	0.021	0.2940	0.0389	0.0000	4.70E-08
352	*	0.00	0.000	0.011	0.2960	0.0389	0.0000	4.70E-08
353		0.00	0.048	0.036	0.3088	0.0389	0.0000	4.70E-08
354	*	0.00	0.000	0.021	0.3067	0.0390	0.0000	4.71E-08
355		0.00	0.000	0.024	0.3043	0.0391	0.0000	4.71E-08
356		0.00	0.000	0.028	0.3015	0.0390	0.0000	4.71E-08
357		0.39	0.190	0.060	0.3155	0.0390	0.0000	4.71E-08
358		0.30	0.140	0.051	0.3261	0.0390	0.0000	4.71E-08
359		0.04	0.000	0.044	0.3256	0.0390	0.0000	4.71E-08
360		0.44	0.238	0.076	0.3381	0.0390	0.0000	4.71E-08
361		1.11	0.898	0.134	0.3464	0.0390	0.0000	4.71E-08
362		0.00	0.000	0.075	0.3389	0.0390	0.0000	4.71E-08
363		0.02	0.000	0.060	0.3351	0.0390	0.0000	4.70E-08
364		0.00	0.000	0.056	0.3295	0.0389	0.0000	4.70E-08
365		0.00	0.000	0.070	0.3225	0.0389	0.0000	4.70E-08

* = Frozen (air or soil)

Annual Totals for Year 9

	inches	cubic feet	percent
Precipitation	38.65	140,315.5	100.00
Runoff	20.354	73,886.4	52.66
Evapotranspiration	18.033	65,460.1	46.65
Recirculation into Layer 1	0.0016	5.8039	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0016	5.8039	0.00
Percolation/Leakage through Layer 5	0.000017	0.0619	0.00
Average Head on Top of Layer 4	0.0386	---	---
Change in Water Storage	0.2669	968.9	0.69
Soil Water at Start of Year	1,406.6645	5,106,192.1	3639.08
Soil Water at End of Year	1,406.9314	5,107,161.1	3639.77
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0016	-5.8033	0.00

Daily Output for Year 10

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.038	0.3186	0.0389	0.0000	4.70E-08
2			0.00	0.000	0.027	0.3159	0.0389	0.0000	4.70E-08
3			0.00	0.000	0.036	0.3123	0.0389	0.0000	4.70E-08
4	*		0.00	0.000	0.020	0.3103	0.0389	0.0000	4.70E-08
5			0.00	0.000	0.042	0.3061	0.0389	0.0000	4.70E-08
6			0.00	0.000	0.030	0.3032	0.0389	0.0000	4.70E-08
7	*		0.00	0.000	0.000	0.3032	0.0389	0.0000	4.70E-08
8			0.00	0.000	0.026	0.3005	0.0388	0.0000	4.69E-08
9			0.00	0.000	0.043	0.2962	0.0388	0.0000	4.69E-08
10			0.00	0.000	0.037	0.2925	0.0388	0.0000	4.69E-08
11			0.00	0.000	0.050	0.2875	0.0388	0.0000	4.69E-08
12			0.00	0.000	0.040	0.2835	0.0388	0.0000	4.69E-08
13			0.00	0.000	0.025	0.2810	0.0388	0.0000	4.69E-08
14			0.00	0.000	0.025	0.2785	0.0388	0.0000	4.69E-08
15			0.00	0.000	0.015	0.2770	0.0388	0.0000	4.69E-08
16			0.00	0.000	0.000	0.2770	0.0388	0.0000	4.69E-08
17			0.00	0.000	0.001	0.2770	0.0387	0.0000	4.68E-08
18			0.00	0.000	0.001	0.2770	0.0387	0.0000	4.68E-08
19			0.25	0.089	0.034	0.2897	0.0387	0.0000	4.68E-08
20			0.02	0.000	0.022	0.2895	0.0387	0.0000	4.68E-08
21			0.03	0.000	0.030	0.2892	0.0387	0.0000	4.68E-08
22			0.00	0.000	0.012	0.2880	0.0387	0.0000	4.68E-08
23			0.21	0.046	0.036	0.3009	0.0387	0.0000	4.68E-08
24	*		0.00	0.000	0.000	0.3009	0.0387	0.0000	4.68E-08

25	*	0.01	0.000	0.011	0.3009	0.0387	0.0000	4.68E-08
26	*	0.00	0.000	0.001	0.3009	0.0386	0.0000	4.68E-08
27	*	0.00	0.000	0.000	0.3009	0.0386	0.0000	4.67E-08
28	*	0.00	0.000	0.000	0.3009	0.0386	0.0000	4.67E-08
29	*	0.34	0.000	0.041	0.3029	0.0386	0.0000	4.67E-08
30	*	0.11	0.000	0.021	0.3048	0.0386	0.0000	4.67E-08
31	*	0.14	0.000	0.026	0.3068	0.0386	0.0000	4.67E-08
32	*	0.10	0.000	0.000	0.3088	0.0386	0.0000	4.67E-08
33		0.00	0.336	0.060	0.3215	0.0386	0.0000	4.67E-08
34		0.00	0.000	0.023	0.3192	0.0386	0.0000	4.67E-08
35		0.00	0.000	0.039	0.3153	0.0385	0.0000	4.67E-08
36		0.00	0.000	0.053	0.3100	0.0385	0.0000	4.66E-08
37		0.04	0.000	0.065	0.3079	0.0385	0.0000	4.66E-08
38		0.01	0.000	0.073	0.3012	0.0385	0.0000	4.66E-08
39		0.00	0.000	0.033	0.2979	0.0385	0.0000	4.66E-08
40		0.00	0.000	0.078	0.2902	0.0385	0.0000	4.66E-08
41		0.04	0.000	0.077	0.2863	0.0385	0.0000	4.66E-08
42		0.42	0.200	0.079	0.3008	0.0385	0.0000	4.66E-08
43		0.00	0.000	0.090	0.2919	0.0385	0.0000	4.66E-08
44		0.00	0.000	0.076	0.2843	0.0384	0.0000	4.66E-08
45		0.00	0.000	0.057	0.2786	0.0384	0.0000	4.66E-08
46		0.00	0.000	0.008	0.2778	0.0384	0.0000	4.65E-08
47		0.00	0.000	0.004	0.2774	0.0384	0.0000	4.65E-08
48		0.00	0.000	0.003	0.2771	0.0384	0.0000	4.65E-08
49		0.11	0.000	0.029	0.2850	0.0384	0.0000	4.65E-08
50		0.00	0.000	0.012	0.2839	0.0384	0.0000	4.65E-08
51		0.00	0.000	0.013	0.2825	0.0384	0.0000	4.65E-08
52		0.00	0.000	0.015	0.2810	0.0384	0.0000	4.65E-08
53		0.00	0.000	0.015	0.2795	0.0383	0.0000	4.65E-08
54		0.00	0.000	0.014	0.2781	0.0383	0.0000	4.65E-08
55		0.00	0.000	0.005	0.2776	0.0383	0.0000	4.65E-08
56		0.67	0.465	0.045	0.2935	0.0383	0.0000	4.64E-08

57		0.00	0.000	0.058	0.2878	0.0383	0.0000	4.64E-08
58		0.00	0.000	0.012	0.2865	0.0383	0.0000	4.64E-08
59		0.00	0.000	0.012	0.2853	0.0383	0.0000	4.64E-08
60		0.00	0.000	0.012	0.2841	0.0383	0.0000	4.64E-08
61	*	0.00	0.000	0.000	0.2841	0.0383	0.0000	4.64E-08
62	*	0.03	0.000	0.030	0.2841	0.0382	0.0000	4.64E-08
63		0.00	0.000	0.011	0.2830	0.0382	0.0000	4.64E-08
64	*	0.00	0.000	0.011	0.2820	0.0382	0.0000	4.64E-08
65		0.00	0.000	0.010	0.2809	0.0382	0.0000	4.63E-08
66	*	0.00	0.000	0.010	0.2799	0.0382	0.0000	4.63E-08
67		0.00	0.000	0.012	0.2787	0.0382	0.0000	4.63E-08
68		0.42	0.238	0.040	0.2934	0.0382	0.0000	4.63E-08
69		0.00	0.000	0.032	0.2904	0.0382	0.0000	4.63E-08
70	*	0.36	0.000	0.035	0.2923	0.0382	0.0000	4.63E-08
71	*	0.01	0.000	0.020	0.2943	0.0381	0.0000	4.63E-08
72	*	0.00	0.000	0.015	0.2963	0.0381	0.0000	4.63E-08
73	*	0.00	0.000	0.032	0.2982	0.0381	0.0000	4.63E-08
74	*	0.07	0.000	0.000	0.3002	0.0381	0.0000	4.63E-08
75	*	0.11	0.000	0.019	0.3022	0.0381	0.0000	4.62E-08
76	*	0.00	0.000	0.011	0.3041	0.0381	0.0000	4.62E-08
77	*	0.00	0.000	0.030	0.3061	0.0381	0.0000	4.62E-08
78	*	0.00	0.000	0.021	0.3081	0.0381	0.0000	4.62E-08
79	*	0.00	0.000	0.074	0.3101	0.0381	0.0000	4.62E-08
80		0.03	0.000	0.093	0.3136	0.0380	0.0000	4.62E-08
81	*	0.43	0.000	0.035	0.3156	0.0380	0.0000	4.62E-08
82		0.69	0.937	0.000	0.3283	0.0380	0.0000	4.62E-08
83	*	0.00	0.000	0.000	0.3283	0.0380	0.0000	4.62E-08
84	*	0.00	0.000	0.057	0.3226	0.0380	0.0000	4.62E-08
85		0.00	0.000	0.076	0.3149	0.0380	0.0000	4.61E-08
86		0.00	0.000	0.039	0.3111	0.0380	0.0000	4.61E-08
87		0.00	0.000	0.077	0.3034	0.0380	0.0000	4.61E-08
88		0.02	0.000	0.050	0.3000	0.0380	0.0000	4.61E-08

89		0.00	0.000	0.050	0.2955	0.0379	0.0000	4.61E-08
90		0.00	0.000	0.043	0.2912	0.0380	0.0000	4.61E-08
91		0.00	0.000	0.077	0.2835	0.0381	0.0000	4.62E-08
92		0.00	0.000	0.056	0.2780	0.0381	0.0000	4.62E-08
93		0.00	0.000	0.007	0.2772	0.0381	0.0000	4.62E-08
94		0.00	0.000	0.002	0.2770	0.0381	0.0000	4.62E-08
95		0.00	0.000	0.000	0.2770	0.0381	0.0000	4.62E-08
96		0.11	0.000	0.028	0.2853	0.0380	0.0000	4.62E-08
97		0.08	0.000	0.037	0.2896	0.0380	0.0000	4.62E-08
98		0.13	0.000	0.039	0.2983	0.0380	0.0000	4.62E-08
99		0.00	0.000	0.011	0.2972	0.0380	0.0000	4.62E-08
100	*	0.00	0.000	0.016	0.2956	0.0380	0.0000	4.62E-08
101	*	0.00	0.000	0.000	0.2956	0.0380	0.0000	4.61E-08
102		0.00	0.000	0.015	0.2941	0.0380	0.0000	4.61E-08
103		0.00	0.000	0.014	0.2926	0.0380	0.0000	4.61E-08
104		0.05	0.000	0.035	0.2939	0.0380	0.0000	4.61E-08
105		0.00	0.000	0.016	0.2923	0.0380	0.0000	4.61E-08
106		0.00	0.000	0.015	0.2908	0.0379	0.0000	4.61E-08
107		0.01	0.000	0.019	0.2896	0.0379	0.0000	4.61E-08
108		0.00	0.000	0.015	0.2884	0.0379	0.0000	4.61E-08
109		0.00	0.000	0.011	0.2873	0.0379	0.0000	4.61E-08
110		0.00	0.000	0.011	0.2862	0.0379	0.0000	4.61E-08
111	*	0.62	0.000	0.044	0.2881	0.0379	0.0000	4.60E-08
112	*	0.18	0.000	0.028	0.2901	0.0379	0.0000	4.60E-08
113		0.50	1.058	0.000	0.3028	0.0379	0.0000	4.60E-08
114	*	0.94	0.000	0.043	0.3048	0.0379	0.0000	4.60E-08
115		0.00	0.710	0.038	0.3175	0.0378	0.0000	4.60E-08
116		0.00	0.000	0.133	0.3042	0.0378	0.0000	4.60E-08
117		0.00	0.000	0.186	0.2856	0.0378	0.0000	4.60E-08
118		0.10	0.000	0.082	0.2875	0.0378	0.0000	4.60E-08
119		0.00	0.000	0.074	0.2801	0.0378	0.0000	4.60E-08
120		0.00	0.000	0.021	0.2780	0.0378	0.0000	4.60E-08

121	0.00	0.000	0.008	0.2772	0.0378	0.0000	4.59E-08
122	0.06	0.000	0.029	0.2808	0.0378	0.0000	4.59E-08
123	0.13	0.000	0.041	0.2899	0.0378	0.0000	4.59E-08
124	0.03	0.000	0.032	0.2901	0.0377	0.0000	4.59E-08
125	0.06	0.000	0.038	0.2925	0.0377	0.0000	4.59E-08
126	0.43	0.238	0.052	0.3063	0.0377	0.0000	4.59E-08
127	0.00	0.000	0.060	0.3003	0.0377	0.0000	4.59E-08
128	2.14	1.898	0.087	0.3154	0.0377	0.0000	4.59E-08
129	1.00	0.675	0.256	0.3227	0.0377	0.0000	4.59E-08
130	0.57	0.355	0.104	0.3338	0.0377	0.0000	4.59E-08
131	0.00	0.000	0.220	0.3118	0.0377	0.0000	4.58E-08
132	0.00	0.000	0.079	0.3039	0.0377	0.0000	4.58E-08
133	0.00	0.000	0.233	0.2806	0.0376	0.0000	4.58E-08
134	0.02	0.000	0.050	0.2779	0.0376	0.0000	4.58E-08
135	0.01	0.000	0.013	0.2774	0.0376	0.0000	4.58E-08
136	1.09	0.863	0.068	0.2936	0.0376	0.0000	4.58E-08
137	0.01	0.000	0.067	0.2877	0.0376	0.0000	4.58E-08
138	1.06	0.825	0.081	0.3032	0.0376	0.0000	4.58E-08
139	0.00	0.000	0.102	0.2930	0.0376	0.0000	4.58E-08
140	0.00	0.000	0.071	0.2859	0.0376	0.0000	4.58E-08
141	0.00	0.000	0.067	0.2792	0.0376	0.0000	4.57E-08
142	0.42	0.156	0.239	0.2822	0.0376	0.0000	4.57E-08
143	0.05	0.000	0.044	0.2824	0.0375	0.0000	4.57E-08
144	0.00	0.000	0.039	0.2785	0.0375	0.0000	4.57E-08
145	0.00	0.000	0.011	0.2774	0.0375	0.0000	4.57E-08
146	0.00	0.000	0.003	0.2771	0.0375	0.0000	4.57E-08
147	0.00	0.000	0.001	0.2770	0.0375	0.0000	4.57E-08
148	0.02	0.000	0.019	0.2776	0.0375	0.0000	4.57E-08
149	0.00	0.000	0.003	0.2773	0.0375	0.0000	4.57E-08
150	0.02	0.000	0.018	0.2775	0.0375	0.0000	4.57E-08
151	0.31	0.130	0.051	0.2900	0.0375	0.0000	4.57E-08
152	0.00	0.000	0.011	0.2889	0.0375	0.0000	4.57E-08

153	0.00	0.000	0.016	0.2873	0.0375	0.0000	4.57E-08
154	0.00	0.000	0.015	0.2859	0.0375	0.0000	4.57E-08
155	0.00	0.000	0.014	0.2845	0.0375	0.0000	4.56E-08
156	0.22	0.067	0.040	0.2960	0.0374	0.0000	4.56E-08
157	0.00	0.000	0.014	0.2946	0.0374	0.0000	4.56E-08
158	0.00	0.000	0.015	0.2931	0.0374	0.0000	4.56E-08
159	0.00	0.000	0.013	0.2918	0.0374	0.0000	4.56E-08
160	0.00	0.000	0.013	0.2904	0.0374	0.0000	4.56E-08
161	0.00	0.000	0.013	0.2892	0.0374	0.0000	4.56E-08
162	0.00	0.000	0.013	0.2878	0.0374	0.0000	4.56E-08
163	0.00	0.000	0.013	0.2866	0.0374	0.0000	4.56E-08
164	0.00	0.000	0.013	0.2853	0.0374	0.0000	4.56E-08
165	0.00	0.000	0.012	0.2840	0.0374	0.0000	4.56E-08
166	0.67	0.473	0.042	0.2993	0.0374	0.0000	4.56E-08
167	0.00	0.000	0.062	0.2931	0.0374	0.0000	4.56E-08
168	0.05	0.000	0.103	0.2880	0.0374	0.0000	4.56E-08
169	0.03	0.000	0.097	0.2818	0.0374	0.0000	4.56E-08
170	0.54	0.326	0.085	0.2946	0.0373	0.0000	4.55E-08
171	0.37	0.124	0.233	0.2964	0.0373	0.0000	4.55E-08
172	0.29	0.096	0.162	0.2995	0.0373	0.0000	4.55E-08
173	0.17	0.006	0.130	0.3025	0.0373	0.0000	4.55E-08
174	0.00	0.000	0.125	0.2900	0.0373	0.0000	4.55E-08
175	0.23	0.065	0.117	0.2951	0.0373	0.0000	4.55E-08
176	2.64	2.440	0.083	0.3064	0.0373	0.0000	4.55E-08
177	0.01	0.000	0.078	0.3001	0.0373	0.0000	4.55E-08
178	0.00	0.000	0.168	0.2834	0.0373	0.0000	4.55E-08
179	0.11	0.000	0.106	0.2835	0.0373	0.0000	4.55E-08
180	0.13	0.000	0.071	0.2895	0.0376	0.0000	4.58E-08
181	0.00	0.000	0.026	0.2869	0.0379	0.0000	4.60E-08
182	0.00	0.000	0.034	0.2835	0.0378	0.0000	4.60E-08
183	0.00	0.000	0.026	0.2809	0.0378	0.0000	4.60E-08
184	0.00	0.000	0.026	0.2783	0.0378	0.0000	4.60E-08

185	0.00	0.000	0.010	0.2773	0.0378	0.0000	4.60E-08
186	0.00	0.000	0.002	0.2770	0.0378	0.0000	4.60E-08
187	0.00	0.000	0.000	0.2770	0.0378	0.0000	4.60E-08
188	0.00	0.000	0.000	0.2770	0.0378	0.0000	4.59E-08
189	0.45	0.251	0.051	0.2915	0.0378	0.0000	4.59E-08
190	0.15	0.008	0.037	0.3023	0.0378	0.0000	4.59E-08
191	0.00	0.000	0.096	0.2926	0.0377	0.0000	4.59E-08
192	0.82	0.626	0.049	0.3069	0.0377	0.0000	4.59E-08
193	0.11	0.000	0.212	0.2970	0.0377	0.0000	4.59E-08
194	0.00	0.000	0.128	0.2842	0.0377	0.0000	4.59E-08
195	0.22	0.053	0.114	0.2895	0.0377	0.0000	4.59E-08
196	0.00	0.000	0.049	0.2846	0.0377	0.0000	4.59E-08
197	0.00	0.000	0.039	0.2807	0.0379	0.0000	4.61E-08
198	0.23	0.073	0.059	0.2908	0.0381	0.0000	4.63E-08
199	0.41	0.135	0.234	0.2944	0.0381	0.0000	4.62E-08
200	0.00	0.000	0.066	0.2878	0.0381	0.0000	4.62E-08
201	0.00	0.000	0.050	0.2828	0.0381	0.0000	4.62E-08
202	0.39	0.175	0.088	0.2959	0.0381	0.0000	4.62E-08
203	0.03	0.000	0.084	0.2904	0.0381	0.0000	4.62E-08
204	0.00	0.000	0.063	0.2841	0.0380	0.0000	4.62E-08
205	0.35	0.134	0.116	0.2943	0.0380	0.0000	4.62E-08
206	0.16	0.009	0.092	0.3002	0.0380	0.0000	4.62E-08
207	0.35	0.125	0.224	0.3003	0.0380	0.0000	4.62E-08
208	0.01	0.000	0.062	0.2949	0.0380	0.0000	4.62E-08
209	0.00	0.000	0.064	0.2886	0.0380	0.0000	4.61E-08
210	0.00	0.000	0.073	0.2813	0.0380	0.0000	4.61E-08
211	0.00	0.000	0.038	0.2775	0.0380	0.0000	4.61E-08
212	0.00	0.000	0.003	0.2772	0.0380	0.0000	4.61E-08
213	0.00	0.000	0.002	0.2771	0.0380	0.0000	4.62E-08
214	0.05	0.000	0.026	0.2790	0.0380	0.0000	4.61E-08
215	0.32	0.126	0.061	0.2929	0.0380	0.0000	4.61E-08
216	0.07	0.000	0.039	0.2962	0.0380	0.0000	4.61E-08

217	0.73	0.550	0.056	0.3085	0.0380	0.0000	4.61E-08
218	0.08	0.000	0.088	0.3080	0.0379	0.0000	4.61E-08
219	0.00	0.000	0.155	0.2925	0.0379	0.0000	4.61E-08
220	1.04	0.703	0.200	0.3066	0.0379	0.0000	4.61E-08
221	0.04	0.000	0.191	0.2919	0.0379	0.0000	4.61E-08
222	0.01	0.000	0.107	0.2822	0.0379	0.0000	4.61E-08
223	0.78	0.504	0.118	0.2977	0.0379	0.0000	4.61E-08
224	0.00	0.000	0.090	0.2892	0.0379	0.0000	4.60E-08
225	0.00	0.000	0.099	0.2793	0.0379	0.0000	4.60E-08
226	0.00	0.000	0.018	0.2775	0.0379	0.0000	4.60E-08
227	0.00	0.000	0.003	0.2772	0.0378	0.0000	4.60E-08
228	0.00	0.000	0.001	0.2770	0.0378	0.0000	4.60E-08
229	0.26	0.093	0.057	0.2881	0.0378	0.0000	4.60E-08
230	0.32	0.143	0.066	0.2994	0.0378	0.0000	4.60E-08
231	0.00	0.000	0.043	0.2951	0.0378	0.0000	4.60E-08
232	0.05	0.000	0.052	0.2954	0.0378	0.0000	4.60E-08
233	0.69	0.509	0.063	0.3074	0.0378	0.0000	4.60E-08
234	0.20	0.052	0.094	0.3133	0.0378	0.0000	4.59E-08
235	0.00	0.000	0.192	0.2941	0.0378	0.0000	4.59E-08
236	0.00	0.000	0.114	0.2827	0.0378	0.0000	4.59E-08
237	0.00	0.000	0.054	0.2773	0.0378	0.0000	4.59E-08
238	0.00	0.000	0.002	0.2771	0.0378	0.0000	4.59E-08
239	0.00	0.000	0.001	0.2770	0.0378	0.0000	4.59E-08
240	0.00	0.000	0.000	0.2770	0.0378	0.0000	4.59E-08
241	0.82	0.597	0.073	0.2924	0.0377	0.0000	4.59E-08
242	0.39	0.128	0.235	0.2951	0.0377	0.0000	4.59E-08
243	0.00	0.000	0.108	0.2846	0.0377	0.0000	4.59E-08
244	0.00	0.000	0.065	0.2781	0.0377	0.0000	4.59E-08
245	0.05	0.000	0.038	0.2796	0.0377	0.0000	4.59E-08
246	0.18	0.020	0.054	0.2903	0.0377	0.0000	4.59E-08
247	0.00	0.000	0.025	0.2882	0.0377	0.0000	4.59E-08
248	0.40	0.191	0.064	0.3026	0.0377	0.0000	4.58E-08

249	0.00	0.000	0.072	0.2954	0.0377	0.0000	4.58E-08
250	0.00	0.000	0.128	0.2827	0.0376	0.0000	4.58E-08
251	0.00	0.000	0.046	0.2781	0.0376	0.0000	4.58E-08
252	0.03	0.000	0.035	0.2779	0.0376	0.0000	4.58E-08
253	0.22	0.063	0.050	0.2888	0.0376	0.0000	4.58E-08
254	0.00	0.000	0.022	0.2866	0.0376	0.0000	4.58E-08
255	0.05	0.000	0.050	0.2867	0.0376	0.0000	4.58E-08
256	0.00	0.000	0.032	0.2835	0.0376	0.0000	4.58E-08
257	0.00	0.000	0.025	0.2809	0.0376	0.0000	4.58E-08
258	0.00	0.000	0.027	0.2782	0.0376	0.0000	4.58E-08
259	0.00	0.000	0.008	0.2774	0.0376	0.0000	4.58E-08
260	0.04	0.000	0.028	0.2791	0.0377	0.0000	4.58E-08
261	0.23	0.063	0.043	0.2916	0.0376	0.0000	4.58E-08
262	0.01	0.000	0.024	0.2905	0.0376	0.0000	4.58E-08
263	0.00	0.000	0.020	0.2884	0.0376	0.0000	4.58E-08
264	0.00	0.000	0.018	0.2866	0.0376	0.0000	4.58E-08
265	0.00	0.000	0.016	0.2850	0.0376	0.0000	4.58E-08
266	0.00	0.000	0.014	0.2836	0.0376	0.0000	4.58E-08
267	0.00	0.000	0.018	0.2818	0.0376	0.0000	4.58E-08
268	0.07	0.000	0.041	0.2846	0.0376	0.0000	4.58E-08
269	0.02	0.000	0.029	0.2833	0.0376	0.0000	4.57E-08
270	1.00	0.818	0.054	0.2958	0.0376	0.0000	4.57E-08
271	0.09	0.000	0.142	0.2906	0.0375	0.0000	4.57E-08
272	0.43	0.149	0.174	0.3014	0.0376	0.0000	4.58E-08
273	0.05	0.000	0.111	0.2953	0.0376	0.0000	4.58E-08
274	0.00	0.000	0.099	0.2855	0.0376	0.0000	4.58E-08
275	0.00	0.000	0.059	0.2796	0.0376	0.0000	4.58E-08
276	0.00	0.000	0.017	0.2778	0.0376	0.0000	4.58E-08
277	0.00	0.000	0.006	0.2772	0.0376	0.0000	4.58E-08
278	0.00	0.000	0.002	0.2770	0.0376	0.0000	4.58E-08
279	0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
280	0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08

281		0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
282		0.00	0.000	0.000	0.2770	0.0376	0.0000	4.58E-08
283		0.01	0.000	0.008	0.2770	0.0376	0.0000	4.57E-08
284		0.00	0.000	0.000	0.2770	0.0375	0.0000	4.57E-08
285		0.00	0.000	0.000	0.2770	0.0375	0.0000	4.57E-08
286		0.17	0.006	0.039	0.2896	0.0375	0.0000	4.57E-08
287		0.00	0.000	0.009	0.2886	0.0375	0.0000	4.57E-08
288		0.00	0.000	0.014	0.2872	0.0375	0.0000	4.57E-08
289		0.00	0.000	0.013	0.2859	0.0375	0.0000	4.57E-08
290		0.00	0.000	0.013	0.2847	0.0375	0.0000	4.57E-08
291		0.00	0.000	0.013	0.2834	0.0375	0.0000	4.57E-08
292		0.00	0.000	0.013	0.2821	0.0375	0.0000	4.57E-08
293		0.00	0.000	0.012	0.2809	0.0375	0.0000	4.56E-08
294		0.00	0.000	0.011	0.2798	0.0374	0.0000	4.56E-08
295		0.00	0.000	0.010	0.2788	0.0374	0.0000	4.56E-08
296		0.54	0.339	0.044	0.2948	0.0374	0.0000	4.56E-08
297	*	1.40	0.000	0.032	0.2968	0.0374	0.0000	4.56E-08
298		0.00	0.187	0.009	0.3095	0.0374	0.0000	4.56E-08
299	*	0.00	0.000	0.034	0.3115	0.0374	0.0000	4.56E-08
300		0.00	0.312	0.000	0.3241	0.0374	0.0000	4.56E-08
301		0.00	0.364	0.051	0.3358	0.0374	0.0000	4.56E-08
302		0.00	0.000	0.047	0.3310	0.0374	0.0000	4.56E-08
303	*	0.72	0.000	0.029	0.3330	0.0374	0.0000	4.56E-08
304	*	0.00	0.000	0.035	0.3350	0.0373	0.0000	4.55E-08
305	*	0.00	0.000	0.037	0.3369	0.0373	0.0000	4.55E-08
306		0.00	0.367	0.066	0.3497	0.0373	0.0000	4.55E-08
307		0.00	0.000	0.066	0.3431	0.0373	0.0000	4.55E-08
308		0.00	0.000	0.079	0.3352	0.0373	0.0000	4.55E-08
309		0.00	0.000	0.081	0.3271	0.0373	0.0000	4.55E-08
310		0.00	0.000	0.058	0.3213	0.0373	0.0000	4.55E-08
311		0.00	0.000	0.071	0.3142	0.0373	0.0000	4.55E-08
312		0.00	0.000	0.055	0.3087	0.0373	0.0000	4.55E-08

313		0.00	0.000	0.062	0.3025	0.0372	0.0000	4.54E-08
314		0.00	0.000	0.073	0.2952	0.0372	0.0000	4.54E-08
315		0.71	0.445	0.103	0.3113	0.0372	0.0000	4.54E-08
316		0.00	0.000	0.065	0.3047	0.0372	0.0000	4.54E-08
317		0.00	0.000	0.059	0.2988	0.0372	0.0000	4.54E-08
318		0.00	0.000	0.084	0.2904	0.0372	0.0000	4.54E-08
319		0.00	0.000	0.042	0.2862	0.0372	0.0000	4.54E-08
320		0.00	0.000	0.038	0.2824	0.0372	0.0000	4.54E-08
321	*	0.76	0.000	0.027	0.2844	0.0372	0.0000	4.54E-08
322		0.00	0.000	0.034	0.2957	0.0371	0.0000	4.54E-08
323	*	0.00	0.000	0.028	0.2977	0.0371	0.0000	4.53E-08
324		0.00	0.000	0.032	0.3095	0.0371	0.0000	4.53E-08
325		0.12	0.234	0.000	0.3220	0.0371	0.0000	4.53E-08
326	*	0.00	0.000	0.045	0.3239	0.0371	0.0000	4.53E-08
327	*	0.00	0.000	0.022	0.3259	0.0371	0.0000	4.53E-08
328	*	0.45	0.000	0.000	0.3279	0.0371	0.0000	4.53E-08
329		0.00	0.068	0.023	0.3406	0.0371	0.0000	4.53E-08
330		0.00	0.071	0.048	0.3523	0.0371	0.0000	4.53E-08
331		0.00	0.000	0.025	0.3497	0.0370	0.0000	4.53E-08
332	*	0.00	0.000	0.000	0.3497	0.0370	0.0000	4.53E-08
333	*	0.75	0.000	0.022	0.3517	0.0370	0.0000	4.52E-08
334	*	0.00	0.000	0.011	0.3536	0.0370	0.0000	4.52E-08
335	*	0.74	0.000	0.000	0.3556	0.0370	0.0000	4.52E-08
336	*	0.11	0.000	0.015	0.3576	0.0370	0.0000	4.52E-08
337		0.03	0.031	0.000	0.3703	0.0370	0.0000	4.52E-08
338	*	0.00	0.000	0.029	0.3723	0.0370	0.0000	4.52E-08
339	*	0.00	0.000	0.031	0.3743	0.0370	0.0000	4.52E-08
340	*	0.00	0.000	0.013	0.3763	0.0370	0.0000	4.52E-08
341	*	0.00	0.000	0.028	0.3783	0.0369	0.0000	4.52E-08
342		0.00	0.005	0.041	0.3849	0.0369	0.0000	4.52E-08
343	*	0.02	0.000	0.025	0.3869	0.0369	0.0000	4.51E-08
344		0.24	0.056	0.000	0.3996	0.0369	0.0000	4.51E-08

345			0.05	0.567	0.000	0.4112	0.0369	0.0000	4.51E-08
346			0.00	0.326	0.011	0.4178	0.0369	0.0000	4.51E-08
347			0.00	0.000	0.051	0.4172	0.0369	0.0000	4.51E-08
348	*		0.00	0.000	0.020	0.4152	0.0369	0.0000	4.51E-08
349	*	*	0.00	0.000	0.000	0.4152	0.0369	0.0000	4.51E-08
350		*	0.07	0.006	0.025	0.4187	0.0368	0.0000	4.51E-08
351		*	0.35	0.237	0.027	0.4273	0.0368	0.0000	4.51E-08
352			0.00	0.000	0.061	0.4213	0.0368	0.0000	4.51E-08
353			0.00	0.000	0.074	0.4135	0.0368	0.0000	4.50E-08
354			0.00	0.000	0.045	0.4038	0.0368	0.0000	4.50E-08
355			0.00	0.000	0.077	0.3913	0.0472	0.0000	5.48E-08
356	*		0.05	0.000	0.049	0.3881	0.1491	0.0000	1.51E-07
357	*		0.00	0.000	0.000	0.3858	0.2650	0.0000	2.56E-07
358	*		0.00	0.000	0.028	0.3810	0.3534	0.0000	3.33E-07
359	*	*	0.00	0.000	0.000	0.3810	0.4371	0.0000	4.05E-07
360	*	*	0.06	0.000	0.010	0.3810	0.5014	0.0001	4.59E-07
361	*	*	0.01	0.000	0.017	0.3810	0.5398	0.0001	4.91E-07
362		*	0.61	0.613	0.000	0.3847	0.5673	0.0001	5.14E-07
363		*	0.00	0.000	0.002	0.3847	0.5830	0.0001	5.27E-07
364			0.03	0.000	0.057	0.3800	0.5834	0.0001	5.27E-07
365			0.53	0.347	0.050	0.3924	0.5843	0.0001	5.28E-07

* = Frozen (air or soil)

Annual Totals for Year 10			
	inches	cubic feet	percent
Precipitation	41.28	149,854.0	100.00
Runoff	23.693	86,004.3	57.39
Evapotranspiration	16.683	60,558.3	40.41
Recirculation into Layer 1	0.0020	7.4037	0.00
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0020	7.4037	0.00
Percolation/Leakage through Layer 5	0.000021	0.0745	0.00
Average Head on Top of Layer 4	0.0493	---	---
Change in Water Storage	0.9066	3,291.1	2.20
Soil Water at Start of Year	1,406.9314	5,107,161.1	3408.09
Soil Water at End of Year	1,407.8381	5,110,452.2	3410.29
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0020	-7.1792	0.00

Daily Output for Year 11

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.053	0.3862	0.5975	0.0001	5.39E-07
2	*		0.00	0.000	0.034	0.3828	0.6311	0.0001	5.66E-07
3			0.00	0.000	0.056	0.3773	0.6654	0.0001	5.94E-07
4			0.00	0.000	0.046	0.3726	0.6907	0.0001	6.15E-07
5			0.00	0.000	0.067	0.3659	0.7000	0.0001	6.23E-07
6			0.00	0.000	0.066	0.3593	0.6998	0.0001	6.22E-07
7			0.00	0.000	0.070	0.3523	0.6996	0.0001	6.22E-07
8			0.00	0.000	0.073	0.3450	0.6994	0.0001	6.22E-07
9			0.00	0.000	0.088	0.3362	0.6992	0.0001	6.22E-07
10			0.00	0.000	0.088	0.3274	0.6990	0.0001	6.22E-07
11	*		0.00	0.000	0.032	0.3241	0.6988	0.0001	6.22E-07
12	*		0.00	0.000	0.000	0.3242	0.6986	0.0001	6.21E-07
13			0.00	0.000	0.041	0.3200	0.6984	0.0001	6.21E-07
14			0.00	0.000	0.035	0.3166	0.6982	0.0001	6.21E-07
15			0.01	0.000	0.036	0.3136	0.6980	0.0001	6.21E-07
16			0.00	0.000	0.028	0.3108	0.6978	0.0001	6.21E-07
17			0.00	0.000	0.025	0.3083	0.6975	0.0001	6.21E-07
18			0.00	0.000	0.024	0.3059	0.6973	0.0001	6.20E-07
19	*		0.85	0.000	0.032	0.3079	0.6971	0.0001	6.20E-07
20			0.00	0.653	0.000	0.3222	0.6969	0.0001	6.20E-07
21			0.00	0.000	0.131	0.3091	0.6967	0.0001	6.20E-07
22			0.00	0.000	0.148	0.2943	0.6965	0.0001	6.20E-07
23			0.00	0.000	0.126	0.2817	0.6963	0.0001	6.20E-07
24			0.00	0.000	0.046	0.2771	0.6961	0.0001	6.19E-07

25		0.00	0.000	0.001	0.2770	0.6959	0.0001	6.19E-07
26		0.00	0.000	0.000	0.2770	0.6957	0.0001	6.19E-07
27		0.00	0.000	0.000	0.2770	0.6955	0.0001	6.19E-07
28		0.00	0.000	0.000	0.2770	0.6953	0.0001	6.19E-07
29		0.00	0.000	0.000	0.2770	0.6951	0.0001	6.19E-07
30		0.00	0.000	0.000	0.2770	0.6949	0.0001	6.18E-07
31	*	0.00	0.000	0.000	0.2770	0.6947	0.0001	6.18E-07
32	*	0.00	0.000	0.000	0.2770	0.6945	0.0001	6.18E-07
33		0.00	0.000	0.000	0.2770	0.6943	0.0001	6.18E-07
34		0.00	0.000	0.000	0.2770	0.6941	0.0001	6.18E-07
35		0.00	0.000	0.000	0.2770	0.6939	0.0001	6.18E-07
36		0.00	0.000	0.000	0.2770	0.6937	0.0001	6.17E-07
37		0.00	0.000	0.000	0.2770	0.6935	0.0001	6.17E-07
38		0.00	0.000	0.000	0.2770	0.6933	0.0001	6.17E-07
39		0.52	0.329	0.029	0.2931	0.6931	0.0001	6.17E-07
40		0.00	0.000	0.007	0.2924	0.6929	0.0001	6.17E-07
41	*	0.00	0.000	0.011	0.2913	0.6927	0.0001	6.17E-07
42	*	0.02	0.000	0.020	0.2913	0.6925	0.0001	6.16E-07
43	*	0.28	0.000	0.009	0.2933	0.6923	0.0001	6.16E-07
44	*	0.00	0.000	0.041	0.2953	0.6921	0.0001	6.16E-07
45		0.00	0.004	0.089	0.3053	0.6919	0.0001	6.16E-07
46		0.00	0.000	0.011	0.3042	0.6917	0.0001	6.16E-07
47		0.00	0.000	0.010	0.3032	0.6915	0.0001	6.16E-07
48		0.00	0.000	0.010	0.3022	0.6913	0.0001	6.15E-07
49		0.23	0.083	0.022	0.3149	0.6911	0.0001	6.15E-07
50		0.00	0.000	0.088	0.3061	0.6909	0.0001	6.15E-07
51		0.00	0.000	0.010	0.3051	0.6906	0.0001	6.15E-07
52		0.00	0.000	0.011	0.3040	0.6904	0.0001	6.15E-07
53		0.32	0.153	0.026	0.3181	0.6902	0.0001	6.15E-07
54		0.97	0.736	0.113	0.3297	0.6900	0.0001	6.14E-07
55		0.00	0.000	0.065	0.3232	0.6898	0.0001	6.14E-07
56		0.00	0.000	0.039	0.3193	0.6896	0.0001	6.14E-07

57		0.02	0.000	0.058	0.3152	0.6894	0.0001	6.14E-07
58		0.00	0.000	0.081	0.3071	0.6892	0.0001	6.14E-07
59	*	0.04	0.000	0.039	0.3071	0.6890	0.0001	6.14E-07
60	*	0.00	0.000	0.063	0.3008	0.6888	0.0001	6.14E-07
61		0.03	0.000	0.087	0.2951	0.6886	0.0001	6.13E-07
62		0.04	0.000	0.130	0.2859	0.6884	0.0001	6.13E-07
63		0.00	0.000	0.047	0.2812	0.6882	0.0001	6.13E-07
64	*	0.00	0.000	0.023	0.2789	0.6880	0.0001	6.13E-07
65	*	0.00	0.000	0.000	0.2789	0.6878	0.0001	6.13E-07
66	*	0.01	0.000	0.023	0.2782	0.6876	0.0001	6.13E-07
67		0.09	0.000	0.019	0.2852	0.6874	0.0001	6.12E-07
68		0.05	0.000	0.025	0.2881	0.6872	0.0001	6.12E-07
69		0.01	0.000	0.019	0.2867	0.6870	0.0001	6.12E-07
70		0.00	0.000	0.012	0.2855	0.6868	0.0001	6.12E-07
71		0.00	0.000	0.014	0.2841	0.6866	0.0001	6.12E-07
72		0.00	0.000	0.014	0.2827	0.6864	0.0001	6.12E-07
73	*	0.27	0.000	0.040	0.2847	0.6862	0.0001	6.11E-07
74		0.00	0.003	0.162	0.2894	0.6860	0.0001	6.11E-07
75		0.00	0.000	0.014	0.2880	0.6858	0.0001	6.11E-07
76		0.00	0.000	0.011	0.2869	0.6856	0.0001	6.11E-07
77		0.00	0.000	0.012	0.2856	0.6854	0.0001	6.11E-07
78		0.00	0.000	0.012	0.2845	0.6852	0.0001	6.11E-07
79		0.00	0.000	0.012	0.2833	0.6850	0.0001	6.10E-07
80		0.00	0.000	0.011	0.2822	0.6848	0.0001	6.10E-07
81		0.00	0.000	0.011	0.2811	0.6846	0.0001	6.10E-07
82		0.00	0.000	0.010	0.2801	0.6844	0.0001	6.10E-07
83	*	0.00	0.000	0.010	0.2791	0.6842	0.0001	6.10E-07
84		0.00	0.000	0.010	0.2781	0.6840	0.0001	6.10E-07
85		0.00	0.000	0.007	0.2774	0.6838	0.0001	6.09E-07
86		0.00	0.000	0.003	0.2771	0.6836	0.0001	6.09E-07
87	*	0.00	0.000	0.001	0.2770	0.6834	0.0001	6.09E-07
88		0.00	0.000	0.000	0.2770	0.6832	0.0001	6.09E-07

89	*	0.00	0.000	0.000	0.2770	0.6830	0.0001	6.09E-07
90		0.00	0.000	0.000	0.2770	0.6828	0.0001	6.09E-07
91		0.00	0.000	0.000	0.2770	0.6826	0.0001	6.08E-07
92		0.67	0.484	0.025	0.2933	0.6824	0.0001	6.08E-07
93		0.00	0.000	0.005	0.2928	0.6822	0.0001	6.08E-07
94		0.00	0.000	0.008	0.2919	0.6820	0.0001	6.08E-07
95		0.00	0.000	0.008	0.2911	0.6818	0.0001	6.08E-07
96		0.00	0.000	0.008	0.2903	0.6816	0.0001	6.08E-07
97		0.00	0.000	0.008	0.2895	0.6814	0.0001	6.07E-07
98		0.00	0.000	0.008	0.2887	0.6812	0.0001	6.07E-07
99		0.00	0.000	0.008	0.2879	0.6810	0.0001	6.07E-07
100		0.00	0.000	0.008	0.2871	0.6808	0.0001	6.07E-07
101		0.00	0.000	0.008	0.2864	0.6806	0.0001	6.07E-07
102		0.34	0.164	0.023	0.3013	0.6804	0.0001	6.07E-07
103		0.12	0.000	0.077	0.3060	0.6802	0.0001	6.07E-07
104		0.00	0.000	0.156	0.2904	0.6800	0.0001	6.06E-07
105		0.00	0.000	0.098	0.2807	0.6798	0.0001	6.06E-07
106		0.00	0.000	0.033	0.2774	0.6796	0.0001	6.06E-07
107		0.21	0.065	0.034	0.2890	0.6794	0.0001	6.06E-07
108		0.00	0.000	0.018	0.2875	0.6792	0.0001	6.06E-07
109		1.38	1.193	0.044	0.3022	0.6790	0.0001	6.06E-07
110		0.00	0.000	0.066	0.2956	0.6788	0.0001	6.05E-07
111		0.00	0.000	0.162	0.2795	0.6786	0.0001	6.05E-07
112		0.00	0.000	0.019	0.2776	0.6785	0.0001	6.05E-07
113		0.55	0.326	0.067	0.2930	0.6783	0.0001	6.05E-07
114		0.01	0.000	0.124	0.2815	0.6781	0.0001	6.05E-07
115		0.00	0.000	0.030	0.2784	0.6779	0.0001	6.05E-07
116		0.00	0.000	0.011	0.2774	0.6777	0.0001	6.04E-07
117		0.00	0.000	0.003	0.2771	0.6775	0.0001	6.04E-07
118		0.07	0.000	0.016	0.2827	0.6773	0.0001	6.04E-07
119		0.01	0.000	0.019	0.2819	0.6771	0.0001	6.04E-07
120		0.05	0.000	0.029	0.2843	0.6769	0.0001	6.04E-07

121	0.01	0.000	0.019	0.2831	0.6767	0.0001	6.04E-07
122	0.41	0.237	0.035	0.2971	0.6765	0.0001	6.03E-07
123	0.49	0.211	0.159	0.3086	0.6763	0.0001	6.03E-07
124	0.33	0.125	0.276	0.3013	0.6761	0.0001	6.03E-07
125	0.07	0.000	0.185	0.2902	0.6759	0.0001	6.03E-07
126	0.00	0.000	0.104	0.2801	0.6757	0.0001	6.03E-07
127	2.03	1.810	0.068	0.2952	0.6755	0.0001	6.03E-07
128	0.00	0.000	0.090	0.2863	0.6753	0.0001	6.02E-07
129	0.01	0.000	0.076	0.2797	0.6753	0.0001	6.02E-07
130	0.26	0.106	0.091	0.2863	0.6752	0.0001	6.02E-07
131	0.00	0.000	0.068	0.2796	0.6750	0.0001	6.02E-07
132	0.00	0.000	0.021	0.2775	0.6748	0.0001	6.02E-07
133	0.00	0.000	0.003	0.2771	0.6746	0.0001	6.02E-07
134	0.00	0.000	0.001	0.2770	0.6744	0.0001	6.02E-07
135	0.02	0.000	0.013	0.2777	0.6742	0.0001	6.02E-07
136	0.00	0.000	0.003	0.2774	0.6740	0.0001	6.01E-07
137	0.02	0.000	0.015	0.2781	0.6738	0.0001	6.01E-07
138	0.00	0.000	0.003	0.2778	0.6736	0.0001	6.01E-07
139	0.00	0.000	0.005	0.2774	0.6734	0.0001	6.01E-07
140	0.00	0.000	0.003	0.2771	0.6732	0.0001	6.01E-07
141	0.05	0.000	0.015	0.2807	0.6730	0.0001	6.01E-07
142	0.00	0.000	0.004	0.2805	0.6728	0.0001	6.00E-07
143	0.00	0.000	0.009	0.2796	0.6726	0.0001	6.00E-07
144	0.00	0.000	0.007	0.2789	0.6724	0.0001	6.00E-07
145	0.00	0.000	0.005	0.2784	0.6722	0.0001	6.00E-07
146	0.00	0.000	0.004	0.2781	0.6720	0.0001	6.00E-07
147	0.01	0.000	0.010	0.2780	0.6718	0.0001	6.00E-07
148	0.00	0.000	0.002	0.2778	0.6716	0.0001	5.99E-07
149	0.00	0.000	0.003	0.2775	0.6714	0.0001	5.99E-07
150	0.01	0.000	0.010	0.2776	0.6712	0.0001	5.99E-07
151	0.00	0.000	0.002	0.2774	0.6710	0.0001	5.99E-07
152	0.00	0.000	0.003	0.2771	0.6708	0.0001	5.99E-07

153	0.18	0.027	0.022	0.2898	0.6707	0.0001	5.99E-07
154	0.00	0.000	0.008	0.2890	0.6705	0.0001	5.99E-07
155	0.18	0.041	0.023	0.3010	0.6703	0.0001	5.98E-07
156	1.23	1.089	0.030	0.3123	0.6701	0.0001	5.98E-07
157	0.67	0.386	0.167	0.3236	0.6699	0.0001	5.98E-07
158	0.03	0.000	0.094	0.3174	0.6697	0.0001	5.98E-07
159	0.01	0.000	0.182	0.2997	0.6695	0.0001	5.98E-07
160	0.00	0.000	0.112	0.2885	0.6693	0.0001	5.98E-07
161	0.04	0.000	0.060	0.2863	0.6691	0.0001	5.97E-07
162	0.00	0.000	0.043	0.2823	0.6689	0.0001	5.97E-07
163	0.00	0.000	0.030	0.2793	0.6687	0.0001	5.97E-07
164	3.18	2.984	0.050	0.2943	0.6685	0.0001	5.97E-07
165	0.42	0.133	0.312	0.2915	0.6683	0.0001	5.97E-07
166	0.35	0.092	0.309	0.2864	0.6681	0.0001	5.97E-07
167	0.08	0.000	0.086	0.2859	0.6679	0.0001	5.96E-07
168	0.01	0.000	0.062	0.2806	0.6677	0.0001	5.96E-07
169	0.00	0.000	0.021	0.2785	0.6675	0.0001	5.96E-07
170	0.00	0.000	0.012	0.2773	0.6673	0.0001	5.96E-07
171	0.00	0.000	0.003	0.2771	0.6671	0.0001	5.96E-07
172	0.00	0.000	0.001	0.2770	0.6669	0.0001	5.96E-07
173	0.00	0.000	0.000	0.2770	0.6667	0.0001	5.95E-07
174	0.00	0.000	0.000	0.2770	0.6665	0.0001	5.95E-07
175	0.00	0.000	0.003	0.2770	0.6664	0.0001	5.95E-07
176	0.00	0.000	0.000	0.2770	0.6662	0.0001	5.95E-07
177	0.00	0.000	0.000	0.2770	0.6660	0.0001	5.95E-07
178	0.00	0.000	0.000	0.2770	0.6658	0.0001	5.95E-07
179	0.18	0.034	0.022	0.2897	0.6656	0.0001	5.95E-07
180	0.00	0.000	0.011	0.2886	0.6654	0.0001	5.94E-07
181	0.00	0.000	0.016	0.2870	0.6652	0.0001	5.94E-07
182	0.25	0.092	0.029	0.2996	0.6650	0.0001	5.94E-07
183	0.06	0.000	0.025	0.3036	0.6648	0.0001	5.94E-07
184	0.00	0.000	0.016	0.3020	0.6646	0.0001	5.94E-07

185	0.00	0.000	0.017	0.3003	0.6644	0.0001	5.94E-07
186	0.00	0.000	0.014	0.2989	0.6642	0.0001	5.93E-07
187	0.00	0.000	0.013	0.2975	0.6640	0.0001	5.93E-07
188	0.44	0.271	0.030	0.3113	0.6638	0.0001	5.93E-07
189	0.36	0.165	0.132	0.3178	0.6636	0.0001	5.93E-07
190	0.07	0.000	0.092	0.3161	0.6634	0.0001	5.93E-07
191	0.32	0.133	0.192	0.3155	0.6632	0.0001	5.93E-07
192	0.00	0.000	0.172	0.2982	0.6630	0.0001	5.92E-07
193	0.00	0.000	0.105	0.2877	0.6629	0.0001	5.92E-07
194	0.30	0.114	0.148	0.2916	0.6627	0.0001	5.92E-07
195	0.00	0.000	0.104	0.2812	0.6625	0.0001	5.92E-07
196	0.00	0.000	0.032	0.2780	0.6623	0.0001	5.92E-07
197	0.00	0.000	0.008	0.2773	0.6621	0.0001	5.92E-07
198	0.00	0.000	0.002	0.2771	0.6619	0.0001	5.92E-07
199	1.05	0.846	0.047	0.2932	0.6617	0.0001	5.91E-07
200	0.07	0.000	0.059	0.2945	0.6615	0.0001	5.91E-07
201	0.05	0.000	0.134	0.2862	0.6613	0.0001	5.91E-07
202	0.00	0.000	0.054	0.2808	0.6611	0.0001	5.91E-07
203	0.00	0.000	0.027	0.2781	0.6609	0.0001	5.91E-07
204	0.00	0.000	0.008	0.2773	0.6607	0.0001	5.91E-07
205	0.00	0.000	0.002	0.2771	0.6605	0.0001	5.90E-07
206	0.10	0.000	0.018	0.2856	0.6603	0.0001	5.90E-07
207	0.20	0.053	0.030	0.2976	0.6601	0.0001	5.90E-07
208	0.31	0.152	0.042	0.3090	0.6600	0.0001	5.90E-07
209	0.02	0.000	0.171	0.2944	0.6598	0.0001	5.90E-07
210	0.46	0.265	0.044	0.3091	0.6596	0.0001	5.90E-07
211	0.03	0.000	0.153	0.2965	0.6594	0.0001	5.89E-07
212	0.25	0.096	0.044	0.3078	0.6592	0.0001	5.89E-07
213	0.17	0.030	0.133	0.3088	0.6590	0.0001	5.89E-07
214	0.00	0.000	0.140	0.2948	0.6588	0.0001	5.89E-07
215	0.01	0.000	0.089	0.2867	0.6586	0.0001	5.89E-07
216	0.51	0.230	0.142	0.3002	0.6584	0.0001	5.89E-07

217	0.17	0.003	0.237	0.2929	0.6582	0.0001	5.89E-07
218	0.00	0.000	0.047	0.2881	0.6580	0.0001	5.88E-07
219	0.00	0.000	0.042	0.2839	0.6578	0.0001	5.88E-07
220	0.00	0.000	0.036	0.2803	0.6576	0.0001	5.88E-07
221	0.00	0.000	0.025	0.2778	0.6574	0.0001	5.88E-07
222	0.00	0.000	0.006	0.2772	0.6573	0.0001	5.88E-07
223	0.01	0.000	0.007	0.2771	0.6571	0.0001	5.88E-07
224	0.00	0.000	0.000	0.2770	0.6569	0.0001	5.87E-07
225	0.00	0.000	0.005	0.2770	0.6567	0.0001	5.87E-07
226	0.20	0.049	0.027	0.2894	0.6565	0.0001	5.87E-07
227	0.00	0.000	0.016	0.2879	0.6563	0.0001	5.87E-07
228	0.00	0.000	0.025	0.2853	0.6561	0.0001	5.87E-07
229	0.00	0.000	0.019	0.2835	0.6559	0.0001	5.87E-07
230	0.00	0.000	0.018	0.2816	0.6557	0.0001	5.86E-07
231	0.38	0.197	0.041	0.2956	0.6555	0.0001	5.86E-07
232	0.24	0.074	0.152	0.2974	0.6553	0.0001	5.86E-07
233	0.06	0.000	0.024	0.3012	0.6551	0.0001	5.86E-07
234	0.00	0.000	0.067	0.2945	0.6550	0.0001	5.86E-07
235	0.00	0.000	0.016	0.2929	0.6548	0.0001	5.86E-07
236	0.39	0.219	0.035	0.3068	0.6546	0.0001	5.86E-07
237	1.15	0.823	0.220	0.3179	0.6544	0.0001	5.85E-07
238	0.07	0.000	0.076	0.3169	0.6542	0.0001	5.85E-07
239	0.00	0.000	0.069	0.3100	0.6540	0.0001	5.85E-07
240	0.00	0.000	0.135	0.2965	0.6538	0.0001	5.85E-07
241	0.27	0.099	0.110	0.3021	0.6536	0.0001	5.85E-07
242	0.02	0.000	0.102	0.2938	0.6534	0.0001	5.85E-07
243	0.67	0.326	0.201	0.3080	0.6532	0.0001	5.84E-07
244	0.34	0.154	0.100	0.3166	0.6530	0.0001	5.84E-07
245	0.09	0.000	0.137	0.3121	0.6529	0.0001	5.84E-07
246	0.04	0.000	0.122	0.3034	0.6527	0.0001	5.84E-07
247	0.00	0.000	0.109	0.2925	0.6525	0.0001	5.84E-07
248	0.00	0.000	0.110	0.2815	0.6523	0.0001	5.84E-07

249	0.00	0.000	0.035	0.2781	0.6521	0.0001	5.83E-07
250	0.00	0.000	0.009	0.2772	0.6519	0.0001	5.83E-07
251	0.00	0.000	0.002	0.2770	0.6517	0.0001	5.83E-07
252	0.00	0.000	0.000	0.2770	0.6515	0.0001	5.83E-07
253	0.04	0.000	0.017	0.2793	0.6513	0.0001	5.83E-07
254	0.58	0.395	0.047	0.2932	0.6511	0.0001	5.83E-07
255	0.01	0.000	0.089	0.2857	0.6509	0.0001	5.83E-07
256	1.25	1.047	0.045	0.3011	0.6508	0.0001	5.82E-07
257	0.36	0.136	0.183	0.3053	0.6506	0.0001	5.82E-07
258	0.11	0.000	0.084	0.3077	0.6504	0.0001	5.82E-07
259	0.01	0.000	0.066	0.3023	0.6502	0.0001	5.82E-07
260	0.52	0.231	0.150	0.3163	0.6500	0.0001	5.82E-07
261	0.00	0.000	0.109	0.3054	0.6498	0.0001	5.82E-07
262	0.00	0.000	0.094	0.2960	0.6496	0.0001	5.81E-07
263	0.00	0.000	0.100	0.2860	0.6494	0.0001	5.81E-07
264	0.00	0.000	0.075	0.2785	0.6492	0.0001	5.81E-07
265	0.00	0.000	0.011	0.2774	0.6490	0.0001	5.81E-07
266	0.00	0.000	0.003	0.2771	0.6489	0.0001	5.81E-07
267	0.00	0.000	0.001	0.2770	0.6487	0.0001	5.81E-07
268	0.00	0.000	0.000	0.2770	0.6485	0.0001	5.81E-07
269	0.00	0.000	0.000	0.2770	0.6483	0.0001	5.80E-07
270	0.00	0.000	0.000	0.2770	0.6481	0.0001	5.80E-07
271	0.00	0.000	0.000	0.2770	0.6479	0.0001	5.80E-07
272	0.00	0.000	0.000	0.2770	0.6477	0.0001	5.80E-07
273	0.62	0.422	0.039	0.2933	0.6475	0.0001	5.80E-07
274	0.40	0.241	0.038	0.3049	0.6473	0.0001	5.80E-07
275	0.12	0.002	0.056	0.3112	0.6472	0.0001	5.79E-07
276	0.00	0.000	0.108	0.3004	0.6470	0.0001	5.79E-07
277	0.00	0.000	0.084	0.2920	0.6468	0.0001	5.79E-07
278	0.00	0.000	0.055	0.2864	0.6466	0.0001	5.79E-07
279	0.00	0.000	0.045	0.2819	0.6464	0.0001	5.79E-07
280	0.00	0.000	0.038	0.2781	0.6462	0.0001	5.79E-07

281	0.00	0.000	0.009	0.2771	0.6460	0.0001	5.79E-07
282	0.00	0.000	0.001	0.2770	0.6458	0.0001	5.78E-07
283	0.00	0.000	0.000	0.2770	0.6456	0.0001	5.78E-07
284	0.00	0.000	0.000	0.2770	0.6455	0.0001	5.78E-07
285	0.00	0.000	0.000	0.2770	0.6453	0.0001	5.78E-07
286	0.00	0.000	0.000	0.2770	0.6451	0.0001	5.78E-07
287	0.31	0.144	0.037	0.2904	0.6449	0.0001	5.78E-07
288	1.05	0.898	0.036	0.3020	0.6447	0.0001	5.77E-07
289	0.43	0.204	0.108	0.3136	0.6445	0.0001	5.77E-07
290	0.00	0.000	0.040	0.3096	0.6443	0.0001	5.77E-07
291	0.00	0.000	0.077	0.3019	0.6441	0.0001	5.77E-07
292	0.00	0.000	0.104	0.2915	0.6440	0.0001	5.77E-07
293	0.05	0.000	0.058	0.2902	0.6438	0.0001	5.77E-07
294	0.00	0.000	0.072	0.2830	0.6436	0.0001	5.77E-07
295	0.00	0.000	0.047	0.2784	0.6434	0.0001	5.76E-07
296	0.00	0.000	0.010	0.2773	0.6432	0.0001	5.76E-07
297	0.00	0.000	0.003	0.2771	0.6430	0.0001	5.76E-07
298	0.00	0.000	0.000	0.2770	0.6428	0.0001	5.76E-07
299	0.01	0.000	0.012	0.2772	0.6426	0.0001	5.76E-07
300	0.00	0.000	0.001	0.2771	0.6424	0.0001	5.76E-07
301	0.00	0.000	0.001	0.2770	0.6423	0.0001	5.75E-07
302	0.00	0.000	0.000	0.2770	0.6421	0.0001	5.75E-07
303	0.00	0.000	0.000	0.2770	0.6419	0.0001	5.75E-07
304	0.00	0.000	0.000	0.2770	0.6417	0.0001	5.75E-07
305	0.00	0.000	0.000	0.2770	0.6415	0.0001	5.75E-07
306	0.00	0.000	0.000	0.2770	0.6413	0.0001	5.75E-07
307	0.00	0.000	0.000	0.2770	0.6411	0.0001	5.75E-07
308	0.14	0.000	0.019	0.2892	0.6409	0.0001	5.74E-07
309	0.00	0.000	0.007	0.2885	0.6408	0.0001	5.74E-07
310	0.00	0.000	0.008	0.2877	0.6406	0.0001	5.74E-07
311	0.00	0.000	0.010	0.2867	0.6404	0.0001	5.74E-07
312	0.00	0.000	0.011	0.2856	0.6402	0.0001	5.74E-07

313		0.00	0.000	0.010	0.2846	0.6400	0.0001	5.74E-07
314		0.00	0.000	0.010	0.2836	0.6398	0.0001	5.73E-07
315		0.00	0.000	0.010	0.2826	0.6396	0.0001	5.73E-07
316		0.00	0.000	0.010	0.2816	0.6394	0.0001	5.73E-07
317		0.14	0.000	0.025	0.2929	0.6393	0.0001	5.73E-07
318		0.45	0.295	0.029	0.3051	0.6391	0.0001	5.73E-07
319		0.00	0.000	0.014	0.3041	0.6389	0.0001	5.73E-07
320	*	0.05	0.000	0.026	0.3060	0.6387	0.0001	5.73E-07
321		0.07	0.000	0.028	0.3111	0.6385	0.0001	5.72E-07
322		0.00	0.000	0.010	0.3101	0.6383	0.0001	5.72E-07
323		0.00	0.000	0.009	0.3092	0.6382	0.0001	5.72E-07
324		0.00	0.000	0.008	0.3084	0.6380	0.0001	5.72E-07
325	*	0.00	0.000	0.000	0.3084	0.6378	0.0001	5.72E-07
326	*	0.00	0.000	0.000	0.3084	0.6376	0.0001	5.72E-07
327		0.00	0.000	0.008	0.3076	0.6374	0.0001	5.71E-07
328		0.75	0.584	0.026	0.3213	0.6372	0.0001	5.71E-07
329		0.00	0.000	0.073	0.3140	0.6370	0.0001	5.71E-07
330		0.00	0.000	0.068	0.3073	0.6369	0.0001	5.71E-07
331	*	0.00	0.000	0.030	0.3042	0.6367	0.0001	5.71E-07
332		0.00	0.000	0.072	0.2971	0.6365	0.0001	5.71E-07
333		0.00	0.000	0.087	0.2884	0.6363	0.0001	5.71E-07
334		0.03	0.000	0.061	0.2852	0.6361	0.0001	5.70E-07
335	*	0.00	0.000	0.034	0.2819	0.6359	0.0001	5.70E-07
336	*	0.77	0.000	0.034	0.2838	0.6357	0.0001	5.70E-07
337		0.00	0.575	0.000	0.2976	0.6356	0.0001	5.70E-07
338	*	0.00	0.000	0.038	0.2938	0.6354	0.0001	5.70E-07
339	*	0.00	0.000	0.000	0.2938	0.6352	0.0001	5.70E-07
340	*	0.00	0.000	0.000	0.2938	0.6350	0.0001	5.69E-07
341	*	0.00	0.000	0.000	0.2938	0.6348	0.0001	5.69E-07
342	*	0.00	0.000	0.000	0.2938	0.6346	0.0001	5.69E-07
343	*	0.00	0.000	0.000	0.2938	0.6344	0.0001	5.69E-07
344	*	0.00	0.000	0.000	0.2939	0.6343	0.0001	5.69E-07

345	*		0.00	0.000	0.000	0.2939	0.6341	0.0001	5.69E-07
346	*		0.00	0.000	0.000	0.2939	0.6339	0.0001	5.69E-07
347	*		1.57	0.000	0.000	0.2958	0.6337	0.0001	5.68E-07
348	*		0.15	0.000	0.016	0.2978	0.6335	0.0001	5.68E-07
349	*		0.00	0.000	0.035	0.2998	0.6333	0.0001	5.68E-07
350	*		0.00	0.000	0.039	0.3018	0.6331	0.0001	5.68E-07
351			0.00	0.028	0.028	0.3145	0.6330	0.0001	5.68E-07
352			0.00	0.645	0.000	0.3261	0.6328	0.0001	5.68E-07
353			0.20	0.695	0.000	0.3378	0.6326	0.0001	5.68E-07
354			0.26	0.127	0.093	0.3423	0.6324	0.0001	5.67E-07
355			0.08	0.002	0.108	0.3395	0.6322	0.0001	5.67E-07
356			0.00	0.000	0.042	0.3353	0.6320	0.0001	5.67E-07
357			0.00	0.000	0.054	0.3300	0.6319	0.0001	5.67E-07
358	*		0.00	0.000	0.030	0.3270	0.6317	0.0001	5.67E-07
359			0.00	0.000	0.041	0.3229	0.6315	0.0001	5.67E-07
360	*		0.00	0.000	0.000	0.3229	0.6313	0.0001	5.66E-07
361	*	*	0.00	0.000	0.000	0.3229	0.6311	0.0001	5.66E-07
362		*	0.00	0.000	0.000	0.3229	0.6309	0.0001	5.66E-07
363		*	0.00	0.000	0.000	0.3229	0.6307	0.0001	5.66E-07
364			0.00	0.000	0.068	0.3161	0.6306	0.0001	5.66E-07
365			0.00	0.000	0.054	0.3109	0.6304	0.0001	5.66E-07

* = Frozen (air or soil)

Annual Totals for Year 11

	inches	cubic feet	percent
Precipitation	37.15	134,843.1	100.00
Runoff	22.532	81,791.6	60.66
Evapotranspiration	15.445	56,064.1	41.58
Recirculation into Layer 1	0.0275	99.8	0.07
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0275	99.8	0.07
Percolation/Leakage through Layer 5	0.000217	0.7864	0.00
Average Head on Top of Layer 4	0.6644	---	---
Change in Water Storage	-0.8301	-3,013.4	-2.23
Soil Water at Start of Year	1,407.8381	5,110,452.2	3789.92
Soil Water at End of Year	1,407.0079	5,107,438.8	3787.69
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0275	-99.8	-0.07

Daily Output for Year 12

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.01	0.000	0.011	0.3109	0.6302	0.0001	5.66E-07
2	*	*	0.00	0.000	0.000	0.3109	0.6300	0.0001	5.65E-07
3	*	*	0.00	0.000	0.000	0.3109	0.6298	0.0001	5.65E-07
4		*	0.00	0.000	0.000	0.3109	0.6296	0.0001	5.65E-07
5	*	*	0.00	0.000	0.000	0.3109	0.6295	0.0001	5.65E-07
6	*	*	0.00	0.000	0.000	0.3109	0.6293	0.0001	5.65E-07
7	*	*	0.00	0.000	0.000	0.3109	0.6291	0.0001	5.65E-07
8	*	*	0.00	0.000	0.000	0.3109	0.6289	0.0001	5.64E-07
9		*	0.00	0.000	0.000	0.3109	0.6287	0.0001	5.64E-07
10		*	0.20	0.137	0.014	0.3156	0.6285	0.0001	5.64E-07
11			0.00	0.000	0.048	0.3108	0.6284	0.0001	5.64E-07
12			0.00	0.000	0.087	0.3020	0.6282	0.0001	5.64E-07
13			0.00	0.000	0.052	0.2969	0.6280	0.0001	5.64E-07
14	*		0.00	0.000	0.000	0.2969	0.6278	0.0001	5.64E-07
15	*		0.00	0.000	0.000	0.2969	0.6276	0.0001	5.63E-07
16			0.00	0.000	0.046	0.2923	0.6274	0.0001	5.63E-07
17	*		0.00	0.000	0.031	0.2892	0.6272	0.0001	5.63E-07
18			0.00	0.000	0.064	0.2829	0.6271	0.0001	5.63E-07
19			0.54	0.273	0.131	0.2967	0.6269	0.0001	5.63E-07
20			0.10	0.000	0.098	0.2973	0.6267	0.0001	5.63E-07
21			0.00	0.000	0.055	0.2918	0.6265	0.0001	5.63E-07
22			0.00	0.000	0.112	0.2807	0.6263	0.0001	5.62E-07
23			0.00	0.000	0.032	0.2775	0.6261	0.0001	5.62E-07
24			0.00	0.000	0.004	0.2771	0.6260	0.0001	5.62E-07

25	*	0.00	0.000	0.000	0.2771	0.6258	0.0001	5.62E-07
26	*	0.00	0.000	0.001	0.2770	0.6256	0.0001	5.62E-07
27		0.11	0.000	0.018	0.2859	0.6254	0.0001	5.62E-07
28	*	0.00	0.000	0.013	0.2846	0.6252	0.0001	5.61E-07
29	*	0.00	0.000	0.000	0.2846	0.6251	0.0001	5.61E-07
30	*	0.00	0.000	0.000	0.2846	0.6249	0.0001	5.61E-07
31	*	0.00	0.000	0.000	0.2846	0.6247	0.0001	5.61E-07
32	*	0.00	0.000	0.000	0.2846	0.6245	0.0001	5.61E-07
33	*	0.00	0.000	0.000	0.2846	0.6243	0.0001	5.61E-07
34	*	0.67	0.000	0.023	0.2866	0.6241	0.0001	5.61E-07
35		0.00	0.501	0.000	0.2993	0.6240	0.0001	5.60E-07
36	*	0.65	0.000	0.034	0.3013	0.6238	0.0001	5.60E-07
37	*	0.00	0.000	0.037	0.3033	0.6236	0.0001	5.60E-07
38		0.00	0.396	0.015	0.3160	0.6234	0.0001	5.60E-07
39		0.00	0.000	0.063	0.3097	0.6232	0.0001	5.60E-07
40		1.00	0.753	0.116	0.3234	0.6230	0.0001	5.60E-07
41		0.72	0.527	0.073	0.3350	0.6229	0.0001	5.60E-07
42	*	0.00	0.000	0.043	0.3307	0.6227	0.0001	5.59E-07
43	*	0.00	0.000	0.000	0.3307	0.6225	0.0001	5.59E-07
44		0.00	0.000	0.084	0.3223	0.6223	0.0001	5.59E-07
45		0.00	0.000	0.082	0.3141	0.6221	0.0001	5.59E-07
46		0.02	0.000	0.058	0.3103	0.6220	0.0001	5.59E-07
47		0.00	0.000	0.095	0.3008	0.6218	0.0001	5.59E-07
48		0.00	0.000	0.082	0.2925	0.6216	0.0001	5.58E-07
49		0.00	0.000	0.085	0.2841	0.6214	0.0001	5.58E-07
50		0.00	0.000	0.058	0.2783	0.6212	0.0001	5.58E-07
51		0.00	0.000	0.010	0.2773	0.6210	0.0001	5.58E-07
52		0.00	0.000	0.003	0.2770	0.6209	0.0001	5.58E-07
53		0.00	0.000	0.000	0.2770	0.6207	0.0001	5.58E-07
54		0.00	0.000	0.000	0.2770	0.6205	0.0001	5.58E-07
55		0.00	0.000	0.000	0.2770	0.6203	0.0001	5.57E-07
56		0.00	0.000	0.000	0.2770	0.6201	0.0001	5.57E-07

57		0.00	0.000	0.000	0.2770	0.6200	0.0001	5.57E-07
58		0.23	0.081	0.024	0.2896	0.6198	0.0001	5.57E-07
59		1.13	0.974	0.035	0.3013	0.6196	0.0001	5.57E-07
60		0.00	0.000	0.074	0.2938	0.6194	0.0001	5.57E-07
61		0.00	0.000	0.096	0.2842	0.6192	0.0001	5.57E-07
62		0.00	0.000	0.053	0.2789	0.6191	0.0001	5.56E-07
63		0.00	0.000	0.014	0.2775	0.6189	0.0001	5.56E-07
64		0.00	0.000	0.004	0.2771	0.6187	0.0001	5.56E-07
65		0.51	0.302	0.056	0.2925	0.6185	0.0001	5.56E-07
66		0.06	0.000	0.030	0.2952	0.6183	0.0001	5.56E-07
67	*	0.00	0.000	0.000	0.2952	0.6181	0.0001	5.56E-07
68	*	0.08	0.000	0.037	0.2972	0.6180	0.0001	5.55E-07
69		0.00	0.000	0.070	0.2930	0.6178	0.0001	5.55E-07
70	*	0.19	0.000	0.070	0.2950	0.6176	0.0001	5.55E-07
71		0.10	0.005	0.139	0.3010	0.6174	0.0001	5.55E-07
72		0.00	0.000	0.090	0.2920	0.6172	0.0001	5.55E-07
73		0.00	0.000	0.021	0.2899	0.6171	0.0001	5.55E-07
74		0.00	0.000	0.019	0.2880	0.6169	0.0001	5.55E-07
75		0.00	0.000	0.017	0.2863	0.6167	0.0001	5.54E-07
76		0.06	0.000	0.030	0.2897	0.6165	0.0001	5.54E-07
77		0.22	0.071	0.033	0.3017	0.6163	0.0001	5.54E-07
78		0.24	0.091	0.108	0.3060	0.6162	0.0001	5.54E-07
79		0.00	0.000	0.076	0.2983	0.6160	0.0001	5.54E-07
80		0.00	0.000	0.079	0.2904	0.6158	0.0001	5.54E-07
81		0.00	0.000	0.036	0.2868	0.6156	0.0001	5.54E-07
82	*	0.00	0.000	0.000	0.2868	0.6154	0.0001	5.53E-07
83		0.28	0.117	0.052	0.2977	0.6153	0.0001	5.53E-07
84		0.71	0.541	0.049	0.3093	0.6151	0.0001	5.53E-07
85		0.56	0.305	0.138	0.3209	0.6149	0.0001	5.53E-07
86		0.42	0.206	0.302	0.3121	0.6147	0.0001	5.53E-07
87		0.00	0.000	0.135	0.2985	0.6145	0.0001	5.53E-07
88		0.13	0.000	0.159	0.2959	0.6144	0.0001	5.53E-07

89		0.00	0.000	0.146	0.2813	0.6142	0.0001	5.52E-07
90		0.00	0.000	0.031	0.2783	0.6140	0.0001	5.52E-07
91		0.00	0.000	0.010	0.2773	0.6138	0.0001	5.52E-07
92		0.00	0.000	0.003	0.2771	0.6136	0.0001	5.52E-07
93		0.00	0.000	0.000	0.2770	0.6135	0.0001	5.52E-07
94		0.00	0.000	0.000	0.2770	0.6133	0.0001	5.52E-07
95		0.00	0.000	0.000	0.2770	0.6131	0.0001	5.52E-07
96		0.00	0.000	0.000	0.2770	0.6129	0.0001	5.51E-07
97		0.00	0.000	0.000	0.2770	0.6128	0.0001	5.51E-07
98		0.12	0.000	0.016	0.2870	0.6126	0.0001	5.51E-07
99	*	0.00	0.000	0.009	0.2861	0.6124	0.0001	5.51E-07
100		0.00	0.000	0.010	0.2851	0.6122	0.0001	5.51E-07
101		0.00	0.000	0.012	0.2838	0.6120	0.0001	5.51E-07
102		0.00	0.000	0.012	0.2826	0.6119	0.0001	5.50E-07
103		0.15	0.008	0.026	0.2937	0.6117	0.0001	5.50E-07
104	*	0.01	0.000	0.018	0.2928	0.6115	0.0001	5.50E-07
105	*	0.00	0.000	0.000	0.2929	0.6113	0.0001	5.50E-07
106		0.00	0.000	0.012	0.2917	0.6111	0.0001	5.50E-07
107		0.00	0.000	0.011	0.2906	0.6110	0.0001	5.50E-07
108		0.00	0.000	0.011	0.2895	0.6108	0.0001	5.50E-07
109		0.00	0.000	0.011	0.2884	0.6106	0.0001	5.49E-07
110		0.00	0.000	0.010	0.2874	0.6104	0.0001	5.49E-07
111		0.00	0.000	0.010	0.2864	0.6102	0.0001	5.49E-07
112		0.00	0.000	0.010	0.2854	0.6101	0.0001	5.49E-07
113		0.00	0.000	0.010	0.2844	0.6099	0.0001	5.49E-07
114		0.01	0.000	0.018	0.2838	0.6097	0.0001	5.49E-07
115		0.08	0.000	0.024	0.2898	0.6095	0.0001	5.49E-07
116		0.01	0.000	0.018	0.2890	0.6094	0.0001	5.48E-07
117		0.00	0.000	0.011	0.2879	0.6092	0.0001	5.48E-07
118		0.00	0.000	0.011	0.2868	0.6090	0.0001	5.48E-07
119		0.02	0.000	0.021	0.2867	0.6088	0.0001	5.48E-07
120		0.50	0.335	0.027	0.3002	0.6087	0.0001	5.48E-07

121		0.01	0.000	0.014	0.2994	0.6085	0.0001	5.48E-07
122		0.00	0.000	0.010	0.2984	0.6083	0.0001	5.48E-07
123		0.00	0.000	0.009	0.2975	0.6081	0.0001	5.47E-07
124		0.00	0.000	0.009	0.2966	0.6079	0.0001	5.47E-07
125		0.00	0.000	0.008	0.2958	0.6078	0.0001	5.47E-07
126		0.00	0.000	0.008	0.2950	0.6076	0.0001	5.47E-07
127		1.58	1.404	0.026	0.3101	0.6074	0.0001	5.47E-07
128		0.00	0.000	0.102	0.2999	0.6072	0.0001	5.47E-07
129	*	0.00	0.000	0.060	0.2940	0.6071	0.0001	5.47E-07
130		0.00	0.000	0.129	0.2810	0.6069	0.0001	5.46E-07
131		0.00	0.000	0.030	0.2780	0.6067	0.0001	5.46E-07
132		0.00	0.000	0.008	0.2773	0.6065	0.0001	5.46E-07
133		0.00	0.000	0.006	0.2771	0.6063	0.0001	5.46E-07
134	*	0.01	0.000	0.010	0.2770	0.6062	0.0001	5.46E-07
135		0.00	0.000	0.000	0.2770	0.6060	0.0001	5.46E-07
136		0.01	0.000	0.010	0.2770	0.6058	0.0001	5.45E-07
137		0.04	0.000	0.016	0.2792	0.6056	0.0001	5.45E-07
138		0.00	0.000	0.002	0.2789	0.6055	0.0001	5.45E-07
139		0.25	0.093	0.027	0.2923	0.6053	0.0001	5.45E-07
140		0.16	0.024	0.024	0.3031	0.6051	0.0001	5.45E-07
141		0.00	0.000	0.009	0.3023	0.6049	0.0001	5.45E-07
142		0.00	0.000	0.014	0.3008	0.6047	0.0001	5.45E-07
143		0.00	0.000	0.014	0.2995	0.6046	0.0001	5.44E-07
144		0.00	0.000	0.014	0.2981	0.6044	0.0001	5.44E-07
145		0.00	0.000	0.013	0.2968	0.6042	0.0001	5.44E-07
146		0.00	0.000	0.013	0.2955	0.6040	0.0001	5.44E-07
147		0.00	0.000	0.012	0.2943	0.6039	0.0001	5.44E-07
148		0.00	0.000	0.012	0.2931	0.6037	0.0001	5.44E-07
149		0.00	0.000	0.012	0.2919	0.6035	0.0001	5.44E-07
150		0.00	0.000	0.012	0.2906	0.6033	0.0001	5.43E-07
151		1.23	1.047	0.032	0.3057	0.6032	0.0001	5.43E-07
152		0.13	0.000	0.081	0.3104	0.6030	0.0001	5.43E-07

153	0.00	0.000	0.211	0.2893	0.6028	0.0001	5.43E-07
154	0.00	0.000	0.113	0.2781	0.6026	0.0001	5.43E-07
155	0.00	0.000	0.008	0.2772	0.6025	0.0001	5.43E-07
156	0.66	0.423	0.073	0.2931	0.6023	0.0001	5.43E-07
157	0.00	0.000	0.056	0.2875	0.6021	0.0001	5.42E-07
158	0.26	0.095	0.050	0.2988	0.6019	0.0001	5.42E-07
159	0.05	0.000	0.085	0.2958	0.6018	0.0001	5.42E-07
160	0.72	0.466	0.127	0.3090	0.6016	0.0001	5.42E-07
161	0.10	0.001	0.107	0.3087	0.6014	0.0001	5.42E-07
162	0.10	0.000	0.208	0.2981	0.6012	0.0001	5.42E-07
163	0.27	0.087	0.171	0.2997	0.6011	0.0001	5.42E-07
164	0.84	0.578	0.150	0.3111	0.6009	0.0001	5.41E-07
165	0.00	0.000	0.192	0.2919	0.6007	0.0001	5.41E-07
166	0.00	0.000	0.132	0.2786	0.6005	0.0001	5.41E-07
167	0.27	0.109	0.078	0.2867	0.6004	0.0001	5.41E-07
168	0.03	0.000	0.090	0.2811	0.6002	0.0001	5.41E-07
169	0.00	0.000	0.027	0.2784	0.6000	0.0001	5.41E-07
170	0.03	0.000	0.026	0.2787	0.5998	0.0001	5.41E-07
171	0.33	0.137	0.055	0.2928	0.5997	0.0001	5.40E-07
172	0.50	0.334	0.049	0.3043	0.5995	0.0001	5.40E-07
173	0.00	0.000	0.047	0.2997	0.5993	0.0001	5.40E-07
174	0.24	0.090	0.088	0.3063	0.5991	0.0001	5.40E-07
175	0.00	0.000	0.144	0.2919	0.5989	0.0001	5.40E-07
176	0.00	0.000	0.085	0.2834	0.5988	0.0001	5.40E-07
177	0.00	0.000	0.048	0.2785	0.5986	0.0001	5.40E-07
178	0.00	0.000	0.013	0.2773	0.5984	0.0001	5.39E-07
179	0.00	0.000	0.002	0.2771	0.5982	0.0001	5.39E-07
180	0.22	0.066	0.034	0.2890	0.5981	0.0001	5.39E-07
181	0.08	0.000	0.032	0.2940	0.5979	0.0001	5.39E-07
182	0.00	0.000	0.016	0.2925	0.5977	0.0001	5.39E-07
183	0.16	0.010	0.039	0.3034	0.5976	0.0001	5.39E-07
184	0.00	0.000	0.065	0.2971	0.5974	0.0001	5.39E-07

185	0.00	0.000	0.023	0.2952	0.5972	0.0001	5.38E-07
186	0.65	0.453	0.042	0.3109	0.5970	0.0001	5.38E-07
187	0.00	0.000	0.099	0.3009	0.5969	0.0001	5.38E-07
188	0.00	0.000	0.167	0.2842	0.5967	0.0001	5.38E-07
189	0.00	0.000	0.060	0.2782	0.5965	0.0001	5.38E-07
190	0.00	0.000	0.009	0.2773	0.5963	0.0001	5.38E-07
191	0.00	0.000	0.002	0.2771	0.5962	0.0001	5.38E-07
192	0.00	0.000	0.001	0.2770	0.5960	0.0001	5.37E-07
193	0.00	0.000	0.000	0.2770	0.5958	0.0001	5.37E-07
194	0.00	0.000	0.000	0.2770	0.5956	0.0001	5.37E-07
195	0.00	0.000	0.000	0.2770	0.5955	0.0001	5.37E-07
196	0.00	0.000	0.000	0.2770	0.5953	0.0001	5.37E-07
197	0.00	0.000	0.000	0.2770	0.5951	0.0001	5.37E-07
198	0.07	0.000	0.019	0.2820	0.5949	0.0001	5.37E-07
199	0.00	0.000	0.013	0.2806	0.5948	0.0001	5.36E-07
200	0.00	0.000	0.017	0.2789	0.5946	0.0001	5.36E-07
201	0.00	0.000	0.006	0.2783	0.5944	0.0001	5.36E-07
202	0.32	0.143	0.037	0.2923	0.5942	0.0001	5.36E-07
203	0.50	0.354	0.036	0.3037	0.5941	0.0001	5.36E-07
204	0.08	0.000	0.107	0.3008	0.5939	0.0001	5.36E-07
205	0.00	0.000	0.019	0.2989	0.5937	0.0001	5.36E-07
206	0.00	0.000	0.017	0.2972	0.5935	0.0001	5.35E-07
207	0.06	0.000	0.030	0.2999	0.5934	0.0001	5.35E-07
208	0.02	0.000	0.028	0.2991	0.5932	0.0001	5.35E-07
209	0.00	0.000	0.021	0.2970	0.5930	0.0001	5.35E-07
210	0.00	0.000	0.020	0.2950	0.5929	0.0001	5.35E-07
211	0.04	0.000	0.027	0.2958	0.5927	0.0001	5.35E-07
212	0.65	0.492	0.034	0.3082	0.5925	0.0001	5.35E-07
213	0.00	0.000	0.143	0.2938	0.5923	0.0001	5.34E-07
214	0.21	0.053	0.097	0.3001	0.5922	0.0001	5.34E-07
215	0.00	0.000	0.147	0.2855	0.5920	0.0001	5.34E-07
216	0.00	0.000	0.050	0.2805	0.5918	0.0001	5.34E-07

217	0.02	0.000	0.042	0.2782	0.5916	0.0001	5.34E-07
218	0.00	0.000	0.008	0.2773	0.5915	0.0001	5.34E-07
219	0.00	0.000	0.003	0.2771	0.5913	0.0001	5.34E-07
220	0.00	0.000	0.001	0.2770	0.5911	0.0001	5.33E-07
221	0.00	0.000	0.000	0.2770	0.5910	0.0001	5.33E-07
222	0.00	0.000	0.000	0.2770	0.5908	0.0001	5.33E-07
223	0.07	0.000	0.018	0.2825	0.5906	0.0001	5.33E-07
224	0.59	0.413	0.040	0.2961	0.5904	0.0001	5.33E-07
225	0.00	0.000	0.013	0.2948	0.5903	0.0001	5.33E-07
226	0.00	0.000	0.020	0.2928	0.5901	0.0001	5.33E-07
227	0.00	0.000	0.020	0.2907	0.5899	0.0001	5.32E-07
228	0.00	0.000	0.021	0.2886	0.5897	0.0001	5.32E-07
229	0.03	0.000	0.036	0.2881	0.5896	0.0001	5.32E-07
230	0.00	0.000	0.021	0.2860	0.5894	0.0001	5.32E-07
231	0.18	0.033	0.034	0.2976	0.5892	0.0001	5.32E-07
232	0.03	0.000	0.069	0.2936	0.5891	0.0001	5.32E-07
233	0.08	0.000	0.031	0.2990	0.5889	0.0001	5.32E-07
234	0.00	0.000	0.017	0.2973	0.5887	0.0001	5.31E-07
235	0.00	0.000	0.016	0.2958	0.5885	0.0001	5.31E-07
236	0.18	0.028	0.036	0.3075	0.5884	0.0001	5.31E-07
237	0.00	0.000	0.181	0.2895	0.5882	0.0001	5.31E-07
238	0.00	0.000	0.023	0.2872	0.5880	0.0001	5.31E-07
239	0.00	0.000	0.021	0.2851	0.5878	0.0001	5.31E-07
240	0.00	0.000	0.019	0.2832	0.5878	0.0001	5.31E-07
241	0.00	0.000	0.022	0.2809	0.5876	0.0001	5.31E-07
242	0.00	0.000	0.017	0.2792	0.5875	0.0001	5.30E-07
243	0.04	0.000	0.030	0.2797	0.5873	0.0001	5.30E-07
244	0.88	0.712	0.033	0.2937	0.5871	0.0001	5.30E-07
245	0.00	0.000	0.037	0.2900	0.5870	0.0001	5.30E-07
246	0.00	0.000	0.054	0.2847	0.5868	0.0001	5.30E-07
247	0.00	0.000	0.058	0.2789	0.5866	0.0001	5.30E-07
248	0.00	0.000	0.016	0.2773	0.5864	0.0001	5.30E-07

249	0.00	0.000	0.002	0.2771	0.5863	0.0001	5.29E-07
250	0.00	0.000	0.001	0.2770	0.5861	0.0001	5.29E-07
251	0.00	0.000	0.000	0.2770	0.5859	0.0001	5.29E-07
252	0.00	0.000	0.000	0.2770	0.5858	0.0001	5.29E-07
253	0.00	0.000	0.000	0.2770	0.5856	0.0001	5.29E-07
254	0.28	0.124	0.037	0.2892	0.5854	0.0001	5.29E-07
255	0.00	0.000	0.013	0.2879	0.5852	0.0001	5.29E-07
256	0.00	0.000	0.019	0.2860	0.5851	0.0001	5.28E-07
257	0.00	0.000	0.016	0.2844	0.5849	0.0001	5.28E-07
258	0.00	0.000	0.015	0.2830	0.5847	0.0001	5.28E-07
259	0.00	0.000	0.016	0.2814	0.5846	0.0001	5.28E-07
260	0.00	0.000	0.014	0.2800	0.5844	0.0001	5.28E-07
261	0.00	0.000	0.014	0.2785	0.5842	0.0001	5.28E-07
262	0.00	0.000	0.009	0.2776	0.5841	0.0001	5.28E-07
263	0.00	0.000	0.005	0.2772	0.5839	0.0001	5.27E-07
264	0.00	0.000	0.001	0.2770	0.5837	0.0001	5.27E-07
265	0.00	0.000	0.000	0.2770	0.5835	0.0001	5.27E-07
266	0.01	0.000	0.005	0.2770	0.5834	0.0001	5.27E-07
267	0.15	0.000	0.023	0.2898	0.5832	0.0001	5.27E-07
268	0.00	0.000	0.007	0.2891	0.5830	0.0001	5.27E-07
269	0.00	0.000	0.010	0.2880	0.5829	0.0001	5.27E-07
270	0.04	0.000	0.025	0.2894	0.5827	0.0001	5.26E-07
271	0.00	0.000	0.013	0.2883	0.5825	0.0001	5.26E-07
272	0.00	0.000	0.008	0.2876	0.5823	0.0001	5.26E-07
273	0.02	0.000	0.021	0.2878	0.5822	0.0001	5.26E-07
274	0.00	0.000	0.009	0.2870	0.5820	0.0001	5.26E-07
275	0.00	0.000	0.008	0.2862	0.5818	0.0001	5.26E-07
276	0.00	0.000	0.009	0.2853	0.5817	0.0001	5.26E-07
277	0.00	0.000	0.009	0.2845	0.5815	0.0001	5.25E-07
278	0.00	0.000	0.008	0.2836	0.5813	0.0001	5.25E-07
279	0.00	0.000	0.008	0.2828	0.5812	0.0001	5.25E-07
280	0.00	0.000	0.008	0.2819	0.5810	0.0001	5.25E-07

281	0.00	0.000	0.009	0.2811	0.5808	0.0001	5.25E-07
282	0.00	0.000	0.008	0.2803	0.5807	0.0001	5.25E-07
283	0.00	0.000	0.008	0.2795	0.5805	0.0001	5.25E-07
284	0.00	0.000	0.008	0.2787	0.5803	0.0001	5.24E-07
285	0.00	0.000	0.008	0.2779	0.5801	0.0001	5.24E-07
286	0.00	0.000	0.006	0.2773	0.5800	0.0001	5.24E-07
287	0.00	0.000	0.003	0.2770	0.5798	0.0001	5.24E-07
288	0.00	0.000	0.000	0.2770	0.5796	0.0001	5.24E-07
289	0.37	0.201	0.027	0.2912	0.5795	0.0001	5.24E-07
290	0.05	0.000	0.021	0.2944	0.5793	0.0001	5.24E-07
291	0.00	0.000	0.006	0.2939	0.5791	0.0001	5.23E-07
292	0.00	0.000	0.007	0.2931	0.5790	0.0001	5.23E-07
293	0.00	0.000	0.007	0.2925	0.5788	0.0001	5.23E-07
294	0.00	0.000	0.007	0.2918	0.5786	0.0001	5.23E-07
295	0.00	0.000	0.006	0.2912	0.5785	0.0001	5.23E-07
296	0.00	0.000	0.006	0.2906	0.5783	0.0001	5.23E-07
297	0.00	0.000	0.006	0.2899	0.5781	0.0001	5.23E-07
298	0.00	0.000	0.006	0.2893	0.5779	0.0001	5.22E-07
299	0.00	0.000	0.006	0.2887	0.5778	0.0001	5.22E-07
300	0.00	0.000	0.006	0.2881	0.5776	0.0001	5.22E-07
301	0.50	0.325	0.026	0.3028	0.5774	0.0001	5.22E-07
302	0.63	0.490	0.026	0.3144	0.5773	0.0001	5.22E-07
303	0.00	0.000	0.064	0.3080	0.5771	0.0001	5.22E-07
304	0.00	0.000	0.068	0.3013	0.5769	0.0001	5.22E-07
305	0.00	0.000	0.071	0.2941	0.5768	0.0001	5.22E-07
306	0.00	0.000	0.075	0.2867	0.5766	0.0001	5.21E-07
307	0.00	0.000	0.082	0.2785	0.5764	0.0001	5.21E-07
308	0.00	0.000	0.012	0.2773	0.5763	0.0001	5.21E-07
309	0.50	0.288	0.058	0.2924	0.5761	0.0001	5.21E-07
310	0.00	0.000	0.049	0.2879	0.5759	0.0001	5.21E-07
311	0.00	0.000	0.044	0.2835	0.5757	0.0001	5.21E-07
312	0.00	0.000	0.058	0.2777	0.5756	0.0001	5.21E-07

313		0.00	0.000	0.005	0.2772	0.5754	0.0001	5.20E-07
314		0.00	0.000	0.001	0.2770	0.5752	0.0001	5.20E-07
315		0.81	0.592	0.052	0.2933	0.5751	0.0001	5.20E-07
316		0.37	0.191	0.067	0.3050	0.5749	0.0001	5.20E-07
317		0.00	0.000	0.034	0.3016	0.5747	0.0001	5.20E-07
318		0.00	0.000	0.051	0.2965	0.5746	0.0001	5.20E-07
319		0.00	0.000	0.057	0.2908	0.5744	0.0001	5.20E-07
320		0.00	0.000	0.063	0.2845	0.5742	0.0001	5.19E-07
321		0.00	0.000	0.059	0.2787	0.5741	0.0001	5.19E-07
322		0.00	0.000	0.014	0.2773	0.5739	0.0001	5.19E-07
323		0.00	0.000	0.002	0.2771	0.5737	0.0001	5.19E-07
324		0.02	0.000	0.016	0.2777	0.5736	0.0001	5.19E-07
325		0.05	0.000	0.018	0.2811	0.5734	0.0001	5.19E-07
326		0.00	0.000	0.005	0.2806	0.5732	0.0001	5.19E-07
327		0.00	0.000	0.012	0.2795	0.5731	0.0001	5.18E-07
328		0.00	0.000	0.007	0.2788	0.5729	0.0001	5.18E-07
329		0.00	0.000	0.006	0.2782	0.5727	0.0001	5.18E-07
330		0.00	0.000	0.004	0.2778	0.5726	0.0001	5.18E-07
331		0.02	0.000	0.016	0.2787	0.5724	0.0001	5.18E-07
332		0.00	0.000	0.002	0.2785	0.5722	0.0001	5.18E-07
333		0.00	0.000	0.004	0.2781	0.5721	0.0001	5.18E-07
334		0.00	0.000	0.003	0.2778	0.5719	0.0001	5.17E-07
335		0.00	0.000	0.003	0.2775	0.5717	0.0001	5.17E-07
336		0.05	0.000	0.019	0.2810	0.5716	0.0001	5.17E-07
337		0.00	0.000	0.002	0.2809	0.5714	0.0001	5.17E-07
338		0.32	0.155	0.032	0.2946	0.5712	0.0001	5.17E-07
339		0.00	0.000	0.007	0.2940	0.5711	0.0001	5.17E-07
340		0.00	0.000	0.010	0.2930	0.5709	0.0001	5.17E-07
341		0.00	0.000	0.010	0.2920	0.5707	0.0001	5.17E-07
342		0.00	0.000	0.010	0.2910	0.5706	0.0001	5.16E-07
343	*	0.00	0.000	0.000	0.2910	0.5704	0.0001	5.16E-07
344		0.00	0.000	0.009	0.2901	0.5702	0.0001	5.16E-07

345	*	0.00	0.000	0.009	0.2892	0.5701	0.0001	5.16E-07
346		0.00	0.000	0.009	0.2883	0.5699	0.0001	5.16E-07
347	*	0.00	0.000	0.009	0.2874	0.5697	0.0001	5.16E-07
348		0.00	0.000	0.009	0.2865	0.5696	0.0001	5.16E-07
349		0.00	0.000	0.009	0.2857	0.5694	0.0001	5.15E-07
350		0.00	0.000	0.008	0.2849	0.5692	0.0001	5.15E-07
351		0.00	0.000	0.008	0.2840	0.5691	0.0001	5.15E-07
352		0.00	0.000	0.008	0.2832	0.5689	0.0001	5.15E-07
353		0.00	0.000	0.008	0.2824	0.5687	0.0001	5.15E-07
354		0.00	0.000	0.009	0.2817	0.5686	0.0001	5.15E-07
355	*	0.31	0.000	0.031	0.2836	0.5684	0.0001	5.15E-07
356		0.16	0.084	0.000	0.2976	0.5682	0.0001	5.14E-07
357	*	0.00	0.000	0.028	0.2996	0.5681	0.0001	5.14E-07
358		0.00	0.000	0.061	0.3083	0.5679	0.0001	5.14E-07
359		0.00	0.000	0.008	0.3076	0.5677	0.0001	5.14E-07
360		0.00	0.000	0.008	0.3068	0.5676	0.0001	5.14E-07
361	*	0.09	0.000	0.035	0.3088	0.5674	0.0001	5.14E-07
362	*	0.56	0.000	0.028	0.3107	0.5673	0.0001	5.14E-07
363	*	0.02	0.000	0.000	0.3127	0.5671	0.0001	5.14E-07
364	*	0.00	0.000	0.021	0.3147	0.5669	0.0001	5.13E-07
365	*	0.00	0.000	0.010	0.3167	0.5668	0.0001	5.13E-07

* = Frozen (air or soil)

Annual Totals for Year 12

	inches	cubic feet	percent
Precipitation	28.20	102,377.7	100.00
Runoff	15.716	57,048.0	55.72
Evapotranspiration	11.991	43,527.5	42.52
Recirculation into Layer 1	0.0248	90.0	0.09
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0248	90.0	0.09
Percolation/Leakage through Layer 5	0.000197	0.7159	0.00
Average Head on Top of Layer 4	0.5978	---	---
Change in Water Storage	0.4963	1,801.5	1.76
Soil Water at Start of Year	1,407.0079	5,107,438.8	4988.82
Soil Water at End of Year	1,407.0650	5,107,646.1	4989.02
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.4392	1,594.2	1.56
Annual Water Budget Balance	-0.0248	-90.1	-0.09

Daily Output for Year 13

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.015	0.3206	0.5664	0.0001	5.13E-07
2	*		0.00	0.000	0.029	0.3226	0.5663	0.0001	5.13E-07
3	*		0.00	0.000	0.029	0.3246	0.5661	0.0001	5.13E-07
4	*		0.00	0.000	0.013	0.3265	0.5659	0.0001	5.13E-07
5	*		0.02	0.000	0.000	0.3285	0.5658	0.0001	5.12E-07
6	*	*	0.19	0.000	0.015	0.3285	0.5656	0.0001	5.12E-07
7	*	*	0.00	0.000	0.022	0.3285	0.5654	0.0001	5.12E-07
8	*	*	0.00	0.000	0.000	0.3285	0.5653	0.0001	5.12E-07
9		*	0.00	0.221	0.027	0.3323	0.5651	0.0001	5.12E-07
10		*	0.00	0.021	0.129	0.3323	0.5649	0.0001	5.12E-07
11			0.00	0.000	0.079	0.3245	0.5648	0.0001	5.12E-07
12			0.09	0.000	0.061	0.3278	0.5648	0.0001	5.12E-07
13			0.21	0.061	0.066	0.3363	0.5646	0.0001	5.11E-07
14	*		0.00	0.000	0.034	0.3333	0.5644	0.0001	5.11E-07
15	*	*	0.81	0.000	0.040	0.3333	0.5643	0.0001	5.11E-07
16		*	0.00	0.420	0.000	0.3349	0.5641	0.0001	5.11E-07
17	*	*	0.09	0.000	0.024	0.3349	0.5639	0.0001	5.11E-07
18	*	*	0.00	0.000	0.009	0.3349	0.5638	0.0001	5.11E-07
19	*	*	0.00	0.000	0.005	0.3349	0.5636	0.0001	5.11E-07
20	*	*	0.00	0.000	0.003	0.3349	0.5634	0.0001	5.10E-07
21	*	*	0.00	0.000	0.003	0.3350	0.5633	0.0001	5.10E-07
22	*	*	0.00	0.000	0.008	0.3350	0.5631	0.0001	5.10E-07
23	*	*	0.00	0.000	0.041	0.3350	0.5629	0.0001	5.10E-07
24	*	*	0.27	0.000	0.021	0.3350	0.5628	0.0001	5.10E-07

25	*	*	0.17	0.000	0.000	0.3350	0.5626	0.0001	5.10E-07
26	*	*	0.00	0.000	0.037	0.3350	0.5624	0.0001	5.10E-07
27	*	*	0.00	0.000	0.015	0.3350	0.5623	0.0001	5.10E-07
28	*	*	0.00	0.000	0.028	0.3350	0.5621	0.0001	5.09E-07
29		*	0.19	0.158	0.000	0.3350	0.5620	0.0001	5.09E-07
30	*	*	0.00	0.000	0.039	0.3350	0.5618	0.0001	5.09E-07
31		*	0.00	0.649	0.000	0.3350	0.5616	0.0001	5.09E-07
32		*	0.08	0.003	0.016	0.3413	0.5615	0.0001	5.09E-07
33			0.05	0.000	0.082	0.3382	0.5613	0.0001	5.09E-07
34			0.00	0.000	0.070	0.3313	0.5611	0.0001	5.09E-07
35			0.00	0.000	0.085	0.3228	0.5610	0.0001	5.08E-07
36	*		0.03	0.000	0.066	0.3191	0.5608	0.0001	5.08E-07
37			0.00	0.000	0.060	0.3132	0.5607	0.0001	5.08E-07
38			0.00	0.000	0.118	0.3014	0.5605	0.0001	5.08E-07
39			0.00	0.000	0.060	0.2953	0.5604	0.0001	5.08E-07
40			0.00	0.000	0.037	0.2916	0.5602	0.0001	5.08E-07
41			0.00	0.000	0.068	0.2848	0.5600	0.0001	5.08E-07
42			0.00	0.000	0.049	0.2799	0.5599	0.0001	5.08E-07
43			0.00	0.000	0.024	0.2775	0.5597	0.0001	5.07E-07
44			0.00	0.000	0.005	0.2770	0.5595	0.0001	5.07E-07
45			0.00	0.000	0.000	0.2770	0.5594	0.0001	5.07E-07
46			0.00	0.000	0.000	0.2770	0.5592	0.0001	5.07E-07
47			0.00	0.000	0.000	0.2770	0.5590	0.0001	5.07E-07
48			0.00	0.000	0.000	0.2770	0.5589	0.0001	5.07E-07
49			0.00	0.000	0.000	0.2770	0.5587	0.0001	5.07E-07
50			0.00	0.000	0.000	0.2770	0.5586	0.0001	5.06E-07
51			0.00	0.000	0.000	0.2770	0.5584	0.0001	5.06E-07
52			0.00	0.000	0.000	0.2770	0.5582	0.0001	5.06E-07
53			0.00	0.000	0.000	0.2770	0.5581	0.0001	5.06E-07
54	*		0.00	0.000	0.000	0.2770	0.5579	0.0001	5.06E-07
55			0.00	0.000	0.000	0.2770	0.5577	0.0001	5.06E-07
56			0.00	0.000	0.000	0.2770	0.5576	0.0001	5.06E-07

57		0.00	0.000	0.000	0.2770	0.5574	0.0001	5.05E-07
58		0.03	0.000	0.015	0.2786	0.5573	0.0001	5.05E-07
59		0.00	0.000	0.001	0.2785	0.5571	0.0001	5.05E-07
60		0.00	0.000	0.003	0.2782	0.5569	0.0001	5.05E-07
61		0.00	0.000	0.003	0.2779	0.5568	0.0001	5.05E-07
62		0.00	0.000	0.003	0.2777	0.5566	0.0001	5.05E-07
63		0.00	0.000	0.002	0.2775	0.5564	0.0001	5.05E-07
64		0.00	0.000	0.002	0.2772	0.5563	0.0001	5.05E-07
65		0.00	0.000	0.002	0.2770	0.5561	0.0001	5.04E-07
66		0.00	0.000	0.000	0.2770	0.5560	0.0001	5.04E-07
67		0.00	0.000	0.000	0.2770	0.5558	0.0001	5.04E-07
68		0.00	0.000	0.000	0.2770	0.5556	0.0001	5.04E-07
69		0.00	0.000	0.000	0.2770	0.5555	0.0001	5.04E-07
70		0.00	0.000	0.000	0.2770	0.5553	0.0001	5.04E-07
71	*	0.00	0.000	0.000	0.2770	0.5551	0.0001	5.04E-07
72	*	0.24	0.000	0.024	0.2790	0.5550	0.0001	5.03E-07
73	*	0.00	0.000	0.082	0.2810	0.5548	0.0001	5.03E-07
74	*	0.48	0.000	0.020	0.2829	0.5547	0.0001	5.03E-07
75	*	0.00	0.000	0.014	0.2849	0.5545	0.0001	5.03E-07
76	*	0.00	0.000	0.012	0.2869	0.5543	0.0001	5.03E-07
77	*	0.00	0.000	0.018	0.2888	0.5542	0.0001	5.03E-07
78		0.00	0.212	0.089	0.3016	0.5540	0.0001	5.03E-07
79	*	0.40	0.000	0.036	0.3036	0.5538	0.0001	5.03E-07
80	*	0.04	0.000	0.018	0.3055	0.5537	0.0001	5.02E-07
81		0.04	0.160	0.102	0.3183	0.5535	0.0001	5.02E-07
82		0.00	0.000	0.008	0.3175	0.5534	0.0001	5.02E-07
83		0.00	0.000	0.008	0.3167	0.5532	0.0001	5.02E-07
84		1.09	0.927	0.027	0.3299	0.5530	0.0001	5.02E-07
85		0.00	0.000	0.057	0.3242	0.5529	0.0001	5.02E-07
86		0.00	0.000	0.134	0.3108	0.5527	0.0001	5.02E-07
87		0.00	0.000	0.079	0.3029	0.5525	0.0001	5.01E-07
88		0.00	0.000	0.116	0.2913	0.5524	0.0001	5.01E-07

89		0.00	0.000	0.119	0.2794	0.5522	0.0001	5.01E-07
90		0.00	0.000	0.022	0.2772	0.5521	0.0001	5.01E-07
91		0.00	0.000	0.002	0.2770	0.5519	0.0001	5.01E-07
92		0.00	0.000	0.000	0.2770	0.5517	0.0001	5.01E-07
93		0.00	0.000	0.000	0.2770	0.5516	0.0001	5.01E-07
94		0.00	0.000	0.000	0.2770	0.5514	0.0001	5.01E-07
95		0.02	0.000	0.012	0.2774	0.5513	0.0001	5.00E-07
96	*	0.00	0.000	0.000	0.2774	0.5511	0.0001	5.00E-07
97		0.00	0.000	0.002	0.2772	0.5509	0.0001	5.00E-07
98	*	0.00	0.000	0.001	0.2770	0.5508	0.0001	5.00E-07
99		0.00	0.000	0.000	0.2770	0.5506	0.0001	5.00E-07
100		0.00	0.000	0.000	0.2770	0.5505	0.0001	5.00E-07
101		0.03	0.000	0.016	0.2789	0.5503	0.0001	5.00E-07
102		0.21	0.057	0.024	0.2918	0.5501	0.0001	4.99E-07
103		0.03	0.000	0.020	0.2923	0.5500	0.0001	4.99E-07
104		0.00	0.000	0.012	0.2912	0.5498	0.0001	4.99E-07
105		0.00	0.000	0.012	0.2900	0.5497	0.0001	4.99E-07
106		0.45	0.281	0.033	0.3041	0.5495	0.0001	4.99E-07
107		0.00	0.000	0.011	0.3030	0.5493	0.0001	4.99E-07
108		0.02	0.000	0.021	0.3026	0.5492	0.0001	4.99E-07
109		0.00	0.000	0.010	0.3016	0.5490	0.0001	4.99E-07
110		0.00	0.000	0.010	0.3006	0.5489	0.0001	4.98E-07
111		0.10	0.000	0.026	0.3081	0.5487	0.0001	4.98E-07
112		0.00	0.000	0.012	0.3070	0.5485	0.0001	4.98E-07
113		0.00	0.000	0.011	0.3059	0.5484	0.0001	4.98E-07
114		0.00	0.000	0.010	0.3049	0.5482	0.0001	4.98E-07
115		0.00	0.000	0.009	0.3040	0.5480	0.0001	4.98E-07
116		0.00	0.000	0.009	0.3031	0.5479	0.0001	4.98E-07
117		0.01	0.000	0.018	0.3026	0.5477	0.0001	4.97E-07
118		0.21	0.057	0.028	0.3153	0.5476	0.0001	4.97E-07
119		1.04	0.753	0.167	0.3268	0.5474	0.0001	4.97E-07
120		0.00	0.000	0.220	0.3048	0.5472	0.0001	4.97E-07

121	0.00	0.000	0.108	0.2940	0.5471	0.0001	4.97E-07
122	0.00	0.000	0.050	0.2890	0.5469	0.0001	4.97E-07
123	0.00	0.000	0.039	0.2851	0.5468	0.0001	4.97E-07
124	0.00	0.000	0.033	0.2817	0.5466	0.0001	4.97E-07
125	0.00	0.000	0.029	0.2788	0.5464	0.0001	4.96E-07
126	0.17	0.021	0.043	0.2898	0.5463	0.0001	4.96E-07
127	0.01	0.000	0.024	0.2888	0.5461	0.0001	4.96E-07
128	0.00	0.000	0.017	0.2870	0.5460	0.0001	4.96E-07
129	0.00	0.000	0.016	0.2855	0.5458	0.0001	4.96E-07
130	0.02	0.000	0.025	0.2845	0.5456	0.0001	4.96E-07
131	2.07	1.883	0.038	0.2990	0.5455	0.0001	4.96E-07
132	0.48	0.205	0.238	0.3030	0.5453	0.0001	4.95E-07
133	0.00	0.000	0.053	0.2980	0.5452	0.0001	4.95E-07
134	0.19	0.040	0.075	0.3051	0.5450	0.0001	4.95E-07
135	0.42	0.184	0.227	0.3062	0.5449	0.0001	4.95E-07
136	0.00	0.000	0.173	0.2888	0.5447	0.0001	4.95E-07
137	0.00	0.000	0.079	0.2810	0.5445	0.0001	4.95E-07
138	0.04	0.000	0.062	0.2787	0.5444	0.0001	4.95E-07
139	0.00	0.000	0.011	0.2775	0.5442	0.0001	4.95E-07
140	0.00	0.000	0.004	0.2772	0.5441	0.0001	4.94E-07
141	0.00	0.000	0.001	0.2770	0.5439	0.0001	4.94E-07
142	0.01	0.000	0.012	0.2771	0.5437	0.0001	4.94E-07
143	0.01	0.000	0.007	0.2770	0.5436	0.0001	4.94E-07
144	0.25	0.101	0.029	0.2895	0.5434	0.0001	4.94E-07
145	0.08	0.000	0.028	0.2942	0.5433	0.0001	4.94E-07
146	0.00	0.000	0.012	0.2930	0.5431	0.0001	4.94E-07
147	0.00	0.000	0.018	0.2912	0.5429	0.0001	4.93E-07
148	0.00	0.000	0.017	0.2895	0.5428	0.0001	4.93E-07
149	0.00	0.000	0.016	0.2880	0.5426	0.0001	4.93E-07
150	0.31	0.127	0.037	0.3025	0.5425	0.0001	4.93E-07
151	0.01	0.000	0.024	0.3014	0.5423	0.0001	4.93E-07
152	1.45	1.275	0.037	0.3155	0.5422	0.0001	4.93E-07

153	0.16	0.020	0.077	0.3218	0.5420	0.0001	4.93E-07
154	0.00	0.000	0.130	0.3089	0.5418	0.0001	4.93E-07
155	0.00	0.000	0.139	0.2951	0.5417	0.0001	4.92E-07
156	0.00	0.000	0.163	0.2788	0.5415	0.0001	4.92E-07
157	0.52	0.265	0.112	0.2928	0.5414	0.0001	4.92E-07
158	0.00	0.000	0.068	0.2860	0.5412	0.0001	4.92E-07
159	0.00	0.000	0.069	0.2791	0.5410	0.0001	4.92E-07
160	0.00	0.000	0.018	0.2773	0.5409	0.0001	4.92E-07
161	0.00	0.000	0.002	0.2771	0.5407	0.0001	4.92E-07
162	0.00	0.000	0.001	0.2770	0.5406	0.0001	4.92E-07
163	0.12	0.000	0.021	0.2866	0.5404	0.0001	4.91E-07
164	0.33	0.145	0.049	0.2998	0.5403	0.0001	4.91E-07
165	0.00	0.000	0.014	0.2984	0.5401	0.0001	4.91E-07
166	0.01	0.000	0.027	0.2968	0.5399	0.0001	4.91E-07
167	0.00	0.000	0.021	0.2947	0.5398	0.0001	4.91E-07
168	0.00	0.000	0.021	0.2927	0.5396	0.0001	4.91E-07
169	0.00	0.000	0.021	0.2906	0.5395	0.0001	4.91E-07
170	0.25	0.088	0.037	0.3029	0.5393	0.0001	4.90E-07
171	0.00	0.000	0.168	0.2862	0.5392	0.0001	4.90E-07
172	0.00	0.000	0.018	0.2844	0.5390	0.0001	4.90E-07
173	0.00	0.000	0.019	0.2825	0.5388	0.0001	4.90E-07
174	0.00	0.000	0.019	0.2806	0.5387	0.0001	4.90E-07
175	0.00	0.000	0.024	0.2782	0.5385	0.0001	4.90E-07
176	0.00	0.000	0.010	0.2772	0.5384	0.0001	4.90E-07
177	0.17	0.015	0.029	0.2896	0.5382	0.0001	4.90E-07
178	0.00	0.000	0.010	0.2886	0.5381	0.0001	4.89E-07
179	0.77	0.594	0.036	0.3028	0.5379	0.0001	4.89E-07
180	0.27	0.110	0.087	0.3099	0.5377	0.0001	4.89E-07
181	0.16	0.020	0.089	0.3153	0.5376	0.0001	4.89E-07
182	0.57	0.314	0.185	0.3223	0.5374	0.0001	4.89E-07
183	0.00	0.000	0.074	0.3149	0.5373	0.0001	4.89E-07
184	0.00	0.000	0.089	0.3060	0.5371	0.0001	4.89E-07

185	0.00	0.000	0.237	0.2823	0.5370	0.0001	4.88E-07
186	0.00	0.000	0.046	0.2777	0.5368	0.0001	4.88E-07
187	0.00	0.000	0.005	0.2772	0.5366	0.0001	4.88E-07
188	0.65	0.424	0.064	0.2930	0.5365	0.0001	4.88E-07
189	0.19	0.051	0.063	0.3010	0.5363	0.0001	4.88E-07
190	0.01	0.000	0.113	0.2911	0.5362	0.0001	4.88E-07
191	0.18	0.016	0.094	0.2978	0.5360	0.0001	4.88E-07
192	0.00	0.000	0.152	0.2826	0.5359	0.0001	4.88E-07
193	0.00	0.000	0.037	0.2789	0.5357	0.0001	4.87E-07
194	0.00	0.000	0.014	0.2775	0.5355	0.0001	4.87E-07
195	0.00	0.000	0.004	0.2771	0.5354	0.0001	4.87E-07
196	0.00	0.000	0.001	0.2770	0.5352	0.0001	4.87E-07
197	0.12	0.000	0.021	0.2866	0.5351	0.0001	4.87E-07
198	0.00	0.000	0.014	0.2852	0.5349	0.0001	4.87E-07
199	0.00	0.000	0.018	0.2834	0.5348	0.0001	4.87E-07
200	0.35	0.163	0.050	0.2972	0.5346	0.0001	4.87E-07
201	0.37	0.216	0.048	0.3081	0.5344	0.0001	4.86E-07
202	0.00	0.000	0.156	0.2925	0.5343	0.0001	4.86E-07
203	0.00	0.000	0.026	0.2898	0.5341	0.0001	4.86E-07
204	0.00	0.000	0.027	0.2871	0.5340	0.0001	4.86E-07
205	0.00	0.000	0.022	0.2850	0.5338	0.0001	4.86E-07
206	0.00	0.000	0.018	0.2832	0.5337	0.0001	4.86E-07
207	0.00	0.000	0.025	0.2807	0.5335	0.0001	4.86E-07
208	0.25	0.097	0.039	0.2922	0.5334	0.0001	4.86E-07
209	0.18	0.046	0.044	0.3014	0.5332	0.0001	4.85E-07
210	0.00	0.000	0.129	0.2885	0.5330	0.0001	4.85E-07
211	0.00	0.000	0.020	0.2865	0.5329	0.0001	4.85E-07
212	0.00	0.000	0.017	0.2849	0.5327	0.0001	4.85E-07
213	0.00	0.000	0.022	0.2826	0.5326	0.0001	4.85E-07
214	0.00	0.000	0.019	0.2808	0.5324	0.0001	4.85E-07
215	0.00	0.000	0.021	0.2787	0.5323	0.0001	4.85E-07
216	0.00	0.000	0.014	0.2773	0.5321	0.0001	4.84E-07

217	0.00	0.000	0.003	0.2771	0.5319	0.0001	4.84E-07
218	0.00	0.000	0.001	0.2770	0.5318	0.0001	4.84E-07
219	0.00	0.000	0.000	0.2770	0.5316	0.0001	4.84E-07
220	0.00	0.000	0.000	0.2770	0.5315	0.0001	4.84E-07
221	0.03	0.000	0.016	0.2779	0.5313	0.0001	4.84E-07
222	0.07	0.000	0.019	0.2829	0.5312	0.0001	4.84E-07
223	0.00	0.000	0.009	0.2820	0.5310	0.0001	4.84E-07
224	0.00	0.000	0.013	0.2807	0.5309	0.0001	4.83E-07
225	0.00	0.000	0.013	0.2794	0.5307	0.0001	4.83E-07
226	0.00	0.000	0.009	0.2785	0.5306	0.0001	4.83E-07
227	0.00	0.000	0.004	0.2781	0.5304	0.0001	4.83E-07
228	0.00	0.000	0.005	0.2776	0.5302	0.0001	4.83E-07
229	0.00	0.000	0.005	0.2771	0.5301	0.0001	4.83E-07
230	0.00	0.000	0.001	0.2770	0.5299	0.0001	4.83E-07
231	0.12	0.000	0.021	0.2872	0.5298	0.0001	4.83E-07
232	0.17	0.021	0.026	0.2997	0.5296	0.0001	4.82E-07
233	0.00	0.000	0.008	0.2990	0.5295	0.0001	4.82E-07
234	0.00	0.000	0.012	0.2978	0.5293	0.0001	4.82E-07
235	0.04	0.000	0.030	0.2991	0.5292	0.0001	4.82E-07
236	1.44	1.282	0.034	0.3113	0.5290	0.0001	4.82E-07
237	0.00	0.000	0.162	0.2953	0.5289	0.0001	4.82E-07
238	0.07	0.000	0.145	0.2880	0.5287	0.0001	4.82E-07
239	0.00	0.000	0.071	0.2809	0.5285	0.0001	4.82E-07
240	0.00	0.000	0.029	0.2780	0.5284	0.0001	4.81E-07
241	0.00	0.000	0.008	0.2772	0.5282	0.0001	4.81E-07
242	0.00	0.000	0.002	0.2770	0.5281	0.0001	4.81E-07
243	0.10	0.000	0.023	0.2844	0.5279	0.0001	4.81E-07
244	0.00	0.000	0.020	0.2824	0.5278	0.0001	4.81E-07
245	0.00	0.000	0.024	0.2800	0.5276	0.0001	4.81E-07
246	1.32	1.129	0.062	0.2934	0.5275	0.0001	4.81E-07
247	0.02	0.000	0.060	0.2890	0.5273	0.0001	4.80E-07
248	0.00	0.000	0.079	0.2811	0.5272	0.0001	4.80E-07

249	0.00	0.000	0.033	0.2778	0.5270	0.0001	4.80E-07
250	0.00	0.000	0.006	0.2772	0.5269	0.0001	4.80E-07
251	0.00	0.000	0.001	0.2771	0.5267	0.0001	4.80E-07
252	0.00	0.000	0.000	0.2770	0.5265	0.0001	4.80E-07
253	0.00	0.000	0.000	0.2770	0.5264	0.0001	4.80E-07
254	0.01	0.000	0.008	0.2770	0.5262	0.0001	4.80E-07
255	0.05	0.000	0.021	0.2801	0.5261	0.0001	4.79E-07
256	0.00	0.000	0.003	0.2798	0.5259	0.0001	4.79E-07
257	0.00	0.000	0.009	0.2789	0.5258	0.0001	4.79E-07
258	0.33	0.145	0.050	0.2928	0.5256	0.0001	4.79E-07
259	0.00	0.000	0.016	0.2913	0.5255	0.0001	4.79E-07
260	0.00	0.000	0.018	0.2895	0.5253	0.0001	4.79E-07
261	0.00	0.000	0.018	0.2877	0.5252	0.0001	4.79E-07
262	0.00	0.000	0.025	0.2852	0.5250	0.0001	4.79E-07
263	0.00	0.000	0.016	0.2836	0.5249	0.0001	4.78E-07
264	0.28	0.114	0.042	0.2959	0.5247	0.0001	4.78E-07
265	0.00	0.000	0.021	0.2938	0.5245	0.0001	4.78E-07
266	0.00	0.000	0.020	0.2919	0.5244	0.0001	4.78E-07
267	0.00	0.000	0.014	0.2904	0.5242	0.0001	4.78E-07
268	0.08	0.000	0.034	0.2945	0.5241	0.0001	4.78E-07
269	0.00	0.000	0.020	0.2925	0.5239	0.0001	4.78E-07
270	0.00	0.000	0.017	0.2908	0.5238	0.0001	4.78E-07
271	0.03	0.000	0.028	0.2914	0.5236	0.0001	4.77E-07
272	1.23	1.066	0.036	0.3039	0.5235	0.0001	4.77E-07
273	0.78	0.562	0.107	0.3152	0.5233	0.0001	4.77E-07
274	0.00	0.000	0.134	0.3018	0.5232	0.0001	4.77E-07
275	0.00	0.000	0.118	0.2900	0.5230	0.0001	4.77E-07
276	0.00	0.000	0.115	0.2785	0.5229	0.0001	4.77E-07
277	0.00	0.000	0.011	0.2774	0.5227	0.0001	4.77E-07
278	0.64	0.345	0.154	0.2913	0.5226	0.0001	4.77E-07
279	0.00	0.000	0.033	0.2879	0.5224	0.0001	4.76E-07
280	0.00	0.000	0.060	0.2819	0.5223	0.0001	4.76E-07

281		0.00	0.000	0.037	0.2782	0.5221	0.0001	4.76E-07
282		0.00	0.000	0.010	0.2773	0.5220	0.0001	4.76E-07
283		0.00	0.000	0.002	0.2771	0.5218	0.0001	4.76E-07
284	*	0.00	0.000	0.001	0.2770	0.5216	0.0001	4.76E-07
285	*	0.05	0.000	0.050	0.2770	0.5215	0.0001	4.76E-07
286		0.02	0.000	0.016	0.2775	0.5213	0.0001	4.75E-07
287	*	0.00	0.000	0.003	0.2773	0.5212	0.0001	4.75E-07
288		0.00	0.000	0.002	0.2771	0.5210	0.0001	4.75E-07
289		0.00	0.000	0.001	0.2770	0.5209	0.0001	4.75E-07
290		0.00	0.000	0.000	0.2770	0.5207	0.0001	4.75E-07
291		0.00	0.000	0.000	0.2770	0.5206	0.0001	4.75E-07
292		0.64	0.433	0.041	0.2933	0.5204	0.0001	4.75E-07
293		0.00	0.000	0.034	0.2898	0.5203	0.0001	4.75E-07
294		0.00	0.000	0.015	0.2883	0.5201	0.0001	4.74E-07
295		0.00	0.000	0.015	0.2869	0.5200	0.0001	4.74E-07
296		0.00	0.000	0.013	0.2855	0.5198	0.0001	4.74E-07
297		0.00	0.000	0.013	0.2842	0.5197	0.0001	4.74E-07
298		0.13	0.000	0.031	0.2936	0.5195	0.0001	4.74E-07
299		0.00	0.000	0.017	0.2921	0.5194	0.0001	4.74E-07
300		0.00	0.000	0.014	0.2907	0.5192	0.0001	4.74E-07
301		0.00	0.000	0.013	0.2894	0.5191	0.0001	4.74E-07
302		0.00	0.000	0.011	0.2883	0.5189	0.0001	4.73E-07
303		0.00	0.000	0.011	0.2872	0.5188	0.0001	4.73E-07
304		0.00	0.000	0.011	0.2861	0.5186	0.0001	4.73E-07
305		0.74	0.557	0.034	0.3011	0.5185	0.0001	4.73E-07
306		0.00	0.000	0.057	0.2954	0.5183	0.0001	4.73E-07
307		0.02	0.000	0.051	0.2922	0.5181	0.0001	4.73E-07
308		0.00	0.000	0.060	0.2863	0.5180	0.0001	4.73E-07
309		0.00	0.000	0.072	0.2790	0.5178	0.0001	4.73E-07
310		0.00	0.000	0.019	0.2773	0.5177	0.0001	4.72E-07
311		0.01	0.000	0.014	0.2771	0.5175	0.0001	4.72E-07
312		0.00	0.000	0.001	0.2770	0.5174	0.0001	4.72E-07

313		0.00	0.000	0.000	0.2770	0.5172	0.0001	4.72E-07
314		0.03	0.000	0.018	0.2783	0.5171	0.0001	4.72E-07
315		0.02	0.000	0.015	0.2788	0.5169	0.0001	4.72E-07
316		0.00	0.000	0.002	0.2786	0.5168	0.0001	4.72E-07
317		0.00	0.000	0.004	0.2782	0.5166	0.0001	4.72E-07
318	*	0.00	0.000	0.000	0.2782	0.5165	0.0001	4.71E-07
319		0.00	0.000	0.004	0.2778	0.5163	0.0001	4.71E-07
320		0.00	0.000	0.004	0.2774	0.5162	0.0001	4.71E-07
321		0.00	0.000	0.003	0.2771	0.5160	0.0001	4.71E-07
322		0.24	0.082	0.027	0.2898	0.5159	0.0001	4.71E-07
323		0.48	0.322	0.037	0.3014	0.5157	0.0001	4.71E-07
324		0.00	0.000	0.027	0.2987	0.5156	0.0001	4.71E-07
325		0.00	0.000	0.060	0.2928	0.5154	0.0001	4.71E-07
326		0.00	0.000	0.036	0.2892	0.5153	0.0001	4.70E-07
327		0.00	0.000	0.036	0.2855	0.5151	0.0001	4.70E-07
328		0.00	0.000	0.028	0.2828	0.5150	0.0001	4.70E-07
329		0.00	0.000	0.023	0.2805	0.5148	0.0001	4.70E-07
330		0.00	0.000	0.025	0.2780	0.5147	0.0001	4.70E-07
331		0.01	0.000	0.020	0.2774	0.5145	0.0001	4.70E-07
332		0.07	0.000	0.021	0.2820	0.5144	0.0001	4.70E-07
333		0.04	0.000	0.027	0.2833	0.5142	0.0001	4.70E-07
334		0.00	0.000	0.012	0.2821	0.5141	0.0001	4.69E-07
335		0.00	0.000	0.010	0.2811	0.5139	0.0001	4.69E-07
336		0.00	0.000	0.013	0.2799	0.5138	0.0001	4.69E-07
337		0.00	0.000	0.012	0.2786	0.5136	0.0001	4.69E-07
338		0.28	0.107	0.037	0.2922	0.5135	0.0001	4.69E-07
339		0.08	0.000	0.029	0.2976	0.5133	0.0001	4.69E-07
340		0.00	0.000	0.008	0.2968	0.5132	0.0001	4.69E-07
341		0.00	0.000	0.011	0.2957	0.5130	0.0001	4.69E-07
342		0.00	0.000	0.011	0.2947	0.5129	0.0001	4.68E-07
343		0.00	0.000	0.010	0.2936	0.5127	0.0001	4.68E-07
344		0.04	0.000	0.027	0.2953	0.5126	0.0001	4.68E-07

345		0.10	0.000	0.030	0.3026	0.5124	0.0001	4.68E-07
346		0.00	0.000	0.012	0.3014	0.5123	0.0001	4.68E-07
347		0.00	0.000	0.010	0.3004	0.5121	0.0001	4.68E-07
348		0.00	0.000	0.009	0.2994	0.5120	0.0001	4.68E-07
349		0.00	0.000	0.009	0.2985	0.5118	0.0001	4.68E-07
350		0.00	0.000	0.009	0.2977	0.5117	0.0001	4.67E-07
351		0.02	0.000	0.020	0.2974	0.5115	0.0001	4.67E-07
352		0.00	0.000	0.010	0.2966	0.5114	0.0001	4.67E-07
353	*	0.00	0.000	0.010	0.2956	0.5112	0.0001	4.67E-07
354	*	0.00	0.000	0.000	0.2956	0.5111	0.0001	4.67E-07
355	*	0.00	0.000	0.000	0.2956	0.5109	0.0001	4.67E-07
356	*	0.00	0.000	0.000	0.2956	0.5108	0.0001	4.67E-07
357	*	0.00	0.000	0.000	0.2956	0.5106	0.0001	4.67E-07
358	*	0.00	0.000	0.000	0.2956	0.5105	0.0001	4.66E-07
359	*	0.00	0.000	0.000	0.2956	0.5103	0.0001	4.66E-07
360	*	0.14	0.000	0.045	0.2976	0.5102	0.0001	4.66E-07
361	*	0.20	0.000	0.021	0.2996	0.5100	0.0001	4.66E-07
362		0.08	0.147	0.039	0.3123	0.5099	0.0001	4.66E-07
363		0.01	0.000	0.056	0.3075	0.5097	0.0001	4.66E-07
364		0.00	0.000	0.034	0.3044	0.5096	0.0001	4.66E-07
365	*	0.17	0.000	0.030	0.3064	0.5094	0.0001	4.66E-07

* = Frozen (air or soil)

Annual Totals for Year 13			
	inches	cubic feet	percent
Precipitation	28.23	102,472.1	100.00
Runoff	16.712	60,665.6	59.20
Evapotranspiration	11.976	43,472.6	42.42
Recirculation into Layer 1	0.0222	80.7	0.08
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0222	80.7	0.08
Percolation/Leakage through Layer 5	0.000178	0.6478	0.00
Average Head on Top of Layer 4	0.5375	---	---
Change in Water Storage	-0.4592	-1,666.7	-1.63
Soil Water at Start of Year	1,407.0650	5,107,646.1	4984.43
Soil Water at End of Year	1,406.9235	5,107,132.3	4983.92
Snow Water at Start of Year	0.4392	1,594.2	1.56
Snow Water at End of Year	0.1216	441.2	0.43
Annual Water Budget Balance	-0.0223	-80.8	-0.08

Daily Output for Year 14

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.36	0.000	0.015	0.3083	0.5093	0.0001	4.65E-07
2			0.16	0.452	0.000	0.3211	0.5091	0.0001	4.65E-07
3	*		0.03	0.000	0.030	0.3230	0.5090	0.0001	4.65E-07
4	*		0.14	0.000	0.019	0.3250	0.5088	0.0001	4.65E-07
5			0.00	0.000	0.058	0.3300	0.5087	0.0001	4.65E-07
6			0.02	0.000	0.042	0.3277	0.5086	0.0001	4.65E-07
7			0.00	0.000	0.066	0.3211	0.5085	0.0001	4.65E-07
8			0.25	0.082	0.116	0.3262	0.5084	0.0001	4.65E-07
9			0.00	0.000	0.065	0.3198	0.5083	0.0001	4.65E-07
10	*		0.00	0.000	0.031	0.3167	0.5081	0.0001	4.64E-07
11	*		0.00	0.000	0.000	0.3167	0.5080	0.0001	4.64E-07
12			0.00	0.000	0.051	0.3116	0.5078	0.0001	4.64E-07
13			0.00	0.000	0.061	0.3054	0.5077	0.0001	4.64E-07
14			0.00	0.000	0.052	0.3002	0.5075	0.0001	4.64E-07
15			0.20	0.049	0.104	0.3050	0.5074	0.0001	4.64E-07
16			0.03	0.000	0.094	0.2988	0.5072	0.0001	4.64E-07
17			0.00	0.000	0.170	0.2818	0.5071	0.0001	4.64E-07
18			0.00	0.000	0.039	0.2779	0.5069	0.0001	4.63E-07
19			0.00	0.000	0.008	0.2771	0.5068	0.0001	4.63E-07
20			0.00	0.000	0.001	0.2770	0.5066	0.0001	4.63E-07
21			0.00	0.000	0.000	0.2770	0.5065	0.0001	4.63E-07
22			0.00	0.000	0.000	0.2770	0.5063	0.0001	4.63E-07
23			0.00	0.000	0.000	0.2770	0.5062	0.0001	4.63E-07
24			0.00	0.000	0.000	0.2770	0.5060	0.0001	4.63E-07

25	*	0.21	0.000	0.054	0.2790	0.5059	0.0001	4.63E-07
26		0.00	0.000	0.083	0.2842	0.5057	0.0001	4.62E-07
27	*	0.04	0.000	0.050	0.2834	0.5056	0.0001	4.62E-07
28		0.15	0.004	0.028	0.2953	0.5054	0.0001	4.62E-07
29		0.00	0.000	0.009	0.2944	0.5053	0.0001	4.62E-07
30		0.00	0.000	0.014	0.2930	0.5051	0.0001	4.62E-07
31		0.00	0.000	0.013	0.2917	0.5050	0.0001	4.62E-07
32		0.00	0.000	0.012	0.2905	0.5048	0.0001	4.62E-07
33		0.00	0.000	0.012	0.2893	0.5047	0.0001	4.62E-07
34		0.00	0.000	0.011	0.2882	0.5046	0.0001	4.61E-07
35		0.89	0.708	0.035	0.3029	0.5044	0.0001	4.61E-07
36		0.07	0.000	0.092	0.3009	0.5043	0.0001	4.61E-07
37		0.00	0.000	0.047	0.2962	0.5041	0.0001	4.61E-07
38		0.26	0.090	0.110	0.3026	0.5040	0.0001	4.61E-07
39		0.00	0.000	0.039	0.2987	0.5038	0.0001	4.61E-07
40		0.00	0.000	0.027	0.2960	0.5037	0.0001	4.61E-07
41		0.00	0.000	0.071	0.2889	0.5035	0.0001	4.61E-07
42		0.00	0.000	0.033	0.2856	0.5034	0.0001	4.60E-07
43		0.00	0.000	0.033	0.2823	0.5032	0.0001	4.60E-07
44		0.00	0.000	0.031	0.2792	0.5031	0.0001	4.60E-07
45		0.00	0.000	0.019	0.2773	0.5029	0.0001	4.60E-07
46		0.00	0.000	0.003	0.2771	0.5028	0.0001	4.60E-07
47		0.00	0.000	0.001	0.2770	0.5026	0.0001	4.60E-07
48		0.12	0.000	0.021	0.2874	0.5025	0.0001	4.60E-07
49		0.00	0.000	0.010	0.2864	0.5023	0.0001	4.60E-07
50		0.00	0.000	0.012	0.2853	0.5022	0.0001	4.60E-07
51		0.00	0.000	0.014	0.2839	0.5021	0.0001	4.59E-07
52	*	0.00	0.000	0.000	0.2839	0.5019	0.0001	4.59E-07
53		0.00	0.000	0.013	0.2826	0.5018	0.0001	4.59E-07
54		0.18	0.042	0.031	0.2937	0.5016	0.0001	4.59E-07
55		0.00	0.000	0.009	0.2928	0.5015	0.0001	4.59E-07
56	*	0.05	0.000	0.051	0.2928	0.5013	0.0001	4.59E-07

57		0.00	0.000	0.012	0.2916	0.5012	0.0001	4.59E-07
58		0.00	0.000	0.012	0.2904	0.5010	0.0001	4.59E-07
59		0.04	0.000	0.027	0.2913	0.5009	0.0001	4.58E-07
60		0.00	0.000	0.012	0.2902	0.5007	0.0001	4.58E-07
61	*	0.44	0.000	0.033	0.2921	0.5006	0.0001	4.58E-07
62	*	0.03	0.000	0.032	0.2941	0.5004	0.0001	4.58E-07
63		0.00	0.131	0.107	0.3069	0.5003	0.0001	4.58E-07
64		0.17	0.033	0.031	0.3173	0.5002	0.0001	4.58E-07
65		0.00	0.000	0.071	0.3102	0.5000	0.0001	4.58E-07
66		0.00	0.000	0.069	0.3034	0.4999	0.0001	4.58E-07
67		0.22	0.064	0.079	0.3113	0.4997	0.0001	4.57E-07
68		0.00	0.000	0.055	0.3058	0.4996	0.0001	4.57E-07
69	*	0.00	0.000	0.033	0.3026	0.4994	0.0001	4.57E-07
70	*	0.00	0.000	0.000	0.3026	0.4993	0.0001	4.57E-07
71	*	0.06	0.000	0.031	0.3046	0.4991	0.0001	4.57E-07
72	*	0.34	0.000	0.010	0.3065	0.4990	0.0001	4.57E-07
73	*	0.11	0.000	0.020	0.3085	0.4988	0.0001	4.57E-07
74		0.00	0.239	0.025	0.3213	0.4987	0.0001	4.57E-07
75		0.28	0.138	0.112	0.3248	0.4985	0.0001	4.56E-07
76		0.00	0.000	0.041	0.3207	0.4984	0.0001	4.56E-07
77		0.51	0.290	0.084	0.3347	0.4983	0.0001	4.56E-07
78		0.48	0.315	0.115	0.3394	0.4981	0.0001	4.56E-07
79		0.00	0.000	0.168	0.3227	0.4980	0.0001	4.56E-07
80		0.00	0.000	0.172	0.3055	0.4978	0.0001	4.56E-07
81		0.00	0.000	0.159	0.2897	0.4977	0.0001	4.56E-07
82		0.00	0.000	0.109	0.2788	0.4975	0.0001	4.56E-07
83		0.02	0.000	0.030	0.2778	0.4974	0.0001	4.55E-07
84		0.00	0.000	0.007	0.2772	0.4972	0.0001	4.55E-07
85		0.00	0.000	0.001	0.2771	0.4971	0.0001	4.55E-07
86		0.00	0.000	0.000	0.2770	0.4969	0.0001	4.55E-07
87		0.00	0.000	0.000	0.2770	0.4968	0.0001	4.55E-07
88		0.00	0.000	0.000	0.2770	0.4967	0.0001	4.55E-07

89		0.02	0.000	0.013	0.2774	0.4965	0.0001	4.55E-07
90		0.52	0.321	0.041	0.2933	0.4964	0.0001	4.55E-07
91	*	0.20	0.000	0.084	0.2953	0.4962	0.0001	4.55E-07
92		0.00	0.000	0.110	0.2941	0.4961	0.0001	4.54E-07
93		0.68	0.505	0.039	0.3075	0.4959	0.0001	4.54E-07
94		0.00	0.000	0.148	0.2930	0.4958	0.0001	4.54E-07
95		0.00	0.000	0.137	0.2793	0.4956	0.0001	4.54E-07
96		0.00	0.000	0.021	0.2776	0.4955	0.0001	4.54E-07
97		0.00	0.000	0.006	0.2771	0.4954	0.0001	4.54E-07
98		0.13	0.000	0.023	0.2878	0.4952	0.0001	4.54E-07
99		0.18	0.032	0.034	0.2996	0.4951	0.0001	4.54E-07
100		0.02	0.000	0.025	0.2990	0.4949	0.0001	4.53E-07
101		0.06	0.000	0.037	0.3015	0.4948	0.0001	4.53E-07
102		0.30	0.127	0.045	0.3141	0.4946	0.0001	4.53E-07
103		0.36	0.169	0.159	0.3174	0.4945	0.0001	4.53E-07
104		0.00	0.000	0.164	0.3010	0.4943	0.0001	4.53E-07
105		0.00	0.000	0.108	0.2902	0.4942	0.0001	4.53E-07
106		0.00	0.000	0.045	0.2857	0.4940	0.0001	4.53E-07
107		1.46	1.234	0.062	0.3016	0.4939	0.0001	4.53E-07
108		0.00	0.000	0.151	0.2866	0.4938	0.0001	4.52E-07
109		0.38	0.136	0.264	0.2850	0.4936	0.0001	4.52E-07
110		0.20	0.055	0.074	0.2921	0.4935	0.0001	4.52E-07
111		0.09	0.000	0.149	0.2857	0.4933	0.0001	4.52E-07
112		0.29	0.092	0.139	0.2917	0.4932	0.0001	4.52E-07
113		0.52	0.331	0.074	0.3032	0.4930	0.0001	4.52E-07
114		0.04	0.000	0.085	0.2986	0.4929	0.0001	4.52E-07
115		1.13	0.763	0.238	0.3120	0.4927	0.0001	4.52E-07
116		0.29	0.107	0.277	0.3030	0.4926	0.0001	4.51E-07
117		0.03	0.000	0.160	0.2899	0.4925	0.0001	4.51E-07
118		0.00	0.000	0.072	0.2827	0.4923	0.0001	4.51E-07
119		0.00	0.000	0.044	0.2783	0.4922	0.0001	4.51E-07
120	*	0.92	0.000	0.060	0.2803	0.4920	0.0001	4.51E-07

