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Groundwater/Leachate Modeling Study Report
for
Area A Landfill Remedial Design

Naval Submarine Base New London
Groton, Connecticut

Volume III
Sections 4.0, 5.0, 6.0, and 7.0
Appendices

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4.0 GROUNDWATER/LEACHATE MODELING

This section of the report provides a detailed description of the groundwater/leachate modeling procedure and results. Section 4.1 describes the conceptual model and rationale for the modeling approach. Section 4.2 describes the structure of the MODFLOW groundwater flow model. Section 4.3 presents the boundary conditions and initial model inputs. Section 4.4 describes the model calibration procedure and presents the calibrated results. Section 4.5 describes the sensitivity analyses that were specifically performed. Section 4.6 describes the model applications, i.e., the application of the model to conditions with the landfill cap, uphill trench, and toe drain. Section 4.7 provides an estimate of the reduction in contaminant discharge to the wetland for conditions with the landfill cap, uphill trench, and toe drain.

These sections are supported by five large plan-view maps (Figures 4-1, 4-2, 4-10, 4-14, and 4-34) and thirty-nine, 8 1/2 x 11 inch figures (Figures 4-3 through 4-9, 4-11 through 4-13, 4-15 through 4-33, and 4-35 through 4-44). All of these figures are located at the end of this section, with the large figures enclosed in plastic pockets.

4.1 CONCEPTUAL MODEL

The hydrogeologic conditions of the Area A Landfill are described in Section 3.3. Four cross-sections (A-A', B-B', C-C', and D-D') were utilized to summarize the characteristics of the four lithologic units: landfill material, dredge spoil, alluvium, and bedrock (refer to Figure 3-14). Conceptual flow nets were utilized to demonstrate groundwater flow characteristics (refer to Figures 3-15 through 3-18).

Figure 4-1 shows the same four cross-sections, but the cross-sections are simplified to depict the modeling approach for this investigation. Groundwater in the landfill material flows primarily to the Area A Wetland. As a conservative assumption, the dredge spoil (where present) is assumed to be an impermeable boundary beneath the landfill material. Near the southern hillside boundary where dredge spoil is not present, groundwater in the alluvium and bedrock recharges into the landfill material from below.

The lower boundary of the model is shown for each cross-section on Figure 4-1. Where dredge spoil is present, the upper surface of the dredge spoil is the lower model boundary. The dredge spoil is assumed to be an impermeable boundary. This assumption provides for a conservative estimate of groundwater flow through the landfill material, because realistically some leakage through the dredge spoil occurs. Along the southern hillside, the lower model boundary is approximately 10 feet below the ground surface. This

allows for upward recharge from the alluvium and bedrock. The upper boundary of the model is the saturated groundwater elevation.

For the existing condition, infiltration moves through the unsaturated zone to the saturated zone. The currently designed landfill cover system will reduce infiltration. The upgradient interception trench will collect surface water and also groundwater when the trench intercepts the water table. The conceptual model provides a basis for modeling groundwater flow and estimating the saturated thickness of the landfill material for both existing conditions and following installation of the currently designed landfill cover system and upgradient interception trench, which is referred to hereafter as the capped condition.

The OBDA groundwater seep is not considered in the model. As discussed in Section 3.3, the reduced hydraulic potential at bedrock monitoring well 2LMW9D and evidence that collected groundwater from the OBDA seep is clean suggests that the source of the seep water is from bedrock and possibly overlying alluvium, not landfill material. Because the model addresses recharge from the alluvium and bedrock to the landfill material and saturated groundwater flow through the landfill material, it is not necessary to include the OBDA seep in the model.

4.2 MODFLOW MODEL STRUCTURE

Groundwater flow is modeled with the MODFLOW model (USGS, 1988). MODFLOW is a block-centered, finite difference groundwater flow model that is utilized here to simulate three-dimensional steady, saturated flow through the landfill as described in the conceptual model. The model structure is defined in the following sections.

4.2.1 Model Grid

Figure 4-2 shows the MODFLOW model grid. The model boundaries were established outside of the landfill area with a sufficient buffer, so that the boundary conditions are not sensitive to the model results within the Area A Landfill boundary.

The model grid is oriented to the predominant groundwater flow direction. The size of the model blocks were based on an estimated distance of a one-foot change in the water table elevations, the desired degree of model resolution, in the predominant groundwater flow direction across the landfill toward the Area A Wetland. Given that the hydraulic gradient of the water table is steepest in the western portion of the landfill, this area dictated the size of the blocks, which is 25 feet in the direction of flow. Some blocks along the model boundary where it is not critical to have a one-foot change in the water table (upgradient area) or the

water table is very flat (wetland), are 50 feet in the direction of flow. All of the blocks are 50 feet in the orthogonal, cross-flow direction.

Figure 4-3 is a duplication of the model grid produced by the modeling software, GMS, which is a pre- and post-processing package for MODFLOW. This figure can be utilized as a reference for the many figures that are to be presented for the modeling effort.

4.2.2 Bottom Elevations and Thickness of the Model

Figure 4-4 shows the bottom elevation of the model for each model block, which is the lower boundary of the model. As discussed in Section 4.1, the bottom of the model was defined as the top of the dredge spoil (bottom of landfill material) where dredge spoil is present and approximately 10 feet below ground surface along the hillside. Between these two areas, the bottom elevation of the model was smoothed.

Figure 4-5 shows the model thickness for each model block. The overall thickness was calculated as the difference in the ground surface elevation and the bottom of the model elevation.

4.2.3 Number of Model Layers

Multiple model layers were established within the Area A Landfill boundary, so that the model remains flexible for estimating contaminant transport at different depths. Figure 4-6 shows the number of model layers. Within the landfill boundary, the model layers are five feet thick until the bottom of the model is reached. The bottom elevation of the model layers is 70 feet for Layer 1, 65 feet for Layer 2, 60 feet for Layer 3, and 55 feet for Layer 4 (all in feet msl). Four layers were required in the eastern portion of the landfill where the dredge spoil surface is depressed. Outside of the landfill boundary, there is one model layer.

4.3 BOUNDARY CONDITIONS AND INITIAL MODEL INPUTS

In this section, boundary conditions are defined and the method for estimating initial model inputs is described.

4.3.1 B undary Conditions

Figure 4-7 shows the model blocks that have a defined boundary condition. Constant head model blocks are located in the Area A Wetland, northwest of the Area A Landfill in the Area A Downstream/OBDA, and along the southern hillside.

The constant head values in the Area A Wetland were approximated from surface water elevations measured at staff gauges during the Modeling Field Investigation. The constant head values in the Area A Downstream/OBDA were initialized by initial groundwater elevations measured at two shallow wells (2DMW11S and 3MW11S) at that site. The constant head values along the southern hillside boundary were initialized as one foot below the ground surface elevation.

4.3.2 Distribution of Hydraulic Conductivity

Figure 4-8 shows the seven zones of hydraulic conductivity that were utilized to initialize hydraulic conductivity at each model block. Zone 1 is located outside of the Area A Landfill boundary where alluvium and bedrock are the combined materials in the single model layer. Zone 2 is the Area A Wetland where groundwater flow and surface water are highly connected. Zones 3, 4, 5, 6, and 7 are areas within the Area A Landfill boundary where slug tests were performed at monitoring wells screened in the Area A Landfill material.

The initial value of hydraulic conductivity for Zone 1 is 3.4 feet/day. This estimated value was derived from the result of a slug test performed during the Phase II RI Field Investigation at monitoring well 4MW4S, which is screened in alluvium and bedrock. The initial value of hydraulic conductivity for Zone 2 is 1000 feet/day. This high value was assumed, because surface water has a small resistance to flow.

The initial values for Zones 3, 4, 5, 6, and 7 are 0.81, 0.059, 170, 56, and 17 feet/day, respectively. These estimated values were derived from the results of slug tests performed at the 2LM28F, 2LMW29F, 2LMW30F, 2LMW31F, and 2LMW32F monitoring wells installed during the Modeling Field Investigation. No vertical variation in hydraulic conductivity was assumed for the model.

4.3.3 Zones of Upward Recharge

Figure 4-9 shows the model blocks where upward recharge from the alluvium and bedrock is an input. Zones 1 and 2 are located within the Area A Landfill boundary and are qualitatively designated as low and

intermediate rates of recharge. Zone 3 is located outside of the Area A Landfill boundary along the southern hillside and is qualitatively designated as a high rate of recharge.

These qualitative assessments were made by considering vertical hydraulic gradients at well cluster 2LMW29 (Zones 1 and 3) and well cluster 2LMW13 (Zone 2) and estimated values of hydraulic conductivity for monitoring well 2LMW29A (Zones 1 and 2) and monitoring well 4MW4S (Zone 3). The magnitudes of upward recharge were determined through model calibration.

4.3.4 Rates of Infiltration

As discussed in Sections 2.1.1 and 2.2.1, ten surface infiltration tests were performed at five types of surface soils within the Area A Landfill boundary during the Modeling Field Investigation. The estimated values of vertical hydraulic conductivity for the unsaturated zone are reported in Table 2-1. Because three of the five surface soil types resulted in similar estimates of vertical hydraulic conductivity, these groups were combined into one type.

Figure 4-10 shows six zones where different rates of infiltration are expected. Three of these zones: gravel parking areas and unpaved roadways (yellow), vegetated area with minimal slope (green), and non-vegetated area with cobbles and boulders (pink) have initial values of vertical hydraulic conductivity from surface infiltration tests. The remaining three zones: waterbody (blue), vegetated area with steeper slope (red), and buildings and paved roadways (red hatching) do not have initial values of vertical hydraulic conductivity from surface infiltration tests.

The HELP model (USEPA, 1993) was used to estimate initial values of areal infiltration in the MODFLOW model. The HELP model was utilized to estimate rates of infiltration for three zones: vegetated area with steeper slope (red), gravel parking and unpaved roadways (yellow), and vegetated area with minimal slope (green). Table 4-1 shows the HELP model inputs and results for these three surface types under the existing condition and one simulation for the capped condition (a more detailed record of the model inputs and results is included in Appendix D.3). The primary model inputs were the layer thicknesses, vertical hydraulic conductivity, and curve number. The curve number is a function of the surface slope and a qualitative assessment of the degree of vegetation. For a higher curve number, the rate of run-off is higher and the rate of infiltration is lower. Also, the default data set in the HELP model for New Haven, Connecticut was selected for precipitation and wind speeds.

TABLE 4-1

SUMMARY OF HELP MODEL INPUTS AND RESULTS
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

HELP MODEL RUN FOR THE EXISTING CONDITION

INPUTS				RESULTS
Hillside - Vegetated with Steeper Slope (red)				
	Thickness (ft)	K(ft/day)	Curve number	Infiltration rate (in/yr)
Layer 1	2.5	4	91	12.83
Layer 2	2.5	4		
Gravel Parking and Unpaved Roadways (yellow)				
	Thickness (ft)	K(ft/day)	Curve number	Infiltration rate (in/yr)
Layer 1	3	24	85	19.2
Layer 2	7	4		
Layer 1	3	24	85	19.2
Layer 2	7	17		
Layer 1	3	24	85	19.2
Layer 2	7	170		
Vegetated Area with Minimal Slope (green)				
	Thickness (ft)	K(ft/day)	Curve number	Infiltration rate (in/yr)
Layer 1	3	12	85	17.9
Layer 2	7	4		
Layer 1	3	12	85	17.9
Layer 2	7	17		
Layer 1	3	12	85	17.9
Layer 2	7	170		

HELP MODEL RUN FOR THE CAPPED CONDITION

INPUTS				RESULTS
Cap area				
	Thickness (ft)	K(ft/day)	Curve number	Infiltration rate (in/yr)
Layer 1	3	10^{-7} (cm/sec	92	0.6
Layer 2	3	24		
Layer 3	7	17		

The estimated rate of infiltration was 12.8 inches/year for the red zone, 19.2 inches/year for the yellow zone, and 17.9 inches/year for the green zone. Multiple simulations were performed for varying hydraulic conductivity of the second layer. However, resulting rates of infiltration did not change.

Figure 4-11 shows the initial rate of infiltration defined for the model blocks. An infiltration rate of 13 inches/year was assigned to blocks in the red zone (hillside), and an infiltration rate of 20 inches/year was assigned to blocks in the yellow and green zones.

The HELP model was not used to estimate an infiltration rate for the cobble and boulders zone (pink), because the area is very small. Although it is expected that infiltration is minimal in the building and paved roadway zone (red hatching), the area is also small. Finally, because the boundary condition in the Area A Wetland (blue) for the MODFLOW model is a constant head boundary, a rate of infiltration will have no effect on the boundary. For these three areas, the rate of infiltration was assigned to be 20 inches/year.

Within the currently designed boundaries of the Area A Landfill cover system, the HELP model was utilized to estimate the rate of infiltration for the capped condition. The primary change in the model input was the addition of a three-foot thick layer at the surface with a low vertical hydraulic conductivity (10^{-7} centimeters/second). The resulting rate of infiltration was 0.6 inches/year.

4.4 MODEL CALIBRATION

Once the initial model inputs were established, the MODFLOW model was executed and resulting simulated groundwater elevations were compared to calibration targets. Based on an analysis of the difference between simulated and targeted groundwater elevations, model inputs were varied at some model blocks. This process continued until the simulated groundwater elevations met the calibrated targets within a reasonable limit.

4.4.1 Calibration Targets

Figure 4-12 shows the calibration targets, which are the water levels measured at monitoring wells, piezometers, and staff gauges that represent the water table (refer to Section 3.3.2 for discussion of the water table and accompanying Figure 3-9 for the contoured map of the water table).

In order to establish reasonable limits or bounds for the calibration targets, monthly water levels collected during the Phase II RI field investigation in 1994 were analyzed. Table 4-2 reports the monthly water levels measured for monitoring wells in the Area A Landfill. Additionally, the water levels measured during the

TABLE 4-2

MONTHLY WATER LEVELS FROM 1994 AND NOVEMBER, 1995
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

Well/Staff Gauge Screened Unit	2LMW7S F/DS	2LMW7D BR	2LMW18S F	2LMW18D BR	2LMW20S F/A	2LMW20D BR	2WMW3S F/DS	2WMW3D BR	SG-6
30-Mar	75.66	80.29	72.65	71.66	72.98	79.76	74.47	76.54	70.48
3-May	73.90	78.88	71.74	70.41	72.61	77.13	75.38	73.75	70.32
26-May	73.55	78.65	71.63	69.63	72.37	76.40	73.42	75.21	70.43
29-Jun	72.81	77.05	71.08	66.21	71.74	74.63	72.85	73.48	69.92
26-Jul	72.06	74.96	70.60	65.00	71.43	74.14	72.53	73.17	69.50
23-Aug	73.16	76.47	71.23	68.02	71.28	77.20	74.21	75.23	69.84
28-Sep	73.22	78.02	71.18	68.01	72.34	76.42	73.40	74.68	70.29
31-Oct	72.63	75.74	70.63	66.83	71.62	74.06	73.13	73.02	71.10
27-Nov	75.03	79.24	71.39	na	na	76.43	73.33	74.55	70.17
21-Dec	74.23	79.59	71.69	na	69.40	77.62	73.39	75.39	70.32
Nov-20,1995	74.47	79.66	71.76	69.85	71.89	77.90	73.73	75.95	70.34

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Modeling Field Investigation in November 1995 are reported. In all cases, the water levels for November 1995 are similar to the water levels for November 1994 and are within the range of monthly water levels for all months in 1994.

The range of water levels for 1994 at each monitoring well or staff gauge is representative of an acceptable range of water levels for the calibration target. Measured values at wells 2LMW7S, 2LMW18S, and 2WMW3S are representative ranges for the western, central, and eastern portions of the Area A Landfill. The range of groundwater elevations are 3.6 feet at 2LMW7S, 2.0 feet at 2LMW18S, and 2.8 feet at 2WMW3S. The range of values at staff gauge SG-6 (1.6 feet range) are representative of the surface water elevations measured in the Area A Wetland.

4.4.2 Calibration Results

Figure 4-13 shows the calibrated groundwater elevations for the model grid, and Figure 4-14 (large map) shows the contoured calibrated groundwater elevations. Overall, the calibrated water table matches the targeted water levels very well, and the contoured calibrated water table is similar to the contoured groundwater table of Figure 3-9. The calibrated water table is below the ground surface in all areas except the Area A Wetland.

Figure 4-15 is a graph that compares the calibrated groundwater elevations to the measured groundwater elevations at the targeted model blocks.

Figure 4-16 reports the residual errors in the calibration targets, which are the differences in the measured groundwater elevations and the calibrated groundwater elevations. Most of the residual errors are less than one foot. The smallest residual errors occur near the Area A Wetland boundary and in the central portion of the Area A Landfill. The largest residual errors occur in the western portion of the landfill and along the southern hillside boundary.

Figures 4-17 through 4-20 show the calibrated boundary head values, distribution of hydraulic conductivity, rate of upward recharge, and rate of total recharge (infiltration plus upward recharge). These are the final adjustments for the calibrated groundwater table. Boundary head values were adjusted along the hillside boundary. Hydraulic conductivity were adjusted (increased) in the western portion of the landfill where initial values from slug test analyses were very low. Otherwise, the boundaries between initial hydraulic conductivity zones were smoothed, so that there were no sharp changes in hydraulic conductivity across model blocks.

The initial zones of low, intermediate, and high magnitudes of upward recharge were honored in the calibration. The calibrated values of low, intermediate, and high recharge are 5, 7, and 11 inches/year, respectively. However, in the western portion of the landfill, in order for the calibrated water table to best meet the calibration target, the total rate of recharge was reduced.

4.5 SENSITIVITY ANALYSES

Once the model was calibrated, a sensitivity analysis was performed to analyze the change in the calibrated groundwater table when specific model inputs were varied. A different combination of model inputs may result in a similar calibrated groundwater table, but may cause a different outcome when the model inputs are used for predictive purposes.

The model inputs to be varied were selected and varied independently to analyze the direct effect of each model input on the calibrated groundwater table. When a model input is varied, three general conclusions may occur: 1) the calibrated result is insensitive to changes in the model input, 2) the calibrated result is highly sensitive to the model input (there is a narrow range of input that produces an acceptable output), and 3) the calibrated result is acceptable for a range of the model input. In the first and second cases, the calibrated model input is concluded to be the acceptable value. In the third case, a value of the model input within the range that produces an acceptable calibrated result needs to be selected and justifiably conservative for predictive purposes.

In this analysis, five model inputs were varied: rate of infiltration, leakage rate through the dredge spoil, Area A Wetland surface water elevations, southern hillside groundwater elevations, and hydraulic conductivity on the hillside. The following sections describe the changes in these model inputs and the sensitivity results.

4.5.1 Infiltration Rate

During the calibration procedure, the total recharge (infiltration plus upward recharge) was changed from the initial model inputs in some areas, so that the calibrated water table met the calibration targets. For the sensitivity analysis, the calibrated rates of infiltration were decreased by 50 percent. In the western portion of the landfill where the total recharge rate was decreased to 13 inches/year for the calibrated model, the total recharge rate was reduced by 50 percent (the total calibrated recharge is not differentiated by infiltration and upward recharge).

Figure 4-21, 4-22, and 4-23 show the recharge rate, resulting water table, and change in the water table for the 50 percent decrease in infiltration. When the infiltration rate is decreased, groundwater elevations

decrease by approximately 0.02 to 0.04 feet along the Area A Wetland boundary, 0.1 to 0.5 feet across most of the Area A Landfill itself, and more than 1 foot along the western portion of the southern hillside boundary.

These results suggests that the model is insensitive along the Area A Wetland boundary, moderately sensitive within the Area A Landfill itself, and very sensitive along the southern hillside to the rate of infiltration. Therefore, the calibrated rate of infiltration is acceptable for the Area A Wetland and the southern hillside.

Because the model is moderately sensitive to the rate of infiltration for the Area A Landfill itself, there is some uncertainty in the model input. However, the landfill area will be capped, so the uncertainty in the calibrated input will not affect the predicted water table under the capped condition.

4.5.2 Dredge Spoil Leakage Rate

In the calibrated model, the dredge spoil beneath the landfill material was assumed to be an impermeable boundary. For the sensitivity analysis, a leakage rate of 5 inches/year was assumed, which was modeled as a decrease in the rate of infiltration of 5 inches/year in model blocks where dredge spoil is present.

Figure 4-24, 4-25, and 4-26, show respectively, the recharge rate, resulting water table, and change in the water table for a leakage rate through the dredge spoil of 5 inches/year. The resulting groundwater elevations decrease by approximately 0.01 feet along the wetland, and 0.02 to 0.1 feet across most of the landfill where dredge spoil is present. Near the hillside where dredge spoil is not present, changes in groundwater elevations are less than 0.01 feet.

This result suggests that the model is insensitive to a dredge spoil leakage rate along the Area A Wetland and near the southern hillside. As in the sensitivity test for the rate of infiltration, the model is moderately sensitive to the dredge spoil leakage rate in the Area A Landfill area. However, leakage in the dredge spoil produces decreases in the groundwater elevations, so the estimate of the calibrated water table is conservative.

4.5.3 Wetland Surface Water Elevation

In the calibrated model, the surface water elevation at each block along the Area A Wetland boundary is fixed by a constant head boundary condition. For the sensitivity analysis, the constant head values were decreased by 0.9 feet to about the elevation of dredge spoil surface.

Figures 4-27 and 4-28 show the resulting water table and the change in the water table elevation for the 0.9 foot decrease in head values along the Area A Wetland. The resulting groundwater elevations are affected primarily in the Area A Wetland and near the landfill boundary along the wetland. Generally, groundwater elevations decrease. In the eastern portion of the Area A Landfill where the calibrated hydraulic gradient is relatively flat, the decreases in the groundwater elevations persist further upgradient than in the western portion of the landfill where the calibrated hydraulic gradient is steeper.

In the central portion of the landfill area, groundwater elevations increase, because the fixed groundwater elevation is only 0.1 feet above the bottom of the model. The small resulting discharge area causes an increase in the hydraulic gradient.

These results suggest that the calibrated water table is sensitive to the wetland boundary condition. However, realistically, the surface water elevation in the Area A Wetland would not decrease without a corresponding decrease in total recharge and groundwater elevations in the upgradient areas. Therefore, the combination of the recharge rates and wetland water elevations in the calibrated model represent an acceptable condition. If only one of the two parameters is changed, the estimated elevations in the water table are unreasonable.

4.5.4 Groundwater Elevation Along The Southern Hillside Boundary

In the calibrated model, the groundwater elevation at each block along the southern hillside boundary was fixed by a constant head boundary condition. For the sensitivity analysis, these constant head values were decreased by 3 feet.

Figures 4-29 and 4-30 show the resulting water table and the change in the water table for the 3 foot decrease in head values along the hillside boundary. The resulting groundwater elevations change minimally (generally less than 0.05 feet) in the far western and far eastern portions of the Area A Landfill from the Area A Wetland to the southern hillside. In the central portion of the landfill area, groundwater elevations decrease by approximately 0.1 feet near the wetland, 0.3 to 0.8 feet across the landfill, and greater than 1 foot along the hillside.

This result suggests that the model is insensitive to changes in the southern hillside boundary condition in the far western and eastern portions of the landfill. The model is moderately sensitive to the change in the hillside boundary condition in the central portion of the landfill area along the hillside. For these two conditions, the calibrated model input along the southern hillside is acceptable.

Because the model is sensitive to the southern hillside boundary condition in the central portion of the landfill, there is some uncertainty in the hillside boundary conditions. However, the range of uncertainty in the model input results in an acceptable range of predicted groundwater elevations when compared to the calibration targets. The calibrated model input is acceptable, because the groundwater elevations near the hillside boundary are closer to measured groundwater elevations at monitoring wells near the hillside boundary.

4.5.5 Hydraulic Conductivity Along The Southern Hillside

In the calibrated model, the hydraulic conductivity along the southern hillside was set to 4 feet/day, based on a resulting slug test estimate of hydraulic conductivity from the 4MW4S monitoring well, which is screened across alluvium and bedrock. Slug tests performed at the three deep bedrock wells 2LMW32B, 2LMW35B, and 2LMW36B during the field investigation resulted in an estimated geometric mean of hydraulic conductivity of 0.014 feet/day.

For the sensitivity analysis, the hydraulic conductivity along the hillside was set to 0.014 feet/day to determine if the value for the deep bedrock is appropriate for the shallow bedrock. Resulting groundwater elevations along the hillside are not reasonable, with over a 100 percent increase in the western area of the hillside boundary and over a 30 percent increase in the eastern area of the hillside boundary (as compared to the calibrated groundwater elevations). This result suggests that the value of hydraulic conductivity for the deep bedrock is not appropriate for the shallow bedrock. Therefore, the value of 4 feet/day utilized in the calibrated model is acceptable.

4.6 MODEL APPLICATIONS

Once the model was calibrated and a series of sensitivity tests were performed to provide an acceptable verification of the calibrated input values, the model was utilized for predicting the water table under three different scenarios: 1) under capped condition, 2) under capped condition when the Area A Wetland experiences flooded conditions, and 3) under capped condition when a toe drain system is added along the Area A Wetland to collect groundwater discharge from the landfill. Changes to the model inputs and predicted groundwater elevations for these three scenarios are presented in the following sections.

4.6.1 Capped Condition

For the capped condition, the rate of infiltration was decreased across the cap area, and an additional boundary condition was imposed along the upgradient interception trench. The rate of infiltration was

estimated from the HELP model as 0.6 inches/year. Figure 4-31 shows the combined recharge rate (infiltration and upward recharge) for the modeled area.

Figure 4-32 shows the boundary conditions for this scenario. The boundary condition along the upgradient interception trench was defined as a trench boundary. If the groundwater elevation along the trench is higher than the bottom of the trench elevation, the groundwater elevation was decreased to the bottom of the trench. This simulated the collection of groundwater in the trench. The boundary condition was only imposed along a short span where the calibrated groundwater elevation was above the bottom of the trench. The remaining boundary conditions were the same as in the calibrated model.

Figure 4-33 shows the predicted water table at each model block, and Figure 4-34 shows a contoured map (large map) of the predicted water table for the landfill cap and uphill trench scenario. The general shape of the contours is similar to those of the calibrated water table (Figure 4-14). Figure 4-35 shows the difference in the calibrated water table minus and the water table for the landfill cap and uphill trench.

The capped condition reduces groundwater elevations, and consequently the thickness of the saturated landfill material, by approximately 0.1 feet along the Area A Wetland boundary, 0.5 feet in the eastern portion of the landfill, 0.2 feet in the central portion of the landfill, and greater than 1 foot in the western portion of the landfill.

To investigate the design elevation of the upgradient interception trench, the bottom elevation of the trench was lowered by two feet. The resulting trench boundary condition increased in span by two model blocks. Figure 4-36 shows the predicted water table when the uphill trench was lowered by two feet (the underlined model boxes indicate the trench location).

Figure 4-37 shows the difference in the water table for the landfill cap and design uphill trench condition and the water table when the uphill trench is lowered by two feet. Groundwater elevations change by approximately 0.1 to 0.3 feet in a localized area downgradient of the trench. Near the trench, groundwater elevations decrease by greater than 1 foot. Groundwater elevations in landfill areas away from the trench and along the wetland boundary are insensitive to the lowering of the trench.

4.6.2 Capped Condition With Flooded Area A Wetland

In order to investigate the stability of the landfill cap when the wetland becomes flooded (stability results are reported in Section 5.0), the flow rate from the wetland into the landfill material under the 100 year flood condition was estimated. The flow rate was estimated as:

$Q = L * H * K * i$ (Equation 4.1)

with:

Q: Flow rate in ft^3/day,

L: length of the Area A Wetland boundary with the Area A Landfill cover system (1,750 feet),

H: landfill material thickness under the edge of the Area Landfill cover system (3 feet),

K: hydraulic conductivity (56 feet/day), and

i: maximum hydarulic gradient, estimated as:

$i: = (h_1 - h_2)/l = (73.91 - 70.0)/ 100 = 0.039$ (Equation 4.2)

with:

h_1: maximum Area A Wetland surface water elevation during 100-year flood (73.91 feet)

h_2: minimum groundwater table elevation beneath the Area A Landfill cover system (70.0 feet)

l: upgradient distance over which the hydraulic gradient is estimated (100 feet)

The resulting flow rate is $Q = 11{,}495\ ft^3$/day

The rate at which the water table rises under the cap was estimated as:

$h = Q / (A * n)$ (Equation 4.3)

with:

- h: rate of water table rise in feet/day,
  A: total capped area (497,000 ft^2), and
- n: porosity (0.30).

The resulting rate of increase under the cap is h = 0.077 feet/day. Even if the flood duration is assumed to be 10 days, the total height that the water table rises under the cap is less than 1 foot. These calculations are included in Appendix D.4.

The model was utilized to estimate the change in the water table surface when the boundary condition along the wetland is increased to 72 feet msl. Figure 4-38 shows the predicted water table and Figure 4-39 shows the difference in the predicted water table for the landfill cap and uphill trench and the landfill cap and uphill trench under flooded conditions. Resulting changes in the groundwater elevations persist from the Area A Wetland boundary upgradient through the Area A Landfill.

4.6.3 Capped Condition and Toe Drain System

The final scenario to be investigated was the effect of a toe drain that would be installed along the landfill/wetland boundary. For this scenario, the bottom elevation of the model along the landfill/wetland boundary was lowered to 68 feet msl. Figure 4-40 shows the boundary conditions for the capped condition and toe drain. The toe drain was assumed to collect groundwater from the Area A Landfill, such that the bottom elevation of the toe drain was 70.0 feet msl and the constant head boundary was 70.02 feet msl.

Figure 4-41 shows the predicted water table and Figure 4-42 shows the difference in the predicted water table for the capped condition and the water table with capped condition and toe drain. Groundwater elevations decrease along the wetland boundary by approximately 1.5 feet with the toe drain.

In the western portion of the landfill, changes in groundwater elevations resulting from a toe drain addition would occur only near the Area A Wetland boundary and the effect of the toe drain system would be localized. In the central portion of the landfill, small changes in groundwater elevations would persist further upgradient. In the eastern portion of the landfill (where the calibrated hydraulic gradient is relatively flat), changes in groundwater elevations of greater than 1 foot would persist both upgradient and downgradient of the toe drain.

The initial intention of a toe drain was to potentially dewater the saturated landfill material. However, the depth of the toe drain is limited by the dredge spoil, which has an approximate elevation of 70 feet msl. Landfill material is also present below 70 feet msl, so it would not be possible for a toe drain to dewater the entire saturated landfill material.

Figures 4-43 shows the predicted water table if the elevation of the surface water in the toe drain is increased to 71 feet msl, which is the approximate surface water elevation in the Area A Wetland. The purpose of this test was to investigate the ability of a toe drain system to reduce the saturated landfill thickness without creating in-flow from the wetland.

Figure 4-44 shows the difference in the predicted water table for the capped condition and toe drain and the water table with the toe drain elevation increased to 71 feet msl. The saturated landfill thickness would increase by approximately 1 foot along the toe drain boundary, 0.7 feet in the eastern portion of the wetland, and 0.2 feet in the central portion of the landfill. As in the previous scenario, the toe drain system would have little effect on the saturated landfill thickness in the western portion of the landfill. In the eastern and central portions, the increased surface water elevation in the toe drain would decrease the effectiveness of the toe drain to reduce the saturated thickness of the landfill by approximately 50 percent.

4.7 ESTIMATED REDUCTION IN CONTAMINANT DISCHARGE TO THE AREA A WETLAND

From the groundwater modeling results, it is evident that the thickness of saturated landfill material will be reduced by the capped condition and would be reduced a little further with the addition of a toe drain system. The initial purpose of the Groundwater/Leachate Modeling Study was to provide estimates of groundwater elevations under the capped condition and capped condition and toe drain for the computation stability analyses of the Area A Landfill cover system design. As a supplemental task, bulk estimates of contaminant discharge to the wetland are provided for three scenarios: 1) the existing condition, 2) The capped condition, and 3) the capped condition and toe drain. These estimates were utilized to analyze the reduction in contaminant discharge to the Area A Wetland under the capped condition and toe drain. Detailed contaminant transport modeling was not performed.

4.7.1 List of Groundwater Constituents

A database of analytical results of soil and groundwater sampling from the Phase II RI (B&R Environmental, 1996) was utilized for this analysis. Contaminants of Concern (COCs) have been established for groundwater in the Area A Landfill in the Phase II RI Report (the CBU Drum Storage Area has been included with the Area A Landfill, because it resides within the boundary of the Area A Landfill cover system as currently designed). The list of COCs that had detections at wells within the Area A Landfill boundary are as follows.

- Inorganics: aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, iron, lead, manganese, nickel, vanadium
- VOCs: benzene, chlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene
- SVOCs: 4-methylphenol, bis(2 ethylhexyl) phthalate
- PCBs: Aroclor 1016, Aroclor 1260

4 Methylphenol has been eliminated from this list, because no detected concentrations exceed the risk-based COC screening level. For the remaining constituents, the geometric mean of the detected concentrations is presented in Table 4-3 (a more detailed record of detections and calculations is included in Appendix D.5).

TABLE 4-3

LOADING FROM GROUNDWATER
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

Group	COC	Groundwater Concentration (ug/L)	Kd (L/kg)	Rd	Existing Condition		Capped Condition with Trench		Reduction by Cap	
					Flow rate (ft^3/day)	Mass g/yr	Flow rate (ft^3/day)	Mass (g/yr)	Mass (g/yr)	%
1	Aluminum	2.11E+03	4.55E+03	2.58E+04	4.09E+03	3.47E+00	3.08E+03	2.61E+00	8.56E-01	25
1	Barium	1.63E+02	4.00E+02	2.27E+03	4.09E+03	3.04E+00	3.08E+03	2.29E+00	7.52E-01	25
1	Boron	4.90E+02	3.00E+00	1.80E+01	4.09E+03	1.15E+03	3.08E+03	8.67E+02	2.84E+02	25
1	Chromium	9.90E+00	2.08E+03	1.18E+04	4.09E+03	3.55E-02	3.08E+03	2.67E-02	8.76E-03	25
1	Iron	3.22E+04	4.02E+02	2.28E+03	4.09E+03	5.97E+02	3.08E+03	4.50E+02	1.47E+02	25
1	Lead	3.91E+01	5.88E+02	3.33E+03	4.09E+03	4.96E-01	3.08E+03	3.73E-01	1.22E-01	25
1	Manganese	5.36E+02	3.23E+02	1.83E+03	4.09E+03	1.24E+01	3.08E+03	9.32E+00	3.06E+00	25
1	Nickel	2.49E+01	1.27E+03	7.18E+03	4.09E+03	1.47E-01	3.08E+03	1.10E-01	3.62E-02	25
1	Vanadium	2.72E+01	3.45E+02	1.96E+03	4.09E+03	5.88E-01	3.08E+03	4.43E-01	1.45E-01	25
1	Bis(2-ethylhexyl)phthalate	1.16E+01	3.33E+02	1.89E+03	4.09E+03	2.60E-01	3.08E+03	1.96E-01	6.41E-02	25
2	Arsenic	9.50E+00	2.70E+02	1.53E+03	2.45E+03	1.57E-01	1.71E+03	1.10E-01	4.75E-02	30
2	Beryllium	1.80E+00	1.82E+02	1.03E+03	2.45E+03	4.42E-02	1.71E+03	3.08E-02	1.33E-02	30
3	Cadmium	2.42E+00	9.50E+02	5.38E+03	7.38E+02	3.43E-03	3.35E+02	1.56E-03	1.87E-03	55
4	Benzene	9.80E+00	1.70E-01	1.96E+00	3.93E+03	2.03E+02	3.03E+03	1.56E+02	4.64E+01	23
5	Chlorobenzene	1.20E+03	8.70E-01	5.93E+00	1.64E+03	3.43E+03	1.38E+03	2.89E+03	5.44E+02	16
5	1,2,4-Trichlorobenzene	6.50E+01	1.20E+01	6.90E+01	1.64E+03	1.60E+01	1.38E+03	1.34E+01	2.53E+00	16
5	1,4-Dichlorobenzene	5.50E+01	3.10E+00	1.86E+01	1.64E+03	5.02E+01	1.38E+03	4.23E+01	7.96E+00	16
5	Arochlor 1016	7.50E+00	2.40E+04	1.36E+05	1.64E+03	9.35E-04	1.38E+03	7.87E-04	1.48E-04	16
5	Arochlor 1260	2.90E+02	1.29E+06	7.30E+06	1.64E+03	6.73E-04	1.38E+03	5.67E-04	1.07E-04	16

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4.7.2 Areas of Groundwater Constituent Detections

To establish if each constituent listed in the previous section was detected across the entire landfill or in some smaller sub-area of the landfill, the spatial distribution of detections was analyzed. Because there have been no groundwater samples analyzed in the eastern portion of the landfill, groundwater concentrations for that were assumed to be the same as those detected at well 2LMW18S. This assumption is based on a comparison of detections in soil at well 2LMW18S with surface soil and test pit soil detections in the eastern portion of the landfill. Constituent detections in soil are reasonably similar at 2LMW18S and the east end.

This assumption is also supported by a qualitative assessment of these two locations. First, well 2LMW18S is closest to the eastern portion of the landfill. Second, based on results from the Area A East End Investigation (B&R Environmental, December 1995), there is no evidence that the waste material in the eastern portion of the landfill is different than wastes near well 2LMW18S. Third, in both the eastern portion of the landfill and the well 2LMW18S area, the dredge spoil surface is depressed and the saturated landfill material is greater than 10 feet. Therefore, each constituent detected at well 2LMW18S was assumed to be present in the eastern portion of the landfill. This is a conservative assumption, because VOCs, SVOCs, and PCBs were not detected at wells 2WMW3S and 2LMW20S, which are located outside of but near the eastern landfill boundary.

The spatial distribution of constituents is as follows:

- Across the entire Area A Landfill: aluminum, barium, chromium, iron, lead, manganese, nickel, vanadium, bis(2ethylhexyl)phthalate

- In western and central portions of the landfill to well 2LMW7S: arsenic, beryllium

  Around well 2LWM7S only: cadmium

- In central and eastern portions of landfill from well 2LMW7S to the eastern boundary of the landfill cover system as currently designed: benzene

- In eastern portion of landfill from 2LMW18S to east: chlorobenzene, trichlorobenzene, dichlorobenzene, Aroclor 1016, Aroclor 1260

These areas of detection are shown on figures that are included in Appendix D.5. Antimony was detected at one monitoring well, 2LMW13S. Groundwater in this area likely does not discharge to the Area A Wetland. Therefore, antimony was eliminated from the list of COCs.

4.7.3 Estimation of Contaminant Discharge for Existing Conditions

For each one of the areas of detection, the total discharge from the saturated landfill material to the Area A Wetland was estimated along the wetland boundary. The total discharge was estimated as the summation of discharges across each MODFLOW model block. At each block, the discharge is the product of the hydraulic conductivity for the landfill material, the hydraulic gradient of the water table across the wetland boundary, and the cross-sectional area of saturated landfill material for the existing conditions.

The mass flux m_i to the Area A Wetland for each constituent in grams/year was estimated as

$$m_i = Q_i * C_i / Rd_i$$

with:

- Q_i: total discharge for the constituent area,
  C_i: geometric mean of the constituent concentration, and
- Rd_i: factor of retardation for the constituent.

estimated as:

$$Rd:_i = 1 + (rhob_i * Kd_i/n) \quad \text{(Equation 4.5)}$$

with:

- $rhob_i$: bulk density of the material (1.7 grams/cubic centimeters)

  n: porosity of the landfill saturated material (0.3), and

  Kd_i: soil-water partitioning coefficient, which is estimated here as the quotient of the subsurface soil concentration and groundwater concentration in liters/kilogram (refer to Appendix D.5 for detailed analysis).

For constituents where subsurface soil concentrations were not available, literature values of the soil-water partitioning coefficient were used.

Table 4-3 reports the total discharge, groundwater concentration, soil-water partitioning coefficient, factor of retardation, and resulting estimate of mass flux to the Area A Wetland for each constituent. More detailed calculations are included in Appendix D.5.

4.7.4 Reduction in Contaminant Discharge for the Capped Condition

To estimate the reduction in contaminant discharge for the capped condition, the same calculation of total discharge and mass flux of each constituent was performed. The reduction in contaminant discharge is due to the reduction in the area of saturated landfill material for each model block.

Table 4-3 reports the mass flux for each constituent and reduction in mass flux under the capped condition. The reduction in contaminant discharge to the Area A Wetland is attributable primarily to the landfill cover system. The percent reduction in the mass flux of all constituents ranges from 16 to 55 percent, with most reductions between 16 and 25 percent. Although these reductions are not large, the magnitudes of the mass flux for most constituents under existing conditions are already very small and would be even smaller under the capped condition.

The mass loading of each constituent from the unsaturated zone to the saturated zone was estimated as

$$m_i = C_i * r * A_i / Rd_i \quad \text{(Equation 4.6)}$$

with:

- m_i: mass flux from the unsaturated zone to the saturated zone,
- C_i: unsaturated groundwater concentration,
- r: infiltration rate,
- A_i: area of infiltration, and
- Rd_i is the retardation factor.

To estimate the reduction in mass loading from the landfill cover system, the mass flux was calculated for the existing condition when the infiltration rate is 20 inches/year and for the capped condition when the infiltration rate is 0.6 inches/year.

The unsaturated groundwater concentration was estimated as the arithmetic mean of shallower soil detections in the unsaturated zone divided by the soil-water partitioning coefficient, Kd (detections and calculations are presented in Appendix D.5). Leachate concentrations could not be estimated for some

constituents, because either the constituent was not detected in unsaturated soil samples or unsaturated soil samples were not analyzed.

The areas of constituent detections are presented in Section 4.7.2 and shown on figures in Appendix D.5. The square footage of these areas is estimated as a summation of model block areas.

Table 4-4 reports the mass flux estimates for the existing and capped conditions. The percent reduction in mass flux from the unsaturated landfill material for all constituents where leachate concentrations could be determined is 97 percent.

Table 4-5 summarizes the loading reductions by the capped condition from groundwater and the landfilled mass.

4.7.5 Reduction in Contaminant Discharge for Capped Condition and Toe Drain

If a toe drain system were added to the capped condition, contaminant discharge to the Area A Wetland would be zero, assuming that the toe drain system would collect all of the discharge. This would result in a 100 percent reduction in mass flux to the Area A Wetland.

In order to assess the need to treat the contaminated discharge that is collected in the toe drain, an estimate of the concentration in the toe drain system was compared to the Maximum Contaminant Level (MCL) for each COC. The estimated groundwater/leachate concentration was assumed to be collected at the discharge end of the toe drain system. First, the flow rate of each area and the mass flux for each COC were estimated for the capped condition with the toe drain system included. The formulations are the same as that documented in Section 4.7.3. Second, the toe drain groundwater/leachate concentration was calculated as the mass flux divided by the entire discharge into the toe drain (10,700 ft 3/day). Finally, the toe drain groundwater/leachate concentration was compared to MCLs reported in the Drinking Water Regulations and Health Advisories (USEPA, 1995). Table 4-6 reports the flow rate, mass flux, toe drain groundwater/leachate concentrations, and MCLs for each COC. In all cases where an MCL is available, the toe drain groundwater/leachate concentration is lower than the MCL criteria. This result suggests that even if groundwater/leachate were collected in a toe drain system, that the collected leachate would meet drinking water standards and not require treatment.

TABLE 4-4

LOADING FROM LANDFILLED MASS
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

Group	COC	Unsaturated Layer Leachate Concentration (ug/L)	Kd (L/kg)	Area (ft^2)	Existing Condition		Capped Condition with Trench		Reduction by Cap	
					Inf. Rate (in/yr)	Mass g/yr	Inf. Rate (in/yr)	Mass (g/yr)	Mass (g/yr)	%
1	Aluminum	2.20E+03	4.55E+03	4.98E+05	2.00E+01	2.01E+00	6.00E-01	6.02E-02	1.95E+00	97
1	Barium	1.34E+02	4.00E+02	4.98E+05	2.00E+01	1.39E+00	6.00E-01	4.16E-02	1.35E+00	97
1	Boron	1.67E+04	3.00E+00	4.98E+05	2.00E+01	2.17E+04	6.00E-01	6.52E+02	2.11E+04	97
1	Chromium	9.20E+00	2.08E+03	4.98E+05	2.00E+01	1.83E-02	6.00E-01	5.49E-04	1.78E-02	97
1	Iron	3.21E+04	4.02E+02	4.98E+05	2.00E+01	3.30E+02	6.00E-01	9.91E+00	3.21E+02	97
1	Lead	8.65E+01	5.88E+02	4.98E+05	2.00E+01	6.09E-01	6.00E-01	1.83E-02	5.91E-01	97
1	Manganese	5.04E+02	3.23E+02	4.98E+05	2.00E+01	6.46E+00	6.00E-01	1.94E-01	6.27E+00	97
1	Nickel	3.39E+01	1.27E+03	4.98E+05	2.00E+01	1.11E-01	6.00E-01	3.33E-03	1.08E-01	97
1	Vanadium	8.64E+01	3.45E+02	4.98E+05	2.00E+01	1.04E+00	6.00E-01	3.11E-02	1.01E+00	97
1	Bis(2-ethylhexyl)phthalate	1.20E+00	3.33E+02	4.98E+05	2.00E+01	1.49E-02	6.00E-01	4.48E-04	1.45E-02	97
2	Arsenic	9.80E+00	2.70E+02	3.50E+05	2.00E+01	1.06E-01	6.00E-01	3.17E-03	1.03E-01	97
2	Beryllium	3.50E+00	1.82E+02	3.50E+05	2.00E+01	5.60E-02	6.00E-01	1.68E-03	5.43E-02	97
3	Cadmium	NA	9.50E+02	7.25E+04	2.00E+01	NA	6.00E-01	NA	NA	NA
4	Benzene	NA	1.70E-01	4.48E+05	2.00E+01	NA	6.00E-01	NA	NA	NA
5	Chlorobenzene	NA	8.70E-01	1.48E+05	2.00E+01	NA	6.00E-01	NA	NA	NA
5	1,2,4-Trichlorobenzene	NA	1.20E+01	1.48E+05	2.00E+01	NA	6.00E-01	NA	NA	NA
5	1,4-Dichlorobenzene	NA	3.10E+00	1.48E+05	2.00E+01	NA	6.00E-01	NA	NA	NA
5	Arochlor 1016	NA	2.40E+04	1.48E+05	2.00E+01	NA	6.00E-01	NA	NA	NA
5	Arochlor 1260	NA	1.29E+06	1.48E+05	2.00E+01	NA	6.00E-01	NA	NA	NA

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TABLE 4-5

SUMMARY OF CAPPED CONDITION LOADING REDUCTIONS FROM GROUNDWATER AND LANDFILLED MASS
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

Group	COC	Groundwater				Landfilled Mass			
		Existing Condition	Capped Condition with Trench	Reduction by Cap		Existing Condition	Capped Condition with Trench	Reduction by Cap	
		Mass g/yr	Mass (g/yr)	Mass (g/yr)	%	Mass g/yr	Mass (g/yr)	Mass (g/yr)	%
1	Aluminum	3.47E+00	2.61E+00	8.56E-01	25	2.01E+00	6.02E-02	1.95E+00	97
1	Barium	3.04E+00	2.29E+00	7.52E-01	25	1.39E+00	4.16E-02	1.35E+00	97
1	Boron	1.15E+03	8.67E+02	2.84E+02	25	8.20E+02	2.46E+01	7.96E+02	97
1	Chromium	3.55E-02	2.67E-02	8.76E-03	25	1.83E-02	5.49E-04	1.78E-02	97
1	Iron	5.97E+02	4.50E+02	1.47E+02	25	2.39E+02	7.17E+00	2.32E+02	97
1	Lead	4.96E-01	3.73E-01	1.22E-01	25	6.09E-01	1.83E-02	5.91E-01	97
1	Manganese	1.24E+01	9.32E+00	3.06E+00	25	6.46E+00	1.94E-01	6.27E+00	97
1	Nickel	1.47E-01	1.10E-01	3.62E-02	25	1.11E-01	3.33E-03	1.08E-01	97
1	Vanadium	5.88E-01	4.43E-01	1.45E-01	25	1.04E+00	3.11E-02	1.01E+00	97
1	Bis(2-ethylhexyl)phthalate	2.60E-01	1.96E-01	6.41E-02	25	1.49E-02	4.48E-04	1.45E-02	97
2	Arsenic	1.57E-01	1.10E-01	4.75E-02	30	1.06E-01	3.17E-03	1.03E-01	97
2	Beryllium	4.42E-02	3.08E-02	1.33E-02	30	5.60E-02	1.68E-03	5.43E-02	97
3	Cadmium	3.43E-03	1.56E-03	1.87E-03	55	NA	NA	NA	NA
4	Benzene	2.03E+02	1.56E+02	4.64E+01	23	NA	NA	NA	NA
5	Chlorobenzene	3.43E+03	2.89E+03	5.44E+02	16	NA	NA	NA	NA
5	1,2,4-Trichlorobenzene	1.60E+01	1.34E+01	2.53E+00	16	NA	NA	NA	NA
5	1,4-Dichlorobenzene	5.02E+01	4.23E+01	7.96E+00	16	NA	NA	NA	NA
5	Arochlor 1016	9.35E-04	7.87E-04	1.48E-04	16	NA	NA	NA	NA
5	Arochlor 1260	6.73E-04	5.67E-04	1.07E-04	16	NA	NA	NA	NA

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TABLE 4-6

COMPARISON OF TOE DRAIN GROUNDWATER\LEACHATE CONCENTRATION TO MCL CRITERIA
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

Group	COC	Toe drain			MCL
		Flow rate (ft^3/day)	Mass (g/yr)	Groundwater/Leachate Concentration(ug/L)	(ug/L)
1	Aluminum	1.07E+04	9.07E+00	8.20E-02	NA
1	Barium	1.07E+04	7.96E+00	7.20E-02	2.00E+03
1	Boron	1.07E+04	3.01E+03	2.72E+01	NA
1	Chromium	1.07E+04	9.28E-02	8.39E-04	1.00E+02
1	Iron	1.07E+04	1.56E+03	1.41E+01	NA
1	Lead	1.07E+04	1.30E+00	1.17E-02	1.50E+01
1	Manganese	1.07E+04	3.24E+01	2.93E-01	NA
1	Nickel	1.07E+04	3.84E-01	3.47E-03	1.00E+02
1	Vanadium	1.07E+04	1.54E+00	1.39E-02	NA
1	Bis(2-ethylhexyl)phthalate	1.07E+04	6.80E-01	6.14E-03	NA
2	Arsenic	6.15E+03	3.94E-01	3.57E-03	5.00E+01
2	Beryllium	6.15E+03	1.11E-01	1.00E-03	4.00E+00
3	Cadmium	1.19E+03	5.53E-03	5.00E-05	5.00E+00
4	Benzene	1.06E+04	5.47E+02	4.94E+00	5.00E+00
5	Chlorobenzene	4.54E+03	9.50E+03	8.59E+01	1.00E+02
5	1,2,4-Trichlorobenzene	4.54E+03	4.42E+01	4.00E-01	7.00E+01
5	1,4-Dichlorobenzene	4.54E+03	1.39E+02	1.26E+00	7.50E+01
5	Arochlor 1016	4.54E+03	2.59E-03	2.34E-05	5.00E-01
5	Arochlor 1260	4.54E+03	1.86E-03	1.69E-05	5.00E-01

4.94 < 5

~~8.59~~ < 85.9 < 100

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4.8 SUMMARY OF MODELING RESULTS

The capped condition will reduce groundwater elevations and consequently the thickness of the saturated landfill material by approximately 0.1 feet along the wetland boundary, 0.5 feet in the eastern portion of the landfill, 0.2 feet in the central portion of the landfill, and greater than 1 foot in the western portion of the landfill.