121	0.00	0.655	0.000	0.2946	0.4919	0.0001	4.51E-07
122	0.00	0.000	0.142	0.2841	0.4917	0.0001	4.51E-07
123	0.00	0.000	0.044	0.2797	0.4916	0.0001	4.51E-07
124	0.00	0.000	0.021	0.2777	0.4915	0.0001	4.51E-07
125	0.16	0.000	0.050	0.2884	0.4913	0.0001	4.50E-07
126	0.00	0.000	0.025	0.2860	0.4912	0.0001	4.50E-07
127	0.00	0.000	0.027	0.2833	0.4911	0.0001	4.50E-07
128	0.00	0.000	0.025	0.2808	0.4909	0.0001	4.50E-07
129	0.00	0.000	0.026	0.2786	0.4908	0.0001	4.50E-07
130	0.34	0.160	0.048	0.2920	0.4906	0.0001	4.50E-07
131	0.24	0.080	0.092	0.2987	0.4905	0.0001	4.50E-07
132	0.12	0.000	0.183	0.2924	0.4903	0.0001	4.50E-07
133	0.00	0.000	0.090	0.2834	0.4902	0.0001	4.49E-07
134	0.45	0.226	0.076	0.2979	0.4900	0.0001	4.49E-07
135	0.00	0.000	0.061	0.2921	0.4899	0.0001	4.49E-07
136	0.00	0.000	0.035	0.2887	0.4898	0.0001	4.49E-07
137	0.00	0.000	0.028	0.2859	0.4896	0.0001	4.49E-07
138	0.00	0.000	0.023	0.2836	0.4895	0.0001	4.49E-07
139	0.00	0.000	0.026	0.2810	0.4893	0.0001	4.49E-07
140	0.00	0.000	0.023	0.2787	0.4892	0.0001	4.49E-07
141	0.00	0.000	0.015	0.2773	0.4890	0.0001	4.48E-07
142	0.00	0.000	0.003	0.2770	0.4889	0.0001	4.48E-07
143	0.00	0.000	0.002	0.2770	0.4888	0.0001	4.48E-07
144	0.46	0.267	0.040	0.2921	0.4886	0.0001	4.48E-07
145	0.00	0.000	0.039	0.2882	0.4885	0.0001	4.48E-07
146	0.00	0.000	0.015	0.2867	0.4883	0.0001	4.48E-07
147	0.00	0.000	0.015	0.2852	0.4882	0.0001	4.48E-07
148	0.28	0.111	0.040	0.2980	0.4880	0.0001	4.48E-07
149	0.10	0.000	0.167	0.2909	0.4879	0.0001	4.48E-07
150	0.01	0.000	0.025	0.2894	0.4878	0.0001	4.47E-07
151	0.17	0.019	0.038	0.3011	0.4876	0.0001	4.47E-07
152	0.60	0.276	0.339	0.2995	0.4875	0.0001	4.47E-07

153	0.01	0.000	0.098	0.2902	0.4873	0.0001	4.47E-07
154	0.00	0.000	0.093	0.2810	0.4872	0.0001	4.47E-07
155	1.44	1.208	0.076	0.2970	0.4871	0.0001	4.47E-07
156	0.23	0.083	0.080	0.3034	0.4869	0.0001	4.47E-07
157	0.54	0.273	0.194	0.3102	0.4868	0.0001	4.47E-07
158	0.33	0.136	0.208	0.3083	0.4866	0.0001	4.46E-07
159	0.00	0.000	0.183	0.2900	0.4865	0.0001	4.46E-07
160	0.00	0.000	0.087	0.2813	0.4863	0.0001	4.46E-07
161	0.00	0.000	0.032	0.2781	0.4862	0.0001	4.46E-07
162	0.00	0.000	0.008	0.2773	0.4861	0.0001	4.46E-07
163	0.02	0.000	0.021	0.2775	0.4859	0.0001	4.46E-07
164	0.60	0.383	0.066	0.2929	0.4858	0.0001	4.46E-07
165	0.00	0.000	0.112	0.2817	0.4856	0.0001	4.46E-07
166	0.40	0.204	0.060	0.2951	0.4855	0.0001	4.46E-07
167	1.36	0.996	0.249	0.3062	0.4853	0.0001	4.45E-07
168	0.16	0.011	0.147	0.3068	0.4852	0.0001	4.45E-07
169	0.19	0.030	0.163	0.3061	0.4851	0.0001	4.45E-07
170	0.00	0.000	0.150	0.2911	0.4849	0.0001	4.45E-07
171	0.45	0.164	0.157	0.3043	0.4848	0.0001	4.45E-07
172	0.01	0.000	0.194	0.2864	0.4846	0.0001	4.45E-07
173	0.00	0.000	0.055	0.2809	0.4845	0.0001	4.45E-07
174	0.00	0.000	0.031	0.2779	0.4844	0.0001	4.45E-07
175	0.00	0.000	0.007	0.2772	0.4842	0.0001	4.44E-07
176	2.02	1.803	0.060	0.2927	0.4841	0.0001	4.44E-07
177	0.00	0.000	0.118	0.2810	0.4839	0.0001	4.44E-07
178	0.00	0.000	0.030	0.2780	0.4838	0.0001	4.44E-07
179	0.05	0.000	0.035	0.2797	0.4836	0.0001	4.44E-07
180	0.11	0.000	0.027	0.2877	0.4835	0.0001	4.44E-07
181	0.46	0.274	0.065	0.3001	0.4834	0.0001	4.44E-07
182	0.00	0.000	0.020	0.2981	0.4832	0.0001	4.44E-07
183	0.00	0.000	0.033	0.2948	0.4831	0.0001	4.43E-07
184	0.00	0.000	0.031	0.2917	0.4829	0.0001	4.43E-07

185	0.00	0.000	0.025	0.2892	0.4828	0.0001	4.43E-07
186	0.00	0.000	0.025	0.2867	0.4827	0.0001	4.43E-07
187	0.00	0.000	0.029	0.2839	0.4825	0.0001	4.43E-07
188	0.70	0.495	0.047	0.2992	0.4824	0.0001	4.43E-07
189	0.21	0.061	0.098	0.3040	0.4822	0.0001	4.43E-07
190	0.79	0.509	0.175	0.3148	0.4821	0.0001	4.43E-07
191	0.07	0.000	0.240	0.2975	0.4820	0.0001	4.43E-07
192	0.43	0.136	0.350	0.2919	0.4818	0.0001	4.42E-07
193	0.19	0.041	0.115	0.2952	0.4817	0.0001	4.42E-07
194	0.46	0.173	0.244	0.2994	0.4815	0.0001	4.42E-07
195	0.00	0.000	0.090	0.2904	0.4814	0.0001	4.42E-07
196	0.40	0.122	0.334	0.2851	0.4812	0.0001	4.42E-07
197	0.26	0.084	0.122	0.2902	0.4811	0.0001	4.42E-07
198	0.00	0.000	0.107	0.2795	0.4810	0.0001	4.42E-07
199	0.36	0.141	0.155	0.2860	0.4808	0.0001	4.42E-07
200	0.00	0.000	0.066	0.2794	0.4807	0.0001	4.41E-07
201	0.00	0.000	0.020	0.2773	0.4805	0.0001	4.41E-07
202	0.00	0.000	0.003	0.2771	0.4804	0.0001	4.41E-07
203	2.47	2.249	0.065	0.2926	0.4803	0.0001	4.41E-07
204	0.00	0.000	0.102	0.2824	0.4801	0.0001	4.41E-07
205	0.00	0.000	0.041	0.2784	0.4800	0.0001	4.41E-07
206	0.00	0.000	0.010	0.2773	0.4798	0.0001	4.41E-07
207	0.00	0.000	0.003	0.2771	0.4797	0.0001	4.41E-07
208	0.00	0.000	0.001	0.2770	0.4796	0.0001	4.41E-07
209	0.00	0.000	0.000	0.2770	0.4794	0.0001	4.40E-07
210	0.00	0.000	0.000	0.2770	0.4793	0.0001	4.40E-07
211	0.00	0.000	0.000	0.2770	0.4791	0.0001	4.40E-07
212	0.00	0.000	0.000	0.2770	0.4790	0.0001	4.40E-07
213	0.00	0.000	0.000	0.2770	0.4789	0.0001	4.40E-07
214	0.00	0.000	0.000	0.2770	0.4787	0.0001	4.40E-07
215	0.00	0.000	0.000	0.2770	0.4786	0.0001	4.40E-07
216	0.00	0.000	0.000	0.2770	0.4784	0.0001	4.40E-07

217	0.00	0.000	0.000	0.2770	0.4783	0.0001	4.39E-07
218	0.00	0.000	0.000	0.2770	0.4782	0.0001	4.39E-07
219	0.02	0.000	0.017	0.2776	0.4780	0.0001	4.39E-07
220	0.00	0.000	0.003	0.2773	0.4779	0.0001	4.39E-07
221	0.00	0.000	0.002	0.2771	0.4777	0.0001	4.39E-07
222	0.00	0.000	0.001	0.2770	0.4776	0.0001	4.39E-07
223	0.21	0.055	0.034	0.2893	0.4775	0.0001	4.39E-07
224	0.00	0.000	0.013	0.2880	0.4773	0.0001	4.39E-07
225	0.00	0.000	0.021	0.2859	0.4772	0.0001	4.39E-07
226	0.00	0.000	0.021	0.2838	0.4770	0.0001	4.38E-07
227	0.00	0.000	0.016	0.2823	0.4769	0.0001	4.38E-07
228	0.01	0.000	0.023	0.2812	0.4768	0.0001	4.38E-07
229	0.51	0.325	0.044	0.2959	0.4766	0.0001	4.38E-07
230	0.02	0.000	0.035	0.2947	0.4765	0.0001	4.38E-07
231	0.00	0.000	0.018	0.2928	0.4763	0.0001	4.38E-07
232	0.00	0.000	0.017	0.2911	0.4762	0.0001	4.38E-07
233	0.00	0.000	0.015	0.2896	0.4761	0.0001	4.38E-07
234	1.18	0.999	0.038	0.3037	0.4759	0.0001	4.37E-07
235	0.00	0.000	0.127	0.2909	0.4758	0.0001	4.37E-07
236	0.00	0.000	0.108	0.2802	0.4757	0.0001	4.37E-07
237	0.00	0.000	0.024	0.2778	0.4755	0.0001	4.37E-07
238	0.00	0.000	0.006	0.2772	0.4754	0.0001	4.37E-07
239	0.00	0.000	0.002	0.2771	0.4752	0.0001	4.37E-07
240	0.00	0.000	0.001	0.2770	0.4751	0.0001	4.37E-07
241	0.30	0.128	0.045	0.2892	0.4750	0.0001	4.37E-07
242	0.02	0.000	0.026	0.2883	0.4748	0.0001	4.37E-07
243	0.78	0.590	0.051	0.3023	0.4747	0.0001	4.36E-07
244	0.02	0.000	0.104	0.2936	0.4745	0.0001	4.36E-07
245	0.00	0.000	0.019	0.2917	0.4744	0.0001	4.36E-07
246	0.00	0.000	0.019	0.2897	0.4743	0.0001	4.36E-07
247	0.00	0.000	0.018	0.2880	0.4741	0.0001	4.36E-07
248	0.00	0.000	0.020	0.2860	0.4740	0.0001	4.36E-07

249	0.00	0.000	0.018	0.2842	0.4738	0.0001	4.36E-07
250	0.23	0.070	0.040	0.2959	0.4737	0.0001	4.36E-07
251	0.00	0.000	0.099	0.2861	0.4736	0.0001	4.36E-07
252	0.00	0.000	0.018	0.2843	0.4734	0.0001	4.35E-07
253	0.00	0.000	0.013	0.2829	0.4733	0.0001	4.35E-07
254	0.00	0.000	0.012	0.2817	0.4732	0.0001	4.35E-07
255	0.00	0.000	0.012	0.2806	0.4730	0.0001	4.35E-07
256	0.00	0.000	0.011	0.2795	0.4729	0.0001	4.35E-07
257	0.00	0.000	0.013	0.2782	0.4727	0.0001	4.35E-07
258	0.00	0.000	0.010	0.2772	0.4726	0.0001	4.35E-07
259	0.11	0.000	0.024	0.2854	0.4725	0.0001	4.35E-07
260	0.02	0.000	0.019	0.2855	0.4723	0.0001	4.34E-07
261	0.00	0.000	0.006	0.2848	0.4722	0.0001	4.34E-07
262	0.00	0.000	0.006	0.2842	0.4721	0.0001	4.34E-07
263	0.00	0.000	0.008	0.2834	0.4719	0.0001	4.34E-07
264	0.00	0.000	0.008	0.2826	0.4718	0.0001	4.34E-07
265	0.00	0.000	0.008	0.2818	0.4716	0.0001	4.34E-07
266	0.44	0.257	0.034	0.2967	0.4715	0.0001	4.34E-07
267	0.00	0.000	0.081	0.2887	0.4714	0.0001	4.34E-07
268	0.00	0.000	0.008	0.2878	0.4712	0.0001	4.34E-07
269	0.00	0.000	0.008	0.2870	0.4711	0.0001	4.33E-07
270	0.00	0.000	0.008	0.2862	0.4709	0.0001	4.33E-07
271	0.66	0.469	0.033	0.3016	0.4708	0.0001	4.33E-07
272	0.03	0.000	0.080	0.2969	0.4707	0.0001	4.33E-07
273	0.79	0.524	0.124	0.3106	0.4705	0.0001	4.33E-07
274	0.21	0.070	0.074	0.3176	0.4704	0.0001	4.33E-07
275	0.00	0.000	0.075	0.3101	0.4703	0.0001	4.33E-07
276	0.00	0.000	0.076	0.3025	0.4701	0.0001	4.33E-07
277	0.30	0.106	0.134	0.3082	0.4700	0.0001	4.32E-07
278	0.01	0.000	0.192	0.2897	0.4698	0.0001	4.32E-07
279	0.00	0.000	0.106	0.2791	0.4697	0.0001	4.32E-07
280	0.00	0.000	0.017	0.2775	0.4696	0.0001	4.32E-07

281		0.00	0.000	0.004	0.2771	0.4695	0.0001	4.32E-07
282		0.00	0.000	0.001	0.2770	0.4693	0.0001	4.32E-07
283		0.00	0.000	0.000	0.2770	0.4692	0.0001	4.32E-07
284		0.00	0.000	0.000	0.2770	0.4690	0.0001	4.32E-07
285		0.00	0.000	0.000	0.2770	0.4689	0.0001	4.32E-07
286	*	0.00	0.000	0.000	0.2770	0.4688	0.0001	4.31E-07
287	*	0.03	0.000	0.031	0.2770	0.4686	0.0001	4.31E-07
288		0.02	0.000	0.014	0.2773	0.4685	0.0001	4.31E-07
289		0.00	0.000	0.002	0.2771	0.4684	0.0001	4.31E-07
290		0.00	0.000	0.001	0.2770	0.4682	0.0001	4.31E-07
291		0.00	0.000	0.000	0.2770	0.4681	0.0001	4.31E-07
292		0.84	0.634	0.042	0.2933	0.4680	0.0001	4.31E-07
293		0.00	0.000	0.009	0.2924	0.4678	0.0001	4.31E-07
294		0.02	0.000	0.027	0.2920	0.4677	0.0001	4.31E-07
295		0.34	0.162	0.041	0.3059	0.4675	0.0001	4.30E-07
296		1.25	1.053	0.079	0.3174	0.4674	0.0001	4.30E-07
297		0.59	0.345	0.130	0.3289	0.4673	0.0001	4.30E-07
298		1.86	1.636	0.110	0.3405	0.4671	0.0001	4.30E-07
299		0.00	0.000	0.051	0.3353	0.4670	0.0001	4.30E-07
300		0.00	0.000	0.072	0.3282	0.4669	0.0001	4.30E-07
301		0.20	0.042	0.108	0.3333	0.4667	0.0001	4.30E-07
302		0.00	0.000	0.077	0.3255	0.4666	0.0001	4.30E-07
303		0.05	0.000	0.062	0.3248	0.4665	0.0001	4.30E-07
304	*	0.00	0.000	0.000	0.3248	0.4663	0.0001	4.29E-07
305		0.00	0.000	0.049	0.3199	0.4662	0.0001	4.29E-07
306		0.00	0.000	0.059	0.3140	0.4660	0.0001	4.29E-07
307	*	0.22	0.000	0.030	0.3160	0.4659	0.0001	4.29E-07
308	*	0.00	0.000	0.023	0.3180	0.4658	0.0001	4.29E-07
309		0.00	0.000	0.096	0.3213	0.4656	0.0001	4.29E-07
310		0.01	0.000	0.074	0.3147	0.4655	0.0001	4.29E-07
311		0.00	0.000	0.091	0.3057	0.4654	0.0001	4.29E-07
312		0.00	0.000	0.090	0.2967	0.4652	0.0001	4.28E-07

313		0.00	0.000	0.039	0.2928	0.4651	0.0001	4.28E-07
314		0.00	0.000	0.055	0.2873	0.4650	0.0001	4.28E-07
315		0.00	0.000	0.060	0.2813	0.4648	0.0001	4.28E-07
316		0.49	0.267	0.078	0.2957	0.4647	0.0001	4.28E-07
317		0.54	0.353	0.069	0.3072	0.4645	0.0001	4.28E-07
318	*	0.00	0.000	0.035	0.3037	0.4644	0.0001	4.28E-07
319		0.00	0.000	0.053	0.2985	0.4643	0.0001	4.28E-07
320		0.00	0.000	0.051	0.2934	0.4641	0.0001	4.28E-07
321		0.00	0.000	0.031	0.2903	0.4640	0.0001	4.27E-07
322		0.00	0.000	0.042	0.2861	0.4639	0.0001	4.27E-07
323		0.00	0.000	0.031	0.2831	0.4637	0.0001	4.27E-07
324	*	0.62	0.000	0.030	0.2850	0.4636	0.0001	4.27E-07
325		0.14	0.085	0.000	0.2994	0.4635	0.0001	4.27E-07
326		0.00	0.069	0.024	0.3110	0.4633	0.0001	4.27E-07
327		0.00	0.002	0.039	0.3213	0.4632	0.0001	4.27E-07
328		0.00	0.002	0.090	0.3254	0.4631	0.0001	4.27E-07
329		0.37	0.202	0.093	0.3332	0.4629	0.0001	4.27E-07
330		1.07	0.853	0.140	0.3410	0.4628	0.0001	4.26E-07
331		0.00	0.000	0.086	0.3324	0.4627	0.0001	4.26E-07
332		0.00	0.000	0.093	0.3232	0.4625	0.0001	4.26E-07
333		0.00	0.000	0.048	0.3184	0.4624	0.0001	4.26E-07
334		0.00	0.000	0.067	0.3117	0.4623	0.0001	4.26E-07
335		0.00	0.000	0.084	0.3033	0.4621	0.0001	4.26E-07
336		0.00	0.000	0.046	0.2987	0.4620	0.0001	4.26E-07
337		0.00	0.000	0.035	0.2952	0.4619	0.0001	4.26E-07
338		0.00	0.000	0.070	0.2882	0.4617	0.0001	4.26E-07
339		0.00	0.000	0.076	0.2805	0.4616	0.0001	4.25E-07
340		0.00	0.000	0.029	0.2777	0.4615	0.0001	4.25E-07
341		0.00	0.000	0.007	0.2770	0.4613	0.0001	4.25E-07
342		0.00	0.000	0.000	0.2770	0.4612	0.0001	4.25E-07
343		0.00	0.000	0.000	0.2770	0.4611	0.0001	4.25E-07
344	*	0.11	0.000	0.027	0.2790	0.4609	0.0001	4.25E-07

345	*	0.06	0.000	0.039	0.2810	0.4608	0.0001	4.25E-07
346		0.00	0.000	0.069	0.2804	0.4607	0.0001	4.25E-07
347		0.00	0.000	0.011	0.2793	0.4605	0.0001	4.25E-07
348		0.00	0.000	0.005	0.2788	0.4604	0.0001	4.24E-07
349	*	0.00	0.000	0.005	0.2783	0.4603	0.0001	4.24E-07
350		0.00	0.000	0.004	0.2779	0.4601	0.0001	4.24E-07
351	*	0.00	0.000	0.004	0.2776	0.4600	0.0001	4.24E-07
352		0.00	0.000	0.003	0.2773	0.4598	0.0001	4.24E-07
353		0.00	0.000	0.002	0.2771	0.4597	0.0001	4.24E-07
354		0.00	0.000	0.000	0.2770	0.4596	0.0001	4.24E-07
355		0.31	0.134	0.038	0.2904	0.4594	0.0001	4.24E-07
356		0.57	0.417	0.037	0.3020	0.4593	0.0001	4.24E-07
357		0.03	0.000	0.033	0.3017	0.4592	0.0001	4.23E-07
358		0.00	0.000	0.021	0.2996	0.4591	0.0001	4.23E-07
359		0.00	0.000	0.032	0.2964	0.4589	0.0001	4.23E-07
360	*	0.21	0.000	0.035	0.2983	0.4588	0.0001	4.23E-07
361	*	0.11	0.000	0.030	0.3003	0.4587	0.0001	4.23E-07
362	*	0.00	0.000	0.041	0.3023	0.4585	0.0001	4.23E-07
363		0.00	0.001	0.090	0.3089	0.4584	0.0001	4.23E-07
364		0.05	0.000	0.046	0.3095	0.4583	0.0001	4.23E-07
365		0.00	0.000	0.035	0.3060	0.4581	0.0001	4.22E-07

* = Frozen (air or soil)

Annual Totals for Year 14			
	inches	cubic feet	percent
Precipitation	47.32	171,759.9	100.00
Runoff	27.727	100,649.5	58.60
Evapotranspiration	19.731	71,624.9	41.70
Recirculation into Layer 1	0.0200	72.6	0.04
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0200	72.6	0.04
Percolation/Leakage through Layer 5	0.000162	0.5878	0.00
Average Head on Top of Layer 4	0.4833	---	---
Change in Water Storage	-0.1419	-515.0	-0.30
Soil Water at Start of Year	1,406.9235	5,107,132.3	2973.41
Soil Water at End of Year	1,406.9032	5,107,058.5	2973.37
Snow Water at Start of Year	0.1216	441.2	0.26
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0200	-72.6	-0.04

Daily Output for Year 15

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.00	0.000	0.017	0.3043	0.4580	0.0001	4.22E-07
2	*		0.00	0.000	0.000	0.3043	0.4579	0.0001	4.22E-07
3	*		0.00	0.000	0.000	0.3043	0.4577	0.0001	4.22E-07
4	*		0.00	0.000	0.000	0.3043	0.4576	0.0001	4.22E-07
5	*		0.00	0.000	0.001	0.3043	0.4575	0.0001	4.22E-07
6	*		0.00	0.000	0.021	0.3027	0.4573	0.0001	4.22E-07
7	*		0.00	0.000	0.016	0.3011	0.4572	0.0001	4.22E-07
8	*		0.00	0.000	0.000	0.3011	0.4571	0.0001	4.22E-07
9	*		0.00	0.000	0.000	0.3011	0.4569	0.0001	4.21E-07
10	*		0.00	0.000	0.000	0.3011	0.4568	0.0001	4.21E-07
11	*		0.00	0.000	0.000	0.3011	0.4567	0.0001	4.21E-07
12	*	*	0.00	0.000	0.000	0.3011	0.4565	0.0001	4.21E-07
13	*	*	0.00	0.000	0.000	0.3011	0.4564	0.0001	4.21E-07
14	*	*	0.01	0.000	0.007	0.3011	0.4562	0.0001	4.21E-07
15	*	*	0.10	0.000	0.051	0.3011	0.4561	0.0001	4.21E-07
16		*	0.06	0.000	0.103	0.3016	0.4560	0.0001	4.21E-07
17		*	0.06	0.000	0.020	0.3057	0.4558	0.0001	4.21E-07
18			0.30	0.110	0.099	0.3146	0.4557	0.0001	4.20E-07
19			0.39	0.184	0.092	0.3260	0.4556	0.0001	4.20E-07
20			0.00	0.000	0.063	0.3197	0.4555	0.0001	4.20E-07
21			0.00	0.000	0.160	0.3037	0.4554	0.0001	4.20E-07
22			0.00	0.000	0.183	0.2853	0.4553	0.0001	4.20E-07
23			0.06	0.000	0.101	0.2814	0.4551	0.0001	4.20E-07
24			0.00	0.000	0.016	0.2801	0.4550	0.0001	4.20E-07

25		0.00	0.000	0.017	0.2787	0.4549	0.0001	4.20E-07
26		0.05	0.000	0.024	0.2811	0.4547	0.0001	4.20E-07
27		0.43	0.252	0.051	0.2936	0.4546	0.0001	4.20E-07
28		0.00	0.000	0.045	0.2893	0.4545	0.0001	4.19E-07
29		0.00	0.000	0.019	0.2874	0.4543	0.0001	4.19E-07
30		0.00	0.000	0.017	0.2857	0.4542	0.0001	4.19E-07
31	*	0.00	0.000	0.000	0.2857	0.4541	0.0001	4.19E-07
32		0.00	0.000	0.016	0.2841	0.4539	0.0001	4.19E-07
33	*	0.00	0.000	0.000	0.2841	0.4538	0.0001	4.19E-07
34		0.04	0.000	0.032	0.2846	0.4537	0.0001	4.19E-07
35	*	0.33	0.000	0.022	0.2866	0.4536	0.0001	4.19E-07
36	*	0.00	0.000	0.025	0.2886	0.4534	0.0001	4.19E-07
37	*	0.00	0.000	0.018	0.2905	0.4533	0.0001	4.18E-07
38	*	0.00	0.000	0.034	0.2925	0.4532	0.0001	4.18E-07
39	*	0.21	0.000	0.000	0.2945	0.4530	0.0001	4.18E-07
40	*	0.17	0.000	0.017	0.2965	0.4529	0.0001	4.18E-07
41	*	0.00	0.000	0.033	0.2984	0.4528	0.0001	4.18E-07
42	*	0.00	0.000	0.039	0.3004	0.4526	0.0001	4.18E-07
43		0.00	0.217	0.026	0.3132	0.4525	0.0001	4.18E-07
44		0.00	0.000	0.025	0.3107	0.4524	0.0001	4.18E-07
45		0.00	0.000	0.037	0.3070	0.4522	0.0001	4.18E-07
46	*	0.00	0.000	0.000	0.3070	0.4521	0.0001	4.17E-07
47		0.00	0.000	0.043	0.3027	0.4520	0.0001	4.17E-07
48		0.00	0.000	0.055	0.2972	0.4518	0.0001	4.17E-07
49		0.00	0.000	0.036	0.2937	0.4517	0.0001	4.17E-07
50		0.00	0.000	0.052	0.2885	0.4516	0.0001	4.17E-07
51		0.00	0.000	0.065	0.2820	0.4514	0.0001	4.17E-07
52		0.00	0.000	0.043	0.2776	0.4513	0.0001	4.17E-07
53		0.00	0.000	0.006	0.2771	0.4512	0.0001	4.17E-07
54		0.06	0.000	0.024	0.2806	0.4510	0.0001	4.17E-07
55		1.25	1.070	0.055	0.2933	0.4509	0.0001	4.16E-07
56		0.00	0.000	0.047	0.2886	0.4508	0.0001	4.16E-07

57		0.13	0.000	0.080	0.2941	0.4506	0.0001	4.16E-07
58		0.00	0.000	0.036	0.2905	0.4505	0.0001	4.16E-07
59	*	0.00	0.000	0.039	0.2866	0.4504	0.0001	4.16E-07
60		0.00	0.000	0.066	0.2799	0.4502	0.0001	4.16E-07
61		0.38	0.156	0.108	0.2920	0.4501	0.0001	4.16E-07
62		0.31	0.106	0.114	0.3013	0.4500	0.0001	4.16E-07
63	*	0.16	0.000	0.062	0.3033	0.4499	0.0001	4.16E-07
64		0.97	0.922	0.000	0.3160	0.4497	0.0001	4.15E-07
65		0.00	0.000	0.089	0.3071	0.4496	0.0001	4.15E-07
66		0.00	0.000	0.090	0.2981	0.4495	0.0001	4.15E-07
67	*	0.00	0.000	0.045	0.2936	0.4493	0.0001	4.15E-07
68	*	0.05	0.000	0.045	0.2945	0.4492	0.0001	4.15E-07
69	*	0.00	0.000	0.000	0.2945	0.4491	0.0001	4.15E-07
70	*	0.00	0.000	0.000	0.2945	0.4489	0.0001	4.15E-07
71	*	0.00	0.000	0.000	0.2945	0.4488	0.0001	4.15E-07
72	*	0.00	0.000	0.004	0.2945	0.4487	0.0001	4.15E-07
73		0.03	0.000	0.083	0.2888	0.4486	0.0001	4.14E-07
74		0.03	0.000	0.105	0.2813	0.4485	0.0001	4.14E-07
75		0.34	0.111	0.116	0.2925	0.4484	0.0001	4.14E-07
76		0.19	0.049	0.066	0.3002	0.4482	0.0001	4.14E-07
77		0.00	0.000	0.042	0.2960	0.4481	0.0001	4.14E-07
78		0.00	0.000	0.105	0.2856	0.4480	0.0001	4.14E-07
79		0.13	0.000	0.094	0.2892	0.4478	0.0001	4.14E-07
80		0.40	0.195	0.069	0.3025	0.4477	0.0001	4.14E-07
81		0.01	0.000	0.053	0.2984	0.4476	0.0001	4.14E-07
82		0.13	0.000	0.169	0.2941	0.4475	0.0001	4.13E-07
83		0.00	0.000	0.063	0.2878	0.4473	0.0001	4.13E-07
84		0.00	0.000	0.035	0.2843	0.4472	0.0001	4.13E-07
85		0.00	0.000	0.028	0.2816	0.4471	0.0001	4.13E-07
86	*	0.00	0.000	0.000	0.2816	0.4469	0.0001	4.13E-07
87		0.00	0.000	0.030	0.2785	0.4468	0.0001	4.13E-07
88		0.00	0.000	0.018	0.2772	0.4467	0.0001	4.13E-07

89	0.06	0.000	0.024	0.2808	0.4465	0.0001	4.13E-07
90	0.00	0.000	0.003	0.2805	0.4464	0.0001	4.13E-07
91	0.00	0.000	0.013	0.2793	0.4463	0.0001	4.13E-07
92	0.57	0.376	0.046	0.2938	0.4461	0.0001	4.12E-07
93	0.01	0.000	0.042	0.2904	0.4460	0.0001	4.12E-07
94	0.00	0.000	0.044	0.2861	0.4459	0.0001	4.12E-07
95	0.00	0.000	0.076	0.2785	0.4458	0.0001	4.12E-07
96	0.00	0.000	0.012	0.2773	0.4456	0.0001	4.12E-07
97	0.14	0.000	0.027	0.2882	0.4455	0.0001	4.12E-07
98	0.00	0.000	0.018	0.2864	0.4454	0.0001	4.12E-07
99	0.00	0.000	0.021	0.2844	0.4452	0.0001	4.12E-07
100	0.13	0.000	0.041	0.2937	0.4451	0.0001	4.12E-07
101	0.01	0.000	0.021	0.2924	0.4450	0.0001	4.11E-07
102	0.02	0.000	0.030	0.2917	0.4448	0.0001	4.11E-07
103	0.00	0.000	0.017	0.2900	0.4447	0.0001	4.11E-07
104	0.02	0.000	0.026	0.2892	0.4446	0.0001	4.11E-07
105	0.00	0.000	0.015	0.2877	0.4445	0.0001	4.11E-07
106	0.00	0.000	0.015	0.2862	0.4443	0.0001	4.11E-07
107	0.00	0.000	0.014	0.2848	0.4442	0.0001	4.11E-07
108	2.07	1.879	0.040	0.2997	0.4441	0.0001	4.11E-07
109	0.00	0.000	0.073	0.2924	0.4439	0.0001	4.11E-07
110	0.00	0.000	0.110	0.2814	0.4438	0.0001	4.10E-07
111	0.00	0.000	0.036	0.2778	0.4437	0.0001	4.10E-07
112	0.00	0.000	0.007	0.2771	0.4435	0.0001	4.10E-07
113	0.00	0.000	0.001	0.2770	0.4434	0.0001	4.10E-07
114	0.00	0.000	0.000	0.2770	0.4433	0.0001	4.10E-07
115	0.00	0.000	0.000	0.2770	0.4432	0.0001	4.10E-07
116	0.00	0.000	0.000	0.2770	0.4430	0.0001	4.10E-07
117	0.00	0.000	0.000	0.2770	0.4429	0.0001	4.10E-07
118	0.00	0.000	0.000	0.2770	0.4428	0.0001	4.10E-07
119	0.40	0.214	0.043	0.2913	0.4426	0.0001	4.09E-07
120	0.25	0.091	0.042	0.3026	0.4425	0.0001	4.09E-07

121		0.00	0.000	0.084	0.2942	0.4424	0.0001	4.09E-07
122		0.00	0.000	0.015	0.2928	0.4423	0.0001	4.09E-07
123		0.00	0.000	0.014	0.2914	0.4421	0.0001	4.09E-07
124		0.00	0.000	0.013	0.2900	0.4420	0.0001	4.09E-07
125		0.00	0.000	0.013	0.2888	0.4419	0.0001	4.09E-07
126		0.00	0.000	0.012	0.2875	0.4417	0.0001	4.09E-07
127	*	0.00	0.000	0.012	0.2864	0.4416	0.0001	4.09E-07
128	*	0.00	0.000	0.000	0.2864	0.4415	0.0001	4.08E-07
129	*	0.19	0.000	0.080	0.2884	0.4413	0.0001	4.08E-07
130		0.00	0.000	0.103	0.2872	0.4412	0.0001	4.08E-07
131		0.36	0.181	0.038	0.3015	0.4411	0.0001	4.08E-07
132		0.00	0.000	0.061	0.2954	0.4410	0.0000	4.08E-07
133		0.00	0.000	0.015	0.2939	0.4408	0.0000	4.08E-07
134		0.00	0.000	0.013	0.2926	0.4407	0.0000	4.08E-07
135		0.00	0.000	0.011	0.2915	0.4406	0.0000	4.08E-07
136		0.00	0.000	0.011	0.2904	0.4404	0.0000	4.08E-07
137		0.00	0.000	0.011	0.2893	0.4403	0.0000	4.07E-07
138		0.00	0.000	0.011	0.2881	0.4402	0.0000	4.07E-07
139		0.00	0.000	0.011	0.2871	0.4401	0.0000	4.07E-07
140		0.63	0.432	0.038	0.3026	0.4399	0.0000	4.07E-07
141		0.00	0.000	0.155	0.2871	0.4398	0.0000	4.07E-07
142		0.00	0.000	0.084	0.2787	0.4397	0.0000	4.07E-07
143		0.00	0.000	0.014	0.2774	0.4395	0.0000	4.07E-07
144		0.00	0.000	0.003	0.2771	0.4394	0.0000	4.07E-07
145		0.00	0.000	0.001	0.2770	0.4393	0.0000	4.07E-07
146		0.00	0.000	0.000	0.2770	0.4392	0.0000	4.06E-07
147		0.00	0.000	0.000	0.2770	0.4390	0.0000	4.06E-07
148		0.00	0.000	0.000	0.2770	0.4389	0.0000	4.06E-07
149		0.04	0.000	0.021	0.2791	0.4388	0.0000	4.06E-07
150		0.21	0.050	0.034	0.2917	0.4386	0.0000	4.06E-07
151		0.00	0.000	0.012	0.2905	0.4385	0.0000	4.06E-07
152		0.00	0.000	0.018	0.2887	0.4384	0.0000	4.06E-07

153	0.00	0.000	0.015	0.2872	0.4383	0.0000	4.06E-07
154	0.00	0.000	0.016	0.2856	0.4381	0.0000	4.06E-07
155	0.00	0.000	0.015	0.2841	0.4380	0.0000	4.06E-07
156	0.00	0.000	0.015	0.2827	0.4379	0.0000	4.05E-07
157	0.00	0.000	0.016	0.2814	0.4377	0.0000	4.05E-07
158	0.00	0.000	0.014	0.2800	0.4376	0.0000	4.05E-07
159	0.00	0.000	0.017	0.2783	0.4375	0.0000	4.05E-07
160	0.00	0.000	0.012	0.2772	0.4374	0.0000	4.05E-07
161	0.00	0.000	0.001	0.2771	0.4372	0.0000	4.05E-07
162	0.00	0.000	0.003	0.2770	0.4371	0.0000	4.05E-07
163	0.31	0.144	0.038	0.2902	0.4370	0.0000	4.05E-07
164	0.20	0.061	0.029	0.3013	0.4369	0.0000	4.05E-07
165	0.04	0.000	0.026	0.3028	0.4367	0.0000	4.04E-07
166	0.00	0.000	0.013	0.3015	0.4366	0.0000	4.04E-07
167	0.44	0.273	0.038	0.3144	0.4365	0.0000	4.04E-07
168	0.01	0.000	0.171	0.2979	0.4363	0.0000	4.04E-07
169	0.14	0.000	0.035	0.3084	0.4362	0.0000	4.04E-07
170	0.01	0.000	0.085	0.3012	0.4361	0.0000	4.04E-07
171	0.03	0.000	0.032	0.3009	0.4360	0.0000	4.04E-07
172	0.17	0.017	0.035	0.3128	0.4358	0.0000	4.04E-07
173	0.07	0.000	0.092	0.3107	0.4357	0.0000	4.04E-07
174	1.33	1.080	0.126	0.3230	0.4356	0.0000	4.03E-07
175	0.00	0.000	0.169	0.3062	0.4355	0.0000	4.03E-07
176	0.00	0.000	0.170	0.2892	0.4353	0.0000	4.03E-07
177	0.00	0.000	0.096	0.2796	0.4352	0.0000	4.03E-07
178	0.26	0.104	0.066	0.2890	0.4351	0.0000	4.03E-07
179	0.35	0.101	0.246	0.2893	0.4349	0.0000	4.03E-07
180	0.06	0.000	0.041	0.2913	0.4348	0.0000	4.03E-07
181	0.04	0.000	0.039	0.2912	0.4347	0.0000	4.03E-07
182	0.12	0.000	0.039	0.2996	0.4346	0.0000	4.03E-07
183	0.00	0.000	0.086	0.2913	0.4344	0.0000	4.02E-07
184	0.27	0.107	0.043	0.3028	0.4343	0.0000	4.02E-07

185	0.64	0.312	0.243	0.3115	0.4342	0.0000	4.02E-07
186	0.02	0.000	0.073	0.3057	0.4341	0.0000	4.02E-07
187	0.27	0.096	0.161	0.3070	0.4339	0.0000	4.02E-07
188	0.17	0.027	0.113	0.3104	0.4338	0.0000	4.02E-07
189	0.00	0.000	0.091	0.3013	0.4337	0.0000	4.02E-07
190	0.00	0.000	0.159	0.2854	0.4335	0.0000	4.02E-07
191	0.00	0.000	0.063	0.2790	0.4334	0.0000	4.02E-07
192	0.00	0.000	0.015	0.2775	0.4333	0.0000	4.02E-07
193	0.11	0.000	0.030	0.2856	0.4332	0.0000	4.01E-07
194	0.38	0.192	0.063	0.2985	0.4330	0.0000	4.01E-07
195	0.00	0.000	0.018	0.2967	0.4329	0.0000	4.01E-07
196	0.88	0.692	0.055	0.3096	0.4328	0.0000	4.01E-07
197	0.00	0.000	0.074	0.3022	0.4327	0.0000	4.01E-07
198	0.00	0.000	0.070	0.2952	0.4325	0.0000	4.01E-07
199	0.00	0.000	0.159	0.2793	0.4324	0.0000	4.01E-07
200	0.39	0.153	0.164	0.2864	0.4323	0.0000	4.01E-07
201	0.00	0.000	0.061	0.2803	0.4322	0.0000	4.01E-07
202	0.00	0.000	0.026	0.2777	0.4321	0.0000	4.01E-07
203	0.00	0.000	0.005	0.2772	0.4320	0.0000	4.00E-07
204	0.00	0.000	0.001	0.2770	0.4319	0.0000	4.00E-07
205	0.00	0.000	0.000	0.2770	0.4318	0.0000	4.00E-07
206	0.00	0.000	0.000	0.2770	0.4317	0.0000	4.00E-07
207	0.00	0.000	0.000	0.2770	0.4315	0.0000	4.00E-07
208	0.00	0.000	0.000	0.2770	0.4314	0.0000	4.00E-07
209	0.00	0.000	0.000	0.2770	0.4313	0.0000	4.00E-07
210	0.29	0.126	0.039	0.2894	0.4311	0.0000	4.00E-07
211	0.00	0.000	0.015	0.2878	0.4310	0.0000	4.00E-07
212	0.00	0.000	0.023	0.2855	0.4309	0.0000	3.99E-07
213	0.00	0.000	0.024	0.2831	0.4308	0.0000	3.99E-07
214	0.00	0.000	0.022	0.2809	0.4306	0.0000	3.99E-07
215	0.00	0.000	0.019	0.2790	0.4305	0.0000	3.99E-07
216	0.00	0.000	0.015	0.2775	0.4304	0.0000	3.99E-07

217	0.00	0.000	0.003	0.2771	0.4303	0.0000	3.99E-07
218	0.00	0.000	0.001	0.2770	0.4301	0.0000	3.99E-07
219	0.00	0.000	0.000	0.2770	0.4300	0.0000	3.99E-07
220	0.00	0.000	0.000	0.2770	0.4299	0.0000	3.99E-07
221	0.00	0.000	0.002	0.2770	0.4298	0.0000	3.99E-07
222	0.07	0.000	0.024	0.2816	0.4296	0.0000	3.98E-07
223	0.00	0.000	0.011	0.2805	0.4295	0.0000	3.98E-07
224	0.00	0.000	0.013	0.2792	0.4294	0.0000	3.98E-07
225	0.00	0.000	0.005	0.2786	0.4293	0.0000	3.98E-07
226	0.00	0.000	0.006	0.2781	0.4291	0.0000	3.98E-07
227	0.06	0.000	0.027	0.2815	0.4290	0.0000	3.98E-07
228	0.00	0.000	0.015	0.2800	0.4289	0.0000	3.98E-07
229	1.12	0.940	0.048	0.2930	0.4288	0.0000	3.98E-07
230	0.00	0.000	0.107	0.2822	0.4286	0.0000	3.98E-07
231	0.00	0.000	0.027	0.2796	0.4285	0.0000	3.97E-07
232	0.00	0.000	0.019	0.2777	0.4284	0.0000	3.97E-07
233	0.15	0.000	0.036	0.2893	0.4283	0.0000	3.97E-07
234	0.26	0.085	0.093	0.2975	0.4281	0.0000	3.97E-07
235	0.00	0.000	0.081	0.2895	0.4280	0.0000	3.97E-07
236	0.82	0.523	0.163	0.3032	0.4279	0.0000	3.97E-07
237	0.00	0.000	0.150	0.2882	0.4278	0.0000	3.97E-07
238	0.00	0.000	0.087	0.2795	0.4276	0.0000	3.97E-07
239	0.00	0.000	0.019	0.2776	0.4275	0.0000	3.97E-07
240	0.00	0.000	0.005	0.2772	0.4274	0.0000	3.97E-07
241	0.00	0.000	0.001	0.2770	0.4273	0.0000	3.96E-07
242	0.07	0.000	0.028	0.2809	0.4271	0.0000	3.96E-07
243	0.00	0.000	0.005	0.2804	0.4270	0.0000	3.96E-07
244	0.00	0.000	0.014	0.2790	0.4269	0.0000	3.96E-07
245	0.00	0.000	0.009	0.2782	0.4268	0.0000	3.96E-07
246	0.00	0.000	0.008	0.2774	0.4266	0.0000	3.96E-07
247	0.00	0.000	0.003	0.2771	0.4265	0.0000	3.96E-07
248	0.68	0.473	0.050	0.2929	0.4264	0.0000	3.96E-07

249		0.00	0.000	0.013	0.2916	0.4263	0.0000	3.96E-07
250		0.00	0.000	0.018	0.2898	0.4261	0.0000	3.95E-07
251		0.02	0.000	0.033	0.2885	0.4260	0.0000	3.95E-07
252		0.00	0.000	0.021	0.2863	0.4259	0.0000	3.95E-07
253		0.61	0.421	0.045	0.3006	0.4258	0.0000	3.95E-07
254		0.01	0.000	0.103	0.2912	0.4256	0.0000	3.95E-07
255		0.00	0.000	0.016	0.2896	0.4255	0.0000	3.95E-07
256		0.25	0.089	0.038	0.3017	0.4254	0.0000	3.95E-07
257		3.71	3.512	0.081	0.3131	0.4253	0.0000	3.95E-07
258		0.00	0.000	0.135	0.2996	0.4251	0.0000	3.95E-07
259		0.00	0.000	0.125	0.2871	0.4250	0.0000	3.95E-07
260		0.00	0.000	0.088	0.2783	0.4249	0.0000	3.94E-07
261		0.00	0.000	0.013	0.2773	0.4248	0.0000	3.94E-07
262		0.58	0.334	0.095	0.2924	0.4246	0.0000	3.94E-07
263		0.02	0.000	0.057	0.2892	0.4245	0.0000	3.94E-07
264		0.00	0.000	0.049	0.2843	0.4244	0.0000	3.94E-07
265		0.00	0.000	0.040	0.2803	0.4243	0.0000	3.94E-07
266		0.00	0.000	0.018	0.2784	0.4242	0.0000	3.94E-07
267		0.12	0.000	0.046	0.2857	0.4240	0.0000	3.94E-07
268		0.00	0.000	0.055	0.2802	0.4239	0.0000	3.94E-07
269		0.00	0.000	0.023	0.2779	0.4238	0.0000	3.93E-07
270		0.00	0.000	0.007	0.2772	0.4237	0.0000	3.93E-07
271		0.00	0.000	0.002	0.2771	0.4235	0.0000	3.93E-07
272		0.00	0.000	0.000	0.2770	0.4234	0.0000	3.93E-07
273		0.00	0.000	0.000	0.2770	0.4233	0.0000	3.93E-07
274	*	0.00	0.000	0.000	0.2770	0.4232	0.0000	3.93E-07
275		0.17	0.006	0.035	0.2895	0.4230	0.0000	3.93E-07
276		0.00	0.000	0.011	0.2884	0.4229	0.0000	3.93E-07
277		0.00	0.000	0.017	0.2868	0.4228	0.0000	3.93E-07
278		0.00	0.000	0.017	0.2851	0.4227	0.0000	3.93E-07
279		0.00	0.000	0.015	0.2836	0.4225	0.0000	3.92E-07
280		0.00	0.000	0.014	0.2821	0.4224	0.0000	3.92E-07

281		0.46	0.262	0.043	0.2976	0.4223	0.0000	3.92E-07
282		0.03	0.000	0.029	0.2974	0.4222	0.0000	3.92E-07
283		0.01	0.000	0.022	0.2961	0.4220	0.0000	3.92E-07
284		0.14	0.000	0.036	0.3067	0.4219	0.0000	3.92E-07
285		0.69	0.394	0.196	0.3166	0.4218	0.0000	3.92E-07
286		0.00	0.000	0.100	0.3066	0.4217	0.0000	3.92E-07
287		0.00	0.000	0.084	0.2982	0.4216	0.0000	3.92E-07
288		0.00	0.000	0.107	0.2875	0.4214	0.0000	3.91E-07
289		0.00	0.000	0.045	0.2830	0.4213	0.0000	3.91E-07
290		0.00	0.000	0.038	0.2792	0.4212	0.0000	3.91E-07
291		0.00	0.000	0.020	0.2772	0.4211	0.0000	3.91E-07
292		0.00	0.000	0.002	0.2770	0.4209	0.0000	3.91E-07
293		0.04	0.000	0.023	0.2792	0.4208	0.0000	3.91E-07
294		0.10	0.000	0.026	0.2863	0.4207	0.0000	3.91E-07
295		0.00	0.000	0.010	0.2853	0.4206	0.0000	3.91E-07
296		0.85	0.659	0.046	0.2995	0.4204	0.0000	3.91E-07
297		0.00	0.000	0.030	0.2965	0.4203	0.0000	3.91E-07
298		0.00	0.000	0.054	0.2911	0.4202	0.0000	3.90E-07
299		0.00	0.000	0.040	0.2871	0.4201	0.0000	3.90E-07
300	*	0.05	0.000	0.053	0.2871	0.4200	0.0000	3.90E-07
301		0.04	0.000	0.072	0.2841	0.4198	0.0000	3.90E-07
302		0.98	0.764	0.078	0.2976	0.4197	0.0000	3.90E-07
303		2.94	2.686	0.142	0.3092	0.4196	0.0000	3.90E-07
304		0.00	0.000	0.084	0.3008	0.4195	0.0000	3.90E-07
305		0.00	0.000	0.079	0.2929	0.4193	0.0000	3.90E-07
306		0.00	0.000	0.066	0.2863	0.4192	0.0000	3.90E-07
307		0.00	0.000	0.069	0.2794	0.4191	0.0000	3.89E-07
308		0.00	0.000	0.018	0.2776	0.4190	0.0000	3.89E-07
309		0.00	0.000	0.005	0.2772	0.4189	0.0000	3.89E-07
310		0.00	0.000	0.001	0.2770	0.4187	0.0000	3.89E-07
311		0.00	0.000	0.000	0.2770	0.4186	0.0000	3.89E-07
312		0.16	0.000	0.037	0.2892	0.4185	0.0000	3.89E-07

313		0.00	0.000	0.012	0.2880	0.4184	0.0000	3.89E-07
314		0.00	0.000	0.016	0.2864	0.4182	0.0000	3.89E-07
315		0.00	0.000	0.016	0.2848	0.4181	0.0000	3.89E-07
316		0.00	0.000	0.016	0.2832	0.4180	0.0000	3.89E-07
317		0.00	0.000	0.015	0.2817	0.4179	0.0000	3.88E-07
318		0.00	0.000	0.014	0.2803	0.4178	0.0000	3.88E-07
319		0.00	0.000	0.014	0.2789	0.4176	0.0000	3.88E-07
320		0.28	0.121	0.037	0.2910	0.4175	0.0000	3.88E-07
321		0.55	0.394	0.041	0.3027	0.4174	0.0000	3.88E-07
322		0.00	0.000	0.038	0.2989	0.4173	0.0000	3.88E-07
323		0.00	0.000	0.072	0.2917	0.4171	0.0000	3.88E-07
324		0.14	0.000	0.081	0.2971	0.4170	0.0000	3.88E-07
325		0.35	0.125	0.125	0.3070	0.4169	0.0000	3.88E-07
326		0.33	0.148	0.099	0.3154	0.4168	0.0000	3.88E-07
327		0.06	0.000	0.070	0.3142	0.4167	0.0000	3.87E-07
328		0.00	0.000	0.049	0.3094	0.4165	0.0000	3.87E-07
329		0.00	0.000	0.031	0.3062	0.4164	0.0000	3.87E-07
330	*	0.00	0.000	0.000	0.3062	0.4163	0.0000	3.87E-07
331	*	0.05	0.000	0.038	0.3077	0.4162	0.0000	3.87E-07
332	*	0.00	0.000	0.027	0.3050	0.4160	0.0000	3.87E-07
333		0.00	0.000	0.036	0.3014	0.4159	0.0000	3.87E-07
334	*	0.00	0.000	0.000	0.3014	0.4158	0.0000	3.87E-07
335		0.00	0.000	0.040	0.2976	0.4157	0.0000	3.87E-07
336		0.00	0.000	0.042	0.2934	0.4156	0.0000	3.86E-07
337		0.00	0.000	0.063	0.2871	0.4154	0.0000	3.86E-07
338		0.00	0.000	0.028	0.2843	0.4153	0.0000	3.86E-07
339	*	0.01	0.000	0.008	0.2843	0.4152	0.0000	3.86E-07
340	*	1.08	0.000	0.033	0.2863	0.4151	0.0000	3.86E-07
341		0.00	0.040	0.027	0.2995	0.4150	0.0000	3.86E-07
342		0.00	0.716	0.000	0.3111	0.4148	0.0000	3.86E-07
343		0.00	0.000	0.054	0.3057	0.4147	0.0000	3.86E-07
344		0.22	0.062	0.078	0.3143	0.4146	0.0000	3.86E-07

345		0.49	0.291	0.082	0.3259	0.4145	0.0000	3.86E-07
346		0.00	0.000	0.054	0.3205	0.4143	0.0000	3.85E-07
347	*	0.00	0.000	0.026	0.3179	0.4142	0.0000	3.85E-07
348	*	0.00	0.000	0.024	0.3155	0.4141	0.0000	3.85E-07
349		0.00	0.000	0.041	0.3114	0.4140	0.0000	3.85E-07
350		0.00	0.000	0.040	0.3075	0.4139	0.0000	3.85E-07
351		0.00	0.000	0.031	0.3048	0.4137	0.0000	3.85E-07
352	*	0.27	0.000	0.024	0.3068	0.4136	0.0000	3.85E-07
353	*	0.00	0.000	0.041	0.3088	0.4135	0.0000	3.85E-07
354		0.00	0.001	0.087	0.3169	0.4134	0.0000	3.85E-07
355	*	0.00	0.000	0.027	0.3142	0.4133	0.0000	3.85E-07
356		0.00	0.000	0.034	0.3108	0.4131	0.0000	3.84E-07
357		0.00	0.000	0.029	0.3079	0.4130	0.0000	3.84E-07
358		0.00	0.000	0.044	0.3035	0.4129	0.0000	3.84E-07
359	*	0.00	0.000	0.027	0.3008	0.4128	0.0000	3.84E-07
360	*	0.00	0.000	0.023	0.2985	0.4127	0.0000	3.84E-07
361		0.00	0.000	0.050	0.2935	0.4125	0.0000	3.84E-07
362	*	0.00	0.000	0.024	0.2912	0.4124	0.0000	3.84E-07
363	*	0.00	0.000	0.000	0.2912	0.4123	0.0000	3.84E-07
364	*	0.00	0.000	0.021	0.2890	0.4122	0.0000	3.84E-07
365	*	0.00	0.000	0.000	0.2890	0.4120	0.0000	3.83E-07

* = Frozen (air or soil)

Annual Totals for Year 15			
	inches	cubic feet	percent
Precipitation	37.97	137,843.5	100.00
Runoff	23.126	83,946.4	60.90
Evapotranspiration	15.032	54,566.6	39.59
Recirculation into Layer 1	0.0180	65.3	0.05
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0180	65.3	0.05
Percolation/Leakage through Layer 5	0.000147	0.5335	0.00
Average Head on Top of Layer 4	0.4347	---	---
Change in Water Storage	-0.1846	-670.0	-0.49
Soil Water at Start of Year	1,406.9032	5,107,058.5	3704.97
Soil Water at End of Year	1,406.7186	5,106,388.6	3704.48
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0180	-65.3	-0.05

Daily Output for Year 16

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.000	0.2890	0.4119	0.0000	3.83E-07
2	*		0.00	0.000	0.000	0.2890	0.4118	0.0000	3.83E-07
3	*		0.00	0.000	0.000	0.2891	0.4117	0.0000	3.83E-07
4	*		0.00	0.000	0.000	0.2891	0.4116	0.0000	3.83E-07
5	*	*	0.00	0.000	0.000	0.2891	0.4114	0.0000	3.83E-07
6	*	*	0.00	0.000	0.000	0.2891	0.4113	0.0000	3.83E-07
7	*	*	0.00	0.000	0.000	0.2891	0.4112	0.0000	3.83E-07
8		*	0.04	0.000	0.019	0.2913	0.4111	0.0000	3.83E-07
9		*	0.00	0.000	0.000	0.2913	0.4110	0.0000	3.83E-07
10	*	*	0.00	0.000	0.000	0.2913	0.4108	0.0000	3.82E-07
11	*	*	0.00	0.000	0.000	0.2913	0.4107	0.0000	3.82E-07
12		*	0.00	0.000	0.000	0.2913	0.4106	0.0000	3.82E-07
13	*	*	0.00	0.000	0.000	0.2913	0.4105	0.0000	3.82E-07
14	*	*	0.00	0.000	0.000	0.2913	0.4104	0.0000	3.82E-07
15	*	*	0.00	0.000	0.000	0.2913	0.4102	0.0000	3.82E-07
16	*	*	0.00	0.000	0.000	0.2913	0.4101	0.0000	3.82E-07
17		*	0.00	0.000	0.000	0.2913	0.4100	0.0000	3.82E-07
18		*	0.39	0.342	0.023	0.2938	0.4099	0.0000	3.82E-07
19			0.00	0.000	0.050	0.2888	0.4098	0.0000	3.82E-07
20			0.00	0.000	0.063	0.2825	0.4096	0.0000	3.81E-07
21			0.00	0.000	0.043	0.2782	0.4095	0.0000	3.81E-07
22			0.00	0.000	0.009	0.2773	0.4094	0.0000	3.81E-07
23			0.16	0.000	0.043	0.2888	0.4093	0.0000	3.81E-07
24			1.13	0.877	0.135	0.3010	0.4092	0.0000	3.81E-07

25		0.00	0.000	0.051	0.2959	0.4090	0.0000	3.81E-07
26		0.00	0.000	0.040	0.2919	0.4089	0.0000	3.81E-07
27		0.00	0.000	0.045	0.2874	0.4088	0.0000	3.81E-07
28		0.00	0.000	0.071	0.2803	0.4087	0.0000	3.81E-07
29		0.00	0.000	0.028	0.2775	0.4086	0.0000	3.81E-07
30		0.00	0.000	0.004	0.2771	0.4084	0.0000	3.80E-07
31		0.00	0.000	0.001	0.2770	0.4083	0.0000	3.80E-07
32		0.00	0.000	0.000	0.2770	0.4082	0.0000	3.80E-07
33		0.00	0.000	0.000	0.2770	0.4081	0.0000	3.80E-07
34	*	0.00	0.000	0.000	0.2770	0.4080	0.0000	3.80E-07
35		0.00	0.000	0.000	0.2770	0.4079	0.0000	3.80E-07
36		0.00	0.000	0.000	0.2770	0.4077	0.0000	3.80E-07
37		0.06	0.000	0.023	0.2805	0.4076	0.0000	3.80E-07
38		0.02	0.000	0.016	0.2810	0.4075	0.0000	3.80E-07
39		0.00	0.000	0.009	0.2800	0.4074	0.0000	3.80E-07
40		0.04	0.000	0.028	0.2812	0.4073	0.0000	3.79E-07
41		0.06	0.000	0.029	0.2838	0.4071	0.0000	3.79E-07
42	*	0.30	0.000	0.027	0.2858	0.4070	0.0000	3.79E-07
43		0.00	0.064	0.061	0.2985	0.4069	0.0000	3.79E-07
44		0.00	0.000	0.008	0.2977	0.4068	0.0000	3.79E-07
45		0.02	0.000	0.026	0.2972	0.4067	0.0000	3.79E-07
46		0.27	0.107	0.041	0.3097	0.4065	0.0000	3.79E-07
47		0.02	0.000	0.069	0.3052	0.4064	0.0000	3.79E-07
48		0.02	0.000	0.052	0.3015	0.4063	0.0000	3.79E-07
49		0.00	0.000	0.052	0.2964	0.4062	0.0000	3.79E-07
50		0.09	0.000	0.067	0.2983	0.4061	0.0000	3.78E-07
51		0.00	0.000	0.037	0.2946	0.4059	0.0000	3.78E-07
52		0.00	0.000	0.031	0.2915	0.4058	0.0000	3.78E-07
53		0.00	0.000	0.024	0.2891	0.4057	0.0000	3.78E-07
54		0.09	0.000	0.043	0.2935	0.4056	0.0000	3.78E-07
55	*	0.00	0.000	0.000	0.2935	0.4055	0.0000	3.78E-07
56		0.00	0.000	0.022	0.2913	0.4054	0.0000	3.78E-07

57	0.00	0.000	0.018	0.2895	0.4052	0.0000	3.78E-07
58	0.00	0.000	0.016	0.2879	0.4051	0.0000	3.78E-07
59	0.00	0.000	0.014	0.2865	0.4050	0.0000	3.77E-07
60	0.00	0.000	0.014	0.2851	0.4049	0.0000	3.77E-07
61	0.00	0.000	0.013	0.2838	0.4048	0.0000	3.77E-07
62	0.00	0.000	0.015	0.2826	0.4046	0.0000	3.77E-07
63	0.11	0.000	0.035	0.2903	0.4045	0.0000	3.77E-07
64	0.00	0.000	0.014	0.2889	0.4044	0.0000	3.77E-07
65	0.00	0.000	0.014	0.2875	0.4043	0.0000	3.77E-07
66	0.00	0.000	0.014	0.2861	0.4042	0.0000	3.77E-07
67	0.00	0.000	0.011	0.2850	0.4041	0.0000	3.77E-07
68	0.00	0.000	0.011	0.2840	0.4039	0.0000	3.77E-07
69	0.00	0.000	0.010	0.2830	0.4038	0.0000	3.76E-07
70	0.00	0.000	0.010	0.2820	0.4037	0.0000	3.76E-07
71	0.00	0.000	0.010	0.2810	0.4036	0.0000	3.76E-07
72	0.00	0.000	0.009	0.2801	0.4035	0.0000	3.76E-07
73	0.08	0.000	0.032	0.2850	0.4033	0.0000	3.76E-07
74	0.05	0.000	0.031	0.2868	0.4032	0.0000	3.76E-07
75	0.01	0.000	0.019	0.2858	0.4031	0.0000	3.76E-07
76	0.57	0.398	0.036	0.2994	0.4030	0.0000	3.76E-07
77	0.00	0.000	0.042	0.2951	0.4029	0.0000	3.76E-07
78	0.00	0.000	0.010	0.2942	0.4028	0.0000	3.76E-07
79	0.15	0.000	0.032	0.3058	0.4026	0.0000	3.75E-07
80	0.04	0.000	0.066	0.3035	0.4025	0.0000	3.75E-07
81	0.92	0.674	0.112	0.3163	0.4024	0.0000	3.75E-07
82	0.39	0.190	0.139	0.3221	0.4023	0.0000	3.75E-07
83	0.00	0.000	0.077	0.3144	0.4022	0.0000	3.75E-07
84	0.00	0.000	0.197	0.2948	0.4020	0.0000	3.75E-07
85	0.00	0.000	0.142	0.2806	0.4019	0.0000	3.75E-07
86	0.10	0.000	0.061	0.2842	0.4018	0.0000	3.75E-07
87	0.00	0.000	0.027	0.2816	0.4017	0.0000	3.75E-07
88	0.00	0.000	0.026	0.2790	0.4016	0.0000	3.75E-07

89		0.00	0.000	0.009	0.2781	0.4015	0.0000	3.74E-07
90		0.00	0.000	0.006	0.2775	0.4013	0.0000	3.74E-07
91		0.00	0.000	0.004	0.2771	0.4012	0.0000	3.74E-07
92		0.00	0.000	0.001	0.2770	0.4011	0.0000	3.74E-07
93		0.00	0.000	0.000	0.2770	0.4010	0.0000	3.74E-07
94		0.28	0.119	0.033	0.2896	0.4009	0.0000	3.74E-07
95		1.33	1.169	0.044	0.3012	0.4008	0.0000	3.74E-07
96		0.00	0.000	0.089	0.2923	0.4006	0.0000	3.74E-07
97		0.00	0.000	0.125	0.2799	0.4005	0.0000	3.74E-07
98		0.00	0.000	0.022	0.2776	0.4004	0.0000	3.74E-07
99		0.00	0.000	0.005	0.2772	0.4003	0.0000	3.73E-07
100		0.00	0.000	0.001	0.2770	0.4002	0.0000	3.73E-07
101	*	0.00	0.000	0.000	0.2770	0.4001	0.0000	3.73E-07
102		0.00	0.000	0.000	0.2770	0.3999	0.0000	3.73E-07
103	*	0.00	0.000	0.000	0.2770	0.3998	0.0000	3.73E-07
104		0.00	0.000	0.000	0.2770	0.3997	0.0000	3.73E-07
105	*	0.00	0.000	0.000	0.2770	0.3996	0.0000	3.73E-07
106	*	0.17	0.000	0.112	0.2790	0.3995	0.0000	3.73E-07
107	*	0.00	0.000	0.000	0.2809	0.3994	0.0000	3.73E-07
108		1.01	0.832	0.067	0.2936	0.3992	0.0000	3.73E-07
109		0.06	0.000	0.064	0.2935	0.3991	0.0000	3.72E-07
110	*	1.92	0.000	0.000	0.2955	0.3990	0.0000	3.72E-07
111		0.00	1.768	0.000	0.3082	0.3989	0.0000	3.72E-07
112		0.00	0.000	0.082	0.3000	0.3988	0.0000	3.72E-07
113		0.00	0.000	0.138	0.2862	0.3987	0.0000	3.72E-07
114		0.24	0.085	0.081	0.2938	0.3985	0.0000	3.72E-07
115		0.00	0.000	0.065	0.2873	0.3984	0.0000	3.72E-07
116		0.00	0.000	0.075	0.2798	0.3983	0.0000	3.72E-07
117		0.00	0.000	0.023	0.2774	0.3982	0.0000	3.72E-07
118		0.90	0.583	0.154	0.2934	0.3981	0.0000	3.72E-07
119		0.41	0.140	0.243	0.2961	0.3980	0.0000	3.71E-07
120		0.68	0.362	0.199	0.3076	0.3978	0.0000	3.71E-07

121		0.01	0.000	0.093	0.2989	0.3977	0.0000	3.71E-07
122	*	0.01	0.000	0.071	0.2927	0.3976	0.0000	3.71E-07
123	*	0.21	0.000	0.084	0.2946	0.3975	0.0000	3.71E-07
124		0.93	0.892	0.000	0.3089	0.3974	0.0000	3.71E-07
125		0.05	0.000	0.100	0.3040	0.3973	0.0000	3.71E-07
126		0.26	0.083	0.198	0.3019	0.3971	0.0000	3.71E-07
127		0.54	0.317	0.110	0.3134	0.3970	0.0000	3.71E-07
128		0.59	0.344	0.127	0.3250	0.3969	0.0000	3.71E-07
129		0.18	0.024	0.243	0.3165	0.3968	0.0000	3.70E-07
130		0.00	0.000	0.180	0.2985	0.3967	0.0000	3.70E-07
131		0.00	0.000	0.179	0.2806	0.3966	0.0000	3.70E-07
132		0.00	0.000	0.030	0.2776	0.3964	0.0000	3.70E-07
133		0.11	0.000	0.033	0.2851	0.3965	0.0000	3.70E-07
134		0.00	0.000	0.023	0.2831	0.3963	0.0000	3.70E-07
135		0.00	0.000	0.022	0.2810	0.3962	0.0000	3.70E-07
136		0.00	0.000	0.021	0.2788	0.3961	0.0000	3.70E-07
137		0.43	0.223	0.052	0.2941	0.3960	0.0000	3.70E-07
138		0.79	0.417	0.260	0.3055	0.3959	0.0000	3.70E-07
139		0.00	0.000	0.072	0.2983	0.3958	0.0000	3.70E-07
140		0.00	0.000	0.105	0.2878	0.3957	0.0000	3.70E-07
141		0.00	0.000	0.066	0.2812	0.3955	0.0000	3.69E-07
142		0.03	0.000	0.056	0.2788	0.3954	0.0000	3.69E-07
143		1.10	0.884	0.068	0.2939	0.3953	0.0000	3.69E-07
144		0.08	0.000	0.111	0.2912	0.3952	0.0000	3.69E-07
145		0.00	0.000	0.080	0.2833	0.3951	0.0000	3.69E-07
146		0.00	0.000	0.055	0.2778	0.3950	0.0000	3.69E-07
147		0.00	0.000	0.006	0.2771	0.3948	0.0000	3.69E-07
148		0.01	0.000	0.014	0.2770	0.3947	0.0000	3.69E-07
149		2.13	1.899	0.067	0.2931	0.3946	0.0000	3.69E-07
150		0.09	0.000	0.168	0.2856	0.3945	0.0000	3.69E-07
151		0.02	0.000	0.086	0.2795	0.3944	0.0000	3.68E-07
152		0.04	0.000	0.049	0.2789	0.3943	0.0000	3.68E-07

153	0.00	0.000	0.010	0.2779	0.3942	0.0000	3.68E-07
154	0.00	0.000	0.007	0.2772	0.3940	0.0000	3.68E-07
155	0.00	0.000	0.002	0.2771	0.3939	0.0000	3.68E-07
156	0.00	0.000	0.000	0.2770	0.3938	0.0000	3.68E-07
157	0.00	0.000	0.000	0.2770	0.3937	0.0000	3.68E-07
158	0.00	0.000	0.000	0.2770	0.3936	0.0000	3.68E-07
159	0.00	0.000	0.000	0.2770	0.3935	0.0000	3.68E-07
160	0.00	0.000	0.000	0.2770	0.3933	0.0000	3.68E-07
161	0.00	0.000	0.000	0.2770	0.3932	0.0000	3.67E-07
162	0.00	0.000	0.000	0.2770	0.3931	0.0000	3.67E-07
163	0.00	0.000	0.000	0.2770	0.3930	0.0000	3.67E-07
164	0.00	0.000	0.000	0.2770	0.3929	0.0000	3.67E-07
165	0.00	0.000	0.000	0.2770	0.3928	0.0000	3.67E-07
166	0.13	0.000	0.025	0.2877	0.3927	0.0000	3.67E-07
167	0.43	0.260	0.042	0.3006	0.3925	0.0000	3.67E-07
168	0.01	0.000	0.014	0.2998	0.3924	0.0000	3.67E-07
169	0.06	0.000	0.034	0.3027	0.3923	0.0000	3.67E-07
170	0.01	0.000	0.025	0.3015	0.3922	0.0000	3.67E-07
171	0.11	0.000	0.037	0.3086	0.3921	0.0000	3.66E-07
172	0.18	0.021	0.038	0.3206	0.3920	0.0000	3.66E-07
173	0.00	0.000	0.014	0.3193	0.3919	0.0000	3.66E-07
174	0.76	0.595	0.040	0.3323	0.3917	0.0000	3.66E-07
175	0.00	0.000	0.156	0.3167	0.3916	0.0000	3.66E-07
176	0.00	0.000	0.016	0.3151	0.3915	0.0000	3.66E-07
177	0.00	0.000	0.016	0.3135	0.3914	0.0000	3.66E-07
178	0.69	0.504	0.040	0.3279	0.3913	0.0000	3.66E-07
179	0.00	0.000	0.192	0.3087	0.3912	0.0000	3.66E-07
180	0.13	0.000	0.129	0.3091	0.3911	0.0000	3.66E-07
181	0.00	0.000	0.105	0.2986	0.3909	0.0000	3.66E-07
182	0.00	0.000	0.124	0.2862	0.3908	0.0000	3.65E-07
183	0.36	0.154	0.084	0.2988	0.3907	0.0000	3.65E-07
184	0.19	0.037	0.109	0.3027	0.3906	0.0000	3.65E-07

185	0.23	0.084	0.107	0.3069	0.3905	0.0000	3.65E-07
186	0.34	0.133	0.238	0.3034	0.3904	0.0000	3.65E-07
187	0.00	0.000	0.184	0.2850	0.3903	0.0000	3.65E-07
188	0.00	0.000	0.062	0.2788	0.3901	0.0000	3.65E-07
189	0.79	0.547	0.089	0.2941	0.3900	0.0000	3.65E-07
190	0.20	0.046	0.079	0.3012	0.3899	0.0000	3.65E-07
191	0.42	0.187	0.140	0.3101	0.3898	0.0000	3.65E-07
192	0.07	0.000	0.211	0.2965	0.3897	0.0000	3.64E-07
193	0.00	0.000	0.114	0.2851	0.3896	0.0000	3.64E-07
194	0.00	0.000	0.060	0.2792	0.3895	0.0000	3.64E-07
195	0.72	0.482	0.082	0.2951	0.3893	0.0000	3.64E-07
196	0.12	0.000	0.081	0.2992	0.3892	0.0000	3.64E-07
197	0.86	0.617	0.120	0.3118	0.3891	0.0000	3.64E-07
198	0.04	0.000	0.085	0.3078	0.3890	0.0000	3.64E-07
199	0.00	0.000	0.209	0.2870	0.3889	0.0000	3.64E-07
200	0.00	0.000	0.072	0.2798	0.3888	0.0000	3.64E-07
201	0.00	0.000	0.021	0.2777	0.3887	0.0000	3.64E-07
202	0.00	0.000	0.005	0.2772	0.3885	0.0000	3.63E-07
203	0.00	0.000	0.002	0.2770	0.3884	0.0000	3.63E-07
204	0.00	0.000	0.000	0.2770	0.3883	0.0000	3.63E-07
205	0.00	0.000	0.000	0.2770	0.3882	0.0000	3.63E-07
206	0.00	0.000	0.000	0.2770	0.3881	0.0000	3.63E-07
207	0.00	0.000	0.004	0.2770	0.3880	0.0000	3.63E-07
208	0.24	0.080	0.038	0.2893	0.3879	0.0000	3.63E-07
209	0.20	0.061	0.035	0.3001	0.3878	0.0000	3.63E-07
210	0.04	0.000	0.031	0.3005	0.3876	0.0000	3.63E-07
211	0.20	0.045	0.045	0.3118	0.3875	0.0000	3.63E-07
212	0.00	0.000	0.021	0.3097	0.3874	0.0000	3.62E-07
213	0.00	0.000	0.021	0.3076	0.3873	0.0000	3.62E-07
214	0.12	0.000	0.043	0.3148	0.3872	0.0000	3.62E-07
215	0.00	0.000	0.182	0.2966	0.3871	0.0000	3.62E-07
216	0.68	0.481	0.051	0.3113	0.3870	0.0000	3.62E-07

217	0.14	0.003	0.129	0.3125	0.3868	0.0000	3.62E-07
218	0.72	0.480	0.113	0.3247	0.3867	0.0000	3.62E-07
219	0.00	0.000	0.223	0.3024	0.3866	0.0000	3.62E-07
220	0.00	0.000	0.223	0.2801	0.3865	0.0000	3.62E-07
221	0.02	0.000	0.047	0.2776	0.3864	0.0000	3.62E-07
222	0.01	0.000	0.013	0.2772	0.3863	0.0000	3.62E-07
223	0.00	0.000	0.002	0.2770	0.3862	0.0000	3.61E-07
224	0.08	0.000	0.027	0.2827	0.3861	0.0000	3.61E-07
225	0.07	0.000	0.040	0.2852	0.3859	0.0000	3.61E-07
226	0.08	0.000	0.047	0.2885	0.3858	0.0000	3.61E-07
227	0.01	0.000	0.029	0.2870	0.3857	0.0000	3.61E-07
228	0.00	0.000	0.025	0.2845	0.3856	0.0000	3.61E-07
229	0.30	0.109	0.053	0.2982	0.3855	0.0000	3.61E-07
230	0.00	0.000	0.018	0.2965	0.3854	0.0000	3.61E-07
231	0.00	0.000	0.017	0.2947	0.3853	0.0000	3.61E-07
232	0.00	0.000	0.018	0.2929	0.3852	0.0000	3.61E-07
233	0.00	0.000	0.018	0.2912	0.3850	0.0000	3.60E-07
234	0.00	0.000	0.016	0.2896	0.3849	0.0000	3.60E-07
235	0.04	0.000	0.035	0.2902	0.3848	0.0000	3.60E-07
236	0.00	0.000	0.015	0.2887	0.3847	0.0000	3.60E-07
237	0.52	0.338	0.050	0.3017	0.3846	0.0000	3.60E-07
238	1.44	0.999	0.411	0.3050	0.3845	0.0000	3.60E-07
239	0.00	0.000	0.202	0.2848	0.3844	0.0000	3.60E-07
240	0.00	0.000	0.067	0.2781	0.3843	0.0000	3.60E-07
241	0.00	0.000	0.010	0.2772	0.3841	0.0000	3.60E-07
242	0.00	0.000	0.001	0.2770	0.3840	0.0000	3.60E-07
243	0.00	0.000	0.000	0.2770	0.3839	0.0000	3.60E-07
244	0.00	0.000	0.000	0.2770	0.3838	0.0000	3.59E-07
245	0.34	0.158	0.054	0.2903	0.3837	0.0000	3.59E-07
246	0.00	0.000	0.013	0.2890	0.3836	0.0000	3.59E-07
247	0.00	0.000	0.017	0.2873	0.3835	0.0000	3.59E-07
248	0.00	0.000	0.016	0.2857	0.3834	0.0000	3.59E-07

249	0.00	0.000	0.015	0.2842	0.3832	0.0000	3.59E-07
250	0.09	0.000	0.038	0.2896	0.3831	0.0000	3.59E-07
251	0.03	0.000	0.035	0.2893	0.3830	0.0000	3.59E-07
252	0.11	0.000	0.036	0.2962	0.3829	0.0000	3.59E-07
253	0.00	0.000	0.009	0.2954	0.3828	0.0000	3.59E-07
254	0.00	0.000	0.013	0.2941	0.3827	0.0000	3.58E-07
255	0.12	0.000	0.036	0.3023	0.3826	0.0000	3.58E-07
256	0.50	0.326	0.041	0.3154	0.3825	0.0000	3.58E-07
257	1.78	1.511	0.150	0.3270	0.3824	0.0000	3.58E-07
258	0.00	0.000	0.089	0.3181	0.3822	0.0000	3.58E-07
259	0.00	0.000	0.167	0.3013	0.3821	0.0000	3.58E-07
260	0.00	0.000	0.210	0.2803	0.3820	0.0000	3.58E-07
261	0.00	0.000	0.025	0.2778	0.3819	0.0000	3.58E-07
262	0.00	0.000	0.006	0.2772	0.3818	0.0000	3.58E-07
263	0.00	0.000	0.004	0.2770	0.3817	0.0000	3.58E-07
264	0.10	0.000	0.027	0.2844	0.3816	0.0000	3.58E-07
265	0.00	0.000	0.014	0.2831	0.3815	0.0000	3.57E-07
266	0.00	0.000	0.015	0.2817	0.3814	0.0000	3.57E-07
267	0.00	0.000	0.017	0.2800	0.3813	0.0000	3.57E-07
268	0.00	0.000	0.016	0.2784	0.3811	0.0000	3.57E-07
269	0.00	0.000	0.006	0.2778	0.3810	0.0000	3.57E-07
270	0.00	0.000	0.004	0.2774	0.3809	0.0000	3.57E-07
271	0.00	0.000	0.003	0.2771	0.3808	0.0000	3.57E-07
272	0.12	0.000	0.027	0.2863	0.3807	0.0000	3.57E-07
273	0.38	0.204	0.043	0.2996	0.3806	0.0000	3.57E-07
274	0.10	0.000	0.032	0.3063	0.3805	0.0000	3.57E-07
275	0.00	0.000	0.012	0.3051	0.3804	0.0000	3.56E-07
276	0.00	0.000	0.011	0.3040	0.3803	0.0000	3.56E-07
277	0.00	0.000	0.011	0.3029	0.3801	0.0000	3.56E-07
278	0.00	0.000	0.011	0.3019	0.3800	0.0000	3.56E-07
279	0.03	0.000	0.027	0.3020	0.3799	0.0000	3.56E-07
280	0.00	0.000	0.010	0.3010	0.3798	0.0000	3.56E-07

281	0.00	0.000	0.012	0.2998	0.3797	0.0000	3.56E-07
282	0.00	0.000	0.011	0.2987	0.3796	0.0000	3.56E-07
283	1.08	0.896	0.039	0.3130	0.3795	0.0000	3.56E-07
284	0.00	0.000	0.053	0.3078	0.3794	0.0000	3.56E-07
285	1.20	0.957	0.107	0.3213	0.3793	0.0000	3.56E-07
286	0.16	0.016	0.137	0.3224	0.3792	0.0000	3.55E-07
287	0.00	0.000	0.050	0.3174	0.3791	0.0000	3.55E-07
288	0.00	0.000	0.127	0.3047	0.3790	0.0000	3.55E-07
289	0.00	0.000	0.101	0.2946	0.3788	0.0000	3.55E-07
290	0.02	0.000	0.090	0.2881	0.3787	0.0000	3.55E-07
291	0.80	0.446	0.207	0.3026	0.3786	0.0000	3.55E-07
292	0.00	0.000	0.141	0.2885	0.3785	0.0000	3.55E-07
293	0.02	0.000	0.078	0.2828	0.3784	0.0000	3.55E-07
294	0.00	0.000	0.051	0.2778	0.3783	0.0000	3.55E-07
295	0.00	0.000	0.006	0.2772	0.3782	0.0000	3.55E-07
296	0.00	0.000	0.001	0.2770	0.3781	0.0000	3.54E-07
297	0.44	0.229	0.067	0.2912	0.3780	0.0000	3.54E-07
298	0.06	0.000	0.058	0.2913	0.3778	0.0000	3.54E-07
299	0.00	0.000	0.068	0.2845	0.3777	0.0000	3.54E-07
300	0.00	0.000	0.063	0.2783	0.3776	0.0000	3.54E-07
301	0.00	0.000	0.010	0.2773	0.3775	0.0000	3.54E-07
302	0.00	0.000	0.002	0.2771	0.3774	0.0000	3.54E-07
303	0.00	0.000	0.001	0.2770	0.3773	0.0000	3.54E-07
304	0.81	0.587	0.056	0.2933	0.3772	0.0000	3.54E-07
305	0.00	0.000	0.026	0.2906	0.3771	0.0000	3.54E-07
306	0.08	0.000	0.054	0.2935	0.3770	0.0000	3.54E-07
307	0.00	0.000	0.041	0.2894	0.3769	0.0000	3.53E-07
308	0.00	0.000	0.033	0.2861	0.3767	0.0000	3.53E-07
309	0.00	0.000	0.038	0.2823	0.3766	0.0000	3.53E-07
310	0.00	0.000	0.027	0.2797	0.3765	0.0000	3.53E-07
311	0.00	0.000	0.021	0.2776	0.3764	0.0000	3.53E-07
312	0.00	0.000	0.005	0.2771	0.3763	0.0000	3.53E-07

313		0.00	0.000	0.001	0.2770	0.3762	0.0000	3.53E-07
314		0.00	0.000	0.000	0.2770	0.3761	0.0000	3.53E-07
315		0.00	0.000	0.000	0.2770	0.3760	0.0000	3.53E-07
316		0.00	0.000	0.000	0.2770	0.3759	0.0000	3.53E-07
317		0.00	0.000	0.000	0.2770	0.3758	0.0000	3.53E-07
318		0.15	0.000	0.031	0.2892	0.3757	0.0000	3.52E-07
319		0.00	0.000	0.011	0.2880	0.3755	0.0000	3.52E-07
320		0.00	0.000	0.010	0.2871	0.3754	0.0000	3.52E-07
321		0.00	0.000	0.011	0.2860	0.3753	0.0000	3.52E-07
322		0.00	0.000	0.011	0.2848	0.3752	0.0000	3.52E-07
323		0.35	0.158	0.041	0.2997	0.3751	0.0000	3.52E-07
324		0.00	0.000	0.011	0.2987	0.3750	0.0000	3.52E-07
325		0.00	0.000	0.011	0.2975	0.3749	0.0000	3.52E-07
326		0.00	0.000	0.010	0.2965	0.3748	0.0000	3.52E-07
327		0.00	0.000	0.010	0.2955	0.3747	0.0000	3.52E-07
328		0.00	0.000	0.010	0.2946	0.3746	0.0000	3.51E-07
329		0.00	0.000	0.009	0.2936	0.3744	0.0000	3.51E-07
330		0.00	0.000	0.009	0.2927	0.3743	0.0000	3.51E-07
331	*	0.00	0.000	0.000	0.2927	0.3742	0.0000	3.51E-07
332		0.19	0.037	0.033	0.3048	0.3741	0.0000	3.51E-07
333		0.06	0.000	0.055	0.3056	0.3740	0.0000	3.51E-07
334		0.66	0.471	0.063	0.3181	0.3739	0.0000	3.51E-07
335		0.00	0.000	0.060	0.3121	0.3738	0.0000	3.51E-07
336		0.06	0.000	0.047	0.3131	0.3737	0.0000	3.51E-07
337	*	0.16	0.000	0.030	0.3150	0.3736	0.0000	3.51E-07
338	*	0.02	0.000	0.035	0.3170	0.3735	0.0000	3.51E-07
339	*	0.28	0.000	0.027	0.3190	0.3733	0.0000	3.50E-07
340		0.08	0.236	0.030	0.3317	0.3732	0.0000	3.50E-07
341		0.00	0.000	0.028	0.3289	0.3732	0.0000	3.50E-07
342		0.00	0.000	0.034	0.3255	0.3732	0.0000	3.50E-07
343	*	0.00	0.000	0.018	0.3237	0.3731	0.0000	3.50E-07
344		0.00	0.000	0.037	0.3200	0.3729	0.0000	3.50E-07

345		0.11	0.000	0.070	0.3243	0.3728	0.0000	3.50E-07
346		0.00	0.000	0.058	0.3185	0.3727	0.0000	3.50E-07
347	*	0.00	0.000	0.024	0.3161	0.3726	0.0000	3.50E-07
348	*	0.00	0.000	0.000	0.3161	0.3725	0.0000	3.50E-07
349		0.00	0.000	0.040	0.3122	0.3724	0.0000	3.50E-07
350		0.00	0.000	0.058	0.3063	0.3723	0.0000	3.50E-07
351		0.01	0.000	0.132	0.2941	0.3722	0.0000	3.49E-07
352		0.42	0.204	0.085	0.3077	0.3721	0.0000	3.49E-07
353		0.06	0.000	0.130	0.3004	0.3720	0.0000	3.49E-07
354		0.17	0.016	0.077	0.3084	0.3719	0.0000	3.49E-07
355		0.00	0.000	0.055	0.3029	0.3718	0.0000	3.49E-07
356		0.00	0.000	0.071	0.2958	0.3716	0.0000	3.49E-07
357		0.24	0.070	0.085	0.3042	0.3715	0.0000	3.49E-07
358		0.34	0.141	0.106	0.3134	0.3714	0.0000	3.49E-07
359		0.00	0.000	0.034	0.3099	0.3713	0.0000	3.49E-07
360		0.23	0.072	0.071	0.3190	0.3712	0.0000	3.49E-07
361		0.01	0.000	0.035	0.3162	0.3711	0.0000	3.49E-07
362		0.00	0.000	0.048	0.3114	0.3710	0.0000	3.48E-07
363		0.00	0.000	0.035	0.3080	0.3709	0.0000	3.48E-07
364		0.00	0.000	0.027	0.3052	0.3708	0.0000	3.48E-07
365		0.00	0.000	0.036	0.3016	0.3707	0.0000	3.48E-07

* = Frozen (air or soil)

Annual Totals for Year 16			
	inches	cubic feet	percent
Precipitation	43.48	157,837.2	100.00
Runoff	25.791	93,620.2	59.31
Evapotranspiration	17.578	63,807.7	40.43
Recirculation into Layer 1	0.0162	58.9	0.04
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0162	58.9	0.04
Percolation/Leakage through Layer 5	0.000134	0.4854	0.00
Average Head on Top of Layer 4	0.3908	---	---
Change in Water Storage	0.1126	408.8	0.26
Soil Water at Start of Year	1,406.7186	5,106,388.6	3235.23
Soil Water at End of Year	1,406.8312	5,106,797.3	3235.48
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0162	-58.9	-0.04

Daily Output for Year 17

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.061	0.2956	0.3704	0.0000	3.48E-07
2			0.01	0.000	0.044	0.2923	0.3703	0.0000	3.48E-07
3			0.82	0.583	0.077	0.3086	0.3702	0.0000	3.48E-07
4			0.00	0.000	0.055	0.3031	0.3701	0.0000	3.48E-07
5			0.00	0.000	0.038	0.2993	0.3700	0.0000	3.48E-07
6			0.38	0.184	0.058	0.3134	0.3699	0.0000	3.47E-07
7			0.00	0.000	0.049	0.3084	0.3698	0.0000	3.47E-07
8			0.00	0.000	0.025	0.3060	0.3697	0.0000	3.47E-07
9	*		0.00	0.000	0.000	0.3060	0.3696	0.0000	3.47E-07
10	*		0.00	0.000	0.000	0.3060	0.3695	0.0000	3.47E-07
11	*		0.00	0.000	0.000	0.3060	0.3694	0.0000	3.47E-07
12			0.00	0.000	0.038	0.3022	0.3693	0.0000	3.47E-07
13	*		0.00	0.000	0.000	0.3022	0.3692	0.0000	3.47E-07
14	*		0.00	0.000	0.000	0.3022	0.3690	0.0000	3.47E-07
15	*		0.00	0.000	0.000	0.3022	0.3689	0.0000	3.47E-07
16			0.00	0.000	0.038	0.2984	0.3688	0.0000	3.47E-07
17			0.00	0.000	0.042	0.2942	0.3687	0.0000	3.46E-07
18	*		0.00	0.000	0.019	0.2924	0.3686	0.0000	3.46E-07
19			0.00	0.000	0.035	0.2889	0.3685	0.0000	3.46E-07
20			0.00	0.000	0.062	0.2826	0.3684	0.0000	3.46E-07
21			0.00	0.000	0.048	0.2778	0.3683	0.0000	3.46E-07
22			0.00	0.000	0.006	0.2772	0.3682	0.0000	3.46E-07
23			0.00	0.000	0.002	0.2771	0.3681	0.0000	3.46E-07
24			0.00	0.000	0.001	0.2770	0.3680	0.0000	3.46E-07

25		0.00	0.000	0.000	0.2770	0.3679	0.0000	3.46E-07
26	*	0.00	0.000	0.000	0.2770	0.3678	0.0000	3.46E-07
27		0.00	0.000	0.000	0.2770	0.3676	0.0000	3.46E-07
28		0.00	0.000	0.000	0.2770	0.3675	0.0000	3.45E-07
29		0.00	0.000	0.000	0.2770	0.3674	0.0000	3.45E-07
30		0.00	0.000	0.000	0.2770	0.3673	0.0000	3.45E-07
31		0.00	0.000	0.000	0.2770	0.3672	0.0000	3.45E-07
32		0.00	0.000	0.000	0.2770	0.3671	0.0000	3.45E-07
33	*	0.00	0.000	0.000	0.2770	0.3670	0.0000	3.45E-07
34	*	0.00	0.000	0.000	0.2770	0.3669	0.0000	3.45E-07
35		0.01	0.000	0.013	0.2772	0.3668	0.0000	3.45E-07
36		0.24	0.085	0.032	0.2898	0.3667	0.0000	3.45E-07
37	*	0.13	0.000	0.050	0.2917	0.3666	0.0000	3.45E-07
38	*	0.01	0.000	0.021	0.2937	0.3665	0.0000	3.45E-07
39	*	0.00	0.000	0.045	0.2929	0.3664	0.0000	3.44E-07
40	*	0.00	0.000	0.000	0.2929	0.3662	0.0000	3.44E-07
41	*	0.00	0.000	0.012	0.2918	0.3661	0.0000	3.44E-07
42		0.46	0.284	0.041	0.3057	0.3660	0.0000	3.44E-07
43	*	0.00	0.000	0.000	0.3057	0.3659	0.0000	3.44E-07
44	*	0.00	0.000	0.000	0.3057	0.3658	0.0000	3.44E-07
45	*	0.17	0.000	0.055	0.3077	0.3657	0.0000	3.44E-07
46		0.00	0.000	0.086	0.3084	0.3656	0.0000	3.44E-07
47		0.06	0.000	0.064	0.3081	0.3655	0.0000	3.44E-07
48		0.00	0.000	0.083	0.2998	0.3654	0.0000	3.44E-07
49		0.00	0.000	0.064	0.2934	0.3653	0.0000	3.44E-07
50		0.00	0.000	0.036	0.2898	0.3652	0.0000	3.43E-07
51		0.00	0.000	0.030	0.2871	0.3651	0.0000	3.43E-07
52		0.00	0.000	0.029	0.2842	0.3650	0.0000	3.43E-07
53	*	0.00	0.000	0.025	0.2817	0.3649	0.0000	3.43E-07
54		0.00	0.000	0.025	0.2792	0.3648	0.0000	3.43E-07
55		0.00	0.000	0.019	0.2773	0.3647	0.0000	3.43E-07
56		0.00	0.000	0.002	0.2771	0.3646	0.0000	3.43E-07

57		0.05	0.000	0.024	0.2801	0.3644	0.0000	3.43E-07
58		0.00	0.000	0.002	0.2800	0.3643	0.0000	3.43E-07
59		0.06	0.000	0.030	0.2827	0.3642	0.0000	3.43E-07
60		0.00	0.000	0.011	0.2816	0.3641	0.0000	3.43E-07
61		0.00	0.000	0.009	0.2807	0.3640	0.0000	3.42E-07
62	*	0.00	0.000	0.011	0.2796	0.3639	0.0000	3.42E-07
63		0.17	0.020	0.034	0.2909	0.3638	0.0000	3.42E-07
64		0.00	0.000	0.010	0.2902	0.3637	0.0000	3.42E-07
65		0.00	0.000	0.011	0.2891	0.3636	0.0000	3.42E-07
66		0.00	0.000	0.010	0.2881	0.3635	0.0000	3.42E-07
67		0.00	0.000	0.010	0.2870	0.3634	0.0000	3.42E-07
68		0.00	0.000	0.010	0.2861	0.3633	0.0000	3.42E-07
69		0.74	0.551	0.039	0.3012	0.3632	0.0000	3.42E-07
70		0.00	0.000	0.038	0.2974	0.3631	0.0000	3.42E-07
71	*	0.00	0.000	0.000	0.2974	0.3630	0.0000	3.42E-07
72	*	0.00	0.000	0.000	0.2974	0.3629	0.0000	3.41E-07
73		0.29	0.105	0.093	0.3065	0.3628	0.0000	3.41E-07
74		0.00	0.000	0.030	0.3035	0.3627	0.0000	3.41E-07
75		0.00	0.000	0.051	0.2984	0.3626	0.0000	3.41E-07
76		0.12	0.000	0.079	0.3028	0.3624	0.0000	3.41E-07
77	*	0.25	0.000	0.030	0.3048	0.3623	0.0000	3.41E-07
78	*	0.00	0.000	0.032	0.3068	0.3622	0.0000	3.41E-07
79	*	0.08	0.000	0.019	0.3087	0.3621	0.0000	3.41E-07
80		0.00	0.008	0.122	0.3151	0.3620	0.0000	3.41E-07
81		0.00	0.000	0.086	0.3065	0.3619	0.0000	3.41E-07
82		0.00	0.000	0.071	0.2995	0.3618	0.0000	3.41E-07
83		0.00	0.000	0.200	0.2795	0.3617	0.0000	3.40E-07
84		0.00	0.000	0.019	0.2776	0.3616	0.0000	3.40E-07
85		0.00	0.000	0.004	0.2771	0.3615	0.0000	3.40E-07
86		0.00	0.000	0.001	0.2770	0.3614	0.0000	3.40E-07
87		0.00	0.000	0.000	0.2770	0.3613	0.0000	3.40E-07
88		0.00	0.000	0.000	0.2770	0.3612	0.0000	3.40E-07

89		0.00	0.000	0.000	0.2770	0.3611	0.0000	3.40E-07
90		0.00	0.000	0.000	0.2770	0.3610	0.0000	3.40E-07
91		0.00	0.000	0.000	0.2770	0.3609	0.0000	3.40E-07
92	*	0.00	0.000	0.000	0.2770	0.3608	0.0000	3.40E-07
93		0.00	0.000	0.000	0.2770	0.3606	0.0000	3.40E-07
94		0.04	0.000	0.021	0.2786	0.3605	0.0000	3.39E-07
95		0.38	0.189	0.044	0.2933	0.3604	0.0000	3.39E-07
96		0.06	0.000	0.030	0.2963	0.3603	0.0000	3.39E-07
97		0.32	0.155	0.042	0.3088	0.3602	0.0000	3.39E-07
98		0.00	0.000	0.012	0.3076	0.3601	0.0000	3.39E-07
99		0.00	0.000	0.011	0.3065	0.3600	0.0000	3.39E-07
100		0.07	0.000	0.034	0.3103	0.3599	0.0000	3.39E-07
101		0.00	0.000	0.012	0.3090	0.3598	0.0000	3.39E-07
102		0.18	0.020	0.035	0.3213	0.3597	0.0000	3.39E-07
103		0.23	0.088	0.037	0.3318	0.3596	0.0000	3.39E-07
104		0.00	0.000	0.123	0.3195	0.3595	0.0000	3.39E-07
105		0.93	0.750	0.039	0.3336	0.3594	0.0000	3.38E-07
106		0.00	0.000	0.089	0.3247	0.3593	0.0000	3.38E-07
107		0.00	0.000	0.305	0.2942	0.3592	0.0000	3.38E-07
108		0.36	0.143	0.156	0.3005	0.3591	0.0000	3.38E-07
109		0.00	0.000	0.207	0.2798	0.3590	0.0000	3.38E-07
110		1.88	1.637	0.079	0.2959	0.3589	0.0000	3.38E-07
111		0.00	0.000	0.093	0.2867	0.3588	0.0000	3.38E-07
112		0.00	0.000	0.059	0.2808	0.3587	0.0000	3.38E-07
113		0.00	0.000	0.030	0.2778	0.3586	0.0000	3.38E-07
114	*	0.00	0.000	0.007	0.2771	0.3584	0.0000	3.38E-07
115		0.00	0.000	0.001	0.2770	0.3583	0.0000	3.38E-07
116		0.00	0.000	0.000	0.2770	0.3582	0.0000	3.37E-07
117		0.00	0.000	0.000	0.2770	0.3581	0.0000	3.37E-07
118		0.00	0.000	0.000	0.2770	0.3580	0.0000	3.37E-07
119		1.73	1.507	0.056	0.2933	0.3579	0.0000	3.37E-07
120		1.25	1.046	0.090	0.3049	0.3578	0.0000	3.37E-07

121	0.00	0.000	0.033	0.3016	0.3577	0.0000	3.37E-07
122	0.00	0.000	0.132	0.2884	0.3576	0.0000	3.37E-07
123	0.78	0.426	0.204	0.3034	0.3575	0.0000	3.37E-07
124	0.06	0.000	0.129	0.2969	0.3574	0.0000	3.37E-07
125	0.00	0.000	0.117	0.2855	0.3573	0.0000	3.37E-07
126	0.00	0.000	0.073	0.2782	0.3572	0.0000	3.37E-07
127	0.00	0.000	0.009	0.2773	0.3571	0.0000	3.36E-07
128	0.00	0.000	0.002	0.2771	0.3570	0.0000	3.36E-07
129	0.00	0.000	0.001	0.2770	0.3569	0.0000	3.36E-07
130	0.47	0.259	0.067	0.2916	0.3568	0.0000	3.36E-07
131	0.07	0.000	0.078	0.2911	0.3567	0.0000	3.36E-07
132	0.91	0.710	0.078	0.3037	0.3566	0.0000	3.36E-07
133	0.66	0.365	0.176	0.3152	0.3565	0.0000	3.36E-07
134	0.04	0.000	0.059	0.3135	0.3564	0.0000	3.36E-07
135	0.48	0.275	0.080	0.3263	0.3563	0.0000	3.36E-07
136	0.00	0.000	0.048	0.3220	0.3562	0.0000	3.36E-07
137	0.00	0.000	0.196	0.3024	0.3560	0.0000	3.36E-07
138	0.00	0.000	0.083	0.2941	0.3559	0.0000	3.35E-07
139	1.29	0.850	0.301	0.3082	0.3558	0.0000	3.35E-07
140	0.01	0.000	0.233	0.2855	0.3557	0.0000	3.35E-07
141	0.00	0.000	0.075	0.2780	0.3556	0.0000	3.35E-07
142	0.00	0.000	0.008	0.2772	0.3555	0.0000	3.35E-07
143	0.00	0.000	0.002	0.2770	0.3554	0.0000	3.35E-07
144	0.00	0.000	0.000	0.2770	0.3553	0.0000	3.35E-07
145	0.00	0.000	0.000	0.2770	0.3552	0.0000	3.35E-07
146	0.00	0.000	0.000	0.2770	0.3551	0.0000	3.35E-07
147	0.00	0.000	0.000	0.2770	0.3550	0.0000	3.35E-07
148	0.00	0.000	0.000	0.2770	0.3549	0.0000	3.35E-07
149	0.00	0.000	0.000	0.2770	0.3548	0.0000	3.35E-07
150	0.00	0.000	0.000	0.2770	0.3547	0.0000	3.34E-07
151	0.01	0.000	0.008	0.2770	0.3546	0.0000	3.34E-07
152	0.01	0.000	0.010	0.2770	0.3545	0.0000	3.34E-07

153	0.01	0.000	0.007	0.2770	0.3544	0.0000	3.34E-07
154	0.00	0.000	0.000	0.2770	0.3543	0.0000	3.34E-07
155	0.00	0.000	0.000	0.2770	0.3542	0.0000	3.34E-07
156	0.13	0.000	0.026	0.2875	0.3541	0.0000	3.34E-07
157	0.00	0.000	0.009	0.2866	0.3540	0.0000	3.34E-07
158	0.00	0.000	0.011	0.2855	0.3539	0.0000	3.34E-07
159	0.00	0.000	0.013	0.2841	0.3538	0.0000	3.34E-07
160	0.55	0.357	0.045	0.2984	0.3537	0.0000	3.34E-07
161	0.23	0.086	0.036	0.3091	0.3536	0.0000	3.33E-07
162	0.00	0.000	0.014	0.3077	0.3535	0.0000	3.33E-07
163	0.00	0.000	0.013	0.3065	0.3534	0.0000	3.33E-07
164	0.00	0.000	0.012	0.3053	0.3533	0.0000	3.33E-07
165	0.24	0.077	0.037	0.3179	0.3531	0.0000	3.33E-07
166	0.01	0.000	0.069	0.3123	0.3530	0.0000	3.33E-07
167	0.02	0.000	0.069	0.3071	0.3529	0.0000	3.33E-07
168	0.05	0.000	0.116	0.3007	0.3528	0.0000	3.33E-07
169	0.00	0.000	0.050	0.2956	0.3527	0.0000	3.33E-07
170	0.00	0.000	0.044	0.2912	0.3526	0.0000	3.33E-07
171	0.00	0.000	0.035	0.2877	0.3525	0.0000	3.33E-07
172	0.00	0.000	0.034	0.2843	0.3524	0.0000	3.32E-07
173	0.00	0.000	0.027	0.2817	0.3523	0.0000	3.32E-07
174	0.00	0.000	0.026	0.2791	0.3522	0.0000	3.32E-07
175	0.00	0.000	0.018	0.2773	0.3521	0.0000	3.32E-07
176	0.00	0.000	0.005	0.2771	0.3520	0.0000	3.32E-07
177	0.09	0.000	0.027	0.2835	0.3519	0.0000	3.32E-07
178	0.21	0.057	0.037	0.2956	0.3518	0.0000	3.32E-07
179	0.28	0.115	0.046	0.3071	0.3517	0.0000	3.32E-07
180	0.29	0.119	0.154	0.3084	0.3516	0.0000	3.32E-07
181	0.00	0.000	0.015	0.3068	0.3515	0.0000	3.32E-07
182	0.06	0.000	0.036	0.3089	0.3514	0.0000	3.32E-07
183	0.00	0.000	0.016	0.3073	0.3513	0.0000	3.31E-07
184	0.00	0.000	0.017	0.3057	0.3512	0.0000	3.31E-07

185	0.00	0.000	0.017	0.3039	0.3511	0.0000	3.31E-07
186	0.00	0.000	0.014	0.3026	0.3510	0.0000	3.31E-07
187	0.00	0.000	0.017	0.3009	0.3509	0.0000	3.31E-07
188	0.00	0.000	0.016	0.2993	0.3508	0.0000	3.31E-07
189	0.00	0.000	0.015	0.2977	0.3507	0.0000	3.31E-07
190	0.00	0.000	0.015	0.2963	0.3506	0.0000	3.31E-07
191	0.03	0.000	0.030	0.2964	0.3505	0.0000	3.31E-07
192	0.00	0.000	0.014	0.2950	0.3504	0.0000	3.31E-07
193	0.03	0.000	0.032	0.2946	0.3503	0.0000	3.31E-07
194	0.29	0.118	0.047	0.3073	0.3502	0.0000	3.31E-07
195	0.54	0.227	0.328	0.3057	0.3501	0.0000	3.30E-07
196	1.16	0.819	0.231	0.3168	0.3500	0.0000	3.30E-07
197	0.00	0.000	0.080	0.3088	0.3499	0.0000	3.30E-07
198	0.00	0.000	0.105	0.2983	0.3498	0.0000	3.30E-07
199	0.00	0.000	0.182	0.2802	0.3497	0.0000	3.30E-07
200	0.00	0.000	0.028	0.2774	0.3496	0.0000	3.30E-07
201	0.00	0.000	0.003	0.2771	0.3494	0.0000	3.30E-07
202	0.04	0.000	0.025	0.2784	0.3493	0.0000	3.30E-07
203	0.41	0.203	0.064	0.2930	0.3492	0.0000	3.30E-07
204	0.02	0.000	0.114	0.2836	0.3491	0.0000	3.30E-07
205	0.13	0.000	0.049	0.2920	0.3490	0.0000	3.30E-07
206	0.01	0.000	0.036	0.2892	0.3489	0.0000	3.29E-07
207	0.18	0.018	0.053	0.2997	0.3488	0.0000	3.29E-07
208	0.04	0.000	0.045	0.2990	0.3487	0.0000	3.29E-07
209	0.00	0.000	0.022	0.2968	0.3486	0.0000	3.29E-07
210	0.00	0.000	0.018	0.2950	0.3485	0.0000	3.29E-07
211	0.00	0.000	0.017	0.2933	0.3484	0.0000	3.29E-07
212	0.00	0.000	0.020	0.2913	0.3483	0.0000	3.29E-07
213	0.00	0.000	0.019	0.2895	0.3482	0.0000	3.29E-07
214	0.00	0.000	0.021	0.2873	0.3481	0.0000	3.29E-07
215	0.32	0.135	0.047	0.3011	0.3480	0.0000	3.29E-07
216	0.09	0.000	0.177	0.2924	0.3479	0.0000	3.29E-07

217	0.19	0.038	0.045	0.3033	0.3478	0.0000	3.28E-07
218	0.00	0.000	0.164	0.2869	0.3477	0.0000	3.28E-07
219	0.00	0.000	0.018	0.2851	0.3476	0.0000	3.28E-07
220	0.00	0.000	0.021	0.2830	0.3475	0.0000	3.28E-07
221	0.00	0.000	0.018	0.2813	0.3474	0.0000	3.28E-07
222	0.00	0.000	0.023	0.2790	0.3473	0.0000	3.28E-07
223	0.00	0.000	0.016	0.2774	0.3472	0.0000	3.28E-07
224	0.00	0.000	0.003	0.2771	0.3471	0.0000	3.28E-07
225	0.00	0.000	0.001	0.2770	0.3470	0.0000	3.28E-07
226	0.00	0.000	0.000	0.2770	0.3469	0.0000	3.28E-07
227	0.09	0.000	0.027	0.2832	0.3468	0.0000	3.28E-07
228	0.00	0.000	0.008	0.2824	0.3467	0.0000	3.28E-07
229	0.00	0.000	0.010	0.2813	0.3466	0.0000	3.27E-07
230	0.00	0.000	0.015	0.2800	0.3465	0.0000	3.27E-07
231	0.01	0.000	0.021	0.2788	0.3464	0.0000	3.27E-07
232	0.24	0.077	0.037	0.2913	0.3463	0.0000	3.27E-07
233	0.00	0.000	0.008	0.2905	0.3462	0.0000	3.27E-07
234	0.29	0.108	0.047	0.3038	0.3461	0.0000	3.27E-07
235	0.00	0.000	0.052	0.2986	0.3460	0.0000	3.27E-07
236	0.00	0.000	0.015	0.2971	0.3459	0.0000	3.27E-07
237	0.00	0.000	0.011	0.2960	0.3458	0.0000	3.27E-07
238	0.16	0.012	0.041	0.3071	0.3457	0.0000	3.27E-07
239	0.00	0.000	0.132	0.2938	0.3456	0.0000	3.27E-07
240	0.00	0.000	0.014	0.2924	0.3455	0.0000	3.26E-07
241	0.00	0.000	0.015	0.2910	0.3454	0.0000	3.26E-07
242	0.00	0.000	0.012	0.2897	0.3453	0.0000	3.26E-07
243	0.00	0.000	0.010	0.2887	0.3452	0.0000	3.26E-07
244	0.00	0.000	0.011	0.2877	0.3451	0.0000	3.26E-07
245	0.00	0.000	0.012	0.2865	0.3450	0.0000	3.26E-07
246	0.00	0.000	0.012	0.2853	0.3449	0.0000	3.26E-07
247	0.00	0.000	0.009	0.2844	0.3448	0.0000	3.26E-07
248	0.00	0.000	0.011	0.2833	0.3447	0.0000	3.26E-07

249		0.17	0.009	0.037	0.2957	0.3446	0.0000	3.26E-07
250		1.78	1.624	0.039	0.3070	0.3445	0.0000	3.26E-07
251		0.06	0.000	0.111	0.3018	0.3444	0.0000	3.26E-07
252		0.00	0.000	0.109	0.2909	0.3443	0.0000	3.25E-07
253		0.00	0.000	0.040	0.2869	0.3442	0.0000	3.25E-07
254		0.24	0.076	0.131	0.2904	0.3441	0.0000	3.25E-07
255		0.09	0.000	0.105	0.2890	0.3440	0.0000	3.25E-07
256		0.06	0.000	0.095	0.2856	0.3439	0.0000	3.25E-07
257		0.27	0.089	0.109	0.2931	0.3438	0.0000	3.25E-07
258		0.00	0.000	0.105	0.2826	0.3437	0.0000	3.25E-07
259		0.00	0.000	0.041	0.2785	0.3436	0.0000	3.25E-07
260		0.00	0.000	0.011	0.2774	0.3435	0.0000	3.25E-07
261		0.06	0.000	0.030	0.2800	0.3434	0.0000	3.25E-07
262		0.12	0.000	0.030	0.2886	0.3433	0.0000	3.25E-07
263		0.13	0.000	0.041	0.2975	0.3432	0.0000	3.24E-07
264		0.00	0.000	0.013	0.2962	0.3431	0.0000	3.24E-07
265		0.00	0.000	0.019	0.2943	0.3430	0.0000	3.24E-07
266		0.00	0.000	0.017	0.2926	0.3429	0.0000	3.24E-07
267		0.44	0.252	0.050	0.3066	0.3428	0.0000	3.24E-07
268		1.59	1.385	0.089	0.3182	0.3427	0.0000	3.24E-07
269		1.50	1.308	0.072	0.3298	0.3426	0.0000	3.24E-07
270		0.69	0.504	0.073	0.3413	0.3425	0.0000	3.24E-07
271		0.10	0.007	0.152	0.3356	0.3424	0.0000	3.24E-07
272		1.83	1.588	0.121	0.3476	0.3423	0.0000	3.24E-07
273		0.77	0.602	0.159	0.3487	0.3422	0.0000	3.24E-07
274		0.17	0.040	0.087	0.3530	0.3421	0.0000	3.24E-07
275		0.01	0.000	0.061	0.3481	0.3420	0.0000	3.23E-07
276		0.00	0.000	0.074	0.3408	0.3419	0.0000	3.23E-07
277	*	0.00	0.000	0.054	0.3354	0.3418	0.0000	3.23E-07
278		0.00	0.000	0.104	0.3249	0.3417	0.0000	3.23E-07
279		0.00	0.000	0.149	0.3100	0.3416	0.0000	3.23E-07
280		0.00	0.000	0.141	0.2959	0.3415	0.0000	3.23E-07

281	0.13	0.000	0.153	0.2935	0.3414	0.0000	3.23E-07
282	0.01	0.000	0.062	0.2885	0.3413	0.0000	3.23E-07
283	0.03	0.000	0.058	0.2853	0.3412	0.0000	3.23E-07
284	0.39	0.198	0.062	0.2986	0.3411	0.0000	3.23E-07
285	0.10	0.000	0.084	0.2997	0.3413	0.0000	3.23E-07
286	0.24	0.076	0.055	0.3105	0.3416	0.0000	3.23E-07
287	0.00	0.000	0.028	0.3077	0.3415	0.0000	3.23E-07
288	0.00	0.000	0.045	0.3032	0.3414	0.0000	3.23E-07
289	0.00	0.000	0.070	0.2962	0.3413	0.0000	3.23E-07
290	0.00	0.000	0.059	0.2903	0.3412	0.0000	3.23E-07
291	0.00	0.000	0.059	0.2844	0.3411	0.0000	3.23E-07
292	0.01	0.000	0.047	0.2804	0.3410	0.0000	3.23E-07
293	0.00	0.000	0.031	0.2773	0.3409	0.0000	3.23E-07
294	0.00	0.000	0.003	0.2771	0.3408	0.0000	3.22E-07
295	0.00	0.000	0.001	0.2770	0.3407	0.0000	3.22E-07
296	0.00	0.000	0.000	0.2770	0.3406	0.0000	3.22E-07
297	0.00	0.000	0.000	0.2770	0.3405	0.0000	3.22E-07
298	0.00	0.000	0.000	0.2770	0.3404	0.0000	3.22E-07
299	0.00	0.000	0.000	0.2770	0.3403	0.0000	3.22E-07
300	0.00	0.000	0.000	0.2770	0.3402	0.0000	3.22E-07
301	0.00	0.000	0.000	0.2770	0.3401	0.0000	3.22E-07
302	0.00	0.000	0.000	0.2770	0.3400	0.0000	3.22E-07
303	0.00	0.000	0.000	0.2770	0.3399	0.0000	3.22E-07
304	0.06	0.000	0.026	0.2805	0.3398	0.0000	3.22E-07
305	0.04	0.000	0.023	0.2826	0.3397	0.0000	3.21E-07
306	0.09	0.000	0.033	0.2883	0.3396	0.0000	3.21E-07
307	0.16	0.016	0.035	0.2997	0.3395	0.0000	3.21E-07
308	0.07	0.000	0.032	0.3036	0.3394	0.0000	3.21E-07
309	0.00	0.000	0.011	0.3026	0.3393	0.0000	3.21E-07
310	0.00	0.000	0.010	0.3016	0.3392	0.0000	3.21E-07
311	0.00	0.000	0.010	0.3006	0.3391	0.0000	3.21E-07
312	0.00	0.000	0.010	0.2996	0.3390	0.0000	3.21E-07

313		0.00	0.000	0.010	0.2986	0.3389	0.0000	3.21E-07
314		0.00	0.000	0.009	0.2977	0.3388	0.0000	3.21E-07
315		0.00	0.000	0.009	0.2968	0.3387	0.0000	3.21E-07
316		0.22	0.060	0.036	0.3096	0.3386	0.0000	3.21E-07
317		0.00	0.000	0.011	0.3085	0.3385	0.0000	3.20E-07
318		0.00	0.000	0.010	0.3075	0.3384	0.0000	3.20E-07
319		0.00	0.000	0.009	0.3066	0.3383	0.0000	3.20E-07
320		0.00	0.000	0.008	0.3058	0.3382	0.0000	3.20E-07
321		0.00	0.000	0.008	0.3050	0.3381	0.0000	3.20E-07
322		0.04	0.000	0.029	0.3066	0.3380	0.0000	3.20E-07
323		0.00	0.000	0.009	0.3056	0.3379	0.0000	3.20E-07
324		0.10	0.000	0.035	0.3124	0.3378	0.0000	3.20E-07
325		0.00	0.000	0.009	0.3115	0.3377	0.0000	3.20E-07
326		0.00	0.000	0.010	0.3105	0.3376	0.0000	3.20E-07
327		0.00	0.000	0.008	0.3097	0.3375	0.0000	3.20E-07
328		0.00	0.000	0.007	0.3090	0.3374	0.0000	3.20E-07
329		0.00	0.000	0.008	0.3083	0.3373	0.0000	3.19E-07
330	*	0.00	0.000	0.000	0.3083	0.3372	0.0000	3.19E-07
331		0.00	0.000	0.009	0.3074	0.3371	0.0000	3.19E-07
332		0.00	0.000	0.008	0.3066	0.3370	0.0000	3.19E-07
333		0.00	0.000	0.008	0.3057	0.3369	0.0000	3.19E-07
334		0.00	0.000	0.008	0.3049	0.3368	0.0000	3.19E-07
335		0.00	0.000	0.008	0.3041	0.3367	0.0000	3.19E-07
336		0.00	0.000	0.008	0.3033	0.3366	0.0000	3.19E-07
337		0.00	0.000	0.008	0.3025	0.3365	0.0000	3.19E-07
338		0.00	0.000	0.008	0.3017	0.3365	0.0000	3.19E-07
339		0.00	0.000	0.008	0.3010	0.3364	0.0000	3.19E-07
340		0.00	0.000	0.008	0.3002	0.3363	0.0000	3.19E-07
341		0.00	0.000	0.008	0.2995	0.3362	0.0000	3.18E-07
342		0.00	0.000	0.008	0.2987	0.3361	0.0000	3.18E-07
343	*	0.00	0.000	0.000	0.2987	0.3360	0.0000	3.18E-07
344	*	0.31	0.000	0.018	0.3007	0.3359	0.0000	3.18E-07

345	*	0.03	0.000	0.000	0.3026	0.3358	0.0000	3.18E-07
346	*	0.05	0.000	0.000	0.3046	0.3357	0.0000	3.18E-07
347	*	0.06	0.000	0.016	0.3066	0.3356	0.0000	3.18E-07
348	*	0.07	0.000	0.009	0.3086	0.3355	0.0000	3.18E-07
349	*	0.00	0.000	0.006	0.3105	0.3354	0.0000	3.18E-07
350	*	0.00	0.000	0.005	0.3125	0.3353	0.0000	3.18E-07
351	*	0.00	0.000	0.000	0.3145	0.3352	0.0000	3.18E-07
352		0.08	0.257	0.012	0.3272	0.3351	0.0000	3.17E-07
353		0.08	0.000	0.059	0.3288	0.3350	0.0000	3.17E-07
354		0.00	0.000	0.032	0.3256	0.3349	0.0000	3.17E-07
355		0.00	0.000	0.023	0.3233	0.3348	0.0000	3.17E-07
356	*	0.03	0.000	0.022	0.3244	0.3347	0.0000	3.17E-07
357	*	0.04	0.000	0.040	0.3242	0.3346	0.0000	3.17E-07
358		0.00	0.000	0.037	0.3205	0.3345	0.0000	3.17E-07
359		0.00	0.000	0.031	0.3175	0.3345	0.0000	3.17E-07
360		0.00	0.000	0.036	0.3138	0.3344	0.0000	3.17E-07
361	*	0.00	0.000	0.020	0.3118	0.3343	0.0000	3.17E-07
362		0.00	0.000	0.036	0.3082	0.3342	0.0000	3.17E-07
363		0.00	0.000	0.032	0.3050	0.3341	0.0000	3.17E-07
364		0.00	0.000	0.028	0.3022	0.3340	0.0000	3.17E-07
365		0.00	0.000	0.024	0.2998	0.3339	0.0000	3.16E-07

* = Frozen (air or soil)

Annual Totals for Year 17			
	inches	cubic feet	percent
Precipitation	35.29	128,090.7	100.00
Runoff	20.899	75,862.2	59.23
Evapotranspiration	14.418	52,337.2	40.86
Recirculation into Layer 1	0.0146	52.8	0.04
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0146	52.8	0.04
Percolation/Leakage through Layer 5	0.000121	0.4396	0.00
Average Head on Top of Layer 4	0.3516	---	---
Change in Water Storage	-0.0301	-109.2	-0.09
Soil Water at Start of Year	1,406.8312	5,106,797.3	3986.86
Soil Water at End of Year	1,406.8011	5,106,688.2	3986.78
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0146	-52.8	-0.04

Daily Output for Year 18

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.023	0.2975	0.3338	0.0000	3.16E-07
2			0.08	0.000	0.046	0.3005	0.3337	0.0000	3.16E-07
3	*		0.38	0.000	0.024	0.3025	0.3336	0.0000	3.16E-07
4	*	*	0.00	0.000	0.011	0.3025	0.3335	0.0000	3.16E-07
5	*	*	0.00	0.000	0.016	0.3025	0.3334	0.0000	3.16E-07
6	*	*	0.00	0.000	0.008	0.3025	0.3333	0.0000	3.16E-07
7	*	*	0.00	0.000	0.005	0.3025	0.3332	0.0000	3.16E-07
8	*	*	0.00	0.000	0.010	0.3025	0.3331	0.0000	3.16E-07
9	*	*	0.00	0.000	0.000	0.3025	0.3330	0.0000	3.16E-07
10	*	*	0.00	0.000	0.018	0.3025	0.3329	0.0000	3.16E-07
11		*	0.00	0.219	0.040	0.3037	0.3328	0.0000	3.16E-07
12		*	0.01	0.000	0.007	0.3038	0.3327	0.0000	3.15E-07
13			0.00	0.000	0.100	0.2938	0.3326	0.0000	3.15E-07
14			0.00	0.000	0.020	0.2918	0.3325	0.0000	3.15E-07
15			0.00	0.000	0.019	0.2899	0.3324	0.0000	3.15E-07
16			0.00	0.000	0.018	0.2880	0.3324	0.0000	3.15E-07
17			0.00	0.000	0.017	0.2864	0.3323	0.0000	3.15E-07
18	*		0.00	0.000	0.018	0.2846	0.3322	0.0000	3.15E-07
19			0.00	0.000	0.017	0.2829	0.3321	0.0000	3.15E-07
20			0.28	0.120	0.043	0.2947	0.3322	0.0000	3.15E-07
21			0.15	0.007	0.041	0.3049	0.3322	0.0000	3.15E-07
22	*		0.00	0.000	0.025	0.3025	0.3321	0.0000	3.15E-07
23	*		0.00	0.000	0.022	0.3002	0.3320	0.0000	3.15E-07
24	*		0.06	0.000	0.044	0.3020	0.3319	0.0000	3.15E-07

25	*		0.06	0.000	0.042	0.3040	0.3318	0.0000	3.15E-07
26	*		0.15	0.000	0.018	0.3060	0.3317	0.0000	3.15E-07
27	*	*	0.01	0.000	0.031	0.3060	0.3316	0.0000	3.14E-07
28	*	*	0.00	0.000	0.000	0.3060	0.3315	0.0000	3.14E-07
29		*	0.00	0.001	0.084	0.3066	0.3314	0.0000	3.14E-07
30	*	*	0.00	0.000	0.000	0.3067	0.3313	0.0000	3.14E-07
31		*	0.47	0.438	0.026	0.3071	0.3312	0.0000	3.14E-07
32		*	0.19	0.160	0.026	0.3071	0.3311	0.0000	3.14E-07
33			0.07	0.000	0.092	0.3052	0.3310	0.0000	3.14E-07
34			0.00	0.000	0.052	0.2999	0.3309	0.0000	3.14E-07
35			0.00	0.000	0.044	0.2955	0.3311	0.0000	3.14E-07
36			0.09	0.000	0.063	0.2977	0.3310	0.0000	3.14E-07
37			0.00	0.000	0.037	0.2941	0.3309	0.0000	3.14E-07
38			0.00	0.000	0.040	0.2901	0.3308	0.0000	3.14E-07
39	*		0.00	0.000	0.000	0.2901	0.3307	0.0000	3.14E-07
40	*		0.00	0.000	0.000	0.2901	0.3306	0.0000	3.14E-07
41	*		0.00	0.000	0.000	0.2901	0.3305	0.0000	3.14E-07
42	*		0.05	0.000	0.046	0.2901	0.3304	0.0000	3.13E-07
43	*		0.00	0.000	0.031	0.2870	0.3303	0.0000	3.13E-07
44			0.00	0.000	0.052	0.2817	0.3302	0.0000	3.13E-07
45			0.00	0.000	0.041	0.2776	0.3301	0.0000	3.13E-07
46			0.00	0.000	0.005	0.2772	0.3300	0.0000	3.13E-07
47			0.00	0.000	0.002	0.2770	0.3299	0.0000	3.13E-07
48			0.22	0.055	0.049	0.2886	0.3298	0.0000	3.13E-07
49			0.00	0.000	0.066	0.2820	0.3297	0.0000	3.13E-07
50			0.00	0.000	0.026	0.2794	0.3296	0.0000	3.13E-07
51			0.03	0.000	0.043	0.2784	0.3295	0.0000	3.13E-07
52			0.00	0.000	0.005	0.2780	0.3294	0.0000	3.13E-07
53			0.00	0.000	0.006	0.2774	0.3293	0.0000	3.13E-07
54			0.00	0.000	0.004	0.2771	0.3292	0.0000	3.12E-07
55			0.21	0.049	0.036	0.2896	0.3292	0.0000	3.12E-07
56			0.00	0.000	0.009	0.2887	0.3291	0.0000	3.12E-07

57		0.00	0.000	0.014	0.2872	0.3290	0.0000	3.12E-07
58		0.00	0.000	0.013	0.2859	0.3289	0.0000	3.12E-07
59		0.00	0.000	0.013	0.2846	0.3288	0.0000	3.12E-07
60		0.00	0.000	0.012	0.2834	0.3287	0.0000	3.12E-07
61		0.00	0.000	0.012	0.2822	0.3286	0.0000	3.12E-07
62		0.00	0.000	0.011	0.2811	0.3285	0.0000	3.12E-07
63		0.00	0.000	0.011	0.2799	0.3284	0.0000	3.12E-07
64		0.00	0.000	0.011	0.2789	0.3283	0.0000	3.12E-07
65	*	0.00	0.000	0.010	0.2779	0.3282	0.0000	3.12E-07
66		0.00	0.000	0.008	0.2771	0.3281	0.0000	3.11E-07
67		0.00	0.000	0.001	0.2770	0.3280	0.0000	3.11E-07
68		0.08	0.000	0.026	0.2828	0.3279	0.0000	3.11E-07
69		0.27	0.098	0.040	0.2964	0.3278	0.0000	3.11E-07
70		0.08	0.000	0.031	0.3012	0.3277	0.0000	3.11E-07
71		0.01	0.000	0.017	0.3005	0.3276	0.0000	3.11E-07
72		0.00	0.000	0.012	0.2996	0.3275	0.0000	3.11E-07
73		0.51	0.335	0.039	0.3136	0.3274	0.0000	3.11E-07
74		0.00	0.000	0.038	0.3098	0.3273	0.0000	3.11E-07
75		0.00	0.000	0.049	0.3049	0.3272	0.0000	3.11E-07
76	*	0.00	0.000	0.026	0.3024	0.3271	0.0000	3.11E-07
77		0.00	0.000	0.095	0.2929	0.3271	0.0000	3.11E-07
78		0.08	0.000	0.088	0.2925	0.3270	0.0000	3.10E-07
79		0.07	0.000	0.073	0.2918	0.3269	0.0000	3.10E-07
80		0.07	0.000	0.062	0.2926	0.3268	0.0000	3.10E-07
81		0.67	0.472	0.061	0.3065	0.3267	0.0000	3.10E-07
82		0.00	0.000	0.079	0.2986	0.3266	0.0000	3.10E-07
83	*	0.00	0.000	0.030	0.2956	0.3265	0.0000	3.10E-07
84	*	0.00	0.000	0.000	0.2956	0.3264	0.0000	3.10E-07
85		0.00	0.000	0.080	0.2875	0.3263	0.0000	3.10E-07
86		0.00	0.000	0.070	0.2805	0.3262	0.0000	3.10E-07
87		0.00	0.000	0.029	0.2776	0.3261	0.0000	3.10E-07
88		0.00	0.000	0.005	0.2772	0.3260	0.0000	3.10E-07

89		0.00	0.000	0.001	0.2770	0.3259	0.0000	3.10E-07
90		0.00	0.000	0.000	0.2770	0.3258	0.0000	3.09E-07
91		0.68	0.461	0.057	0.2933	0.3257	0.0000	3.09E-07
92		0.02	0.000	0.027	0.2921	0.3256	0.0000	3.09E-07
93	*	0.55	0.000	0.028	0.2941	0.3255	0.0000	3.09E-07
94		0.04	0.388	0.025	0.3067	0.3254	0.0000	3.09E-07
95		0.34	0.161	0.078	0.3169	0.3253	0.0000	3.09E-07
96		0.00	0.000	0.053	0.3117	0.3252	0.0000	3.09E-07
97		0.52	0.268	0.118	0.3252	0.3251	0.0000	3.09E-07
98		0.00	0.000	0.096	0.3156	0.3250	0.0000	3.09E-07
99		0.18	0.025	0.078	0.3238	0.3250	0.0000	3.09E-07
100		0.02	0.000	0.085	0.3174	0.3249	0.0000	3.09E-07
101		0.10	0.000	0.102	0.3168	0.3248	0.0000	3.09E-07
102		0.00	0.000	0.133	0.3035	0.3247	0.0000	3.08E-07
103		0.00	0.000	0.124	0.2911	0.3246	0.0000	3.08E-07
104		0.46	0.187	0.163	0.3026	0.3245	0.0000	3.08E-07
105		0.12	0.000	0.069	0.3080	0.3244	0.0000	3.08E-07
106	*	0.41	0.000	0.047	0.3100	0.3243	0.0000	3.08E-07
107		0.00	0.115	0.101	0.3227	0.3242	0.0000	3.08E-07
108		0.00	0.000	0.052	0.3176	0.3241	0.0000	3.08E-07
109		1.16	0.936	0.090	0.3309	0.3240	0.0000	3.08E-07
110		0.00	0.000	0.056	0.3254	0.3239	0.0000	3.08E-07
111		0.08	0.000	0.113	0.3220	0.3238	0.0000	3.08E-07
112		0.01	0.000	0.052	0.3182	0.3237	0.0000	3.08E-07
113	*	0.00	0.000	0.080	0.3106	0.3236	0.0000	3.08E-07
114		1.01	0.742	0.122	0.3251	0.3235	0.0000	3.07E-07
115		0.00	0.000	0.084	0.3168	0.3234	0.0000	3.07E-07
116		0.00	0.000	0.103	0.3064	0.3233	0.0000	3.07E-07
117		0.13	0.000	0.162	0.3031	0.3232	0.0000	3.07E-07
118		2.19	1.855	0.201	0.3161	0.3232	0.0000	3.07E-07
119		0.00	0.000	0.075	0.3086	0.3231	0.0000	3.07E-07
120		0.00	0.000	0.121	0.2965	0.3230	0.0000	3.07E-07

121	0.11	0.000	0.119	0.2952	0.3229	0.0000	3.07E-07
122	0.31	0.094	0.202	0.2966	0.3228	0.0000	3.07E-07
123	0.00	0.000	0.123	0.2843	0.3227	0.0000	3.07E-07
124	0.00	0.000	0.054	0.2789	0.3226	0.0000	3.07E-07
125	0.00	0.000	0.015	0.2775	0.3225	0.0000	3.07E-07
126	0.21	0.045	0.054	0.2886	0.3224	0.0000	3.06E-07
127	0.01	0.000	0.029	0.2870	0.3223	0.0000	3.06E-07
128	0.40	0.192	0.063	0.3014	0.3222	0.0000	3.06E-07
129	0.01	0.000	0.092	0.2930	0.3221	0.0000	3.06E-07
130	1.04	0.825	0.060	0.3088	0.3220	0.0000	3.06E-07
131	0.28	0.120	0.098	0.3146	0.3219	0.0000	3.06E-07
132	0.00	0.000	0.182	0.2965	0.3218	0.0000	3.06E-07
133	0.00	0.000	0.098	0.2867	0.3217	0.0000	3.06E-07
134	0.00	0.000	0.086	0.2780	0.3216	0.0000	3.06E-07
135	0.00	0.000	0.008	0.2772	0.3215	0.0000	3.06E-07
136	0.00	0.000	0.002	0.2770	0.3215	0.0000	3.06E-07
137	0.00	0.000	0.000	0.2770	0.3214	0.0000	3.06E-07
138	0.00	0.000	0.000	0.2770	0.3213	0.0000	3.06E-07
139	0.44	0.238	0.059	0.2913	0.3212	0.0000	3.05E-07
140	0.00	0.000	0.013	0.2901	0.3211	0.0000	3.05E-07
141	0.00	0.000	0.019	0.2882	0.3210	0.0000	3.05E-07
142	0.00	0.000	0.018	0.2864	0.3209	0.0000	3.05E-07
143	0.54	0.337	0.051	0.3012	0.3208	0.0000	3.05E-07
144	0.01	0.000	0.064	0.2959	0.3207	0.0000	3.05E-07
145	0.07	0.000	0.089	0.2936	0.3206	0.0000	3.05E-07
146	0.00	0.000	0.118	0.2818	0.3205	0.0000	3.05E-07
147	0.00	0.000	0.037	0.2781	0.3205	0.0000	3.05E-07
148	0.40	0.185	0.082	0.2913	0.3205	0.0000	3.05E-07
149	0.24	0.087	0.057	0.3006	0.3204	0.0000	3.05E-07
150	0.00	0.000	0.131	0.2875	0.3203	0.0000	3.05E-07
151	0.00	0.000	0.026	0.2849	0.3202	0.0000	3.05E-07
152	0.00	0.000	0.027	0.2822	0.3201	0.0000	3.05E-07

153	0.17	0.011	0.054	0.2931	0.3200	0.0000	3.04E-07
154	0.00	0.000	0.027	0.2904	0.3199	0.0000	3.04E-07
155	0.00	0.000	0.024	0.2880	0.3198	0.0000	3.04E-07
156	0.00	0.000	0.024	0.2856	0.3197	0.0000	3.04E-07
157	0.00	0.000	0.018	0.2838	0.3196	0.0000	3.04E-07
158	0.00	0.000	0.016	0.2822	0.3196	0.0000	3.04E-07
159	0.00	0.000	0.017	0.2805	0.3195	0.0000	3.04E-07
160	0.00	0.000	0.014	0.2790	0.3194	0.0000	3.04E-07
161	0.00	0.000	0.013	0.2777	0.3193	0.0000	3.04E-07
162	0.00	0.000	0.005	0.2772	0.3192	0.0000	3.04E-07
163	0.00	0.000	0.001	0.2770	0.3191	0.0000	3.04E-07
164	0.26	0.099	0.036	0.2897	0.3190	0.0000	3.04E-07
165	0.05	0.000	0.030	0.2915	0.3189	0.0000	3.03E-07
166	0.32	0.151	0.044	0.3040	0.3188	0.0000	3.03E-07
167	0.00	0.000	0.119	0.2922	0.3187	0.0000	3.03E-07
168	0.00	0.000	0.014	0.2907	0.3186	0.0000	3.03E-07
169	0.00	0.000	0.013	0.2894	0.3185	0.0000	3.03E-07
170	0.05	0.000	0.038	0.2910	0.3184	0.0000	3.03E-07
171	0.19	0.035	0.044	0.3020	0.3183	0.0000	3.03E-07
172	0.03	0.000	0.034	0.3020	0.3183	0.0000	3.03E-07
173	1.33	1.160	0.043	0.3150	0.3182	0.0000	3.03E-07
174	0.39	0.178	0.253	0.3110	0.3181	0.0000	3.03E-07
175	0.05	0.000	0.119	0.3040	0.3180	0.0000	3.03E-07
176	0.00	0.000	0.189	0.2852	0.3179	0.0000	3.03E-07
177	0.00	0.000	0.067	0.2784	0.3178	0.0000	3.02E-07
178	0.02	0.000	0.035	0.2773	0.3177	0.0000	3.02E-07
179	0.00	0.000	0.002	0.2771	0.3176	0.0000	3.02E-07
180	0.00	0.000	0.001	0.2770	0.3175	0.0000	3.02E-07
181	0.00	0.000	0.000	0.2770	0.3174	0.0000	3.02E-07
182	0.00	0.000	0.000	0.2770	0.3173	0.0000	3.02E-07
183	0.00	0.000	0.000	0.2770	0.3172	0.0000	3.02E-07
184	0.00	0.000	0.000	0.2770	0.3171	0.0000	3.02E-07

185	1.74	1.529	0.052	0.2932	0.3170	0.0000	3.02E-07
186	0.00	0.000	0.055	0.2876	0.3170	0.0000	3.02E-07
187	0.00	0.000	0.022	0.2854	0.3169	0.0000	3.02E-07
188	0.00	0.000	0.020	0.2834	0.3168	0.0000	3.02E-07
189	0.00	0.000	0.017	0.2817	0.3167	0.0000	3.02E-07
190	0.03	0.000	0.034	0.2810	0.3166	0.0000	3.01E-07
191	0.00	0.000	0.019	0.2791	0.3165	0.0000	3.01E-07
192	0.00	0.000	0.015	0.2776	0.3164	0.0000	3.01E-07
193	0.00	0.000	0.005	0.2771	0.3163	0.0000	3.01E-07
194	0.00	0.000	0.001	0.2770	0.3162	0.0000	3.01E-07
195	0.00	0.000	0.000	0.2770	0.3161	0.0000	3.01E-07
196	0.00	0.000	0.000	0.2770	0.3160	0.0000	3.01E-07
197	0.03	0.000	0.021	0.2781	0.3159	0.0000	3.01E-07
198	0.26	0.096	0.035	0.2910	0.3158	0.0000	3.01E-07
199	0.00	0.000	0.011	0.2900	0.3157	0.0000	3.01E-07
200	0.06	0.000	0.039	0.2925	0.3157	0.0000	3.01E-07
201	0.00	0.000	0.019	0.2909	0.3156	0.0000	3.01E-07
202	0.41	0.232	0.045	0.3044	0.3155	0.0000	3.00E-07
203	0.90	0.679	0.111	0.3157	0.3154	0.0000	3.00E-07
204	0.00	0.000	0.094	0.3063	0.3153	0.0000	3.00E-07
205	0.00	0.000	0.070	0.2993	0.3152	0.0000	3.00E-07
206	0.08	0.000	0.227	0.2849	0.3151	0.0000	3.00E-07
207	0.00	0.000	0.051	0.2799	0.3150	0.0000	3.00E-07
208	0.33	0.125	0.132	0.2876	0.3149	0.0000	3.00E-07
209	0.00	0.000	0.080	0.2796	0.3148	0.0000	3.00E-07
210	0.00	0.000	0.018	0.2778	0.3147	0.0000	3.00E-07
211	0.00	0.000	0.006	0.2772	0.3146	0.0000	3.00E-07
212	0.00	0.000	0.006	0.2770	0.3146	0.0000	3.00E-07
213	0.00	0.000	0.000	0.2770	0.3145	0.0000	3.00E-07
214	0.00	0.000	0.000	0.2770	0.3144	0.0000	3.00E-07
215	0.00	0.000	0.000	0.2770	0.3143	0.0000	2.99E-07
216	0.00	0.000	0.000	0.2770	0.3142	0.0000	2.99E-07

217	0.13	0.000	0.029	0.2874	0.3141	0.0000	2.99E-07
218	0.11	0.000	0.038	0.2949	0.3140	0.0000	2.99E-07
219	0.02	0.000	0.029	0.2944	0.3139	0.0000	2.99E-07
220	0.00	0.000	0.018	0.2927	0.3138	0.0000	2.99E-07
221	0.00	0.000	0.019	0.2908	0.3137	0.0000	2.99E-07
222	0.03	0.000	0.033	0.2905	0.3136	0.0000	2.99E-07
223	0.19	0.028	0.045	0.3020	0.3135	0.0000	2.99E-07
224	0.00	0.000	0.016	0.3004	0.3135	0.0000	2.99E-07
225	0.00	0.000	0.018	0.2986	0.3134	0.0000	2.99E-07
226	0.00	0.000	0.014	0.2972	0.3133	0.0000	2.99E-07
227	0.00	0.000	0.018	0.2957	0.3132	0.0000	2.98E-07
228	0.00	0.000	0.013	0.2945	0.3131	0.0000	2.98E-07
229	0.00	0.000	0.015	0.2930	0.3130	0.0000	2.98E-07
230	0.00	0.000	0.017	0.2913	0.3129	0.0000	2.98E-07
231	0.00	0.000	0.017	0.2896	0.3128	0.0000	2.98E-07
232	0.00	0.000	0.015	0.2881	0.3127	0.0000	2.98E-07
233	0.00	0.000	0.015	0.2866	0.3126	0.0000	2.98E-07
234	0.00	0.000	0.013	0.2853	0.3125	0.0000	2.98E-07
235	0.00	0.000	0.013	0.2842	0.3124	0.0000	2.98E-07
236	0.00	0.000	0.011	0.2830	0.3124	0.0000	2.98E-07
237	0.04	0.000	0.037	0.2836	0.3123	0.0000	2.98E-07
238	0.00	0.000	0.018	0.2822	0.3122	0.0000	2.98E-07
239	0.01	0.000	0.024	0.2810	0.3121	0.0000	2.98E-07
240	0.00	0.000	0.015	0.2794	0.3120	0.0000	2.97E-07
241	0.85	0.664	0.041	0.2941	0.3119	0.0000	2.97E-07
242	0.18	0.028	0.083	0.3012	0.3118	0.0000	2.97E-07
243	0.00	0.000	0.023	0.2989	0.3117	0.0000	2.97E-07
244	0.00	0.000	0.081	0.2908	0.3116	0.0000	2.97E-07
245	0.24	0.070	0.061	0.3016	0.3115	0.0000	2.97E-07
246	0.00	0.000	0.109	0.2907	0.3114	0.0000	2.97E-07
247	0.00	0.000	0.065	0.2842	0.3114	0.0000	2.97E-07
248	0.00	0.000	0.055	0.2787	0.3113	0.0000	2.97E-07