If the upgradient interception trench is lowered by two feet, the reduction in the saturated landfill material would be localized along the trench boundary in the western portion of the landfill. There would be no reductions in the saturated landfill thickness along the Area A Wetland boundary.

If the Area A Wetland is inundated by a 100 year flood, the rate of increase of the water table under the Area A Landfill cover system will be 0.077 feet/day. Even if the flood duration is 10 days, the total height that the water table rises will be less than 1 foot. Resulting increases in the saturated landfill thickness will persist from the wetland boundary upgradient through the landfill.

The capped condition will reduce the mass flux of COCs by 16 to 55 percent. It should be noted that the mass flux of most COCs is on the order of 1 gram/year or less. The mass flux for benzene and chlorobenzene are approximately 156 and 2890 grams/year, respectively. However, the area of detection used for the mass flux computation for these constituents is likely overestimated, because the levels of detection in the 2LMW18S well near the crane test pad were assumed to be appropriate for the eastern portion of the landfill, where analytical sampling of groundwater has not been performed.

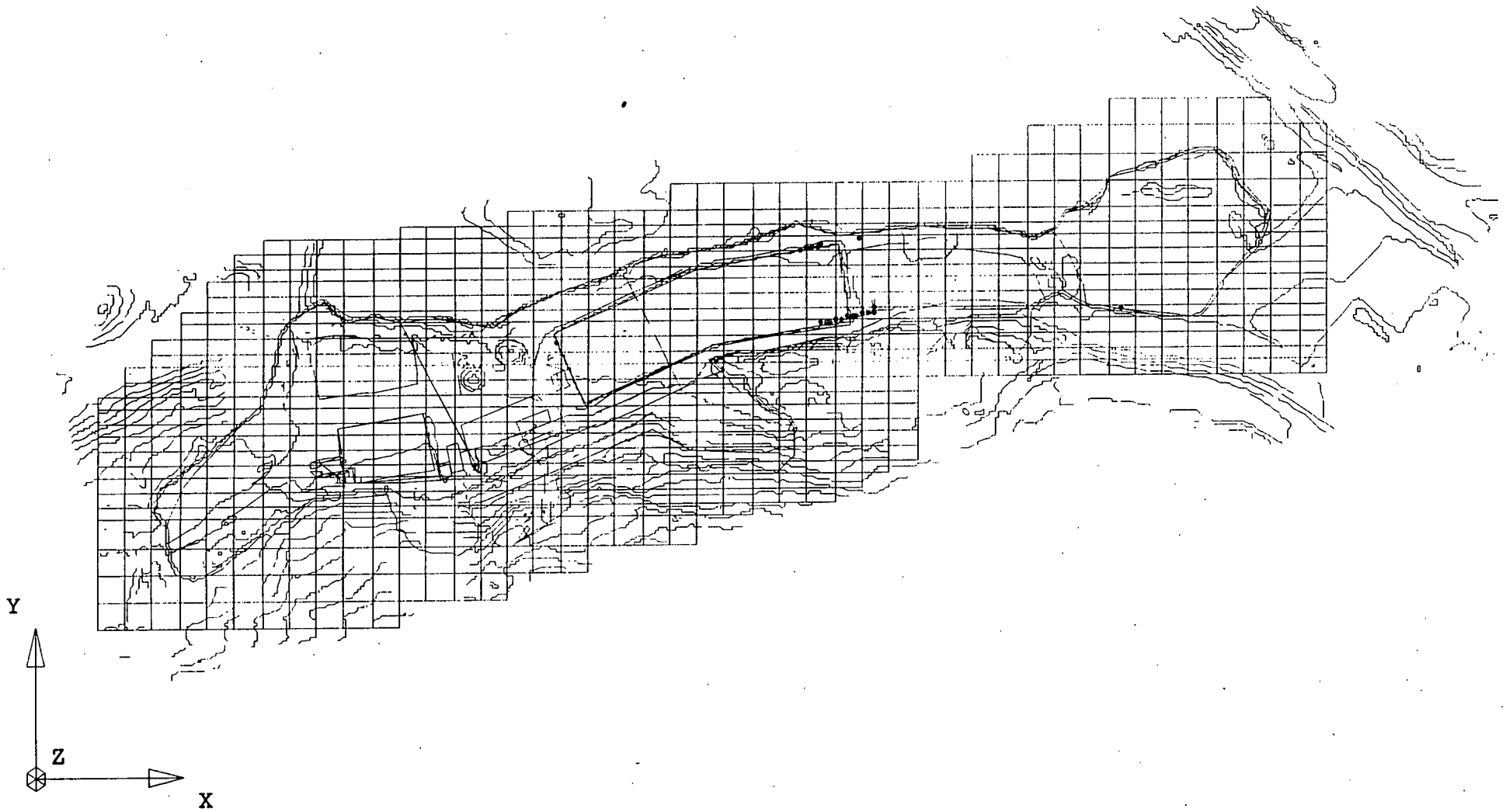
The Area A Landfill cover system as currently designed will reduce the leachate loading from the unsaturated zone by 97 percent for COCs that could be analyzed. The analysis required soil detections in the unsaturated zone.

Addition of a toe drain system would further reduce the thickness of the saturated landfill material by approximately 1 to 1.5 feet along the Area A Wetland boundary, 1 to 1.5 feet in the eastern portion of the landfill, and 0.1 to 0.5 feet in the central portion of the landfill. In the western portion of the landfill, the toe drain system would have little effect on the saturated landfill thickness. Because the toe drain system would increase the hydraulic gradient and groundwater flow velocity from the Area A Landfill to the Area A Wetland, the addition of a such a system would increase the discharge from the landfill from 3080 ft 3/day to 10,700 ft 3/day.

If the surface water elevation in the toe drain is increased to prevent reverse flow from the Area A Wetland, the saturated landfill thickness would increase by approximately 1 foot along the toe drain boundary, 0.7 feet in the eastern portion of the landfill, and 0.2 feet in the central portion of the landfill. As in the previous scenario, the toe drain system would have little effect on the saturated landfill thickness in the western portion of the landfill. In the eastern and central portions of the landfill, the increased surface water elevation in the toe drain would decrease its effectiveness to reduce the saturated thickness of the landfill by approximately 50 percent.

Assuming that the toe drain system would collect all of the contaminant discharge to the Area A Wetland, the reduction in the mass flux would be 100 percent. Based on an analysis of groundwater/leachate concentrations in the toe drain, all COC concentrations would be less than MCL criteria (for COCs with available MCLs). This result suggests that even if groundwater/leachate were collected in the toe drain, the collected water would meet drinking water standards.

Figure 4-3 Plan View Of The Model Grid



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	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						70.00	70.00	70.00	70.00	70.03	70.00		
2																																			70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00
3																																	70.00	70.00	70.00	70.00	70.00	70.23	68.87	67.42	64.78	60.00	70.00	70.00	70.00
4																						70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.45	71.21	64.39	63.68	62.31	60.67	59.99	70.00	70.00	70.00
5																70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	64.37	62.41	60.45	60.00	59.74	59.98	59.99	61.31	70.00	70.00
6												69.00	69.00	69.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.09	69.91	70.00	70.00	68.74	68.39	67.88	67.79	68.53	70.81	70.78	61.45	60.00	60.00	59.99	59.99	59.84	59.99	62.53	68.00	70.00
7							65.00	65.00	69.17	69.00	69.00	69.00	69.00	69.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	71.30	69.92	69.93	69.94	70.00	67.45	63.30	63.94	64.55	65.09	63.92	61.24	60.00	59.99	60.17	61.07	61.40	61.75	62.13	64.24	68.00	70.00
8						35.00	66.00	68.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	70.00	70.00	70.00	70.00	70.59	69.23	69.02	69.92	69.93	69.93	69.94	69.96	70.00	66.97	59.99	59.99	61.31	61.73	59.99	59.99	61.94	63.09	63.56	63.55	63.05	63.49	64.09	68.00	68.00	68.00
9						35.49	55.00	65.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	70.25	70.00	69.92	68.28	67.53	69.94	69.94	69.95	69.96	69.97	70.00	66.81	62.64	59.99	59.99	59.99	59.99	65.68	69.75	67.82	66.84	66.05	64.68	65.23	66.04	68.00	68.00	68.00
10					33.00	34.65	55.00	65.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	69.00	70.31	69.92	69.94	68.55	67.25	69.90	69.96	69.97	69.98	69.99	70.98	69.56	66.21	62.81	60.78	62.05	66.00	71.65	72.29	71.83	70.02	68.36	66.82	66.97	69.00	69.00	69.00	69.00
11					33.00	36.46	55.00	65.00	70.00	70.05	69.00	69.00	69.00	69.00	69.76	69.00	69.55	69.92	69.93	69.95	68.97	68.20	69.71	69.98	69.99	69.99	70.62	72.56	70.77	69.99	67.64	66.86	68.35	70.13	72.00	72.00	72.00	71.25	70.40	69.12	69.13	70.00	69.00	69.00	69.00
12				33.00	33.00	42.86	55.00	65.87	69.97	71.90	69.77	69.29	68.59	69.67	71.47	68.87	68.78	69.94	69.95	69.97	69.39	69.22	69.61	70.00	71.07	71.82	73.44	74.11	71.20	70.73	71.68	70.89	72.21	72.05	71.16	72.36	73.37	73.81	71.80	71.20	71.60	70.00	70.00	69.00	69.00
13				32.59	33.00	48.63	55.00	69.73	71.14	70.26	70.05	70.22	70.00	69.96	69.95	68.10	68.39	69.95	69.97	69.98	69.81	70.80	72.68	74.57	73.45	73.00	72.26	71.30	71.57	74.04	74.06	78.35	75.00	75.00	75.00	74.07	76.30	74.00	71.80	71.20	71.60	70.00	70.00	69.00	69.00
14			31.33	32.57	33.24	47.71	55.00	69.76	70.12	72.25	72.01	72.67	72.35	70.00	69.97	67.79	67.99	69.97	69.99	70.18	70.93	73.45	76.70	74.00	74.00	73.65	74.00	73.00	73.00	76.72	77.61	84.01	80.00	80.00	80.00	78.89	76.41	74.00	71.80	71.20	71.60	70.00	70.00	70.00	68.00
15			31.45	32.94	35.81	47.82	68.14	69.50	71.70	74.61	73.73	75.17	76.00	73.92	69.99	68.56	69.68	69.86	70.54	72.32	72.14	74.73	74.78	75.07	75.00	75.00	75.00	75.00	75.00	78.00	85.27	86.72	85.00	85.00	85.00	80.00	80.00	74.00	71.80	71.20	71.60	70.00	70.00	70.00	68.00
16		31.92	35.62	42.95	45.95	54.28	63.25	69.26	73.29	76.96	75.47	77.67	75.57	73.89	70.70	69.50	69.79	71.03	72.51	74.80	74.09	76.02	75.58	76.21	76.00	76.00	76.00	77.00	77.00	80.00	86.28	87.23	90.00	90.00	90.00	85.00	85.00	74.00	71.80	71.20	71.60	70.00	70.00	70.00	70.00
17		38.68	46.81	54.17	52.74	65.00	65.87	68.71	73.13	79.57	77.22	77.29	74.32	73.85	72.17	72.12	72.83	74.11	75.01	77.20	76.19	76.93	75.95	77.00	77.00	77.00	77.00	79.00	79.00	82.00															
18	38.66	47.38	56.32	58.12	60.00	71.65	70.56	69.41	73.20	77.07	80.12	77.74	74.93	74.18	73.99	75.13	76.32	77.28	78.13	75.79	75.68	75.84	76.20	77.00	78.00	78.00	78.00	81.00	81.00	84.00															
19	45.06	54.06	59.78	60.00	60.00	72.85	72.47	70.78	73.40	77.68	77.93	78.75	75.69	75.76	76.57	77.97	79.80	81.14	77.43	78.55	78.05	76.97	77.00	77.17	78.97	79.00	79.00	83.00	83.00	86.00															
20	54.66	59.28	60.00	62.29	67.77	74.28	73.58	74.41	74.64	78.83	78.81	81.59	76.76	79.23	78.66	80.00	87.37	79.59	80.42	84.46	86.08	79.14	80.18	79.78	79.03	80.00	82.37	85.00	85.00	88.00															
21	60.00	60.00	60.00	62.00	74.00	77.00	75.00	78.00	76.00	79.26	79.43	79.85	82.30	80.00	80.00	80.00	81.77	82.86	85.53	90.39	92.09	88.67	88.91	88.30	87.31	84.80	86.26	87.00	87.99	90.39															
22	60.00	60.00	61.78	70.00	76.00	77.00	77.00	80.00	80.00	83.38	80.01	80.17	79.72	88.31	80.31	82.95	84.77	86.92	89.38	93.20	98.18	99.09	97.27	97.11	96.34	92.70	92.15	95.88	96.86	97.79															
23	60.00	60.00	64.01	76.00	77.00	78.00	79.00	78.97	82.00	80.71	80.58	80.75	80.33	79.19	83.43	88.05	88.15	91.28	95.64	100.31	101.47	104.00	105.73	104.44	103.85	100.75	97.65	100.06	104.25																	
24	60.98	60.98	73.00	78.00	80.00	80.64	80.00	79.82	81.62	81.00	82.43	82.61	81.63	83.58	89.31	92.98	94.80	99.83	109.61	104.52	107.67	110.47	109.97	111.73	110.99	110.02	106.95	104.42																	
25	63.82	63.56	78.00	80.00	82.00	81.00	81.11	82.86	85.42	88.06	87.23	85.97	83.68	87.97	92.65	99.38	104.66	115.56	122.01	118.72	115.14	115.73	115.58	115.44	115.78	116.70	116.08																			
26	73.33	73.76	81.00	82.00	83.00	82.25	85.76	87.13	93.09	94.95	94.69	92.86	93.35	94.47	98.89	116.27	115.48	119.46	127.00	123.97	124.96	122.41	120.43	122.78																					
27	80.95	80.67	83.00	84.00	84.68	85.00	89.25	93.53	98.58	101.96	105.61	105.13	104.77	105.04	111.65	120.60	117.85	117.99	123.30	126.38	129.73	130.61																							
28	87.00	85.00	85.85	85.90	86.00	88.17	95.14	100.89	104.99	110.33	114.31	116.18	116.38	118.48	124.30	130.14	130.00	128.24																											
29	88.20	86.00	85.00	86.57	90.65	93.82	99.60	107.47	110.60	114.61	118.77	120.82	122.66	126.85	125.22																														
30	88.90	87.31	89.35	91.74	95.84	101.80	107.77	113.89	118.00	121.49	124.71																																		

Figure 4-4 Bottom Elevation of the Model (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						2.00	2.00	2.00	2.00	2.00	4.00		
2																																			2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.92	4.19	10.09
3																																	2.00	2.00	2.00	2.00	2.00	2.00	4.99	7.07	12.40	14.03	3.00	3.84	8.61
4																						2.02	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	-2.00	2.00	2.00	2.00	14.73	18.32	17.56	20.32	18.62	3.00	3.43	5.18
5																11.60	13.96	12.06	9.02	9.36	7.69	2.51	2.00	2.00	2.00	2.00	2.41	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	9.43	18.66	21.81	22.18	21.65	20.73	19.49	14.69	3.84	11.78
6												2.00	2.00	2.00	6.55	10.87	13.08	12.08	10.00	9.27	4.06	2.00	2.00	2.00	2.00	7.12	7.33	5.36	7.54	6.73	9.21	9.59	7.27	2.00	2.00	14.69	21.95	23.00	22.55	21.01	20.61	21.01	12.63	9.06	12.87
7							9.58	32.00	2.00	2.00	2.00	2.00	2.00	2.00	1.79	8.94	11.34	11.00	6.24	2.00	2.00	2.00	2.00	3.37	7.80	9.07	8.88	8.43	10.80	14.31	13.93	13.45	12.46	14.08	15.37	17.30	21.57	22.78	21.84	19.60	18.40	18.87	11.38	13.05	13.00
8						20.15	13.21	20.47	2.00	2.00	2.00	2.00	2.00	2.00	2.00	3.00	8.62	7.02	2.00	2.00	6.65	8.13	8.05	9.11	10.15	9.75	9.66	9.38	11.85	18.53	18.31	16.69	16.27	18.01	18.73	16.35	16.57	19.16	19.13	17.47	16.51	16.78	12.80	14.72	23.00
9						10.00	18.92	18.70	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	6.74	11.04	12.55	10.59	10.76	10.97	10.48	10.37	10.06	12.34	16.36	18.66	18.15	18.01	18.01	14.20	8.85	11.05	15.16	16.13	15.32	14.77	14.90	14.02	15.71	15.81
10					10.00	10.00	24.12	17.16	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	9.70	10.37	12.31	14.42	11.63	11.44	11.26	11.12	10.97	9.58	9.93	12.79	16.19	17.53	15.95	12.00	7.15	6.71	7.17	11.98	13.64	13.50	13.79	12.00	13.68	15.34	16.28
11					10.00	10.00	26.87	17.03	4.02	2.00	2.00	2.00	2.00	2.00	2.00	2.00	3.08	9.41	11.07	11.49	12.87	14.24	12.55	12.30	11.95	11.82	10.81	8.42	8.97	9.51	11.83	11.91	10.07	8.48	7.26	7.00	7.49	10.75	12.26	12.02	12.40	12.21	14.70	16.21	17.31
12				10.00	10.00	10.00	26.75	18.65	13.64	2.00	2.00	2.00	2.98	2.00	2.00	6.27	10.42	11.44	12.09	12.48	13.39	13.82	13.39	13.13	11.53	10.77	8.56	7.29	8.95	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	11.63	10.94	10.85	13.00	14.91	17.32	18.20
13				10.00	10.00	10.00	26.67	19.35	13.86	13.58	11.98	13.20	8.29	3.92	6.00	12.59	13.71	12.67	12.96	13.19	13.92	13.20	11.20	9.08	10.02	10.00	10.00	10.00	10.00	10.00	10.00	10.00	18.95	16.82	12.54	10.00	10.00	13.23	15.01	16.25	14.38	15.10	15.77	18.25	19.04
14			10.00	10.00	10.00	10.00	27.57	16.12	15.12	12.79	12.07	12.33	13.65	16.00	12.33	17.00	15.01	13.53	13.63	13.54	13.18	10.91	7.57	10.00	10.00	10.00	12.85	12.49	15.38	10.00	10.00	10.00	25.76	21.31	14.67	10.00	10.00	13.71	15.66	16.04	16.40	18.76	17.07	17.92	20.69
15			10.00	10.00	10.00	10.00	15.96	16.79	13.98	11.21	12.05	10.52	10.00	11.06	14.01	17.43	15.74	14.20	13.60	11.91	12.36	10.02	10.00	14.00	23.20	26.60	23.84	20.95	20.08	16.06	10.00	10.00	17.70	20.10	17.34	19.07	17.84	18.55	16.60	16.85	16.40	18.08	19.00	17.13	21.71
16		10.00	10.00	10.00	10.00	10.00	22.15	17.44	12.84	9.34	10.95	8.59	10.43	14.87	14.61	16.03	15.42	13.85	12.26	9.88	10.91	8.98	10.00	17.00	24.67	24.12	21.93	19.34	19.00	15.74	10.00	10.00	10.74	12.18	15.00	22.92	22.70	31.36	29.45	28.00	24.18	20.80	19.00	19.47	20.00
17		10.00	10.00	10.00	10.00	10.86	20.44	18.17	13.44	7.13	9.64	9.71	12.10	15.28	13.89	13.94	12.82	11.47	10.42	7.96	8.91	8.17	10.00	12.11	19.00	23.41	21.85	17.67	17.41	14.77																
18	10.00	10.00	10.00	10.00	10.59	10.00	16.29	17.59	13.80	10.00	7.25	9.39	12.17	12.98	13.05	11.47	9.89	9.05	7.87	10.00	10.00	10.00	10.00	10.68	20.09	24.44	26.00	16.00	15.88	13.66																
19	10.00	10.00	10.00	13.24	16.23	10.90	14.03	16.57	14.09	10.00	10.00	9.53	12.14	12.08	11.24	9.38	7.33	5.86	10.00	10.00	10.00	10.00	10.00	10.00	10.00	21.61	18.85	13.48	14.00	12.00																
20	10.00	10.00	15.26	20.00	14.00	13.34	13.25	13.39	13.35	10.00	10.00	7.75	11.84	8.95	9.55	8.31	1.38	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.48	12.00	10.00																
21	11.54	14.90	19.45	23.61	16.02	12.76	12.74	10.14	12.56	10.00	10.00	10.00	6.70	9.00	9.14	14.93	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	8.83	10.00	10.00																
22	13.86	18.30	20.00	18.78	15.55	15.00	13.05	8.60	8.98	6.36	10.00	10.14	10.00	2.69	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																
23	17.72	19.00	20.00	14.69	15.00	13.75	10.61	10.00	8.35	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																	
24	20.00	20.00	16.95	14.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																		
25	20.00	20.00	14.00	12.33	10.04	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																			
26	14.00	13.00	11.72	11.46	10.20	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																						
27	10.00	10.00	10.92	10.31	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																								
28	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																												
29	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																															
30	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00																																		

Figure 4-5 Overall Thickness of the Model Domain (ft)
(Model Bottom to Ground Surface)

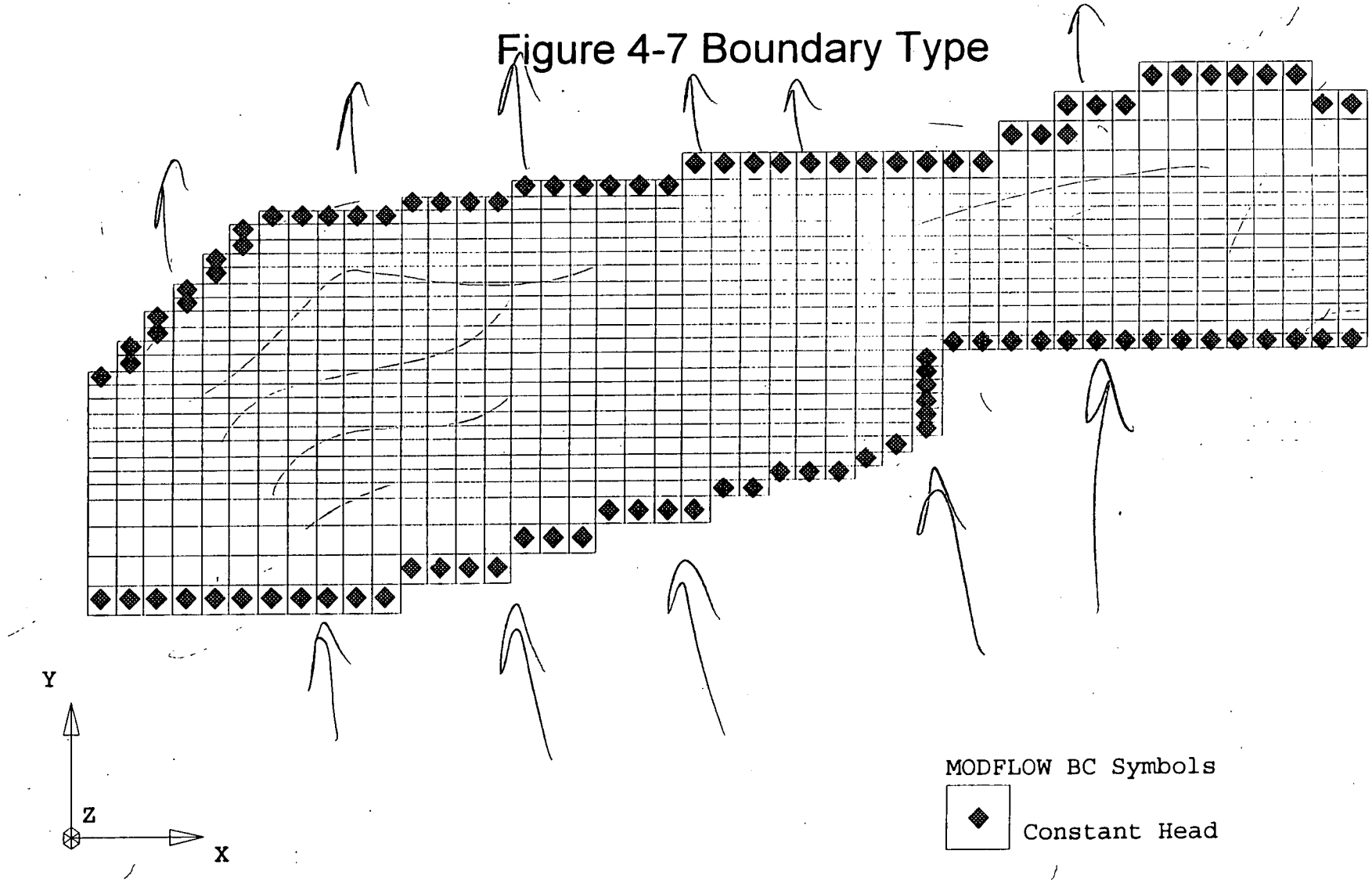
DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						1	1	1	1	1	1		
2																																			1	1	1	1	1	1	1	1	1	1	1
3																																	1	1	1	1	1	1	2	2	3	4	1	1	1
4																						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	3	4	1	1	1
5																1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	3	3	4	4	4	4	3	1	1
6												2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	2	1	1	3	4	4	4	4	4	4	3	2	1
7							1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	3	3	3	2	3	3	4	4	3	3	3	3	3	3	2	1
8						1	1	1	2	2	2	2	2	2	2	1	1	1	1	1	2	2	2	2	2	2	2	1	2	4	4	3	3	4	4	3	3	3	3	3	3	3	2	2	3
9						1	1	1	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	1	2	3	4	4	4	4	2	2	2	2	2	3	2	2	2	2	2
10					1	1	1	1	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	2	2	3	3	3	2	1	1	1	1	2	2	2	2	2	2	2
11					1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	1	1	1	1	1	1	2	2	1	2	2	2
12				1	1	1	1	2	2	1	2	2	2	2	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
13				1	1	1	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
14			1	1	1	1	1	2	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
15			1	1	1	1	2	2	1	1	1	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2
16		1	1	1	1	1	3	2	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17		1	1	1	1	1	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
18	1	1	1	1	1	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1															
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																
24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																	
25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																		
26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																					
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																							
28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																											
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																														
30	1	1	1	1	1	1	1	1	1	1	1																																		

Figure 4-6 Number of Model Layers

DRAFT

Figure 4-7 Boundary Type



DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						2	2	2	2	2	2		
2																																			2	2	2	2	2	2	2	2	1	1	1
3																																	2	2	2	2	2	2	7	7	7	7	2	1	1
4																						1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	7	7	7	7	7	2	2	2
5																1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	7	7	7	7	7	7	7	7	2	1
6												2	2	2	1	1	1	1	1	1	1	2	2	2	2	5	5	2	2	5	5	5	5	2	2	7	7	7	7	7	7	7	7	7	1	1
7							1	2	2	2	2	2	2	2	1	1	1	1	1	2	2	2	2	5	5	5	5	5	6	5	5	5	5	5	7	7	7	7	7	7	7	7	7	1	1
8						1	1	2	2	2	2	2	2	2	2	1	1	1	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	7	7	7	7	7	7	7	7	7	1	1	1
9						1	1	2	2	2	2	2	2	2	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	7	7	7	7	7	7	7	7	7	1	1	1
10					1	1	1	2	2	2	2	2	2	2	2	2	2	2	5	5	5	5	5	5	5	5	5	5	6	6	6	6	6	6	7	7	7	7	7	7	7	7	1	1	1
11					1	1	1	2	2	2	2	2	2	2	2	2	3	3	5	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7	7	1	1	1
12				1	1	1	1	3	3	2	2	2	2	2	2	3	3	3	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	1	1	1	7	7	7	7	1	1	1	1
13				1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	5	5	6	6	6	6	6	6	6	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14			1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	5	6	6	6	6	6	6	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15			1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	6	6	6	6	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16		1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	3	4	6	6	6	6	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7		1	1	1	1	1	3	3	3	3	3	3	3	3	3	3	4	4	6	6	6	6	6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	3	3	3	3	3	4	4	4	4	4	4	4	6	6	6	6	6	6	1	1	1	1	1	1															
19	1	1	1	1	1	3	3	3	4	4	4	4	4	4	4	4	4	4	6	6	6	6	6	6	6	1	1	1	1	1															
20	1	1	1	1	1	3	3	3	4	4	4	4	4	4	4	4	4	4	6	6	1	1	1	6	6	1	1	1	1	1															
21	1	1	1	1	3	3	3	4	4	4	4	4	4	4	4	4	4	4	6	1	1	1	1	1	1	1	1	1	1	1															
22	1	1	1	1	3	3	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1															
23	1	1	1	3	3	4	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1																
24	1	1	3	3	4	4	4	4	4	4	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1																	
25	1	1	3	3	4	4	4	4	1	1	1	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1																		
26	1	1	3	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																					
27	1	1	4	4	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																							
28	1	1	1	4	4	1	1	1	1	1	1	1	1	1	1	1	1	1																											
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																														
30	1	1	1	1	1	1	1	1	1	1	1																																		

Figure 4-8 Hydraulic Conductivity Zones

DRAFT

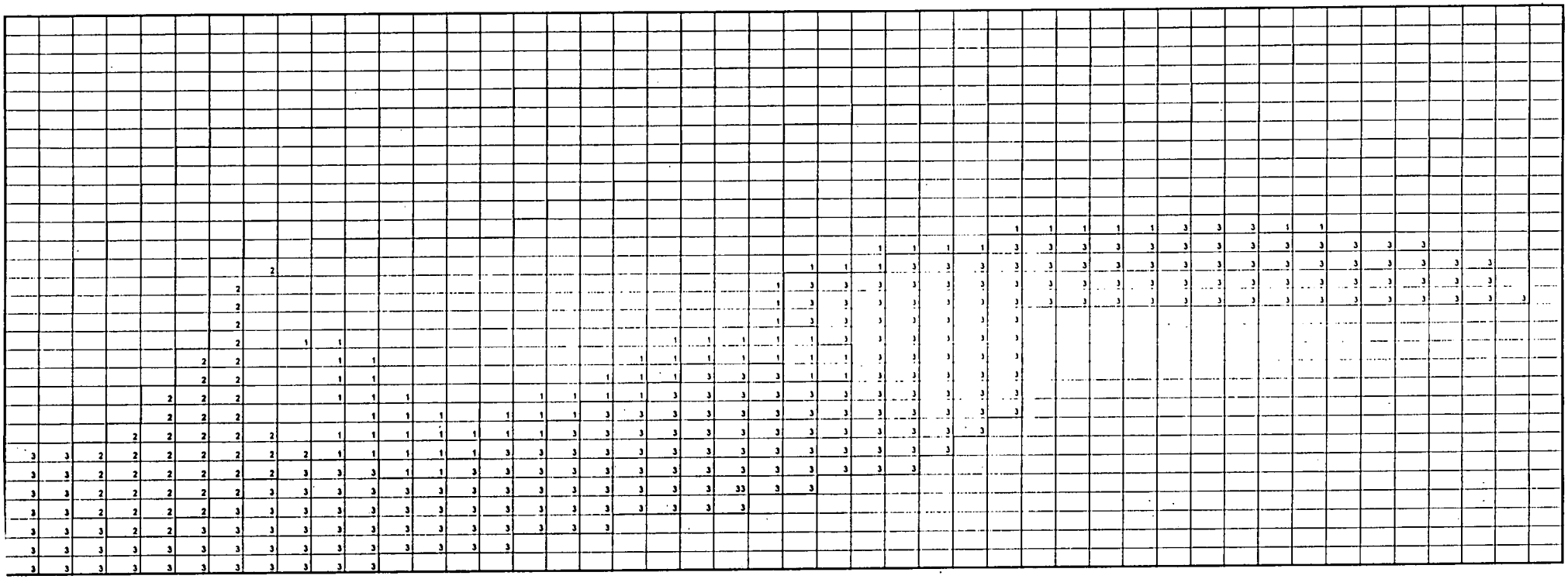


Figure 4-9 Upward Recharge Zones

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						20	20	20	20	20	20		
2																																			20	20	20	20	20	20	20	20	20	20	20
3																																	20	20	20	20	20	20	20	20	20	20	20	20	20
4																						20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
5																20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
6												20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
7							13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
8						13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
9						13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
10					13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
11					13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
12				13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	20	20	20	20	20	20	20	20
13				13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	20	20	20	20	20	20	20
14			13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	20	20	20
15			13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	20	20
16		13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	20
17		13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13															
18	13	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13															
19	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13															
20	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	20	20	13	13	13	13	13															
21	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13															
22	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13															
23	13	13	13	20	13	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13																
24	13	13	20	20	20	20	20	20	20	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13	13																	
25	13	13	20	20	20	20	20	20	13	13	13	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13	13																		
26	13	13	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13																					
27	13	13	20	20	20	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13																							
28	13	13	13	20	20	13	13	13	13	13	13	13	13	13	13	13	13	13																											
29	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13																														
30	13	13	13	13	13	13	13	13	13	13	13																																		

Figure 4-11 Infiltration Rate (in/yr)

DRAFT

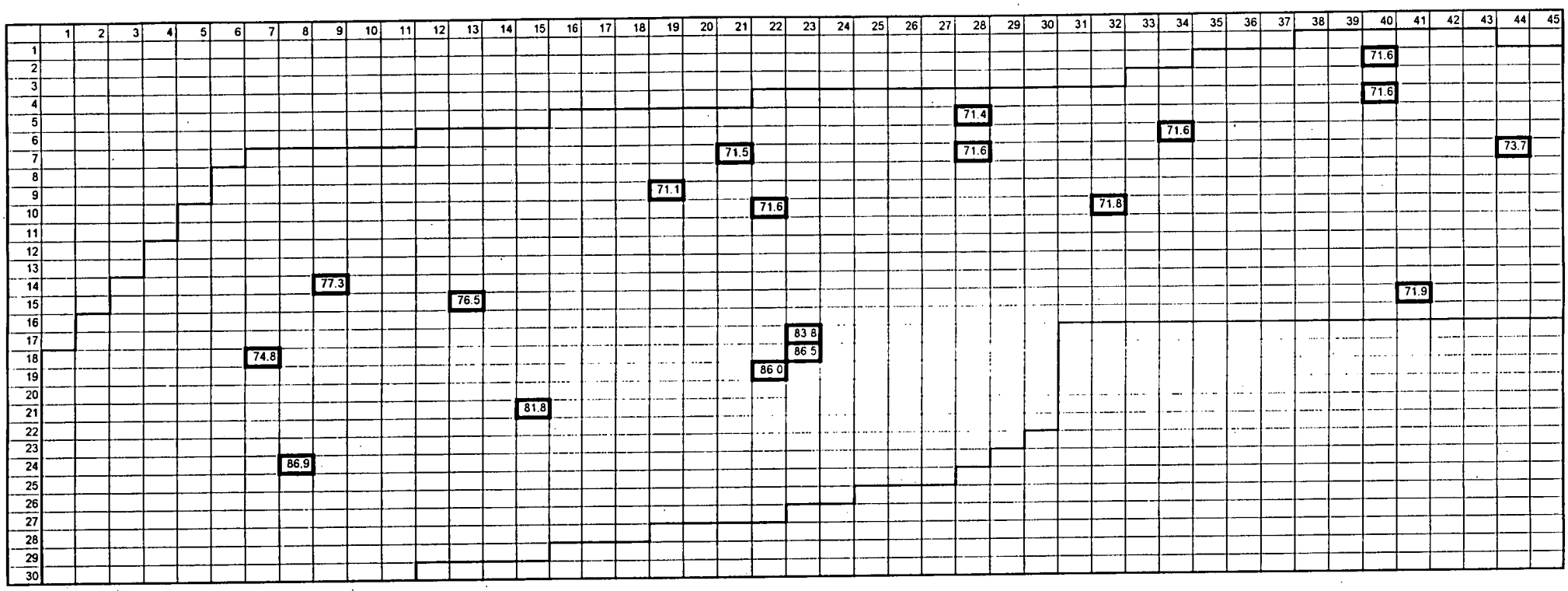


Figure 4-12 Calibration Targets (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44
1																																						71.5	71.5	71.5	71.5	71.5	71.5	
2																																			71.0	71.0	71.5	71.5	71.6	71.6	71.7	71.7	72.0	72.5	73
3																																	71.0	71.0	71.0	71.2	71.4	71.6	71.6	71.7	71.8	71.9	72.1	72.3	72
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.5	71.6	71.7	71.8	72.0	72.1	72.2	72
5																71.0	71.0	71.0	71.0	71.0	71.0	71.2	71.3	71.3	71.3	71.3	71.2	71.3	71.3	71.2	71.2	71.2	71.2	71.2	71.2	71.7	71.9	71.9	71.9	72.0	72.1	72.1	72.3	72.2	73
6												71.0	71.0	71.0	71.0	71.1	71.2	71.2	71.2	71.2	71.3	71.4	71.5	71.4	71.6	71.7	71.7	71.4	71.5	71.7	71.7	71.6	71.5	71.3	71.2	71.8	72.0	72.1	72.2	72.2	72.3	72.3	72.4	72.8	73
7							60.0	65.0	71.0	71.0	71.0	71.0	71.1	71.1	71.2	71.3	71.3	71.4	71.4	71.4	71.5	71.6	71.6	72.0	72.1	72.4	72.4	72.0	71.9	72.1	72.0	71.9	71.8	71.7	71.7	72.0	72.2	72.3	72.3	72.4	72.4	72.5	72.6	73.5	74
8						37.2	60.0	65.1	70.8	71.0	71.0	71.1	71.1	71.2	71.3	71.4	71.4	71.5	71.6	71.6	71.9	72.0	72.1	72.7	72.8	73.0	73.0	72.8	72.5	72.3	72.2	72.0	71.9	71.8	72.0	72.2	72.3	72.4	72.5	72.5	72.6	72.6	73.1	74.0	74
9						38.7	60.0	65.1	70.7	70.9	71.0	71.1	71.2	71.3	71.4	71.5	71.5	71.6	71.7	72.0	72.3	72.5	72.7	73.1	73.3	73.5	73.5	73.5	73.1	72.6	72.3	72.1	72.0	71.9	72.1	72.6	72.6	72.7	72.7	72.7	72.7	72.8	73.7	74.4	74
10					36.2	49.1	60.0	65.1	70.7	70.9	71.1	71.2	71.2	71.3	71.4	71.6	71.6	71.8	72.2	72.5	72.7	72.8	73.0	73.5	73.7	73.9	74.0	74.2	73.9	73.1	72.6	72.3	72.1	72.1	72.8	73.4	73.3	73.1	72.9	72.9	72.9	73.2	74.1	74.7	75
11					37.3	48.6	58.0	65.5	71.6	71.6	71.1	71.2	71.3	71.4	71.5	71.7	72.2	72.4	72.9	73.0	73.0	73.1	73.3	73.8	74.4	74.8	74.8	75.1	74.8	73.8	72.8	72.4	72.3	72.5	73.6	74.3	73.9	73.4	73.2	73.1	73.1	73.6	74.3	74.9	75
12				36.1	41.5	48.6	57.1	70.1	73.2	73.1	71.2	71.3	71.4	72.1	72.6	72.6	73.2	73.3	73.4	73.4	73.4	73.4	73.5	74.5	75.6	76.1	76.3	76.3	75.8	74.2	73.4	72.7	73.0	73.1	74.8	75.6	75.3	74.3	73.6	73.3	73.3	73.8	74.4	75.0	75
13				37.2	43.3	49.8	58.3	70.6	74.3	74.4	72.5	71.7	71.8	73.4	74.1	73.9	73.9	74.0	73.9	73.8	74.0	74.0	74.0	76.3	77.1	77.5	77.6	77.4	77.0	77.0	76.7	76.7	76.7	76.4	77.2	77.6	77.7	75.7	74.2	73.7	73.7	73.9	74.4	74.9	75.
14			38.1	40.3	45.1	51.3	59.9	72.4	75.2	75.3	74.6	73.0	72.7	74.3	74.8	74.7	74.6	74.6	74.3	74.4	75.0	75.3	76.8	78.3	78.6	78.8	78.7	78.0	78.0	81.4	81.4	85.7	82.0	81.4	81.1	80.4	79.6	76.6	74.8	73.9	73.8	73.7	74.1	74.8	75.
15			37.1	41.9	46.9	52.5	70.2	75.1	76.3	76.6	76.6	75.8	76.1	75.6	75.6	75.4	75.2	75.2	75.0	75.4	76.1	76.9	78.9	79.3	79.9	80.1	80.1	79.5	79.9	85.3	86.8	89.4	86.5	86.2	85.9	83.1	81.7	76.7	74.8	73.7	73.5	73.2	73.5	74.6	75.
16		39.2	39.9	44.8	50.5	56.4	74.0	76.4	77.7	78.3	78.4	78.5	78.5	77.0	76.4	76.0	75.6	75.8	76.1	76.6	77.3	78.1	79.5	80.3	81.1	81.4	81.5	81.5	82.6	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.
17		43.0	47.6	54.7	56.2	65.2	76.1	77.7	79.0	80.4	79.9	80.0	79.1	77.8	77.2	76.8	76.1	76.6	77.5	78.5	78.8	79.9	81.5	82.0	82.4	82.6	82.8	83.3	84.8	95.8															
18	43.3	49.2	57.8	63.5	62.9	72.7	77.6	79.0	80.3	81.9	81.7	80.8	79.8	78.6	78.1	77.9	76.9	78.3	79.8	80.0	80.0	81.9	84.2	84.0	83.7	83.8	84.1	84.8	86.5	96.7														
19	50.0	56.7	63.0	65.5	67.0	75.2	79.0	80.1	81.4	82.6	83.0	81.9	80.7	79.3	79.3	79.7	80.2	81.7	81.7	81.0	81.6	85.3	87.1	85.5	84.8	84.9	85.2	86.3	88.0	97.0														
20	57.4	62.5	65.9	67.6	70.1	77.7	80.4	81.3	82.5	83.6	84.0	83.4	81.8	80.4	80.9	81.9	87.5	86.2	83.2	84.8	88.7	90.4	90.5	87.1	85.7	85.9	86.4	87.8	89.4	97.0														
21	64.1	66.3	67.8	69.3	75.1	80.3	81.9	82.9	83.7	84.6	85.1	85.0	84.0	81.3	82.4	83.6	92.3	91.5	86.4	93.3	97.7	90.0	96.1	93.5	92.0	91.8	92.8	93.3	95.3	99.4														
22	67.6	68.6	69.4	72.3	79.7	82.4	83.5	84.6	85.0	86.0	86.1	85.9	86.4	86.5	83.5	87.5	96.1	96.8	93.1	101.2	104.2	103.9	103.6	103.2	102.3	101.4	102.2	102.2	104.8	106.8														
23	69.5	70.3	70.6	77.2	82.0	84.0	85.1	86.2	86.6	87.3	87.0	86.6	87.5	89.9	87.7	93.0	100.5	102.2	99.3	106.5	110.2	111.6	111.7	111.5	110.7	109.4	109.3	109.0	113.3															
24	71.0	71.8	74.3	81.6	84.0	85.8	86.7	87.4	87.9	88.1	88.0	87.7	88.3	91.4	93.2	97.1	105.7	108.7	110.1	112.2	115.6	117.8	118.6	119.0	118.3	117.6	116.5	113.4																
25	72.2	73.4	79.0	84.0	86.1	87.5	88.1	88.8	89.3	90.0	89.5	89.4	90.0	94.2	97.8	101.0	112.7	120.2	123.0	121.0	122.0	124.1	124.3	125.6	124.8	125.7	125.1																	
26	75.0	76.8	83.0	86.0	87.9	89.0	89.8	90.8	93.9	95.6	95.1	93.6	94.7	98.5	102.8	116.3	121.4	129.0	129.6	129.8	129.7	130.3	129.4	131.8																				
27	82.1	83.4	88.4	88.5	90.1	91.3	92.9	95.7	100.6	103.3	106.1	105.6	105.8	107.5	114.6	127.3	128.2	130.0	132.3	135.4	138.7	139.6																						
28	88.0	88.1	89.5	90.9	92.4	94.1	97.3	102.3	107.3	111.3	115.2	116.5	117.2	119.3	125.1	135.1	135.0	132.2																										
29	90.1	89.9	90.8	92.1	94.3	97.3	101.9	108.5	113.1	116.9	120.0	121.0	123.6	127.9	126.2																													
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																	

Figure 4-13 Calibrated Groundwater Table (ft)