249	0.01	0.000	0.024	0.2774	0.3112	0.0000	2.97E-07
250	0.17	0.000	0.048	0.2891	0.3111	0.0000	2.97E-07
251	0.01	0.000	0.026	0.2878	0.3110	0.0000	2.97E-07
252	0.00	0.000	0.022	0.2856	0.3109	0.0000	2.96E-07
253	0.00	0.000	0.020	0.2836	0.3108	0.0000	2.96E-07
254	0.00	0.000	0.019	0.2817	0.3107	0.0000	2.96E-07
255	0.00	0.000	0.018	0.2799	0.3106	0.0000	2.96E-07
256	0.00	0.000	0.016	0.2783	0.3105	0.0000	2.96E-07
257	0.00	0.000	0.011	0.2773	0.3104	0.0000	2.96E-07
258	0.27	0.104	0.039	0.2897	0.3104	0.0000	2.96E-07
259	0.25	0.092	0.048	0.3008	0.3103	0.0000	2.96E-07
260	0.07	0.000	0.061	0.3016	0.3102	0.0000	2.96E-07
261	0.28	0.117	0.049	0.3131	0.3101	0.0000	2.96E-07
262	0.12	0.002	0.140	0.3112	0.3100	0.0000	2.96E-07
263	0.00	0.000	0.121	0.2991	0.3099	0.0000	2.96E-07
264	0.00	0.000	0.094	0.2897	0.3098	0.0000	2.96E-07
265	0.00	0.000	0.045	0.2852	0.3097	0.0000	2.95E-07
266	0.00	0.000	0.037	0.2815	0.3096	0.0000	2.95E-07
267	0.00	0.000	0.032	0.2782	0.3095	0.0000	2.95E-07
268	0.47	0.264	0.060	0.2930	0.3094	0.0000	2.95E-07
269	0.00	0.000	0.069	0.2861	0.3094	0.0000	2.95E-07
270	0.00	0.000	0.021	0.2840	0.3093	0.0000	2.95E-07
271	0.00	0.000	0.018	0.2823	0.3092	0.0000	2.95E-07
272	0.01	0.000	0.028	0.2807	0.3091	0.0000	2.95E-07
273	0.00	0.000	0.019	0.2788	0.3090	0.0000	2.95E-07
274	0.16	0.000	0.047	0.2900	0.3089	0.0000	2.95E-07
275	0.45	0.284	0.049	0.3021	0.3088	0.0000	2.95E-07
276	0.17	0.016	0.055	0.3115	0.3087	0.0000	2.95E-07
277	0.00	0.000	0.092	0.3024	0.3086	0.0000	2.95E-07
278	0.00	0.000	0.131	0.2892	0.3085	0.0000	2.94E-07
279	0.00	0.000	0.095	0.2798	0.3085	0.0000	2.94E-07
280	0.00	0.000	0.024	0.2773	0.3084	0.0000	2.94E-07

281		0.00	0.000	0.002	0.2771	0.3083	0.0000	2.94E-07
282		0.00	0.000	0.001	0.2770	0.3082	0.0000	2.94E-07
283		0.00	0.000	0.000	0.2770	0.3081	0.0000	2.94E-07
284		0.00	0.000	0.000	0.2770	0.3080	0.0000	2.94E-07
285		0.00	0.000	0.000	0.2770	0.3079	0.0000	2.94E-07
286		0.00	0.000	0.000	0.2770	0.3078	0.0000	2.94E-07
287		0.00	0.000	0.000	0.2770	0.3077	0.0000	2.94E-07
288		0.00	0.000	0.000	0.2770	0.3076	0.0000	2.94E-07
289		0.00	0.000	0.000	0.2770	0.3076	0.0000	2.94E-07
290		0.00	0.000	0.000	0.2770	0.3075	0.0000	2.94E-07
291		0.57	0.361	0.047	0.2932	0.3074	0.0000	2.93E-07
292		0.00	0.000	0.007	0.2924	0.3073	0.0000	2.93E-07
293		0.00	0.000	0.012	0.2913	0.3072	0.0000	2.93E-07
294		0.00	0.000	0.011	0.2902	0.3071	0.0000	2.93E-07
295		0.00	0.000	0.011	0.2891	0.3070	0.0000	2.93E-07
296		0.00	0.000	0.010	0.2881	0.3069	0.0000	2.93E-07
297		0.00	0.000	0.010	0.2870	0.3068	0.0000	2.93E-07
298	*	0.00	0.000	0.000	0.2871	0.3067	0.0000	2.93E-07
299		0.08	0.000	0.036	0.2910	0.3067	0.0000	2.93E-07
300		0.00	0.000	0.011	0.2899	0.3066	0.0000	2.93E-07
301		0.04	0.000	0.032	0.2903	0.3065	0.0000	2.93E-07
302		0.00	0.000	0.012	0.2890	0.3064	0.0000	2.93E-07
303		0.00	0.000	0.007	0.2883	0.3063	0.0000	2.92E-07
304		0.00	0.000	0.008	0.2875	0.3062	0.0000	2.92E-07
305		0.00	0.000	0.008	0.2866	0.3061	0.0000	2.92E-07
306		0.15	0.001	0.037	0.2977	0.3060	0.0000	2.92E-07
307		0.01	0.000	0.016	0.2973	0.3059	0.0000	2.92E-07
308		0.00	0.000	0.009	0.2964	0.3059	0.0000	2.92E-07
309	*	0.00	0.000	0.008	0.2956	0.3058	0.0000	2.92E-07
310		0.00	0.000	0.008	0.2948	0.3057	0.0000	2.92E-07
311		0.00	0.000	0.008	0.2940	0.3056	0.0000	2.92E-07
312		0.00	0.000	0.008	0.2932	0.3055	0.0000	2.92E-07

313		0.00	0.000	0.008	0.2924	0.3054	0.0000	2.92E-07
314	*	0.00	0.000	0.000	0.2924	0.3053	0.0000	2.92E-07
315		0.00	0.000	0.008	0.2917	0.3052	0.0000	2.92E-07
316		0.02	0.000	0.021	0.2914	0.3051	0.0000	2.91E-07
317		0.00	0.000	0.007	0.2907	0.3050	0.0000	2.91E-07
318		0.00	0.000	0.007	0.2899	0.3050	0.0000	2.91E-07
319		0.00	0.000	0.007	0.2892	0.3049	0.0000	2.91E-07
320		0.00	0.000	0.007	0.2885	0.3048	0.0000	2.91E-07
321		0.00	0.000	0.007	0.2878	0.3047	0.0000	2.91E-07
322		0.00	0.000	0.007	0.2872	0.3046	0.0000	2.91E-07
323		0.00	0.000	0.007	0.2865	0.3045	0.0000	2.91E-07
324	*	0.00	0.000	0.000	0.2865	0.3044	0.0000	2.91E-07
325	*	0.00	0.000	0.007	0.2858	0.3043	0.0000	2.91E-07
326		0.00	0.000	0.007	0.2852	0.3042	0.0000	2.91E-07
327		0.00	0.000	0.006	0.2845	0.3042	0.0000	2.91E-07
328		0.00	0.000	0.006	0.2839	0.3041	0.0000	2.91E-07
329		0.00	0.000	0.006	0.2833	0.3040	0.0000	2.90E-07
330	*	0.00	0.000	0.006	0.2826	0.3039	0.0000	2.90E-07
331		0.00	0.000	0.006	0.2820	0.3038	0.0000	2.90E-07
332		0.00	0.000	0.008	0.2813	0.3037	0.0000	2.90E-07
333		0.00	0.000	0.007	0.2805	0.3036	0.0000	2.90E-07
334	*	0.33	0.000	0.032	0.2825	0.3035	0.0000	2.90E-07
335		0.00	0.097	0.035	0.2968	0.3034	0.0000	2.90E-07
336	*	0.01	0.000	0.010	0.2968	0.3034	0.0000	2.90E-07
337		0.64	0.465	0.036	0.3108	0.3033	0.0000	2.90E-07
338		0.00	0.000	0.057	0.3051	0.3032	0.0000	2.90E-07
339		0.00	0.000	0.051	0.2999	0.3031	0.0000	2.90E-07
340		0.00	0.000	0.056	0.2943	0.3030	0.0000	2.90E-07
341		0.00	0.000	0.035	0.2908	0.3029	0.0000	2.90E-07
342	*	0.00	0.000	0.015	0.2893	0.3028	0.0000	2.89E-07
343	*	0.00	0.000	0.012	0.2881	0.3027	0.0000	2.89E-07
344	*	0.00	0.000	0.016	0.2866	0.3027	0.0000	2.89E-07

345		0.21	0.043	0.050	0.2979	0.3026	0.0000	2.89E-07
346	*	0.27	0.000	0.027	0.2999	0.3025	0.0000	2.89E-07
347		0.00	0.029	0.065	0.3126	0.3024	0.0000	2.89E-07
348		0.00	0.000	0.041	0.3085	0.3023	0.0000	2.89E-07
349		0.00	0.000	0.035	0.3050	0.3022	0.0000	2.89E-07
350	*	0.00	0.000	0.000	0.3050	0.3021	0.0000	2.89E-07
351	*	0.00	0.000	0.000	0.3050	0.3020	0.0000	2.89E-07
352	*	0.39	0.000	0.034	0.3070	0.3020	0.0000	2.89E-07
353		0.00	0.180	0.025	0.3198	0.3019	0.0000	2.89E-07
354	*	0.00	0.000	0.000	0.3198	0.3018	0.0000	2.89E-07
355		0.00	0.000	0.031	0.3167	0.3017	0.0000	2.88E-07
356		0.00	0.000	0.043	0.3124	0.3016	0.0000	2.88E-07
357		0.00	0.000	0.027	0.3097	0.3015	0.0000	2.88E-07
358	*	0.00	0.000	0.000	0.3097	0.3014	0.0000	2.88E-07
359		0.00	0.000	0.023	0.3074	0.3013	0.0000	2.88E-07
360	*	0.00	0.000	0.018	0.3056	0.3013	0.0000	2.88E-07
361		0.00	0.000	0.034	0.3022	0.3012	0.0000	2.88E-07
362		0.00	0.000	0.028	0.2994	0.3011	0.0000	2.88E-07
363		0.00	0.000	0.023	0.2971	0.3010	0.0000	2.88E-07
364		0.00	0.000	0.033	0.2937	0.3009	0.0000	2.88E-07
365		0.00	0.000	0.023	0.2914	0.3008	0.0000	2.88E-07

* = Frozen (air or soil)

Annual Totals for Year 18

	inches	cubic feet	percent
Precipitation	30.15	109,433.6	100.00
Runoff	16.354	59,366.3	54.25
Evapotranspiration	13.887	50,410.9	46.07
Recirculation into Layer 1	0.0131	47.7	0.04
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0131	47.7	0.04
Percolation/Leakage through Layer 5	0.000110	0.4002	0.00
Average Head on Top of Layer 4	0.3173	---	---
Change in Water Storage	-0.0947	-343.9	-0.31
Soil Water at Start of Year	1,406.8011	5,106,688.2	4666.47
Soil Water at End of Year	1,406.7064	5,106,344.2	4666.16
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0131	-47.7	-0.04

Daily Output for Year 19

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.032	0.2883	0.3007	0.0000	2.88E-07
2			0.04	0.000	0.048	0.2871	0.3006	0.0000	2.88E-07
3	*		0.10	0.000	0.037	0.2891	0.3005	0.0000	2.87E-07
4			0.14	0.001	0.057	0.3016	0.3005	0.0000	2.87E-07
5			0.00	0.000	0.048	0.2969	0.3004	0.0000	2.87E-07
6			0.00	0.000	0.096	0.2873	0.3003	0.0000	2.87E-07
7			0.00	0.000	0.058	0.2815	0.3002	0.0000	2.87E-07
8			0.00	0.000	0.029	0.2785	0.3001	0.0000	2.87E-07
9			0.00	0.000	0.012	0.2774	0.3000	0.0000	2.87E-07
10			0.00	0.000	0.007	0.2771	0.2999	0.0000	2.87E-07
11			0.03	0.000	0.022	0.2781	0.2998	0.0000	2.87E-07
12			0.00	0.000	0.002	0.2779	0.2998	0.0000	2.87E-07
13			0.00	0.000	0.005	0.2774	0.2997	0.0000	2.87E-07
14			0.12	0.000	0.031	0.2859	0.2996	0.0000	2.87E-07
15			0.06	0.000	0.034	0.2885	0.2995	0.0000	2.87E-07
16			0.02	0.000	0.026	0.2878	0.2994	0.0000	2.86E-07
17			0.01	0.000	0.020	0.2865	0.2993	0.0000	2.86E-07
18			0.17	0.015	0.039	0.2985	0.2992	0.0000	2.86E-07
19			0.00	0.000	0.008	0.2976	0.2991	0.0000	2.86E-07
20			0.00	0.000	0.012	0.2964	0.2991	0.0000	2.86E-07
21			0.00	0.000	0.012	0.2953	0.2990	0.0000	2.86E-07
22			0.00	0.000	0.011	0.2942	0.2989	0.0000	2.86E-07
23			0.00	0.000	0.011	0.2931	0.2988	0.0000	2.86E-07
24			0.00	0.000	0.010	0.2921	0.2987	0.0000	2.86E-07

25		0.00	0.000	0.010	0.2911	0.2986	0.0000	2.86E-07
26		0.00	0.000	0.010	0.2901	0.2985	0.0000	2.86E-07
27		0.00	0.000	0.010	0.2891	0.2984	0.0000	2.86E-07
28		0.00	0.000	0.009	0.2882	0.2984	0.0000	2.86E-07
29		0.00	0.000	0.009	0.2872	0.2983	0.0000	2.85E-07
30		0.00	0.000	0.009	0.2863	0.2982	0.0000	2.85E-07
31	*	0.28	0.000	0.026	0.2883	0.2981	0.0000	2.85E-07
32	*	0.08	0.000	0.014	0.2903	0.2980	0.0000	2.85E-07
33	*	0.00	0.000	0.019	0.2923	0.2979	0.0000	2.85E-07
34	*	0.00	0.000	0.037	0.2942	0.2978	0.0000	2.85E-07
35		0.00	0.002	0.066	0.3063	0.2978	0.0000	2.85E-07
36		0.01	0.000	0.019	0.3057	0.2977	0.0000	2.85E-07
37		0.00	0.000	0.009	0.3048	0.2976	0.0000	2.85E-07
38		0.00	0.000	0.008	0.3040	0.2975	0.0000	2.85E-07
39		0.00	0.000	0.008	0.3031	0.2974	0.0000	2.85E-07
40	*	0.00	0.000	0.008	0.3023	0.2973	0.0000	2.85E-07
41		0.27	0.103	0.039	0.3156	0.2973	0.0000	2.85E-07
42	*	0.54	0.000	0.024	0.3176	0.2972	0.0000	2.85E-07
43		0.04	0.397	0.008	0.3302	0.2971	0.0000	2.84E-07
44		0.00	0.000	0.079	0.3224	0.2970	0.0000	2.84E-07
45		0.00	0.000	0.035	0.3189	0.2969	0.0000	2.84E-07
46		0.00	0.000	0.041	0.3148	0.2968	0.0000	2.84E-07
47		0.00	0.000	0.050	0.3098	0.2967	0.0000	2.84E-07
48	*	0.50	0.000	0.027	0.3118	0.2966	0.0000	2.84E-07
49		0.00	0.302	0.024	0.3249	0.2966	0.0000	2.84E-07
50		0.31	0.141	0.087	0.3329	0.2965	0.0000	2.84E-07
51		0.09	0.000	0.086	0.3328	0.2964	0.0000	2.84E-07
52		0.01	0.000	0.110	0.3224	0.2963	0.0000	2.84E-07
53		0.00	0.000	0.079	0.3145	0.2962	0.0000	2.84E-07
54		0.00	0.000	0.086	0.3059	0.2961	0.0000	2.84E-07
55		0.61	0.384	0.070	0.3217	0.2960	0.0000	2.84E-07
56	*	0.00	0.000	0.000	0.3217	0.2960	0.0000	2.83E-07

57	*	0.00	0.000	0.000	0.3217	0.2959	0.0000	2.83E-07
58		0.00	0.000	0.050	0.3168	0.2958	0.0000	2.83E-07
59	*	0.00	0.000	0.000	0.3168	0.2957	0.0000	2.83E-07
60	*	0.00	0.000	0.000	0.3168	0.2956	0.0000	2.83E-07
61		0.10	0.000	0.106	0.3163	0.2955	0.0000	2.83E-07
62		0.00	0.000	0.038	0.3125	0.2954	0.0000	2.83E-07
63		0.00	0.000	0.058	0.3067	0.2953	0.0000	2.83E-07
64		0.66	0.317	0.199	0.3212	0.2953	0.0000	2.83E-07
65		0.00	0.000	0.112	0.3100	0.2952	0.0000	2.83E-07
66		0.01	0.000	0.037	0.3071	0.2951	0.0000	2.83E-07
67	*	0.12	0.000	0.055	0.3091	0.2950	0.0000	2.83E-07
68	*	0.05	0.000	0.058	0.3110	0.2949	0.0000	2.83E-07
69	*	0.00	0.000	0.009	0.3111	0.2948	0.0000	2.82E-07
70	*	0.25	0.000	0.010	0.3130	0.2947	0.0000	2.82E-07
71		0.29	0.337	0.048	0.3258	0.2947	0.0000	2.82E-07
72	*	0.22	0.000	0.029	0.3277	0.2946	0.0000	2.82E-07
73		0.40	0.358	0.084	0.3404	0.2945	0.0000	2.82E-07
74		0.72	0.540	0.098	0.3483	0.2944	0.0000	2.82E-07
75		0.00	0.000	0.081	0.3402	0.2943	0.0000	2.82E-07
76		0.00	0.000	0.057	0.3345	0.2942	0.0000	2.82E-07
77		0.00	0.000	0.073	0.3273	0.2941	0.0000	2.82E-07
78		0.00	0.000	0.097	0.3176	0.2941	0.0000	2.82E-07
79		0.00	0.000	0.210	0.2966	0.2940	0.0000	2.82E-07
80		0.00	0.000	0.113	0.2853	0.2939	0.0000	2.82E-07
81		0.00	0.000	0.047	0.2806	0.2938	0.0000	2.82E-07
82		0.00	0.000	0.031	0.2775	0.2937	0.0000	2.81E-07
83		0.00	0.000	0.005	0.2770	0.2936	0.0000	2.81E-07
84		0.00	0.000	0.000	0.2770	0.2935	0.0000	2.81E-07
85		0.36	0.168	0.055	0.2904	0.2934	0.0000	2.81E-07
86		0.00	0.000	0.011	0.2893	0.2934	0.0000	2.81E-07
87		0.00	0.000	0.016	0.2877	0.2933	0.0000	2.81E-07
88		0.00	0.000	0.015	0.2862	0.2932	0.0000	2.81E-07

89		0.00	0.000	0.014	0.2847	0.2931	0.0000	2.81E-07
90	*	0.00	0.000	0.014	0.2834	0.2930	0.0000	2.81E-07
91		0.00	0.000	0.013	0.2821	0.2929	0.0000	2.81E-07
92		0.00	0.000	0.013	0.2808	0.2929	0.0000	2.81E-07
93		0.00	0.000	0.012	0.2796	0.2928	0.0000	2.81E-07
94		0.00	0.000	0.011	0.2785	0.2927	0.0000	2.81E-07
95		2.01	1.799	0.045	0.2948	0.2926	0.0000	2.81E-07
96		0.00	0.000	0.041	0.2908	0.2925	0.0000	2.80E-07
97		0.12	0.000	0.082	0.2946	0.2924	0.0000	2.80E-07
98		0.00	0.000	0.053	0.2893	0.2923	0.0000	2.80E-07
99		0.00	0.000	0.030	0.2862	0.2923	0.0000	2.80E-07
100	*	0.00	0.000	0.047	0.2815	0.2923	0.0000	2.80E-07
101		0.46	0.233	0.089	0.2957	0.2923	0.0000	2.80E-07
102		0.71	0.480	0.116	0.3073	0.2922	0.0000	2.80E-07
103		0.00	0.000	0.140	0.2933	0.2921	0.0000	2.80E-07
104		0.00	0.000	0.137	0.2796	0.2920	0.0000	2.80E-07
105		0.00	0.000	0.020	0.2776	0.2919	0.0000	2.80E-07
106		0.00	0.000	0.007	0.2771	0.2918	0.0000	2.80E-07
107		0.00	0.000	0.001	0.2770	0.2917	0.0000	2.80E-07
108		0.00	0.000	0.000	0.2770	0.2917	0.0000	2.80E-07
109		0.00	0.000	0.000	0.2770	0.2916	0.0000	2.80E-07
110		0.00	0.000	0.000	0.2770	0.2915	0.0000	2.80E-07
111		0.17	0.011	0.040	0.2894	0.2914	0.0000	2.79E-07
112		0.15	0.002	0.038	0.3002	0.2913	0.0000	2.79E-07
113		0.00	0.000	0.010	0.2991	0.2912	0.0000	2.79E-07
114		0.00	0.000	0.016	0.2975	0.2912	0.0000	2.79E-07
115		0.00	0.000	0.015	0.2960	0.2911	0.0000	2.79E-07
116		0.01	0.000	0.022	0.2947	0.2910	0.0000	2.79E-07
117		0.00	0.000	0.014	0.2933	0.2909	0.0000	2.79E-07
118		0.00	0.000	0.014	0.2920	0.2908	0.0000	2.79E-07
119		0.00	0.000	0.013	0.2907	0.2907	0.0000	2.79E-07
120		0.00	0.000	0.013	0.2894	0.2906	0.0000	2.79E-07

121	0.00	0.000	0.013	0.2881	0.2906	0.0000	2.79E-07
122	0.00	0.000	0.015	0.2870	0.2905	0.0000	2.79E-07
123	0.00	0.000	0.012	0.2858	0.2904	0.0000	2.79E-07
124	0.00	0.000	0.014	0.2844	0.2903	0.0000	2.79E-07
125	0.00	0.000	0.014	0.2830	0.2902	0.0000	2.78E-07
126	0.00	0.000	0.014	0.2816	0.2901	0.0000	2.78E-07
127	0.00	0.000	0.014	0.2803	0.2901	0.0000	2.78E-07
128	0.09	0.000	0.040	0.2851	0.2900	0.0000	2.78E-07
129	0.03	0.000	0.032	0.2849	0.2899	0.0000	2.78E-07
130	0.00	0.000	0.012	0.2837	0.2898	0.0000	2.78E-07
131	0.00	0.000	0.007	0.2830	0.2897	0.0000	2.78E-07
132	0.68	0.496	0.042	0.2971	0.2896	0.0000	2.78E-07
133	0.07	0.000	0.100	0.2936	0.2895	0.0000	2.78E-07
134	0.21	0.056	0.038	0.3055	0.2895	0.0000	2.78E-07
135	0.01	0.000	0.104	0.2965	0.2894	0.0000	2.78E-07
136	0.01	0.000	0.019	0.2955	0.2893	0.0000	2.78E-07
137	0.00	0.000	0.010	0.2945	0.2892	0.0000	2.78E-07
138	0.00	0.000	0.011	0.2934	0.2891	0.0000	2.77E-07
139	0.00	0.000	0.010	0.2924	0.2890	0.0000	2.77E-07
140	0.00	0.000	0.009	0.2915	0.2890	0.0000	2.77E-07
141	0.00	0.000	0.010	0.2905	0.2889	0.0000	2.77E-07
142	0.00	0.000	0.011	0.2894	0.2888	0.0000	2.77E-07
143	0.44	0.252	0.044	0.3040	0.2887	0.0000	2.77E-07
144	0.01	0.000	0.139	0.2909	0.2886	0.0000	2.77E-07
145	0.04	0.000	0.160	0.2792	0.2885	0.0000	2.77E-07
146	0.00	0.000	0.018	0.2775	0.2885	0.0000	2.77E-07
147	0.05	0.000	0.032	0.2790	0.2884	0.0000	2.77E-07
148	0.11	0.000	0.033	0.2872	0.2883	0.0000	2.77E-07
149	1.70	1.510	0.066	0.3001	0.2882	0.0000	2.77E-07
150	0.08	0.000	0.054	0.3026	0.2881	0.0000	2.77E-07
151	0.00	0.000	0.127	0.2899	0.2880	0.0000	2.77E-07
152	0.06	0.000	0.154	0.2805	0.2879	0.0000	2.76E-07

153	0.00	0.000	0.024	0.2781	0.2879	0.0000	2.76E-07
154	0.00	0.000	0.008	0.2773	0.2878	0.0000	2.76E-07
155	0.00	0.000	0.002	0.2771	0.2877	0.0000	2.76E-07
156	0.00	0.000	0.001	0.2770	0.2876	0.0000	2.76E-07
157	0.00	0.000	0.000	0.2770	0.2875	0.0000	2.76E-07
158	0.00	0.000	0.005	0.2770	0.2874	0.0000	2.76E-07
159	0.00	0.000	0.000	0.2770	0.2874	0.0000	2.76E-07
160	0.02	0.000	0.018	0.2774	0.2873	0.0000	2.76E-07
161	0.91	0.699	0.054	0.2930	0.2872	0.0000	2.76E-07
162	0.01	0.000	0.019	0.2918	0.2871	0.0000	2.76E-07
163	1.17	0.979	0.052	0.3062	0.2870	0.0000	2.76E-07
164	0.00	0.000	0.158	0.2904	0.2869	0.0000	2.76E-07
165	0.71	0.442	0.124	0.3052	0.2869	0.0000	2.75E-07
166	0.04	0.000	0.081	0.3008	0.2868	0.0000	2.75E-07
167	0.00	0.000	0.089	0.2919	0.2867	0.0000	2.75E-07
168	0.00	0.000	0.099	0.2820	0.2866	0.0000	2.75E-07
169	0.00	0.000	0.043	0.2777	0.2865	0.0000	2.75E-07
170	0.00	0.000	0.005	0.2772	0.2864	0.0000	2.75E-07
171	1.26	1.018	0.088	0.2930	0.2864	0.0000	2.75E-07
172	0.37	0.124	0.192	0.2980	0.2863	0.0000	2.75E-07
173	0.00	0.000	0.060	0.2920	0.2862	0.0000	2.75E-07
174	1.10	0.731	0.238	0.3055	0.2861	0.0000	2.75E-07
175	0.00	0.000	0.120	0.2935	0.2860	0.0000	2.75E-07
176	0.35	0.115	0.153	0.3017	0.2859	0.0000	2.75E-07
177	2.37	2.098	0.163	0.3127	0.2859	0.0000	2.75E-07
178	0.16	0.009	0.233	0.3042	0.2858	0.0000	2.75E-07
179	0.00	0.000	0.153	0.2889	0.2857	0.0000	2.74E-07
180	0.05	0.000	0.093	0.2844	0.2856	0.0000	2.74E-07
181	0.00	0.000	0.058	0.2791	0.2855	0.0000	2.74E-07
182	0.00	0.000	0.015	0.2776	0.2854	0.0000	2.74E-07
183	0.00	0.000	0.005	0.2771	0.2854	0.0000	2.74E-07
184	0.00	0.000	0.001	0.2770	0.2853	0.0000	2.74E-07

185	0.00	0.000	0.000	0.2770	0.2852	0.0000	2.74E-07
186	0.00	0.000	0.000	0.2770	0.2851	0.0000	2.74E-07
187	0.00	0.000	0.000	0.2770	0.2850	0.0000	2.74E-07
188	0.00	0.000	0.002	0.2770	0.2849	0.0000	2.74E-07
189	0.07	0.000	0.030	0.2814	0.2849	0.0000	2.74E-07
190	0.41	0.234	0.059	0.2933	0.2848	0.0000	2.74E-07
191	0.11	0.000	0.041	0.3005	0.2847	0.0000	2.74E-07
192	0.76	0.573	0.052	0.3137	0.2846	0.0000	2.74E-07
193	0.00	0.000	0.067	0.3071	0.2845	0.0000	2.73E-07
194	0.70	0.440	0.112	0.3220	0.2844	0.0000	2.73E-07
195	0.00	0.000	0.089	0.3131	0.2844	0.0000	2.73E-07
196	0.01	0.000	0.098	0.3048	0.2843	0.0000	2.73E-07
197	0.01	0.000	0.064	0.2990	0.2842	0.0000	2.73E-07
198	0.00	0.000	0.128	0.2862	0.2841	0.0000	2.73E-07
199	0.13	0.000	0.118	0.2876	0.2840	0.0000	2.73E-07
200	0.00	0.000	0.041	0.2835	0.2839	0.0000	2.73E-07
201	0.00	0.000	0.044	0.2791	0.2839	0.0000	2.73E-07
202	0.92	0.697	0.072	0.2941	0.2838	0.0000	2.73E-07
203	0.12	0.000	0.139	0.2918	0.2837	0.0000	2.73E-07
204	0.89	0.472	0.301	0.3038	0.2836	0.0000	2.73E-07
205	0.00	0.000	0.108	0.2932	0.2835	0.0000	2.73E-07
206	0.07	0.000	0.171	0.2827	0.2834	0.0000	2.72E-07
207	0.25	0.074	0.123	0.2879	0.2834	0.0000	2.72E-07
208	0.03	0.000	0.053	0.2858	0.2833	0.0000	2.72E-07
209	0.00	0.000	0.040	0.2818	0.2832	0.0000	2.72E-07
210	0.27	0.100	0.064	0.2928	0.2831	0.0000	2.72E-07
211	0.01	0.000	0.109	0.2828	0.2830	0.0000	2.72E-07
212	0.00	0.000	0.027	0.2802	0.2829	0.0000	2.72E-07
213	0.89	0.673	0.074	0.2950	0.2829	0.0000	2.72E-07
214	0.00	0.000	0.070	0.2880	0.2828	0.0000	2.72E-07
215	0.00	0.000	0.077	0.2803	0.2827	0.0000	2.72E-07
216	0.00	0.000	0.025	0.2778	0.2826	0.0000	2.72E-07

217	0.00	0.000	0.007	0.2771	0.2825	0.0000	2.72E-07
218	0.00	0.000	0.001	0.2770	0.2824	0.0000	2.72E-07
219	0.00	0.000	0.000	0.2770	0.2824	0.0000	2.72E-07
220	0.00	0.000	0.000	0.2770	0.2823	0.0000	2.71E-07
221	0.00	0.000	0.004	0.2770	0.2822	0.0000	2.71E-07
222	0.00	0.000	0.000	0.2770	0.2821	0.0000	2.71E-07
223	0.00	0.000	0.000	0.2770	0.2820	0.0000	2.71E-07
224	0.00	0.000	0.000	0.2770	0.2820	0.0000	2.71E-07
225	0.00	0.000	0.000	0.2770	0.2819	0.0000	2.71E-07
226	0.00	0.000	0.000	0.2770	0.2818	0.0000	2.71E-07
227	0.00	0.000	0.000	0.2770	0.2817	0.0000	2.71E-07
228	0.00	0.000	0.000	0.2770	0.2816	0.0000	2.71E-07
229	0.00	0.000	0.000	0.2770	0.2815	0.0000	2.71E-07
230	0.00	0.000	0.000	0.2770	0.2815	0.0000	2.71E-07
231	0.02	0.000	0.018	0.2773	0.2814	0.0000	2.71E-07
232	0.02	0.000	0.016	0.2775	0.2813	0.0000	2.71E-07
233	0.15	0.000	0.038	0.2891	0.2812	0.0000	2.71E-07
234	0.04	0.000	0.037	0.2891	0.2811	0.0000	2.70E-07
235	0.00	0.000	0.016	0.2875	0.2811	0.0000	2.70E-07
236	0.00	0.000	0.019	0.2856	0.2810	0.0000	2.70E-07
237	0.00	0.000	0.021	0.2835	0.2809	0.0000	2.70E-07
238	0.00	0.000	0.017	0.2818	0.2808	0.0000	2.70E-07
239	0.00	0.000	0.020	0.2798	0.2807	0.0000	2.70E-07
240	0.00	0.000	0.019	0.2779	0.2806	0.0000	2.70E-07
241	0.08	0.000	0.037	0.2818	0.2806	0.0000	2.70E-07
242	0.00	0.000	0.014	0.2804	0.2805	0.0000	2.70E-07
243	0.00	0.000	0.013	0.2792	0.2804	0.0000	2.70E-07
244	0.01	0.000	0.011	0.2787	0.2803	0.0000	2.70E-07
245	0.53	0.337	0.047	0.2932	0.2802	0.0000	2.70E-07
246	1.17	1.008	0.048	0.3044	0.2802	0.0000	2.70E-07
247	0.65	0.385	0.154	0.3153	0.2801	0.0000	2.70E-07
248	0.00	0.000	0.067	0.3086	0.2800	0.0000	2.69E-07

249	0.00	0.000	0.058	0.3028	0.2799	0.0000	2.69E-07
250	0.00	0.000	0.097	0.2931	0.2798	0.0000	2.69E-07
251	0.00	0.000	0.142	0.2789	0.2797	0.0000	2.69E-07
252	0.00	0.000	0.016	0.2773	0.2797	0.0000	2.69E-07
253	0.00	0.000	0.002	0.2771	0.2796	0.0000	2.69E-07
254	0.00	0.000	0.001	0.2770	0.2795	0.0000	2.69E-07
255	0.82	0.591	0.069	0.2930	0.2794	0.0000	2.69E-07
256	0.00	0.000	0.109	0.2821	0.2793	0.0000	2.69E-07
257	0.00	0.000	0.028	0.2793	0.2793	0.0000	2.69E-07
258	0.00	0.000	0.019	0.2774	0.2792	0.0000	2.69E-07
259	0.00	0.000	0.003	0.2771	0.2791	0.0000	2.69E-07
260	0.00	0.000	0.001	0.2770	0.2790	0.0000	2.69E-07
261	0.00	0.000	0.000	0.2770	0.2789	0.0000	2.69E-07
262	0.00	0.000	0.000	0.2770	0.2788	0.0000	2.68E-07
263	0.03	0.000	0.022	0.2780	0.2788	0.0000	2.68E-07
264	0.02	0.000	0.015	0.2782	0.2787	0.0000	2.68E-07
265	0.71	0.511	0.050	0.2932	0.2786	0.0000	2.68E-07
266	0.00	0.000	0.041	0.2892	0.2785	0.0000	2.68E-07
267	0.00	0.000	0.030	0.2862	0.2784	0.0000	2.68E-07
268	0.03	0.000	0.058	0.2832	0.2784	0.0000	2.68E-07
269	0.00	0.000	0.054	0.2778	0.2783	0.0000	2.68E-07
270	0.00	0.000	0.007	0.2772	0.2782	0.0000	2.68E-07
271	0.10	0.000	0.035	0.2833	0.2781	0.0000	2.68E-07
272	1.14	0.946	0.067	0.2963	0.2780	0.0000	2.68E-07
273	0.01	0.000	0.040	0.2936	0.2780	0.0000	2.68E-07
274	0.04	0.000	0.078	0.2897	0.2779	0.0000	2.68E-07
275	0.06	0.000	0.139	0.2821	0.2778	0.0000	2.68E-07
276	0.99	0.763	0.097	0.2951	0.2777	0.0000	2.67E-07
277	0.31	0.102	0.160	0.2997	0.2776	0.0000	2.67E-07
278	0.00	0.000	0.056	0.2941	0.2775	0.0000	2.67E-07
279	0.00	0.000	0.088	0.2853	0.2775	0.0000	2.67E-07
280	0.00	0.000	0.065	0.2788	0.2774	0.0000	2.67E-07

281		0.00	0.000	0.014	0.2775	0.2773	0.0000	2.67E-07
282		0.13	0.000	0.038	0.2871	0.2772	0.0000	2.67E-07
283		1.96	1.757	0.072	0.3003	0.2771	0.0000	2.67E-07
284		0.23	0.073	0.098	0.3065	0.2771	0.0000	2.67E-07
285		0.00	0.000	0.088	0.2977	0.2770	0.0000	2.67E-07
286		0.00	0.000	0.078	0.2899	0.2769	0.0000	2.67E-07
287		0.00	0.000	0.088	0.2810	0.2768	0.0000	2.67E-07
288		0.00	0.000	0.035	0.2775	0.2767	0.0000	2.67E-07
289		0.00	0.000	0.004	0.2771	0.2767	0.0000	2.67E-07
290		0.00	0.000	0.001	0.2770	0.2766	0.0000	2.66E-07
291		0.00	0.000	0.000	0.2770	0.2765	0.0000	2.66E-07
292		0.00	0.000	0.000	0.2770	0.2764	0.0000	2.66E-07
293		0.00	0.000	0.000	0.2770	0.2763	0.0000	2.66E-07
294		0.00	0.000	0.000	0.2770	0.2763	0.0000	2.66E-07
295	*	0.00	0.000	0.000	0.2770	0.2762	0.0000	2.66E-07
296	*	0.00	0.000	0.000	0.2770	0.2761	0.0000	2.66E-07
297		0.00	0.000	0.000	0.2770	0.2760	0.0000	2.66E-07
298	*	0.00	0.000	0.000	0.2770	0.2759	0.0000	2.66E-07
299		0.00	0.000	0.000	0.2770	0.2759	0.0000	2.66E-07
300		0.00	0.000	0.000	0.2770	0.2758	0.0000	2.66E-07
301		0.00	0.000	0.000	0.2770	0.2757	0.0000	2.66E-07
302		0.00	0.000	0.000	0.2770	0.2756	0.0000	2.66E-07
303		0.00	0.000	0.000	0.2770	0.2755	0.0000	2.66E-07
304	*	0.00	0.000	0.000	0.2770	0.2755	0.0000	2.65E-07
305	*	0.00	0.000	0.000	0.2770	0.2754	0.0000	2.65E-07
306		0.02	0.000	0.014	0.2772	0.2753	0.0000	2.65E-07
307		0.02	0.000	0.015	0.2775	0.2752	0.0000	2.65E-07
308	*	0.00	0.000	0.000	0.2775	0.2751	0.0000	2.65E-07
309	*	0.05	0.000	0.016	0.2795	0.2751	0.0000	2.65E-07
310	*	0.00	0.000	0.015	0.2795	0.2750	0.0000	2.65E-07
311	*	0.00	0.000	0.003	0.2792	0.2749	0.0000	2.65E-07
312	*	0.77	0.000	0.017	0.2811	0.2748	0.0000	2.65E-07

313	*		0.03	0.000	0.000	0.2831	0.2747	0.0000	2.65E-07
314	*		0.00	0.000	0.023	0.2851	0.2747	0.0000	2.65E-07
315	*		0.00	0.000	0.015	0.2871	0.2746	0.0000	2.65E-07
316	*		0.00	0.000	0.008	0.2890	0.2745	0.0000	2.65E-07
317	*	*	0.00	0.000	0.015	0.2890	0.2744	0.0000	2.65E-07
318	*	*	0.00	0.000	0.022	0.2890	0.2743	0.0000	2.64E-07
319	*	*	0.00	0.000	0.012	0.2890	0.2743	0.0000	2.64E-07
320	*	*	0.00	0.000	0.016	0.2890	0.2742	0.0000	2.64E-07
321	*	*	0.00	0.000	0.000	0.2890	0.2741	0.0000	2.64E-07
322		*	0.00	0.534	0.000	0.2902	0.2740	0.0000	2.64E-07
323		*	0.01	0.000	0.043	0.2902	0.2739	0.0000	2.64E-07
324			0.02	0.000	0.022	0.2901	0.2739	0.0000	2.64E-07
325			0.00	0.000	0.010	0.2891	0.2738	0.0000	2.64E-07
326			0.00	0.000	0.010	0.2881	0.2737	0.0000	2.64E-07
327			0.00	0.000	0.010	0.2871	0.2736	0.0000	2.64E-07
328			0.00	0.000	0.009	0.2862	0.2735	0.0000	2.64E-07
329			0.00	0.000	0.009	0.2853	0.2735	0.0000	2.64E-07
330			0.29	0.112	0.043	0.2992	0.2734	0.0000	2.64E-07
331			0.00	0.000	0.009	0.2983	0.2733	0.0000	2.64E-07
332			0.00	0.000	0.009	0.2973	0.2732	0.0000	2.64E-07
333			0.00	0.000	0.009	0.2965	0.2731	0.0000	2.63E-07
334			0.00	0.000	0.008	0.2956	0.2731	0.0000	2.63E-07
335			0.00	0.000	0.008	0.2948	0.2730	0.0000	2.63E-07
336			0.12	0.000	0.037	0.3036	0.2729	0.0000	2.63E-07
337	*		0.02	0.000	0.034	0.3017	0.2728	0.0000	2.63E-07
338	*		0.14	0.000	0.029	0.3037	0.2727	0.0000	2.63E-07
339	*		0.00	0.000	0.035	0.3056	0.2727	0.0000	2.63E-07
340	*		0.00	0.000	0.038	0.3057	0.2726	0.0000	2.63E-07
341	*		0.00	0.000	0.000	0.3057	0.2725	0.0000	2.63E-07
342	*		0.00	0.000	0.000	0.3057	0.2724	0.0000	2.63E-07
343			0.00	0.000	0.021	0.3036	0.2723	0.0000	2.63E-07
344	*		0.00	0.000	0.000	0.3036	0.2723	0.0000	2.63E-07

345	*	0.00	0.000	0.008	0.3028	0.2722	0.0000	2.63E-07
346		0.00	0.000	0.008	0.3020	0.2721	0.0000	2.63E-07
347		0.11	0.000	0.036	0.3091	0.2720	0.0000	2.62E-07
348		0.00	0.000	0.036	0.3055	0.2719	0.0000	2.62E-07
349	*	0.00	0.000	0.008	0.3047	0.2719	0.0000	2.62E-07
350	*	0.02	0.000	0.029	0.3039	0.2718	0.0000	2.62E-07
351		0.05	0.000	0.031	0.3054	0.2717	0.0000	2.62E-07
352		0.42	0.249	0.040	0.3181	0.2716	0.0000	2.62E-07
353	*	0.00	0.000	0.000	0.3181	0.2715	0.0000	2.62E-07
354		0.43	0.250	0.053	0.3312	0.2715	0.0000	2.62E-07
355		0.06	0.000	0.068	0.3307	0.2714	0.0000	2.62E-07
356		0.39	0.210	0.054	0.3430	0.2713	0.0000	2.62E-07
357	*	0.00	0.000	0.003	0.3430	0.2712	0.0000	2.62E-07
358	*	0.00	0.000	0.000	0.3430	0.2711	0.0000	2.62E-07
359	*	0.00	0.000	0.000	0.3430	0.2711	0.0000	2.62E-07
360		0.00	0.000	0.029	0.3401	0.2710	0.0000	2.62E-07
361		0.00	0.000	0.027	0.3374	0.2709	0.0000	2.61E-07
362		0.00	0.000	0.033	0.3342	0.2708	0.0000	2.61E-07
363		0.00	0.000	0.036	0.3309	0.2708	0.0000	2.61E-07
364		0.02	0.000	0.043	0.3289	0.2707	0.0000	2.61E-07
365		0.04	0.000	0.052	0.3279	0.2706	0.0000	2.61E-07

* = Frozen (air or soil)

Annual Totals for Year 19

	inches	cubic feet	percent
Precipitation	40.33	146,385.5	100.00
Runoff	25.211	91,515.1	62.52
Evapotranspiration	14.761	53,582.7	36.60
Recirculation into Layer 1	0.0118	42.9	0.03
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0118	42.9	0.03
Percolation/Leakage through Layer 5	0.000100	0.3634	0.00
Average Head on Top of Layer 4	0.2854	---	---
Change in Water Storage	0.3547	1,287.4	0.88
Soil Water at Start of Year	1,406.7064	5,106,344.2	3488.28
Soil Water at End of Year	1,407.0611	5,107,631.7	3489.16
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0118	-42.9	-0.03

Daily Output for Year 20

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.00	0.000	0.028	0.3251	0.2705	0.0000	2.61E-07
2	*		0.00	0.000	0.000	0.3251	0.2704	0.0000	2.61E-07
3	*		0.74	0.000	0.013	0.3271	0.2704	0.0000	2.61E-07
4	*		0.00	0.000	0.016	0.3291	0.2703	0.0000	2.61E-07
5	*	*	0.29	0.000	0.018	0.3291	0.2702	0.0000	2.61E-07
6		*	0.04	0.322	0.000	0.3302	0.2701	0.0000	2.61E-07
7		*	0.14	0.795	0.000	0.3302	0.2700	0.0000	2.61E-07
8			0.00	0.000	0.054	0.3248	0.2700	0.0000	2.61E-07
9			0.00	0.000	0.134	0.3113	0.2699	0.0000	2.61E-07
10			0.00	0.000	0.047	0.3066	0.2699	0.0000	2.61E-07
11			0.00	0.000	0.053	0.3013	0.2698	0.0000	2.60E-07
12			0.00	0.000	0.027	0.2986	0.2697	0.0000	2.60E-07
13	*		0.00	0.000	0.000	0.2986	0.2696	0.0000	2.60E-07
14	*		0.00	0.000	0.000	0.2986	0.2695	0.0000	2.60E-07
15	*		0.00	0.000	0.000	0.2986	0.2695	0.0000	2.60E-07
16	*		0.09	0.000	0.021	0.3006	0.2694	0.0000	2.60E-07
17			0.00	0.000	0.058	0.2996	0.2693	0.0000	2.60E-07
18			0.00	0.000	0.034	0.2961	0.2692	0.0000	2.60E-07
19			0.00	0.000	0.039	0.2922	0.2691	0.0000	2.60E-07
20			0.00	0.000	0.050	0.2873	0.2691	0.0000	2.60E-07
21			0.00	0.000	0.044	0.2829	0.2690	0.0000	2.60E-07
22	*		0.00	0.000	0.021	0.2808	0.2689	0.0000	2.60E-07
23			0.00	0.000	0.031	0.2777	0.2688	0.0000	2.60E-07
24			0.00	0.000	0.007	0.2770	0.2688	0.0000	2.60E-07

25		0.00	0.000	0.000	0.2770	0.2687	0.0000	2.60E-07
26		0.00	0.000	0.000	0.2770	0.2686	0.0000	2.59E-07
27		0.00	0.000	0.000	0.2770	0.2685	0.0000	2.59E-07
28	*	0.02	0.000	0.016	0.2770	0.2684	0.0000	2.59E-07
29		0.00	0.000	0.000	0.2770	0.2684	0.0000	2.59E-07
30		0.00	0.000	0.000	0.2770	0.2683	0.0000	2.59E-07
31		0.00	0.000	0.000	0.2770	0.2682	0.0000	2.59E-07
32	*	0.00	0.000	0.000	0.2770	0.2681	0.0000	2.59E-07
33		0.30	0.130	0.042	0.2897	0.2681	0.0000	2.59E-07
34		0.00	0.000	0.008	0.2888	0.2680	0.0000	2.59E-07
35		0.73	0.534	0.049	0.3034	0.2679	0.0000	2.59E-07
36		0.02	0.000	0.088	0.2969	0.2678	0.0000	2.59E-07
37		0.00	0.000	0.040	0.2934	0.2677	0.0000	2.59E-07
38		0.00	0.000	0.044	0.2890	0.2677	0.0000	2.59E-07
39		0.00	0.000	0.029	0.2860	0.2676	0.0000	2.59E-07
40		0.01	0.000	0.046	0.2825	0.2675	0.0000	2.58E-07
41	*	0.08	0.000	0.034	0.2844	0.2674	0.0000	2.58E-07
42	*	0.02	0.000	0.029	0.2858	0.2673	0.0000	2.58E-07
43	*	0.00	0.000	0.000	0.2858	0.2673	0.0000	2.58E-07
44		0.00	0.000	0.037	0.2822	0.2672	0.0000	2.58E-07
45	*	0.00	0.000	0.000	0.2822	0.2671	0.0000	2.58E-07
46	*	0.00	0.000	0.000	0.2822	0.2670	0.0000	2.58E-07
47		0.00	0.000	0.027	0.2796	0.2670	0.0000	2.58E-07
48		0.12	0.000	0.045	0.2876	0.2669	0.0000	2.58E-07
49		0.01	0.000	0.021	0.2860	0.2668	0.0000	2.58E-07
50		0.43	0.231	0.057	0.3000	0.2667	0.0000	2.58E-07
51		0.74	0.525	0.097	0.3116	0.2666	0.0000	2.58E-07
52		0.05	0.000	0.068	0.3099	0.2666	0.0000	2.58E-07
53		0.00	0.000	0.088	0.3015	0.2665	0.0000	2.58E-07
54		0.12	0.000	0.054	0.3086	0.2664	0.0000	2.58E-07
55		0.00	0.000	0.049	0.3037	0.2663	0.0000	2.57E-07
56	*	0.00	0.000	0.000	0.3037	0.2663	0.0000	2.57E-07

57	*	0.00	0.000	0.017	0.3020	0.2662	0.0000	2.57E-07
58		0.48	0.276	0.058	0.3162	0.2661	0.0000	2.57E-07
59	*	0.00	0.000	0.000	0.3162	0.2660	0.0000	2.57E-07
60		0.00	0.000	0.058	0.3104	0.2659	0.0000	2.57E-07
61		0.00	0.000	0.057	0.3048	0.2659	0.0000	2.57E-07
62		0.00	0.000	0.061	0.2986	0.2658	0.0000	2.57E-07
63		0.00	0.000	0.038	0.2948	0.2657	0.0000	2.57E-07
64		0.00	0.000	0.048	0.2900	0.2656	0.0000	2.57E-07
65		0.00	0.000	0.049	0.2851	0.2656	0.0000	2.57E-07
66		0.00	0.000	0.066	0.2785	0.2655	0.0000	2.57E-07
67		0.00	0.000	0.013	0.2772	0.2654	0.0000	2.57E-07
68		0.00	0.000	0.002	0.2770	0.2653	0.0000	2.57E-07
69		0.00	0.000	0.000	0.2770	0.2653	0.0000	2.57E-07
70	*	0.00	0.000	0.000	0.2770	0.2652	0.0000	2.56E-07
71		0.00	0.000	0.000	0.2770	0.2651	0.0000	2.56E-07
72		0.00	0.000	0.000	0.2770	0.2650	0.0000	2.56E-07
73		0.07	0.000	0.029	0.2807	0.2650	0.0000	2.56E-07
74		0.98	0.794	0.057	0.2933	0.2649	0.0000	2.56E-07
75		0.11	0.000	0.114	0.2926	0.2648	0.0000	2.56E-07
76		0.00	0.000	0.032	0.2893	0.2647	0.0000	2.56E-07
77		0.00	0.000	0.025	0.2868	0.2646	0.0000	2.56E-07
78		0.00	0.000	0.025	0.2845	0.2646	0.0000	2.56E-07
79		2.29	2.078	0.063	0.2999	0.2645	0.0000	2.56E-07
80		0.00	0.000	0.039	0.2961	0.2644	0.0000	2.56E-07
81		0.00	0.000	0.061	0.2903	0.2643	0.0000	2.56E-07
82		0.00	0.000	0.025	0.2878	0.2643	0.0000	2.56E-07
83	*	0.00	0.000	0.019	0.2858	0.2642	0.0000	2.56E-07
84	*	0.00	0.000	0.041	0.2817	0.2641	0.0000	2.55E-07
85	*	0.04	0.000	0.027	0.2826	0.2640	0.0000	2.55E-07
86	*	0.00	0.000	0.000	0.2826	0.2640	0.0000	2.55E-07
87		0.00	0.000	0.046	0.2779	0.2639	0.0000	2.55E-07
88		0.08	0.000	0.048	0.2815	0.2638	0.0000	2.55E-07

89		0.00	0.000	0.019	0.2796	0.2637	0.0000	2.55E-07
90		0.00	0.000	0.020	0.2776	0.2636	0.0000	2.55E-07
91		0.00	0.000	0.005	0.2772	0.2636	0.0000	2.55E-07
92		0.00	0.000	0.001	0.2770	0.2635	0.0000	2.55E-07
93		0.00	0.000	0.000	0.2770	0.2634	0.0000	2.55E-07
94	*	0.00	0.000	0.000	0.2770	0.2633	0.0000	2.55E-07
95		0.00	0.000	0.000	0.2770	0.2633	0.0000	2.55E-07
96		0.00	0.000	0.000	0.2770	0.2632	0.0000	2.55E-07
97		0.00	0.000	0.000	0.2770	0.2631	0.0000	2.55E-07
98		0.94	0.723	0.052	0.2933	0.2630	0.0000	2.55E-07
99		0.41	0.203	0.093	0.3049	0.2630	0.0000	2.54E-07
100		0.00	0.000	0.105	0.2944	0.2629	0.0000	2.54E-07
101		0.00	0.000	0.102	0.2842	0.2628	0.0000	2.54E-07
102		0.00	0.000	0.060	0.2782	0.2627	0.0000	2.54E-07
103		0.00	0.000	0.009	0.2773	0.2626	0.0000	2.54E-07
104		0.00	0.000	0.002	0.2771	0.2626	0.0000	2.54E-07
105		0.00	0.000	0.001	0.2770	0.2625	0.0000	2.54E-07
106		0.00	0.000	0.000	0.2770	0.2624	0.0000	2.54E-07
107		0.00	0.000	0.000	0.2770	0.2623	0.0000	2.54E-07
108		0.34	0.149	0.055	0.2904	0.2623	0.0000	2.54E-07
109		0.00	0.000	0.011	0.2894	0.2622	0.0000	2.54E-07
110	*	0.00	0.000	0.000	0.2894	0.2621	0.0000	2.54E-07
111	*	0.23	0.000	0.042	0.2914	0.2620	0.0000	2.54E-07
112	*	0.00	0.000	0.035	0.2933	0.2620	0.0000	2.54E-07
113	*	0.00	0.000	0.088	0.2953	0.2619	0.0000	2.54E-07
114	*	0.08	0.000	0.067	0.2966	0.2618	0.0000	2.53E-07
115	*	0.02	0.000	0.024	0.2966	0.2617	0.0000	2.53E-07
116	*	0.00	0.000	0.015	0.2951	0.2617	0.0000	2.53E-07
117		0.00	0.000	0.014	0.2937	0.2616	0.0000	2.53E-07
118		0.00	0.000	0.014	0.2923	0.2615	0.0000	2.53E-07
119		0.00	0.000	0.013	0.2910	0.2614	0.0000	2.53E-07
120		0.00	0.000	0.013	0.2898	0.2613	0.0000	2.53E-07

121		0.02	0.000	0.029	0.2893	0.2613	0.0000	2.53E-07
122		0.00	0.000	0.012	0.2881	0.2612	0.0000	2.53E-07
123		0.63	0.438	0.046	0.3025	0.2611	0.0000	2.53E-07
124		0.01	0.000	0.049	0.2982	0.2610	0.0000	2.53E-07
125		0.05	0.000	0.109	0.2920	0.2610	0.0000	2.53E-07
126	*	0.42	0.000	0.063	0.2939	0.2609	0.0000	2.53E-07
127		0.85	0.971	0.086	0.3067	0.2608	0.0000	2.53E-07
128		0.00	0.000	0.122	0.2945	0.2607	0.0000	2.52E-07
129		0.00	0.000	0.124	0.2821	0.2607	0.0000	2.52E-07
130		0.00	0.000	0.044	0.2777	0.2606	0.0000	2.52E-07
131		0.00	0.000	0.006	0.2772	0.2605	0.0000	2.52E-07
132		0.05	0.000	0.030	0.2792	0.2604	0.0000	2.52E-07
133		0.02	0.000	0.018	0.2793	0.2604	0.0000	2.52E-07
134		0.01	0.000	0.010	0.2791	0.2603	0.0000	2.52E-07
135		0.06	0.000	0.032	0.2824	0.2602	0.0000	2.52E-07
136		0.00	0.000	0.013	0.2811	0.2601	0.0000	2.52E-07
137		0.00	0.000	0.014	0.2797	0.2600	0.0000	2.52E-07
138		0.00	0.000	0.008	0.2789	0.2600	0.0000	2.52E-07
139		0.00	0.000	0.006	0.2783	0.2599	0.0000	2.52E-07
140		0.00	0.000	0.007	0.2778	0.2598	0.0000	2.52E-07
141		0.33	0.145	0.050	0.2914	0.2597	0.0000	2.52E-07
142		0.05	0.000	0.034	0.2934	0.2597	0.0000	2.52E-07
143		0.16	0.002	0.043	0.3052	0.2596	0.0000	2.51E-07
144		0.20	0.051	0.044	0.3157	0.2595	0.0000	2.51E-07
145		0.06	0.000	0.039	0.3180	0.2594	0.0000	2.51E-07
146		1.54	1.157	0.454	0.3106	0.2594	0.0000	2.51E-07
147		0.00	0.000	0.015	0.3091	0.2593	0.0000	2.51E-07
148		0.00	0.000	0.017	0.3074	0.2592	0.0000	2.51E-07
149		0.00	0.000	0.016	0.3058	0.2591	0.0000	2.51E-07
150		0.00	0.000	0.016	0.3041	0.2591	0.0000	2.51E-07
151		0.00	0.000	0.014	0.3027	0.2590	0.0000	2.51E-07
152		0.00	0.000	0.014	0.3013	0.2589	0.0000	2.51E-07

153	0.00	0.000	0.013	0.3000	0.2588	0.0000	2.51E-07
154	0.00	0.000	0.015	0.2984	0.2588	0.0000	2.51E-07
155	0.00	0.000	0.017	0.2970	0.2587	0.0000	2.51E-07
156	0.01	0.000	0.023	0.2958	0.2586	0.0000	2.51E-07
157	0.75	0.559	0.044	0.3109	0.2585	0.0000	2.51E-07
158	0.06	0.000	0.087	0.3086	0.2585	0.0000	2.50E-07
159	0.48	0.230	0.117	0.3218	0.2584	0.0000	2.50E-07
160	0.01	0.000	0.201	0.3023	0.2583	0.0000	2.50E-07
161	0.00	0.000	0.170	0.2854	0.2582	0.0000	2.50E-07
162	0.00	0.000	0.073	0.2780	0.2582	0.0000	2.50E-07
163	0.00	0.000	0.011	0.2772	0.2581	0.0000	2.50E-07
164	0.00	0.000	0.002	0.2770	0.2580	0.0000	2.50E-07
165	0.00	0.000	0.000	0.2770	0.2579	0.0000	2.50E-07
166	0.00	0.000	0.000	0.2770	0.2579	0.0000	2.50E-07
167	0.00	0.000	0.000	0.2770	0.2578	0.0000	2.50E-07
168	1.07	0.854	0.057	0.2931	0.2577	0.0000	2.50E-07
169	0.00	0.000	0.103	0.2832	0.2576	0.0000	2.50E-07
170	0.02	0.000	0.033	0.2819	0.2576	0.0000	2.50E-07
171	0.13	0.000	0.051	0.2894	0.2575	0.0000	2.50E-07
172	0.00	0.000	0.020	0.2873	0.2574	0.0000	2.50E-07
173	0.00	0.000	0.018	0.2855	0.2573	0.0000	2.49E-07
174	0.00	0.000	0.016	0.2840	0.2573	0.0000	2.49E-07
175	0.00	0.000	0.015	0.2825	0.2572	0.0000	2.49E-07
176	0.14	0.000	0.045	0.2920	0.2571	0.0000	2.49E-07
177	0.20	0.041	0.041	0.3043	0.2570	0.0000	2.49E-07
178	1.47	1.102	0.252	0.3155	0.2570	0.0000	2.49E-07
179	0.00	0.000	0.152	0.3004	0.2569	0.0000	2.49E-07
180	0.00	0.000	0.163	0.2841	0.2568	0.0000	2.49E-07
181	0.00	0.000	0.062	0.2779	0.2567	0.0000	2.49E-07
182	0.00	0.000	0.007	0.2771	0.2567	0.0000	2.49E-07
183	0.00	0.000	0.001	0.2770	0.2566	0.0000	2.49E-07
184	0.00	0.000	0.000	0.2770	0.2565	0.0000	2.49E-07

185	0.00	0.000	0.000	0.2770	0.2564	0.0000	2.49E-07
186	0.00	0.000	0.000	0.2770	0.2564	0.0000	2.49E-07
187	0.00	0.000	0.000	0.2770	0.2563	0.0000	2.49E-07
188	0.15	0.000	0.034	0.2891	0.2562	0.0000	2.48E-07
189	0.13	0.000	0.042	0.2981	0.2561	0.0000	2.48E-07
190	0.00	0.000	0.012	0.2969	0.2561	0.0000	2.48E-07
191	0.51	0.321	0.056	0.3098	0.2560	0.0000	2.48E-07
192	0.00	0.000	0.171	0.2927	0.2559	0.0000	2.48E-07
193	0.00	0.000	0.022	0.2905	0.2558	0.0000	2.48E-07
194	0.00	0.000	0.024	0.2882	0.2558	0.0000	2.48E-07
195	0.00	0.000	0.018	0.2864	0.2557	0.0000	2.48E-07
196	0.00	0.000	0.018	0.2846	0.2556	0.0000	2.48E-07
197	0.00	0.000	0.020	0.2826	0.2555	0.0000	2.48E-07
198	0.00	0.000	0.017	0.2809	0.2555	0.0000	2.48E-07
199	0.00	0.000	0.020	0.2789	0.2554	0.0000	2.48E-07
200	0.00	0.000	0.015	0.2774	0.2553	0.0000	2.48E-07
201	0.00	0.000	0.003	0.2770	0.2552	0.0000	2.48E-07
202	0.04	0.000	0.025	0.2787	0.2552	0.0000	2.48E-07
203	0.01	0.000	0.011	0.2787	0.2551	0.0000	2.48E-07
204	1.03	0.835	0.047	0.2931	0.2550	0.0000	2.47E-07
205	0.00	0.000	0.097	0.2835	0.2549	0.0000	2.47E-07
206	0.00	0.000	0.012	0.2823	0.2549	0.0000	2.47E-07
207	0.00	0.000	0.017	0.2807	0.2548	0.0000	2.47E-07
208	0.00	0.000	0.017	0.2789	0.2547	0.0000	2.47E-07
209	0.03	0.000	0.033	0.2785	0.2546	0.0000	2.47E-07
210	0.00	0.000	0.006	0.2779	0.2546	0.0000	2.47E-07
211	0.00	0.000	0.004	0.2774	0.2549	0.0000	2.47E-07
212	0.00	0.000	0.003	0.2771	0.2552	0.0000	2.48E-07
213	0.28	0.111	0.038	0.2899	0.2551	0.0000	2.48E-07
214	0.04	0.000	0.056	0.2882	0.2550	0.0000	2.47E-07
215	0.00	0.000	0.010	0.2872	0.2550	0.0000	2.47E-07
216	0.00	0.000	0.013	0.2859	0.2549	0.0000	2.47E-07

217	0.02	0.000	0.028	0.2849	0.2548	0.0000	2.47E-07
218	0.00	0.000	0.014	0.2836	0.2547	0.0000	2.47E-07
219	0.00	0.000	0.013	0.2823	0.2547	0.0000	2.47E-07
220	0.00	0.000	0.013	0.2810	0.2546	0.0000	2.47E-07
221	0.00	0.000	0.013	0.2798	0.2545	0.0000	2.47E-07
222	0.00	0.000	0.011	0.2786	0.2544	0.0000	2.47E-07
223	0.00	0.000	0.010	0.2776	0.2544	0.0000	2.47E-07
224	0.05	0.000	0.030	0.2800	0.2543	0.0000	2.47E-07
225	0.19	0.024	0.037	0.2929	0.2542	0.0000	2.47E-07
226	0.01	0.000	0.032	0.2911	0.2541	0.0000	2.47E-07
227	0.00	0.000	0.009	0.2902	0.2541	0.0000	2.47E-07
228	0.00	0.000	0.011	0.2890	0.2540	0.0000	2.47E-07
229	0.05	0.000	0.037	0.2907	0.2539	0.0000	2.46E-07
230	2.12	1.957	0.043	0.3031	0.2538	0.0000	2.46E-07
231	0.04	0.000	0.058	0.3008	0.2538	0.0000	2.46E-07
232	0.00	0.000	0.080	0.2929	0.2537	0.0000	2.46E-07
233	0.00	0.000	0.136	0.2793	0.2536	0.0000	2.46E-07
234	0.00	0.000	0.017	0.2776	0.2535	0.0000	2.46E-07
235	0.00	0.000	0.004	0.2771	0.2535	0.0000	2.46E-07
236	0.00	0.000	0.001	0.2770	0.2534	0.0000	2.46E-07
237	0.00	0.000	0.000	0.2770	0.2533	0.0000	2.46E-07
238	0.00	0.000	0.000	0.2770	0.2533	0.0000	2.46E-07
239	0.00	0.000	0.000	0.2770	0.2532	0.0000	2.46E-07
240	0.00	0.000	0.000	0.2770	0.2531	0.0000	2.46E-07
241	0.00	0.000	0.000	0.2770	0.2530	0.0000	2.46E-07
242	0.00	0.000	0.000	0.2770	0.2530	0.0000	2.46E-07
243	0.05	0.000	0.028	0.2794	0.2529	0.0000	2.46E-07
244	0.00	0.000	0.003	0.2792	0.2528	0.0000	2.45E-07
245	0.00	0.000	0.006	0.2786	0.2527	0.0000	2.45E-07
246	0.00	0.000	0.005	0.2781	0.2527	0.0000	2.45E-07
247	0.12	0.000	0.035	0.2868	0.2526	0.0000	2.45E-07
248	0.06	0.000	0.037	0.2895	0.2525	0.0000	2.45E-07

249		0.00	0.000	0.010	0.2884	0.2524	0.0000	2.45E-07
250		0.00	0.000	0.010	0.2875	0.2524	0.0000	2.45E-07
251		0.00	0.000	0.013	0.2862	0.2523	0.0000	2.45E-07
252		0.00	0.000	0.013	0.2849	0.2522	0.0000	2.45E-07
253		0.00	0.000	0.013	0.2836	0.2521	0.0000	2.45E-07
254		0.00	0.000	0.013	0.2823	0.2521	0.0000	2.45E-07
255		0.00	0.000	0.012	0.2810	0.2520	0.0000	2.45E-07
256		0.00	0.000	0.011	0.2800	0.2519	0.0000	2.45E-07
257		0.01	0.000	0.017	0.2790	0.2519	0.0000	2.45E-07
258		0.00	0.000	0.011	0.2778	0.2518	0.0000	2.45E-07
259		0.00	0.000	0.006	0.2772	0.2517	0.0000	2.45E-07
260		0.00	0.000	0.001	0.2770	0.2516	0.0000	2.44E-07
261		0.13	0.000	0.033	0.2865	0.2516	0.0000	2.44E-07
262		0.00	0.000	0.007	0.2859	0.2515	0.0000	2.44E-07
263		0.00	0.000	0.008	0.2851	0.2514	0.0000	2.44E-07
264		0.00	0.000	0.010	0.2842	0.2513	0.0000	2.44E-07
265		0.00	0.000	0.009	0.2832	0.2513	0.0000	2.44E-07
266		0.00	0.000	0.009	0.2823	0.2512	0.0000	2.44E-07
267		0.63	0.436	0.044	0.2973	0.2511	0.0000	2.44E-07
268		0.23	0.077	0.040	0.3082	0.2510	0.0000	2.44E-07
269		0.00	0.000	0.074	0.3008	0.2510	0.0000	2.44E-07
270		0.38	0.195	0.044	0.3144	0.2509	0.0000	2.44E-07
271		0.00	0.000	0.101	0.3043	0.2508	0.0000	2.44E-07
272		0.00	0.000	0.043	0.3001	0.2508	0.0000	2.44E-07
273		0.00	0.000	0.086	0.2914	0.2507	0.0000	2.44E-07
274		0.01	0.000	0.055	0.2872	0.2506	0.0000	2.44E-07
275		0.00	0.000	0.034	0.2838	0.2505	0.0000	2.43E-07
276		0.57	0.349	0.058	0.2997	0.2505	0.0000	2.43E-07
277	*	0.00	0.000	0.000	0.2997	0.2504	0.0000	2.43E-07
278		0.01	0.000	0.069	0.2933	0.2503	0.0000	2.43E-07
279		0.21	0.046	0.097	0.3000	0.2502	0.0000	2.43E-07
280		0.02	0.000	0.087	0.2937	0.2502	0.0000	2.43E-07

281		0.18	0.024	0.077	0.3019	0.2501	0.0000	2.43E-07
282		0.03	0.000	0.060	0.2991	0.2500	0.0000	2.43E-07
283		0.07	0.000	0.099	0.2964	0.2499	0.0000	2.43E-07
284		0.64	0.443	0.071	0.3092	0.2499	0.0000	2.43E-07
285		0.02	0.000	0.050	0.3061	0.2498	0.0000	2.43E-07
286		0.00	0.000	0.044	0.3018	0.2497	0.0000	2.43E-07
287	*	0.15	0.000	0.043	0.3037	0.2497	0.0000	2.43E-07
288		0.00	0.000	0.053	0.3057	0.2496	0.0000	2.43E-07
289		0.00	0.000	0.076	0.2995	0.2495	0.0000	2.43E-07
290		0.00	0.000	0.058	0.2937	0.2494	0.0000	2.42E-07
291		0.00	0.000	0.030	0.2907	0.2494	0.0000	2.42E-07
292		0.00	0.000	0.031	0.2876	0.2493	0.0000	2.42E-07
293	*	0.00	0.000	0.030	0.2845	0.2492	0.0000	2.42E-07
294		0.00	0.000	0.044	0.2801	0.2491	0.0000	2.42E-07
295		0.00	0.000	0.027	0.2778	0.2491	0.0000	2.42E-07
296		0.00	0.000	0.006	0.2772	0.2490	0.0000	2.42E-07
297		0.00	0.000	0.005	0.2770	0.2489	0.0000	2.42E-07
298		0.00	0.000	0.000	0.2770	0.2489	0.0000	2.42E-07
299		0.00	0.000	0.000	0.2770	0.2488	0.0000	2.42E-07
300	*	0.29	0.000	0.032	0.2790	0.2487	0.0000	2.42E-07
301		0.07	0.119	0.048	0.2933	0.2486	0.0000	2.42E-07
302		0.00	0.000	0.012	0.2921	0.2486	0.0000	2.42E-07
303		0.47	0.271	0.057	0.3063	0.2485	0.0000	2.42E-07
304		0.00	0.000	0.063	0.2999	0.2484	0.0000	2.42E-07
305		0.00	0.000	0.042	0.2958	0.2483	0.0000	2.42E-07
306	*	0.00	0.000	0.018	0.2940	0.2483	0.0000	2.41E-07
307		0.00	0.000	0.028	0.2912	0.2482	0.0000	2.41E-07
308	*	0.06	0.000	0.040	0.2930	0.2481	0.0000	2.41E-07
309	*	0.13	0.000	0.049	0.2949	0.2481	0.0000	2.41E-07
310		0.25	0.171	0.013	0.3077	0.2480	0.0000	2.41E-07
311		0.00	0.000	0.031	0.3045	0.2479	0.0000	2.41E-07
312		0.00	0.000	0.040	0.3005	0.2478	0.0000	2.41E-07

313		0.00	0.000	0.053	0.2952	0.2478	0.0000	2.41E-07
314		0.00	0.000	0.026	0.2926	0.2477	0.0000	2.41E-07
315		0.00	0.000	0.022	0.2904	0.2476	0.0000	2.41E-07
316		0.00	0.000	0.021	0.2883	0.2475	0.0000	2.41E-07
317	*	0.00	0.000	0.011	0.2871	0.2475	0.0000	2.41E-07
318	*	0.00	0.000	0.000	0.2871	0.2474	0.0000	2.41E-07
319	*	0.00	0.000	0.023	0.2849	0.2473	0.0000	2.41E-07
320		0.00	0.000	0.048	0.2800	0.2473	0.0000	2.41E-07
321		0.00	0.000	0.015	0.2785	0.2472	0.0000	2.40E-07
322		0.00	0.000	0.013	0.2772	0.2471	0.0000	2.40E-07
323	*	0.00	0.000	0.000	0.2772	0.2470	0.0000	2.40E-07
324	*	0.00	0.000	0.000	0.2772	0.2470	0.0000	2.40E-07
325		0.00	0.000	0.002	0.2771	0.2469	0.0000	2.40E-07
326		0.00	0.000	0.001	0.2770	0.2468	0.0000	2.40E-07
327		0.00	0.000	0.000	0.2770	0.2467	0.0000	2.40E-07
328		0.00	0.000	0.000	0.2770	0.2467	0.0000	2.40E-07
329		0.00	0.000	0.000	0.2770	0.2466	0.0000	2.40E-07
330		0.18	0.009	0.040	0.2897	0.2465	0.0000	2.40E-07
331		0.05	0.000	0.034	0.2914	0.2465	0.0000	2.40E-07
332		0.00	0.000	0.012	0.2902	0.2464	0.0000	2.40E-07
333		0.20	0.032	0.040	0.3029	0.2463	0.0000	2.40E-07
334		0.00	0.000	0.030	0.2999	0.2462	0.0000	2.40E-07
335		0.03	0.000	0.033	0.2999	0.2462	0.0000	2.40E-07
336		0.01	0.000	0.023	0.2987	0.2461	0.0000	2.40E-07
337		0.00	0.000	0.013	0.2974	0.2460	0.0000	2.39E-07
338		0.00	0.000	0.011	0.2963	0.2460	0.0000	2.39E-07
339	*	0.00	0.000	0.000	0.2963	0.2459	0.0000	2.39E-07
340		0.00	0.000	0.011	0.2952	0.2458	0.0000	2.39E-07
341		0.05	0.000	0.034	0.2963	0.2457	0.0000	2.39E-07
342		0.00	0.000	0.011	0.2952	0.2457	0.0000	2.39E-07
343		0.00	0.000	0.012	0.2940	0.2456	0.0000	2.39E-07
344		0.00	0.000	0.012	0.2929	0.2455	0.0000	2.39E-07

345	*	0.01	0.000	0.007	0.2929	0.2455	0.0000	2.39E-07
346	*	0.00	0.000	0.010	0.2919	0.2454	0.0000	2.39E-07
347		0.00	0.000	0.009	0.2910	0.2453	0.0000	2.39E-07
348		0.32	0.133	0.044	0.3055	0.2452	0.0000	2.39E-07
349		0.29	0.122	0.062	0.3162	0.2452	0.0000	2.39E-07
350		0.15	0.007	0.045	0.3256	0.2451	0.0000	2.39E-07
351	*	0.02	0.000	0.018	0.3256	0.2450	0.0000	2.39E-07
352		0.00	0.000	0.032	0.3224	0.2450	0.0000	2.39E-07
353		0.00	0.000	0.034	0.3190	0.2449	0.0000	2.38E-07
354		0.12	0.000	0.060	0.3253	0.2448	0.0000	2.38E-07
355		0.00	0.000	0.017	0.3236	0.2448	0.0000	2.38E-07
356	*	0.39	0.000	0.023	0.3255	0.2447	0.0000	2.38E-07
357		0.00	0.173	0.042	0.3383	0.2446	0.0000	2.38E-07
358		1.31	1.136	0.061	0.3499	0.2445	0.0000	2.38E-07
359		0.16	0.041	0.057	0.3564	0.2445	0.0000	2.38E-07
360		0.00	0.000	0.037	0.3527	0.2444	0.0000	2.38E-07
361		0.00	0.000	0.029	0.3498	0.2443	0.0000	2.38E-07
362	*	0.00	0.000	0.000	0.3498	0.2443	0.0000	2.38E-07
363	*	0.61	0.000	0.015	0.3518	0.2442	0.0000	2.38E-07
364	*	0.00	0.000	0.020	0.3538	0.2441	0.0000	2.38E-07
365	*	0.00	0.000	0.022	0.3558	0.2440	0.0000	2.38E-07

* = Frozen (air or soil)

Annual Totals for Year 20

	inches	cubic feet	percent
Precipitation	32.23	116,991.7	100.00
Runoff	19.342	70,210.6	60.01
Evapotranspiration	12.137	44,056.0	37.66
Recirculation into Layer 1	0.0107	38.7	0.03
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0107	38.7	0.03
Percolation/Leakage through Layer 5	0.000091	0.3310	0.00
Average Head on Top of Layer 4	0.2570	---	---
Change in Water Storage	0.7506	2,724.7	2.33
Soil Water at Start of Year	1,407.0611	5,107,631.7	4365.81
Soil Water at End of Year	1,407.3507	5,108,683.1	4366.71
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.4610	1,673.3	1.43
Annual Water Budget Balance	-0.0107	-38.7	-0.03

Daily Output for Year 21

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.07	0.000	0.010	0.3597	0.2439	0.0000	2.38E-07
2			0.20	0.113	0.000	0.3724	0.2438	0.0000	2.38E-07
3	*		0.12	0.000	0.020	0.3744	0.2438	0.0000	2.37E-07
4	*		0.20	0.000	0.025	0.3764	0.2437	0.0000	2.37E-07
5	*		0.13	0.000	0.000	0.3784	0.2436	0.0000	2.37E-07
6	*	*	0.04	0.000	0.017	0.3784	0.2435	0.0000	2.37E-07
7	*	*	0.15	0.000	0.023	0.3784	0.2435	0.0000	2.37E-07
8	*	*	0.02	0.000	0.000	0.3784	0.2434	0.0000	2.37E-07
9		*	0.39	1.359	0.000	0.3795	0.2433	0.0000	2.37E-07
10		*	0.00	0.000	0.000	0.3795	0.2433	0.0000	2.37E-07
11	*	*	0.00	0.000	0.000	0.3795	0.2432	0.0000	2.37E-07
12		*	0.00	0.000	0.000	0.3795	0.2431	0.0000	2.37E-07
13	*	*	0.00	0.000	0.000	0.3795	0.2430	0.0000	2.37E-07
14	*	*	0.00	0.000	0.000	0.3795	0.2430	0.0000	2.37E-07
15	*	*	0.00	0.000	0.000	0.3795	0.2429	0.0000	2.37E-07
16	*	*	0.00	0.000	0.000	0.3795	0.2428	0.0000	2.37E-07
17		*	0.00	0.000	0.000	0.3795	0.2428	0.0000	2.37E-07
18		*	0.00	0.000	0.000	0.3795	0.2427	0.0000	2.36E-07
19			0.00	0.000	0.039	0.3756	0.2426	0.0000	2.36E-07
20			0.00	0.000	0.043	0.3715	0.2425	0.0000	2.36E-07
21	*		0.17	0.000	0.046	0.3735	0.2425	0.0000	2.36E-07
22	*	*	0.18	0.000	0.032	0.3735	0.2424	0.0000	2.36E-07
23		*	0.00	0.097	0.077	0.3823	0.2423	0.0000	2.36E-07
24		*	0.02	0.000	0.014	0.3828	0.2423	0.0000	2.36E-07

25			0.00	0.000	0.031	0.3796	0.2422	0.0000	2.36E-07
26	*		0.00	0.000	0.030	0.3766	0.2421	0.0000	2.36E-07
27			0.00	0.000	0.039	0.3728	0.2420	0.0000	2.36E-07
28			0.00	0.000	0.023	0.3705	0.2420	0.0000	2.36E-07
29	*		0.00	0.000	0.000	0.3705	0.2419	0.0000	2.36E-07
30	*	*	0.23	0.000	0.009	0.3705	0.2418	0.0000	2.36E-07
31	*	*	0.01	0.000	0.013	0.3705	0.2418	0.0000	2.36E-07
32	*	*	0.03	0.000	0.006	0.3705	0.2417	0.0000	2.36E-07
33	*	*	0.00	0.000	0.012	0.3705	0.2416	0.0000	2.36E-07
34		*	0.00	0.150	0.052	0.3734	0.2415	0.0000	2.35E-07
35		*	0.00	0.000	0.000	0.3734	0.2415	0.0000	2.35E-07
36	*	*	0.00	0.000	0.000	0.3734	0.2414	0.0000	2.35E-07
37	*	*	0.00	0.000	0.000	0.3734	0.2413	0.0000	2.35E-07
38	*	*	0.00	0.000	0.000	0.3735	0.2413	0.0000	2.35E-07
39	*	*	0.00	0.000	0.000	0.3735	0.2412	0.0000	2.35E-07
40	*	*	0.00	0.000	0.000	0.3735	0.2411	0.0000	2.35E-07
41		*	0.00	0.000	0.000	0.3735	0.2411	0.0000	2.35E-07
42	*	*	0.00	0.000	0.000	0.3735	0.2410	0.0000	2.35E-07
43	*	*	0.14	0.000	0.047	0.3735	0.2409	0.0000	2.35E-07
44	*	*	0.09	0.000	0.045	0.3735	0.2408	0.0000	2.35E-07
45		*	0.03	0.033	0.042	0.3821	0.2408	0.0000	2.35E-07
46		*	0.00	0.000	0.000	0.3822	0.2407	0.0000	2.35E-07
47			0.00	0.000	0.024	0.3797	0.2406	0.0000	2.35E-07
48	*		0.29	0.000	0.041	0.3817	0.2406	0.0000	2.35E-07
49	*	*	0.02	0.000	0.018	0.3817	0.2405	0.0000	2.35E-07
50	*	*	0.00	0.000	0.035	0.3817	0.2404	0.0000	2.34E-07
51	*	*	0.00	0.000	0.045	0.3817	0.2403	0.0000	2.34E-07
52		*	0.14	0.139	0.054	0.3916	0.2403	0.0000	2.34E-07
53		*	0.00	0.000	0.000	0.3916	0.2402	0.0000	2.34E-07
54			0.00	0.000	0.114	0.3801	0.2401	0.0000	2.34E-07
55			0.00	0.000	0.156	0.3645	0.2401	0.0000	2.34E-07
56			0.00	0.000	0.060	0.3585	0.2400	0.0000	2.34E-07

57		0.00	0.000	0.126	0.3459	0.2399	0.0000	2.34E-07
58		0.00	0.000	0.175	0.3284	0.2399	0.0000	2.34E-07
59		0.00	0.000	0.130	0.3154	0.2398	0.0000	2.34E-07
60		0.05	0.000	0.063	0.3137	0.2397	0.0000	2.34E-07
61		0.00	0.000	0.038	0.3099	0.2396	0.0000	2.34E-07
62		0.00	0.000	0.035	0.3064	0.2396	0.0000	2.34E-07
63		0.00	0.000	0.031	0.3034	0.2395	0.0000	2.34E-07
64		0.00	0.000	0.027	0.3007	0.2394	0.0000	2.34E-07
65		0.00	0.000	0.025	0.2982	0.2394	0.0000	2.34E-07
66		0.00	0.000	0.024	0.2958	0.2393	0.0000	2.33E-07
67	*	0.00	0.000	0.000	0.2958	0.2392	0.0000	2.33E-07
68	*	0.00	0.000	0.000	0.2958	0.2392	0.0000	2.33E-07
69	*	0.00	0.000	0.000	0.2958	0.2391	0.0000	2.33E-07
70		0.33	0.144	0.049	0.3092	0.2390	0.0000	2.33E-07
71		0.08	0.000	0.046	0.3127	0.2389	0.0000	2.33E-07
72		0.00	0.000	0.020	0.3107	0.2389	0.0000	2.33E-07
73		0.01	0.000	0.024	0.3088	0.2388	0.0000	2.33E-07
74		1.10	0.921	0.044	0.3228	0.2387	0.0000	2.33E-07
75		0.51	0.291	0.108	0.3344	0.2387	0.0000	2.33E-07
76		0.02	0.000	0.250	0.3116	0.2386	0.0000	2.33E-07
77		0.37	0.164	0.104	0.3215	0.2385	0.0000	2.33E-07
78		0.00	0.000	0.101	0.3115	0.2385	0.0000	2.33E-07
79		0.00	0.000	0.066	0.3052	0.2384	0.0000	2.33E-07
80		0.00	0.000	0.055	0.2997	0.2419	0.0000	2.36E-07
81		0.20	0.038	0.112	0.3046	0.2428	0.0000	2.37E-07
82		0.00	0.000	0.092	0.2951	0.2459	0.0000	2.39E-07
83		0.00	0.000	0.048	0.2907	0.2499	0.0000	2.43E-07
84		0.73	0.387	0.199	0.3053	0.2498	0.0000	2.43E-07
85		0.00	0.000	0.078	0.2976	0.2497	0.0000	2.43E-07
86		0.00	0.000	0.069	0.2909	0.2496	0.0000	2.43E-07
87	*	0.03	0.000	0.034	0.2909	0.2496	0.0000	2.43E-07
88	*	0.24	0.000	0.021	0.2929	0.2495	0.0000	2.43E-07

89		0.00	0.002	0.127	0.2998	0.2494	0.0000	2.42E-07
90	*	0.00	0.000	0.004	0.2998	0.2494	0.0000	2.42E-07
91		0.00	0.000	0.050	0.2948	0.2493	0.0000	2.42E-07
92		0.00	0.000	0.119	0.2829	0.2492	0.0000	2.42E-07
93		0.00	0.000	0.046	0.2783	0.2491	0.0000	2.42E-07
94		0.21	0.047	0.073	0.2875	0.2491	0.0000	2.42E-07
95		0.83	0.640	0.077	0.2991	0.2490	0.0000	2.42E-07
96		0.00	0.000	0.056	0.2935	0.2489	0.0000	2.42E-07
97		0.00	0.000	0.084	0.2852	0.2488	0.0000	2.42E-07
98	*	0.00	0.000	0.034	0.2817	0.2488	0.0000	2.42E-07
99	*	0.00	0.000	0.000	0.2817	0.2487	0.0000	2.42E-07
100	*	0.00	0.000	0.035	0.2782	0.2486	0.0000	2.42E-07
101		0.00	0.000	0.009	0.2773	0.2486	0.0000	2.42E-07
102	*	0.09	0.000	0.047	0.2793	0.2485	0.0000	2.42E-07
103		0.00	0.000	0.033	0.2779	0.2484	0.0000	2.42E-07
104		0.00	0.000	0.007	0.2773	0.2483	0.0000	2.42E-07
105	*	0.00	0.000	0.002	0.2771	0.2483	0.0000	2.41E-07
106		0.00	0.000	0.000	0.2770	0.2482	0.0000	2.41E-07
107		0.89	0.678	0.054	0.2933	0.2481	0.0000	2.41E-07
108		0.82	0.482	0.222	0.3048	0.2480	0.0000	2.41E-07
109		0.28	0.115	0.129	0.3088	0.2480	0.0000	2.41E-07
110		0.00	0.000	0.132	0.2956	0.2479	0.0000	2.41E-07
111		0.00	0.000	0.156	0.2799	0.2478	0.0000	2.41E-07
112		0.00	0.000	0.022	0.2777	0.2478	0.0000	2.41E-07
113		0.00	0.000	0.006	0.2772	0.2477	0.0000	2.41E-07
114		0.63	0.398	0.065	0.2933	0.2476	0.0000	2.41E-07
115		0.18	0.029	0.077	0.3006	0.2475	0.0000	2.41E-07
116		0.00	0.000	0.040	0.2966	0.2475	0.0000	2.41E-07
117		0.06	0.000	0.165	0.2862	0.2474	0.0000	2.41E-07
118		0.35	0.115	0.154	0.2944	0.2473	0.0000	2.41E-07
119		0.57	0.381	0.078	0.3059	0.2473	0.0000	2.41E-07
120		0.00	0.000	0.197	0.2862	0.2472	0.0000	2.40E-07

121	0.00	0.000	0.034	0.2828	0.2471	0.0000	2.40E-07
122	0.00	0.000	0.030	0.2798	0.2470	0.0000	2.40E-07
123	0.00	0.000	0.024	0.2774	0.2470	0.0000	2.40E-07
124	0.00	0.000	0.003	0.2771	0.2469	0.0000	2.40E-07
125	0.00	0.000	0.001	0.2770	0.2468	0.0000	2.40E-07
126	0.00	0.000	0.000	0.2770	0.2467	0.0000	2.40E-07
127	0.00	0.000	0.000	0.2770	0.2467	0.0000	2.40E-07
128	0.00	0.000	0.000	0.2770	0.2466	0.0000	2.40E-07
129	0.00	0.000	0.000	0.2770	0.2465	0.0000	2.40E-07
130	0.00	0.000	0.000	0.2770	0.2465	0.0000	2.40E-07
131	0.00	0.000	0.000	0.2770	0.2464	0.0000	2.40E-07
132	0.10	0.000	0.024	0.2843	0.2463	0.0000	2.40E-07
133	0.00	0.000	0.008	0.2835	0.2462	0.0000	2.40E-07
134	0.00	0.000	0.008	0.2828	0.2462	0.0000	2.40E-07
135	0.00	0.000	0.010	0.2817	0.2461	0.0000	2.40E-07
136	0.00	0.000	0.011	0.2806	0.2460	0.0000	2.39E-07
137	0.07	0.000	0.034	0.2847	0.2460	0.0000	2.39E-07
138	0.29	0.122	0.039	0.2971	0.2459	0.0000	2.39E-07
139	0.00	0.000	0.014	0.2962	0.2458	0.0000	2.39E-07
140	0.83	0.643	0.038	0.3107	0.2457	0.0000	2.39E-07
141	0.02	0.000	0.057	0.3073	0.2457	0.0000	2.39E-07
142	0.00	0.000	0.075	0.2998	0.2456	0.0000	2.39E-07
143	0.00	0.000	0.136	0.2861	0.2455	0.0000	2.39E-07
144	0.00	0.000	0.077	0.2784	0.2455	0.0000	2.39E-07
145	0.00	0.000	0.011	0.2774	0.2454	0.0000	2.39E-07
146	0.50	0.289	0.066	0.2922	0.2453	0.0000	2.39E-07
147	0.27	0.082	0.145	0.2964	0.2452	0.0000	2.39E-07
148	0.00	0.000	0.072	0.2892	0.2452	0.0000	2.39E-07
149	0.19	0.034	0.100	0.2950	0.2451	0.0000	2.39E-07
150	0.14	0.000	0.058	0.3031	0.2450	0.0000	2.39E-07
151	0.57	0.319	0.128	0.3151	0.2450	0.0000	2.39E-07
152	0.00	0.000	0.153	0.2997	0.2449	0.0000	2.38E-07

153	0.00	0.000	0.106	0.2892	0.2448	0.0000	2.38E-07
154	0.00	0.000	0.046	0.2846	0.2447	0.0000	2.38E-07
155	0.94	0.711	0.066	0.3005	0.2447	0.0000	2.38E-07
156	0.00	0.000	0.168	0.2837	0.2446	0.0000	2.38E-07
157	0.00	0.000	0.035	0.2804	0.2445	0.0000	2.38E-07
158	0.00	0.000	0.027	0.2777	0.2445	0.0000	2.38E-07
159	0.00	0.000	0.005	0.2772	0.2444	0.0000	2.38E-07
160	0.00	0.000	0.001	0.2770	0.2443	0.0000	2.38E-07
161	0.00	0.000	0.000	0.2770	0.2442	0.0000	2.38E-07
162	0.01	0.000	0.009	0.2770	0.2442	0.0000	2.38E-07
163	0.15	0.000	0.031	0.2892	0.2441	0.0000	2.38E-07
164	0.43	0.260	0.045	0.3013	0.2440	0.0000	2.38E-07
165	0.00	0.000	0.114	0.2899	0.2440	0.0000	2.38E-07
166	0.00	0.000	0.017	0.2882	0.2439	0.0000	2.38E-07
167	0.54	0.341	0.044	0.3034	0.2438	0.0000	2.38E-07
168	0.00	0.000	0.069	0.2968	0.2437	0.0000	2.37E-07
169	0.05	0.000	0.205	0.2811	0.2437	0.0000	2.37E-07
170	0.08	0.000	0.054	0.2838	0.2436	0.0000	2.37E-07
171	0.12	0.000	0.051	0.2907	0.2435	0.0000	2.37E-07
172	0.04	0.000	0.038	0.2907	0.2435	0.0000	2.37E-07
173	0.00	0.000	0.019	0.2889	0.2434	0.0000	2.37E-07
174	0.00	0.000	0.021	0.2868	0.2433	0.0000	2.37E-07
175	0.21	0.057	0.042	0.2982	0.2432	0.0000	2.37E-07
176	0.00	0.000	0.015	0.2968	0.2432	0.0000	2.37E-07
177	0.00	0.000	0.020	0.2948	0.2431	0.0000	2.37E-07
178	0.00	0.000	0.017	0.2930	0.2430	0.0000	2.37E-07
179	0.00	0.000	0.016	0.2914	0.2430	0.0000	2.37E-07
180	0.00	0.000	0.016	0.2899	0.2429	0.0000	2.37E-07
181	0.50	0.309	0.046	0.3041	0.2428	0.0000	2.37E-07
182	0.20	0.048	0.132	0.3065	0.2427	0.0000	2.37E-07
183	0.07	0.000	0.152	0.2980	0.2427	0.0000	2.36E-07
184	0.00	0.000	0.154	0.2826	0.2426	0.0000	2.36E-07

185	0.71	0.428	0.124	0.2981	0.2425	0.0000	2.36E-07
186	1.33	1.082	0.137	0.3094	0.2425	0.0000	2.36E-07
187	0.00	0.000	0.173	0.2921	0.2424	0.0000	2.36E-07
188	0.00	0.000	0.117	0.2804	0.2423	0.0000	2.36E-07
189	0.00	0.000	0.027	0.2778	0.2424	0.0000	2.36E-07
190	0.00	0.000	0.006	0.2771	0.2424	0.0000	2.36E-07
191	0.01	0.000	0.015	0.2770	0.2423	0.0000	2.36E-07
192	0.33	0.138	0.063	0.2899	0.2422	0.0000	2.36E-07
193	0.79	0.623	0.058	0.3013	0.2421	0.0000	2.36E-07
194	0.00	0.000	0.134	0.2879	0.2421	0.0000	2.36E-07
195	0.00	0.000	0.092	0.2787	0.2420	0.0000	2.36E-07
196	0.76	0.452	0.161	0.2931	0.2419	0.0000	2.36E-07
197	1.07	0.706	0.253	0.3041	0.2419	0.0000	2.36E-07
198	0.11	0.001	0.169	0.2984	0.2418	0.0000	2.36E-07
199	0.00	0.000	0.112	0.2872	0.2417	0.0000	2.36E-07
200	0.01	0.000	0.086	0.2795	0.2416	0.0000	2.36E-07
201	0.36	0.148	0.086	0.2920	0.2416	0.0000	2.36E-07
202	0.00	0.000	0.107	0.2813	0.2415	0.0000	2.35E-07
203	0.00	0.000	0.029	0.2784	0.2414	0.0000	2.35E-07
204	0.00	0.000	0.010	0.2773	0.2414	0.0000	2.35E-07
205	0.00	0.000	0.003	0.2771	0.2413	0.0000	2.35E-07
206	0.04	0.000	0.024	0.2792	0.2412	0.0000	2.35E-07
207	0.00	0.000	0.003	0.2789	0.2412	0.0000	2.35E-07
208	0.00	0.000	0.006	0.2783	0.2411	0.0000	2.35E-07
209	0.11	0.000	0.029	0.2860	0.2410	0.0000	2.35E-07
210	1.42	1.246	0.050	0.2984	0.2409	0.0000	2.35E-07
211	0.66	0.328	0.269	0.3048	0.2409	0.0000	2.35E-07
212	0.12	0.001	0.093	0.3070	0.2408	0.0000	2.35E-07
213	0.30	0.107	0.215	0.3045	0.2407	0.0000	2.35E-07
214	0.00	0.000	0.091	0.2954	0.2407	0.0000	2.35E-07
215	0.27	0.081	0.166	0.2975	0.2406	0.0000	2.35E-07
216	0.86	0.537	0.214	0.3084	0.2405	0.0000	2.35E-07

217	0.00	0.000	0.105	0.2979	0.2404	0.0000	2.35E-07
218	0.16	0.002	0.076	0.3057	0.2404	0.0000	2.34E-07
219	0.00	0.000	0.123	0.2934	0.2403	0.0000	2.34E-07
220	0.00	0.000	0.103	0.2831	0.2402	0.0000	2.34E-07
221	0.00	0.000	0.047	0.2785	0.2402	0.0000	2.34E-07
222	0.22	0.056	0.069	0.2881	0.2401	0.0000	2.34E-07
223	0.05	0.000	0.047	0.2881	0.2400	0.0000	2.34E-07
224	0.00	0.000	0.033	0.2848	0.2400	0.0000	2.34E-07
225	0.00	0.000	0.023	0.2825	0.2399	0.0000	2.34E-07
226	0.00	0.000	0.024	0.2800	0.2398	0.0000	2.34E-07
227	0.00	0.000	0.023	0.2777	0.2397	0.0000	2.34E-07
228	0.00	0.000	0.006	0.2772	0.2397	0.0000	2.34E-07
229	0.00	0.000	0.001	0.2770	0.2396	0.0000	2.34E-07
230	0.00	0.000	0.000	0.2770	0.2395	0.0000	2.34E-07
231	0.00	0.000	0.000	0.2770	0.2395	0.0000	2.34E-07
232	0.10	0.000	0.026	0.2848	0.2394	0.0000	2.34E-07
233	0.00	0.000	0.018	0.2834	0.2393	0.0000	2.34E-07
234	0.00	0.000	0.017	0.2817	0.2393	0.0000	2.33E-07
235	0.00	0.000	0.016	0.2801	0.2392	0.0000	2.33E-07
236	0.00	0.000	0.015	0.2786	0.2391	0.0000	2.33E-07
237	0.06	0.000	0.029	0.2815	0.2390	0.0000	2.33E-07
238	0.09	0.000	0.033	0.2872	0.2390	0.0000	2.33E-07
239	0.00	0.000	0.010	0.2862	0.2389	0.0000	2.33E-07
240	0.00	0.000	0.011	0.2850	0.2388	0.0000	2.33E-07
241	0.00	0.000	0.015	0.2835	0.2388	0.0000	2.33E-07
242	0.00	0.000	0.015	0.2820	0.2387	0.0000	2.33E-07
243	0.00	0.000	0.014	0.2807	0.2386	0.0000	2.33E-07
244	0.32	0.141	0.042	0.2943	0.2386	0.0000	2.33E-07
245	0.76	0.608	0.041	0.3056	0.2385	0.0000	2.33E-07
246	0.21	0.063	0.077	0.3127	0.2384	0.0000	2.33E-07
247	0.00	0.000	0.075	0.3053	0.2383	0.0000	2.33E-07
248	0.00	0.000	0.054	0.2998	0.2383	0.0000	2.33E-07

249	0.01	0.000	0.068	0.2937	0.2382	0.0000	2.33E-07
250	0.00	0.000	0.110	0.2827	0.2381	0.0000	2.32E-07
251	0.00	0.000	0.048	0.2779	0.2381	0.0000	2.32E-07
252	0.00	0.000	0.007	0.2772	0.2380	0.0000	2.32E-07
253	0.00	0.000	0.002	0.2771	0.2379	0.0000	2.32E-07
254	0.00	0.000	0.001	0.2770	0.2379	0.0000	2.32E-07
255	0.00	0.000	0.000	0.2770	0.2378	0.0000	2.32E-07
256	0.00	0.000	0.000	0.2770	0.2377	0.0000	2.32E-07
257	0.00	0.000	0.000	0.2770	0.2377	0.0000	2.32E-07
258	0.00	0.000	0.000	0.2770	0.2376	0.0000	2.32E-07
259	0.00	0.000	0.000	0.2770	0.2375	0.0000	2.32E-07
260	0.38	0.199	0.047	0.2909	0.2374	0.0000	2.32E-07
261	0.00	0.000	0.009	0.2900	0.2374	0.0000	2.32E-07
262	0.00	0.000	0.015	0.2884	0.2373	0.0000	2.32E-07
263	0.00	0.000	0.013	0.2871	0.2372	0.0000	2.32E-07
264	0.00	0.000	0.013	0.2858	0.2372	0.0000	2.32E-07
265	0.01	0.000	0.020	0.2847	0.2371	0.0000	2.32E-07
266	0.00	0.000	0.013	0.2834	0.2370	0.0000	2.31E-07
267	0.00	0.000	0.013	0.2822	0.2370	0.0000	2.31E-07
268	0.00	0.000	0.011	0.2810	0.2369	0.0000	2.31E-07
269	0.00	0.000	0.012	0.2799	0.2368	0.0000	2.31E-07
270	0.12	0.000	0.036	0.2878	0.2368	0.0000	2.31E-07
271	0.04	0.000	0.032	0.2883	0.2367	0.0000	2.31E-07
272	1.10	0.931	0.040	0.3011	0.2366	0.0000	2.31E-07
273	0.89	0.655	0.118	0.3126	0.2365	0.0000	2.31E-07
274	0.03	0.000	0.062	0.3092	0.2365	0.0000	2.31E-07
275	1.44	1.119	0.180	0.3231	0.2364	0.0000	2.31E-07
276	0.04	0.000	0.166	0.3108	0.2364	0.0000	2.31E-07
277	0.00	0.000	0.144	0.2964	0.2364	0.0000	2.31E-07
278	0.00	0.000	0.058	0.2906	0.2363	0.0000	2.31E-07
279	0.00	0.000	0.125	0.2781	0.2362	0.0000	2.31E-07
280	2.28	2.008	0.111	0.2944	0.2362	0.0000	2.31E-07

281		0.00	0.000	0.091	0.2853	0.2361	0.0000	2.31E-07
282		0.00	0.000	0.065	0.2788	0.2360	0.0000	2.31E-07
283		0.00	0.000	0.014	0.2775	0.2360	0.0000	2.31E-07
284		0.00	0.000	0.003	0.2771	0.2359	0.0000	2.30E-07
285		0.13	0.000	0.030	0.2870	0.2358	0.0000	2.30E-07
286		0.00	0.000	0.018	0.2853	0.2358	0.0000	2.30E-07
287		0.00	0.000	0.022	0.2831	0.2357	0.0000	2.30E-07
288		0.00	0.000	0.021	0.2810	0.2356	0.0000	2.30E-07
289		0.00	0.000	0.019	0.2792	0.2356	0.0000	2.30E-07
290		0.48	0.271	0.050	0.2947	0.2355	0.0000	2.30E-07
291		0.00	0.000	0.096	0.2851	0.2354	0.0000	2.30E-07
292		0.00	0.000	0.017	0.2834	0.2354	0.0000	2.30E-07
293		0.00	0.000	0.014	0.2820	0.2353	0.0000	2.30E-07
294		0.00	0.000	0.017	0.2803	0.2352	0.0000	2.30E-07
295		0.23	0.065	0.042	0.2921	0.2351	0.0000	2.30E-07
296	*	0.49	0.000	0.040	0.2941	0.2351	0.0000	2.30E-07
297	*	0.00	0.000	0.022	0.2961	0.2350	0.0000	2.30E-07
298		0.35	0.605	0.000	0.3088	0.2349	0.0000	2.30E-07
299	*	0.00	0.000	0.024	0.3064	0.2349	0.0000	2.30E-07
300		0.00	0.000	0.050	0.3015	0.2348	0.0000	2.29E-07
301		0.00	0.000	0.087	0.2928	0.2347	0.0000	2.29E-07
302		0.00	0.000	0.059	0.2869	0.2347	0.0000	2.29E-07
303		0.00	0.000	0.068	0.2800	0.2346	0.0000	2.29E-07
304		0.00	0.000	0.025	0.2776	0.2345	0.0000	2.29E-07
305		0.09	0.000	0.040	0.2825	0.2345	0.0000	2.29E-07
306		0.36	0.140	0.079	0.2962	0.2344	0.0000	2.29E-07
307		0.00	0.000	0.035	0.2927	0.2343	0.0000	2.29E-07
308		0.00	0.000	0.041	0.2886	0.2343	0.0000	2.29E-07
309		0.00	0.000	0.035	0.2851	0.2342	0.0000	2.29E-07
310		0.07	0.000	0.058	0.2858	0.2341	0.0000	2.29E-07
311		0.08	0.000	0.067	0.2872	0.2340	0.0000	2.29E-07
312		0.00	0.000	0.029	0.2843	0.2340	0.0000	2.29E-07

313		0.27	0.095	0.054	0.2965	0.2339	0.0000	2.29E-07
314		0.06	0.000	0.052	0.2974	0.2338	0.0000	2.29E-07
315		0.00	0.000	0.034	0.2941	0.2338	0.0000	2.29E-07
316		0.00	0.000	0.033	0.2907	0.2337	0.0000	2.28E-07
317		0.00	0.000	0.037	0.2871	0.2336	0.0000	2.28E-07
318		0.00	0.000	0.037	0.2834	0.2336	0.0000	2.28E-07
319		0.00	0.000	0.028	0.2805	0.2335	0.0000	2.28E-07
320		0.00	0.000	0.023	0.2783	0.2334	0.0000	2.28E-07
321		0.00	0.000	0.010	0.2773	0.2334	0.0000	2.28E-07
322		0.00	0.000	0.002	0.2771	0.2333	0.0000	2.28E-07
323		0.00	0.000	0.001	0.2770	0.2332	0.0000	2.28E-07
324	*	0.00	0.000	0.000	0.2770	0.2332	0.0000	2.28E-07
325	*	0.00	0.000	0.000	0.2770	0.2331	0.0000	2.28E-07
326	*	0.00	0.000	0.000	0.2770	0.2330	0.0000	2.28E-07
327	*	0.00	0.000	0.000	0.2770	0.2330	0.0000	2.28E-07
328		0.00	0.000	0.000	0.2770	0.2330	0.0000	2.28E-07
329		0.00	0.000	0.000	0.2770	0.2331	0.0000	2.28E-07
330		0.02	0.000	0.015	0.2774	0.2330	0.0000	2.28E-07
331		0.00	0.000	0.002	0.2773	0.2329	0.0000	2.28E-07
332		0.00	0.000	0.002	0.2771	0.2329	0.0000	2.28E-07
333		0.40	0.215	0.042	0.2913	0.2328	0.0000	2.28E-07
334		0.01	0.000	0.015	0.2907	0.2327	0.0000	2.28E-07
335		0.00	0.000	0.012	0.2895	0.2327	0.0000	2.28E-07
336		0.04	0.000	0.031	0.2908	0.2326	0.0000	2.28E-07
337		0.00	0.000	0.012	0.2896	0.2325	0.0000	2.27E-07
338		0.04	0.000	0.028	0.2908	0.2325	0.0000	2.27E-07
339	*	0.00	0.000	0.009	0.2898	0.2324	0.0000	2.27E-07
340		0.00	0.000	0.007	0.2891	0.2324	0.0000	2.27E-07
341	*	0.00	0.000	0.009	0.2882	0.2324	0.0000	2.27E-07
342	*	0.00	0.000	0.000	0.2882	0.2323	0.0000	2.27E-07
343		0.00	0.000	0.009	0.2873	0.2322	0.0000	2.27E-07
344	*	0.33	0.000	0.031	0.2893	0.2322	0.0000	2.27E-07

345		0.00	0.099	0.053	0.3020	0.2321	0.0000	2.27E-07
346		0.21	0.063	0.049	0.3115	0.2320	0.0000	2.27E-07
347		0.06	0.000	0.041	0.3135	0.2320	0.0000	2.27E-07
348		0.00	0.000	0.027	0.3108	0.2319	0.0000	2.27E-07
349		0.00	0.000	0.032	0.3076	0.2318	0.0000	2.27E-07
350	*	0.00	0.000	0.020	0.3056	0.2318	0.0000	2.27E-07
351	*	0.00	0.000	0.017	0.3039	0.2317	0.0000	2.27E-07
352	*	0.00	0.000	0.000	0.3039	0.2316	0.0000	2.27E-07
353	*	0.00	0.000	0.000	0.3039	0.2315	0.0000	2.27E-07
354	*	0.00	0.000	0.000	0.3039	0.2315	0.0000	2.27E-07
355	*	0.00	0.000	0.000	0.3039	0.2314	0.0000	2.26E-07
356	*	0.00	0.000	0.000	0.3039	0.2313	0.0000	2.26E-07
357	*	0.00	0.000	0.000	0.3039	0.2313	0.0000	2.26E-07
358		0.30	0.106	0.059	0.3169	0.2312	0.0000	2.26E-07
359		0.00	0.000	0.049	0.3120	0.2311	0.0000	2.26E-07
360		0.00	0.000	0.056	0.3063	0.2311	0.0000	2.26E-07
361		0.00	0.000	0.102	0.2962	0.2310	0.0000	2.26E-07
362		0.00	0.000	0.107	0.2855	0.2309	0.0000	2.26E-07
363		0.00	0.000	0.044	0.2810	0.2309	0.0000	2.26E-07
364		0.00	0.000	0.032	0.2778	0.2308	0.0000	2.26E-07
365		0.00	0.000	0.007	0.2772	0.2307	0.0000	2.26E-07

* = Frozen (air or soil)

Annual Totals for Year 21			
	inches	cubic feet	percent
Precipitation	39.15	142,115.0	100.00
Runoff	23.255	84,415.9	59.40
Evapotranspiration	17.166	62,311.9	43.85
Recirculation into Layer 1	0.0099	36.1	0.03
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0099	36.1	0.03
Percolation/Leakage through Layer 5	0.000086	0.3105	0.00
Average Head on Top of Layer 4	0.2403	---	---
Change in Water Storage	-1.2708	-4,613.1	-3.25
Soil Water at Start of Year	1,407.3507	5,108,683.1	3594.75
Soil Water at End of Year	1,406.5409	5,105,743.3	3592.68
Snow Water at Start of Year	0.4610	1,673.3	1.18
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0099	-36.1	-0.03

Daily Output for Year 22

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.002	0.2770	0.2307	0.0000	2.26E-07
2			0.00	0.000	0.000	0.2770	0.2306	0.0000	2.26E-07
3			0.00	0.000	0.000	0.2770	0.2305	0.0000	2.26E-07
4			0.00	0.000	0.000	0.2770	0.2305	0.0000	2.26E-07
5			0.00	0.000	0.000	0.2770	0.2304	0.0000	2.26E-07
6	*		0.00	0.000	0.000	0.2770	0.2303	0.0000	2.25E-07
7			0.22	0.060	0.033	0.2897	0.2303	0.0000	2.25E-07
8	*		0.00	0.000	0.000	0.2897	0.2302	0.0000	2.25E-07
9	*		0.03	0.000	0.033	0.2897	0.2301	0.0000	2.25E-07
10	*		0.03	0.000	0.016	0.2908	0.2301	0.0000	2.25E-07
11	*		0.46	0.000	0.007	0.2928	0.2300	0.0000	2.25E-07
12	*		0.07	0.000	0.005	0.2947	0.2299	0.0000	2.25E-07
13	*		0.00	0.000	0.010	0.2967	0.2299	0.0000	2.25E-07
14	*		0.00	0.000	0.014	0.2987	0.2298	0.0000	2.25E-07
15	*		0.00	0.000	0.000	0.3006	0.2297	0.0000	2.25E-07
16			0.00	0.249	0.024	0.3134	0.2297	0.0000	2.25E-07
17			0.00	0.000	0.040	0.3094	0.2296	0.0000	2.25E-07
18			0.00	0.000	0.106	0.2987	0.2295	0.0000	2.25E-07
19			0.00	0.000	0.078	0.2909	0.2295	0.0000	2.25E-07
20			0.00	0.000	0.041	0.2868	0.2294	0.0000	2.25E-07
21			0.00	0.000	0.035	0.2833	0.2293	0.0000	2.25E-07
22			0.00	0.000	0.032	0.2801	0.2293	0.0000	2.25E-07
23			0.00	0.000	0.025	0.2776	0.2292	0.0000	2.24E-07
24			0.00	0.000	0.005	0.2771	0.2291	0.0000	2.24E-07

25	0.00	0.000	0.001	0.2770	0.2291	0.0000	2.24E-07
26	0.00	0.000	0.000	0.2770	0.2290	0.0000	2.24E-07
27	0.00	0.000	0.000	0.2770	0.2289	0.0000	2.24E-07
28	0.00	0.000	0.000	0.2770	0.2289	0.0000	2.24E-07
29	0.31	0.132	0.044	0.2900	0.2288	0.0000	2.24E-07
30	0.12	0.000	0.032	0.2992	0.2287	0.0000	2.24E-07
31	0.09	0.000	0.031	0.3048	0.2287	0.0000	2.24E-07
32	0.00	0.000	0.012	0.3036	0.2286	0.0000	2.24E-07
33	0.00	0.000	0.011	0.3025	0.2285	0.0000	2.24E-07
34	0.00	0.000	0.011	0.3013	0.2285	0.0000	2.24E-07
35	0.00	0.000	0.011	0.3003	0.2284	0.0000	2.24E-07
36	0.00	0.000	0.010	0.2992	0.2283	0.0000	2.24E-07
37	0.00	0.000	0.010	0.2982	0.2283	0.0000	2.24E-07
38	0.00	0.000	0.010	0.2972	0.2282	0.0000	2.24E-07
39	0.00	0.000	0.010	0.2963	0.2281	0.0000	2.24E-07
40	0.00	0.000	0.009	0.2953	0.2281	0.0000	2.23E-07
41	0.12	0.000	0.033	0.3037	0.2280	0.0000	2.23E-07
42	0.11	0.000	0.035	0.3111	0.2279	0.0000	2.23E-07
43	0.28	0.124	0.036	0.3232	0.2279	0.0000	2.23E-07
44	0.00	0.000	0.045	0.3187	0.2278	0.0000	2.23E-07
45	0.00	0.000	0.116	0.3071	0.2277	0.0000	2.23E-07
46	0.00	0.000	0.061	0.3010	0.2277	0.0000	2.23E-07
47	0.00	0.000	0.044	0.2966	0.2276	0.0000	2.23E-07
48	0.00	0.000	0.035	0.2931	0.2275	0.0000	2.23E-07
49	0.00	0.000	0.029	0.2902	0.2275	0.0000	2.23E-07
50	0.00	0.000	0.028	0.2874	0.2274	0.0000	2.23E-07
51	0.00	0.000	0.025	0.2849	0.2273	0.0000	2.23E-07
52	0.22	0.056	0.047	0.2962	0.2273	0.0000	2.23E-07
53	0.03	0.000	0.038	0.2951	0.2272	0.0000	2.23E-07
54	0.01	0.000	0.025	0.2931	0.2271	0.0000	2.23E-07
55	0.00	0.000	0.019	0.2912	0.2271	0.0000	2.23E-07
56	0.00	0.000	0.018	0.2894	0.2270	0.0000	2.23E-07

57	*	0.00	0.000	0.000	0.2894	0.2269	0.0000	2.22E-07
58	*	0.00	0.000	0.019	0.2875	0.2269	0.0000	2.22E-07
59	*	0.00	0.000	0.000	0.2875	0.2268	0.0000	2.22E-07
60		0.00	0.000	0.017	0.2858	0.2267	0.0000	2.22E-07
61		0.00	0.000	0.014	0.2845	0.2267	0.0000	2.22E-07
62		0.00	0.000	0.012	0.2833	0.2266	0.0000	2.22E-07
63		0.00	0.000	0.011	0.2822	0.2265	0.0000	2.22E-07
64		0.01	0.000	0.019	0.2813	0.2265	0.0000	2.22E-07
65		0.02	0.000	0.027	0.2808	0.2264	0.0000	2.22E-07
66		0.00	0.000	0.012	0.2796	0.2263	0.0000	2.22E-07
67		0.30	0.121	0.039	0.2933	0.2263	0.0000	2.22E-07
68	*	0.10	0.000	0.042	0.2952	0.2262	0.0000	2.22E-07
69	*	0.51	0.000	0.000	0.2972	0.2261	0.0000	2.22E-07
70		0.00	0.328	0.073	0.3099	0.2261	0.0000	2.22E-07
71		0.00	0.000	0.083	0.3017	0.2260	0.0000	2.22E-07
72	*	0.43	0.000	0.046	0.3037	0.2259	0.0000	2.22E-07
73		0.00	0.064	0.169	0.3164	0.2259	0.0000	2.21E-07
74		0.00	0.000	0.082	0.3082	0.2258	0.0000	2.21E-07
75		0.05	0.000	0.109	0.3020	0.2257	0.0000	2.21E-07
76		0.00	0.000	0.100	0.2920	0.2257	0.0000	2.21E-07
77		0.02	0.000	0.047	0.2888	0.2256	0.0000	2.21E-07
78		0.36	0.153	0.066	0.3027	0.2255	0.0000	2.21E-07
79		0.00	0.000	0.175	0.2853	0.2255	0.0000	2.21E-07
80		0.00	0.000	0.031	0.2822	0.2254	0.0000	2.21E-07
81		0.00	0.000	0.028	0.2793	0.2253	0.0000	2.21E-07
82		0.15	0.000	0.048	0.2897	0.2253	0.0000	2.21E-07
83		0.01	0.000	0.023	0.2883	0.2252	0.0000	2.21E-07
84		0.31	0.124	0.049	0.3019	0.2251	0.0000	2.21E-07
85		0.09	0.000	0.101	0.3012	0.2251	0.0000	2.21E-07
86		0.13	0.001	0.040	0.3101	0.2250	0.0000	2.21E-07
87		1.75	1.528	0.088	0.3231	0.2249	0.0000	2.21E-07
88		2.20	1.976	0.107	0.3347	0.2249	0.0000	2.21E-07

89		0.11	0.010	0.079	0.3369	0.2248	0.0000	2.21E-07
90		0.01	0.000	0.045	0.3336	0.2247	0.0000	2.20E-07
91		0.00	0.000	0.105	0.3231	0.2247	0.0000	2.20E-07
92		0.00	0.000	0.109	0.3122	0.2246	0.0000	2.20E-07
93		0.00	0.000	0.065	0.3058	0.2245	0.0000	2.20E-07
94		0.02	0.000	0.189	0.2894	0.2245	0.0000	2.20E-07
95		0.07	0.000	0.131	0.2834	0.2244	0.0000	2.20E-07
96		0.00	0.000	0.027	0.2807	0.2244	0.0000	2.20E-07
97		0.00	0.000	0.018	0.2789	0.2243	0.0000	2.20E-07
98		0.00	0.000	0.007	0.2782	0.2242	0.0000	2.20E-07
99		0.00	0.000	0.007	0.2775	0.2242	0.0000	2.20E-07
100		0.00	0.000	0.004	0.2771	0.2241	0.0000	2.20E-07
101		0.43	0.231	0.050	0.2915	0.2240	0.0000	2.20E-07
102		0.00	0.000	0.011	0.2904	0.2240	0.0000	2.20E-07
103		0.00	0.000	0.016	0.2889	0.2239	0.0000	2.20E-07
104		0.00	0.000	0.015	0.2874	0.2239	0.0000	2.20E-07
105		0.00	0.000	0.014	0.2860	0.2238	0.0000	2.20E-07
106		0.00	0.000	0.014	0.2846	0.2237	0.0000	2.20E-07
107		0.00	0.000	0.013	0.2832	0.2237	0.0000	2.20E-07
108		0.00	0.000	0.013	0.2819	0.2236	0.0000	2.19E-07
109		0.00	0.000	0.013	0.2807	0.2235	0.0000	2.19E-07
110		0.00	0.000	0.013	0.2794	0.2235	0.0000	2.19E-07
111		0.00	0.000	0.015	0.2779	0.2234	0.0000	2.19E-07
112		0.00	0.000	0.009	0.2770	0.2233	0.0000	2.19E-07
113		0.00	0.000	0.000	0.2770	0.2233	0.0000	2.19E-07
114		0.89	0.687	0.040	0.2933	0.2232	0.0000	2.19E-07
115	*	0.00	0.000	0.025	0.2908	0.2231	0.0000	2.19E-07
116		0.78	0.477	0.165	0.3050	0.2231	0.0000	2.19E-07
117		0.36	0.161	0.150	0.3103	0.2230	0.0000	2.19E-07
118		0.00	0.000	0.094	0.3009	0.2229	0.0000	2.19E-07
119		0.00	0.000	0.073	0.2935	0.2229	0.0000	2.19E-07
120		0.01	0.000	0.113	0.2835	0.2228	0.0000	2.19E-07

121	0.04	0.000	0.071	0.2809	0.2227	0.0000	2.19E-07
122	0.28	0.098	0.091	0.2904	0.2227	0.0000	2.19E-07
123	0.57	0.369	0.084	0.3019	0.2226	0.0000	2.19E-07
124	0.00	0.000	0.065	0.2953	0.2225	0.0000	2.19E-07
125	0.00	0.000	0.122	0.2832	0.2226	0.0000	2.19E-07
126	0.00	0.000	0.047	0.2785	0.2225	0.0000	2.19E-07
127	0.00	0.000	0.012	0.2772	0.2225	0.0000	2.18E-07
128	0.00	0.000	0.002	0.2771	0.2224	0.0000	2.18E-07
129	0.00	0.000	0.001	0.2770	0.2223	0.0000	2.18E-07
130	0.00	0.000	0.000	0.2770	0.2223	0.0000	2.18E-07
131	0.00	0.000	0.000	0.2770	0.2222	0.0000	2.18E-07
132	0.00	0.000	0.000	0.2770	0.2221	0.0000	2.18E-07
133	0.21	0.054	0.037	0.2894	0.2221	0.0000	2.18E-07
134	0.05	0.000	0.033	0.2910	0.2220	0.0000	2.18E-07
135	0.00	0.000	0.016	0.2894	0.2219	0.0000	2.18E-07
136	0.00	0.000	0.013	0.2880	0.2219	0.0000	2.18E-07
137	0.02	0.000	0.031	0.2874	0.2218	0.0000	2.18E-07
138	0.07	0.000	0.039	0.2907	0.2218	0.0000	2.18E-07
139	0.63	0.448	0.046	0.3043	0.2217	0.0000	2.18E-07
140	0.05	0.000	0.060	0.3036	0.2216	0.0000	2.18E-07
141	1.22	1.008	0.087	0.3161	0.2216	0.0000	2.18E-07
142	0.00	0.000	0.097	0.3065	0.2215	0.0000	2.18E-07
143	0.08	0.000	0.072	0.3069	0.2214	0.0000	2.18E-07
144	0.00	0.000	0.168	0.2902	0.2214	0.0000	2.17E-07
145	0.14	0.000	0.164	0.2882	0.2213	0.0000	2.17E-07
146	0.18	0.013	0.094	0.2954	0.2212	0.0000	2.17E-07
147	0.79	0.592	0.084	0.3066	0.2212	0.0000	2.17E-07
148	0.00	0.000	0.109	0.2957	0.2211	0.0000	2.17E-07
149	0.00	0.000	0.160	0.2798	0.2210	0.0000	2.17E-07
150	0.00	0.000	0.021	0.2777	0.2210	0.0000	2.17E-07
151	0.00	0.000	0.005	0.2772	0.2209	0.0000	2.17E-07
152	2.23	1.999	0.071	0.2930	0.2208	0.0000	2.17E-07

153	0.47	0.170	0.272	0.2955	0.2208	0.0000	2.17E-07
154	0.10	0.000	0.063	0.2993	0.2207	0.0000	2.17E-07
155	0.47	0.228	0.112	0.3124	0.2207	0.0000	2.17E-07
156	0.00	0.000	0.178	0.2946	0.2206	0.0000	2.17E-07
157	0.00	0.000	0.157	0.2790	0.2205	0.0000	2.17E-07
158	0.03	0.000	0.040	0.2776	0.2205	0.0000	2.17E-07
159	0.03	0.000	0.036	0.2772	0.2204	0.0000	2.17E-07
160	0.05	0.000	0.029	0.2789	0.2203	0.0000	2.17E-07
161	0.00	0.000	0.008	0.2784	0.2203	0.0000	2.16E-07
162	0.00	0.000	0.009	0.2775	0.2202	0.0000	2.16E-07
163	0.00	0.000	0.004	0.2771	0.2201	0.0000	2.16E-07
164	0.16	0.000	0.039	0.2891	0.2201	0.0000	2.16E-07
165	0.06	0.000	0.036	0.2913	0.2200	0.0000	2.16E-07
166	1.06	0.875	0.055	0.3046	0.2199	0.0000	2.16E-07
167	0.25	0.101	0.071	0.3125	0.2199	0.0000	2.16E-07
168	0.00	0.000	0.137	0.2988	0.2198	0.0000	2.16E-07
169	0.00	0.000	0.154	0.2834	0.2198	0.0000	2.16E-07
170	0.00	0.000	0.048	0.2786	0.2197	0.0000	2.16E-07
171	0.00	0.000	0.012	0.2774	0.2196	0.0000	2.16E-07
172	0.00	0.000	0.003	0.2771	0.2196	0.0000	2.16E-07
173	0.00	0.000	0.001	0.2770	0.2195	0.0000	2.16E-07
174	0.00	0.000	0.000	0.2770	0.2194	0.0000	2.16E-07
175	0.00	0.000	0.000	0.2770	0.2194	0.0000	2.16E-07
176	0.00	0.000	0.000	0.2770	0.2193	0.0000	2.16E-07
177	0.00	0.000	0.000	0.2770	0.2192	0.0000	2.16E-07
178	0.00	0.000	0.000	0.2770	0.2192	0.0000	2.15E-07
179	0.00	0.000	0.000	0.2770	0.2191	0.0000	2.15E-07
180	0.00	0.000	0.000	0.2770	0.2190	0.0000	2.15E-07
181	0.00	0.000	0.000	0.2770	0.2190	0.0000	2.15E-07
182	0.00	0.000	0.000	0.2770	0.2189	0.0000	2.15E-07
183	0.00	0.000	0.000	0.2770	0.2189	0.0000	2.15E-07
184	0.00	0.000	0.000	0.2770	0.2188	0.0000	2.15E-07

185	0.00	0.000	0.000	0.2770	0.2187	0.0000	2.15E-07
186	0.00	0.000	0.000	0.2770	0.2187	0.0000	2.15E-07
187	0.39	0.203	0.043	0.2909	0.2186	0.0000	2.15E-07
188	0.11	0.000	0.034	0.2990	0.2185	0.0000	2.15E-07
189	0.14	0.001	0.037	0.3089	0.2185	0.0000	2.15E-07
190	0.26	0.105	0.043	0.3204	0.2184	0.0000	2.15E-07
191	0.07	0.000	0.235	0.3043	0.2184	0.0000	2.15E-07
192	0.00	0.000	0.020	0.3023	0.2183	0.0000	2.15E-07
193	0.01	0.000	0.027	0.3010	0.2182	0.0000	2.15E-07
194	0.68	0.501	0.043	0.3145	0.2182	0.0000	2.15E-07
195	0.00	0.000	0.194	0.2951	0.2181	0.0000	2.15E-07
196	0.00	0.000	0.023	0.2928	0.2180	0.0000	2.14E-07
197	0.00	0.000	0.021	0.2907	0.2180	0.0000	2.14E-07
198	0.00	0.000	0.016	0.2890	0.2179	0.0000	2.14E-07
199	0.00	0.000	0.019	0.2872	0.2178	0.0000	2.14E-07
200	0.00	0.000	0.022	0.2850	0.2178	0.0000	2.14E-07
201	0.60	0.403	0.046	0.3004	0.2177	0.0000	2.14E-07
202	0.00	0.000	0.105	0.2898	0.2177	0.0000	2.14E-07
203	0.92	0.534	0.243	0.3039	0.2176	0.0000	2.14E-07
204	0.85	0.504	0.235	0.3147	0.2175	0.0000	2.14E-07
205	0.90	0.574	0.261	0.3208	0.2175	0.0000	2.14E-07
206	0.00	0.000	0.173	0.3034	0.2174	0.0000	2.14E-07
207	0.00	0.000	0.191	0.2843	0.2174	0.0000	2.14E-07
208	0.00	0.000	0.054	0.2789	0.2173	0.0000	2.14E-07
209	0.00	0.000	0.014	0.2775	0.2172	0.0000	2.14E-07
210	0.00	0.000	0.004	0.2771	0.2172	0.0000	2.14E-07
211	0.00	0.000	0.001	0.2770	0.2171	0.0000	2.14E-07
212	0.00	0.000	0.000	0.2770	0.2170	0.0000	2.14E-07
213	0.01	0.000	0.005	0.2770	0.2170	0.0000	2.14E-07
214	0.02	0.000	0.019	0.2774	0.2169	0.0000	2.13E-07
215	0.79	0.578	0.058	0.2928	0.2168	0.0000	2.13E-07
216	0.00	0.000	0.103	0.2825	0.2168	0.0000	2.13E-07

217	0.03	0.000	0.040	0.2818	0.2167	0.0000	2.13E-07
218	0.52	0.321	0.054	0.2964	0.2167	0.0000	2.13E-07
219	0.14	0.000	0.174	0.2926	0.2166	0.0000	2.13E-07
220	0.33	0.153	0.057	0.3048	0.2165	0.0000	2.13E-07
221	0.00	0.000	0.108	0.2939	0.2165	0.0000	2.13E-07
222	0.14	0.000	0.048	0.3027	0.2164	0.0000	2.13E-07
223	0.03	0.000	0.088	0.2969	0.2163	0.0000	2.13E-07
224	0.38	0.204	0.054	0.3093	0.2163	0.0000	2.13E-07
225	0.00	0.000	0.186	0.2908	0.2162	0.0000	2.13E-07
226	0.00	0.000	0.028	0.2880	0.2162	0.0000	2.13E-07
227	0.00	0.000	0.027	0.2853	0.2161	0.0000	2.13E-07
228	0.00	0.000	0.027	0.2829	0.2160	0.0000	2.13E-07
229	0.07	0.000	0.049	0.2854	0.2160	0.0000	2.13E-07
230	0.00	0.000	0.023	0.2831	0.2159	0.0000	2.13E-07
231	0.00	0.000	0.031	0.2800	0.2158	0.0000	2.13E-07
232	0.51	0.320	0.050	0.2939	0.2158	0.0000	2.12E-07
233	0.44	0.159	0.260	0.2963	0.2157	0.0000	2.12E-07
234	0.07	0.000	0.068	0.2967	0.2156	0.0000	2.12E-07
235	0.00	0.000	0.106	0.2862	0.2156	0.0000	2.12E-07
236	0.00	0.000	0.069	0.2793	0.2155	0.0000	2.12E-07
237	0.64	0.345	0.169	0.2923	0.2155	0.0000	2.12E-07
238	0.38	0.131	0.179	0.2997	0.2154	0.0000	2.12E-07
239	0.00	0.000	0.108	0.2889	0.2153	0.0000	2.12E-07
240	0.00	0.000	0.091	0.2798	0.2157	0.0000	2.12E-07
241	0.00	0.000	0.021	0.2777	0.2159	0.0000	2.13E-07
242	0.00	0.000	0.005	0.2772	0.2158	0.0000	2.12E-07
243	0.00	0.000	0.001	0.2770	0.2158	0.0000	2.12E-07
244	0.00	0.000	0.000	0.2770	0.2157	0.0000	2.12E-07
245	0.00	0.000	0.000	0.2770	0.2156	0.0000	2.12E-07
246	0.00	0.000	0.000	0.2770	0.2156	0.0000	2.12E-07
247	0.06	0.000	0.026	0.2800	0.2155	0.0000	2.12E-07
248	0.03	0.000	0.022	0.2809	0.2154	0.0000	2.12E-07

249	0.93	0.748	0.053	0.2935	0.2154	0.0000	2.12E-07
250	0.00	0.000	0.069	0.2866	0.2153	0.0000	2.12E-07
251	1.24	1.041	0.056	0.3009	0.2153	0.0000	2.12E-07
252	0.00	0.000	0.117	0.2891	0.2152	0.0000	2.12E-07
253	0.00	0.000	0.081	0.2811	0.2151	0.0000	2.12E-07
254	0.96	0.690	0.110	0.2969	0.2151	0.0000	2.12E-07
255	0.26	0.093	0.091	0.3043	0.2150	0.0000	2.12E-07
256	0.30	0.118	0.149	0.3075	0.2149	0.0000	2.12E-07
257	0.58	0.308	0.233	0.3118	0.2149	0.0000	2.12E-07
258	0.07	0.000	0.086	0.3100	0.2148	0.0000	2.12E-07
259	0.06	0.000	0.145	0.3018	0.2148	0.0000	2.12E-07
260	0.45	0.168	0.196	0.3101	0.2147	0.0000	2.11E-07
261	0.70	0.505	0.078	0.3215	0.2146	0.0000	2.11E-07
262	0.00	0.000	0.055	0.3160	0.2146	0.0000	2.11E-07
263	0.25	0.081	0.083	0.3245	0.2145	0.0000	2.11E-07
264	0.03	0.000	0.068	0.3212	0.2144	0.0000	2.11E-07
265	0.54	0.333	0.070	0.3345	0.2144	0.0000	2.11E-07
266	0.00	0.000	0.130	0.3215	0.2143	0.0000	2.11E-07
267	0.00	0.000	0.049	0.3166	0.2143	0.0000	2.11E-07
268	0.00	0.000	0.127	0.3040	0.2142	0.0000	2.11E-07
269	0.00	0.000	0.151	0.2889	0.2141	0.0000	2.11E-07
270	0.00	0.000	0.111	0.2777	0.2141	0.0000	2.11E-07
271	0.00	0.000	0.005	0.2772	0.2140	0.0000	2.11E-07
272	0.00	0.000	0.002	0.2770	0.2139	0.0000	2.11E-07
273	0.00	0.000	0.000	0.2770	0.2139	0.0000	2.11E-07
274	0.00	0.000	0.000	0.2770	0.2138	0.0000	2.11E-07
275	0.00	0.000	0.000	0.2770	0.2138	0.0000	2.11E-07
276	0.00	0.000	0.000	0.2770	0.2137	0.0000	2.11E-07
277	0.00	0.000	0.000	0.2770	0.2136	0.0000	2.11E-07
278	0.01	0.000	0.005	0.2770	0.2136	0.0000	2.10E-07
279	0.82	0.604	0.050	0.2933	0.2135	0.0000	2.10E-07
280	0.00	0.000	0.009	0.2923	0.2134	0.0000	2.10E-07

281		0.00	0.000	0.014	0.2909	0.2134	0.0000	2.10E-07
282		0.03	0.000	0.032	0.2907	0.2133	0.0000	2.10E-07
283		0.00	0.000	0.013	0.2894	0.2133	0.0000	2.10E-07
284		0.00	0.000	0.015	0.2879	0.2132	0.0000	2.10E-07
285		0.00	0.000	0.013	0.2866	0.2131	0.0000	2.10E-07
286		0.05	0.000	0.034	0.2878	0.2131	0.0000	2.10E-07
287		0.00	0.000	0.012	0.2866	0.2130	0.0000	2.10E-07
288		0.00	0.000	0.008	0.2858	0.2129	0.0000	2.10E-07
289		0.08	0.000	0.035	0.2907	0.2129	0.0000	2.10E-07
290		0.00	0.000	0.007	0.2899	0.2128	0.0000	2.10E-07
291		0.00	0.000	0.009	0.2890	0.2128	0.0000	2.10E-07
292		0.00	0.000	0.010	0.2881	0.2127	0.0000	2.10E-07
293		0.00	0.000	0.009	0.2872	0.2126	0.0000	2.10E-07
294		0.00	0.000	0.009	0.2863	0.2126	0.0000	2.10E-07
295		0.00	0.000	0.009	0.2854	0.2125	0.0000	2.10E-07
296		0.00	0.000	0.009	0.2845	0.2124	0.0000	2.09E-07
297		0.00	0.000	0.009	0.2837	0.2124	0.0000	2.09E-07
298		0.00	0.000	0.008	0.2828	0.2123	0.0000	2.09E-07
299		0.00	0.000	0.008	0.2820	0.2123	0.0000	2.09E-07
300	*	0.00	0.000	0.000	0.2820	0.2122	0.0000	2.09E-07
301		0.00	0.000	0.008	0.2812	0.2121	0.0000	2.09E-07
302		0.00	0.000	0.008	0.2804	0.2121	0.0000	2.09E-07
303		0.00	0.000	0.008	0.2796	0.2120	0.0000	2.09E-07
304		0.01	0.000	0.013	0.2789	0.2120	0.0000	2.09E-07
305		0.02	0.000	0.021	0.2787	0.2119	0.0000	2.09E-07
306		0.02	0.000	0.025	0.2787	0.2118	0.0000	2.09E-07
307	*	0.15	0.000	0.048	0.2807	0.2118	0.0000	2.09E-07
308		0.00	0.000	0.081	0.2807	0.2117	0.0000	2.09E-07
309		0.06	0.000	0.031	0.2840	0.2117	0.0000	2.09E-07
310		0.00	0.000	0.007	0.2833	0.2116	0.0000	2.09E-07
311		0.00	0.000	0.005	0.2828	0.2115	0.0000	2.09E-07
312		0.00	0.000	0.007	0.2821	0.2115	0.0000	2.09E-07

313		0.06	0.000	0.031	0.2851	0.2114	0.0000	2.09E-07
314		0.00	0.000	0.006	0.2845	0.2113	0.0000	2.08E-07
315		0.00	0.000	0.005	0.2840	0.2113	0.0000	2.08E-07
316		0.00	0.000	0.009	0.2834	0.2112	0.0000	2.08E-07
317		0.00	0.000	0.007	0.2827	0.2112	0.0000	2.08E-07
318		0.00	0.000	0.007	0.2820	0.2111	0.0000	2.08E-07
319		0.23	0.071	0.034	0.2948	0.2110	0.0000	2.08E-07
320		0.00	0.000	0.006	0.2944	0.2110	0.0000	2.08E-07
321		0.00	0.000	0.006	0.2937	0.2109	0.0000	2.08E-07
322		0.00	0.000	0.006	0.2931	0.2108	0.0000	2.08E-07
323		0.00	0.000	0.006	0.2925	0.2108	0.0000	2.08E-07
324	*	0.00	0.000	0.006	0.2919	0.2107	0.0000	2.08E-07
325	*	0.00	0.000	0.006	0.2912	0.2107	0.0000	2.08E-07
326	*	0.06	0.000	0.023	0.2932	0.2106	0.0000	2.08E-07
327	*	0.00	0.000	0.015	0.2932	0.2105	0.0000	2.08E-07
328	*	0.00	0.000	0.000	0.2932	0.2105	0.0000	2.08E-07
329	*	0.00	0.000	0.000	0.2932	0.2104	0.0000	2.08E-07
330	*	0.00	0.000	0.000	0.2932	0.2104	0.0000	2.08E-07
331	*	0.00	0.000	0.000	0.2932	0.2103	0.0000	2.08E-07
332	*	0.00	0.000	0.000	0.2932	0.2102	0.0000	2.07E-07
333	*	0.00	0.000	0.004	0.2932	0.2102	0.0000	2.07E-07
334	*	0.00	0.000	0.006	0.2926	0.2101	0.0000	2.07E-07
335	*	0.00	0.000	0.000	0.2926	0.2100	0.0000	2.07E-07
336	*	0.00	0.000	0.006	0.2920	0.2100	0.0000	2.07E-07
337		0.00	0.000	0.006	0.2914	0.2099	0.0000	2.07E-07
338		0.00	0.000	0.007	0.2909	0.2099	0.0000	2.07E-07
339		0.14	0.000	0.032	0.3018	0.2098	0.0000	2.07E-07
340		0.00	0.000	0.007	0.3011	0.2097	0.0000	2.07E-07
341		0.00	0.000	0.006	0.3005	0.2097	0.0000	2.07E-07
342		0.00	0.000	0.006	0.2999	0.2096	0.0000	2.07E-07
343		0.00	0.000	0.009	0.2994	0.2096	0.0000	2.07E-07
344		0.00	0.000	0.006	0.2988	0.2095	0.0000	2.07E-07

345	*		0.00	0.000	0.006	0.2982	0.2094	0.0000	2.07E-07
346	*		0.00	0.000	0.000	0.2982	0.2094	0.0000	2.07E-07
347	*		0.00	0.000	0.000	0.2983	0.2093	0.0000	2.07E-07
348	*		0.00	0.000	0.000	0.2983	0.2093	0.0000	2.07E-07
349	*	*	0.00	0.000	0.000	0.2983	0.2092	0.0000	2.07E-07
350	*	*	0.00	0.000	0.000	0.2983	0.2091	0.0000	2.06E-07
351		*	0.00	0.000	0.000	0.2983	0.2091	0.0000	2.06E-07
352	*	*	0.00	0.000	0.000	0.2983	0.2090	0.0000	2.06E-07
353	*	*	0.00	0.000	0.000	0.2983	0.2090	0.0000	2.06E-07
354		*	0.00	0.000	0.000	0.2983	0.2089	0.0000	2.06E-07
355	*	*	0.00	0.000	0.000	0.2983	0.2088	0.0000	2.06E-07
356		*	0.00	0.000	0.000	0.2983	0.2088	0.0000	2.06E-07
357		*	0.28	0.200	0.026	0.3032	0.2087	0.0000	2.06E-07
358			0.00	0.000	0.031	0.3001	0.2086	0.0000	2.06E-07
359			0.01	0.000	0.013	0.2995	0.2086	0.0000	2.06E-07
360			0.18	0.026	0.033	0.3121	0.2085	0.0000	2.06E-07
361			0.00	0.000	0.067	0.3057	0.2085	0.0000	2.06E-07
362			0.00	0.000	0.058	0.2999	0.2084	0.0000	2.06E-07
363			0.00	0.000	0.038	0.2961	0.2083	0.0000	2.06E-07
364	*		0.00	0.000	0.000	0.2961	0.2083	0.0000	2.06E-07
365			0.00	0.000	0.035	0.2926	0.2082	0.0000	2.06E-07

* = Frozen (air or soil)

Annual Totals for Year 22			
	inches	cubic feet	percent
Precipitation	38.57	140,026.1	100.00
Runoff	22.460	81,530.9	58.23
Evapotranspiration	15.968	57,962.7	41.39
Recirculation into Layer 1	0.0091	32.9	0.02
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0091	32.9	0.02
Percolation/Leakage through Layer 5	0.000079	0.2855	0.00
Average Head on Top of Layer 4	0.2192	---	---
Change in Water Storage	0.1466	532.3	0.38
Soil Water at Start of Year	1,406.5409	5,105,743.3	3646.28
Soil Water at End of Year	1,406.6875	5,106,275.6	3646.66
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0091	-32.9	-0.02

Daily Output for Year 23

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.034	0.2892	0.2082	0.0000	2.06E-07
2			0.00	0.000	0.029	0.2863	0.2081	0.0000	2.06E-07
3			0.00	0.000	0.025	0.2838	0.2080	0.0000	2.05E-07
4			0.00	0.000	0.024	0.2814	0.2080	0.0000	2.05E-07
5			0.00	0.000	0.023	0.2791	0.2079	0.0000	2.05E-07
6	*		0.00	0.000	0.019	0.2772	0.2079	0.0000	2.05E-07
7	*		0.00	0.000	0.000	0.2772	0.2078	0.0000	2.05E-07
8			0.00	0.000	0.002	0.2771	0.2077	0.0000	2.05E-07
9	*		0.00	0.000	0.001	0.2770	0.2077	0.0000	2.05E-07
10			0.00	0.000	0.000	0.2770	0.2076	0.0000	2.05E-07
11	*		0.47	0.000	0.035	0.2790	0.2076	0.0000	2.05E-07
12	*		0.01	0.000	0.034	0.2809	0.2075	0.0000	2.05E-07
13			0.00	0.139	0.030	0.2936	0.2074	0.0000	2.05E-07
14	*		0.00	0.000	0.035	0.2956	0.2074	0.0000	2.05E-07
15			0.04	0.000	0.071	0.2950	0.2073	0.0000	2.05E-07
16	*		0.00	0.000	0.013	0.2938	0.2072	0.0000	2.05E-07
17			0.00	0.000	0.012	0.2926	0.2072	0.0000	2.05E-07
18			0.00	0.000	0.011	0.2914	0.2071	0.0000	2.05E-07
19			0.16	0.009	0.037	0.3029	0.2071	0.0000	2.05E-07
20			0.00	0.000	0.013	0.3016	0.2070	0.0000	2.05E-07
21			0.00	0.000	0.012	0.3004	0.2069	0.0000	2.04E-07
22	*		0.00	0.000	0.010	0.2994	0.2069	0.0000	2.04E-07
23	*		0.00	0.000	0.010	0.2984	0.2068	0.0000	2.04E-07
24			0.00	0.000	0.010	0.2974	0.2068	0.0000	2.04E-07