DRAFT

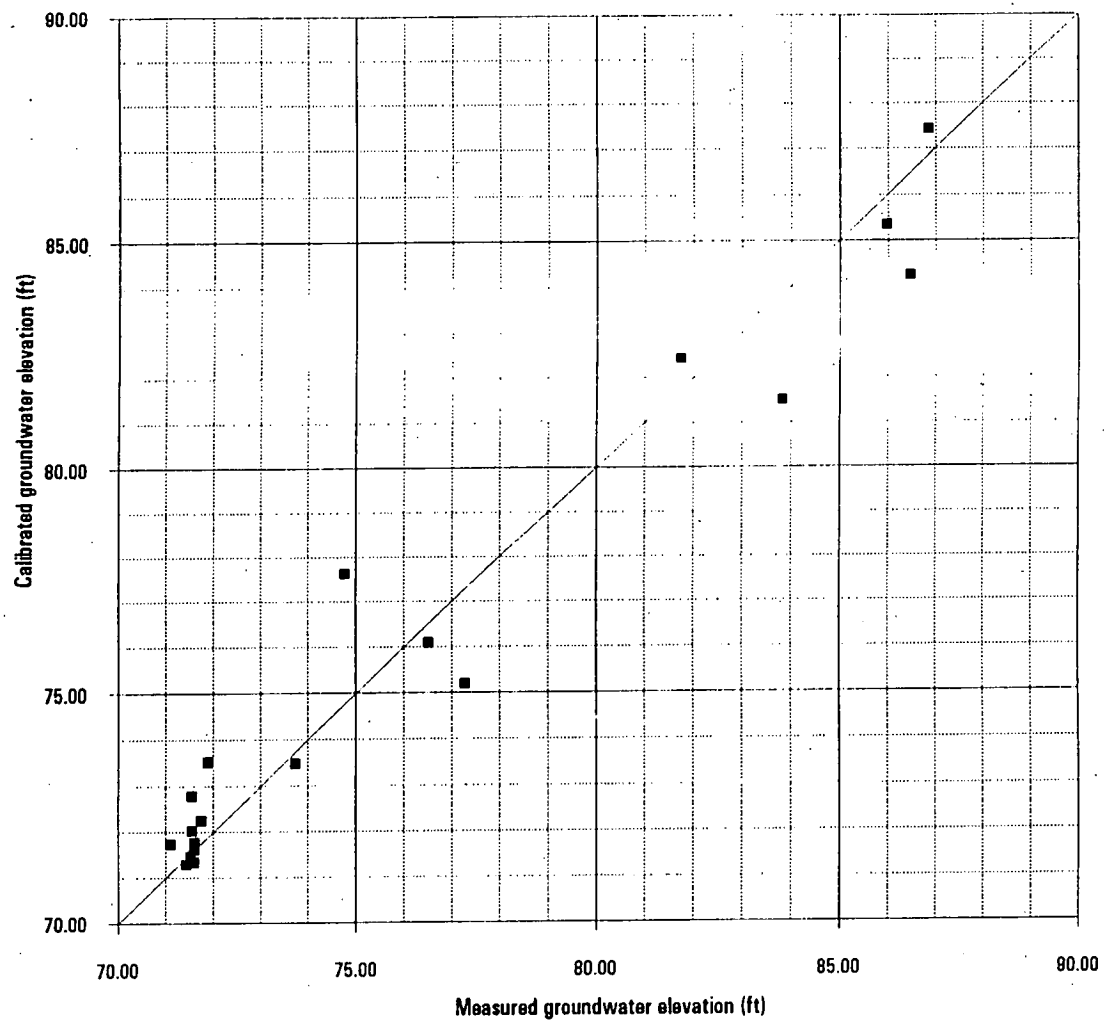


Figure 4-15 Calibrated vs.Measured Groundwater Elevation

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																													
2																																								0.01					
3																																													
4																																								-0.15					
5																												0.16																	
6																																		0.27											
7																					0.07							-0.46																0.25	
8																																													
9																			-0.63																										
10																						-1.22										-0.49													
11																																													
12																																													
13																																													
14									2.10																																				
15													0.42																												-1.62				
16																																													
17																							2 33																						
18							-2.85																2 22																						
19																						0 62																							
20																																													
21															-0.69																														
22																																													
23																																													
24								-0.57																																					
25																																													
26																																													
27																																													
28																																													
29																																													
30																																													

Figure 4-16 Residual Errors
(Measured Groundwater Elevation - Calibrated Groundwater Elevation) (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.5	71.5	71.5	71.5	71.5	71.5		
2																																			71.0	71.0	71.5							72.5	73.0
3																																	71.0	71.0											
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0													
5																71.0	71.0	71.0	71.0	71.0	71.0																								
6												71.0	71.0	71.0	71.0																														
7							60.0	65.0	71.0	71.0	71.0																																		
8						37.2																																							
9						38.7																																							
10					36.2																																								
11					37.3																																								
12				36.1																																									
13				37.2																																									
14			36.1																																										
15			37.1																																										
16		39.2																													91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		43.0																												95.8															
18	43.3																													96.7															
19																														97.0															
20																														97.0															
21																														99.4															
22																														106.8															
23																													113.3																
24																												113.4																	
25																									124.8	125.7	125.1																			
26																							129.4	131.8																						
27																			132.3	135.4	138.7	139.6																								
28																135.1	135.0	132.2																												
29												121.0	123.6	127.9	126.2																														
30	90.0	88.3	90.4	92.7	96.9	102.6	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-17 Calibrated Boundary Head Values (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						1000	1000	1000	1000	1000	1000		
2																																			2000	1000	1000	1000	1000	1000	1000	1000	1000	1000	4
3																																	2000	2000	2000	1000	1000	1000	1000	1000	1000	1000	1000	1000	4
4																						1000	1000	1000	1000	1000	2000	2000	2000	2000	2000	2000	2000	2000	2000	1000	1000	1000	1000	1000	1000	1000	1000	1000	4
5																1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	2000	2000	2000	2000	2000	2000	2000	2000	2000	17	17	17	17	17	17	17	17	1000	4
6												1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	170	170	2000	2000	170	170	170	170	2000	2000	17	17	17	17	17	17	17	17	4	4
7							1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	170	170	170	170	170	170	170	170	170	170	170	17	17	17	17	17	17	17	17	17	4	4
8						4	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	170	170	170	170	170	170	170	170	170	170	170	170	170	170	17	17	17	17	17	17	17	17	4	4	4
9						4	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	17	17	17	17	17	17	17	17	4	4	4
10					4	4	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	56	17	17	17	17	17	17	17	4	4	4	4
11					4	4	4	4	4	4	1000	1000	1000	1000	1000	1000	56	56	170	170	170	170	170	170	56	56	56	170	170	170	170	170	56	56	17	17	17	17	17	17	17	4	4	4	4
12				4	4	4	4	4	4	4	1000	1000	1000	56	56	56	56	56	170	170	170	170	170	56	56	56	56	170	170	170	56	56	56	56	4	4	4	17	17	17	17	4	4	4	4
13				4	4	4	4	4	4	4	4	56	56	56	56	56	56	56	170	170	56	56	56	56	56	56	56	170	170	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
14			4	4	4	4	4	4	4	4	4	56	56	56	56	56	56	56	170	56	56	56	56	56	56	56	56	170	170	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
15			4	4	4	4	4	4	4	4	4	17	17	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
16		4	4	4	4	4	4	4	4	4	4	17	17	56	56	56	56	56	56	56	56	56	17	56	56	56	56	56	56	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
17		4	4	4	4	4	4	4	4	4	4	17	17	56	56	56	56	56	56	56	56	17	4	17	56	56	56	56	56	4															
18	4	4	4	4	4	4	4	4	4	4	4	17	17	56	56	56	56	56	56	56	56	17	4	17	56	56	56	56	56	4															
19	4	4	4	4	4	4	4	4	4	4	4	17	17	56	56	56	4	56	56	56	17	4	4	17	56	56	56	56	56	4															
20	4	4	4	4	4	4	4	4	4	4	4	17	17	56	56	56	4	4	56	56	4	4	4	17	56	56	56	56	56	4															
21	4	4	4	4	4	4	4	4	4	4	4	17	17	56	56	56	4	4	56	4	4	4	4	4	4	4	4	4	4	4															
22	4	4	4	4	4	4	4	4	4	4	4	17	17	4	56	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4															
23	4	4	4	4	4	4	4	4	4	4	4	17	17	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4																
24	4	4	4	4	4	4	4	4	4	4	4	4	17	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4																	
25	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4																		
26	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	56	4	4	4	4	4	4																					
27	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	56	4	4	4	4																							
28	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	56																											
29	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4																														
30	4	4	4	4	4	4	4	4	4	4	4																																		

Figure 4-18 Calibrated Distribution of Hydraulic Conductivity (ft/day)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0	0	0	0	0	0		
2																																			0	0	0	0	0	0	0	0	0	0	0
3																																	0	0	0	0	0	0	0	0	0	0	0	0	0
4																						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5																0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6												0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	5	5	11	11	11	5	5	5	5	5	5	5	5
13				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	5	11	11	11	11	11	11	11	11	5	5	5	5	5	5	5	5
14			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	5	5	11	11	11	11	11	11	11	11	11	11	11	5	5	5	5	5	5	5	5
15			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11	5	5	5	5	5	5	5	5
16		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11	5	5	5	5	5	5	5	5
17		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	11	11	11	11	11	11	11															
18	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	5	5	5	5	5	11	11	11	11	11	11															
19	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	5	5	5	5	5	5	5	11	11	11	11	11															
20	0	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	5	5	5	11	11	11	5	5	11	11	11	11	11															
21	0	0	0	0	0	0	0	0	0	5	5	5	0	0	0	5	5	5	5	11	11	11	11	11	11	11	11	11	11	11															
22	0	0	0	0	0	0	0	0	0	0	5	5	5	0	5	5	5	11	11	11	11	11	11	11	11	11	11	11	11	11															
23	0	0	0	0	0	0	0	0	0	5	5	5	5	5	5	5	11	11	11	11	11	11	11	11	11	11	11	11	11																
24	0	0	0	0	0	0	0	0	0	5	5	5	5	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11																	
25	11	11	7	7	7	7	7	7	11	11	11	5	5	11	11	11	11	11	11	11	11	11	11	11	11	11	11																		
26	11	11	7	7	7	7	7	11	11	11	11	11	11	11	11	11	11	11	11	11	11	0	11	11																					
27	11	11	7	7	7	7	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11																							
28	11	11	11	7	7	11	11	11	11	11	11	11	11	11	11	11	11	11																											
29	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11																														
30	11	11	11	11	11	11	11	11	11	11	11																																		

Figure 4-19 Calibrated Rates of Upward Recharge (in/yr)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						20	20	20	20	20	20		
2																																			20	20	20	20	20	20	20	20	20	20	20
3																																	20	20	20	20	20	20	20	20	20	20	20	20	20
4																						20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
5																20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
6												20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
7							13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
8						13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
9						13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
10					13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
11					13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
12				13	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	18	18	18	18	18	24	24	24	18	18	18	18	18	18	18	18
13				13	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	18	18	18	18	24	24	24	24	24	24	24	24	18	18	18	18	18	18	18	18
14			13	13	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	20	18	18	18	24	24	24	24	24	24	24	24	24	24	24	18	18	18	18	18	18	18	18
15			13	13	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	18	24	24	24	24	24	24	24	24	24	24	24	24	24	24	18	18	18	18	18	18	18	18
16		13	13	13	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	18	24	24	24	24	24	24	24	24	24	24	24	24	24	24	18	18	18	18	18	18	18	18
17		13	13	13	13	13	13	13	13	20	20	20	20	20	20	20	20	20	20	20	20	20	18	24	24	24	24	24	24	24																
18	13	13	13	13	13	13	13	13	13	18	20	20	20	20	20	20	20	20	20	18	18	18	18	18	24	24	24	24	24	24																
19	13	13	13	13	13	13	13	13	13	18	18	20	20	20	20	20	20	20	18	18	18	18	18	18	18	24	24	24	24	24																
20	13	13	13	13	13	13	13	13	13	18	18	20	20	20	20	20	20	18	18	18	24	24	24	18	18	24	24	24	24	24																
21	13	13	13	13	13	13	13	13	13	18	18	18	20	20	20	18	18	18	18	24	24	24	24	24	24	24	24	24	24	24																
22	13	13	13	13	13	13	13	13	13	20	18	18	18	20	18	18	18	24	24	24	24	24	24	24	24	24	24	24	24	24																
23	13	13	13	13	13	13	13	13	13	18	18	18	18	18	18	18	24	24	24	24	24	24	24	24	24	24	24	24	24																	
24	13	13	13	13	13	13	13	13	13	18	18	18	18	18	24	24	24	24	24	24	24	24	24	24	24	24	24	24																		
25	24	24	20	20	20	20	20	20	24	24	24	18	18	24	24	24	24	24	24	24	24	24	24	24	24	24																				
26	24	24	20	20	20	20	20	24	24	24	24	24	24	24	24	24	24	24	24	24	24	20	24	24																						
27	24	24	20	20	20	20	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24																								
28	24	24	24	20	20	24	24	24	24	24	24	24	24	24	24	24	24	24																												
29	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24																															
30	24	24	24	24	24	24	24	24	24	24	24																																			

Figure 4-20 Calibrated Recharge Rate (Downward Infiltration +Upward Flow) (in/yr)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						10.0	10.0	10.0	10.0	10.0	10.0		
2																																			10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
3																																	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
4																						10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
5																10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
6												10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
7							6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
8						6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
9						6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
10					6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
11					6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
12				6.5	6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	11.5	11.5	11.5	11.5	17.5	17.5	17.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
13				6.5	6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	11.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
14			6.5	6.5	6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
15			6.5	6.5	6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5
16		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5															
17		6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																
18	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	11.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	11.5	11.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5																
19	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	11.5	11.5	10.0	10.0	10.0	10.0	10.0	10.0	10.0	11.5	11.5	11.5	11.5	11.5	11.5	11.5	17.5	17.5	17.5	17.5																
20	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	11.5	11.5	10.0	10.0	10.0	10.0	10.0	10.0	11.5	11.5	11.5	17.5	17.5	17.5	11.5	11.5	17.5	17.5	17.5	17.5																
21	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	11.5	11.5	11.5	10.0	10.0	10.0	11.5	11.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																
22	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	10.0	11.5	11.5	11.5	10.0	11.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																
23	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																	
24	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	11.5	11.5	11.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																		
25	17.5	17.5	9.8	9.8	9.8	9.8	9.8	9.8	17.5	17.5	17.5	11.5	11.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																			
26	17.5	17.5	9.8	9.8	9.8	9.8	9.8	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	10.0	17.5	17.5																					
27	17.5	17.5	9.8	9.8	9.8	9.8	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																							
28	17.5	17.5	17.5	9.8	9.8	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																											
29	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																														
30	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5																																		

Figure 4-21 Recharge Rate for 50% Decrease in Infiltration (in/yr)

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.5	71.5	71.5	71.5	71.5	71.5		
2																																			71.0	71.0	71.5	71.5	71.6	71.6	71.6	71.7	71.9	72.5	73.0
3																																	71.0	71.0	71.0	71.1	71.4	71.5	71.6	71.7	71.7	71.8	72.0	72.2	72.7
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.4	71.6	71.6	71.7	71.8	71.9	72.0	72.2	72.6
5																71.0	71.0	71.0	71.0	71.0	71.0	71.2	71.3	71.3	71.3	71.3	71.2	71.3	71.3	71.2	71.2	71.2	71.2	71.2	71.2	71.5	71.7	71.8	71.8	71.9	71.9	72.0	72.1	72.2	72.8
6												71.0	71.0	71.0	71.0	71.1	71.1	71.2	71.2	71.2	71.2	71.4	71.4	71.4	71.5	71.7	71.6	71.4	71.5	71.6	71.6	71.5	71.5	71.3	71.2	71.7	71.8	71.9	71.9	72.0	72.0	72.1	72.2	72.5	73.1
7							60.0	65.0	71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.3	71.3	71.4	71.4	71.4	71.5	71.6	71.9	72.0	72.3	72.3	72.0	71.9	72.0	71.9	71.8	71.7	71.6	71.6	71.8	71.9	72.0	72.0	72.1	72.1	72.2	72.3	72.9	73.4
8						37.2	60.0	65.1	70.8	70.9	71.0	71.1	71.1	71.2	71.3	71.3	71.4	71.4	71.5	71.6	71.8	72.0	72.1	72.6	72.7	72.9	72.9	72.8	72.5	72.3	72.1	71.9	71.8	71.8	71.8	72.0	72.1	72.1	72.2	72.2	72.2	72.3	72.7	73.4	73.7
9						38.7	60.0	65.1	70.7	70.9	71.0	71.1	71.1	71.2	71.3	71.4	71.5	71.6	71.7	71.9	72.2	72.4	72.6	73.0	73.2	73.4	73.4	73.4	73.0	72.6	72.2	72.0	71.9	71.8	72.0	72.3	72.3	72.3	72.3	72.3	72.3	72.4	73.1	73.7	74.0
10					36.2	48.9	59.9	65.1	70.7	70.9	71.0	71.1	71.2	71.3	71.4	71.5	71.5	71.7	72.1	72.4	72.6	72.7	72.9	73.4	73.6	73.8	73.9	74.1	73.8	73.1	72.5	72.2	72.0	72.0	72.6	73.1	72.9	72.6	72.5	72.4	72.5	72.7	73.4	73.9	74.2
11					37.3	48.2	57.8	65.3	71.4	71.4	71.1	71.2	71.3	71.4	71.5	71.6	72.1	72.3	72.7	72.9	72.9	72.9	73.2	73.7	74.3	74.7	74.7	75.0	74.7	73.7	72.7	72.3	72.2	72.4	73.4	74.0	73.6	73.0	72.8	72.6	72.6	73.1	73.6	74.1	74.5
12				36.1	40.6	47.8	56.6	70.0	72.7	72.6	71.1	71.2	71.3	72.0	72.5	72.4	73.0	73.1	73.3	73.3	73.2	73.2	73.4	74.4	75.5	76.0	76.2	76.3	75.8	74.2	73.3	72.6	72.9	72.9	74.5	75.4	75.0	74.1	73.1	72.8	72.8	73.3	73.8	74.3	74.7
13				37.1	42.1	46.8	57.7	70.3	73.6	73.6	72.2	71.4	71.6	73.2	73.9	73.6	73.7	73.8	73.7	73.7	73.8	73.9	73.8	76.2	77.0	77.4	77.5	77.3	76.9	76.9	76.6	76.7	76.6	76.3	76.9	77.3	77.4	75.5	73.8	73.2	73.1	73.3	73.8	74.4	74.9
14			36.1	39.4	43.5	50.1	59.3	71.9	74.4	74.3	74.0	72.8	72.5	74.0	74.6	74.4	74.3	74.3	74.1	74.2	74.8	75.2	76.7	78.2	78.5	78.7	78.6	78.0	77.9	81.3	81.3	85.8	82.0	81.3	80.9	80.3	79.4	76.4	74.4	73.4	73.3	73.2	73.6	74.4	75.2
15			37.1	40.6	45.1	50.9	70.2	74.5	75.4	75.5	75.8	75.5	76.0	75.3	75.3	75.1	74.9	74.9	74.8	75.2	75.9	76.8	78.8	79.2	79.8	80.0	80.0	79.4	79.9	85.3	86.7	89.4	86.4	86.1	85.9	83.0	81.6	76.5	74.4	73.2	73.1	72.8	73.1	74.3	75.5
16		39.2	39.2	43.6	49.1	55.3	74.2	75.8	76.8	77.3	77.6	78.2	78.1	76.6	76.1	75.7	75.3	75.5	75.9	76.4	77.2	78.0	79.4	80.2	81.0	81.3	81.4	81.4	82.5	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		42.9	47.3	54.3	55.2	65.1	75.8	77.0	78.1	79.8	79.1	79.5	78.6	77.4	76.8	76.4	75.7	76.4	77.4	78.4	78.7	79.8	81.4	81.9	82.3	82.5	82.7	83.2	84.7	95.8															
18	43.2	48.7	57.5	63.3	62.3	72.6	77.0	78.1	79.4	81.2	81.0	80.3	79.3	78.1	77.7	77.5	76.6	78.2	79.6	79.9	79.9	81.8	84.1	83.9	83.6	83.7	84.0	84.7	86.5	96.7															
19	48.8	55.9	62.2	64.8	65.9	74.5	78.2	79.1	80.4	81.8	82.4	81.3	80.1	78.7	79.0	79.4	80.0	81.6	81.6	80.9	81.5	85.2	86.9	85.4	84.7	84.7	85.1	86.2	88.0	97.0															
20	56.5	61.7	64.9	66.5	69.2	77.1	79.5	80.2	81.4	82.6	83.3	82.9	81.2	79.9	80.7	81.7	87.4	86.2	83.2	84.8	88.6	90.2	90.3	87.0	85.6	85.8	86.3	87.7	89.3	97.0															
21	63.3	65.3	66.5	68.0	74.7	79.6	80.9	81.7	82.5	83.5	84.4	84.6	83.6	81.0	82.2	83.5	92.3	91.4	86.4	93.3	97.6	95.8	95.9	93.4	91.9	91.7	92.7	93.2	95.3	99.4															
22	66.4	67.2	67.8	71.4	79.6	81.6	82.5	83.5	83.8	85.0	85.3	85.5	86.1	86.4	83.3	87.3	96.0	96.8	93.0	101.0	104.1	103.8	103.4	103.1	102.2	101.3	102.2	102.1	104.8	106.8															
23	68.1	68.7	69.0	76.8	81.5	83.1	84.1	85.1	85.5	86.4	86.2	86.1	87.0	89.4	87.4	92.8	100.5	102.1	99.1	106.4	110.1	111.5	111.6	111.4	110.6	109.3	109.2	109.0	113.3																
24	69.3	70.2	73.5	81.7	83.3	84.8	85.6	86.3	86.8	87.1	87.0	87.0	87.8	90.9	92.9	96.8	105.7	108.6	110.1	112.0	115.5	117.8	118.6	119.0	118.2	117.6	116.5	113.4																	
25	70.4	71.7	78.7	83.5	85.3	86.5	87.0	87.7	88.2	89.2	88.7	88.6	89.3	93.7	97.4	100.7	112.7	120.2	123.0	121.0	122.0	124.0	124.2	125.5	124.8	125.7	125.1																		
26	74.1	75.8	82.5	85.3	87.1	88.1	88.7	89.9	93.6	95.4	95.0	93.3	94.4	98.0	102.5	116.4	121.4	129.0	129.5	129.8	129.7	130.3	129.4	131.8																					
27	81.8	82.8	85.8	87.7	89.3	90.4	92.1	95.3	100.5	103.1	106.0	105.5	105.6	107.2	114.4	127.3	128.2	130.0	132.3	135.4	138.7	139.6																							
28	87.7	87.6	88.9	90.2	91.7	93.4	96.8	102.0	107.1	111.1	115.0	116.4	117.1	119.2	125.0	135.1	135.0	132.2																											
29	89.8	89.4	90.3	91.6	93.8	96.9	101.7	108.4	113.0	116.8	119.9	121.0	123.6	127.8	126.2																														
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-22 Water Table for 50% Decrease in Infiltration (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.000	0.000	0.000	0.000	0.000	0.000		
2																																			0.000	0.000	0.000	0.013	0.020	0.023	0.024	0.024	0.020	0.000	0.000
3																																	0.000	0.000	0.000	0.013	0.019	0.031	0.037	0.041	0.042	0.042	0.039	0.029	0.202
4																						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.016	0.020	0.032	0.044	0.048	0.052	0.055	0.056	0.054	0.050	0.047	0.304
5																0.000	0.000	0.000	0.000	0.000	0.000	0.022	0.026	0.024	0.023	0.018	0.012	0.015	0.016	0.012	0.013	0.014	0.020	0.027	0.028	0.117	0.144	0.137	0.138	0.138	0.138	0.148	0.055	0.433
6												0.000	0.000	0.000	0.000	0.018	0.022	0.023	0.024	0.024	0.024	0.034	0.037	0.033	0.033	0.035	0.030	0.021	0.023	0.032	0.036	0.039	0.042	0.035	0.034	0.160	0.202	0.208	0.212	0.213	0.213	0.215	0.225	0.286	0.588
7							0.000	0.000	0.000	0.000	0.000	0.011	0.015	0.018	0.025	0.035	0.039	0.040	0.041	0.040	0.039	0.044	0.047	0.052	0.050	0.056	0.052	0.039	0.038	0.050	0.054	0.057	0.061	0.062	0.101	0.194	0.239	0.257	0.265	0.269	0.270	0.274	0.286	0.526	0.703
8						0.002	0.007	0.003	-0.002	0.006	0.013	0.023	0.029	0.034	0.044	0.049	0.052	0.053	0.055	0.053	0.063	0.069	0.068	0.072	0.070	0.070	0.066	0.060	0.056	0.060	0.063	0.067	0.071	0.076	0.137	0.228	0.279	0.304	0.315	0.321	0.325	0.331	0.455	0.668	0.776
9						0.016	0.013	0.004	-0.004	0.011	0.024	0.034	0.041	0.046	0.054	0.062	0.063	0.064	0.067	0.077	0.091	0.094	0.093	0.089	0.083	0.079	0.076	0.072	0.067	0.068	0.070	0.074	0.078	0.085	0.169	0.291	0.333	0.359	0.368	0.372	0.379	0.385	0.591	0.739	0.808
10					0.007	0.251	0.017	0.007	-0.004	0.015	0.034	0.045	0.053	0.057	0.064	0.070	0.070	0.073	0.093	0.108	0.111	0.113	0.111	0.101	0.091	0.086	0.083	0.079	0.072	0.074	0.078	0.082	0.087	0.104	0.204	0.281	0.355	0.425	0.421	0.421	0.432	0.504	0.667	0.759	0.800
11					0.051	0.427	0.234	0.196	0.208	0.271	0.054	0.064	0.071	0.071	0.075	0.079	0.111	0.115	0.129	0.132	0.128	0.126	0.128	0.111	0.101	0.095	0.090	0.081	0.073	0.075	0.085	0.090	0.103	0.139	0.200	0.237	0.328	0.462	0.463	0.465	0.481	0.576	0.680	0.731	0.749
12				0.013	0.855	0.748	0.499	0.032	0.521	0.533	0.068	0.082	0.088	0.132	0.139	0.142	0.176	0.167	0.156	0.151	0.141	0.142	0.144	0.122	0.108	0.100	0.089	0.074	0.072	0.075	0.089	0.105	0.095	0.139	0.243	0.267	0.285	0.238	0.456	0.482	0.501	0.574	0.639	0.656	0.654
13				0.068	1.233	0.997	0.603	0.323	0.643	0.776	0.358	0.209	0.190	0.226	0.222	0.221	0.224	0.202	0.177	0.166	0.157	0.160	0.188	0.097	0.103	0.099	0.085	0.071	0.070	0.087	0.113	0.057	0.098	0.136	0.261	0.276	0.212	0.138	0.413	0.486	0.515	0.548	0.573	0.557	0.534
14			0.017	0.967	1.515	1.213	0.519	0.478	0.766	1.011	0.625	0.196	0.226	0.295	0.281	0.272	0.263	0.229	0.194	0.187	0.168	0.153	0.034	0.074	0.099	0.100	0.089	0.075	0.069	0.072	0.114	-0.034	0.084	0.095	0.128	0.167	0.137	0.197	0.391	0.464	0.499	0.481	0.477	0.425	0.384
15			0.054	1.365	1.730	1.576	0.033	0.568	0.850	1.118	0.748	0.260	0.061	0.336	0.324	0.310	0.299	0.252	0.213	0.206	0.167	0.120	0.046	0.087	0.103	0.102	0.091	0.077	0.062	0.053	0.079	0.041	0.064	0.055	0.032	0.045	0.092	0.166	0.375	0.407	0.449	0.348	0.332	0.249	0.204
16		0.011	0.673	1.139	1.445	1.103	-0.232	0.645	0.887	0.916	0.809	0.382	0.396	0.365	0.361	0.340	0.335	0.265	0.220	0.192	0.156	0.119	0.079	0.099	0.107	0.103	0.092	0.076	0.051	0.027	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17		0.041	0.308	0.335	0.948	0.131	0.344	0.762	0.921	0.599	0.842	0.436	0.471	0.428	0.389	0.355	0.382	0.238	0.186	0.132	0.134	0.119	0.121	0.113	0.111	0.105	0.093	0.074	0.044	0.000																
18	0.083	0.549	0.178	0.157	0.667	0.067	0.626	0.883	0.957	0.691	0.695	0.553	0.533	0.482	0.396	0.317	0.294	0.098	0.112	0.094	0.120	0.123	0.149	0.126	0.115	0.105	0.093	0.071	0.040	0.000															
19	1.176	0.747	0.840	0.739	1.013	0.606	0.784	0.999	-1.040	0.857	0.600	0.603	0.577	0.532	0.353	0.216	0.199	0.021	0.082	0.105	0.128	0.153	0.168	0.136	0.116	0.104	0.092	0.066	0.037	0.000															
20	0.937	0.815	1.041	1.091	0.912	0.561	0.903	1.102	1.123	0.971	0.675	0.520	0.604	0.424	0.241	0.112	0.079	0.028	0.096	0.023	0.109	0.184	0.180	0.141	0.117	0.101	0.085	0.056	0.034	0.000															
21	0.827	1.064	1.311	1.312	0.435	0.668	0.987	1.142	1.193	1.069	0.705	0.417	0.454	0.320	0.188	0.089	0.012	0.049	0.054	0.030	0.099	0.183	0.165	0.119	0.096	0.088	0.070	0.054	0.032	0.000															
22	1.205	1.338	1.553	0.907	0.120	0.759	1.039	1.111	1.204	1.013	0.744	0.491	0.362	0.090	0.211	0.165	0.032	0.074	0.113	0.136	0.124	0.133	0.119	0.078	0.060	0.064	0.051	0.041	0.019	0.000															
23	1.461	1.528	1.763	0.359	0.518	0.873	1.069	1.103	1.136	0.945	0.824	0.559	0.469	0.482	0.323	0.262	0.029	0.082	0.185	0.145	0.117	0.091	0.079	0.063	0.050	0.052	0.043	0.022	0.000																
24	1.645	1.647	0.801	-0.008	0.684	0.930	1.102	1.151	1.146	1.056	0.935	0.692	0.544	0.553	0.390	0.336	0.005	0.077	0.040	0.145	0.111	0.083	0.054	0.044	0.028	0.028	0.025	0.000																	
25	1.777	1.684	0.324	0.454	0.782	0.956	1.141	1.150	1.099	0.754	0.815	0.802	0.666	0.586	0.376	0.304	-0.022	0.043	-0.032	0.069	0.080	0.063	0.033	0.022	0.000	0.000	0.000																		
26	0.676	1.036	0.449	0.652	0.823	0.963	1.052	0.939	0.282	0.171	0.143	0.281	0.373	0.511	0.300	-0.015	0.021	0.009	0.072	-0.006	0.038	0.039	0.000	0.000																					
27	0.301	0.519	0.622	0.755	0.848	0.914	0.809	0.450	0.041	0.215	0.095	0.099	0.167	0.343	0.168	-0.047	0.019	0.009	0.000	0.000	0.000	0.000																							
28	0.325	0.490	0.582	0.704	0.763	0.749	0.489	0.244	0.229	0.201	0.151	0.082	0.107	0.147	0.147	0.000	0.000	0.000																											
29	0.309	0.440	0.492	0.557	0.520	0.398	0.191	0.113	0.076	0.067	0.104	0.000	0.000	0.000	0.000																														
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																																		

Fihure 4-23 Calibrated Water Table Minus Water Table with 50% Decrease in Infiltration (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						15.0	15.0	15.0	15.0	15.0	15.0		
2																																			15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
3																																	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
4																						15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
5																15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
6												15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
7							13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
8						13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
9						13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
10					13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
11					13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
12				13.0	13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
13				13.0	13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
14			13.0	13.0	13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
15			13.0	13.0	13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
16		13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
17		13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0															
18	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	18.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0															
19	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	18.0	18.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0															
20	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	18.0	18.0	15.0	15.0	15.0	15.0	15.0	15.0	18.0	18.0	18.0	24.0	24.0	24.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0															
21	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	18.0	18.0	18.0	15.0	15.0	15.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0															
22	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	15.0	18.0	18.0	18.0	15.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0															
23	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																
24	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																	
25	24.0	24.0	20.0	20.0	20.0	20.0	20.0	20.0	24.0	24.0	24.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																		
26	24.0	24.0	20.0	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																					
27	24.0	24.0	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																							
28	24.0	24.0	24.0	20.0	20.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																											
29	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																														
30	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																																		

Figure 4-24 Recharge Rate For 5 in/year Leakage Through Dredge Spoil (in/yr)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.50	71.50	71.50	71.50	71.50	71.50		
2																																			71.00	71.00	71.50	71.54	71.58	71.61	71.66	71.71	71.96	72.50	73.00
3																																	71.00	71.00	71.00	71.16	71.42	71.56	71.64	71.71	71.78	71.89	72.08	72.27	72.86
4																						71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.00	71.09	71.12	71.13	71.22	71.48	71.64	71.70	71.77	71.85	71.95	72.09	72.20	72.91
5																71.00	71.00	71.00	71.00	71.00	71.00	71.24	71.30	71.29	71.35	71.28	71.21	71.28	71.31	71.21	71.18	71.16	71.19	71.21	71.19	71.67	71.85	71.90	71.95	72.00	72.06	72.14	72.27	72.21	73.24
6												71.00	71.00	71.00	71.00	71.13	71.16	71.19	71.22	71.23	71.27	71.41	71.47	71.43	71.55	71.73	71.66	71.44	71.50	71.68	71.65	71.59	71.52	71.33	71.23	71.86	72.04	72.11	72.16	72.20	72.25	72.32	72.42	72.79	73.71
7							60.00	65.00	71.00	71.00	71.00	71.04	71.07	71.10	71.16	71.25	71.31	71.35	71.40	71.41	71.46	71.58	71.65	71.99	72.10	72.39	72.39	72.02	71.93	72.08	71.98	71.86	71.77	71.70	71.73	72.02	72.18	72.26	72.31	72.36	72.41	72.46	72.56	73.48	74.13
8						37.24	60.01	65.08	70.81	70.95	71.02	71.08	71.13	71.19	71.29	71.38	71.43	71.49	71.57	71.61	71.88	72.03	72.12	72.71	72.77	72.96	72.99	72.83	72.52	72.33	72.16	72.01	71.91	71.85	71.95	72.19	72.34	72.42	72.47	72.52	72.56	72.61	73.12	74.02	74.50
9						38.68	60.00	65.09	70.70	70.92	71.04	71.12	71.19	71.27	71.38	71.49	71.55	71.63	71.74	72.01	72.33	72.47	72.66	73.08	73.28	73.47	73.52	73.48	73.06	72.62	72.31	72.11	71.99	71.92	72.14	72.58	72.60	72.65	72.67	72.68	72.72	72.77	73.66	74.41	74.79
10					36.17	49.13	59.97	65.08	70.65	70.91	71.07	71.16	71.24	71.34	71.45	71.57	71.62	71.75	72.18	72.53	72.68	72.78	73.04	73.46	73.71	73.93	74.00	74.17	73.91	73.15	72.56	72.25	72.09	72.08	72.85	73.39	73.26	73.06	72.91	72.86	72.89	73.24	74.08	74.69	75.03
11					37.31	48.63	58.04	65.54	71.56	71.64	71.15	71.23	71.32	71.45	71.54	71.65	72.17	72.40	72.86	73.00	73.02	73.07	73.33	73.82	74.44	74.76	74.84	75.10	74.82	73.76	72.81	72.40	72.29	72.51	73.64	74.25	73.93	73.45	73.23	73.07	73.09	73.64	74.32	74.87	75.21
12				36.09	41.48	48.58	57.05	70.06	73.23	73.10	71.20	71.28	71.39	72.14	72.63	72.59	73.15	73.30	73.41	73.42	73.36	73.36	73.52	74.49	75.61	76.07	76.28	76.35	75.85	74.25	73.36	72.67	72.97	73.07	74.79	75.62	75.30	74.32	73.57	73.32	73.34	73.85	74.42	74.96	75.33
13				37.20	43.34	49.77	58.29	70.64	74.25	74.38	72.51	71.65	71.81	73.38	74.07	73.86	73.94	73.97	73.89	73.82	74.00	74.01	74.02	76.29	77.09	77.47	77.62	77.37	76.98	77.03	76.73	76.74	76.70	76.39	77.15	77.60	77.65	75.66	74.23	73.70	73.66	73.90	74.35	74.95	75.44
14			36.10	40.35	45.06	51.34	59.87	72.37	75.19	75.30	74.59	73.04	72.69	74.31	74.84	74.70	74.60	74.57	74.32	74.43	75.01	75.34	76.75	78.27	78.58	78.79	78.73	78.04	77.97	81.35	81.42	85.74	82.04	81.43	81.06	80.43	79.58	76.57	74.76	73.90	73.75	73.70	74.08	74.83	75.54
15			37.13	41.91	46.87	52.49	70.23	75.06	76.29	76.59	76.57	75.80	76.09	76.60	76.63	75.41	75.17	75.16	75.04	75.36	76.10	76.95	78.89	79.32	79.86	80.07	80.10	79.51	79.93	85.31	86.76	89.45	86.47	86.17	85.92	83.09	81.65	76.68	74.81	73.65	73.51	73.17	73.47	74.55	75.70
16		39.18	39.88	44.77	50.50	56.41	73.97	78.42	77.66	78.26	78.37	78.54	78.54	76.99	76.41	76.04	75.63	75.77	76.11	76.64	77.34	78.08	79.49	80.34	81.13	81.36	81.50	81.51	82.55	89.89	91.20	92.20	91.00	91.00	91.00	86.00	86.00	76.00	72.00	72.00	72.00	72.00	72.00	74.00	76.00
17		42.98	47.63	54.65	56.19	65.19	76.11	77.72	79.05	80.39	79.92	79.97	79.10	77.85	77.22	76.76	76.07	76.62	77.54	78.49	78.81	79.92	81.50	82.01	82.43	82.60	82.83	83.26	84.78	95.77															
18	43.29	49.23	57.80	63.48	62.93	72.70	77.62	78.96	80.32	81.87	81.67	80.84	79.78	78.56	78.14	77.86	76.86	78.34	79.76	80.01	80.04	81.92	84.25	83.98	83.67	83.77	84.05	84.81	86.53	96.56															
19	50.02	56.66	62.99	65.53	66.96	75.15	78.95	80.12	81.42	82.64	83.00	81.86	80.67	79.25	79.32	79.66	80.21	81.66	81.73	81.00	81.63	85.35	87.08	85.54	84.78	84.85	85.15	86.26	88.01	97.00															
20	57.41	62.47	65.90	67.58	70.14	77.67	80.39	81.34	82.53	83.57	83.99	83.43	81.78	80.35	80.90	81.86	87.53	86.22	83.25	84.79	88.68	90.42	90.49	87.14	85.68	85.86	86.38	87.77	89.37	97.00															
21	64.08	66.33	67.80	69.35	75.13	80.27	81.93	82.85	83.68	84.56	85.07	85.05	84.02	81.30	82.44	83.59	92.33	91.47	86.42	93.29	97.67	95.99	96.06	93.51	91.99	91.80	92.78	93.28	95.31	99.39															
22	67.60	68.55	69.35	72.33	79.67	82.36	83.51	84.60	85.04	85.98	86.09	85.94	86.42	86.46	83.52	87.50	96.08	96.84	93.13	101.16	104.20	103.90	103.56	103.16	102.27	101.35	102.23	102.19	104.77	106.79															
23	69.53	70.27	70.81	77.16	81.97	83.99	85.14	86.16	86.62	87.30	87.01	86.61	87.46	89.92	87.71	93.03	100.50	102.20	99.26	106.55	110.18	111.56	111.66	111.45	110.67	109.38	109.28	109.02	113.25																
24	70.96	71.81	74.35	81.64	83.95	85.76	86.70	87.43	87.90	88.13	87.96	87.70	88.34	91.40	93.24	97.12	105.67	108.71	110.10	112.16	115.65	117.84	118.63	119.02	118.26	117.61	116.49	113.42																	
25	72.20	73.41	79.02	83.96	86.06	87.50	88.09	88.83	89.32	90.00	89.53	89.37	90.01	94.25	97.80	100.96	112.65	120.20	122.97	121.02	122.04	124.06	124.27	125.55	124.78	125.70	125.08																		
26	74.99	76.80	82.97	85.98	87.88	89.02	89.79	90.64	93.90	95.61	95.13	93.63	94.73	98.46	102.84	116.34	121.45	129.02	129.58	129.80	129.74	130.34	129.43	131.78																					
27	82.08	83.35	86.41	88.48	90.11	91.34	92.92	95.75	100.87	103.27	106.09	105.58	105.78	107.55	114.57	127.30	128.24	129.98	132.30	135.38	138.73	139.61																							
28	88.02	88.13	89.49	90.93	92.42	94.11	97.29	102.26	107.28	111.30	115.15	116.52	117.22	119.30	125.15	135.14	135.00	132.24																											
29	90.09	89.86	90.80	92.13	94.30	97.28	101.86	108.49	113.11	116.85	120.02	121.00	123.60	127.90	126.20																														
30	90.00	88.30	90.40	92.70	96.90	102.60	108.80	114.90	119.00	122.50	125.70																																		

Figure 4-25 Water Table for 5 in/y ar Leakage through Dredge Spoil (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.000	0.000	0.000	0.000	0.000	0.000		
2																																			0.000	0.000	0.000	0.006	0.009	0.010	0.011	0.011	0.009	0.000	0.000
3																																	0.000	0.000	0.000	0.006	0.008	0.013	0.016	0.018	0.018	0.018	0.018	0.013	0.006
4																						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.008	0.008	0.013	0.019	0.020	0.022	0.023	0.024	0.023	0.022	0.021	0.140
5																0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.008	0.008	0.007	0.005	0.004	0.004	0.005	0.004	0.004	0.005	0.007	0.010	0.011	0.048	0.058	0.054	0.055	0.056	0.056	0.057	0.082	0.025	0.196
6												0.000	0.000	0.000	0.000	0.008	0.007	0.007	0.008	0.008	0.008	0.011	0.012	0.011	0.010	0.010	0.009	0.006	0.006	0.009	0.011	0.012	0.013	0.012	0.013	0.062	0.078	0.081	0.083	0.084	0.085	0.088	0.094	0.123	0.252
7							0.000	0.000	0.000	0.000	0.000	0.004	0.005	0.005	0.008	0.010	0.012	0.012	0.013	0.012	0.012	0.014	0.015	0.018	0.015	0.015	0.014	0.011	0.010	0.014	0.015	0.017	0.018	0.020	0.037	0.074	0.091	0.098	0.101	0.103	0.105	0.108	0.116	0.218	0.297
8						0.000	0.001	0.000	0.001	0.003	0.004	0.007	0.009	0.010	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.021	0.020	0.020	0.019	0.018	0.017	0.015	0.014	0.016	0.018	0.020	0.022	0.024	0.049	0.084	0.103	0.112	0.116	0.119	0.123	0.128	0.182	0.267	0.312
9						0.000	0.001	0.001	0.002	0.005	0.008	0.011	0.013	0.014	0.018	0.018	0.018	0.019	0.020	0.023	0.027	0.028	0.027	0.024	0.021	0.020	0.018	0.017	0.016	0.018	0.019	0.021	0.023	0.028	0.057	0.100	0.118	0.128	0.130	0.133	0.138	0.147	0.224	0.283	0.312
10					0.000	0.008	0.002	0.001	0.002	0.006	0.012	0.014	0.015	0.017	0.018	0.020	0.020	0.021	0.027	0.031	0.032	0.033	0.032	0.026	0.022	0.020	0.018	0.017	0.015	0.018	0.020	0.023	0.025	0.029	0.061	0.088	0.113	0.135	0.139	0.142	0.148	0.178	0.236	0.274	0.292
11					0.001	0.014	0.009	0.007	0.032	0.083	0.017	0.020	0.021	0.020	0.021	0.022	0.031	0.033	0.036	0.036	0.036	0.036	0.036	0.027	0.022	0.019	0.018	0.015	0.014	0.016	0.020	0.023	0.028	0.031	0.043	0.055	0.088	0.130	0.138	0.143	0.152	0.178	0.217	0.241	0.252
12				0.000	0.016	0.023	0.025	0.001	0.069	0.143	0.021	0.025	0.027	0.032	0.034	0.036	0.046	0.045	0.042	0.041	0.039	0.039	0.041	0.026	0.019	0.018	0.014	0.011	0.011	0.014	0.016	0.021	0.015	0.021	0.024	0.032	0.041	0.053	0.110	0.125	0.133	0.141	0.168	0.184	0.189
13				0.001	0.021	0.029	0.040	0.024	0.088	0.178	0.101	0.057	0.059	0.047	0.048	0.053	0.057	0.053	0.048	0.043	0.041	0.042	0.057	0.013	0.012	0.010	0.008	0.007	0.008	0.008	0.006	0.002	0.001	0.005	0.011	0.015	0.010	0.004	0.089	0.093	0.101	0.111	0.128	0.135	0.135
14			0.000	0.010	0.023	0.028	0.037	0.032	0.089	0.218	0.184	0.053	0.085	0.056	0.058	0.063	0.065	0.058	0.049	0.048	0.040	0.035	0.015	-0.007	0.005	0.006	0.006	0.002	0.007	0.007	0.001	-0.005	0.001	-0.001	0.001	0.004	0.001	0.007	0.042	0.064	0.073	0.093	0.093	0.091	0.087
15			0.000	0.013	0.022	0.028	0.002	0.032	0.081	0.232	0.182	0.055	0.078	0.063	0.068	0.069	0.073	0.063	0.051	0.047	0.035	0.018	0.021	0.003	0.003	0.004	0.004	0.005	0.004	0.001	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.005	0.033	0.046	0.055	0.053	0.058	0.048	0.042
16		0.000	0.002	0.008	0.018	0.018	0.009	0.030	0.083	0.192	0.175	0.088	0.050	0.084	0.071	0.074	0.082	0.085	0.049	0.039	0.029	0.017	-0.011	0.002	0.002	0.003	0.003	0.003	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17		0.000	0.000	0.001	0.007	0.002	0.014	0.027	0.045	0.105	0.153	0.087	0.069	0.072	0.072	0.074	0.095	0.057	0.025	0.020	0.019	0.014	-0.002	0.000	0.002	0.002	0.002	0.002	0.001	0.000															
18	0.000	0.000	0.000	0.000	0.003	0.001	0.014	0.023	0.030	0.013	0.098	0.072	0.074	0.077	0.069	0.081	0.089	0.022	0.014	0.008	0.011	0.007	0.002	0.001	0.001	0.002	0.002	0.001	0.001	0.000															
19	0.000	0.001	0.001	0.002	0.005	0.008	0.013	0.021	0.028	0.022	0.032	0.083	0.070	0.081	0.057	0.038	0.091	0.002	-0.001	0.004	0.007	0.005	0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.000															
20	0.000	0.000	0.001	0.002	0.004	0.005	0.012	0.019	0.024	0.027	0.025	0.039	0.057	0.088	0.034	0.013	0.038	-0.005	0.000	0.000	0.003	0.005	0.003	0.001	0.001	0.001	0.001	0.001	0.000	0.000															
21	0.000	0.001	0.001	0.002	0.002	0.004	0.010	0.015	0.023	0.032	0.018	0.009	0.028	0.053	0.018	0.001	-0.027	-0.007	0.000	0.000	0.002	0.005	0.003	0.001	0.001	0.001	0.000	0.000	0.000	0.000															
22	0.000	0.001	0.001	0.001	0.001	0.004	0.008	0.011	0.020	0.041	0.013	0.004	-0.005	0.034	0.010	-0.001	-0.013	-0.005	0.000	0.002	0.003	0.004	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000															
23	0.000	0.001	0.001	0.001	0.001	0.003	0.008	0.008	0.013	0.016	0.009	0.002	-0.008	-0.026	0.000	-0.003	-0.006	-0.003	0.000	0.002	0.004	0.005	0.002	0.000	0.000	0.000	0.000	0.000	0.000																
24	0.000	0.000	0.000	0.000	0.001	0.003	0.005	0.007	0.010	0.012	0.007	0.000	-0.007	-0.015	0.003	-0.003	-0.003	-0.002	0.000	0.002	0.004	0.007	0.002	0.000	0.000	0.000	0.000	0.000																	
25	0.000	0.000	0.000	0.000	0.001	0.002	0.004	0.005	0.007	0.008	0.004	0.000	-0.006	-0.008	-0.007	-0.001	-0.001	-0.001	0.000	0.001	0.004	0.009	0.001	0.000	0.000	0.000	0.000																		
26	0.000	0.000	0.000	0.000	0.001	0.001	0.002	0.003	0.001	0.000	0.000	0.000	-0.002	-0.003	-0.001	0.000	0.000	0.000	0.000	0.000	0.002	0.012	0.000	0.000																					
27	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.000	-0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																							
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																											
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																														
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																																		

Figure 4-26 Calibrated Water Table Minus Water Table with 5 in/year Leakage through Dredge Spoil (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						70.6	70.6	70.6	70.6	70.6	70.6		
2																																			70.1	70.1	70.6	70.7	70.8	70.8	70.9	71.0	71.2	71.6	72.1
3																																	70.1	70.1	70.1	70.5	70.7	70.9	70.9	71.0	71.1	71.2	71.3	71.4	72.2
4																						70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.9	70.9	70.9	70.8	71.2	71.0	71.0	71.1	71.2	71.2	71.3	71.4	72.3
5																70.1	70.1	70.1	70.1	70.1	70.1	71.7	71.8	71.9	72.0	71.9	71.8	71.8	71.8	71.6	71.4	71.3	71.1	71.1	71.0	71.4	71.7	71.4	71.4	71.4	71.4	71.5	71.6	71.4	72.7
6												70.1	70.1	70.1	70.1	70.9	71.0	71.2	71.3	71.4	71.6	71.8	71.9	72.0	72.1	72.2	72.1	71.9	71.9	72.0	71.8	71.7	71.5	71.2	71.1	71.7	71.8	71.7	71.6	71.6	71.7	71.7	71.8	72.2	73.3
7							60.0	65.0	70.1	70.1	70.1	70.2	70.3	70.4	70.8	71.0	71.2	71.3	71.5	71.6	71.7	71.9	72.1	72.4	72.5	72.7	72.7	72.4	72.3	72.3	72.1	72.0	71.8	71.7	71.6	71.8	71.9	71.9	71.8	71.8	71.8	71.9	72.0	73.1	73.8
8						37.2	59.9	65.0	70.1	70.1	70.2	70.3	70.4	70.6	70.9	71.1	71.3	71.5	71.6	71.7	72.1	72.3	72.4	72.9	73.1	73.2	73.3	73.1	72.8	72.5	72.3	72.1	72.0	71.9	71.9	72.0	72.1	72.0	72.0	72.0	72.0	72.0	72.6	73.7	74.2
9						38.7	59.8	65.0	70.1	70.2	70.3	70.4	70.5	70.7	71.0	71.2	71.4	71.6	71.8	72.1	72.5	72.7	72.9	73.3	73.5	73.7	73.7	73.7	73.3	72.8	72.5	72.2	72.1	72.0	72.1	72.4	72.3	72.3	72.2	72.2	72.2	72.2	73.3	74.1	74.6
10					36.2	49.0	59.7	65.0	70.1	70.2	70.3	70.5	70.6	70.8	71.1	71.3	71.5	71.7	72.2	72.6	72.8	73.0	73.2	73.6	73.9	74.1	74.2	74.3	74.1	73.3	72.7	72.4	72.2	72.1	72.8	73.3	73.1	72.7	72.5	72.4	72.4	72.8	73.8	74.5	74.8
11					37.3	48.5	57.8	65.5	71.3	71.2	70.5	70.6	70.8	71.0	71.2	71.4	72.0	72.4	72.9	73.1	73.2	73.2	73.5	74.0	74.6	74.9	75.0	75.2	74.9	73.9	72.9	72.5	72.4	72.5	73.8	74.2	73.8	73.2	72.9	72.7	72.7	73.3	74.1	74.7	75.0
12				36.1	41.4	48.4	56.9	70.1	73.2	72.9	70.6	70.7	70.9	71.9	72.5	72.4	73.1	73.3	73.4	73.5	73.5	73.5	73.7	74.6	75.7	76.2	76.4	76.4	75.9	74.4	73.5	72.8	73.0	73.1	74.8	75.6	75.3	74.2	73.3	73.0	73.0	73.6	74.2	74.8	75.2
13				37.2	43.3	49.7	58.3	70.6	74.2	74.3	72.2	71.2	71.4	73.3	74.0	73.8	73.9	74.0	73.9	73.9	74.1	74.1	74.2	76.4	77.2	77.5	77.7	77.4	77.1	77.1	76.8	78.7	76.7	76.4	77.2	77.6	77.6	75.7	74.1	73.4	73.4	73.7	74.2	74.8	75.3
14			36.1	40.3	45.0	51.3	59.9	72.4	75.2	75.3	74.5	73.0	72.6	74.3	74.8	74.7	74.6	74.6	74.3	74.5	75.1	75.4	76.8	78.3	78.6	78.8	78.8	78.1	78.0	81.4	81.4	85.7	82.0	81.4	81.1	80.4	79.6	76.6	74.7	73.7	73.6	73.6	74.0	74.7	75.5
15			37.1	41.9	46.8	52.5	70.2	75.1	76.3	76.6	76.5	75.8	76.1	75.6	75.6	75.4	75.1	75.2	75.1	75.4	76.1	77.0	78.9	79.3	79.9	80.1	80.1	79.6	80.0	85.3	86.8	89.5	86.5	86.2	85.9	83.1	81.7	76.7	74.7	73.5	73.4	73.1	73.4	74.5	75.7
16		39.2	39.9	44.8	50.5	56.4	74.0	76.4	77.7	78.3	78.4	78.5	78.5	77.0	76.4	76.0	75.6	75.8	76.1	76.7	77.4	78.1	79.5	80.4	81.7	81.4	81.5	81.5	82.6	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		43.0	47.6	54.7	56.2	65.2	76.1	77.7	79.0	80.4	79.9	80.0	79.1	77.8	77.2	76.7	76.1	76.6	77.5	78.5	78.8	79.9	81.5	82.0	82.4	82.6	82.8	83.3	84.8	95.8															
18	43.3	49.2	57.8	63.5	62.9	72.7	77.6	79.0	80.3	81.9	81.7	80.8	79.8	78.6	78.1	77.9	76.8	76.3	79.8	80.0	80.0	81.9	84.2	84.0	83.7	83.8	84.1	84.8	86.5	96.7															
19	50.0	56.7	63.0	65.5	67.0	75.1	79.0	80.1	81.4	82.6	83.0	81.9	80.7	79.2	79.3	79.7	80.2	81.7	81.7	81.0	81.6	85.3	87.1	85.5	84.8	84.9	85.2	86.3	88.0	97.0															
20	57.4	62.5	65.9	67.6	70.1	77.7	80.4	81.3	82.5	83.6	84.0	83.4	81.8	80.3	80.9	81.9	87.5	86.2	83.2	84.8	88.7	90.4	90.5	87.1	85.7	85.9	86.4	87.9	89.4	97.0															
21	64.1	66.3	67.8	69.3	75.1	80.3	81.9	82.9	83.7	84.6	85.1	85.0	84.0	81.3	82.4	83.6	92.3	91.5	86.4	93.3	97.7	96.0	96.1	93.5	92.0	91.8	92.8	93.3	95.3	99.4															
22	67.6	68.6	69.4	72.3	79.7	82.4	83.5	84.6	85.0	86.0	86.1	85.9	86.4	86.5	83.5	87.5	98.1	96.8	93.1	101.2	104.2	103.9	103.6	103.2	102.3	101.4	102.2	102.2	104.8	106.8															
23	69.5	70.3	70.8	77.2	82.0	84.0	85.1	86.2	86.6	87.3	87.0	86.6	87.5	89.9	87.7	93.0	100.5	102.2	99.3	106.5	110.2	111.6	111.7	111.5	110.7	109.4	109.3	109.0	113.3																
24	71.0	71.6	74.3	81.6	84.0	85.8	86.7	87.4	87.9	88.1	88.0	87.7	88.3	91.4	93.2	97.1	105.7	108.7	110.1	112.2	115.6	117.6	118.6	119.0	118.3	117.6	116.5	113.4																	
25	72.2	73.4	79.0	84.0	86.1	87.5	88.1	88.8	89.3	90.0	89.5	89.4	90.0	94.2	97.8	101.0	112.7	120.2	123.0	121.0	122.0	124.1	124.3	125.6	124.8	125.7	125.1																		
26	75.0	76.8	83.0	86.0	87.9	89.0	89.8	90.8	93.9	95.6	95.1	93.6	94.7	98.5	102.8	116.3	121.4	129.0	129.6	129.8	129.7	130.3	129.4	131.8																					
27	82.1	83.4	86.4	88.5	90.1	91.3	92.9	95.7	100.6	103.3	106.1	105.6	105.8	107.5	114.6	127.3	128.2	130.0	132.3	135.4	138.7	139.6																							
28	88.0	88.1	89.5	90.9	92.4	94.1	97.3	102.3	107.3	111.3	115.2	116.5	117.2	119.3	125.1	135.1	135.0	132.2																											
29	90.1	89.9	90.8	92.1	94.3	97.3	101.9	108.5	113.1	116.9	120.0	121.0	123.6	127.9	126.2																														
30	90.0	88.3	90.4	92.7	98.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-27 Water Table for 0.9 Foot Lower Head Along Wetland Boundary (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.900	0.900	0.900	0.900	0.900	0.900		
2																																			0.900	0.900	0.900	0.820	0.790	0.777	0.759	0.710	0.771	0.900	0.900
3																																	0.900	0.900	0.900	0.617	0.746	0.713	0.709	0.714	0.720	0.735	0.798	0.827	0.710
4																						0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.900	0.200	0.213	0.258	0.417	0.254	0.619	0.654	0.676	0.697	0.725	0.766	0.786	0.620
5																0.900	0.900	0.900	0.900	0.900	0.900	-0.480	-0.545	-0.614	-0.628	-0.609	-0.568	-0.534	-0.483	-0.378	-0.244	-0.100	0.093	0.159	0.216	0.241	0.172	0.475	0.553	0.598	0.630	0.656	0.666	0.775	0.521
6												0.900	0.900	0.900	0.900	0.268	0.149	0.025	-0.093	-0.208	-0.330	-0.413	-0.476	-0.563	-0.548	-0.488	-0.462	-0.480	-0.424	-0.290	-0.187	-0.096	0.010	0.104	0.182	0.212	0.264	0.421	0.508	0.562	0.598	0.622	0.631	0.593	0.411
7							0.000	0.000	0.900	0.900	0.900	0.830	0.785	0.715	0.395	0.255	0.145	0.034	-0.069	-0.176	-0.285	-0.362	-0.415	-0.393	-0.414	-0.351	-0.328	-0.373	-0.345	-0.234	-0.168	-0.103	-0.036	0.009	0.087	0.196	0.283	0.401	0.484	0.537	0.574	0.597	0.604	0.420	0.339
8						0.001	0.109	0.069	0.709	0.808	0.818	0.767	0.701	0.597	0.389	0.251	0.149	0.043	-0.048	-0.139	-0.217	-0.274	-0.320	-0.232	-0.289	-0.274	-0.261	-0.263	-0.269	-0.213	-0.161	-0.107	-0.054	-0.018	0.058	0.184	0.285	0.388	0.464	0.514	0.547	0.568	0.467	0.330	0.286
9						0.012	0.185	0.079	0.586	0.740	0.761	0.717	0.643	0.532	0.374	0.248	0.159	0.052	-0.033	-0.109	-0.178	-0.219	-0.242	-0.213	-0.232	-0.226	-0.218	-0.213	-0.224	-0.197	-0.157	-0.110	-0.064	-0.029	0.040	0.159	0.277	0.370	0.443	0.489	0.517	0.535	0.361	0.273	0.243
10					0.002	0.167	0.222	0.072	0.529	0.703	0.726	0.681	0.604	0.493	0.358	0.248	0.161	0.059	-0.028	-0.091	-0.156	-0.193	-0.206	-0.192	-0.198	-0.194	-0.189	-0.174	-0.167	-0.168	-0.149	-0.112	-0.071	-0.035	0.020	0.094	0.195	0.319	0.413	0.461	0.482	0.418	0.285	0.228	0.206
11					0.005	0.177	0.197	0.044	0.269	0.432	0.625	0.591	0.525	0.425	0.333	0.245	0.125	0.035	-0.033	-0.079	-0.137	-0.174	-0.187	-0.172	-0.161	-0.155	-0.152	-0.129	-0.125	-0.138	-0.140	-0.113	-0.074	-0.035	0.004	0.041	0.119	0.272	0.354	0.421	0.437	0.319	0.232	0.189	0.171
12				0.001	0.053	0.144	0.108	0.001	0.040	0.154	0.579	0.542	0.485	0.280	0.176	0.149	0.065	0.012	-0.033	-0.069	-0.119	-0.158	-0.178	-0.147	-0.116	-0.108	-0.097	-0.083	-0.092	-0.121	-0.114	-0.104	-0.045	-0.024	0.002	0.024	0.052	0.106	0.283	0.352	0.355	0.246	0.186	0.153	0.137
13				0.001	0.047	0.075	0.028	0.005	0.025	0.039	0.313	0.402	0.390	0.091	0.029	0.060	0.039	0.004	-0.030	-0.058	-0.092	-0.126	-0.162	-0.074	-0.072	-0.070	-0.060	-0.059	-0.069	-0.067	-0.045	-0.010	-0.004	-0.005	0.002	0.011	0.011	0.004	0.173	0.250	0.247	0.185	0.146	0.118	0.104
14			0.000	0.013	0.035	0.033	0.012	0.003	0.015	0.029	0.066	0.066	0.131	0.046	0.028	0.037	0.026	0.001	-0.025	-0.047	-0.062	-0.070	-0.018	-0.018	-0.041	-0.047	-0.047	-0.052	-0.056	-0.019	0.002	0.025	0.006	0.002	0.000	0.003	0.002	0.015	0.105	0.152	0.165	0.135	0.108	0.082	0.069
15			0.000	0.014	0.027	0.020	0.000	0.002	0.009	0.017	0.021	-0.034	-0.001	0.027	0.022	0.026	0.019	0.001	-0.019	-0.036	-0.040	-0.023	0.016	-0.014	-0.028	-0.034	-0.034	-0.039	-0.037	-0.012	-0.001	-0.003	0.000	0.000	0.000	0.000	0.001	0.013	0.080	0.114	0.120	0.086	0.068	0.044	0.034
16		0.000	0.002	0.007	0.014	0.008	-0.004	0.001	0.005	0.007	0.011	0.021	0.009	0.012	0.018	0.020	0.016	0.001	-0.013	-0.022	-0.024	-0.013	0.005	-0.013	-0.021	-0.024	-0.025	0.025	-0.020	-0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17		0.000	0.000	0.000	0.003	0.000	-0.001	0.001	0.002	0.001	0.005	0.001	0.006	0.009	0.014	0.016	0.014	0.001	-0.007	-0.008	-0.013	-0.007	-0.002	-0.011	-0.016	-0.018	-0.019	-0.017	-0.012	0.000																
18	0.000	0.000	0.000	0.000	0.000	-0.002	0.000	0.000	0.001	0.000	0.002	0.001	0.005	0.008	0.010	0.011	0.008	0.000	-0.003	-0.003	-0.007	-0.004	-0.004	-0.009	-0.013	-0.014	-0.014	-0.012	-0.008	0.000															
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.003	0.006	0.006	0.005	0.001	0.000	-0.001	-0.002	-0.004	-0.003	-0.004	-0.008	-0.011	-0.012	-0.012	-0.009	-0.005	0.000															
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.004	0.003	0.001	0.000	0.000	0.000	0.000	-0.001	-0.002	-0.003	-0.006	-0.009	-0.010	-0.009	-0.005	-0.004	0.000															
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	-0.001	-0.003	-0.004	-0.005	-0.004	-0.002	-0.002	0.000															
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.000	0.000	0.000															
23	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																	
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																			
26	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																					
27	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																							
28	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																											
29	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																														
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																																		

Figure 4-28 Calibrated Water Table Minus Water Table with 0.9 Foot Lower Head along Wetland Boundary (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.5	71.5	71.5	71.5	71.5	71.5		
2																																			71.0	71.0	71.5	71.5	71.6	71.6	71.7	71.7	72.0	72.5	73.0
3																																	71.0	71.0	71.0	71.2	71.4	71.6	71.6	71.7	71.8	71.9	72.1	72.3	72.9
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.5	71.6	71.7	71.8	71.8	72.0	72.1	72.2	72.9
5																71.0	71.0	71.0	71.0	71.0	71.0	71.2	71.2	71.2	71.2	71.2	71.1	71.2	71.2	71.1	71.1	71.1	71.2	71.2	71.2	71.6	71.8	71.9	71.9	72.0	72.1	72.1	72.3	72.2	73.2
6												71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.1	71.2	71.2	71.3	71.3	71.3	71.4	71.5	71.5	71.3	71.4	71.5	71.5	71.5	71.4	71.3	71.2	71.8	72.0	72.1	72.1	72.2	72.3	72.3	72.4	72.8	73.7
7							60.0	65.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.2	71.2	71.2	71.3	71.3	71.3	71.4	71.5	71.6	71.6	72.1	72.1	71.8	71.7	71.6	71.7	71.7	71.6	71.6	71.6	72.0	72.1	72.2	72.3	72.4	72.4	72.5	72.6	73.5	74.1
8						37.2	60.0	65.1	70.8	70.9	71.0	71.1	71.1	71.1	71.2	71.3	71.3	71.3	71.4	71.4	71.7	71.8	71.9	72.4	72.4	72.5	72.5	72.4	72.1	72.0	71.9	71.8	71.7	71.7	71.8	72.1	72.3	72.4	72.5	72.5	72.6	72.6	73.1	74.0	74.5
9						38.7	60.0	65.1	70.7	70.9	71.0	71.1	71.1	71.2	71.3	71.3	71.4	71.4	71.5	71.7	72.0	72.1	72.3	72.6	72.8	72.9	73.0	72.9	72.5	72.2	72.0	71.9	71.8	71.8	72.0	72.5	72.6	72.6	72.7	72.7	72.7	72.8	73.7	74.4	74.8
10					36.2	49.1	60.0	65.1	70.6	70.9	71.0	71.1	71.2	71.2	71.3	71.4	71.4	71.5	71.8	72.1	72.3	72.4	72.6	72.9	73.2	73.3	73.3	73.4	73.2	72.6	72.2	71.9	71.9	71.9	72.8	73.4	73.2	73.0	72.9	72.9	72.9	73.2	74.1	74.7	75.0
11					37.3	48.6	58.0	65.5	71.5	71.6	71.1	71.2	71.2	71.3	71.4	71.5	71.8	72.0	72.3	72.5	72.5	72.6	72.8	73.2	73.8	74.0	74.0	74.2	74.0	73.1	72.3	72.1	72.0	72.3	73.6	74.2	73.9	73.4	73.2	73.1	73.1	73.6	74.3	74.9	75.2
12				36.1	41.4	48.5	57.0	70.1	73.2	73.1	71.1	71.2	71.3	71.8	72.3	72.2	72.6	72.6	72.7	72.8	72.8	72.8	73.0	73.7	74.8	75.2	75.4	75.4	74.9	73.6	72.7	72.2	72.7	72.9	74.7	75.6	75.3	74.3	73.6	73.3	73.3	73.8	74.4	75.0	75.3
13				37.2	43.3	49.7	58.2	70.6	74.2	74.3	72.4	71.5	71.6	72.8	73.4	73.1	73.1	73.1	73.1	73.1	73.3	73.3	73.5	75.5	76.2	76.5	76.6	76.4	75.9	76.1	75.2	78.5	76.4	76.3	77.1	77.6	77.7	75.7	74.2	73.7	73.7	73.9	74.3	74.9	75.4
14			36.1	40.3	45.0	51.3	59.8	72.3	75.1	75.2	74.5	72.9	72.5	73.5	74.0	73.8	73.6	73.5	73.4	73.5	74.2	74.6	76.7	77.5	77.5	77.6	77.6	76.9	76.8	80.0	78.7	84.8	81.6	81.4	81.1	80.4	79.6	76.6	74.8	73.9	73.8	73.7	74.1	74.8	75.5
15			37.1	41.9	46.8	52.4	70.2	75.0	76.2	76.5	76.4	75.6	76.0	74.8	74.7	74.3	74.0	74.0	73.9	74.3	75.2	76.2	78.0	78.4	78.7	78.8	78.8	78.2	78.6	83.5	85.4	87.7	86.2	86.2	85.9	83.1	81.7	78.7	74.8	73.6	73.5	73.2	73.5	74.5	75.7
16		39.2	39.9	44.7	50.5	56.4	73.9	76.4	77.6	78.1	78.1	78.2	77.9	76.2	75.3	74.6	74.3	74.4	74.7	75.5	76.5	77.3	78.6	79.2	79.8	80.0	80.1	80.0	81.1	87.6	88.2	89.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		43.0	47.6	54.6	58.2	65.2	76.1	77.7	79.0	80.3	79.7	79.6	78.4	76.9	76.0	75.4	74.7	75.1	76.1	77.7	78.0	79.1	80.4	80.7	81.0	81.1	81.3	81.6	83.2	92.8															
18	43.3	49.2	57.8	63.5	62.9	72.7	77.6	78.9	80.2	81.8	81.4	80.4	79.1	77.5	76.8	76.4	76.4	77.6	78.7	79.4	79.2	80.9	82.8	82.5	82.1	82.2	82.4	83.1	84.8	93.7															
19	50.0	56.7	63.0	65.5	68.9	75.1	78.9	80.0	81.3	82.5	82.8	81.4	80.0	78.1	78.0	78.6	80.1	81.4	80.7	80.2	80.6	83.8	85.2	83.8	83.1	83.2	83.5	84.7	86.3	94.0															
20	57.4	62.5	65.9	67.6	70.1	77.6	80.3	81.3	82.4	83.4	83.7	83.0	81.1	79.6	79.9	81.0	87.4	84.8	81.8	84.6	87.6	88.2	88.2	85.2	83.9	84.2	84.8	86.4	87.7	94.0															
21	64.1	66.3	67.8	69.3	75.1	80.2	81.9	82.8	83.6	84.4	84.6	84.7	83.5	80.8	81.4	82.5	89.7	88.3	85.7	92.8	96.2	93.5	93.7	91.6	90.2	89.8	91.0	91.5	93.2	96.4															
22	67.6	68.6	69.3	72.3	79.7	82.3	83.5	84.5	84.9	85.8	85.8	85.5	85.9	86.4	82.2	85.2	92.8	91.8	91.2	98.9	102.1	101.6	101.4	101.3	100.2	98.8	99.9	99.8	102.1	103.8															
23	69.5	70.3	70.8	77.2	82.0	84.0	85.1	86.1	86.5	87.1	86.7	86.1	86.6	88.6	85.8	89.5	96.7	95.4	96.4	103.8	107.7	109.6	109.6	109.3	108.2	106.5	106.4	106.4	110.3																
24	71.0	71.8	74.3	81.6	83.9	85.7	86.7	87.4	87.8	88.0	87.7	87.2	87.5	89.8	91.1	93.7	101.7	101.3	109.7	108.7	112.7	115.4	116.3	116.6	115.6	114.7	113.4	110.4																	
25	72.2	73.4	79.0	84.0	86.1	87.5	88.1	88.8	89.3	89.9	89.3	88.9	89.0	92.4	95.6	99.5	109.1	116.1	122.5	119.4	119.1	121.4	121.5	122.8	121.8	122.7	122.1																		
26	75.0	76.8	83.0	86.0	87.9	89.0	89.8	90.8	93.9	95.6	95.1	93.6	94.3	98.8	100.7	0.0	118.9	127.0	127.6	129.0	127.4	127.6	126.4	128.8																					
27	82.1	83.4	86.4	88.5	90.1	91.3	92.9	95.7	100.6	103.3	106.1	105.6	105.7	106.6	113.0	125.0	125.5	127.3	129.3	132.4	135.7	136.6																							
28	88.0	88.1	89.5	90.9	92.4	94.1	97.3	102.3	107.3	111.3	115.1	116.5	117.2	119.1	124.6	132.1	132.0	129.2																											
29	90.1	89.9	90.8	92.1	94.3	97.3	101.9	108.5	113.1	116.9	120.0	121.0	123.6	127.9	126.2																														
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-29 Water Table with 3 feet Lower Head along Hillside Boundary (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.000	0.000	0.000	0.000	0.000	0.000		
2																																			0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
3																																	0.000	0.000	0.000	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000
4																						0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.019	0.022	0.018	0.011	0.005	0.002	0.002	0.001	0.001	0.001	0.001	0.000	0.000
5																0.000	0.000	0.000	0.000	0.000	0.000	0.070	0.087	0.089	0.098	0.092	0.064	0.083	0.087	0.058	0.048	0.041	0.041	0.040	0.029	0.027	0.018	0.009	0.006	0.003	0.002	0.002	0.001	0.000	0.000
6												0.000	0.000	0.000	0.000	0.041	0.054	0.063	0.071	0.072	0.077	0.113	0.129	0.127	0.146	0.182	0.171	0.125	0.132	0.164	0.151	0.128	0.103	0.058	0.035	0.039	0.026	0.015	0.009	0.005	0.003	0.002	0.002	0.001	0.001
7							0.000	0.000	0.000	0.000	0.000	0.014	0.022	0.033	0.053	0.082	0.098	0.113	0.127	0.125	0.126	0.152	0.169	0.216	0.253	0.323	0.336	0.265	0.239	0.266	0.234	0.194	0.157	0.122	0.085	0.053	0.032	0.018	0.011	0.007	0.004	0.003	0.002	0.001	0.001
8						0.000	0.001	0.000	0.002	0.006	0.013	0.028	0.043	0.063	0.094	0.118	0.136	0.155	0.175	0.174	0.220	0.247	0.264	0.346	0.384	0.434	0.462	0.456	0.389	0.337	0.284	0.232	0.188	0.155	0.113	0.062	0.035	0.020	0.012	0.007	0.005	0.003	0.002	0.001	0.001
9						0.001	0.002	0.001	0.004	0.011	0.024	0.041	0.062	0.087	0.120	0.152	0.170	0.194	0.222	0.274	0.331	0.353	0.379	0.440	0.480	0.527	0.569	0.602	0.518	0.414	0.331	0.263	0.208	0.170	0.126	0.061	0.034	0.020	0.012	0.008	0.005	0.004	0.002	0.001	0.001
10					0.000	0.012	0.003	0.001	0.005	0.014	0.033	0.053	0.078	0.109	0.144	0.176	0.191	0.229	0.342	0.413	0.419	0.430	0.461	0.525	0.558	0.608	0.662	0.744	0.662	0.526	0.404	0.305	0.231	0.181	0.092	0.039	0.025	0.017	0.011	0.008	0.006	0.003	0.002	0.001	0.001
11					0.002	0.020	0.011	0.005	0.018	0.028	0.047	0.069	0.101	0.139	0.172	0.204	0.340	0.408	0.527	0.532	0.501	0.498	0.523	0.606	0.678	0.739	0.806	0.870	0.787	0.625	0.481	0.352	0.261	0.170	0.060	0.022	0.016	0.015	0.010	0.007	0.006	0.003	0.002	0.001	0.001
12				0.000	0.031	0.034	0.029	0.001	0.038	0.045	0.054	0.082	0.120	0.302	0.365	0.423	0.601	0.656	0.677	0.641	0.574	0.562	0.563	0.756	0.842	0.896	0.915	0.919	0.905	0.697	0.651	0.426	0.218	0.126	0.042	0.016	0.009	0.006	0.008	0.007	0.005	0.003	0.001	0.001	0.001
13				0.002	0.042	0.045	0.047	0.024	0.051	0.068	0.076	0.147	0.242	0.584	0.646	0.712	0.803	0.843	0.812	0.744	0.682	0.676	0.505	0.759	0.938	1.016	1.012	0.988	1.035	0.942	1.506	0.229	0.271	0.065	0.022	0.009	0.003	0.001	0.005	0.005	0.004	0.002	0.001	0.001	0.000
14			0.000	0.026	0.049	0.052	0.048	0.040	0.065	0.093	0.099	0.119	0.204	0.796	0.830	0.907	0.978	1.019	0.942	0.903	0.801	0.734	0.021	0.777	1.031	1.139	1.162	1.128	1.156	1.368	2.692	1.185	0.417	0.041	0.005	0.003	0.001	0.001	0.003	0.003	0.002	0.002	0.001	0.000	0.000
15			0.001	0.034	0.054	0.060	0.004	0.050	0.076	0.119	0.162	0.179	0.041	0.808	0.975	1.071	1.139	1.209	1.153	1.105	0.870	0.738	0.849	0.970	1.164	1.261	1.297	1.307	1.312	1.782	1.352	1.698	0.222	0.013	-0.001	0.000	0.000	0.000	0.002	0.002	0.002	0.001	0.001	0.000	0.000
16		0.000	0.008	0.026	0.046	0.047	0.023	0.059	0.084	0.125	0.228	0.307	0.615	0.800	1.095	1.226	1.288	1.411	1.400	1.090	0.870	0.739	0.896	1.098	1.293	1.374	1.425	1.500	1.494	2.321	3.000	3.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17		0.000	0.002	0.005	0.027	0.006	0.040	0.067	0.092	0.101	0.269	0.374	0.671	0.938	1.207	1.378	1.415	1.490	1.404	0.769	0.814	0.804	1.088	1.266	1.425	1.479	1.538	1.621	1.625	3.000															
18	0.000	0.002	0.000	-0.001	0.017	0.008	0.048	0.074	0.100	0.117	0.240	0.457	0.710	1.045	1.300	1.415	0.481	0.784	1.011	0.633	0.830	1.015	1.434	1.496	1.542	1.571	1.630	1.667	1.692	3.000															
19	0.003	0.003	0.006	0.008	0.022	0.024	0.051	0.080	0.111	0.151	0.242	0.471	0.697	1.130	1.289	1.078	0.148	0.307	1.069	0.834	1.022	1.515	1.842	1.717	1.646	1.646	1.701	1.601	1.706	3.000															
20	0.002	0.003	0.006	0.011	0.019	0.024	0.050	0.082	0.118	0.172	0.259	0.391	0.640	0.764	1.080	0.851	0.100	1.419	1.475	0.168	1.047	2.237	2.264	1.915	1.747	1.698	1.622	1.382	1.670	3.000															
21	0.002	0.003	0.006	0.011	0.009	0.023	0.046	0.076	0.121	0.186	0.276	0.328	0.503	0.492	1.052	1.141	2.652	3.191	0.684	0.451	1.479	2.509	2.398	1.873	1.787	1.990	1.770	1.774	2.148	3.000															
22	0.002	0.003	0.006	0.008	0.004	0.020	0.041	0.063	0.111	0.171	0.299	0.410	0.495	0.066	1.270	2.293	3.262	5.053	1.931	2.247	2.063	2.058	2.198	1.896	2.049	2.550	2.363	2.343	2.693	3.000															
23	0.003	0.003	0.006	0.003	0.008	0.019	0.035	0.053	0.094	0.154	0.303	0.472	0.692	1.274	1.901	3.562	3.755	6.823	2.844	2.699	2.454	1.981	2.071	2.191	2.427	2.927	2.923	2.652	3.000																
24	0.003	0.003	0.003	0.001	0.008	0.016	0.029	0.047	0.081	0.148	0.282	0.505	0.834	1.568	2.171	3.437	3.945	7.403	0.370	3.447	2.930	2.444	2.333	2.402	2.650	2.918	3.109	3.000																	
25	0.003	0.003	0.001	0.002	0.006	0.013	0.023	0.037	0.061	0.081	0.192	0.446	0.976	1.844	2.199	1.452	3.530	4.119	0.491	1.563	2.943	2.658	2.746	2.733	3.000	3.000	3.000																		
26	0.001	0.002	0.001	0.002	0.005	0.009	0.016	0.021	0.009	0.003	0.009	0.075	0.389	1.624	2.100	0.070	2.508	1.981	1.941	0.828	2.386	2.782	3.000	3.000																					
27	0.000	0.001	0.001	0.002	0.004	0.005	0.006	0.002	-0.007	-0.003	-0.004	-0.006	0.065	0.907	1.550	2.350	2.747	2.648	3.000	3.000	3.000	3.000																							
28	0.000	0.000	0.001	0.001	0.002	0.002	0.001	0.000	0.002	0.003	0.007	0.004	0.018	0.186	0.537	3.000	3.000	3.000																											
29	0.000	0.000	0.001	0.001	0.001	0.001	0.000	-0.001	-0.002	-0.003	-0.003	0.000	0.000	0.000	0.000																														
30	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000																																		

Bottom elevation of the model is subtracted from the calibrated water table because the cell is dry in the 3 feet lower head along hillside boundary scenario.

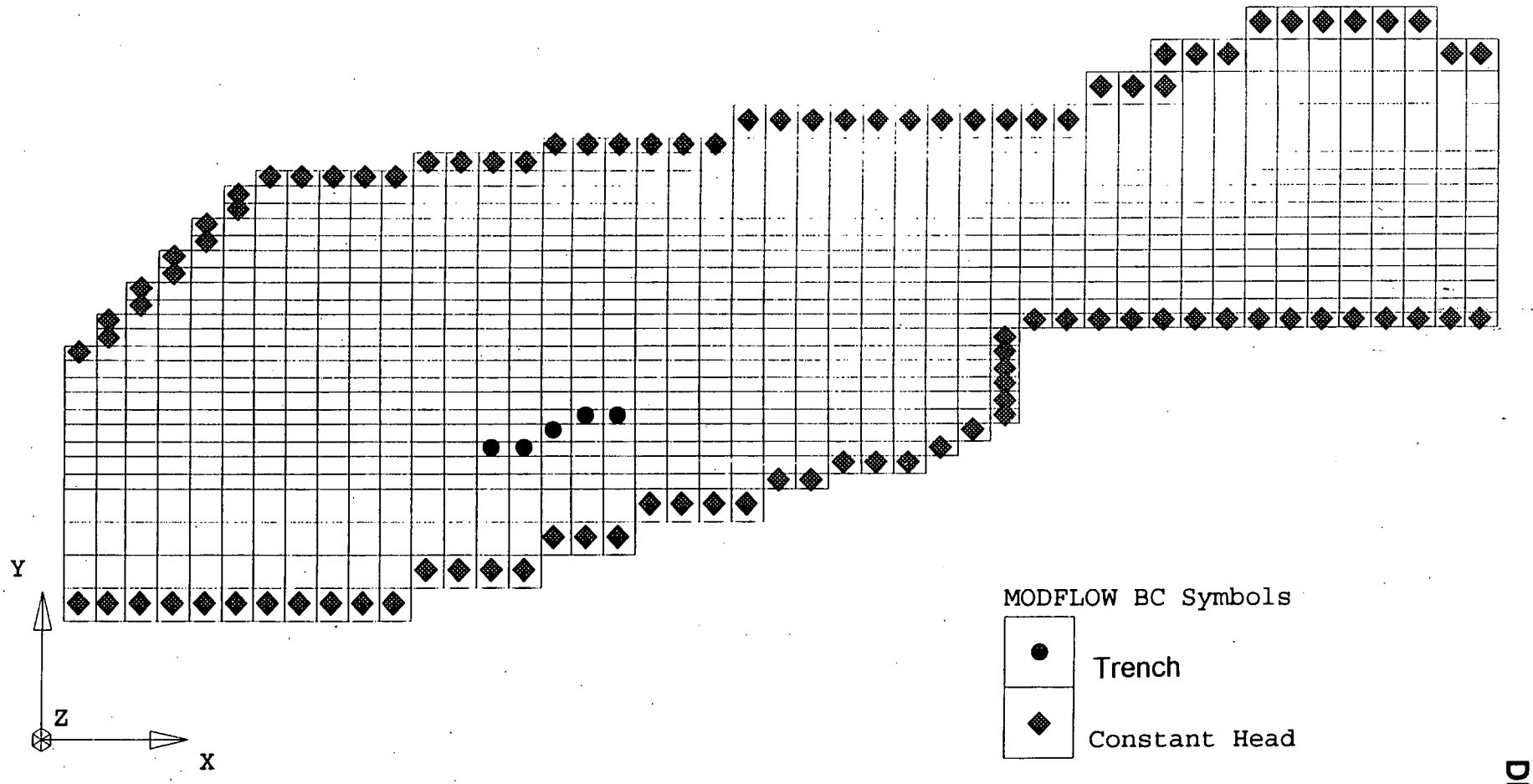
Figure 4-30 Calibrated Water Table Minus Water Table with 3 Feet Lower Head along Hillside Boundary (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						20.0	20.0	20.0	20.0	20.0	20.0		
2																																			20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
3																																	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	20.0	20.0	20.0
4																						20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	20.0	20.0	20.0
5																20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	20.0	20.0
6												20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	20.0	20.0	0.6	0.6	0.6	0.6	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	20.0	20.0
7							13.0	13.0	13.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	20.0	20.0
8						13.0	13.0	13.0	13.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	20.0	20.0	20.0
9						13.0	13.0	13.0	13.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	20.0	20.0	20.0
10					13.0	13.0	13.0	13.0	13.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	20.0	20.0	20.0	20.0
11					13.0	13.0	13.0	13.0	13.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	20.0	20.0	20.0	20.0
12				13.0	13.0	13.0	13.0	0.6	0.6	20.0	20.0	20.0	20.0	20.0	20.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	5.6	5.6	24.0	24.0	24.0	5.6	5.6	0.6	0.6	18.0	18.0	18.0	18.0
13				13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
14			13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
15			13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
16		13.0	13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
17		13.0	13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0															
18	13.0	13.0	13.0	13.0	13.0	13.0	0.6	0.6	0.6	5.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0															
19	13.0	13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	5.6	5.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0															
20	13.0	13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	5.6	5.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	5.6	5.6	24.0	24.0	24.0	24.0															
21	13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	0.6	0.6	0.6	5.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0															
22	13.0	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	0.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0															
23	13.0	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																
24	13.0	13.0	0.6	0.6	0.6	0.6	0.6	0.6	0.6	5.6	5.6	5.6	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																	
25	24.0	24.0	7.6	7.6	7.6	7.6	7.6	7.6	24.0	24.0	24.0	5.6	5.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																		
26	24.0	24.0	7.6	7.6	7.6	7.6	7.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	20.0	24.0	24.0																					
27	24.0	24.0	7.6	7.6	7.6	7.6	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																							
28	24.0	24.0	11.7	7.6	20.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																											
29	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																														
30	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0	24.0																																		

Figure 4-31 Recharge Rate For Landfill Cap With Uphill Trench (in/yr)

Figure 4-32 Boundary Condition For Landfill Cap With Uphill Trench



DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.5	71.5	71.5	71.5	71.5	71.5		
2																																			71.0	71.0	71.5	71.5	71.6	71.6	71.6	71.7	71.9	72.5	73.0
3																																	71.0	71.0	71.0	71.1	71.4	71.5	71.6	71.7	71.7	71.8	72.0	72.2	72.8
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.4	71.6	71.6	71.7	71.8	71.9	72.0	72.2	72.9
5																71.0	71.0	71.0	71.0	71.0	71.0	71.2	71.3	71.3	71.3	71.3	71.2	71.3	71.3	71.2	71.2	71.1	71.2	71.2	71.2	71.5	71.6	71.7	71.7	71.8	71.9	72.0	72.1	72.2	73.2
6												71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.2	71.2	71.3	71.4	71.4	71.5	71.7	71.6	71.4	71.5	71.6	71.6	71.5	71.5	71.3	71.2	71.6	71.7	71.8	71.9	71.9	72.0	72.1	72.2	72.7	73.7
7							60.0	65.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.2	71.2	71.3	71.3	71.4	71.5	71.6	71.9	72.0	72.3	72.3	72.0	71.9	72.0	71.9	71.8	71.7	71.6	71.6	71.7	71.8	71.9	71.9	72.0	72.1	72.2	72.3	73.4	74.1
8						37.2	60.0	65.1	70.8	70.9	71.0	71.0	71.1	71.1	71.2	71.2	71.3	71.3	71.4	71.5	71.7	71.9	72.0	72.6	72.7	72.9	72.9	72.8	72.5	72.3	72.1	71.9	71.8	71.7	71.8	71.9	71.9	72.0	72.0	72.1	72.2	72.3	72.9	73.9	74.4
9						38.7	60.0	65.1	70.7	70.9	71.0	71.0	71.1	71.1	71.2	71.3	71.3	71.4	71.5	71.8	72.1	72.3	72.5	72.9	73.2	73.4	73.4	73.4	73.0	72.5	72.2	72.0	71.9	71.8	71.9	72.2	72.1	72.1	72.2	72.2	72.3	72.4	73.5	74.3	74.7
10					36.2	48.9	60.0	65.1	70.6	70.9	71.0	71.1	71.1	71.2	71.2	71.3	71.4	71.5	71.9	72.2	72.4	72.5	72.8	73.3	73.6	73.8	73.9	74.1	73.8	73.1	72.5	72.2	72.0	72.0	72.6	73.1	72.8	72.5	72.3	72.3	72.4	72.9	73.9	74.6	74.9
11					37.3	48.2	57.8	65.4	71.2	71.3	71.0	71.1	71.1	71.2	71.3	71.4	71.7	72.0	72.4	72.6	72.7	72.8	73.1	73.7	74.3	74.7	74.7	75.0	74.8	73.7	72.7	72.3	72.2	72.4	73.5	74.1	73.6	72.9	72.7	72.5	72.6	73.3	74.2	74.8	75.1
12				36.1	40.7	47.8	56.4	70.0	72.3	72.3	71.1	71.1	71.2	71.6	72.0	71.9	72.3	72.6	72.8	73.0	73.0	73.1	73.3	74.3	75.5	76.0	76.2	76.3	75.8	74.2	73.3	72.6	72.9	73.0	74.7	75.5	75.2	74.1	73.1	72.8	72.8	73.6	74.3	74.9	75.3
13				37.1	42.[illegible]	48.7	57.2	70.1	73.1	72.6	71.8	71.2	71.3	72.3	73.0	72.7	72.8	73.0	73.2	73.3	73.6	73.7	73.7	76.2	77.0	77.4	77.6	77.3	76.9	77.0	76.7	76.7	76.7	76.4	77.1	77.5	77.6	75.7	74.0	73.3	73.3	73.7	74.2	74.9	75.4
14			36.1	39.5	43.6	50.1	58.8	71.6	73.9	73.0	73.3	72.7	0.0	72.6	73.4	73.2	73.2	73.4	73.5	73.8	74.6	75.0	0.0	78.2	78.5	78.7	78.7	78.0	77.9	81.3	81.4	85.8	82.0	81.4	81.1	80.4	79.6	76.6	74.6	73.7	73.5	73.6	74.0	74.8	75.5
15			37.1	40.8	45.2	51.0	70.2	74.2	75.0	0.0	75.2	75.3	0.0	74.3	74.0	73.7	73.5	73.7	74.1	74.7	75.7	76.8	78.9	79.3	79.8	80.0	80.1	79.5	79.9	85.3	86.8	89.4	86.5	86.2	85.9	83.1	81.7	76.7	74.7	73.5	73.4	73.1	73.4	74.5	75.7
16		39.2	39.4	43.9	49.1	55.5	73.7	75.4	76.4	0.0	76.9	77.8	77.5	75.8	74.6	74.0	73.7	74.0	75.2	76.1	77.0	77.9	79.4	80.3	81.1	81.3	81.5	81.5	82.5	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		43.0	47.4	54.5	65.2	65.1	75.4	76.6	77.8	80.0	78.6	79.4	78.0	76.4	75.2	74.4	73.9	74.4	76.9	78.2	78.6	79.8	81.4	82.0	82.4	82.6	82.8	83.2	84.8	95.8															
18	43.3	48.9	57.7	63.3	62.2	72.3	76.7	77.8	79.1	80.9	80.6	80.1	78.7	76.9	76.0	75.6	0.0	0.0	79.3	79.8	79.9	81.8	84.1	83.9	83.6	83.7	84.0	84.8	86.5	96.7															
19	49.5	56.2	62.4	64.9	66.0	74.5	78.0	78.9	80.2	81.6	82.4	81.1	79.7	77.5	77.3	78.2	0.0	0.0	81.2	80.8	81.5	85.2	87.0	85.5	84.7	84.8	85.1	86.3	88.0	97.0															
20	57.0	62.0	65.2	66.7	69.2	77.0	79.4	80.1	81.3	82.5	83.3	82.9	81.0	79.4	79.4	80.7	0.0	85.0	82.6	84.8	86.6	90.4	90.4	87.1	85.6	85.8	86.4	87.8	89.4	97.0															
21	63.7	65.7	66.9	68.3	74.6	79.6	80.9	81.6	82.4	83.4	84.4	84.7	83.6	80.9	81.0	81.8	86.8	86.2	86.1	93.4	97.7	96.0	96.0	93.5	92.0	91.8	92.8	93.3	95.3	99.4															
22	67.0	67.8	68.3	71.6	79.6	81.6	82.5	83.6	83.9	85.0	85.5	85.6	86.2	0.0	81.7	84.5	89.1	88.5	93.0	101.1	104.2	103.9	103.5	103.2	102.3	101.4	102.2	102.2	104.8	106.8															
23	68.9	69.5	69.6	76.8	81.5	83.2	84.2	85.3	85.7	86.6	86.4	86.2	87.2	89.4	85.0	89.4	99.9	103.9	99.6	106.5	110.2	111.6	111.7	111.5	110.7	109.4	109.3	109.0	113.3															
24	70.2	71.0	73.7	81.7	83.4	85.0	85.9	86.6	87.2	87.5	87.4	87.3	88.0	90.8	90.0	99.1	105.4	109.5	110.1	112.1	115.6	117.8	118.6	119.0	118.3	117.6	116.5	113.4																	
25	71.5	72.6	78.7	83.6	85.5	86.8	87.3	88.1	88.8	89.7	89.2	89.0	89.8	94.5	100.3	102.2	112.4	120.4	122.9	121.0	122.0	124.1	124.3	125.6	124.8	125.7	125.1																		
26	74.6	76.3	82.6	85.5	87.3	88.4	89.2	90.4	93.8	95.6	95.1	93.6	94.7	98.8	103.8	116.4	121.4	129.0	129.6	129.8	129.7	130.3	129.4	131.8																					
27	82.0	83.1	85.9	88.0	89.6	90.8	92.6	95.7	100.6	103.3	106.1	105.6	105.8	107.6	114.6	127.2	128.2	130.0	132.3	135.4	138.7	139.6																							
28	88.0	88.0	89.1	90.5	92.1	93.9	97.2	102.3	107.3	111.3	115.1	116.5	117.2	119.3	125.2	135.1	135.0	132.2																											
29	90.0	89.7	90.6	91.9	94.1	97.2	101.9	108.5	113.1	116.9	120.0	121.0	123.6	127.9	126.2																														
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-33 Predicted Water Table For Landfill Cap With Uphill Trench (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.00	0.00	0.00	0.00	0.00	0.00		
2																																			0.00	0.00	0.00	0.01	0.02	0.03	0.03	0.02	0.01	0.00	0.00
3																																	0.00	0.00	0.00	0.01	0.02	0.04	0.05	0.05	0.05	0.04	0.03	0.02	0.02
4																						0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.05	0.06	0.07	0.07	0.07	0.06	0.04	0.03	0.03
5																0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.03	0.03	0.02	0.01	0.02	0.02	0.01	0.01	0.02	0.02	0.03	0.03	0.18	0.22	0.20	0.20	0.19	0.18	0.16	0.15	0.04	0.05
6												0.00	0.00	0.00	0.00	0.05	0.07	0.07	0.07	0.06	0.05	0.06	0.06	0.05	0.04	0.05	0.04	0.02	0.03	0.04	0.05	0.05	0.05	0.04	0.04	0.24	0.30	0.31	0.30	0.29	0.27	0.25	0.22	0.08	0.06
7							0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.05	0.08	0.11	0.12	0.12	0.12	0.10	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.05	0.04	0.06	0.07	0.07	0.08	0.08	0.14	0.29	0.36	0.38	0.38	0.36	0.34	0.30	0.25	0.11	0.07
8						0.00	0.01	0.00	0.00	0.01	0.03	0.05	0.07	0.10	0.14	0.16	0.17	0.17	0.16	0.14	0.15	0.14	0.12	0.11	0.10	0.09	0.08	0.07	0.06	0.07	0.08	0.08	0.09	0.10	0.19	0.33	0.41	0.44	0.44	0.43	0.40	0.35	0.22	0.11	0.08
9						0.01	0.01	0.00	0.01	0.02	0.05	0.08	0.11	0.14	0.18	0.21	0.22	0.21	0.20	0.21	0.21	0.20	0.17	0.14	0.11	0.10	0.09	0.08	0.07	0.08	0.08	0.09	0.10	0.11	0.23	0.40	0.47	0.50	0.50	0.48	0.45	0.38	0.20	0.11	0.08
10					0.00	0.24	0.01	0.01	0.01	0.03	0.07	0.10	0.14	0.17	0.21	0.25	0.25	0.25	0.31	0.31	0.27	0.24	0.20	0.15	0.12	0.10	0.09	0.08	0.07	0.08	0.09	0.10	0.11	0.12	0.24	0.34	0.45	0.57	0.56	0.53	0.50	0.33	0.18	0.11	0.08
11					0.05	0.42	0.21	0.19	0.33	0.31	0.11	0.14	0.18	0.23	0.26	0.29	0.47	0.45	0.46	0.40	0.32	0.27	0.23	0.16	0.13	0.11	0.09	0.08	0.07	0.08	0.09	0.10	0.12	0.14	0.16	0.19	0.33	0.57	0.57	0.56	0.52	0.30	0.16	0.10	0.08
12				0.01	0.82	0.80	0.69	0.05	0.93	0.76	0.14	0.18	0.23	0.54	0.61	0.66	0.84	0.74	0.58	0.47	0.35	0.30	0.26	0.17	0.12	0.10	0.08	0.06	0.06	0.07	0.08	0.11	0.08	0.11	0.09	0.11	0.14	0.24	0.49	0.53	0.49	0.24	0.14	0.09	0.07
13				0.06	1.18	1.10	1.12	0.49	1.14	1.7	0.7	0.4	0.5	1.1	1.1	1.1	1.1	1.0	0.7	0.53	0.39	0.33	0.33	0.10	0.09	0.08	0.06	0.05	0.05	0.04	0.03	0.01	0.01	0.02	0.04	0.05	0.03	-0.06	0.27	0.37	0.33	0.19	0.11	0.07	0.05
14			0.01	0.80	1.43	1.25	1.08	0.75	1.24	2.3	1.2	0.3	0.3	1.5	1.4	1.5	1.4	1.2	0.8	0.59	0.40	0.29	0.05	0.04	0.07	0.06	0.05	0.04	0.04	0.01	0.00	-0.03	-0.01	-0.01	0.00	0.01	0.00	0.00	0.15	0.23	0.21	0.14	0.08	0.05	0.04
15			0.04	1.12	1.63	1.46	0.07	0.87	1.29	2.0	1.4	0.5	0.1	1.3	1.6	1.7	1.7	1.5	0.9	0.63	0.36	0.19	0.01	0.04	0.05	0.05	0.04	0.04	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.11	0.16	0.15	0.09	0.05	0.03	0.02
16		0.01	0.45	0.86	1.41	0.96	0.26	0.98	1.26	1.3	1.4	0.7	1.0	1.2	1.8	2.0	1.9	1.8	0.9	0.53	0.30	0.17	0.06	0.05	0.05	0.04	0.03	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17		0.02	0.19	0.20	0.99	0.10	0.70	1.08	1.20	0.4	1.4	0.6	1.1	1.5	2.0	2.3	2.2	2.2	0.7	0.31	0.22	0.15	0.11	0.06	0.05	0.04	0.03	0.02	0.01	0.00															
18	0.04	0.30	0.14	0.21	0.77	0.37	0.88	1.17	1.22	1.0	1.0	0.8	1.1	1.6	2.1	2.3	0.5	1.1	0.4	0.19	0.17	0.12	0.11	0.07	0.05	0.04	0.03	0.02	0.01	0.00															
19	0.55	0.42	0.56	0.64	0.99	0.69	0.99	1.24	1.26	1.1	0.6	0.8	1.0	1.7	2.0	1.5	0.4	0.5	0.5	0.23	0.14	0.10	0.09	0.07	0.05	0.03	0.02	0.01	0.01	0.00															
20	0.45	0.47	0.70	0.88	0.91	0.64	1.04	1.27	1.27	1.1	0.7	0.6	0.7	1.0	1.5	1.1	0.2	1.3	0.7	0.03	0.03	0.05	0.06	0.06	0.05	0.03	0.02	0.01	0.00	0.00															
21	0.41	0.59	0.88	1.05	0.48	0.69	1.03	1.20	1.25	1.1	0.7	0.3	0.4	0.4	1.5	1.8	5.6	5.2	0.4	-0.14	-0.01	0.02	0.03	0.03	0.02	0.02	0.01	0.00	0.00	0.00															
22	0.56	0.73	1.04	0.75	0.08	0.71	0.99	1.03	1.13	0.9	0.5	0.4	0.2	0.1	1.8	3.0	7.0	8.4	0.1	0.06	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00															
23	0.67	0.81	1.22	0.37	0.44	0.76	0.91	0.89	0.90	0.7	0.6	0.4	0.3	0.5	2.7	3.6	0.8	-1.7	-0.4	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00																
24	0.73	0.85	0.66	-0.03	0.57	0.74	0.84	0.82	0.75	0.65	0.57	0.42	0.32	0.59	3.22	-2.01	0.29	-0.78	-0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00																	
25	0.75	0.85	0.30	0.34	0.59	0.68	0.76	0.69	0.56	0.32	0.34	0.35	0.20	-0.29	-2.65	-1.23	0.29	-0.18	0.07	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00																		
26	0.38	0.55	0.37	0.49	0.57	0.62	0.60	0.42	0.09	0.00	0.01	0.05	0.02	-0.31	-0.98	-0.01	0.09	0.03	-0.06	-0.01	0.00	0.00	0.00	0.00																					
27	0.08	0.26	0.48	0.53	0.52	0.49	0.29	0.08	-0.07	-0.01	-0.01	-0.01	-0.01	-0.07	-0.06	0.08	0.03	0.02	0.00	0.00	0.00	0.00																							
28	0.05	0.19	0.38	0.40	0.30	0.24	0.09	0.00	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00																											
29	0.04	0.12	0.18	0.21	0.15	0.08	0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00																														
30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00																																		

Bottom elevation of the model is subtracted from the calibrated water table because the cell is dry in the landfill cap with uphill trench scenario.