25		0.00	0.000	0.009	0.2965	0.2067	0.0000	2.04E-07
26		0.00	0.000	0.009	0.2955	0.2066	0.0000	2.04E-07
27		0.00	0.000	0.009	0.2946	0.2066	0.0000	2.04E-07
28		0.00	0.000	0.009	0.2938	0.2065	0.0000	2.04E-07
29		0.00	0.000	0.009	0.2929	0.2065	0.0000	2.04E-07
30		0.00	0.000	0.008	0.2921	0.2064	0.0000	2.04E-07
31		0.00	0.000	0.008	0.2912	0.2063	0.0000	2.04E-07
32		0.00	0.000	0.008	0.2904	0.2063	0.0000	2.04E-07
33		0.02	0.000	0.023	0.2903	0.2062	0.0000	2.04E-07
34		0.00	0.000	0.010	0.2894	0.2062	0.0000	2.04E-07
35		0.00	0.000	0.009	0.2885	0.2061	0.0000	2.04E-07
36		0.00	0.000	0.008	0.2877	0.2060	0.0000	2.04E-07
37	*	0.00	0.000	0.000	0.2877	0.2060	0.0000	2.04E-07
38	*	0.51	0.000	0.016	0.2896	0.2059	0.0000	2.04E-07
39	*	0.25	0.000	0.008	0.2916	0.2059	0.0000	2.04E-07
40		0.00	0.000	0.000	0.2936	0.2058	0.0000	2.03E-07
41		0.03	0.358	0.000	0.3063	0.2057	0.0000	2.03E-07
42		0.05	0.067	0.083	0.3179	0.2057	0.0000	2.03E-07
43		0.54	0.361	0.065	0.3296	0.2056	0.0000	2.03E-07
44		0.05	0.000	0.052	0.3294	0.2056	0.0000	2.03E-07
45		0.00	0.000	0.032	0.3261	0.2055	0.0000	2.03E-07
46		0.00	0.000	0.026	0.3236	0.2054	0.0000	2.03E-07
47		0.00	0.000	0.044	0.3192	0.2054	0.0000	2.03E-07
48		0.00	0.000	0.080	0.3113	0.2053	0.0000	2.03E-07
49		0.00	0.000	0.074	0.3039	0.2053	0.0000	2.03E-07
50		0.00	0.000	0.059	0.2980	0.2052	0.0000	2.03E-07
51		0.00	0.000	0.060	0.2920	0.2051	0.0000	2.03E-07
52		0.00	0.000	0.071	0.2849	0.2051	0.0000	2.03E-07
53		0.00	0.000	0.042	0.2807	0.2050	0.0000	2.03E-07
54		0.00	0.000	0.032	0.2775	0.2050	0.0000	2.03E-07
55	*	0.00	0.000	0.000	0.2775	0.2049	0.0000	2.03E-07
56	*	0.00	0.000	0.000	0.2775	0.2048	0.0000	2.03E-07

57	0.00	0.000	0.004	0.2771	0.2048	0.0000	2.03E-07
58	0.00	0.000	0.001	0.2770	0.2047	0.0000	2.02E-07
59	0.00	0.000	0.000	0.2770	0.2047	0.0000	2.02E-07
60	0.00	0.000	0.000	0.2770	0.2046	0.0000	2.02E-07
61	0.35	0.160	0.054	0.2904	0.2045	0.0000	2.02E-07
62	0.00	0.000	0.031	0.2873	0.2045	0.0000	2.02E-07
63	0.00	0.000	0.017	0.2856	0.2044	0.0000	2.02E-07
64	0.00	0.000	0.016	0.2840	0.2044	0.0000	2.02E-07
65	0.00	0.000	0.015	0.2825	0.2043	0.0000	2.02E-07
66	0.00	0.000	0.014	0.2811	0.2043	0.0000	2.02E-07
67	0.00	0.000	0.013	0.2797	0.2042	0.0000	2.02E-07
68	0.00	0.000	0.012	0.2785	0.2041	0.0000	2.02E-07
69	0.00	0.000	0.013	0.2772	0.2041	0.0000	2.02E-07
70	0.00	0.000	0.002	0.2771	0.2040	0.0000	2.02E-07
71	0.04	0.000	0.023	0.2789	0.2040	0.0000	2.02E-07
72	0.02	0.000	0.017	0.2796	0.2039	0.0000	2.02E-07
73	0.00	0.000	0.001	0.2795	0.2038	0.0000	2.02E-07
74	0.00	0.000	0.004	0.2790	0.2038	0.0000	2.02E-07
75	0.57	0.385	0.041	0.2935	0.2037	0.0000	2.02E-07
76	0.01	0.000	0.055	0.2893	0.2037	0.0000	2.02E-07
77	0.02	0.000	0.076	0.2842	0.2036	0.0000	2.01E-07
78	0.00	0.000	0.060	0.2782	0.2035	0.0000	2.01E-07
79	0.00	0.000	0.009	0.2773	0.2035	0.0000	2.01E-07
80	0.00	0.000	0.002	0.2771	0.2034	0.0000	2.01E-07
81	0.00	0.000	0.001	0.2770	0.2034	0.0000	2.01E-07
82	0.00	0.000	0.000	0.2770	0.2033	0.0000	2.01E-07
83	0.00	0.000	0.000	0.2770	0.2032	0.0000	2.01E-07
84	0.00	0.000	0.000	0.2770	0.2032	0.0000	2.01E-07
85	0.00	0.000	0.000	0.2770	0.2031	0.0000	2.01E-07
86	0.00	0.000	0.000	0.2770	0.2031	0.0000	2.01E-07
87	0.00	0.000	0.000	0.2770	0.2030	0.0000	2.01E-07
88	0.00	0.000	0.000	0.2770	0.2029	0.0000	2.01E-07

89		0.00	0.000	0.004	0.2770	0.2029	0.0000	2.01E-07
90		0.05	0.000	0.024	0.2796	0.2028	0.0000	2.01E-07
91	*	0.77	0.000	0.037	0.2815	0.2028	0.0000	2.01E-07
92	*	0.00	0.000	0.025	0.2835	0.2027	0.0000	2.01E-07
93	*	0.00	0.000	0.031	0.2855	0.2026	0.0000	2.01E-07
94	*	0.05	0.000	0.016	0.2874	0.2026	0.0000	2.01E-07
95	*	0.00	0.000	0.044	0.2894	0.2025	0.0000	2.01E-07
96		0.00	0.402	0.042	0.3021	0.2025	0.0000	2.00E-07
97		0.00	0.000	0.008	0.3014	0.2024	0.0000	2.00E-07
98		0.00	0.000	0.012	0.3002	0.2023	0.0000	2.00E-07
99		0.00	0.000	0.011	0.2991	0.2023	0.0000	2.00E-07
100		0.00	0.000	0.011	0.2980	0.2022	0.0000	2.00E-07
101		0.00	0.000	0.011	0.2970	0.2022	0.0000	2.00E-07
102		0.69	0.512	0.041	0.3110	0.2021	0.0000	2.00E-07
103		0.11	0.001	0.141	0.3077	0.2021	0.0000	2.00E-07
104		0.01	0.000	0.175	0.2909	0.2020	0.0000	2.00E-07
105		0.32	0.128	0.151	0.2951	0.2019	0.0000	2.00E-07
106		0.00	0.000	0.117	0.2834	0.2019	0.0000	2.00E-07
107		0.00	0.000	0.039	0.2795	0.2018	0.0000	2.00E-07
108		0.00	0.000	0.021	0.2774	0.2018	0.0000	2.00E-07
109		0.00	0.000	0.003	0.2771	0.2017	0.0000	2.00E-07
110		0.35	0.161	0.058	0.2904	0.2016	0.0000	2.00E-07
111		1.19	0.850	0.220	0.3019	0.2016	0.0000	2.00E-07
112		0.17	0.022	0.071	0.3100	0.2015	0.0000	2.00E-07
113		0.00	0.000	0.155	0.2944	0.2015	0.0000	2.00E-07
114		0.00	0.000	0.106	0.2839	0.2014	0.0000	2.00E-07
115		0.00	0.000	0.053	0.2786	0.2014	0.0000	1.99E-07
116		0.00	0.000	0.013	0.2773	0.2013	0.0000	1.99E-07
117		0.00	0.000	0.003	0.2770	0.2012	0.0000	1.99E-07
118		0.00	0.000	0.000	0.2770	0.2012	0.0000	1.99E-07
119		0.00	0.000	0.000	0.2770	0.2011	0.0000	1.99E-07
120		0.00	0.000	0.000	0.2770	0.2011	0.0000	1.99E-07

121	0.00	0.000	0.002	0.2770	0.2010	0.0000	1.99E-07
122	0.03	0.000	0.020	0.2780	0.2010	0.0000	1.99E-07
123	0.19	0.034	0.036	0.2896	0.2009	0.0000	1.99E-07
124	0.00	0.000	0.010	0.2886	0.2008	0.0000	1.99E-07
125	0.63	0.441	0.048	0.3031	0.2008	0.0000	1.99E-07
126	0.09	0.000	0.040	0.3083	0.2007	0.0000	1.99E-07
127	0.00	0.000	0.014	0.3070	0.2007	0.0000	1.99E-07
128	0.00	0.000	0.013	0.3057	0.2006	0.0000	1.99E-07
129	0.00	0.000	0.013	0.3044	0.2005	0.0000	1.99E-07
130	1.11	0.926	0.044	0.3181	0.2005	0.0000	1.99E-07
131	2.25	1.922	0.208	0.3296	0.2004	0.0000	1.99E-07
132	0.09	0.003	0.141	0.3244	0.2004	0.0000	1.99E-07
133	0.00	0.000	0.158	0.3086	0.2003	0.0000	1.99E-07
134	0.00	0.000	0.127	0.2960	0.2002	0.0000	1.98E-07
135	0.25	0.077	0.193	0.2943	0.2002	0.0000	1.98E-07
136	0.00	0.000	0.128	0.2815	0.2001	0.0000	1.98E-07
137	0.00	0.000	0.032	0.2784	0.2001	0.0000	1.98E-07
138	0.00	0.000	0.011	0.2773	0.2000	0.0000	1.98E-07
139	0.00	0.000	0.003	0.2771	0.2000	0.0000	1.98E-07
140	0.00	0.000	0.000	0.2770	0.1999	0.0000	1.98E-07
141	0.00	0.000	0.000	0.2770	0.1998	0.0000	1.98E-07
142	0.45	0.247	0.056	0.2915	0.1998	0.0000	1.98E-07
143	0.57	0.405	0.053	0.3031	0.1997	0.0000	1.98E-07
144	0.68	0.386	0.186	0.3143	0.1997	0.0000	1.98E-07
145	0.00	0.000	0.093	0.3051	0.1996	0.0000	1.98E-07
146	0.27	0.101	0.110	0.3106	0.1995	0.0000	1.98E-07
147	0.24	0.086	0.155	0.3106	0.1995	0.0000	1.98E-07
148	0.04	0.000	0.137	0.3013	0.1994	0.0000	1.98E-07
149	0.00	0.000	0.106	0.2906	0.1994	0.0000	1.98E-07
150	0.00	0.000	0.105	0.2802	0.1993	0.0000	1.98E-07
151	0.00	0.000	0.025	0.2777	0.1993	0.0000	1.98E-07
152	0.00	0.000	0.005	0.2772	0.1992	0.0000	1.98E-07

153	0.00	0.000	0.001	0.2770	0.1991	0.0000	1.97E-07
154	0.04	0.000	0.024	0.2783	0.1991	0.0000	1.97E-07
155	0.15	0.000	0.038	0.2890	0.1990	0.0000	1.97E-07
156	0.00	0.000	0.015	0.2875	0.1990	0.0000	1.97E-07
157	0.59	0.391	0.056	0.3014	0.1989	0.0000	1.97E-07
158	0.70	0.376	0.260	0.3076	0.1989	0.0000	1.97E-07
159	0.01	0.000	0.060	0.3022	0.1988	0.0000	1.97E-07
160	0.06	0.000	0.089	0.2998	0.1987	0.0000	1.97E-07
161	0.01	0.000	0.200	0.2813	0.1987	0.0000	1.97E-07
162	0.93	0.648	0.121	0.2976	0.1986	0.0000	1.97E-07
163	1.73	1.308	0.308	0.3087	0.1986	0.0000	1.97E-07
164	0.54	0.277	0.276	0.3076	0.1985	0.0000	1.97E-07
165	0.37	0.171	0.108	0.3172	0.1984	0.0000	1.97E-07
166	0.02	0.000	0.062	0.3129	0.1984	0.0000	1.97E-07
167	0.04	0.000	0.068	0.3098	0.1983	0.0000	1.97E-07
168	0.01	0.000	0.057	0.3047	0.1983	0.0000	1.97E-07
169	0.00	0.000	0.131	0.2916	0.1982	0.0000	1.97E-07
170	0.00	0.000	0.127	0.2788	0.1982	0.0000	1.97E-07
171	0.00	0.000	0.014	0.2774	0.1981	0.0000	1.97E-07
172	0.06	0.000	0.037	0.2801	0.1980	0.0000	1.96E-07
173	0.00	0.000	0.006	0.2795	0.1980	0.0000	1.96E-07
174	0.00	0.000	0.011	0.2784	0.1979	0.0000	1.96E-07
175	0.00	0.000	0.007	0.2777	0.1979	0.0000	1.96E-07
176	0.33	0.138	0.061	0.2905	0.1978	0.0000	1.96E-07
177	0.12	0.000	0.040	0.2986	0.1977	0.0000	1.96E-07
178	0.00	0.000	0.013	0.2973	0.1977	0.0000	1.96E-07
179	0.00	0.000	0.020	0.2953	0.1976	0.0000	1.96E-07
180	0.00	0.000	0.020	0.2933	0.1976	0.0000	1.96E-07
181	0.00	0.000	0.020	0.2912	0.1975	0.0000	1.96E-07
182	0.02	0.000	0.036	0.2900	0.1975	0.0000	1.96E-07
183	1.11	0.920	0.049	0.3036	0.1974	0.0000	1.96E-07
184	1.25	1.023	0.109	0.3150	0.1973	0.0000	1.96E-07

185	0.01	0.000	0.080	0.3082	0.1973	0.0000	1.96E-07
186	0.00	0.000	0.064	0.3019	0.1972	0.0000	1.96E-07
187	0.00	0.000	0.071	0.2948	0.1972	0.0000	1.96E-07
188	0.00	0.000	0.155	0.2794	0.1971	0.0000	1.96E-07
189	0.00	0.000	0.020	0.2773	0.1971	0.0000	1.96E-07
190	0.00	0.000	0.002	0.2771	0.1970	0.0000	1.96E-07
191	0.00	0.000	0.001	0.2770	0.1969	0.0000	1.95E-07
192	0.00	0.000	0.000	0.2770	0.1969	0.0000	1.95E-07
193	0.01	0.000	0.009	0.2770	0.1968	0.0000	1.95E-07
194	0.14	0.000	0.030	0.2876	0.1968	0.0000	1.95E-07
195	0.00	0.000	0.014	0.2862	0.1967	0.0000	1.95E-07
196	0.78	0.590	0.054	0.3000	0.1967	0.0000	1.95E-07
197	0.00	0.000	0.073	0.2927	0.1966	0.0000	1.95E-07
198	0.00	0.000	0.019	0.2908	0.1965	0.0000	1.95E-07
199	0.00	0.000	0.022	0.2885	0.1965	0.0000	1.95E-07
200	0.03	0.000	0.036	0.2882	0.1964	0.0000	1.95E-07
201	0.00	0.000	0.022	0.2860	0.1964	0.0000	1.95E-07
202	0.00	0.000	0.019	0.2841	0.1963	0.0000	1.95E-07
203	0.43	0.236	0.048	0.2988	0.1963	0.0000	1.95E-07
204	0.00	0.000	0.078	0.2910	0.1962	0.0000	1.95E-07
205	0.00	0.000	0.105	0.2805	0.1961	0.0000	1.95E-07
206	0.00	0.000	0.031	0.2774	0.1961	0.0000	1.95E-07
207	0.00	0.000	0.003	0.2771	0.1960	0.0000	1.95E-07
208	0.00	0.000	0.001	0.2770	0.1960	0.0000	1.95E-07
209	0.00	0.000	0.000	0.2770	0.1959	0.0000	1.95E-07
210	0.00	0.000	0.000	0.2770	0.1959	0.0000	1.94E-07
211	0.00	0.000	0.000	0.2770	0.1958	0.0000	1.94E-07
212	0.00	0.000	0.000	0.2770	0.1957	0.0000	1.94E-07
213	0.00	0.000	0.000	0.2770	0.1957	0.0000	1.94E-07
214	0.00	0.000	0.000	0.2770	0.1956	0.0000	1.94E-07
215	0.00	0.000	0.000	0.2770	0.1956	0.0000	1.94E-07
216	0.17	0.004	0.038	0.2896	0.1955	0.0000	1.94E-07

217	0.00	0.000	0.012	0.2884	0.1955	0.0000	1.94E-07
218	0.40	0.207	0.049	0.3026	0.1954	0.0000	1.94E-07
219	0.00	0.000	0.017	0.3009	0.1953	0.0000	1.94E-07
220	0.00	0.000	0.018	0.2992	0.1953	0.0000	1.94E-07
221	0.00	0.000	0.019	0.2973	0.1952	0.0000	1.94E-07
222	0.00	0.000	0.019	0.2955	0.1952	0.0000	1.94E-07
223	0.00	0.000	0.017	0.2938	0.1951	0.0000	1.94E-07
224	0.00	0.000	0.019	0.2918	0.1951	0.0000	1.94E-07
225	0.00	0.000	0.017	0.2901	0.1950	0.0000	1.94E-07
226	0.00	0.000	0.017	0.2884	0.1949	0.0000	1.94E-07
227	0.00	0.000	0.015	0.2868	0.1949	0.0000	1.94E-07
228	0.06	0.000	0.039	0.2893	0.1948	0.0000	1.94E-07
229	0.00	0.000	0.025	0.2868	0.1948	0.0000	1.93E-07
230	0.00	0.000	0.018	0.2850	0.1947	0.0000	1.93E-07
231	0.00	0.000	0.019	0.2831	0.1947	0.0000	1.93E-07
232	0.00	0.000	0.017	0.2814	0.1946	0.0000	1.93E-07
233	0.37	0.176	0.050	0.2954	0.1945	0.0000	1.93E-07
234	0.00	0.000	0.116	0.2837	0.1945	0.0000	1.93E-07
235	0.00	0.000	0.021	0.2816	0.1944	0.0000	1.93E-07
236	0.00	0.000	0.025	0.2791	0.1944	0.0000	1.93E-07
237	0.00	0.000	0.018	0.2773	0.1943	0.0000	1.93E-07
238	0.05	0.000	0.029	0.2798	0.1943	0.0000	1.93E-07
239	0.00	0.000	0.002	0.2796	0.1942	0.0000	1.93E-07
240	0.11	0.000	0.033	0.2868	0.1941	0.0000	1.93E-07
241	0.00	0.000	0.014	0.2854	0.1941	0.0000	1.93E-07
242	0.00	0.000	0.012	0.2842	0.1940	0.0000	1.93E-07
243	0.00	0.000	0.011	0.2831	0.1940	0.0000	1.93E-07
244	0.00	0.000	0.010	0.2821	0.1939	0.0000	1.93E-07
245	0.00	0.000	0.011	0.2809	0.1939	0.0000	1.93E-07
246	0.00	0.000	0.010	0.2800	0.1938	0.0000	1.93E-07
247	0.00	0.000	0.010	0.2790	0.1938	0.0000	1.93E-07
248	0.00	0.000	0.010	0.2780	0.1937	0.0000	1.93E-07

249		0.00	0.000	0.008	0.2772	0.1936	0.0000	1.92E-07
250		0.00	0.000	0.002	0.2770	0.1936	0.0000	1.92E-07
251		0.00	0.000	0.000	0.2770	0.1935	0.0000	1.92E-07
252		0.16	0.000	0.035	0.2895	0.1935	0.0000	1.92E-07
253		0.01	0.000	0.013	0.2889	0.1934	0.0000	1.92E-07
254		0.00	0.000	0.009	0.2881	0.1934	0.0000	1.92E-07
255		0.00	0.000	0.010	0.2871	0.1933	0.0000	1.92E-07
256		0.39	0.202	0.040	0.3014	0.1932	0.0000	1.92E-07
257		0.00	0.000	0.090	0.2924	0.1932	0.0000	1.92E-07
258		0.00	0.000	0.009	0.2915	0.1931	0.0000	1.92E-07
259		0.00	0.000	0.008	0.2907	0.1931	0.0000	1.92E-07
260		0.00	0.000	0.008	0.2899	0.1930	0.0000	1.92E-07
261		0.00	0.000	0.007	0.2892	0.1930	0.0000	1.92E-07
262		0.00	0.000	0.009	0.2883	0.1929	0.0000	1.92E-07
263		0.00	0.000	0.007	0.2876	0.1928	0.0000	1.92E-07
264		0.00	0.000	0.008	0.2868	0.1928	0.0000	1.92E-07
265		0.00	0.000	0.007	0.2861	0.1927	0.0000	1.92E-07
266		0.22	0.057	0.036	0.2985	0.1927	0.0000	1.92E-07
267		0.37	0.178	0.079	0.3101	0.1926	0.0000	1.92E-07
268		0.06	0.000	0.148	0.3012	0.1926	0.0000	1.91E-07
269		0.02	0.000	0.072	0.2956	0.1925	0.0000	1.91E-07
270		0.00	0.000	0.045	0.2911	0.1925	0.0000	1.91E-07
271		0.21	0.057	0.060	0.3008	0.1924	0.0000	1.91E-07
272		1.16	0.985	0.062	0.3124	0.1923	0.0000	1.91E-07
273	*	0.00	0.000	0.026	0.3098	0.1923	0.0000	1.91E-07
274		0.00	0.000	0.077	0.3021	0.1922	0.0000	1.91E-07
275		0.00	0.000	0.064	0.2957	0.1922	0.0000	1.91E-07
276		0.00	0.000	0.077	0.2881	0.1921	0.0000	1.91E-07
277		0.00	0.000	0.058	0.2823	0.1921	0.0000	1.91E-07
278		0.00	0.000	0.045	0.2778	0.1920	0.0000	1.91E-07
279		0.00	0.000	0.006	0.2772	0.1919	0.0000	1.91E-07
280		0.00	0.000	0.001	0.2771	0.1919	0.0000	1.91E-07

281		0.00	0.000	0.001	0.2770	0.1918	0.0000	1.91E-07
282		0.00	0.000	0.000	0.2770	0.1918	0.0000	1.91E-07
283		0.00	0.000	0.000	0.2770	0.1917	0.0000	1.91E-07
284		0.00	0.000	0.000	0.2770	0.1917	0.0000	1.91E-07
285		0.00	0.000	0.000	0.2770	0.1916	0.0000	1.91E-07
286		0.00	0.000	0.000	0.2770	0.1916	0.0000	1.91E-07
287		0.00	0.000	0.000	0.2770	0.1915	0.0000	1.91E-07
288		0.00	0.000	0.000	0.2770	0.1914	0.0000	1.90E-07
289		0.24	0.074	0.038	0.2896	0.1914	0.0000	1.90E-07
290		0.01	0.000	0.017	0.2889	0.1913	0.0000	1.90E-07
291		0.16	0.013	0.041	0.2998	0.1913	0.0000	1.90E-07
292		0.00	0.000	0.009	0.2988	0.1912	0.0000	1.90E-07
293		0.14	0.001	0.041	0.3089	0.1912	0.0000	1.90E-07
294		0.11	0.001	0.087	0.3110	0.1911	0.0000	1.90E-07
295		0.01	0.000	0.059	0.3058	0.1911	0.0000	1.90E-07
296		0.00	0.000	0.085	0.2973	0.1910	0.0000	1.90E-07
297		0.00	0.000	0.044	0.2929	0.1909	0.0000	1.90E-07
298		0.00	0.000	0.036	0.2893	0.1909	0.0000	1.90E-07
299	*	0.00	0.000	0.029	0.2864	0.1908	0.0000	1.90E-07
300		0.00	0.000	0.021	0.2844	0.1908	0.0000	1.90E-07
301		0.00	0.000	0.023	0.2821	0.1907	0.0000	1.90E-07
302	*	0.00	0.000	0.000	0.2821	0.1907	0.0000	1.90E-07
303	*	0.00	0.000	0.000	0.2821	0.1906	0.0000	1.90E-07
304	*	0.00	0.000	0.000	0.2821	0.1906	0.0000	1.90E-07
305		0.00	0.000	0.023	0.2798	0.1905	0.0000	1.90E-07
306		0.39	0.201	0.053	0.2937	0.1904	0.0000	1.90E-07
307		0.00	0.000	0.020	0.2917	0.1904	0.0000	1.90E-07
308		0.08	0.000	0.047	0.2952	0.1903	0.0000	1.89E-07
309		0.32	0.150	0.049	0.3076	0.1903	0.0000	1.89E-07
310	*	0.03	0.000	0.056	0.3049	0.1902	0.0000	1.89E-07
311		0.00	0.000	0.031	0.3017	0.1902	0.0000	1.89E-07
312	*	0.01	0.000	0.013	0.3017	0.1901	0.0000	1.89E-07

313	*	0.00	0.000	0.014	0.3004	0.1900	0.0000	1.89E-07
314	*	0.00	0.000	0.014	0.2990	0.1900	0.0000	1.89E-07
315	*	0.00	0.000	0.000	0.2990	0.1899	0.0000	1.89E-07
316		0.00	0.000	0.026	0.2966	0.1899	0.0000	1.89E-07
317		0.06	0.000	0.085	0.2942	0.1898	0.0000	1.89E-07
318		0.00	0.000	0.028	0.2914	0.1898	0.0000	1.89E-07
319		0.01	0.000	0.041	0.2880	0.1897	0.0000	1.89E-07
320		1.60	1.391	0.064	0.3026	0.1897	0.0000	1.89E-07
321		0.00	0.000	0.056	0.2970	0.1896	0.0000	1.89E-07
322		0.00	0.000	0.032	0.2938	0.1895	0.0000	1.89E-07
323		0.00	0.000	0.035	0.2903	0.1895	0.0000	1.89E-07
324		0.00	0.000	0.032	0.2872	0.1894	0.0000	1.89E-07
325		0.00	0.000	0.036	0.2835	0.1894	0.0000	1.89E-07
326		0.00	0.000	0.057	0.2779	0.1893	0.0000	1.89E-07
327		0.00	0.000	0.007	0.2771	0.1893	0.0000	1.89E-07
328		0.00	0.000	0.001	0.2770	0.1892	0.0000	1.88E-07
329		0.05	0.000	0.030	0.2794	0.1892	0.0000	1.88E-07
330		0.11	0.000	0.032	0.2870	0.1891	0.0000	1.88E-07
331		0.00	0.000	0.017	0.2853	0.1891	0.0000	1.88E-07
332		0.00	0.000	0.020	0.2833	0.1890	0.0000	1.88E-07
333		0.00	0.000	0.016	0.2817	0.1889	0.0000	1.88E-07
334		0.00	0.000	0.019	0.2799	0.1889	0.0000	1.88E-07
335		0.00	0.000	0.017	0.2781	0.1888	0.0000	1.88E-07
336		0.31	0.133	0.052	0.2907	0.1888	0.0000	1.88E-07
337		0.00	0.000	0.031	0.2875	0.1887	0.0000	1.88E-07
338		0.00	0.000	0.016	0.2859	0.1887	0.0000	1.88E-07
339		0.00	0.000	0.015	0.2845	0.1886	0.0000	1.88E-07
340	*	0.00	0.000	0.014	0.2831	0.1886	0.0000	1.88E-07
341		0.00	0.000	0.013	0.2818	0.1885	0.0000	1.88E-07
342		0.00	0.000	0.012	0.2806	0.1884	0.0000	1.88E-07
343		0.00	0.000	0.012	0.2794	0.1884	0.0000	1.88E-07
344		0.00	0.000	0.009	0.2785	0.1883	0.0000	1.88E-07

345	0.00	0.000	0.012	0.2773	0.1883	0.0000	1.88E-07
346	0.00	0.000	0.002	0.2770	0.1882	0.0000	1.88E-07
347	0.00	0.000	0.000	0.2770	0.1882	0.0000	1.88E-07
348	0.88	0.670	0.043	0.2933	0.1881	0.0000	1.87E-07
349	0.03	0.000	0.036	0.2926	0.1881	0.0000	1.87E-07
350	0.00	0.000	0.032	0.2894	0.1881	0.0000	1.87E-07
351	0.09	0.000	0.063	0.2926	0.1880	0.0000	1.87E-07
352	0.04	0.000	0.055	0.2908	0.1880	0.0000	1.87E-07
353	0.00	0.000	0.037	0.2870	0.1879	0.0000	1.87E-07
354	0.00	0.000	0.038	0.2832	0.1879	0.0000	1.87E-07
355	0.00	0.000	0.044	0.2788	0.1878	0.0000	1.87E-07
356	0.00	0.000	0.014	0.2774	0.1878	0.0000	1.87E-07
357	0.00	0.000	0.003	0.2771	0.1877	0.0000	1.87E-07
358	0.00	0.000	0.000	0.2770	0.1876	0.0000	1.87E-07
359	0.00	0.000	0.000	0.2770	0.1876	0.0000	1.87E-07
360	0.00	0.000	0.000	0.2770	0.1875	0.0000	1.87E-07
361	0.00	0.000	0.000	0.2770	0.1875	0.0000	1.87E-07
362	0.00	0.000	0.000	0.2770	0.1874	0.0000	1.87E-07
363	0.00	0.000	0.000	0.2770	0.1874	0.0000	1.87E-07
364	0.00	0.000	0.000	0.2770	0.1873	0.0000	1.87E-07
365	0.00	0.000	0.000	0.2770	0.1873	0.0000	1.87E-07

* = Frozen (air or soil)

Annual Totals for Year 23			
	inches	cubic feet	percent
Precipitation	31.69	115,043.0	100.00
Runoff	18.763	68,108.4	59.20
Evapotranspiration	13.092	47,524.3	41.31
Recirculation into Layer 1	0.0082	29.7	0.03
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0082	29.7	0.03
Percolation/Leakage through Layer 5	0.000072	0.2596	0.00
Average Head on Top of Layer 4	0.1975	---	---
Change in Water Storage	-0.1625	-589.9	-0.51
Soil Water at Start of Year	1,406.6875	5,106,275.6	4438.58
Soil Water at End of Year	1,406.5250	5,105,685.7	4438.07
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0082	-29.7	-0.03

Daily Output for Year 24

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.000	0.2770	0.1872	0.0000	1.87E-07
2			0.00	0.000	0.000	0.2770	0.1872	0.0000	1.87E-07
3			0.00	0.000	0.000	0.2770	0.1871	0.0000	1.87E-07
4	*		0.00	0.000	0.000	0.2770	0.1871	0.0000	1.86E-07
5	*		0.51	0.000	0.035	0.2790	0.1870	0.0000	1.86E-07
6	*		0.00	0.000	0.034	0.2809	0.1869	0.0000	1.86E-07
7			0.00	0.237	0.040	0.2936	0.1869	0.0000	1.86E-07
8			0.12	0.000	0.035	0.3023	0.1868	0.0000	1.86E-07
9			0.48	0.309	0.044	0.3151	0.1868	0.0000	1.86E-07
10			0.00	0.000	0.027	0.3124	0.1867	0.0000	1.86E-07
11			0.00	0.000	0.022	0.3102	0.1867	0.0000	1.86E-07
12			0.00	0.000	0.051	0.3051	0.1866	0.0000	1.86E-07
13			0.00	0.000	0.028	0.3024	0.1866	0.0000	1.86E-07
14	*		0.01	0.000	0.008	0.3024	0.1865	0.0000	1.86E-07
15			0.00	0.000	0.028	0.2995	0.1865	0.0000	1.86E-07
16			0.00	0.000	0.040	0.2956	0.1864	0.0000	1.86E-07
17			0.00	0.000	0.044	0.2911	0.1863	0.0000	1.86E-07
18	*		0.00	0.000	0.025	0.2886	0.1863	0.0000	1.86E-07
19	*		0.11	0.000	0.049	0.2906	0.1862	0.0000	1.86E-07
20	*		0.19	0.000	0.015	0.2926	0.1862	0.0000	1.86E-07
21	*		0.10	0.000	0.008	0.2946	0.1861	0.0000	1.86E-07
22			0.00	0.000	0.042	0.2965	0.1861	0.0000	1.86E-07
23	*		0.08	0.000	0.021	0.2985	0.1860	0.0000	1.86E-07
24	*		0.33	0.000	0.012	0.3005	0.1860	0.0000	1.85E-07

25	*		0.42	0.000	0.008	0.3025	0.1859	0.0000	1.85E-07
26	*		0.09	0.000	0.005	0.3044	0.1859	0.0000	1.85E-07
27	*		0.00	0.000	0.000	0.3064	0.1858	0.0000	1.85E-07
28			0.00	0.746	0.000	0.3191	0.1857	0.0000	1.85E-07
29			0.00	0.000	0.077	0.3233	0.1857	0.0000	1.85E-07
30	*		0.00	0.000	0.000	0.3233	0.1856	0.0000	1.85E-07
31			0.00	0.000	0.032	0.3201	0.1856	0.0000	1.85E-07
32			0.00	0.000	0.071	0.3130	0.1855	0.0000	1.85E-07
33			0.00	0.000	0.032	0.3098	0.1855	0.0000	1.85E-07
34	*		0.21	0.000	0.051	0.3117	0.1854	0.0000	1.85E-07
35	*	*	0.00	0.000	0.022	0.3117	0.1854	0.0000	1.85E-07
36	*	*	0.00	0.000	0.011	0.3117	0.1853	0.0000	1.85E-07
37	*	*	0.00	0.000	0.007	0.3117	0.1853	0.0000	1.85E-07
38	*	*	0.00	0.000	0.032	0.3117	0.1852	0.0000	1.85E-07
39	*	*	0.00	0.000	0.037	0.3117	0.1852	0.0000	1.85E-07
40	*	*	0.01	0.000	0.042	0.3117	0.1851	0.0000	1.85E-07
41	*	*	0.09	0.000	0.015	0.3117	0.1850	0.0000	1.85E-07
42	*	*	0.00	0.000	0.034	0.3117	0.1850	0.0000	1.85E-07
43		*	0.00	0.000	0.039	0.3117	0.1849	0.0000	1.85E-07
44		*	0.00	0.000	0.000	0.3117	0.1849	0.0000	1.85E-07
45			0.02	0.000	0.056	0.3077	0.1848	0.0000	1.84E-07
46			0.11	0.000	0.068	0.3116	0.1848	0.0000	1.84E-07
47			0.00	0.000	0.044	0.3077	0.1847	0.0000	1.84E-07
48			0.05	0.000	0.084	0.3042	0.1847	0.0000	1.84E-07
49			0.00	0.000	0.034	0.3008	0.1846	0.0000	1.84E-07
50			0.00	0.000	0.029	0.2979	0.1846	0.0000	1.84E-07
51			0.00	0.000	0.081	0.2898	0.1845	0.0000	1.84E-07
52			1.11	0.859	0.090	0.3055	0.1844	0.0000	1.84E-07
53			0.22	0.068	0.096	0.3109	0.1844	0.0000	1.84E-07
54			0.03	0.000	0.087	0.3049	0.1844	0.0000	1.84E-07
55			0.00	0.000	0.072	0.2977	0.1846	0.0000	1.84E-07
56			0.00	0.000	0.039	0.2938	0.1845	0.0000	1.84E-07

57		0.00	0.000	0.058	0.2879	0.1845	0.0000	1.84E-07
58		0.00	0.000	0.050	0.2829	0.1844	0.0000	1.84E-07
59	*	0.00	0.000	0.000	0.2829	0.1844	0.0000	1.84E-07
60	*	0.62	0.000	0.023	0.2849	0.1843	0.0000	1.84E-07
61	*	0.62	0.000	0.036	0.2869	0.1843	0.0000	1.84E-07
62	*	0.00	0.000	0.021	0.2888	0.1842	0.0000	1.84E-07
63	*	0.03	0.000	0.012	0.2908	0.1841	0.0000	1.84E-07
64		0.04	0.283	0.000	0.3036	0.1841	0.0000	1.84E-07
65		0.00	0.402	0.000	0.3152	0.1840	0.0000	1.84E-07
66		0.65	0.758	0.002	0.3268	0.1840	0.0000	1.84E-07
67		0.08	0.000	0.107	0.3239	0.1839	0.0000	1.84E-07
68		0.13	0.005	0.091	0.3274	0.1839	0.0000	1.84E-07
69		0.16	0.016	0.094	0.3322	0.1838	0.0000	1.84E-07
70		0.01	0.000	0.073	0.3255	0.1838	0.0000	1.84E-07
71		0.01	0.000	0.055	0.3208	0.1837	0.0000	1.83E-07
72		0.01	0.000	0.143	0.3072	0.1837	0.0000	1.83E-07
73		0.00	0.000	0.127	0.2945	0.1836	0.0000	1.83E-07
74		0.26	0.090	0.084	0.3028	0.1836	0.0000	1.83E-07
75		0.00	0.000	0.072	0.2957	0.1835	0.0000	1.83E-07
76	*	0.00	0.000	0.000	0.2957	0.1834	0.0000	1.83E-07
77	*	0.00	0.000	0.000	0.2957	0.1834	0.0000	1.83E-07
78		0.00	0.000	0.047	0.2910	0.1833	0.0000	1.83E-07
79		0.00	0.000	0.084	0.2826	0.1833	0.0000	1.83E-07
80		0.00	0.000	0.050	0.2776	0.1832	0.0000	1.83E-07
81		0.00	0.000	0.005	0.2771	0.1832	0.0000	1.83E-07
82		0.21	0.042	0.047	0.2890	0.1831	0.0000	1.83E-07
83		0.10	0.000	0.044	0.2944	0.1831	0.0000	1.83E-07
84		0.76	0.568	0.063	0.3077	0.1830	0.0000	1.83E-07
85		0.27	0.113	0.144	0.3093	0.1830	0.0000	1.83E-07
86		0.00	0.000	0.081	0.3016	0.1829	0.0000	1.83E-07
87		0.25	0.083	0.114	0.3066	0.1829	0.0000	1.83E-07
88		2.12	1.868	0.136	0.3182	0.1828	0.0000	1.83E-07

89		0.32	0.145	0.143	0.3210	0.1827	0.0000	1.83E-07
90		0.00	0.000	0.095	0.3115	0.1827	0.0000	1.83E-07
91		0.01	0.000	0.040	0.3083	0.1826	0.0000	1.82E-07
92	*	0.00	0.000	0.002	0.3083	0.1826	0.0000	1.82E-07
93	*	0.01	0.000	0.007	0.3083	0.1825	0.0000	1.82E-07
94	*	0.05	0.000	0.041	0.3096	0.1825	0.0000	1.82E-07
95	*	0.00	0.000	0.000	0.3096	0.1824	0.0000	1.82E-07
96	*	0.37	0.000	0.014	0.3115	0.1824	0.0000	1.82E-07
97		0.62	0.826	0.000	0.3243	0.1823	0.0000	1.82E-07
98	*	0.00	0.000	0.000	0.3243	0.1823	0.0000	1.82E-07
99	*	0.01	0.000	0.036	0.3216	0.1822	0.0000	1.82E-07
100	*	0.05	0.000	0.099	0.3162	0.1822	0.0000	1.82E-07
101		0.01	0.000	0.058	0.3116	0.1821	0.0000	1.82E-07
102		0.00	0.000	0.079	0.3037	0.1821	0.0000	1.82E-07
103		0.00	0.000	0.087	0.2950	0.1820	0.0000	1.82E-07
104		0.00	0.000	0.145	0.2805	0.1820	0.0000	1.82E-07
105		0.00	0.000	0.031	0.2776	0.1819	0.0000	1.82E-07
106		1.10	0.845	0.091	0.2939	0.1819	0.0000	1.82E-07
107		0.04	0.000	0.101	0.2882	0.1818	0.0000	1.82E-07
108		0.00	0.000	0.099	0.2783	0.1818	0.0000	1.82E-07
109		0.34	0.134	0.124	0.2863	0.1817	0.0000	1.82E-07
110		0.21	0.047	0.113	0.2912	0.1817	0.0000	1.82E-07
111		0.22	0.058	0.135	0.2942	0.1816	0.0000	1.82E-07
112		0.32	0.116	0.116	0.3026	0.1815	0.0000	1.81E-07
113		0.00	0.000	0.103	0.2923	0.1815	0.0000	1.81E-07
114		0.00	0.000	0.078	0.2845	0.1814	0.0000	1.81E-07
115		0.76	0.512	0.084	0.3007	0.1814	0.0000	1.81E-07
116		0.00	0.000	0.055	0.2951	0.1813	0.0000	1.81E-07
117		0.91	0.635	0.123	0.3100	0.1813	0.0000	1.81E-07
118		0.00	0.000	0.177	0.2924	0.1812	0.0000	1.81E-07
119		0.38	0.126	0.256	0.2921	0.1812	0.0000	1.81E-07
120		0.00	0.000	0.106	0.2815	0.1811	0.0000	1.81E-07

121	0.16	0.000	0.089	0.2887	0.1811	0.0000	1.81E-07
122	0.06	0.000	0.088	0.2855	0.1810	0.0000	1.81E-07
123	0.01	0.000	0.048	0.2819	0.1810	0.0000	1.81E-07
124	0.00	0.000	0.024	0.2795	0.1809	0.0000	1.81E-07
125	0.02	0.000	0.025	0.2789	0.1809	0.0000	1.81E-07
126	0.00	0.000	0.004	0.2785	0.1808	0.0000	1.81E-07
127	0.01	0.000	0.012	0.2780	0.1807	0.0000	1.81E-07
128	0.00	0.000	0.004	0.2777	0.1807	0.0000	1.81E-07
129	1.12	0.910	0.053	0.2934	0.1806	0.0000	1.81E-07
130	0.58	0.247	0.222	0.3044	0.1806	0.0000	1.81E-07
131	0.60	0.331	0.177	0.3138	0.1805	0.0000	1.81E-07
132	0.75	0.448	0.251	0.3187	0.1805	0.0000	1.81E-07
133	0.02	0.000	0.064	0.3148	0.1804	0.0000	1.80E-07
134	0.00	0.000	0.105	0.3043	0.1804	0.0000	1.80E-07
135	0.56	0.259	0.214	0.3134	0.1803	0.0000	1.80E-07
136	0.00	0.000	0.151	0.2982	0.1803	0.0000	1.80E-07
137	0.00	0.000	0.060	0.2922	0.1802	0.0000	1.80E-07
138	1.09	0.689	0.253	0.3068	0.1802	0.0000	1.80E-07
139	0.34	0.111	0.287	0.3009	0.1801	0.0000	1.80E-07
140	0.11	0.000	0.145	0.2974	0.1801	0.0000	1.80E-07
141	0.03	0.000	0.129	0.2875	0.1800	0.0000	1.80E-07
142	0.44	0.155	0.270	0.2889	0.1800	0.0000	1.80E-07
143	0.00	0.000	0.083	0.2806	0.1804	0.0000	1.80E-07
144	0.01	0.000	0.039	0.2776	0.1812	0.0000	1.81E-07
145	1.16	0.734	0.285	0.2913	0.1812	0.0000	1.81E-07
146	0.12	0.000	0.062	0.2975	0.1811	0.0000	1.81E-07
147	0.00	0.000	0.104	0.2872	0.1810	0.0000	1.81E-07
148	0.18	0.001	0.166	0.2883	0.1810	0.0000	1.81E-07
149	0.13	0.000	0.098	0.2910	0.1809	0.0000	1.81E-07
150	0.00	0.000	0.029	0.2882	0.1809	0.0000	1.81E-07
151	0.00	0.000	0.030	0.2852	0.1808	0.0000	1.81E-07
152	0.14	0.000	0.056	0.2937	0.1808	0.0000	1.81E-07

153	0.00	0.000	0.019	0.2918	0.1807	0.0000	1.81E-07
154	0.00	0.000	0.022	0.2896	0.1807	0.0000	1.81E-07
155	0.00	0.000	0.020	0.2876	0.1806	0.0000	1.81E-07
156	0.74	0.543	0.056	0.3020	0.1806	0.0000	1.81E-07
157	0.04	0.000	0.098	0.2958	0.1805	0.0000	1.81E-07
158	0.37	0.130	0.194	0.3006	0.1805	0.0000	1.80E-07
159	0.00	0.000	0.074	0.2932	0.1804	0.0000	1.80E-07
160	0.00	0.000	0.085	0.2847	0.1804	0.0000	1.80E-07
161	0.00	0.000	0.043	0.2805	0.1803	0.0000	1.80E-07
162	0.00	0.000	0.030	0.2775	0.1803	0.0000	1.80E-07
163	0.00	0.000	0.004	0.2771	0.1802	0.0000	1.80E-07
164	0.00	0.000	0.001	0.2770	0.1801	0.0000	1.80E-07
165	0.00	0.000	0.000	0.2770	0.1801	0.0000	1.80E-07
166	0.00	0.000	0.000	0.2770	0.1800	0.0000	1.80E-07
167	0.00	0.000	0.000	0.2770	0.1800	0.0000	1.80E-07
168	0.00	0.000	0.000	0.2770	0.1799	0.0000	1.80E-07
169	0.00	0.000	0.000	0.2770	0.1799	0.0000	1.80E-07
170	0.00	0.000	0.000	0.2770	0.1798	0.0000	1.80E-07
171	0.31	0.133	0.053	0.2895	0.1798	0.0000	1.80E-07
172	0.00	0.000	0.012	0.2882	0.1797	0.0000	1.80E-07
173	0.41	0.216	0.054	0.3022	0.1797	0.0000	1.80E-07
174	0.28	0.104	0.152	0.3049	0.1796	0.0000	1.80E-07
175	0.42	0.192	0.169	0.3106	0.1796	0.0000	1.80E-07
176	0.00	0.000	0.165	0.2943	0.1795	0.0000	1.80E-07
177	1.07	0.802	0.107	0.3106	0.1795	0.0000	1.80E-07
178	0.45	0.195	0.315	0.3049	0.1794	0.0000	1.80E-07
179	0.00	0.000	0.121	0.2928	0.1794	0.0000	1.79E-07
180	0.12	0.000	0.174	0.2875	0.1793	0.0000	1.79E-07
181	0.00	0.000	0.080	0.2795	0.1793	0.0000	1.79E-07
182	0.00	0.000	0.019	0.2776	0.1792	0.0000	1.79E-07
183	0.00	0.000	0.004	0.2771	0.1792	0.0000	1.79E-07
184	0.00	0.000	0.001	0.2770	0.1791	0.0000	1.79E-07

185	0.00	0.000	0.000	0.2770	0.1790	0.0000	1.79E-07
186	0.00	0.000	0.000	0.2770	0.1790	0.0000	1.79E-07
187	0.00	0.000	0.000	0.2770	0.1789	0.0000	1.79E-07
188	0.00	0.000	0.000	0.2770	0.1789	0.0000	1.79E-07
189	0.00	0.000	0.000	0.2770	0.1788	0.0000	1.79E-07
190	0.00	0.000	0.000	0.2770	0.1788	0.0000	1.79E-07
191	0.00	0.000	0.000	0.2770	0.1787	0.0000	1.79E-07
192	0.03	0.000	0.021	0.2776	0.1787	0.0000	1.79E-07
193	0.00	0.000	0.007	0.2773	0.1786	0.0000	1.79E-07
194	0.86	0.653	0.052	0.2933	0.1786	0.0000	1.79E-07
195	0.13	0.000	0.040	0.3024	0.1785	0.0000	1.79E-07
196	0.03	0.000	0.031	0.3021	0.1785	0.0000	1.79E-07
197	0.08	0.000	0.045	0.3061	0.1784	0.0000	1.79E-07
198	0.16	0.006	0.049	0.3168	0.1784	0.0000	1.79E-07
199	0.00	0.000	0.024	0.3144	0.1783	0.0000	1.79E-07
200	0.00	0.000	0.023	0.3121	0.1783	0.0000	1.78E-07
201	0.00	0.000	0.025	0.3096	0.1782	0.0000	1.78E-07
202	0.07	0.000	0.047	0.3116	0.1782	0.0000	1.78E-07
203	0.00	0.000	0.025	0.3091	0.1781	0.0000	1.78E-07
204	0.17	0.008	0.051	0.3202	0.1781	0.0000	1.78E-07
205	0.00	0.000	0.118	0.3084	0.1780	0.0000	1.78E-07
206	0.00	0.000	0.027	0.3057	0.1780	0.0000	1.78E-07
207	0.00	0.000	0.029	0.3029	0.1779	0.0000	1.78E-07
208	0.02	0.000	0.034	0.3017	0.1778	0.0000	1.78E-07
209	0.00	0.000	0.018	0.2999	0.1778	0.0000	1.78E-07
210	0.08	0.000	0.056	0.3019	0.1777	0.0000	1.78E-07
211	0.00	0.000	0.029	0.2990	0.1777	0.0000	1.78E-07
212	0.04	0.000	0.048	0.2981	0.1776	0.0000	1.78E-07
213	2.48	2.306	0.052	0.3100	0.1776	0.0000	1.78E-07
214	0.00	0.000	0.056	0.3044	0.1775	0.0000	1.78E-07
215	0.00	0.000	0.156	0.2888	0.1775	0.0000	1.78E-07
216	0.01	0.000	0.073	0.2827	0.1774	0.0000	1.78E-07

217	0.00	0.000	0.054	0.2773	0.1774	0.0000	1.78E-07
218	0.27	0.096	0.065	0.2879	0.1773	0.0000	1.78E-07
219	0.00	0.000	0.035	0.2846	0.1773	0.0000	1.78E-07
220	0.00	0.000	0.058	0.2789	0.1772	0.0000	1.78E-07
221	0.00	0.000	0.017	0.2772	0.1772	0.0000	1.77E-07
222	0.00	0.000	0.002	0.2771	0.1771	0.0000	1.77E-07
223	0.07	0.000	0.033	0.2805	0.1771	0.0000	1.77E-07
224	0.13	0.000	0.043	0.2890	0.1770	0.0000	1.77E-07
225	0.00	0.000	0.022	0.2868	0.1770	0.0000	1.77E-07
226	0.00	0.000	0.028	0.2840	0.1769	0.0000	1.77E-07
227	0.00	0.000	0.026	0.2813	0.1769	0.0000	1.77E-07
228	0.00	0.000	0.025	0.2789	0.1768	0.0000	1.77E-07
229	0.00	0.000	0.014	0.2774	0.1768	0.0000	1.77E-07
230	0.00	0.000	0.003	0.2771	0.1767	0.0000	1.77E-07
231	0.13	0.000	0.034	0.2867	0.1767	0.0000	1.77E-07
232	0.00	0.000	0.012	0.2854	0.1766	0.0000	1.77E-07
233	0.00	0.000	0.019	0.2835	0.1766	0.0000	1.77E-07
234	0.60	0.401	0.061	0.2972	0.1765	0.0000	1.77E-07
235	0.00	0.000	0.097	0.2874	0.1764	0.0000	1.77E-07
236	0.00	0.000	0.025	0.2850	0.1764	0.0000	1.77E-07
237	0.00	0.000	0.019	0.2831	0.1763	0.0000	1.77E-07
238	0.17	0.003	0.049	0.2947	0.1763	0.0000	1.77E-07
239	0.07	0.000	0.053	0.2969	0.1762	0.0000	1.77E-07
240	0.00	0.000	0.025	0.2944	0.1762	0.0000	1.77E-07
241	0.17	0.012	0.049	0.3055	0.1761	0.0000	1.77E-07
242	0.27	0.115	0.061	0.3144	0.1761	0.0000	1.76E-07
243	0.02	0.000	0.080	0.3084	0.1760	0.0000	1.76E-07
244	0.00	0.000	0.087	0.2997	0.1760	0.0000	1.76E-07
245	0.00	0.000	0.151	0.2845	0.1759	0.0000	1.76E-07
246	0.00	0.000	0.063	0.2782	0.1759	0.0000	1.76E-07
247	0.00	0.000	0.010	0.2772	0.1758	0.0000	1.76E-07
248	0.00	0.000	0.002	0.2770	0.1758	0.0000	1.76E-07

249	0.00	0.000	0.000	0.2770	0.1757	0.0000	1.76E-07
250	0.00	0.000	0.000	0.2770	0.1757	0.0000	1.76E-07
251	0.00	0.000	0.000	0.2770	0.1756	0.0000	1.76E-07
252	0.10	0.000	0.034	0.2834	0.1756	0.0000	1.76E-07
253	0.32	0.133	0.063	0.2959	0.1755	0.0000	1.76E-07
254	0.00	0.000	0.017	0.2941	0.1755	0.0000	1.76E-07
255	0.00	0.000	0.031	0.2910	0.1754	0.0000	1.76E-07
256	0.00	0.000	0.028	0.2882	0.1754	0.0000	1.76E-07
257	0.00	0.000	0.033	0.2849	0.1753	0.0000	1.76E-07
258	0.00	0.000	0.020	0.2829	0.1753	0.0000	1.76E-07
259	0.00	0.000	0.022	0.2808	0.1752	0.0000	1.76E-07
260	0.00	0.000	0.014	0.2794	0.1752	0.0000	1.76E-07
261	0.35	0.166	0.063	0.2914	0.1751	0.0000	1.76E-07
262	0.46	0.293	0.056	0.3023	0.1751	0.0000	1.76E-07
263	0.14	0.003	0.138	0.3024	0.1750	0.0000	1.76E-07
264	0.00	0.000	0.115	0.2909	0.1750	0.0000	1.75E-07
265	0.00	0.000	0.086	0.2823	0.1749	0.0000	1.75E-07
266	0.00	0.000	0.044	0.2779	0.1749	0.0000	1.75E-07
267	0.00	0.000	0.010	0.2772	0.1748	0.0000	1.75E-07
268	0.01	0.000	0.011	0.2771	0.1748	0.0000	1.75E-07
269	0.11	0.000	0.035	0.2848	0.1747	0.0000	1.75E-07
270	0.10	0.000	0.045	0.2907	0.1747	0.0000	1.75E-07
271	0.00	0.000	0.015	0.2892	0.1746	0.0000	1.75E-07
272	0.05	0.000	0.042	0.2902	0.1746	0.0000	1.75E-07
273	0.00	0.000	0.015	0.2887	0.1745	0.0000	1.75E-07
274	0.00	0.000	0.014	0.2873	0.1745	0.0000	1.75E-07
275	0.00	0.000	0.016	0.2857	0.1744	0.0000	1.75E-07
276	0.00	0.000	0.015	0.2843	0.1744	0.0000	1.75E-07
277	0.00	0.000	0.015	0.2828	0.1743	0.0000	1.75E-07
278	0.00	0.000	0.013	0.2814	0.1743	0.0000	1.75E-07
279	0.00	0.000	0.012	0.2802	0.1742	0.0000	1.75E-07
280	0.00	0.000	0.012	0.2790	0.1742	0.0000	1.75E-07

281	0.00	0.000	0.011	0.2780	0.1741	0.0000	1.75E-07
282	0.00	0.000	0.007	0.2772	0.1741	0.0000	1.75E-07
283	0.00	0.000	0.002	0.2770	0.1740	0.0000	1.75E-07
284	0.00	0.000	0.000	0.2770	0.1740	0.0000	1.75E-07
285	0.19	0.022	0.038	0.2899	0.1739	0.0000	1.74E-07
286	0.35	0.186	0.046	0.3015	0.1739	0.0000	1.74E-07
287	0.00	0.000	0.006	0.3009	0.1738	0.0000	1.74E-07
288	0.00	0.000	0.009	0.3000	0.1738	0.0000	1.74E-07
289	0.00	0.000	0.009	0.2990	0.1737	0.0000	1.74E-07
290	0.00	0.000	0.009	0.2981	0.1737	0.0000	1.74E-07
291	0.00	0.000	0.009	0.2972	0.1736	0.0000	1.74E-07
292	0.00	0.000	0.008	0.2964	0.1736	0.0000	1.74E-07
293	0.00	0.000	0.008	0.2956	0.1735	0.0000	1.74E-07
294	0.00	0.000	0.008	0.2948	0.1735	0.0000	1.74E-07
295	0.00	0.000	0.008	0.2940	0.1734	0.0000	1.74E-07
296	0.00	0.000	0.008	0.2932	0.1734	0.0000	1.74E-07
297	0.00	0.000	0.008	0.2924	0.1733	0.0000	1.74E-07
298	1.00	0.807	0.043	0.3072	0.1733	0.0000	1.74E-07
299	0.00	0.000	0.075	0.2998	0.1732	0.0000	1.74E-07
300	0.00	0.000	0.043	0.2955	0.1732	0.0000	1.74E-07
301	0.00	0.000	0.047	0.2908	0.1731	0.0000	1.74E-07
302	0.45	0.240	0.057	0.3061	0.1731	0.0000	1.74E-07
303	0.00	0.000	0.038	0.3023	0.1730	0.0000	1.74E-07
304	0.00	0.000	0.068	0.2955	0.1729	0.0000	1.74E-07
305	0.00	0.000	0.037	0.2918	0.1729	0.0000	1.74E-07
306	0.00	0.000	0.044	0.2874	0.1728	0.0000	1.74E-07
307	0.00	0.000	0.023	0.2852	0.1728	0.0000	1.73E-07
308	0.02	0.000	0.055	0.2817	0.1727	0.0000	1.73E-07
309	0.00	0.000	0.035	0.2782	0.1727	0.0000	1.73E-07
310	0.00	0.000	0.011	0.2772	0.1726	0.0000	1.73E-07
311	0.00	0.000	0.002	0.2770	0.1726	0.0000	1.73E-07
312	0.00	0.000	0.000	0.2770	0.1725	0.0000	1.73E-07

313		0.00	0.000	0.000	0.2770	0.1725	0.0000	1.73E-07
314	*	0.06	0.000	0.041	0.2790	0.1724	0.0000	1.73E-07
315		0.00	0.000	0.003	0.2787	0.1724	0.0000	1.73E-07
316	*	0.00	0.000	0.000	0.2787	0.1723	0.0000	1.73E-07
317		0.00	0.000	0.006	0.2781	0.1723	0.0000	1.73E-07
318	*	0.01	0.000	0.019	0.2777	0.1722	0.0000	1.73E-07
319		0.00	0.000	0.008	0.2772	0.1722	0.0000	1.73E-07
320		0.61	0.396	0.056	0.2935	0.1721	0.0000	1.73E-07
321		0.00	0.000	0.019	0.2916	0.1721	0.0000	1.73E-07
322		0.00	0.000	0.020	0.2897	0.1720	0.0000	1.73E-07
323		0.00	0.000	0.024	0.2873	0.1720	0.0000	1.73E-07
324		0.10	0.000	0.062	0.2908	0.1719	0.0000	1.73E-07
325		0.00	0.000	0.027	0.2881	0.1719	0.0000	1.73E-07
326		0.00	0.000	0.025	0.2856	0.1718	0.0000	1.73E-07
327		0.00	0.000	0.017	0.2839	0.1718	0.0000	1.73E-07
328		0.01	0.000	0.036	0.2814	0.1717	0.0000	1.73E-07
329		0.23	0.070	0.054	0.2920	0.1717	0.0000	1.72E-07
330	*	0.00	0.000	0.015	0.2905	0.1716	0.0000	1.72E-07
331		0.00	0.000	0.022	0.2882	0.1716	0.0000	1.72E-07
332	*	0.00	0.000	0.000	0.2882	0.1715	0.0000	1.72E-07
333	*	0.00	0.000	0.000	0.2882	0.1715	0.0000	1.72E-07
334	*	0.35	0.000	0.026	0.2902	0.1714	0.0000	1.72E-07
335	*	0.63	0.000	0.027	0.2922	0.1714	0.0000	1.72E-07
336	*	0.00	0.000	0.000	0.2942	0.1713	0.0000	1.72E-07
337	*	0.00	0.000	0.040	0.2961	0.1713	0.0000	1.72E-07
338	*	0.00	0.000	0.037	0.2981	0.1712	0.0000	1.72E-07
339	*	0.05	0.000	0.035	0.3001	0.1712	0.0000	1.72E-07
340		0.00	0.032	0.029	0.3128	0.1711	0.0000	1.72E-07
341		0.00	0.411	0.026	0.3244	0.1711	0.0000	1.72E-07
342		0.00	0.000	0.022	0.3222	0.1710	0.0000	1.72E-07
343		0.00	0.000	0.037	0.3185	0.1710	0.0000	1.72E-07
344		0.00	0.000	0.031	0.3153	0.1709	0.0000	1.72E-07

345		0.00	0.000	0.025	0.3128	0.1709	0.0000	1.72E-07
346		0.03	0.000	0.043	0.3113	0.1708	0.0000	1.72E-07
347		0.23	0.062	0.059	0.3223	0.1708	0.0000	1.72E-07
348		0.00	0.000	0.046	0.3177	0.1707	0.0000	1.72E-07
349		0.00	0.000	0.029	0.3148	0.1707	0.0000	1.72E-07
350		0.00	0.000	0.044	0.3104	0.1706	0.0000	1.72E-07
351		0.00	0.000	0.046	0.3058	0.1706	0.0000	1.71E-07
352		0.00	0.000	0.021	0.3037	0.1705	0.0000	1.71E-07
353	*	0.29	0.000	0.026	0.3057	0.1705	0.0000	1.71E-07
354		0.00	0.059	0.055	0.3185	0.1704	0.0000	1.71E-07
355		0.11	0.000	0.061	0.3236	0.1704	0.0000	1.71E-07
356		0.00	0.000	0.050	0.3186	0.1703	0.0000	1.71E-07
357		0.00	0.000	0.022	0.3165	0.1703	0.0000	1.71E-07
358		0.00	0.000	0.034	0.3131	0.1702	0.0000	1.71E-07
359		0.00	0.000	0.036	0.3094	0.1702	0.0000	1.71E-07
360		0.00	0.000	0.045	0.3049	0.1701	0.0000	1.71E-07
361		0.00	0.000	0.075	0.2974	0.1701	0.0000	1.71E-07
362		0.00	0.000	0.038	0.2936	0.1700	0.0000	1.71E-07
363		0.00	0.000	0.019	0.2918	0.1700	0.0000	1.71E-07
364		0.00	0.000	0.033	0.2885	0.1699	0.0000	1.71E-07
365	*	0.00	0.000	0.021	0.2864	0.1699	0.0000	1.71E-07

* = Frozen (air or soil)

Annual Totals for Year 24			
	inches	cubic feet	percent
Precipitation	40.62	147,456.0	100.00
Runoff	22.573	81,940.8	55.57
Evapotranspiration	17.960	65,193.8	44.21
Recirculation into Layer 1	0.0074	26.9	0.02
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0074	26.9	0.02
Percolation/Leakage through Layer 5	0.000065	0.2376	0.00
Average Head on Top of Layer 4	0.1786	---	---
Change in Water Storage	0.0885	321.2	0.22
Soil Water at Start of Year	1,406.5250	5,105,685.7	3462.51
Soil Water at End of Year	1,406.6135	5,106,006.9	3462.73
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0074	-26.9	-0.02

Daily Output for Year 25

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.002	0.2864	0.1698	0.0000	1.71E-07
2	*		0.39	0.000	0.021	0.2884	0.1697	0.0000	1.71E-07
3	*		0.01	0.000	0.022	0.2904	0.1697	0.0000	1.71E-07
4	*		0.10	0.000	0.000	0.2923	0.1696	0.0000	1.71E-07
5	*		0.00	0.000	0.034	0.2943	0.1696	0.0000	1.71E-07
6			0.00	0.159	0.057	0.3070	0.1695	0.0000	1.70E-07
7			0.00	0.000	0.065	0.3006	0.1695	0.0000	1.70E-07
8			0.00	0.000	0.054	0.2952	0.1694	0.0000	1.70E-07
9			0.00	0.000	0.053	0.2898	0.1694	0.0000	1.70E-07
10			0.00	0.000	0.074	0.2824	0.1693	0.0000	1.70E-07
11			0.00	0.000	0.041	0.2783	0.1693	0.0000	1.70E-07
12			0.00	0.000	0.011	0.2773	0.1692	0.0000	1.70E-07
13			0.00	0.000	0.002	0.2770	0.1692	0.0000	1.70E-07
14			0.00	0.000	0.000	0.2770	0.1691	0.0000	1.70E-07
15			0.00	0.000	0.000	0.2770	0.1691	0.0000	1.70E-07
16			0.00	0.000	0.000	0.2770	0.1690	0.0000	1.70E-07
17			0.00	0.000	0.000	0.2770	0.1690	0.0000	1.70E-07
18	*		0.00	0.000	0.000	0.2770	0.1689	0.0000	1.70E-07
19			0.00	0.000	0.000	0.2770	0.1689	0.0000	1.70E-07
20	*		0.00	0.000	0.000	0.2770	0.1689	0.0000	1.70E-07
21	*		0.23	0.000	0.029	0.2790	0.1688	0.0000	1.70E-07
22	*		0.44	0.000	0.000	0.2809	0.1688	0.0000	1.70E-07
23			0.00	0.387	0.007	0.2936	0.1687	0.0000	1.70E-07
24			0.00	0.000	0.062	0.2950	0.1687	0.0000	1.70E-07

25		0.18	0.014	0.054	0.3062	0.1686	0.0000	1.70E-07
26		0.03	0.000	0.048	0.3040	0.1686	0.0000	1.70E-07
27		0.00	0.000	0.027	0.3012	0.1685	0.0000	1.70E-07
28		0.00	0.000	0.032	0.2981	0.1685	0.0000	1.70E-07
29		0.00	0.000	0.018	0.2962	0.1684	0.0000	1.69E-07
30		0.00	0.000	0.025	0.2937	0.1684	0.0000	1.69E-07
31	*	0.06	0.000	0.023	0.2957	0.1683	0.0000	1.69E-07
32		0.00	0.000	0.044	0.2933	0.1683	0.0000	1.69E-07
33		0.00	0.000	0.036	0.2897	0.1682	0.0000	1.69E-07
34		0.00	0.000	0.068	0.2829	0.1682	0.0000	1.69E-07
35		0.00	0.000	0.029	0.2800	0.1681	0.0000	1.69E-07
36		0.00	0.000	0.025	0.2775	0.1681	0.0000	1.69E-07
37		0.00	0.000	0.004	0.2771	0.1680	0.0000	1.69E-07
38		0.00	0.000	0.001	0.2770	0.1680	0.0000	1.69E-07
39		0.00	0.000	0.000	0.2770	0.1679	0.0000	1.69E-07
40		0.00	0.000	0.000	0.2770	0.1679	0.0000	1.69E-07
41		0.00	0.000	0.000	0.2770	0.1678	0.0000	1.69E-07
42		0.01	0.000	0.010	0.2770	0.1678	0.0000	1.69E-07
43		0.00	0.000	0.000	0.2770	0.1677	0.0000	1.69E-07
44		0.00	0.000	0.000	0.2770	0.1677	0.0000	1.69E-07
45		0.00	0.000	0.000	0.2770	0.1676	0.0000	1.69E-07
46		0.00	0.000	0.000	0.2770	0.1676	0.0000	1.69E-07
47		0.00	0.000	0.000	0.2770	0.1675	0.0000	1.69E-07
48		0.00	0.000	0.000	0.2770	0.1675	0.0000	1.69E-07
49		0.00	0.000	0.003	0.2770	0.1674	0.0000	1.69E-07
50		0.05	0.000	0.026	0.2792	0.1674	0.0000	1.69E-07
51	*	0.23	0.000	0.039	0.2812	0.1674	0.0000	1.68E-07
52	*	0.01	0.000	0.036	0.2831	0.1673	0.0000	1.68E-07
53	*	0.00	0.000	0.061	0.2851	0.1673	0.0000	1.68E-07
54		0.00	0.000	0.059	0.2844	0.1672	0.0000	1.68E-07
55		0.00	0.000	0.007	0.2838	0.1672	0.0000	1.68E-07
56		0.00	0.000	0.009	0.2829	0.1671	0.0000	1.68E-07

57	*		0.00	0.000	0.009	0.2819	0.1671	0.0000	1.68E-07
58	*		0.00	0.000	0.000	0.2819	0.1670	0.0000	1.68E-07
59			0.00	0.000	0.009	0.2810	0.1670	0.0000	1.68E-07
60			0.06	0.000	0.036	0.2835	0.1669	0.0000	1.68E-07
61			0.36	0.184	0.044	0.2966	0.1669	0.0000	1.68E-07
62	*		0.00	0.000	0.000	0.2966	0.1668	0.0000	1.68E-07
63	*		0.03	0.000	0.029	0.2966	0.1668	0.0000	1.68E-07
64	*		0.08	0.000	0.023	0.2986	0.1667	0.0000	1.68E-07
65			0.00	0.000	0.048	0.2976	0.1667	0.0000	1.68E-07
66	*		0.24	0.000	0.023	0.2996	0.1666	0.0000	1.68E-07
67			0.18	0.150	0.101	0.3123	0.1666	0.0000	1.68E-07
68	*		0.00	0.000	0.036	0.3087	0.1665	0.0000	1.68E-07
69	*		0.00	0.000	0.000	0.3087	0.1665	0.0000	1.68E-07
70	*		0.00	0.000	0.009	0.3078	0.1664	0.0000	1.68E-07
71	*		0.00	0.000	0.009	0.3070	0.1664	0.0000	1.68E-07
72	*		0.00	0.000	0.000	0.3070	0.1663	0.0000	1.68E-07
73	*		0.00	0.000	0.000	0.3070	0.1663	0.0000	1.68E-07
74			0.00	0.000	0.010	0.3060	0.1662	0.0000	1.67E-07
75			0.00	0.000	0.010	0.3050	0.1662	0.0000	1.67E-07
76			0.00	0.000	0.010	0.3040	0.1661	0.0000	1.67E-07
77			0.00	0.000	0.010	0.3030	0.1661	0.0000	1.67E-07
78			0.43	0.243	0.042	0.3172	0.1660	0.0000	1.67E-07
79			0.63	0.393	0.122	0.3288	0.1660	0.0000	1.67E-07
80			1.05	0.820	0.113	0.3405	0.1659	0.0000	1.67E-07
81			0.00	0.000	0.062	0.3342	0.1659	0.0000	1.67E-07
82			0.00	0.000	0.059	0.3283	0.1658	0.0000	1.67E-07
83			0.00	0.000	0.064	0.3219	0.1658	0.0000	1.67E-07
84	*		0.00	0.000	0.000	0.3219	0.1657	0.0000	1.67E-07
85	*	*	0.00	0.000	0.000	0.3219	0.1657	0.0000	1.67E-07
86		*	0.00	0.000	0.000	0.3219	0.1656	0.0000	1.67E-07
87		*	0.00	0.000	0.000	0.3219	0.1656	0.0000	1.67E-07
88			0.01	0.000	0.071	0.3154	0.1655	0.0000	1.67E-07

89		0.00	0.000	0.038	0.3115	0.1655	0.0000	1.67E-07
90	*	0.00	0.000	0.026	0.3089	0.1655	0.0000	1.67E-07
91		0.01	0.000	0.098	0.2998	0.1654	0.0000	1.67E-07
92		0.01	0.000	0.082	0.2923	0.1655	0.0000	1.67E-07
93		0.00	0.000	0.075	0.2848	0.1655	0.0000	1.67E-07
94		0.00	0.000	0.046	0.2802	0.1654	0.0000	1.67E-07
95	*	0.00	0.000	0.000	0.2802	0.1654	0.0000	1.67E-07
96		0.00	0.000	0.025	0.2777	0.1653	0.0000	1.67E-07
97		0.00	0.000	0.007	0.2770	0.1656	0.0000	1.67E-07
98		0.42	0.222	0.062	0.2912	0.1656	0.0000	1.67E-07
99		0.00	0.000	0.039	0.2873	0.1656	0.0000	1.67E-07
100		0.00	0.000	0.019	0.2853	0.1655	0.0000	1.67E-07
101		0.11	0.000	0.047	0.2918	0.1655	0.0000	1.67E-07
102		0.20	0.034	0.051	0.3029	0.1654	0.0000	1.67E-07
103		0.00	0.000	0.058	0.2971	0.1654	0.0000	1.67E-07
104		0.00	0.000	0.038	0.2933	0.1653	0.0000	1.67E-07
105		0.29	0.099	0.069	0.3051	0.1653	0.0000	1.67E-07
106	*	0.20	0.000	0.098	0.3070	0.1652	0.0000	1.67E-07
107		0.00	0.000	0.124	0.3026	0.1652	0.0000	1.66E-07
108		0.00	0.000	0.124	0.2903	0.1651	0.0000	1.66E-07
109		0.01	0.000	0.058	0.2854	0.1651	0.0000	1.66E-07
110		0.15	0.000	0.075	0.2925	0.1650	0.0000	1.66E-07
111		0.28	0.095	0.073	0.3033	0.1650	0.0000	1.66E-07
112		0.00	0.000	0.061	0.2972	0.1649	0.0000	1.66E-07
113		0.20	0.017	0.137	0.3014	0.1649	0.0000	1.66E-07
114		0.00	0.000	0.062	0.2952	0.1648	0.0000	1.66E-07
115		0.02	0.000	0.055	0.2921	0.1648	0.0000	1.66E-07
116		0.15	0.000	0.059	0.3017	0.1648	0.0000	1.66E-07
117		0.01	0.000	0.036	0.2988	0.1647	0.0000	1.66E-07
118		0.11	0.000	0.059	0.3040	0.1647	0.0000	1.66E-07
119		0.00	0.000	0.023	0.3018	0.1646	0.0000	1.66E-07
120		0.20	0.030	0.050	0.3133	0.1646	0.0000	1.66E-07

121	0.38	0.180	0.161	0.3172	0.1645	0.0000	1.66E-07
122	0.21	0.044	0.153	0.3181	0.1645	0.0000	1.66E-07
123	0.12	0.003	0.109	0.3188	0.1644	0.0000	1.66E-07
124	0.15	0.010	0.080	0.3252	0.1644	0.0000	1.66E-07
125	0.04	0.000	0.063	0.3230	0.1643	0.0000	1.66E-07
126	0.00	0.000	0.185	0.3045	0.1643	0.0000	1.66E-07
127	0.00	0.000	0.109	0.2936	0.1642	0.0000	1.66E-07
128	0.00	0.000	0.053	0.2884	0.1642	0.0000	1.66E-07
129	0.00	0.000	0.043	0.2841	0.1641	0.0000	1.66E-07
130	0.00	0.000	0.034	0.2806	0.1641	0.0000	1.65E-07
131	0.00	0.000	0.030	0.2776	0.1640	0.0000	1.65E-07
132	0.00	0.000	0.005	0.2771	0.1640	0.0000	1.65E-07
133	0.00	0.000	0.001	0.2770	0.1639	0.0000	1.65E-07
134	0.00	0.000	0.000	0.2770	0.1639	0.0000	1.65E-07
135	0.00	0.000	0.000	0.2770	0.1638	0.0000	1.65E-07
136	0.37	0.181	0.053	0.2905	0.1638	0.0000	1.65E-07
137	0.14	0.000	0.041	0.3006	0.1637	0.0000	1.65E-07
138	0.13	0.001	0.040	0.3097	0.1637	0.0000	1.65E-07
139	0.06	0.000	0.042	0.3114	0.1636	0.0000	1.65E-07
140	0.58	0.404	0.052	0.3241	0.1636	0.0000	1.65E-07
141	0.00	0.000	0.148	0.3093	0.1636	0.0000	1.65E-07
142	0.00	0.000	0.017	0.3076	0.1635	0.0000	1.65E-07
143	0.00	0.000	0.018	0.3057	0.1635	0.0000	1.65E-07
144	0.00	0.000	0.017	0.3040	0.1634	0.0000	1.65E-07
145	2.61	2.417	0.050	0.3187	0.1634	0.0000	1.65E-07
146	0.01	0.000	0.076	0.3117	0.1633	0.0000	1.65E-07
147	0.02	0.000	0.058	0.3081	0.1633	0.0000	1.65E-07
148	0.00	0.000	0.090	0.2996	0.1632	0.0000	1.65E-07
149	0.17	0.002	0.160	0.3006	0.1632	0.0000	1.65E-07
150	0.00	0.000	0.066	0.2940	0.1631	0.0000	1.65E-07
151	0.05	0.000	0.189	0.2803	0.1631	0.0000	1.65E-07
152	0.00	0.000	0.022	0.2781	0.1630	0.0000	1.65E-07

153	0.00	0.000	0.008	0.2773	0.1630	0.0000	1.64E-07
154	0.00	0.000	0.002	0.2771	0.1629	0.0000	1.64E-07
155	0.00	0.000	0.000	0.2770	0.1629	0.0000	1.64E-07
156	0.00	0.000	0.000	0.2770	0.1628	0.0000	1.64E-07
157	0.00	0.000	0.000	0.2770	0.1628	0.0000	1.64E-07
158	0.32	0.135	0.060	0.2893	0.1627	0.0000	1.64E-07
159	0.00	0.000	0.012	0.2882	0.1627	0.0000	1.64E-07
160	0.01	0.000	0.023	0.2864	0.1626	0.0000	1.64E-07
161	0.01	0.000	0.028	0.2848	0.1626	0.0000	1.64E-07
162	0.00	0.000	0.016	0.2832	0.1626	0.0000	1.64E-07
163	0.62	0.420	0.054	0.2982	0.1625	0.0000	1.64E-07
164	0.00	0.000	0.113	0.2869	0.1625	0.0000	1.64E-07
165	0.03	0.000	0.035	0.2866	0.1624	0.0000	1.64E-07
166	0.00	0.000	0.020	0.2846	0.1624	0.0000	1.64E-07
167	0.37	0.171	0.058	0.2985	0.1623	0.0000	1.64E-07
168	0.00	0.000	0.086	0.2899	0.1623	0.0000	1.64E-07
169	0.00	0.000	0.104	0.2795	0.1622	0.0000	1.64E-07
170	0.36	0.143	0.155	0.2860	0.1622	0.0000	1.64E-07
171	0.65	0.293	0.244	0.2970	0.1621	0.0000	1.64E-07
172	0.12	0.000	0.078	0.3007	0.1621	0.0000	1.64E-07
173	0.00	0.000	0.070	0.2937	0.1620	0.0000	1.64E-07
174	0.00	0.000	0.102	0.2835	0.1620	0.0000	1.64E-07
175	0.10	0.000	0.098	0.2834	0.1619	0.0000	1.64E-07
176	0.04	0.000	0.057	0.2820	0.1619	0.0000	1.63E-07
177	1.72	1.513	0.085	0.2938	0.1618	0.0000	1.63E-07
178	0.13	0.000	0.155	0.2915	0.1618	0.0000	1.63E-07
179	0.01	0.000	0.117	0.2809	0.1617	0.0000	1.63E-07
180	0.05	0.000	0.069	0.2794	0.1617	0.0000	1.63E-07
181	0.00	0.000	0.012	0.2781	0.1617	0.0000	1.63E-07
182	0.00	0.000	0.009	0.2772	0.1616	0.0000	1.63E-07
183	0.00	0.000	0.002	0.2770	0.1616	0.0000	1.63E-07
184	0.72	0.489	0.070	0.2928	0.1615	0.0000	1.63E-07

185	0.18	0.023	0.072	0.3012	0.1615	0.0000	1.63E-07
186	0.18	0.013	0.141	0.3042	0.1614	0.0000	1.63E-07
187	0.00	0.000	0.128	0.2914	0.1614	0.0000	1.63E-07
188	0.00	0.000	0.082	0.2832	0.1613	0.0000	1.63E-07
189	0.00	0.000	0.048	0.2784	0.1613	0.0000	1.63E-07
190	0.00	0.000	0.012	0.2772	0.1612	0.0000	1.63E-07
191	0.00	0.000	0.002	0.2771	0.1612	0.0000	1.63E-07
192	0.99	0.765	0.069	0.2929	0.1611	0.0000	1.63E-07
193	0.72	0.343	0.268	0.3040	0.1611	0.0000	1.63E-07
194	1.01	0.666	0.239	0.3146	0.1610	0.0000	1.63E-07
195	0.00	0.000	0.148	0.2998	0.1610	0.0000	1.63E-07
196	0.00	0.000	0.161	0.2836	0.1609	0.0000	1.63E-07
197	0.46	0.214	0.115	0.2970	0.1609	0.0000	1.63E-07
198	0.00	0.000	0.098	0.2872	0.1609	0.0000	1.63E-07
199	0.00	0.000	0.078	0.2795	0.1608	0.0000	1.62E-07
200	0.00	0.000	0.021	0.2774	0.1608	0.0000	1.62E-07
201	0.00	0.000	0.003	0.2771	0.1607	0.0000	1.62E-07
202	0.00	0.000	0.001	0.2770	0.1607	0.0000	1.62E-07
203	0.00	0.000	0.000	0.2770	0.1606	0.0000	1.62E-07
204	0.86	0.637	0.066	0.2931	0.1606	0.0000	1.62E-07
205	0.27	0.084	0.145	0.2972	0.1605	0.0000	1.62E-07
206	0.33	0.127	0.126	0.3049	0.1605	0.0000	1.62E-07
207	0.11	0.001	0.141	0.3017	0.1604	0.0000	1.62E-07
208	0.00	0.000	0.157	0.2860	0.1604	0.0000	1.62E-07
209	0.47	0.185	0.172	0.2971	0.1603	0.0000	1.62E-07
210	0.32	0.117	0.096	0.3082	0.1603	0.0000	1.62E-07
211	0.00	0.000	0.116	0.2966	0.1602	0.0000	1.62E-07
212	0.00	0.000	0.054	0.2913	0.1602	0.0000	1.62E-07
213	0.00	0.000	0.080	0.2832	0.1601	0.0000	1.62E-07
214	0.00	0.000	0.055	0.2778	0.1601	0.0000	1.62E-07
215	0.00	0.000	0.006	0.2772	0.1601	0.0000	1.62E-07
216	0.00	0.000	0.004	0.2770	0.1600	0.0000	1.62E-07

217	0.27	0.102	0.059	0.2884	0.1600	0.0000	1.62E-07
218	0.00	0.000	0.022	0.2862	0.1599	0.0000	1.62E-07
219	0.00	0.000	0.028	0.2834	0.1599	0.0000	1.62E-07
220	0.00	0.000	0.033	0.2802	0.1598	0.0000	1.62E-07
221	0.00	0.000	0.021	0.2781	0.1598	0.0000	1.62E-07
222	0.00	0.000	0.009	0.2772	0.1597	0.0000	1.61E-07
223	0.00	0.000	0.001	0.2770	0.1597	0.0000	1.61E-07
224	0.00	0.000	0.000	0.2770	0.1596	0.0000	1.61E-07
225	0.00	0.000	0.000	0.2770	0.1596	0.0000	1.61E-07
226	0.00	0.000	0.000	0.2770	0.1595	0.0000	1.61E-07
227	0.00	0.000	0.000	0.2770	0.1595	0.0000	1.61E-07
228	0.00	0.000	0.000	0.2770	0.1595	0.0000	1.61E-07
229	0.00	0.000	0.000	0.2770	0.1594	0.0000	1.61E-07
230	0.41	0.213	0.054	0.2908	0.1594	0.0000	1.61E-07
231	0.47	0.298	0.060	0.3015	0.1593	0.0000	1.61E-07
232	0.00	0.000	0.056	0.2960	0.1593	0.0000	1.61E-07
233	0.00	0.000	0.047	0.2913	0.1592	0.0000	1.61E-07
234	0.00	0.000	0.120	0.2793	0.1592	0.0000	1.61E-07
235	0.00	0.000	0.017	0.2776	0.1591	0.0000	1.61E-07
236	0.00	0.000	0.004	0.2771	0.1591	0.0000	1.61E-07
237	0.61	0.372	0.088	0.2919	0.1590	0.0000	1.61E-07
238	0.00	0.000	0.034	0.2885	0.1590	0.0000	1.61E-07
239	0.00	0.000	0.031	0.2855	0.1589	0.0000	1.61E-07
240	0.00	0.000	0.027	0.2827	0.1589	0.0000	1.61E-07
241	0.00	0.000	0.029	0.2799	0.1589	0.0000	1.61E-07
242	0.13	0.000	0.055	0.2874	0.1588	0.0000	1.61E-07
243	0.00	0.000	0.023	0.2851	0.1588	0.0000	1.61E-07
244	0.00	0.000	0.023	0.2828	0.1587	0.0000	1.61E-07
245	0.00	0.000	0.028	0.2800	0.1587	0.0000	1.60E-07
246	0.00	0.000	0.024	0.2775	0.1586	0.0000	1.60E-07
247	0.00	0.000	0.004	0.2771	0.1586	0.0000	1.60E-07
248	0.00	0.000	0.001	0.2770	0.1585	0.0000	1.60E-07

249	0.00	0.000	0.000	0.2770	0.1585	0.0000	1.60E-07
250	0.00	0.000	0.000	0.2770	0.1584	0.0000	1.60E-07
251	0.00	0.000	0.000	0.2770	0.1584	0.0000	1.60E-07
252	0.00	0.000	0.000	0.2770	0.1583	0.0000	1.60E-07
253	0.00	0.000	0.000	0.2770	0.1583	0.0000	1.60E-07
254	0.00	0.000	0.000	0.2770	0.1583	0.0000	1.60E-07
255	0.06	0.000	0.030	0.2798	0.1582	0.0000	1.60E-07
256	0.00	0.000	0.002	0.2797	0.1582	0.0000	1.60E-07
257	0.00	0.000	0.006	0.2790	0.1581	0.0000	1.60E-07
258	0.00	0.000	0.004	0.2786	0.1581	0.0000	1.60E-07
259	0.00	0.000	0.004	0.2783	0.1580	0.0000	1.60E-07
260	0.00	0.000	0.003	0.2779	0.1580	0.0000	1.60E-07
261	0.00	0.000	0.004	0.2776	0.1579	0.0000	1.60E-07
262	0.00	0.000	0.003	0.2773	0.1579	0.0000	1.60E-07
263	0.08	0.000	0.034	0.2817	0.1578	0.0000	1.60E-07
264	0.00	0.000	0.009	0.2808	0.1578	0.0000	1.60E-07
265	0.02	0.000	0.027	0.2805	0.1577	0.0000	1.60E-07
266	0.00	0.000	0.008	0.2797	0.1577	0.0000	1.60E-07
267	0.00	0.000	0.006	0.2791	0.1577	0.0000	1.60E-07
268	0.00	0.000	0.004	0.2787	0.1576	0.0000	1.60E-07
269	0.00	0.000	0.004	0.2783	0.1576	0.0000	1.59E-07
270	0.00	0.000	0.004	0.2779	0.1575	0.0000	1.59E-07
271	0.00	0.000	0.004	0.2776	0.1575	0.0000	1.59E-07
272	0.06	0.000	0.031	0.2807	0.1574	0.0000	1.59E-07
273	0.00	0.000	0.002	0.2806	0.1574	0.0000	1.59E-07
274	0.00	0.000	0.006	0.2800	0.1573	0.0000	1.59E-07
275	0.00	0.000	0.008	0.2793	0.1573	0.0000	1.59E-07
276	0.00	0.000	0.005	0.2789	0.1572	0.0000	1.59E-07
277	0.00	0.000	0.003	0.2785	0.1572	0.0000	1.59E-07
278	0.00	0.000	0.003	0.2782	0.1571	0.0000	1.59E-07
279	0.00	0.000	0.003	0.2780	0.1571	0.0000	1.59E-07
280	0.00	0.000	0.003	0.2777	0.1571	0.0000	1.59E-07

281		0.14	0.000	0.036	0.2883	0.1570	0.0000	1.59E-07
282		0.30	0.121	0.046	0.3013	0.1570	0.0000	1.59E-07
283		0.00	0.000	0.005	0.3008	0.1569	0.0000	1.59E-07
284		0.00	0.000	0.007	0.3001	0.1569	0.0000	1.59E-07
285		0.00	0.000	0.007	0.2993	0.1568	0.0000	1.59E-07
286		0.00	0.000	0.009	0.2985	0.1568	0.0000	1.59E-07
287		0.00	0.000	0.007	0.2978	0.1567	0.0000	1.59E-07
288		0.00	0.000	0.007	0.2971	0.1567	0.0000	1.59E-07
289		0.00	0.000	0.007	0.2963	0.1566	0.0000	1.59E-07
290		0.00	0.000	0.007	0.2956	0.1566	0.0000	1.59E-07
291		0.00	0.000	0.007	0.2949	0.1565	0.0000	1.59E-07
292		0.00	0.000	0.007	0.2942	0.1565	0.0000	1.59E-07
293		0.07	0.000	0.035	0.2973	0.1565	0.0000	1.58E-07
294		0.10	0.000	0.040	0.3032	0.1564	0.0000	1.58E-07
295		0.00	0.000	0.008	0.3024	0.1564	0.0000	1.58E-07
296		0.00	0.000	0.006	0.3018	0.1563	0.0000	1.58E-07
297		0.00	0.000	0.006	0.3012	0.1563	0.0000	1.58E-07
298		0.00	0.000	0.006	0.3006	0.1562	0.0000	1.58E-07
299		0.00	0.000	0.006	0.3001	0.1562	0.0000	1.58E-07
300		0.00	0.000	0.005	0.2995	0.1561	0.0000	1.58E-07
301	*	0.00	0.000	0.005	0.2990	0.1561	0.0000	1.58E-07
302		0.00	0.000	0.005	0.2985	0.1561	0.0000	1.58E-07
303		0.00	0.000	0.005	0.2979	0.1560	0.0000	1.58E-07
304	*	0.00	0.000	0.000	0.2979	0.1560	0.0000	1.58E-07
305		0.00	0.000	0.005	0.2974	0.1559	0.0000	1.58E-07
306	*	0.00	0.000	0.005	0.2969	0.1559	0.0000	1.58E-07
307		0.00	0.000	0.005	0.2964	0.1558	0.0000	1.58E-07
308		0.00	0.000	0.005	0.2958	0.1558	0.0000	1.58E-07
309		0.00	0.000	0.005	0.2953	0.1557	0.0000	1.58E-07
310		0.00	0.000	0.005	0.2948	0.1557	0.0000	1.58E-07
311		0.00	0.000	0.005	0.2943	0.1556	0.0000	1.58E-07
312		0.00	0.000	0.005	0.2938	0.1556	0.0000	1.58E-07

313		0.06	0.000	0.033	0.2963	0.1556	0.0000	1.58E-07
314		0.00	0.000	0.006	0.2957	0.1555	0.0000	1.58E-07
315		0.02	0.000	0.023	0.2958	0.1555	0.0000	1.58E-07
316		1.21	1.036	0.042	0.3090	0.1554	0.0000	1.57E-07
317		0.00	0.000	0.061	0.3029	0.1554	0.0000	1.57E-07
318		0.01	0.000	0.055	0.2982	0.1553	0.0000	1.57E-07
319		0.00	0.000	0.084	0.2897	0.1553	0.0000	1.57E-07
320		0.00	0.000	0.079	0.2818	0.1552	0.0000	1.57E-07
321		0.03	0.000	0.069	0.2779	0.1552	0.0000	1.57E-07
322		0.01	0.000	0.017	0.2774	0.1551	0.0000	1.57E-07
323		0.07	0.000	0.035	0.2805	0.1551	0.0000	1.57E-07
324		0.12	0.000	0.036	0.2885	0.1551	0.0000	1.57E-07
325		0.26	0.092	0.050	0.3003	0.1550	0.0000	1.57E-07
326		0.00	0.000	0.012	0.2991	0.1550	0.0000	1.57E-07
327		0.13	0.000	0.079	0.3040	0.1549	0.0000	1.57E-07
328		0.04	0.000	0.042	0.3035	0.1549	0.0000	1.57E-07
329		0.00	0.000	0.033	0.3002	0.1548	0.0000	1.57E-07
330		0.00	0.000	0.079	0.2923	0.1548	0.0000	1.57E-07
331		0.00	0.000	0.036	0.2887	0.1547	0.0000	1.57E-07
332		0.00	0.000	0.025	0.2861	0.1547	0.0000	1.57E-07
333		0.00	0.000	0.020	0.2841	0.1546	0.0000	1.57E-07
334		0.00	0.000	0.025	0.2816	0.1546	0.0000	1.57E-07
335		0.00	0.000	0.023	0.2794	0.1546	0.0000	1.57E-07
336		0.10	0.000	0.053	0.2842	0.1545	0.0000	1.57E-07
337		1.18	0.992	0.057	0.2971	0.1545	0.0000	1.57E-07
338		0.01	0.000	0.026	0.2958	0.1544	0.0000	1.57E-07
339	*	0.17	0.000	0.044	0.2977	0.1544	0.0000	1.57E-07
340		0.02	0.000	0.055	0.3053	0.1543	0.0000	1.56E-07
341	*	0.50	0.000	0.029	0.3073	0.1543	0.0000	1.56E-07
342		0.00	0.115	0.027	0.3200	0.1542	0.0000	1.56E-07
343		0.38	0.443	0.000	0.3316	0.1542	0.0000	1.56E-07
344	*	0.22	0.000	0.022	0.3336	0.1542	0.0000	1.56E-07

345	*	0.34	0.000	0.023	0.3356	0.1541	0.0000	1.56E-07
346	*	0.00	0.000	0.022	0.3376	0.1541	0.0000	1.56E-07
347	*	0.00	0.000	0.023	0.3395	0.1540	0.0000	1.56E-07
348	*	0.00	0.000	0.022	0.3415	0.1540	0.0000	1.56E-07
349	*	0.00	0.000	0.009	0.3435	0.1539	0.0000	1.56E-07
350	*	0.01	0.000	0.000	0.3454	0.1539	0.0000	1.56E-07
351		0.24	0.416	0.013	0.3582	0.1538	0.0000	1.56E-07
352		0.00	0.000	0.064	0.3518	0.1538	0.0000	1.56E-07
353		0.00	0.000	0.095	0.3423	0.1537	0.0000	1.56E-07
354		0.00	0.000	0.070	0.3352	0.1537	0.0000	1.56E-07
355		0.00	0.000	0.059	0.3293	0.1537	0.0000	1.56E-07
356		0.00	0.000	0.034	0.3259	0.1536	0.0000	1.56E-07
357		0.00	0.000	0.053	0.3206	0.1536	0.0000	1.56E-07
358		0.00	0.000	0.051	0.3155	0.1535	0.0000	1.56E-07
359		0.00	0.000	0.121	0.3033	0.1535	0.0000	1.56E-07
360		0.00	0.000	0.038	0.2995	0.1534	0.0000	1.56E-07
361	*	0.00	0.000	0.000	0.2995	0.1534	0.0000	1.56E-07
362	*	0.00	0.000	0.000	0.2995	0.1533	0.0000	1.56E-07
363	*	0.19	0.000	0.044	0.3015	0.1533	0.0000	1.56E-07
364		0.02	0.000	0.073	0.3090	0.1533	0.0000	1.55E-07
365		0.89	0.662	0.097	0.3225	0.1532	0.0000	1.55E-07

* = Frozen (air or soil)

Annual Totals for Year 25			
	inches	cubic feet	percent
Precipitation	32.32	117,337.9	100.00
Runoff	17.289	62,758.1	53.48
Evapotranspiration	14.681	53,290.3	45.42
Recirculation into Layer 1	0.0067	24.3	0.02
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0067	24.3	0.02
Percolation/Leakage through Layer 5	0.000060	0.2161	0.00
Average Head on Top of Layer 4	0.1615	---	---
Change in Water Storage	0.3552	1,289.2	1.10
Soil Water at Start of Year	1,406.6135	5,106,006.9	4351.54
Soil Water at End of Year	1,406.9686	5,107,296.1	4352.64
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0067	-24.3	-0.02

Daily Output for Year 26

Column key:	Head #1: drainage from Layer 4
	Drain #1: drainage from Layer 3
	Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1			0.00	0.000	0.033	0.3192	0.1532	0.0000	1.55E-07
2			0.00	0.000	0.035	0.3157	0.1531	0.0000	1.55E-07
3			0.00	0.000	0.044	0.3113	0.1531	0.0000	1.55E-07
4			1.15	0.955	0.057	0.3255	0.1530	0.0000	1.55E-07
5			0.00	0.000	0.029	0.3225	0.1530	0.0000	1.55E-07
6			0.00	0.000	0.032	0.3194	0.1529	0.0000	1.55E-07
7	*		0.00	0.000	0.014	0.3179	0.1529	0.0000	1.55E-07
8			0.00	0.000	0.030	0.3149	0.1528	0.0000	1.55E-07
9			0.00	0.000	0.043	0.3106	0.1528	0.0000	1.55E-07
10			0.00	0.000	0.048	0.3058	0.1528	0.0000	1.55E-07
11			0.00	0.000	0.046	0.3013	0.1527	0.0000	1.55E-07
12	*		0.22	0.000	0.037	0.3032	0.1527	0.0000	1.55E-07
13	*		0.00	0.000	0.041	0.3052	0.1526	0.0000	1.55E-07
14	*		0.01	0.000	0.021	0.3072	0.1526	0.0000	1.55E-07
15	*		0.00	0.000	0.025	0.3091	0.1525	0.0000	1.55E-07
16	*		0.01	0.000	0.028	0.3091	0.1525	0.0000	1.55E-07
17			0.00	0.000	0.036	0.3055	0.1524	0.0000	1.55E-07
18			0.00	0.000	0.021	0.3035	0.1524	0.0000	1.55E-07
19			0.00	0.000	0.027	0.3008	0.1524	0.0000	1.55E-07
20			0.00	0.000	0.037	0.2970	0.1523	0.0000	1.55E-07
21			0.00	0.000	0.031	0.2939	0.1523	0.0000	1.55E-07
22			0.00	0.000	0.049	0.2891	0.1522	0.0000	1.55E-07
23	*		0.00	0.000	0.021	0.2869	0.1522	0.0000	1.55E-07
24	*		0.00	0.000	0.016	0.2854	0.1521	0.0000	1.54E-07

25	*	0.08	0.000	0.020	0.2873	0.1521	0.0000	1.54E-07
26	*	0.00	0.000	0.057	0.2853	0.1520	0.0000	1.54E-07
27	*	0.26	0.000	0.018	0.2873	0.1520	0.0000	1.54E-07
28	*	0.06	0.000	0.010	0.2893	0.1520	0.0000	1.54E-07
29		0.00	0.117	0.000	0.3020	0.1519	0.0000	1.54E-07
30		0.00	0.000	0.052	0.2977	0.1519	0.0000	1.54E-07
31		0.00	0.000	0.048	0.2930	0.1518	0.0000	1.54E-07
32		0.00	0.000	0.078	0.2856	0.1518	0.0000	1.54E-07
33		0.00	0.000	0.031	0.2824	0.1517	0.0000	1.54E-07
34		0.00	0.000	0.014	0.2810	0.1517	0.0000	1.54E-07
35		0.00	0.000	0.033	0.2777	0.1516	0.0000	1.54E-07
36		0.00	0.000	0.005	0.2771	0.1516	0.0000	1.54E-07
37	*	0.00	0.000	0.001	0.2770	0.1516	0.0000	1.54E-07
38	*	0.48	0.000	0.018	0.2790	0.1515	0.0000	1.54E-07
39		0.00	0.269	0.032	0.2933	0.1515	0.0000	1.54E-07
40		0.00	0.000	0.041	0.2892	0.1515	0.0000	1.54E-07
41		0.33	0.127	0.060	0.3037	0.1515	0.0000	1.54E-07
42	*	0.00	0.000	0.000	0.3037	0.1515	0.0000	1.54E-07
43	*	0.00	0.000	0.011	0.3026	0.1514	0.0000	1.54E-07
44		0.00	0.000	0.024	0.3002	0.1514	0.0000	1.54E-07
45		0.00	0.000	0.028	0.2974	0.1513	0.0000	1.54E-07
46	*	0.15	0.000	0.072	0.2994	0.1513	0.0000	1.54E-07
47		0.50	0.422	0.008	0.3122	0.1513	0.0000	1.54E-07
48		0.50	0.289	0.093	0.3238	0.1512	0.0000	1.54E-07
49		0.02	0.000	0.081	0.3179	0.1512	0.0000	1.54E-07
50		0.00	0.000	0.031	0.3148	0.1511	0.0000	1.54E-07
51		0.00	0.000	0.047	0.3101	0.1511	0.0000	1.53E-07
52		0.00	0.000	0.068	0.3033	0.1510	0.0000	1.53E-07
53		0.30	0.124	0.102	0.3104	0.1510	0.0000	1.53E-07
54		0.10	0.000	0.105	0.3097	0.1509	0.0000	1.53E-07
55		0.08	0.000	0.067	0.3114	0.1509	0.0000	1.53E-07
56		0.70	0.476	0.084	0.3252	0.1509	0.0000	1.53E-07

57		0.00	0.000	0.055	0.3197	0.1508	0.0000	1.53E-07
58		0.00	0.000	0.063	0.3134	0.1508	0.0000	1.53E-07
59	*	0.00	0.000	0.000	0.3134	0.1507	0.0000	1.53E-07
60	*	0.00	0.000	0.019	0.3115	0.1507	0.0000	1.53E-07
61		0.00	0.000	0.077	0.3038	0.1506	0.0000	1.53E-07
62		0.00	0.000	0.028	0.3011	0.1506	0.0000	1.53E-07
63	*	0.00	0.000	0.000	0.3011	0.1505	0.0000	1.53E-07
64	*	0.00	0.000	0.000	0.3011	0.1505	0.0000	1.53E-07
65	*	0.00	0.000	0.000	0.3011	0.1505	0.0000	1.53E-07
66	*	0.00	0.000	0.000	0.3011	0.1504	0.0000	1.53E-07
67	*	0.00	0.000	0.000	0.3011	0.1504	0.0000	1.53E-07
68	*	0.15	0.000	0.011	0.3031	0.1503	0.0000	1.53E-07
69	*	0.00	0.000	0.045	0.3050	0.1503	0.0000	1.53E-07
70	*	0.00	0.000	0.040	0.3066	0.1502	0.0000	1.53E-07
71		0.00	0.000	0.042	0.3024	0.1502	0.0000	1.53E-07
72		0.00	0.000	0.115	0.2909	0.1502	0.0000	1.53E-07
73		0.00	0.000	0.094	0.2816	0.1501	0.0000	1.53E-07
74		0.00	0.000	0.042	0.2773	0.1501	0.0000	1.53E-07
75		0.00	0.000	0.003	0.2770	0.1500	0.0000	1.53E-07
76	*	0.00	0.000	0.000	0.2770	0.1500	0.0000	1.52E-07
77	*	0.00	0.000	0.000	0.2770	0.1499	0.0000	1.52E-07
78		0.00	0.000	0.000	0.2770	0.1499	0.0000	1.52E-07
79		0.00	0.000	0.000	0.2770	0.1498	0.0000	1.52E-07
80	*	0.68	0.000	0.042	0.2790	0.1498	0.0000	1.52E-07
81	*	2.34	0.000	0.000	0.2809	0.1498	0.0000	1.52E-07
82	*	0.00	0.000	0.015	0.2829	0.1497	0.0000	1.52E-07
83		0.02	0.559	0.000	0.2956	0.1497	0.0000	1.52E-07
84		0.57	1.534	0.000	0.3073	0.1496	0.0000	1.52E-07
85		0.01	1.046	0.000	0.3189	0.1496	0.0000	1.52E-07
86		0.06	0.000	0.048	0.3198	0.1495	0.0000	1.52E-07
87		0.04	0.000	0.064	0.3177	0.1495	0.0000	1.52E-07
88		0.01	0.000	0.039	0.3144	0.1495	0.0000	1.52E-07

89		0.00	0.000	0.099	0.3045	0.1494	0.0000	1.52E-07
90		0.00	0.000	0.113	0.2932	0.1494	0.0000	1.52E-07
91		0.00	0.000	0.124	0.2808	0.1493	0.0000	1.52E-07
92		0.04	0.000	0.064	0.2781	0.1493	0.0000	1.52E-07
93		0.00	0.000	0.007	0.2774	0.1492	0.0000	1.52E-07
94		0.00	0.000	0.003	0.2771	0.1492	0.0000	1.52E-07
95	*	0.35	0.000	0.044	0.2791	0.1491	0.0000	1.52E-07
96		0.09	0.199	0.032	0.2934	0.1491	0.0000	1.52E-07
97		0.00	0.000	0.041	0.2893	0.1491	0.0000	1.52E-07
98		0.00	0.000	0.104	0.2789	0.1490	0.0000	1.52E-07
99		0.00	0.000	0.016	0.2773	0.1490	0.0000	1.52E-07
100	*	0.03	0.000	0.036	0.2771	0.1489	0.0000	1.51E-07
101		0.41	0.201	0.074	0.2907	0.1489	0.0000	1.51E-07
102		0.08	0.000	0.045	0.2946	0.1488	0.0000	1.51E-07
103		0.01	0.000	0.026	0.2930	0.1488	0.0000	1.51E-07
104		0.00	0.000	0.017	0.2913	0.1488	0.0000	1.51E-07
105		0.00	0.000	0.017	0.2896	0.1487	0.0000	1.51E-07
106		0.01	0.000	0.026	0.2881	0.1487	0.0000	1.51E-07
107		0.00	0.000	0.015	0.2866	0.1486	0.0000	1.51E-07
108		0.00	0.000	0.015	0.2852	0.1486	0.0000	1.51E-07
109		0.00	0.000	0.014	0.2838	0.1485	0.0000	1.51E-07
110	*	0.00	0.000	0.000	0.2838	0.1485	0.0000	1.51E-07
111	*	0.00	0.000	0.013	0.2825	0.1485	0.0000	1.51E-07
112		0.00	0.000	0.013	0.2812	0.1484	0.0000	1.51E-07
113		0.00	0.000	0.012	0.2800	0.1484	0.0000	1.51E-07
114		1.24	1.027	0.050	0.2960	0.1483	0.0000	1.51E-07
115		0.54	0.326	0.099	0.3076	0.1483	0.0000	1.51E-07
116		0.00	0.000	0.102	0.2974	0.1482	0.0000	1.51E-07
117		0.00	0.000	0.036	0.2938	0.1482	0.0000	1.51E-07
118		0.00	0.000	0.051	0.2887	0.1481	0.0000	1.51E-07
119		0.00	0.000	0.108	0.2779	0.1481	0.0000	1.51E-07
120		0.00	0.000	0.007	0.2772	0.1481	0.0000	1.51E-07

121	0.31	0.123	0.105	0.2854	0.1480	0.0000	1.51E-07
122	0.15	0.000	0.102	0.2905	0.1480	0.0000	1.51E-07
123	0.10	0.000	0.105	0.2895	0.1479	0.0000	1.51E-07
124	0.00	0.000	0.085	0.2811	0.1479	0.0000	1.51E-07
125	0.00	0.000	0.029	0.2782	0.1478	0.0000	1.50E-07
126	0.00	0.000	0.010	0.2773	0.1478	0.0000	1.50E-07
127	2.03	1.795	0.069	0.2935	0.1478	0.0000	1.50E-07
128	0.00	0.000	0.066	0.2869	0.1477	0.0000	1.50E-07
129	0.00	0.000	0.077	0.2792	0.1477	0.0000	1.50E-07
130	0.00	0.000	0.019	0.2773	0.1476	0.0000	1.50E-07
131	0.00	0.000	0.002	0.2771	0.1476	0.0000	1.50E-07
132	0.00	0.000	0.001	0.2770	0.1475	0.0000	1.50E-07
133	0.00	0.000	0.000	0.2770	0.1475	0.0000	1.50E-07
134	0.02	0.000	0.017	0.2771	0.1475	0.0000	1.50E-07
135	0.09	0.000	0.034	0.2828	0.1474	0.0000	1.50E-07
136	0.09	0.000	0.043	0.2873	0.1474	0.0000	1.50E-07
137	0.40	0.201	0.060	0.3010	0.1473	0.0000	1.50E-07
138	0.32	0.148	0.059	0.3124	0.1473	0.0000	1.50E-07
139	0.00	0.000	0.097	0.3028	0.1472	0.0000	1.50E-07
140	0.00	0.000	0.057	0.2971	0.1472	0.0000	1.50E-07
141	1.06	0.750	0.163	0.3118	0.1472	0.0000	1.50E-07
142	0.03	0.000	0.111	0.3038	0.1471	0.0000	1.50E-07
143	0.00	0.000	0.091	0.2947	0.1471	0.0000	1.50E-07
144	0.10	0.000	0.178	0.2869	0.1470	0.0000	1.50E-07
145	0.01	0.000	0.077	0.2803	0.1470	0.0000	1.50E-07
146	0.98	0.663	0.166	0.2957	0.1469	0.0000	1.50E-07
147	0.00	0.000	0.057	0.2901	0.1469	0.0000	1.50E-07
148	0.18	0.016	0.091	0.2976	0.1469	0.0000	1.50E-07
149	0.02	0.000	0.055	0.2941	0.1468	0.0000	1.50E-07
150	0.10	0.000	0.081	0.2957	0.1468	0.0000	1.49E-07
151	0.03	0.000	0.131	0.2861	0.1467	0.0000	1.49E-07
152	0.44	0.155	0.167	0.2980	0.1467	0.0000	1.49E-07

153	0.18	0.011	0.159	0.2988	0.1466	0.0000	1.49E-07
154	1.14	0.815	0.207	0.3101	0.1466	0.0000	1.49E-07
155	0.00	0.000	0.162	0.2938	0.1466	0.0000	1.49E-07
156	0.00	0.000	0.139	0.2799	0.1465	0.0000	1.49E-07
157	0.00	0.000	0.022	0.2777	0.1465	0.0000	1.49E-07
158	0.19	0.020	0.062	0.2887	0.1464	0.0000	1.49E-07
159	0.06	0.000	0.049	0.2898	0.1464	0.0000	1.49E-07
160	0.79	0.588	0.072	0.3028	0.1463	0.0000	1.49E-07
161	0.01	0.000	0.106	0.2936	0.1463	0.0000	1.49E-07
162	0.00	0.000	0.120	0.2816	0.1463	0.0000	1.49E-07
163	0.00	0.000	0.040	0.2776	0.1462	0.0000	1.49E-07
164	0.00	0.000	0.004	0.2771	0.1462	0.0000	1.49E-07
165	0.25	0.084	0.053	0.2889	0.1461	0.0000	1.49E-07
166	0.19	0.033	0.050	0.2992	0.1461	0.0000	1.49E-07
167	0.95	0.767	0.066	0.3106	0.1460	0.0000	1.49E-07
168	0.00	0.000	0.103	0.3004	0.1460	0.0000	1.49E-07
169	0.00	0.000	0.119	0.2884	0.1460	0.0000	1.49E-07
170	0.00	0.000	0.095	0.2789	0.1459	0.0000	1.49E-07
171	0.29	0.119	0.085	0.2879	0.1459	0.0000	1.49E-07
172	0.00	0.000	0.028	0.2852	0.1458	0.0000	1.49E-07
173	0.28	0.105	0.064	0.2967	0.1458	0.0000	1.49E-07
174	0.77	0.530	0.122	0.3081	0.1457	0.0000	1.49E-07
175	0.39	0.195	0.109	0.3171	0.1457	0.0000	1.48E-07
176	2.08	1.736	0.235	0.3284	0.1457	0.0000	1.48E-07
177	0.00	0.000	0.045	0.3238	0.1456	0.0000	1.48E-07
178	1.11	0.858	0.099	0.3387	0.1456	0.0000	1.48E-07
179	0.14	0.017	0.236	0.3271	0.1455	0.0000	1.48E-07
180	0.02	0.000	0.086	0.3205	0.1455	0.0000	1.48E-07
181	0.00	0.000	0.203	0.3002	0.1454	0.0000	1.48E-07
182	0.00	0.000	0.172	0.2830	0.1454	0.0000	1.48E-07
183	0.00	0.000	0.053	0.2777	0.1454	0.0000	1.48E-07
184	0.00	0.000	0.005	0.2772	0.1453	0.0000	1.48E-07

185	0.00	0.000	0.002	0.2770	0.1453	0.0000	1.48E-07
186	0.00	0.000	0.000	0.2770	0.1452	0.0000	1.48E-07
187	0.00	0.000	0.000	0.2770	0.1452	0.0000	1.48E-07
188	0.00	0.000	0.000	0.2770	0.1451	0.0000	1.48E-07
189	0.06	0.000	0.031	0.2801	0.1451	0.0000	1.48E-07
190	0.00	0.000	0.002	0.2799	0.1451	0.0000	1.48E-07
191	0.00	0.000	0.011	0.2791	0.1450	0.0000	1.48E-07
192	0.11	0.000	0.036	0.2860	0.1450	0.0000	1.48E-07
193	0.02	0.000	0.027	0.2855	0.1449	0.0000	1.48E-07
194	0.01	0.000	0.027	0.2840	0.1449	0.0000	1.48E-07
195	0.92	0.730	0.057	0.2974	0.1449	0.0000	1.48E-07
196	0.34	0.135	0.093	0.3087	0.1448	0.0000	1.48E-07
197	0.29	0.127	0.100	0.3145	0.1448	0.0000	1.48E-07
198	0.00	0.000	0.166	0.2981	0.1447	0.0000	1.48E-07
199	0.00	0.000	0.168	0.2813	0.1447	0.0000	1.48E-07
200	0.00	0.000	0.033	0.2780	0.1446	0.0000	1.48E-07
201	0.00	0.000	0.008	0.2772	0.1446	0.0000	1.47E-07
202	0.00	0.000	0.002	0.2770	0.1446	0.0000	1.47E-07
203	0.00	0.000	0.000	0.2770	0.1445	0.0000	1.47E-07
204	0.00	0.000	0.000	0.2770	0.1445	0.0000	1.47E-07
205	0.00	0.000	0.000	0.2770	0.1444	0.0000	1.47E-07
206	0.87	0.648	0.061	0.2931	0.1444	0.0000	1.47E-07
207	0.66	0.407	0.143	0.3046	0.1443	0.0000	1.47E-07
208	0.00	0.000	0.107	0.2939	0.1443	0.0000	1.47E-07
209	0.00	0.000	0.056	0.2883	0.1443	0.0000	1.47E-07
210	0.00	0.000	0.065	0.2818	0.1442	0.0000	1.47E-07
211	0.04	0.000	0.065	0.2796	0.1442	0.0000	1.47E-07
212	0.00	0.000	0.013	0.2783	0.1441	0.0000	1.47E-07
213	0.00	0.000	0.010	0.2773	0.1441	0.0000	1.47E-07
214	0.00	0.000	0.003	0.2770	0.1440	0.0000	1.47E-07
215	0.52	0.308	0.065	0.2921	0.1440	0.0000	1.47E-07
216	0.01	0.000	0.093	0.2841	0.1440	0.0000	1.47E-07

217	0.00	0.000	0.023	0.2818	0.1439	0.0000	1.47E-07
218	0.81	0.592	0.062	0.2978	0.1439	0.0000	1.47E-07
219	0.44	0.228	0.103	0.3090	0.1438	0.0000	1.47E-07
220	0.00	0.000	0.064	0.3027	0.1438	0.0000	1.47E-07
221	0.05	0.000	0.076	0.3004	0.1438	0.0000	1.47E-07
222	0.12	0.000	0.151	0.2972	0.1437	0.0000	1.47E-07
223	0.00	0.000	0.140	0.2832	0.1437	0.0000	1.47E-07
224	0.00	0.000	0.044	0.2788	0.1436	0.0000	1.47E-07
225	0.00	0.000	0.014	0.2775	0.1436	0.0000	1.47E-07
226	0.00	0.000	0.004	0.2771	0.1435	0.0000	1.46E-07
227	0.00	0.000	0.001	0.2770	0.1435	0.0000	1.46E-07
228	0.00	0.000	0.000	0.2770	0.1435	0.0000	1.46E-07
229	0.00	0.000	0.000	0.2770	0.1434	0.0000	1.46E-07
230	0.06	0.000	0.031	0.2795	0.1434	0.0000	1.46E-07
231	0.00	0.000	0.003	0.2792	0.1433	0.0000	1.46E-07
232	0.00	0.000	0.007	0.2786	0.1433	0.0000	1.46E-07
233	0.00	0.000	0.006	0.2780	0.1433	0.0000	1.46E-07
234	0.00	0.000	0.006	0.2774	0.1432	0.0000	1.46E-07
235	0.00	0.000	0.003	0.2771	0.1432	0.0000	1.46E-07
236	0.00	0.000	0.001	0.2770	0.1431	0.0000	1.46E-07
237	0.00	0.000	0.000	0.2770	0.1431	0.0000	1.46E-07
238	0.00	0.000	0.000	0.2770	0.1430	0.0000	1.46E-07
239	0.00	0.000	0.000	0.2770	0.1430	0.0000	1.46E-07
240	0.07	0.000	0.032	0.2808	0.1430	0.0000	1.46E-07
241	0.60	0.423	0.055	0.2929	0.1429	0.0000	1.46E-07
242	0.00	0.000	0.009	0.2920	0.1429	0.0000	1.46E-07
243	0.00	0.000	0.013	0.2907	0.1428	0.0000	1.46E-07
244	0.00	0.000	0.018	0.2889	0.1428	0.0000	1.46E-07
245	0.00	0.000	0.015	0.2874	0.1427	0.0000	1.46E-07
246	1.76	1.565	0.054	0.3019	0.1427	0.0000	1.46E-07
247	0.14	0.002	0.076	0.3076	0.1427	0.0000	1.46E-07
248	0.00	0.000	0.039	0.3042	0.1426	0.0000	1.46E-07

249		0.00	0.000	0.032	0.3009	0.1426	0.0000	1.46E-07
250		0.00	0.000	0.032	0.2978	0.1425	0.0000	1.46E-07
251		0.00	0.000	0.076	0.2902	0.1425	0.0000	1.46E-07
252		0.00	0.000	0.098	0.2804	0.1425	0.0000	1.45E-07
253		0.00	0.000	0.026	0.2777	0.1424	0.0000	1.45E-07
254		0.00	0.000	0.006	0.2771	0.1424	0.0000	1.45E-07
255		0.00	0.000	0.001	0.2770	0.1423	0.0000	1.45E-07
256		0.00	0.000	0.000	0.2770	0.1423	0.0000	1.45E-07
257		0.37	0.163	0.071	0.2903	0.1423	0.0000	1.45E-07
258		0.00	0.000	0.017	0.2886	0.1422	0.0000	1.45E-07
259		0.00	0.000	0.023	0.2863	0.1422	0.0000	1.45E-07
260		0.64	0.426	0.065	0.3010	0.1421	0.0000	1.45E-07
261		0.00	0.000	0.059	0.2951	0.1421	0.0000	1.45E-07
262		0.00	0.000	0.127	0.2824	0.1420	0.0000	1.45E-07
263		0.00	0.000	0.043	0.2781	0.1420	0.0000	1.45E-07
264		0.00	0.000	0.010	0.2772	0.1420	0.0000	1.45E-07
265		0.00	0.000	0.001	0.2770	0.1419	0.0000	1.45E-07
266		0.00	0.000	0.000	0.2770	0.1419	0.0000	1.45E-07
267	*	0.18	0.000	0.048	0.2790	0.1418	0.0000	1.45E-07
268	*	0.07	0.000	0.069	0.2809	0.1418	0.0000	1.45E-07
269		0.10	0.031	0.000	0.2936	0.1418	0.0000	1.45E-07
270		0.01	0.000	0.061	0.2920	0.1417	0.0000	1.45E-07
271		0.64	0.384	0.116	0.3060	0.1417	0.0000	1.45E-07
272		0.65	0.447	0.085	0.3175	0.1416	0.0000	1.45E-07
273		0.46	0.270	0.078	0.3290	0.1416	0.0000	1.45E-07
274		0.00	0.000	0.037	0.3253	0.1415	0.0000	1.45E-07
275		0.02	0.000	0.071	0.3201	0.1415	0.0000	1.45E-07
276		0.00	0.000	0.098	0.3104	0.1415	0.0000	1.45E-07
277		0.00	0.000	0.136	0.2968	0.1414	0.0000	1.45E-07
278		0.00	0.000	0.059	0.2909	0.1414	0.0000	1.44E-07
279		0.00	0.000	0.119	0.2790	0.1413	0.0000	1.44E-07
280		0.00	0.000	0.018	0.2772	0.1413	0.0000	1.44E-07

281		0.00	0.000	0.002	0.2770	0.1413	0.0000	1.44E-07
282		0.00	0.000	0.000	0.2770	0.1412	0.0000	1.44E-07
283		0.00	0.000	0.003	0.2770	0.1412	0.0000	1.44E-07
284		0.00	0.000	0.000	0.2770	0.1411	0.0000	1.44E-07
285		0.02	0.000	0.016	0.2771	0.1411	0.0000	1.44E-07
286		0.05	0.000	0.029	0.2793	0.1411	0.0000	1.44E-07
287		0.20	0.033	0.045	0.2919	0.1410	0.0000	1.44E-07
288		0.30	0.128	0.057	0.3035	0.1410	0.0000	1.44E-07
289		0.00	0.000	0.009	0.3026	0.1409	0.0000	1.44E-07
290		0.00	0.000	0.014	0.3012	0.1409	0.0000	1.44E-07
291		0.67	0.484	0.054	0.3146	0.1409	0.0000	1.44E-07
292		0.00	0.000	0.094	0.3052	0.1408	0.0000	1.44E-07
293		0.00	0.000	0.073	0.2979	0.1408	0.0000	1.44E-07
294		0.00	0.000	0.084	0.2895	0.1407	0.0000	1.44E-07
295		0.00	0.000	0.027	0.2867	0.1407	0.0000	1.44E-07
296		0.00	0.000	0.046	0.2822	0.1406	0.0000	1.44E-07
297		0.01	0.000	0.031	0.2802	0.1406	0.0000	1.44E-07
298		0.06	0.000	0.061	0.2806	0.1406	0.0000	1.44E-07
299		0.00	0.000	0.005	0.2801	0.1405	0.0000	1.44E-07
300		0.00	0.000	0.010	0.2791	0.1405	0.0000	1.44E-07
301		0.00	0.000	0.005	0.2787	0.1404	0.0000	1.44E-07
302		0.00	0.000	0.005	0.2782	0.1404	0.0000	1.44E-07
303		0.02	0.000	0.018	0.2782	0.1404	0.0000	1.44E-07
304		0.00	0.000	0.002	0.2780	0.1403	0.0000	1.43E-07
305	*	0.00	0.000	0.004	0.2776	0.1403	0.0000	1.43E-07
306	*	0.04	0.000	0.048	0.2773	0.1402	0.0000	1.43E-07
307		0.00	0.000	0.002	0.2771	0.1402	0.0000	1.43E-07
308	*	0.00	0.000	0.000	0.2770	0.1402	0.0000	1.43E-07
309		0.00	0.000	0.000	0.2770	0.1401	0.0000	1.43E-07
310	*	0.00	0.000	0.000	0.2770	0.1401	0.0000	1.43E-07
311	*	0.16	0.000	0.038	0.2790	0.1400	0.0000	1.43E-07
312	*	0.00	0.000	0.028	0.2809	0.1400	0.0000	1.43E-07

313		0.00	0.000	0.064	0.2805	0.1399	0.0000	1.43E-07
314	*	0.00	0.000	0.007	0.2798	0.1399	0.0000	1.43E-07
315		0.00	0.000	0.012	0.2791	0.1399	0.0000	1.43E-07
316	*	0.04	0.000	0.036	0.2796	0.1398	0.0000	1.43E-07
317	*	0.21	0.000	0.040	0.2815	0.1398	0.0000	1.43E-07
318		0.23	0.190	0.070	0.2943	0.1398	0.0000	1.43E-07
319		0.43	0.263	0.050	0.3059	0.1397	0.0000	1.43E-07
320		0.09	0.000	0.100	0.3046	0.1397	0.0000	1.43E-07
321		0.00	0.000	0.074	0.2973	0.1396	0.0000	1.43E-07
322		0.11	0.000	0.089	0.2990	0.1396	0.0000	1.43E-07
323		0.00	0.000	0.029	0.2962	0.1396	0.0000	1.43E-07
324		0.00	0.000	0.034	0.2927	0.1395	0.0000	1.43E-07
325		0.00	0.000	0.024	0.2903	0.1395	0.0000	1.43E-07
326		0.00	0.000	0.021	0.2882	0.1394	0.0000	1.43E-07
327		0.00	0.000	0.019	0.2864	0.1394	0.0000	1.43E-07
328		0.00	0.000	0.017	0.2847	0.1394	0.0000	1.43E-07
329		0.00	0.000	0.014	0.2832	0.1393	0.0000	1.43E-07
330		0.00	0.000	0.016	0.2816	0.1393	0.0000	1.43E-07
331		0.00	0.000	0.017	0.2799	0.1392	0.0000	1.42E-07
332		0.00	0.000	0.018	0.2780	0.1392	0.0000	1.42E-07
333		0.00	0.000	0.009	0.2771	0.1392	0.0000	1.42E-07
334		0.00	0.000	0.001	0.2770	0.1391	0.0000	1.42E-07
335		0.00	0.000	0.000	0.2770	0.1391	0.0000	1.42E-07
336	*	0.00	0.000	0.000	0.2770	0.1390	0.0000	1.42E-07
337	*	0.01	0.000	0.012	0.2770	0.1390	0.0000	1.42E-07
338	*	0.00	0.000	0.000	0.2770	0.1389	0.0000	1.42E-07
339	*	0.00	0.000	0.000	0.2770	0.1389	0.0000	1.42E-07
340	*	0.00	0.000	0.000	0.2770	0.1389	0.0000	1.42E-07
341	*	0.07	0.000	0.014	0.2790	0.1388	0.0000	1.42E-07
342	*	0.05	0.000	0.000	0.2809	0.1388	0.0000	1.42E-07
343	*	0.03	0.000	0.000	0.2829	0.1387	0.0000	1.42E-07
344	*	0.00	0.000	0.039	0.2849	0.1387	0.0000	1.42E-07

345	*	0.00	0.000	0.019	0.2843	0.1387	0.0000	1.42E-07
346	*	0.06	0.000	0.036	0.2863	0.1386	0.0000	1.42E-07
347	*	0.00	0.000	0.000	0.2863	0.1386	0.0000	1.42E-07
348	*	0.00	0.000	0.000	0.2863	0.1385	0.0000	1.42E-07
349	*	0.00	0.000	0.004	0.2863	0.1385	0.0000	1.42E-07
350	*	0.06	0.000	0.008	0.2882	0.1385	0.0000	1.42E-07
351	*	0.00	0.000	0.014	0.2902	0.1384	0.0000	1.42E-07
352	*	0.00	0.000	0.000	0.2902	0.1384	0.0000	1.42E-07
353		0.00	0.000	0.007	0.2895	0.1383	0.0000	1.42E-07
354		0.14	0.000	0.042	0.2997	0.1383	0.0000	1.42E-07
355		0.74	0.569	0.049	0.3123	0.1383	0.0000	1.42E-07
356		0.00	0.000	0.027	0.3096	0.1382	0.0000	1.42E-07
357		0.00	0.000	0.016	0.3080	0.1382	0.0000	1.41E-07
358	*	0.00	0.000	0.000	0.3080	0.1381	0.0000	1.41E-07
359		0.06	0.000	0.042	0.3098	0.1381	0.0000	1.41E-07
360		0.01	0.000	0.045	0.3067	0.1381	0.0000	1.41E-07
361		0.00	0.000	0.030	0.3036	0.1380	0.0000	1.41E-07
362		0.00	0.000	0.033	0.3003	0.1380	0.0000	1.41E-07
363		0.00	0.000	0.041	0.2962	0.1379	0.0000	1.41E-07
364		0.00	0.000	0.034	0.2928	0.1379	0.0000	1.41E-07
365		0.00	0.000	0.029	0.2899	0.1379	0.0000	1.41E-07

* = Frozen (air or soil)

Annual Totals for Year 26

	inches	cubic feet	percent
Precipitation	41.89	152,056.3	100.00
Runoff	25.954	94,212.9	61.96
Evapotranspiration	16.266	59,043.9	38.83
Recirculation into Layer 1	0.0060	21.8	0.01
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0060	21.8	0.01
Percolation/Leakage through Layer 5	0.000054	0.1964	0.00
Average Head on Top of Layer 4	0.1454	---	---
Change in Water Storage	-0.3307	-1,200.6	-0.79
Soil Water at Start of Year	1,406.9686	5,107,296.1	3358.82
Soil Water at End of Year	1,406.6379	5,106,095.5	3358.03
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0060	-21.9	-0.01

Daily Output for Year 27

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.18	0.000	0.044	0.2919	0.1378	0.0000	1.41E-07
2			0.00	0.000	0.089	0.2942	0.1378	0.0000	1.41E-07
3			0.00	0.000	0.026	0.2917	0.1377	0.0000	1.41E-07
4			0.00	0.000	0.020	0.2896	0.1377	0.0000	1.41E-07
5	*		0.00	0.000	0.020	0.2877	0.1377	0.0000	1.41E-07
6	*		0.00	0.000	0.017	0.2860	0.1376	0.0000	1.41E-07
7	*		0.00	0.000	0.000	0.2860	0.1376	0.0000	1.41E-07
8	*		0.00	0.000	0.000	0.2860	0.1375	0.0000	1.41E-07
9	*		0.00	0.000	0.016	0.2845	0.1375	0.0000	1.41E-07
10			0.00	0.000	0.018	0.2827	0.1375	0.0000	1.41E-07
11			0.00	0.000	0.013	0.2814	0.1374	0.0000	1.41E-07
12			0.00	0.000	0.014	0.2800	0.1374	0.0000	1.41E-07
13			0.00	0.000	0.015	0.2785	0.1373	0.0000	1.41E-07
14			0.05	0.000	0.039	0.2792	0.1373	0.0000	1.41E-07
15	*		0.00	0.000	0.000	0.2792	0.1372	0.0000	1.41E-07
16	*		0.00	0.000	0.000	0.2792	0.1372	0.0000	1.41E-07
17	*		0.00	0.000	0.000	0.2792	0.1372	0.0000	1.41E-07
18	*		0.00	0.000	0.000	0.2792	0.1371	0.0000	1.41E-07
19	*		0.00	0.000	0.000	0.2792	0.1371	0.0000	1.40E-07
20			0.00	0.000	0.006	0.2786	0.1370	0.0000	1.40E-07
21			0.00	0.000	0.003	0.2783	0.1370	0.0000	1.40E-07
22	*		0.00	0.000	0.003	0.2780	0.1370	0.0000	1.40E-07
23			0.03	0.000	0.023	0.2788	0.1369	0.0000	1.40E-07
24			0.47	0.280	0.049	0.2933	0.1369	0.0000	1.40E-07

25	*		0.31	0.000	0.022	0.2953	0.1368	0.0000	1.40E-07
26	*		0.24	0.000	0.023	0.2973	0.1368	0.0000	1.40E-07
27	*		0.00	0.000	0.040	0.2992	0.1368	0.0000	1.40E-07
28	*	*	0.00	0.000	0.018	0.2992	0.1367	0.0000	1.40E-07
29	*	*	0.00	0.000	0.035	0.2992	0.1367	0.0000	1.40E-07
30	*	*	0.00	0.000	0.019	0.2992	0.1366	0.0000	1.40E-07
31		*	0.00	0.295	0.031	0.3004	0.1366	0.0000	1.40E-07
32		*	0.00	0.000	0.000	0.3004	0.1366	0.0000	1.40E-07
33			0.00	0.000	0.014	0.2990	0.1365	0.0000	1.40E-07
34	*		0.00	0.000	0.000	0.2990	0.1365	0.0000	1.40E-07
35	*	*	0.29	0.000	0.038	0.2990	0.1364	0.0000	1.40E-07
36	*	*	0.14	0.000	0.019	0.2990	0.1364	0.0000	1.40E-07
37	*	*	0.76	0.000	0.022	0.2990	0.1364	0.0000	1.40E-07
38	*	*	0.00	0.000	0.012	0.2990	0.1363	0.0000	1.40E-07
39	*	*	0.00	0.000	0.026	0.2990	0.1363	0.0000	1.40E-07
40	*	*	0.00	0.000	0.035	0.2990	0.1362	0.0000	1.40E-07
41	*	*	0.00	0.000	0.000	0.2990	0.1362	0.0000	1.40E-07
42	*	*	0.24	0.000	0.000	0.2990	0.1362	0.0000	1.40E-07
43	*	*	0.01	0.000	0.000	0.2990	0.1361	0.0000	1.40E-07
44	*	*	0.24	0.000	0.000	0.2990	0.1361	0.0000	1.40E-07
45		*	0.01	1.520	0.000	0.3006	0.1360	0.0000	1.39E-07
46		*	0.00	0.000	0.000	0.3006	0.1360	0.0000	1.39E-07
47			0.00	0.000	0.059	0.2947	0.1360	0.0000	1.39E-07
48			0.00	0.000	0.035	0.2912	0.1360	0.0000	1.39E-07
49	*		0.00	0.000	0.000	0.2912	0.1359	0.0000	1.39E-07
50	*	*	0.00	0.000	0.000	0.2912	0.1359	0.0000	1.39E-07
51		*	0.00	0.000	0.000	0.2912	0.1358	0.0000	1.39E-07
52		*	0.00	0.000	0.000	0.2912	0.1358	0.0000	1.39E-07
53			0.00	0.000	0.025	0.2887	0.1358	0.0000	1.39E-07
54			0.00	0.000	0.075	0.2812	0.1357	0.0000	1.39E-07
55			0.00	0.000	0.031	0.2781	0.1357	0.0000	1.39E-07
56			0.64	0.353	0.144	0.2925	0.1357	0.0000	1.39E-07

57		0.26	0.087	0.093	0.3000	0.1356	0.0000	1.39E-07
58		0.01	0.000	0.037	0.2976	0.1356	0.0000	1.39E-07
59		0.13	0.000	0.050	0.3059	0.1355	0.0000	1.39E-07
60	*	0.01	0.000	0.009	0.3059	0.1355	0.0000	1.39E-07
61	*	0.06	0.000	0.035	0.3078	0.1355	0.0000	1.39E-07
62		0.47	0.256	0.095	0.3206	0.1354	0.0000	1.39E-07
63		0.00	0.000	0.020	0.3186	0.1354	0.0000	1.39E-07
64		0.07	0.000	0.051	0.3203	0.1353	0.0000	1.39E-07
65		0.48	0.258	0.093	0.3328	0.1353	0.0000	1.39E-07
66		0.00	0.000	0.056	0.3273	0.1353	0.0000	1.39E-07
67		0.55	0.356	0.062	0.3407	0.1352	0.0000	1.39E-07
68		0.03	0.000	0.046	0.3388	0.1352	0.0000	1.39E-07
69		0.06	0.000	0.081	0.3369	0.1352	0.0000	1.39E-07
70		0.00	0.000	0.024	0.3345	0.1351	0.0000	1.39E-07
71		0.00	0.000	0.074	0.3271	0.1351	0.0000	1.39E-07
72		0.01	0.000	0.039	0.3245	0.1351	0.0000	1.39E-07
73		0.01	0.000	0.041	0.3214	0.1350	0.0000	1.39E-07
74		0.10	0.000	0.082	0.3232	0.1350	0.0000	1.39E-07
75		0.28	0.100	0.162	0.3249	0.1349	0.0000	1.38E-07
76		0.00	0.000	0.111	0.3138	0.1349	0.0000	1.38E-07
77		0.00	0.000	0.042	0.3096	0.1349	0.0000	1.38E-07
78		0.00	0.000	0.064	0.3032	0.1348	0.0000	1.38E-07
79		2.15	1.924	0.081	0.3182	0.1348	0.0000	1.38E-07
80		0.00	0.000	0.033	0.3149	0.1348	0.0000	1.38E-07
81		0.00	0.000	0.093	0.3056	0.1347	0.0000	1.38E-07
82		0.12	0.000	0.088	0.3090	0.1347	0.0000	1.38E-07
83		0.13	0.000	0.122	0.3098	0.1346	0.0000	1.38E-07
84	*	0.00	0.000	0.054	0.3043	0.1346	0.0000	1.38E-07
85		0.39	0.150	0.145	0.3137	0.1346	0.0000	1.38E-07
86		1.20	0.949	0.140	0.3253	0.1345	0.0000	1.38E-07
87		0.00	0.000	0.087	0.3166	0.1345	0.0000	1.38E-07
88		0.00	0.000	0.147	0.3019	0.1344	0.0000	1.38E-07

89		0.00	0.000	0.059	0.2961	0.1344	0.0000	1.38E-07
90	*	0.00	0.000	0.062	0.2901	0.1344	0.0000	1.38E-07
91	*	0.00	0.000	0.001	0.2901	0.1343	0.0000	1.38E-07
92	*	0.00	0.000	0.000	0.2901	0.1343	0.0000	1.38E-07
93		0.33	0.133	0.146	0.2952	0.1342	0.0000	1.38E-07
94		0.00	0.000	0.034	0.2917	0.1342	0.0000	1.38E-07
95		0.29	0.102	0.080	0.3024	0.1342	0.0000	1.38E-07
96		0.00	0.000	0.059	0.2965	0.1341	0.0000	1.38E-07
97		0.00	0.000	0.073	0.2891	0.1341	0.0000	1.38E-07
98		0.00	0.000	0.064	0.2827	0.1340	0.0000	1.38E-07
99		0.00	0.000	0.040	0.2788	0.1340	0.0000	1.38E-07
100		0.22	0.040	0.093	0.2872	0.1340	0.0000	1.38E-07
101		0.00	0.000	0.037	0.2836	0.1339	0.0000	1.38E-07
102		0.00	0.000	0.049	0.2787	0.1339	0.0000	1.37E-07
103		0.02	0.000	0.038	0.2773	0.1338	0.0000	1.37E-07
104		0.00	0.000	0.002	0.2771	0.1338	0.0000	1.37E-07
105		0.93	0.689	0.077	0.2933	0.1338	0.0000	1.37E-07
106		0.00	0.000	0.024	0.2909	0.1337	0.0000	1.37E-07
107		0.00	0.000	0.067	0.2842	0.1337	0.0000	1.37E-07
108		0.00	0.000	0.039	0.2802	0.1337	0.0000	1.37E-07
109		0.18	0.003	0.089	0.2890	0.1336	0.0000	1.37E-07
110	*	0.26	0.000	0.040	0.2909	0.1336	0.0000	1.37E-07
111		0.00	0.003	0.123	0.2987	0.1335	0.0000	1.37E-07
112		0.03	0.000	0.041	0.2978	0.1335	0.0000	1.37E-07
113	*	0.04	0.000	0.096	0.2926	0.1335	0.0000	1.37E-07
114		0.02	0.000	0.051	0.2899	0.1334	0.0000	1.37E-07
115		0.12	0.000	0.098	0.2925	0.1334	0.0000	1.37E-07
116		0.41	0.185	0.089	0.3056	0.1333	0.0000	1.37E-07
117		0.22	0.054	0.122	0.3100	0.1333	0.0000	1.37E-07
118		0.00	0.000	0.057	0.3047	0.1333	0.0000	1.37E-07
119		0.01	0.000	0.158	0.2896	0.1333	0.0000	1.37E-07
120		0.00	0.000	0.069	0.2827	0.1333	0.0000	1.37E-07

121	0.28	0.104	0.086	0.2914	0.1333	0.0000	1.37E-07
122	0.06	0.000	0.067	0.2904	0.1332	0.0000	1.37E-07
123	0.08	0.000	0.056	0.2926	0.1332	0.0000	1.37E-07
124	0.00	0.000	0.019	0.2907	0.1331	0.0000	1.37E-07
125	0.00	0.000	0.017	0.2891	0.1331	0.0000	1.37E-07
126	0.00	0.000	0.020	0.2871	0.1331	0.0000	1.37E-07
127	0.00	0.000	0.018	0.2852	0.1330	0.0000	1.37E-07
128	0.19	0.034	0.052	0.2959	0.1330	0.0000	1.37E-07
129	0.00	0.000	0.069	0.2889	0.1329	0.0000	1.37E-07
130	0.00	0.000	0.016	0.2873	0.1329	0.0000	1.37E-07
131	0.00	0.000	0.016	0.2857	0.1329	0.0000	1.37E-07
132	0.00	0.000	0.014	0.2843	0.1328	0.0000	1.36E-07
133	0.00	0.000	0.014	0.2828	0.1328	0.0000	1.36E-07
134	0.00	0.000	0.013	0.2815	0.1327	0.0000	1.36E-07
135	0.00	0.000	0.013	0.2803	0.1327	0.0000	1.36E-07
136	0.00	0.000	0.017	0.2786	0.1327	0.0000	1.36E-07
137	0.00	0.000	0.013	0.2772	0.1326	0.0000	1.36E-07
138	0.00	0.000	0.002	0.2771	0.1326	0.0000	1.36E-07
139	0.00	0.000	0.001	0.2770	0.1326	0.0000	1.36E-07
140	0.04	0.000	0.024	0.2783	0.1325	0.0000	1.36E-07
141	0.43	0.229	0.052	0.2930	0.1325	0.0000	1.36E-07
142	0.00	0.000	0.009	0.2921	0.1324	0.0000	1.36E-07
143	0.01	0.000	0.016	0.2910	0.1324	0.0000	1.36E-07
144	0.31	0.120	0.051	0.3047	0.1324	0.0000	1.36E-07
145	0.15	0.006	0.068	0.3121	0.1323	0.0000	1.36E-07
146	0.00	0.000	0.085	0.3036	0.1323	0.0000	1.36E-07
147	0.65	0.320	0.192	0.3173	0.1322	0.0000	1.36E-07
148	0.00	0.000	0.075	0.3099	0.1322	0.0000	1.36E-07
149	0.00	0.000	0.082	0.3016	0.1322	0.0000	1.36E-07
150	0.00	0.000	0.086	0.2930	0.1321	0.0000	1.36E-07
151	0.00	0.000	0.083	0.2848	0.1321	0.0000	1.36E-07
152	0.00	0.000	0.067	0.2781	0.1321	0.0000	1.36E-07