Figure 4-35 Calibrated Water Table Minus Water Table For Landfill Cap With Uphill Trench (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.5	71.5	71.5	71.5	71.5	71.5		
2																																			71.0	71.0	71.5	71.5	71.6	71.6	71.6	71.7	71.8	72.5	73.0
3																																	71.0	71.0	71.0	71.1	71.4	71.5	71.6	71.7	71.7	71.8	72.0	72.2	72.8
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.4	71.6	71.6	71.7	71.8	71.9	72.0	72.2	72.9
5																71.0	71.0	71.0	71.0	71.0	71.0	71.2	71.3	71.3	71.3	71.3	71.2	71.3	71.3	71.2	71.2	71.1	71.2	71.2	71.2	71.5	71.6	71.7	71.7	71.8	71.9	72.0	72.1	72.2	73.2
6												71.0	71.0	71.0	71.0	71.1	71.1	71.1	71.2	71.2	71.2	71.4	71.4	71.4	71.5	71.7	71.6	71.4	71.5	71.6	71.6	71.5	71.5	71.3	71.2	71.6	71.7	71.8	71.9	71.9	72.0	72.1	72.2	72.7	73.7
7							60.0	65.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.1	71.2	71.2	71.3	71.3	71.4	71.5	71.6	71.9	72.0	72.3	72.3	72.0	71.9	72.0	71.9	71.8	71.7	71.6	71.6	71.7	71.8	71.9	71.9	72.0	72.1	72.2	72.3	73.4	74.1
8						37.2	60.0	65.1	70.8	70.9	71.0	71.0	71.1	71.1	71.1	71.2	71.3	71.3	71.4	71.5	71.7	71.9	72.0	72.6	72.7	72.9	72.9	72.8	72.5	72.3	72.1	71.9	71.8	71.7	71.8	71.9	71.9	72.0	72.0	72.1	72.2	72.3	72.9	73.9	74.4
9						38.7	60.0	65.1	70.7	70.9	71.0	71.0	71.1	71.1	71.2	71.3	71.3	71.4	71.5	71.8	72.1	72.3	72.5	73.0	73.2	73.4	73.4	73.4	73.0	72.5	72.2	72.0	71.9	71.8	71.9	72.2	72.1	72.1	72.2	72.2	72.3	72.4	73.5	74.3	74.7
10					36.2	48.9	60.0	65.1	70.6	70.9	71.0	71.0	71.1	71.2	71.2	71.3	71.4	71.5	71.9	72.2	72.4	72.6	72.9	73.3	73.6	73.8	73.9	74.1	73.8	73.1	72.5	72.2	72.0	72.0	72.6	73.1	72.8	72.5	72.3	72.3	72.4	72.9	73.9	74.6	74.9
11					37.3	48.2	57.6	65.3	71.2	71.3	71.0	71.1	71.1	71.2	71.3	71.3	71.7	72.0	72.4	72.6	72.7	72.8	73.1	73.7	74.3	74.7	74.7	75.0	74.8	73.7	72.7	72.3	72.2	72.4	73.5	74.1	73.6	72.9	72.7	72.5	72.6	73.3	74.2	74.8	75.1
12				36.1	40.6	47.8	58.3	70.0	72.3	72.3	71.0	71.1	71.1	71.5	72.0	71.9	72.3	72.6	72.9	73.0	73.0	73.1	73.3	74.3	75.5	76.0	76.2	76.3	75.8	74.2	73.3	72.6	72.9	73.0	74.7	75.5	75.2	74.1	73.1	72.8	72.8	73.6	74.3	74.9	75.3
13				37.1	42.1	48.7	57.1	70.1	73.1	72.6	71.7	71.1	71.3	72.1	72.8	72.8	72.8	73.0	73.3	73.3	73.6	73.7	73.7	76.2	77.0	77.4	77.6	77.3	76.9	77.0	76.7	78.7	76.7	76.4	77.1	77.5	77.6	75.7	74.0	73.3	73.3	73.7	74.2	74.9	75.4
14			36.1	39.5	43.6	50.1	58.8	71.6	73.9	72.9	73.1	72.7	0.0	72.5	73.2	73.1	73.1	73.4	73.6	73.9	74.7	75.1	0.0	78.2	78.5	78.7	78.7	78.0	77.9	81.3	81.4	85.8	82.0	81.4	81.1	80.4	79.6	76.6	74.6	73.7	73.5	73.6	74.0	74.8	75.5
15			37.1	40.8	45.2	51.0	70.2	74.2	75.0	0.0	74.9	75.2	0.0	74.1	73.8	73.5	73.4	73.7	74.3	74.8	75.8	76.8	78.9	79.3	79.8	80.0	80.1	79.5	79.9	85.3	86.8	89.4	86.5	86.2	85.9	83.1	81.7	78.7	74.7	73.5	73.4	73.1	73.4	74.5	75.7
16		39.2	39.4	43.9	49.1	55.4	73.7	75.4	76.4	0.0	76.6	77.7	77.4	75.7	74.3	73.8	73.6	74.0	75.4	76.2	77.1	77.9	79.4	80.3	81.1	81.3	81.5	81.5	82.5	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		43.0	47.4	54.5	55.2	65.1	75.4	76.6	77.8	80.0	78.3	78.3	77.8	76.2	74.9	74.1	73.8	74.5	77.2	78.3	78.6	79.8	81.4	82.0	82.4	82.5	82.6	83.2	84.8	95.8															
18	43.3	48.9	57.7	63.3	62.2	72.3	76.7	77.7	79.0	80.8	80.5	79.9	78.4	76.6	75.6	75.3	0.0	0.0	79.6	79.9	79.9	81.8	84.[illegible]	83.6	83.5	83.[illegible]	84.[illegible]	84.5	85.5	96.7															
19	49.5	56.2	62.4	64.9	66.0	74.5	77.9	78.8	80.1	81.5	82.3	80.8	79.4	77.1	77.0	78.1	0.0	0.0	81.6	80.9	81.5	85.3	87.[illegible]	85.5	84.7	84.5	85.[illegible]	86.[illegible]	88.[illegible]	97															
20	57.0	62.0	65.2	66.7	69.2	77.0	79.3	80.0	81.2	82.4	83.2	82.7	80.7	79.3	79.2	80.5	0.0	84.4	83.0	84.8	88.7	90.4	90.4	87.1	85.6	85.6	85.4	87.8	89.4	97.6															
21	63.7	65.7	66.9	68.3	74.6	79.6	80.9	81.6	82.3	83.3	84.2	84.5	83.3	81.1	80.8	81.4	85.5	85.3	85.2	93.3	97.7	96.0	96.0	93.5	92.0	91.8	92.8	93.3	95.3	99.4															
22	67.0	67.8	68.3	71.6	79.6	81.6	82.5	83.5	83.8	84.9	85.3	85.3	85.9	0.0	81.4	83.8	87.1	86.6	91.9	101.3	104.2	103.9	103.6	103.2	102.3	101.4	102.2	102.2	104.8	106.8															
23	68.9	69.5	69.6	76.8	81.5	83.2	84.2	85.2	85.7	86.5	86.2	85.9	86.7	88.1	84.5	87.4	98.6	102.7	99.5	106.6	110.2	111.6	111.7	111.5	110.7	109.4	109.3	109.0	113.3																
24	70.2	71.0	73.7	81.7	83.4	85.0	85.8	86.6	87.1	87.4	87.2	86.9	87.5	88.8	88.2	96.2	104.9	108.8	110.1	112.2	115.7	117.8	118.6	119.0	118.3	117.6	116.5	113.4																	
25	71.5	72.6	78.7	83.6	85.5	86.8	87.3	88.1	88.7	89.6	89.1	88.7	89.1	92.9	98.6	100.7	112.4	120.2	122.9	121.0	122.0	124.1	124.3	125.8	124.8	125.7	125.1																		
26	74.6	76.2	82.6	85.5	87.3	88.4	89.2	90.4	93.8	95.6	95.1	93.5	94.5	98.1	103.1	116.3	121.4	129.0	129.6	129.8	129.7	130.3	129.4	131.8																					
27	82.0	83.1	85.9	88.0	89.6	90.8	92.6	95.7	100.6	103.3	106.1	105.6	105.8	107.5	114.6	127.3	128.2	130.0	132.3	135.4	138.7	139.6																							
28	88.0	88.0	89.1	90.5	92.1	93.9	97.2	102.3	107.3	111.3	115.1	116.5	117.2	119.3	125.2	135.1	135.0	132.2																											
29	90.0	89.7	90.6	91.9	94.1	97.2	101.9	108.5	113.1	116.9	120.0	121.0	123.6	127.9	128.2																														
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-36 Water Table For Uphill Trench Two Feet Lower Than Design (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.0	0.0	0.0	0.0	0.0	0.0		
2																																			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3																																	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4																						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5																0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6												0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11					0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
12				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13				0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.3	0.2	0.1	0.1	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0	0.2	0.2	0.2	0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.2	0.1	0.3	0.2	0.1	-0.1	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.1	0.2	0.2	0.3	0.3	0.1	-0.1	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.2	0.0	0.0	-0.3	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.3	0.1	0.0	0.0	-0.4	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4	0.1	0.2	0.2	0.0	0.5	-0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	-0.2	0.2	0.4	1.3	0.9	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.0	0.3	0.7	2.0	1.9	1.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.5	1.4	0.5	2.0	1.3	1.2	0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.5	2.0	1.8	2.9	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																		
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.7	1.6	1.8	1.5	-0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																			
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																						
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0																								
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																												
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																															
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																																		

Figure 4-37 Water Table For Cap And Uphill Trench Minus Water Table With Uphill Trench Two Feet Lower Than Design (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						72.0	72.0	72.0	72.0	72.0	72.0		
2																																			72.0	72.0	72.0	72.0	72.0	72.1	72.1	72.1	72.2	72.5	73.0
3																																	72.0	72.0	72.0	72.0	72.0	72.1	72.1	72.1	72.1	72.2	72.3	72.4	72.9
4																						72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.1	72.1	72.1	72.1	72.2	72.2	72.3	72.4	73.0
5																72.0	72.0	72.0	72.0	72.0	72.0	72.1	72.1	72.1	72.2	72.1	72.1	72.1	72.2	72.1	72.1	72.1	72.1	72.1	72.1	72.2	72.2	72.2	72.2	72.2	72.3	72.3	72.4	72.4	73.3
6												72.0	72.0	72.0	72.0	72.0	72.1	72.1	72.1	72.1	72.1	72.2	72.2	72.2	72.3	72.4	72.4	72.2	72.3	72.4	72.4	72.3	72.3	72.1	72.1	72.3	72.3	72.3	72.3	72.3	72.4	72.4	72.5	72.9	73.8
7							60.0	65.0	72.0	72.0	72.0	72.0	72.0	72.0	72.0	72.1	72.1	72.1	72.2	72.2	72.2	72.3	72.3	72.6	72.7	72.9	72.9	72.7	72.6	72.7	72.6	72.5	72.4	72.3	72.3	72.4	72.4	72.4	72.4	72.4	72.4	72.5	72.6	73.5	74.2
8						37.2	60.3	65.2	71.6	71.8	71.9	72.0	72.0	72.0	72.1	72.1	72.1	72.2	72.2	72.3	72.4	72.6	72.6	73.1	73.2	73.4	73.4	73.3	73.1	72.9	72.8	72.6	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.6	73.1	74.1	74.5
9						38.7	60.4	65.3	71.2	71.7	71.9	72.0	72.0	72.1	72.1	72.2	72.2	72.2	72.3	72.5	72.7	72.9	73.0	73.4	73.6	73.8	73.9	73.9	73.6	73.2	72.9	72.7	72.6	72.5	72.6	72.8	72.7	72.6	72.6	72.6	72.6	72.7	73.7	74.4	74.8
10					36.2	49.3	60.5	65.3	71.1	71.7	71.9	72.0	72.0	72.1	72.1	72.2	72.2	72.3	72.6	72.8	73.0	73.1	73.3	73.7	74.0	74.2	74.3	74.5	74.3	73.6	73.1	72.6	72.7	72.7	73.1	73.4	73.2	72.9	72.8	72.7	72.8	73.2	74.1	74.7	75.0
11					37.3	48.6	58.3	65.4	71.5	72.0	71.9	72.0	72.1	72.1	72.2	72.2	72.4	72.6	73.0	73.1	73.2	73.3	73.6	74.0	74.6	75.0	75.1	75.3	75.1	74.1	73.3	73.0	72.8	73.0	73.7	74.2	73.8	73.2	73.0	72.9	72.9	73.6	74.3	74.9	75.2
12				36.1	40.8	48.2	56.6	0.0	72.4	72.6	72.0	72.0	72.1	72.4	72.6	72.6	72.9	73.1	73.3	73.4	73.5	73.5	73.7	74.7	75.7	76.2	76.4	76.5	76.0	74.6	73.8	73.2	73.3	73.4	74.9	75.6	75.3	74.2	73.4	73.1	73.1	73.8	74.4	75.0	75.3
13				37.1	42.3	48.9	57.3	70.2	73.2	72.9	72.4	72.1	72.2	72.9	73.3	73.2	73.3	73.5	73.6	73.7	74.0	74.1	74.1	76.4	77.2	77.5	77.7	77.5	77.1	77.2	76.9	76.8	76.8	76.5	77.2	77.6	77.6	75.7	74.1	73.5	73.5	73.8	74.3	74.9	75.4
14			36.1	39.6	43.7	50.2	58.8	71.6	74.0	73.2	73.5	72.8	72.4	73.3	73.7	73.6	73.6	73.8	73.9	74.2	74.9	75.3	0.0	76.3	78.6	78.8	78.8	78.1	78.1	81.4	81.4	85.6	82.0	81.4	81.1	80.4	79.6	76.6	74.7	73.8	73.7	73.7	74.1	74.8	75.5
15			37.1	40.8	45.3	51.1	70.2	74.2	75.0	0.0	75.2	75.3	0.0	74.5	74.2	74.0	73.9	74.1	74.5	75.0	75.9	76.9	78.9	79.3	79.9	80.1	80.1	79.6	80.0	85.3	86.8	89.5	86.5	86.2	85.9	83.1	81.7	76.7	74.8	73.6	73.4	73.1	73.5	74.5	75.7
16		39.2	39.4	43.9	49.1	55.5	73.7	75.4	76.4	0.0	76.9	78.0	77.5	75.8	74.8	74.3	74.1	74.4	75.4	76.3	77.2	78.0	79.5	80.3	81.1	81.4	81.5	81.5	82.6	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		43.0	47.4	54.5	55.2	65.1	75.4	76.6	77.8	0.0	78.4	79.2	78.0	76.4	75.4	74.7	74.2	74.7	76.9	78.2	78.7	79.8	81.4	82.0	82.4	82.6	82.8	83.3	84.8	95.8															
18	43.3	48.9	57.7	63.3	62.2	72.3	76.7	77.8	79.1	81.1	80.6	80.0	78.7	76.9	76.1	75.7	0.0	0.0	79.4	79.8	79.9	81.6	84.2	83.9	83.7	83.8	84.1	84.8	86.5	96.7															
19	49.5	56.2	62.4	64.9	66.0	74.5	78.0	78.9	80.2	81.7	82.4	81.1	79.7	77.5	77.3	78.2	0.0	0.0	81.2	80.8	81.5	85.3	87.0	85.5	84.8	84.8	85.2	86.3	88.0	97.0															
20	57.0	62.0	65.2	66.7	69.2	77.0	79.4	80.1	81.3	82.5	83.3	82.9	81.0	79.4	79.4	80.7	0.0	85.0	82.6	84.8	88.7	90.4	90.4	87.1	85.7	85.9	86.4	87.8	89.4	97.0															
21	63.7	65.7	66.9	68.3	74.7	79.6	80.9	81.7	82.5	83.5	84.4	84.7	83.6	80.9	81.0	81.8	86.8	86.2	86.1	93.4	97.7	96.0	96.0	93.5	92.0	91.8	92.8	93.3	95.3	99.4															
22	67.0	67.8	68.3	71.6	79.6	81.6	82.5	83.6	83.9	85.0	85.5	85.6	86.2	0.0	81.7	84.5	89.1	88.5	93.0	101.1	104.2	103.9	103.5	103.2	102.3	101.4	102.2	102.2	104.8	106.8															
23	68.9	69.5	69.6	76.8	81.5	83.2	84.2	85.3	85.7	86.6	86.4	86.2	87.2	89.4	85.0	89.4	99.9	103.9	99.6	106.5	110.2	111.6	111.7	111.5	110.7	109.4	109.3	109.0	113.3																
24	70.2	71.0	73.7	81.7	83.4	85.0	85.9	86.6	87.2	87.5	87.4	87.3	88.0	90.6	90.0	99.2	105.4	109.5	110.1	112.1	115.6	117.6	118.6	119.0	118.3	117.6	116.5	113.4																	
25	71.5	72.6	76.7	83.6	85.5	86.8	87.3	88.1	88.8	89.7	89.2	89.0	89.8	94.5	100.4	102.3	112.3	120.4	122.9	121.0	122.0	124.1	124.3	125.6	124.8	125.7	125.1																		
26	74.6	76.3	82.6	85.5	87.3	88.4	89.2	90.4	93.8	95.6	95.1	93.6	94.7	98.8	103.8	116.3	121.3	129.0	129.6	129.8	129.7	130.3	129.4	131.8																					
27	82.0	83.1	85.9	88.0	89.6	90.8	92.6	95.7	100.6	103.3	106.1	105.6	105.8	107.6	114.6	127.2	128.2	130.0	132.3	135.4	138.7	139.6																							
28	88.0	88.0	89.1	90.5	92.1	93.9	97.2	102.3	107.3	111.3	115.1	116.5	117.2	119.3	125.2	135.1	135.0	132.2																											
29	90.0	89.7	90.6	91.9	94.1	97.2	101.9	109.5	113.1	116.9	120.0	121.0	123.6	127.9	126.2																														
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-38 Predicted Water Table For Landfill Cap With Trench Under Flood Conditions (ft)

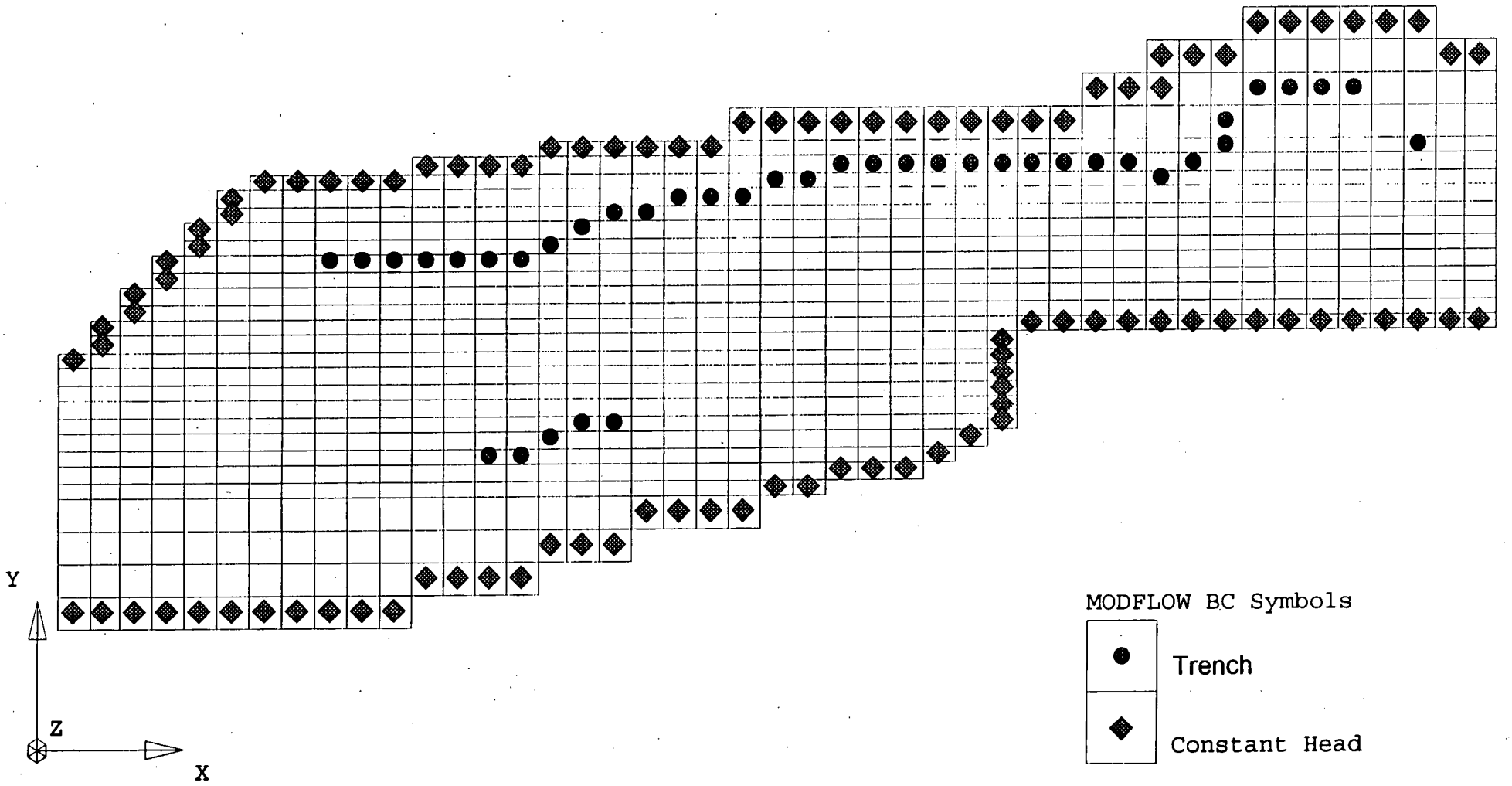
DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						-0.5	-0.5	-0.5	-0.5	-0.5	-0.5		
2																																			-1.0	-1.0	-0.5	-0.5	-0.5	-0.5	-0.4	-0.4	-0.3	0.0	0.0
3																																	-1.0	-1.0	-1.0	-0.9	-0.6	-0.5	-0.5	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1
4																						-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9	-0.6	-0.5	-0.5	-0.4	-0.4	-0.3	-0.2	-0.2	-0.1
5																-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.3	-0.2	-0.1
6												-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9	-0.8	-0.8	-0.8	-0.8	-0.7	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	-0.9	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.1
7							0.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.8	-0.8	-0.8	-0.6	-0.6	-0.6	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.3	-0.3	-0.2	-0.1
8						0.0	-0.3	-0.2	-0.7	-0.9	-1.0	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9	-0.8	-0.8	-0.7	-0.7	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-0.6	-0.5	-0.5	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1
9						0.0	-0.4	-0.2	-0.5	-0.8	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.8	-0.8	-0.7	-0.6	-0.6	-0.5	-0.4	-0.4	-0.4	-0.4	-0.5	-0.6	-0.6	-0.7	-0.7	-0.7	-0.7	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1
10					0.0	-0.4	-0.5	-0.2	-0.4	-0.8	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.8	-0.8	-0.7	-0.6	-0.6	-0.6	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.6	-0.6	-0.7	-0.7	-0.7	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1
11					0.0	-0.4	-0.5	-0.1	-0.3	-0.6	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.7	-0.7	-0.6	-0.5	-0.5	-0.5	-0.5	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.5	-0.6	-0.7	-0.7	-0.6	-0.3	-0.1	-0.2	-0.4	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1
12				0.0	-0.1	-0.4	-0.3	4.1	-0.1	-0.3	-0.9	-0.9	-0.9	-0.8	-0.6	-0.7	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.3	-0.2	-0.2	-0.2	-0.2	-0.3	-0.4	-0.5	-0.6	-0.4	-0.4	-0.2	-0.1	-0.1	-0.3	-0.3	-0.3	-0.3	-0.2	-0.1	-0.1	-0.1
13				0.0	-0.1	-0.2	-0.1	0.0	-0.1	-0.2	-0.6	-0.9	-0.9	-0.6	-0.3	-0.5	-0.5	-0.5	-0.4	-0.4	-0.4	-0.4	-0.4	-0.2	-0.2	-0.2	-0.1	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1
14			0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	-0.2	-0.2	-0.1	-0.1	-0.5	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
15			0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.3	-0.2	-0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
16		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	-0.2	-0.3	-0.4	-0.4	-0.2	-0.2	-0.1	-0.1	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.1	0.0	0.0	-0.1	-0.3	-0.4	-0.3	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.1	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																		
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																			
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																				
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																					
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																		
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																			
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																						
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																								
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																											
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																														
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																																		

Figure 4-39 Predicted Water Table For Landfill Cap With Uphill Trench Minus Water Table Under Flo ding Conditi ns (ft)

DRAFT

Figure 4-40 Boundary Conditions For Landfill Cap With Uphill Trench And Toe Drain



DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.5	71.5	71.5	71.5	71.5	71.5		
2																																			71.0	71.0	71.5	71.5	71.5	71.5	71.5	71.6	71.9	72.5	73.0
3																																	71.0	71.0	71.0	70.9	70.8	70.0	70.0	70.0	70.0	71.7	72.0	72.2	72.6
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	70.6	70.0	70.1	70.2	70.2	70.3	70.0	72.1	72.2	72.9
5																71.0	71.0	71.0	71.0	71.0	71.0	70.9	70.7	70.7	70.5	70.8	70.7	70.5	70.9	71.0	71.0	71.0	71.0	70.9	70.9	70.2	70.0	70.3	70.4	70.4	70.4	70.4	70.0	72.2	73.1
6												71.0	71.0	71.0	71.0	70.9	70.9	70.9	70.8	70.8	70.9	70.7	70.4	70.4	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.9	70.0	70.3	70.4	70.4	70.5	70.5	70.5	70.5	72.5	73.5
7							60.0	65.0	71.0	71.0	71.0	71.0	71.0	70.9	70.9	70.8	70.7	70.7	70.6	70.4	70.8	70.6	70.0	70.0	70.9	72.0	71.2	70.9	70.7	70.8	70.7	70.5	70.4	70.5	70.0	70.3	70.4	70.5	70.5	70.6	70.6	70.6	70.7	73.0	73.6
8						37.2	60.0	65.1	70.8	70.9	71.0	70.9	70.9	70.9	70.7	70.6	70.6	70.3	70.3	70.0	70.0	70.0	70.7	71.1	71.9	72.4	72.3	72.1	71.4	71.1	70.9	70.7	70.6	70.6	70.4	70.4	70.5	70.6	70.6	70.7	70.7	70.8	72.0	73.6	74.2
9						38.7	60.0	65.1	70.7	70.9	70.9	70.9	70.9	70.8	70.6	70.3	70.1	70.0	70.0	70.6	70.8	71.0	71.5	72.0	72.5	72.9	72.9	72.8	72.1	71.4	71.0	70.8	70.7	70.6	70.6	71.1	70.8	70.8	70.8	70.8	70.9	71.0	72.8	74.0	74.5
10					36.2	48.9	59.9	65.1	70.6	70.8	70.9	70.9	70.8	70.8	70.6	70.2	70.0	70.4	70.8	71.4	71.3	71.4	72.0	72.6	73.0	73.4	73.5	73.6	73.2	72.2	71.4	71.0	70.8	70.8	72.1	72.7	72.3	71.5	71.1	71.0	71.1	72.0	73.4	74.3	74.7
11					37.3	48.2	57.8	65.3	70.6	70.8	70.8	70.8	70.8	70.7	70.5	70.0	71.1	71.3	71.7	71.9	71.8	71.8	72.3	73.0	73.9	74.3	74.4	74.7	74.3	73.0	71.7	71.2	71.1	71.7	73.5	74.2	73.6	72.2	71.7	71.3	71.4	72.7	73.8	74.5	74.9
12				36.1	40.7	47.8	56.4	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	71.4	71.8	72.0	72.3	72.3	72.2	72.2	72.5	73.8	75.2	75.7	76.0	76.1	75.5	73.7	72.6	71.6	72.5	72.6	74.7	75.6	75.2	74.0	72.5	72.0	72.1	73.2	74.0	74.7	75.1
13				37.1	42.2	48.8	57.3	70.2	74.1	71.0	71.2	70.4	70.8	72.1	71.6	72.1	72.3	72.5	72.7	72.7	73.0	73.0	73.1	76.0	76.8	77.2	77.4	77.2	76.7	76.7	76.5	78.7	78.8	76.3	77.1	77.6	77.6	75.9	73.8	72.9	72.9	73.4	74.0	74.7	75.2
14			38.1	39.6	43.7	50.2	58.9	71.8	74.5	72.3	73.3	72.7	0.0	72.4	72.7	72.7	72.7	72.9	73.1	73.4	74.2	74.7	0.0	78.2	78.4	78.6	78.6	77.9	77.8	81.3	81.5	86.0	82.1	81.4	81.1	80.4	79.6	76.6	74.5	73.4	73.3	73.4	73.8	74.7	75.4
15			37.1	40.8	45.3	51.1	70.2	74.3	75.3	0.0	75.2	75.2	0.0	74.1	73.5	73.2	73.0	73.2	73.8	74.4	75.5	76.7	76.8	79.2	79.7	79.9	80.0	79.4	79.8	85.3	86.8	89.4	86.5	85.2	85.9	83.1	81.7	76.7	74.6	73.3	73.2	73.0	73.3	74.5	75.6
16		39.2	39.4	43.9	49.1	55.5	73.7	75.5	76.6	0.0	76.9	77.7	77.6	75.9	74.3	73.6	73.2	73.5	75.0	76.0	76.9	77.8	79.4	80.3	81.0	81.3	81.4	81.4	82.5	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	78.0
17		43.0	47.4	54.5	55.2	65.1	75.4	76.7	77.9	80.1	78.7	79.6	78.1	76.4	75.0	74.1	73.4	74.1	76.9	78.1	78.5	79.7	81.4	81.9	82.3	82.5	82.8	83.2	84.7	95.8															
18	43.3	48.9	57.7	63.3	62.2	72.3	76.8	77.6	79.1	80.9	80.7	80.2	78.8	76.9	75.9	75.5	0.0	0.0	79.3	79.8	79.8	81.6	84.1	83.9	83.6	83.7	84.0	84.8	86.5	96.7															
19	49.5	56.2	62.4	64.9	66.0	74.5	78.0	78.9	80.2	81.6	82.4	81.2	79.8	77.5	77.3	76.2	0.0	0.0	81.2	80.8	81.5	85.2	87.0	85.4	84.7	84.8	85.1	86.2	88.0	97.0															
20	57.0	62.0	65.2	66.7	69.2	77.0	79.4	80.1	81.3	82.5	83.3	82.9	81.1	79.4	79.4	80.7	0.0	85.0	82.6	84.8	88.6	90.4	90.4	87.1	85.6	85.8	86.3	87.8	89.4	97.0															
21	63.7	65.7	66.9	68.3	74.7	79.6	80.9	81.7	82.4	83.4	84.4	84.7	83.6	80.9	81.0	81.8	86.8	86.2	86.1	93.4	97.7	96.0	96.0	93.5	92.0	91.8	92.8	93.3	95.3	99.4															
22	67.0	67.8	68.3	71.6	79.6	81.6	82.5	83.6	83.9	85.0	85.5	85.6	86.2	0.0	81.7	84.5	89.1	88.5	93.0	101.1	104.2	103.9	103.5	103.2	102.3	101.3	102.2	102.2	104.8	106.8															
23	68.9	69.5	69.6	76.8	81.5	83.2	84.2	85.3	85.7	86.6	86.4	86.2	87.2	89.4	85.0	89.4	99.9	103.9	99.6	106.5	110.2	111.6	111.7	111.5	110.7	109.4	109.3	109.0	113.3																
24	70.2	71.0	73.7	81.7	83.4	85.0	85.9	86.6	87.2	87.5	87.4	87.3	88.0	90.8	90.0	99.1	105.4	109.5	110.1	112.1	115.6	117.8	118.6	119.0	118.3	117.6	116.5	113.4																	
25	71.5	72.6	78.7	83.6	85.5	88.8	87.3	88.1	88.8	89.7	89.2	89.0	89.8	94.5	100.3	102.2	112.4	120.4	122.9	121.0	122.0	124.1	124.3	125.6	124.8	125.7	125.1																		
26	74.6	76.3	82.6	85.5	87.3	88.4	89.2	90.4	93.8	95.6	95.1	93.6	94.7	98.8	103.8	116.4	121.4	129.0	129.6	129.8	129.7	130.3	129.4	131.8																					
27	82.0	83.1	85.9	88.0	89.6	90.8	92.6	95.7	100.6	103.3	108.1	105.6	105.8	107.6	114.6	127.2	128.2	130.0	132.3	135.4	138.7	139.6																							
28	88.0	88.0	89.1	90.5	92.1	93.9	97.2	102.3	107.3	111.3	115.1	116.5	117.2	119.3	125.2	135.1	135.0	132.2																											
29	90.0	89.7	90.6	91.9	94.1	97.2	101.9	108.5	113.1	116.9	120.0	121.0	123.6	127.9	126.2																														
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-41 Predicted Water Table For Landfill Cap with Uphill Trench and Toe Drain (ft)

DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.0	0.0	0.0	0.0	0.0	0.0		
2																																			0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0
3																																	0.0	0.0	0.0	0.2	0.6	1.5	1.6	1.6	1.7	0.1	0.0	0.0	0.0
4																						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.6	1.4	1.4	1.4	1.4	1.5	1.9	0.0	0.0	0.0
5																0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.6	0.8	0.4	0.5	0.8	0.4	0.2	0.2	0.2	0.2	0.3	0.2	1.3	1.6	1.4	1.4	1.4	1.5	1.6	2.1	0.0	0.1
6												0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.3	0.4	0.3	0.6	1.0	1.0	1.5	1.7	1.6	1.4	1.5	1.6	1.6	1.5	1.4	1.3	0.3	1.6	1.5	1.4	1.4	1.4	1.5	1.6	1.7	0.2	0.1
7							0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.4	0.6	0.7	0.9	0.6	0.9	1.5	1.9	1.1	0.4	1.1	1.1	1.2	1.2	1.3	1.3	1.2	1.1	1.6	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.6	0.3	0.2
8						0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.6	0.7	1.0	1.1	1.4	1.7	1.9	1.3	1.5	0.7	0.5	0.7	0.7	1.0	1.2	1.2	1.2	1.2	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.4	1.5	0.9	0.3	0.2
9						0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.6	0.9	1.2	1.4	1.5	1.2	1.3	1.3	1.0	0.9	0.6	0.5	0.5	0.6	0.9	1.1	1.2	1.2	1.2	1.2	1.3	1.1	1.3	1.3	1.4	1.4	1.4	1.4	0.6	0.3	0.2
10					0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4	0.7	1.1	1.4	1.1	1.1	0.9	1.1	1.1	0.9	0.7	0.5	0.4	0.5	0.5	0.6	0.9	1.1	1.2	1.2	1.1	0.5	0.4	0.5	1.0	1.3	1.3	1.3	0.9	0.5	0.3	0.2
11					0.0	0.0	0.0	0.1	0.6	0.6	0.2	0.2	0.3	0.5	0.8	1.3	0.6	0.7	0.7	0.7	0.9	1.0	0.8	0.5	0.4	0.4	0.4	0.4	0.4	0.6	1.0	1.1	1.1	0.7	0.0	-0.1	0.0	0.7	0.9	1.2	1.2	0.6	0.4	0.3	0.2
12				0.0	0.0	0.0	-0.1	0.0	2.3	2.3	1.0	1.1	1.1	1.6	2.0	0.5	0.5	0.5	0.6	0.6	0.8	0.9	0.8	0.5	0.3	0.3	0.2	0.2	0.3	0.5	0.7	0.9	0.4	0.3	0.0	-0.1	0.0	0.1	0.6	0.8	0.8	0.4	0.3	0.2	0.2
13				0.0	-0.1	-0.1	-0.2	-0.1	-1.0	1.7	0.6	0.8	0.6	0.2	1.4	0.6	0.5	0.5	0.5	0.5	0.6	0.7	0.6	0.2	0.2	0.2	0.1	0.2	0.2	0.3	0.2	0.1	-0.1	0.0	0.0	0.0	0.0	-0.2	0.2	0.4	0.4	0.3	0.2	0.2	0.1
14			0.0	0.0	-0.1	-0.1	-0.2	-0.1	-0.6	0.7	0.0	0.0	0.0	0.4	0.7	0.5	0.5	0.5	0.4	0.5	0.4	0.3	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.0	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1
15			0.0	0.0	-0.1	-0.1	0.0	-0.1	-0.3	0.0	0.0	0.1	0.0	0.2	0.4	0.5	0.5	0.5	0.3	0.3	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.0
16		0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	0.0	0.0	0.2	-0.1	-0.1	0.3	0.4	0.5	0.5	0.2	0.2	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17		0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	-0.1	-0.3	-0.1	0.0	0.2	0.3	0.5	0.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																			
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																				
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																					
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																						
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																								
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																									
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																												
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																														
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																																		

Figure 4-42 Predicted Water Table F r Landfill Cap With Uphill Trench Minus Water Table For Landfill Cap With Uphill Trench And Toe Drain (ft)

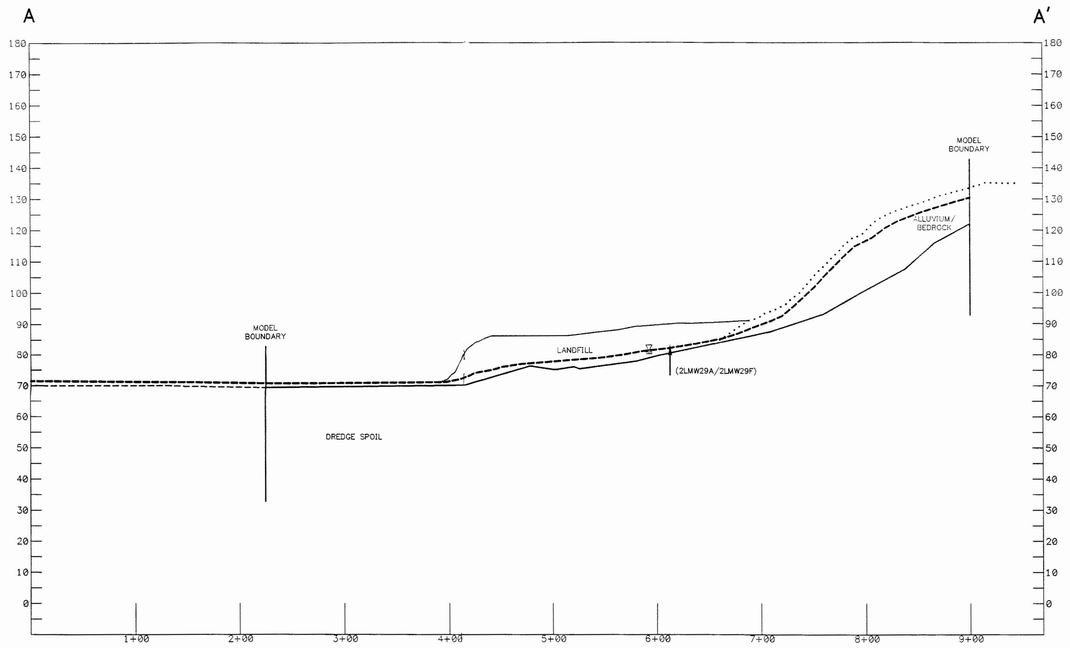
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						71.5	71.5	71.5	71.5	71.5	71.5		
2																																			71.0	71.0	71.5	71.3	71.3	71.3	71.3	71.4	71.8	72.5	73.0
3																																	71.0	71.0	71.0	71.0	71.1	71.0	71.0	71.0	71.0	71.3	71.7	72.0	72.7
4																						71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.5	71.8	72.6
5																71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.0	71.1	71.1	71.1	71.1	71.1	71.0	71.8	72.5
6												71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.2	71.2	71.2	71.2	71.3	71.3	72.3	73.4
7							60.0	65.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.5	71.8	71.7	71.6	71.4	71.5	71.4	71.3	71.2	71.2	71.0	71.2	71.2	71.3	71.3	71.3	71.3	71.4	71.5	73.0	73.6
8						37.2	60.0	65.1	70.8	70.9	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.4	71.7	72.2	72.5	72.5	72.4	72.0	71.8	71.8	71.4	71.4	71.3	71.3	71.3	71.4	71.4	71.4	71.4	71.5	71.5	72.3	73.6	74.2
9						38.7	60.0	65.1	70.7	70.9	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.3	71.4	71.5	71.9	72.3	72.7	73.0	73.1	73.1	72.6	72.1	71.7	71.5	71.4	71.4	71.4	71.7	71.6	71.6	71.5	71.6	71.6	71.7	73.0	74.0	74.5
10					36.2	48.9	59.9	65.1	70.6	70.9	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.1	71.4	71.8	71.8	71.9	72.3	72.8	73.2	73.5	73.6	73.8	73.5	72.7	72.0	71.7	71.5	71.5	72.3	72.8	72.5	72.0	71.8	71.7	71.8	72.4	73.6	74.4	74.6
11					37.3	48.2	57.8	65.3	70.7	71.1	71.0	71.0	71.0	71.0	71.0	71.0	71.4	71.6	72.0	72.2	72.2	72.2	72.6	73.2	74.0	74.4	74.5	74.8	74.5	73.4	72.3	71.8	71.7	72.0	73.4	74.1	73.5	72.5	72.2	71.9	72.0	73.0	73.9	74.6	75.0
12				36.1	40.7	47.8	56.4	70.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.5	72.0	72.2	72.5	72.6	72.6	72.5	72.8	74.0	75.3	75.8	76.1	76.2	75.6	73.9	73.0	72.2	72.7	72.8	74.7	75.5	75.1	74.0	72.8	72.3	72.4	73.3	74.1	74.7	75.1
13				37.1	42.2	48.7	57.2	70.2	72.7	71.4	71.6	71.1	71.1	71.6	71.9	72.3	72.5	72.7	72.9	73.0	73.2	73.3	73.3	76.1	76.9	77.3	77.5	77.2	76.8	76.9	76.6	76.7	76.7	76.3	77.1	77.5	77.6	75.8	73.8	73.1	73.1	73.5	74.1	74.8	75.3
14			36.1	39.5	43.6	50.1	58.8	71.6	73.8	72.3	73.3	72.7	0.0	72.1	72.8	72.9	72.9	73.1	73.3	73.6	74.4	74.8	0.0	78.2	78.4	78.6	78.6	77.9	77.8	81.3	81.4	85.9	82.1	81.4	81.1	80.4	79.6	76.6	74.5	73.5	73.4	73.4	73.9	74.7	75.4
15			37.1	40.8	45.2	51.0	70.2	74.2	75.0	0.0	75.2	75.3	0.0	74.0	73.7	73.3	73.2	73.4	73.9	74.5	75.6	76.7	78.8	79.2	79.8	80.0	80.0	79.4	79.8	85.3	86.8	89.4	86.5	86.2	85.9	83.1	81.7	76.7	74.6	73.4	73.3	73.0	73.3	74.5	75.6
16		39.2	39.4	43.9	49.1	55.4	73.7	75.4	76.4	0.0	76.9	77.8	77.6	76.0	74.4	73.8	73.4	73.7	75.1	76.0	77.0	77.9	79.4	80.3	81.0	81.3	81.4	81.4	82.5	89.9	91.2	92.2	91.0	91.0	91.0	86.0	86.0	76.0	72.0	72.0	72.0	72.0	72.0	74.0	76.0
17		43.0	47.4	54.5	55.2	65.1	75.4	76.6	77.8	80.0	78.6	79.4	78.1	76.5	75.1	74.2	73.6	74.2	76.9	78.2	78.6	79.8	81.4	81.9	82.4	82.5	82.8	83.2	84.8	95.8															
18	43.3	48.9	57.7	63.3	62.2	72.3	76.7	77.8	79.1	80.9	80.6	80.1	78.8	77.0	76.0	75.5	0.0	0.0	79.3	79.8	79.8	81.8	84.1	83.9	83.6	83.7	84.0	84.8	86.5	96.7															
19	49.5	56.2	62.4	64.9	66.0	74.5	78.0	78.9	80.2	81.6	82.4	81.1	79.7	77.6	77.3	78.2	0.0	0.0	81.2	80.8	81.5	85.2	87.0	85.5	84.7	84.8	85.1	85.2	88.0	97.0															
20	57.0	62.0	65.2	66.7	69.2	77.0	79.4	80.1	81.3	82.5	83.3	82.9	81.1	79.4	79.4	80.7	0.0	85.0	82.6	84.8	88.6	90.4	90.4	87.1	85.8	85.8	86.3	87.8	89.4	97.0															
21	63.7	65.7	66.9	68.3	74.6	79.6	80.9	81.6	82.4	83.4	84.4	84.7	83.6	80.9	81.0	81.8	86.8	86.2	86.1	93.4	97.7	96.0	96.0	93.5	92.0	91.8	92.8	93.3	95.3	99.4															
22	67.0	67.8	68.3	71.6	79.6	81.6	82.5	83.6	83.9	85.0	85.5	85.6	86.2	0.0	81.7	84.5	89.1	88.5	93.0	101.1	104.2	103.9	103.5	103.2	102.3	101.3	102.2	102.2	104.8	106.8															
23	68.9	69.5	69.6	76.8	81.5	83.2	84.2	85.3	85.7	86.6	86.4	86.2	87.2	89.4	85.0	89.4	99.9	103.9	99.6	106.5	110.2	111.6	111.7	111.5	110.7	109.4	109.3	109.0	113.3																
24	70.2	71.0	73.7	81.7	83.4	85.0	85.9	86.6	87.2	87.5	87.4	87.3	88.0	90.8	90.0	99.1	105.4	109.5	110.1	112.1	115.6	117.8	118.6	119.0	118.3	117.6	116.5	113.4																	
25	71.5	72.6	78.7	83.6	85.5	86.8	87.3	88.1	88.8	89.7	89.2	89.0	89.8	94.5	100.3	102.2	112.4	120.4	122.9	121.0	122.0	124.1	124.3	125.6	124.8	125.7	125.1																		
26	74.6	76.3	82.6	85.5	87.3	88.4	89.2	90.4	93.8	95.6	95.1	93.6	94.7	98.8	103.8	116.4	121.4	129.0	129.6	129.8	129.7	130.3	129.4	131.8																					
27	82.0	83.1	85.9	88.0	89.6	90.8	92.6	95.7	100.6	103.3	106.1	105.6	105.8	107.6	114.6	127.2	128.2	130.0	132.3	135.4	138.7	139.6																							
28	88.0	88.0	89.1	90.5	92.1	93.9	97.2	102.3	107.3	111.3	115.1	116.5	117.2	119.3	125.2	135.1	135.0	132.2																											
29	90.0	89.7	90.6	91.9	94.1	97.2	101.9	108.5	113.1	116.9	120.0	121.0	123.6	127.9	126.2																														
30	90.0	88.3	90.4	92.7	96.9	102.8	108.8	114.9	119.0	122.5	125.7																																		