153	0.04	0.000	0.036	0.2782	0.1320	0.0000	1.36E-07
154	0.00	0.000	0.006	0.2776	0.1320	0.0000	1.36E-07
155	0.00	0.000	0.004	0.2772	0.1319	0.0000	1.36E-07
156	0.00	0.000	0.001	0.2771	0.1319	0.0000	1.36E-07
157	0.62	0.392	0.065	0.2931	0.1319	0.0000	1.36E-07
158	0.08	0.000	0.086	0.2930	0.1318	0.0000	1.36E-07
159	0.50	0.316	0.066	0.3052	0.1318	0.0000	1.36E-07
160	0.34	0.153	0.100	0.3138	0.1317	0.0000	1.35E-07
161	0.00	0.000	0.105	0.3033	0.1317	0.0000	1.35E-07
162	0.00	0.000	0.143	0.2890	0.1317	0.0000	1.35E-07
163	0.11	0.000	0.088	0.2912	0.1316	0.0000	1.35E-07
164	0.00	0.000	0.111	0.2801	0.1316	0.0000	1.35E-07
165	0.01	0.000	0.033	0.2779	0.1316	0.0000	1.35E-07
166	0.04	0.000	0.037	0.2786	0.1315	0.0000	1.35E-07
167	1.12	0.895	0.082	0.2931	0.1315	0.0000	1.35E-07
168	0.00	0.000	0.056	0.2874	0.1314	0.0000	1.35E-07
169	0.00	0.000	0.047	0.2828	0.1314	0.0000	1.35E-07
170	0.46	0.177	0.266	0.2844	0.1314	0.0000	1.35E-07
171	0.00	0.000	0.043	0.2801	0.1313	0.0000	1.35E-07
172	0.00	0.000	0.025	0.2776	0.1313	0.0000	1.35E-07
173	0.10	0.000	0.043	0.2831	0.1312	0.0000	1.35E-07
174	0.00	0.000	0.022	0.2808	0.1312	0.0000	1.35E-07
175	0.07	0.000	0.051	0.2825	0.1312	0.0000	1.35E-07
176	0.36	0.158	0.074	0.2955	0.1311	0.0000	1.35E-07
177	0.19	0.018	0.114	0.3008	0.1311	0.0000	1.35E-07
178	0.33	0.127	0.161	0.3047	0.1311	0.0000	1.35E-07
179	0.19	0.015	0.177	0.3045	0.1310	0.0000	1.35E-07
180	0.00	0.000	0.095	0.2950	0.1310	0.0000	1.35E-07
181	0.05	0.000	0.069	0.2932	0.1309	0.0000	1.35E-07
182	0.00	0.000	0.039	0.2893	0.1309	0.0000	1.35E-07
183	0.00	0.000	0.034	0.2859	0.1309	0.0000	1.35E-07
184	0.01	0.000	0.045	0.2827	0.1308	0.0000	1.35E-07

185	0.63	0.406	0.076	0.2970	0.1308	0.0000	1.35E-07
186	0.00	0.000	0.105	0.2864	0.1307	0.0000	1.35E-07
187	0.09	0.000	0.070	0.2883	0.1307	0.0000	1.34E-07
188	0.00	0.000	0.035	0.2848	0.1307	0.0000	1.34E-07
189	0.11	0.000	0.066	0.2892	0.1306	0.0000	1.34E-07
190	0.01	0.000	0.033	0.2872	0.1306	0.0000	1.34E-07
191	0.04	0.000	0.049	0.2868	0.1306	0.0000	1.34E-07
192	0.46	0.274	0.071	0.2982	0.1305	0.0000	1.34E-07
193	0.00	0.000	0.050	0.2932	0.1305	0.0000	1.34E-07
194	0.00	0.000	0.108	0.2824	0.1304	0.0000	1.34E-07
195	0.00	0.000	0.047	0.2776	0.1304	0.0000	1.34E-07
196	0.00	0.000	0.005	0.2771	0.1304	0.0000	1.34E-07
197	0.47	0.246	0.087	0.2905	0.1303	0.0000	1.34E-07
198	0.08	0.000	0.140	0.2843	0.1303	0.0000	1.34E-07
199	0.00	0.000	0.028	0.2815	0.1302	0.0000	1.34E-07
200	0.00	0.000	0.024	0.2791	0.1302	0.0000	1.34E-07
201	0.00	0.000	0.010	0.2782	0.1302	0.0000	1.34E-07
202	0.00	0.000	0.009	0.2773	0.1301	0.0000	1.34E-07
203	0.06	0.000	0.034	0.2797	0.1301	0.0000	1.34E-07
204	0.00	0.000	0.003	0.2794	0.1301	0.0000	1.34E-07
205	0.00	0.000	0.008	0.2786	0.1300	0.0000	1.34E-07
206	0.03	0.000	0.027	0.2789	0.1300	0.0000	1.34E-07
207	0.13	0.000	0.039	0.2880	0.1299	0.0000	1.34E-07
208	0.00	0.000	0.017	0.2863	0.1299	0.0000	1.34E-07
209	0.00	0.000	0.022	0.2841	0.1299	0.0000	1.34E-07
210	0.01	0.000	0.023	0.2824	0.1298	0.0000	1.34E-07
211	0.03	0.000	0.039	0.2815	0.1298	0.0000	1.34E-07
212	0.20	0.030	0.058	0.2922	0.1298	0.0000	1.34E-07
213	0.07	0.000	0.050	0.2939	0.1297	0.0000	1.34E-07
214	0.53	0.346	0.064	0.3060	0.1297	0.0000	1.34E-07
215	0.00	0.000	0.110	0.2951	0.1296	0.0000	1.33E-07
216	0.00	0.000	0.023	0.2928	0.1296	0.0000	1.33E-07

217	0.01	0.000	0.039	0.2903	0.1296	0.0000	1.33E-07
218	0.00	0.000	0.023	0.2881	0.1295	0.0000	1.33E-07
219	0.79	0.578	0.059	0.3031	0.1295	0.0000	1.33E-07
220	0.00	0.000	0.192	0.2839	0.1295	0.0000	1.33E-07
221	0.00	0.000	0.058	0.2781	0.1294	0.0000	1.33E-07
222	0.00	0.000	0.008	0.2773	0.1294	0.0000	1.33E-07
223	0.00	0.000	0.002	0.2770	0.1293	0.0000	1.33E-07
224	0.00	0.000	0.000	0.2770	0.1293	0.0000	1.33E-07
225	0.00	0.000	0.000	0.2770	0.1293	0.0000	1.33E-07
226	0.74	0.503	0.076	0.2930	0.1292	0.0000	1.33E-07
227	0.06	0.000	0.067	0.2922	0.1292	0.0000	1.33E-07
228	0.00	0.000	0.034	0.2888	0.1291	0.0000	1.33E-07
229	0.00	0.000	0.029	0.2859	0.1291	0.0000	1.33E-07
230	0.00	0.000	0.029	0.2830	0.1291	0.0000	1.33E-07
231	0.00	0.000	0.023	0.2807	0.1290	0.0000	1.33E-07
232	0.00	0.000	0.026	0.2781	0.1290	0.0000	1.33E-07
233	0.00	0.000	0.010	0.2771	0.1290	0.0000	1.33E-07
234	0.00	0.000	0.001	0.2770	0.1289	0.0000	1.33E-07
235	0.00	0.000	0.000	0.2770	0.1289	0.0000	1.33E-07
236	0.00	0.000	0.000	0.2770	0.1288	0.0000	1.33E-07
237	0.00	0.000	0.000	0.2770	0.1288	0.0000	1.33E-07
238	0.00	0.000	0.000	0.2770	0.1288	0.0000	1.33E-07
239	0.00	0.000	0.000	0.2770	0.1287	0.0000	1.33E-07
240	0.00	0.000	0.000	0.2770	0.1287	0.0000	1.33E-07
241	0.00	0.000	0.000	0.2770	0.1287	0.0000	1.33E-07
242	0.00	0.000	0.000	0.2770	0.1286	0.0000	1.33E-07
243	0.00	0.000	0.000	0.2770	0.1286	0.0000	1.33E-07
244	0.00	0.000	0.000	0.2770	0.1286	0.0000	1.32E-07
245	0.71	0.496	0.058	0.2928	0.1285	0.0000	1.32E-07
246	0.00	0.000	0.041	0.2887	0.1285	0.0000	1.32E-07
247	0.00	0.000	0.019	0.2867	0.1284	0.0000	1.32E-07
248	1.38	1.181	0.065	0.3005	0.1284	0.0000	1.32E-07

249	0.00	0.000	0.045	0.2959	0.1284	0.0000	1.32E-07
250	0.00	0.000	0.071	0.2888	0.1283	0.0000	1.32E-07
251	0.00	0.000	0.088	0.2800	0.1283	0.0000	1.32E-07
252	0.00	0.000	0.025	0.2775	0.1283	0.0000	1.32E-07
253	0.00	0.000	0.004	0.2771	0.1282	0.0000	1.32E-07
254	0.43	0.174	0.174	0.2856	0.1282	0.0000	1.32E-07
255	0.10	0.000	0.091	0.2861	0.1281	0.0000	1.32E-07
256	0.00	0.000	0.073	0.2790	0.1281	0.0000	1.32E-07
257	1.27	0.945	0.178	0.2942	0.1281	0.0000	1.32E-07
258	0.01	0.000	0.103	0.2853	0.1280	0.0000	1.32E-07
259	0.00	0.000	0.069	0.2784	0.1280	0.0000	1.32E-07
260	0.04	0.000	0.039	0.2782	0.1280	0.0000	1.32E-07
261	0.00	0.000	0.006	0.2776	0.1279	0.0000	1.32E-07
262	0.00	0.000	0.005	0.2771	0.1279	0.0000	1.32E-07
263	0.00	0.000	0.001	0.2770	0.1278	0.0000	1.32E-07
264	0.00	0.000	0.000	0.2770	0.1278	0.0000	1.32E-07
265	0.07	0.000	0.034	0.2809	0.1278	0.0000	1.32E-07
266	0.00	0.000	0.003	0.2807	0.1277	0.0000	1.32E-07
267	0.00	0.000	0.012	0.2795	0.1277	0.0000	1.32E-07
268	0.00	0.000	0.007	0.2787	0.1277	0.0000	1.32E-07
269	0.00	0.000	0.006	0.2781	0.1276	0.0000	1.32E-07
270	0.00	0.000	0.005	0.2777	0.1276	0.0000	1.32E-07
271	0.00	0.000	0.004	0.2772	0.1275	0.0000	1.32E-07
272	0.00	0.000	0.002	0.2771	0.1275	0.0000	1.31E-07
273	0.25	0.075	0.047	0.2897	0.1275	0.0000	1.31E-07
274	0.00	0.000	0.010	0.2887	0.1274	0.0000	1.31E-07
275	0.00	0.000	0.014	0.2873	0.1274	0.0000	1.31E-07
276	0.00	0.000	0.014	0.2859	0.1274	0.0000	1.31E-07
277	0.00	0.000	0.013	0.2847	0.1273	0.0000	1.31E-07
278	0.00	0.000	0.011	0.2835	0.1273	0.0000	1.31E-07
279	0.00	0.000	0.011	0.2824	0.1272	0.0000	1.31E-07
280	0.00	0.000	0.011	0.2813	0.1272	0.0000	1.31E-07

281	*	0.00	0.000	0.010	0.2803	0.1272	0.0000	1.31E-07
282		0.00	0.000	0.010	0.2793	0.1271	0.0000	1.31E-07
283		0.00	0.000	0.010	0.2784	0.1271	0.0000	1.31E-07
284	*	0.00	0.000	0.000	0.2784	0.1271	0.0000	1.31E-07
285	*	0.11	0.000	0.047	0.2804	0.1270	0.0000	1.31E-07
286	*	0.05	0.000	0.038	0.2823	0.1270	0.0000	1.31E-07
287		0.40	0.258	0.055	0.2950	0.1270	0.0000	1.31E-07
288		0.17	0.009	0.064	0.3043	0.1269	0.0000	1.31E-07
289		0.84	0.638	0.087	0.3158	0.1269	0.0000	1.31E-07
290		0.00	0.000	0.127	0.3031	0.1268	0.0000	1.31E-07
291		0.00	0.000	0.044	0.2989	0.1268	0.0000	1.31E-07
292		0.00	0.000	0.080	0.2909	0.1268	0.0000	1.31E-07
293		0.00	0.000	0.119	0.2790	0.1268	0.0000	1.31E-07
294		0.00	0.000	0.017	0.2773	0.1268	0.0000	1.31E-07
295		0.00	0.000	0.002	0.2771	0.1268	0.0000	1.31E-07
296		0.00	0.000	0.001	0.2770	0.1267	0.0000	1.31E-07
297		0.00	0.000	0.000	0.2770	0.1267	0.0000	1.31E-07
298		0.00	0.000	0.000	0.2770	0.1267	0.0000	1.31E-07
299		0.00	0.000	0.000	0.2770	0.1266	0.0000	1.31E-07
300		0.00	0.000	0.000	0.2770	0.1266	0.0000	1.31E-07
301		0.00	0.000	0.000	0.2770	0.1266	0.0000	1.31E-07
302		0.00	0.000	0.000	0.2770	0.1265	0.0000	1.31E-07
303		0.00	0.000	0.000	0.2770	0.1265	0.0000	1.31E-07
304		0.01	0.000	0.008	0.2770	0.1264	0.0000	1.30E-07
305		0.00	0.000	0.000	0.2770	0.1264	0.0000	1.30E-07
306		0.00	0.000	0.000	0.2770	0.1264	0.0000	1.30E-07
307		0.00	0.000	0.000	0.2770	0.1263	0.0000	1.30E-07
308		0.00	0.000	0.000	0.2770	0.1263	0.0000	1.30E-07
309		0.00	0.000	0.000	0.2770	0.1263	0.0000	1.30E-07
310		0.00	0.000	0.000	0.2770	0.1262	0.0000	1.30E-07
311		0.00	0.000	0.000	0.2770	0.1262	0.0000	1.30E-07
312		0.00	0.000	0.000	0.2770	0.1262	0.0000	1.30E-07

313		0.00	0.000	0.000	0.2770	0.1261	0.0000	1.30E-07
314		0.00	0.000	0.000	0.2770	0.1261	0.0000	1.30E-07
315		0.00	0.000	0.000	0.2770	0.1260	0.0000	1.30E-07
316		0.11	0.000	0.037	0.2840	0.1260	0.0000	1.30E-07
317		0.00	0.000	0.007	0.2833	0.1260	0.0000	1.30E-07
318		0.00	0.000	0.007	0.2826	0.1259	0.0000	1.30E-07
319		0.00	0.000	0.008	0.2818	0.1259	0.0000	1.30E-07
320	*	0.00	0.000	0.008	0.2810	0.1259	0.0000	1.30E-07
321		0.00	0.000	0.008	0.2802	0.1258	0.0000	1.30E-07
322		0.00	0.000	0.008	0.2794	0.1258	0.0000	1.30E-07
323		0.00	0.000	0.008	0.2786	0.1258	0.0000	1.30E-07
324		2.16	1.963	0.048	0.2940	0.1257	0.0000	1.30E-07
325		0.00	0.000	0.008	0.2932	0.1257	0.0000	1.30E-07
326		0.00	0.000	0.008	0.2924	0.1256	0.0000	1.30E-07
327	*	0.00	0.000	0.000	0.2924	0.1256	0.0000	1.30E-07
328	*	0.00	0.000	0.008	0.2916	0.1256	0.0000	1.30E-07
329		0.02	0.000	0.024	0.2914	0.1255	0.0000	1.30E-07
330		0.00	0.000	0.007	0.2907	0.1255	0.0000	1.30E-07
331	*	0.00	0.000	0.000	0.2907	0.1255	0.0000	1.30E-07
332	*	0.50	0.000	0.029	0.2927	0.1254	0.0000	1.30E-07
333		0.00	0.225	0.019	0.3054	0.1254	0.0000	1.30E-07
334		0.00	0.000	0.103	0.3027	0.1254	0.0000	1.29E-07
335		0.00	0.000	0.030	0.2998	0.1253	0.0000	1.29E-07
336		0.00	0.000	0.014	0.2985	0.1253	0.0000	1.29E-07
337	*	0.69	0.000	0.029	0.3005	0.1253	0.0000	1.29E-07
338		0.00	0.516	0.001	0.3132	0.1252	0.0000	1.29E-07
339		0.02	0.000	0.038	0.3113	0.1252	0.0000	1.29E-07
340		0.16	0.005	0.058	0.3208	0.1251	0.0000	1.29E-07
341		0.00	0.000	0.071	0.3136	0.1251	0.0000	1.29E-07
342		0.00	0.000	0.097	0.3045	0.1251	0.0000	1.29E-07
343		0.00	0.000	0.047	0.3002	0.1250	0.0000	1.29E-07
344		0.00	0.000	0.067	0.2935	0.1254	0.0000	1.30E-07

345		0.82	0.575	0.080	0.3098	0.1256	0.0000	1.30E-07
346		0.00	0.000	0.033	0.3065	0.1256	0.0000	1.30E-07
347		0.00	0.000	0.058	0.3007	0.1255	0.0000	1.30E-07
348		0.00	0.000	0.070	0.2937	0.1255	0.0000	1.30E-07
349		0.00	0.000	0.059	0.2879	0.1254	0.0000	1.30E-07
350		0.00	0.000	0.093	0.2786	0.1254	0.0000	1.30E-07
351		0.02	0.000	0.029	0.2774	0.1254	0.0000	1.29E-07
352		0.00	0.000	0.003	0.2771	0.1253	0.0000	1.29E-07
353		0.00	0.000	0.001	0.2770	0.1253	0.0000	1.29E-07
354		0.00	0.000	0.000	0.2770	0.1253	0.0000	1.29E-07
355		0.00	0.000	0.000	0.2770	0.1252	0.0000	1.29E-07
356		0.00	0.000	0.000	0.2770	0.1252	0.0000	1.29E-07
357		0.00	0.000	0.000	0.2770	0.1252	0.0000	1.29E-07
358		1.20	0.982	0.055	0.2933	0.1251	0.0000	1.29E-07
359	*	0.00	0.000	0.006	0.2927	0.1251	0.0000	1.29E-07
360		0.00	0.000	0.017	0.2911	0.1250	0.0000	1.29E-07
361		0.00	0.000	0.017	0.2894	0.1250	0.0000	1.29E-07
362		0.00	0.000	0.010	0.2883	0.1250	0.0000	1.29E-07
363	*	0.00	0.000	0.000	0.2883	0.1249	0.0000	1.29E-07
364	*	0.01	0.000	0.006	0.2883	0.1249	0.0000	1.29E-07
365	*	0.00	0.000	0.000	0.2883	0.1249	0.0000	1.29E-07

* = Frozen (air or soil)

	Annual Totals for Year 27		
	inches	cubic feet	percent
Precipitation	36.13	131,160.8	100.00
Runoff	21.224	77,041.9	58.74
Evapotranspiration	14.929	54,190.9	41.32
Recirculation into Layer 1	0.0054	19.7	0.01
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0054	19.7	0.01
Percolation/Leakage through Layer 5	0.000049	0.1785	0.00
Average Head on Top of Layer 4	0.1309	---	---
Change in Water Storage	-0.0199	-72.2	-0.06
Soil Water at Start of Year	1,406.6379	5,106,095.5	3893.00
Soil Water at End of Year	1,406.6180	5,106,023.4	3892.95
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0054	-19.7	-0.02

Daily Output for Year 28

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1	*		0.00	0.000	0.000	0.2883	0.1248	0.0000	1.29E-07
2	*		0.00	0.000	0.000	0.2883	0.1248	0.0000	1.29E-07
3	*		0.00	0.000	0.000	0.2883	0.1248	0.0000	1.29E-07
4			0.00	0.000	0.020	0.2863	0.1247	0.0000	1.29E-07
5			0.00	0.000	0.018	0.2845	0.1247	0.0000	1.29E-07
6	*		0.00	0.000	0.000	0.2845	0.1246	0.0000	1.29E-07
7			0.00	0.000	0.014	0.2831	0.1246	0.0000	1.29E-07
8			0.00	0.000	0.027	0.2804	0.1246	0.0000	1.29E-07
9			0.00	0.000	0.024	0.2780	0.1245	0.0000	1.29E-07
10	*		0.00	0.000	0.008	0.2772	0.1245	0.0000	1.29E-07
11	*		0.27	0.000	0.035	0.2792	0.1245	0.0000	1.29E-07
12			0.00	0.006	0.043	0.2913	0.1244	0.0000	1.29E-07
13			0.10	0.000	0.102	0.2957	0.1244	0.0000	1.29E-07
14			0.00	0.000	0.018	0.2939	0.1244	0.0000	1.29E-07
15			0.00	0.000	0.025	0.2915	0.1243	0.0000	1.28E-07
16			0.00	0.000	0.038	0.2876	0.1243	0.0000	1.28E-07
17			0.00	0.000	0.019	0.2858	0.1242	0.0000	1.28E-07
18			0.00	0.000	0.022	0.2835	0.1242	0.0000	1.28E-07
19	*		0.39	0.000	0.031	0.2855	0.1242	0.0000	1.28E-07
20	*		0.07	0.000	0.032	0.2875	0.1241	0.0000	1.28E-07
21			0.00	0.171	0.063	0.3002	0.1241	0.0000	1.28E-07
22			0.00	0.000	0.030	0.2972	0.1241	0.0000	1.28E-07
23			0.00	0.000	0.024	0.2948	0.1240	0.0000	1.28E-07
24			0.00	0.000	0.027	0.2921	0.1240	0.0000	1.28E-07

25		0.00	0.000	0.044	0.2877	0.1240	0.0000	1.28E-07
26		0.06	0.000	0.064	0.2870	0.1239	0.0000	1.28E-07
27		0.00	0.000	0.032	0.2838	0.1239	0.0000	1.28E-07
28		0.02	0.000	0.047	0.2813	0.1238	0.0000	1.28E-07
29	*	0.04	0.000	0.032	0.2817	0.1238	0.0000	1.28E-07
30	*	0.00	0.000	0.000	0.2817	0.1238	0.0000	1.28E-07
31		0.00	0.000	0.016	0.2801	0.1237	0.0000	1.28E-07
32	*	0.00	0.000	0.000	0.2801	0.1237	0.0000	1.28E-07
33	*	0.00	0.000	0.000	0.2801	0.1237	0.0000	1.28E-07
34	*	0.16	0.000	0.038	0.2820	0.1236	0.0000	1.28E-07
35	*	0.11	0.000	0.024	0.2840	0.1236	0.0000	1.28E-07
36	*	0.09	0.000	0.030	0.2860	0.1236	0.0000	1.28E-07
37		0.22	0.178	0.000	0.2987	0.1235	0.0000	1.28E-07
38	*	0.03	0.000	0.038	0.3007	0.1235	0.0000	1.28E-07
39		0.00	0.000	0.085	0.3012	0.1235	0.0000	1.28E-07
40		0.00	0.000	0.044	0.2969	0.1234	0.0000	1.28E-07
41		0.00	0.000	0.043	0.2926	0.1234	0.0000	1.28E-07
42		0.00	0.000	0.034	0.2891	0.1233	0.0000	1.28E-07
43	*	0.00	0.000	0.000	0.2891	0.1233	0.0000	1.28E-07
44	*	0.13	0.000	0.027	0.2911	0.1233	0.0000	1.28E-07
45	*	0.00	0.000	0.053	0.2931	0.1232	0.0000	1.27E-07
46	*	0.00	0.000	0.012	0.2931	0.1232	0.0000	1.27E-07
47	*	0.00	0.000	0.000	0.2931	0.1232	0.0000	1.27E-07
48		0.00	0.000	0.020	0.2910	0.1232	0.0000	1.27E-07
49	*	0.00	0.000	0.000	0.2910	0.1233	0.0000	1.28E-07
50	*	0.00	0.000	0.000	0.2910	0.1232	0.0000	1.27E-07
51		0.12	0.000	0.078	0.2957	0.1232	0.0000	1.27E-07
52		0.45	0.211	0.106	0.3089	0.1232	0.0000	1.27E-07
53		0.00	0.000	0.084	0.3005	0.1231	0.0000	1.27E-07
54		0.00	0.000	0.058	0.2947	0.1231	0.0000	1.27E-07
55		0.00	0.000	0.014	0.2933	0.1231	0.0000	1.27E-07
56	*	0.00	0.000	0.013	0.2920	0.1230	0.0000	1.27E-07

57		0.00	0.000	0.023	0.2897	0.1230	0.0000	1.27E-07
58		0.00	0.000	0.056	0.2841	0.1230	0.0000	1.27E-07
59		0.45	0.208	0.107	0.2977	0.1229	0.0000	1.27E-07
60		0.00	0.000	0.103	0.2874	0.1229	0.0000	1.27E-07
61		0.00	0.000	0.055	0.2818	0.1228	0.0000	1.27E-07
62		0.00	0.000	0.036	0.2782	0.1228	0.0000	1.27E-07
63		0.00	0.000	0.009	0.2773	0.1228	0.0000	1.27E-07
64		0.00	0.000	0.002	0.2771	0.1227	0.0000	1.27E-07
65		0.25	0.074	0.059	0.2886	0.1227	0.0000	1.27E-07
66		0.00	0.000	0.024	0.2862	0.1227	0.0000	1.27E-07
67	*	0.00	0.000	0.000	0.2862	0.1226	0.0000	1.27E-07
68		0.00	0.000	0.036	0.2826	0.1226	0.0000	1.27E-07
69	*	0.11	0.000	0.035	0.2846	0.1226	0.0000	1.27E-07
70	*	0.04	0.000	0.039	0.2865	0.1225	0.0000	1.27E-07
71		0.00	0.000	0.090	0.2820	0.1225	0.0000	1.27E-07
72		0.00	0.000	0.035	0.2785	0.1225	0.0000	1.27E-07
73		0.02	0.000	0.027	0.2778	0.1224	0.0000	1.27E-07
74		0.07	0.000	0.036	0.2813	0.1224	0.0000	1.27E-07
75	*	0.00	0.000	0.000	0.2813	0.1223	0.0000	1.27E-07
76	*	0.00	0.000	0.015	0.2798	0.1223	0.0000	1.27E-07
77	*	0.00	0.000	0.009	0.2789	0.1224	0.0000	1.27E-07
78	*	0.00	0.000	0.006	0.2783	0.1223	0.0000	1.27E-07
79		0.06	0.000	0.034	0.2812	0.1223	0.0000	1.27E-07
80		0.10	0.000	0.040	0.2868	0.1223	0.0000	1.27E-07
81		0.00	0.000	0.011	0.2857	0.1222	0.0000	1.27E-07
82	*	0.21	0.000	0.095	0.2877	0.1222	0.0000	1.26E-07
83		0.00	0.000	0.104	0.2866	0.1222	0.0000	1.26E-07
84		0.00	0.000	0.010	0.2857	0.1221	0.0000	1.26E-07
85		0.00	0.000	0.012	0.2845	0.1221	0.0000	1.26E-07
86		0.00	0.000	0.012	0.2832	0.1221	0.0000	1.26E-07
87		0.00	0.000	0.012	0.2820	0.1220	0.0000	1.26E-07
88		0.00	0.000	0.012	0.2809	0.1220	0.0000	1.26E-07

89	0.63	0.421	0.053	0.2965	0.1220	0.0000	1.26E-07
90	0.10	0.000	0.093	0.2976	0.1219	0.0000	1.26E-07
91	0.41	0.232	0.053	0.3106	0.1219	0.0000	1.26E-07
92	0.68	0.400	0.232	0.3156	0.1218	0.0000	1.26E-07
93	0.05	0.000	0.075	0.3128	0.1218	0.0000	1.26E-07
94	0.00	0.000	0.042	0.3086	0.1218	0.0000	1.26E-07
95	1.02	0.659	0.222	0.3224	0.1217	0.0000	1.26E-07
96	1.20	0.902	0.217	0.3308	0.1217	0.0000	1.26E-07
97	0.45	0.289	0.079	0.3385	0.1217	0.0000	1.26E-07
98	0.59	0.420	0.089	0.3467	0.1216	0.0000	1.26E-07
99	0.00	0.000	0.112	0.3355	0.1216	0.0000	1.26E-07
100	0.01	0.000	0.055	0.3304	0.1216	0.0000	1.26E-07
101	0.01	0.000	0.071	0.3239	0.1215	0.0000	1.26E-07
102	0.00	0.000	0.121	0.3119	0.1215	0.0000	1.26E-07
103	0.28	0.090	0.237	0.3071	0.1215	0.0000	1.26E-07
104	0.18	0.014	0.202	0.3036	0.1214	0.0000	1.26E-07
105	1.98	1.718	0.147	0.3152	0.1214	0.0000	1.26E-07
106	0.00	0.000	0.181	0.2970	0.1213	0.0000	1.26E-07
107	0.00	0.000	0.073	0.2897	0.1215	0.0000	1.26E-07
108	0.14	0.000	0.074	0.2959	0.1219	0.0000	1.26E-07
109	0.61	0.357	0.118	0.3091	0.1219	0.0000	1.26E-07
110	0.00	0.000	0.067	0.3024	0.1218	0.0000	1.26E-07
111	0.02	0.000	0.067	0.2981	0.1218	0.0000	1.26E-07
112	0.00	0.000	0.104	0.2877	0.1218	0.0000	1.26E-07
113	0.00	0.000	0.062	0.2815	0.1217	0.0000	1.26E-07
114	0.00	0.000	0.036	0.2778	0.1217	0.0000	1.26E-07
115	0.00	0.000	0.006	0.2772	0.1216	0.0000	1.26E-07
116	0.00	0.000	0.002	0.2771	0.1216	0.0000	1.26E-07
117	1.23	0.985	0.079	0.2933	0.1216	0.0000	1.26E-07
118	0.06	0.000	0.059	0.2936	0.1215	0.0000	1.26E-07
119	0.00	0.000	0.089	0.2847	0.1215	0.0000	1.26E-07
120	0.00	0.000	0.060	0.2787	0.1215	0.0000	1.26E-07

121	0.00	0.000	0.013	0.2774	0.1214	0.0000	1.26E-07
122	0.00	0.000	0.003	0.2771	0.1214	0.0000	1.26E-07
123	0.00	0.000	0.001	0.2770	0.1214	0.0000	1.26E-07
124	0.44	0.231	0.072	0.2911	0.1213	0.0000	1.26E-07
125	0.00	0.000	0.098	0.2813	0.1213	0.0000	1.26E-07
126	0.00	0.000	0.020	0.2792	0.1213	0.0000	1.26E-07
127	0.00	0.000	0.019	0.2774	0.1212	0.0000	1.26E-07
128	0.00	0.000	0.003	0.2771	0.1212	0.0000	1.26E-07
129	1.96	1.738	0.062	0.2933	0.1212	0.0000	1.26E-07
130	0.00	0.000	0.090	0.2843	0.1211	0.0000	1.25E-07
131	0.00	0.000	0.062	0.2781	0.1211	0.0000	1.25E-07
132	0.00	0.000	0.008	0.2773	0.1211	0.0000	1.25E-07
133	0.00	0.000	0.002	0.2771	0.1210	0.0000	1.25E-07
134	0.00	0.000	0.001	0.2770	0.1210	0.0000	1.25E-07
135	0.50	0.279	0.073	0.2917	0.1209	0.0000	1.25E-07
136	0.00	0.000	0.013	0.2903	0.1209	0.0000	1.25E-07
137	0.00	0.000	0.020	0.2884	0.1209	0.0000	1.25E-07
138	0.00	0.000	0.019	0.2865	0.1208	0.0000	1.25E-07
139	0.00	0.000	0.018	0.2847	0.1208	0.0000	1.25E-07
140	0.00	0.000	0.016	0.2831	0.1208	0.0000	1.25E-07
141	0.00	0.000	0.016	0.2815	0.1207	0.0000	1.25E-07
142	0.00	0.000	0.015	0.2800	0.1207	0.0000	1.25E-07
143	0.00	0.000	0.012	0.2787	0.1207	0.0000	1.25E-07
144	0.00	0.000	0.014	0.2773	0.1206	0.0000	1.25E-07
145	0.00	0.000	0.003	0.2771	0.1206	0.0000	1.25E-07
146	0.00	0.000	0.000	0.2770	0.1206	0.0000	1.25E-07
147	0.00	0.000	0.000	0.2770	0.1205	0.0000	1.25E-07
148	0.00	0.000	0.000	0.2770	0.1205	0.0000	1.25E-07
149	0.00	0.000	0.000	0.2770	0.1205	0.0000	1.25E-07
150	1.66	1.444	0.053	0.2932	0.1204	0.0000	1.25E-07
151	0.14	0.000	0.063	0.3008	0.1204	0.0000	1.25E-07
152	0.80	0.556	0.110	0.3139	0.1204	0.0000	1.25E-07

153	0.30	0.122	0.238	0.3082	0.1203	0.0000	1.25E-07
154	0.00	0.000	0.052	0.3030	0.1203	0.0000	1.25E-07
155	0.00	0.000	0.174	0.2856	0.1202	0.0000	1.25E-07
156	0.00	0.000	0.049	0.2807	0.1202	0.0000	1.25E-07
157	0.00	0.000	0.035	0.2772	0.1202	0.0000	1.25E-07
158	0.00	0.000	0.002	0.2771	0.1201	0.0000	1.25E-07
159	0.00	0.000	0.001	0.2770	0.1201	0.0000	1.25E-07
160	0.00	0.000	0.000	0.2770	0.1201	0.0000	1.24E-07
161	0.14	0.000	0.040	0.2866	0.1200	0.0000	1.24E-07
162	0.00	0.000	0.016	0.2850	0.1200	0.0000	1.24E-07
163	0.00	0.000	0.021	0.2829	0.1200	0.0000	1.24E-07
164	0.18	0.020	0.058	0.2929	0.1199	0.0000	1.24E-07
165	0.00	0.000	0.015	0.2914	0.1199	0.0000	1.24E-07
166	0.00	0.000	0.020	0.2894	0.1199	0.0000	1.24E-07
167	0.00	0.000	0.020	0.2874	0.1198	0.0000	1.24E-07
168	0.00	0.000	0.019	0.2855	0.1198	0.0000	1.24E-07
169	0.00	0.000	0.017	0.2838	0.1198	0.0000	1.24E-07
170	0.02	0.000	0.029	0.2825	0.1197	0.0000	1.24E-07
171	0.01	0.000	0.025	0.2809	0.1197	0.0000	1.24E-07
172	0.00	0.000	0.016	0.2793	0.1197	0.0000	1.24E-07
173	0.00	0.000	0.016	0.2777	0.1196	0.0000	1.24E-07
174	0.00	0.000	0.006	0.2772	0.1196	0.0000	1.24E-07
175	0.07	0.000	0.034	0.2805	0.1196	0.0000	1.24E-07
176	0.21	0.047	0.045	0.2926	0.1195	0.0000	1.24E-07
177	0.00	0.000	0.009	0.2917	0.1195	0.0000	1.24E-07
178	0.00	0.000	0.014	0.2903	0.1194	0.0000	1.24E-07
179	0.18	0.015	0.053	0.3011	0.1194	0.0000	1.24E-07
180	0.32	0.153	0.058	0.3121	0.1194	0.0000	1.24E-07
181	0.00	0.000	0.093	0.3028	0.1193	0.0000	1.24E-07
182	0.00	0.000	0.015	0.3013	0.1193	0.0000	1.24E-07
183	0.16	0.001	0.050	0.3121	0.1193	0.0000	1.24E-07
184	0.00	0.000	0.073	0.3048	0.1192	0.0000	1.24E-07

185	0.00	0.000	0.016	0.3032	0.1192	0.0000	1.24E-07
186	0.00	0.000	0.015	0.3017	0.1192	0.0000	1.24E-07
187	0.03	0.000	0.034	0.3018	0.1191	0.0000	1.24E-07
188	0.05	0.000	0.042	0.3027	0.1191	0.0000	1.24E-07
189	0.09	0.000	0.047	0.3069	0.1191	0.0000	1.24E-07
190	0.27	0.092	0.176	0.3071	0.1190	0.0000	1.23E-07
191	0.55	0.272	0.257	0.3094	0.1190	0.0000	1.23E-07
192	0.02	0.000	0.175	0.2936	0.1190	0.0000	1.23E-07
193	0.13	0.000	0.136	0.2929	0.1189	0.0000	1.23E-07
194	0.00	0.000	0.054	0.2876	0.1189	0.0000	1.23E-07
195	0.89	0.665	0.082	0.3018	0.1189	0.0000	1.23E-07
196	0.26	0.104	0.085	0.3091	0.1188	0.0000	1.23E-07
197	0.28	0.117	0.077	0.3172	0.1188	0.0000	1.23E-07
198	0.41	0.216	0.093	0.3276	0.1188	0.0000	1.23E-07
199	0.05	0.000	0.073	0.3256	0.1187	0.0000	1.23E-07
200	0.44	0.227	0.188	0.3281	0.1187	0.0000	1.23E-07
201	0.10	0.001	0.237	0.3144	0.1186	0.0000	1.23E-07
202	0.01	0.000	0.179	0.2975	0.1186	0.0000	1.23E-07
203	0.05	0.000	0.187	0.2833	0.1186	0.0000	1.23E-07
204	0.16	0.000	0.089	0.2904	0.1186	0.0000	1.23E-07
205	0.00	0.000	0.061	0.2843	0.1188	0.0000	1.23E-07
206	0.00	0.000	0.042	0.2801	0.1188	0.0000	1.23E-07
207	0.56	0.316	0.100	0.2945	0.1187	0.0000	1.23E-07
208	0.30	0.097	0.168	0.2982	0.1187	0.0000	1.23E-07
209	0.06	0.000	0.073	0.2968	0.1187	0.0000	1.23E-07
210	0.12	0.000	0.138	0.2953	0.1186	0.0000	1.23E-07
211	0.54	0.229	0.208	0.3053	0.1186	0.0000	1.23E-07
212	0.00	0.000	0.096	0.2957	0.1186	0.0000	1.23E-07
213	0.00	0.000	0.118	0.2839	0.1185	0.0000	1.23E-07
214	0.11	0.000	0.102	0.2852	0.1185	0.0000	1.23E-07
215	0.00	0.000	0.042	0.2810	0.1185	0.0000	1.23E-07
216	0.00	0.000	0.025	0.2785	0.1184	0.0000	1.23E-07

217	0.00	0.000	0.008	0.2776	0.1184	0.0000	1.23E-07
218	0.22	0.046	0.054	0.2896	0.1183	0.0000	1.23E-07
219	0.00	0.000	0.018	0.2878	0.1183	0.0000	1.23E-07
220	0.15	0.000	0.063	0.2963	0.1183	0.0000	1.23E-07
221	0.19	0.024	0.053	0.3076	0.1182	0.0000	1.23E-07
222	0.00	0.000	0.135	0.2941	0.1182	0.0000	1.23E-07
223	0.00	0.000	0.024	0.2916	0.1182	0.0000	1.23E-07
224	0.00	0.000	0.020	0.2897	0.1182	0.0000	1.23E-07
225	0.00	0.000	0.018	0.2879	0.1182	0.0000	1.23E-07
226	0.00	0.000	0.022	0.2857	0.1182	0.0000	1.23E-07
227	0.00	0.000	0.024	0.2833	0.1181	0.0000	1.23E-07
228	0.00	0.000	0.026	0.2807	0.1181	0.0000	1.23E-07
229	0.00	0.000	0.031	0.2776	0.1181	0.0000	1.23E-07
230	0.00	0.000	0.005	0.2771	0.1180	0.0000	1.23E-07
231	0.00	0.000	0.001	0.2770	0.1180	0.0000	1.23E-07
232	0.00	0.000	0.000	0.2770	0.1180	0.0000	1.22E-07
233	0.02	0.000	0.019	0.2773	0.1179	0.0000	1.22E-07
234	0.09	0.000	0.036	0.2824	0.1179	0.0000	1.22E-07
235	0.22	0.043	0.050	0.2953	0.1179	0.0000	1.22E-07
236	0.58	0.409	0.058	0.3064	0.1178	0.0000	1.22E-07
237	0.01	0.000	0.055	0.3022	0.1178	0.0000	1.22E-07
238	1.14	0.904	0.087	0.3167	0.1178	0.0000	1.22E-07
239	0.34	0.162	0.140	0.3207	0.1177	0.0000	1.22E-07
240	0.00	0.000	0.039	0.3168	0.1177	0.0000	1.22E-07
241	0.00	0.000	0.038	0.3130	0.1177	0.0000	1.22E-07
242	0.00	0.000	0.097	0.3033	0.1176	0.0000	1.22E-07
243	0.00	0.000	0.039	0.2994	0.1176	0.0000	1.22E-07
244	0.00	0.000	0.095	0.2899	0.1175	0.0000	1.22E-07
245	0.00	0.000	0.097	0.2802	0.1175	0.0000	1.22E-07
246	0.00	0.000	0.029	0.2773	0.1175	0.0000	1.22E-07
247	0.21	0.014	0.101	0.2865	0.1174	0.0000	1.22E-07
248	0.00	0.000	0.051	0.2814	0.1174	0.0000	1.22E-07

249		0.00	0.000	0.037	0.2777	0.1174	0.0000	1.22E-07
250		0.00	0.000	0.005	0.2772	0.1173	0.0000	1.22E-07
251		0.17	0.001	0.049	0.2890	0.1173	0.0000	1.22E-07
252		0.09	0.000	0.057	0.2928	0.1173	0.0000	1.22E-07
253		0.00	0.000	0.024	0.2904	0.1172	0.0000	1.22E-07
254		0.06	0.000	0.053	0.2912	0.1172	0.0000	1.22E-07
255		0.00	0.000	0.019	0.2893	0.1172	0.0000	1.22E-07
256		0.00	0.000	0.015	0.2878	0.1171	0.0000	1.22E-07
257		0.00	0.000	0.018	0.2860	0.1171	0.0000	1.22E-07
258		0.00	0.000	0.018	0.2842	0.1171	0.0000	1.22E-07
259		0.00	0.000	0.017	0.2825	0.1170	0.0000	1.22E-07
260		0.32	0.127	0.059	0.2959	0.1170	0.0000	1.22E-07
261		0.00	0.000	0.014	0.2945	0.1170	0.0000	1.22E-07
262		0.00	0.000	0.014	0.2931	0.1169	0.0000	1.22E-07
263		0.00	0.000	0.013	0.2918	0.1169	0.0000	1.21E-07
264		0.00	0.000	0.013	0.2905	0.1169	0.0000	1.21E-07
265		0.00	0.000	0.013	0.2891	0.1168	0.0000	1.21E-07
266		0.00	0.000	0.013	0.2879	0.1168	0.0000	1.21E-07
267		0.00	0.000	0.011	0.2867	0.1168	0.0000	1.21E-07
268		0.00	0.000	0.011	0.2856	0.1167	0.0000	1.21E-07
269		0.06	0.000	0.042	0.2870	0.1167	0.0000	1.21E-07
270		0.00	0.000	0.012	0.2859	0.1167	0.0000	1.21E-07
271		0.00	0.000	0.013	0.2846	0.1166	0.0000	1.21E-07
272		0.02	0.000	0.030	0.2839	0.1166	0.0000	1.21E-07
273		0.89	0.699	0.053	0.2976	0.1166	0.0000	1.21E-07
274		0.00	0.000	0.056	0.2920	0.1165	0.0000	1.21E-07
275		0.00	0.000	0.027	0.2893	0.1165	0.0000	1.21E-07
276	*	0.00	0.000	0.017	0.2876	0.1165	0.0000	1.21E-07
277		0.00	0.000	0.044	0.2832	0.1164	0.0000	1.21E-07
278		0.00	0.000	0.025	0.2806	0.1164	0.0000	1.21E-07
279		0.00	0.000	0.028	0.2779	0.1164	0.0000	1.21E-07
280		0.00	0.000	0.007	0.2772	0.1163	0.0000	1.21E-07

281		0.00	0.000	0.002	0.2771	0.1163	0.0000	1.21E-07
282		0.00	0.000	0.000	0.2770	0.1163	0.0000	1.21E-07
283		0.00	0.000	0.000	0.2770	0.1162	0.0000	1.21E-07
284		0.00	0.000	0.000	0.2770	0.1162	0.0000	1.21E-07
285		0.00	0.000	0.000	0.2770	0.1162	0.0000	1.21E-07
286		0.57	0.350	0.066	0.2927	0.1161	0.0000	1.21E-07
287		0.02	0.000	0.121	0.2821	0.1161	0.0000	1.21E-07
288		0.00	0.000	0.017	0.2804	0.1161	0.0000	1.21E-07
289		0.00	0.000	0.019	0.2785	0.1160	0.0000	1.21E-07
290		0.03	0.000	0.035	0.2778	0.1160	0.0000	1.21E-07
291		1.07	0.851	0.060	0.2935	0.1160	0.0000	1.21E-07
292		0.42	0.200	0.102	0.3051	0.1159	0.0000	1.21E-07
293		0.60	0.411	0.077	0.3167	0.1159	0.0000	1.21E-07
294		0.00	0.000	0.098	0.3068	0.1159	0.0000	1.20E-07
295		0.00	0.000	0.095	0.2973	0.1158	0.0000	1.20E-07
296		0.00	0.000	0.095	0.2878	0.1158	0.0000	1.20E-07
297		0.10	0.000	0.149	0.2834	0.1157	0.0000	1.20E-07
298		0.00	0.000	0.041	0.2793	0.1157	0.0000	1.20E-07
299		0.00	0.000	0.016	0.2777	0.1157	0.0000	1.20E-07
300		0.00	0.000	0.005	0.2772	0.1156	0.0000	1.20E-07
301		0.00	0.000	0.001	0.2770	0.1156	0.0000	1.20E-07
302		0.00	0.000	0.000	0.2770	0.1156	0.0000	1.20E-07
303		0.31	0.129	0.052	0.2894	0.1155	0.0000	1.20E-07
304		0.05	0.000	0.052	0.2896	0.1155	0.0000	1.20E-07
305		0.00	0.000	0.012	0.2886	0.1155	0.0000	1.20E-07
306	*	0.00	0.000	0.000	0.2886	0.1154	0.0000	1.20E-07
307		0.00	0.000	0.018	0.2868	0.1154	0.0000	1.20E-07
308		0.39	0.179	0.063	0.3012	0.1154	0.0000	1.20E-07
309		0.00	0.000	0.031	0.2981	0.1153	0.0000	1.20E-07
310		0.00	0.000	0.035	0.2946	0.1153	0.0000	1.20E-07
311		0.00	0.000	0.024	0.2923	0.1153	0.0000	1.20E-07
312	*	0.00	0.000	0.000	0.2923	0.1152	0.0000	1.20E-07

313	*	0.10	0.000	0.042	0.2942	0.1152	0.0000	1.20E-07
314		1.07	0.977	0.000	0.3069	0.1152	0.0000	1.20E-07
315	*	0.06	0.000	0.050	0.3083	0.1151	0.0000	1.20E-07
316		0.14	0.002	0.058	0.3164	0.1151	0.0000	1.20E-07
317		0.00	0.000	0.027	0.3137	0.1151	0.0000	1.20E-07
318	*	0.00	0.000	0.015	0.3123	0.1150	0.0000	1.20E-07
319		0.61	0.406	0.065	0.3259	0.1150	0.0000	1.20E-07
320		0.00	0.000	0.031	0.3230	0.1150	0.0000	1.20E-07
321		0.24	0.071	0.077	0.3319	0.1149	0.0000	1.20E-07
322		0.00	0.000	0.088	0.3231	0.1149	0.0000	1.20E-07
323		0.00	0.000	0.120	0.3112	0.1149	0.0000	1.20E-07
324		0.00	0.000	0.031	0.3081	0.1148	0.0000	1.20E-07
325		0.00	0.000	0.066	0.3015	0.1148	0.0000	1.20E-07
326		0.00	0.000	0.027	0.2989	0.1148	0.0000	1.19E-07
327		0.00	0.000	0.033	0.2956	0.1147	0.0000	1.19E-07
328	*	0.00	0.000	0.012	0.2944	0.1147	0.0000	1.19E-07
329		0.56	0.344	0.063	0.3101	0.1147	0.0000	1.19E-07
330	*	0.00	0.000	0.001	0.3101	0.1146	0.0000	1.19E-07
331		1.24	1.054	0.053	0.3235	0.1146	0.0000	1.19E-07
332		0.00	0.000	0.026	0.3209	0.1146	0.0000	1.19E-07
333		0.00	0.000	0.035	0.3173	0.1145	0.0000	1.19E-07
334		0.00	0.000	0.031	0.3143	0.1145	0.0000	1.19E-07
335		0.00	0.000	0.019	0.3124	0.1145	0.0000	1.19E-07
336		0.07	0.000	0.052	0.3146	0.1144	0.0000	1.19E-07
337	*	0.00	0.000	0.017	0.3128	0.1146	0.0000	1.19E-07
338	*	0.00	0.000	0.000	0.3128	0.1151	0.0000	1.20E-07
339	*	0.00	0.000	0.000	0.3128	0.1151	0.0000	1.20E-07
340		0.00	0.000	0.016	0.3112	0.1150	0.0000	1.20E-07
341	*	0.00	0.000	0.000	0.3112	0.1150	0.0000	1.20E-07
342	*	0.00	0.000	0.014	0.3098	0.1150	0.0000	1.20E-07
343	*	0.00	0.000	0.015	0.3084	0.1149	0.0000	1.20E-07
344		0.00	0.000	0.016	0.3067	0.1149	0.0000	1.20E-07

345		0.00	0.000	0.016	0.3051	0.1149	0.0000	1.20E-07
346		0.00	0.000	0.015	0.3036	0.1148	0.0000	1.20E-07
347		0.02	0.000	0.033	0.3024	0.1148	0.0000	1.19E-07
348		0.00	0.000	0.022	0.3002	0.1148	0.0000	1.19E-07
349		0.00	0.000	0.030	0.2972	0.1147	0.0000	1.19E-07
350		0.00	0.000	0.024	0.2948	0.1147	0.0000	1.19E-07
351		0.00	0.000	0.018	0.2930	0.1147	0.0000	1.19E-07
352	*	0.00	0.000	0.001	0.2930	0.1146	0.0000	1.19E-07
353	*	0.77	0.000	0.025	0.2950	0.1146	0.0000	1.19E-07
354	*	0.18	0.000	0.012	0.2969	0.1146	0.0000	1.19E-07
355	*	0.00	0.000	0.026	0.2989	0.1145	0.0000	1.19E-07
356	*	0.00	0.000	0.014	0.3009	0.1145	0.0000	1.19E-07
357		0.77	1.450	0.000	0.3136	0.1145	0.0000	1.19E-07
358		0.01	0.000	0.018	0.3123	0.1144	0.0000	1.19E-07
359	*	0.10	0.000	0.030	0.3143	0.1144	0.0000	1.19E-07
360		0.00	0.000	0.069	0.3126	0.1144	0.0000	1.19E-07
361		0.00	0.000	0.042	0.3084	0.1143	0.0000	1.19E-07
362		0.00	0.000	0.017	0.3067	0.1143	0.0000	1.19E-07
363	*	0.00	0.000	0.016	0.3052	0.1143	0.0000	1.19E-07
364		0.00	0.000	0.018	0.3033	0.1142	0.0000	1.19E-07
365		0.00	0.000	0.035	0.2999	0.1142	0.0000	1.19E-07

* = Frozen (air or soil)

Annual Totals for Year 28			
	inches	cubic feet	percent
Precipitation	40.07	145,445.7	100.00
Runoff	23.128	83,954.2	57.72
Evapotranspiration	16.828	61,086.1	42.00
Recirculation into Layer 1	0.0050	18.0	0.01
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0050	18.0	0.01
Percolation/Leakage through Layer 5	0.000045	0.1644	0.00
Average Head on Top of Layer 4	0.1193	---	---
Change in Water Storage	0.1117	405.3	0.28
Soil Water at Start of Year	1,406.6180	5,106,023.4	3510.60
Soil Water at End of Year	1,406.7297	5,106,428.7	3510.88
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0050	-18.0	-0.01

Daily Output for Year 29

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status*		Rain	Runoff	ET	Evap. Zone Water	Head #1	Drain #1	Leak #1
	Air	Soil	(inches)	(inches)	(inches)	(in/in)	(inches)	(inches)	(inches)
1			0.01	0.000	0.039	0.2974	0.1141	0.0000	1.19E-07
2	*		0.10	0.000	0.032	0.2994	0.1141	0.0000	1.19E-07
3	*		0.22	0.000	0.000	0.3014	0.1141	0.0000	1.19E-07
4			0.08	0.176	0.022	0.3141	0.1140	0.0000	1.19E-07
5	*		0.00	0.000	0.000	0.3141	0.1140	0.0000	1.19E-07
6	*		0.00	0.000	0.011	0.3130	0.1140	0.0000	1.19E-07
7			0.00	0.000	0.031	0.3099	0.1139	0.0000	1.19E-07
8			0.00	0.000	0.029	0.3070	0.1139	0.0000	1.19E-07
9			0.00	0.000	0.038	0.3032	0.1139	0.0000	1.19E-07
10			0.01	0.000	0.020	0.3018	0.1138	0.0000	1.19E-07
11			0.01	0.000	0.049	0.2981	0.1138	0.0000	1.19E-07
12			0.00	0.000	0.036	0.2945	0.1138	0.0000	1.19E-07
13			0.44	0.194	0.110	0.3083	0.1137	0.0000	1.18E-07
14			0.04	0.000	0.040	0.3082	0.1137	0.0000	1.18E-07
15			0.00	0.000	0.024	0.3058	0.1137	0.0000	1.18E-07
16			0.07	0.000	0.066	0.3060	0.1136	0.0000	1.18E-07
17			0.00	0.000	0.034	0.3026	0.1136	0.0000	1.18E-07
18			0.00	0.000	0.038	0.2988	0.1136	0.0000	1.18E-07
19			0.00	0.000	0.019	0.2971	0.1135	0.0000	1.18E-07
20			0.00	0.000	0.025	0.2946	0.1135	0.0000	1.18E-07
21			0.06	0.000	0.061	0.2950	0.1135	0.0000	1.18E-07
22			0.00	0.000	0.030	0.2920	0.1134	0.0000	1.18E-07
23			0.00	0.000	0.030	0.2890	0.1134	0.0000	1.18E-07
24			0.00	0.000	0.025	0.2865	0.1134	0.0000	1.18E-07

25		0.00	0.000	0.020	0.2845	0.1133	0.0000	1.18E-07
26		0.00	0.000	0.032	0.2812	0.1133	0.0000	1.18E-07
27		0.00	0.000	0.032	0.2780	0.1133	0.0000	1.18E-07
28		0.00	0.000	0.008	0.2772	0.1132	0.0000	1.18E-07
29		0.00	0.000	0.001	0.2770	0.1132	0.0000	1.18E-07
30		0.00	0.000	0.000	0.2770	0.1132	0.0000	1.18E-07
31		0.16	0.000	0.044	0.2890	0.1131	0.0000	1.18E-07
32		0.21	0.038	0.055	0.3003	0.1131	0.0000	1.18E-07
33		0.10	0.000	0.053	0.3050	0.1131	0.0000	1.18E-07
34	*	0.07	0.000	0.049	0.3070	0.1130	0.0000	1.18E-07
35		0.00	0.000	0.030	0.3040	0.1130	0.0000	1.18E-07
36	*	0.67	0.000	0.030	0.3060	0.1130	0.0000	1.18E-07
37	*	0.36	0.000	0.032	0.3080	0.1129	0.0000	1.18E-07
38	*	0.00	0.000	0.015	0.3099	0.1129	0.0000	1.18E-07
39	*	0.00	0.000	0.009	0.3119	0.1129	0.0000	1.18E-07
40	*	0.00	0.000	0.023	0.3139	0.1128	0.0000	1.18E-07
41		0.00	0.694	0.000	0.3266	0.1128	0.0000	1.18E-07
42		0.00	0.000	0.030	0.3236	0.1128	0.0000	1.18E-07
43	*	0.00	0.000	0.015	0.3221	0.1127	0.0000	1.18E-07
44		0.00	0.000	0.039	0.3186	0.1127	0.0000	1.18E-07
45		0.28	0.101	0.100	0.3269	0.1127	0.0000	1.17E-07
46		0.04	0.000	0.112	0.3193	0.1126	0.0000	1.17E-07
47		0.15	0.003	0.105	0.3231	0.1126	0.0000	1.17E-07
48		0.01	0.000	0.042	0.3197	0.1126	0.0000	1.17E-07
49		0.92	0.667	0.109	0.3336	0.1126	0.0000	1.17E-07
50		0.00	0.000	0.026	0.3311	0.1125	0.0000	1.17E-07
51		0.00	0.000	0.034	0.3277	0.1125	0.0000	1.17E-07
52		0.00	0.000	0.035	0.3242	0.1125	0.0000	1.17E-07
53		0.00	0.000	0.045	0.3197	0.1124	0.0000	1.17E-07
54		0.00	0.000	0.020	0.3177	0.1124	0.0000	1.17E-07
55		0.02	0.000	0.049	0.3152	0.1124	0.0000	1.17E-07
56		0.00	0.000	0.019	0.3133	0.1123	0.0000	1.17E-07

57		0.00	0.000	0.082	0.3051	0.1123	0.0000	1.17E-07
58		0.00	0.000	0.059	0.2993	0.1123	0.0000	1.17E-07
59		0.11	0.000	0.080	0.3019	0.1122	0.0000	1.17E-07
60		0.00	0.000	0.170	0.2850	0.1122	0.0000	1.17E-07
61		0.00	0.000	0.038	0.2812	0.1122	0.0000	1.17E-07
62		0.11	0.000	0.073	0.2844	0.1121	0.0000	1.17E-07
63		0.03	0.000	0.035	0.2837	0.1121	0.0000	1.17E-07
64		0.57	0.371	0.073	0.2968	0.1121	0.0000	1.17E-07
65		0.00	0.000	0.019	0.2949	0.1120	0.0000	1.17E-07
66		0.00	0.000	0.035	0.2914	0.1120	0.0000	1.17E-07
67		0.00	0.000	0.034	0.2880	0.1120	0.0000	1.17E-07
68	*	0.00	0.000	0.013	0.2867	0.1119	0.0000	1.17E-07
69		0.50	0.273	0.073	0.3017	0.1119	0.0000	1.17E-07
70		0.00	0.000	0.036	0.2981	0.1119	0.0000	1.17E-07
71		0.00	0.000	0.030	0.2951	0.1118	0.0000	1.17E-07
72		0.00	0.000	0.041	0.2909	0.1118	0.0000	1.17E-07
73		0.00	0.000	0.047	0.2862	0.1118	0.0000	1.17E-07
74		0.00	0.000	0.048	0.2815	0.1117	0.0000	1.17E-07
75		0.00	0.000	0.020	0.2795	0.1117	0.0000	1.17E-07
76		0.04	0.000	0.051	0.2782	0.1117	0.0000	1.17E-07
77		0.00	0.000	0.007	0.2775	0.1116	0.0000	1.16E-07
78		0.00	0.000	0.006	0.2771	0.1116	0.0000	1.16E-07
79		1.61	1.369	0.081	0.2934	0.1116	0.0000	1.16E-07
80		0.00	0.000	0.031	0.2903	0.1115	0.0000	1.16E-07
81		0.00	0.000	0.039	0.2864	0.1115	0.0000	1.16E-07
82		0.02	0.000	0.079	0.2808	0.1115	0.0000	1.16E-07
83		0.00	0.000	0.021	0.2787	0.1114	0.0000	1.16E-07
84		0.84	0.615	0.064	0.2948	0.1114	0.0000	1.16E-07
85		0.37	0.168	0.084	0.3064	0.1114	0.0000	1.16E-07
86		0.05	0.000	0.061	0.3053	0.1113	0.0000	1.16E-07
87		0.04	0.000	0.047	0.3049	0.1113	0.0000	1.16E-07
88		0.03	0.000	0.079	0.2998	0.1113	0.0000	1.16E-07

89		0.69	0.381	0.176	0.3133	0.1112	0.0000	1.16E-07
90		0.00	0.000	0.059	0.3075	0.1112	0.0000	1.16E-07
91	*	0.08	0.000	0.047	0.3094	0.1112	0.0000	1.16E-07
92	*	0.35	0.000	0.000	0.3114	0.1111	0.0000	1.16E-07
93		0.00	0.117	0.095	0.3241	0.1111	0.0000	1.16E-07
94		0.00	0.000	0.123	0.3118	0.1111	0.0000	1.16E-07
95		1.61	1.193	0.272	0.3259	0.1110	0.0000	1.16E-07
96		0.00	0.000	0.038	0.3223	0.1110	0.0000	1.16E-07
97		0.00	0.000	0.097	0.3126	0.1110	0.0000	1.16E-07
98		0.00	0.000	0.156	0.2970	0.1109	0.0000	1.16E-07
99		0.00	0.000	0.131	0.2839	0.1109	0.0000	1.16E-07
100		0.00	0.000	0.063	0.2776	0.1109	0.0000	1.16E-07
101		0.00	0.000	0.004	0.2771	0.1108	0.0000	1.16E-07
102		0.31	0.130	0.059	0.2889	0.1108	0.0000	1.16E-07
103		0.00	0.000	0.012	0.2877	0.1108	0.0000	1.16E-07
104		0.00	0.000	0.029	0.2849	0.1108	0.0000	1.16E-07
105		0.00	0.000	0.029	0.2820	0.1107	0.0000	1.16E-07
106		0.00	0.000	0.033	0.2787	0.1107	0.0000	1.16E-07
107		0.00	0.000	0.013	0.2773	0.1107	0.0000	1.16E-07
108		0.00	0.000	0.003	0.2770	0.1106	0.0000	1.16E-07
109		0.00	0.000	0.000	0.2770	0.1106	0.0000	1.15E-07
110		0.00	0.000	0.000	0.2770	0.1106	0.0000	1.15E-07
111		0.23	0.058	0.049	0.2895	0.1105	0.0000	1.15E-07
112		0.06	0.000	0.041	0.2916	0.1105	0.0000	1.15E-07
113		0.00	0.000	0.013	0.2903	0.1105	0.0000	1.15E-07
114		0.84	0.645	0.060	0.3042	0.1104	0.0000	1.15E-07
115		0.56	0.329	0.119	0.3158	0.1104	0.0000	1.15E-07
116	*	0.03	0.000	0.078	0.3111	0.1104	0.0000	1.15E-07
117		0.17	0.008	0.126	0.3151	0.1103	0.0000	1.15E-07
118		0.09	0.000	0.109	0.3132	0.1103	0.0000	1.15E-07
119		1.26	1.062	0.070	0.3258	0.1103	0.0000	1.15E-07
120		0.00	0.000	0.059	0.3202	0.1102	0.0000	1.15E-07

121	0.27	0.098	0.147	0.3230	0.1102	0.0000	1.15E-07
122	0.38	0.196	0.128	0.3290	0.1102	0.0000	1.15E-07
123	0.00	0.000	0.128	0.3162	0.1101	0.0000	1.15E-07
124	0.00	0.000	0.074	0.3088	0.1101	0.0000	1.15E-07
125	0.00	0.000	0.120	0.2968	0.1101	0.0000	1.15E-07
126	0.00	0.000	0.093	0.2875	0.1100	0.0000	1.15E-07
127	0.00	0.000	0.086	0.2789	0.1100	0.0000	1.15E-07
128	0.00	0.000	0.016	0.2773	0.1100	0.0000	1.15E-07
129	0.00	0.000	0.003	0.2770	0.1099	0.0000	1.15E-07
130	0.00	0.000	0.000	0.2770	0.1099	0.0000	1.15E-07
131	0.00	0.000	0.000	0.2770	0.1099	0.0000	1.15E-07
132	0.00	0.000	0.000	0.2770	0.1099	0.0000	1.15E-07
133	0.00	0.000	0.000	0.2770	0.1098	0.0000	1.15E-07
134	0.20	0.027	0.050	0.2895	0.1098	0.0000	1.15E-07
135	0.00	0.000	0.011	0.2884	0.1098	0.0000	1.15E-07
136	0.00	0.000	0.016	0.2868	0.1097	0.0000	1.15E-07
137	0.32	0.121	0.061	0.3009	0.1097	0.0000	1.15E-07
138	0.00	0.000	0.016	0.2993	0.1097	0.0000	1.15E-07
139	0.00	0.000	0.016	0.2977	0.1096	0.0000	1.15E-07
140	0.48	0.288	0.058	0.3110	0.1096	0.0000	1.15E-07
141	0.00	0.000	0.068	0.3042	0.1096	0.0000	1.15E-07
142	0.17	0.003	0.156	0.3049	0.1095	0.0000	1.14E-07
143	0.05	0.000	0.075	0.3020	0.1095	0.0000	1.14E-07
144	0.00	0.000	0.123	0.2896	0.1095	0.0000	1.14E-07
145	0.00	0.000	0.084	0.2813	0.1094	0.0000	1.14E-07
146	0.00	0.000	0.035	0.2778	0.1094	0.0000	1.14E-07
147	0.00	0.000	0.007	0.2771	0.1094	0.0000	1.14E-07
148	0.02	0.000	0.019	0.2771	0.1093	0.0000	1.14E-07
149	0.00	0.000	0.001	0.2770	0.1093	0.0000	1.14E-07
150	0.00	0.000	0.000	0.2770	0.1093	0.0000	1.14E-07
151	0.00	0.000	0.000	0.2770	0.1093	0.0000	1.14E-07
152	0.00	0.000	0.000	0.2770	0.1092	0.0000	1.14E-07

153	0.00	0.000	0.000	0.2770	0.1092	0.0000	1.14E-07
154	0.70	0.476	0.062	0.2932	0.1092	0.0000	1.14E-07
155	0.00	0.000	0.010	0.2921	0.1091	0.0000	1.14E-07
156	0.00	0.000	0.017	0.2905	0.1091	0.0000	1.14E-07
157	0.17	0.012	0.055	0.3012	0.1091	0.0000	1.14E-07
158	0.00	0.000	0.015	0.2997	0.1090	0.0000	1.14E-07
159	0.23	0.060	0.055	0.3115	0.1090	0.0000	1.14E-07
160	0.00	0.000	0.058	0.3058	0.1090	0.0000	1.14E-07
161	0.00	0.000	0.103	0.2955	0.1089	0.0000	1.14E-07
162	0.00	0.000	0.095	0.2860	0.1089	0.0000	1.14E-07
163	0.74	0.485	0.098	0.3014	0.1089	0.0000	1.14E-07
164	0.01	0.000	0.131	0.2891	0.1088	0.0000	1.14E-07
165	0.00	0.000	0.038	0.2853	0.1088	0.0000	1.14E-07
166	0.00	0.000	0.030	0.2823	0.1088	0.0000	1.14E-07
167	0.00	0.000	0.029	0.2794	0.1087	0.0000	1.14E-07
168	0.00	0.000	0.021	0.2773	0.1087	0.0000	1.14E-07
169	0.00	0.000	0.003	0.2770	0.1087	0.0000	1.14E-07
170	0.00	0.000	0.000	0.2770	0.1086	0.0000	1.14E-07
171	0.00	0.000	0.000	0.2770	0.1086	0.0000	1.14E-07
172	0.00	0.000	0.000	0.2770	0.1086	0.0000	1.14E-07
173	0.00	0.000	0.000	0.2770	0.1086	0.0000	1.14E-07
174	0.00	0.000	0.000	0.2770	0.1085	0.0000	1.14E-07
175	0.00	0.000	0.000	0.2770	0.1085	0.0000	1.13E-07
176	0.00	0.000	0.000	0.2770	0.1085	0.0000	1.13E-07
177	0.12	0.000	0.040	0.2855	0.1084	0.0000	1.13E-07
178	0.01	0.000	0.024	0.2846	0.1084	0.0000	1.13E-07
179	0.00	0.000	0.016	0.2830	0.1084	0.0000	1.13E-07
180	0.00	0.000	0.017	0.2813	0.1083	0.0000	1.13E-07
181	0.98	0.773	0.058	0.2958	0.1083	0.0000	1.13E-07
182	0.02	0.000	0.049	0.2929	0.1083	0.0000	1.13E-07
183	0.00	0.000	0.062	0.2867	0.1082	0.0000	1.13E-07
184	0.00	0.000	0.069	0.2799	0.1082	0.0000	1.13E-07

185	0.00	0.000	0.022	0.2777	0.1082	0.0000	1.13E-07
186	0.00	0.000	0.005	0.2772	0.1081	0.0000	1.13E-07
187	0.00	0.000	0.001	0.2770	0.1081	0.0000	1.13E-07
188	0.00	0.000	0.000	0.2770	0.1081	0.0000	1.13E-07
189	0.00	0.000	0.000	0.2770	0.1081	0.0000	1.13E-07
190	0.00	0.000	0.000	0.2770	0.1080	0.0000	1.13E-07
191	0.25	0.072	0.054	0.2892	0.1080	0.0000	1.13E-07
192	0.03	0.000	0.032	0.2888	0.1080	0.0000	1.13E-07
193	0.00	0.000	0.020	0.2868	0.1079	0.0000	1.13E-07
194	0.00	0.000	0.020	0.2848	0.1079	0.0000	1.13E-07
195	0.35	0.150	0.065	0.2987	0.1079	0.0000	1.13E-07
196	0.04	0.000	0.043	0.2989	0.1078	0.0000	1.13E-07
197	0.03	0.000	0.042	0.2977	0.1078	0.0000	1.13E-07
198	0.00	0.000	0.019	0.2958	0.1078	0.0000	1.13E-07
199	0.00	0.000	0.019	0.2939	0.1077	0.0000	1.13E-07
200	0.05	0.000	0.043	0.2944	0.1077	0.0000	1.13E-07
201	0.00	0.000	0.018	0.2926	0.1077	0.0000	1.13E-07
202	0.00	0.000	0.022	0.2904	0.1076	0.0000	1.13E-07
203	1.29	1.093	0.066	0.3039	0.1076	0.0000	1.13E-07
204	0.76	0.435	0.242	0.3122	0.1076	0.0000	1.13E-07
205	0.22	0.051	0.162	0.3131	0.1075	0.0000	1.13E-07
206	0.08	0.000	0.085	0.3127	0.1075	0.0000	1.13E-07
207	0.04	0.000	0.166	0.2996	0.1075	0.0000	1.13E-07
208	1.08	0.842	0.098	0.3135	0.1075	0.0000	1.13E-07
209	0.01	0.000	0.055	0.3092	0.1074	0.0000	1.12E-07
210	0.00	0.000	0.117	0.2974	0.1074	0.0000	1.12E-07
211	0.31	0.126	0.159	0.3002	0.1074	0.0000	1.12E-07
212	0.05	0.000	0.202	0.2854	0.1073	0.0000	1.12E-07
213	0.23	0.046	0.164	0.2878	0.1073	0.0000	1.12E-07
214	1.55	1.344	0.100	0.2988	0.1073	0.0000	1.12E-07
215	0.00	0.000	0.110	0.2878	0.1074	0.0000	1.12E-07
216	0.00	0.000	0.085	0.2794	0.1078	0.0000	1.13E-07

217	0.00	0.000	0.018	0.2776	0.1077	0.0000	1.13E-07
218	0.00	0.000	0.004	0.2771	0.1077	0.0000	1.13E-07
219	0.00	0.000	0.001	0.2770	0.1077	0.0000	1.13E-07
220	0.00	0.000	0.000	0.2770	0.1076	0.0000	1.13E-07
221	0.00	0.000	0.000	0.2770	0.1076	0.0000	1.13E-07
222	0.00	0.000	0.000	0.2770	0.1076	0.0000	1.13E-07
223	0.00	0.000	0.000	0.2770	0.1075	0.0000	1.13E-07
224	0.00	0.000	0.000	0.2770	0.1075	0.0000	1.13E-07
225	0.53	0.315	0.068	0.2921	0.1075	0.0000	1.13E-07
226	0.00	0.000	0.013	0.2909	0.1074	0.0000	1.13E-07
227	0.00	0.000	0.019	0.2889	0.1074	0.0000	1.12E-07
228	0.00	0.000	0.019	0.2870	0.1074	0.0000	1.12E-07
229	0.00	0.000	0.022	0.2848	0.1074	0.0000	1.12E-07
230	0.00	0.000	0.018	0.2830	0.1073	0.0000	1.12E-07
231	0.00	0.000	0.019	0.2811	0.1073	0.0000	1.12E-07
232	0.00	0.000	0.016	0.2795	0.1073	0.0000	1.12E-07
233	0.00	0.000	0.021	0.2774	0.1072	0.0000	1.12E-07
234	0.45	0.246	0.063	0.2913	0.1072	0.0000	1.12E-07
235	0.00	0.000	0.078	0.2835	0.1072	0.0000	1.12E-07
236	0.07	0.000	0.050	0.2856	0.1071	0.0000	1.12E-07
237	0.42	0.234	0.063	0.2977	0.1071	0.0000	1.12E-07
238	0.98	0.590	0.293	0.3078	0.1071	0.0000	1.12E-07
239	0.14	0.005	0.096	0.3118	0.1070	0.0000	1.12E-07
240	0.00	0.000	0.218	0.2900	0.1070	0.0000	1.12E-07
241	0.00	0.000	0.114	0.2786	0.1070	0.0000	1.12E-07
242	0.00	0.000	0.012	0.2774	0.1070	0.0000	1.12E-07
243	0.00	0.000	0.003	0.2771	0.1069	0.0000	1.12E-07
244	0.02	0.000	0.019	0.2770	0.1069	0.0000	1.12E-07
245	0.00	0.000	0.001	0.2770	0.1069	0.0000	1.12E-07
246	0.00	0.000	0.000	0.2770	0.1068	0.0000	1.12E-07
247	0.26	0.087	0.057	0.2891	0.1068	0.0000	1.12E-07
248	0.22	0.063	0.055	0.2996	0.1068	0.0000	1.12E-07

249		0.29	0.114	0.100	0.3073	0.1067	0.0000	1.12E-07
250		0.00	0.000	0.081	0.2992	0.1067	0.0000	1.12E-07
251		0.00	0.000	0.024	0.2969	0.1067	0.0000	1.12E-07
252		0.00	0.000	0.041	0.2928	0.1067	0.0000	1.12E-07
253		0.00	0.000	0.033	0.2895	0.1066	0.0000	1.12E-07
254		0.00	0.000	0.026	0.2869	0.1066	0.0000	1.12E-07
255		0.00	0.000	0.020	0.2849	0.1066	0.0000	1.12E-07
256	*	0.00	0.000	0.026	0.2824	0.1065	0.0000	1.12E-07
257		0.00	0.000	0.026	0.2798	0.1065	0.0000	1.12E-07
258		0.00	0.000	0.022	0.2775	0.1065	0.0000	1.12E-07
259		0.00	0.000	0.005	0.2771	0.1064	0.0000	1.12E-07
260		0.19	0.016	0.051	0.2896	0.1064	0.0000	1.12E-07
261		0.00	0.000	0.010	0.2886	0.1064	0.0000	1.11E-07
262		0.00	0.000	0.017	0.2869	0.1063	0.0000	1.11E-07
263		0.00	0.000	0.016	0.2853	0.1063	0.0000	1.11E-07
264		0.00	0.000	0.016	0.2837	0.1063	0.0000	1.11E-07
265		0.00	0.000	0.016	0.2821	0.1063	0.0000	1.11E-07
266		0.00	0.000	0.016	0.2805	0.1062	0.0000	1.11E-07
267		0.00	0.000	0.016	0.2789	0.1062	0.0000	1.11E-07
268		0.06	0.000	0.046	0.2808	0.1062	0.0000	1.11E-07
269		0.00	0.000	0.007	0.2801	0.1061	0.0000	1.11E-07
270		0.00	0.000	0.009	0.2792	0.1061	0.0000	1.11E-07
271		0.08	0.000	0.039	0.2831	0.1061	0.0000	1.11E-07
272		0.00	0.000	0.009	0.2821	0.1060	0.0000	1.11E-07
273		0.00	0.000	0.011	0.2813	0.1060	0.0000	1.11E-07
274		0.39	0.192	0.057	0.2953	0.1060	0.0000	1.11E-07
275		0.00	0.000	0.009	0.2944	0.1060	0.0000	1.11E-07
276		0.05	0.000	0.039	0.2954	0.1059	0.0000	1.11E-07
277		0.00	0.000	0.013	0.2942	0.1059	0.0000	1.11E-07
278		1.57	1.386	0.056	0.3074	0.1059	0.0000	1.11E-07
279		0.00	0.000	0.082	0.2992	0.1058	0.0000	1.11E-07
280		0.00	0.000	0.026	0.2966	0.1058	0.0000	1.11E-07

281		0.00	0.000	0.048	0.2918	0.1058	0.0000	1.11E-07
282		0.50	0.246	0.106	0.3066	0.1057	0.0000	1.11E-07
283		0.00	0.000	0.022	0.3044	0.1057	0.0000	1.11E-07
284		0.00	0.000	0.037	0.3007	0.1057	0.0000	1.11E-07
285		0.01	0.000	0.069	0.2951	0.1056	0.0000	1.11E-07
286		0.00	0.000	0.024	0.2928	0.1056	0.0000	1.11E-07
287		0.02	0.000	0.056	0.2889	0.1056	0.0000	1.11E-07
288	*	0.78	0.000	0.038	0.2908	0.1055	0.0000	1.11E-07
289		0.00	0.000	0.046	0.2928	0.1055	0.0000	1.11E-07
290		0.00	0.298	0.000	0.3055	0.1055	0.0000	1.11E-07
291		0.00	0.068	0.042	0.3172	0.1055	0.0000	1.11E-07
292		0.00	0.000	0.036	0.3136	0.1054	0.0000	1.11E-07
293		0.00	0.000	0.033	0.3103	0.1054	0.0000	1.11E-07
294		0.00	0.000	0.064	0.3039	0.1054	0.0000	1.11E-07
295		0.05	0.000	0.091	0.2997	0.1053	0.0000	1.10E-07
296		0.09	0.000	0.094	0.2992	0.1053	0.0000	1.10E-07
297		0.00	0.000	0.026	0.2966	0.1053	0.0000	1.10E-07
298		0.00	0.000	0.035	0.2931	0.1052	0.0000	1.10E-07
299		0.00	0.000	0.110	0.2821	0.1052	0.0000	1.10E-07
300		0.00	0.000	0.038	0.2784	0.1052	0.0000	1.10E-07
301		0.00	0.000	0.010	0.2773	0.1051	0.0000	1.10E-07
302		0.00	0.000	0.002	0.2771	0.1051	0.0000	1.10E-07
303		0.00	0.000	0.001	0.2770	0.1051	0.0000	1.10E-07
304		0.00	0.000	0.000	0.2770	0.1051	0.0000	1.10E-07
305		0.00	0.000	0.000	0.2770	0.1050	0.0000	1.10E-07
306		0.01	0.000	0.007	0.2770	0.1050	0.0000	1.10E-07
307		0.00	0.000	0.000	0.2770	0.1050	0.0000	1.10E-07
308		0.00	0.000	0.000	0.2770	0.1049	0.0000	1.10E-07
309		0.00	0.000	0.000	0.2770	0.1049	0.0000	1.10E-07
310		0.00	0.000	0.000	0.2770	0.1049	0.0000	1.10E-07
311		0.07	0.000	0.035	0.2803	0.1048	0.0000	1.10E-07
312	*	0.00	0.000	0.001	0.2802	0.1048	0.0000	1.10E-07

313	*	0.00	0.000	0.005	0.2797	0.1048	0.0000	1.10E-07
314	*	0.00	0.000	0.006	0.2791	0.1048	0.0000	1.10E-07
315		0.00	0.000	0.003	0.2788	0.1047	0.0000	1.10E-07
316		0.06	0.000	0.035	0.2813	0.1047	0.0000	1.10E-07
317	*	0.43	0.000	0.029	0.2833	0.1047	0.0000	1.10E-07
318	*	0.00	0.000	0.018	0.2852	0.1046	0.0000	1.10E-07
319	*	0.00	0.000	0.036	0.2872	0.1046	0.0000	1.10E-07
320		0.00	0.076	0.086	0.2999	0.1046	0.0000	1.10E-07
321		0.02	0.000	0.020	0.2995	0.1045	0.0000	1.10E-07
322		0.05	0.000	0.040	0.3008	0.1045	0.0000	1.10E-07
323		0.00	0.000	0.011	0.2997	0.1045	0.0000	1.10E-07
324		0.43	0.245	0.055	0.3129	0.1045	0.0000	1.10E-07
325		0.00	0.000	0.017	0.3113	0.1044	0.0000	1.10E-07
326		0.00	0.000	0.013	0.3100	0.1044	0.0000	1.10E-07
327	*	0.00	0.000	0.016	0.3088	0.1044	0.0000	1.10E-07
328	*	0.43	0.000	0.019	0.3108	0.1043	0.0000	1.10E-07
329	*	0.01	0.000	0.000	0.3128	0.1043	0.0000	1.09E-07
330	*	0.01	0.000	0.000	0.3147	0.1043	0.0000	1.09E-07
331		0.00	0.229	0.020	0.3275	0.1042	0.0000	1.09E-07
332	*	0.00	0.000	0.000	0.3275	0.1042	0.0000	1.09E-07
333		0.00	0.000	0.015	0.3259	0.1042	0.0000	1.09E-07
334		0.00	0.000	0.032	0.3228	0.1041	0.0000	1.09E-07
335		0.05	0.000	0.055	0.3225	0.1041	0.0000	1.09E-07
336		0.47	0.266	0.075	0.3352	0.1041	0.0000	1.09E-07
337		0.11	0.005	0.049	0.3411	0.1041	0.0000	1.09E-07
338	*	0.00	0.000	0.000	0.3411	0.1040	0.0000	1.09E-07
339		0.00	0.000	0.024	0.3387	0.1040	0.0000	1.09E-07
340		0.00	0.000	0.020	0.3367	0.1040	0.0000	1.09E-07
341		0.00	0.000	0.016	0.3350	0.1039	0.0000	1.09E-07
342	*	0.00	0.000	0.000	0.3350	0.1039	0.0000	1.09E-07
343	*	0.00	0.000	0.000	0.3350	0.1039	0.0000	1.09E-07
344	*	0.00	0.000	0.000	0.3350	0.1038	0.0000	1.09E-07

345	*	0.00	0.000	0.013	0.3337	0.1038	0.0000	1.09E-07
346		0.00	0.000	0.018	0.3320	0.1038	0.0000	1.09E-07
347		0.00	0.000	0.022	0.3298	0.1038	0.0000	1.09E-07
348		0.00	0.000	0.029	0.3269	0.1037	0.0000	1.09E-07
349		0.00	0.000	0.015	0.3254	0.1037	0.0000	1.09E-07
350		0.00	0.000	0.015	0.3239	0.1037	0.0000	1.09E-07
351		0.00	0.000	0.010	0.3228	0.1036	0.0000	1.09E-07
352		0.00	0.000	0.016	0.3212	0.1036	0.0000	1.09E-07
353		0.00	0.000	0.018	0.3194	0.1036	0.0000	1.09E-07
354	*	0.00	0.000	0.000	0.3194	0.1035	0.0000	1.09E-07
355		0.00	0.000	0.015	0.3178	0.1035	0.0000	1.09E-07
356		0.00	0.000	0.021	0.3158	0.1035	0.0000	1.09E-07
357		0.00	0.000	0.031	0.3126	0.1034	0.0000	1.09E-07
358		0.00	0.000	0.029	0.3097	0.1034	0.0000	1.09E-07
359		0.00	0.000	0.025	0.3072	0.1034	0.0000	1.09E-07
360		0.00	0.000	0.011	0.3061	0.1034	0.0000	1.09E-07
361		0.00	0.000	0.016	0.3045	0.1033	0.0000	1.09E-07
362		0.00	0.000	0.012	0.3033	0.1033	0.0000	1.09E-07
363	*	0.00	0.000	0.011	0.3022	0.1033	0.0000	1.09E-07
364	*	0.00	0.000	0.000	0.3022	0.1032	0.0000	1.08E-07
365	*	0.00	0.000	0.000	0.3022	0.1032	0.0000	1.08E-07

* = Frozen (air or soil)

Annual Totals for Year 29			
	inches	cubic feet	percent
Precipitation	35.25	127,961.1	100.00
Runoff	19.969	72,485.7	56.65
Evapotranspiration	15.263	55,403.7	43.30
Recirculation into Layer 1	0.0045	16.3	0.01
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0045	16.3	0.01
Percolation/Leakage through Layer 5	0.000041	0.1504	0.00
Average Head on Top of Layer 4	0.1085	---	---
Change in Water Storage	0.0197	71.5	0.06
Soil Water at Start of Year	1,406.7297	5,106,428.7	3990.61
Soil Water at End of Year	1,406.7494	5,106,500.2	3990.67
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0045	-16.3	-0.01

Daily Output for Year 30

Column key: Head #1: drainage from Layer 4
Drain #1: drainage from Layer 3
Leak #1: leakage thru Layer 5

Title: AEL Lateral Expansion
Simulated On: 6/29/2023 9:04

Day	Freezing Status* Air	Soil	Rain (inches)	Runoff (inches)	ET (inches)	Evap. Zone Water (in/in)	Head #1 (inches)	Drain #1 (inches)	Leak #1 (inches)
1	*		0.00	0.000	0.000	0.3022	0.1032	0.0000	1.08E-07
2	*		0.00	0.000	0.000	0.3022	0.1031	0.0000	1.08E-07
3	*		0.03	0.000	0.014	0.3038	0.1031	0.0000	1.08E-07
4	*	*	0.00	0.000	0.000	0.3038	0.1031	0.0000	1.08E-07
5	*	*	0.00	0.000	0.000	0.3038	0.1031	0.0000	1.08E-07
6	*	*	0.00	0.000	0.000	0.3038	0.1030	0.0000	1.08E-07
7	*	*	0.00	0.000	0.000	0.3038	0.1030	0.0000	1.08E-07
8	*	*	0.00	0.000	0.000	0.3038	0.1030	0.0000	1.08E-07
9	*	*	0.00	0.000	0.000	0.3038	0.1029	0.0000	1.08E-07
10	*	*	0.43	0.000	0.009	0.3038	0.1029	0.0000	1.08E-07
11	*	*	0.00	0.000	0.021	0.3038	0.1029	0.0000	1.08E-07
12	*	*	0.00	0.000	0.023	0.3038	0.1028	0.0000	1.08E-07
13	*	*	0.00	0.000	0.000	0.3038	0.1028	0.0000	1.08E-07
14	*	*	0.03	0.000	0.019	0.3038	0.1028	0.0000	1.08E-07
15		*	0.00	0.334	0.022	0.3069	0.1028	0.0000	1.08E-07
16		*	0.17	0.131	0.040	0.3069	0.1027	0.0000	1.08E-07
17			0.00	0.000	0.043	0.3026	0.1027	0.0000	1.08E-07
18			0.03	0.000	0.052	0.2999	0.1027	0.0000	1.08E-07
19			0.03	0.000	0.046	0.2979	0.1026	0.0000	1.08E-07
20			0.19	0.017	0.055	0.3092	0.1026	0.0000	1.08E-07
21			0.08	0.000	0.081	0.3090	0.1026	0.0000	1.08E-07
22			0.12	0.000	0.082	0.3129	0.1025	0.0000	1.08E-07
23			0.21	0.045	0.071	0.3227	0.1025	0.0000	1.08E-07
24			0.00	0.000	0.019	0.3209	0.1025	0.0000	1.08E-07

25		0.00	0.000	0.055	0.3153	0.1025	0.0000	1.08E-07
26		0.00	0.000	0.050	0.3103	0.1024	0.0000	1.08E-07
27		0.00	0.000	0.021	0.3082	0.1024	0.0000	1.08E-07
28		0.00	0.000	0.067	0.3015	0.1024	0.0000	1.08E-07
29		0.00	0.000	0.097	0.2919	0.1023	0.0000	1.08E-07
30		0.00	0.000	0.039	0.2879	0.1026	0.0000	1.08E-07
31	*	0.00	0.000	0.020	0.2858	0.1044	0.0000	1.10E-07
32	*	0.00	0.000	0.000	0.2858	0.1043	0.0000	1.10E-07
33		0.00	0.000	0.026	0.2832	0.1043	0.0000	1.09E-07
34	*	0.00	0.000	0.003	0.2832	0.1043	0.0000	1.09E-07
35	*	0.00	0.000	0.000	0.2832	0.1042	0.0000	1.09E-07
36	*	0.00	0.000	0.000	0.2832	0.1042	0.0000	1.09E-07
37	*	0.25	0.000	0.039	0.2852	0.1042	0.0000	1.09E-07
38		0.02	0.012	0.074	0.2974	0.1042	0.0000	1.09E-07
39		0.01	0.000	0.087	0.2901	0.1041	0.0000	1.09E-07
40		0.02	0.000	0.036	0.2886	0.1041	0.0000	1.09E-07
41		0.83	0.615	0.071	0.3033	0.1041	0.0000	1.09E-07
42		0.00	0.000	0.033	0.3000	0.1040	0.0000	1.09E-07
43		0.02	0.000	0.111	0.2911	0.1040	0.0000	1.09E-07
44		0.00	0.000	0.058	0.2853	0.1040	0.0000	1.09E-07
45		0.00	0.000	0.027	0.2826	0.1039	0.0000	1.09E-07
46		0.00	0.000	0.029	0.2797	0.1039	0.0000	1.09E-07
47		0.41	0.205	0.065	0.2936	0.1039	0.0000	1.09E-07
48		0.00	0.000	0.025	0.2910	0.1039	0.0000	1.09E-07
49		0.00	0.000	0.014	0.2896	0.1038	0.0000	1.09E-07
50	*	0.93	0.000	0.024	0.2916	0.1038	0.0000	1.09E-07
51	*	0.34	0.000	0.000	0.2935	0.1038	0.0000	1.09E-07
52	*	0.18	0.000	0.000	0.2955	0.1037	0.0000	1.09E-07
53	*	0.00	0.000	0.034	0.2975	0.1037	0.0000	1.09E-07
54	*	0.00	0.000	0.016	0.2994	0.1037	0.0000	1.09E-07
55		0.00	0.310	0.000	0.3122	0.1036	0.0000	1.09E-07
56	*	0.00	0.000	0.027	0.3142	0.1036	0.0000	1.09E-07

57	*		0.00	0.000	0.030	0.3161	0.1036	0.0000	1.09E-07
58	*		0.00	0.000	0.032	0.3181	0.1035	0.0000	1.09E-07
59	*		0.00	0.000	0.017	0.3201	0.1035	0.0000	1.09E-07
60	*		0.00	0.000	0.033	0.3221	0.1035	0.0000	1.09E-07
61	*		0.00	0.000	0.035	0.3241	0.1035	0.0000	1.09E-07
62	*		0.00	0.000	0.038	0.3261	0.1034	0.0000	1.09E-07
63			0.25	0.615	0.000	0.3388	0.1034	0.0000	1.09E-07
64	*		0.12	0.000	0.082	0.3408	0.1034	0.0000	1.09E-07
65	*		0.03	0.000	0.055	0.3399	0.1033	0.0000	1.09E-07
66	*		0.00	0.000	0.036	0.3363	0.1033	0.0000	1.09E-07
67			0.00	0.000	0.071	0.3292	0.1033	0.0000	1.09E-07
68	*		0.00	0.000	0.042	0.3251	0.1032	0.0000	1.08E-07
69			0.00	0.000	0.046	0.3204	0.1032	0.0000	1.08E-07
70	*		0.00	0.000	0.000	0.3204	0.1032	0.0000	1.08E-07
71			0.00	0.000	0.047	0.3157	0.1032	0.0000	1.08E-07
72	*		0.00	0.000	0.000	0.3157	0.1031	0.0000	1.08E-07
73	*	*	0.11	0.000	0.034	0.3157	0.1031	0.0000	1.08E-07
74	*	*	0.37	0.000	0.024	0.3157	0.1031	0.0000	1.08E-07
75	*	*	0.06	0.000	0.000	0.3157	0.1030	0.0000	1.08E-07
76	*	*	0.80	0.000	0.000	0.3157	0.1030	0.0000	1.08E-07
77		*	0.84	2.088	0.000	0.3194	0.1030	0.0000	1.08E-07
78		*	0.00	0.000	0.000	0.3194	0.1029	0.0000	1.08E-07
79			0.00	0.000	0.108	0.3086	0.1029	0.0000	1.08E-07
80			0.00	0.000	0.065	0.3021	0.1029	0.0000	1.08E-07
81	*		0.00	0.000	0.000	0.3021	0.1029	0.0000	1.08E-07
82	*	*	0.00	0.000	0.000	0.3021	0.1028	0.0000	1.08E-07
83	*	*	0.00	0.000	0.000	0.3021	0.1028	0.0000	1.08E-07
84	*	*	0.83	0.000	0.032	0.3021	0.1028	0.0000	1.08E-07
85	*	*	0.69	0.000	0.018	0.3021	0.1028	0.0000	1.08E-07
86	*	*	0.00	0.000	0.047	0.3021	0.1027	0.0000	1.08E-07
87	*	*	0.35	0.000	0.029	0.3021	0.1027	0.0000	1.08E-07
88	*	*	0.00	0.000	0.021	0.3021	0.1027	0.0000	1.08E-07

89	*	*	0.08	0.000	0.029	0.3021	0.1026	0.0000	1.08E-07
90		*	0.00	1.325	0.000	0.3067	0.1026	0.0000	1.08E-07
91		*	0.00	0.303	0.101	0.3067	0.1026	0.0000	1.08E-07
92			0.00	0.000	0.059	0.3008	0.1025	0.0000	1.08E-07
93			0.21	0.047	0.075	0.3100	0.1025	0.0000	1.08E-07
94			0.00	0.000	0.068	0.3031	0.1025	0.0000	1.08E-07
95			0.00	0.000	0.075	0.2956	0.1025	0.0000	1.08E-07
96			0.04	0.000	0.108	0.2885	0.1024	0.0000	1.08E-07
97			0.02	0.000	0.046	0.2861	0.1024	0.0000	1.08E-07
98			0.54	0.308	0.084	0.3013	0.1024	0.0000	1.08E-07
99			0.17	0.008	0.130	0.3047	0.1023	0.0000	1.08E-07
100			0.00	0.000	0.035	0.3012	0.1023	0.0000	1.08E-07
101			0.00	0.000	0.110	0.2902	0.1023	0.0000	1.08E-07
102			0.00	0.000	0.079	0.2823	0.1022	0.0000	1.08E-07
103			0.00	0.000	0.042	0.2780	0.1022	0.0000	1.07E-07
104			0.59	0.354	0.083	0.2935	0.1022	0.0000	1.07E-07
105			0.15	0.001	0.110	0.2975	0.1022	0.0000	1.07E-07
106			0.43	0.178	0.174	0.3055	0.1021	0.0000	1.07E-07
107			0.00	0.000	0.100	0.2955	0.1021	0.0000	1.07E-07
108			0.00	0.000	0.046	0.2909	0.1021	0.0000	1.07E-07
109			0.00	0.000	0.120	0.2788	0.1020	0.0000	1.07E-07
110			0.08	0.000	0.063	0.2806	0.1020	0.0000	1.07E-07
111			1.03	0.828	0.072	0.2937	0.1020	0.0000	1.07E-07
112			0.00	0.000	0.057	0.2881	0.1019	0.0000	1.07E-07
113			0.00	0.000	0.083	0.2798	0.1019	0.0000	1.07E-07
114			0.22	0.036	0.127	0.2857	0.1019	0.0000	1.07E-07
115			0.18	0.012	0.079	0.2942	0.1019	0.0000	1.07E-07
116			0.59	0.335	0.141	0.3057	0.1018	0.0000	1.07E-07
117			0.01	0.000	0.038	0.3032	0.1018	0.0000	1.07E-07
118			0.06	0.000	0.057	0.3034	0.1018	0.0000	1.07E-07
119			0.00	0.000	0.064	0.2970	0.1017	0.0000	1.07E-07
120			0.56	0.226	0.196	0.3110	0.1017	0.0000	1.07E-07

121	0.21	0.041	0.119	0.3157	0.1017	0.0000	1.07E-07
122	0.08	0.000	0.088	0.3145	0.1016	0.0000	1.07E-07
123	0.29	0.112	0.115	0.3207	0.1016	0.0000	1.07E-07
124	0.19	0.025	0.160	0.3214	0.1016	0.0000	1.07E-07
125	0.70	0.457	0.159	0.3302	0.1016	0.0000	1.07E-07
126	0.22	0.061	0.107	0.3359	0.1015	0.0000	1.07E-07
127	0.19	0.039	0.163	0.3344	0.1015	0.0000	1.07E-07
128	2.68	2.367	0.185	0.3471	0.1015	0.0000	1.07E-07
129	0.00	0.000	0.100	0.3371	0.1014	0.0000	1.07E-07
130	0.52	0.291	0.214	0.3389	0.1014	0.0000	1.07E-07
131	0.18	0.024	0.189	0.3357	0.1014	0.0000	1.07E-07
132	0.00	0.000	0.163	0.3194	0.1014	0.0000	1.07E-07
133	0.00	0.000	0.173	0.3021	0.1013	0.0000	1.07E-07
134	0.00	0.000	0.200	0.2821	0.1013	0.0000	1.07E-07
135	0.12	0.000	0.086	0.2856	0.1013	0.0000	1.07E-07
136	1.00	0.784	0.098	0.2975	0.1012	0.0000	1.07E-07
137	0.00	0.000	0.035	0.2941	0.1012	0.0000	1.07E-07
138	0.78	0.409	0.241	0.3074	0.1012	0.0000	1.06E-07
139	0.04	0.000	0.146	0.2969	0.1011	0.0000	1.06E-07
140	0.27	0.077	0.184	0.2976	0.1011	0.0000	1.06E-07
141	0.07	0.000	0.131	0.2910	0.1011	0.0000	1.06E-07
142	0.00	0.000	0.105	0.2805	0.1011	0.0000	1.06E-07
143	0.34	0.138	0.097	0.2912	0.1010	0.0000	1.06E-07
144	0.05	0.000	0.119	0.2847	0.1010	0.0000	1.06E-07
145	0.00	0.000	0.040	0.2807	0.1010	0.0000	1.06E-07
146	0.00	0.000	0.027	0.2780	0.1009	0.0000	1.06E-07
147	0.61	0.303	0.177	0.2909	0.1009	0.0000	1.06E-07
148	1.07	0.842	0.113	0.3023	0.1009	0.0000	1.06E-07
149	0.00	0.000	0.077	0.2946	0.1008	0.0000	1.06E-07
150	0.00	0.000	0.061	0.2885	0.1008	0.0000	1.06E-07
151	0.00	0.000	0.074	0.2811	0.1008	0.0000	1.06E-07
152	0.00	0.000	0.036	0.2775	0.1008	0.0000	1.06E-07

153	0.00	0.000	0.004	0.2771	0.1007	0.0000	1.06E-07
154	0.00	0.000	0.001	0.2770	0.1007	0.0000	1.06E-07
155	0.61	0.367	0.085	0.2925	0.1007	0.0000	1.06E-07
156	1.23	0.873	0.246	0.3038	0.1006	0.0000	1.06E-07
157	0.01	0.000	0.093	0.2956	0.1006	0.0000	1.06E-07
158	0.33	0.134	0.168	0.2981	0.1006	0.0000	1.06E-07
159	0.03	0.000	0.073	0.2936	0.1006	0.0000	1.06E-07
160	0.00	0.000	0.122	0.2815	0.1005	0.0000	1.06E-07
161	0.00	0.000	0.041	0.2774	0.1005	0.0000	1.06E-07
162	0.21	0.033	0.073	0.2881	0.1005	0.0000	1.06E-07
163	0.09	0.000	0.058	0.2918	0.1004	0.0000	1.06E-07
164	0.56	0.362	0.080	0.3039	0.1004	0.0000	1.06E-07
165	0.00	0.000	0.104	0.2934	0.1004	0.0000	1.06E-07
166	0.00	0.000	0.104	0.2831	0.1003	0.0000	1.06E-07
167	0.00	0.000	0.050	0.2780	0.1003	0.0000	1.06E-07
168	0.00	0.000	0.008	0.2773	0.1003	0.0000	1.06E-07
169	0.21	0.034	0.064	0.2888	0.1003	0.0000	1.06E-07
170	0.00	0.000	0.020	0.2868	0.1002	0.0000	1.06E-07
171	0.33	0.122	0.079	0.3002	0.1002	0.0000	1.06E-07
172	0.30	0.115	0.133	0.3057	0.1002	0.0000	1.06E-07
173	0.00	0.000	0.120	0.2937	0.1001	0.0000	1.06E-07
174	0.00	0.000	0.091	0.2846	0.1001	0.0000	1.05E-07
175	0.76	0.499	0.110	0.2995	0.1001	0.0000	1.05E-07
176	0.00	0.000	0.147	0.2847	0.1001	0.0000	1.05E-07
177	0.00	0.000	0.045	0.2802	0.1000	0.0000	1.05E-07
178	0.10	0.000	0.069	0.2837	0.1000	0.0000	1.05E-07
179	0.00	0.000	0.021	0.2816	0.1000	0.0000	1.05E-07
180	1.00	0.782	0.077	0.2953	0.0999	0.0000	1.05E-07
181	0.00	0.000	0.093	0.2860	0.0999	0.0000	1.05E-07
182	1.50	1.256	0.098	0.3007	0.0999	0.0000	1.05E-07
183	0.04	0.000	0.070	0.2973	0.0999	0.0000	1.05E-07
184	0.00	0.000	0.046	0.2927	0.0998	0.0000	1.05E-07

185	0.00	0.000	0.113	0.2813	0.0998	0.0000	1.05E-07
186	0.00	0.000	0.036	0.2778	0.0998	0.0000	1.05E-07
187	0.00	0.000	0.006	0.2772	0.0997	0.0000	1.05E-07
188	0.00	0.000	0.001	0.2770	0.0997	0.0000	1.05E-07
189	0.00	0.000	0.000	0.2770	0.0997	0.0000	1.05E-07
190	0.00	0.000	0.000	0.2770	0.0996	0.0000	1.05E-07
191	0.00	0.000	0.000	0.2770	0.0996	0.0000	1.05E-07
192	0.05	0.000	0.035	0.2790	0.0996	0.0000	1.05E-07
193	0.03	0.000	0.024	0.2792	0.0996	0.0000	1.05E-07
194	0.00	0.000	0.004	0.2788	0.0995	0.0000	1.05E-07
195	0.00	0.000	0.008	0.2781	0.0995	0.0000	1.05E-07
196	0.00	0.000	0.007	0.2773	0.0995	0.0000	1.05E-07
197	0.01	0.000	0.018	0.2771	0.0994	0.0000	1.05E-07
198	0.52	0.304	0.072	0.2915	0.0994	0.0000	1.05E-07
199	0.49	0.315	0.065	0.3028	0.0994	0.0000	1.05E-07
200	0.00	0.000	0.106	0.2922	0.0994	0.0000	1.05E-07
201	0.00	0.000	0.092	0.2830	0.0993	0.0000	1.05E-07
202	0.00	0.000	0.054	0.2776	0.0993	0.0000	1.05E-07
203	0.00	0.000	0.004	0.2771	0.0993	0.0000	1.05E-07
204	0.00	0.000	0.001	0.2770	0.0992	0.0000	1.05E-07
205	0.17	0.000	0.047	0.2888	0.0992	0.0000	1.05E-07
206	1.40	1.197	0.083	0.3008	0.0992	0.0000	1.05E-07
207	0.00	0.000	0.028	0.2982	0.0992	0.0000	1.05E-07
208	0.69	0.421	0.130	0.3124	0.0991	0.0000	1.05E-07
209	0.00	0.000	0.149	0.2976	0.0991	0.0000	1.05E-07
210	0.05	0.000	0.165	0.2860	0.0991	0.0000	1.04E-07
211	0.03	0.000	0.100	0.2790	0.0990	0.0000	1.04E-07
212	0.00	0.000	0.015	0.2775	0.0990	0.0000	1.04E-07
213	0.00	0.000	0.004	0.2771	0.0990	0.0000	1.04E-07
214	0.00	0.000	0.002	0.2770	0.0990	0.0000	1.04E-07
215	0.00	0.000	0.000	0.2770	0.0989	0.0000	1.04E-07
216	0.00	0.000	0.000	0.2770	0.0989	0.0000	1.04E-07

217	0.00	0.000	0.000	0.2770	0.0989	0.0000	1.04E-07
218	0.01	0.000	0.007	0.2770	0.0988	0.0000	1.04E-07
219	0.00	0.000	0.000	0.2770	0.0988	0.0000	1.04E-07
220	0.01	0.000	0.009	0.2770	0.0988	0.0000	1.04E-07
221	0.00	0.000	0.000	0.2770	0.0988	0.0000	1.04E-07
222	0.00	0.000	0.000	0.2770	0.0987	0.0000	1.04E-07
223	0.00	0.000	0.000	0.2770	0.0987	0.0000	1.04E-07
224	0.00	0.000	0.000	0.2770	0.0987	0.0000	1.04E-07
225	0.00	0.000	0.000	0.2770	0.0986	0.0000	1.04E-07
226	0.00	0.000	0.000	0.2770	0.0986	0.0000	1.04E-07
227	0.00	0.000	0.000	0.2770	0.0986	0.0000	1.04E-07
228	0.00	0.000	0.000	0.2770	0.0986	0.0000	1.04E-07
229	0.00	0.000	0.000	0.2770	0.0985	0.0000	1.04E-07
230	0.00	0.000	0.000	0.2770	0.0985	0.0000	1.04E-07
231	0.00	0.000	0.000	0.2770	0.0985	0.0000	1.04E-07
232	0.56	0.339	0.065	0.2921	0.0984	0.0000	1.04E-07
233	0.00	0.000	0.010	0.2911	0.0984	0.0000	1.04E-07
234	0.02	0.000	0.041	0.2894	0.0984	0.0000	1.04E-07
235	0.00	0.000	0.016	0.2878	0.0984	0.0000	1.04E-07
236	0.00	0.000	0.019	0.2858	0.0983	0.0000	1.04E-07
237	0.00	0.000	0.015	0.2843	0.0983	0.0000	1.04E-07
238	0.38	0.179	0.070	0.2978	0.0983	0.0000	1.04E-07
239	0.05	0.000	0.049	0.2976	0.0982	0.0000	1.04E-07
240	0.37	0.183	0.067	0.3095	0.0982	0.0000	1.04E-07
241	0.00	0.000	0.166	0.2928	0.0982	0.0000	1.04E-07
242	0.29	0.102	0.069	0.3045	0.0982	0.0000	1.04E-07
243	0.01	0.000	0.177	0.2874	0.0981	0.0000	1.04E-07
244	0.91	0.691	0.081	0.3013	0.0981	0.0000	1.04E-07
245	0.00	0.000	0.061	0.2953	0.0981	0.0000	1.04E-07
246	0.74	0.475	0.122	0.3091	0.0980	0.0000	1.03E-07
247	0.00	0.000	0.049	0.3042	0.0980	0.0000	1.03E-07
248	0.00	0.000	0.089	0.2953	0.0980	0.0000	1.03E-07

249	0.07	0.000	0.071	0.2948	0.0980	0.0000	1.03E-07
250	0.04	0.000	0.122	0.2869	0.0979	0.0000	1.03E-07
251	0.00	0.000	0.067	0.2802	0.0979	0.0000	1.03E-07
252	0.00	0.000	0.023	0.2779	0.0979	0.0000	1.03E-07
253	0.00	0.000	0.007	0.2772	0.0979	0.0000	1.03E-07
254	0.01	0.000	0.011	0.2770	0.0980	0.0000	1.03E-07
255	0.00	0.000	0.000	0.2770	0.0980	0.0000	1.03E-07
256	0.18	0.001	0.060	0.2890	0.0980	0.0000	1.03E-07
257	0.00	0.000	0.017	0.2873	0.0979	0.0000	1.03E-07
258	0.00	0.000	0.021	0.2851	0.0979	0.0000	1.03E-07
259	0.00	0.000	0.024	0.2828	0.0979	0.0000	1.03E-07
260	0.00	0.000	0.022	0.2806	0.0979	0.0000	1.03E-07
261	0.00	0.000	0.018	0.2788	0.0978	0.0000	1.03E-07
262	0.48	0.265	0.067	0.2934	0.0978	0.0000	1.03E-07
263	0.13	0.000	0.070	0.2995	0.0978	0.0000	1.03E-07
264	0.50	0.286	0.087	0.3123	0.0977	0.0000	1.03E-07
265	0.00	0.000	0.091	0.3032	0.0977	0.0000	1.03E-07
266	0.00	0.000	0.041	0.2991	0.0977	0.0000	1.03E-07
267	0.00	0.000	0.158	0.2834	0.0977	0.0000	1.03E-07
268	0.00	0.000	0.048	0.2786	0.0976	0.0000	1.03E-07
269	0.45	0.217	0.101	0.2918	0.0976	0.0000	1.03E-07
270	0.00	0.000	0.063	0.2855	0.0976	0.0000	1.03E-07
271	0.00	0.000	0.060	0.2795	0.0975	0.0000	1.03E-07
272	0.00	0.000	0.020	0.2775	0.0975	0.0000	1.03E-07
273	0.00	0.000	0.004	0.2771	0.0975	0.0000	1.03E-07
274	0.00	0.000	0.001	0.2770	0.0975	0.0000	1.03E-07
275	0.00	0.000	0.000	0.2770	0.0974	0.0000	1.03E-07
276	0.32	0.135	0.053	0.2897	0.0974	0.0000	1.03E-07
277	0.16	0.001	0.055	0.3003	0.0974	0.0000	1.03E-07
278	0.00	0.000	0.011	0.2992	0.0973	0.0000	1.03E-07
279	0.00	0.000	0.055	0.2938	0.0973	0.0000	1.03E-07
280	0.00	0.000	0.024	0.2914	0.0973	0.0000	1.03E-07

281		0.00	0.000	0.014	0.2900	0.0973	0.0000	1.03E-07
282		0.00	0.000	0.029	0.2871	0.0972	0.0000	1.03E-07
283		0.00	0.000	0.024	0.2847	0.0972	0.0000	1.03E-07
284		0.00	0.000	0.021	0.2826	0.0972	0.0000	1.03E-07
285		0.00	0.000	0.016	0.2810	0.0971	0.0000	1.03E-07
286		0.06	0.000	0.054	0.2815	0.0971	0.0000	1.03E-07
287	*	0.02	0.000	0.030	0.2806	0.0971	0.0000	1.03E-07
288	*	0.00	0.000	0.000	0.2806	0.0971	0.0000	1.03E-07
289	*	0.00	0.000	0.000	0.2806	0.0970	0.0000	1.03E-07
290		0.00	0.000	0.014	0.2792	0.0970	0.0000	1.02E-07
291	*	0.00	0.000	0.007	0.2785	0.0970	0.0000	1.02E-07
292	*	0.00	0.000	0.004	0.2781	0.0969	0.0000	1.02E-07
293		0.54	0.328	0.063	0.2934	0.0969	0.0000	1.02E-07
294		0.00	0.000	0.024	0.2909	0.0969	0.0000	1.02E-07
295		0.00	0.000	0.013	0.2896	0.0969	0.0000	1.02E-07
296		0.00	0.000	0.012	0.2884	0.0968	0.0000	1.02E-07
297		0.00	0.000	0.012	0.2872	0.0968	0.0000	1.02E-07
298		0.00	0.000	0.011	0.2860	0.0968	0.0000	1.02E-07
299		0.00	0.000	0.011	0.2850	0.0967	0.0000	1.02E-07
300		0.00	0.000	0.011	0.2839	0.0967	0.0000	1.02E-07
301		0.00	0.000	0.010	0.2829	0.0967	0.0000	1.02E-07
302		0.00	0.000	0.010	0.2819	0.0967	0.0000	1.02E-07
303	*	1.24	0.000	0.039	0.2839	0.0966	0.0000	1.02E-07
304		0.00	0.855	0.000	0.2977	0.0966	0.0000	1.02E-07
305		0.01	0.005	0.085	0.3087	0.0966	0.0000	1.02E-07
306	*	0.19	0.000	0.058	0.3107	0.0965	0.0000	1.02E-07
307	*	0.00	0.000	0.023	0.3127	0.0965	0.0000	1.02E-07
308		0.45	0.388	0.001	0.3254	0.0965	0.0000	1.02E-07
309		0.12	0.008	0.053	0.3316	0.0965	0.0000	1.02E-07
310		0.03	0.000	0.041	0.3306	0.0964	0.0000	1.02E-07
311		1.30	1.117	0.057	0.3437	0.0964	0.0000	1.02E-07
312		0.08	0.002	0.047	0.3466	0.0964	0.0000	1.02E-07

313		0.00	0.000	0.022	0.3443	0.0964	0.0000	1.02E-07
314		0.00	0.000	0.023	0.3420	0.0963	0.0000	1.02E-07
315		0.00	0.000	0.024	0.3396	0.0963	0.0000	1.02E-07
316		0.00	0.000	0.065	0.3331	0.0963	0.0000	1.02E-07
317		0.00	0.000	0.056	0.3275	0.0962	0.0000	1.02E-07
318		0.00	0.000	0.050	0.3225	0.0962	0.0000	1.02E-07
319		0.03	0.000	0.083	0.3176	0.0962	0.0000	1.02E-07
320		0.00	0.000	0.055	0.3120	0.0962	0.0000	1.02E-07
321		0.22	0.046	0.060	0.3233	0.0961	0.0000	1.02E-07
322		0.04	0.000	0.049	0.3222	0.0961	0.0000	1.02E-07
323		0.02	0.000	0.035	0.3204	0.0963	0.0000	1.02E-07
324	*	0.01	0.000	0.019	0.3194	0.0963	0.0000	1.02E-07
325		0.00	0.000	0.019	0.3174	0.0963	0.0000	1.02E-07
326		0.00	0.000	0.039	0.3136	0.0962	0.0000	1.02E-07
327		0.00	0.000	0.040	0.3095	0.0962	0.0000	1.02E-07
328		0.00	0.000	0.045	0.3050	0.0962	0.0000	1.02E-07
329		0.17	0.001	0.139	0.3076	0.0962	0.0000	1.02E-07
330		0.28	0.098	0.061	0.3196	0.0961	0.0000	1.02E-07
331		0.00	0.000	0.067	0.3129	0.0961	0.0000	1.02E-07
332		0.00	0.000	0.023	0.3107	0.0961	0.0000	1.02E-07
333		0.00	0.000	0.047	0.3060	0.0960	0.0000	1.02E-07
334		0.03	0.000	0.049	0.3038	0.0960	0.0000	1.02E-07
335		0.00	0.000	0.017	0.3021	0.0960	0.0000	1.02E-07
336		0.00	0.000	0.015	0.3006	0.0960	0.0000	1.01E-07
337		0.00	0.000	0.018	0.2989	0.0959	0.0000	1.01E-07
338		0.00	0.000	0.011	0.2978	0.0959	0.0000	1.01E-07
339	*	0.00	0.000	0.013	0.2965	0.0959	0.0000	1.01E-07
340	*	0.00	0.000	0.000	0.2965	0.0959	0.0000	1.01E-07
341	*	0.00	0.000	0.012	0.2953	0.0958	0.0000	1.01E-07
342	*	0.00	0.000	0.008	0.2945	0.0958	0.0000	1.01E-07
343		0.00	0.000	0.015	0.2930	0.0958	0.0000	1.01E-07
344		0.00	0.000	0.018	0.2912	0.0957	0.0000	1.01E-07

345		0.00	0.000	0.021	0.2891	0.0957	0.0000	1.01E-07
346		0.00	0.000	0.020	0.2872	0.0957	0.0000	1.01E-07
347		0.00	0.000	0.019	0.2852	0.0957	0.0000	1.01E-07
348		0.00	0.000	0.017	0.2836	0.0956	0.0000	1.01E-07
349		0.00	0.000	0.011	0.2825	0.0956	0.0000	1.01E-07
350	*	0.00	0.000	0.013	0.2812	0.0956	0.0000	1.01E-07
351		0.00	0.000	0.026	0.2786	0.0955	0.0000	1.01E-07
352		0.00	0.000	0.013	0.2773	0.0955	0.0000	1.01E-07
353		0.27	0.093	0.057	0.2895	0.0955	0.0000	1.01E-07
354		0.00	0.000	0.007	0.2887	0.0955	0.0000	1.01E-07
355		0.00	0.000	0.015	0.2872	0.0954	0.0000	1.01E-07
356		0.00	0.000	0.034	0.2838	0.0954	0.0000	1.01E-07
357		0.00	0.000	0.024	0.2814	0.0954	0.0000	1.01E-07
358		0.00	0.000	0.024	0.2790	0.0953	0.0000	1.01E-07
359		0.00	0.000	0.015	0.2774	0.0953	0.0000	1.01E-07
360		0.00	0.000	0.004	0.2771	0.0953	0.0000	1.01E-07
361		0.00	0.000	0.001	0.2770	0.0953	0.0000	1.01E-07
362		0.58	0.359	0.068	0.2928	0.0952	0.0000	1.01E-07
363		0.00	0.000	0.009	0.2919	0.0952	0.0000	1.01E-07
364		0.01	0.000	0.025	0.2907	0.0952	0.0000	1.01E-07
365		0.00	0.000	0.029	0.2879	0.0952	0.0000	1.01E-07

* = Frozen (air or soil)

Annual Totals for Year 30			
	inches	cubic feet	percent
Precipitation	45.52	165,241.2	100.00
Runoff	27.288	99,054.9	59.95
Evapotranspiration	18.379	66,715.3	40.37
Recirculation into Layer 1	0.0041	15.0	0.01
Drainage Collected from Layer 3	0.0000	0.0000	0.00

Recirculation from Layer 3	0.0041	15.0	0.01
Percolation/Leakage through Layer 5	0.000038	0.1394	0.00
Average Head on Top of Layer 4	0.0998	---	---
Change in Water Storage	-0.1458	-529.2	-0.32
Soil Water at Start of Year	1,406.7494	5,106,500.2	3090.33
Soil Water at End of Year	1,406.6036	5,105,971.0	3090.01
Snow Water at Start of Year	0.0000	0.0000	0.00
Snow Water at End of Year	0.0000	0.0000	0.00
Annual Water Budget Balance	-0.0041	-15.0	-0.01

Average Annual Totals Summary

Title: AEL Lateral Expansion
Simulated on: 6/29/2023 9:04

	Average Annual Totals for Years 1 - 30*			
	(inches)	[std dev]	(cubic feet)	(percent)
Precipitation	37.26	[5.79]	135,260.0	100.00
Runoff	22.193	[4.34]	80,560.7	59.56
Evapotranspiration	15.068	[2.294]	54,698.1	40.44
Subprofile1				
Recirculation into Layer 1	0.0086	[0.0078]	31.4	0.02
Lateral drainage collected from Layer 3	0.0000	[0]	0.0000	0.00
Drainage recirculated from Layer 3	0.0086	[0.0078]	31.4	0.02
Percolation/leakage through Layer 5	0.000073	[0.000061]	0.2664	0.00
Average Head on Top of Layer 4	0.2087	[0.1873]	---	---
Water storage				
Change in water storage	0.0003	[0.4116]	0.9824	0.00

* Note: Average inches are converted to volume based on the user-specified area.

Peak Values Summary

Title: AEL Lateral Expansion
Simulated on: 6/29/2023 9:04

	Peak Values for Years 1 - 30*		
	(inches)		(cubic feet)
Precipitation	4.75		17,255.9
Runoff	5.591		20,293.8
Subprofile1			
Drainage Recirculated into Layer 1	0.0001		0.2881
Drainage collected from Layer 3	0.0000		0.0000
Drainage recirculated from Layer 3	0.0001		0.2881
Percolation/leakage through Layer 5	0.000001		0.0023
Average head on Layer 4	0.7000		---
Maximum head on Layer 4	1.1774		---
Location of maximum head in Layer 3	39.74	(feet from drain)	
Other Parameters			
Snow water	2.9391		10,668.9
Maximum vegetation soil water	0.4273	(vol/vol)	
Minimum vegetation soil water	0.2770	(vol/vol)	

Final Water Storage in Landfill Profile at End of Simulation Period

Title: AEL Lateral Expansion
Simulated on: 6/29/2023 9:04
Simulation period: 30 years

	Final Water Storage	
Layer	(inches)	(vol/vol)
1	3.6646	0.3054
2	1,391.0880	0.2920
3	1.6030	0.1336
4	0.0000	0.0000
5	10.2480	0.4270
Snow water	0.0000	---

Appendix C

Pipe Defection Calculations - Proposed Pipe

Sheet 1

Pipe Deflection Calculations

v7a

Project Name: **AEL Lateral Expansion Pipe Calculations**

28-Jun-23

AEL

By: J.F. Hartwell, Ph.D., P.E.

6 inch pipe (Nominal) Proposed 6-inch HDPE SDR 7.3

Positive (x) or Trench / Negative ( ) Trench = x Positive

Circular (x) or Horizontal Elliptical ( ) = x Circular

Flexible (x) or Rigid Walled Pipe ( )= x

Inside Diameter 5.72 in

Input Variables

OD = B_c = **6.625 in**

K= bedding constant = **0.083**

D = deflection lag factor (Range = 1.0 to 2.0; Typical Design Value = 1.25) **1.25**

from I11 => 144.23 deg Bed Depth H_d= **6.00 in**

E = Pipe Modulus of Elasticity = 133000psi typical max per manufacturer's specs **23,000 psi** **HDPE**

E'= Soil Modulus of Elasticity =er **3,000 psi** Should be no higher than 2203.8 psi/in E' is OK

D = H = Height of layered components above pipe 400.4 ft

γ = Average denisty of overlying layers 86.1 pcf

Source: RL Handy & Spangler "Soil Engineering" 3rd Ed. Pg723, Table 26.4

Bedding Angle (α)	Bedding Constant (K)
0	0.110
15	0.108
22.5	0.105
30	0.102
45	0.096
60	0.090
90	0.083

Hole Perfs

Load on Conduits (W_c) at Maximum Height with Final Cover

From Sheets 2a or 2b

Total $_{\text{Factored}}$

Trench	Flexible Pipe	545.3 p/ft	45.44 p/in	
Positive Projecting		21899.6 lb/ft	1825.0 lb/in	USE

for Incomplete Projection Condition

Projecting Load Factors (L_f)

From Sheets 2a or 2b

Ditch Condition*	1.90	
Projecting Pipe**	2.03	USE

Source: E' Value from RL Handy *Soil Engineering* (3rd Ed.) pg 725 - Table 26-7

1.0 st dev e=E'/r

			E'	E' St Dev	CI Low	Ave	CI Low
	Top Soil	Uncompacted	294 psi			102.8 psi/in	
	Well graded Gravel	Uncompacted	672 psi			235.1 psi/in	
	Sandy Clay Loam	Uncompacted	311 psi	55 psi	257 psi	108.9 psi/in	38.7 psi/in
		Tamped	626 psi	134 psi	491 psi	218.9 psi/in	74.2 psi/in
	Sand		734 psi	365 psi	369 psi	256.6 psi/in	55.7 psi/in
	Crushed Sandstone	Compacted	7980 psi			2791.4 psi/in	
	Clayey Sandy Silt	Compacted	1320 psi			461.7 psi/in	
x	Graded Crushed Gravel	Compacted	6300 psi			2203.8 psi/in	

1

Perforation Correction Calculation on Perf Worksheet

Use Vp = Ap*L = Total Unslotted Volume of the Pipe per unit length (L) = 195.6000

Use Vperf = Aperf*Tw*Ns = Volume of the Perforations = 0.534582

Use (Vp - Vs)/Vp*100 = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 0.997267

Use Correction for Pipe Hole Perforations = Vp/(Vp-Vperf) = Cperf = 1.002760

Deflection Allowable = **7.5%**

Deflection Maximum Recommended = **5.0%**

Deflection Calculations

Cperf =	1.002760	1.002741	1.002660	1.002600	1.002553	1.002528	1.002513	1.002494	1.002484	1.002459	
		1									
Selection of SDR Value - input one (x)		x									
SDR =	**7**	**7.3**	**9**	**11**	**13.5**	**15.5**	**17**	**19**	**21**	**26**	7.3

N Use Man Min (Y) or Calc'd Min (N)

t= OD/SDR = 0.908 in

I = $t^3/12$ = moment of inertia = 0.062 ci

r = (OD-t)/2 = Mean Radius = 2.859 in

e = E/r = Modulus of passive resistance of the enveloping soil = 1049.4 psi/in

E'= Soil Modulus of Elasticity = er = 3,000 psi

Wc = Load on Positive Projecting Pipe = Pipe in a Trench in lbs/in = 1824.97 #/in

Corrected Load for Positive Projecting Pipe =Wc/Lf = Wcor = 901.07 #/in

$\mathbf{W_p} = W_c C_{perf}$ = Modified Vert Load / in of diameter = 903.54 #/in

$\Delta\mathbf{x} = (DKW_c r^3)/[(EI)+(0.061E'r^3)]$ = Vertical and Horizontal Pipe Deflection = 0.384 in

Deflection (%) = 5.8%

New Pipe

Deflection Maximum Allowable = OK

Sheet 2b

Load and L_f Computation of Positive Projecting Pipe Condition**

USE**

sign convention 1

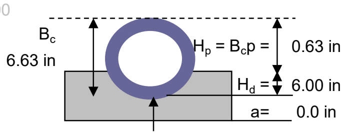
for Incomplete Projection Condition

H (From Sheet 2a) =	400.4 ft	7	
B_c (From Sheet 1) =	0.552 ft	0	
H/B_c = Projection ratio =	725.34	725.34	
r_{sd} = Settlement Ratio =	**0.00**	8	0%
$r_{sd}p$ =	0	0.1	0.00
C_c =	**725.34**	892.15	
		0.1	
γ =	86.1 pcf	0.1	
$k\mu$ =	0.187	166.81	

Depth of Select Bedding = H_d = 6.00 in

H_{prof} = $H-H_d$ = 0.63 in

p =projection ratio = H_p/B_c = **0.09**



Load Factors	1.15	1.7		-2.6875
Factored Loads	Dead (D_f)	Live (L_f)	**Total (T_f)**	-0.81132
$W_c = C_c\gamma B_c^2$ =	21899 lb/ft	000.3 lb/ft	**21,900 lb/ft**	-54.2252
	1824.9 lb/in	0.0 lb/in	**1825.0 lb/in**	Bedding Angle, α (deg) = 144.2252

Table 25-1 - Values of Cc in Terms of H/Bc (Ref 1)

	$k\mu$	$r_{sd}p$	b*	c*	C_c for H/B_c 725.34	
1		-20	Complete Ditch		3.85	
2	0.13	-1.0	0.47	0.40	341.31	2
3	0.13	-0.7	0.55	0.25	399.19	3
4	0.13	-0.5	0.61	0.20	442.66	4
5	0.13	-0.3	0.69	0.11	500.59	5
6	0.13	-0.1	0.82	0.05	594.83	6
7		0.0	1.00	0.00	725.34	7
8	0.19	0.1	1.23	-0.02	892.15	8
9	0.19	0.3	1.39	-0.05	1008.17	9
10	0.19	0.5	1.50	-0.07	1087.94	10
11	0.19	0.7	1.59	-0.09	1153.20	11
12	0.19	1.0	1.69	-0.12	1225.70	12
13	0.19	2.0	1.93	-0.17	1399.74	13
14		20	Complete Projection		1.3E+120	14

Notes*:

where b = slope coefficient from formulas shown in R.L. Handy and M.G. Spangler, "Soil Engineering", 3rd Ed, Table 25-1 pg 676

where c = constant from formulas shown in R.L. Handy and M.G. Spangler, "Soil Engineering", 3rd Ed, Table 25-1 pg 676

Linear Interpolation between RsdP values provided in Table 25-1 were used.

Table 25-2 Settlement Ratio (r_{sd})
Handy 3rd, Ed - pg 677

Rigid Pipe	on Rock		1
	Ordingary soil	0.5	0.8
	Yielding Material	0	0.5
Flexible pipe	Poorly Compacted Side Fill	-0.4	0
	Well Compacted Side fill	-0.2	0.8
		high	low

to Cell L9

Load Factors for Positively Projected Pipes

From Handy 'Geotechnical Engineering' 5th Ed - Pages 765-767, Eqn 25.13

L_f = Load Factor = A/(N-xq) =	**2.025**				x	N
A = Shape parameter	1.43	Circluar	1.43	x	#N/A	0.707
K = Lateral Stress Ratio =	0.249	Elliptical	1.34			0.63
N = Bedding Factor =	0.707					
x = side area function =	0.040					
q =(pK/C_c)((H/B_c) +(p/2)) =	0.023				Eqn 25.15	

Positive Projecting Culvert Bedding Type

From Handy 5th Ed - Page766, Table 25.2

	A	B	C	D	
Select one (x)		x			3

1	2	3	4	5	6
Table 25.2	Values of N and x for Eqn 25.15, pg 766 Handy Geot Eng 5th Ed				
		Bedding (BCD)		Bedding A	
p ro m Circular	Bedding	x	N	x	N
0		0		0	
0.3	D	0.217	1.31	0.743	
0.5	C	0.423	0.84	0.856	
0.7	B	0.594	0.707	0.811	
0.9		0.655		0.678	
1		0.638		0.638	0.505
Hor Elliptical					
0		0			
0.3	C	0.146	0.763		
0.5	B	0.268	0.63		
0.7		0.369			
0.9		0.421			
1		0.425			

Sheet 3

Dead Load Development

Calculate Dead Load

Layer	Thickness	Unit Weight	Ratio of Waste to Soil	
Final Vegetative Layer	1.0 ft	100.0 pcf		
Final Cover Cap Soil	2.0 ft	115.0 pcf		
Waste and Daily cover	394.5 ft	85.7 pcf		
MSW		**75.3 pcf**	**3.17**	76%
Daily Soil Cover		119.0 pcf	1	24%
Drainage Gravel Layer (A)	1.5 ft	119.0 pcf		
Compacted Clay Layer		110.0 pcf		
Subgrade		130.4 pcf		
Gravel Backfill ABOVE in Pipe Trench	1.45 ft	110.0 pcf		

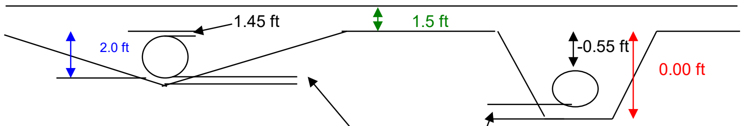
γ average for overlying column= **86.1 pcf**

H = Total Height = **400.45 ft**

Dead Load of column over top of pipe 34492.8 psf

239.5 psi

USE** Positive Projection Condition or Trench Condition



a= **0.0 in**

a_{min} = 6.0 in

Positive Projection Condition **24.0 in** Total Thickness of Drainage Layer invicinity of Pipe

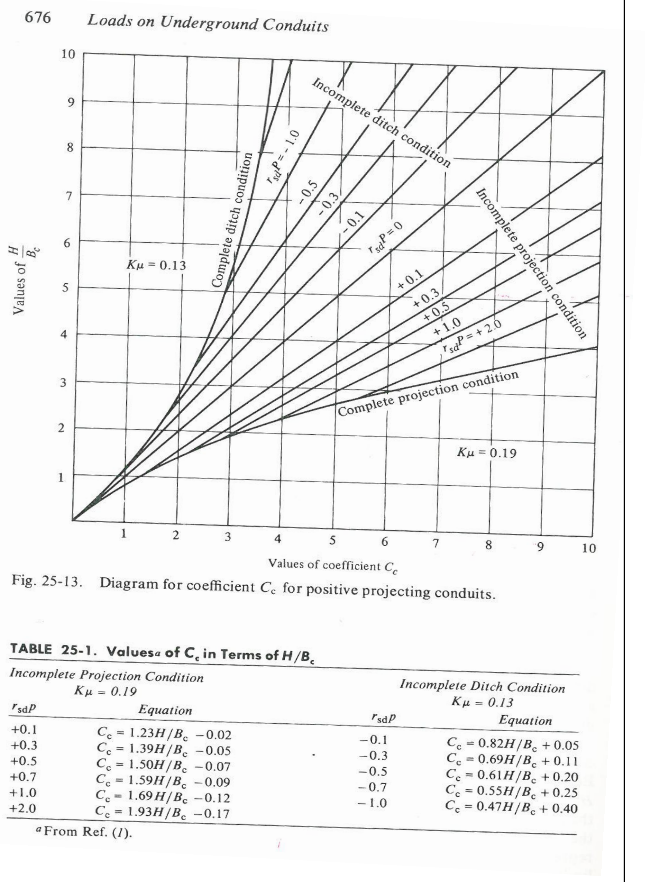
2.00 ft EXCLUDING Normal Drainage Layer (A)

Trench Condition Total Depth of Trench EXCLUDING Normal Drainage Layer (A)

0.00 ft

	a = Fill below Pipe	
OD	Soil	Rock
1 in	3 in	6 in
30 in	4 in	9 in
66 in	3 in	12 in

Source: RL Handy - Soil Engineering, 3rd Edition, Page 676



676 *Loads on Underground Conduits*

Fig. 25-13. Diagram for coefficient C_c for positive projecting conduits.

TABLE 25-1. Values[a] of C_c in Terms of H/B_c

Incomplete Projection Condition $K\mu = 0.19$		*Incomplete Ditch Condition* $K\mu = 0.13$	
$r_{sd}P$	*Equation*	$r_{sd}P$	*Equation*
+0.1	$C_c = 1.23H/B_c - 0.02$	−0.1	$C_c = 0.82H/B_c + 0.05$
+0.3	$C_c = 1.39H/B_c - 0.05$	−0.3	$C_c = 0.69H/B_c + 0.11$
+0.5	$C_c = 1.50H/B_c - 0.07$	−0.5	$C_c = 0.61H/B_c + 0.20$
+0.7	$C_c = 1.59H/B_c - 0.09$	−0.7	$C_c = 0.55H/B_c + 0.25$
+1.0	$C_c = 1.69H/B_c - 0.12$	−1.0	$C_c = 0.47H/B_c + 0.40$
+2.0	$C_c = 1.93H/B_c - 0.17$		

[a] From Ref. (*1*).

Source: Ref 1 = Clark, N.W.B., Buried Pipelines, Maclaren & Sons, London, 1968

Sheet 4

Determination of H_e - the Height of the Equal Settlement Plane above the top of the Conduit

Determiniation of Fill Loading on Buried Pipe

Determination of Coefficient C_c for Positive Projection Conduit

Using Marstons Formula for Load on positive projecting conduits 500

Source: From Handy, R.L. and Spangler, M.G., Soil Engineering, 3rd Ed, Intext Educational Publishers, New York and London, , pp 748

Settlement Ratio is Positive 1

For Positive or Negatively Projecting Culvert

Manual Override

H (from Sheet 2a or 2b) = 400.4 ft

γ = Average Unit weight of Fill (from Sheet 2a) = 86.1 pcf

B_c = Pipe OD (from Sheet 1) = 0.552 ft

H/B_c = 725.34

r_{sd} = Settlement Ratio (from Sheet 2) 0.00

p = Projection Ratio (from Sheet 2b) = 0.09

$r_{sd}p$ = 0.000

ϕ_{gravel} (From Sheet 2a) = 37.0 deg

K = Lat Pressure Ratio (From Sheet 2a) 0.249

$\phi'_{gravel / sidewall}$ = 26.0 deg

$k\mu$ (from Sheet 2a) = 0.187

$\mu = \tan\phi$ = 0.754

$k\mu'$(from Sheet 2a) = 0.121

$\mu' = \tan\phi'$ = 0.488

H_e/B_c = -0.031

for Incomplete Projection Condition

$2K\mu(H/B_c)$ = 271.743

$e^{2K\mu(H/Bc)}$ = 1.04E+118

$2k\mu$ = 0.375 $1/(2k\mu)$ = 2.67

$r_{sd}p/3$ = 0.000

$r_{sd}p(H/B_c)$ = 0.000

$2K\mu(H_e/B_c)$ = -0.011 1

$e^{2K\mu(He/Bc)}$ = 0.989

$(H/B_c)-(H_e/B_c)$ = 725.37

H_e - Iterative Calculation Area

Compute Eqn 25-10

-22.341

0.000

0.000

0.082

22.256

0.000

-0.0029

If run away change sign

-0.0001 0.00002

-0.01704 0.0001

$-H_e$ = **-0.017 ft**

USE He= 0.02 ft

OK

Trial and error (+ for +Δ)

$H_{e\ max\ trial}$ = 1.10 ft 2

To reset enter a realistic # into He hit enter and then assign =M19

If r_{sd} is negative this may have no solution

if H <= H_e then use $C_c = [e^{2K\mu(H/Bc)} - 1]/2K_\mu$ = 2.7724E+118 Ref 1 Eqn 25-8

if H > H_e then use $C_c = [[e^{2K\mu(He/Bc)} - 1]/2K_\mu]+((H/B_c)-(H_e/B_c))e^{2Km(He/Bc)}$ = 717.05 Ref 1 Eqn 25-9

USE C_c = 717.05

W_c = 18825.3 lbs/ft 1568.8 lbs/in Using trial and error computation of Eqsn 25-9 and 25-10 Ref #1

$Wc = C_c\gamma B_c^2$ = 7.279E+119 Ref 1 Eqn 25-7

18825.3

Compared to

$W_c = C_c\gamma B_c^2$ = 19042.9 lb/ft 1586.9 lbs/in Using approximations from Table 25-1 of Ref #1

W_c (use max) = 19042.9 lb/ft Use W_c Max for Calculatioin of Pipe Loading.

Sheet 5

Calculation of Buried Pipe Deflection from Dead and Live Loading vs Height of Fill

Ref: Spangler, M.G. & Handy, R.L., "Soil Engineering", 3rd Ed, In Text Educational Publishers, 1973, pp 748, pg. 376 - 379.

Note: Live Load applied at the height of fill shown

Depth of MSW Fill = 2.00 ft Manual Override 2.00 ft Maximum = 400.4 ft

Manual Override SDR = 7.3

Maximum Deflection = 0.43% *@ 1.77 ft*

Deflection Allowable = 7.5% **OK < Allowable**

Deflection Maximum Recommended = 5.0% **OK < Maximum Recommended**

Calculate Dead Load

Take these from Sheet 3 or Override

Layer	Thickness	Unit Weight			
Final Vegetative Layer	1.0 ft	100.0 pcf			100 lbs
Final Cover Cap Soil	2.0 ft	115.0 pcf			230 lbs
Waste and Daily cover	395.0 ft	89.9 pcf	Ratio of Waste to Soil		35500 lbs
MSW		80.7 pcf	3.175	76%	
Daily Soil Cover		119.0 pcf	1	24%	
Drainage Gravel Layer (A)	1.0 ft	119.0 pcf			119 lbs
Compacted Clay Layer		119.0 pcf			0 lbs
Subgrade		130.4 pcf			0 lbs
Gravel Backfill ABOVE in Pipe Trench	1.45 ft	110.0 pcf			159 lbs
Average Density of Fill =		90.2 pcf	36108.4		36108 lbs
Total Height of Fill =		400.45 ft			

Manual Override of combined MSW/Soil Column

Top of Subgrade	1	0.00 ft	130.4 pcf	0	0	1
Top of Compacted Clay Layer	2	0.00 ft	119.0 pcf	0	0	2
Top of Drainage Gravel Layer (A)	3	2.45 ft	119.0 pcf	291.3020833	291.3021	3
Top of Waste and Daily cover	4	397.45 ft	89.87 pcf	35500.09281	35791.39	4
Top of Final Cover Cap Soil	5	399.45 ft	115.0 pcf	230	36021.39	5
Top of Final Vegetative Layer	6	400.45 ft	100.0 pcf	100	36121.39	6

	Dead	Live
FoS =	1.15	1.70
SDR =	7.3	7.3

t = 0.908 in

K = 0.249

μ = 0.754

2Kμ = 0.375

Dia of Pipe = 0.552 ft 6.63 in

He = -0.017 ft

A_{pipe} = 195.60 in

A_{perf} = 0.53 in

N = # of Perfs / ft = 0.997266964

Use Correction for Pipe Hole Perforations = Vp/(Vp-Vperf) = Cperf = 1.002759829

r = (OD-t)/2 = Mean Radius = 2.86 in

r^3 = 23.363 in^3

D = Deflection Lag Factor = 1.25

K = Bedding Constant = 0.083

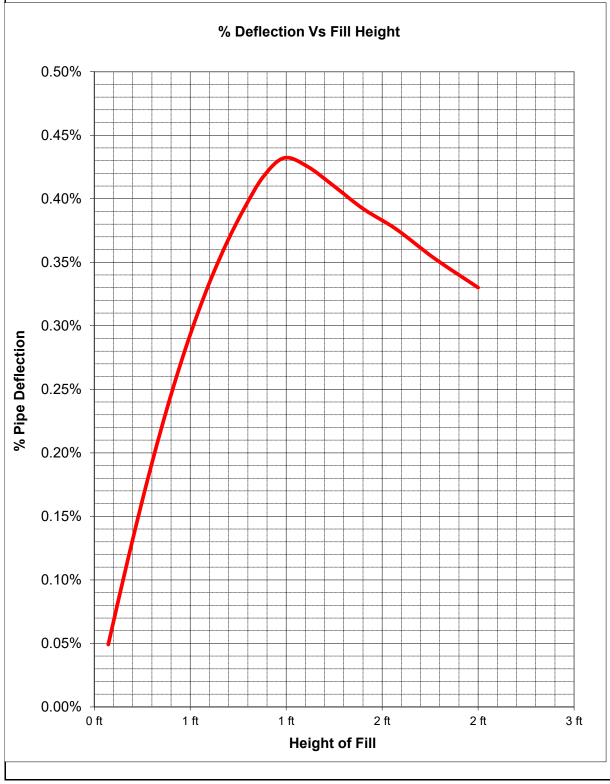
E = Pipe Mod of Elasticity = 23000 psi

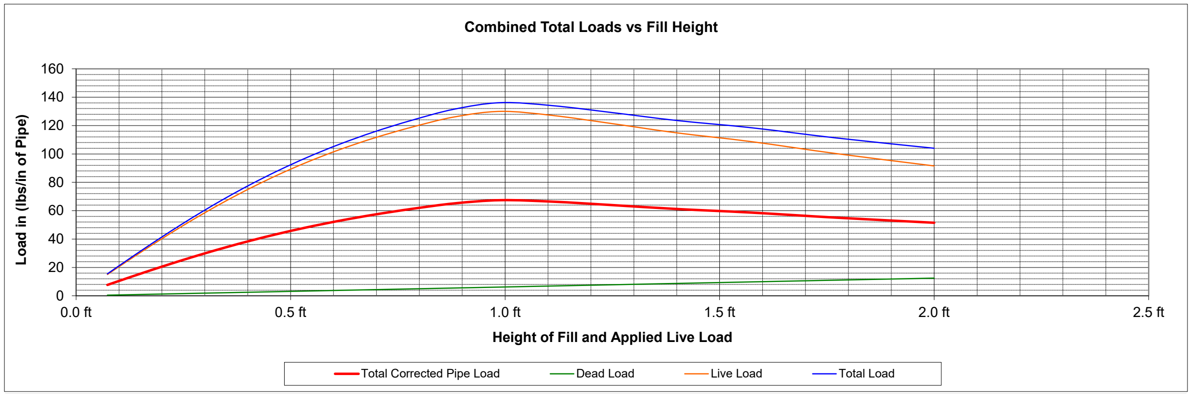
I = Moment of Inertia / length of pipe (in^4) = 0.0623 in^4

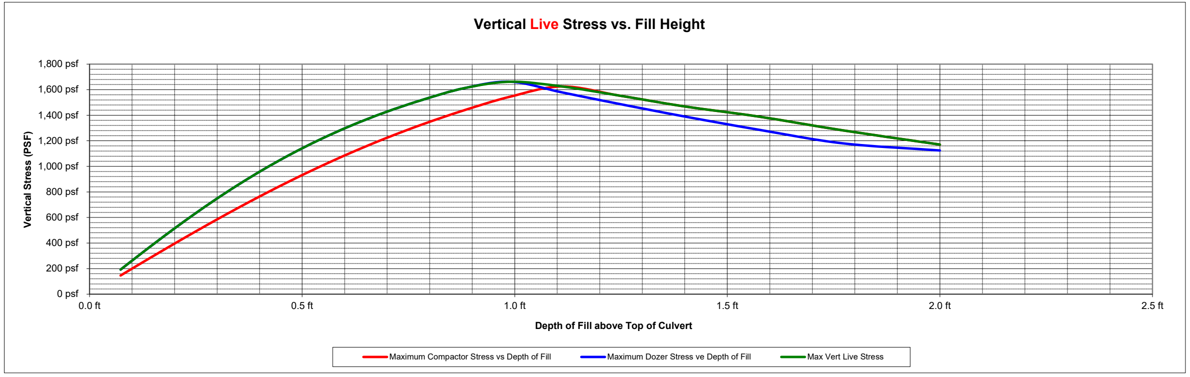
E' = Mod of Soil Reaction = 3000 psi

e = Modulus of passive resistance of Enveloping Soil = 1049.41599 psi/in

Deflection Coefficient = 0.000425







Sheet 6

Calculation of Buried Pipe Deflection from Dead and Live Loading vs Height of Fill

Ref: Spangler, M.G. & Handy, R.L., "Soil Engineering", 3rd Ed, In Text Educational Publishers, 1973, pp 748, pg. 376 - 379.

Note: Live Load applied at the height of fill shown

		Manual Override			**Manual Override**
Depth of MSW Fill =	400.45 ft		Maximum =	400.4 ft	SDR = **7.3**
Maximum Deflection =	**6.00%**	*@ 400.45 ft*			

Deflection Allowable = 7.5% **OK < Allowable**

Deflection Maximum Recommended = 5.0% **400.4 ft**

Calculate Dead Load

Layer	Thickness	Unit Weight			
	Take these from Sheet 3 or Override				
Final Vegetative Layer	1.0 ft	100.0 pcf			100 lbs
Final Cover Cap Soil	2.0 ft	115.0 pcf			230 lbs
Waste and Daily cover	395.0 ft	89.9 pcf	Ratio of Waste to Soil		35500 lbs
	MSW	80.7 pcf	3.175	76%	
	Daily Soil Cover	119.0 pcf	1	24%	
Drainage Gravel Layer (A)	1.0 ft	119.0 pcf			119 lbs
Compacted Clay Layer		119.0 pcf			0 lbs
Subgrade		130.4 pcf			0 lbs
Gravel Backfill ABOVE in Pipe Trench	1.45 ft	110.0 pcf			159 lbs
Average Density of Fill =		90.2 pcf	36108.4		36108 lbs
Total Height of Fill =		400.45 ft			

Manual Override of combined MSW/Soil Column

Top of Subgrade	1	0.00 ft	130.4 pcf	0	0	1
Top of Compacted Clay Layer	2	0.00 ft	119.0 pcf	0	0	2
Top of Drainage Gravel Layer (A)	3	2.45 ft	119.0 pcf	291.3020833	291.3021	3
Top of Waste and Daily cover	4	397.45 ft	89.87 pcf	35500.09281	35791.39	4
Top of Final Cover Cap Soil	5	399.45 ft	115.0 pcf	230	36021.39	5
Top of Final Vegetative Layer	6	400.45 ft	100.0 pcf	100	36121.39	6

	Dead	Live
FoS =	**1.15**	**1.70**

SDR = 7.3 7.3

t = 0.908 in

K = 0.249

μ = 0.754

2Kμ = 0.375

Dia of Pipe = 0.552 ft 6.63 in

He = -0.017 ft

A_{pipe} = 195.60 in

A_{perf} = 0.53 in

N = # of Perfs / ft = 0.997266964

Use Correction for Pipe Hole Perforations = Vp/(Vp-Vperf) = Cperf = 1.002759829

r = (OD-t)/2 = Mean Radius = 2.86 in

r^3 = 23.363 in^3

D = Deflection Lag Factor = 1.25

K = Bedding Constant = 0.083

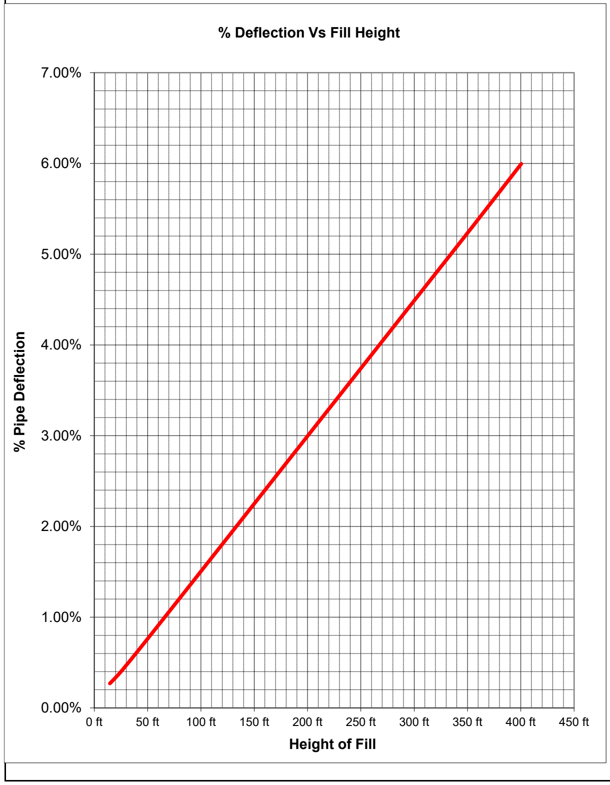
E = Pipe Mod of Elasticity = 23000 psi

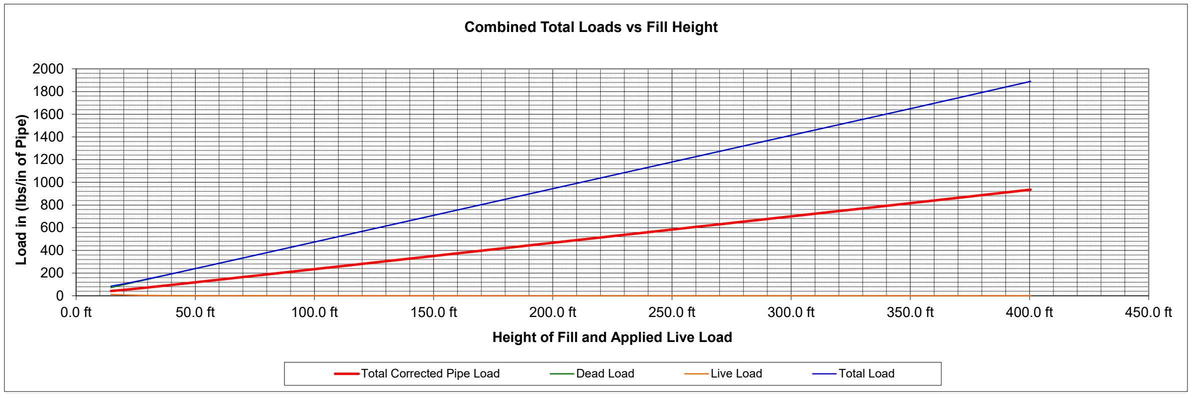
I = Moment of Inertia / length of pipe (in^4) = 0.0623 in^4

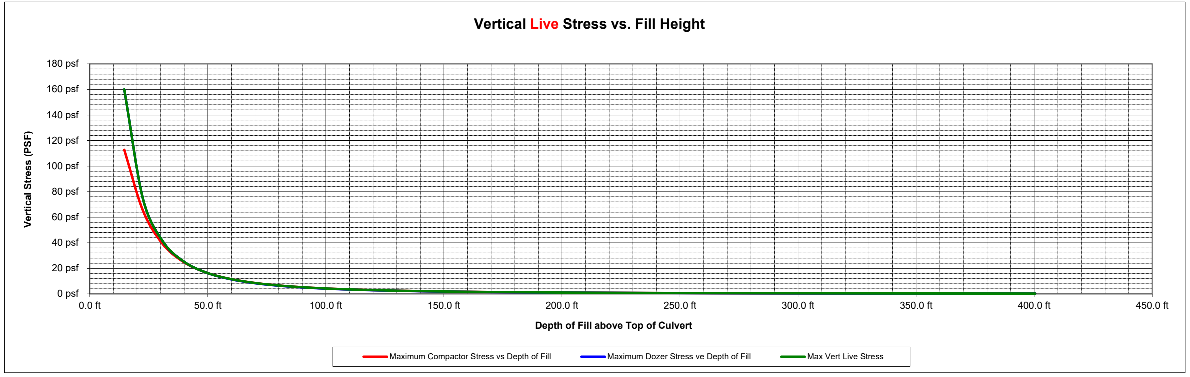
E' = Mod of Soil Reaction = 3000 psi

e = Modulus of passive resistance of Enveloping Soil = 1049.41599 psi/in

Deflection Coefficient = 0.000425


% Deflection Vs Fill Height


Combined Total Loads vs Fill Height


Vertical Live Stress vs. Fill Height

Sheet 7

Determination of Perforation Impact Correlation on Pipe Load

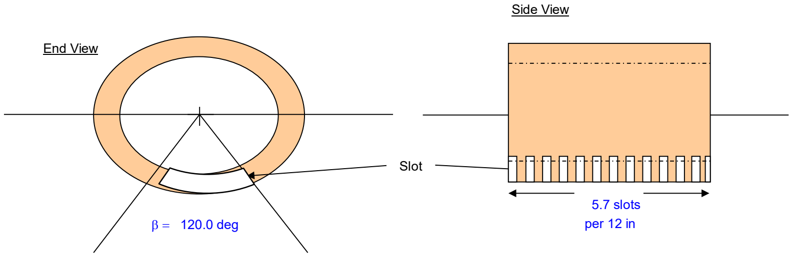
Perforation Type = (Bottom Saw Slots (**B**), Side Saw Slots (**S**) or Drilled Holes (**H**)) = **H** Use **0** (zero) if no perferations in pipe

L = Assumed Length of Pipe = **12.0 in***

d_o = Outside Diameter of the Pipe = **6.63 in***

d_i = Inside Diameter of the Pipe = **4.81 in*** Example for SDR 7.3

B - Saw Slotted (Bottom) Perforations Rows



Bottom Slotted Pipe Calculations

S_S = Spacing between Slots = **2.00 in***

W_s = Width of Slots = **0.10 in***

L_s = Length of one Slot (outside surface)= **6.94 in*** $L_s=\pi d_o\beta/360$

Slot Central Angle = β = **120.0 deg**

$N_s = (L-S_s)/(W_s+S_s)$ = Number of Slots = 5.7 slots *whole number only*

Number of Rows of Slots in line Across Pipe Section = N_R = 1 slot *Only 1 Slot allowed with this option*

$A_T = \pi * d_o * L$ = Total Outside Area of the Pipe = 249.8 si

$A_p = \pi/4*(d_o^2 - d_i^2)$ = Cross Sectional Area of the Pipe = 16.30 si

A_s = Total Area of the Slot Rows across Pipe Cross Section = $(\pi\beta/360)(r_o^2-r_i^2)$ = 5.43 si

$V_p = A_p*L$ = Total Unslotted Volume of the Pipe per unit length (L) = 195.60 ci

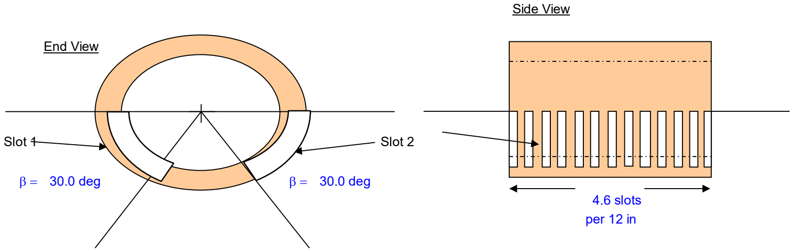
$V_s = A_s*W_s*N_s$ = Volume of the Slot = 3.10 ci

$(V_p - V_s)/V_p*100$ = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 98.4%

Correction for Pipe Slot Perforations = $V_p/(V_p-V_s) = C_{perf}$ = **1.0161**

B

S - Saw Slotted (Side) Perforations Rows



Side Slotted Pipe Calculations

S_S = Spacing between Slots = **2.50 in***

W_s = Width of Slots = **0.10 in***

L_s = Length of one Slot (outside surface)= **1.73 in*** $L_s=\pi d_o\beta/360$

Slot Central Angle = β = **30.0 deg**

$N_s = (L-S_s)/(W_s+S_s)$ = Number of Slots = 4.6 slots *whole number only* 4.615385

Number of Rows of Slots in line Across Pipe Section = N_R = **4 slots**

$A_T = \pi * d_o * L$ = Total Outside Area of the Pipe = 249.8 si

$A_p = \pi/4*(d_o^2 - d_i^2)$ = Cross Sectional Area of the Pipe = 16.30 si

A_s = Total Area of the Slot Rows across Pipe Cross Section =N_R $(\pi\beta/360)(r_o^2-r_i^2)$ = 5.43 si

$V_p = A_p*L$ = Total Unslotted Volume of the Pipe per unit length (L) = 195.60 ci

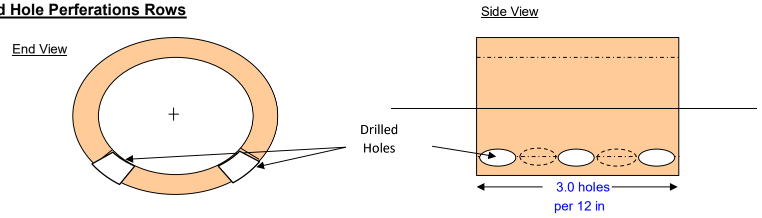
$V_s = A_s*W_s*N_s$ = Volume of the Slot = 2.51 ci

$(V_p - V_s)/V_p*100$ = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 98.7%

Correction for Pipe Slot Perforations = $V_p/(V_p-V_s) = C_{perf}$ = **1.0130**

S

H - Drilled Hole Perforations Rows



Perforated Pipe (Hole) Calculations

D_p = Dia of perforations = **0.50 in**

A_{pipe} = 249.8 si

A_{perf} = 0.196 si

$V_p = A_p*L$ = Total Unslotted Volume of the Pipe per unit length (L) = 195.60 ci

N = # of Perfs / ft **3 perf/ft**

Wall Thickness = T_w = 0.908 in

$V_{perf} = A_{perf}*T_w*N_s$ = Volume of the Perforations = 0.53 ci

$(V_p - V_{perf})/V_p*100$ = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 99.7%

Correction for Pipe Perforations = $A_{pipe}/(A_{pipe} - (N)(A_{perf}))$= 1.0024

Correction for Pipe Hole Perforations = $V_p/(V_p-V_{perf}) = C_{perf}$ = 1.0027

Use Max **1.0027**

*Note: * Values referenced from PVC Pipe and Specs Worksheet*
by Ilias Gibigaye - Aquaterra Omaha - Nov 2011

NOTE: Hole Pattern may differ from Permit Plans but the # of Holes per running foot of Pipe is correct.

Use these Values in Pipe Deflection Calculations

Use Vp = Ap*L = Total Unslotted Volume of the Pipe per unit length (L) = 195.6000 ci

Use Vperf = Aperf*Tw*Ns = Volume of the Perforations = 0.5346 ci

Use (Vp - Vs)/Vp*100 = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 0.9973 ci

Use Correction for Pipe Hole Perforations = Vp/(Vp-Vperf) = Cperf = 1.0027 ci

Using

H

Use this Configuration

H

Pipe Defection Calculations - Existing Pipe

Sheet 1

Pipe Deflection Calculations

v7a

Project Name: **AEL Lateral Expansion Pipe Calculations**

28-Jun-23

AEL

By: J.F. Hartwell, Ph.D., P.E.

6 inch pipe (Nominal) Exisitng 6-inch HDPE SDR 11

Positive (x) or Trench / Negative ( ) Trench = x Positive

Circular (x) or Horizontal Elliptical ( ) = x Circular

Flexible (x) or Rigid Walled Pipe ( )= x

Inside Diameter 6.02 in

Input Variables

OD = B_c = **6.625 in**

K= bedding constant = **0.083**

D = deflection lag factor (Range = 1.0 to 2.0; Typical Design Value = 1.25) **1.25**

E = Pipe Modulus of Elasticity = 133000psi typical max per manufacturer's specs **23,000 psi** **HDPE**

E'= Soil Modulus of Elasticity =er **3,000 psi** Should be no higher than 2092.1 psi/in E' is OK

Source: RL Handy & Spangler "Soil Engineering" 3rd Ed. Pg723, Table 26.4

Bedding Angle (α)	Bedding Constant (K)
0	0.110
15	0.108
22.5	0.105
30	0.102
45	0.096
60	0.090
90	0.083

from I11 => 144.23 deg Bed Depth H_d= **6.00 in**

Hole Perfs

Load on Conduits (W_c) at Maximum Height with Final Cover

From Sheets 2a or 2b

Total Factored

Trench	Flexible Pipe	1643.7 p/ft	136.97 p/in	
Positive Projecting		22998.0 lb/ft	1916.5 lb/in	USE

for Incomplete Projection Condition

Projecting Load Factors (L_f)

From Sheets 2a or 2b

Ditch Condition*	1.90	
Projecting Pipe**	2.03	USE

Source: E' Value from RL Handy *Soil Engineering* (3rd Ed.) pg 725 - Table 26-7

				E'	E' St Dev *1.0 st dev*	CI Low	e=E'/r Ave	CI Low
D = H = Height of layered components above pipe = 400.4 ft		Top Soil	Uncompacted	294 psi			97.6 psi/in	
γ = Average denisty of overlying layers = 86.1 pcf		Well graded Gravel	Uncompacted	672 psi			223.2 psi/in	
		Sandy Clay Loam	Uncompacted	311 psi	55 psi	257 psi	103.4 psi/in	38.7 psi/in
			Tamped	626 psi	134 psi	491 psi	207.8 psi/in	74.2 psi/in
		Sand		734 psi	365 psi	369 psi	243.6 psi/in	55.7 psi/in
Use Vp = Ap*L = Total Unslotted Volume of the Pipe per unit length (L) = 136.8000		Crushed Sandstone	Compacted	7980 psi			2650.0 psi/in	
Use Vperf = Aperf*Tw*Ns = Volume of the Perforations = 0.354768		Clayey Sandy Silt	Compacted	1320 psi			438.3 psi/in	
Use (Vp - Vs)/Vp*100 = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 0.997407	x	Graded Crushed Gravel	Compacted	6300 psi			2092.1 psi/in	

Perforation Correction Calculation on Perf Worksheet

1

Use Correction for Pipe Hole Perforations = Vp/(Vp-Vperf) = Cperf = 1.002760 1.002741 1.002660 1.002600 1.002553 1.002528 1.002513 1.002494 1.002484 1.002459

Deflection Allowable = **7.5%**

Deflection Maximum Recommended = **5.0%**

Deflection Calculations

1

Selection of SDR Value - input one (x)				x						
SDR =	**7**	**7.3**	**9**	**11**	**13.5**	**15.5**	**17**	**19**	**21**	**26**

11

N Use Man Min (Y) or Calc'd Min (N)

t= OD/SDR = 0.602 in

I = $t^3/12$ = moment of inertia = 0.0182 in

r = (OD-t)/2 = Mean Radius = 3.01 in

e = E/r = Modulus of passive resistance of the enveloping soil = 996.2 psi/in

E'= Soil Modulus of Elasticity = er = 3,000 psi

Wc = Load on Positive Projecting Pipe = Pipe in a Trench in lbs/in = 1917 #/in

Corrected Load for Positive Projecting Pipe =Wc/Lf = Wcor = 946 #/in

W_p = $W_c C_{perf}$ = Modified Vert Load / in of diameter = 948.73 #/in

$\Delta x = (DKW_c r^3)/[(EI)+(0.061E'r^3)]$ = Vertical and Horizontal Pipe Deflection = 0.496 in

Deflection (%) = 7.5%

Existing Pipe

Deflection Maximum Allowable = **OK**

Sheet 2b

Load and L_f Computation of Positive Projecting Pipe Condition**

USE**

sign convention 1

for Incomplete Projection Condition

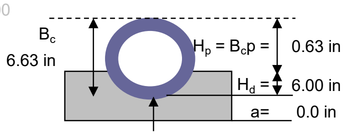
H (From Sheet 2a) =	400.4 ft	7	
B_c (From Sheet 1) =	0.552 ft	0	
H/B_c = Projection ratio =	725.34	725.34	
r_{sd} = Settlement Ratio =	**0.00**	8	0%
$r_{sd}p$ =	0	0.1	0.00
C_c =	**725.34**	892.15	
		0.1	
γ =	86.1 pcf	0.1	
$k\mu$ =	0.187	166.81	

Depth of Select Bedding = H_d = 6.00 in

H_{prof} = $H-H_d$ = 0.63 in

p =projection ratio = H_p/B_c = **0.09**

to Cell L9



Load Factors	1.15	1.7		-2.6875
Factored Loads	Dead (D_f)	Live (L_f)	**Total (T_f)**	-0.81132
$W_c = C_c\gamma B_c^2$ =	21899 lb/ft	1,098.6 lb/ft	**22,998 lb/ft**	-54.2252
	1824.9 lb/in	91.6 lb/in	**1916.5 lb/in**	Bedding Angle, α (deg) = 144.2252

Table 25-2 Settlement Ratio (r_{sd}) **Handy 3rd, Ed - pg 677**			
Rigid Pipe	on Rock		1
	Ordingary soil	0.5	0.8
	Yielding Material	0	0.5
Flexible pipe	Poorly Compacted Side Fill	-0.4	0
	Well Compacted Side fill	-0.2	0.8
		high	low

Load Factors for Positively Projected Pipes

From Handy 'Geotechnical Engineering' 5th Ed - Pages 765-767, Eqn 25.13

L_f = Load Factor = A/(N-xq) =	**2.025**				x	N
A = Shape parameter	1.43	Circluar	1.43	x	#N/A	0.707
K = Lateral Stress Ratio =	0.249	Elliptical	1.34			0.63
N = Bedding Factor =	0.707					
x = side area function =	0.040					
q =(pK/C_c)((H/B_c) +(p/2)) =	0.023				Eqn 25.15	

Table 25-1 - Values of Cc in Terms of H/Bc (Ref 1)

	$k\mu$	$r_{sd}p$	b*	c*	C_c for H/B_c	
					725.34	
1		-20	Complete Ditch		3.85	
2	0.13	-1.0	0.47	0.40	341.31	2
3	0.13	-0.7	0.55	0.25	399.19	3
4	0.13	-0.5	0.61	0.20	442.66	4
5	0.13	-0.3	0.69	0.11	500.59	5
6	0.13	-0.1	0.82	0.05	594.83	6
7		0.0	1.00	0.00	725.34	7
8	0.19	0.1	1.23	-0.02	892.15	8
9	0.19	0.3	1.39	-0.05	1008.17	9
10	0.19	0.5	1.50	-0.07	1087.94	10
11	0.19	0.7	1.59	-0.09	1153.20	11
12	0.19	1.0	1.69	-0.12	1225.70	12
13	0.19	2.0	1.93	-0.17	1399.74	13
14		20	Complete Projection		1.3E+120	14

Notes*:

where b = slope coefficient from formulas shown in R.L. Handy and M.G. Spangler, "Soil Engineering", 3rd Ed, Table 25-1 pg 676

where c = constant from formulas shown in R.L. Handy and M.G. Spangler, "Soil Engineering", 3rd Ed, Table 25-1 pg 676

Linear Interpolation between RsdP values provided in Table 25-1 were used.

Positive Projecting Culvert Bedding Type

From Handy 5th Ed - Page766, Table 25.2

		A	B	C	D	
	Select one (x)		x			3
1	2	3	4	5	6	

Table 25.2	Values of N and x for Eqn 25.15, pg 766 Handy Geot Eng 5th Ed				
		Bedding (BCD)		Bedding A	
p ro m Circular	Bedding	x	N	x	N
0		0		0	
0.3	D	0.217	1.31	0.743	
0.5	C	0.423	0.84	0.856	
0.7	B	0.594	0.707	0.811	
0.9		0.655		0.678	
1		0.638		0.638	0.505
Hor Elliptical					
0		0			
0.3	C	0.146	0.763		
0.5	B	0.268	0.63		
0.7		0.369			
0.9		0.421			
1		0.425			

Sheet 3

Dead Load Development

Calculate Dead Load

Layer	Thickness	Unit Weight	Ratio of Waste to Soil	
Final Vegetative Layer	1.0 ft	100.0 pcf		
Final Cover Cap Soil	2.0 ft	115.0 pcf		
Waste and Daily cover	394.5 ft	85.7 pcf		
MSW		**75.3 pcf**	**3.17**	76%
Daily Soil Cover		119.0 pcf	1	24%
Drainage Gravel Layer (A)	1.5 ft	119.0 pcf		
Compacted Clay Layer		110.0 pcf		
Subgrade		130.4 pcf		
Gravel Backfill ABOVE in Pipe Trench	1.45 ft	110.0 pcf		

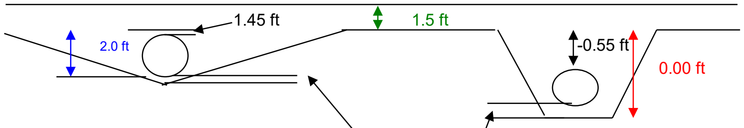
γ average for overlying column= **86.1 pcf**

H = Total Height = **400.45 ft**

Dead Load of column over top of pipe 34492.8 psf

239.5 psi

USE** Positive Projection Condition or Trench Condition



a= **0.0 in**

a_{min} = 6.0 in

Positive Projection Condition **24.0 in** Total Thickness of Drainage Layer invicinity of Pipe

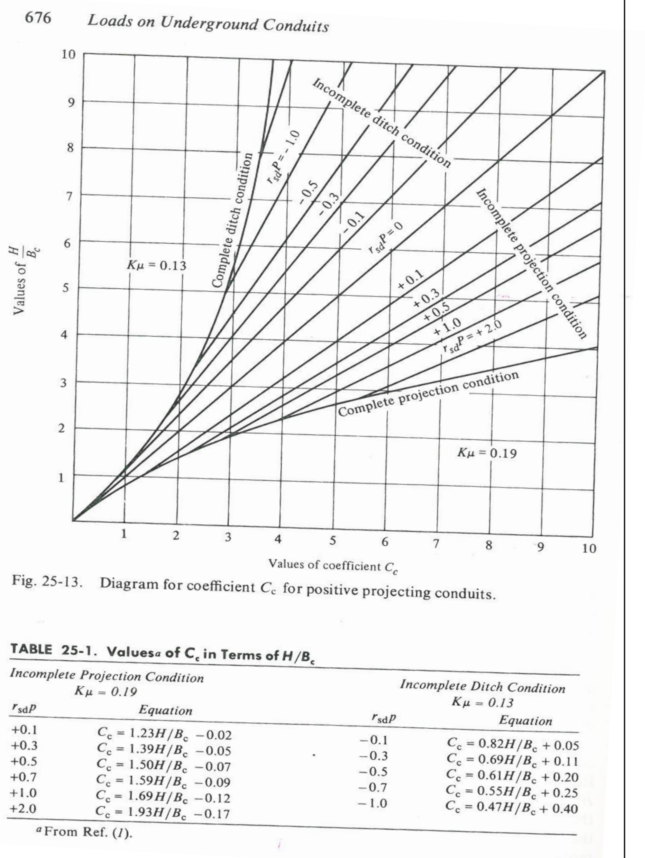
2.00 ft EXCLUDING Normal Drainage Layer (A)

Trench Condition Total Depth of Trench EXCLUDING Normal Drainage Layer (A)

0.00 ft

	a = Fill below Pipe	
OD	Soil	Rock
1 in	3 in	6 in
30 in	4 in	9 in
66 in	3 in	12 in

Source: RL Handy - Soil Engineering, 3rd Edition, Page 676



676 *Loads on Underground Conduits*

Fig. 25-13. Diagram for coefficient C_c for positive projecting conduits.

TABLE 25-1. Values[a] of C_c in Terms of H/B_c

Incomplete Projection Condition $K\mu = 0.19$		*Incomplete Ditch Condition* $K\mu = 0.13$	
$r_{sd}P$	*Equation*	$r_{sd}P$	*Equation*
+0.1	$C_c = 1.23H/B_c - 0.02$	−0.1	$C_c = 0.82H/B_c + 0.05$
+0.3	$C_c = 1.39H/B_c - 0.05$	−0.3	$C_c = 0.69H/B_c + 0.11$
+0.5	$C_c = 1.50H/B_c - 0.07$	−0.5	$C_c = 0.61H/B_c + 0.20$
+0.7	$C_c = 1.59H/B_c - 0.09$	−0.7	$C_c = 0.55H/B_c + 0.25$
+1.0	$C_c = 1.69H/B_c - 0.12$	−1.0	$C_c = 0.47H/B_c + 0.40$
+2.0	$C_c = 1.93H/B_c - 0.17$		

[a] From Ref. (*1*).

Source: Ref 1 = Clark, N.W.B., Buried Pipelines, Maclaren & Sons, London, 1968

Sheet 4

Determination of H_e - the Height of the Equal Settlement Plane above the top of the Conduit

Determiniation of Fill Loading on Buried Pipe

Determination of Coefficient C_c for Positive Projection Conduit

Using Marstons Formula for Load on positive projecting conduits

500

Source: From Handy, R.L. and Spangler, M.G., Soil Engineering, 3rd Ed, Intext Educational Publishers, New York and London, , pp 748

Settlement Ratio is Positive 1

For Positive or Negatively Projecting Culvert

Manual Override

H (from Sheet 2a or 2b) = 400.4 ft

γ = Average Unit weight of Fill (from Sheet 2a) = 86.1 pcf

B_c = Pipe OD (from Sheet 1) = 0.552 ft

H/B_c = 725.34

r_{sd} = Settlement Ratio (from Sheet 2) 0.00

p = Projection Ratio (from Sheet 2b) = 0.09

$r_{sd}p$ = 0.000

ϕ_{gravel} (From Sheet 2a) = 37.0 deg

K = Lat Pressure Ratio (From Sheet 2a) 0.249

$\phi'_{gravel / sidewall}$ = 26.0 deg

$k\mu$ (from Sheet 2a) = 0.187

$k\mu'$(from Sheet 2a) = 0.121

H_e/B_c = -0.031

$\mu = \tan\phi$ = 0.754

$\mu' = \tan\phi'$ = 0.488

for Incomplete Projection Condition

$2K\mu(H/B_c)$ = 271.743

$e^{2K\mu(H/Bc)}$ = 1.04E+118

$2k\mu$ = 0.375 $1/(2k\mu)$ = 2.67

$r_{sd}p/3$ = 0.000

$r_{sd}p(H/B_c)$ = 0.000

$2K\mu(H_e/B_c)$ = -0.011 1

$e^{2K\mu(He/Bc)}$ = 0.989

$(H/B_c)-(H_e/B_c)$ = 725.37

H_e - Iterative Calculation Area

Compute Eqn 25-10

-22.341

0.000

0.000

0.082

22.256

0.000

-0.0029

If run away change sign

-0.0001 0.00002

-0.01704 0.0001

$-H_e$ = -0.017 ft

USE He= 0.02 ft

OK

Trial and error (+ for +Δ)

$H_{e\ max\ trial}$ = 1.10 ft 2

To reset enter a realistic # into He hit enter and then assign =M19

If r_{sd} is negative this may have no solution

if H <= H_e then use $C_c = [e^{2K\mu(H/Bc)} - 1]/2K_\mu$ = 2.7724E+118 Ref 1 Eqn 25-8

if H > H_e then use $C_c = [[e^{2K\mu(He/Bc)} - 1]/2K_\mu]+((H/B_c)-(H_e/B_c))e^{2Km(He/Bc)}$ = 717.05 Ref 1 Eqn 25-9

USE C_c = 717.05

W_c = 18825.3 lbs/ft 1568.8 lbs/in Using trial and error computation of Eqsn 25-9 and 25-10 Ref #1

$Wc = C_c\gamma B_c^2$ = 7.279E+119 Ref 1 Eqn 25-7

18825.3

Compared to

$W_c = C_c\gamma B_c^2$ = 19042.9 lb/ft 1586.9 lbs/in Using approximations from Table 25-1 of Ref #1

W_c (use max) = 19042.9 lb/ft Use W_c Max for Calculatioin of Pipe Loading.

Sheet 5

Calculation of Buried Pipe Deflection from Dead and Live Loading vs Height of Fill

Ref: Spangler, M.G. & Handy, R.L., "Soil Engineering", 3rd Ed, In Text Educational Publishers, 1973, pp 748, pg. 376 - 379.

Note: Live Load applied at the height of fill shown

Depth of MSW Fill = 400.45 ft   Manual Override: ☐   Maximum = 400.4 ft   Manual Override SDR = 11

Maximum Deflection = **7.39%** *@ 400.45 ft*

Deflection Allowable = 7.5% **OK < Allowable**

Deflection Maximum Recommended = 5.0% **400.4 ft**

Calculate Dead Load

Take these from Sheet 3 or Override

Layer	Thickness	Unit Weight			
Final Vegetative Layer	1.0 ft	100.0 pcf			100 lbs
Final Cover Cap Soil	2.0 ft	115.0 pcf			230 lbs
Waste and Daily cover	395.0 ft	89.9 pcf	Ratio of Waste to Soil		35500 lbs
MSW		80.7 pcf	3.175	76%	
Daily Soil Cover		119.0 pcf	1	24%	
Drainage Gravel Layer (A)	1.0 ft	119.0 pcf			119 lbs
Compacted Clay Layer		119.0 pcf			0 lbs
Subgrade		130.4 pcf			0 lbs
Gravel Backfill ABOVE in Pipe Trench	1.45 ft	110.0 pcf			159 lbs
Average Density of Fill =		90.2 pcf	36108.4		36108 lbs
Total Height of Fill =		400.45 ft			

☐ Manual Override of combined MSW/Soil Column

Top of Subgrade	1	0.00 ft	130.4 pcf	0	0	1
Top of Compacted Clay Layer	2	0.00 ft	119.0 pcf	0	0	2
Top of Drainage Gravel Layer (A)	3	2.45 ft	119.0 pcf	291.3020833	291.3021	3
Top of Waste and Daily cover	4	397.45 ft	89.87 pcf	35500.09281	35791.39	4
Top of Final Cover Cap Soil	5	399.45 ft	115.0 pcf	230	36021.39	5
Top of Final Vegetative Layer	6	400.45 ft	100.0 pcf	100	36121.39	6

	Dead	Live
FoS =	1.15	1.70
SDR =	11	11

t = 0.602 in

K = 0.249

μ = 0.754

2Kμ = 0.375

Dia of Pipe = 0.552 ft   6.63 in

He = -0.017 ft

A_{pipe} = 136.80 in

A_{perf} = 0.35 in

N = # of Perfs / ft = 0.997406667

Use Correction for Pipe Hole Perforations = Vp/(Vp-Vperf) = Cperf = 1.002759829

r = (OD-t)/2 = Mean Radius = 3.01 in

r^3 = 27.308 in^3

D = Deflection Lag Factor = 1.25

K = Bedding Constant = 0.083

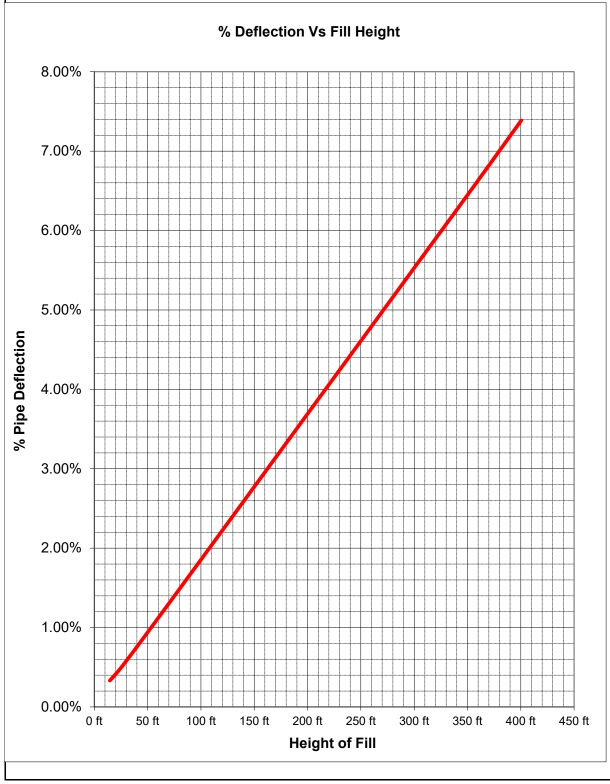
E = Pipe Mod of Elasticity = 23000 psi

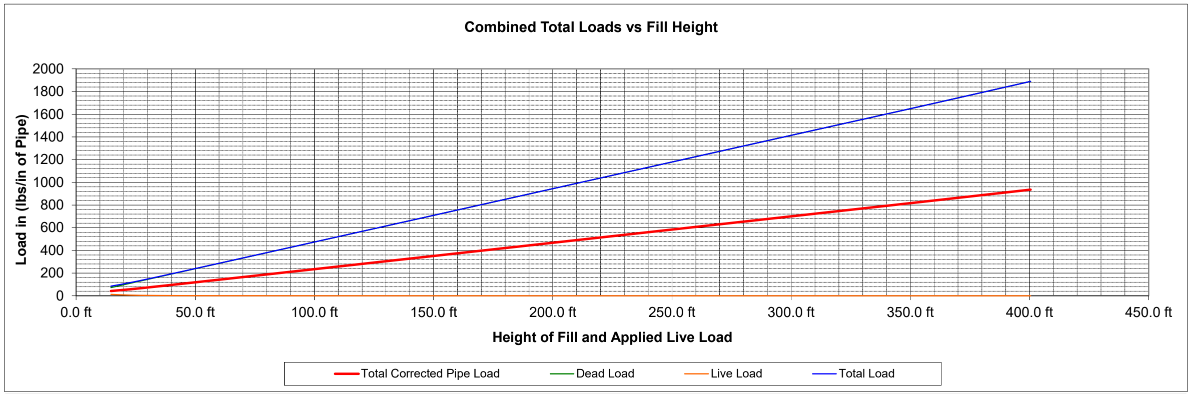
I = Moment of Inertia / length of pipe (in^4) = 0.0182 in^4

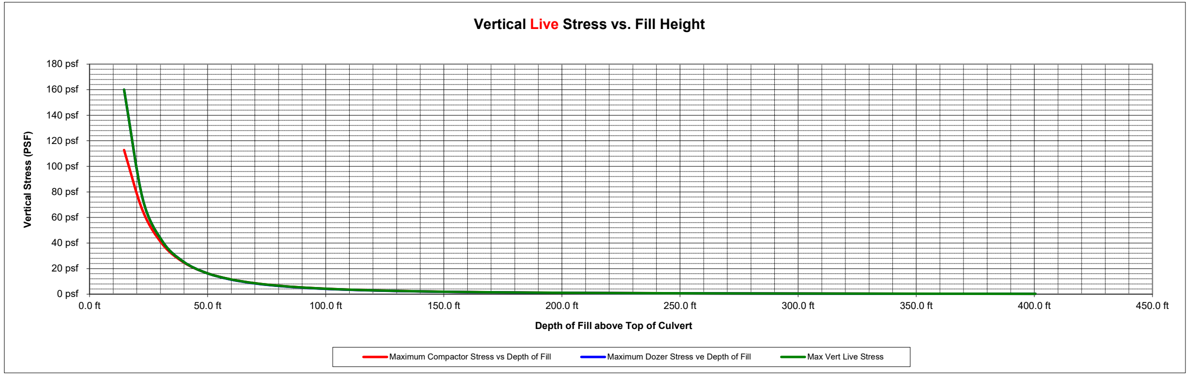
E' = Mod of Soil Reaction = 3000 psi

e = Modulus of passive resistance of Enveloping Soil = 996.226415 psi/in

Deflection Coefficient = 0.000523







Sheet 6

Determination of Perforation Impact Correlation on Pipe Load

B - Saw Slotted (Bottom) Perforations Rows

Perforation Type = (Bottom Saw Slots (**B**), Side Saw Slots (**S**) or Drilled Holes (**H**)) = **H** Use **0** (zero) if no perferations in pipe

L = Assumed Length of Pipe = **12.0 in***

d_o = Outside Diameter of the Pipe = **6.63 in***

d_i = Inside Diameter of the Pipe = **5.42 in*** Example for SDR 11

Bottom Slotted Pipe Calculations

S_S = Spacing between Slots = **2.00 in***

W_s = Width of Slots = **0.10 in***

L_s = Length of one Slot (outside surface)= **6.94 in*** $L_s=\pi d_o\beta/360$

Slot Central Angle = β = **120.0 deg**

$N_s = (L-S_s)/(W_s+S_s)$ = Number of Slots = 5.7 slots *whole number only*

Number of Rows of Slots in line Across Pipe Section = N_R = 1 slot *Only 1 Slot allowed with this option*

$A_T = \pi*d_o*L$ = Total Outside Area of the Pipe = 249.8 si

$A_p = \pi/4*(d_o^2 - d_i^2)$ = Cross Sectional Area of the Pipe = 11.40 si

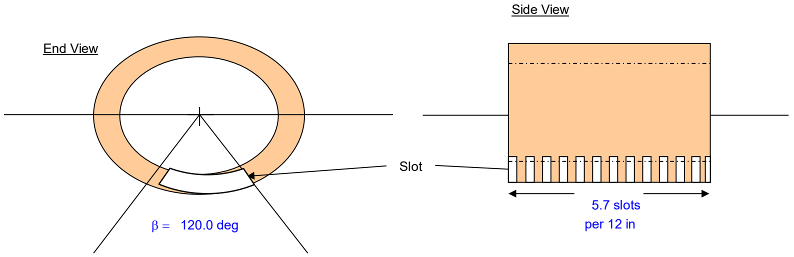
A_s = Total Area of the Slot Rows across Pipe Cross Section = $(\pi\beta/360)(r_o^2-r_i^2)$ = 3.80 si

$V_p = A_p*L$ = Total Unslotted Volume of the Pipe per unit length (L) = 136.80 ci

$V_s = A_s*W_s*N_s$ = Volume of the Slot = 2.17 ci

$(V_p - V_s)/V_p*100$ = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 98.4%

Correction for Pipe Slot Perforations = $V_p/(V_p-V_s) = C_{perf}$ = **1.0161**



B

S - Saw Slotted (Side) Perforations Rows

Side Slotted Pipe Calculations

S_S = Spacing between Slots = **2.50 in***

W_s = Width of Slots = **0.10 in***

L_s = Length of one Slot (outside surface)= **1.73 in*** $L_s=\pi d_o\beta/360$

Slot Central Angle = β = **30.0 deg**

$N_s = (L-S_s)/(W_s+S_s)$ = Number of Slots = 4.6 slots *whole number only* 4.615385

Number of Rows of Slots in line Across Pipe Section = N_R = **4 slots**

$A_T = \pi*d_o*L$ = Total Outside Area of the Pipe = 249.8 si

$A_p = \pi/4*(d_o^2 - d_i^2)$ = Cross Sectional Area of the Pipe = 11.40 si

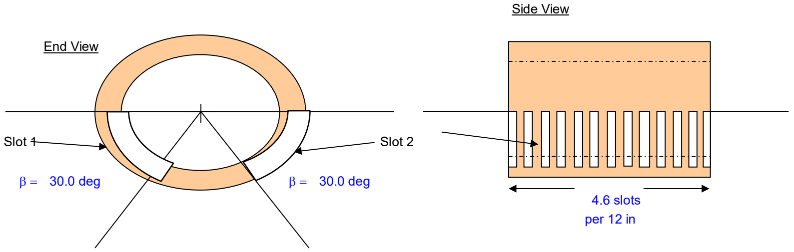
A_s = Total Area of the Slot Rows across Pipe Cross Section =N_R $(\pi\beta/360)(r_o^2-r_i^2)$ = 3.80 si

$V_p = A_p*L$ = Total Unslotted Volume of the Pipe per unit length (L) = 136.80 ci

$V_s = A_s*W_s*N_s$ = Volume of the Slot = 1.75 ci

$(V_p - V_s)/V_p*100$ = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 98.7%

Correction for Pipe Slot Perforations = $V_p/(V_p-V_s) = C_{perf}$ = **1.0130**



S

H - Drilled Hole Perferations Rows

Perforated Pipe (Hole) Calculations

D_p = Dia of perforations = **0.50 in**

A_{pipe} = 249.8 si

A_{perf} = 0.196 si

$V_p = A_p*L$ = Total Unslotted Volume of the Pipe per unit length (L) = 136.80 ci

N = # of Perfs / ft = **3 perf/ft**

Wall Thickness = T_w = 0.602 in

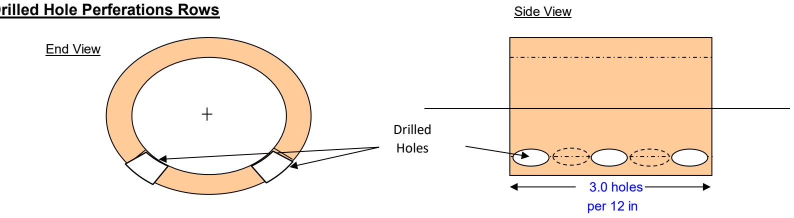
$V_{perf} = A_{perf}*T_w*N_s$ = Volume of the Perforations = 0.35 ci

$(V_p - V_{perf})/V_p*100$ = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 99.7%

Correction for Pipe Perforations = $A_{pipe}/(A_{pipe} - (N)(A_{perf}))$= 1.0024

Correction for Pipe Hole Perforations = $V_p/(V_p-V_{perf}) = C_{perf}$ = 1.0026

Use Max **1.0026**



*Note: * Values referenced from PVC Pipe and Specs Worksheet*
by Ilias Gibigaye - Aquaterra Omaha - Nov 2011

NOTE: Hole Pattern may differ from
Permit Plans but the # of Holes
per running foot of Pipe is
correct.

Use these Values in Pipe Deflection Calculations

Use Vp = Ap*L = Total Unslotted Volume of the Pipe per unit length (L) = 136.8000 ci

Use Vperf = Aperf*Tw*Ns = Volume of the Perforations = 0.3548 ci

Use (Vp - Vs)/Vp*100 = Percentage of Solid Pipe per Unit Length of Pipe (Volume) = 0.9974 ci

Use Correction for Pipe Hole Perforations = Vp/(Vp-Vperf) = Cperf = 1.0026 ci

Using

H

Use this Configuration

H

Appendix D

Buried Pipe Design References

Book 2: Chapter 7 - Buried Pipe Design

The design of a subsurface pipe installation is based on principles of soil-structure interaction, that is, the pipe and the surrounding soil act together to control pipe performance. The role each plays in controlling performance depends on their stiffness relative to each other.

Pipes that are stiffer than the surrounding soil are typically called rigid. With rigid pipes, soil and surcharge loads are transmitted around the pipe ring from crown (top) to invert (bottom) by virtue of the pipe's internal bending and compressive strength. Rigid pipes undergo little deflection. In some circumstances, polyethylene pipes may behave as a rigid pipe, such as the installation of low DR pipe in marsh soils. Here the pipe has greater stiffness than the surrounding soil, so pipe properties become the major determinant of burial strength.

Pipes that are less stiff than the surrounding soil are called flexible. With weak soil support; relatively small earth loads may cause flexible pipe deflection. However, when properly buried, the surrounding soil greatly increases pipe load-carrying capability as well as reducing earth loads that reach the pipe.

Earth load and surcharge pressures applied to the soil backfill cause vertical and horizontal pipe deflection. Horizontal deflection, usually extension, results in the pipe wall pushing out into the embedment soil. This action mobilizes passive resistance forces, which in turn limits horizontal deflection and balances the vertical load. Greater passive resistance is mobilized with stiffer surrounding soil, so less deflection occurs. Most polyethylene pipe should be considered flexible because the pipe's contribution to resisting deflection is usually less than that of the surrounding soil.

Therefore, with polyethylene pipe it is important to check each application to ensure the adequacy of the installed design, including both pipe and embedment soils. The design procedures in this section may be applied to both rigid and flexible pipes.

General Design Procedure

Once pipe diameter is determined, a pipe is selected by its wall construction. Lower DR DriscoPlex™ OD controlled pipe, and higher RSC DriscoPlex™ 2000 SPIROLITE® pipe have greater external load capacity. However, greater load capacity is also more costly, so the optimum design is the balance of pipe strength and embedment quality that is capable of handling the imposed loads. The completed buried pipe design should specify the pipe size (OD or ID), wall construction (DR or RSC Class), required embedment materials, and placement (installation) requirements for that embedment.

The initial design step is to determine dead loads and surcharge loads. Following this, the pipe selection is checked for its ability to carry the imposed loads relative to the quality of the embedment that surrounds the pipe.

Usually, this is an iterative process. Several pipe selections may need to be tried before settling on the optimum design. The pipe selection may need to be changed if loads or embedment are changed, or where an initially selected pipe is insufficient or excessive for the anticipated loads.

Typically, only the loads around the pipe ring (circumferential direction) are checked. The designer usually assumes that there are no significant loads acting in the longitudinal (axial) direction along the pipe. This assumption is reasonable for buried pipe that is supported uniformly along its length.

In this chapter, the methods for calculating loads and the pipe's response are based on analytical and empirical equations that are appropriate for polyethylene pipe. Generally, these equations are sufficient for most designs, but they are not exact due to the non-homogeneous nature of soil, the difficulty in characterizing soil as an engineering material, the complexity of soil-pipe interaction, and the variability of construction. Other satisfactory methods for design may be available.

The design guidelines in this manual are contingent upon the pipe being installed according to recognized principles and standards for flexible pipe installation such as ASTM D-2321 *Standard Practice for underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow applications*, ASTM D-2774 *Standard Practice for Underground Installation of Thermoplastic Pressure Pipe*, Performance Pipe *Bulletin PP 517 SPIROLITE Installation Guide*, and PPI Handbook of Polyethylene Pipe *Underground Installation of Polyethylene Piping*. Because of complexities in soil-pipe interaction, this chapter should not be substituted for the judgment of a professional engineer for achieving specific project requirements. Some cases may require more exact solutions than can be obtained from the equations and methods in this chapter.

Loads on Buried Pipe

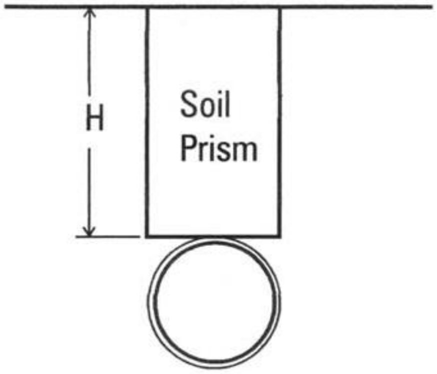
The load applied to a buried pipe consists of dead load and surcharge load. The dead load is the permanent load from the weight of soil and pavement above the pipe. Surcharge loads are loads applied at the surface and may or may not be permanent. Surcharge loads include the loads from vehicles and structures. Vehicular loads are called live loads.

Dead Loads

In designing polyethylene pipes, it is commonplace to assume that the overburden load applied to the pipe crown is equal to the weight of the soil column (or prismatic element) projecting above the pipe. Often, this is referred to as the prism load. See Figure 7-1.

The prism load is a handy convention for calculating the earth pressure on the pipe when estimating vertical deflection, but the actual load transmitted to a pipe from the soil mass depends on the relative soil stiffness and pipe stiffness. The dead load applied to a flexible plastic pipe may be considerably less than the prism load because soil shear resistance transfers part of the soil load that is directly above the pipe into trench sidewalls and embedment. This transfer is called arching. To account for arching, pipe designers often calculate loads using the Marston method.

Figure 7-1 Soil Prism



Design methods for both prism and arching loads follow. The designer may use both methods for a buried pipe design.

Prism Load

The simplest case for determining the vertical earth load on a horizontal surface in a mass of soil occurs when the soil has uniform stiffness and weight throughout, with no large voids or buried structures present. Under these conditions, the vertical earth pressure acting on a horizontal surface at a depth is equal to the prism load per unit area.

$$P_E = w H \tag{7-1}$$

Where:

P_E = vertical soil pressure, lb/ft^2
w = unit weight of soil, lb/ft^3
H = soil height above pipe crown, ft

Soil Arching

Theoretically, the prism load occurs on a buried pipe only when the pipe has stiffness equivalent to that of the surrounding soil. More commonly, the pipe and soil are not the same stiffness, so the pipe either sees more or less than the prism load, depending on the relative pipe stiffness and soil stiffness.

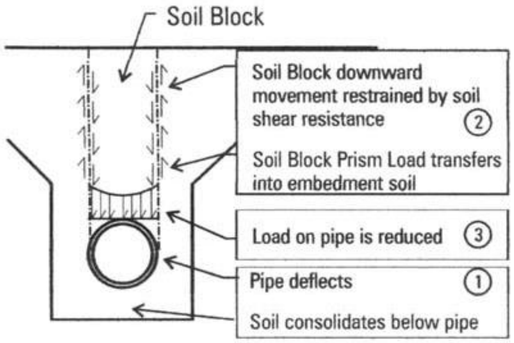
When the pipe is less stiff than the soil, as is the case with most flexible pipe, the soil above the pipe distributes load away from the pipe and into the soil beside the pipe.

Arching may be defined as the difference between the applied load and the prism load. The term arching is usually taken to imply a reduction in vertical load. When the pipe takes on more vertical load than the prism load, reverse arching is said to occur.

Downward backfill movement mobilizes arching in the backfill above a buried pipe. This may be initiated by pipe deflection, compression of the deeper layers of the backfill, or settlement beneath the pipe.

For a flexible pipe, arching is usually initiated by vertical deflection of the pipe crown. The soil tries to follow the pipe downward, but soil movement is restrained by shear resistance (frictional forces and cohesion) along shear planes in the backfill. This action causes part of the weight of the backfill soil to be transferred into the adjacent soil. Therefore, the amount of force exerted on the pipe by the backfill is less than the weight of the backfill soil mass, that is, less than the prism load.

Figure 7-2 Soil Arching Development



In most cases, arching is permanent and it occurs in most stable applications. However, arching is maintained by soil shear stresses and may not occur when pipe is located beneath large vibrating machines, in shallow cover locations subjected to vehicular traffic, or in soft, unstable soil backfills.

Marston Load

When calculating the earth load on a flexible pipe, the Marston load generally gives a more realistic value than the prism load. Based on experiments and field measurements, Marston published a buried pipe design method in 1930 that accounts for arching. His method is widely accepted and can be found in ASCE Manual No. 60.

Marston considered pipe buried in a trench and pipe buried in an embankment to be different cases. The backfill soil in a trench is considered to be supported through shear stresses by the undisturbed trench wall soil. This is the most common case for polyethylene pipe arching. Marston's formula gives the equation for finding the loads on a flexible pipe buried in a trench. This equation can be modified to obtain the vertical soil pressure applied to a pipe installed in a trench as given in Formula 7-2.

$$P_M = C_D \, w \, B_D \tag{7-2}$$

Where terms are previously defined[1] and:

P_M = vertical soil pressure, lb/ft^2
B_D = trench width at pipe crown, ft
C_D = load coefficient

$$C_D = \frac{1 - e^{-2Ku'\frac{H}{B_D}}}{2Ku'} \tag{7-3}$$

e = natural log base number, 2.71828
K = Rankine earth pressure coefficient

$$K = \tan^2\left(45 - \frac{\Phi}{2}\right) \tag{7-4}$$

Φ = internal soil friction angle, deg
u' = friction coefficient between backfill and trench sides

Ku´ values may be characterized as follows:

Table 7-1 Typical Values for Ku'

Soil	*Typical Value for Ku'*
Saturated clay	0.110
Ordinary clay	0.130
Saturated top soil	0.150
Sand and gravel	0.165
Clean granular soil	0.192

The load applied to a pipe in an embankment is typically higher than that for a pipe in a trench. The actual load depends on the relative stiffness between the embankment soil and the pipe.

For an embankment condition, the prism load is typically used for calculating vertical pressure on flexible pipe.

---

[1] All terms for Chapter 7 formulas are defined in Chapter 7. Where previously defined terms are referenced, it refers to previously defined terms in Chapter 7. Terms from other chapters in the Manual do not apply.

Soil Creep

When analytical methods are not available for precise calculations, pipe designers frequently ignore soil creep, especially when the backfill is cohesionless. This is a conservative design approach for plastic pipe, which tends to creep at a faster rate than cohesionless soils. When subjected to 50% or more of their peak shear load strength, clayey soils exhibit considerable creep and show significantly more creep than cohesionless soils, especially when saturated.

When a clay backfill is placed over a pipe, shear resistance mobilization occurs and, initially, arching may be high. However, where backfill stress concentrations exist such as along the shearing surfaces, the stress level in the clay may approach significant levels. Along these stress concentrations, creep occurs, allowing backfill soil movement toward the pipe and a corresponding load increase on the pipe. With the passage of time more creep occurs.

Because most clayey soils have some frictional resistance, the prism load is usually never reached. However, a conservative design approach should be taken. A low friction angle is usually assumed for clays when using Marston's equation. Typical values are 11° for ordinary clay, and 8° for saturated clay. The typical values for Ku´ in Table 7-1 reflect these friction angles.

Example 7-1

(a) Find the Marston Load vertical soil pressure acting on a 36" OD pipe under 18 ft of 120 lb/ft^3 ordinary clay cover in a 6 ft wide trench. (b) Compare the vertical soil pressures by the Marston and prism methods.

Solution: (a) First, the load coefficient, C_D is found using Formula 7-3 and Table 7-1. Then the Marston load soil pressure is determined using Formula 7-2.

To find the load coefficient, C_D, calculate the ratio of H/B_D:

$$\frac{H}{B_D} = \frac{18}{6} = 3$$

From Table 7-1, the Ku´ value for ordinary clay is 0.130. Solving Formula 7-3 yields:

$$C_D = \frac{1 - e^{-2(0.130)(3)}}{2(0.130)} = 2.1$$

Solving Formula 7-2 for P_M yields:

$$P_M = 2.1(120)(6) = 1512 \ \ lb/ft^3$$

(b) The prism load soil pressure is determined from Formula 7-1.

$$P_E = (120)(18) = 2160 \ lb/ft^3$$

Modified Arching Load

For flexible pipe, a more conservative approach is to use a soil pressure load between the prism load and the Marston load. One approach is to add 40 percent of the difference between the prism load and the Marston load to the Marston load. Formula 7-5 may be used to obtain the modified arching load vertical soil pressure.

$$P_C = 0.6 P_M + 0.4 P_E \qquad \textbf{(7-5)}$$

Where terms are previously defined and:

P_C = modified arching vertical soil pressure, lb/ft^2

In example 7-1, the modified arching vertical soil pressure from Formula 7-5 is:

$$P_C = 0.6(1512) + 0.4(2160) = 1771\ lb/ft^2$$

A value for the modified arching vertical soil pressure suitable for most soils may be determined from formula 7-6.

$$P_C = F\,w\,H \qquad \textbf{(7-6)}$$

Where terms are previously defined and

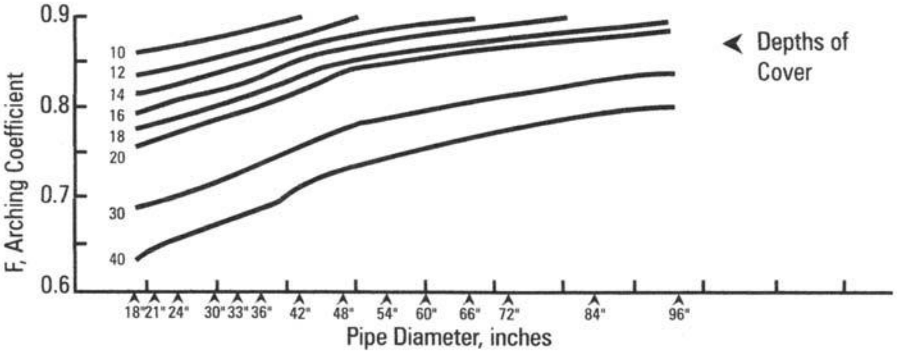
F = arching coefficient

$$F = \frac{P_M + 0.4(P_E - P_M)}{P_E} \qquad \textbf{(7-7)}$$

Figure 7-3 is a graphical solution for the arching coefficient, F, based on the Marston load obtained with Ku´ = 0.130 for ordinary clay soil. Thus the Figure 7-3 arching coefficient is conservative for soils having a Ku´ value greater than 0.130. The arching coefficient should be used only where the trench width does not exceed 3 ft plus pipe OD for 42" and smaller pipe, and 4 ft plus pipe OD for 48" and larger pipe.

Figure 7-3 Arching Coefficient for Modified Arching Load

Based on clay soil, Ku' = 0.130, and trench widths of 3 ft plus pipe OD for 42" diameter and smaller pipe, and trench widths of 4 ft plus pipe OD for 48" diameter and larger pipe.



In Example 7-1, the arching coefficient, F, from Figure 7-3 is 0.82. Solving Formula 7-6 yields:

$$P_C = 0.82(120)(18) = 1771\ lb/ft^2$$

Surcharge Load

The design methods that follow may be used to determine vertical pressures on the pipe from surface loads. The formulas are accurate only to the extent that they are appropriate for a given application. Therefore, it is recommended that a professional engineer review the final design.

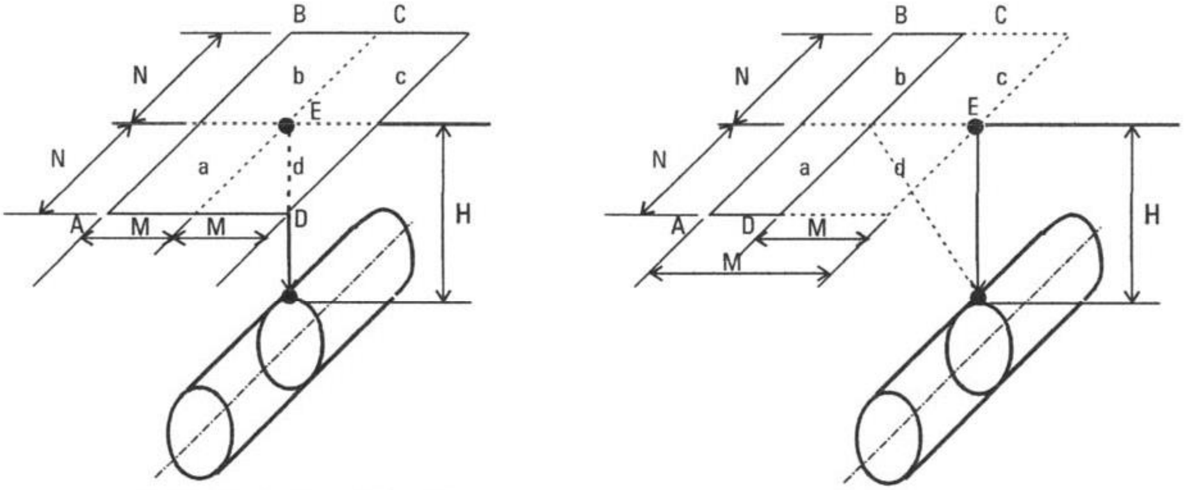
Surcharge loads may be distributed loads, such as a footing, a foundation or an ash pile, or may be point loads, such as vehicle wheels. The load is distributed through the soil such that there is a reduction in pressure with increasing depth or horizontal distance from the surcharge load area. The pressure at a point beneath the surcharge load depends on the magnitude of the load and on the surface area over which the surcharge is applied. Usual design practice is to equate the surcharge load on a buried pipe with downward pressure acting on a plane at the pipe crown. Once the surcharge load is determined, the total load acting on the pipe is the sum of the earth load and the surcharge load.

Distributed Load Over Pipe

This design method may be used to find a rectangular area, distributed surcharge load on a buried pipe beneath structures such as footings, floors or other stationary loads such as coal or ash piles.

The method assumes the Boussinesq equation for pressure, and finds the soil pressure acting at a point below the surcharge, and located at the same depth as the crown of the pipe. This pressure is considered to be equal to the vertical pressure acting on the pipe.

Figure 7-4 Distributed Surcharge Load Over Pipe



A. Distributed Load Over Pipe

B. Distributed Load Not Over Pipe

In Figure 7-4A, the point pressure is found by dividing the rectangular surcharge area (ABCD) into four sub-area rectangles (a, b, c, and d), which have a common corner, E, in the surcharge area, and over the pipe. The surcharge load is the sum of the four sub-area loads at the subsurface point. Each sub-area load is calculated by multiplying the surcharge pressure by an influence coefficient, I_C, from Table 7-2.

$$P_L = P_a + P_b + P_c + P_d \qquad \textbf{(7-8)}$$

Where

P_L = surcharge load pressure at point, lb/ft^2
P_a = sub-area a surcharge load, lb/ft^2
P_b = sub-area b surcharge load, lb/ft^2
P_c = sub-area c surcharge load, lb/ft^2
P_d = sub-area d surcharge load, lb/ft^2

$$P_x = I_C \, w_S \tag{7-9}$$

P_x = sub-area (a, b, c or d) surcharge load, lb/ft^2
I_C = influence coefficient from Table 7-2
W_S = distributed surcharge pressure acting over ground surface, lb/ft^2

When the four sub-areas are equivalent, Formula 7-8 may be simplified to

$$P_L = 4 \, I_C \, w_S \tag{7-10}$$

The influence factor is dependent on the dimensions of the rectangular area and the depth to the pipe crown. Table 7-2 Influence Coefficient terms are shown in Figure 7-4 and defined as

H = vertical distance from surface to pipe crown, ft
M = horizontal distance, normal to the pipe centerline, from the center of the surcharge load to the load edge, ft
N = horizontal distance, parallel to the pipe centerline, from the center of the surcharge load to the load edge, ft

The influence factor gives the portion (or influence) of the load that reaches a given depth beneath the corner of the loaded area. Interpolation may be used to find values not shown in Table 7-2.

Example 7-2

Find the vertical surcharge load for the 4´ x 6´, 2000 lb/ft^2 footing in Figure 7-5.

Solution: Use Equations (7-7) and (7-8), Table 7-2, and Figure 7-4. The 4´ x 6´ footing is divided into four sub-areas, such that the common corner is over the pipe. Determine sub-area dimensions M, N, and H for each sub-area; calculate M/H and N/H for each sub-area. Find the Influence Coefficient, I_C, from Table 7-2; solve Formula 7-9 for each sub-area, and solve Formula 7-8 for P_L.

	Sub-Area			
	a	b	c	d
M	2.5	2.5	1.5	1.5
N	3	3	3	3
M/H	0.5	0.5	0.3	0.3
N/H	0.6	0.6	0.6	0.6
I_C	0.095	0.095	0.063	0.063
P_x	190	190	126	126
P_L = 632 lb/ft^2				

Figure 7-5 Illustration for Example 7-2

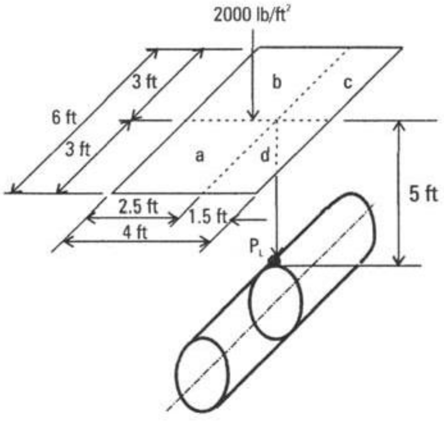


Table 7-2 Influence Coefficient, I_C, for Distributed Loads Over Pipe

M/H	N/H													
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0	∞
0.1	0.005	0.009	0.013	0.017	0.020	0.022	0.024	0.026	0.027	0.028	0.029	0.030	0.031	0.032
0.2	0.009	0.018	0.026	0.033	0.039	0.043	0.047	0.050	0.053	0.055	0.057	0.060	0.061	0.062
0.3	0.013	0.026	0.037	0.047	0.056	0.063	0.069	0.073	0.077	0.079	0.083	0.086	0.089	0.090
0.4	0.017	0.033	0.047	0.060	0.071	0.080	0.087	0.093	0.098	0.101	0.106	0.110	0.113	0.115
0.5	0.020	0.039	0.056	0.071	0.084	0.095	0.103	0.110	0.116	0.120	0.126	0.131	0.135	0.137
0.6	0.022	0.043	0.063	0.080	0.095	0.107	0.117	0.125	0.131	0.136	0.143	0.149	0.153	0.156
0.7	0.024	0.047	0.069	0.087	0.103	0.117	0.128	0.137	0.144	0.149	0.157	0.164	0.169	0.172
0.8	0.026	0.050	0.073	0.093	0.110	0.125	0.137	0.146	0.154	0.160	0.168	0.176	0.181	0.185
0.9	0.027	0.053	0.077	0.098	0.116	0.131	0.144	0.154	0.162	0.168	0.176	0.186	0.192	0.196
1.0	0.028	0.055	0.079	0.101	0.120	0.136	0.149	0.160	0.168	0.175	0.185	0.194	0.200	0.205
1.2	0.029	0.057	0.083	0.106	0.126	0.143	0.157	0.168	0.178	0.185	0.196	0.205	0.209	0.212
1.5	0.030	0.060	0.086	0.110	0.131	0.149	0.164	0.176	0.186	0.194	0.205	0.211	0.216	0.223
2.0	0.031	0.061	0.089	0.113	0.135	0.153	0.169	0.181	0.192	0.200	0.209	0.216	0.232	0.240
∞	0.032	0.062	0.090	0.115	0.137	0.156	0.172	0.185	0.196	0.205	0.212	0.223	0.240	0.250

Distributed Load Not Over Pipe

This design method may be used to determine the surcharge load on buried pipes that are near, but not directly below uniformly distributed loads such as concrete slabs, footings and floors, or other stationary rectangular area loads.

The method is similar to the method for determining the surcharge load when the surcharge is directly above the pipe, except that the area directly above the pipe that is not covered by the surcharge load must be deducted from the overall load on the pipe.

Refer to Figure 7-4B. Since there is no surcharge directly above the pipe centerline, an imaginary surcharge load of the same pressure per unit area as the actual load, is applied to sub-areas c and d. The surcharge loads for sub-areas a + d and b + c, are determined, then the surcharge loads from the imaginary areas c and d are deducted to find the surcharge pressure on the pipe.

$$P_L = P_{a+d} + P_{b+c} - P_c - P_d \qquad \textbf{(7-11)}$$

Where terms are previously defined and:

P_{a+d} = surcharge load of combined sub-areas a and d, lb/ft^2
P_{b+c} = surcharge load of combined sub-areas b and c, lb/ft^2

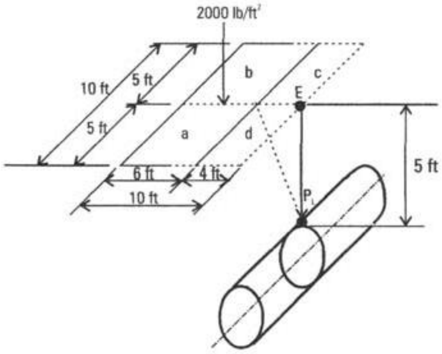
Example 7-3

Find the vertical surcharge pressure for the 6' x 10', 2000 lb/ft^2 slab shown in Figure 7-6.

Solution: The surcharge area includes the non-loaded area between the pipe and the slab. Divide the surcharge area into four sub-areas, a, b, c, and d. See Figure 7-4B. Using Formulas 7-9 and 7-11, and Table 7-2, determine the surcharge pressures for the combined sub-areas a + d and b + c, and then for sub-areas c and d. The surcharge pressure is the sum of the surcharge sub-areas a + d and b + c, less the imaginary sub-areas c and d.

	Sub-area			
	a + d	b + c	c	d
M	10	10	4	4
N	5	5	5	5
M/H	2.0	2.0	0.8	0.8
N/H	1.0	1.0	1.0	1.0
I_C	0.200	0.200	0.160	0.160
P_x	400	400	(320)	(320)
P_L = 160 lb/ft^2				

Figure 7-6 Illustration for Example 7-3



Vehicular Loads

Wheel loads from trucks, trains, or other vehicles are significant for pipe buried at shallow depths. The pressure on the pipe due to a surface vehicular live load depends on vehicle weight, the tire pressure and size, vehicle speed, surface smoothness, the amount and type of paving, the soil, and the distance from the pipe to the point of loading.

Minimum Cover Depth

Where pipe is to be subjected to vehicular loads, it is recommended to install it under at least one pipe diameter or eighteen inches of cover, whichever is greater. However, for pipe 36" in diameter or larger, this cover depth may not always be available. For these shallow cover cases, special design considerations are required.

Highway Loads

The most common loading used for design is the H20 highway loading. The American Association of State Highway and Transportation Officials (AASHTO) publishes wheel loadings for standard H and HS trucks as illustrated in Figures 7-7 and 7-8. A standard H20 truck has a front axle load of 8,000 pounds, and a rear axle load of 32,000 pounds, for a total weight of 40,000 pounds or 20 tons. At the rear axle(s), each wheel load is 0.4 W, where W is the total weight of the truck. The 0.4 W wheel load may be used to represent the load applied by either a single axle or tandem axles. The heaviest tandem axle loads normally encountered on highways are

Figure 7-7 AASHTO Standard H20 Static Loading

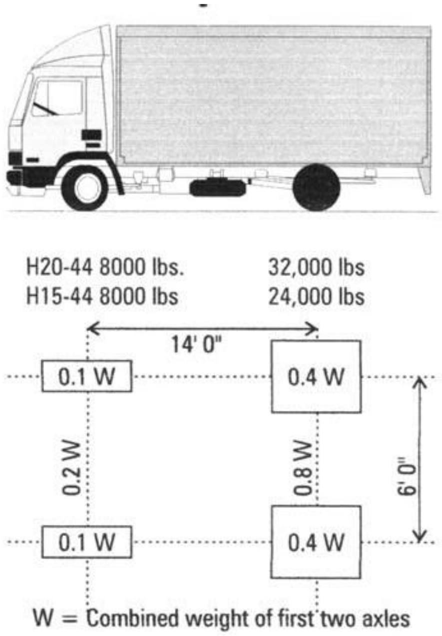
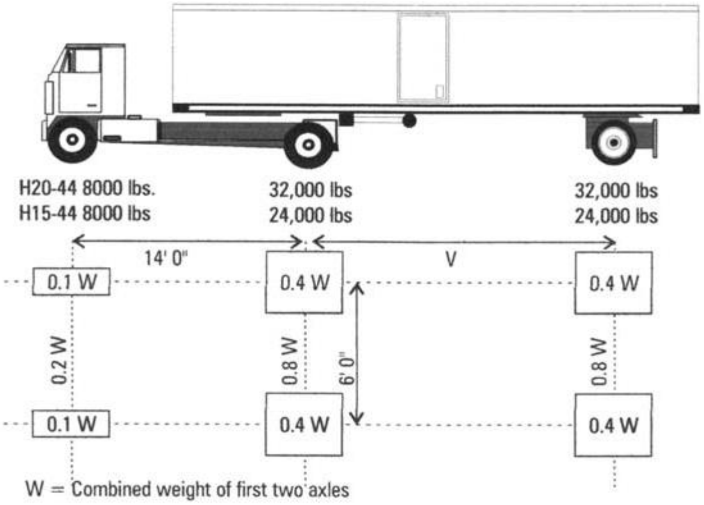


Figure 7-8 AASHTO Standard HS20 Static Loading



around 40,000 pounds. Occasionally, vehicles may be permitted with loads up to 50 percent higher.

The standard AASHTO wheel loading is a static load. However, a vehicle in motion will strike bumps and increase the downward force. For vehicles on paved roads, impact loading is addressed by multiplying the static load by an impact factor of 1.5. For unpaved roads, higher impact factors may be required.

Pavement rigidity is an important variable affecting the live load surcharge pressure transmitted to the pipe. Pavement is usually considered to be rigid (concrete) or flexible (asphalt). Rigid pavement distributes the load, and tends to transmit a reduced load directly onto the pipe.

Rigid Pavement Highway Loads

For common highway surcharge loading applications, the pressure acting on the pipe can be obtained from a table developed by the American Iron and Steel Institute (AISI) that provides H20 and HS20 highway surcharge loading on rigid pavement.

AISI H20 and HS20 highway loading assumes that the axle load is equally distributed over two, 18 by 20 inch areas, spaced 72 inches apart, and applied through a 12-inch thick, rigid pavement. To account for vehicle speed, an impact factor of 1.5 is incorporated in Table 7-3 values. For other loadings, such as heavier trucks, or trucks on unpaved surfaces the AISI values in Table 7-3 cannot be used and one of the methods discussed below should be considered.

Table 7-3 H20 and HS20 Highway Loading (AISI)‡

	Cover, ft								
	1	2	3	4	5	6	7	8	10
Transferred Load, lb/ft^2	1800	800	600	400	250	200	175	100	†

‡ Simulates 20-ton truck traffic plus impact. † Negligible live load influence.

Off-Highway and Unpaved Road Loads

Off-highway vehicles may be considerably heavier than H20 or HS20 trucks, and these vehicles frequently operate on unpaved roads that may have uneven surfaces. Thus impact factors higher than 1.5 may be reached depending on the vehicle speed. Except for slow traffic, an impact factor of 2.0 to 3.0 should be considered.

During construction, both permanent and temporary underground pipelines may be subjected to heavy vehicle loading from construction equipment. A designated vehicle crossing with special design measures such as temporary pavement or structural sheeting may be prudent, as well as vehicle speed controls to limit impact loading.

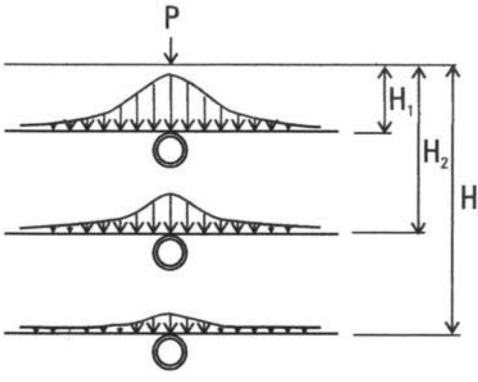
Vehicular Loads As Point Loads

There are generally two approaches for calculating vehicle live load surcharge pressure. The more conservative approach is to treat the wheel load as a concentrated (point) load. The other is to treat it as a distributed load spread over the contact area of the tire with the ground (imprint area). The pressure due to a distributed load and the pressure due to a concentrated load begin to approach the same value at a depth of about twice the square root of the loaded area.

The distributed load method gives more realistic values where the depth equals less than twice the square root of the loaded area, whereas for deeper depths concentrated loads are preferred because the calculations are simpler and typically more conservative.

The pressure distribution under a concentrated load varies with depth as illustrated in Figure 7-9. When the live load is calculated using the point load methods in the following sections, a conservative approach is to assume that the maximum pressure at the pipe crown is distributed across the entire pipe.

Figure 7-9 Concentrated Vehicular Load Pressure Distribution at Various



A key consideration in determining live load pressure on the pipe is the location of vehicle wheels relative to the pipe. A higher pressure may occur below a point between two vehicles passing in adjacent lanes than directly under a single vehicle wheel. This depends on the depth of cover.

When depths are not greater than four or five feet, the combined H20 load for two separate wheels straddling the pipe is greater than that for a single wheel directly over the pipe. Deeper than five feet, H20 loads are not usually significant because the load is attenuated significantly compared loads under one or two feet of cover. However, greater live loads may produce design significant effects at depths greater than five feet. Therefore, the designer should check load conditions for a single wheel directly over the pipe, and for two wheels spaced six feet apart and centered over the pipe.

Single Wheel Load Centered On Pipe

To check a single wheel load centered directly over the pipe, a method based on Holl's integration of Boussinesq's equation assumes that the wheel load is a concentrated (point) load. Holl's integration finds the pressure at the depth of the pipe crown that is distributed over a surface three feet long and the width of the pipe outside diameter.

Holl's Integration

Holl's equation for the average vertical pressure acting on a pipe due to a concentrated surface load is:

Holl's Equation

$$P_L = C_H \frac{I_I W_L}{L D} \tag{7-12}$$

Where terms are previously defined and:

I_I = impact factor
C_H = load coefficient, Table 7-4
W_L = wheel load, lb
L = pipe length, ft
D = pipe outside diameter, ft

If the pipe is longer than 3 ft, the usual practice is to assume a length of 3 ft. Values for C_H are found in Table 7-4 as a function of D/2H and L/2H where H is the depth of cover.

Example 7-4

Find the single H20 rear wheel live load surcharge pressure on a 30" OD pipe buried 4 feet deep. Assume an impact factor of 1.5.

Solution: Use Formula 7-12, Table 7-4, and Figure 7-7. To solve Formula 7-12, the load coefficient, C_H, from Table 7-4 is required. For 4 ft of cover, D/2H = 0.31, and L/2H = 0.38. Interpolating Table 7-4 for C_H yields 0.189. From Figure 7-7, the H20 rear wheel live load is 0.4 x 40,000 = 16,000 lb. Solving Formula 7-12 yields:

$$P_L = (0.189)\frac{(1.5)(16{,}000)}{3\left(\frac{30}{12}\right)}$$

$$P_L = 598\ lb/ft^2$$

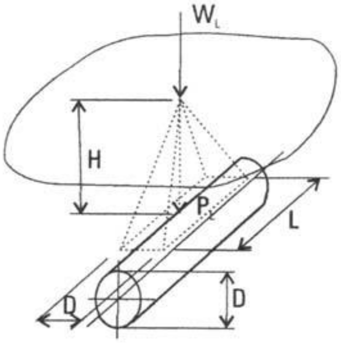
Multiple Wheel Loads Along Pipe Length

In many cases, the maximum load on the pipe occurs when a single (or dual) wheel is located directly over the pipe. However, at some depths the combined load due to more than one wheel may be larger than the single wheel load. This usually occurs at a location along the pipe that is not directly beneath a wheel load. This point (Figure 7-10, Case I, Point 2) will usually be centered between two wheel loads.

Point Load on Pipe Crown

The Boussinesq point load equation may be used to find the wheel load pressure on the pipe, neglecting any pavement effects. Pavement effects are covered later using a modified form of Boussinesq's equation, Formula 7-13.

Table 7-4 Load Coefficient, C_H, for Holl's Integration of Boussinesq's Equation



D/2H	L/2H													
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.5	2.0	20.0
0.1	0.019	0.037	0.053	0.067	0.079	0.089	0.097	0.103	0.108	0.112	0.117	0.121	0.124	0.127
0.2	0.037	0.072	0.103	0.131	0.155	0.174	0.189	0.202	0.211	0.219	0.229	0.238	0.244	0.248
0.3	0.053	0.103	0.149	0.190	0.224	0.252	0.274	0.292	0.306	0.318	0.333	0.346	0.355	0.361
0.4	0.067	0.131	0.190	0.241	0.284	0.320	0.349	0.373	0.391	0.405	0.425	0.442	0.454	0.462
0.5	0.079	0.155	0.224	0.284	0.336	0.379	0.414	0.441	0.463	0.481	0.505	0.525	0.540	0.550
0.6	0.089	0.174	0.252	0.320	0.379	0.428	0.467	0.499	0.524	0.544	0.572	0.596	0.613	0.625
0.7	0.097	0.189	0.274	0.349	0.414	0.467	0.511	0.546	0.574	0.597	0.628	0.655	0.674	0.688
0.8	0.103	0.202	0.292	0.373	0.441	0.499	0.546	0.584	0.615	0.639	0.674	0.703	0.725	0.740
0.9	0.108	0.211	0.306	0.391	0.463	0.524	0.574	0.615	0.647	0.673	0.711	0.743	0.766	0.783
1.0	0.112	0.219	0.318	0.405	0.481	0.544	0.597	0.639	0.673	0.701	0.740	0.775	0.800	0.818
1.2	0.117	0.229	0.333	0.425	0.505	0.572	0.628	0.674	0.711	0.740	0.783	0.821	0.849	0.871
1.5	0.121	0.238	0.346	0.422	0.525	0.596	0.655	0.703	0.743	0.775	0.821	0.863	0.895	0.920
2.0	0.124	0.244	0.355	0.454	0.540	0.613	0.674	0.725	0.766	0.800	0.849	0.895	0.930	0.960
20.0	0.127	0.248	0.361	0.462	0.550	0.625	0.688	0.740	0.783	0.818	0.871	0.920	0.960	1.000

Boussinesq's Equation

$$P_L = \frac{3 I_l W_L H^3}{2 \pi r^5} \qquad \textbf{(7-13)}$$

Where terms are previously defined and:

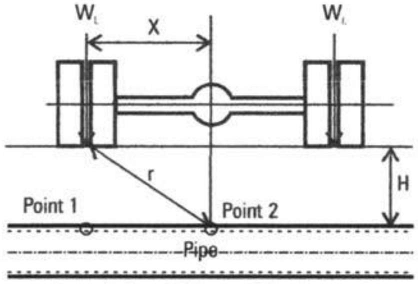
H = vertical depth to point on pipe crown, ft
r = distance from the point of load application to the pipe crown, ft

$$r = \sqrt{X^2 + H^2} \qquad \textbf{(7-14)}$$

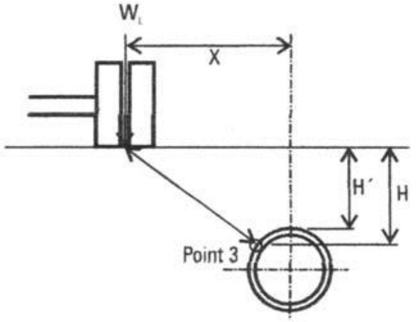
Where:

X = horizontal distance from the point of load application to the pipe crown, ft

Figure 7-10 Concentrated Point Load



Case I: Load Along Pipe Length



Case II: Load At Horizontal Distance From Pipe

Using the Boussinesq point load equation in this way is conservative, as the pressure applied to the point on the pipe crown is taken as the pressure applied across the pipes diameter.

Equation (7-12) applies only where the axle is located directly over the pipe, and when seeking the pipe crown load at some point between the wheels. This is depicted in Figure 7-10, Case I.

Example 7-5

Determine the vertical soil pressure exerted on a 12" pipe buried 2 ft deep when two 16,000 lb wheel loads cross simultaneously over the pipe. Assume the loads are 6 feet apart. (Six feet is the typical wheel spacing on an axle, and the normal separation for wheel loads traveling in adjacent lanes.)

Solution: Use Formulas 7-13 and 7-14. Assuming the vehicle is traveling, a 1.5 impact factor is applied. The maximum load will be at the center between the two wheels, thus X = 3 ft. Determine r from Formula 7-14.

$$r = \sqrt{2^2 + 3^2} = 3.61\,ft$$

Then,

$$P_L = \frac{3(1.5)(16{,}000)(2)^2}{2\pi(3.61)^5} = 149.5\ lb/ft^2$$

This is the load from each wheel; however, the load on the pipe crown is from both wheels, thus

$$2P_L = 299\ lb/ft^2$$

Point Load Not On Pipe Crown

With some modification of equation terms, the pressure at a point other than at the pipe crown may be determined. A pipe buried along a road shoulder is such an application. Pictorially, this is Figure 7-10, Case II. For this application, H and r are determined using the following formulas:

$$\alpha = \tan^{-1}\left(\frac{X}{H' + \frac{D}{2}}\right) \qquad \textbf{(7-15)}$$

$$H = H' + \frac{D}{2}\left(1 - \cos\alpha\right) \qquad \textbf{(7-16)}$$

$$r = \sqrt{X^2 + \left(H' + \frac{D}{2}\right)^2} - \frac{D}{2} \qquad \textbf{(7-17)}$$

Where terms are previously defined and

H' = depth of cover, ft

Multiple Wheel Loads on Rigid Pavement

The Portland Cement Association method may be used to find the load on a pipe from multiple wheel loads on rigid pavement. The solution accounts for pavement rigidity, and the stiffness of the pipe embedment soil. To determine the maximum load when two vehicles pass each other, two common cases are checked. The first calculates the load directly under a wheel, and the other calculates the combined load of two passing vehicles. Usually the later case gives the highest load.

The pressure at a point beneath a single wheel is given by:

$$P_L = \frac{C_H \, I_I \, W_L}{{R_S}^2} \qquad \textbf{(7-18)}$$

Where terms are previously defined and

R_S = radius of stiffness, ft

$$R_S = \frac{\sqrt[4]{\dfrac{E\,h^3}{12\left(1 - \nu^2\right)E'}}}{12} \qquad \textbf{(7-19)}$$

Where

E = pavement modulus, lb/in^2 (4,000,000 lb/in^2 for concrete)
h = pavement thickness, in
v = Poisson's ratio (0.15 for concrete)
E' = embedment soil modulus, lb/in^2 (Table 7-7)

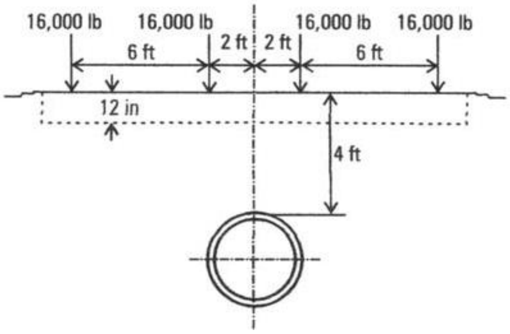
Example 7-6

Find the pressure at the crown of the pipe illustrated in Figure 7-11, using an impact factor of 1.5. Pavement is 12" thick and the pipe is 4 feet below the pavement surface. Assume E′ = 700 lb/in^2.

Solution: Using Formula 7-19, solve for R_S; then determine C_H from Table 7-5. Using Formula 7-18, solve for each wheel load. The total pressure on the pipe is the sum of the four wheel loads.

$$R_S = \frac{\sqrt[4]{\dfrac{(4{,}000{,}000)(12)^3}{12(1 - 0.15^2)(700)}}}{12} = 2.52\,ft$$

Figure 7-11 Illustration for Example 7-6



	Outer	*Inner*
X/R_S	8/2.52 = 3.2	2/2.52 = 0.8
H/R_S	4/2.52 = 1.6	4/2.52 = 1.6
C_H	0.011	0.054

The loads are cumulative, thus it is convenient to add the load coefficients together; then solve for the pressure on the pipe in one calculation.

$$C_{H\,(total)} = 2(\,0.011 + 0.054\,) = 0.13$$

$$P_L = \frac{(0.13)(1.5)(16{,}000)}{2.52^2} = 492\,lb/ft^2$$

H/R_S	X/R_S										
	0.0	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
0.0	0.113	0.105	0.089	0.068	0.048	0.032	0.020	0.011	0.006	0.002	0.000
0.4	0.101	0.095	0.082	0.065	0.047	0.033	0.021	0.011	0.004	0.001	0.000
0.8	0.089	0.084	0.074	0.061	0.045	0.033	0.022	0.012	0.005	0.002	0.001
1.2	0.076	0.072	0.065	0.054	0.043	0.032	0.022	0.014	0.008	0.005	0.003
1.6	0.062	0.059	0.054	0.047	0.039	0.030	0.022	0.016	0.011	0.007	0.005
2.0	0.051	0.049	0.046	0.042	0.035	0.028	0.022	0.016	0.011	0.008	0.006
2.4	0.043	0.041	0.039	0.036	0.030	0.026	0.021	0.016	0.011	0.008	0.006
2.8	0.037	0.036	0.033	0.031	0.027	0.023	0.019	0.015	0.011	0.009	0.006
3.2	0.032	0.030	0.029	0.026	0.024	0.021	0.018	0.014	0.011	0.009	0.007
3.6	0.027	0.026	0.025	0.023	0.021	0.019	0.016	0.014	0.011	0.009	0.007
4.0	0.024	0.023	0.022	0.020	0.019	0.018	0.015	0.013	0.011	0.009	0.007
4.4	0.020	0.020	0.019	0.018	0.017	0.015	0.014	0.012	0.010	0.009	0.007
4.8	0.018	0.017	0.017	0.016	0.015	0.013	0.012	0.011	0.009	0.008	0.007
5.2	0.015	0.015	0.014	0.014	0.013	0.012	0.011	0.010	0.008	0.007	0.006
5.6	0.014	0.013	0.013	0.012	0.011	0.010	0.010	0.009	0.008	0.007	0.006
6.0	0.012	0.012	0.011	0.011	0.010	0.009	0.009	0.008	0.007	0.007	0.006

Vehicular Loads As Distributed Loads

The concentrated load methods presented above typically provide conservative results compared to distributed load methods and should be satisfactory for most applications. However, with shallow cover and heavy load conditions, concentrated load methods may yield results that are unrealistically conservative. In this event or where a more precise answer is sought, the surcharge load pressure on the pipe may be evaluated using distributed load methods.

Distributed Wheel Loads

The methods presented above for determining surcharge pressure on the pipe from a stationary distributed load can be applied to a wheel load as well, provided that the dimensions of the area loaded by the wheel are known. Allowing for traveling vehicle impact and wheel load over a known area, Formula 7-10 becomes

$$P_L = 4\,I_C\left(\frac{I_I\,W_L}{A_C}\right) \qquad \textbf{(7-20)}$$

Where terms are previously defined and

A_C = contact area, ft^2

Load Areas

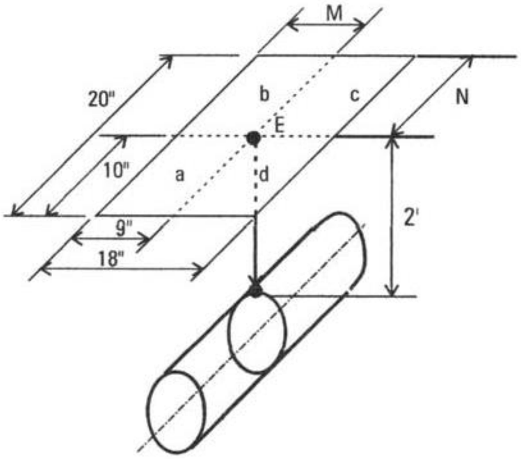
AISI and AASHTO provide guidelines for wheel load areas. AISI gives dual wheel contact area for rear axle on an H20 or HS20 vehicle, as an 18 in by 20 in rectangle. For a single tire, AASHTO assumes that the tire imprint area is a rectangle with an area in square inches equal to $0.01W_L$ where W_L is the wheel load in lbs. The AASHTO area has a 1 to 2.5 ratio of direction-of-traffic length to tire width. The contact area may also be found by dividing the wheel load by the tire pressure. For off road and heavy trucks, the tire contact area should be obtained from the vehicle manufacturer.

Example 7-7

(a) Using the distributed load method, find the pressure at the crown of a 24" O.D. polyethylene pipe with 2 ft of cover under an HS20 vehicle with a 16,000 lb wheel load and an impact factor of 1.5. Assume the AISI contact area for a dual tire rear wheel.

(b) Compare this value with that obtained using the Boussinesq point load equation.

Figure 7-12 Illustration for Example 7-7



Solution: (a) The vertical pressure at the crown of the pipe may be found using Formula 7-20, and Table 7-2. The live load is divided into four equal areas, with the common corner centered over the pipe as shown in Figure 7-12.

$$\frac{M}{H} = \frac{9/12}{2} = 0.375$$

$$\frac{N}{H} = \frac{10/12}{2} = 0.420$$

By interpolation of Table 7-2, the influence coefficient, I_C, is 0.059, thus

$$P_L = 4(0.059)\frac{(1.5)(16{,}000)}{\left(\frac{18}{12}\right)\left(\frac{20}{12}\right)} = 2265\ lb/ft^2$$

(b) To determine the point load, Equations (7-12) and (7-13) apply. Since the load is directly above the pipe, r = H = 2 ft, and

$$P_L = \frac{3(1.5)(16{,}000)(2)^3}{2\pi(2)^5} = 2865\ lb/ft^2$$

Timoshenko's Method

The Timoshenko method is a conservative approach that finds the stress at a point in the soil under a distributed wheel load. The pressure acting at the crown of a buried pipe may be calculated using the following:

Timoshenko's Equation

$$P_L = \left(\frac{I_l W_L}{A_C}\right)\left(1 - \frac{H^3}{\left(r_\gamma{}^2 + H^2\right)^{1.5}}\right) \qquad \textbf{(7-21)}$$

Where terms are previously defined and

r_γ = equivalent radius, ft

For standard H20 and HS20 highway vehicle loading, the contact area is normally taken for dual wheels, that is, 16,000 lb over an 18 in by 20 in area. The equivalent radius is given by:

$$r_\gamma = \sqrt{\frac{A_C}{\pi}} \qquad \textbf{(7-22)}$$

Example 7-8

Find the vertical pressure on a 24" polyethylene pipe buried 3 ft beneath an unpaved road when an R-50 truck is over the pipe. The manufacturer lists the truck with a gross weight of 183,540 lbs on 21X35 E3 tires, each having a 30,590 lb load over an imprint area of 370 in^2.

Solution: Use Formulas 7-21 and 7-22. For a vehicle is operating on an unpaved road, an impact factor of 2.0 is appropriate.

$$r_\gamma = \sqrt{\frac{370/144}{\pi}} = 0.90\,ft$$

$$P_L = \frac{(2.0)(30{,}590)}{(370/144)}\left(1 - \frac{3^2}{(0.90^2 + 3^2)}\right)$$

$$P_L = 2890\,lb/ft^2$$

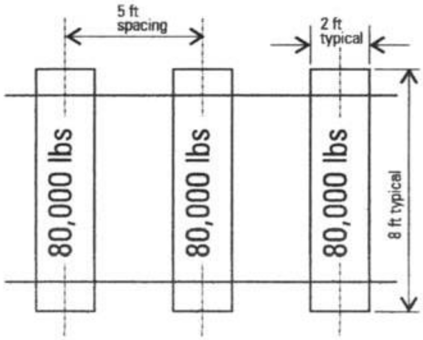
Railroad Loads

Figure 7-13 and Table 7-6 illustrate Cooper E80 live loading based on AISI published information for three, 80,000 lb loads over three 2 ft x 8 ft areas spaced 5 ft apart. At sufficient depth, smaller diameter pipes and pipes carrying non-hazardous fluids may safely withstand design loads without encasement. Based upon design and permitting requirements, the design engineer should determine if a casing is required. Commercial railroads frequently require casings for plastic pipes if they are within 25 feet of the tracks.

Table 7-5 Cooper E80 Live Loading

Height of Cover, ft.	*Load,lb/ft^2*
2	3800
5	2400
8	1600
10	1100
12	800
15	600
20	300
30	100

Figure 7-13 Cooper E80 Live Loading



Designing Polyethylene Pipes to Withstand Loads

Polyethylene pipes are subjected to stress from the combination of internal and external forces applied to the pipe. The most common internal force is fluid pressure. For buried pipes, the most common external forces are earth and surcharge loads. This section discusses pipe stresses and deformations due to external forces. Internal pressure stress may increase or decrease stresses or deformations from external forces.

External Forces On Pipe

Buried pipe is subjected to radial compressive loads and circumferential shear loads from the surrounding soil and surcharge loads. Radial loads are loads that are applied to the pipe wall and have a line of action that passes through the center of the pipe. These loads will produce stresses and deformations in the pipe. Radial loads will cause a minute decrease in the pipe diameter.

A radially directed load is not normally uniform and this causes the pipe to undergo ring deflection. The amount of ring deflection will depend on the load, pipe stiffness and soil stiffness. When buried in very weak, viscous soils that offer little or no stiffness compared to the pipe, the ring deflection of the pipe will be governed almost entirely by pipe properties. On the other hand, when buried in compacted granular embedment, the ring deflection is governed by the interaction between the pipe and the surrounding soil.

In buried applications, polyethylene pipe is usually characterized by measures of ring stiffness such as RSC (Ring Stiffness Constant) or PS (pipe stiffness), ductility (which governs permissible deflection limits) and compressive strength. Soil stiffness is usually characterized by the modulus of passive resistance, a measure of the combined stiffness of the pipe and the soil, and related to the soil's compressibility and density.

Radial compressive loads and ring deflection or ring bending that occur in a flexible pipe, cause deformations and stresses in the pipe wall. Some of the more common design concerns for buried flexible pipe are presented below. An engineer should review all designs to determine suitability for a particular application.

Constrained Pipe Wall Compressive Stress

When a non-pressurized pipe that is confined in a dense embedment is subjected to a radially directed soil pressure, a circumferential, compressive thrust occurs in its wall. This is similar to the thrust force that occurs within the wall of a ring when it is squeezed. This thrust creates a ring (or hoop) compressive stress within the pipe wall. This is similar to a hoop tensile stress from internal pressure, but compressive stress acts in the opposite direction.

As is often the case, the radial soil pressure that causes compressive stress is not uniform. However, for convenience in calculating wall compressive stress, radial soil pressure is assumed to be uniform and equal to the vertical soil pressure at the crown of the pipe.

With buried pressure pipe, internal pressure may be greater than the radial external pressure applied by the soil. This results in a tensile stress rather than a compressive stress in the pipe wall. Thus for pressure pipe, compressive wall stresses are normally not considered. This can be verified by comparing internal pressure hoop stress to wall compressive stress.

When subjected to a uniform radial soil pressure, the compressive stress in the pipe wall is:

DriscoPlex™ OD controlled pipe:

$$S = \frac{P_T D_O}{288\,t} \qquad \textbf{(7-23)}$$

DriscoPlex™ 2000 SPIROLITE® pipe:

$$S = \frac{P_T D_O}{288\,A} \qquad \textbf{(7-24)}$$

Where

P_T = vertical load applied to pipe, lb/ft^2
S = pipe wall compressive stress, lb/in^2
D_O = pipe outside diameter, in
t = pipe wall thickness, in
A = pipe wall profile average cross-sectional area, in^2/in

Because arching commonly occurs for entrenched pipe, the modified arching load rather than the prism load is used to determine the vertical soil pressure at the pipe crown.

The pipe wall compressive stress should be compared to an allowable material stress value that should be determined by testing. The recommended, long-term compressive strength design value for DriscoPlex™ polyethylene pipe is 800 lb/in^2.

Example 7-9

Find the pipe wall compressive ring (or hoop) stress in a DriscoPlex™ 2000 SPIROLITE® 36" Class 100 pipe buried under 18 ft of cover. The ground water level is at the surface, the saturated weight of the insitu silty-clay soil is 120 lbs/ft^3 and the trench width equals the pipe diameter plus 3 ft.

Solution: Determine the modified arching load using Formula 7-5. The arching coefficient from Formula 7-7 or from Figure 7-3 is

$$F = 0.83$$

Although net soil pressure is equal to the buoyant weight of the soil, ground water pressure is also acting on the pipe. Therefore the total pressure (water and earth load) can be found using the saturated unit weight of the soil.

$$P_C = (0.83)(120)(18) = 1793\, lb/in^2$$

Next, solve Formula 7-24 for the compressive stress. For DriscoPlex™ 2000 SPIROLITE® 36" Class 100 pipe, the wall cross-sectional area, A, and outside diameter, D_O are found in DriscoPlex™ 2000 SPIROLITE® pipe product literature. A is 0.470 in^2/in, and D_O is 36 plus twice the 2.02" wall height, or 40.04 in.

$$S = \frac{(1793)(40.04)}{(288)(0.470)} = 530\ lb/in^2$$

The application is within the 800 lb/in^2 allowable stress guideline.

Unconstrained Pipe Wall Buckling

Flexible pipe may be viewed as having the cross section of a long, slender column rolled into a cylinder. Compressive thrust, in combination with radially directed forces, may cause instability or buckling, that is, a large wrinkle or dimple in the pipe wall. This type of deflection can be compared to the Euler buckling of a column.

Unconstrained pipe wall buckling can be a consideration for low pressure and non-pressure pipes where the pipe is not externally supported by embedment, or when embedment provides little or no support. Compared to the capacity for tensile wall stress from internal pressure, unconstrained flexible pipe has less resistance to external, radially directed pressure. Some examples of external pressures on unconstrained pipe include: external atmospheric pressure from vacuum within the pipe; external hydrostatic load such as groundwater above a slipliner, or water above partially full underwater pipeline; a column separation in a liquid flow in a downhill pipeline; siphoning or a reduced internal pressure where a flow liquid in a pipeline crests a rise; and cavitation due to pump shut-off or start-up. If an unconstrained pipe will be subjected to an external pressure during service, the unconstrained buckling resistance should be checked.

For unconstrained pipe, the critical external pressure or negative pressure above which buckling can occur may be estimated by:

For DriscoPlex™ 2000 SPIROLITE® pipe:

$$P_{CR} = \frac{24\, E\, I_P}{(1-\mu^2)\, D_M{}^3} \tag{7-25}$$

Where

P_{CR} = vertical load applied to pipe, lb/ft^2
E = elastic modulus, lb/in^2 (Table 5-1)
I_P = profile wall moment of inertia, in^4/in
μ = Poisson's ratio
D_M = pipe mean diameter, in

For DriscoPlex™ 2000 SPIROLITE® pipe:

$$D_M = D_I + 2Z \qquad \textbf{(7-26)}$$

For DriscoPlex™ OD controlled pipe:

$$D_M = D_O - 1.06t \qquad \textbf{(7-27)}$$

Where

D_I = pipe inside diameter, in
Z = profile wall centroid, in
D_O = pipe outside diameter
t = pipe minimum wall thickness

Poisson's ratio, μ, for polyethylene pipe is 0.45 for long-term loading and 0.35 for short-term loading. Expressing critical external buckling pressure in terms of DR for OD controlled pipe, Formula 7-25 becomes

$$P_{CR} = \frac{2E}{(1-\mu^2)}\left(\frac{1}{DR-1}\right)^3 \qquad \textbf{(7-28)}$$

Where

DR = pipe dimension ratio

$$DR = \frac{D_O}{t} \qquad \textbf{(7-29)}$$

Ovality Effects

Ovality or deflection of the pipe diameter reduces buckling resistance because the bending moment in the pipe wall increases.

$$P = f_O\, P_{CR} \qquad \textbf{(7-30)}$$

Where

P = buckling pressure, lb/in^2
f_O = ovality compensation factor, Figure 7-14

Initially deflected unconstrained pipe generally assumes an oval shape. The percent deflection (ovality) of pipe is determined by

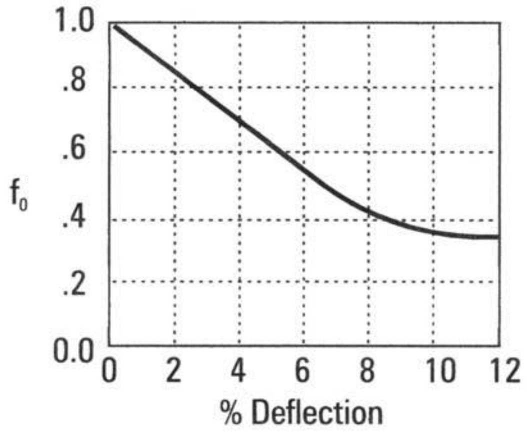
$$\%\,Deflection = 100\left(\frac{D - D_O}{D}\right) \qquad \textbf{(7-31)}$$

Where

D = pipe average diameter, in
D_O = pipe minimum diameter, in

See Table 5-1 for elastic modulus values for determining critical buckling pressure in Formulas 7-25 and 7-28. The modulus selected should account for the temperature of the pipe and the duration of the applied load. When unconstrained pipes are installed on or above the surface, sunlight heating can increase pipe temperature and reduce buckling resistance.

Figure 7-14 Ovality Compensation Factor for Unconstrained Buckling



The designer should compare the critical buckling pressure to the actual anticipated pressure, and apply a safety factor commensurate with his assessment of the application. Safety factors in the range of 2 to 1 are common, but specific circumstances may warrant a higher or lower safety factor. An alternative to a direct safety factor may be to apply a long-term elastic modulus to a short-term stress event.

The resilience and toughness of DriscoPlex™ OD controlled and DriscoPlex™ 2000 SPIROLITE® pipe may allow the pipe to recover from a short-term or one-time buckling or flattening event. For example, a high DR, unconstrained OD controlled pipe may be pressed flat by a short duration vacuum inside the pipe, but relieving the vacuum can allow the pipe to recover most of its original round shape. When such events are rare or one-time, a loss of serviceability or permanent damage is not anticipated. However, repetitive unconstrained buckling events can cause permanent damage. If temporary buckling events are possible with DriscoPlex™ 2000 SPIROLITE® pipe, bell and spigot joints should be extrusion-welded to enhance joint sealing capability.

Example 7-10

Find the allowable ground water level above a 24" Class 160 DriscoPlex™ 2000 SPIROLITE® pipe installed in a casing without grout in the annular space. Consider cases where the pipe is below the normal water table, and where the water table rises during a flood.

Solution: Use Formulas 7-26, 7-28 and 7-30; Bulletin PP-401 *ASTM F 894 High Density Polyethylene Pipe Product Data;* Figure 7-14 and Table 5-1 for elastic modulus values. The critical external collapse pressure depends upon the how long the water level is above the pipe. If the water level is constant, a long-term elastic modulus should be used, but if the water level rises only occasionally, an elastic modulus for lesser duration may be applied.

Bulletin PP-401 supplies pipe dimensions and I values. For 24" Class 160 pipe, I is 0.124 in^4/in and Z, the wall centroid, is 0.50 in. Solving Formula 7-26

$$D_M = 24 + 2(0.50) = 25.0 \ in$$

For a constant water table above the pipe, Table 5-1 indicates a 50-year, 73° F modulus of 28,200 lb/in^2, thus Formula 7-28 yields

$$P_{CR} = \frac{(24)(28{,}200)(0.124)}{(1-0.45^2)(25^3)} = 6.79\ lb/in^2$$

Assuming 5% ovality and a 2 to 1 safety factor, f_O from Figure 7-14 is 0.64. Formula 7-30 yields

$$P = \frac{(0.64)(6.79)}{2} = 2.17\ lb/in^2 = 5.0\ ft\ H_2O$$

Flooding conditions are occasional happenings, usually lasting a few days to a week or so. From Table 5-1, 1000 hours (41.6 days) is about twice the expected flood duration, so a value of 43,700 lb/in^2 provides about a 2 to 1 safety margin. Solving as above,

$$P_{CR} = \frac{(24)(43{,}700)(0.124)}{(1-0.45^2)(25^3)} = 10.44\ lb/in^2$$

$$P = (0.64)(10.44) = 6.68\ lb/in^2 = 15.4\ ft\ H_2O$$

Constrained Pipe Wall Buckling

Buckling resistance is increased when flexible pipe is embedded in soil. The soil and pipe couple together to resist buckling forces. A vertically applied thrust force causes the pipe to widen horizontally, but horizontal pipe deflection is restrained by the embedment soil, thus the pipes critical buckling pressure increases. A pipe/soil interaction occurs when the depth of cover is sufficient to mobilize soil support. A publication by the American Water Works Association, AWWA C-950, indicates that at least four feet of cover is needed to mobilize soil support.

AWWA C-950 provides a design equation for buckling of a buried plastic pipe. The following constrained pipe buckling equation is applicable to DriscoPlex™ OD controlled and DriscoPlex™ 2000 SPIROLITE® pipe.

For OD Controlled Pipe

$$P_{WC} = \frac{5.65}{N}\sqrt{R\,B'\,E'\frac{E}{12(DR-1)^3}} \qquad \textbf{(7-32)}$$

For DriscoPlex™ 2000 SPIROLITE® Pipe

$$P_{WC} = \frac{5.65}{N}\sqrt{R\,B'\,E'\frac{E\,I}{{D_M}^3}} \qquad \textbf{(7-33)}$$

Where terms are previously defined and

P_{WC} = allowable constrained buckling pressure, lb/in^2
N = safety factor
R = buoyancy reduction factor

$$R = 1 - 0.33\frac{H'}{H} \qquad \textbf{(7-34)}$$

H' = groundwater height above pipe, ft
H = cover above pipe, ft

B' = elastic support factor

$$B' = \frac{1}{1 + 4e^{(-0.065H)}} \tag{7-35}$$

E' = soil reaction modulus, lb/in^2 (Table 7-7)

The designer should apply a safety factor appropriate to the application. A safety factor of 2.0 has been used for thermoplastic pipe.

The allowable constrained buckling pressure should be compared to the total vertical stress acting on the pipe crown from the combined load of soil and groundwater or floodwater. It is prudent to check buckling resistance against a groundwater level for a 100-year-flood. In this calculation the total vertical stress is typically taken as the prism load pressure for saturated soil, plus the fluid pressure of any floodwater above the ground surface.

Example 7-11

Find the allowable buckling pressure for a DriscoPlex™ 2000 SPIROLITE® 36" Class 100 36" pipe, installed in compacted soil embedment having an E´ of 2000 lb/in^2. Determine if Class 100 pipe is sufficient for an applied load from 18 feet of cover and ground water to the surface.

Solution: Solve Formula 7-33 using Formulas 7-26, 7-35, 7-34 and Table 5-1. DriscoPlex™ 2000 SPIROLITE® pipe dimensions and properties are published in Bulletin PP-401. For DriscoPlex™ 2000 SPIROLITE® 36" Class 100 pipe, I is 0.171 in^4/in, and Z is 0.58 in. Solve for terms D_M, B', and R.

$$D_M = 36 + 2(0.58) = 37.16\,in$$

$$B' = \frac{1}{1 + 4e^{(-0.065(18))}} = 0.446$$

$$R = 1 - 0.33\frac{18}{18} = 0.67$$

Under a 100-year-flood condition, soil cover, H, and floodwater height, H´, are both 18 feet.

From Table 5-1, E is 28,200 lb/in^2 for 50 years at 73° F. A common practice is a safety factor of 2. Solving Formula 7-32,

$$P_{WC} = \frac{5.65}{2}\sqrt{\frac{(0.67)(0.446)(2000)(28{,}800)(0.171)}{(37.16)^3}}$$

$$P_{WC} = 21.17\,lb/in^2 = 3051\,lb/ft^2$$

The load applied to the pipe is found using the prism load, Formula 7-1.

(In this example, the specified soil reaction modulus, E´, is an empirical value that was developed using prism load rather than arching load methods. Therefore, the prism soil load must be used. If a soil reaction modulus value is developed using arching or modified arching methods, then soil loads should be calculated using the appropriate method. See discussions on Soil Reaction Modulus and Vertical Soil Pressure.)

$$P_E = (120)(18) = 2160\,lb/ft^2$$

The allowable buckling stress, P_{WC}, is greater than the applied load pressure, P_E, therefore, Class 100 pipe is satisfactory for this installation.

Ring Deflection

Some vertical pipe deflection is desirable to promote arching and to mobilize the passive soil resistance forces that support the pipe. However, deflection may affect other pipe or system performance areas, such as pipe material long-term strain capability, pipeline hydraulic capacity and compatibility with cleaning equipment. In DriscoPlex™ 2000 SPIROLITE® pipe, bell-and-spigot joint sealing capability may be affected by excessive deflection.

The two components of buried pipe deflection are construction deflection and service load deflection. Construction deflection occurs during shipping and handling and placing embedment around the pipe up to the pipe crown. Construction deflection incorporates all forces acting on the pipe up to the point where backfill is placed above the pipe. Service load deflection occurs from backfill placement above the pipe and from applied surcharge loads. The deflection observed in a buried pipe after the completing an installation is the sum of construction deflection and service load deflection.

Several methods are available for determining flexible pipe deflection from earth loads and surcharge loads. Historically, Spangler's Modified Iowa formula has been used to find the deflection of plastic pipes. Other methods include closed form solutions, and numerical methods such as finite element solutions. Alternatives to Spangler's formula may give more accurate values, but they usually require more precise information on soil and pipe properties. Therefore, these methods are not as commonly used as Spangler's Modified Iowa formula.

Spangler's Modified Iowa Formula can be written for DriscoPlex™ 2000 SPIROLITE® pipe as:

$$\frac{\Delta X}{D_I} = \frac{P_T}{144}\left(\frac{K\,L}{\frac{1.24\,(RSC)}{D_I} + 0.061E'}\right) \qquad \textbf{(7-36)}$$

And for DriscoPlex™ OD controlled pipe as:

$$\frac{\Delta X}{D_I} = \frac{P_T}{144}\left(\frac{K\,L}{\frac{2\,E}{3}\left(\frac{1}{DR-1}\right)^3 + 0.061E'}\right) \qquad \textbf{(7-37)}$$

Where

ΔX = horizontal deflection, in
D_I = inside diameter, in
P_T = pipe crown vertical pressure, lb/ft^2
K = bedding factor, typically 0.1
L = deflection lag factor
E' = soil reaction modulus, lb/in^2
E = elastic modulus, lb/in^2 (Table 5-1)

$$\%\,Deflection = \frac{\Delta X}{D_I}(100) = \frac{\Delta X}{D_M}(100) \qquad \textbf{(7-38)}$$

D_M = mean diameter, in (Formula 7-26 or 7-27)

Soil Reaction Modulus, E´

The soil reaction modulus, E’, is an interactive modulus representing the support or stiffness of the embedment soil in reaction to lateral pipe deflection under load. It is dependent on both soil and pipe properties, so there are no convenient laboratory tests to determine the soil reaction modulus for a given soil.

For the most part the modulus must be determined empirically, that is, it must be found by measuring the deflection of a buried pipe, then substituting that value into Spangler’s formula and back-calculating.

Table 7-7 presents soil reaction modulus values from an extensive field study for the Bureau of Reclamation performed by A. Howard. These values for soil reaction modulus are commonly used in flexible pipe design.

Howard noted deflection variability along the length of a typical pipeline. To determine maximum deflection, variability should be accommodated by reducing the Table 7-7 E´ value by 25%, or by adding the deflection percentage given in Table 7-7.

As cover depth increases, so does the earth pressure on the embedment material. Both horizontal and vertical pressures exist in a soil mass, but unlike water, these pressures are not normally equal to each other. As the enveloping or confining pressure is increased on a granular material, soil grains are held together more tightly, and the entire system stiffens. J. Hartley and J. Duncan published a study of soil reaction modulus variation with depth. Their recommended soil reaction modulus values are presented in Table 7-8, and should be considered when cover depth is less than 20 feet.

The vertical soil pressure exerted on a buried flexible pipe is typically equal to the Marston load. However, Howard’s Bureau of Reclamation E´ values assumed that the pipe was subjected to a prism load, which means that soil arching is incorporated in Howard’s E´ values. When using Table 7-7 or Table 7-8, the prism load should be used.

The soil reaction modulus represents the stiffness of the soil surrounding the pipe. In Tables 7-7 and 7-8, E´ values are given for the embedment material. However, when the insitu trench soil is highly compressible (marsh clay, peat, saturated organic soils, etc.) compared to the embedment around the pipe, the embedment soil may not develop the E´ values presented in the tables, resulting in pipe deflection greater than the design prediction. Increasing trench width, thereby increasing the width of embedment soil around the pipe, can minimize the effect of highly plastic insitu trench soil.

Janson recommends the use of the short-term pipe elastic modulus value in Spangler’s equation. The concept is that soil settlement around the buried pipe occurs in discrete events as soil grains shift or fracture. Once movement occurs, soil arching redistributes the load, and no further deflection occurs for that event. Since these load increments are felt like impulse loads, the pipe resists them with its short-term elastic modulus.

Table 7-7 Bureau of Reclamation Average E’ Values for Iowa Formula (Initial Deflection)

Soil type – pipe bedding material (Unified Classification)†	*E’ for Degree of Bedding Compaction, lb/in^2*			
	Dumped	*Slight (<85% Proctor <40% relative density)*	*Moderate (48%-95% Proctor 40%-70% relative density)*	*High (>95% Proctor >70% relative density)*
Fine-grained soils (LL>50)‡ Soils with medium to high plasticity CH, MH, CH-MH	No data available; consult a competent soils engineer; otherwise, use E’ = 0.			
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with <25% coarse grained particles	50	200	400	1000
Fine-grained soils (LL<50) Soils with medium to no plasticity CL, ML, CL-ML, with >25% coarse grained particles Coarse-grained soils with fines GM, GC, SM, SC◊ contains >12% fines	100	400	1000	2000
Coarse-grained soils with little or no fines GW, GP, SW, SP◊ contains <12% fines	200	1000	2000	3000
Crushed rock	1000	3000	3000	3000
Accuracy in terms of percentage deflection▼	±2%	±2%	±1%	±0.5%

† ASTM D 2487; USBR Designation E-3. ‡ LL = Liquid limit. ◊ Or any borderline soil beginning with one of these symbols, i.e., GM-GC, GC-SC. ▼For ±1% accuracy and predicted deflection of 3%, actual deflection would be between 2% and 4%.

Note – Values applicable only for fills less than 50 ft (15 m). No safety factor included in table values. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections. If bedding falls on the borderline between two compaction categories, select the lower E’ value or average the two values. Percentage Proctor based on laboratory maximum dry density from test standards using 12,500 ft-lb/ft^3 (598,000 J/m^2) (ASTM D 698, AASHTO T-99, USBR Designation E-11). 1 lb/in^2 = 6.895 kPa.

Table 7-8 Duncan-Hartley Soil Reaction Modulus

Type of Soil	Depth of Cover, ft	E’ for Standard AASHTO Relative Compaction, lb.in^2			
		85%	90%	95%	100%
Fine-grained soils with <25% sand content (CL, ML, CL-ML)	0-5	500	700	1000	1500
	5-10	600	1000	1400	2000
	10-15	700	1200	1600	2300
	15-20	800	1300	1800	2600
Coarse-grained soils with fines (SM, SC)	0-5	600	1000	1200	1900
	5-10	900	1400	1800	2700
	10-15	1000	1500	2100	3200
	15-20	1100	1600	1400	3700
Coarse-grained soils with little or no fines (SP, SW, GP, GW)	0-5	700	1000	1600	2500
	5-10	1000	1500	2200	3300
	10-15	1050	1600	2400	3600
	15-20	1100	1700	2500	3800

Lag Factor and Long Term Deflection

Long-term buried pipe deflection is determined by both pipe and soil properties, because both pipe and soil are subjected to visco-elastic deformations. For a properly installed pipe, soil properties generally prevail.

Visco-elastic deformation can continue forever, but total deformation is typically small. For example, most buildings settle after construction due to soil creep, but rarely does this cause distress. The same is true for most flexible pipe, whether plastic or metal. Visco-elastic deformation typically accounts for only a small percentage of the total deflection of the pipe, and a large portion of this deflection normally occurs within a few weeks after installation.

Research conducted by R. Lytton at Texas A&M University, has shown that for properly installed plastic pipe, long-term deflection is controlled principally by the embedment soil.

Spangler recommended addressing visco-elastic effects by using a deflection lag factor in the Iowa Formula. Recommended values range from 1.0 to 1.5.

Lytton and Brown published time factors based on a visco-elastic solution for long-term deflection of pipe installed in saturated clay. The ratio of the 50-year deflection to the 30-day (or short term) deflection gave a lag factor of 1.5. Field measurements of HDPE pipe have confirmed values in the same range.

Example 7-12

Estimate the vertical deflection of a DriscoPlex™ 2000 SPIROLITE® 36" Class 100 pipe installed under 18 feet of cover. The embedment material is well-graded sandy gravel, compacted to at least 90 percent of Standard Proctor density.

Solution: Use the prism load, Formula 7-1, Table 7-7 and Formulas 7-37 and 7-39. From Table 7-7 the E´ value for compacted sandy gravel or GW-SW soil is 2000 lb/in^2. For an estimate of maximum long-term deflection, the value is reduced by 25% to 1500 lb/in^2. (The Duncan-Hartley value in Table 7-8 for this material with 18 ft of cover is 1700 lb/in^2.)

From Formula 7-1, the prism load on the pipe is:

$$P_E = (120)(18) = 2160\ lb / ft^2$$

Solving Formulas 7-37 and 7-39 yields:

$$\frac{\Delta X}{D_I} = \frac{2160}{144}\left(\frac{(0.1)(1.5)}{\frac{(1.24)(100}{36+2(0.58)} + (0.061)(1500)} \right) = 0.0237$$

$$\%\,Deflection = (0.0237)(100) = 2.37\,\%$$

Deflection Limits

Flexible pipe deflection is a natural, essential, response to soil loading. Deflection mobilizes passive resistance in the surrounding soil, and promotes arching. Small deflections are desirable, but large deflections should be limited.

DriscoPlex™ 2000 SPIROLITE® pipe is manufactured to ASTM F 894, which states that profile pipe designed for 7.5% deflection will perform satisfactorily when installed in accordance with ASTM D 2321. Deflection is measured at least 30 days after installation.

Manufacturing processes for DriscoPlex™ 2000 SPIROLITE® and DriscoPlex™ OD controlled pipe differ. Deflection limitations for OD controlled pipe are controlled by long-term material strain.

Ring Bending Strain

As pipe deflects, bending strains occur in the pipe wall. For an elliptically deformed pipe, the pipe wall ring bending strain, ε, can be related to deflection:

$$\varepsilon = f_D \frac{\Delta X}{D_M} \frac{2C}{D_M} \quad \textbf{(7-39)}$$

Where

ε = wall strain
f_D = deformation shape factor
ΔX = deflection, in
D_M = mean diameter, in
C = distance from outer fiber to wall centroid, in

For DriscoPlex™ 2000 SPIROLITE® pipe

$$C = h - z \quad \textbf{(7-40)}$$

For DriscoPlex™ OD Controlled pipe

$$C = 0.5(1.06\,t) \quad \textbf{(7-41)}$$

Where

h = pipe wall height, in
z = pipe wall centroid, in
t = pipe minimum wall thickness, in

For elliptical deformation, f_D = 4.28. However, buried pipe rarely has a perfectly elliptical shape. Irregular deformation can occur from installation forces such as compaction variation alongside the pipe. To account for the non-elliptical shape many designers use f_D = 6.0.

Lytton and Chua report that for high performance polyethylene materials such as those used by Performance Pipe, 4.2% ring bending strain is a conservative value for non-pressure pipe. Jansen reports that high performance polyethylene material at an 8% strain level has a life expectancy of at least 50 years.

When designing non-pressure heavy wall OD controlled pipe (DR less than 17), and high RSC (above 200) DriscoPlex™ 2000 SPIROLITE® pipe, the ring bending strain at the predicted deflection should be calculated and compared to the allowable strain.

In pressure pipe, the combined stress from deflection and internal pressure should not exceed the material's long-term design stress rating. Combined stresses are incorporated into Table 7-9 values, which presumes deflected pipe at full pressure. At reduced pressure, greater deflection is allowable.

Table 7-9 Safe Pressure Pipe Deflection

DR	*Safe Deflection as % of Diameter*
32.5	8.5
26	7.0
21	6.0
17	5.0
13.5	4.0
11	3.0
9	2.5

Example 7-13

Find the ring bending strain in the wall of the DriscoPlex™ 2000 SPIROLITE® 36" Class 100 pipe in Example 7-12.

Solution: Use Formula 7-40 and f_D = 6.0. From Bulletin PP-401, h = 2.02 in., and z = 0.58 in.

$$\varepsilon = 6(0.0237)\frac{(2.02-0.58)}{(36+2(0.58))} = 0.0055 = 0.55\%$$

The strain is well below the permissible strain for ASTM F 894 profile pipe.

Design Considerations For Shallow Cover Pipe

Pipe installed under shallow cover does not completely develop a the interaction between pipe and soil structure interaction; therefore, design methods must be modified. The designer should consider the following three cases: (1) flotation due to insufficient soil cover, (2) ring bending due to live load, and (3) upward buckling due to flooding or high groundwater levels.

The exact depth of cover required to fully develop pipe-soil structure interaction depends on the particular installation conditions.

Shallow Cover Surcharge Load

The preceding design methods assume that the pipe behaves primarily as a membrane structure, that is, the pipe is almost perfectly flexible with little ability to resist bending.

At depths of cover less than one pipe diameter, this membrane action may not develop fully, thus a surcharge load or live load places a bending load on the pipe crown. For this reason, flexible pipe manufacturers often recommend that pipe be buried at least one pipe diameter below a live load. If this cannot be accomplished, the designer should perform a special analysis to determine if the pipe has adequate beam bending strength.

R. Watkins in *Minimum Soil Cover Required Over Buried Flexible Cylinders* provides a design equation for determining the pipe cross section for shallow cover live load applications. Watkins' method presumes that a combination of pipe flexural strength and the ring resistance of the soil surrounding the pipe resist the live load at shallow cover. The maximum bending stress occurring in the pipe wall can be found by considering the top half of the pipe as a pinned-end arch.

For polyethylene pipe, Watkins' analysis should be used only where the minimum depth of cover is the greater of one-half of the pipe diameter or 18 inches. For lesser cover depths, a reinforced concrete cap should be considered.

Based on Watkins' analysis, the live load pressure on the pipe, P_L, should not exceed the Formula 7-43 upper limit

$$P_L \leq \frac{12\,w\,(K\,H)^2}{N\,D_O} + \frac{7387.2\,(I)}{N\,{D_O}^2\,C}\left(S - \frac{w\,D_O\,H}{288\,A}\right) \qquad \textbf{(7-43)}$$

Where

w = unit weight of soil, lb/ft^2

K = passive earth pressure coefficient

$$K = \frac{1 + \sin\Phi}{1 - \sin\Phi} \qquad \textbf{(7-44)}$$

Φ = angle of internal soil friction, deg

H = cover height, ft

N = safety factor

D_O = pipe outside diameter, in

I = pipe wall moment of inertia, in^4/in

C = distance from outer fiber to wall centroid, in

S = material yield strength, lb/in^2

A = pipe wall area, in^2/in

In developing Formula 7-43, Watkins applied a load to a part of the pipe crown. Therefore, any surcharge load should be calculated a point load method, rather than a distributed load method.

A design safety factor of at least 2 should be applied.

In addition to the pipe bending check with Watkins' formula, the designer should check pipe wall compressive stress, and pipe wall buckling from live load stress. When a pipe is installed with shallow cover below an unpaved surface, rutting can occur, which will not only reduce cover depth, but also increase the impact factor. State highway authorities commonly set a minimum cover depth under below pavement. This cover depth varies by State, but is usually 2.5 to 5 ft.

Shallow Cover Buckling

The buckling resistance of a buried pipe increases with increasing cover depth because the surrounding soil is stiffened by the increase in overburden pressure. However, a different buckling mechanism may occur when pipe is located near the surface.

Groundwater or flooding may apply an external pressure to the pipe that may result in upward buckling, that is the sides of the pipe deflect inward (negative horizontal deflection) and the crown deflects upward. This mechanism is possible when cover depth is insufficient to restrain upward crown movement and when the pipe is empty or partially full.

Shallow cover may not be sufficient for complete development of soil support. AWWA C-950 suggests that a minimum cover of four feet is required, however, larger diameter pipe may require as much as a diameter and a half to develop full support.

Shallow cover buckling may also occur if the pipe can float slightly upward and lose contact with the embedment material below its springline.

Shallow cover deserves special design attention. A conservative design alternative is to assume no soil support, and design using unconstrained pipe wall buckling methods. A concrete cap, sufficient to resist upward deflection, may also be placed over the pipe.

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Contents

SOLUTION. First divide the area into four quadrants such that the common corner of each rectangular quadrant is directly under the load, as indicated in Fig. 17-3. Since $A = 2$, $B = 3$, and $H = 4$, then $m = 0.5$ and $n = 0.75$. From Table 17-1 the value of the coefficient corresponding to the point having these coordinates is 0.107. The total load on the area under consideration is, therefore,

$$0.107 \times 10{,}000 \times 4 = 4280 \text{ lb}$$

17.9. UNIT PRESSURE AT POINT IN UNDERSOIL. Another problem of frequent occurrence is that of determining the unit pressure in the soil at a point some depth below a uniformly distributed load applied over a rectangular area at or near the soil surface. An example of this type of problem is the calculation of the pressures at various points in the undersoil for the purpose of estimating the probable settlement of a structure such as a bridge pier or building foundation resting on the soil. Newmark (9) solved this problem by integrating the Boussinesq formula for the case of loads uniformly distributed over a rectangular area. The resulting formula for the unit pressure at a point in the undersoil at depth H directly under one corner of a loaded rectangle of dimensions A and B, as indicated in Fig. 17-5, is

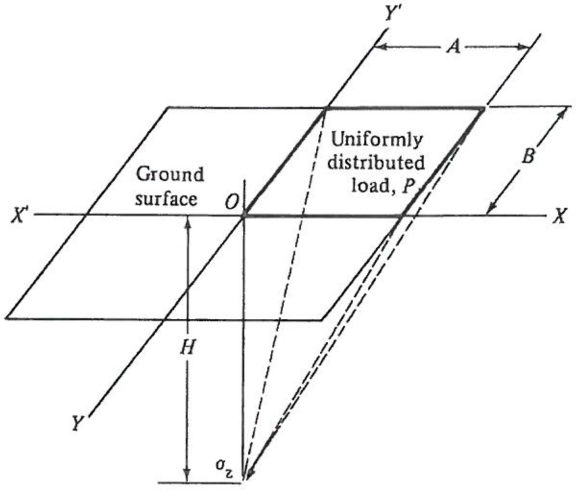


Fig. 17-5. Loading condition for Eq. (17-8).

$$\frac{\sigma_z}{p} = \frac{1}{4\pi}\left[\frac{2ABH\sqrt{(A^2+B^2+H^2)}}{H^2(A^2+B^2+H^2)+A^2B^2}\cdot\frac{A^2+B^2+2H^2}{A^2+B^2+H^2} + \left(\sin^{-1}\frac{2ABH\sqrt{A^2+B^2+H^2}}{H^2(A^2+B^2+H^2)+A^2B^2}\right)\right] \tag{17-8}$$

in which σ_z is the unit pressure at depth H; and p is the unit load applied over rectangular area A by B.

Again, the value of the right-hand member in Eq. (17-8) for known values of A, B, and H, as in Eq. (17-7), is called the influence coefficient.

Although Holl's problem and Newmark's problem were directed toward different objectives, they both involved the integration of the Boussinesq equation over a rectangular area and the right-hand member of Eq. (17-8) has the same value as that of Equation (17-7). Therefore, the solution of Eq. (17-8) can also be obtained by the use of the diagram in Fig. 17-4 or Table 17-1 in a manner similar to that outlined in Section 17.8.

EXAMPLE 17-2. Calculate the unit pressure at a depth of 20 ft under the center of a 20 ft by 40 ft rectangular area which carries a load of 1600 tons, or 2 tons per sq ft.

SOLUTION. The applied unit pressure is 2 tons per sq ft. With the origin of coordinates directly over the center and the area divided into four quadrants, the values of A, B, and H are 10 ft, 20 ft, and 20 ft, respectively. Then, $m = 0.5$ and $n = 1.0$. From Table 17-1 the influence coefficient corresponding to these values is 0.120. For an applied unit pressure of 2 tons per sq ft, the value of σ_z is 0.24 ton per sq ft. This is the unit pressure in the undersoil at a depth of 20 ft under a corner of one quadrant of the loaded area. Since all four quadrants have a common corner at the center, the unit pressure due to the total area load is $4 \times 0.24 = 0.96$ ton per sq ft.

17.10. PRESSURE UNDER ECCENTRIC LOADING. Equation (17-7) and Fig. 17-4 or Table 17-1 may also be used to solve problems in which the concentrated surface load is not over the center of the area on which the total load is desired, as illustrated in Fig. 17-6. The general procedure in a situation of this kind is to extend the area in question in such a manner as to form a series of rectangles having a common corner directly under the load. Then determine the influence coefficient for the largest rectangle which includes the original area; and subtract the influence coefficients for the smaller rectangles lying outside the original area. The result is the influence coefficient for the desired area. For example, in Fig. 17-6 let the

25

Loads on Underground Conduits

25.1. THEORY OF LOADS ON UNDERGROUND CONDUITS. Underground conduits of the types used for sewers, drains, culverts, water mains, gas lines, and the like have served to improve the standard of living of mankind since the dawn of civilization. Remnants of structures of this kind have been found among the earliest examples of the practice of the engineering arts, but only within the past several decades has it been possible to design conduits on a rational basis with a degree of precision comparable with that obtained in the design of bridges and buildings. The loads to which buried conduits are subjected in service and their supporting strength under various installation conditions may be determined by means of the Marston Theory of Loads on Underground Conduits.

The Marston theory is named for Anson Marston who developed it in the early years of the twentieth century. Marston was the first Dean of Engineering at Iowa State University and Director of the Engineering Research Institute, serving in those capacities from 1904 to 1932. In the early 1900s a great deal of land drainage was being done in northern Iowa and engineers began using larger diameter pipelines and deeper cuts with the result that structural failures became widespread. They turned to Marston for help and the development of the theory began. Since then numerous investigations of failures of sewers, culverts, and other structures of this type have verified the general correctness of the Marston approach.

The basic concept of the theory is that the load due to the weight of the soil column above a buried pipe is modified by arch action in which a part of its weight is transferred to the adjacent side prisms, with the result that in some cases the load on the pipe may be less than the weight of the overlying column of soil. Or, in other cases, the load on the pipe may be increased by an inverted arch action in which load from the side prisms is transferred to the soil over the pipe. The key to the direction of load transfer by arch action lies in the direction of relative movement or tendency for movement, between the overlying prism of soil and the adjacent side prisms, as illustrated in Figs. 25-1 and 25-2.

The transfer force associated with arch action at the plane of relative movement is the resultant of vertical and horizontal components of force. The Marston theory of loads deals with these components rather than the resultant itself.

25.2. CLASSES OF UNDERGROUND CONDUITS. For purposes of load computation, underground conduits are divided into two major classes, known as *ditch conduits* and *projecting conduits*, the classification being based on the construction or environmental conditions which influence

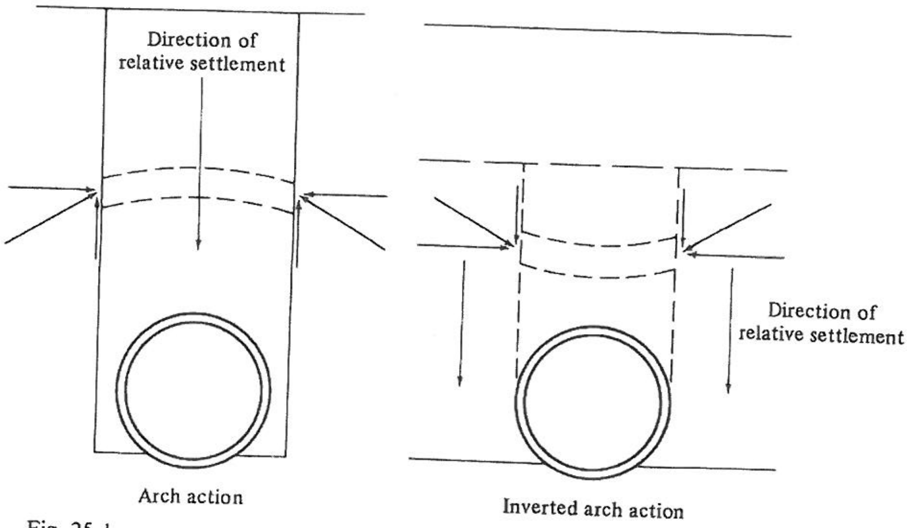


Fig. 25-1.

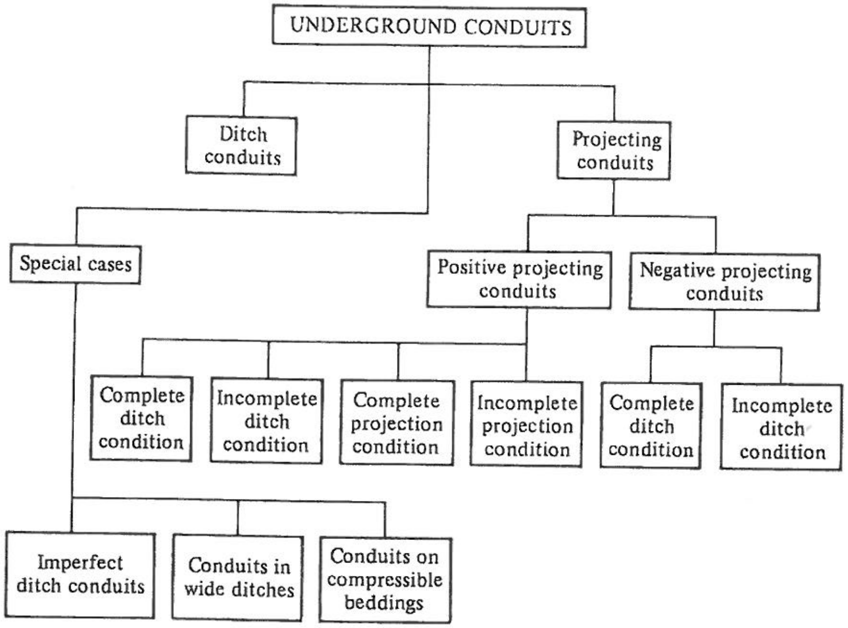


Fig. 25-2. Construction conditions which influence loads on underground conduits.

the load. Projecting conduits are further subdivided into *positive projecting conduits* and *negative projecting conduits.* Also there are several special cases having characteristics which are similar to those of both of the major classes. The accompanying chart shows the various construction conditions which influence loads on underground conduits.