Figure 4-43 Predicted Water Table With Toe Drain Stage Increased to 71 ft (ft)

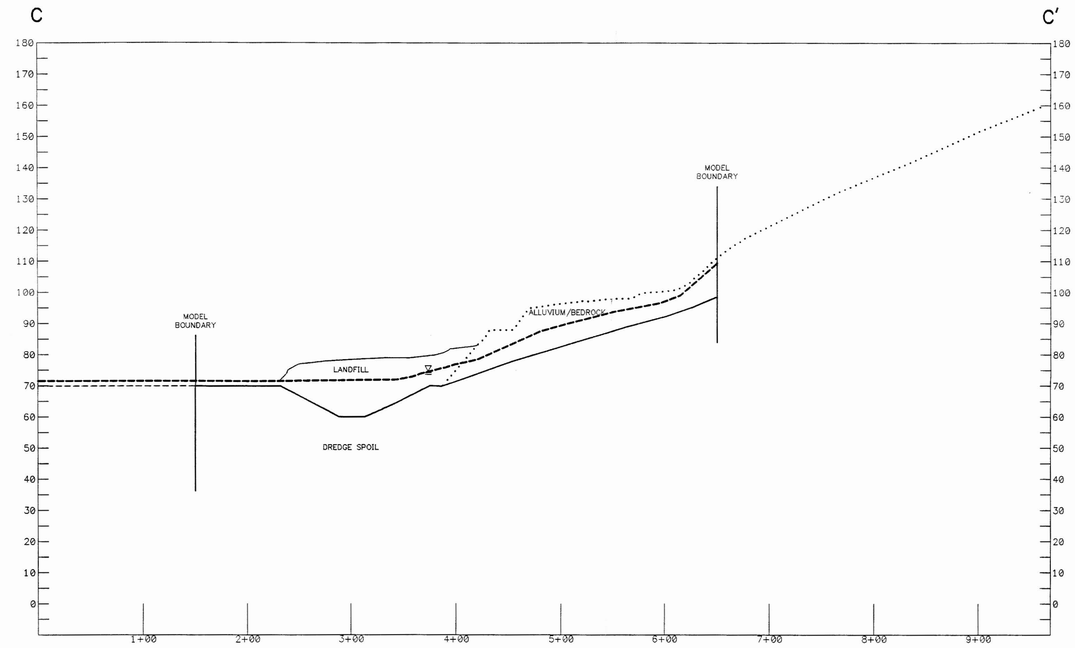
DRAFT

	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	32	33	34	35	36	37	38	39	40	41	42	43	44	45
1																																						0.0	0.0	0.0	0.0	0.0	0.0		
2																																			0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.0	0.0
3																																	0.0	0.0	0.0	-0.1	-0.4	-1.0	-1.0	-1.0	-1.0	0.4	0.4	0.2	0.2
4																						0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.4	-1.0	-0.9	-0.8	-0.8	-0.8	-1.0	0.6	0.4	0.2
5																0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.3	-0.3	-0.5	-0.2	-0.3	-0.5	-0.1	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.8	-1.0	-0.8	-0.8	-0.8	-0.7	-0.8	-1.0	0.4	0.2
6												0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.1	-0.3	-0.6	-0.7	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-0.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	0.2	0.1
7							0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4	-0.6	-0.2	-0.4	-1.0	-1.0	-0.6	0.1	-0.5	-0.6	-0.7	-0.7	-0.7	-0.8	-0.8	-0.7	-1.0	-0.9	-0.9	-0.8	-0.8	-0.8	-0.7	-0.7	-0.7	0.0	0.0
8						0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.3	-0.4	-0.4	-0.7	-0.7	-1.0	-1.0	-1.0	-0.7	-0.6	-0.2	-0.1	-0.2	-0.3	-0.6	-0.7	-0.7	-0.8	-0.8	-0.7	-0.8	-0.9	-0.8	-0.8	-0.8	-0.7	-0.7	-0.7	-0.4	0.0	0.0
9						0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.2	-0.4	-0.7	-0.9	-1.0	-1.0	-0.7	-0.6	-0.6	-0.4	-0.3	-0.2	-0.1	-0.2	-0.3	-0.5	-0.6	-0.7	-0.8	-0.8	-0.7	-0.8	-0.6	-0.8	-0.8	-0.7	-0.7	-0.7	-0.7	-0.2	-0.1	0.0
10					0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.2	-0.2	-0.4	-0.8	-1.0	-0.7	-0.6	-0.4	-0.5	-0.5	-0.3	-0.2	-0.2	-0.1	-0.2	-0.2	-0.3	-0.5	-0.7	-0.7	-0.7	-0.7	-0.3	-0.2	-0.2	-0.5	-0.7	-0.7	-0.7	-0.4	-0.2	-0.1	0.0
11					0.0	0.0	0.0	-0.1	-0.1	-0.3	-0.1	-0.2	-0.2	-0.3	-0.5	-1.0	-0.2	-0.3	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.6	-0.7	-0.7	-0.4	0.1	0.1	0.1	-0.3	-0.5	-0.6	-0.6	-0.3	-0.1	-0.1	0.0
12				0.0	0.0	0.0	0.0	0.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-0.1	-0.2	-0.2	-0.2	-0.3	-0.3	-0.4	-0.3	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.3	-0.4	-0.5	-0.2	-0.2	0.0	0.1	0.1	0.0	-0.2	-0.4	-0.3	-0.1	-0.1	-0.1	0.0
13				0.0	0.1	0.1	0.2	0.1	1.5	-0.4	-0.4	-0.7	-0.3	0.5	-0.3	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3	-0.2	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	-0.1	-0.2	-0.1	-0.1	-0.1	0.0	0.0
14			0.0	0.0	0.1	0.1	0.2	0.2	0.7	0.0	0.0	0.0	0.0	0.4	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	0.0	0.0
15			0.0	0.0	0.1	0.1	0.0	0.1	0.4	0.0	0.0	-0.1	0.0	0.1	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0
16		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	-0.1	0.0	-0.1	-0.1	-0.1	-0.2	-0.2	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17		0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.2	0.0	-0.1	-0.1	-0.1	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
18	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																
24	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																	
25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																		
26	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																					
27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																							
28	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																											
29	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																														
30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0																																		

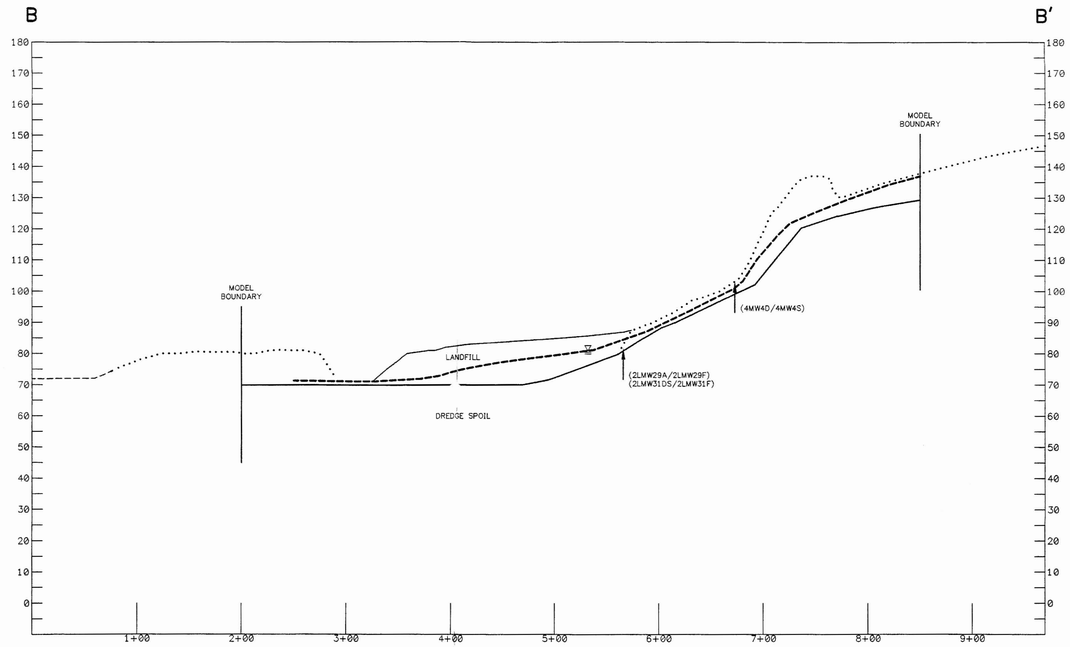
Figure 4-44 Predicted Water Table For Landfill Cap With Uphill Trench And Toe Drain Minus Water Table For Toe Drain Stage Increased To 71 ft (ft)



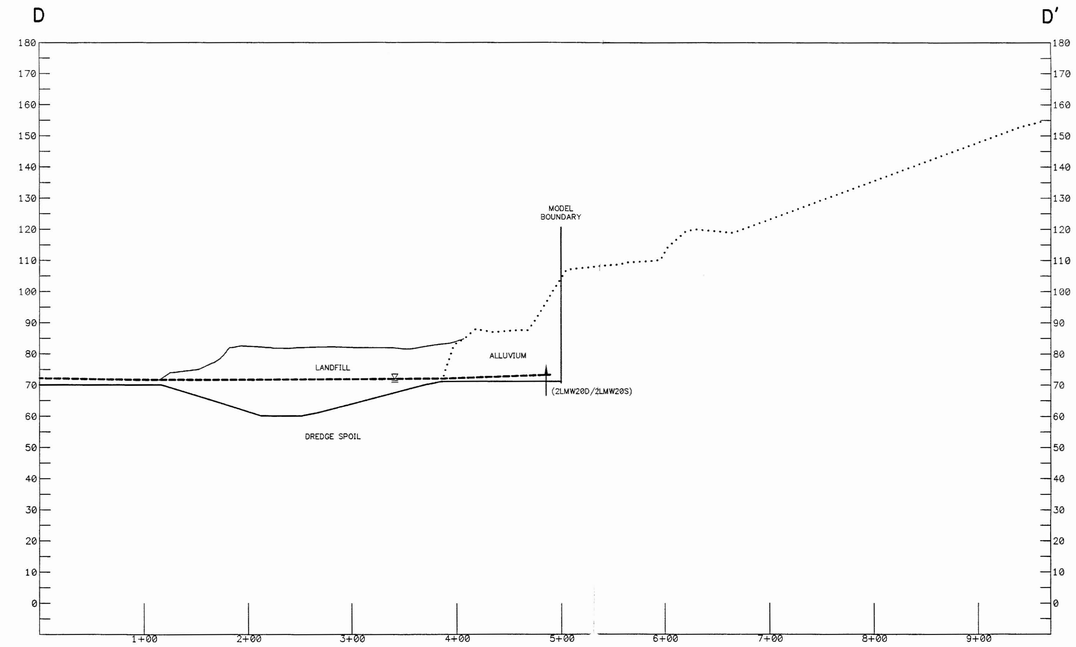
A–A'



C–C'



B–B'



D–D'

LEGEND

- TOP OF LANDFILL
- TOP OF DREDGE SPOIL
- TOP OF ALLUVIUM
- BOTTOM OF MODEL
- WATER TABLE
- VERTICAL FLOW COMPONENT

0 20 40 VERTICAL SCALE IN FEET

0 60 120 HORIZONTAL SCALE IN FEET

ACAD: O:\DATA\CADD\SB82\XSECTAB.DWG 02/13/96 MB

PLOT LIMITS

FIGURE 4–1

SIMPLIFICATIONS FOR THE CONCEPTUAL MODEL MODELING/LEACHATE STUDY NSB–NEW LONDON GROTON, CONNECTICUT

Brown & Root Environmental

000449FB01X

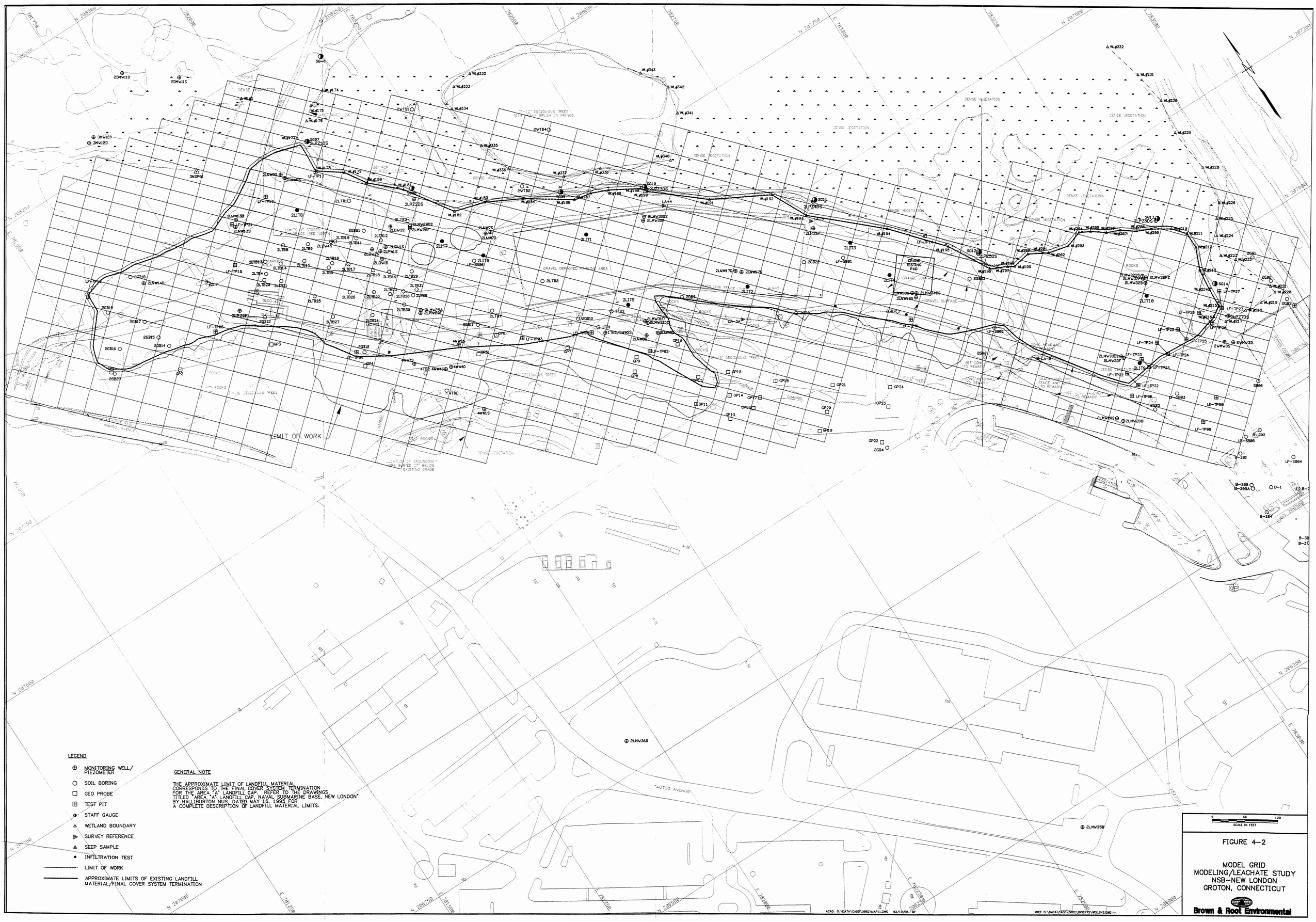
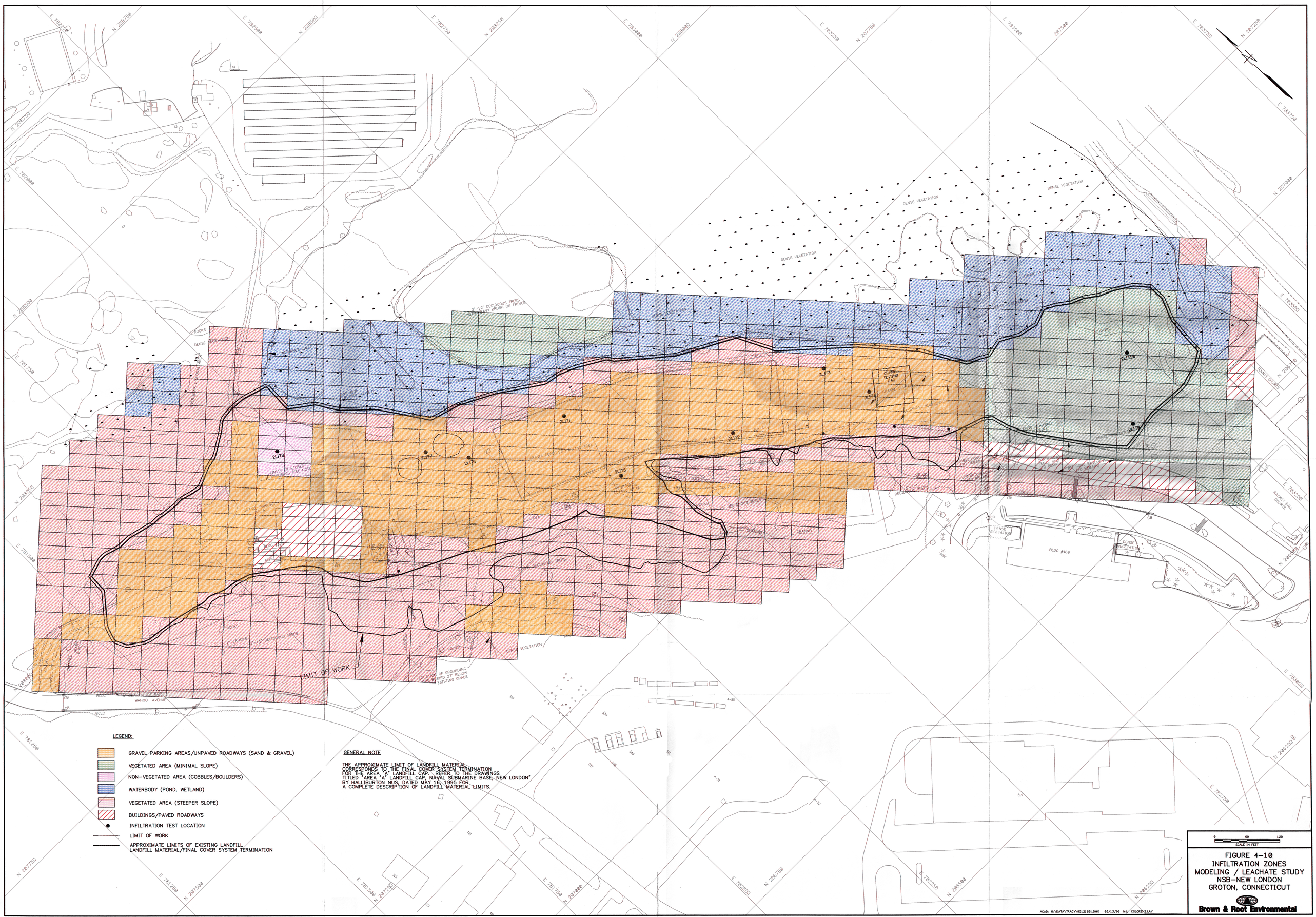


FIGURE 4-2

MODEL GRID
MODELING/LEACHATE STUDY
NSB-NEW LONDON
GROTON, CONNECTICUT


LEGEND:
GRAVEL PARKING AREAS/UNPAVED ROADWAYS (SAND & GRAVEL)
VEGETATED AREA (MINIMAL SLOPE)
NON-VEGETATED AREA (COBBLES/BOULDERS)
WATERBODY (POND, WETLAND)
VEGETATED AREA (STEEPER SLOPE)
BUILDINGS/PAVED ROADWAYS
INFILTRATION TEST LOCATION
LIMIT OF WORK
APPROXIMATE LIMITS OF EXISTING LANDFILL
LANDFILL MATERIAL/FINAL COVER SYSTEM TERMINATION
GENERAL NOTE
THE APPROXIMATE LIMIT OF LANDFILL MATERIAL CORRESPONDS TO THE FINAL COVER SYSTEM TERMINATION FOR THE AREA "A" LANDFILL CAP. REFER TO THE DRAWINGS TITLED "AREA "A" LANDFILL CAP, NAVAL SUBMARINE BASE, NEW LONDON" BY HALLIBURTON NUS, DATED MAY 16, 1995 FOR A COMPLETE DESCRIPTION OF LANDFILL MATERIAL LIMITS.
LIMIT OF WORK
DENSE VEGETATION
ROCKS
BLDG #460
WAHOO AVENUE
BCLC
CHANNEL
TENNIS COURTS
RACQUET BALL COURTS
2LIT8
2LIT7
2LIT6
2LIT5
2LIT4
2LIT3
2LIT2
2LIT1
2LIT9
2LIT10
CRANE TESTING PAD
LOCATION OF GROUNDING WIRE BURIED 27" BELOW EXISTING GRADE
ACAD: N:\DATA\TRACY\05121801.DWG 03/13/96 MJJ COLOR2NS.LAY
0 60 120
SCALE IN FEET
FIGURE 4-10
INFILTRATION ZONES
MODELING / LEACHATE STUDY
NSB-NEW LONDON
GROTON, CONNECTICUT
Brown & Root Environmental

LEGEND

- MONITORING WELL/ PIEZOMETER
- SOIL BORING
- GEO PROBE
- TEST PIT
- STAFF GAUGE
- WETLAND BOUNDARY
- SURVEY REFERENCE
- SEEP SAMPLE
- INFILTRATION TEST
- LIMIT OF WORK
- APPROXIMATE LIMITS OF EXISTING LANDFILL MATERIAL/FINAL COVER SYSTEM TERMINATION
- 100 GROUNDWATER CONTOUR

GENERAL NOTE

THE APPROXIMATE LIMIT OF LANDFILL MATERIAL CORRESPONDS TO THE FINAL COVER SYSTEM TERMINATION FOR THE AREA "A" LANDFILL CAP. REFER TO THE DRAWINGS TITLED "AREA "A" LANDFILL CAP, NAVAL SUBMARINE BASE, NEW LONDON" BY HALLIBURTON NUS, DATED MAY 16, 1995 FOR A COMPLETE DESCRIPTION OF LANDFILL MATERIAL LIMITS.

0 60 120
SCALE IN FEET

FIGURE 4-14

CALIBRATED WATER TABLE CONTOUR MAP
MODELING/LEACHATE STUDY
NSB-NEW LONDON
GROTON, CONNECTICUT

Brown & Root Environmental

ACAD: Q:\DATA\CADD\5082\5082GM01.DWG 03/12/96 MF
PLOT LIMITS, MSVIEW=OWG XREF Q:\DATA\CADD\5082\INSERTS\WELLINS.SITEMAP.WATER.DWG

LEGEND

- ⊕ MONITORING WELL/ PIEZOMETER
- ○ SOIL BORING
- □ GEO PROBE
- ⊞ TEST PIT
- ◑ STAFF GAUGE
- △ WETLAND BOUNDARY
- ▷ SURVEY REFERENCE
- ▲ SEEP SAMPLE
- ● INFILTRATION TEST
- LIMIT OF WORK
- APPROXIMATE LIMITS OF EXISTING LANDFILL MATERIAL/FINAL COVER SYSTEM TERMINATION
- —100— GROUNDWATER CONTOUR

GENERAL NOTE

THE APPROXIMATE LIMIT OF LANDFILL MATERIAL CORRESPONDS TO THE FINAL COVER SYSTEM TERMINATION FOR THE AREA "A" LANDFILL CAP. REFER TO THE DRAWINGS TITLED "AREA "A" LANDFILL CAP, NAVAL SUBMARINE BASE, NEW LONDON" BY HALLIBURTON NUS, DATED MAY 16, 1995 FOR A COMPLETE DESCRIPTION OF LANDFILL MATERIAL LIMITS.

SCALE IN FEET: 0 60 120

FIGURE 4-34
PREDICTED WATER TABLE CONTOUR MAP FOR CAPPED CONDITION MODELING/LEACHATE STUDY NSB-NEW LONDON GROTON, CONNECTICUT

Brown & Root Environmental

5.0 REVISED GEOTECHNICAL EVALUATION

Detailed geotechnical evaluations, including stability and settlement analyses, were previously performed in conjunction with preparation of the remedial design for the Area A Landfill. The results of these analyses were presented in the Design Analysis Report (B&R Environmental, May 1995). However, in response to subsequent discussions with the USEPA and CTDEP, the Navy elected to perform an additional Modeling Field Investigation described in Section 2.0 of this report. The results of this Modeling Field Investigation were then utilized in conjunction with existing site characterization data, to evaluate the validity of input data that was used for the stability and settlement analyses presented in the Design Analysis Report. These analyses were modified, if appropriate, based upon the criteria described in the Groundwater/Leachate Modeling Study Letter Work Plan, attached to this report as Appendix A.1. The corresponding appendices (C and D) of the Design Analysis Report have been revised, and the revised stability and settlement analyses are attached to this report as Appendices F.1 and F.2, respectively. A detailed discussion of the data evaluation and subsequent calculation revisions is provided below.

5.1 INPUT DATA

5.1.1 Stratigraphic Evaluation

As part of the Modeling Field Investigation activities, several additional test borings were installed throughout the Area A Landfill. Descriptive logs for these test borings are attached to this report as Appendices C.1 and C.2. A summary of descriptive logs for previously installed test borings and wells is also attached to this report as Appendix C.3. The borings logs from both sources were used to prepare surface contour maps, utilizing an advanced site design software program (TERRAMODEL®) for each of the major lithologic units, as presented on Figures 3-1, 3-3, 3-4, and 3-5. Several stratigraphic cross-sections were then developed, at various locations along the northern slope of the Area A Landfill. A comparative review of these cross-sections was performed, and a "most critical" cross-section was identified. It was established that the selected "most critical" cross-section was, in fact, very similar to that utilized for the slope stability analyses presented in the Design Analysis Report. Nevertheless, additional slope stability analyses were performed, based upon the more recently developed "most critical" cross-section, and these are attached to this report as Appendix F.1. A discussion of the results of the slope stability analyses is provided in Section 5.2.

5.1.2 Evaluation of Dredge Spoil Homogeneity

A detailed evaluation was performed of the homogeneity of the dredge spoil layer beneath the Area A Landfill. This review was based upon a compilation of test boring logs obtained during the Modeling Field Investigation and past subsurface investigations at the Area A Landfill. A series of cross-sections were developed utilizing several of the test borings, as shown on Figure 3-1; these cross-sections are presented on Figures 5-1 through 5-3. Corresponding blow counts obtained within the dredge spoil layer were also plotted on these cross-sections, such that any stratification or other discontinuities of dredge spoil strength (based upon the blow counts) would become evident. As is apparent with all of the cross-sections, the blow counts do not show appreciable variability with depth. Therefore, it was concluded that anomalously "weak" layers do not exist within the dredge spoil material beneath the Area A Landfill, and the dredge spoil layer can be adequately modeled, for the purposes of stability analyses, as a single layer.

5.1.3 Verification of Dredge Spoil Strength Properties

For stability analyses provided in the Design Analysis Report, dredge spoil strength properties were established based upon minimum strength values obtained from triaxial tests performed on three representative undisturbed soil samples (sample numbers LF-SB01-21, LF-SB01-23, and LF-SB02-19). A correlation was made between the triaxial test results and blow counts by plotting the undisturbed sample locations on the cross sections described above (see Figure 5-3). It was concluded that the triaxial test results were suitable as conservative average strength values for the dredge spoil material because the blow counts recorded adjacent to the undisturbed samples compare favorably with the average values for the overall dredge spoil layer.

During the Modeling Field Investigation, two additional undisturbed dredge spoil samples were collected, as described in Section 2.0 of this report. In particular, one of the samples was obtained in the proposed crane test pad area, to further characterize dredge spoil strength parameters in this area of potentially acute loading. Triaxial strength tests were performed on the samples, and the results were compared to the values obtained from previous testing as well as the average values utilized in the stability analyses:

Data Source	Sample No.	Total Stress		Effective Stress	
		c(psf)	∅ (°)	c' (psf)	∅ (°)
Geotechnical Field Investigation (February 1995)	LF-SB01-21	346	14.8	130	37.5
	LF-SB01-23	389	11.8	216	30.6
	LF-SB02-19	173	14.8	72	35.3
Modeling Field Investigation (October 1995)	7/2 LMW34D	331	10.1	0	44.4
	2/2 LMW28D	446	12.4	202	36.9
Assumed values for slope stability analyses		170	11.8	72	30.6

It was concluded that the new values were generally consistent with those obtained previously, and that the average values utilized in the stability analyses were valid. In addition, the strength parameters of the dredge spoil material in the crane test pad area were judged to be consistent with the properties of the dredge spoil in other areas of the Area A Landfill.

5.1.4 Establishment of Water Table Conditions

Groundwater table elevation measurements from the Modeling Field Investigation were used to develop a groundwater table contour map (Figure 3-9 in back pocket) within the Area A Landfill, utilizing the previously mentioned Terra Model software program. These contours were used to compute stability analyses to evaluate short-term loading conditions, immediately following construction of the landfill cover system. For long-term conditions, following emplacement of the landfill cover system, the results of the groundwater model discussed in Section 4.0 of this report were used to establish the corresponding groundwater table elevation.

5.2 STABILITY ANALYSES

The stability analyses provided in the Design Analysis Report were revised, as required, based upon the revised input data described above. The PC STABL 5M computer software, a two-dimensional limiting equilibrium slope stability program, was utilized to perform the analyses. A (revised) comprehensive stability analysis was computed for the Area A Landfill, and is attached to this report as Appendix F.1.

5.2.1 Short-Term Conditions

Short-term stability analyses were performed to assess conditions immediately following construction of the Area A Landfill cover system. It should be noted that significant waste excavation will be performed prior to cover material placement, such that no appreciable net increase in loading conditions will occur. For short-term conditions, total stress parameters were assigned to the dredge spoil material. For purposes of the total stress analysis (TSA), groundwater table elevation data was used to assign moist versus saturated soil unit weight conditions within the various soil layers. However, a piezometric surface was not assigned to the dredge spoil layer. If the piezometric surface had been included as part of the model, the PC STABL 5M computer software would have deducted the calculated hydrostatic pressure from the calculated overburden stress, when determining shear strength, for any given failure surface. The approach utilized for these analyses is consistent with published guidance for total stress analyses (Lambe & Whitman, 1969). Assuming that the soils that lie immediately underneath the toe of the cap are landfill material (as currently anticipated), the minimum factor of safety is about 1.3. In the event that the soils that lie immediately underneath the toe of the cap are dredge spoil materials (a very conservative assumption), the minimum factor of safety is about 1.1. It is judged that the estimated factors of safety are acceptable for short-term loading conditions.

5.2.2 Long-Term Conditions

Long-term stability analyses were performed to assess "steady-state" conditions following construction of the landfill cover system after groundwater table elevations have been adjusted in response to reduced infiltration through the landfill cover. For long-term conditions, effective stress parameters were assigned to the soil materials. For purposes of the effective stress analysis (ESA), groundwater table elevations were established based upon the results of the groundwater model described in Section 4.0 of this report. The minimum factor of safety for the effective stress analyses was determined to be 1.4, and is judged to be acceptable.

5.2.3 Flood Conditions

For the Design Analysis Report, analyses were performed to assess the stability of the northern slope of the Area A Landfill, in response to flood conditions in the adjacent Area A Wetland. For these analyses, it was assumed that the groundwater table within the landfill would rise approximately four feet above normal conditions, consistent with the peak wetland pool elevation as a result of a 100-year, 24-hour storm event. This approach results in a very conservative evaluation, because the duration of the flood event is unlikely to be sufficient to affect a consequential rise of the water table within the landfill. To better assess these

conditions, a subsequent evaluation was performed to estimate the time-dependent response of the groundwater table elevation within the landfill to the peak flood event within the wetland. The calculations, which are discussed in Section 4.5 of this report and are attached as Appendix D.4, demonstrate that the time-dependent response of the groundwater table elevation within the landfill to the peak flood event will be approximately 0.1 feet/day. Therefore, no substantial response of the groundwater table elevation within the landfill is anticipated, because the peak pool condition in the Area A Wetland is already reduced by about 15 percent just 6 hours after the peak occurs. Accordingly, no additional stability analyses for this condition is warranted.

The Area A Landfill cover system design provided with the Design Analysis Report includes a toe reinforcement system along the northern slope of the landfill, to be constructed of rock-filled gabion baskets. This reinforcement was designed to offset hydrostatic uplift beneath the cover system that would result from an assumed 4-foot rise of the water table within the landfill. As demonstrated by the previously discussed calculations, this condition was an unduly conservative assumption and the gabion reinforcement system is not required to offset hydrostatic uplift.

5.2.4 Crane Test Pad Area

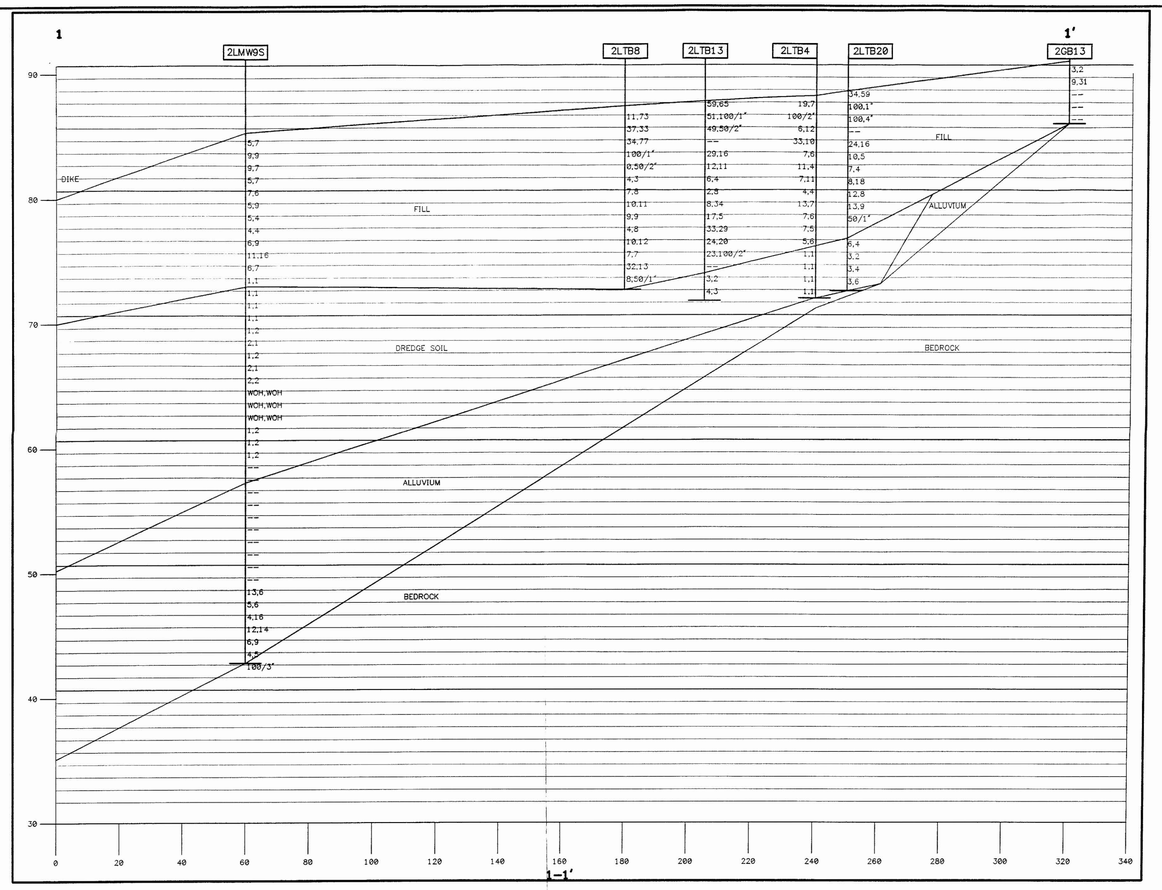
For the May 1995 Design Analysis Report, analyses were performed to assess the stability of the northern slope of the Area A Landfill, in the area of the proposed crane test pad. As described in Section 5.1.3, an additional undisturbed dredge spoil sample was collected to further characterize the strength properties of the dredge spoil in this area. It was concluded that the results from the additional triaxial test were consistent with the values used in the previous stability analyses. Therefore, the previous stability analyses performed for the crane test pad area were judged to be satisfactory, and no additional analyses were performed in conjunction with this report.

5.3 SETTLEMENT ANALYSES

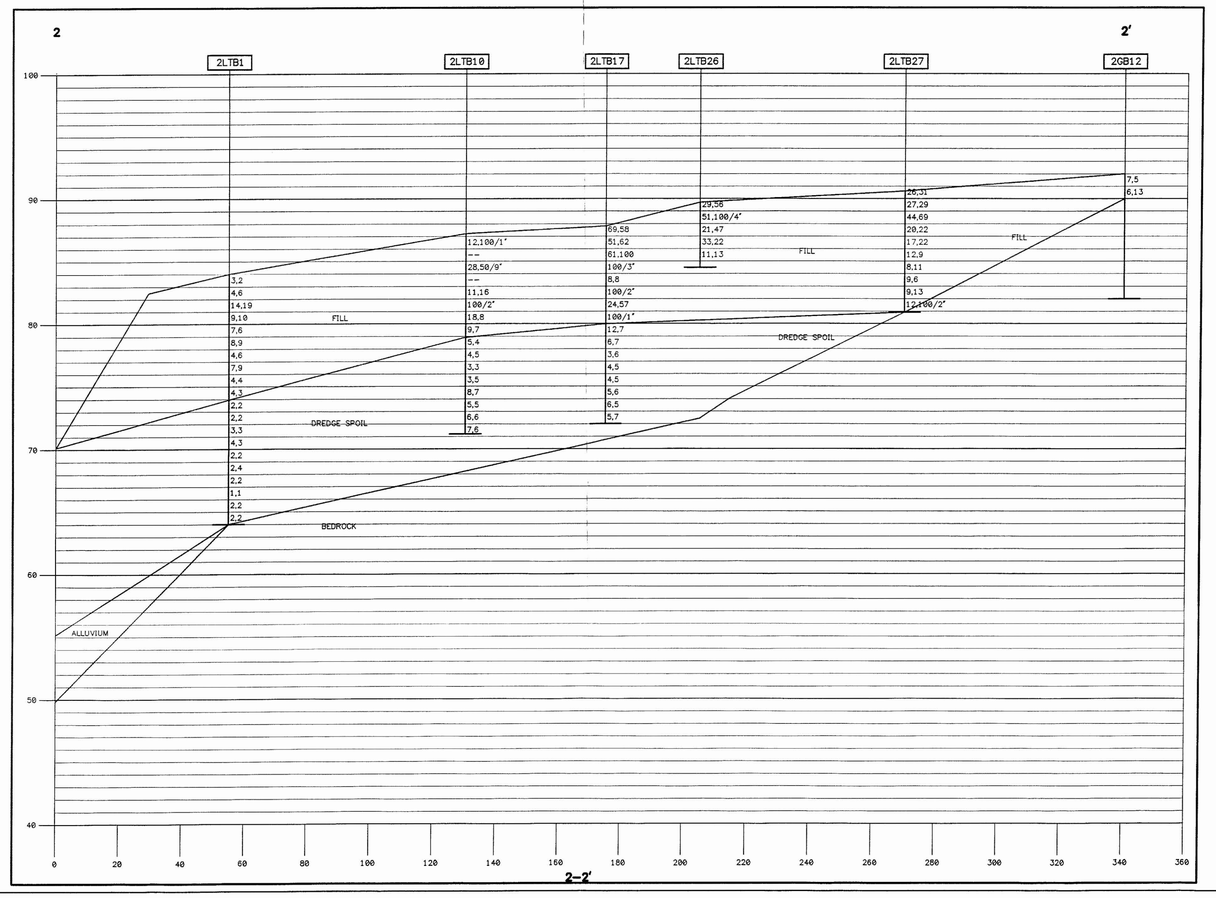
The settlement analysis provided in the Design Analysis Report was performed to determine the effect of surface regrading and changes in groundwater elevation on the proposed grades of the final Area A Landfill cover system. This analysis has been modified as part of this report, based upon:

- The refined stratigraphy developed from the results of the Modeling Field Investigation.
  Current groundwater table elevation data, based upon most recent field measurements.
  Estimated groundwater table elevations following construction of the landfill cover system, based upon results of the Groundwater/Leachate Modeling Study.

The additional settlement analysis indicates that the slope of the final Area A Landfill cover system will meet the minimum standard of 3 percent, following settlement, based upon a construction design grade of 3.3 percent.



1–1'



2–2'

LEGEND

EACH "BLOW COUNT" IS PER 6" INTERVAL, UNLESS INDICATED OTHERWISE.

"WOH" MEANS WEIGHT OF HAMMER

"8" ON HORIZONTAL SCALE IS EDGE OF CAP ALONG WETLAND– EXCEPT CROSS–SECTION 6–6'.

0 5 10
VERTICAL SCALE IN FEET

0 20 40
HORIZONTAL SCALE IN FEET

FIGURE 5–1

GEOTECHNICAL CROSS–SECTIONS 1–1' AND 2–2'
MODELING/LEACHATE STUDY
NSB–NEW LONDON
GROTON, CONNECTICUT

Brown & Root Environmental

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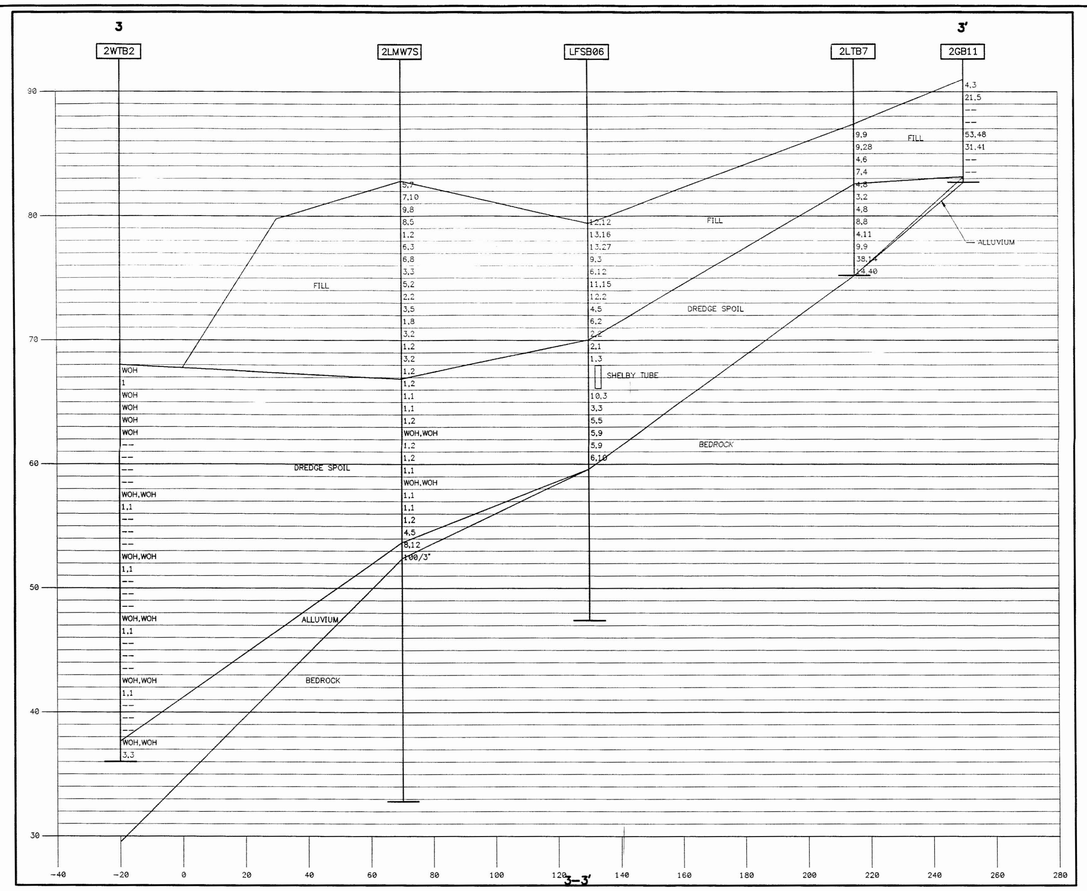

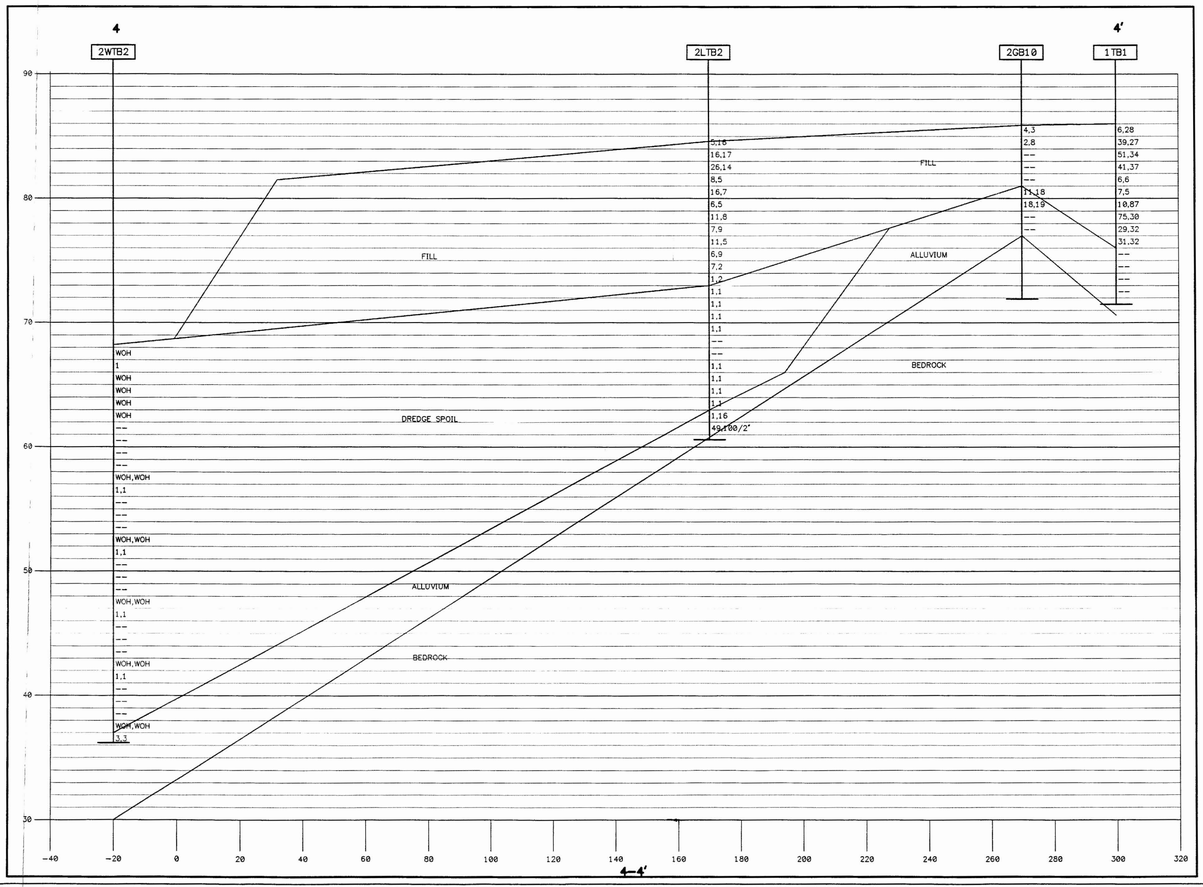

LEGEND:

EACH "BLOW COUNT" IS PER 6" INTERVAL, UNLESS INDICATED OTHERWISE.