25.3. DEFINITIONS. A *ditch conduit* is defined as one which is installed in a relatively narrow ditch dug in passive or undisturbed soil and which is then covered with earth backfill. Examples of this class of conduits are sewers, drains, water mains, and gas mains. A *positive projecting conduit* is one which is installed in shallow bedding with its top projecting above the surface of the natural ground and which is then covered with an embankment. Railway and highway culverts are frequently installed in this manner. A *negative projecting conduit* is one which is installed in a relatively narrow and shallow ditch with its top at an elevation below the natural ground surface and which is then covered with an embankment. This is a very favorable method of installing a railway or highway culvert, since the load produced by a given height of fill is generally less than it would be in the case of a positive projecting conduit. This method of construction is most effective in minimizing the load if the ditch between the top of the conduit and the natural ground surface is backfilled with loose uncompacted soil. The *imperfect ditch conduit*, sometimes called the *induced trench conduit*, is an important special case which is somewhat similar to the negative projecting conduit, but is even more favorable from the standpoint of reduction of load on the structure. Obviously, this method of construction should not be employed in embankments which serve as a water barrier, since the loosely placed backfill may en-

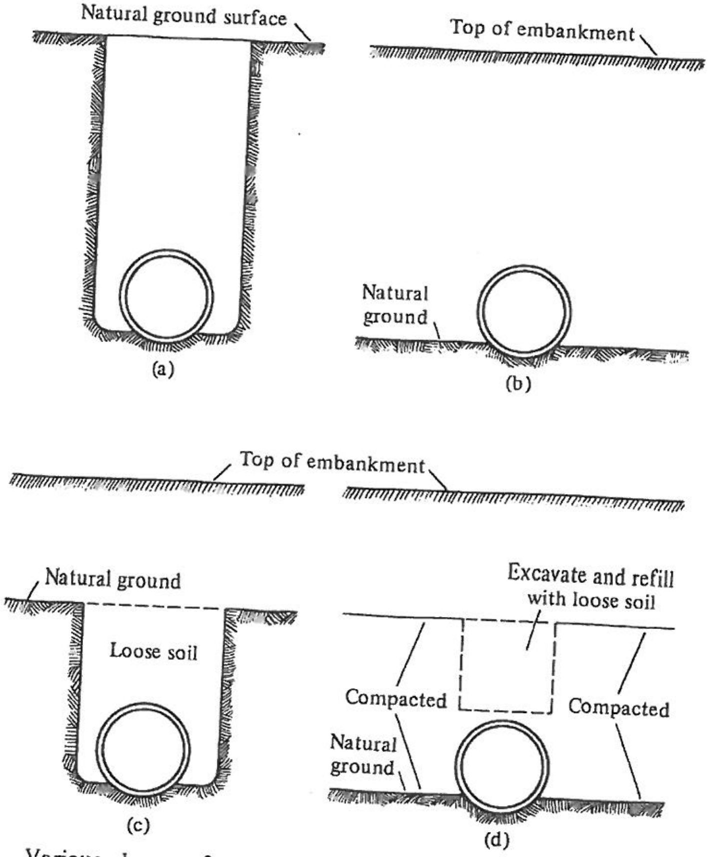


Fig. 25-3. Various classes of conduit installations. (a) Ditch conduit; (b) positive projecting conduit; (c) negative projecting conduit; and (d) imperfect ditch conduit.

courage channeling of seepage water through the embankment. The essential elements of these four main classes of conduits are shown in Fig. 25-3.

25.4. CHARACTERISTICS OF LOAD ON DITCH CONDUIT. In the case of a ditch conduit, the backfilling material has a tendency to consolidate and settle downward. This action plus the settlement of the conduit into its soil foundation, causes the prism of soil within the ditch and above the pipe to move downward relative to the undisturbed soil at the sides. This relative movement mobilizes along the sides of the ditch certain shearing stresses or friction forces which act upward in direction and which, in association with horizontal forces, create an arch action that partially supports the soil backfill. The difference between the weight of the backfill and these upward shearing stresses is the load which must be supported by the conduit at the bottom of the ditch. If it is assumed that cohesion between the backfill material and the sides of the ditch is negligible, then the magnitude of the vertical shearing stresses is equal to the active lateral pressure exerted by the soil backfill against the sides of the ditch multiplied by the tangent of the angle of friction between the two materials.

This assumption of negligible cohesion is justified on two accounts. Even when a ditch is backfilled with cohesive soil, considerable time must elapse before effective cohesion between the backfill and the sides of the ditch can develop after backfilling. Also, the assumption of no cohesion yields the maximum probable load on the conduit. This maximum load may develop at any time during the life of the conduit as a result of heavy rainfall or some other action which may eliminate or greatly reduce cohesion between the backfill and the sides of the ditch.

25.5. VERTICAL PRESSURE ON TOP OF CONDUIT. In the mathematical derivation of the formula for loads on ditch conduits, the following notation will be employed:

W_c = load on conduit, in pounds per linear foot;
γ = unit weight (wet density) of filling material, in pounds per cubic foot;
V = vertical pressure on any horizontal plane in backfill, in pounds per linear foot of ditch;
B_c = horizontal breadth (outside) of conduit, in feet;
B_d = horizontal width of ditch at top of conduit, in feet;
H = height of fill above top of conduit, in feet;

h = distance from ground surface down to any horizontal plane in backfill, in feet;
C_d = load coefficient for ditch conduits;
$\mu = \tan\phi$ = coefficient of internal friction of fill material;
$\mu' = \tan\phi'$ = coefficient of friction between fill material and sides of ditch;
K = ratio of active lateral unit pressure to vertical unit pressure; and
e = base of natural logarithms.

The coefficient μ' may be equal to or less than μ, but cannot be greater than μ. The value of K will be taken as Rankine's ratio and may be found by Eq. (22-3), which is

$$K = \frac{\sqrt{\mu^2+1}-\mu}{\sqrt{\mu^2+1}+\mu} = \frac{1-\sin\phi}{1+\sin\phi} = \tan^2\left(45^\circ - \frac{\phi}{2}\right) = \frac{1}{\tan^2\left(45^\circ + \frac{\phi}{2}\right)}$$

Let Fig. 25-4 represent a section of a ditch and ditch conduit 1 unit in length; and consider a thin horizontal element of the fill material of height dh located at any depth h below the ground surface. The forces acting on

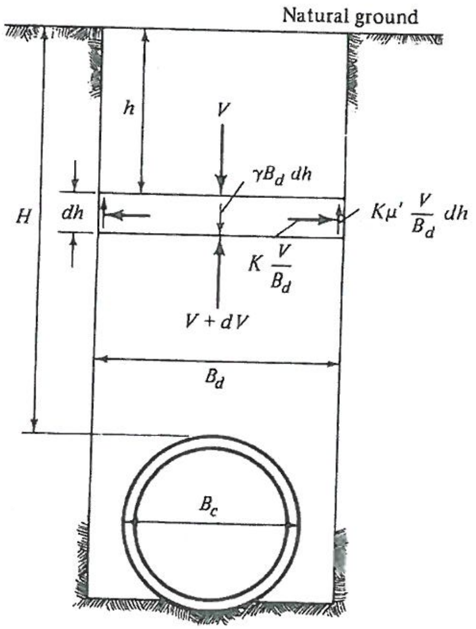


Fig. 25-4. Free-body diagram for ditch conduit.

this element at equilibrium are: V, the vertical pressure on the top of the element; $V + dV$, the vertical pressure on the bottom of the element; $\gamma B_d dh$, the weight of the element; and $K(V/B_d)dh$, the lateral pressure on each side of the element, it being assumed that the vertical pressure on the top of the element is uniformly distributed over the width B_d. Since the element has a tendency to move downward in relation to the sides of the ditch, these lateral pressures induce upward shearing forces equal to $K\mu'(V/B_d)dh$. Equating the upward and downward vertical forces on the element, we obtain

$$V + dV + 2K\mu'\frac{V}{B_d}\,dh = V + \gamma B_d dh \qquad (25\text{-}1)$$

This is a linear differential equation, the solution for which is

$$V = \gamma B_d^2 \frac{1 - e^{-2K\mu'(h/B_d)}}{2K\mu'} \qquad (25\text{-}2)$$

Concrete practically all of V

At the elevation of the top of the conduit, $h = H$; and, by substituting this value in Eq. (25-2), we obtain an expression for the total vertical pressure at the horizontal plane through the top of the conduit. The portion of this total pressure which is carried by the conduit depends on the rigidity of the conduit in comparison with that of the fill material between the sides of the conduit and the sides of the ditch. In the case of a very rigid pipe, such as a burned-clay, concrete, or heavy-walled cast-iron pipe, the side fills may be relatively compressible and the pipe itself will carry practically all of the load V. On the other hand, if the pipe is a relatively flexible, thin-walled pipe, and the soil is thoroughly tamped in at the sides of the pipe, the stiffness of the side fills may approach that of the conduit and the load on the structure will be reduced by the amount of load which the side fills are capable of carrying.

25.6. MAXIMUM LOADS ON DITCH CONDUITS. For the case of a rigid ditch conduit with relatively compressible side fills, the load on the conduit will be

$$W_c = C_d \gamma B_d^2 \qquad (25\text{-}3)$$

in which

$$C_d = \frac{1 - e^{-2K\mu'(H/B_d)}}{2K\mu'} \qquad (25\text{-}4)$$

Evaluation of W_c is made easy by the use of the computation diagram in Fig. 25-5, in which values of C_d for various values of H/B_d are plotted for several kinds of filling materials having different coefficients of internal friction.

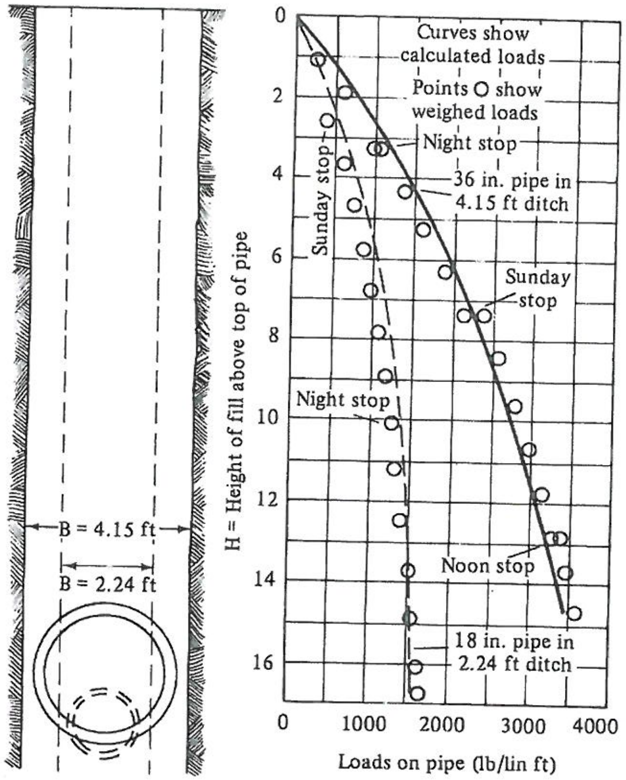


Fig. 25-5. Weighed loads vs. calculated loads by Eq. (25-3) on 18 in. and 36 in. rigid pipes in ditches (*1*).

Comparisons between actual weighed loads on rigid pipes in ditches and calculated loads in two of Marston's early experiments (*4*) are shown in Fig. 25-4.

For the case of a flexible pipe conduit and thoroughly tamped side fills having essentially the same degree of stiffness as the pipe itself, the value of W_c given by Eq. (25-3) might be multiplied by the ratio B_c/B_d. The load on the flexible pipe would then be

$$W_c = C_d \gamma B_c B_d \qquad (25\text{-}5)$$

It is emphasized that for Eq. (25-5) to be applicable, the side fills must be compacted a sufficient amount to have the same resistance to deformation under vertical load as the pipe itself. This equation should not be used merely because the pipe is a flexible type.

In actual practice, it is probable that the load on a pipe lies somewhere

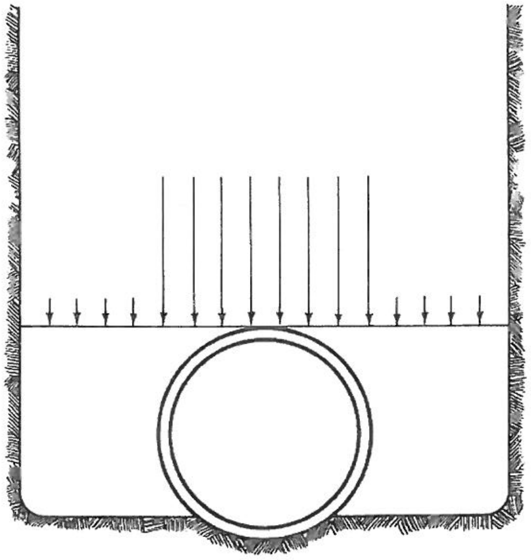


Fig. 25-6. Load distribution at level of top of pipe when sidefill soil columns are substantially less strain resistant than the rigid pipe.

between that indicated by Eq. (25-3) and Eq. (25-5), depending upon the relative rigidity of the pipe and the sidefill columns of soil, as illustrated in Fig. 25-6. Research is needed to establish the relationship between load on a pipe and the total backfill load under various conditions of relative rigidity. Some recent laboratory tests by a private research agency indicated that the load imposed on a 10-in. flexible sewer pipe under a dropped-in sand backfill, with no compaction of the sidefills, was about 70 to 90% of the backfill load on a similarly installed rigid pipe.

EXAMPLE 25-1. Assume that a rigid sewer pipe with an outside diameter of 24 in. is to be laid in a ditch which is 3.5 ft wide at the top of the pipe and is to be covered with 28 ft of clayey soil backfill which weighs 120 pcf. Determine the load on the sewer.

SOLUTION. In this case,

$H = 28$ ft $\qquad \gamma = 120$ pcf

$B_d = 3.5$ ft $\qquad B_d^2 = 12.25$

$H/B_d = 8.0$

From the curve in Fig. 25-7 marked "ordinary maximum for clay," C_d

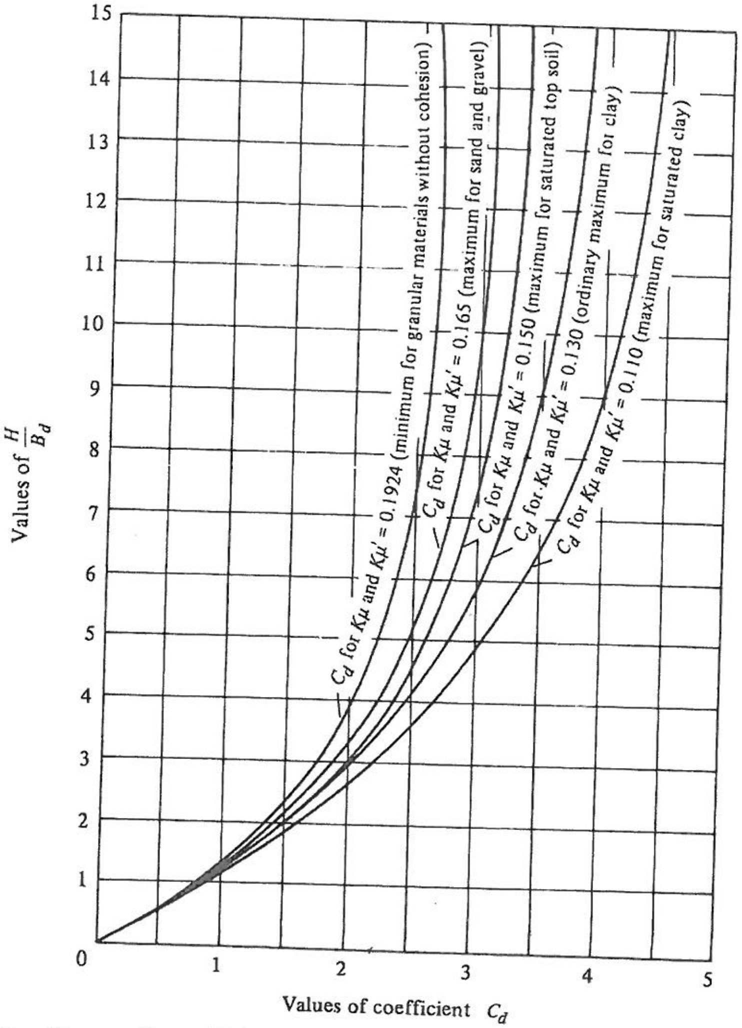


Fig. 25-7. Diagram for coefficient C_d for ditch conduits.

is 3.35. Substituting in Eq. (25-3), we get

$$W_c = 3.35 \times 120 \times 12.25 = 4930 \text{ lb/linear ft of pipe}$$

25.7. DEVELOPMENT OF MAXIMUM LOAD. The preceding ditch-conduit formulas, with proper selection of the physical factors involved, give the maximum loads to which any particular conduit may be subjected in service. However, because of the development of cohesion, any particular conduit may escape the maximum load for a long time, sometimes until it is removed for some reason other than load failure. Experiments and field observations show that the load on a conduit at the time the fill is completed may be less than it will be at some later time. That is, the load keeps building up for a period of time after the maximum height of fill is reached. This lag characteristic has been observed in extreme cases to amount to as much as 20 to 25% of the total load; and its development may require several years. It accounts for the fact that sewers and other conduits which have been observed to be structurally sound immediately upon completion are sometimes found to be cracked several months or several years later.

The theoretical loads found by Eqs. (25-3) and (25-5) are working values which should be used in the design of sewers, drains, and other ditch conduits to prevent cracking of the pipe. This should be the goal of the sewer designer; for, although it is true that a cracked sewer may often continue to function as a conduit for an indefinitely long time without collapsing (as a result of the development of passive resistance pressures against the sides of the pipe), sewers and drains should not be designed to allow such cracks to develop, since there is no assurance that a cracked pipe will always stand up. Long continued, unusually wet periods may so weaken the soil that it will no longer support the sides of the pipe, even though it may have done so for a long time previously. Also, the soil at the sides of the pipe may be dangerously softened, or even washed away, by water forced through the cracks of the pipe if, because of extraordinary circumstances, the pipe is forced to operate under head. Furthermore, a cracked sewer pipe will act as a drain, and an excessive amount of ground water will be allowed to infiltrate into the sewer, overtaxing its capacity and greatly increasing the cost of sewage treatment. Engineers have long recognized the necessity of tightly sealing the joints of sanitary sewer pipes to prevent ground water infiltration, but such efforts are of no avail if the pipes crack. It is obvious that pressure pipes, such as water and gas mains, cannot function if they are cracked.

25.8. LOAD ON CONDUIT IN DITCH WITH SLOPING SIDES. The width of ditch B_d in the load formulas previously derived is the width of a normal ditch with vertical sides. In case the ditch is constructed with sloping sides, as indicated in Fig. 25-8, experiments have shown that the width of the ditch at or slightly below the top of the conduit is the proper width to use for B_d in calculating the load. If it is desired to dig either a ditch with sloping sides or one which is very wide in comparison with the size of the conduit, it is good practice to lay the conduit in a relatively narrow sub-ditch at the bottom of the wider ditch. Then, in accordance with the principle just stated, the load on the conduit will be held to a reasonable minimum value. The use of a sub-ditch for this purpose is illustrated in Fig. 25-9.

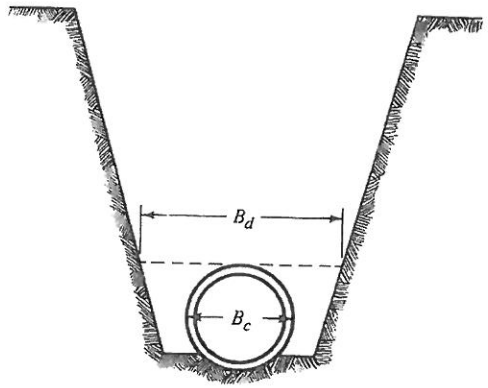
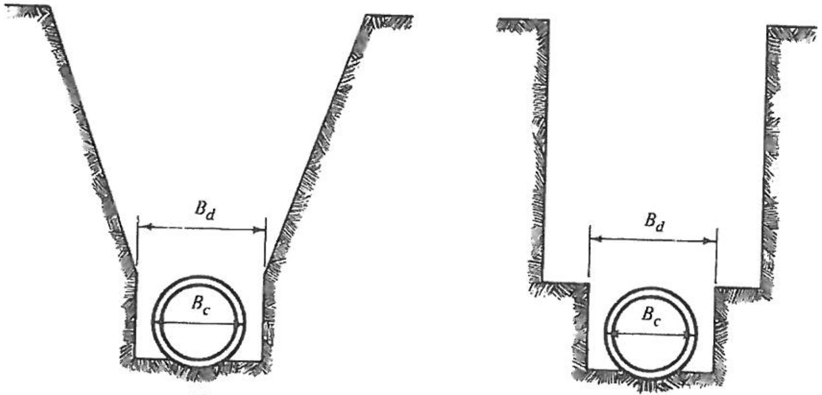


Fig. 25-8. Effective width of ditch with sloping sides.



(a) (b)

Fig. 25-9. Use of subditch.

25.9. SHEARING STRESSES IN EMBANKMENT OVER POSITIVE PROJECTING CONDUIT. A positive projecting conduit, as defined and also as the name implies, is installed with its top projecting some distance above the natural ground surface. It may be of any shape, such as circular, rectangular, or elliptical; it may be made of any material, such as concrete, burned clay, cast iron, corrugated metal, wood, plastic, etc.; and it may possess any degree of rigidity, from the very rigid concrete pipes and

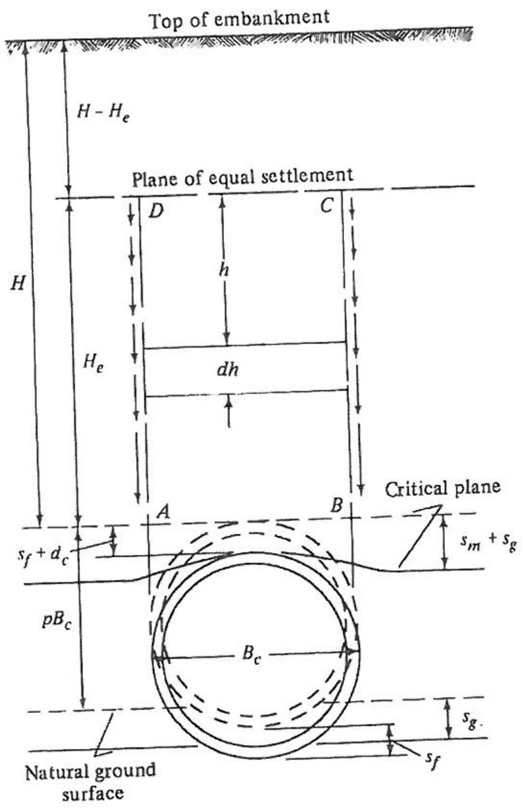


Fig. 25-10. Settlements which influence loads on positive projecting conduits (complete projection condition). Key: dashed line, initial elevation ($H = 0$); solid line, final elevation.

monolithic box culverts to the relatively flexible, light-weight, corrugated-metal pipes.

When a conduit is installed as a positive projecting conduit, shearing forces again play an important role in the production of the resultant load on the structure. In this case the planes along which relative movements are assumed to occur and on which shearing forces are generated are the imaginary vertical planes extending upward from the sides of the conduit, as indicated in Figs. 25-10 and 25-11. The width factor in the development of an expression for load is the outside breadth of the conduit, designated as B_c. The vertical distance from the natural ground surface to the top of the structure is expressed as pB_c, in which p is the *projection ratio.*

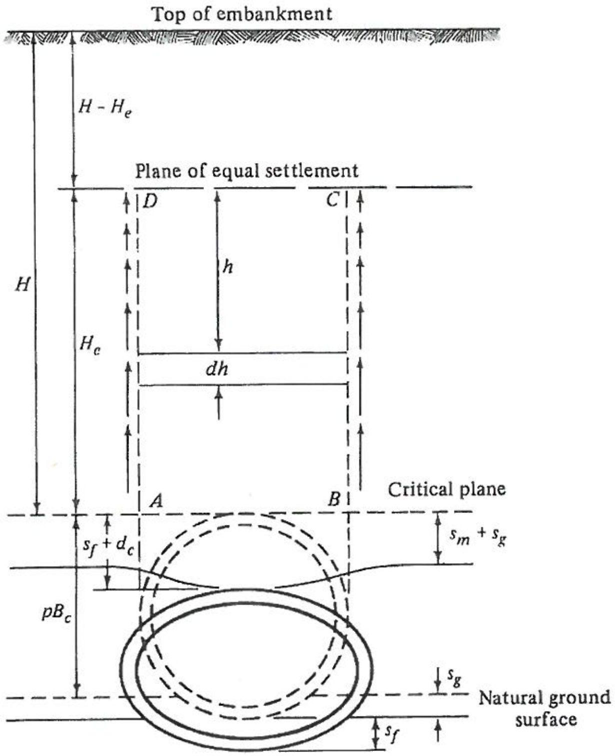


Fig. 25-11. Settlements which influence loads on positive projecting conduits (incomplete ditch condition). Key same as in Fig. 25-10.

25.10. SETTLEMENT RATIO. The magnitudes and directions of relative movements between the interior prism *ABCD*, Fig. 25-10 or Fig. 25-11, and the adjacent exterior prisms are influenced by the settlement of certain elements of the conduit and the adjacent soil. These settlements are combined into an abstract ratio, called the *settlement ratio*, according to the formula

$$r_{sd} = \frac{(s_m + s_g) - (s_f + d_c)}{s_m} \qquad (25\text{-}6)$$

in which

r_{sd} = settlement ratio;
s_m = compression strain of the side columns of soil of height pB_c;

s_g = settlement of the natural ground surface adjacent to the conduit;
s_f = settlement of the conduit into its foundation; and
d_c = shortening of the vertical height of the conduit.

25.11. CRITICAL PLANE. In connection with settlement of a conduit, it is convenient to define a critical plane, which is the horizontal plane through the top of the conduit when the fill is level with its top, that is, when $H = 0$. During and after construction of the embankment, this plane settles downward. If it settles more than the top of the pipe, as illustrated in Fig. 25-10, the settlement ratio is positive; the exterior prisms move downward with respect to the interior prism; the shearing forces on the interior prism are directed downward, and the resultant load on the structure is greater than the weight of the prism of soil directly above it. This is known as the projection condition.

If the critical plane settles less than the top of the conduit, as in Fig. 25-11, the settlement ratio is negative; the interior prism moves downward with respect to the exterior prisms; and the shearing forces on the interior prism are directed upward, and the resultant load is less than the weight of the soil above the structure. This is called the ditch condition, because the shearing forces act upward, or in the same direction as in the case of a ditch conduit.

25.12. PLANE OF EQUAL SETTLEMENT. In the case of a ditch conduit the shearing forces extend all the way from the top of the pipe to the ground surface. In a projecting-conduit installation, however, if the embankment is sufficiently high, the shearing forces may terminate at some horizontal plane in the embankment which is called the *plane of equal settlement*. A plane of equal settlement develops because a part of the vertical pressure in the exterior prisms is transferred by shear to the interior prism, or vice versa. This transfer of pressure causes different unit strains in the interior and exterior prisms, and at some height above the conduit the accumulated strain in the exterior prism plus the settlement of the critical plane will just equal the accumulated strain in the interior prism plus the settlement of the top of the structure. Above the plane of equal settlement the interior and exterior prisms settle equally. Since there are no relative movements between the adjacent prisms, no shearing forces are generated in the zone above this plane.

When the height of the plane of equal settlement above the top of the conduit, which height is designated as H_e, is less than the height H of the embankment, the plane of equal settlement is real. This is called either the incomplete ditch condition or the incomplete projection condition, because the shearing forces do not extend completely throughout the total height of embankment. If H_e is greater than H, the plane of equal settlement is

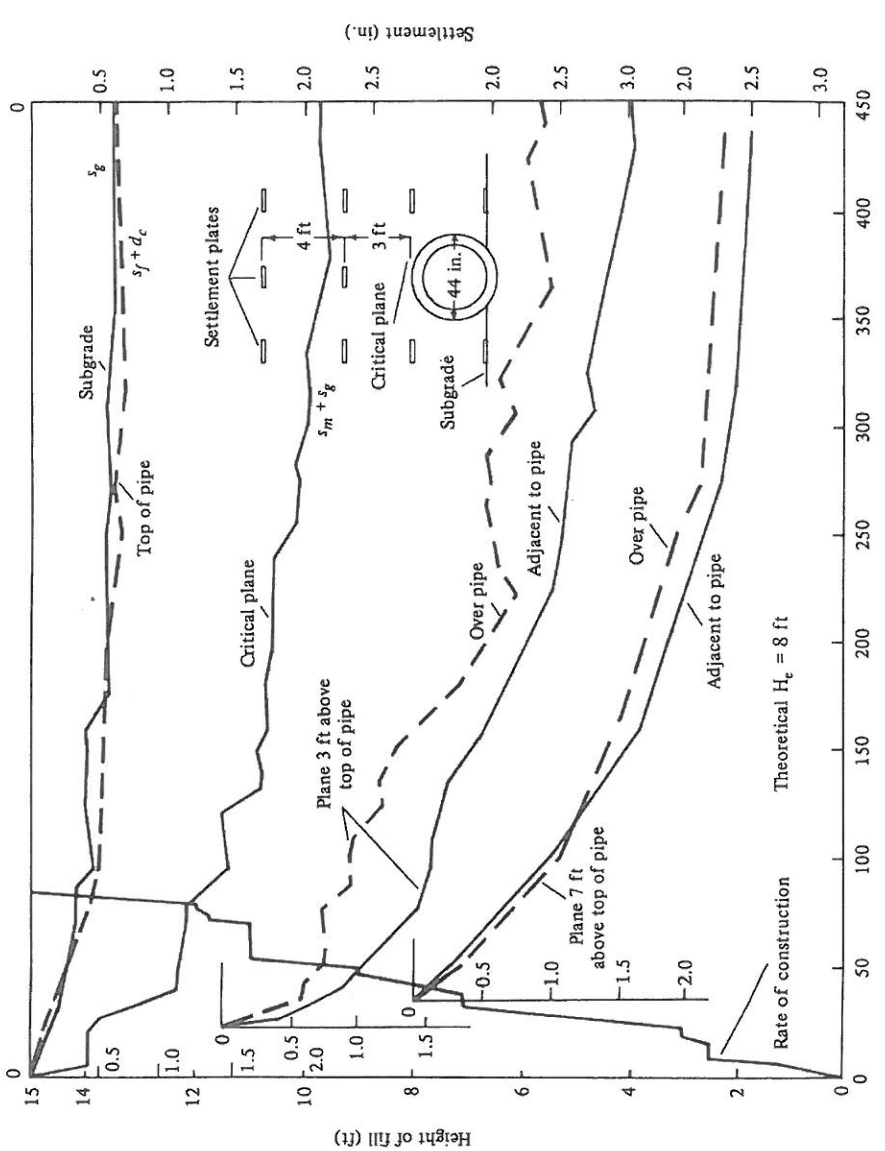


Fig. 25-12. Settlement measurements at planes within a 15-ft high embankment over a 44-in.-concrete pipe culvert. These measurements demonstrate the existence of a plane of equal settlement (*10*).

imaginary. This is referred to as either the complete ditch condition or the complete projection condition, because the shearing forces do extend completely to the top of the embankment.

The actual existence of a plane of equal settlement in a 15 ft high embankment over a 44-in. diameter concrete pipe culvert was demonstrated by measurements of settlements as shown in Fig. 25-12. In this experiment settlements were measured at the subgrade level, in the critical plane at the top of the pipe, and in the planes 3 ft and 7 ft above the top, both within the prism of soil directly over the structure and at points laterally removed from this prism. As shown in the figure, the points adjacent to the pipe settled a greater amount in the critical plane and at an elevation 3 ft above the pipe, but at the 7-ft level, the settlements at points over the pipe and adjacent thereto were nearly the same. The theoretical height of the plane of equal settlement, calculated from measured values of the settlement ratio, was approximately 8 ft.

25.13. MARSTON'S FORMULA FOR LOAD ON POSITIVE PROJECTING CONDUIT. By a process similar to that employed in the case of ditch conduits which is described in Section 25.5, Marston derived a formula for the vertical load on a positive projecting conduit. For the complete ditch or projection condition, the formula is

$$W_c = C_c \gamma B_c^2 \tag{25-7}$$

in which

$$C_c = \frac{e^{\pm 2K\mu(H/B_c)} - 1}{\pm 2K\mu} \tag{25-8}$$

where $H \leq H_e$

The plus signs are used for the complete projection condition, and minus signs are used for the complete ditch condition.

Also, for the incomplete ditch or projection condition,

where $H > H_e$

$$C_c = \frac{e^{\pm 2K\mu(H_e/B_c)} - 1}{\pm 2K\mu} + \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2K\mu(H_e/B_c)} \tag{25-9}$$

The plus signs are used for the incomplete projection condition, and the minus signs are used for the incomplete ditch condition.

In Eqs. (25-7) to (25-9),

W_c = load on conduit, in pounds per linear foot;
γ = unit weight of embankment soil, in pounds per cubic foot;
B_c = outside width of conduit, in feet;
H = height of fill above conduit, in feet;
H_e = height of plane of equal settlement, in feet;
K = Rankine's lateral pressure ratio;

μ = $\tan \phi$ = coefficient of friction of fill material; and
e = base of natural logarithms.

A formula for evaluating H_e is derived by equating an expression for the sum of the total strain in the interior prism plus the settlement of the top of the conduit to a similar expression for the sum of the total strain in an exterior prism plus the settlement of the critical plane. This formula is

$$\left[\frac{1}{2K\mu} \pm \left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) \pm \frac{r_{sd}p}{3}\right] \frac{e^{\pm 2k\mu(H_e/B_c)} - 1}{\pm 2K\mu} \pm \frac{1}{2}\left(\frac{H_e}{B_c}\right)^2$$

$$\pm \frac{r_{sd}p}{3}\left(\frac{H}{B_c} - \frac{H_e}{B_c}\right) e^{\pm 2K\mu(H_e/B_c)} - \frac{1}{2K\mu} \cdot \frac{H_e}{B_c} \mp \frac{H}{B_c} \cdot \frac{H_e}{B_c} = \pm r_{sd}p \frac{H}{B_c} \tag{25-10}$$

Use the upper signs for the incomplete projection condition, for which the settlement ratio is positive, and use the lower signs for the incomplete ditch condition, for which the settlement ratio is negative.

25.14. LOAD-COMPUTATION DIAGRAM FOR POSITIVE PROJECTING CONDUITS. It is both difficult and time-consuming to solve Eqs. (25-9) and (25-10). Fortunately the results can be given in a relatively simple diagram from which values of the load coefficient C_c can be obtained for substitution in Eq. (25-7). Such a diagram is shown in Fig. 25-13. It will be noted that C_c is a function of the ratio of the height of fill to the width of the conduit, or H/B_c, and of the product of the settlement ratio and the projection ratio, or $r_{sd}p$, as well as of the friction characteristics of the soil. However, Marston pointed out that the influence of the coefficient of internal friction μ is relatively minor in this case, and it is not considered necessary to differentiate between various soils as for ditch conduits. Therefore, in constructing Fig. 25-13, it was assumed that $K\mu = 0.19$ for the projection condition, in which the shearing forces are directed downward, and that $K\mu = 0.13$ for the ditch condition, in which the shearing forces are directed upward. This diagram gives reasonable maximum loads the accuracy of which is within the degree of precision of the assumptions upon which the analysis is based.

The ray lines in Fig. 25-13 represent values of C_c versus H/B_c according to Eq. (25-9), whereas the envelope curves correspond to Eq. (25-8). The ray lines intersect the envelope curves at points where $H_e = H$. Therefore, this diagram can be used to estimate the height of the plane of equal settlement in a particular case, as well as to estimate the load on the conduit. Also, the rays are straight lines which can be represented by equations for use when the value of H/B_c exceeds the limit of the diagram. These equations are given in Table 25-1.

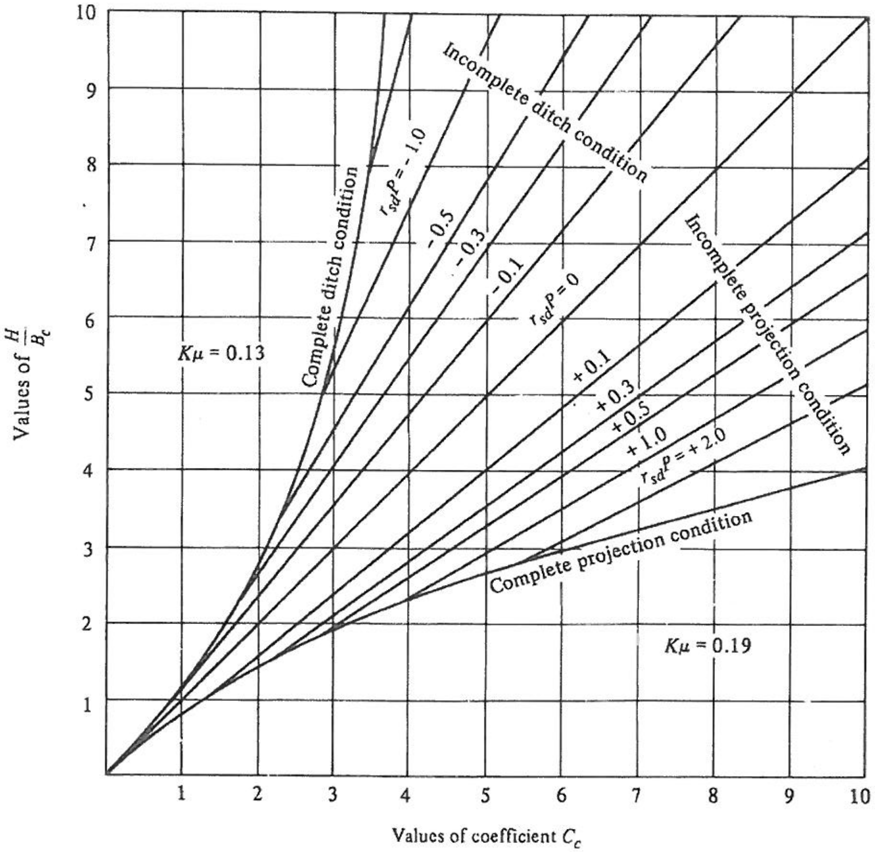


Fig. 25-13. Diagram for coefficient C_c for positive projecting conduits.

TABLE 25-1. Values[a] of C_c in Terms of H/B_c

Incomplete Projection Condition $K\mu = 0.19$		*Incomplete Ditch Condition* $K\mu = 0.13$	
$r_{sd}p$	*Equation*	$r_{sd}p$	*Equation*
+0.1	$C_c = 1.23H/B_c - 0.02$	−0.1	$C_c = 0.82H/B_c + 0.05$
+0.3	$C_c = 1.39H/B_c - 0.05$	−0.3	$C_c = 0.69H/B_c + 0.11$
+0.5	$C_c = 1.50H/B_c - 0.07$	−0.5	$C_c = 0.61H/B_c + 0.20$
+0.7	$C_c = 1.59H/B_c - 0.09$	−0.7	$C_c = 0.55H/B_c + 0.25$
+1.0	$C_c = 1.69H/B_c - 0.12$	−1.0	$C_c = 0.47H/B_c + 0.40$
+2.0	$C_c = 1.93H/B_c - 0.17$		

[a] From Ref. (*1*).

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25.15. NATURE OF THE SETTLEMENT RATIO. Although the settlement ratio r_{sd} is a rational quantity in the development of the load formula, it is difficult, if not impossible, to predetermine the actual value which will be developed in a specific case. Therefore, it is more practicable to consider this ratio as an empirical quantity and to determine working values for design purposes from observations of the performance of actual culverts under embankments. Such observations have been made, and the values recommended in Table 25-2 are based on them.

TABLE 25-2. Design Values of Settlement Ratio

Conditions	*Settlement Ratio*
Rigid culvert on foundation of rock or unyielding soil	+1.0
Rigid culvert on foundation of ordinary soil	+0.5 to +0.8
Rigid culvert on foundation of material that yields with respect to adjacent natural ground	0 to +0.5
Flexible culvert with poorly compacted side fills	−0.4 to 0
Flexible culvert with well-compacted side fills[a]	−0.2 to +0.8

[a] Not well established.

25.16. THE CASE FOR WHICH $r_{sd}p = 0$. Examination of the load-computation diagram in Fig. 25-13 indicates that when the product of the settlement ratio r_{sd} and the projection ratio p equals zero, then $C_c = H/B_c$. When this value of C_c is substituted in Eq. (25-7), the load formula reduces to $W_c = H\gamma B_c$; that is to say, the load is equal to the weight of the prism of soil directly above the conduit. The settlement ratio is equal to zero when the critical plane settles the same amount as the top of the conduit, that is, when $s_m + s_g = s_f + d_c$. The projection ratio is equal to zero when the structure is installed in a narrow and shallow trench so that its top is approximately level with the adjacent natural ground. This is a transition case between positive and negative conduits and is sometimes referred to as a zero projecting conduit.

25.17. MEASURED VERSUS THEORETICAL LOADS. Correlation between actual measured loads on a 44-in. diameter concrete pipe under a 15-ft embankment and the loads calculated by the Marston theory shows very close agreement as indicated in Fig. 25-14. This load-measuring experiment was continued for a period of 21 yr, with the results shown in Fig. 25-15. The average load on the 16-ft long culverts increased rapidly during the first 6 months after completion of the embankment, then fluctuated up and down within a range of about 10% of the maximum load during the balance of the 21-yr period. Also it is indicated that the

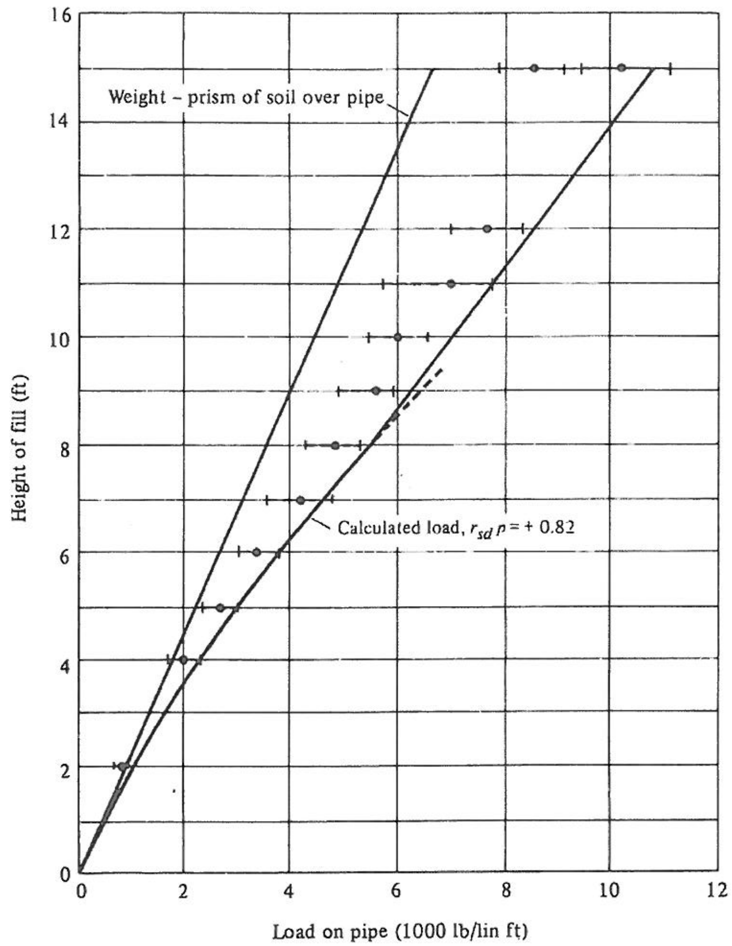

Fig. 25-14. Comparison between measured and theoretical loads on a 44-in. concrete pipe culvert under a 15-ft embankment (*10*). Key: dashed line, during construction of fill; solid line, maximum load after completion of fill (maximum, minimum, and average load on four 4-ft long sections.

load on the concrete pipe was consistently greater by about 50% than that on a parallel corrugated steel pipe of approximately the same diameter. This difference in load reflected the influence of the difference in vertical deflection of the two kinds of pipe, which in turn influenced the settlement ratios of the installations and the magnitude of the shear stress components of the resultant loads on the culverts.

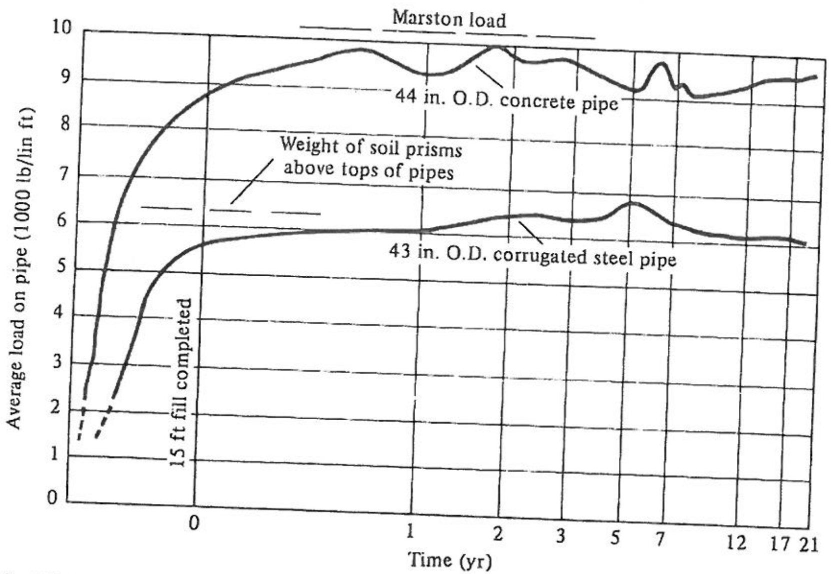

Fig. 25-15. Measured loads on rigid and flexible pipe over period of 21 yr.

EXAMPLE 25-2. Suppose that it is desired to determine the load on a 6 × 6 ft box culvert under a 50-ft fill which has a unit weight of 120 pcf. Assume that the outside width of the barrel is 7.67 ft, the projection ratio is 0.5, and the settlement ratio is +0.6.

SOLUTION. In this case,

$$H = 50 \text{ ft} \qquad p = 0.5$$
$$B_c = 7.67 \text{ ft} \qquad r_{sd} = +0.6$$
$$H/B_c = 6.52 \qquad r_{sd}p = +0.3$$
$$\gamma = 120 \text{ pcf}$$

From Fig. 25-13 the value of C_c is 9.0. Substituting in Eq. (25-7), we obtain

$$W_c = 9 \times 120 \times 7.67^2 = 63{,}500 \text{ lb/linear ft of barrel}$$

25.18. LOAD ON IMPERFECT DITCH CONDUIT DUE TO EARTH FILL. In the imperfect ditch conduit construction procedure, illustrated in Fig. 25-3(d), the pipe is first installed as a positive projecting conduit. Then the soil backfill at the sides and over the pipe is compacted up to some speci-

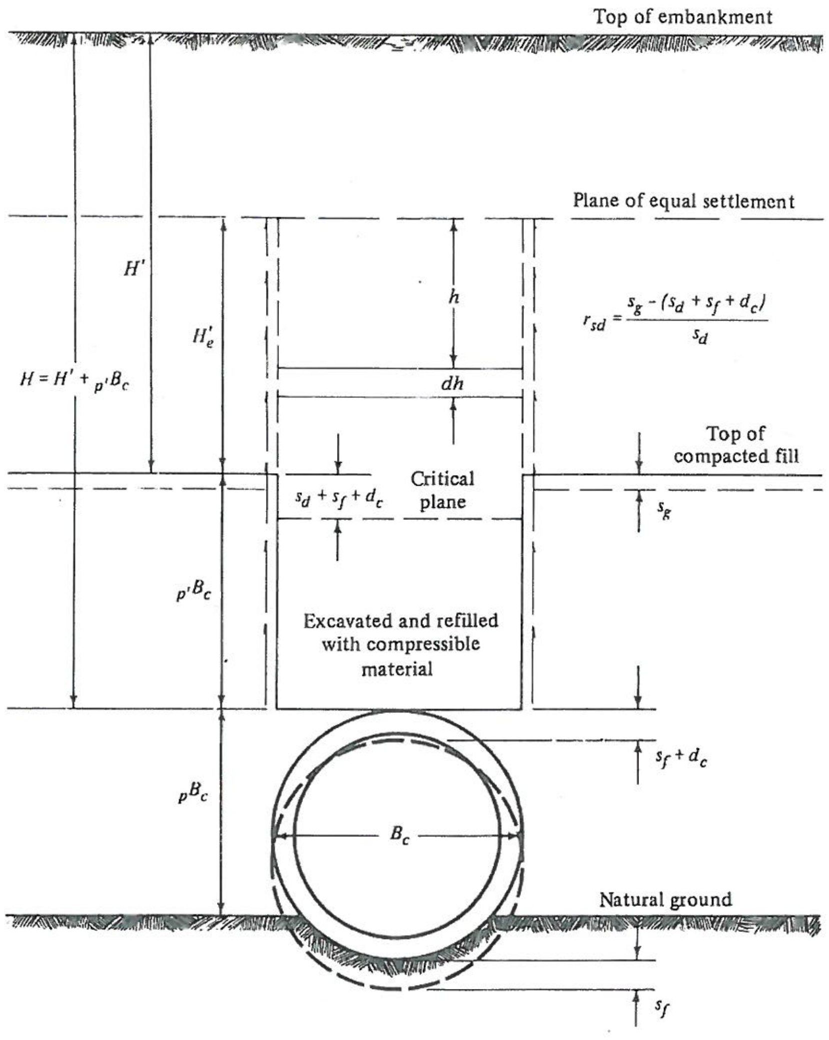

Fig. 25-16. Settlements which influence loads on imperfect ditch conduits. Key: solid line, initial elevation ($H = 0$); dashed line, final elevation.

fied elevation above its top. Next, a trench of the same width as the outside horizontal dimension of the pipe is excavated down to the structure and refilled with very loose, compressible material. This may be simply the excavated and loosened soil, or it may be material whose compressibility is augmented by the addition of straw or hay or other bulky material. The objective of this method of construction is to insure that the interior prism of soil will settle more than the exterior prisms, thereby generating friction forces which are directed upward on the sides of the interior prisms. The resultant load on the conduit is thereby reduced.

A formula for the load on an imperfect ditch conduit may be derived from the settlements and geometrical considerations illustrated in Fig. 25-16. The load formula is

$$W_c = C_n \gamma B_c^2 \qquad (25\text{-}11)$$

in which C_n is a load coefficient which is a function of the ratio of the height of fill to the width of ditch, H/B_c; of the projection ratio p'; and of the settlement ratio r_{sd}.

The projection ratio p' in an imperfect ditch installation is equal to the depth of the ditch divided by its width and is considered to be a positive quantity. The critical plane is defined as the horizontal plane in the ditch filling material at the level of the surface of the compacted backfill before settlement occurs. The settlement ratio r_{sd} is defined as the result obtained by dividing the difference between the settlement of the compacted fill surface and the settlement of the critical plane by the compression of the column of soil of depth $p'B_c$. Thus

$$r_{sd} = \frac{s_g - (s_d + s_f + d_c)}{s_d} \qquad (25\text{-}12)$$

in which

r_{sd} = settlement ratio for imperfect ditch conduits;
s_g = settlement of surface of compacted soil, in feet;
s_d = compression of fill in ditch within height $p'B_c$, in feet;
s_f = settlement of flow line of conduit, in feet;
d_c = deflection of conduit, i.e., shortening of its vertical dimension, in feet; and
$(s_d + s_f + d_c)$ = settlement of critical plane, in feet.

The settlement ratio is always a negative quantity in this case. The value of the coefficient C_n may be obtained from one of the diagrams in Figs. 25-17 to 25-20. As was mentioned in the case of the projecting-conduit diagram of Fig. 25-13, the ray lines in these diagrams intersect the envelope curves at points where $H_e = H$. Therefore, the height of the plane of equal settlement can be estimated by multiplying the value of H/B_c at this intersection by B_c to obtain H_e.

Research directed toward the determination of loads on imperfect ditch conduits has not progressed so far as it has in connection with the other classes of conduits. In the absence of extensive factual data relative to probable values of the settlement ratio for conduits of this class, it is tentatively recommended that this ratio be assumed to lie between −0.3 and −0.5 for the purpose of estimating loads. Recent research reported by Taylor (*14*) of the Illinois Division of Highways indicated that the measured settlement ratio of a 48 in. reinforced concrete pipe culvert, installed as an imperfect ditch conduit under 30 ft of fill varied from −0.25 to −0.45.

25.19. NEGATIVE PROJECTING CONDUIT. An analysis of loads on negative projecting conduits, as illustrated in Fig. 25-3(c), follows the same procedure as that for imperfect ditch conduits, except that width factor is B_d, the width of the shallow ditch in which the pipe is installed, instead of the width of the imperfect ditch, B_c. The same load coefficient diagrams are applicable to both case.

25.20. MODIFIED IMPERFECT DITCH PROCEDURE. A modification of the original imperfect ditch construction procedure, which has been developed by practicing engineers, is to install a conduit and place the sidefills up to a foot or so above the pipe (see Fig. 25-21). Then baled straw is placed directly over the structure and the embankment soil is compacted for a substantial width, say 2 or 3 pipe diameters, along the sides of the straw bales. When the fill has reached the top of the bales, the wires are cut and a second layer of bales installed. Again the fill is placed and compacted up to the top. This procedure can be repeated until the desired negative projection ratio, p', is accomplished, after which construction of the embankment is continued in the normal manner.

Several reinforced concrete pipe culverts installed in the above manner in Humboldt County, California, (*3*) performed very favorably in comparison with culverts in the same area which were installed as ordinary projecting conduits, as indicated in Fig. 25-23. The engineer in charge of these installations also reported that the baled straw method simplified construction procedures. A photograph of the operation is shown in Fig. 25-22.

Another project involving an 18-ft diameter corrugated steel pipe culvert under 83 ft of fill was recently constructed near Wolf Creek, Montana (*6*), using this baled straw procedure. Strain gauges placed at the spring line of the pipe indicated that the vertical load on the structure was equal to about one-half the dead weight of the overlying prism of embankment material. Also it is of interest to note that the original 36-in. depth of baled straw was compressed to 11 in. under the pressure of the prism of soil above. In spite of this substantial amount of compression, there was no visible sag in the grade of the embankment, indicating that a plane of equal settlement had developed at some elevation below grade.

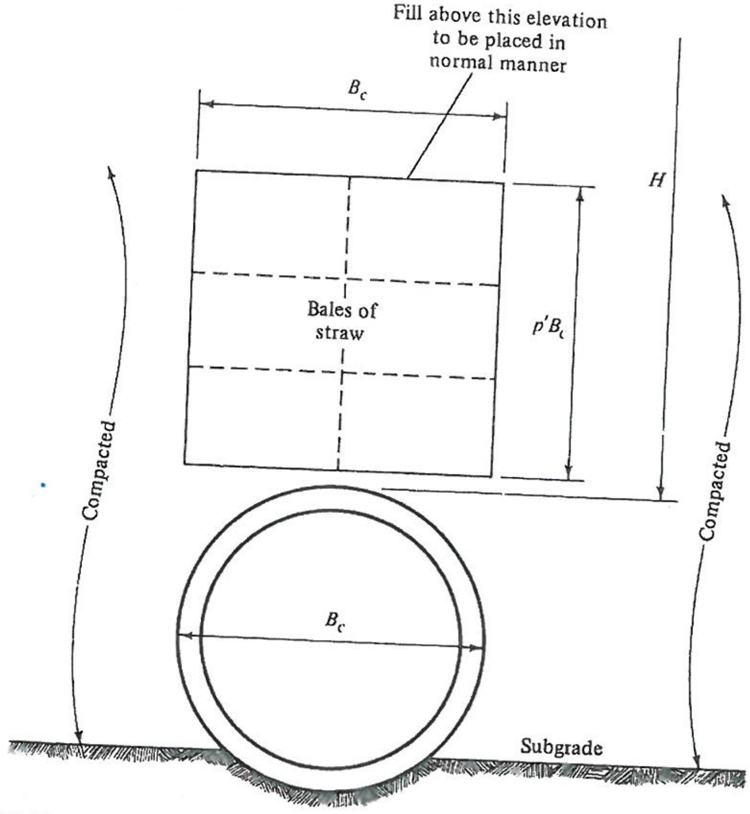

Fig. 25-21. Modified imperfect ditch construction.

EXAMPLE 25-3. Suppose that a 60-in. reinforced concrete pipe, 6 ft in outside diameter, is installed as an Imperfect Ditch Conduit with $p' = 0.5$. The height of fill above the top of the pipe will be 50 ft. Determine the load on the structure and the height of the plane of equal settlement.

SOLUTION. In this case,

$H = 50$ ft $\qquad p' = 0.5$

$B_c = 6$ ft $\qquad r_{sd} = -0.3$ (assumed)

$H/B_c = 8.33 \qquad \gamma = 120$ pcf

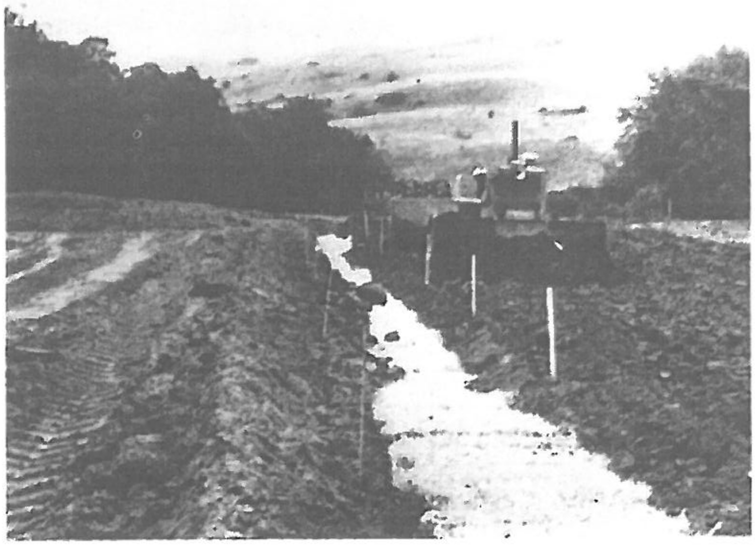

Fig. 25-22. Modified imperfect ditch construction using baled straw (*3*).

From Fig. 25-17, $C_n = 5.8$. Substituting in Eq. (25-11), we obtain

$$W_c = 5.8 \times 120 \times 6^2 = 25{,}000 \text{ lb/linear ft}$$

The ray line for $r_{sd} = -0.5$ in the diagram intersects the envelope curve at $H/B_c = 2.8$. Therefore the height of the plane of equal settlement H_e is $6 \times 2.8 = 16.8$ ft. This is well below the top of the embankment, indicating that there is no danger of sag in the top of the embankment.

25.21. CONDUITS PLACED IN WIDE DITCHES. Equation (25-3) for determining the load on a ditch conduit indicates that this load is a function of the width of the ditch in which the conduit is laid; that is, the wider the ditch, the greater is the load on a conduit laid in it. Obviously, there is a limiting width beyond which this principle does not apply; since, in a ditch which is very wide relative to the conduit, the sides of the ditch will be so far away from the conduit that they cannot possibly affect the load on it.

Studies by Schlick (*7*) of the effect of the width of ditch on the load transmitted to a rigid conduit indicate that it is safe to calculate the load by means of the ditch-conduit formula for all widths of ditch below that which gives a load equal to the load indicated by Eq. (25-7) for a positive projecting conduit. In other words, as the width of the ditch increases,

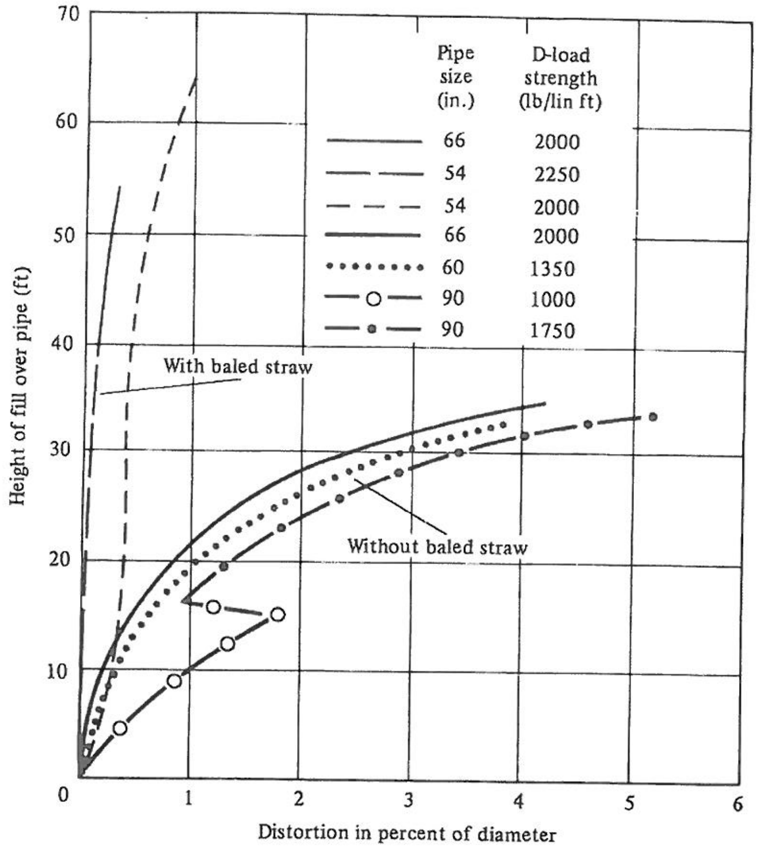

Fig. 25-23. A comparison of the performance of culverts placed with baled straw and without straw. Distortion is horizontal diameter minus vertical diameter.

other factors remaining constant, the load on a rigid conduit increases in accordance with the theory for a ditch conduit until it equals the load determined by the theory for a projecting conduit. The width at which this load equality develops is called the *transition width*. For greater widths, the load remains constant regardless of the width of the ditch.

The diagram in Fig. 25-24 shows values of the ratio of width of ditch to width of conduit, or the ratio B_d/B_c, at which the loads on a rigid conduit are equal by both the ditch conduit theory and the projecting conduit theory. For values of B_d/B_c less than those given in the diagram, the load on a rigid conduit may be determined by the ditch conduit theory. For greater values of this ratio, use the projecting conduit theory.

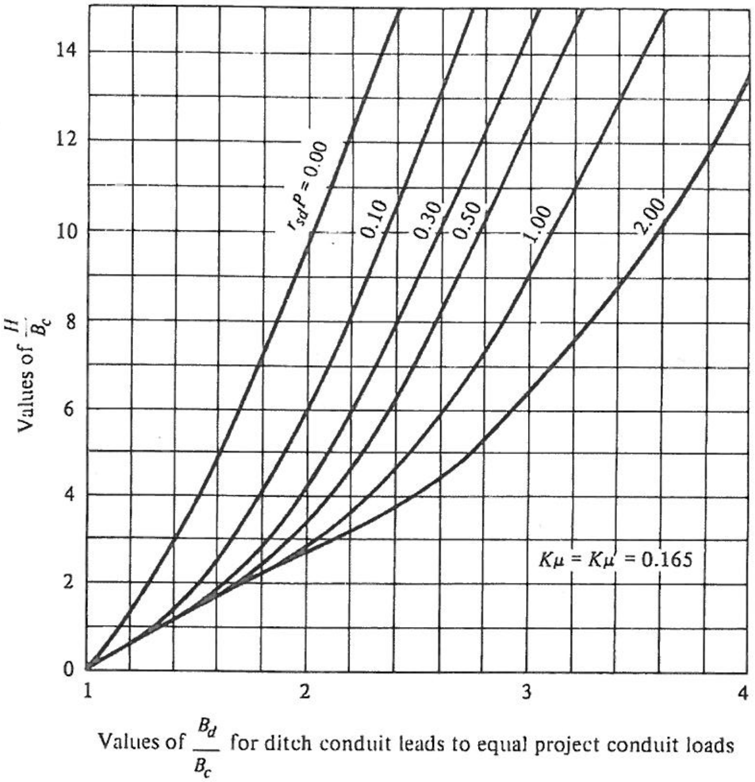

Fig. 25-24. Curves for transition-width ratio.

It is difficult to determine an appropriate value of $r_{sd}p$, the product of the settlement ratio and the projection ratio, in the application of the transition width concept. In the absence of specific information relative to this physical factor, $r_{sd}p = 0.5$ is suggested as a reasonably good working value.

25.22. REDUCTION OF LOAD BY USE OF YIELDING FOUNDATION. In certain situations involving rock foundations and rock fills over the conduits, it may not be practicable to use the imperfect ditch method of construction. Under such conditions, it may be advantageous to apply another special method of constructing projecting conduits so as to make certain that the vertical load will be less than that which would be normally developed. The basic feature of this method is to place the conduit on a very yielding foundation by excavating in the rock foundation a

ch having a width somewhat greater than the outside width of the luit and refilling this trench with loose, highly compressible soil on ch the conduit is constructed.

This method produces a less severe loading condition by insuring an abnormally high settlement of the top of the conduit in relation to the settlement of the critical plane in the embankment; and thereby reducing the value of the settlement ratio and, consequently, the load on the structure. Another favorable feature of this method of construction, especially in the case of a circular pipe conduit, is the opportunity afforded to obtain a wider distribution of the reaction between the pipe and its bedding; and thus to increase its load-carrying capacity, as will be discussed in the next chapter. A disadvantage of this type of construction is that the flow line of the structure is permitted to settle more than it would ordinarily. This disadvantage can be neutralized to an appreciable extent, however, by constructing the conduit on a camber.

25.23. LOADS ON CONDUITS DUE TO LOADS APPLIED TO SURFACE OF FILL. In addition to being subjected to external loads because of the filling material, underground conduits are also subject to loads due to highway, railway, or airplane traffic or to other types of loads applied at the surface of the fill and transmitted through the soil to the underground structure. Such loads are of major importance when a conduit is placed under a traffic way with a relatively shallow covering of earth.

Extensive experiments on both ditch and projecting conduits have indicated that a static concentrated surface load, such as a truck wheel, is transmitted through the soil covering to the underground structure substantially in accordance with the Boussinesq solution (see Chapter 17) for stress distribution in a semi-infinite elastic solid, as indicated in Fig. 25-25. These experiments also indicated the magnitude of impact loads produced by moving wheel loads. From the facts revealed by these tests, Marston (5) proposed the following formula for live loads on underground conduits:

$$W_t = \frac{1}{A} I_c C_t P \tag{25-13}$$

in which

W_t = average load per unit length of conduit, due to wheel load, in pounds per foot;
A = length of conduit section on which load is computed, in feet;
I_c = impact factor;
C_t = load coefficient; and
P = concentrated wheel load on surface of fill, in pounds.

26.14. FAILURE OF FLEXIBLE CONDUITS. Another major difference between the rigid types of conduits and the flexible types is that the latter usually fail by deflection rather than by rupture of the pipe walls, as do the former. A flexible pipe, installed in the ordinary manner without vertical struts or other prestressing devices, will deflect under the vertical earth load, the vertical diameter becoming less and the horizontal diameter becoming greater by appreciable amounts. The outward movement of the sides of the pipe against the enveloping fill material brings into play the passive resistance of the soil, which acts horizontally against the pipe and keeps the actual deflection of the pipe considerably below the amount the pipe would deflect if acted upon by the vertical earth loads alone.

This action continues, as the embankment is built higher, until the top of the pipe becomes approximately flat. Additional load may then cause the curvature of the top portion of the pipe to reverse direction, and the top may become concave upward. When this occurs, the sides of the pipe will pull inward; and the side supports of the pipe will be eliminated, since they are passive forces that cannot follow the inward movement. The deflection of the pipe will therefore proceed as rapidly as the earth above can follow the downward movement of the top of the pipe and exert pressure on the structure. Finally, complete collapse and failure may result. The whole action is one of large deflection change, accompanied by high bending moment in the pipe wall.

A hypothetical sequence of the development of pipe deflection is shown in Fig. 26-14. A complete deflection failure of an 84-in. corrugated steel pipe is illustrated in Fig. 26-15.

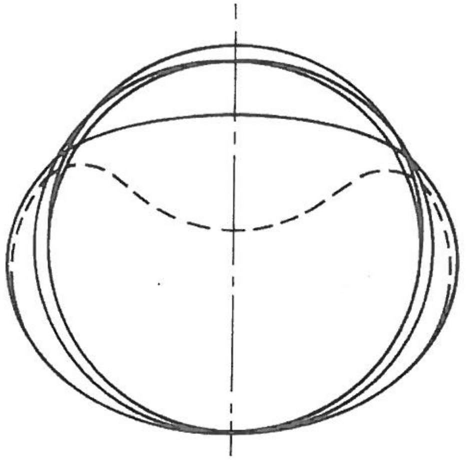

Fig. 26-14. Stages of deflection of a flexible-pipe culvert.

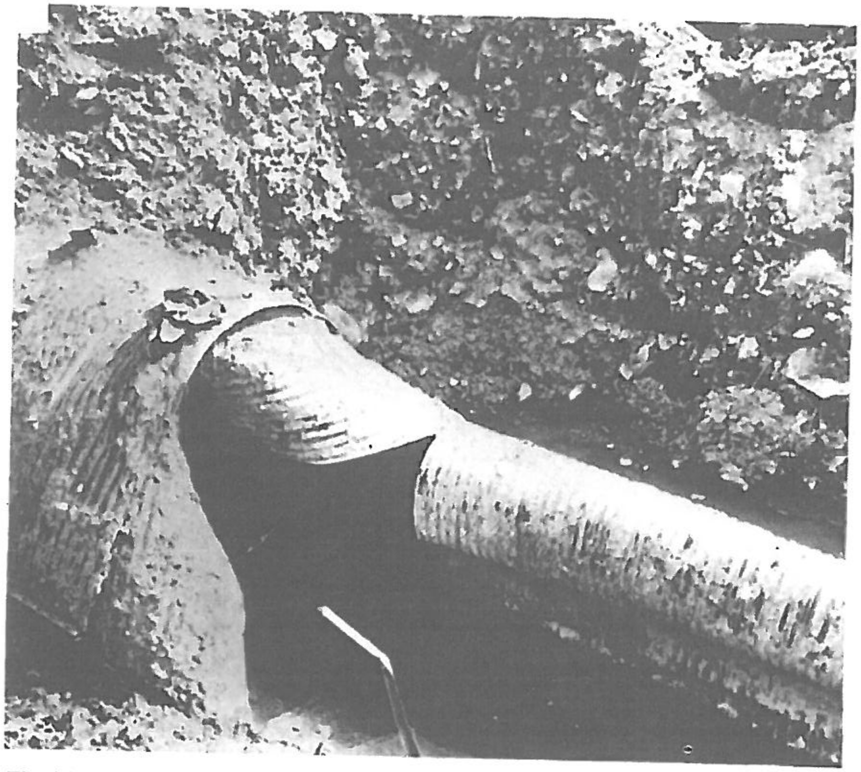

Fig. 26-15. Failure by excessive deflection of an 84-in. corrugated steel pipe.

26.15. STRUCTURAL CHARACTERISTICS OF FLEXIBLE CONDUITS. A number of field loading experiments on corrugated-metal pipe culverts, in which the vertical and lateral pressures on the pipes and the deflections of the pipes were measured, have led to the following conclusions regarding structural characteristics of flexible conduits:

1. The vertical load may be determined by Marston's theory of loads on conduits and is distributed approximately uniformly over the breadth of the pipe.
2. The vertical reaction is equal to the vertical load and is distributed approximately uniformly over the width of bedding of the pipe.
3. The horizontal pressure on each side of the pipe is distributed para-

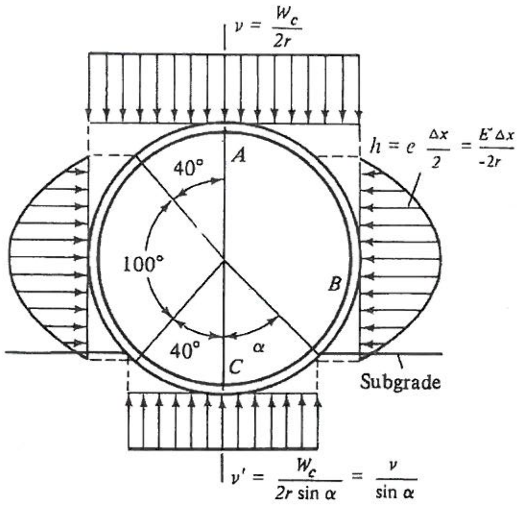

Fig. 26-16. Assumed distribution of pressure on flexible culvert pipe.

bolically over the middle 100° of the pipe; and the maximum unit pressure, which occurs at the ends of the horizontal diameter of the pipe, is equal to the modulus of passive resistance of the fill material multiplied by one-half the horizontal deflection of the pipe, or since $er = E'$, the modulus of soil reaction divided by the radius and multiplied by one-half the horizontal deflection.

This assumed loading is shown graphically in Fig. 26-16. The deflection of a flexible culvert pipe resulting from the load system just described is very often augmented by the continued yielding of the soil at the sides of the pipe in response to the horizontal pressures over a considerable period of time after the maximum vertical load has developed. This yielding results in a continuation of the pipe deformation to a value beyond that which is primarily attributable to the vertical load. Therefore, when it is desired to estimate the maximum ultimate deflection of a flexible pipe culvert, it may be necessary to introduce a quantity which has been called the deflection lag factor. The deflection lag factor cannot be less than unity and has been observed to range upward toward a value of 2.0. It appears to depend upon the quality of the soil at the sides of the pipe. A well-graded dense soil will permit very little, if any, residual deflection, and the lag factor can safely be ignored; while a loosely placed soil may induce a relatively large deflection lag. Except in the case of very high quality, well-compacted backfill soil, a deflection lag factor of about 1.25 is recommended for design purposes. For best results, the backfill soil should be compacted for a width of one or two pipe diameters on each side of the pipe.

26.16. CALCULATION OF DEFLECTION OF FLEXIBLE CULVERT. A formula for computing the deflection of a flexible pipe culvert is

$$\Delta x = D_l \frac{K W_c r^3}{EI + 0.061 E' r^3} \tag{26-7}$$

in which

Δx = horizontal deflection of the pipe, in inches (it may be considered the same as the vertical deflection);
D_l = deflection lag factor;
K = a bedding constant, its value depending on the bedding angle; α, in Fig. 26-16;
W_c = vertical load per unit length of the pipe, in pounds per linear inch;
r = mean radius of the pipe, in inches;
E = modulus of elasticity of the pipe material, in pounds per square inch;
I = moment of inertia per unit length of cross section of the pipe wall, in inches^4 per inch;
E' = er = modulus of soil reaction, in pounds per square inch; and
e = modulus of passive resistance of the enveloping soil, in pounds per square inch per inch.

It is recommended that the deflection of a corrugated-metal pipe culvert should not exceed about 5% of the nominal pipe diameter.

Values of the bedding constant K for various values of the bedding angle are shown in Table 26-4. The bedding angle α is defined as one-half the angle subtended by the arc of the pipe ring which is in contact with the pipe bedding, and over which the bottom reaction is distributed, as shown in Fig. 26-16.

TABLE 26-4. Values of Bedding Constant

Bedding Angle, α (deg)	*Bedding Constant, K*
0	0.110
15	0.108
22½	0.105
30	0.102
45	0.096
60	0.090
90	0.083

26.17. STIFFNESS FACTOR. The stiffness factor EI in Eq. (26-7) may be evaluated by testing the pipe metal to determine its modulus of elasticity and by calculating the moment of inertia of the shape of the cross section of the pipe wall. In many cases, however, it will be easier to subject a representative section of the pipe to a laboratory three-edge bearing test to determine the relationship between the load and the change in diameter of the pipe. The effective values of the product EI may then be obtained by substituting the measured loads and deflections in the following formulas:

$$EI = 0.149 \frac{Wr^3}{\Delta y} \tag{26-8}$$

$$EI = 0.136 \frac{Wr^3}{\Delta x} \tag{26-9}$$

in which Δy and Δx are the vertical and horizontal deflections of the pipe ring, respectively; W is the three-edge bearing test load, in pounds per linear inch; and the meanings of r, E, and I are as given previously.

TABLE 26-5. Moments of Inertia and Values of *EI* per Inch Length of Steel Pipe with Standard Corrugations ($2\frac{2}{3}$ in. Pitch by $\frac{1}{2}$ in. Depth)

U.S. Gauge No.	*Moment of Inertia ($in.^4/in.$)*	*Stiffness Factor EI (lb/in., E = 29,000,000 psi)*
4	0.008275	239,975
6	0.006744	195,576
8	0.005512	159,848
10	0.004373	126,817
12	0.003317	96,193
14	0.002326	67,454
16	0.001848	53,592
20	0.001104	32,016
24	0.000733	21,257
30	0.000366	10,614

TABLE 26-6. Moments of Inertia and Values of *EI* per Inch Length of Steel Pipe with Structural Plate Corrugations (6 in. Pitch by 2 in. Depth)[a]

U.S. Gauge No.	*Moment of Inertia ($in.^4/in.$)*	*Stiffness Factor EI (lb/in., E = 29,000,000 psi)*
1	0.1659	4,811,100
3	0.1463	4,242,700
5	0.1270	3,683,000
7	0.1080	3,132,000
8	0.0961	2,786,900
10	0.0781	2,264,900
12	0.0604	1,751,600

[a] From *Armco Handbook of Drainage and Construction Products*.

Computed values of I, which is the moment of inertia of a cross section of the pipe wall per linear inch of pipe, and values of the stiffness factor EI for metal having a modulus of elasticity of 29,000,000 psi are given in Table 26-5 for pipes having standard corrugations and in Table 26-6 for pipes having structural plate corrugations. For smooth steel pipe, $I = t^3/12$, where t is the thickness of the pipe wall.

26.18. MODULUS OF PASSIVE RESISTANCE. The modulus of passive resistance of the side filling material is defined as the unit pressure developed as the side of a pipe moves outward a unit distance against the side fill. Little is known about the exact nature of this modulus. In the Rankine theory of lateral soil pressures, the limiting value of the ratio of passive horizontal pressure to vertical pressure which a granular soil without cohesion can develop is shown to be the reciprocal of the active pressure ratio. However, this theory does not give a clue in regard to the amount of movement required to develop the limiting value of passive pressure; and it would seem that the actual passive pressure may be any value less

TABLE 26-7. Values of *E'* for 18 Flexible Pipe Culverts

Item	*Location*	*Pipe Diam. (in.)*	*Soil Type[a]*	*Fill Height (ft)*	*Mod. of Passive Resist., e (psi/in.)*	*Value of E' = er (psi)*
1[b]	Ames, Iowa	42	Loam top soil (U)	15	14	294
2[b]	Ames, Iowa	42	Well-graded gravel (U)	16	32	672
3[b]	Ames, Iowa	36	Sandy clay loam (T)	15	28	502
4[b]	Ames, Iowa	36	Sandy clay loam (U)	15	13	234
5[b]	Ames, Iowa	42	Sandy clay loam (T)	15	25	525
6[b]	Ames, Iowa	42	Sandy clay loam (U)	15	15	315
7[b]	Ames, Iowa	48	Sandy clay loam (T)	15	29	696
8[b]	Ames, Iowa	48	Sandy clay loam (U)	15	14	336
9[b]	Ames, Iowa	60	Sandy clay loam (T)	15	26	780
10[b]	Ames, Iowa	60	Sandy clay loam (U)	15	12	360
11[c]	Chapel Hill, N. C.	30	Sand	12	25	375
12[c]	Chapel Hill, N. C.	31.5	Sand	12	56	882
13[c]	Chapel Hill, N. C.	30	Sand	12	80	1200
14[c]	Chapel Hill, N. C.	20	Sand	12	35	350
15[c]	Chapel Hill, N. C.	21	Sand	12	82	861
16[c]	Culman Co., Ala.	84	Crushed sandstone (C)	137	190	7980
17[c]	McDowell Co., N. C.	66	Clayey sandy silt (C)	170	40	1320
18[d]	Wolf Creek, Mont. (reconstructed)	216	Graded crushed gravel (C)	83	58	6300

[a] U—untamped; T—tamped, C—compacted.

[b] Side pressure and pipe deflections measured.

[c] Side pressures estimated, pipe deflections measured.

[d] Load and pipe deflections measured.

than the maximum, the ratio depending on the soil characteristics a amount of movement of the sides of the pipe.

Some recent research (*11*) has indicated that this modulus is strongly influenced by the size of the pipe, and that for a given type of soil in a given state of compaction, the product er of the modulus and the radius of the pipe, designated as E', is reasonably constant. That is to say, for the same soil, the modulus is inversely proportional to the pipe radius. Also, observations on a limited number of pipes in service, where sufficient information is available to make an approximate estimate, indicate that the value of E' varies widely. The range was from a minimum of 234 psi, in the case of a shovel-placed uncompacted sandy clay loam, to a maximum of 7980 psi, for a crushed sandstone soil which was compacted to Proctor density. A tabulation of estimated values of E' for 18 actual flexible pipe culvert installations is given in Table 26-7. This table may be used as a guide in the selection of an appropriate value of E' for use in the design of flexible pipe conduits.

26.19. STRESSES IN FLEXIBLE PIPE WALL. Although pipe deflection is the principal criterion for design of a flexible pipe conduit, it may also be important to determine the bending moment and tangential thrust stresses around the periphery of the pipe wall. This may be of particular importance in the design of longitudinal bolted seams of field-assembled structures. The seams are subjected to a combination of tangential thrust and bending moment. The thrust subjects the bolts to single shear stress and the moment creates a prying action which subjects one row of bolts to direct tension. Therefore the stress on a bolt may be a composite of shear and tension.

Equations for the moment and thrust at the bottom of a circular pipe (point C in Fig. 26-16) are

$$M_c = AW_c r \tag{26-10}$$

$$R_c = BW_c \tag{26-11}$$

with values of A and B given in Table 26-8.

Equations for the moment and thrust at the bottom of the pipe due to horizontal loads (Fig. 26-16) are

$$M_c = -0.166hr^2 \tag{26-12}$$

$$R_c = 0.511hr \tag{26-13}$$

in which

$$h = \frac{E'\,\Delta x}{2r}$$

TABLE 26-8. Values of A and B in Eq. (26-10) and (26-11) for Various Values of the Bedding Angle α

α	A	B	$\sin\alpha$
0	0.294	0.053	0
15	0.234	0.050	0.259
30	0.189	0.040	0.500
45	0.157	0.026	0.707
60	0.138	0.014	0.866

To determine the total stress situation at any point D on the periphery at counterclockwise angle ϕ from the bottom point C, it is most convenient to write the moment and thrust equations for vertical load and lateral pressure separately. Then the resultant stress at a point is obtained by algebraic combination of these stresses. Expressions for evaluating moments and thrusts are given in Eqs. (26-14) to (26-31).

Moment, thrust, and shear resulting from vertical load:
when ϕ lies between 0 and α

$$M_D = W_c r\left[A + B(1 - \cos\phi) - 0.250\,\frac{\sin^2\phi}{\sin\alpha}\right] \tag{26-14}$$

$$R_D = W_c\left(0.500\,\frac{\sin^2\phi}{\sin\alpha} - B\cos\phi\right) \tag{26-15}$$

$$S_D = W_c\left(0.500\,\frac{\sin\phi\cos\phi}{\sin\alpha} - B\sin\phi\right) \tag{26-16}$$

when ϕ lies between α and 90°

$$M_D = W_c r[A + B(1 - \cos\phi) - 0.50\sin\phi + 0.25\sin\alpha] \tag{26-17}$$

$$R_D = W_c(0.500\sin\phi + B\cos\phi) \tag{26-18}$$

$$S_D = W_c(0.500\cos\phi - B\sin\phi) \tag{26-19}$$

when ϕ lies between 90° and 180°

$$M_D = W_c r[A + B(1 - \cos\phi) - 0.25(1 + \sin^2\phi - \sin\alpha)] \tag{26-20}$$

$$R_D = W_c(0.500\sin^2\phi + B\cos\phi) \tag{26-21}$$

$$S_D = W_c(0.500\sin\phi\cos\phi - B\sin\phi) \tag{26-22}$$

Moment, thrust, and shear resulting from horizontal loads:
when ϕ lies between 0° and 40°

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these procedures and the care taken in the installation of a pipe can mean the difference between success and structural failure of a buried conduit.

The supporting strength of this type of structure therefore depends on three factors: (1) the inherent strength of the pipe; (2) the quality of the bedding as it affects the distribution of the bottom reaction; and (3) the magnitude and distribution of lateral pressures that may act on the sides of the pipe.

25.7.3 Classification of Pipe Bedding

Several classes of pipe bedding have been defined to represent construction practices used in the field. Both the distribution of the bottom pressure and the influence of lateral pressure are taken into account in the bedding class. Bedding classes and corresponding load factors are shown in Fig. 25.15; the better the bedding, the higher the load factor and the larger the load that can be sustained by the pipe. It will be noted that because of the empirical nature of the load factors, answers will carry no more than two significant figures.

Impermissible, or Class D Bedding: Load Factor = 1.1

This bedding class describes a situation where no effort has been made to shape the foundation to fit the lower part of the conduit and no attempt has

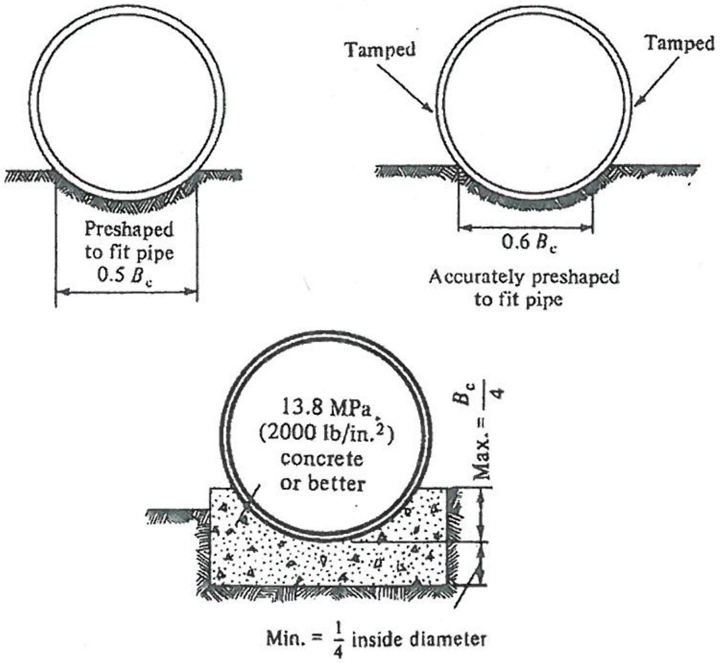

Figure 25.15
Classes of pipe bedding. Italicized numbers are bedding load factors for ditch conduits.

been made to fill the spaces under and around the conduit. Nevertheless there will be some side pressure from backfill, and the load factor determined experimentally for this bedding is 1.1, which is multiplied times the strength from a three-edged bearing test to obtain an estimated strength at failure in the field.

Ordinary or Class C Bedding: Load Factor = 1.5

This class is used to indicate "ordinary care" in preshaping the earth foundation to fit the lower part of the conduit exterior for a width of at least 50 percent of the conduit breadth, and in which the remainder of the conduit is surrounded to a height of at least 0.15 m (0.5 ft) above its top by granular materials that are shovel-placed and shovel-tamped to completely fill all spaces under and adjacent to the conduit. This type of installation must be under the general direction of a competent engineer.

First-Class or Class B Bedding: Load Factor = 1.9

In this class a conduit is carefully laid on fine granular materials that have been carefully preshaped by means of a template to fit the lower part of the conduit exterior for a width of at least 60 percent of the conduit breadth, and the remainder of the conduit is entirely surrounded to a height of at least 0.3 m (1.0 ft) above its top by granular materials that must fill all spaces under and adjacent to the conduit, and are thoroughly tamped on each side and under the conduit in layers not exceeding 0.15 m (0.5 ft) in thickness. Fill at the sides of positive projecting conduits is tamped to a distance at least equal to the conduit width. All work must be done under the direction of a competent engineer, who is represented by an inspector who is constantly present during the operation.

Concrete-Cradle (Class A) Bedding: Load Factor 2.8 to 3.4

This bedding involves settting the lower part of a conduit in plain or reinforced concrete of suitable thickness and extending upward on each side of the conduit for a distance that is *not greater than* one-fourth of the outside diameter of the conduit. Pipe laid in concrete bedding usually shows initial cracking at the top.

In all cases where pipe sections are joined by means of a widened flange or bell at one end, the bell *must* be accommodated by excavation to prevent loading the bell. A failure to excavate for the bell easily can reduce strength by a factor of 2. The strength can be estimated by assuming the pipe acts as a simple beam supported at the ends, but with proper installation procedures it should not be necessary to make this estimation—except in preparation for trial.

25.7.4 Increased Load Factors for Positive Projecting Conduits

Increased efficiency of compaction of soil alongside positive projecting conduits results in higher load factors compared to ditch conduits. A formula that takes this into account is

$$L_f = \frac{A}{N - xq} \qquad (25.13)$$

where A = shape parameter, 1.43 for circular conduit, or 1.34 for a horizontal elliptical shape;

N = bedding factor (Table 25.2);

x = side area function, which depends on p, the projection ratio for circular pipe, or m, the projection ratio from the vertical diameter of a horizontal elliptical pipe;

$$q = \frac{pK}{C_c}\left(\frac{H}{B_c} + \frac{p}{2}\right) \qquad (25.14)$$

where p = projection ratio (proportion of the pipe diameter projecting above the bearing surface);

K = lateral stress ratio;

C_c = load coefficient;

H = height of fill above the conduit;

B_c = horizontal outside dimension of conduit.

25.7.5 Factor of Safety

Design that is based on a failure load must incorporate a factor of safety. Rigid underground conduits may be selected according to the following criterion:

$$S_{eb} = \frac{W_c \times \text{FS}}{L_f} \qquad (25.15)$$

Table 25.2
Values of N and x for use in eq. (25.13)

				Bedding A	
p or *m*	x	Bedding B, C, D	*N*	*x*	*N*
Circular					
0.3	0.217	D	1.310	0.743	—
0.5	0.423	C	0.840	0.856	—
0.7	0.594	B	0.707	0.811	—
0.9	0.655			0.678	—
1.0	0.638			0.638	0.505
Horizontal elliptical:					
0.3	0.146	C	0.763		
0.5	0.268	B	0.630		
0.7	0.369				
0.9	0.421				

where W_c = design load;

S_{eb} = three-edge bearing strength;

FS = factor of safety;

L_f = load factor.

Factors of safety vary widely in practice. For unreinforced concrete pipe, suggested values based on minimum test strength of a representative number of test specimens are from 1.3 to 1.5. For reinforced concrete pipe, the suggested factor of safety is 1.2. As such pipes do not fail by collapsing, the failure load is defined as the load causing one or more 0.25 mm (0.010 in.) wide cracks measured at close intervals throughout a pipe section length of 0.3 m (1 ft) or more. This is usually expressed as a "D-load," which is the test strength per linear meter (foot) of pipe divided by the *internal* diameter in meters (feet).

The 0.25 mm (0.010 in.) crack width can be measured with a mechanic's "feeler gauge" and is not to be regarded as defining a failure situation in the field. All reinforced concrete structures can be expected to crack as the tensile stress is transferred to the reinforcement, because the modulus of elasticity of steel is much greater than that of concrete, and the steel will stretch more than the concrete at working stresses. Unless cracks open up a sufficient amount to permit or promote oxidation and corrosion of the steel, reinforced concrete pipes will continue to perform their load-carrying function indefinitely, even though fine cracks have developed.

Example 25.10

Determine the required three-edge bearing strength for the pipe in Example 25.8 with ordinary Class C bedding and a factor of safety of 1.0 based upon the 0.010 in. (0.025 mm) crack strength. $W_c = 329$ kPa (22,500 lb/ft^2). The internal diameter $D = 1.52$ m (5 ft).

Answer: Expressed in terms of D-load, $W_c = 329/1.52 = 216D$ kPa, or $22{,}500/5 = 4500D$ lb/ft.

$\phi = 30^c$; $K = 0.33$ ✓ $A = 1.43$ ✓

$p = 4.2/6.0 = 0.7$ $N = 0.840$ (Table 25.2) ✓

$X = 0.594$ (Table 25.2) ✓

0,231

$$q = (0.7 \times 0.33)/5.2(8.33 + 0.7/2) = 0.385 \qquad \text{(eq. (25.14))}$$

8.68 .385

$$L_f = 1.43/[0.840 - (0.594 \times 0.386)] = 2.34$$

$$\text{Required three-edge strength} = (3.29 \times 1)/2.34 = 140 \text{ kN/m}, \qquad \text{(eq. (25.13))}$$
$$\text{or } (22{,}500 \times 1)/2.34 = 9600 \text{ lb/ft}$$

D-load strength $= 140/15.25 = 9.18D$ kN/m^2, or $9600/5 = 1920D$ lb/ft^2

ASTM Specification C76 Class IV pipe: $95.8D$ kN/m^2 or $2000D$ lb/ft^2 at 0.25 mm (0.01 in.) crack criterion.

Factor of safety with Class IV pipe: $(95.8D \times 2.34)/216D = 1.04$, or $(2000D \times 2.34)/4500D = 1.04$, which is marginal.

Appendix I

Operations Plan

Operations Plan
American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

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CERTIFICATION

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

Prepared by:

REGISTERED PROFESSIONAL ENGINEER
FLOYD E. COTTER
17783
OKLAHOMA

Floyd Cotter, PE
SCS Engineers

5/30/24

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1.0 INTRODUCTION

This Operations Plan (Plan) is intended to assist the operators of the American Environmental Landfill (AEL) in operating the facility in accordance with the solid waste permit documents and Oklahoma Administrative Code (OAC) Rules and Regulations as promulgated by the Oklahoma Department of Environmental Quality (ODEQ). The AEL is located near Sand Springs, Oklahoma in Sections 35 and 36, Township 20 North, Range 10 East, in Osage County, Oklahoma. The project site is on the Wekiwa Oklahoma 7.5 Minute USGS Quadrangle map. AEL is bordered by the Arkansas River to the South. The AEL operates under the Oklahoma Department of Environmental Quality (ODEQ) Permit Number 3557021.

Any reference to “operator” in this Plan shall mean the individual responsible for the facility on any given day or shift. The individual in responsible charge may assign operational tasks to various personnel. In addition, this Operations Plan shall be available to employees for reference to the operations of the facility. It is the responsibility of AEL to keep this information current. If changes to this Plan are to be made affecting the operations of the facility, then AEL shall notify the DEQ within 5 working days before the change implementation.

1.1 OPERATING HOURS

It is anticipated that the AEL will be open from 7:00 a.m. to 5:00 p.m. Monday through Friday and Saturday from 7:00 a.m. to 3:00 p.m. The daily operation of equipment necessary for compaction and covering waste will normally cease within one hour after the daily closing time.

1.2 PERSONNEL

The operation of the AEL will be under the direction of a certified solid waste operator. The typical staffing level is listed below:

- Landfill Manager/Operator
- Equipment Operator
- Scale House Attendant
- General Maintenance Person
- Truck Drivers

Staff will be modified as necessary to accommodate changes to operations or to meet increased waste flows. A properly trained equipment operator or other landfill employee will be present at the working face of the landfill to observe the unloading of waste and to perform and document random inspections of the waste.

1.3 ACCESS CONTROL

The AEL is located approximately 5.5 miles west of Sand Springs, Oklahoma on State Highway 412. The site is accessed from N. 177th West Ave. The entrance to the landfill is near the center of the property. Per OAC 252:515-19-32, artificial and/or natural barriers shall be used to discourage unauthorized traffic and uncontrolled dumping. Access to the landfill is controlled by a lockable entrance gate. The AEL is also surrounded by dense vegetation, rocky outcrops, and an iron fence.

This provides a natural and artificial barrier around the site that discourages access to unauthorized traffic. Landfill personnel have appropriately placed signs directing waste-hauling vehicles to the working face of the landfill. Scale house and operating personnel shall prohibit any unauthorized access and shall record all incidences of unauthorized access. At the conclusion of each operating day, the entrance gate shall be locked to prohibit vehicle access.

2.0 SOLID WASTE ACCEPTED/EXCLUDED

This section outlines accepted and excluded wastes, waste screening procedures, waste measuring requirements, and quantity limitation requirements which are applicable to the AEL under OAC 252:515.

2.1 WASTE ACCEPTANCE AND EXCLUSION

Under solid waste disposal permit number 3557021, the AEL is permitted to accept and manage solid waste, non-hazardous industrial waste (both liquid and solid), and contaminated soil with no TPH restrictions. AEL also accepts municipal and industrial sludge, both friable and non-friable asbestos, and other non-hazardous industrial waste (NHIW). Municipal sewage sludge treated to Class B requirements, as described in 40 CFR 503.32(b), may be disposed at the AEL if the sludge passes the Paint Filter Liquids Test (PFLT). A procedure for the PFLT is included in Appendix C of this Plan. In addition, the AEL has received approval from the EPA to accept CERCLA waste in Subtitle D areas of the permit waste footprint. The disposal of any quantity of hazardous, radioactive, regulated untreated infectious biomedical waste, or regulated polychlorinated biphenyl (PCB) waste is prohibited at the AEL.

Waste should be visually screened at the scale house to determine if the shipment contains acceptable waste. Shipments received at the facility shall be rejected if the waste is not deemed acceptable. Shipments of waste entering the State of Oklahoma that are subsequently rejected shall be removed from the State by those persons who transported the waste into the State.

Additional information such as sources of waste, amount received, transporters used, and any special handling or management practices to be employed shall be recorded at the scale house and filed within the site's operating record. Detailed information on acceptable and unacceptable wastes; screening procedures; recordkeeping and reporting requirements; and training requirements associated with waste acceptance at the site is detailed in the facility's approved Waste Exclusion Plan, which is maintained in the site's operating record and included as Appendix J of the permit application.

2.2 NHIW MANAGEMENT

Records shall be maintained in the operating record, itemizing the type, quantity, and source of NHIW received from persons disposing greater than 10 cubic yards of NHIW in a calendar month. Such records shall be submitted to the ODEQ no later than the last day of the month following the reporting month.

2.3 WASTE SCREENING

The scale house attendant will be responsible for screening incoming waste so that prohibited wastes are identified and handled properly. If the scale house attendant or other landfill staff refuses such wastes, they will inform customers of the proper disposal alternatives, such as directing them to local facilities that would accept those wastes. This practice is intended to avoid illegal dumping of refused wastes.

Personnel at the site shall conduct routine procedures for the screening and removal of wastes that are not acceptable for receipt at the landfill for disposal. These procedures consist of both routine load screening procedures and random load inspections. Routine load screening procedures include:

- Identifying incoming vehicles by company and vehicle number (Any placards will be noted)

- Review of paperwork included with incoming wastes by the scale house attendant

- Visually inspecting each load as it is pushed into the working face by operators trained to recognize excluded waste

- Notifying the ODEQ if unacceptable waste is discovered at the site by the end of the next working day. (The site's current Waste Exclusion Plan should be referenced for information to include with the notification)

Random load inspections will consist of:

- Conducting random inspections of incoming loads for unacceptable wastes

- Inspection of vehicles that contain uncompacted or open-top loads will primarily occur at the scale house

- Enclosed vehicles, such as commercial refuse vehicles, will be inspected at the working face

- Loads will be visually observed for unacceptable waste when deposited at the toe of the working face by a landfill employee

- Maintained records should include, at a minimum, the company or person delivering the waste, type of vehicle, rate and time, type of waste delivered, and person performing the inspection. These records shall be maintained in the operating record of the facility

Should a particular hauler or refuse from a particular waste generator be suspected of being a source of prohibited waste, routine or planned inspections will be made of the suspected waste at a pull-off area near the truck scale. The facility's current Waste Exclusion Plan should be referenced for waste screening training requirements as well as additional information regarding the waste screening procedures at the AEL.

2.4 WASTE MEASURING

The scale house at the AEL is located on the site's access road east of the active disposal area. All waste delivered to and disposed of at the AEL is weighed on a certified scale. The scale is tested and certified annually in accordance with the requirements of the Oklahoma Department of Agriculture, Food, and Forestry (ODAFF) per OAC 252:515-19-33(a)(2). The AEL should request the ODAFF to test the weighing and measuring of the scale on an annual basis.

If the scale is inoperative, tonnage shall be estimated on a volume basis where one cubic yard of waste shall be calculated to weigh one-third (1/3) ton. Solid waste disposal fees shall be collected and remitted to the ODEQ, except for solid waste received from emergencies or other special events, with prior approval from the ODEQ. Monthly reports shall be filed in the operating record and submitted to the ODEQ no later than the 15th of the month following the reporting period using the online reporting tool. A link to the online reporting tool is located *here*. A copy of the monthly and quarterly reporting forms are included in Appendix A of this Plan. Copies of submitted forms should be maintained in the site's operating record.

2.5 LIMITATIONS ON WASTE RECEIVED

The AEL accepts approximately 2,215 tons per day of waste. Therefore, the facility is required to prepare a Vegetative Cover Plan under OAC 252:515-19-54. Section 8.4 outlines how vegetative cover will be established and sets forth the timeline in which to do so.

As set forth by OAC 252:515-19-34 (c)(3), because the AEL will be constructed of an approved composite liner and leachate collection system, the AEL does not need to prepare a Disposal Plan as required under OAC 252-515-19-34(d).

2.6 RECYCLING OPERATIONS

The site proposes to salvage/recycle landfilled material that is deemed to be salvageable or recyclable. The recycling/salvage operations will be conducted as outlined in the AEL Salvage and Recycling Plan, included in Appendix D.

3.0 SURVEY CONTROL

Horizontal and vertical control must be maintained at the landfill in order to construct the landfill according to the approved permit documents. All boundary markers, benchmarks, horizontal control stations, and construction stakes will be clearly marked and identified. Permanent monuments designating horizontal and vertical control are already in place at the landfill in the form of monuments with surveyed, permanently stamped information. Evidence of permanent monuments and boundary markers placed by a registered land surveyor are shown on the approved Permit Documents maintained in the facility's operating record.

Permanent vertical control has been established by a registered surveyor on the property. In the event a control monument is damaged or destroyed, a registered land surveyor shall re-establish the monument. The permanent monuments at the property corners are established with markers embedded in concrete or other similar-type permanent structures. Boundary markers have been established designating the entire permitted acreage.

Construction staking will be used to mark individual cells where waste is to be placed. Staking will be utilized during landfilling operations to maintain slopes and check filling elevations, as necessary. Stakes will generally be made of wood or some other suitable material for use in a landfill. Construction stakes and temporary benchmarks will be replaced during the landfill operations, as needed.

If established benchmark or horizontal control monuments are disturbed over the life of the facility, these monuments shall be replaced or re-established by or under the supervision of a registered land surveyor.

4.0 WET WEATHER MANAGEMENT

Wet weather should not adversely impact landfill operations due to all-weather access roads. Throughout the landfill operation, adequate temporary landfill roads will be constructed to allow access to the working face of the landfill during all weather conditions. Soil material from the borrow area will be utilized to meet daily cover requirements during wet weather.

5.0 LINER SYSTEM

The liner system at the AEL will be constructed in accordance with the approved Quality Assurance/Quality Control (QA/QC) Plan for Liner and Leachate Collection System Installation and Testing. Liner system material conformance testing, general construction procedures, and testing requirements are presented in the QA/QC Plan. Each portion of the liner must be constructed under the supervision of a professional engineer licensed in the state of Oklahoma. Before waste can be placed in any newly constructed cell, approval of a Liner Installation and Testing Report must be obtained from the ODEQ.

6.0 LEACHATE COLLECTION AND STORAGE

The slope of the bottom of the landfill will allow leachate to be directed to leachate sumps located at the perimeter of the landfill. To facilitate leachate drainage toward the leachate sumps, the geomembrane liner will be covered with an 8-oz/sq yd non-woven geotextile cushion and a 24-inch thick leachate collection/protective cover. Leachate collection pipes will be placed in each drainage area to intercept leachate and transport it to a collection sump. The leachate collection system will be equipped with a pressure transducer, leachate level readout, and high-level alarm to monitor leachate levels. The sump pump will be manually engaged on a daily basis, if needed, to keep leachate levels below one foot above the top of the sump. As-builts for the sumps will be included in the Liner Installation and Testing (LIT) report, which will be submitted to the ODEQ upon construction.

Per OAC 252:515-13-34, the leachate collection pipes shall be cleaned out after the placement of the protective cover layer, again after the placement of the first lift of waste, and once per year thereafter.

Removal of leachate by a leachate collection system will eliminate the pressure head that would be necessary to force leachate through the composite liner. Prior to the placement of waste, traffic will be routed to minimize its detrimental impact on the constructed liner. Additionally, care will be taken when the initial lift of waste is placed in the landfill to avoid large or sharp objects that might damage the liner.

During the active life of the landfill, leachate collected in the sumps within the expansion area will be pumped up the side slope to the dual-contained force main and transported via the dual-contained force main to the proposed leachate storage impoundment. Leachate stored in the leachate storage impoundments will be evaporated, recirculated, and/or hauled offsite for disposal.

7.0 LANDFILLING PROCEDURES

7.1 LANDFILL PROGRESSION AND SEQUENCE OF FILL

Refuse trucks will deposit waste in the area identified as the working face. The working face is a sloped surface upon which the waste is compacted in layers. The waste is compacted by the landfill compactor as it is spread. The slope of the working face will vary based on the location of the slope. For sloped areas located at the limits of the permitted boundary or adjoining an area not proposed to accept waste, the slope will be no more than four feet horizontal to one foot vertical (4:1). For sloped areas located at adjoining areas within the permitted boundary proposed to accept waste, the slope will be no more than three-feet horizontal to one-foot vertical (3:1). The compactor will make multiple passes over the waste layer until the waste rebounds the same amount that it was depressed by the compactor. The height of waste will generally not exceed fifteen feet in height and is referred to as a lift. The width of the working face will be kept as small as practical. The waste will be spread and compacted as it is received.

Under the area fill method, waste is placed next to the previous day's waste until an established row length is reached. Another row is then started parallel to the previously constructed row. As the rows form lifts over each area, the top of each landfill lift should slope in such a manner as to allow surface runoff to drain away from the working face. After a number of rows have been constructed (creating a lift), a second lift is constructed over the first lift. Waste placement will alternate between various lifts of waste and will allow landfill traffic to discharge waste at various levels. This method will allow the earthmoving equipment to stockpile daily cover at the top of the day's waste, if necessary.

When the last load of refuse for the day has been spread and compacted, the application of 6 inches of daily cover soil or an alternative daily cover (ADC) will begin (see Section 8.1). Waste will not be placed in areas where the presence of water would prohibit proper spreading of the waste or promote a mosquito problem.

7.1.1 Placement of Initial Layer of Waste

Upon completion of cell construction and receipt of approval from the ODEQ, the landfill may begin placing waste in a new disposal cell. Filling should begin at the lowest elevations of each cell and work toward higher elevations to prevent excess leachate generation. The initial lift of waste placed in a cell should be comprised of "select" waste that will not damage the composite liner system and will provide an additional protective layer against freeze/thaw effects. This lift of select waste should be comprised of waste that does not contain long, sharp objects, or bulky material. When placing this select waste lift, a compactor should not be used until a minimum of five feet of waste has been placed over the drainage/protective cover layer. A track dozer can be used to spread waste into the cell while operating on already-placed waste.

7.1.2 Placement of Bulky Solid Wastes

Bulky waste should be crushed on the ground surface and then pushed onto the working face near the bottom of the fill area. Bulky waste that cannot be crushed should be placed near the bottom of the cell, though not in the first lift of waste.

7.1.3 Proper Disposal of Dead Animals

Dead animals accepted for disposal should be covered with solid waste or cover soil immediately upon placement at the active face.

7.1.4 Stormwater Management

Per OAC 252:515-19-38(a), solid waste shall not be placed or allowed to enter, accidentally or otherwise, waters that communicate with waters of the state located outside the permit boundary. Stormwater that accumulates in or near the active landfill area will be managed to minimize contact with the working face or other exposed waste. Temporary berms will be constructed along the perimeter of each disposal cell to direct potential stormwater run-on to the appropriate stormwater ditches or structures and to prevent stormwater run-off from the working face of the landfill from intermingling with “clean” stormwater. In addition, temporary stormwater diversion berms or “rain flaps” may be constructed to minimize stormwater that enters the leachate collection system. The construction of such berms or “rain flaps” will be dependent on the rate and location of waste placement within each cell.

7.2 EQUIPMENT

The equipment to be used on the site will include but not necessarily be limited to the following (or equivalent):

- Dozer
- Backhoe
- Haul truck
- Compactor
- Water truck

Available equipment will be modified as necessary to accommodate changes in operations or waste flows. All equipment will receive mechanical service on a routine basis. Fire extinguishers will be provided on all landfill equipment.

The manufacturer’s recommendations on equipment maintenance will be followed for each piece of landfill equipment. Regularly scheduled equipment maintenance is essential if the landfill equipment is to be dependable. In addition, at the end of each operating day, the equipment operator will remove the trash that may be lodged in the operating portion of the equipment tracks or the compaction equipment.

8.0 COVER AND BORROW SOIL

8.1 DAILY COVER

Daily soil cover will be applied at the end of each operating day, regardless of weather, as required by ODEQ, to deter disease vectors, fires, odors, and blowing litter. The daily soil cover material should consist of nominally compacted earthen material free of garbage, trash, or other unsuitable material. The minimum thickness of the daily soil cover will be six inches. The frequency of daily cover application may need to be increased in order to provide adequate control of disease vectors, fires, odors, blowing litter, or scavenging.

8.2 INTERMEDIATE COVER

Intermediate cover shall be applied to inactive areas of the landfill that are not protected by the final cover. The intermediate cover shall consist of 12 inches of nominally compacted earthen material free of garbage, trash, or other unsuitable materials.

The AEL may submit a permit modification to the ODEQ to approve the use of an alternative intermediate cover, demonstrating the alternative is capable of controlling disease vectors, fires, odors, and blowing litter without presenting a threat to human health or the environment. If an alternative intermediate cover is approved by the ODEQ for use at the AEL, this Plan should be revised to discuss the use of the approved alternate intermediate cover.

8.3 FINAL COVER

When the landfill has been filled to final waste elevations, the final landfill cap will be constructed. Terraces and stormwater management structures will be constructed at the same time that the landfill cap is installed. The final cover at AEL will be constructed in accordance with the approved Closure and Post-Closure Plan and QA/QC Plan. Cover system material conformance testing, general construction procedures, and testing requirements are presented in the QA/QC Plan.

The final cover will be an evapotranspiration cover system. The cover system will consist of a 12-inch thickness of intermediate cover, a 24-inch vegetation support layer, and a 12-inch vegetation layer (topsoil). Each layer will be constructed to support vegetative growth.

8.4 VEGETATIVE COVER

The vegetative cover must be effective, long-lasting, and capable of self-regeneration and plant succession. Vegetation shall consist of species that are equal or superior to native vegetation during each season of the year. Permanent or interim vegetation shall be established in areas that have been undisturbed for 90 days or more.

Table 1. Typical Seeding Mixtures

Spring/Summer Planting Season (Optimal Time for Planting – April 1 through May 30)

Seed Mixture	Minimum Percent Pure Live Seed Required	Pounds Per Live Seeds Required Per Acre
Common Bermuda Grass	85	12
Blue Stem	65	4
Side Oats Grama	65	6
Rye	85	4
	Total:	**26**

Fall/Winter Planting Season (Optimal Time for Planting – September 1 through February 15)

Seed Mixture	Minimum Percent Pure Live Seed Required	Pounds Per Live Seeds Required Per Acre
Winter Wheat	75	40
Fescue or Rye	85	15
	Total:	**55**

The Typical Seeding Mixtures table shown above lists typical seeding mixtures that will be used for the site during each season and is only provided as a reference. It is understood that a variety of application rates and types of seed mixtures will produce adequate vegetative cover. The seed may be applied to the landfill slopes by various typical application methods such as hydro-mulch or seed drilling.

Fertilizer will be applied to the seeded area as needed. The following typical application method should be used:

- Additional soil will be added to the side slopes, as needed, and the soil will be processed using a disk to prepare the soil for seeding.

- Fertilizer will be applied using a commercial spreader at a rate of approximately 150 pounds per acre (lb/acre), and the soil will be simultaneously disked using a disk harrow. The fertilizer rate may vary. However, an initial rate of 10 (nitrogen) - 20 (phosphate) -10 (potassium) may be used.

- The seed mixture will then be applied using a commercial spreader and the area simultaneously disked using a disk harrow.

- After disking the seeded area, hay will be mulched at a rate of approximately 3 bales (700 to 1,000 lbs each) per acre. To further minimize erosion potential and facilitate moisture retention, the hay will then be "crimped" using a roller to integrate the hay into the soil.

For future areas that will receive final cover, the initial seeding event will occur as follows:

- For the final cover that is constructed in the winter, the initial seeding event will consist of a Fall/Winter seed mix, followed by permanent vegetation using a Spring/Summer seeding mixture.

- For the final cover that is constructed in the spring, the initial seeding event will consist of a Spring/Summer seed mix, followed by permanent vegetation using a Fall/Winter seeding mixture.

Vegetation will be established during the first possible growing season. Maintenance of the permanent vegetation will typically consist of protection, replanting, maintaining existing grades, repair of erosion damage, and mowing. After the seeds have sprouted, the site will inspect the slopes for areas with no grass or with thin grass. These areas will be reseeded, watered, and fertilized to establish an acceptable permanent vegetation layer. If there are areas where establishing vegetation is unsuccessful, an alternative plan will be developed.

To prevent ponding, the final cover gradient on top of the fill (as measured from the center of the fill area to the break in slope between the top and sides of the fill) shall be four (4) percent, unless otherwise approved by the ODEQ. The final side slope gradient shall not exceed twenty-five (25) percent. Final cover surface contours shall prevent ponding water and erosion of fill areas.

The ODEQ shall be notified in writing prior to the beginning of the final closure of the facility or closure of a disposal cell. Closure activities shall begin no later than 90 days after the final receipt of wastes at the facility or final receipt of wastes into a disposal cell, as applicable. Closure activities shall be completed within 180 days after closure activities are initiated. Extensions of the closure period may be granted by the ODEQ if the AEL demonstrates that closure will, of necessity, take longer than 180 days and that all steps have been taken, and will continue to be taken, to prevent threats to human health or the environment from the cell or facility.

Upon closing the facility, the AEL shall have a licensed surveyor’s plat of the site prepared. The survey plat and detailed description will show, at a minimum, the final contours of the entire site; the permit boundary and boundaries of the disposal areas; the location of gas monitoring wells and extraction systems; the location of groundwater monitoring wells; the location of leachate management systems or surface impoundments; the location of permanent surface drainage structures; aesthetic enhancements; and other relevant information. The site's approved Closure and Post-Closure Plan should be referenced for additional information required for a Certification of Final Closure submittal.

8.5 BORROW SOURCE

Borrow areas for the AEL are located in the expansion area and south of the permitted waste boundary on property owned by American Environmental Landfill, Inc. Borrow areas that are no longer active shall be reshaped and re-vegetated or otherwise reclaimed to blend with surrounding terrain within 180 days of the date the area ceased being used. Borrow areas shall be maintained as outlined in the site's current Stormwater Pollution Prevention Plan (SWP3).

9.0 VECTORS AND AESTHETICS

9.1 VECTORS

In general, vectors will not find suitable harborage in the landfill due to the compaction and covering of the waste. However, if a vector problem should arise, an assessment of the operating conditions will be made and necessary corrective actions will be taken. If the vector problem persists after initial corrective action, a professional exterminator will be hired to mitigate the problem.

9.2 LITTER CONTROL

The AEL is surrounded by dense vegetation consisting of tall trees that minimize wind speeds and air-blown litter from leaving the site. A street sweeper is available to keep the site and approach roadways clean of litter. Additionally, temporary labor is used to pick up litter as needed.

9.3 SPECIAL COVERING

Waste that is received at the site that may cause a nuisance with blowing litter, dust, or odors will be covered immediately rather than waiting for cover at the end of the day.

10.0 ENVIRONMENTAL MONITORING

10.1 SURFACE WATER MONITORING

Surface water will be monitored in accordance with the site's current SWP3. A copy of the SWP3 should be maintained within the site's operating record.

10.2 STORMWATER STRUCTURE MAINTENANCE

Numerous stormwater drainage control structures will be constructed at the landfill. These structures include perimeter channels, letdown channels, and terraces. Routine maintenance must be conducted on these structures for continued proper operation. These drainage structures will be inspected in accordance with the facility's SWP3. If erosion damage has occurred to a drainage structure, it will be repaired as soon as possible.

Temporary surface run-on and run-off control will be implemented as operationally necessary to reduce the amount of run-on and run-off coming into contact with the active refuse face of the landfill or to reduce erosion from disturbed areas of the site.

10.3 GROUNDWATER MONITORING

Groundwater will be monitored in accordance with the approved Groundwater Monitoring Plan for the site, which is maintained in the facility's operating record.

10.4 GAS MONITORING

Landfill gas will be monitored in accordance with the approved Explosive Gas Monitoring Plan for the site, which is maintained in the facility's operating record.

10.5 LEACHATE MONITORING

Leachate monitoring will be conducted as required for recirculation or by the receiving facility when leachate is hauled offsite for disposal. Results of leachate monitoring will be retained in the operating records of the facility.

11.0 AIR QUALITY

11.1 EMISSION CONTROL

The AEL operates under Operating Permit No. 2018-1562-TVR2 and is subject to 40 CFR Part 60, Subpart XXX regulation. A Gas Collection and Control System is used to capture the gas generated within the landfill footprint.

11.2 DUST CONTROL

The AEL shall be operated to prevent the discharge of visible fugitive dust emissions beyond the property boundaries. Fugitive dust emissions shall not damage or interfere with the use of adjacent properties or cause air quality standards to be exceeded. The AEL should spray haul roads using a water truck, as needed when the facility is in operation. Additionally, open burning of solid waste at the AEL is prohibited.

12.0 SAFETY

12.1 FIRES

Protection against fires shall include providing fire extinguishers on all landfill equipment and proper maintenance and cleaning of the equipment to remove trash that may be ignited by equipment exhaust.

Landfill personnel will be on alert for indications that an arriving load of solid waste may be smoldering or have the potential to ignite. If a smoking or smoldering load is observed, the solid waste will immediately be pushed or directed away from the active working face and spread out as much as possible. A thick layer of soil will then be spread over the solid waste and compacted to effectively smother the fire. The sealed solid waste will be observed for several days, and if signs of smoke appear, more soil will be spread and compacted over the solid waste. It may be necessary to leave the "hot" solid waste sealed for an extended period of time before incorporating it into the active working face.

If an area of the daily cell should ignite or show signs of smoldering, the area will be excavated to remove all of the hot material is segregated from the active face. The excavated solid waste will be pushed as far as possible from the working face and sealed as described above.

12.2 EMERGENCY CONTACTS

In the event of an emergency at the AEL, personnel will dial 911 in order to direct the appropriate assistance to the site. Fire, police, and ambulance assistance is available to the site by dialing 911.

12.3 COMMUNICATION EQUIPMENT

All vehicles, including the compactor, will have a two-way radio capable of communicating with the landfill office. Telephone service is available at the landfill office and can be used for calling emergency equipment (fire, police, or ambulance) in the event of an accident or other emergency. Additional emergency telephone numbers will be clearly posted near the telephone.

12.4 TRAFFIC SIGNS

In addition to the entrance sign described in Section 1.3 of this report, additional signs will be posted as necessary. These signs may include:

- Directions to the active face of the landfill
- Speed limits
- Cautionary signs

13.0 RECORDKEEPING AND REPORTING

The AEL shall maintain operating records at the facility containing records concerning the planning, construction, operation, monitoring, closing, and post-closure monitoring of the facility. Such records shall be maintained until the post-closure monitoring period is terminated. A list of recordkeeping and reporting that should be completed by the AEL is included in the ODEQ Guidance on Recordkeeping and Reporting attached in Appendix B of this plan.

Appendix A

Monthly and Quarterly Reporting Forms

OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

MONTHLY REPORT FOR SOLID WASTE DISPOSAL FACILITIES

(Please see instructions prior to completing this form)

Please Remit Original Report to:
Solid Waste Compliance and Enforcement
Land Protection Division
P. O. Box 1677
Oklahoma City, OK 73101-1677
Solidwastereports@deq.ok.gov

And

Please Remit Copy of Report to:
Revenue Management Section
Administrative Services Division
P.O. Box 2036
Oklahoma City, OK 73101-2036
Bernice.Green@deq.ok.gov

Facility Physical Address: ____

Report month/year:_____________________
Permit No.:___________________________

Facility Name:____

Mailing Address: ____

____

Phone No.:(   )___________________

Number of Operating days: _________

Day	(1) Total weight accepted (tons)	(2) Weight which is reused or recycled in accordance with facility permit (tons)	(3) Weight accepted from a DEQ approved emergency or special event (tons)	(4) Weight accepted from large industrial waste generators with DEQ exemption certificate (tons)	(5) Time scales placed out-of-service	(6) Time scales placed into service	(7) Total volume accepted (yd^3)	(8) Volume which is reused or recycled in accordance with facility permit (yd^3)	(9) Volume accepted from a DEQ approved emergency or special event (yd^3)	(10) Volume accepted from large industrial waste generators with DEQ exemption certificate (yd^3)
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Total	0	0	0	0	0	0	0	0	0	0

I hereby certify that the information reported above is accurate and correct to the best of my knowledge and includes all solid waste received at this facility.

Signature of authorized agent:____________________________________

Date:___________________

INSTRUCTIONS FOR COMPLETING THE MONTHLY REPORT FOR SOLID WASTE DISPOSAL FACILITIES

The monthly report for solid waste disposal facilities should be submitted to DEQ no later than the 15th of the month following the reporting month and should include all solid waste received during the month. **If no solid waste is received in a given month, a monthly report is still required. Please include a notation that no solid waste was received during the month. If submitting report electronically, please send to solidwastereports@deq.ok.gov and bernice.green@deq.ok.gov.**

1. In the spaces provided, enter the month and year covered by the report, the facility name, permit number, mailing address, and phone number.

2. For each operating day of the month, provide the following and identify which days during the month the facility was closed.

   Column 1: **Total weight accepted:** Enter the total weight, **in tons,** of all waste accepted at the facility for each day. The total must include weights to be reported in columns 2, 3, and 4.

   Column 2: (Only applicable to landfill disposal facilities) **Weight which is reused or recycled in accordance with facility permit:** Enter the weight, **in tons,** of waste accepted at the facility which was productively reused at the facility in accordance with the facility's permit OR was recovered and sold in accordance with the facility's permit.

   Column 3: (Only applicable to landfill disposal facilities) **Weight accepted from a DEQ approved emergency or special event:** Enter the weight, **in tons,** of waste accepted at the facility from an emergency or special event for which the facility received prior approval from the DEQ to waive the state disposal fee.

   Column 4: (Only applicable to landfill disposal facilities) **Weight accepted from large industrial waste generators with DEQ exemption certificate:** Enter the weight, **in tons**, of waste received from large industrial waste generators **which was accompanied by a large industrial waste generator fee exemption certificate issued by the DEQ.**

   Column 5: (Only applicable to landfill disposal facilities) **Time scales placed out-of-service:** Enter the approximate time (hour:minute) the scales became inoperative.

   Column 6: (Only applicable to landfill disposal facilities) **Time scales placed into service:** Enter the approximate time (hour:minute) the scales were placed into service.

Note: Section 2-10-802 of the Oklahoma Solid Waste Management Act requires operators of certain landfill disposal facilities to weigh all solid waste received at the landfill. ***Only when the scales are inoperative may a landfill record the volume of waste received****.*

   Column 7: **Total volume accepted:** Enter the total volume **in cubic yards** of all waste accepted at the facility. The total must include volumes to be reported in columns 8, 9, and 10.

   Column 8: (Only applicable to landfill disposal facilities) **Volume which is reused or recycled in accordance with facility permit:** Enter the volume, **in cubic yards,** of waste accepted at the facility which was productively reused at the facility in accordance with the facility's permit OR was recovered and sold in accordance with the facility's permit.

   Column 9: (Only applicable to landfill disposal facilities) **Volume accepted from a DEQ approved emergency or special event:** Enter the volume, **in cubic yards,** of waste accepted at the facility from an emergency or special event for which the facility received prior approval from the DEQ to waive the state disposal fee.

   Column 10: (Only applicable to landfill disposal facilities) **Volume accepted from large industrial waste generators with DEQ exemption certificate:** Enter the volume, **in cubic yards**, of waste received from large industrial waste generators **which was accompanied by a large industrial waste generator fee exemption certificate issued by the DEQ.**

3. At the end of the month, calculate the total down time for the scales (hours:minutes) and include in the space provided. Sum each column and include in the appropriate column.

QUARTERLY RETURN FOR SOLID WASTE LANDFILLS

Due no later than 30 days after the end of each calendar quarter

Permit Number	Quarter	Year	DEQ Invoice Number

Facilty Name:
Mailing Address:

1. Number of operating days this quarter (see instructions) days
2. Total weight, in tons, of waste received during this quarter tons
    - 2a. Weight received, in tons, which was productively reused or recovered and sold (see instructions) tons
    - 2b. Weight received, in tons, from a DEQ approved emergency or special event (see instructions) tons
    - 2c. Weight received, in tons, from large industrial waste generators under the large industrial waste generator exemption (see instructions) tons
3. Weight subject to state disposal fees (line 2 minus sum of lines 2a, 2b, and 2c) tons
4. Total volume, in cubic yards, of waste received during this quarter yd3
    - 4a. Weight received, in cubic yards, which was productively reused or recovered and sold (see instructions) yd3
    - 4b. Weight received, in cubic yards, from a DEQ approved emergency or special event (see instructions) yd3
    - 4c. Weight received, in cubic yards, from large industrial waste generators under the large industrial waste generator exemption (see instructions) yd3
5. Volume subject to state disposal fee (line 4 minus sum of lines 4a, 4b, and 4c) yd3
6. Volume weight subject to state disposal fee (multiply line 5 by 0.33) tons
7. Determine volume weight from total volume (multiply line 4 by 0.33) tons
8. Total weight received (add line 2 and line 7) tons
9. Average weight received per operating day (divide line 8 by line 1) tons/day
10. Weight received subject to state disposal fee (add line 3 and line 6) tons
    - 10a. Line 13 from previous quarter
11. Enter state disposal fee (If line 10a < $40,000, line 10 x $1.50, otherwise, line 10 x $1.25)
12. Enter capital investment waiver (see instructions)
13. Determine total capital investment waiver to date (see instructions)
14. Enter handling waiver (see instructions)
15. Enter total allowable waivers (add line 12 and line 14)
16. Penalties (see instructions)
17. **TOTAL STATE DISPOSAL FEE DUE** (line 11 plus line 16 minus line 15)

Typed/Printed Name of
Authorized Agent: Date:

Signature of Authorized agent: Phone No.:
Email Address:

Remit report with payment to:

Oklahoma Department of Environmental Quality
Administrative Service - Accounts Receivable
P.O. Box 2036
Oklahoma City, OK 73101-2036

Remit copy of report to:

Oklahoma Department of Environmental Quality
Land Protection Division
P.O. Box 1677
Oklahoma City, OK 73101-1677

Electronic submissions should be submitted to: solidwastereports@deq.ok.gov bernice.green@deq.ok.gov

INSTRUCTIONS FOR COMPLETING THE QUARTERLY RETURN FOR SOLID WASTE LANDFILLS

GENERAL INSTRUCTIONS

All solid waste landfills, except generator owned and operated non-hazardous industrial waste monofills, are required by 27A O.S. §2-10-802 to collect fees on solid waste received at the landfill.

This return should be completed and returned to the Financial and Human Resources Division of the Department of Environmental Quality no later than 30 days after the end of each calendar quarter. Calendar quarters are: 1st quarter--January 1 through March 31, 2nd quarter--April 1 through June 30, 3rd quarter--July 1 through September 30, 4th quarter--October 1 through December 31.

If the return and fees cannot be submitted within 30 days of the end of the quarter, an extension for up to 30 days may be granted by the Department. A request for an extension must be submitted no later than the due date of the return and must include a detailed description of why the extension is needed. The Department will notify you if the extension is granted or not. Please note that extensions cannot be granted which will result in a due date of more than 60 days after the end of the quarter.

SPECIFIC LINE INSTRUCTIONS

Line 1:	Enter the number of days during the quarter the landfill was open to receive waste.
Line 2a & 4a:	The activities must be included in, and conducted in accordance with, the landfill's permit. Records pertaining to this fee exemption must be included with the quarterly return. Exemption documentation is to include: 1) waste types and 2) weight/volume recycled and method of recycling for each waste type. **If this information is not included, the claim may be disallowed.**
Line 2b & 4b:	A copy of the DEQ's written approval waiving the fee must be included with the quarterly return. **If a copy is not included, the claim may be disallowed.**
Line 2c & 4c:	Enter the amount of waste received from large industrial waste generators **which was accompanied by a large industrial waste generator fee exemption certificate issued by the DEQ.**
Line 12:	If line 13 of last quarter's return is $40,000, enter $0.00, otherwise: If line 9 is less than 100 tons/day, multiply line 8 by $0.50. If line 9 is equal to or more than 100 tons/day, multiply line 8 by $0.25.

NOTE: Records documenting the capital investment and the use of the funds must be included with the quarterly return.

Line 13:	If line 13 of last quarter's return is less than $40,000, add line 13 of last quarter's return and line 12 of this quarter's return. If line 13 of last quarter's return is $40,000, enter $40,000.00.
Line 14:	If line 13 of last quarter's return is less than $40,000.00, enter $0.00. If line 13 of last quarter's return is $40,000 AND this return in filed on time, multiply line 11 by 0.10. Otherwise, enter $0.00.

PENALTIES

There is a 5% penalty for returns postmarked more than 30 days after the due date (or filed after the extension date). Your penalty is determined by multiplying line 11 of the return by 0.05 and including this figure on line 16.

There is a 15% penalty per month for returns postmarked more than 60 days after the due date of the return. Your penalty is determined by multiplying line 11 of the return by 0.15, then by the number of months which have elapsed after the due date (or the extension date if applicable) and including this figure on line 16.

If you have any questions, please contact Amber Edwards, Land Protection Division Solid Waste Unit (405) 702-5133.

Appendix B

ODEQ Guidance on Recordkeeping and Reporting

DEQ Guidance on Recordkeeping and Reporting

Regulatory Reference: OAC 252:515-19-40

Applicability. All solid waste disposal facilities.

Purpose. To provide guidance on the records to be maintained in the facility operating record and submitted to the DEQ.

Technical Discussion. All solid waste disposal facilities are required to maintain an operating record containing all records concerning the planning, construction, operation, closing and, if applicable, post-closure monitoring of the facility.[1] Preferably, the operating record should be maintained at the disposal facility; however, an off-site location near the facility which is under the direct control of the owner/operator and accessible during DEQ inspections can be used. For the purposes of this rule, facility records maintained by consultants cannot be considered part of the operating record.

Various Subchapters of OAC 252:515 identify records that must be maintained and/or submitted to the DEQ. This guidance will identify those records so that owner/operators can ensure all required records are being maintained and submitted in a timely manner.

Subchapters 3 through 31 - Permit Applications and Related Documents

- All applications for new and modified permits must be submitted to the DEQ and maintained in the operating record. The permit application includes all text related to the application as well as all maps, drawings, construction plans, QA/QC reports, legal access documents, public notices, etc. required by other Subchapters.
- All correspondence to/from the DEQ related to the permit application must be maintained in the operating record.
- A copy of the approved permit and all associated modifications must be maintained in the operating record.

Subchapter 9 - Groundwater Monitoring and Corrective Action

- Within 60 days of groundwater sampling, a copy of groundwater monitoring results and associated statistical analysis (or cumulative analysis data for C/D landfills) must be placed in the operating record and submitted to the DEQ.
- Within 14 days of determining there is a statistically significant increase (SSI) in one or more monitoring constituents, the DEQ must be notified of the SSI in writing and a copy of the notice placed in the operating record.
- Within 90 days of determining there is a statistically significant increase, either an assessment monitoring program, or a demonstration that the increase was not caused by the facility, must be submitted to the DEQ and placed in the operating record.

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[1] This includes all correspondence to/from the DEQ.

- Within 14 days of receiving the results from an assessment monitoring event, the DEQ must be notified of the constituents that were detected.
- Prior to a public meeting to discuss an assessment of corrective measures, the DEQ must be provided with:
  - an affidavit (with a copy of the published notice) showing that public notice of the meeting was published in a local newspaper;
  - copies of certified mail receipts showing that the entities identified in OAC 252:515-9-113(b) were notified of the public meeting; and
  - property and mineral ownership maps covering the area within a 2 mile radius of the facility.
- Within 60 days of the public meeting to discuss an assessment of corrective measures, a proposed remedy must be submitted to DEQ for approval and a copy placed in the operating record.
- When the remedy is complete, a certification signed by the owner/operator and a qualified groundwater scientist must be submitted to the DEQ for approval and the approved certification placed in the operating record.

Subchapter 13 - Leachate Collection and Management

- Documentation must be submitted to the DEQ and maintained in the operating record showing any underground storage tanks used to store leachate meet the requirements of the Oklahoma Corporation Commission at OAC 165:25, Subchapter 1, Part 8.
- Plans for leachate recirculation and/or irrigation must be submitted to the DEQ and maintained in the operating record, as well as all correspondence to/from DEQ related to those plans.
- Any testing results required by leachate recirculation/irrigation plans must be submitted to DEQ and maintained in the operating record.
- If leachate is discharged to a POTW, a copy of a letter from the POTW stating it will accept the leachate must be placed in the operating record and submitted to the DEQ.
- The results of any testing required by the POTW must be maintained in the operating record.
- If leachate is discharged under an OPDES permit, a copy of the permit must be maintained in the operating record.
- Any testing required by the OPDES permit must be submitted to DEQ and maintained in the operating record.

NOTE: Quarterly leachate reports are no longer required to be maintained or submitted.

Subchapter 15 - Methane Gas Monitoring and Control

- Within 30 days of monitoring, gas-monitoring results should be submitted to the DEQ and placed in the operating record.[2]

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[2] While the rules don't give a specific time to submit the gas monitoring results, the rules require a remediation plan to be submitted within 30 days of detecting an exceedance. Therefore, it would make sense that the gas monitoring results would be submitted at the same time.

- Within 7 days of detection of an exceedance, submit a written notice to the DEQ of the exceedance and the steps taken to protect human health. A copy of this notice must also be placed in the operating record.
- Within 30 days of detection of an exceedance, a remediation plan must be submitted to the DEQ and a copy placed in the operating record.
- Written notification must be provided to the DEQ when the remediation plan is implemented, and a copy of that notice placed in the operating record.

Subchapter 17 - Stormwater Management

- A copy of the Stormwater Pollution Prevention Plan and OPDES Sector L permit must be maintained in the operating record.
- A copy of the OPDES stormwater permit for construction sites must be maintained in the operating record for any on- or off-site soil borrow areas of 5 acres or more in size.
- OPDES Sector L visual monitoring and Numeric Effluent Limitation Monitoring results must be maintained in the operating record.
- The Annual Comprehensive Site Compliance Evaluation Report must be submitted to the DEQ's WQD no later than December 1st of each year.
- All NELM monitoring results must be submitted to the DEQ no later than October 29th of each year for the period October 2nd of the previous year to October 1st of the current year.

Subchapter 19 - Operational Requirements

- Copies of random waste screening inspections must be maintained in the operating record.[3]
- Monthly waste receipt reports must be submitted to the DEQ and a copy placed in the operating record no later than the 15th of the month following the reporting month.[4]
- To avoid penalties, quarterly returns and fees for landfills must be submitted to the DEQ within 30 days of the end of the quarter.[5] A copy of the quarterly return must be maintained in the operating record.
- Copies of approved out-of-state waste disposal plans must be on file with the DEQ and maintained in the operating record, as well as all correspondence to/from DEQ related to the development of the approved plan.
- The DEQ must be notified at least 5 working days in advance of any proposed changes to an approved out-of-state waste disposal plan.
- Copies of initial design capacity reports required by the New Source Performance Standards (NSPS), as well as required updates to the design capacity, must be submitted to the DEQ and placed in the operating record.
- Copies of all test results required by NSPS must be submitted to DEQ and maintained in the operating record.

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[3] An example of a waste screening checklist is included with this guidance.

[4] Monthly reports are not required to be submitted to the DEQ for large NHIW generator landfills, generator owned and operated NHIW monofills, transfer stations, and processing facilities (including incinerators and regulated medical waste facilities). However, records identifying the amount of waste received must be maintained in the operating record and made available to DEQ upon request.

[5] Returns and fees submitted later than this are subject to penalties and are not eligible for the handling waiver.

- Landfills accepting asbestos must maintain the records identified in the Management of Friable Asbestos guidance document.
- Composting facilities must maintain records documenting when windrows were turned, windrow temperatures, and the amount of waste received, processed, and distributed.

Subchapter 21 - Waste Tire Processing, Certification, Permits, and Compensation

Waste tire facilities

- Records of gross and tare weights of each vehicle must be maintained in the operating record.
- A daily log for each load of tires received must be maintained in the operating record. The daily log must include the name and address of the hauler, the number of tires from each tire source, the name and address of each tire source, the number of tires processed each day, and the use and destination of each daily outbound load of processed tire material.
- No later than the 10th of each month, a monthly report must be submitted to the DEQ identifying the following for the previous month: the number of tires received, the number of tires from community-wide clean up events, the number of tires from PCL dumps, a summary of destinations and intended uses of processed tire material, the number of tons of processed tire material provided for each market category, and the number of tires provided to waste tire incinerators that were not useable by the incinerator. The monthly report must also be maintained in the operating record.
- No later than the 10th of the month following the end of each calendar quarter, a quarterly report must be submitted to the DEQ identifying the following for the previous quarter: statewide collection efforts and documentation the scales were certified in accordance with Department of Agriculture requirements. The quarterly report must also be maintained in the operating record.
- All copies of waste tire manifests must be maintained in the operating record.
- All records required by the Oklahoma Tax Commission for reimbursement purposes must be maintained in the operating record.

Entities installing river bank stabilization or other conservation projects[6]

- A copy of the permit or other authorization for the project must be maintained.
- A copy of the project completion report must be submitted to the DEQ and retained by the installer.
- Copies of any letters to/from the DEQ related to the project must be retained by the installer.

Waste tire baling entities[7]

- A copy of a waste tire baling plan must be submitted to the DEQ and maintained in the operating record.
- A copy of the project completion report must be submitted to the DEQ and retained by the entity.
- Copies of any letters to/from the DEQ related to the plan must be maintained in the operating record.

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[6] Records must be maintained by the entity for at least 3 years after completion of the project.

[7] Records must be maintained by the entity for at least 3 years after completion of the project.

Subchapter 23 - Regulated Medical Waste Facilities

- A copy of the approved certificate of need must be in the operating record.
- Copies of emergency response agreements must be maintained in the operating record.
- The operating record must include records of when waste was placed into and removed from storage.
- Records of any tests done on a regulated medical waste incinerator must be maintained in the operating record.
- Incinerator monitoring data must be maintained for at least 2 years. Such data includes waste feed rates, fuel and combustion gas flows, oxygen and carbon monoxide, and temperature.
- Testing and disposal records for incinerator ash must be maintained in the operating record.
- For regulated medical waste incinerators, an NHIW notification/certification form and associated documentation showing the ash is non-hazardous must be submitted to the DEQ.

Subchapter 25 - Closure and Post-Closure Care

- Copies of closure and post-closure plans, all amendments, maps, drawings, construction plans, QA/QC reports, legal access documents, etc. required by the plans must be submitted to the DEQ and maintained in the operating record. All correspondence to/from the DEQ related to the permit application must also be maintained in the operating record.
- Documentation of all activities performed for closure must be submitted to the DEQ with the final closure report and placed in the operating record.
- A copy of the land records notice as recorded must be submitted to the DEQ at the conclusion of closure activities.
- All correspondence to/from the DEQ related to closure and/or post-closure activities must be maintained in the operating record.
- No later than April 1st of each year, a post-closure maintenance and monitoring report must be submitted to the DEQ, and a copy placed in the operating record.
- At the conclusion of post-closure, a Certification of Post-closure Performance must be submitted to the DEQ.

Subchapter 27 - Cost Estimates and Financial Assurance

- Copies of all cost estimates and financial assurance documents must be submitted to the DEQ and maintained in the operating record. This includes all correspondence to/from DEQ related to these documents.
- When a surety bond, letter of credit, certificate of deposit, or insurance[8] is used as the financial assurance mechanism, an original and one copy of the instrument must be submitted to the DEQ.
- No later than April 1st of each year, life of site calculations must be submitted to the DEQ, identifying the life of the site as of December 31st of the previous year. The calculations must also be placed in the operating record. This includes all correspondence to/from DEQ related to this calculation.

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[8] The actual policy, not a certificate, must be submitted to DEQ.

- No later than April 1st of each year, cost estimates must be recalculated or adjusted for inflation, and the new figures submitted to the DEQ. The calculations must also be placed in the operating record. This includes all correspondence to/from DEQ related to this calculation.
- For all financial assurance mechanisms except the corporate test/guarantee and local government test/guarantee, no later than April 9th of each year, documentation must be submitted to the DEQ to demonstrate financial assurance mechanisms were updated and/or payments made based on the revised cost estimates. The documentation must also be placed in the operating record.
- If the corporate test/guarantee is used as a financial assurance mechanism, no later than 90 days after the end of the corporate fiscal year, the records identified in OAC 252:515-27-81(c) must be submitted to the DEQ and placed in the operating record.
- If the local government test/guarantee is used as a financial assurance mechanism, no later than 180 days after the end of the local government fiscal year, the records identified in OAC 252:515-27-82(h) must be submitted to the DEQ and placed in the operating record.