"WOH" MEANS WEIGHT OF HAMMER

"0" ON HORIZONTAL SCALE IS EDGE OF CAP ALONG WETLAND-EXCEPT CROSS-SECTION 6-6'.

0 5 10
VERTICAL SCALE IN FEET

0 20 40
HORIZONTAL SCALE IN FEET

FIGURE 5-2

GEOTECHNICAL CROSS-SECTIONS 3-3' AND 4-4'
MODELING/LEACHATE STUDY
NSB-NEW LONDON
GROTON, CONNECTICUT

Brown & Root Environmental

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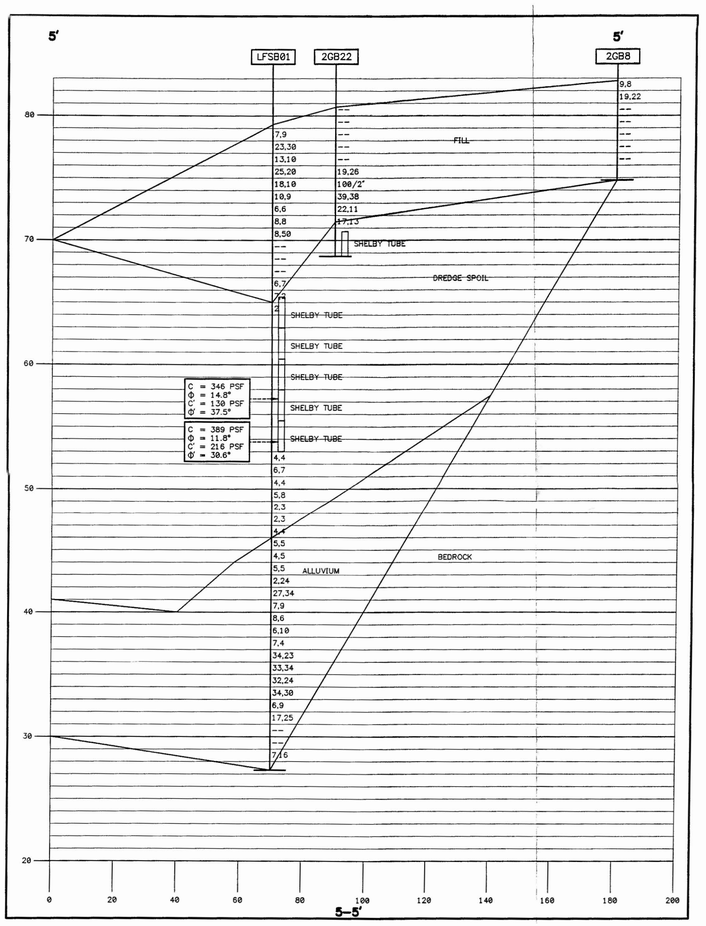

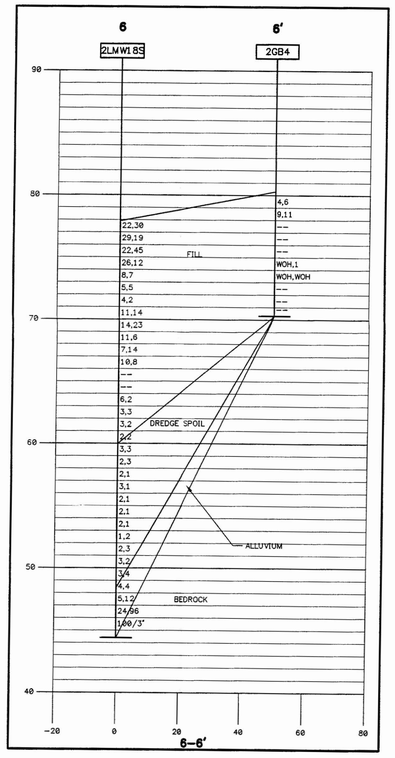

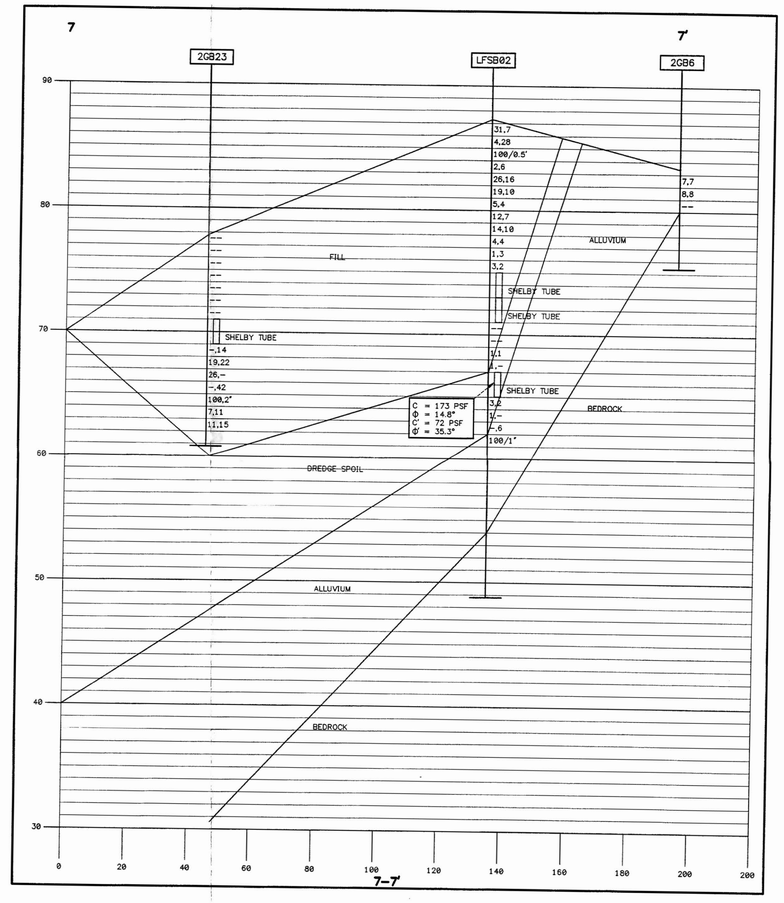

LEGEND

EACH "BLOW COUNT" IS PER 6" INTERVAL, UNLESS INDICATED OTHERWISE.

"WOH" MEANS WEIGHT OF HAMMER

"0" ON HORIZONTAL SCALE IS EDGE OF CAP ALONG WETLAND-EXCEPT CROSS-SECTION 6-6'.

0 5 10
VERTICAL SCALE IN FEET

0 20 40
HORIZONTAL SCALE IN FEET

FIGURE 5-3

GEOTECHNICAL CROSS-SECTIONS 5-5', 6-6' AND 7-7'
MODELING/LEACHATE STUDY
NSB-NEW LONDON
GROTON, CONNECTICUT

Brown & Root Environmental

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6.0 TOE DRAIN SYSTEM EVALUATION

6.1 CONCEPTUAL DESIGN OF TOE DRAIN SYSTEM

In conjunction with the Groundwater/Leachate Modeling Study, a conceptual design was prepared for a toe drain system along the northern limit of the proposed Area A Landfill cover system. The toe drain system is shown on Figure 6-1. Design calculations for the toe drain system are attached to this report as Appendix H.1. The toe drain would be constructed of a coarse aggregate collection area, segregated from the adjacent soils by a geotextile fabric. An HDPE geomembrane would be placed on the downslope face and bottom of the trench, to minimize inflow from the adjacent Area A Wetland. The maximum elevation of the bottom of the toe drain would be the upper surface of the dredge spoil layer, and the drain would be sloped to provide positive drainage into a series of collection sumps. A perforated drain pipe would be embedded within the aggregate, and would discharge directly into the collection sumps. Intercepted groundwater would be accumulated within the collection sumps, until a self-actuated pumping system evacuated the sumps, and pumped the groundwater to a treatment system.

Based upon past discussions between the Navy and the local Publicly Owned Treatment Works (POTW), it is anticipated that the Navy will be unable to secure discharge privileges to the POTW collection system, either with or without pretreatment by the Navy. Therefore, for the purposes of this evaluation, it has been assumed that the Navy must construct and operate a comprehensive on-site treatment facility, sufficient to receive NPDES permitting for discharge to a nearby watercourse.

It is estimated that about 80,000 gallons per day (gpd) of groundwater/leachate would be collected by the toe drain system. For the purpose of this evaluation, it was also assumed that this facility would have a design capacity of about 100,000 gpd, and would consist of a bag filtration system for the removal of suspended materials followed by a liquid-phase granular activated carbon adsorption system for the removal of the trace organic contaminants that may be present in the toe drain effluent.

6.2 STABILITY ANALYSES

Long-term stability analyses were performed to assess "steady-state" conditions following cover system and toe drain construction, after the water table has been adjusted in response to reduced infiltration through the landfill as well as groundwater collection from the toe of the north slope. For long-term conditions, effective stress parameters were assigned to the soil materials, and the location of the water table surface

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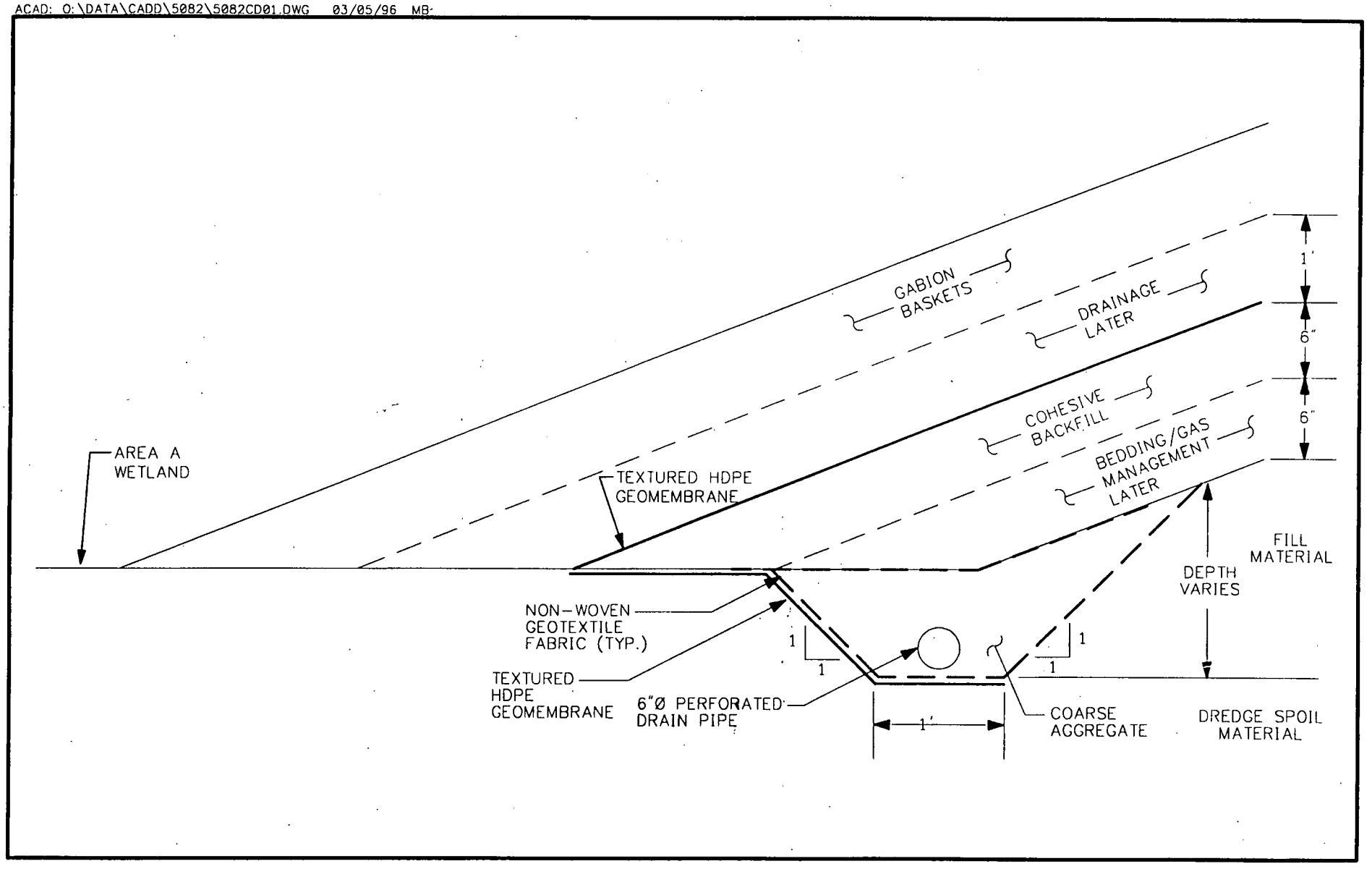

AREA "A" LANDFILL TOE DRAIN SYSTEM
CONCEPTUAL DESIGN
NAVAL SUBMARINE BASE – NEW LONDON, GROTON, CT

N.T.S.

FIGURE 6-1

Brown & Root Environmental

DRAFT

was established based upon the results of the groundwater model. The minimum factor of safety for the effective stress analyses was determined to be 1.5.

6.3 COMPARISON OF TOE DRAIN SYSTEM WITH CURRENT CAP DESIGN

A comparison was made of the current Area A Landfill cover system design to a revised design that incorporated a toe drain system along the northern boundary of the landfill. Three criteria were used for the comparative evaluation:

- Impact on slope stability of the north slope area.
- Reduction of the discharge of potentially contaminated groundwater to the wetland area.
- Cost of construction and operation.

For long-term conditions, the proposed Area A Landfill cover system as currently designed provides a minimum factor of safety of 1.4, whereas the addition of the toe drain system provides a minimum factor of safety of 1.5. The factor of safety is not significantly increased by the addition of a toe drain system because that system only produces a modest change in the groundwater table elevations within the landfill.

Based upon the results of the groundwater/leachate modeling it is estimated that addition of a toe drain system as described in Section 6.1 to the proposed Area A Landfill cover system as currently designed would result in a higher hydraulic gradient and groundwater velocity towards the Area A Wetland. This would increase the estimated groundwater/leachate outflow from the Area A Landfill to the Area A Wetland from about 23,000 gpd to about 80,000 gpd. Impact of the toe drain system on the mass flux of contaminants of concern (COCs) from the Area A Landfill to the Area A Wetland is discussed in Section 4.7.5.

Construction of the toe drain system, collection sumps, treatment system, etc. is estimated to cost approximately $1.6 million. Operation of the system over a 30 year period will require a present worth cost of approximately $1.4 million, resulting in an overall cost of about $3 million. Breakdowns for these cost estimates are attached to this report as Appendix H.2. It is judged that the cost associated with inclusion of the toe drain system is substantial, because in comparison the overall cost associated with construction of the Area A Landfill cover system as currently designed is about $3.5 million.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

Based upon the results of the Groundwater/Leachate Modeling Study, as discussed in Sections 2.0 through 6.0, the following conclusions were developed:

The Area A Landfill cover system as currently designed will reduce groundwater elevations, and consequently the thickness of saturated fill material, by about 0.1 feet along the Area A Wetland boundary, by about 0.5 feet at the eastern end of the landfill, by about 0.2 feet in the center of the landfill, and by over a foot at the western end of the landfill.

- Addition of a toe drain system to the Area A Landfill cover system as currently designed would further decrease the thickness of saturated fill material by 1.0 to 1.5 feet along the Area A Wetland boundary, by 1.0 to 1.5 feet at the east end of the landfill, and by 0.1 to 0.5 feet at the center of the landfill. Addition of a toe drain system would have no significant effect on the thickness of saturated landfill material at the west end of the landfill.

Revised stability analyses based upon the results of the groundwater/leachate modeling and additional geotechnical testing of the dredge spoil material confirmed that the short- and long-term slope stability of the Area A Landfill cover system as currently designed is acceptable. In particular, revision of the stability analyses resulted in an increase of the long-term slope stability factor from 1.3 to 1.4. The revised analyses also confirmed the adequacy of the stability for the northern slope of the Area A Landfill at the stress-critical crane test pad area.

- Addition of a toe drain system to the proposed Area A Landfill cover system as currently designed would not appreciably improve slope stability, only increasing the long-term slope stability safety factor from 1.4 to 1.5.

- The Area A Landfill cover system as currently designed will reduce the mass flux of COCs from the landfill to the Area A Wetland by 16 to 55 percent. Mass flux of COCs from the landfill to the wetland under existing conditions were estimated at about one gram per year for most COCs, with maxima of 156 grams per year for benzene and 2,890 grams per year for chlorobenzene.

- Based on an analysis of groundwater/leachate concentrations collected in a toe drain, all COC concentrations would be less than MCL criteria (for COCs with available MCLs). This result suggests that even if groundwater/leachate were collected in a toe drain, the collected water would meet drinking water standards.

- The addition of a toe drain system to the Area A Landfill cover system as currently designed would increase estimated construction costs by almost 50 percent from about $3.5 million to about $5.1 million. The limited, and un-necessary, increase in slope stability provided by the toe drain cannot therefore be characterized as cost-effective.

- A more detailed modeling analysis of flooding conditions resulting from a 100-year, 24-hour storm event revealed that the maximum head differential between the elevation of the water table beneath the Area A Landfill cover system and that of the water surface in the Area A Wetland will be only a fraction of one foot, which is much smaller than the 4 feet which had been previously assumed. As this assumption of 4 feet of head differential had been used as a basis for the current design of the gabion-reinforced toe, such a conservative design may not be required.

  A detailed blow count analysis for soil borings installed in the dredge spoil for representative cross-sections throughout the Area A Landfill showed that the dredge spoil can be modeled as a single layer for the purpose of stability analyses with no evidence of "lenses" of weaker material being present.

  Revised settlement analyses based upon the results of the modeling work and additional groundwater level measurements confirmed that the slope of the proposed Area A Landfill cover system will meet the minimum standard of 3 percent, following settlement.

7.2 RECOMMENDATIONS

Based upon the above conclusions, it is recommended that the current design of the Area A Landfill cover system not be modified and that a toe drain system not be added.

REFERENCES

(Atlantic, May 1995) Focused Feasibility Study and Addendum, Area A Landfill, Naval Submarine Base New London, Atlantic Environmental Services Inc., May 1995.

(Atlantic, June 1995) Proposed Remedial Action Plan, Area A Landfill, Naval Submarine Base New London, Atlantic Environmental Services Inc., June 1995.

(Atlantic, August 1992) Phase I Remedial Investigation for Naval Submarine Base New London, Atlantic Environmental Services Inc., August 1992.

(Atlantic, July 1994) Remedial Design (Design Analysis Report, Technical Specifications, Construction Drawings), Area A Landfill, Naval Submarine Base New London, Atlantic Environmental Services Inc., July 1994.

(B&R Environmental, March 1996) Phase II Remedial Investigation for Naval Submarine Base New London, Brown & Root Environmental, March 1996.

(B&R Environmental, December 1995) Area A East End Investigation, Area A Landfill Remedial Design, Naval Submarine Base New London, Brown & Root Environmental, December 1995.

(B&R Environmental, May 1995) Design Analysis Report, Area A Landfill Remedial Design, Naval Submarine Base New London, Brown & Root Environmental, May 1995.

(B&R Environmental, May 1995) Geotechnical Field Investigation, Area A Landfill Remedial Design, Naval Submarine Base New London, Brown & Root Environmental, May 1995.

(B&R Environmental, May 1995) Remedial Design (Design Analysis Report, Technical Specifications, Construction Drawings), Area A Landfill, Naval Submarine Base New London, Brown & Root Environmental, May 1995.

(B&R Environmental, March 1996) Phase II Remedial Investigation for Naval Submarine Base New London, Brown & Root Environmental, March 1996.

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B&R Environmental, December 1995) Area A East End Investigation, Area A Landfill Remedial Design, Naval Submarine Base New London, Brown & Root Environmental, December 1995.

APPENDIX A

STUDY PLANNING DOCUMENTS

A.1 Letter Work Plan
A.2 Letter Work Plan Addendum
A.3 Field Investigation Modifications

APPENDIX A.1

LETTER WORK PLAN

Brown & Root Environmental

A Division of Halliburton NUS Corporation

Foster Plaza VII
661 Andersen Drive
Pittsburgh, PA 15220-2745

(412) 921-7090
FAX: (412) 921-4040

C-49-09-5-068
September 6, 1995
Project Number 5082

Mr. Mark Evans
Northern Division (Code 1823)
Naval Facilities Engineering Command
Mail Stop 82, 10 Industrial Highway
Lester, PA 19113-2090

Reference: CLEAN Contract N62472-90-D-1298
Contract Task Order No. 203

Subject: Draft Groundwater/Leachate Modeling Study Letter Work Plan
Area A Landfill Design
Naval Submarine Base New London, Groton, Connecticut

Dear Mr. Evans:

As per our phone conversation of today, please find attached one (1) copy of the referenced letter work plan. Three (3) copies of this document are being sent today, via express mail, to Ms. Kymberlee Keckler at U.S. EPA and Mr. Mark Lewis at CTDEP. One (1) copy of this document is also being sent today to Jim Briggs.

The only difference between the attached document and the one which was faxed to you yesterday is that the company name and logo of Brown & Root Environmental was substituted to that of Halliburton NUS as per instructions from our Program Office.

Very truly yours,

Jean-Luc Glorieux, P.E.
Project Manager

JLG/jlg

Attachment
cc: Mr. Roger Boucher, NORTHDIV (letter only)
Mr. Jim Briggs, NORTHDIV (1 copy)
Mr. John Trepanowski, Brown & Root Environmental, Wayne (1 copy)
Mr. Daryl Hutson, Brown & Root Environmental, Pittsburgh (letter only)
File 5082

Brown & Root Environmental
A Division of Halliburton NUS Corporation

Foster Plaza VII
661 Andersen Drive
Pittsburgh, PA 15220-2745

(412) 921-7090
FAX: (412) 921-4040

C-49-09-5-061
September 6, 1995
Project Number 5082

Ms. Kymberlee Keckler
Remedial Project Manager
U.S. Environmental Protection Agency - Region I
Waste Management Division - HAN-CAN1
J.F.K. Federal Building
Boston, Massachussetts 02203-2211

Reference: CLEAN Contract N62472-90-D-1298
Contract Task Order No. 203

Subject: Draft Groundwater/Leachate Modeling Study Letter Work Plan
Area A landfill Remedial Design
Naval Submarine Base New London, Groton, Connecticut

Dear Ms. Keckler:

On behalf of the U.S. Navy, Northern Division Naval Facilities Engineering Command (the Navy), Brown & Root Environmental (Brown & Root), a division of Halliburton NUS Corporation, is pleased to submit to the U.S. Environmental Protection Agency Region I (USEPA) three (3) copies of a draft letter work plan for a Groundwater/Leachate Modeling Study to assess the impact of the installation of a cap and upgradient interception trench for the Area A Landfill at Naval Submarine Base New London (NSB NLON).

Following your review of the attached document, the Navy would like to meet with USEPA and the Connecticut Department Of Environmental Protection (CTDEP) in Boston at the earliest possible date, possibly on September 19 or 20, 1995, to this work plan and to reach a concensus on the scope of the proposed modeling study so that the work may proceed in a timely fashion.

In the meantime, if you have any questions or comments regarding the attached document, please feel free to contact Mr. Mark Evans at (610) 595-0567, Ext. 162.

Sincerely yours,

Jean-Luc Glorieux, P.E.
Project Manager

Attachment
JLG/jlg
cc: Mr. Roger Boucher, NORTHDIV (letter only)
Mr. Mark Evans, NORTHDIV (letter only)
Mr. James Briggs, NORTHDIV (letter only)
Mr. John Trepanowski, Brown & Root Environmental, Wayne (letter only)
Mr. Daryl Hutson, Brown & Root Environmental, Pittsburgh (letter only)
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C-49-09-5-062
September 6, 1995
Project Number 5082

Mr. Mark Lewis
Environmental Analyst 2
Connecticut Department of Environmental Protection
Bureau of Water Management - PERD
79 Elm Street
Hartford, Connecticut 06106-5127

Reference: CLEAN Contract N62472-90-D-1298
Contract Task Order No. 203

Subject: Draft Groundwater/Leachate Modeling Study Letter Work Plan
Area A landfill Remedial Design
Naval Submarine Base New London, Groton, Connecticut

Dear Mr. Lewis:

On behalf of the U.S. Navy, Northern Division Naval Facilities Engineering Command (the Navy), Brown & Root Environmental (Brown & Root), a division of Halliburton NUS Corporation, is pleased to submit to the Connecticut Department Of Environmental Protection (CTDEP) three (3) copies of a draft letter work plan for a Groundwater/Leachate Modeling Study to assess the impact of the installation of a cap and upgradient interception trench for the Area A Landfill at Naval Submarine Base New London (NSB NLON).

Following your review of the attached document, the Navy would like to meet with CTDEP and the U.S. EPA in Boston at the earliest possible date, possibly on September 19 or 20, 1995, to discuss this work plan and to reach a concensus on the scope of the proposed modeling study so that the work may proceed in a timely fashion.

In the meantime, if you have any questions or comments regarding the attached document, please feel free to contact Mr. Mark Evans at (610) 595-0567, Ext. 162.

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Mr. John Trepanowski, Brown & Root Environmental, Wayne (letter only)
Mr. Daryl Hutson, Brown & Root Environmental, Pittsburgh (letter only)
File 5082

LETTER WORK PLAN
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

Submitted by Brown & Root Environmental
September 6, 1995

1.0 INTRODUCTION

1.1 Project Background

This letter work plan describe the proposed activities of the Groundwater/Leachate Modeling Study for the Area A Landfill at Naval Submarine Base New London (NSB NLON) in Groton, Connecticut. This modeling study is performed in support of and as part of Contract Task Order (CTO) 0203 for the design of a cover system (cap) for the Area A Landfill under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-90-D-1298.

The Area A Landfill is located in the northeastern/north-central section of NSB NLON, encompassing an area of approximately 9.5 acres. The Area A landfill is a relatively flat area bordered to the south by a steep wooded hillside, to the west by a steep wooded ravine, and to the north by the Area A Wetland. The landfill opened for disposal of non-salvageable materials generated by submarines and base operations prior to 1957 and was closed during 1973. Several structures/functions including salt and sand storage, deployed parking, and crane testing are still currently active at the landfill.

A Phase I and Phase II Remedial Investigation (RI) were conducted by Atlantic Environmental Services, Inc. (Atlantic, August 1992) and Brown & Root Environmental, a division of Halliburton NUS Corporation (Brown & Root, March 1995), respectively. A Focused Feasibility Study (FFS, May 1995), Proposed Remedial Action Plan (PRAP, June 1995) were also prepared by Atlantic and Brown & Root. A draft Record Of Decision (ROD) was also prepared for this site and is currently under final review for signature by the Navy and U.S. EPA Region I (EPA). A Remedial Design was also prepared by Atlantic (July 1994) for the proposed landfill cap. This design was subsequently amended and finalized by Brown & Root (May 1995).

1.2 Modeling Study Objectives and Approach

The primary objective of the Groundwater/Leachate Modeling Study is to predict the impact upon the flow rate and quality of the groundwater/leachate discharge at the toe of the Area A Landfill as a result of the installation of an impervious cap and upgradient interception trench. The secondary objective of the modeling study is to compare the slope stability effectiveness and cost of the gabion-reinforced toe of the current landfill cap design with those of a cap featuring a toe drain system. Also as part of this study the dredge spoil stability and cap settlement analyses will be refined based upon additional site-specific geotechnical data.

As shown on Figure 1-1, the groundwater and leachate outflow from the Area A Landfill (Q_f) is the result of three main components including: the precipitation infiltrating through the ground surface to the water table (Q_i), the upgradient groundwater and surface run-off inflow (Q_s), and the groundwater upflow gradient from bedrock through the overburden (dredge spoils or alluvium) into the landfilled mass (Q_b). Depending on which component is predominant, the impact of installing an impervious landfill cap and upgradient interception trench on Q_f may or may not be significant since such a system will greatly reduce Q_i and, to a lesser extent, Q_s but will leave Q_b mainly unaffected.

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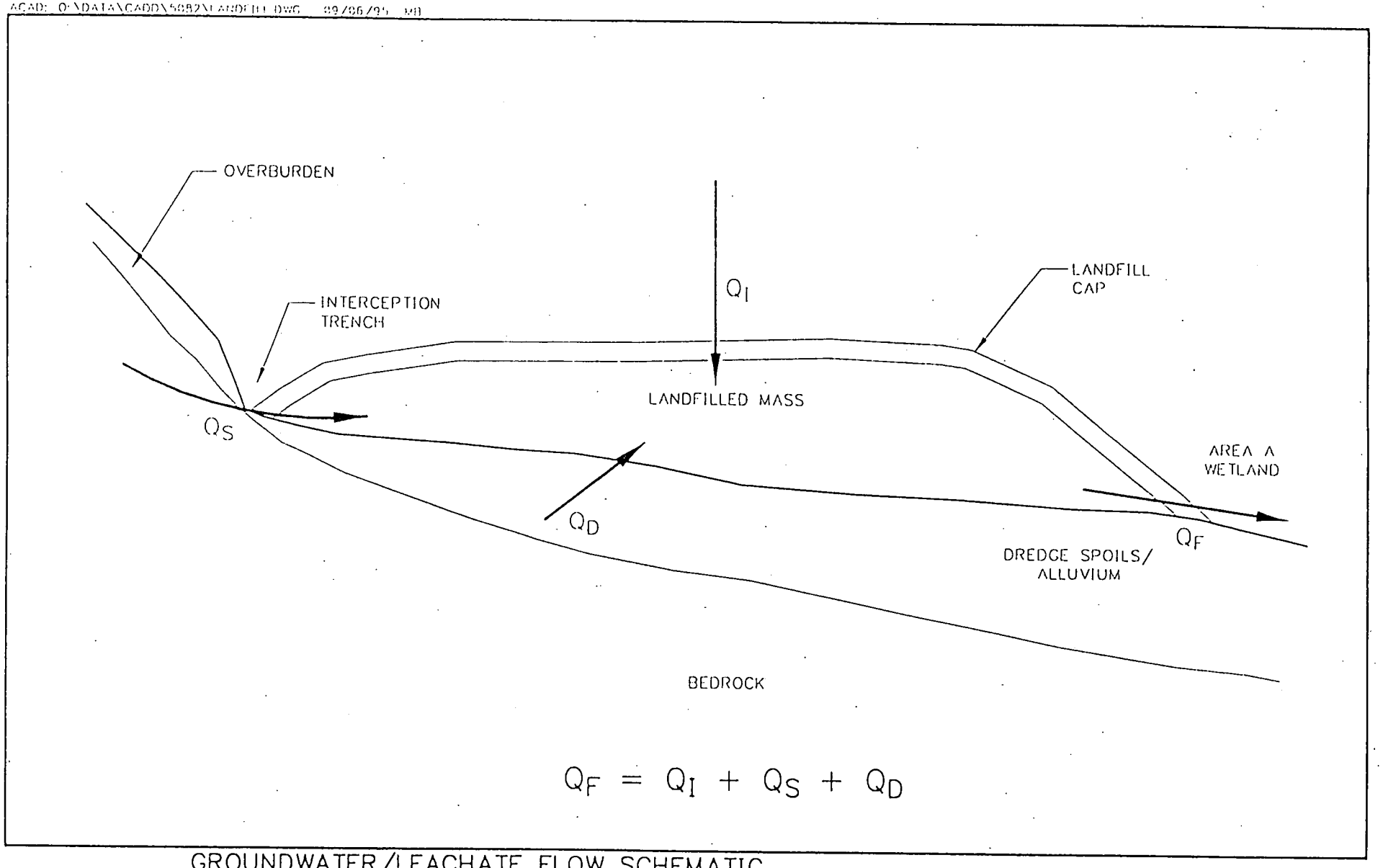

$$Q_F = Q_I + Q_S + Q_D$$

GROUNDWATER/LEACHATE FLOW SCHEMATIC
AREA A LANDFILL
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

FIGURE 1-1

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The sequence of activities for the Groundwater/Leachate Modeling Study is shown on Figure 1-2 and will consist of three main steps:

The first step will consist of gathering the necessary site-specific geological, hydrogeological, geotechnical, and analytical data to fulfill the objectives of the Groundwater/Leachate Modeling Study. This information includes pertinent data from previous site investigations as well as new data which will be obtained from an additional field investigation.

The second step will consist of the modeling effort itself. The site-specific information gathered during the first step will be fed into proven electronic softwares (HELP and MODFLOW) to develop a realistic representation of the existing and future hydrogeological conditions in and around the Area A Landfill.

The third step will consist of using the models developed during the second step to predict changes in hydrogeological conditions and contaminant migration as a result of the installation of an upgradient interception trench and impervious landfill cap, with or without a toe drain system. These predictions will then replace previous assumptions and the slope stability analysis of the gabion-reinforced toe of the current landfill cap design will be refined and compared to that of a cap featuring a toe drain system. As part of the modeling study's third step, some of the new geotechnical data gathered during the first step will also be used to refine the dredge spoils stability and cap settlement analyses.

1.3 Work Plan Organization

This letter work plan includes seven (7) sections. Section 1 is this brief introduction. Section 2 discussed the review of the existing data and the determination of additional data requirements. Section 3 describes the field investigation which will be performed to obtain the additional site-specific data required to support the modeling effort. Section 4 describes the modeling effort itself. Section 5 discusses the interpretation of the modeling results and the comparison of cap design options. Section 6 provides an outline of the Groundwater/Leachate Modeling Study report. Section 7 describes the sequence and purpose of the technical meetings and presentations associated with the Groundwater/Leachate Modeling Study. A Field Sampling and Analysis Plan (FSAP) is attached to the work plan as Appendix A to describe the well and piezometers installation, sampling, and geotechnical and analytical testing procedures for the field investigation. Oversize figures illustrating the field investigation are attached as Appendix B.

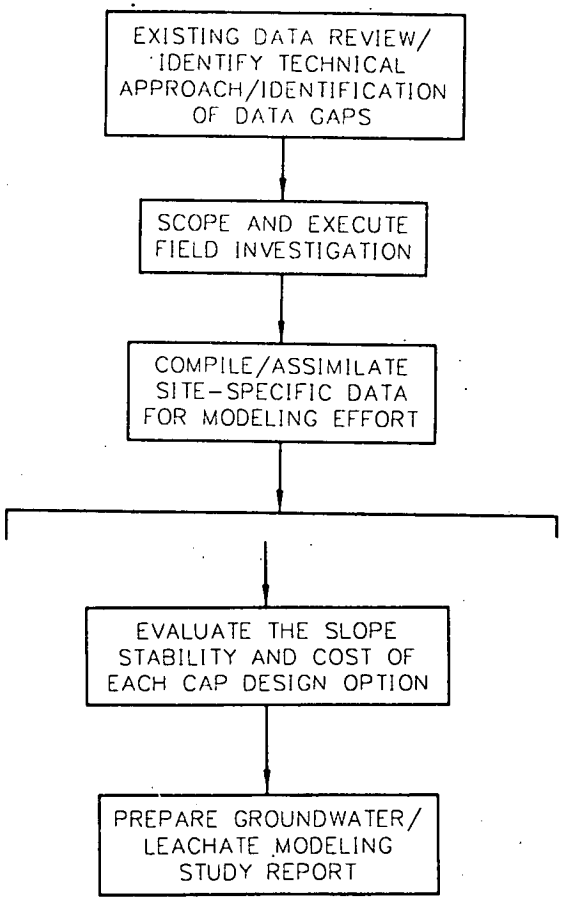
2.0 EXISTING DATA REVIEW

The existing geological and hydrogeological data from the previous above-mentioned site investigations was reviewed for use as modeling input and to determine additional data requirements.

The results of this review, which is essentially complete, revealed that the following additional data was required to support the modeling effort:

- Surface permeability data to model Q_i under existing conditions
- Horizontal hydraulic conductivity data to model Q_s
- Groundwater elevation and horizontal and vertical hydraulic conductivity data to model Q_g
- Geologic data to refine site stratigraphy and define model layers
- Upgradient groundwater hydrogeological data to determine modeling boundary conditions
- Groundwater and surface water elevation data to calibrate the groundwater model
- Groundwater/leachate quality data to compute contaminant transport and loading

In addition, it was determined that additional geotechnical data was required to refine the stability and settlement analyses of the dredge spoil in structurally sensitive areas of the currently designed landfill cap.



GROUNDWATER/LEACHATE MODELING STUDY APPROACH
AREA A LANDFILL
NAVAL SUBMARINE BASE – NEW LONDON
GROTON, CONNECTICUT

FIGURE 1-2

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3.0 FIELD INVESTIGATION

3.1 Objectives, Approach, and Rationale

The objective of the field investigation is to obtain the additional site-specific data identified in Section 2.0 above.

The site-specific surface permeability data required to model Q_t will be obtained by performing percolation tests at locations selected as representative of current landfill cover conditions.

The site-specific horizontal hydraulic conductivity data required to model Q_s will be obtained by performing slug tests in existing and new wells installed in the landfilled mass and underlying overburden along transects selected as representative of the most significant site hydrogeological conditions.

The site-specific groundwater elevation and vertical and horizontal hydraulic conductivity data required to model Q_0 will be obtained by measuring groundwater level in newly installed upgradient bedrock wells and dredge spoil/alluvium wells and by testing for permeability samples of dredge spoil or alluvium collected from the above-mentioned new wells installed in the overburden underneath the landfilled mass.

The site-specific geological data required to refine site stratigraphy and define model layers will be obtained from the boring logs of the new piezometers, wells, and soil boring.

The site-specific data required to develop groundwater/leachate model boundary conditions will be obtained by performing slug tests in newly installed upgradient bedrock wells and by measuring the flow of the groundwater seep in the dike at the western end of the landfill into the OBDA.

The site-specific data required to calibrate the groundwater/leachate model will be obtained by taking groundwater elevation measurements for newly installed piezometers and existing and newly installed staff gauges and overburden and bedrock wells.

The site-specific geotechnical data required to refine the dredge spoil stability and settlement analyses will be obtained by testing for triaxial compression samples of dredge spoil collected from a new soil boring installed at the proposed location of the crane test pad and from that of the above-mentioned new overburden wells with the weakest dredge spoils strength as determined by the lowest blow count.

The site-specific data required to develop a conceptual mass flux model for contaminant transport will be obtained by collecting and analyzing the groundwater seep in the dike at the western end of the landfill into the OBDA.

The surface water level in the wetland will be measured by installing new staff gauges along the wetland-landfill boundary.

As part of the field investigation, the location of all new piezometers, wells, and staff gauges will also be surveyed.

3.2 Description

3.2.1 Percolation Tests

Percolation tests will be performed in locations deemed to be most representative of the following five types of existing landfill cover:

- Roadway surfaces
- Graveled areas near roadway surfaces

Sand storage area
Deployed parking area
- Vegetated areas

Two percolation tests will be performed for each of the above-listed type of surface soil for a total of ten (10) percolation tests. Percolation tests will be performed in accordance with the U.S. Department of Interior (DOI) Bureau Of Reclamation, Method Des-E.18 (Earth Manual, 2nd. Edition, 1974). A detailed description of the percolation test procedures is also provided in the FSAP attached to this work plan as Appendix A.

3.2.2 Installation Of New Piezometers, Wells, and Staff Gauges

As shown on Figure 3-1, new piezometers, wells, and staff gauges will be installed along three transects on and around the Area A Landfill, including A-A' crossing the west end of the landfill, B-B' crossing the deployed parking, and C-C' crossing the east end of the landfill. Cross sections of transects A-A', B-B', and C-C' are shown on Figures 3-2, 3-3, and 3-4, respectively. Figures 3-1 through 3-4 are attached to this work plan as Appendix B.

It is important to gather information along three transects because of geological and hydrogeological differences across the landfill. For example, the depth to bedrock and alluvium thickness are greater along transects B-B' and C-C' than along transect A-A'. While the total thickness of the landfilled mass is fairly consistent (based on existing boring logs), the saturated thickness of that mass is less along transect A-A' than along transects B-B' or C-C'. Another example is that a comparison of the groundwater level measurements taken in March, 1994 to those taken in August, 1994 (Phase II RI) shows a variation of 7 feet upgradient of transect B-B' but of only about 2 to 3 feet upgradient of transects A-A' and C-C'.
The location of each transect was selected as being representative of significant and site-specific hydrogeological conditions and to maximize the use of existing data points.

Transect A-A'is located at the west end of the landfill because in this area there is little evidence of groundwater or leachate discharge from the toe of the landfill into the adjacent wetland which is most often relatively dry. Also, in this area existing upgradient overburden/bedrock well clusters (4MW1S, 4MW1D, 4MW4S, 4MW4D) are available for testing and there are a large number of existing soil borings data points.

Transect B-B' is located across the deployed parking because in this area, in contrast to the west end of the landfill, surface water is most often present in the wetland immediately adjacent to the landfill toe. In this area there is also evidence of a much greater thickness of alluvium in the overburden underneath the dredge spoil and landfilled mass. Finally, an existing upgradient overburden/bedrock well cluster (2LMW8S, 2LMW8D) is available in this area for testing.

Transect C-C' is located at the east end of the landfill because, in this area, it is not known if dredge spoil materials are present and there is also evidence of a great thickness of alluvium in the overburden underlying the landfilled mass. An existing upgradient overburden/bedrock well cluster (2LMW20S, 2LMW20D) is also available in this area for testing.

Along each transect, it is important to gather information from at least two well clusters so that the shallow groundwater flow gradient toward the wetland and the upward gradient from materials beneath the landfilled mass can be established. Along each transect the following new data points will be installed:

- One (1) staff gauge in the wetland at the wetland-landfill interface
- One (1) drive-point piezometer at the wetland-landfill interface
- Two (2) overburden wells installed in the landfilled mass
- Two (2) overburden wells installed in the dredge spoil or alluvium underlying the landfilled mass

A total of three (3) new piezometers, twelve (12) new overburden wells, and three (3) staff gauges will be installed along transects A-A', B-B', and C-C'. An additional five (5) new staff gauges will also be installed along the wetland-landfill boundary between the transects.

In addition, to establish hydrogeological boundary conditions, two (2) new upgradient bedrock wells will be installed near Wahoo Avenue at the top of the hill overlooking the landfill.

Finally, to determine dredge spoil strength under the proposed new location for the crane test pad, one (1) new soil boring will be installed at that location.

Staff gauges and piezometers will be hand-driven, overburden wells and soil boring will be drilled with a hollow stem auger, and bedrock wells will be drilled with a rotary roller bit. Detailed information regarding piezometers and wells size, construction, and installation procedure is provided in the FSAP which is attached to this Work Plan as Appendix A.

3.2.3 Groundwater and Surface Water Elevation Measurements

One (1) round of groundwater elevation measurements will be taken from each existing well and each new piezometer and well. A total of fifty-two (52) groundwater elevation measurements will be taken, including:

- Thirty-five (35) in existing wells,
- Fourteen (14) in new wells, and
- Three (3) in new piezometers,

Groundwater elevation measurements will be taken in accordance with the procedure described in the FSAP attached to this work plan as Appendix A.

One (1) round of surface water measurements will be taken from the existing staff gauge located at the discharge of the wetland into the Area A Downstream and from each new staff gauge installed at the wetland-landfill boundary. A total of nine (9) surface water elevation measurements will be taken in accordance with the procedure described in the FSAP attached to this work plan as Appendix A.

3.2.4 Slug Tests

One slug test will be performed in the each of the two existing bedrock wells located along transects B-B' (2LMW8D) and C-C' (2LMW20D), each of the twelve new overburden wells located along transects A-A', B-B' and C-C', and each of the two new upgradient bedrock wells. A total of sixteen (16) slug tests will be performed in accordance with the procedure described in the FSAP attached to this work plan as Appendix A.

3.2.5 Shelby Tube Samples Collection and Testing

Shelby Tube samples of dredge spoil material will be collected from the new overburden wells installed in the dredge spoil or alluvium along transects A-A', B-B', and C-C'. A Shelby Tube sample will also be collected from the new soil boring installed at the proposed location of the crane test pad. A total of nine (9) Shelby Tube samples will be collected, including one sample from each of the six new overburden wells and one sample from the new soil boring plus a second sample from one of the wells and from the soil boring. Shelby Tube samples will be collected in accordance with the procedure described in the FSAP attached to this work plan as Appendix A.

One Shelby Tube sample from each new dredge spoils/alluvium overburden well will be tested for permeability. A total of six (6) Shelby Tube samples will be tested for permeability in accordance with ASTM 5084 and as further described in the FSAP attached to this work plan as Appendix A.

Two (2) of the nine Shelby Tube samples collected will be tested for triaxial compression. One of these samples will be collected from the new soil boring installed at the proposed new location of the crane test pad and the other sample will be collected from the new overburden well which exhibits the lowest blow count in the dredge spoil/alluvium strata. Triaxial compression testing will be performed in accordance to ASTM D 4318 and as further described in the FSAP attached to this work plan as Appendix A.

3.2.6 Groundwater Seep Flow Measurement, Sampling, and Analysis

One (1) flow measurement will be taken on the groundwater seep discharging from the western landfill dike into the OBDA. The flow of this seep shall be measured with a flume or weir system in accordance with the procedure described in the FSAP attached to this work plan as Appendix A.

One (1) grab sample will be collected from this groundwater seep and analyzed for TCL VOCs, TCL SVOCs, TCL Pesticides/PCBs, and TAL Metals. Sampling and analyses will be performed in accordance with the procedures described in the FSAP attached to this work plan as Appendix A.

4.0 MODELING

4.1 Approach and Rationale

Infiltration (HELP) and three-dimensional groundwater flow modeling (MODFLOW) will be conducted to verify the effects of the proposed landfill cap, upgradient interception trench, and potential toe drain system on the hydrogeologic conditions at the Area A Landfill. In addition, a simple mass flux model will be used to estimate the quality of the leachate which would be discharged from the landfill into the adjacent wetland.

Infiltration and groundwater flow modeling are frequently used to evaluate the effects of design alternatives. Various models exist and can be applied to a variety of natural conditions. Typically, models are selected based on their technical applicability, cost-effectiveness, and ease-of-use and all of these criteria have been considered for this task. U. S. EPA's Hydrologic Evaluation of Landfill Performance (HELP) model will be used to conduct the modeling task as well as the United States Geological Society's MODFLOW model and mass flux equations. A brief description of each model's capabilities is provided in the following section.

The sequence of modeling activities is summarized on Figure 1-2 and will be as follows:

1. Develop conceptual models and the actual HELP models necessary to adequately describe the infiltration conditions under existing and proposed scenarios. Use rainfall data from the local airport and any other available site-specific data as input. Perform model runs.

2. Perform sensitivity analysis on key HELP model parameters to determine a range of predicted infiltration rates. Use worst-case and average infiltration predictions as input to the MODFLOW model.

3. Develop conceptual model and MODFLOW model input file for existing conditions.

4. Calibrate the MODFLOW model for existing conditions by comparing predicted steady-state heads against one comprehensive round of water level measurements and by matching flow gradients between the bedrock and overburden material. Calibration targets are discussed below.

5. Validate the MODFLOW model for existing conditions by comparing predicted steady-state heads against another round of water level measurements. The model should be able to predict the heads within a predetermined goal. If not, the model will be re-calibrated and then validated until it is acceptable. Details on the validation procedure are discussed below.

6. Using the calibrated and validated MODFLOW model for existing conditions, perform sensitivity analysis on key parameters to determine the upper and lower bounds of the predicted water table. Further discussion of the sensitivity procedure is given below.

7. Using the existing conditions MODFLOW model as a base, create separate MODFLOW models to simulate the conditions resulting from landfill cap, upgradient interception trench, and potential toe drain system. Perform simulations.

8. If necessary, use the MODFLOW model results in MODPATH (particle tracking) to verify the capture zone of the proposed interception trench and/or the OBDA leachate breakout.

9. Using the modeling results, estimate the surface infiltration rate, the saturated thickness of fill material, and the total groundwater/leachate flow from the landfill before and after installation of the landfill cap, upgradient interception trench, and potential toe drain system. Using the leachate rate and mass-flux equations, estimate a worst-case scenario of the quality and contaminant loading rate of the leachate.

4.2 Models Description

The models which will be used include HELP, MODFLOW, and possibly MODPATH. A brief description of the models and their capabilities are given below.

4.2.1 HELP Model

The Hydrologic Evaluation of Landfill Performance (HELP) model (U.S. EPA) is a quasi two-dimensional hydrologic model of water movement across, into, through, and out of a waste area. The model accepts climatologic, soil and design data and simulates a number of hydraulic processes including surface storage, runoff, infiltration, percolation, evapotranspiration, soil moisture storage and lateral drainage. The systems that can be modeled by HELP include various combinations of vegetation, cover soil, waste cells, special drainage layers and relatively impermeable barrier soil.