Subchapter 29 - Exclusion of Prohibited Wastes

- A copy of the Waste Exclusion Plan must be maintained in the operating record and submitted to the DEQ. This includes all correspondence to/from the DEQ related to the plan.
- Copies of all random inspections must be maintained in the operating record. Such records must include the date and time of the inspection, the name of the person conducting the inspection, and the results of the inspection.[9]
- No later than the next working day, the DEQ must be notified of any rejected loads.[10] The notification must include: (1) the date of rejection; (2) the name, address, and phone number of the waste generator; (3) the name of the driver; (4) transporter tag number and (5) transporter name, address, contact name, and phone number. This information must also be maintained in the operating record.
- When necessary, documentation to verify proper disposal of rejected wastes must be maintained in the operating record.
- Copies of personnel training must be maintained in the operating record.[11]

Subchapter 31 - NHIW Management

- Generators disposing of more than 10 cubic yards of NHIW per calendar month off site in an Oklahoma landfill must submit an NHIW Notification/Certification to the DEQ for each NHIW to be disposed.
- No later than the last day of the month, commercial landfills accepting NHIW must submit a report to the DEQ itemizing the type, quantity, and source of NHIW received from persons disposing of more than 10 cubic yards of NHIW the previous month. This report must also be maintained in the operating record.

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[9] Attachment 1 is an example of a random inspection sheet that will meet the requirements of the rule.

[10] Telephone notification will suffice.

[11] This includes the training dates, curriculum, and attendees.

XYZ LANDFILL
RANDOM WEP INSPECTION CHECKLIST [EXAMPLE]

Use checklist for all suspicious loads and for 5% of all incoming loads of solid waste.

Date: ________________ **Time:** ________________ **am/pm**

Customer Name: ____

Vehicle License Plate # and State:________________

Type of Waste (check all that apply):

- ☐ **Household**
- ☐ **Construction / Demolition**
- ☐ **Other** _____________________________
- ☐ **Commercial**
- ☐ **Industrial**

Identify All Unauthorized Wastes Present

- ☐ **Hazardous (corrosive, ignitable, reactive, TCLP toxic, or listed hazardous waste)**
- ☐ **Radioactive**
- ☐ **PCB**
- ☐ **Unauthorized Liquid**
- ☐ **Other** _____________________________
- ☐ **Untreated Regulated Medical**
- ☐ **Automobile Batteries**
- ☐ **Non-conforming NHIW**

Waste accepted?

- ☐ **Yes**
- ☐ **No**

If no, what was done with the waste?

Additional Comments

_____________________________ _____________________________

Inspector's Name (Print) **Driver's Name (Print)**

_____________________________ _____________________________

Inspector's Signature **Driver's Signature**

Notification of unauthorized waste:

☐ **DEQ Land Protection Division (405.702.5100)**
Name / Date
☐ **Waste Hauler**
Name / Date
☐ **Waste Generator**
Name / Date

Appendix C

Paint Filter Liquids Test Procedure

METHOD 9095B

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25 ^{o}C.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter -- Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 Glass funnel -- If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker -- 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, a knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

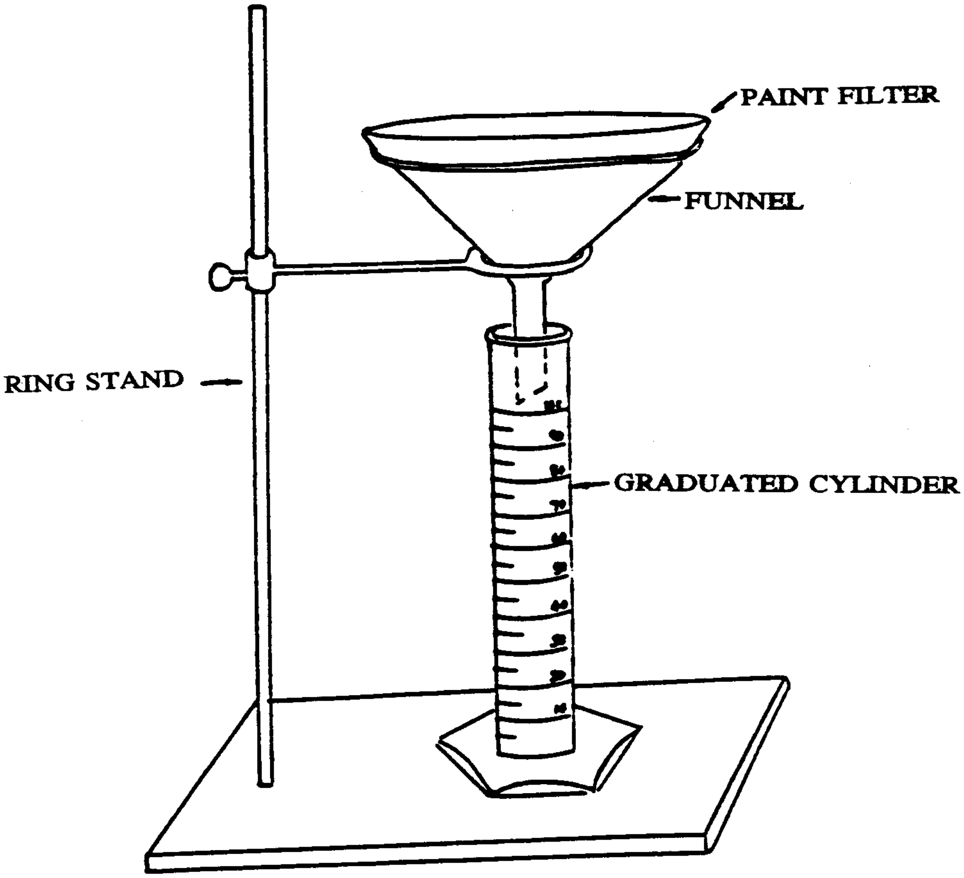
9.0 METHOD PERFORMANCE

9.1 No data provided.

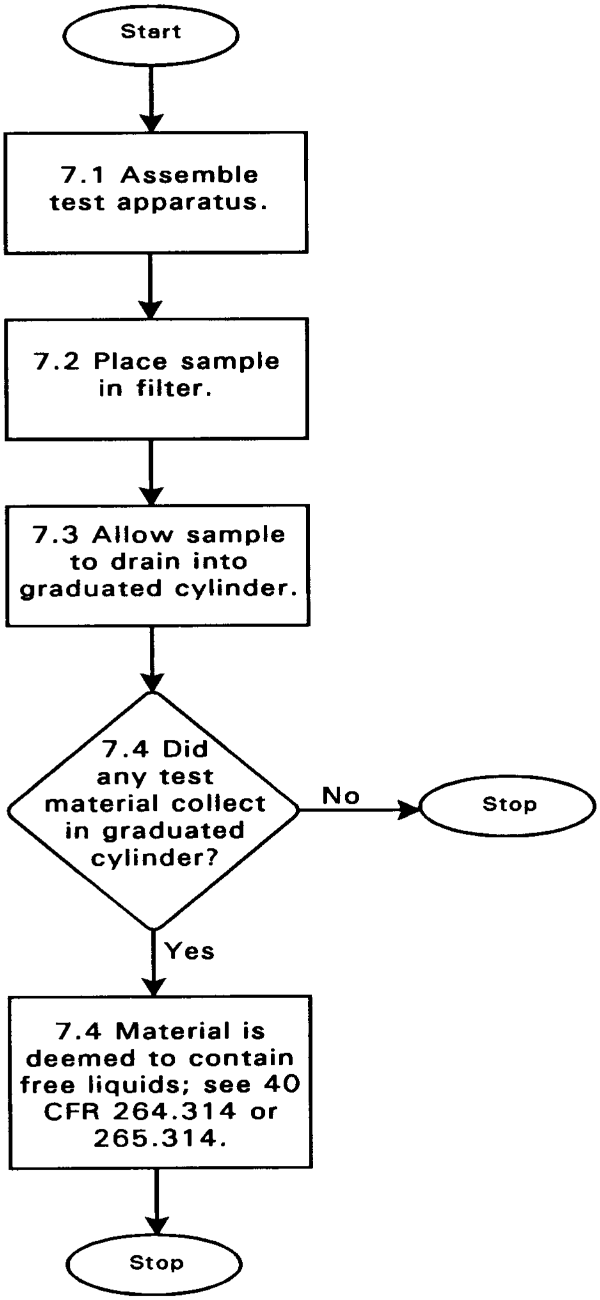
10.0 REFERENCES

10.1 None provided.

FIGURE 1
PAINT FILTER TEST APPARATUS



METHOD 9095B
PAINT FILTER LIQUIDS TEST



Appendix D

AEL Salvage and Recycling Plan

Salvage and Recycling Plan
American Environmental Landfill

American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

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Section Page

Attachments

1.0 INTRODUCTION

In accordance with OAC 252:515-19-39, the American Environmental Landfill (AEL) proposes the following Salvage and Recycling Plan detailing operations for conducting salvage and recycling activities at the permitted facility. A site location map depicting the salvage and recycling operation areas and the permitted areas of the landfill is included in Attachment A. Salvage and recycling activities will be conducted in an area away from the working face. The recycling area will be open for operation during normal operating hours of the landfill disposal facility. Traffic will follow patterns identified at the facility.

2.0 SALVAGE AND RECYCLING WORK PLAN

The following work plan details methods of collection and transportation of recyclable materials both to and from the disposal site. Recyclable materials will be collected by and transported to the disposal site by users of the facility. Upon arriving at the site, recyclable material will be weighed at the facility scale house and directed to the salvage and recycling area.

If material is identified at the working face of the landfill, as suitable and practicable for salvage and recycling activities, the recyclable materials will be removed by facility staff and taken to the salvage and recycling area. When the AEL has collected enough material for the market and there appears to be a financial benefit, the recyclable material will be weighed and transported to the appropriate vendor(s).

2.1 SALVAGEABLE AND RECYCLABLE MATERIAL

This salvage and recycling plan includes, but is not limited, to the following materials:

- Miscellaneous metal products, e.g., refrigerators, stoves, dryers, sheet metal, etc.
- Freon removed from the above recycled miscellaneous metal products, e.g., refrigerators, etc.
- Tires
- Wooden cross-ties
- Wood, e.g., tree limbs, stumps, branches, brush, lumber, pallets
- Uncontaminated rock, dirt, concrete, bricks, and solidified asphalt
- Other materials found appropriate to recycle and/or beneficial reuse

These materials will be sorted and stored in separate piles and will be spaced adequately to allow for a fire lane and allow for vehicle access. When storing tires, the facility should adhere to the Tire Fire and Mosquito Prevention Tips included in Attachment B. The storage of any putrescible wastes at the salvage and recycling area is not expected. The operation of this salvage and recycling area should not significantly add to the population of insects or animals not already present at the disposal facility. These recyclable materials are innocuous and will not negatively impact the environment. Freon removal from recycled metal products will be conducted by an AEL employee or third party licensed to remove Freon.

This plan allows for chipping, shredding, or grinding wood material to produce a product for beneficial reuse at the facility. Uncontaminated rock, dirt, concrete, bricks, and solidified asphalt found suitable for beneficial reuse by the facility may be used as daily and intermediate cover, erosion and run-on/off controls, site improvements, etc. Excessive wood material will be processed when sufficient volumes exist to constituent economic feasibility.

2.2 COLLECTED MATERIALS MANAGEMENT

The collected materials will be transported to the following applicable facilities or suitable equivalents:

- Miscellaneous metal products will be recycled by a metal recycling facility
- Freon will be transported to a refrigerant recycling facility
- Tires will be transported to a tire recycling facility
- Wooden cross-ties will be used by the AEL in the construction of site improvements
- Wood materials will be chipped and used in the construction of site improvements
- Uncontaminated rock, dirt, concrete, bricks, and solidified asphalt will be used by the AEL in the construction of site improvements

The collected materials will be stored in accordance with the following storage times per material:

- Miscellaneous metal products ~ 6-months
- Freon ~ 6-months
- Tires ~ 3-months
- Wooden Cross-ties – as-used
- Processed wood material ~ 3-months or as-used
- Uncontaminated rock, dirt, concrete, bricks, and solidified asphalt – as-used

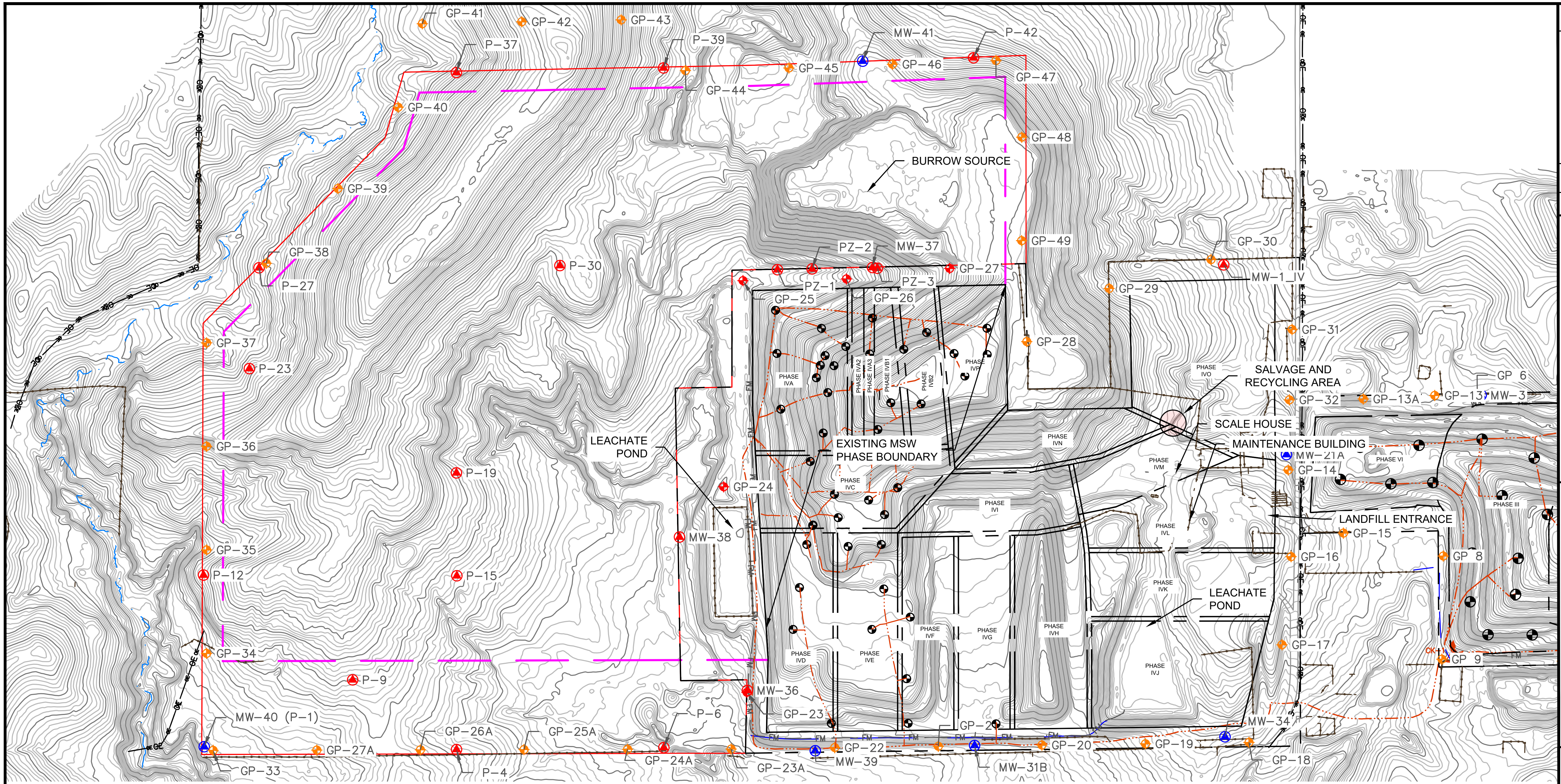
This salvage and recycling plan does not include any processing of waste at locations away from the facility. The landfill will accept source-separated recyclable materials if they pay the appropriate landfill fees. Material recycled by the facility will be weighed prior to transportation offsite or reuse.

2.3 SALVAGE AND RECYCLING DOCUMENTATION

On the monthly report to ODEQ, the AEL will submit the amount of material recycled and the date sent or used. A copy of this Salvage and Recycling Plan will be maintained at the AEL. Additions or changes to this plan will be maintained onsite and available for review upon request from ODEQ.

Attachment A

Salvage and Recycling Area



LEGEND:

- EXISTING 2' MINOR CONTOUR
- 1570 EXISTING 10' MAJOR CONTOUR
- EXISTING FENCE
- OE OE EXISTING OVERHEAD ELECTRIC
- EXISTING UNPAVED ROAD
- EXISTING PAVED ROAD
- EXISTING BODY OF WATER
- SOLID WASTE PHASE BOUNDARY
- SOLID WASTE PERMIT BOUNDARY
- ELECTRICAL CONDUIT
- FM FM LEACHATE FORCEMAIN
- LANDFILL GAS COLLECTION SYSTEM PIPING
- EXTRACTION WELL
- GAS PROBE
- MONITORING WELL
- MONITORING WELL ABANDONMENT
- GAS PROBE ABANDONMENT
- PROPOSED EXPANSION AREA PERMIT BOUNDARY
- PROPOSED LIMITS OF WASTE
- EXISTING STREAM
- SALVAGE AND RECYCLING AREA

NOTES:

1. AERIAL TOPOGRAPHY PERFORMED BY AERIAL DATA SERVICES, LLC ON JANUARY 27, 2023.
2. PROPOSED GAS PROBES AND MONITORING WELLS ARE DEPICTED WITHIN THE EXPANSION AREA

N

500 0 500 1000

SCALE FEET

REV.	DATE	DESCRIPTION	CK. BY
△			
△			
△			
△			
△			
△			

SHEET TITLE
SALVAGE AND RECYCLING AREA

PROJECT TITLE
AEL SALVAGE AND RECYCLING PLAN

CLIENT
AMERICAN ENVIRONMENTAL LANDFILL, INC.
AMERICAN ENVIRONMENTAL LANDFILL
SAND SPRINGS, OK

SCS ENGINEERS
8575 West 110th Street, Suite 100
Overland Park, Kansas 66210
PH. (913) 681-0030 FAX. (913) 681-0012

PROJ. NO. 27220345.00
DSN. BY: TWL
DWN. BY: TWL
CHK. BY: CF
Q/A RVW BY: WJM
PROJ. MGR WJM

CADD FILE: SITE LAYOUT FOR SALVAGE AND RECYCLING.DWG

DATE: 12/11/23

SCALE: 1"=500'

DRAWING NO. 1 of 1

Attachment B

Tire Fire and Mosquito Prevention Tips

Tire Fire Prevention Tips

Learn how to properly store youre tires to avoid hazards and reduce the risk of starting a fire.

Improper storage of tires can lead to large, uncontrollable fires that emit environmental pollutants such as hazardous gases, heavy metals, and oils. These fires often lead to neighborhood evacuations and contaminate air and waterways.

Do your part to avoid fires and store your tires correctly! Check out the tips below to get started.

Outdoor Storage (In accordance with 3405 IFC)

- Tire storage piles should be separated by a clear space of at least 40 feet.
- Tire piles should be located at least 50 feet from lot lines and buildings.
- Ensure that tire piles do not exceed 10 feet in height.
- Keep tire piles away from combustible ground vegetation such as weeds, grass, brush and forested areas.

Make sure to check local ordinances and codes to ensure you are storing tires appropriately.

Indoor Storage (In accordance with 3409 IFC)

- Always store tires on tread.
- Tire piles should not be more than 50 feet in length.
- Tires stored adjacent to or along one wall should not extend more than 25 feet from that wall.

Refrain from open burning, smoking, and operating cutting, welding, or heating devices in tire storage yards. (3404 IFC)

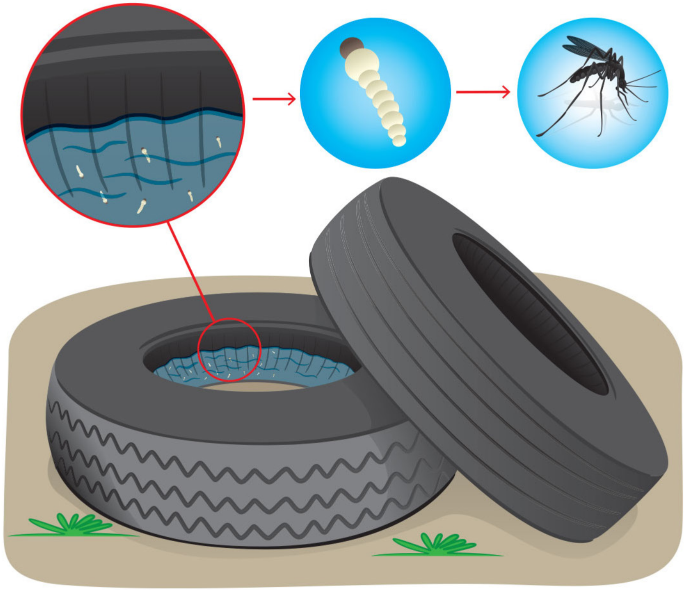
OKLAHOMA
DEPARTMENT OF ENVIRONMENTAL QUALITY

Have questions or want more information on tire storage or mosquitoes? Call the Tire Recycling Program at 405-702-5175.

Oklahoma Department
of Environmental Quality
PO Box 1677
Oklahoma City, OK 73101-1677
Land Protection Division 405-702-5100
Tire Recycling Program 405-702-5175

Mosquito Prevention

Store tires properly to reduce breeding opportunities for mosquitoes that may carry life-threatening diseases.



Tires make for perfect breeding grounds for mosquitoes.

Stagnant water and the collection of leaves offer great conditions for **thousands of mosquitoes to grow in one tire alone**.

Try to store all tires indoors or stack and cover them outdoors.

If this is not possible, attempt to drain water from tires after rain and use approved pesticides or sprays

Appendix J

Waste Exclusion Plan

Waste Exclusion Plan
American Environmental Landfill

AEL
American Environmental Landfill

American Environmental Landfill, Inc.
207 North 117th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
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913-681-0030

INDEX AND CERTIFICATION PAGE

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3.0	Waste Exclusion Procedures	2
4.0	Random Inspections	8
5.0	Personnel Training	2
	Appendices	~29

CERTIFICATION

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

Prepared by:

REGISTERED PROFESSIONAL ENGINEER
FLOYD E.
COTTER
17783
OKLAHOMA

5/30/24

Floyd Cotter, PE
SCS Engineers

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Appendices

1.0 INTRODUCTION

This Waste Exclusion Plan (WEP) is intended to assist the operators of American Environmental Landfill, Inc. in conducting sampling and analysis of waste at the American Environmental Landfill (AEL). The AEL is located near Sand Springs, Oklahoma in Sections 35 and 36, Township 20 North, Range 10 East, in Osage County, Oklahoma. The project site is on the Wekiwa Oklahoma 7.5 Minute USGS Quadrangle map. AEL is bordered by the Arkansas River to the South. The AEL operates under the Oklahoma Department of Environmental Quality (ODEQ) Permit Number 3557021.

The objective of the WEP is to outline the acceptance requirements and the review and approval process used to accept non-hazardous industrial solid waste (NHIW). This plan satisfies the requirements set forth in OAC 252:515-29.

1.1 WEP LOCATION

Complete copies of the WEP will be kept at appropriate locations. The primary location shall be in the scale house office which gate attendants, supervisors, managers, and other relevant personnel have access to.

The WEP must be maintained on file in the operating records of the facility and must be available for onsite review by regulatory authorities to demonstrate compliance with the requirements of Subchapter 29 (OAC 252:515-29).

1.2 WEP AMENDMENTS

Any changes that are made to the approved WEP need to be checked and accepted by the Oklahoma Department of Environmental Quality (ODEQ). The new (or modified) WEP that includes all plan amendments must be submitted within 30 days to the ODEQ for approval.

2.0 WASTE ACCEPTANCE GUIDELINES

Under solid waste disposal permit number 3557021, the AEL is permitted to accept and manage solid waste, non-hazardous industrial waste (both liquid and solid), and contaminated soil with no TPH restrictions. AEL also accepts municipal and industrial sludge, both friable and non-friable asbestos, and other non-hazardous industrial waste (NHIW). Municipal sewage sludge treated to Class B requirements, as described in 40 CFR 503.32(b), may be disposed at the AEL if the sludge passes the Paint Filter Liquids Test (PFLT).

All NHIW is profiled and approved prior to shipment. Transport is manifested and disposal is documented and reported to the Oklahoma Department of Environmental Quality (ODEQ).

2.1 ACCEPTABLE WASTES

Below is the definition of the wastes permitted for disposal at the AEL. These definitions should be used during the waste exclusion identification process.

Solid Waste – all putrescible and non-putrescible refuse in solid or semisolid form including, but not limited to, garbage, rubbish, ashes or incinerator residue, street refuse, dead animals, demolition waste, construction wastes, solid or semisolid commercial and industrial wastes.

Household Waste – any solid waste (including garbage, trash, and sanitary waste in septic tanks) derived from households, which can include single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds, and day-use recreation areas.

Commercial Solid Waste – all types of solid waste generated by stores, offices, restaurants, warehouses, and other non-manufacturing activities.

Construction and Demolition Waste – consists of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges.

Non-Hazardous Industrial Solid Waste (NHIW) – Means any of the following wastes deemed by the ODEQ to require special handling:

- unusable industrial or chemical products
- solid waste generated by the release of an industrial product into the environment
- solid waste generated by a manufacturing or industrial process

The term NHIW shall not include waste that is regulated as hazardous waste or is commonly found as a significant percentage of residential solid waste. Examples of NHIW are listed in Appendix A.

Contaminated Soil – Soils contaminated with concentrations of (TPH) < 1,000 ppm can be disposed in both pre-Subtitle D and Subtitle D areas of the landfill. Soils with TPH > 1,000 ppm are allowed only in Subtitle D areas.

***Sludge* (municipal and industrial)** – Any solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility exclusive of the treated effluent from a wastewater treatment plant. Municipal sewage sludge must be treated to Class B requirements as described in 40 CFR 503.32(b) and pass the PFLT.

Non-Friable Asbestos – any material that contains more than one percent asbestos but cannot be pulverized under hand pressure.

Friable Asbestos – includes any material that contains more than one percent asbestos by weight or area, depending on whether it is a bulk or sheet material and if it can be crumbled, pulverized, or reduced to powder by the pressure of an ordinary human hand. The friable asbestos disposal location, depth, coordinates, and volume must be marked on a map or diagram and placed in the operating record.

Liquid Wastes – Liquid or semi-solid wastes accepted at the facility include, but are not limited to: industrial waste (cooling fluids, cutting oils, rinse water), latex paint, ink, food production waste, municipal waste (tank bottoms, sludges) and drilling waste, among others. Liquid waste is placed into buried containers over a lined area and mixed with bulking material in order to convert the liquid into a solid form that can be accepted for disposal at the landfill.

Special Wastes – Wastes that are non-hazardous wastes, but which, because of their nature or volume, process-generating waste, require special or additional handling aside from that given to routine household refuse. Appendix A presents a list of the wastes that fall under the “special waste” category and it provides the recommended management options for such wastes.

Other – Any NHIW or other wastes that have been deemed by the ODEQ as non-hazardous and can be disposed in an MSWLF.

2.2 PROHIBITED WASTE

Below is the definition of the wastes prohibited for disposal at the AEL. These definitions should be used during the waste exclusion identification process. Please refer to Appendix A and Appendix B for a detailed description, handling procedures, and examples of prohibited wastes.

Hazardous Waste – Includes all the wastes subject to regulation under OAC 252-205. Hazardous wastes may be gases, liquids, solids, or sludges that are listed or exhibit the characteristics described in 40 CFR Part 261. Household hazardous wastes are excluded from Subtitle C regulation; therefore, these wastes may be accepted for disposal at an MSWLF unit. Examples of other classes of solid wastes that are excluded from regulation as hazardous waste under 40 CFR §261.4(b) and may be accepted for disposal at an MSWLF unit can be found in Appendix B. For a comprehensive list of hazardous wastes that shows the exact conditions under which these wastes are excluded from regulation refer to 40 CFR 261.4(b). A detailed hazardous waste identification process is provided in Appendix B.

Radioactive Waste – Waste with radioactivity

Regulated Medical Waste - any waste or reusable material that contains an etiologic agent and is generated in the diagnosis, treatment, or immunization of human beings or animals

Regulated Polychlorinated Biphenyl (PCB) Waste – PCB waste containing PCB concentrations greater than or equal to 50 ppm and may be liquids or non-liquids, sludges, or solids that are defined at 40 CFR Section 761.60. PCB wastes do not include small capacitors found in fluorescent light ballast, white goods, (e.g., washers, dryers, refrigerators), or other consumer electrical products (e.g., radio and television units).

2.3 ANALYTICAL AND SAMPLING REQUIREMENTS

In order to determine whether a material should be considered hazardous or non-hazardous waste, certain analytical tests might be required. The type of analysis is dependent on the waste stream to be disposed. The analyses must always be conducted in accordance with the EPA test procedures outlined in “Test Methods for Evaluation of Solid Wastes, Physical/Chemical Methods” (EPA Publication Number SW-846), “Methods for Chemical Analysis of Water and Wastes” (EPA-600/4-79-020), American Society of Testing and Materials (ASTM) Standard Methods or any other approved EPA method.

Methods used to determine if wastes are hazardous based on the characteristics they exhibit are indicated in Appendix B. A method used to determine the toxicity characteristic of wastes is the Toxicity Characteristic Leaching Procedure (TCLP). The TCLP limits for which a waste can be regulated are shown in Appendix C.

Other testing parameters suggested for various typical wastes include, but are not limited to, pH, flashpoint, reactive cyanide, reactive sulfide, paint filter, total petroleum hydrocarbons, TCLP for metals, TCLP for volatiles, TCLP for semi-volatiles, TCLP for herbicides/pesticides, PCBs, etc. It is the responsibility of the assigned landfill personnel to decide the testing requirements based upon a case-by-case basis.

The analytical data should include information on the reference methods employed for the analysis, and such methods need to be EPA/ODEQ approved. Additionally, Quality Assurance/Quality Control (QA/QC) information should include sampling handling, containerization and preservation techniques, chain of custody records, data on standards, duplicate analysis, spikes and blanks, and other pertinent statistical information.

The analytical methods must be performed using “representative samples” collected through accepted sampling methods as described in SW-846 or other approved references.

3.0 WASTE EXCLUSION PROCEDURES

The acceptance of NHIW at AEL will follow the waste exclusion guidelines and procedures outlined in this section to prevent the disposal of prohibited wastes.

3.1 NOTIFICATION TO GENERATORS AND HAULERS

Generator and hauler inquiries can be directed to the gate attendant, waste coordinator, or other personnel at the facility who have received appropriate training (as specified in Section 5.0). When requested, AEL personnel will supply generators with the necessary forms and any additional analytical requirements prior to acceptance of the NHIW in the facility.

3.2 WASTE EVALUATION AND IDENTIFICATION

OAC 252:515-31 places the burden of NHIW identification on the generators. NHIW intended to be disposed at AEL must be properly identified by the generators as non-hazardous by using appropriate chemical analysis and/or process knowledge. Generators need to submit an NHIW Certification form to the ODEQ, included in Appendix D, which indicates the NHIW is a non-hazardous waste. The ODEQ may require the generator to provide additional documentation in support of the certification.

A copy of the certification form and accompanying supplemental documentation that was submitted to the ODEQ (see Appendix D) needs to be presented to AEL by the generator or hauler prior to disposal of NHIW. Additionally, prior to waste disposal at the landfill, NHIW generators shall also complete the Waste Profile Form included in Appendix D. The Compliance Officer shall complete the Post Review Profile Checklist included in Appendix D for each Waste Profile received.

Each incoming NHIW load must be evaluated to verify whether it is acceptable for disposal at the facility or not. The Waste Profile Form will be reviewed to determine the waste acceptability. The criteria for waste acceptance or rejection will be based on the classification and characteristics of the waste as reported in the Waste Profile Form. Section 2.0 of the WEP provides a description of the wastes that are permitted and prohibited at AEL. A list of examples of acceptable NHIW and special wastes is given in Appendix A. Some categories of hazardous wastes, that can be accepted in an MSWLF because they are excluded from hazardous waste regulations, are shown in Appendix B.

Wastes that are not included in the Appendices can be evaluated using information about the waste as well as the process generating the waste. Examples of such information include, but are not limited to: Material Safety Data Sheets (MSDS), laboratory analysis (e.g. a total metals analysis that can show the metals of concern are not present in the waste), process knowledge, manufacturer's literature, or other means necessary to evaluate and/or analyze the waste and determine its suitability for disposal at the landfill.

When using process knowledge to address one or more NHIW evaluation criteria, the following information shall be documented:

- Waste description, including all waste components and sources
- Description indicating the reason for discarding the material
- Description of changes in the generation process
- Required analysis (if any)

Analytical data review is usually necessary when either of the following occurs:

- A new generator has submitted a request for waste disposal at the landfill
- An existing generator has submitted a request for disposal of a new waste stream
- When an owner/operator becomes aware of a change in the process generating waste

The landfill will periodically re-evaluate approved NHIW waste streams and update waste identification information. The frequency of testing required of the generator will be at the discretion of the owner/operator based on the size and variability of the waste stream, but it will not exceed once every three years.

3.3 WASTE EVALUATION PERSONNEL

Only trained personnel will be responsible for the evaluation and documentation of NHIW loads entering the facility. Examples of trained personnel include:

- General manager
- Foreman
- Scale house attendants
- Compactor operator
- Any other trained personnel approved by the manager

The personnel in charge of waste evaluation and documentation will be trained following the guidelines presented in Section 5.0 and will complete a training refresher course at least once a year.

3.4 GATE ACCEPTANCE PROCEDURES

The gate attendant or scale operator should complete the Gate Attendant Checklist presented in Appendix D for every NHIW load entering the facility. The responsibilities of the gate attendant include, but are not limited to:

- Verify that the Waste Profile Form and any other required state or federal approvals are on file for the generator
- Check the volume of the incoming load
- Check that the information in the manifest agrees with the Waste Profile Form
- Verify that all signatures are in place as required, and the signed manifest is placed in the site operating record

A Manifest Checklist is provided in Appendix D and shall be utilized for every NHIW load entering the facility.

4.0 RANDOM INSPECTIONS

This Section presents the procedures for performing random inspection. Random inspections are conducted by properly trained personnel. Additionally, trained personnel shall be on-site during all hours the facility is open to accept waste.

4.1 PROCEDURES FOR RANDOM INSPECTIONS

Random inspections of waste are conducted at a minimum of 1 load every 2 weeks. Drivers of vehicles who are randomly selected for inspections are directed to the inspection area by the scale house attendant or site personnel. The load is then inspected by site personnel who have undergone WEP Training. Site personnel will inspect the waste and complete the Random Waste Screening Inspection Form provided in Appendix D.

Inspection priority can be given to haulers with unknown service areas, to loads brought to the facility in vehicles not typically used for disposal of municipal solid waste, and to loads transported by previous would-be offenders. For wastes of an unidentifiable nature received from sources other than households (e.g., industrial or commercial establishments) the inspector should question the transporter about the source/composition of the materials.

Loads should be inspected prior to the actual disposal of the waste at the active face of the landfill unit to provide the facility owner or operator the opportunity to refuse or accept the waste. Visual inspections may also occur near the facility scale house, inside the site entrance, or near to, or adjacent to, the active face of the landfill unit. Inspections of materials may be accomplished by discharging the vehicle load in an area designed to contain potentially hazardous wastes that may arrive at the facility. The waste should be carefully spread for observation using a front-end loader or other piece of equipment.

Personnel should be trained to identify suspicious wastes. Some indications of suspicious wastes are:

- hazardous placards or marking
- liquids
- powders or dusts
- sludges
- bright or unusual colors
- drums or commercial-size containers
- chemical odors

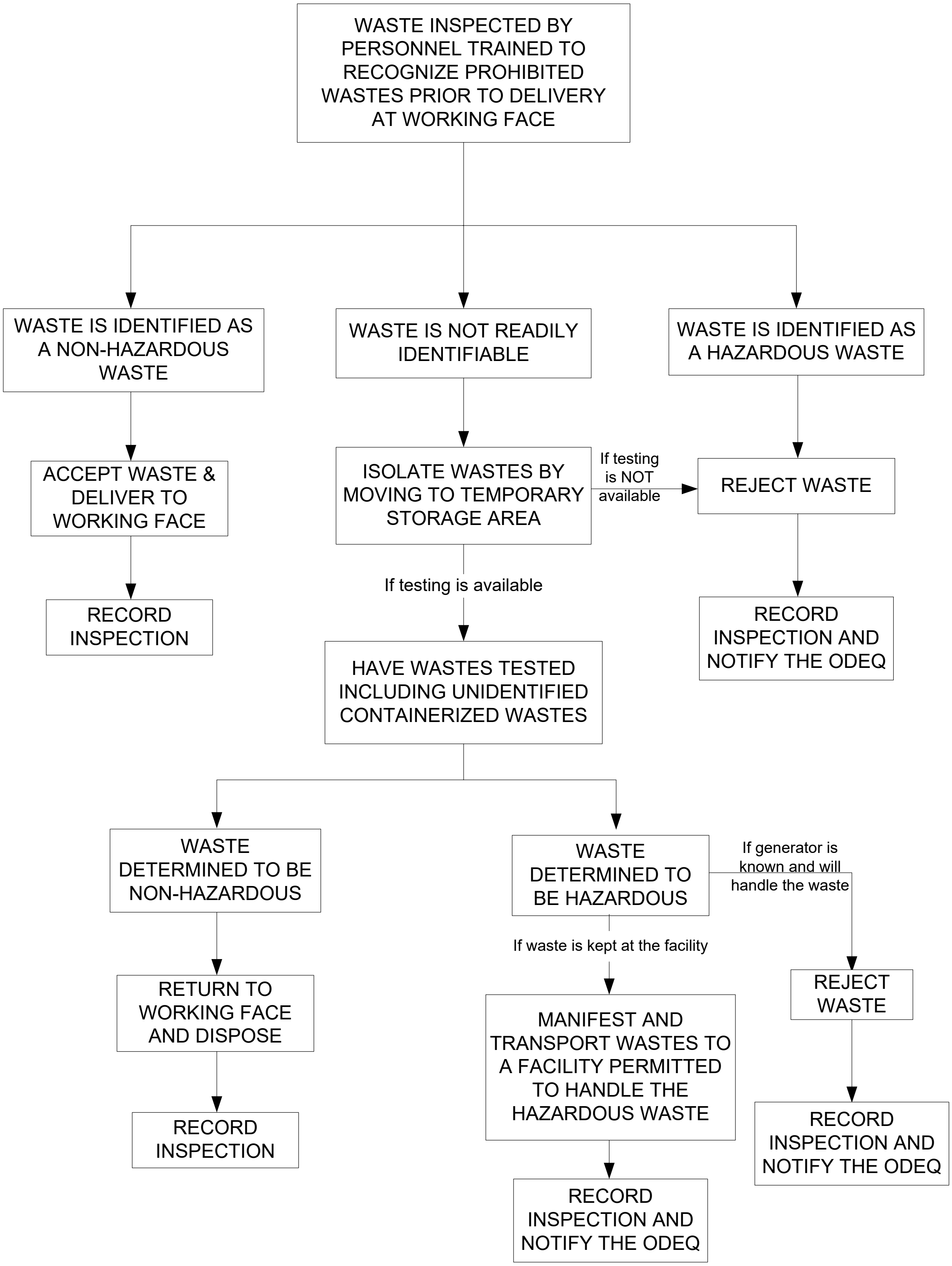
Containers with contents that are not easily identifiable, such as unmarked 55-gallon waste drums, should be opened only by trained personnel. Because these drums could contain hazardous waste, they should be refused whenever possible. Upon verifying that the solid waste is acceptable, it may then be transferred to the active face for disposal.

When prohibited wastes are discovered during an inspection, the wastes should be rejected prior to disposal at the active face of the facility. If such wastes are found after disposal in the landfill, they should be properly managed. If wastes temporarily stored at the site are determined to be hazardous, the owner or operator is responsible for the management of the waste. Guidelines for appropriate management of rejected and prohibited wastes are provided in this section. Whenever prohibited wastes are found and/or rejected, the Waste Rejection Form found in Appendix D must be completed and the waste must be reported to the ODEQ.

If the random inspections indicate unauthorized wastes are being brought to the MSWLF site, then the random inspection program should be modified to increase the frequency of inspections.

An inspection flow chart to identify, accept, or refuse solid waste is provided below:

Prohibited Waste Decision Tree



4.2 INSPECTION RECORDS

All inspections performed shall be documented and recorded in Attachment D. At a minimum, the inspection report shall include:

- Date and time of the inspection
- Person conducting the inspection
- Results of the random inspection

ODEQ shall be notified by the end of the next working day of:

- Any waste identified and rejected prior to receipt as a prohibited waste
- Any load identified and rejected at the gate, during random inspections, or upon disposal at the active face, as a prohibited waste

Notification of rejected waste shall describe the reason for rejection and include:

- Date of rejection
- Name, address, phone number, and contact person of the waste generator (when such data can be obtained)
- Name of the driver, tag number of the vehicle, carrier name, address, phone number, and contact person (when such data can be obtained)

4.3 PROPER STORAGE AND DISPOSAL OF REJECTED WASTE

Any incoming load can be subject to inspections either based on an established random inspection schedule or due to suspicions regarding the nature of the waste, the generator, or the transporter. If the waste does not pass the inspections, i.e., prohibited, unknown, or suspicious wastes are found during the inspection, then the owner, operator, or assigned personnel can refuse to accept the waste at the facility, and the waste will remain the responsibility of the transporter. As a minimum response procedure, the landfill personnel should implement the following steps to deal with rejected or prohibited wastes encountered at the facility:

- Segregate the wastes
- Question the driver
- Contact possible source
- Call the appropriate State or Federal facility for disposal
- Use appropriate protective equipment
- Contact laboratory support if required

- Notify a response agency if necessary

If the owner or operator is unable to identify the transporter who brought the hazardous waste, the owner or operator must ensure that the waste is managed in accordance with all applicable Federal and State regulations. If the wastes are to be transported from the facility, the waste must be: (1) stored at the MSWLF facility in accordance with applicable regulations (2) manifested, (3) transported by a licensed transporter, and (4) sent to a permitted Treatment, Storage, or Disposal (TSD) facility for disposal. These requirements are discussed further in this section.

Operators of MSWLF facilities should be prepared to handle hazardous wastes that are inadvertently received at the MSWLF facility. This may include having containers such as 55-gallon drums available on-site and retaining a list of names and telephone numbers of the nearest haulers licensed to transport hazardous waste. Hazardous waste may be stored at the MSWLF facility for 90 days, provided that the following procedures required by 40 CFR §262.34, or applicable State requirements, are followed:

- The waste is placed in tanks or containers
- The date of receipt of the waste is clearly marked and visible on each container
- The container or tank is marked clearly with the words "Hazardous Waste"
- An employee is designated as the emergency coordinator who is responsible for coordinating all emergency response measures
- The name and telephone number of the emergency coordinator and the number of the fire department are posted next to the facility phone

Extensions to store the waste beyond 90 days may be approved pursuant to 40 CFR 262.34.

If the owner or operator transports the wastes off-site, the owner or operator must comply with 40 CFR Part 262 or the analogous State requirements. The owner or operator is required to:

- Obtain an EPA identification number (EPA form 8700-12 may be used to apply for an EPA identification number)
- State or Regional personnel may be able to provide a provisional identification number over the telephone
- Package the waste in accordance with Department of Transportation (DOT) regulations under 49 CFR Parts 173, 178, and 179 (the container must be labeled, marked, and display a placard in accordance with DOT regulations on hazardous wastes under 49 CFR Part 172)
- Properly manifest the waste by designating a permitted facility to treat, store, or dispose the hazardous waste

If the owner or operator decides to treat, store (for more than 90 days), or dispose the hazardous waste on-site, he or she must comply with the applicable State or Federal requirements for hazardous waste treatment, storage, and disposal facilities. This may require a permit.

PCB wastes containing more than or equal to 50 ppm PCB concentrations detected at an MSWLF facility must be stored and disposed according to 40 CFR Part 761. The owner or operator is required to:

- Obtain an EPA PCB identification number
- Properly store the PCB waste
- Mark containers or items with the words "Caution: contains PCBs"
- Manifest the PCB waste for shipment to a permitted incinerator, chemical waste landfill, or high-efficiency boiler (depending on the nature of the PCB waste) for disposal

The proper disposition/remediation of the prohibited waste will be specific to the waste and implemented upon occurrence and approval by the ODEQ.

Verification of proper disposal of the prohibited waste will be submitted to the ODEQ and a copy will be maintained in the operating record of the facility.

4.4 NHIW TRACKING DOCUMENT OR MANIFEST

Records shall be maintained in the operating record itemizing the type, quantity, and source of NHIW received from persons disposing greater than 10 cubic yards of NHIW in a calendar month. Such records shall be submitted to the ODEQ no later than the last day of the month following the reporting month. A copy of the NHIW Tracking Document is included in Appendix D.

5.0 PERSONNEL TRAINING

All gate attendants and disposal facility operators shall receive an initial 8 hours of basic training and at least 4 hours per year of annual refresher training in waste exclusion and radioactivity, as related to the WEP. Documentation of WEP training shall be kept within Appendix E of the WEP.

The training program should emphasize methods to identify containers and labels typical of hazardous waste and other prohibited wastes. Training also should address hazardous waste handling procedures, safety precautions, and recordkeeping requirements. This information is provided in training courses designed to comply with the Occupational Safety and Health Act (OSHA) under 29 CFR §1910.120. Information covered in these courses includes regulatory requirements under 40 CFR Parts 260 through 270, 29 CFR Part 1910, and related guidance documents that discuss such topics as general hazardous waste management; identification of hazardous wastes; transportation of hazardous wastes; standards for hazardous waste treatment; storage and disposal facilities; hazardous waste worker health and safety training; and monitoring requirements.

5.1 CURRICULUM

The training program should include, as a minimum, the following topics:

- Overview of RCRA and Subtitles C and D Programs
- Regulations and procedures for NHIW acceptance and exclusion
- Waste identification and evaluation, including:
    - Methods to identify containers and labels typical of hazardous, radioactive, PCB, infectious biomedical, and asbestos wastes
    - Methods to identify hazardous wastes and exclusions
    - Basics about the chemistry related to the physical characteristics of wastes
- Waste approval procedures
- Waste rejection procedures
    - Notifications of rejected wastes
    - Storage, disposal, and verification of disposal of rejected/prohibited wastes
- Waste inspections
- Overview of analytical methods, including:
    - Type of testing required for the characterization of different wastes
    - Type of information that should be included in test/laboratory reports
    - Interpretation of analytical test results
    - Significance of laboratory QA/QC procedures
- Record keeping
    - Type of information required to be recorded
    - Monthly reports requirements
    - Procedures for submission of records to State Agencies
- Regulatory procedures for proper notification, certification, and handling of NHIW
- Facility's approved programs regarding PCB, radioactive, asbestos, medical wastes, and other prohibited wastes exclusion

- Sources of alpha, beta, and gamma radiation and radiation safety
- Overview of WEP implementing procedures

5.1.1 **Regulatory Definitions**

Waste is considered hazardous if any of the following criteria are met:

- Ignitability – flash point below 140°F
- Corrosivity – pH < 2 or pH > 12.5
- Reactivity – normally unstable and readily undergoes violent change
- Toxicity – Toxicity Characteristic Leaching Procedure (TCLP) exceeds “Rule of Twenty”

Radioactive Material - any solid, liquid, or gas that emits radiation spontaneously.

Polychlorinated Biphenyls (PCB) Waste – any waste containing PCB concentrations greater than or equal to 50 ppm.

Regulated Medical Waste – any waste or reusable material that contains an etiologic agent and is generated in the diagnosis, treatment, or immunization of human beings or animals; research pertaining to the diagnosis, treatment, or immunization of human beings or animals; or the production or testing of biological products.

Friable Asbestos – any material containing > 1% asbestos, which when dry can be crumbled, pulverized, or reduced to powder by hand.

Nonfriable asbestos – any material containing > 1% asbestos, which when dry cannot be crumbled, pulverized, or reduced to powder by hand.

Liquid waste – any waste material that is determined to contain “free liquid” as defined by the paint filter test.

Special Waste - any wastes that are not hazardous wastes but which, because of their nature or volume, require special or additional handling aside from that given to routine household refuse. This includes but is not limited to sludge, septic tank sludge, grease trap wastes, dead animals, packing house offal and tankage, waste fats and oils, hatchery wastes, cannery waste, process residue and waste, incinerator ash or residue, tires, chemical waste, nonfriable asbestos wastes, spent herbicide and pesticide containers.

Appendix A

Examples of Non-Hazardous Industrial Waste Special Waste and Management Options

Examples of Non-Hazardous Industrial Waste

1. Air pollution control equipment residues
2. Arsenically-treated wood that meets the exemption criteria of 40 CFR 261.4(b)(9)
3. Auto shredder fluff
4. Blasting media and other abrasives used to remove surface coatings
5. Coal combustion ash per 40 CFR 261.4(b)(4)
6. Combustible materials as defined in 49 CFR 173.120 and 173.124, that are not regulated as hazardous wastes
7. Containers that are RCRA empty in accordance with 40 CFR 261.7, or empty containers which have held pesticides (i.e., herbicides, fungicides, or rodenticides)
8. Cooling tower waters and other cooling process-related wastes
9. Incinerator ash
10. Industrial sludges and industrial mud trap residues
11. Industrial wastewater treatment plant sludge (excluding sludge that is exclusively sanitary sewage)
12. Ink wastes
13. Lab-related wastes, including lab packs
14. Lighting fixture ballasts containing non-TSCA regulated PCBs per CFR Part 761
15. Miscellaneous chemical spill residue, primarily non-fuel-related
16. Municipal and non-industrial wastewater treatment plant sludges
17. Non-hazardous pesticides (i.e., herbicides, fungicides, & rodenticides)
18. Oil filters meeting the requirements of 40 CFR 261.4(b)(13)
19. Outdated and off-specification products
20. Outdated, off-specification, or mislabeled over-the-counter medicines that are not hazardous in accordance with 40 CFR 261, Subparts C or D
21. Paint waste and related solvents
22. Petroleum-contaminated soil and debris, oily rags and absorbents with > 1000 ppm TPH
23. Pharmaceutical waste not identified in (20)
24. Refractory & foundry sands and slag, retort, fly ash, cement kiln dust
25. Resins, polymers, and adhesives
26. Sludges containing materials washed from the interior of bulk materials carriers such as tank trucks or railroad tank cars
27. Wastes exempted by the RCRA Bevill waste exclusion in 40 CFR 261.4(b)(7)
28. Wastes rendered non-hazardous that were formerly hazardous pursuant to 40 CFR 261, Subpart C
29. Unknowns
30. Wastes from metal plating processes

Special Waste and Management Options

Waste Type	Management Option
Car wash sumps	Waste from car wash sumps may be accepted without any special testing. Car wash sumps must be bulked in accordance with the facility's liquid bulking plan and pass the Paint Filter Liquid Test (PFLT).
Dry cleaning wastes	Filters and sludges from CESQG should not be accepted for disposal without confirming generators have complied with all requirements specified under State regulations and the waste has been approved for disposal by the facility.
Empty drums	Drums must contain less than 1 inch of product and the bung should be removed. Drums should be crushed prior to disposal. Clean drums (triple-rinsed by generator) in good condition can be stockpiled for reuse as waste containers, used oil storage containers, or recycled.
Floor sumps	All sump wastes must be screened, managed, and disposed in accordance with an approved permit. Floor sumps must be bulked in accordance with the facility's liquid bulking plan and pass the PFLT.
Fluorescent tubes/ ballasts	Fluorescent light tubes contain mercury and may exhibit hazardous waste characteristics (D009). Generators must manage fluorescent light tubes under the Universal Waste Rule and cannot dispose in the landfill if the material tests hazardous. Ballasts manufactured before 1979 may contain small quantities of PCBs. Fluorescent tubes and ballasts may be accepted from households, but cannot be accepted from CESQGs if they are hazardous or contain PCBs ≥ 50ppm. If the ballasts are suspected of containing PCBs, they should be placed in a bucket and mixed with cement prior to disposal.
Grease trap wastes	Grease trap wastes must be bulked in accordance with the facility's liquid bulking plan and pass the PFLT. Generators should be encouraged to recycle this waste.
Grit and bar screen wastes	These wastes must pass the PFLT and must be covered immediately.
Infectious/ Non-infectious/ Red bag waste	Infectious wastes from hospitals, medical clinics, mortuaries, health care units, dental offices, etc. should not be accepted unless properly treated. Non-infectious waste can be containerized in a properly labeled red bag. "Sharps" (needles, syringes, scalpels) should be placed in rigid containers with lids (i.e. 5-gallon plastic buckets or plastic milk jugs) and must be encapsulated in a mixture that will solidify.
Lab chemicals	Laboratory chemicals should not be accepted for disposal without confirming generators have complied with all requirements and the waste has been approved for disposal at the facility.
Latex/oil base paints and cans	Empty cans can be crushed and disposed. Small volumes of paint from households should be absorbed, dried, or solidified prior to disposal.
Lead-acid batteries	Lead-acid batteries should be stockpiled for recycling in an upright, non-leaking position, no more than 2 batteries high, on a pallet. **Lead Batteries, which are not household hazardous waste, MAY NOT be disposed in a landfill*
Liquids.	Bulk or non-containerized liquid waste may not be placed in landfills unless: (1) The waste is household waste other than septic waste; or (2) The waste is leachate or gas condensate derived from the MSWLF which is designed with a composite liner and leachate collection systems; or (3) The waste is sufficiently bulked with soil or other previously approved bulking agent to pass the PFLT prior to disposal. A container holding liquid waste may not be placed in an MSWLF unless: (1) the container is a small container similar in size to that normally found in

	household waste; (2) the container is designed to hold liquids for use other than storage; or (3) the waste is household waste. Class B municipal sewage sludge passing the PFLT may be co-disposed in an MSWLF which is in compliance with OAC 252:515 **Liquid waste MAY NOT be directly disposed in the working face of the landfill. They should be bulked in accordance with the approved liquid bulking plan prior to disposal.*
PCB wastes	Electrical transformers and soils contaminated with PCBs must have concentrations below 50 ppm and generators have complied with all requirements and the waste has been approved for disposal at AEL.
Pesticide containers	Pesticide containers must be empty, triple-rinsed, and punctured. The containers should be crushed prior to disposal
Petroleum contaminated waste	Petroleum-contaminated soil and debris, oily rags and absorbents can be disposed as de minimis waste if the TPH level is < 1,000 ppm.
Sewage treatment plant sludges	Sludges must be treated to Class B requirements, pass the PFLT, and be tested for hazardous waste characteristics using the TCLP. Sludges that are accepted for disposal must be covered immediately. Properly treated sludges may be suitable for use as soil supplements in reclaimed areas. Please contact the ODEQ regarding specific requirements. NOTE: Prior approval must be obtained from the department for any sludge management plan.
Tires	Whole tires should be placed at the bottom of the working face.
Treated wood	Railroad ties, bridge timbers, fence posts, telephone poles, and other materials treated with pentachlorophenol, creosote, or arsenic may exhibit hazardous waste characteristics (D004, D023, D024, D025, D026, D037). However, if the treated wood is quite old, it may be reasonable to assume that it will not exhibit these characteristics and that it may be accepted for disposal without testing. If new and not exempt, recently treated wood waste should be analyzed for hazardous waste characteristics.
Used oil	Used oil may not be accepted from do-it-yourself oil changers for recycling or emergency recovery (burning in a space heater) unless the landfill has an approved recycling plan. Used oil should not be accepted from local businesses. Oil storage should occur in an approved and labeled barrel or tank with secondary containment. Other used oil materials classified as NHIW such as tank bottoms, etc, can be accepted at the landfill but should be first managed in the solidification area. **Used oil MAY NOT be directly disposed in the working face of the landfill. The material should be bulked in accordance with the approved liquid bulking plan prior to disposal.*
Used oil filters	Used oil filters must be drained of all free liquids prior to disposal. NOTE: Spin-on used oil filters must be punctured or crushed to be exempt from a hazardous waste classification. Otherwise, they must be tested.
Water treatment sludges	Sludges must pass the PFLT or should be handled in accordance with the liquid bulking plan approved in the facility's permit.
White goods containing CFCs	If chlorofluorocarbons (CFCs) have been removed from the white good (refrigerator, freezer, or air conditioner), they can be stockpiled for recycling or crushed and disposed. If the CFCs have not been removed from the white good, they must be rejected or stockpiled in a separate area for removal of CFCs at a later date.
Wood and coal ashes	Hot and coal ashes (including fly ash and bottom ash) should be placed in a separate area where they can be spread out by landfill equipment and fully cooled prior to disposal.

*PFLT – Paint Filter Liquid Test (EPA Method SW-846/9095)

Appendix B

Hazardous Waste Identification (HWID) Process

Hazardous Waste Identification (HWID) Process

The Environmental Protection Agency (EPA) regulates all waste in the United States under the Resource Conservation and Recovery Act (RCRA). The three programs established under RCRA are Solid Waste (Subtitle D), Hazardous Waste (Subtitle C), and Underground Storage Tanks (USTs). RCRA Subtitle C establishes a federal program to manage hazardous wastes from cradle to grave. That includes regulations for the generation, transportation, treatment, storage, or disposal of hazardous wastes.

The term “hazardous waste” means a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

- Cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness
- Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed, or otherwise managed

Proper hazardous waste identification (HWID) is essential to ensure the proper handling and disposal of waste; however, this can be a complex task. Therefore, the best approach for the identification of hazardous wastes consists of answering the following four questions:

- Is the material a *solid waste*? (See: *40 CFR Part 261.2*)
- Is the waste *specifically excluded from RCRA*? (*40 CFR Part 261.4*, See examples in Appendix A).
- Is the waste a *listed hazardous waste*? (*40 CFR Part 261.30*)
- Does the waste exhibit a *characteristic of hazardous waste*? (*40 CFR Part 261.20*)

The subsequent sections examine these key questions.

SOLID WASTE

The Subtitle C program uses the term solid waste to denote something that is a waste. In order for a material to be classified as hazardous waste (HW), it must first be a solid waste. The statutory definition points out that whether a material is a solid waste is not based on the physical form of the material (i.e., whether or not it is a solid as opposed to a liquid or gas), but rather that the material is a waste. The regulation further defines solid waste as any material that is discarded by being either: abandoned, inherently waste-like, a certain military munition, or recycled.

Once the material has been identified as a solid waste, then it can be classified as either hazardous or non-hazardous waste. Following the HWID process, the next step is to determine whether the solid waste in hand is subject to any sort of exclusions from the definition of hazardous waste, as described in the next section.

WASTES EXCLUDED FROM RCRA SUBTITLE C REGULATION

Not all RCRA wastes qualify as hazardous wastes. There are four categories excluded from being considered a RCRA hazardous waste. If the waste fits one of these categories, it is not regulated as a RCRA hazardous waste, and the hazardous waste requirements do not apply.

Below are some of the exclusions from the definition of solid waste:

- Domestic sewage and mixtures of domestic sewage
- Industrial wastewater discharges (point source discharges)
- Irrigation return flows
- Radioactive waste
- In-situ mining waste
- Pulping liquors
- Spent sulfuric acid
- Closed-loop recycling
- Spent wood preservatives
- Coke by-product wastes
- Splash condenser dross residue
- Recovered oil from petroleum refining operations
- Condensates from Kraft mill stream strippers
- Comparable fuels
- Processed scrap metal
- Shredded circuit boards
- Mineral processing secondary materials

EPA excludes certain solid wastes from the definition of hazardous waste. If a material meets an exclusion from the definition of hazardous waste, it cannot be hazardous waste, even if the material technically meets a listing or exhibits a characteristic that would make it hazardous. Following are the exemptions from the definition of hazardous waste as per 40 CFR 261.4(b):

- §261.4(b)(1) Household Hazardous Waste
- §261.4(b)(2) Agricultural Waste
- §261.4(b)(3) Mining Overburden
- §261.4(b)(4) Fossil Fuel Combustion Waste (Bevill)
- §261.4(b)(5) Oil, Gas, and Geothermal Wastes (Bentsen Amendment)
- §261.4(b)(6) Trivalent Chromium Wastes
- §261.4(b)(7) Mining and Mineral Processing Wastes (Bevill)
- §261.4(b)(8) Cement Kiln Dust (Bevill)
- §261.4(b)(9) Arsenically Treated Wood
- §261.4(b)(10) Petroleum Contaminated Media & Debris from Underground Storage Tanks
- §261.4(b)(11) Injected Groundwater
- §261.4(b)(12) Spent Chlorofluorocarbon Refrigerants
- §261.4(b)(13) Used Oil Filters
- §261.4(b)(14) Used Oil Distillation Bottoms
- §261.4(b)(15) Landfill Leachate or Gas Condensate Derived from Certain Listed Wastes
- §261.4(b)(17) §261.4(b)(18) Project XL Pilot Project Exclusions

Hazardous wastes generated in raw material, product storage, or process (e.g. manufacturing) units are exempt from Subtitle C hazardous waste regulation while the waste remains in such units. These units include tanks, pipelines, vehicles, and vessels used either in the manufacturing process or for storing raw materials or products, but specifically do not include surface impoundments. Once the waste is removed from the unit, or when a unit temporarily or permanently ceases operation for 90 days the waste is considered generated and is subject to regulation.

Hazardous waste samples are small, discrete amounts of hazardous waste that are essential to ensure accurate characterization and proper hazardous waste treatment. In order to facilitate the analysis of these materials, RCRA exempts characterization samples and treatability study samples from Subtitle C hazardous waste regulation.

The MSWLF Criteria exclude conditionally exempt small quantity generators (CESQG) waste (as defined in 40 CFR §261.5) from the definition of "regulated hazardous wastes" for purposes of complying with 40 CFR 258.20. CESQG waste includes listed hazardous wastes or wastes that exhibit a characteristic of hazardous waste that are generated in quantities no greater than 100 kg/month, or for acute hazardous waste, 1 kg/month. Under 40 CFR §261.5(f)(3)(iv) and (g)(3)(iv), CESQG hazardous wastes may be disposed at facilities permitted, licensed, or registered by a State to manage municipal or industrial solid waste. Although some states allow hazardous waste generated by CESQG to be disposed in an MSWLF, Oklahoma statutes specifically prohibit any quantity of hazardous waste from being disposed at an Oklahoma solid waste disposal facility.

After it is determined that a waste is a solid waste and is not either excluded from the definitions of solid or hazardous waste or exempt from Subtitle C hazardous waste regulation, the next step is to determine if the waste is a regulated hazardous waste.

A solid waste is a regulated hazardous waste if it:

- is listed in Subpart D of 40 CFR Part 261 (termed a "listed" waste)
- exhibits a characteristic of a hazardous waste as defined in Subpart C of 40 CFR Part 261
- is a mixture of a listed hazardous waste and a non-hazardous solid waste

LISTED WASTES

EPA determined that some specific wastes are hazardous. These wastes are incorporated into lists published by the Agency. These lists are organized into three categories:

The F-list (non-specific source wastes). This list identifies wastes from common manufacturing and industrial processes, such as solvents that have been used in cleaning or degreasing operations. Because the processes producing these wastes can occur in different sectors of industry, the F-listed wastes are known as wastes from non-specific sources. Wastes included on the F-list can be found in the regulations at 40 CFR §261.31. The F list wastes can be divided into seven groups, depending on the type of manufacturing or industrial operation that creates them:

- Spent solvent wastes (codes F001 – F005)
- Electroplating and other metal finishing wastes (codes F006 – F012, and F019)
- Dioxin-bearing wastes (codes F020 – F023, and F026 – F028)
- Chlorinated aliphatic hydrocarbons production wastes (codes F024 and F025)
- Wood preserving wastes (F032, F034, and F035)
- Petroleum refinery wastewater treatment sludges (F037 and F038)
- Multisource leachate (F039)

The K-list (source-specific wastes). This list includes certain wastes from specific industries, such as petroleum refining or pesticide manufacturing. Certain sludges and wastewater from treatment and production processes in these industries are examples of source-specific wastes. Wastes included on the K-list can be found in the regulations at *40 CFR §261.32*.

To determine if a waste qualifies as K listed, a facility must first determine whether the waste fits within one of the 17 different industrial or manufacturing categories on the list. Second, a facility must determine if this waste matches one of the detailed K-list waste descriptions in *40 CFR §261.32*. The 17 industries that generate K-list waste are:

- Wood preservation
- Organic chemicals manufacturing
- Pesticides manufacturing
- Petroleum refining
- Primary copper production
- Primary zinc production

- Ferroalloys production
- Veterinary pharmaceuticals manufacturing
- Inorganic pigment manufacturing
- Inorganic chemicals manufacturing
- Explosives manufacturing
- Iron and steel production
- Primary lead production
- Primary aluminum production
- Secondary lead processing
- Ink formulation
- Coking (processing of coal to produce coke, a material used in iron and steel production)

The P-list and the U-list (discarded commercial chemical products). These lists include specific commercial chemical products in an unused form. Some pesticides and some pharmaceutical products become hazardous waste when discarded. Wastes included on the P- and U-lists can be found in the regulations at *40 CFR §261.33*. For a waste to qualify as P- or U-listed, the waste must meet the following three criteria:

- The waste must contain one of the chemicals listed on the P or U list
- The chemical in the waste must be unused
- The chemical in the waste must be in the form of a CCP

For purposes of the P and U lists, a CCP is a chemical that is one of the following: 100% pure, technical (e.g. commercial) grade, or the sole active ingredient in a chemical formulation.

CHARACTERISTIC WASTES

Waste that has not been *specifically listed* may still be considered hazardous waste if it exhibits one of the four characteristics defined in *40 CFR Part 261 Subpart C* - **ignitability (D001), corrosivity (D002), reactivity (D003), and toxicity (D004 - D043).**

Ignitability - Ignitable wastes can create fires under certain conditions, are spontaneously combustible, or have a flash point less than 60 °C (140 °F). Examples include waste oils and used solvents. For more details, refer to 40 CFR §261.21. Test methods that may be used to determine ignitability include the Pensky-Martens Closed-Cup Method for Determining Ignitability (Method

1010A), the Setaflash Closed-Cup Method for Determining Ignitability (Method 1020B), and the Ignitability of Solids (Method 1030).

Corrosivity - Corrosive wastes are acids or bases (pH less than or equal to 2, or greater than or equal to 12.5) that are capable of corroding metal containers, such as storage tanks, drums, and barrels. Battery acid is an example. For more details, refer to 40 CFR §261.22. The test method that may be used to determine corrosivity is the Corrosivity Towards Steel (Method 1110A).

Reactivity - Reactive wastes are unstable under "normal" conditions. They can cause explosions, toxic fumes, gases, or vapors when heated, compressed, or mixed with water. Examples include lithium-sulfur batteries and explosives. For more details, see 40 CFR §261.23. There are currently no test methods available.

Toxicity - Toxic wastes are harmful or fatal when ingested or absorbed (e.g., containing mercury, lead, etc.). When toxic wastes are land disposed, contaminated liquid may leach from the waste and pollute ground water. Toxicity is defined through a laboratory procedure called the Toxicity Characteristic Leaching Procedure (TCLP) (Method 1311). The TCLP helps identify wastes likely to leach concentrations of contaminants that may be harmful to human health or the environment. Limits of TCLP are provided in Appendix C. For more details, refer to 40 CFR §261.24.

Appendix C

TCLP Limits

TCLP Limits

Heavy Metals	EPA HW Code	EPA Method	Regulated Level (mg/l)
Arsenic (As)	D004	7061/6010	5.0
Barium (Ba)	D005	7081/6010	100.0
Cadmium (Cd)	D006	7131/6010	1.0
Lead (Pb)	D008	7421/6010	5.0
Chromium (Cr)	D007	7191/6010	5.0
Mercury (Hg)	D009	7470/6010	0.2
Selenium (Se)	D010	7741/6010	1.0
Silver (Ag)	D011	7761/6010	5.0

Volatiles	EPA HW Code	EPA Method	Regulated Level (mg/l)
Benzene	D018	8240 or 8260	0.5
Carbon Tetrachloride	D019	8240 or 8260	0.5
Chlorobenzene	D021	8240 or 8260	100.0
Chloroform	D022	8240 or 8260	6.0
1,2-Dichloroethane	D028	8240 or 8260	0.5
1,1-Dichloroethylene	D029	8240 or 8260	0.7
Methyl ethyl ketone	D035	8240 or 8260	200.0
Tetrachloroethylene	D039	8240 or 8260	0.7
Trichloroethylene	D040	8240 or 8260	0.5
Vinyl Chloride	D043	8240 or 8260	0.2

Semi-Volatiles	**EPA HW Code**	**EPA Method**	**Regulated Level (mg/l)**
Cresol	D026	8270	200.0
o-Cresol	D023	8270	200.0
m-Cresol	D024	8270	200.0
p-Cresol	D025	8270	200.0
1,4-Dichlorobenzene	D027	8240 or 8270	7.5
2,4-Dinitrotoluene	D030	8270	0.13
Hexachlorobenzene	D032	8270	0.13
Hexachlorobutadiene	D033	8270	0.5
Hexachloroethane	D034	8270	3.0
Nitrobenzene	D036	8270	2.0
Pentachlorophenol	D037	8270	100.0
Pyridine	D038	8270	5.0
2,4,5-Trichlorophenol	D041	8270	400.0
2,4,6-Trichlorophenol	D042	8270	2.0

Pesticides	**EPA HW Code**	**EPA Method**	**Regulated Level (mg/l)**
Chlordane	D020	8080	0.03
Endrin	D012	8080	0.02
Heptachlor	D031	8080	0.008
Lindane	D013	8080	0.4
Methoxychlor	D014	8080	10.0
Toxaphene	D015	8080	0.5
Herbicides	**EPA HW Code**	**EPA Method**	**Regulated Level (mg/l)**
2,4-D	D016	8150	10.0
2,4,5-TP (Silvex)	D017	8150	1.0

Appendix D

ODEQ NHIW Certification Form

Waste Profile Form

Gate Attendant Checklist

NHIW Random Inspection Form

Waste Rejection Form

NHIW Tracking Document

NHIW Manifest Form

NHIW Monthly Report Form

ODEQ NHIW Certification Form

O K L A H O M A
DEPARTMENT OF ENVIRONMENTAL QUALITY

NHIW CERTIFICATION

Please read instructions prior to completing this form.

Generator Name:____

Mailing Address:________________________________ **City** _____________________ **State** ____ **Zip** __________

Point of Generation Address: ______________________________________ **City** _____________________ **State** ____ **Zip** __________

Generator Contact: ______________________________________ **Title** _____________________ **Telephone** ___________

DETAILED WASTE DESCRIPTION

Waste Name:____

If waste was generated out-of-state, is it classified as hazardous in the state of origin? ☐ Yes ☐ No ☐ NA- Okla. waste

Approximate amount of waste to be disposed:			**Disposal frequency:**		**Physical characteristics:**	
	☐ Tons	**☐ Pounds**	**☐ One-time**	**☐ Weekly**	**☐ Solid**	**☐ Liquid**
__________	**☐ Cubic yards**	**☐ Drum**	**☐ Monthly**	**☐ Annually**	**☐ Sludge**	**☐ Combination**
	☐ Other ____________					

Method used to determine waste is non-hazardous: ☐ Analysis ☐ Generator knowledge ☐ Both

Process generating waste (be specific and use additional sheets if necessary):

____

____

____

____

____

DESIGNATED RECEIVING LANDFILL

Name: ____ **Permit #:** _______________________

GENERATOR CERTIFICATION

I understand this form must be signed by the original waste generator or other persons authorized by 27A O.S. §2-10-501(H).

To the best of my knowledge, I certify:

- **The information contained herein is accurate, complete, and representative of the waste to be disposed;**
- **The waste identified above is not a characteristically hazardous waste as identified by 40 CFR 261, Subpart C, is not a listed hazardous waste as identified by 40 CFR 261, Subpart D or contaminated with a listed hazardous waste, and is not otherwise identified as a hazardous waste by the Department of Environmental Quality; and**
- **This waste will be managed in accordance with all applicable statutes and rules of the Department of Environmental Quality.**

____

Generator Signature

____

Printed name **Title** **Date**

INSTRUCTIONS FOR COMPLETING THE NHIW CERTIFICATION

Enter the name of the generating facility, generator mailing address, address where the waste was generated, contact name and title of person at the generating facility who is knowledgeable about the waste, and phone number.

DETAILED WASTE DESCRIPTION

1. Identify the name of the waste.
2. Identify the approximate amount of waste to be disposed under the plan, its frequency of disposal, and its physical characteristics.
3. Identify if the waste was determined to be non-hazardous by either knowledge of process, testing, or both. If requested by DEQ, the generator must be able to provide information about the waste, such as a list of chemical constituents entering into the waste and a list of chemical constituents likely to be in the waste, laboratory analyses, MSDS sheets, and other information used by the generator to determine the waste is non-hazardous.
4. Identify the process generating the waste. Please note that the waste generating description must be specific and sufficient to demonstrate the waste is non-hazardous.

DESIGNATED RECEIVING LANDFILL

Identify the name of the landfill to receive the waste and its DEQ permit number.

GENERATOR CERTIFICATION

Read the certification and sign and date the form. **Please note that the certification may only be dated and signed by one of the following:** 1) the original waste generator; 2) a person who identifies and is under contract with a generator and whose activities under the contract cause the waste to be generated; 3) a party to a remediation project under an order of the DEQ or under the auspices of the Oklahoma Energy Resources Board or other agencies of other states; or 4) a person responding to an environmental emergency.

The completed notification form should be submitted to the DEQ at the following address. Once submitted, the generator may dispose of the waste at the designated landfill.

Department of Environmental Quality
Solid Waste Compliance Unit
P. O. Box 1677
Oklahoma City, OK 73102
Phone (405) 702-5100
Fax (405) 702-5101

Waste Profile Form

American Environmental Landfill, Inc.

"Leading the Industry in Environmental Compliance"

(MUST BE FILLED OUT COMPLETELY)

For more information, please call American Environmental Landfill, Inc. at (918)245-7786

A. GENERATOR INFORMATION

1. Generator Name ____________
2. Site Location ____________
3. City ____________
State ______ Zip Code ______
4. Phone ____________
5. Fax ____________
6. State Waste Code ____________

B. CUSTOMER BILLING INFORMATION

1. Billed to Name ____________
2. Address ____________
3. City ____________
State ______ Zip Code ______
4. Phone ____________
5. Fax ____________
6. Contact ____________
7. Title ____________

ALL BLANKS MUST BE FILLED. IF NOT APPLICABLE PLEASE PUT N/A

C. WASTE STREAM INFORMATION

1. Common Name of Waste ____________
2. Detailed Decription of Process Generating Waste and Material Description ____________

____

____

3. Industrial Generator ☐Yes ☐No
4. Municipal Generator ☐Yes ☐No
5. Physical State at 70° ☐Solid ☐Semisold ☐Liquid ☐Powder ☐Combination
6. Odor ☐Yes ☐No Describe ____________
7. Color ______
8. pH Range ______
9. Flash Point ____________
10. Reactive ☐Yes ☐No With: ____________
11. Free Liquid ☐Yes ☐No
12. Water content % by volume ______
13. Viscosity ______
14. Is the analytical attached dervied from testing a representative sample IAW 40 CFR 261? ☐Yes ☐No
15. Does the waste contain radioactive or U.S.D.O.T. hazardous waste materials? ☐Yes ☐No

D. SUPPLEMENTAL INFORMATION

☐None ☐MSDS ☐Analytical Data ☐Process Knowledge Number of pages attached ______

E. SHIPPING INFORMATION

1. Packaging ☐Bulk Liquid ☐Bulk Solid ☐Drum ☐Other ______ Shipping Frequency ______
2. Estimated Volume ______ ☐Gallons ☐Yards ☐Drums Other ______

F. GENERATOR / CUSTOMER CERTIFICATION

I hereby certify that all information submitted and all attached documents contain true and accurate descriptions of this waste. No deliberate or willful omissions of composition or properties exist, and all known or suspected hazards have been disclosed. I further certify that the waste is not designated a Hazardous Waste as defined by the USEPA in 40 CFR 261, nor does it contain PCBs regulated under TSCA 40 CFR 761.

I, ____________ am employed by ____________ and am authorized to sign this request for ____________

(Company Name) (Signature) (Date)

LANDFILL USE ONLY (DO NOT WRITE IN THIS SPACE)

Compliance Officer ____________
Date ______ ☐ Approved ☐ Rejected
Additional Information ____________

Current WDA on file ☐ Yes ☐ No

Job # ____________

Post Review Profile Checklist

Post Review Profile Checklist

Date Completed: ______________________________________

Generator: ____

Type of Waste: _______________________________________

Assigned Job Number: __________________________________

1. Compliance Officer has reviewed waste profile and NHIW forms
   Yes No N/A
2. Compliance Officer has reviewed 3rd Party analytical including QC Data
   Yes No N/A
3. Compliance Officer has reviewed MSDS provided including but not limited to; CAS no., names of chemicals, physical data, reactive data, disposal information and shipping data
   Yes No N/A
4. Compliance Officer has confirmed the process generating the waste is not a listed waste; P, K, F or U
   Yes No N/A
5. Compliance Officer has reviewed any information regarding process knowledge provided
   Yes No N/A

This form has been completed as a post review of the waste stream submitted for disposal at American Environmental Landfill, I recommend (circle one Acceptance/Rejection) of waste referenced above.

Compliance Officer Printed Name: __________________________

Compliance Officer Signature: ______________________

Gate Attendant Checklist

Gate Attendant Checklist

	YES	NO	N/A
Generator Waste Profile Sheet (GWPS) filled out and signed?			
ODEQ approval letter on file?			
Manifest completed and in order:			
Information in manifest match approval letter and/or GWPS?			
Manifest has been signed by generator?			
Manifest has been signed by transporter?			
Load volume has been verified?			
Cumulative volume does not exceed approval limit?			
Waste conforms to materials described in GWPS?			
Information regarding load has been logged into Operating Log Sheet?			
Manifest has been signed by landfill representative and copy placed on file?			
Remaining copies of the manifest have been forwarded to appropriate facilities via mail?			

N/A – Non-applicable

Checklist completed by:

Name (Print): ______________________________

Signature: ______________________________

Title: ______________________________

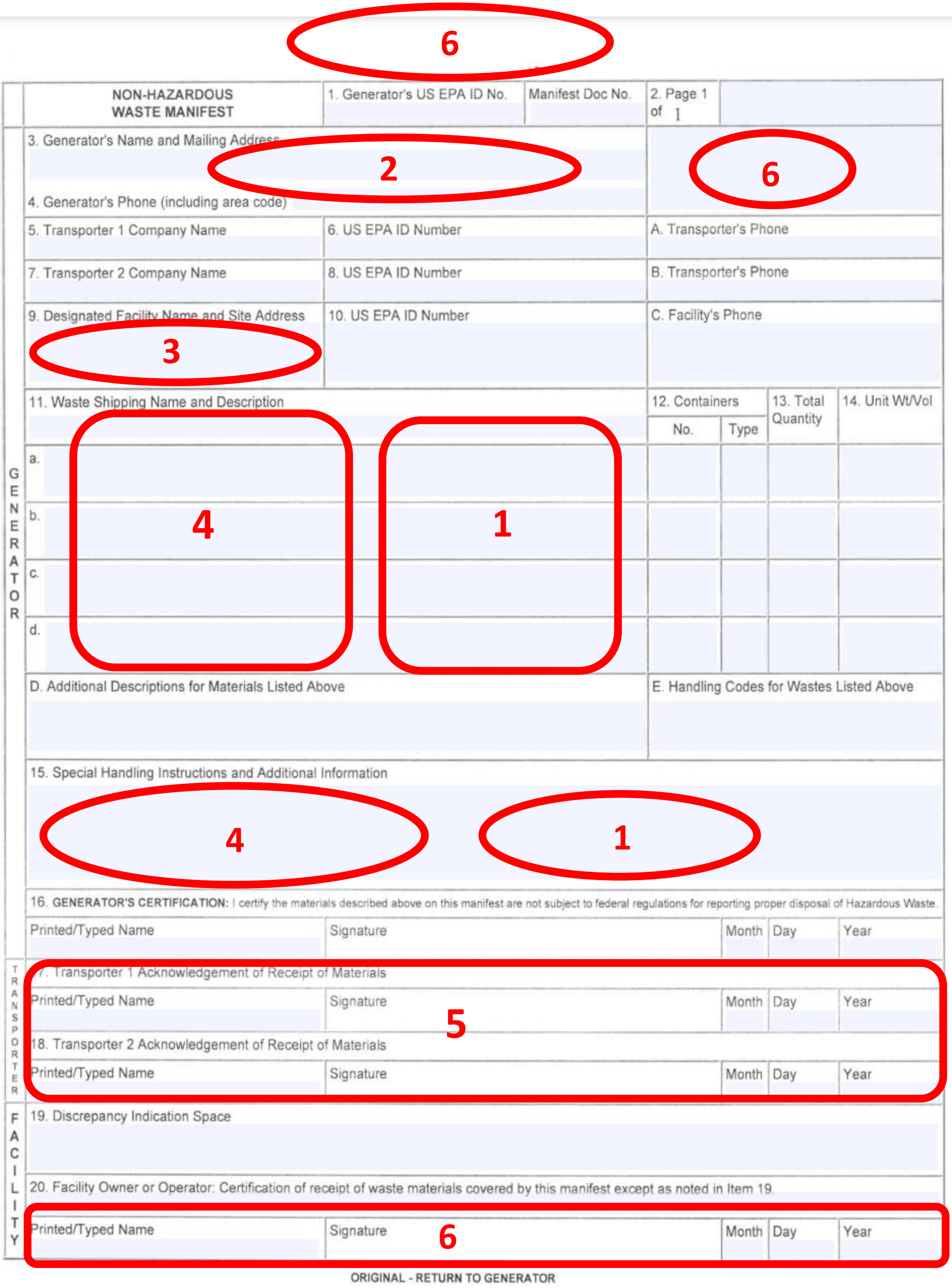
Manifest Checklist

Manifest Checklist

1. **Confirm Job Number**
    a. If job number is on the Manifest, confirm job number matches with profile on online database.
    b. If job number is not listed on the Manifest, inform driver to request job number from company hired to transport load or contact billing representative of waste material. Notify driver to exit scale and once job number is known, they may get back in line. Confirm job number matches with profile on online database.
2. **Match Generator Name and Address to that listed on online database**
    a. If they match then move on to the next step.
    b. If they do not match, contact the Bill To and/or Generator and resolve issue before proceeding to next step. Correct manifest accordingly.
3. **Check Destination Facility Name**
    a. If AEL or American Environmental Landfill is listed, proceed to next step.
    b. If AEL or American Environmental Landfill is not listed, contact the Bill To and/or Generator to verify load is at correct disposal facility. Correct manifest accordingly.
4. **Match Waste Name on Online Database**
    a. If waste name matches then proceed to next step.
    b. If the name does not match call bill to/generator.
5. **Confirm transporter/driver has signed the Manifest**
6. **AEL Authorized Agent Signature, Ticket Number, and Truck Number**
    a. After Input into the online database, sign and date Manifest.
    b. Add Ticket Number (top left corner) and Truck Number (top right corner) to the manifest.
7. **If Manifest states Haz Manifest in the top left corner, write Non Haz in the Discrepancy Section towards the bottom of the manifest.**
8. **See Attached Example Sheets for where each item is located on the Manifest.**

-There is no time limit. Take what time you need to confirm everything is correct.

-If any concerns or issues are identified, ask the truck transport to exit the scale and call Todd at (918-813-2985).



6

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No.	Manifest Doc No.	2. Page 1 of 1

GENERATOR

3. Generator's Name and Mailing Address

2

6

4. Generator's Phone (including area code)

5. Transporter 1 Company Name	6. US EPA ID Number	A. Transporter's Phone
7. Transporter 2 Company Name	8. US EPA ID Number	B. Transporter's Phone
9. Designated Facility Name and Site Address 3	10. US EPA ID Number	C. Facility's Phone

11. Waste Shipping Name and Description	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol
a.				
b. 4 1				
c.				
d.				

D. Additional Descriptions for Materials Listed Above

E. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

4 1

16. **GENERATOR'S CERTIFICATION:** I certify the materials described above on this manifest are not subject to federal regulations for reporting proper disposal of Hazardous Waste.

Printed/Typed Name	Signature	Month	Day	Year

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

5

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month	Day	Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of waste materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature 6	Month	Day	Year

ORIGINAL - RETURN TO GENERATOR

7 ↓ 6

Please print or type (*Form designed for use on elite (12 - pitch) typewriter*) *Form Approved. OMB No. 2050 - 0039 Expires 9 - 30 - 91*

UNIFORM HAZARDOUS WASTE MANIFEST

1 Generator's US EPA ID No.

Manifest Document No.

2. Page 1 of

Information in the shaded areas is not required by Federal law

3. Generator's Name and Mailing Address

2 6

4. Generator's Phone ( )

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name

6. US EPA ID Number

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name

8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address

3

10. US EPA ID Number

G. State Facility's ID

H. Facility's Phone

GENERATOR

11. US DOT Description (*Including Proper Shipping Name, Hazard Class, and ID Number*)	12. Containers No.	12. Containers Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.					
b. 4 1					
c.					
d.					

J. Additional Descriptions for Materials Listed Above

4 1

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; **OR**, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	*Month*	*Day*	*Year*

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	*Month*	*Day*	*Year*

5

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	*Month*	*Day*	*Year*

FACILITY

19. Discrepancy Indication Space

7 Non Haz

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in item 19.

Printed/Typed Name	Signature	*Month*	*Day*	*Year*

6

EPA Form 8700 - 22 (Rev. 9 - 88) Previous editions are obsolete.

NHIW Random Inspection Form

NHIW Random Inspection Form

GENERAL INFORMATION (To be completed by transporter or landfill personnel)

Date and Time: ____________________
Waste Authorization #: ____________________
Generator Name: ____________________
Transporter Name: ____________________
License Plate Number: ____________________
Driver's Name: ____________________
Driver's License Number: ____________________
Source of Waste ____________________
Hauling Permit Number: ____________________
Waste Description: ____________________

INSPECTION OBSERVATIONS (To be completed by landfill personnel)

		COMMENTS
Hazardous waste labels or placards?	YES / NO	
PCB transformers, labels, or placards?	YES / NO	
Lead-acid batteries?	YES / NO	
Unrinsed pesticide containers?	YES / NO	
Bulk or containerized liquids?	YES / NO	
Free liquids present?	YES / NO	
Sludges, pastes, or slurries?	YES / NO	
Powders, dust, smoke, or vapors?	YES / NO	
Petroleum odors?	YES / NO	
Unusual odors?	YES / NO	
Other suspicious conditions?	YES / NO	
If YES, describe		

Photos taken?	YES / NO (attach when available)
Will the waste pass the Paint Filter Liquid Test?	YES / NO
Extraneous or unauthorized materials found in shipment?	YES / NO
Waste accepted?	YES / NO

If NOT ACCEPTED, complete *Waste Rejection Form.*

Signature (landfill inspector) Print Name Date

Waste Rejection Form

Waste Rejection Form

GENERAL INFORMATION (To be completed by transporter or landfill personnel)

Date and Time of Rejection: ____________________

Waste Authorization Number: ____________________

Waste Description: ____________________

Generator Name: ____________________

Generator Contact: ____________________

Generator Address & Phone #: ____________________

Transporter Name: ____________________

Transporter Contact: ____________________

Transporter Address & Phone #: ____________________

Driver's Name and License #: ____________________

Vehicle License Number: ____________________

Hauling Permit Number: ____________________

Reasons for Waste Rejection:

____

____

____

____

What happened to the rejected waste? (Who took it? Where?)

____

____

____

____

Notify the ODEQ by the next working day

Person contacted at the ODEQ: ____________________

Personnel that contacted the ODEQ: ____________________

Time: ____________________

Date: ____________________

ATTACH A COPY OF ANY ON-SITE TEST RESULTS (IF ANY) AND A COPY OF THE RANDOM WASTE INSPECTION FORM OR NON-HAZARDOUS WASTE MANIFEST.

____

Signature of Site Inspector (Print Name) Date

Fax this copy to the ODEQ-Land Protection Division as part of the notification procedure (405) 702-5101

NHIW Tracking Document

NHIW Tracking Document

SECTION 1:	**GENERATOR INFORMATION**	
Generator Name:		Phone Number:
Mailing Address:		
Address where waste was generated:		
	WASTE INFORMATION	
Waste Code or #:		
Waste Description:		
Quantity:		Units:
Type:		
GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and government regulations.		
Generator Authorized Agent Name	*Signature*	*Date*

SECTION 2:	**TRANSPORTER INFORMATION**		
TRANSPORTER 1		**TRANSPORTER 2**	
Name:		Name:	
Address:		Address:	
Driver's Name:		Driver's Name:	
Vehicle License #:		Vehicle License #:	
Phone #:		Phone #:	
Acknowledgment of Receipt of Materials		Acknowledgment of Receipt of Materials	
Driver's Signature	*Date*	*Driver's Signature*	*Date*

SECTION 3:	**RECEIVING FACILITY INFORMATION**	
Facility Name:		
Physical Address:		
Mailing Address:		
Phone Number:		
Discrepancy Indication Space:		
FACILITY CERTIFICATION: I hereby certify that the above-named material has been accepted and to the best of my knowledge the foregoing is true and accurate.		
Facility Authorized Agent Name	*Signature*	*Date*

NHIW Manifest Form

American Environmental Landfill, Inc.
Leading the Industry in Environmental Compliance

Non-Hazardous Waste Manifest

Generator

Generator's Name: ____________________

Mailing Address: ____________________

____
City State Zip

Point of Generation Address: ____________________

____
City State Zip

Contact: ____________________
Name Phone

Manifest Job No. ____________

Bill to Name: ____________________

Address: ____________________

____
City State Zip

Contact: ____________________
Name Phone

Common Name of Waste Material	Container No.	Container Type	Total Quantity	Unit

I hereby certify that the above named material is not a hazardous waste as defined by 40 CFR Part 261 or any applicable state law, has been properly described, classified and packaged, and is in proper condition for transportation according to applicable regulations.

____________________ ____________________ ____________
Generator Authorized Agent Name Signature Shipment Date

Transporter

Transporter Name: ____________________

Address: ____________________

City, State Zip: ____________________

Driver Name (Print): ____________________

Tag No. ____________ State: ________

USDOT No. ____________________

I hereby certify that the above material was picked up at the generator site listed above.

____________________ ____________
Driver Signature Ship Date

I hereby certify that the above named material was delivered without incident to the destination listed below.

____________________ ____________
Driver Signature Delivery Date

Destination

American Environmental Landfill, Inc.
212 N. 177th W Ave.
Sand Springs, OK 74063

Phone: (918) 245-7786
Fax: (918) 245-7774
Permit No: 3557021

I hereby certify that the above named material has been accepted and to the best of my knowledge the foregoing is accurate.

____________________ ____________________ ____________
Name of Authorized Agent Signature Receipt Date

White – Destination Retention • Yellow – Return to Bill to • Pink – Transporter Retain • Goldenrod – Generator Retain

NHIW Monthly Report Form

NHIW Monthly Report

Month/Year:

Facility:____________________________

Permit Number:_____________

Date	Generator Name	Waste Name	App #	Amount

DEQ Form #520-821R

Revised July 1998

Appendix E

Personnel Training Record

Personnel Training Record

INSTRUCTOR NAME:

I______________________certify that the personnel included in this list attended a training course and received training in the areas discussed in Section 5.0 of the Waste Exclusion Plan (WEP).

SIGNATURE: Date:

The undersigned state that they are familiar with the contents of the American Environmental Landfill WEP and that they have received the training to comply with the guidelines as set forth in Section 5.0 of the WEP.

NAME	TITLE	SIGNATURE	DATE

Appendix K

Closure and Post-Closure Plan

Closure and Post-Closure Plan
American Environmental Landfill

AEL
American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

INDEX AND CERTIFICATION PAGE

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7.0	Closure Cost Estimate	1
8.0	Post-Closure Activities	3
9.0	Post-Closure Cost Estimate	1
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11.0	Financial Assurance Mechanism	2
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Certification

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

Prepared by:

FLOYD E. COTTER
[illegible]7783

Floyd Cotter, PE
SCS Engineers

5/30/24

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Appendices

1.0 INTRODUCTION

This Closure and Post-Closure Plan provides the criteria necessary to properly close and maintain the entire disposal area of the American Environmental Landfill (AEL).

The Closure Plan includes the necessary actions to be completed at the site before the facility can be certified closed and sets forth the maintenance and monitoring during the post-closure period.

The Post-Closure Plan will be in effect for a minimum 30-year period. The closed landfill facility will be maintained in order to retain its integrity and will not pose a threat to human health or the environment.

2.0 REGULATIONS

This Closure and Post-Closure Plan has been prepared pursuant to OAC 252:515, as promulgated by the Oklahoma Department of Environmental Quality (ODEQ).

2.1 CLOSURE REQUIREMENTS

OAC 252:515 requires that all Municipal Solid Waste Landfills (MSWLFs) install a final cover system that is designed to minimize infiltration and erosion. The final cover system will consist of an erosion layer/vegetation layer underlain by an infiltration/vegetation support layer. The facility will be closed in accordance with the provisions included in this Closure Plan and in a manner that minimizes the need for further maintenance and controls and minimizes post-closure escape of waste and waste constituents into the environment.

Prior to beginning the final closure of the landfill, the owner/operator is required to give notice of intent to close the site. ODEQ regulations require closure to begin a minimum of 90 days after the final receipt of waste at the facility or for the disposal area, as applicable. ODEQ requires completion of all closure activities within 180 days following the beginning of closure unless otherwise approved.

ODEQ requires a Certification of Final Closure to be prepared and sealed by an independent professional engineer licensed in the State of Oklahoma and signed by the site owner/operator.

ODEQ requires that upon approval of final closure, a notice shall be recorded in the property deed stating that the land has been used as a solid waste disposal facility. The notice shall specify the type, location, and quantity of wastes disposed of at the facility. In addition, the notice shall state that a survey plat and a record of disposal area locations and elevations have been filed with the ODEQ and with an identified city or county, and future uses may be restricted per OAC 252:515-25-57. A file-stamped copy of the notice shall be provided to the ODEQ.

ODEQ also requires Closure/Post-Closure cost estimates to be updated if additional active areas are constructed if the final cover is constructed, or if the landfill gas collection and control system (GCCS) is expanded. The cost estimates will be updated annually consistent with OAC 252:515-27-34.

2.2 POST-CLOSURE REQUIREMENTS

For current active landfills, OAC 252:515-25-51 requires a 30-year post-closure maintenance period including maintenance of the integrity and effectiveness of the final cover, maintaining and operating the leachate collection system, monitoring groundwater, and maintaining any gas venting, collection, or monitoring systems.

The ODEQ requires that a Certification of Post-Closure Performance be prepared and sealed by an independent professional engineer licensed in the State of Oklahoma.

3.0 FINAL COVER SYSTEM

3.1 COVER SYSTEM DESIGN

The final cover system for AEL consists of an Evapotranspiration (ET) alternative earthen final cover system. The components of the ET final cover system from top to bottom are listed below.

- A minimum 12-inch vegetation layer of earthen material capable of sustaining plant growth
- A minimum 24-inch vegetation support layer of earthen material
- A minimum 12-inch intermediate cover layer of earthen material

3.2 COVER SYSTEM INSTALLATION

The final cover should be constructed in accordance with the approved permit documents, design plans, and the Construction Quality Assurance / Construction Quality Control Plan (QA/QC) for Evapotranspiration Alternative Earthen Final Cover, dated April 2020, prepared by SCS Engineers, or more recently approved plan. The intermediate cover soils will be placed by the owner over the completed waste fill prior to installing the final cover system. The material used for the vegetation support layer shall be classified as CL, CH, ML, SM, or SC according to the Unified Soil Classification System. The vegetation support layer material should be placed in one 24-inch lift. The material will be compacted by tracking the material with low-pressure earth-moving equipment.

The vegetation layer will be placed over the vegetation support layer. This layer will consist of soil suitable for sustaining vegetative growth. The soil will be placed in one lift (12-inch minimum thickness) over the entire surface of the final cover and compacted in place with low-pressure earth-moving equipment.

Individual areas of the AEL may be closed in phases. For the construction of each final cover phase, project-specific design plans will be prepared and sealed by an independent professional engineer licensed in the State of Oklahoma, in accordance with the site's current permit documents and QA/QC plan. At this time, it is anticipated that the final cover will be constructed in one phase at the time of closure. To reduce financial assurance (FA) for the disposal area closed in a phased closure scenario, a certification prepared and sealed by an independent professional engineer licensed in the State of Oklahoma shall be submitted to the ODEQ. The ODEQ must approve the closure of the disposal area before FA may be reduced. The certification shall:

- Certify that the area was closed according to the approved permit documents, design plans, QA/QC plan, and applicable rules and regulations
- Contain a closure report with related drawings, plans, or specifications describing how the closure was performed

4.0 BORROW AREAS

Onsite and offsite soil borrow areas will be re-shaped and vegetated to blend in with the surrounding terrain within 180 days of the time that they are no longer utilized. After vegetation is established in the borrow areas, these areas will be routinely inspected throughout the life of the site and the Closure/Post-Closure periods. The vegetation cover will be capable of self-regeneration and will require no maintenance. If bare spots develop, then the area will be re-seeded and maintained (e.g., watered and fertilized) until the vegetation is re-established. Also, during these inspections, the slopes will be inspected and if necessary re-shaped to maintain their grades.

5.0 CLOSURE PROCEDURES

5.1 CLOSURE SEQUENCE

AEL will conduct ongoing closure of the landfill throughout its active life. This procedure allows for successive closures of fill areas by placement of final cover, construction of drainage and erosion control features, and establishment of vegetative cover. It is anticipated that, where possible, portions of the landfill will be closed as additional phases are constructed. If the site is to undergo premature closure, closure activities would be required only on those areas of the site that had been constructed and received waste. AEL will submit a permit modification to the ODEQ showing redesigned final contours and permanent stormwater structures in accordance with the Oklahoma Administrative Code Rules and Regulations prior to the premature closure of AEL.

5.2 CLOSURE DURING ACTIVE LIFE

As described above, the final cover will be constructed as fill areas to achieve the design grades. Should complete closure of the landfill become necessary at any time during the active life of the landfill, the following steps will be taken:

- Engineering plans will be developed to address site closure at the time of discontinued waste-filling
- The final waste received will be placed and properly compacted
- Excavations will be filled with suitable material, and the site will be graded to promote runoff and prevent ponding
- The final cover system will be constructed according to the specifications
- The top of the landfill will be re-graded and re-shaped as needed to provide the proper slope for positive drainage
- During the first growing season, following the application of final cover, the site will be vegetated with permanent vegetation
- Additional soil will be added to the side slopes, as needed, and processed using a disc to prepare the soil for seeding
- A surface water management system will be constructed to minimize erosion
- A closure certification report will be prepared by an independent registered professional engineer in the State of Oklahoma and submitted to ODEQ for approval
- All proper notices and documentation will be filed with the appropriate agencies

5.3 ADDITIONAL CLOSURE INFORMATION

There are numerous onsite structures. These structures along with all other structures that are on site at the time of final closure will be removed or decommissioned. All equipment used during the operation and closure of the landfill will be removed from the site after the final closure has been certified as complete.

The access roads will be maintained throughout the active life and post-closure period of the landfill. Facilities at the site, including the perimeter fencing, will be maintained throughout the post-closure period.

Prior to initiating closure, the existing conditions and applicable regulations will be re-evaluated so that this Closure Plan is still applicable.

6.0 CLOSURE SCHEDULE

The site will be closed in an orderly fashion, consistent with OAC 252:515-25-33. The final closure schedule is as follows:

- The ODEQ shall be notified in writing prior to beginning final closure of AEL or closure of a disposal cell at AEL
- Closure activities shall begin no later than 90 days after the final receipt of wastes at AEL or the final receipt of wastes into a disposal cell
- Closure activities shall be completed according to the approved Closure Plan within 180 days after closure activities are initiated
- Extensions of the closure period may be granted by the ODEQ if AEL demonstrates that closure will, of necessity, take longer than 180 days, and that all steps have been taken, and will continue to be taken, to prevent threats to human health or the environment from the unclosed cell or facility

6.1 CERTIFICATION OF FINAL CLOSURE

Upon completion of closure activities, a professional engineer registered in the State of Oklahoma will submit a certification of final closure to the ODEQ, certifying that the facility or disposal cell was closed in accordance with approved permit documents and this closure plan. The certification of final closure shall:

- Be signed by the owner/operator
- State the facility was closed according to the approved closure plan, the permit documents, and applicable rules
- Contain a closure report with related drawings, plans, or specifications describing how the closure was performed
- Indicate whether inspection of gas, groundwater, or surface water monitoring has shown the presence of elevated levels of any constituent or if any evidence of contamination related to site operations has been found and, if so, what corrective measures were taken
- Include a final closure map

The final closure map shall show as-built conditions at the time of closure including but not limited to:

- Final contours of the entire site
- The final permit boundary and boundaries of disposal areas
- The location of gas monitoring probes

- The location of groundwater monitoring wells
- The location of leachate management systems or surface impoundments
- The location of permanent surface drainage structures
- Aesthetic enhancements
- Other relevant information

6.2 COUNTY LAND RECORDS NOTICE

The ODEQ shall approve the final closure of the facility before the post-closure period can begin. Upon approval of the final closure of the facility, a notice shall be recorded in the land records of the property for Osage County giving notice in perpetuity that the site was used for the disposal of municipal solid waste and is now closed. The notice shall specify the type, location, and quantity of waste disposed. The notice shall also identify the required post-closure monitoring period and state that the facility will be monitored for at least 30 years; that a survey plat and record of the disposal area's locations and elevations have been filed with the ODEQ and with an identified city or county; and that future uses may be restricted in accordance with OAC 252:515-25-57. AEL is responsible for providing a file-stamped copy of the notice to the ODEQ.

7.0 CLOSURE COST ESTIMATE

A closure cost estimate including costs for the activities described above, is provided in Appendix A. Closure estimates and the amount of FA provided must be increased if, at any time during the active life, changes to the closure plan of the facility increase the maximum cost of closure. Proposals for reduction of closure cost estimates and the amount of FA required must be submitted to the ODEQ for approval. To qualify for a reduction, the cost estimate must be demonstrated to exceed the minimum cost of closure during the remaining life of the facility, the amount of security remaining after the reduction must adequately cover the estimated closure cost yet to be performed, and FA shall not be reduced until ODEQ approval has been granted.

At a minimum, cost estimates for closure shall be adjusted no later than April 9th of each year; the adjustment must be submitted to the ODEQ for approval. In the adjustment, the maximum costs of closure may be recalculated, in current dollars, in accordance with OAC 252:515-27-51. If there are no significant changes to the closure plan, the cost estimate may be adjusted by use of an inflation factor derived from the most recent annual Implicit Price Deflator for Gross National Product or the Implicit Price Deflator for Gross Domestic Product published by the U.S. Department of Commerce in its Survey of Current Business in a year for which the adjustment is made. The approved adjusted cost estimate shall be placed in the operating record.

8.0 POST-CLOSURE ACTIVITIES

8.1 MONITORING AND MAINTENANCE

In accordance with OAC 252:515-25-51(b), post-closure care maintenance will commence immediately upon ODEQ approval of final closure. Post-closure activities will continue for a period of 30 years, unless the ODEQ approves a post-closure period of a different duration or if the post-closure period is extended pursuant to OAC 252:515-25-52. Documentation pursuant to OAC 252:515-3-34 is included in Appendix B of this plan showing that AEL has the legal right to access all property subject to post-closure care requirements.

Post-closure inspections shall be performed on a quarterly basis. Additional inspections may be conducted to observe repairs or evaluate problem areas discovered during prior inspections.

The quarterly post-closure inspections will consist of the inspection and evaluation of the final cover system and vegetative cover, the drainage and erosion control structures, the leachate collection system, and the security system. The frequency and specific inspections associated with the groundwater monitoring and gas monitoring programs are addressed in AEL's Groundwater Monitoring Plan and Explosive Gas Control Plan.

8.1.1 Final Cover

Post-closure care will verify the integrity of the final cover system and its ability to minimize infiltration and erosion. The following conditions should be examined during the inspection:

- Settlement
- Cracking
- Erosion
- Animal burrows
- Other disturbances affecting either the thickness or configuration of the final cover

Maintenance and repairs should be conducted as soon as practical and may consist of filling in areas of settlement, re-grading, and slope restabilization. In areas of substantial settlement or displacement of the final cover, the integrity of the cap should be re-evaluated and any necessary repairs made. The final cover should be maintained to provide the proper slope to promote surface water runoff and continuity of the soil components to minimize infiltration and leachate production. Settlement that occurs on side slopes of the landfill will generally not require re-grading or placement of additional cover to maintain surface drainage. Side slopes are designed no greater than a 4:1 (horizontal: vertical) slope, and the crown of the landfill area slopes at a minimum of four percent to minimize the effect of settlement. With these slope conditions, it is anticipated that minimal soil will be required during the post-closure care period for the maintenance of this site.

Included as part of the final cover system inspection, the integrity of the vegetation and its ability to minimize infiltration and erosion will be determined. The following conditions should be examined during the inspection:

- Erosion
- Overgrowth of shrubs, trees, and other deep-rooted vegetation
- Patches of dead vegetation

Maintenance and repairs of the vegetative cover may consist of the following activities:

- Reseeding, fertilizing, liming, and mulching of washed-out areas
- Brush removal
- Mowing

Reseeding should be conducted as necessary to facilitate proper vegetative growth over all areas of the final cover. Mowing and removal of deep-rooted brush and vegetation should be performed as necessary during the growing season.

8.1.2 Borrow Area Reclamation

The borrow areas will have a gently sloping topography to provide wet weather drainage. The borrow area will be excavated in a manner that results in final contours similar to those present before disturbance, except the area will have a lower elevation. The areas will be excavated in a manner to provide positive drainage and possibly create one or more impoundments. In the case that impoundments are proposed/constructed, all applicable permits will be obtained and copies provided to the ODEQ.

Activities will be scheduled to minimize erosion and sedimentation. The borrow area will be re-graded in a manner to provide sufficient soil material for the re-establishment of vegetation. Re-vegetation activities will be completed as needed during the spring or fall growing seasons.

8.1.3 Drainage and Erosion Controls Structures

Drainage and erosion controls will be inspected throughout the post-closure period to promote surface water conveyance away from the landfill and to the perimeter drainage system. Items or conditions to be examined include the following:

- Erosion/ Settlement
- Structural integrity of berms, letdown structures, and other drainage and erosion control structures
- Silt and sediment buildup

Maintenance and repairs should be conducted as soon as practical, and may consist of the following activities:

- Replacement of riprap, gabions, or other structural lining installed for erosion protection
- Removal of obstructions to permit conveyance of surface water

- Placement of fill and re-grading
- Removal of silt and sediment
- Repair to berms
- Repair or replacement of stacked hay bales or silt fencing

8.1.4 Leachate Collection System

Post-closure care of the leachate collection system consists of the operation and maintenance of the leachate collection system, as well as any storage, pumping, or conveyance systems. As required per OAC 252:515-25-54(b)(2)(B), the leachate collection system will be equipped with a system for automatic and continuous leachate removal not requiring intervention by the owner/operator.

The leachate collection system will be observed during each scheduled inspection event throughout the post-closure period. Based on the results of the inspections, more frequent or less frequent monitoring may be required due to problems with the system or changes in the rate of production of leachate. During these inspections, leachate collection sumps and/or piping, cleanouts, or inspection points will be observed to determine the effectiveness of the system in removing leachate and minimizing the head on the liner system.

Maintenance, on an annual or otherwise as-needed basis, may include flushing and pressure cleaning of the leachate collection and removal pipes.

8.1.5 Groundwater Monitoring System

Semi-annual groundwater monitoring of the monitoring network wells will be completed in accordance with the most recently approved groundwater monitoring plan.

8.1.6 Surface Water Monitoring Program

During site inspections, surface water control structures (drainage swales, letdown channels, perimeter channels, culverts, and detention ponds) will be inspected to facilitate proper operation. Any problems noted during the inspection will be addressed as soon as reasonably possible.

8.1.7 Landfill Gas Monitoring System

Monitoring of explosive gas monitoring wells located along the site boundary will be conducted on a semi-annual basis during the post-closure period as outlined in the most recently approved explosive gas monitoring plan.

8.1.8 Site Security and Access Control

Post-closure care of the security system is necessary to control unauthorized access and prevent illegal dumping of waste. Inspection of the security system at the site should be performed during the post-closure inspections. Signs shall be posted on the outer perimeter indicating the site is a closed MSWLF, as required by OAC 252:515-25-54(a)(1). The closed facility will be maintained as necessary to provide access to the closed areas throughout the post-closure period.

9.0 POST-CLOSURE COST ESTIMATE

A cost estimate for post-closure care of the landfill, including costs for the activities described above, is provided in Appendix A. This estimate includes the following costs:

- Quarterly site inspection
- Site security and access control
- Final cover erosion and seeding repair
- Semi-annual groundwater monitoring
- Surface water control structure maintenance
- Semi-annual explosive gas monitoring
- Leachate collection, disposal, and system maintenance
- Annual reporting
- Certification and recordkeeping

Post-closure estimates and the amount of FA provided must be increased if, at any time during the active life, changes to the closure plan of the facility increase the maximum cost of post-closure. Proposals for reduction of post-closure cost estimates and the amount of FA required must be submitted to the ODEQ for approval. To qualify for a reduction, the cost estimate must be demonstrated to exceed the minimum cost of post-closure during the remaining post-closure care period, the amount of security remaining after the reduction must adequately cover the estimated post-closure cost yet to be performed, and FA shall not be reduced until ODEQ approval has been granted.

At a minimum, cost estimates for post-closure shall be adjusted no later than April 9th of each year; the adjustment must be submitted to the ODEQ for approval. In the adjustment, maximum costs of post-closure may be recalculated, in current dollars, in accordance with OAC 252:515-27-51. If there are no significant changes to the post-closure plan, the cost estimate may be adjusted by use of an inflation factor. The inflation factor can be derived from the most recent annual Implicit Price Deflator for Gross National Product or the Implicit Price Deflator for Gross Domestic Product published by the U.S. Department of Commerce in its Survey of Current Business in a year for which the adjustment is made. The approved adjusted cost estimate shall be placed in the operating record.

If corrective action is required at AEL, cost estimates for corrective action shall be submitted to the ODEQ for approval. The cost estimates shall be a detailed written estimate, in current dollars, of the cost of hiring a third party to perform the corrective action in accordance with an approved corrective action plan. The corrective action cost estimate shall be set by the ODEQ and account for the total costs of corrective action activities as described in an approved corrective action plan for the entire corrective action period. The amount of FA provided must be increased to account for corrective action costs.

10.0 FINANCIAL ASSURANCE INSTRUMENT

At a minimum, the financial assurance instrument (FAI) shall be updated no later than April 9 of each year. Updates will address modifications to the landfill's closure and post-closure requirements, if any, and the associated cost estimates. If there are no significant changes to the post-closure plan, the cost estimate may be adjusted by use of an inflation factor. The inflation factor can be derived from the most recent annual Implicit Price Deflator for Gross National Product or the Implicit Price Deflator for Gross Domestic Product published by the U.S. Department of Commerce in its Survey of Current Business in a year for which the adjustment is made. The current FAI shall be placed in the operating record.

In effect of non-renewal of, or failure to maintain or provide FA, the ODEQ shall begin proceedings to summarily suspend or revoke the permit for failure to establish FA in accordance with OAC 252:515-27, renew or maintain an approved FA mechanism, or provide acceptable substitute FA when necessary. Substitute FA may be provided as specified in OAC 252:515-27.

10.1 PERMIT TRANSFER

When the permit is transferred from one owner/operator to another owner/operator, the transferee shall either provide a new FA or assume the existing assurance, so long as the existing assurance is adequate in amount.

11.0 FINANCIAL ASSURANCE MECHANISM

To qualify as FA for the performance costs of closure, post-closure, and/or corrective action, a FA mechanism must meet the following criteria:

- Ensure that the amount of funds assured is sufficient to cover the costs of closure, post-closure care, and/or corrective action for known releases when needed
- Ensure that funds will be available in a timely fashion when needed
- Legally valid, binding, and enforceable under State and Federal law
- Non-negotiable
- Amount approved by the ODEQ
- Indicate the purpose of the FA is to provide funds for the adequate completion of closure, post-closure, and/or corrective action upon the failure of the owner/operator to fully complete performance according to the terms of the permit and applicable law
- Provide the name, address, telephone number(s), contact person(s), and organizational information for the principal and for the FA issuer
- Provide information on the financial responsibility and liability limits of the issuer
- Provide a clause requiring payment to the State of Oklahoma, Department of Environmental Quality Revolving Fund, as the sole beneficiary upon the DEQ's certification that the principal has not fully or satisfactorily performed required closure, post-closure, and/or corrective action activities
- Provide a clause addressing termination and stating that neither the principal nor issuer can revoke or cancel the FA mechanism without notice to the ODEQ 120 days before revocation or cancellation is effective
- Provide a clause requiring notice to the ODEQ by the issuer and to the principal prior to the renewal date, if any
- Provide a clause requiring 30-day notice to the ODEQ by the issuer of principal's failure to pay renewal fee(s), if any
- Specify whether coverage is for the life of the facility through certified closure, the period of post-closure care required by law, and/or corrective action
- Include original signatures and typed names of authorized agents of the principal and the issuer
- Contain evidence that the signatory for the issuer is empowered to commit the issuer to payment.

The owner/operator must choose either cash, certificate of deposit, trust fund, escrow account, surety bond, letter of credit, insurance, corporate financial test, local government financial test, corporate guarantee, local government guarantee, or any other State approved mechanism pursuant OAC 252:27 74 – 85 so long as the FA mechanism criteria specified in OAC 252:515-27-71 are meet and is approved by the ODEQ.

11.1 USE OF MULTIPLE MECHANISMS

FA requirements may be satisfied by establishing more than one approved FA mechanism so long as the amount of FA for all mechanisms is at least the current cost estimate for closure, post-closure care and/or corrective action. Mechanisms guaranteeing performance rather than payment may not be combined with other mechanisms. The financial test or a guarantee may not be combined with other mechanisms if the financial statements of the firms are consolidated.

12.0 POST-CLOSURE LAND USE

There are no current planned uses for AEL after closure. Should the use of the closed landfill not associated with solid waste activities be considered, plans will be prepared and submitted to the ODEQ for review and approval per OAC 252:515-25-55.

13.0 POST-CLOSURE REPORTING REQUIREMENTS

13.1 ANNUAL POST-CLOSURE REPORT

Beginning one year after ODEQ's approval of the certification of final closure, AEL will submit an annual post-closure maintenance and monitoring report to the ODEQ until the post-closure period ends. This report will document the maintenance performed at the site and summarize all monitoring data for the previous year. The report shall be submitted by April 1st of each year after ODEQ's certification of final closure.

13.2 CERTIFICATION OF POST-CLOSURE PERFORMANCE

At the conclusion of the post-closure period, AEL will submit, in lieu of the annual post-closure report, a certification prepared and sealed by a professional engineer registered in the State of Oklahoma certification, indicating that the MSWLF was maintained and monitored in accordance with the approved post-closure plan, the permit, and applicable regulations. This certification will also indicate whether monitoring throughout the post-closure period has shown the presence of elevated levels of any constituent or if any evidence of contamination related to site operations has been found and, if so, what corrective measures were taken. The certification will be maintained in the site operating record.

Appendix A

Closure and Post-Closure Cost Estimates

Table H.1 2024 Site Data

Facility Name: American Environmental Landfill, Inc

Permit Number: 3557021

Description	Quantity	Units
Total Permitted Area	173.71	acres
Active Portion		
Composite Lined	77.90	acres
Soil Lined	0.00	acres
Area of Largest Cell/Phase Requiring Final Cap		
Composite Lined	77.90	acres
Soil Lined	0.00	acres
Perimeter Fencing	19,993.0	linear feet
Groundwater Monitoring Wells	817.8	VLF
Methane Gas Probes	2,285.3	VLF
Terraces	1,720.0	linear feet
Letdown Channels	82.0	linear feet
Perimeter Drainage Ditches	1,168.0	linear feet
Average Daily Waste Flow	2,233.1	tons/day
Landfill Disposal Cost	$36.00	$/ton

VLF = Vertical Linear Feet. The sum of the depths of all monitoring wells.
Average Daily Waste Flow based on 2023 waste receipts and 307 operating days.

Table H.2 2024 Closure Cost Estimate
Facility Name: American Environmental Landfill, Inc.
Permit Number: 3557021

Task/Service		Quantity	Units	Multiplier	Unit Cost	Subtotal
1	**PRELIMINARY SITE WORK**					
1.1	Conduct Site Evaluation	1.0	Lump Sum	1	$4,376.08	$4,376.08
1.2	Dispose Final Waste					
	Average Daily Flow	2,233.1	tons/day			
	Disposal Cost	2,233.1	tons/day	5	$36.00	$401,952.43
1.3	Remove Temporary Building(s)	0.0	Lump Sum	1	$4,012.89	$0.00
1.4	Remove Equipment	1.0	Lump Sum	1	$3,275.69	$3,275.69
1.5	Repair/Replace Perimeter Fencing	19,993.0	Linear Feet	0.25	$4.29	$21,442.49
1.6	Clean Leachate Line(s)	1.0	Lump Sum	1	$1,982.05	$1,982.05
2	**MONITORING EQUIPMENT**					
2.1	Rework/Replace Monitoring Well(s)	817.8	VLF	0.25	$92.01	$18,810.52
2.2	Plug Abandoned Monitoring Well(s)	817.8	VLF	0.25	$36.83	$7,529.53
2.3	Rework/Replace Methane Probe(s)	2,285.3	VLF	0.25	$79.47	$45,402.20
2.4	Plug Abandoned Methane Probe(s)	2,285.3	VLF	0.25	$29.04	$16,590.92
2.5	Rework/Replace Remediation and/or Gas Control System	1.0	Lump Sum	0.05	$832,000.00	$41,600.00
3	**CONSTRUCTION**					
3.1	Complete Site Grading, Including Borrow Area	87.90	Acres	1	$1,735.01	$152,507.38
3.2	Construct Final Cap					
	Compacted On-Site Clay Cap or	377,036.0	Cubic Yards	1	$6.23	$2,348,934.28
	Compacted Off-Site Clay Cap or		Cubic Yards	1	$10.13	$0.00
	Install Geosynthetic Clay Liner Cap		Square Feet	1	$0.65	$0.00
3.3	Construct Landfill Gas Venting Layer					
	Place Sand or		Acres	1	$46,392.25	$0.00
	Install Net and Geotextile		Square Feet	1	$0.46	$0.00
3.4	Install Passive Landfill Gas Vents		Acres	1	$1,111.39	$0.00

Table H.2 2024 Closure Cost Estimate
Facility Name: American Environmental Landfill, Inc.
Permit Number: 3557021

Task/Service		Quantity	Units	Multiplier	Unit Cost	Subtotal
3.5	Install Flexible Membrane Liner		Square Feet	1	$0.51	$0.00
3.6	Drainage layer					
	Place Sand or		Acres	1	$46,392.25	$0.00
	Install Net and Geonet		Square Feet	1	$0.46	$0.00
3.7	Place On-Site Topsoil	125,678.7	Cubic Yards	1	$2.68	$336,818.83
	Place Off-Site Topsoil		Cubic Yards	1	$21.44	$0.00
3.8	Establish Vegetative Cover, Including On- and Off-Site Borrow Areas	87.90	Acres	1	$1,236.49	$108,687.47
4	**DRAINAGE/EROSION CONTROL**					
4.1	Construct Terraces	1,720.0	Linear Feet	1	$11.23	$19,315.60
4.2	Construct Letdown Channels	82.0	Linear Feet	1	$122.82	$10,071.24
4.3	Clean Perimeter Drainage Ditches	1,168.0	Linear Feet	0.5	$8.56	$4,999.04
5	**TASK NOT**					
6	**SUBTOTAL**					$3,544,295.75
7	**ADMINISTRATIVE SERVICES**	1.0	Lump Sum	0.10	$3,544,295.75	$354,429.57
8	**TECHNICAL and PROFESSIONAL SERVICES**	1.0	Lump Sum	0.12	$3,544,295.75	$425,315.49
9	**CLOSURE CONTINGENCY**	1.0	Lump Sum	0.10	$3,544,295.75	$354,429.57
10	**TOTAL FINAL CLOSURE**					$4,678,470.39

Table I.1 2024 Post-Closure Cost Estimate
Facility Name: American Environmental Landfill, Inc.
Permit Number: 3557021

Task/Service		Quantity	Units	Multiplier	Unit Cost	Subtotal
1	**SITE MAINTENANCE**					
1.1	Site Inspections	4.0	Per Year	30	$796.06	$95,527.20
1.2	General Maintenance	1.0	Per Year	30	$2,386.63	$71,598.90
1.3	Remediation and/or Gas Control Equipment	1.0	Lump Sum	0.3	$832,000.00	$249,600.00
2	**MONITORING EQUIPMENT**					
2.1	Rework/Replace Monitoring Well(s)	817.8	VLF	0.25	$92.01	$18,810.52
2.2	Plug Abandoned Monitoring Well(s)	817.8	VLF	0.25	$36.83	$7,529.53
2.3	Final Plugging of Monitoring Well(s)	817.8	VLF	1	$36.83	$30,118.10
2.4	Rework/Replace Methane Probe(s)	2,285.3	VLF	0.25	$79.47	$45,402.20
2.5	Plug Abandoned Methane Probe(s)	2,285.3	VLF	0.25	$29.04	$16,590.92
2.6	Final Plugging of Methane Probe(s)	2,285.3	VLF	1	$29.04	$66,363.66
2.7	Final Plugging of Piezometer(s)	166.9	VLF	1	$29.04	$4,847.94
3	**SAMPLING and ANALYSIS**					
3.1	Groundwater Monitoring Wells	13.0	Wells	60	$858.38	$669,536.40
3.2	Methane Gas Probes	32.0	Probes	60	$55.71	$106,963.20
3.3	Surface Water Monitoring Points	0.0	Points	60	$103.44	$0.00
3.4	Leachate	1.0	Sample	60	$166.69	$10,001.40
4	**FINAL COVER MAINTENANCE**					
4.1	Mow and Fertilize Vegetative Cover	129.29	Acres	30	$263.35	$1,021,455.65
4.2	Repair Erosion, Settlement, and Subsidence for On-Site Soils	129.29	Acres	60	$3.82	$29,633.27
	Repair Erosion, Settlement, and Subsidence for Off-Site Soils	0.0	Acres	30	$22.84	$0.00
4.3	Re-Seed Vegetative Cover	129.29	Acres	0.2	$1,236.49	$31,973.16

Table I.1 2024 Post-Closure Cost Estimate
Facility Name: American Environmental Landfill, Inc.
Permit Number: 3557021

Task/Service		Quantity	Units	Multiplier	Unit Cost	Subtotal
5	**Leachate Management**					
5.1	Clean Leachate Line(s)	1.0	Lump Sum	30	$2,041.31	$61,239.30
5.2	Maintain Leachate Collection System and Equipment	1.0	Lump Sum	30	$3,171.26	$95,137.80
5.3	Collect, Treat, Transport, and Dispose Leachate	0.0	Gallons/Year	30	$0.40	$0.00
6	**TASK NOT**					
7	**SUBTOTAL**					$2,632,329.14
8	**ADMINISTRATIVE SERVICES**	1.0	Lump Sum	0.06	$2,632,329.14	$157,939.75
9	**TECHNICAL and PROFESSIONAL SERVICES**	1.0	Lump Sum	0.07	$2,632,329.14	$184,263.04
10	**POST-CLOSURE CONTINGENCY**	1.0	Lump Sum	0.10	$2,632,329.14	$263,232.91
11	**TOTAL POST CLOSURE**					$3,237,764.84

Appendix B

Right of Access Documentation

TEMPORARY EASEMENT FOR ACCESS

Pursuant to the Oklahoma Environmental Quality Code (27A O.S. §2-1-101 *et seq.*, including the Solid Waste Management Act, the rules promulgated thereunder, and in accordance with the conditions and requirements of Permit No. 3557021, issued by the Oklahoma State Department of Health, the predecessor in interest to the Oklahoma Department of Environmental Quality (DEQ) on May 31, 2024, Kenny Burkett, (his/her heirs and assigns) (its successors and assigns), hereinafter referred to as Grantor, does hereby grant unto the DEQ, including its contractors, employees, and its successors and assigns, the right of access for purposes of performing closure, post-closure monitoring, or corrective action in the event of default by the owner or operator. The Easement is granted over and across the following described land, situated in Osage County, State of Oklahoma:

Tract 1 (the permitted area): As described on attached, more particularly described as the permitted area of American Environmental Landfill, Oklahoma Department of Environmental Quality Permit Number 3557021.

This Temporary Easement for Access is given subject to the following conditions:

1. The Grantor hereby grants unto the DEQ an easement and right-of-way over and across Tract 1, above set out, for access to said Tract 1 for the purposes of conducting closure and post-closure activities and/or corrective action as prescribed by the laws of the State of Oklahoma and Rules of the DEQ;

2. This Easement is temporary and shall become null and void upon certification by the DEQ that post-closure and/or corrective action has been properly completed.

This Easement shall be binding upon the heirs, successors and assigns of the parties hereto.

IN WITNESS WHEREOF, the Grantor has hereunto set (his/her/its) hand this 21st day of MAY, 2024.

Kenny Burkett, Owner

American Environmental Landfill, Inc. Legal Description:

The Northeast Quarter (NE/4) of the Southeast Quarter (SE/4) and the East Half (E/2) of the Northwest Quarter (NW/4) of the Southeast Quarter (SE/4) and the Northwest Quarter (NW/4) of the Northwest Quarter (NW/4) of the Southeast Quarter (SE/4) of Section 36, Township 20 North, Range 10 East of the Indian Meridian, Osage County, Oklahoma.

AND

A tract of land being a part of the West Half (W/2) of Section 36 and the East Half (E/2) of Section 35, Township 20 North, Range 10 East of the Indian Meridian, Osage County, Oklahoma and being more particularly described as follows:

BEGINNING at the Southwest corner of said Section 36;

Thence North 01°10'20" East along the West line of said Section 36, a distance of 354.62 feet to the Southwest corner of the North Half (N/2) of the Southwest Quarter (SW/4) of said Section 36;

Thence South 89°15'49" West along the South line of the East Half (E/2) of the Northeast Quarter (NE/4) of the Southeast Quarter (SE/4) of said Section 35, a distance of 320.25 feet;

Thence North 01°03'24" West, a distance of 1413.21 feet;

Thence North 88°56'36" East, a distance of 273.38 feet;

Thence North 00°03'14" East parallel to and 100.00 feet West of the East line of the Northeast Quarter (NE/4) of said Section 35, a distance of 564.60 feet;

Thence North 88°42'49" East a distance of 100.03 feet to the Northwest corner of the South Half (S/2) of the South Half (S/2) of the Northwest Quarter (NW/4) of said Section 36;

Thence continuing North 88°42'49" East along the North line of the South Half (S/2) of the South Half (S/2) of the Northwest Quarter (NW/4) of said Section 36, a distance of 1318.42 feet;

Thence South 01°01'16" East, a distance of 606.18 feet;

Thence North 88°58'44" East, a distance of 400.00 feet;

Thence North 01°01'16" West, a distance of 608.04 feet to a point on the North line of the South Half (S/2) of the South Half (S/2) of the Northwest Quarter (NW/4) of said Section 36;

Thence North 88°42'49" East along the North line of the South Half (S/2) of the South Half (S/2) of the Northwest Quarter (NW/4) of said Section 36, a distance of 921.97 feet to the Northeast corner of the South Half (S/2) of the South Half (S/2) of the Northwest Quarter (NW/4) of said Section 36;

Thence South 00°06'30" East along the East line of the West Half (W/2) of said Section 36, a distance of 2360.46 feet to the Southeast corner of the Southwest Quarter (SW/4) of said Section 36;

Thence South 89°16'14" West along the South line of the Southwest Quarter (SW/4) of said Section 36, a distance of 2679.26 feet to the POINT OF BEGINNING.

Said tract of land contains 150.09 acres, more or less.

AND

The South 50.00 feet of the East 1165.11 feet of the Southeast Quarter (SE/4) of the Northeast Quarter (NE/4) of Section 36, Township 20 North, Range 10 East of the Indian Meridian, Osage County, Oklahoma.

Said tract of land contains 1.34 acres, more or less.

AND

A Tract of land in the East Half (E/2) of Section Thirty-five (35) and the West Half of the West Half (W/2 W/2) of Section Thirty-six (36), Township Twenty (20) North, Range Ten (10) East of the Indian Meridian, Osage County, Oklahoma and being more particularly described as follows:

BEGINNING at the Southeast Corner of said Section 35;

Thence S89°51'44"W on the South Line of said Section 35 a distance of 2,624.40 feet to the Southwest Corner of said E/2;

Thence N0°10'55"E on the West Line of said E/2 a distance of 2,083.00 feet;

Thence N44°26'58"E a distance of 1,254.02 feet to a point on the South Line of the North Half of the Northeast Quarter (N/2 NE/4) of said Section 35;

Thence N16°00'28"E a distance of 330.70 feet;

Thence N88°51'08"E parallel with the North Line of said E/2 a distance of 1684.00 feet to a point on the East Line of said Section 35;

Thence N87°55'47"E parallel with the North Line of said W/2 W/2 of Section 36 a distance of 1319.51 feet to a point on the East Line of said W/2 W/2;

Thence S0°03'02"E on the East Line of said W/2 W/2 a distance of 1006.10 feet to the Southeast Corner of the North Half of the Southwest Quarter of the Northwest Quarter (N/2 SW/4 NW/4) of said Section 36;

Thence S88°42'53"W on the South Line of said N/2 SW/4 NW/4 a distance of 1.84 feet to a Chiseled Cross found for a corner of the existing Permit Boundary (also the Northwest Corner of the tract known as the Cemetery, as described in JOURNAL ENTRY OF JUDGEMENT, Recorded in Book 1429 @ Page 693);

Thence continuing S88°42'53"W on the existing Permit Boundary and on the South Line of said N/2 SW/4 NW/4 a distance of 1318.20 feet to the Southwest Corner of said N/2 SW/4 NW/4;

Thence continuing S88°42'53"W on the existing Permit Boundary, entering said Section 35, a distance of 100.03 feet;

Thence S0°00'35"W on the existing Permit Boundary, parallel with the East Line of said Section 35 a distance of 564.60 feet;

Thence S88°57'36"W on the existing Permit Boundary a distance of 273.49 feet;

Thence S1°02'24"E on the existing Permit Boundary a distance of 1413.79 feet to a point on the South Line of the Northeast Quarter of the Southeast Quarter (NE/4 SE/4) of said Section 35;

Thence N89°12'15"E on the existing Permit Boundary and on the South Line of said NE/4 SE/4 a distance of 320.25 feet to the Southeast Corner of said NE/4 SE/4;

Thence S1°11'51"W on the existing Permit Boundary and on the East Line of said Section 35 a distance of 354.62 feet to the POINT OF BEGINNING, containing 202.5 acres more or less.

ACKNOWLEDGMENT

STATE OF OKLAHOMA)
) SS:
COUNTY OF Tulsa)

Before me, the undersigned, a Notary Public within and for said County and State, on this 21st day of May, 2024, personally appeared Kenny Burkett, to me known to be the identical person who executed the within and foregoing instrument, and acknowledged to me that (he/she) executed the same as (his/her) free and voluntary act and deed, for the uses and purposes therein set forth.

Witness my hand and official seal the date above written.

SARAH ABBOTT
Notary Public in and for
STATE OF OKLAHOMA
Commission #21004956
Expires: 12 Apr 2025

Sarah Abbott
Notary Public

My commission expires:

April 12, 2025

Appendix L

Quality Assurance/Quality Control Plan for Evapotranspiration Alternative Earthen Final Cover Construction

Quality Assurance/Quality Control Plan for Evapotranspiration Alternative Earthen Final Cover Construction American Environmental Landfill

American Environmental Landfill, Inc.
207 North 177th West Avenue
Sand Springs, Oklahoma 74063

SCS ENGINEERS

27220345.00 | May 2024

8575 W. 110th Street, Suite 100
Overland Park, KS 66210
913-681-0030

INDEX AND CERTIFICATION PAGE

REPORT INDEX

CERTIFICATION

This report has been prepared for exclusive use by American Environmental Landfill, Inc. for the American Environmental Landfill (AEL) for specific application to the project discussed, and it has been prepared in accordance with good engineering practices including consideration of industry standards and the requirements of the Oklahoma Department of Environmental Quality.

Prepared by:

REGISTERED PROFESSIONAL ENGINEER
FLOYD E.
COTTER
17783
OKLAHOMA

5/30/24

Floyd Cotter, PE
SCS Engineers

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Tables

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Quality Assurance/Quality Control (QA/QC) Plan is to describe the quality assurance procedures to be used during the construction of the evapotranspiration alternative earthen final cover at the American Environmental Landfill (AEL).

1.2 SCOPE

This document addresses the test methods, observations, and test frequencies to be provided during the construction of the evapotranspiration alternative earthen final cover. Protocols for reporting test results, correcting construction deficiencies, and documenting such corrections are included in this document. The scope of work and QA/QC includes the following components of the evapotranspiration alternative earthen final cover:

- Intermediate Cover
- Vegetation Support Layer
- Vegetation Layer

2.0 SOIL OBSERVATION AND TESTING

The soils portion of the alternative earthen final cover will consist of three moderately compacted layers. A 12-inch intermediate cover layer will be placed first and will be overlain by a 24-inch vegetation support layer. A 12-inch thick vegetation layer will overlay the vegetation support layer. It is intended that the entire 48-inch soil layer will support the vegetative growth necessary for the successful operation of an evapotranspiration cover.

The following sections describe the CQA observations and tests to be performed when constructing the soil portion of the cover. In general, the objectives of the soil CQA procedures are to:

- Assure the cover is constructed of soils with similar engineering and vegetative growth properties to those specified in the design
- Verify soil compaction is consistent with design specifications
- Verify soil thicknesses meet the minimums specified in the design
- Document that the cover was constructed in accordance with the design specifications and applicable ODEQ regulations

These objectives will be attained by performing pre-construction laboratory soil testing, construction soil conformance testing, field density testing, and general construction observation and surveying.

2.1 CONSTRUCTION TESTING FREQUENCIES

The below table establishes the test frequencies for earthwork construction quality assurance.

Table 1. Construction Testing Frequencies

Test (ASTM No.)	Final Cover
Moisture-Density Relationship (ASTM D 698)	1 per soil type
Atterberg Limits (ASTM D 4318)	1 per soil type
Passing No. 200 Sieve (ASTM D 1140)	1 per soil type
Soil Classification (ASTM D 2487 and ASTM D 2488)	1 per soil type
Moisture/Density of Soil In-Place (ASTM D 2922)	3 tests per acre
Thickness Verification	100-foot square grid with a minimum of 2 reference points.

3.0 EARTHWORK CONSTRUCTION

The following sections describe general construction procedures to be used for the final cover system. When possible, construction sequencing should be phased to reduce soil compaction by heavy construction equipment. For example, designated haul and dump routes should be established at either the top or toe of slopes for delivering the soil. The soil should then be spread up or down slope with lower ground pressure equipment exerting a ground pressure of 16 psi or less (e.g., wide-track bulldozers and graders).

3.1 INTERMEDIATE COVER LAYER

The intermediate cover layer shall consist of intermediate cover soils placed over completed waste fill areas in accordance with the facility operating plan. After the landfill reaches the permitted grade, 12 inches of soil will be placed by the owner over the completed waste fill areas. The contractor will re-work the cover soils (or intermediate cover layer) to provide a smooth, uniformly graded surface upon completion.

Preparation of the intermediate cover layer will be performed under the supervision of the CQA personnel. QA/QC procedures to be performed during the preparation of the intermediate cover layer will include observation of the grading of the intermediate cover layer. Upon completion of intermediate cover layer grading activities, the CQA Engineer will determine that the intermediate cover layer has been prepared to provide a uniform surface. Visual examination of the intermediate cover layer preparation by the CQA Monitor will generally be sufficient to evaluate its sustainability as a foundation for the overlying vegetation support layer soils. The CQA Monitor will approve the prepared intermediate cover layer prior to the placement of the vegetation support layer. Approval will be based on a review of test information, if applicable, and CQA monitoring of the intermediate cover layer preparation.

Surveying will be performed to verify that the completed intermediate cover layer is a minimum of 12 inches thick. The foundation layer will be probed on a 100-foot grid to verify that a minimum 12-inch-thick soil layer is present at each location. This survey will only verify that a minimum 12-inch-thick soil layer is in place, not the total thickness of the intermediate cover layer. As an option for the intermediate layer thickness verification, the vegetation support layer may be installed as a 36-inch thick, single-lift soil layer per Section 3.2 requirements.

3.2 VEGETATION SUPPORT LAYER

The vegetation support layer will consist of a minimum 24-inch thick soil layer (measured perpendicular to the intermediate cover layer surface) that will extend along the top and side slopes of the landfill. The vegetation support layer material will consist of relatively homogeneous clay, silty clay, sandy clay, or clayey sand. Material used for the vegetation support layer shall be classified as CL, CH, ML, SM, or SC according to the Unified Soil Classification System (USCS). The soil will be free of debris and rocks greater than two inches in diameter. The vegetation support layer material should be placed in one 24-inch lift. The material will be compacted by "tracking-in" the material by 2 to 4 passes using low-ground pressure earth moving equipment.

Field moisture and density tests will be performed on the vegetation support layer at a minimum frequency of three per acre and will be completed with a nuclear density gauge in substantial compliance with ASTM D 2922. The nuclear density gauge shall be calibrated in accordance with the manufacturer’s instructions and ASTM requirements. Soil density requirements shall be 80± 5 percent of maximum dry density as determined by the standard proctor (ASTM D 698) at a moisture content less than the optimum moisture content.

Over-compacted vegetation support layer soil will be disked or ripped (or any other method approved by the CQA Engineer) and recompacted to a density that is between 75 and 85 percent of the maximum dry density. If a density test fails (i.e., density is less than 75 percent or more than 85 percent of the maximum dry density), additional tests may be performed to delineate the failing area. The area to be reworked will encompass the area between passing density tests.

The vegetation support layer construction will be conducted in a systematic and timely fashion. Delays will be avoided in the completion of the vegetation support layer and construction of the overlying vegetation layer.

3.3 VEGETATION LAYER

The vegetation layer will be placed over the vegetation support layer. The soil used in the layer should be capable of supporting vegetative growth. The soil will be placed in one 12-inch lift over the entire surface of the vegetation support layer and should be compacted with low-ground pressure earth-moving equipment. The surface of the vegetation layer should be graded to the final grades and disked parallel to the proposed contours to prevent soil loss in the event of heavy rainfall and to prepare the soil for seeding.

The vegetation layer should be placed under the continuous observation of QA/QC personnel to determine that the minimum thickness is applied and that no damage occurs to other structures (e.g., gas system components) installed in the final cover.

3.4 ESTABLISHMENT OF VEGETATION

Vegetation will be established and maintained in accordance with the Vegetation Plan as outlined in section 8.4 of the site's Operations Plan.

4.0 SOIL THICKNESS VERIFICATION

The thickness of the landfill cover shall be verified by a surveyor licensed to practice in the State of Oklahoma or by the CQA Engineer as long as the surveying does not involve the establishment of boundaries. The surveyor must be employed by an organization that operates independently of the landfill owner, contractor, and permit holder. The surveyor may be employed by the CQA Engineer. The thickness of the intermediate cover layer, vegetation support layer, and vegetation layer will be completed on a 100-foot grid. A final survey will be completed at approximately the same 100-foot grid point locations as well as the toe and top of slopes, and grade changes to verify the required compacted soil layer thickness and vegetative soil layer thickness were achieved. Acceptable tolerances for surveying shall be +0.1 feet for elevations and ±1.0 feet for horizontal coordinates.

5.0 REPORTING

Proper documentation of the CQA process is an important aspect of the QA/QC Plan. Documentation will consist of daily field reports, test results, deviation from the QA/QC plan, and the Final Cover Certification Report (FCCR).

5.1 DAILY FIELD REPORTS

The CQA Monitor is to provide daily written reports to the CQA Engineer during the days when observations are made. These reports will include information about the work accomplished each day, tests and observations that were made, and descriptions of the adequacy of the work performed. The reports should include the following:

- Date, project name, location, and personnel involved in major activities
- Description of weather conditions, including temperature, cloud cover, and precipitation
- Location of observation activity or location from which the sample(s) were obtained
- Standard methods and frequency used for tests
- Results of testing performed (passing or failing)
- Equipment calibration results
- Construction or testing problems and required actions
- Photographic documentation of construction progress including time, date, location, and name of photographer
- Signature of the CQA Monitor

5.2 TEST RESULTS

Test results shall be reported on standard sheets and shall include the following:

- Description or title of testing activity
- Location of the field-testing activity or the location from which the sample was obtained
- Type of test and procedure used (reference standard method when appropriate)
- Recorded observation or test data, with all necessary calculations

5.3 DESIGN CHANGE DOCUMENTATION

On occasion, it may be necessary to modify the design during construction activities. Changes to the design or deviations from the permit documents must be approved by the Owner, CQA Engineer, and the ODEQ.

5.4 DEVIATION FROM THE QA/QC PLAN

During the course of construction, deviations from the approved QA/QC Plan may be necessary due to various construction issues, permit modifications, regulatory changes, new technology, or changes to accepted standards. Deviations from this QA/QC Plan must be documented and approved by the Owner, CQA Engineer, and the ODEQ prior to their implementation.

5.5 FINAL COVER CERTIFICATION REPORT

At the completion of the project, the FCCR shall be submitted by the CQA Engineer to the ODEQ on behalf of AEL. The report shall certify that construction was completed in substantial compliance with the QA/QC Plan and approved deviations. This document shall include the following information:

- Scope of work
- Daily field reports
- Laboratory and field test results
- Evaluation of test results with respect to project specifications
- Descriptions of design changes or deviations from the QA/QC Plan
- Final survey report including thickness calculations
- As-built construction drawings (signed, sealed, and dated)
- Representative photographs of alternative earthen cover taken during construction
- Certification (signed, sealed, and dated) by a professional engineer registered in the State of Oklahoma stating that the landfill construction has been completed in accordance with the engineering design and QA/QC Plan