The identification of each layer used in the model is critical because the program models water flow through the various types of layers in different ways. Runoff is computed using the Soil Conservation Service (SCS) runoff curve number method by considering daily precipitation totals. Percolation and vertical water routing are modeled using Darcy's Law for saturated flow with modifications for unsaturated conditions. Evapotranspiration is estimated by a modified Penman method adjusted for limiting soil moisture conditions.

4.2.2 MODFLOW Model

The modular three-dimensional finite-difference groundwater flow model know as MODFLOW was developed by the U.S. Geological Survey to simulate groundwater flow in a variety of situations. MODFLOW uses a block-centered grid for solving the finite-difference equations. This model can be used for two- or three-dimensional applications, and can simulate the effects of aquifers with anisotropic, heterogeneous hydrogeologic properties, spatially varying aquifer thickness and/or aquifer bottom elevation, distributed aerial recharge, wells, drains, rivers as well as, a variety of boundary conditions. This model has been used extensively at Superfund sites and industrial hazardous water sites for simulation of groundwater flow, evaluation of remedial alternatives and can be used in conjunction with other modular programs to model contaminant transport (MT3D) and particle tracking (MODPATH). The model has been reviewed and accepted by many regulatory agencies.

4.2.3 MODPATH Model

MODPATH is a three-dimensional particle tracking code that was developed by the U.S. Geological Survey. MODPATH utilizes hydraulic heads calculated by MODFLOW to determine the flow path of a particle from

its initial position to its final position. MODPATH can also indicate time of travel from one point to another point and can use reverse particle tracking to determine the source of water extracted from wells. Particle tracking is done under steady-state conditions and simulates advection-based transport.

4.3 Conceptual Models

Conceptual models are useful tools which summarize the modeler's understanding of a natural system. It is proposed that conceptual models be created to understand the natural systems to be modeled by the infiltration, groundwater flow, and contaminant mass flux models. Conceptual model development includes summarizing available data, interpreting the data and creating a representative figure of the system to be modeled.

Existing data, as well as, newly collected data will be used to create the conceptual models of the existing hydrologic system at the Area A Landfill. The existing hydrologic system includes groundwater flow, surface water/runoff flow, infiltration, evapotranspiration and interception/storage. The existing contaminant migration system includes leachate generation from source material, leachate migration to the aquifer, adsorption/desorption of contaminants to and from the aquifer media, transport of the contaminants via advection and dispersion in the groundwater, and natural decay of contaminants.

Conceptual models of the proposed conditions at the landfill after construction will also be created to account for the landfill cap, upgradient interception trench, and potential toe drain system. As with the existing conditions, separate conceptual models will be created for the infiltration, groundwater flow, and contaminant mass flux systems for proposed conditions.

Conceptual models for the Area A Landfill hydrologic system were developed as part of the existing data review and scoping of the field investigation. These models are shown on Figures 3-2 through 3-4. These models were developed using only existing data and will be updated with the new data obtained from the field investigation. Contaminant transport conceptual models have not yet been developed but will be developed as part of this modeling effort.

4.4 Model Calibration

4.4.1 HELP Model

A limited calibration of the HELP model will be performed. Model parameters such as hydraulic conductivity, soil type and layer thickness will be fixed for the modeling. Initial moisture content of the soil however is typically not known and is usually calibrated using the HELP model. This involves several iterations of the model with updated estimates of the initial moisture content until equilibrium conditions are reached (i.e., the initial moisture content and the final moisture content for a layer are equal).

4.4.2 MODFLOW Model

The MODFLOW model simulating existing conditions will be calibrated by comparing predicted steady-state heads to measured steady-state heads. The comparison will include calculating the head difference (measured versus predicted) at selected points within the model boundary. It is likely that head measurements from monitoring wells will be translated to model grid block centers to make the comparisons. Model parameters will be adjusted to minimize the overall deviation between the predicted and measured heads. Model input such as hydraulic conductivity and boundary conditions are typical model data which can be modified during calibration. As a target for calibration, the deviation between the modeled and measured heads should be less than the natural fluctuation seen in the water table over time. Water levels have been measured over a year in several wells in the Area A Landfill for the Phase II RI and this data will be used to estimate the natural variation of the groundwater table elevation.

In addition to calibration of the heads, the predicted flow directions of the 3-dimensional MODFLOW model will also be verified against the actually measured flow gradients between the bedrock and overburden. Modifications will be made to model parameters (most likely vertical hydraulic conductivity) until the predicted flow directions and gradients reasonably match the existing conditions.

4.5 MODFLOW Model Validation

Validation is the process of comparing the calibrated model to another, independent, data set for the groundwater regime. This data set should be from another historical period, but lacking data for two historical periods, a single data set can be split up to provide both calibration and validation data sets. The validation procedure will demonstrate the predictive capability of the calibrated site model. The use of two data sets, if they corroborate each other, add a degree of confidence to the model.

The calibrated MODFLOW model will be validated by using it to predict steady-state heads under different conditions for comparison against actual water level measurements taken under the different conditions. The model should be able to predict the heads within a predetermined goal without changing any model parameters with the exception of model boundary conditions. The natural fluctuation of the groundwater table will be used as the goal for the validation procedure. If the model can not, the model will be re-calibrated and then validated until it is acceptable. A detailed review of the initial calibration data set will be made to determine if a significant process was ignored or improperly defined.

4.6 Sensitivity Analyses

Sensitivity analyses will be conducted on model parameters for both the HELP and MODFLOW models. Model parameters will be modified independently to determine their individual impact on model predictions. A final sensitivity simulation will also be conducted to determine a worst-case scenario. This scenario will evaluate the impact of all of the parameters within one model simulation.

Model parameters which have the most uncertainty and/or have the biggest influence on model results will be targeted for sensitivity analysis. For example, in the HELP model parameters such as vegetative conditions, Soil Conservation Service Curve Number (SCS CN), layer thickness, and vertical hydraulic conductivity will most likely be targeted for sensitivity analysis. For the MODFLOW model, boundary conditions, recharge, horizontal and vertical hydraulic conductivity, and layer thicknesses are typical input data which will be targeted for sensitivity analysis.

4.7 Contaminant Transport and Landfill Discharge Quality

Contaminant transport and the quality of the landfill discharge will be estimated using a mass-flux equation and the results of the HELP and MODFLOW models. Existing contaminant data for the soil and groundwater in the Area A landfill area will be summarized and average concentrations in each media will be determined. Only the most significant Contaminants Of Concern (COCs) from the Phase II RI will be evaluated. Contaminant loading from the vadose zone will be estimated from the soils concentrations, default leaching coefficients and HELP model output. The estimated contaminant concentration and flow rates will be combined to determine the mass loading rate under existing and proposed conditions. Contaminant loading from the saturated landfill material to the wetland will be estimated in a similar manner as the vadose zone. The average concentration of contaminant in the groundwater will be used with the estimated groundwater discharge rate from MODFLOW to determine the mass loading rate to the wetland under existing and proposed conditions. Details of the proposed calculations are presented in Section 5.1 below.

5.0 DATA ANALYSIS

5.1 Evaluation Of Modeling Results

5.1.1 Impact Of Cap Configuration On Hydrogeologic Conditions

The results of the HELP and MODFLOW modeling will be used to determine the impact of cap configuration on hydrogeologic conditions at the Area A Landfill. The HELP results will be used to determine areal infiltration rates around the Area A Landfill and the impact the cap configuration has on the quantity of infiltration recharging the aquifer. Estimates of the leachate discharge rate from the saturated fill of the Area A Landfill, the flow rate in the proposed interception trench, the flow rate in the proposed toe drain, and the vertical recharge rate of the dredge spoils to the fill material will be made using the MODFLOW results. Figures 3-2, 3-3, and 3-4 represent the conceptual models of the hydrogeologic system for the Area A Landfill.

Estimates of the existing infiltration rates at the Area A Landfill will be made using the HELP model. Six zones will be selected to represent the Area A Landfill infiltration conditions (5 on plateau of landfill and one on toe) and infiltration rates will be estimated for each. A description of the five ground cover types that represent the existing landfill cover is presented in Section 3.2.1. The HELP model will also be used to estimate the existing infiltration rate for the bedrock hillside upgradient of the Area A Landfill. This infiltration rate is not included in the following calculations. A total infiltration rate ($Q_{I\ existing}$) will be estimated for the entire landfill by summing the infiltration rates for each of the six zones as per Equation 5-1:

$$Q_{I\ existing} = \sum_{i=1}^{i=6} Q_{I\ Zone_i} \qquad (5\text{-}1)$$

Where: $Q_{I\ existing}$ = Total Existing Infiltration Rate (m^3/yr)
$Q_{I\ Zone\ i}$ = Zone i Existing Infiltration Rate (m^3/yr)

Estimates of the infiltration rate at the Area A Landfill after capping will also be made using the HELP model. Two zones will be selected to represent capped infiltration conditions at the Area A Landfill. The first zone will be the main portion of the landfill which will be covered with a uniform cap. The second zone will be the toe of the capped landfill, which will have a steeper slope compared to the main portion of the landfill. A total infiltration rate ($Q_{I\ capped}$) will be estimated for the entire landfill by summing the infiltration rates for the two zones as per Equation 5-2:

$$Q_{I\ capped} = \sum_{i=1}^{i=2} Q_{I\ Zone_i} \qquad (5\text{-}2)$$

Where: $Q_{I\ capped}$ = Total Capped Infiltration Rate (m^3/yr)
$Q_{I\ Zone\ i}$ = Zone i Capped Infiltration Rate (m^3/yr)

The impact of the cap configuration on the infiltration rate will be determined by taking the ratio of the difference of the two total infiltration rates to the total existing infiltration rate and the impact will be presented as a percent reduction as per Equation 5-3:

$$\%\ Reduction = \frac{Q_{Iexisting} - Q_{Icapped}}{Q_{Iexisting}} \times 100 \qquad (5\text{-}3)$$

Increased runoff due to the cap and infiltration intercepted by the cap drainage layer will be discharged directly into the Area A Wetland. The approximate increase in quantity of discharge due to the cap would be the difference between $Q_{lexisting}$ and $Q_{lcapped}$.

Estimates of the groundwater/leachate discharge rate from the saturated landfilled mass of the Area A Landfill will be made using the MODFLOW results. In addition, the modeling results will be used to estimate the quantity of groundwater to be intercepted by the upgradient interception trench and a potential toe drain system.

Using the MODFLOW-predicted steady-state water table elevation for existing conditions, an estimate of the current groundwater/leachate discharge rate to the Area A Wetlands will be made. The estimate will require the following procedures:

(1) Estimate the hydraulic gradient for each MODFLOW model block adjacent to the toe of the landfill using the predicted heads of two adjacent MODFLOW model blocks as per Equation 5-4:

$$i_{i,j} = \frac{H_{i,j+1} - H_{i,j}}{X} \qquad (5\text{-}4)$$

Where: i = Hydraulic Gradient between Block (i,j) and (i,j+1) (m/m)
$H_{i,j}$ = Hydraulic Head in Block (i,j) (m)
$H_{i,j+1}$ = Hydraulic Head in Block (i,j+1) (m)
X = Distance Between Block (i,j) and (i,j+1) (m)

(2) Using the hydraulic gradient, the hydraulic conductivity for the block, and Darcy's Equation, estimate the groundwater velocity for each block as per Equation 5-5:

$$V_{i,j} = i_{i,j} \times K_{i,j} \qquad (5\text{-}5)$$

Where: $V_{i,j}$ = Darcy's Velocity for Block (i,j) (m/yr)
$K_{i,j}$ = Horizontal Hydraulic Conductivity for Block (i,j) (m/yr)

(3) Using the MODFLOW predicted water table elevation estimate the thickness of the saturated fill material and the discharge area in the direction of flow as per Equation 5-6:

$$A_{i,j} = T_{i,j} \times W_{i,j} \qquad (5\text{-}6)$$

Where: $A_{i,j}$ = Discharge Area for Block (i,j) (m^2)
$T_{i,j}$ = Thickness of Saturated Landfilled Mass in Block (i,j) (m)
$W_{i,j}$ = Width of Block (i,j) perpendicular to groundwater flow direction (m)

(4) Estimate the leachate discharge rate for an individual block as per Equation 5-7 and then estimate the total discharge rate along the length of the landfill as per Equation 5-8:

$$Q_{F_{ij}} = A_{i,j} \times V_{i,j} \qquad (5\text{-}7)$$

Where: Q_{fij} = Groundwater/Leachate Discharge Rate for Block (i,j) (m^3/yr)

$$Q_F = \sum_{i=1}^{i=x} Q_{F_{ij}} \tag{5-8}$$

Where: Q_F = Total Groundwater/Leachate Discharge Rate from Area A Landfill (m^3/yr)
x = Total Number of Blocks (dimensionless)

A similar procedure will be conducted using MODFLOW-predicted future conditions to estimate the groundwater/leachate discharge rate.

The quantity of groundwater to be collected by the interception trench and the quantity of groundwater/leachate collected by a potential toe drain system will be estimated in a similar manner as the one presented above for the total groundwater/leachate discharge rate. For both the interception trench and the potential toe drain system, the MODFLOW-predicted heads for capped conditions will be used to estimate Darcy's groundwater velocity for a model block. The bottom elevation of the trench and toe drain will be used to estimate the thickness and discharge area for a model block along each channel. Individual groundwater discharge rates will be estimated from each model block along the interception trench and toe drain ($Q_{trench\ i,j}$ and $Q_{toe\ i,j}$), respectively and then a total groundwater discharge rate will be estimated for each channel (Q_{trench} and Q_{toe}) by summing the individual flow rates. A cross-sectional flow net analysis will be used to check the estimates of Q_{trench} and Q_{toe}.

It should be noted that the groundwater flow rates (Q_{trench} and Q_{toe}) are not total flow rates and do not account for surface water runoff from the upgradient slope which will be collected by the interception trench or runoff from the landfill which could be collected by the toe drain. To determine a total flow rate for these two trenches, runoff would have to be accounted for. The runoff flow rates to the trench and toe drain will be substantially greater than the groundwater flow rates and the runoff flow rates should be used to size the trenches. The groundwater flow rates should be considered as the base flow in each of the trenches.

The vertical recharge rate of the dredge spoil/alluvium to the landfilled mass will also be estimated in a similar manner as the one presented above for the total groundwater/leachate discharge rate with several minor differences. The MODFLOW-predicted heads for the dredge spoil/alluvium layer and the fill layer will be used to calculate the vertical hydraulic gradient between the two layers. The vertical gradient and the vertical hydraulic conductivity for a block will be used in Darcy's equation to estimate the vertical groundwater flow velocity. The velocity will be used with the surface area of the block to determine the block-specific vertical recharge rate ($Q_{D_{i,j}}$). The total vertical recharge rate from the dredge spoil/alluvium (Q_D) will then be estimated by summing the block-specific rates.

As a final step, a mass balance will be performed on the estimated flow rates to determine if there is agreement in the flow rates and to determine the magnitude of each flow rate's contribution to the overall groundwater/leachate discharge rate. This calculation will be performed for existing and future conditions. The flow rates discussed above (Q_D, Q_F, $Q_{I\ capped}$, $Q_{I\ existing}$, Q_{trench} and Q_{toe}) will be used in the calculations, in addition to, the estimated shallow groundwater flow rate from the upgradient overburden into the landfilled mass (Q_S). Q_S will vary from existing conditions to proposed conditions due to the upgradient interception trench. Equations 5-9 through 5-10 summarize the mass balances which will be performed for the conditions to be evaluated. Equation 5-9 summarizes the mass balance for existing conditions:

$$Q_{F_{existing}} = Q_{D_{existing}} + Q_{S_{existing}} + Q_{I_{existing}} \tag{5-9}$$

Equation 5-10 summarizes the mass balance for proposed conditions without the toe drain:

$$Q_{F_{capped}} = Q_{D_{capped}} + Q_{S_{capped}} + Q_{I_{capped}} \quad (5\text{-}10)$$

Equation 5-11 summarizes the mass balance for proposed conditions if a toe drain system were installed:

$$Q_{F_{capped}} = Q_{D_{capped}} + Q_{S_{capped}} + Q_{I_{capped}} - Q_{toe} \quad (5\text{-}11)$$

5.1.2 Impact Of Cap Configuration On Contaminant Migration

The impact of the proposed cap configuration will be evaluated by using the infiltration and groundwater flow modeling results, currently available analytical data, and literature parameters. Calculations will be performed to estimate average COC concentrations using current groundwater and soil analytical data. Estimates of current and future average contaminant mass loading rates from source material in the unsaturated zone to the saturated fill zone will also be made. Finally, current and future average contaminant mass loading rates from the saturated fill zone to the Area A Wetland will be estimated.

Groundwater and soil analytical data from the draft Phase II Remedial Investigation Report (Halliburton NUS, February 1995) and the Focused Feasibility Study for the Area A Landfill (Atlantic, May 1995) will be reviewed and summarized. An appropriate average concentration will be determined for each of the COCs in each media. COCs that contribute significantly to the risk of the site, are the most prevalent, and are most mobile will be the focus of the calculations. An average landfilled mass concentration for COC "i" (C_{si}) will be used to estimate the average mass loading rate of the COC to the aquifer. The average groundwater concentration for COC "i" (C_{gwi}) will be used to calculate the average mass loading rate of the COC to the Area A Wetland.

<u>Estimate Contaminant Loading from Landfilled Mass</u>

The mass loading rate of COC "i" from the landfilled mass will be calculated using estimated flow rates, C_{si} and K_L, which is a contaminant- and soil-specific source leaching coefficient. This coefficient is a measure of a contaminants mobility due to dissolution and desorption from the source. Values of K_L will be determined from site-specific data, if available, or from literature sources. C_{si} and K_L can be used to define the initial aqueous loading of a contaminant and the following equation will be used:

$$C_{L_i} = \frac{C_{s_i}}{K_L} \quad (5\text{-}12)$$

Where: C_{Li} = Initial Leachate Concentration for COC "i" (mg/L)
C_{si} = Average Soil Concentration for COC "i" (mg/kg)
K_L = Source Leaching Coefficient (L/kg)

To be conservative (i.e., neglecting contaminant transport through the vadose zone, decay, and source depletion), the average mass loading rate for the COC will be estimated by Equation 5-13:

$$M_{COC_{S\,i}} = \frac{C_{L_i} \times Q_{I_{existing}}}{1000} \qquad (5\text{-}13)$$

Where: $M_{COC\,Si}$ = Average Mass Loading Rate of COC "i" from Source (kg/yr)
C_{Li} = Initial Leachate Concentration For COC "i" (mg/L)
$Q_{Iexisting}$ = Total Existing Infiltration Rate (m^3/yr)

A similar calculation will also be made for the proposed cap conditions. The two estimated mass loading rates (existing and capped) will be compared to determine the percent reduction in mass loading to the aquifer that is attributable to the cap.

Estimate Contaminant Loading from Groundwater

The mass loading rate of COC "i" from the groundwater (i.e., saturated fill layer of the Area A Landfill) to the Area A Wetland will be calculated using estimated flow rates and C_{gwi}. In addition, an estimate of the current mass of COC "i" in the aquifer material (saturated fill material) will be made using C_{gwi} and K_d, which is a contaminant- and soil-specific distribution coefficient. This coefficient is a measure of a contaminant's affinity to adsorb/desorb from aquifer medium. Values of K_d will be determined from site-specific data, if available, or from literature sources.

As a reasonable estimate (i.e., accounting for limited contaminant transport through the aquifer and neglecting decay), the average mass loading rate for the COC from the fill material of Area A Landfill under existing flow conditions will be estimated by Equation 5-14:

$$M_{COC_{gw\,i}} = \frac{C_{gw_i} \times Q_{F_{existing}} \times 1000}{R_d} \qquad (5\text{-}14)$$

Where: $M_{COC\,gwi}$ = Average Mass Loading Rate of COC "i" from Groundwater (kg/yr)
C_{gwi} = Average Groundwater Concentration For COC "i" (mg/L)
$Q_{Fexisting}$ = Total Existing Groundwater/Leachate Discharge Rate (m^3/yr)
R_d = COC- and Soil-Specific Retardation Factor (unitless)

R_d can be estimated by Equation 5-15:

$$R_d = 1 + \frac{\rho(\frac{K_d}{1000})}{n} \qquad (5\text{-}15)$$

Where: ρ = Bulk Density of Material (kg/m^3)
K_d = Distribution Coefficient (L/kg)
n = porosity

A similar calculation will be made to estimate the average mass loading rate under proposed groundwater flow conditions.

The current mass of COC "i" in the aquifer material (saturated fill material) will be made using Equation 5-16:

$$M_{COC_{aqi}} = \frac{C_{gwi} \times K_d \times \rho \times V_F + 1000 \times (C_{gwi} \times n \times V_F)}{1 \times 10^6} \quad (5\text{-}16)$$

Where: $M_{COC\ aq\ i}$ = Mass of COC "i" in Saturated Fill Material (kg)
C_{gwi} = Average Concentration of COC "i" in Groundwater (mg/L)
K_d = Distribution Coefficient for COC "i" (L/kg)
ρ = Bulk Density of Fill Material (kg/m³)
V_F = Volume of Fill Material (m³)
n = porosity

The previously described methods will adequately evaluate the effects the proposed cap configuration will have on both the hydrogeologic conditions and contaminant migration at the Area A Landfill. All results and calculations will be presented and discussed in the study report.

5.2 Revised Slope Stability Analysis

Modeling results, together with the blow count measurements from wells and soil borings installation and the results from the triaxial compression testing of the Shelby Tube dredge spoil samples, will be evaluated to determine the need for revision of the previously performed landfill slope stability analyses.

5.2.1 Groundwater Table Conditions

The previously performed stability analyses for the northern sideslope portion of the Area A Landfill were based upon an assumed groundwater condition, corresponding to approximately four (4) feet above the toe of the slope. The basis for this conservative assumption was the result of a stormwater routing analysis, performed for the adjacent Area A Wetlands, that indicated a maximum surface water level increase of four (4) feet during a 100-year, 24-hour storm event. In practice, it is improbable that even such a storm event could maintain a pool condition within the wetland for a sufficient period to saturate the landfilled mass to a height of four feet, yet recede rapidly enough that the increased piezometric head would not at least partially dissipate. As such, the previously performed stability analyses represent a conservative groundwater condition, with respect to the prediction of slope stability along the northern slope of the landfill. To refine the accuracy of the slope stability analysis, results of the MODFLOW groundwater model will be compared to the groundwater table conditions assumed for the previous stability analyses, and additional slope stability analyses will be performed, in the event that the conditions as predicted by the model deviate significantly from those previously assumed.

Results from the groundwater modeling will provide a refined approximation of the groundwater table following installation of the landfill cap and the upgradient groundwater interception trench. Analyses will be performed to estimate long-term, steady-state groundwater conditions, as well as the groundwater conditions resulting from a 100-year, 24-hour storm event. The higher resultant groundwater table condition will be compared to the previously assumed condition, and if the difference is greater than one (1) foot in elevation, the stability analyses will be re-run, using the groundwater table condition obtained from the groundwater model. Only the critical failure surfaces/modes, as determined from the previous analyses, will be re-evaluated.

Additional stability analyses will also be performed, using the results of groundwater modeling based upon the possible installation of a toe drain system. The stability analysis results will be utilized to quantify the effect of the toe drain system on slope stability, if any.

5.2.2 Geotechnical Conditions

A detailed evaluation will be performed of the strength characteristics of the dredge spoil material, based upon the triaxial compression test result and well/boring blow counts from the proposed field investigation as well as those currently available. Several stratigraphic cross sections through the landfill will be developed, utilizing the logs of nearby test borings. Blow counts (within the dredge spoil layer) will be plotted on the cross sections, such that any continuous, extensive zones of anomalously low-strength dredge spoil material can be identified. In addition, the locations of all pertinent triaxial compression test results will be plotted on the same cross sections. If it is judged that continuous, extensive zones of anomalously low-strength dredge spoil material exist, a correlation will be made between the triaxial compresion test results and the weaker materials. Additional stability analyses will then be conducted, that model the weaker dredge spoils as a separate substrata. Based upon a less rigorous review of relevant test boring data, it is HNUS' opinion that extensive zones of anomalously low-strength dredge spoil material are nor apparent beneath the landfill.

5.2.3 Crane Test Pad Area

THe dredge spoil traxial compression test results and blow counts measurements will be evaluated for the new soil boring installed at the proposed location of the crane test pad. If it is judged that anomalously low-strength dredge spoil material exist at this location, revised stability analyses will be performed at this location. Based upon a past review of test boring data variability across the landfill, it is Brown & Root's current opinion that the previously performed stability analyses are valid, and that no additional analyses will be required..

5.3 Revised Settlement Analysis

The previously performed settlement analysis for the Area A Landfill cover system will be revised, based upon the long-term, steady-state groundwater conditions determined from the MODFLOW groundwater model. Brown & Root anticipates that the adjustment to the assumed groundwater table condition will we relatively minor, and that the resultant revised settlement analysis will not vary significantly from the previous evaluation. Therefore, it is also anticipated that the currently proposed cover system grades will be adequate to satisfy minimum grade requirements, considering settlement effects.

5.4 Cost Estimates

In order to compare the merits and costs of a cover system only versus a cover system with a toe drain, a construction and operation/maintenance cost estimate will be prepared for the toe drain, based upon the predicted leachate collection rates for a toe drain system. The cost estimate will incorporate provisions required for transmission, storage and treatment/disposal of leachate, in addition to the construction costs associated with installation of the toe drain itself. Since a downgradient barrier would be required to minimize dewatering of the wetland by the toe drain, construction costs for a low permeability barrier will be included.

5.5 Comparison of Alternatives

Following completion of all modeling efforts and development of a cost estimate for the cover system/toe drain scenario, the two options will be compared on the basis of:

- Overall resultant stability of the northern slope of the landfill
- Effectiveness in reducing the discharge of contaminants to the adjacent wetland
- Costs associated with construction and operation/maintenance of each closure approach

Based upon the comparison, a preferred closure alternative will be recommended.

6.0 REPORT PREPARATION

A Groundwater/Leachate Modeling Study Report will be prepared. This report will include the following elements:

- Description of the existing data review and summary of that data
- Description of the field investigation activities, including data points installation, taking of measurements, and sample collection and analysis.
- Summary of the field investigation results
- Description of the HELP modeling activities, including development of a conceptual model and performance of sensitivity analysis
- Presentation of the HELP model results
- Description of the MODFLOW model results, including development of a conceptual model, calibration and validation of the model, and performance of sensitivity analysis
- Presentation of the MODFLOW model results
- Description and results of the contaminant mass flux computations
- Discussion of the predicted impact of installation of an impervious landfill cap and upgradient interception trench upon the landfill discharge flow and quality
- Description and results of and conclusions from the re-computed slope stability analysis for the current gabion-reinforced landfill toe design and of the slope stability analysis for a cap featuring a toe drain system
- Comparison of the slope stability and cost of the current gabion-reinforced landfill toe design with those of a cap featuring a toe drain system
- Description and results of and conclusions from the dredge spoil stability analyses for the crane test pad area and the area of weakest strength

Report appendices will include this work plan, a field activities log, boring logs, field measurements and sampling log sheets, laboratory geotechnical and analytical results, and modeling and geotechnical computations.

Three (3) iterations of the Groundwater/Leachate Modeling Study Report will be prepared. The first iteration will be a preliminary draft report for internal review by the Navy. The second iteration will be a draft report incorporating responses to the internal comments on the preliminary draft report and will be submitted to EPA and the Connecticut Department Of Environmental Protection (CTDEP). The third iteration will be a final report incorporating responses to EPA's and CTDEP's comments on the draft report and will be submitted to EPA, CTDEP, and members of the Remedial Action Board (RAB).

7.0 TECHNICAL MEETINGS AND PRESENTATIONS

An internal technical meeting was held in Pittsburgh, PA on August 23, 1995 between the Navy and their architect/engineer (A/E), Brown & Root, to discuss the approach and scope of the Groundwater/Leachate Modeling Study. This work plan is the outcome of this meeting.

Two (2) additional meetings and technical presentations will be held. The first meeting will be a one-day event and will be held in Boston, MA between the Navy and their A/E, EPA, and CTDEP to discuss and agree upon this work plan prior to initiation of the field investigation. The second meeting will be a one-day event held in Boston, MA between the Navy and their A/E, EPA, and CTDEP to discuss the draft Groundwater/Leachate Modeling Study Report.

APPENDIX A

FIELD SAMPLING AND ANALYSIS PLAN

A.0 FIELD SAMPLING PLAN (FSAP)

A.1 SUMMARY OF APPROACH AND FIELD TASKS

A field investigation is needed to support the modeling effort. Figure 3-1 shows the Area A Landfill and the upgradient hillside to the south and downgradient wetlands to the north. Proposed and existing data point locations are shown. Proposed monitoring wells, piezometers, and staff gauges are located along three transects, A-A', B-B', and C-C'. Cross-sectional views of the transects are depicted on Figures 3-2, 3-3, and 3-4. Each of these figures has two views: one of the existing conditions, and one of the post-construction condition of the landfill cap and interceptor trench. The water table was estimated from measured water levels from August, 1994 (Phase II RFI) at existing wells along or near each transect and an estimated wetland elevation.

The field tasks that are needed for the modeling effort are summarized as follows:

- Perform ten (10) surface infiltration tests
- Install eight (8) staff gauges
- Install three (3) drive point piezometers
- Install twelve (12) overburden wells (in the landfilled mass, dredge spoil, or alluvium)
- Drill one (1) soil boring into dredge spoil
- Perform permeability test on seven (7) dredge spoil samples
- Perform triaxial compression test on two (2) dredge spoil samples
- Install two (2) bedrock wells
- Perform sixteen (16) slug tests, including one each for all new wells and two existing bedrock wells
- Measure water level at fifty-two (52) locations, including new and existing monitoring wells and staff gauges
- Construct a weir to measure the flow of seep discharge from the western dike of the Area A Landfill into the OBDA
- Collect one (1) seep sample and analyze for full TCL/TAL analytes
- Survey all new staff gauges, drive point piezometers, and monitoring wells

Each of these tasks are described in Sections A.2 through A.10. The item and sample nomenclature is summarized in Section A.11. Equipment calibration, decontamination, waste handling, and record keeping are described in Sections A.12 through A.15.

Brown & Root Environmental (Brown & Root) Standard Operating Procedures (SOPs) and ASTM Methods will be followed during the field work activities and referenced in the text where applicable. All SOPs required for these field investigations are attached to this FSAP.

All field activities will be conducted in accordance with the Health and Safety Plan (HASP) previouly developed by Brown & Root for the Phase II Remedial Investigation.

A.2 SURFACE INFILTRATION TESTS

Ten surface infiltration tests, 2LIT1 through 2LIT10, will be performed across the Area A Landfill to estimate the vertical hydraulic conductivity of the vadose zone materials. Two surface infiltration test will be performed at each of 5 ground surface types: roadway, graveled area near roadway, sand storage area, deployed parking, and vegetated areas. The locations of the infiltration tests will be determined during the field activities. The infiltration test procedure described in the Earth Manual (Bureau of Reclamation) will be used. For each test, a description of the ground surface, location of the test, measured flow rate, height of water in the pipe, and the pipe diameter/radius will be recorded on a sample log sheet. The vertical hydraulic conductivity is estimated according to the Bureau of Reclamation method, which requires the flow rate, height of water maintained in the pipe, and pipe radius as inputs. The method and a sample calculation are included at the end of this FSAP.

A.3 STAFF GAUGES

Eight staff gauges, SG-7 through SG-14, will be installed to assess the presence or amount of surface water along the wetland boundary. The proposed locations are shown on Figure 3-1. Three of the staff gauges are located at transects A-A', B-B', and C-C'. Each staff gauge will be surveyed for location and water level reference measurement.

A.4 DRIVE POINT PIEZOMETERS

Three (3) drive point piezometers, 2LPZ1DS through 2LPZ3DS, will be installed along the wetland boundary to assess the potential or degree of discharge from the underlying dredge spoil to the wetland. The proposed locations are shown on Figure 3-1 along at transects A-A', B-B', C-C' along the wetland boundary. Each piezometer will consist of a 1¼-inch inner diameter (ID) drive point with a 2.5-foot slotted interval at the base. The piezometers will be driven with a sledge hammer or if necessary, an electric jack hammer. The piezometers will be driven to a depth such that the slotted interval resides within the dredge spoil in the saturated zone. Anticipated depths are 5 to 10 feet.

A.5 OVERBURDEN MONITORING WELLS

Six (6) monitoring well clusters, 2LMW28 through 2LMW33, each with two 2-inch ID monitoring wells, will be installed in unconsolidated materials. At each cluster, one well will be installed such that the 5-foot screened interval resides in the landfilled mass and intercepts the water table. The second well at each cluster will be installed such that the 5-foot screened interval resides in the saturated material immediately below the landfilled mass, i.e., the dredge spoil or alluvium. If dredge spoil is not encountered below the landfilled mass or the dredge spoil is too thin to accommodate a 5 foot well screen, then the well should be screened in the alluvium below the landfilled mass material or thin dredge spoil. Each well will be installed such that the screened interval monitors only one type of material. The nomenclature for each well at a well cluster ends with a "F", "DS", or "A" to indicate whether the well is screened in the landfilled mass, the dredge spoil, or the alluvium, respectively (refer to Table A-2). The proposed locations of the 12 wells are shown on Figure 3-1 and depicted on Figures 3-2, 3-3, and 3-4 along transects A-A', B-B', and C-C'.

The borings will be drilled using hollow stem auger drilling techniques, in accordance with SOP GH-1.4. The hollow stem augers will have a minimum inside diameter of 3-3/4 inches. Two-inch diameter split spoon samples will be collected continuously from each boring to the bottom of the boring in accordance with SOP GH-1.3. Soil characteristics and geotechnical information from each split-spoon sample will be recorded on boring logs. Samples obtained from the boreholes will be monitored for organic vapors with an HNu (or equivalent) in accordance with the SOP ME-01. The readings will be recorded on the boring logs.

For each well, after the 2-inch PVC well casing is installed, the borehole will be filled with a sand pack around and to approximately 2 feet above the well screen. A bentonite seal will be emplaced above the sand pack, and the remaining borehole will be filled to the ground surface with a cement-bentonite grout. Each well will be completed with a protective casing and cap.

A.6 DREDGE SPOIL SOIL BORING AND PERMEABILITY AND TRIAXIAL TESTS

A dredge spoil sample will be collected from each of the 6 dredge spoil/alluvium monitoring well locations along Transects A-A', B-B', and C-C'. The undisturbed samples will be collected with 3-inch O.D. thin-walled (Shelby) tubes in accordance with SOP GH-1.3. The Shelby tube samples will be collected immediately after the dredge spoil material is encountered by split-spoon sampling.

One soil boring, 2LTB32DS, will be drilled in the middle of the crane testing pad (refer to Figure 3-1 for location). A Shelby tube sample will be collected from that test boring immediately after the dredge spoil material is encountered by split-spoon sampling.

Two additional dredge spoil Shelby Tube samples will be collected from the new monitoring wells and/or soil boring. Selection of the well or boring where an extra sample is collected will be based upon field observations.

One dredge spoil Shelby Tube sample from each new monitoring well and soil boring will be tested for permeablity. Two dredge spoil Shelby Tube samples will also be tested for triaxial compression, including one collected from the new soil boring installed at the location of the crane test pad and one collected from the new data point with the lowest blow count in the dredge spoil. If the lowest blow count occurs in the soil boring installed at the location of the test pad, the second sample to be tested for triaxial compression will be that collected from the test point with the second lowest blow count in the dredge spoil.

The samples will be sealed, packed, and transported in an upright position to a lab for testing. Refer to Table A-1 for a summary of analytical testing and Table A-2 for sample nomenclature.

A.7 BEDROCK MONITORING WELLS

Two open hole wells, 2LMW34B and 2LMW35B, will be drilled into bedrock along the top of the hillside, south of the Area A Landfill, to assess the groundwater potential significantly upgradient of the landfill and proposed interceptor trench. The proposed locations of the wells are shown on Figure 3-1 and depicted on Figures 3-2, 3-3, and 3-4. The wells will be drilled by air rotary methods in accordance with SOP GH-1.4. Bedrock characteristics will be recorded on boring logs. The wells will be advanced into bedrock approximately 5 feet, then a 4 or 6-inch diameter steel casing will be set and grouted into place. Then the wells will be advanced (nominal 4 or 6-inch hole) until adequate water-yielding zones are encountered (i.e., > 1 gpm) to monitor the groundwater head in the bedrock. Anticipated depths are 50 to 70 feet.

TABLE A-1
ANALYTICAL PROGRAM - AREA A LANDFILL
NSB-NLON, GROTON, CONNECTICUT

MEDIA	ANALYSIS	METHOD	NUMBER OF SAMPLES	RINSATE BLANK	TOTAL SAMPLES
Dredge Spoil	Permeability	ASTM D5084	7	-	7
Dredge Spoil	Triaxial Compression	ASTM D4767	2	-	2
Seep Water	TCL/TAL Suite	OLM01.8 ILM02.0	1	1	2

TABLE A-2

SUMMARY OF NOMENCLATURE AREA A LANDFILL
NSB-NLON, GROTON, CONNECTICUT

ITEM	NUMBER	NOMENCLATURE	COMMENT
Infiltration Tests	10	2LIT1 through 2LIT10	Require description of ground surface, flow rate, height of water, and radius of pipe.
Staff Gauges	8	SG-7 through SG-14	Hand driven.
Drive Point Piezometers	3	2LPZ1DS through 2LPZ3DS	Hand or jack driven. "DS" means dredge spoil.
Overburden Monitoring Wells	12	2LMW28F through 2LMW33F 2LMW28DS through 2LMW33DS	"F" means Fill; "DS" means dredge spoil. If dredge spoil is not present, well will be screened in alluvium and designated by "A".
Soil Boring	1	2LTB32DS	"DS" means dredge spoil. Located at crane testing pad.
Dredge Spoil Permeability Tests	6	2LMW28DS-P-XXXX through 2LMW33DS-P-XXXX 2LTB32DS-P-XXXX	"P" means permeability test. XXXX is collection depth defined by field personnel, e.g. 0810 means 8 to 10 foot interval.
Dredge Spoil Triaxial Compression Tests	2	2LTB32DS-T-XXXX and 2LMW??DS-T-XXXX	?? means location will be field determined. "T" means triaxial test. XXXX is collection depth defined by field personnel, e.g. 0608 means 6 to 8 feet deep.
Bedrock Monitoring Wells	2	2LMW34B, 2LMW35B	"B" means bedrock.
Seep Sample	2	3MSP01, 3MSP01-R	"R" means rinsate blank.

A.8 WELL DEVELOPMENT, AQUIFER TESTING, AND WATER LEVELS

All new overburden monitoring wells will be developed in accordance with SOP GH-1.7. Wells will be developed with a small submersible pump. Field measurements of pH, specific conductivity, and temperature will be obtained with a Horiba monitoring instrument and recorded on sample log sheets.

All new monitoring wells (12 unconsolidated and 2 bedrock) will be slug tested to estimate the hydraulic conductivity of the screened intervals. Additionally, 2 existing bedrock wells, 2LMW8D and 2LMW20D will be slug tested. Slug tests will be performed in accordance with SOP GH-2.4.

One round of water levels will be obtained at existing and new monitoring wells, piezometers, and staff gauges in and around the Area A Landfill. Water levels will be obtained from the following 35 existing monitoring wells:

- 1MW2S
- 2DMW11S/11D
- 2LMW7S/7D through 2LMW9S/9D
- 2LMW13S/13D, 2LMW14S
- 2LMW17S/17D through 2LMW20S/20D
- 2LPW1S, 2LOW1S, 2LOW1D, 2LOW2S, 2LOW3S, 2LOW4S
- 2WMW3S/3D
- 3MW12S/12D
- 4MW1S, 4MW2S, 4MW3S, 4MW4S, 4MW4D

Water levels will be obtained at 3 new piezometers, 12 new overburden wells, and 2 new bedrock wells. Surface water levels will be collected at existing staff gauge, SG-6, and 8 new staff gauges, SG-7 through SG-14.

Water level measurements will be taken in accordance with SOP GH-2.5 with an M-Scope using the top of the inner casing (monitoring wells) as the reference point for determining depths-to-water. Measurements will be recorded to the nearest 0.01 foot in the field logbook and on a groundwater level measurements form.

A.9 SEEP SAMPLING

A flume or weir will be constructed at the location of seep discharge in the OBDA (refer to Figure 3-1) to estimate the flow rate. Methods to determine the discharge are provided in SOP GH-2.7. The field personnel will determine the most appropriate means to measure the discharge depending on the seep flow conditions.

One seep sample, 3MSP01 (refer to Figure 3-1), will be collected and analyzed for the full TCL/TAL suite of analytes (refer to Table A-1). Additionally, one rinsate blank, 3MSP01-R, will be analyzed for the same analytes. Samples will be preserved in accordance with SOP SF-1.2. Samples will be packaged and shipped in accordance with Halliburton NUS SOP SA-6.2.

A.10 SURVEYING

Each new monitoring well, piezometer, and staff gauge location will be surveyed by a licensed surveyor. The horizontal location, ground surface elevation, and water level reference elevation will be noted. Elevations will be reported in feet above mean sea level. Surveying will utilize pre-existing reference points and/or existing survey monuments from previous surveying events.

A.11 SUMMARY OF NOMENCLATURE

Table A-2 shows a summary of the field items, number of each item, recommended nomenclature, and comments for the field personnel.

A.12 EQUIPMENT CALIBRATION

An organic vapor monitor (HNu or equivalent) will be used during field activities. It will be calibrated daily or according to the manufacturer's operating manual (refer to SOP ME-01).

Calibration will be documented in the field logbook and on calibration logsheets. During calibration an appropriate maintenance check will be performed on the equipment. If damaged or defective parts are identified during the maintenance check and it is determined that the damage could have an impact on the instrument's performance, the instrument will be removed from service until the defective parts are repaired or replaced.

A.13 DECONTAMINATION

All downhole drilling equipment will be steam cleaned prior to beginning work, between well borings, anytime the drilling rig leaves the site prior to completing a boring, and at the completion of the drilling and excavation program. Decontamination activities will take place at the designated decontamination area. Additional requirements for drilling equipment decontamination can be found in Halliburton NUS SOP GH-1.6.

All sampling equipment used for collecting samples (e.g. split-spoons) will be decontaminated both prior to field sampling and between samples, in accordance with SOP SF-2.3. Decontamination requires a Liquinox wash and potable water rinse.

A.14 WASTE HANDLING

All decontamination liquids, purge water, and drill cuttings will be collected and stored on-site in Department of Transportation (DOT)-approved (Specification 17-C), 55-gallon drums. Drums will be sealed and labeled with drum contents, boring number, site or origin, volume, and date. The drums will be stored on wooden pallets at the Area A Landfill. Halliburton NUS understands that the Navy will arrange for the waste to be disposed in an appropriate manner.

A.15 RECORD KEEPING

In addition to the previously mentioned forms, notebooks and a logbook will be maintained. A field notebook will be maintained by the field crew. All information related to sampling or field activities will be recorded in the field notebook. A site logbook will be maintained by the field operations leader (FOL). This book will contain a summary of the day's activities and will reference the field notebooks when applicable. At the completion of field activities, the FOL will submit to the Project Manager (PM) all field records, data, field notebooks, logbooks, chain-of-custody receipts, sample logsheets, and boring logs.

REVISED TABLE A-2

SUMMARY OF FIELD INVESTIGATION NOMENCLATURE
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON - GROTON, CONNECTICUT

ITEM	NUMBER	NOMENCLATURE	COMMENTS
Infiltration Tests	10	2LIT1 through 2LIT10	Require description of ground surface, flow rate, height of water, and radius of pipe.
Staff Gauges	8	SG-7 through SG-14	Hand driven. SG-9 and SG-14 are stand-alone staff gauges. SG-7, SG-8, SG-10 through SG-13 are coupled with drive points.
Drive Point Piezometers	6 dredge spoil	2LPZ1DS through 2LPZ6DS	Hand or jack driven. "DS" means dredge spoil. These will also be used as/coupled with staff gauges.
Drive Point Piezometers	2 fill material	2LPZ1F and 2LPZ2F	Utilize drill rig. "F" means fill material.
Overburden Monitoring Wells	13	2LMW28F through 2LMW33F, 2LMW28DS through 2LMW33DS, and 2LMW34DS	"F" means fill; "DS" means dredge spoil. If dredge spoil is not present, well will be screened in alluvium and designated by "A".
Bedrock Monitoring Wells	3	2LMW32B, 2LMW35B, and 2LMW36B	2LMW32B is part of well cluster. 2LMW35B and 2LMW36B are on top of hillside.
Dredge Spoil Permeability Tests	7	2LMW28DS-P-XXXX through 2LMW34DS-P-XXXX	"P" means permeability test. XXXX is collection depth defined by field personnel, e.g. 0810 means 8 to 10 foot interval.
Dredge Spoil Triaxial Compression Tests	2	2LMW34DS-T-XXXX and 2LMW??DS-P-XXXX	?? means location will be field determined. "T" means triaxial compression test. XXXX is collection depth defined by field personnel, e.g. 0608 means the 6 to 8 foot interval.

REVISED TABLE A-2 - PAGE TWO

SUMMARY OF FIELD INVESTIGATION NOMENCLATURE
GROUNDWATER/LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE NEW LONDON - GROTON, CONNECTICUT

ITEM	NUMBER	NOMENCLATURE	COMMENTS
Slug Tests	18	2LMW28 through 2LMW33 well clusters, 2LMW34DS, 2LMW35B, 2LMW36B, 2LMW8D, 2LMW20D	13 new overburden wells, 3 new bedrock wells, and 2 existing bedrock wells.
Water Levels	68	1MW2S, 2DMW11S/11D, 2LMW7S/7D through 2LMW9S/9D, 2LMW13S/13D, 2LMW14D, 2LMW17S/17D through 2LMW20S/20D, 2LPW1S, 2LOW1S, 2LOW1D, 2LOW2S, 2LOW3S, 2LOW4S, 2WMW3S/3D, 3MW12S/12D, 4MW1S, 4MW2S, 4MW3S, 4MW4S, 4MW4D, 2LMW28 through 2LMW33 well clusters, 2LMW34DS, 2LMW35B, 2LMW36B, 2LPZ1DS through 2LPZ6DS, 2LPZ1F, 2LPZ2F, SG-6 through SG-14	35 existing wells, 16 new wells, 8 new drive points, 1 existing staff gauge, 8 new staff gauges.
Discharge Measurement	1	Not applicable	Construct weir.
Seep Sample	2	3MSP01, 3MSP01-R	"R" means rinsate blank.
Survey	32	SG-7 through SG-14, 2LPZ1DS through 2LPZ6DS, 2LPZ1F, 2LPZ2F, 2LMW28 through 2LMW33 well clusters, 2LMW34DS, 2LMW35B, 2LMW36B	8 staff gauges, 8 drive points, 13 new overburden wells, 3 new bedrock wells.

APPENDIX A.2

LETTER WORK PLAN ADDENDUM

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LETTER WORK PLAN ADDENDUM
GROUNDWATER / LEACHATE MODELING STUDY
AREA A LANDFILL REMEDIAL DESIGN
NAVAL SUBMARINE BASE - NEW LONDON, GROTON, CONNECTICUT

submitted by Brown & Root Environmental
October 5, 1995

1.0 INTRODUCTION

On September 27, 1995, representatives from Brown & Root, the U.S. Navy (NORTHDIV), CTDEP, Region I EPA, and the EPA contractor (TRC) met to discuss the modeling approach and field effort that has been proposed in the Letter Workplan dated September 6, 1995 for the Leachate Modeling Study, Area A Landfill Remedial Design, Naval Submarine Base - New London (NSB-NLON), Groton Connecticut. Based on EPA and TRC comments, Brown & Root agreed to prepare a detailed summary of the existing and proposed wells to be used in the modeling effort. Also, Brown & Root agreed to develop a more comprehensive discussion of the rationale for the proposed field work.

This Letter Work Plan Addendum consists of this introduction (Section 1.0) and three sections (Sections 2.0 through 4.0) which provide a response to the EPA and TRC comments and concerns. Section 2.0 defines the modeling objectives and relates the field data that is required to meet these objectives. Section 3.0 summarizes the existing data (1 figure and 3 tables are included) and discusses why additional field work is necessary to fulfill the modeling objectives. Section 4.0 defines the rationale for the proposed locations of data collection.

2.0 MODELING OBJECTIVES AND IMPORTANT DATA NEEDS

2.1 Modeling Objectives

As stated in the Letter Work Plan, the primary objective of the Groundwater/Leachate Modeling Study is to estimate the thickness of the saturated fill and the rate of saturated flow from the fill that enters the

wetland under existing and proposed conditions. The flow rate, denoted as Q_F in the workplan, is a function of three inputs: downward flow from infiltration (Q_I), upward flow from the dredge spoil (Q_D), upgradient flow along the hillside (Q_S). These flows will be estimated for the existing conditions and proposed landfill cap/trench configuration in order to estimate the expected reduction in Q_F that the landfill cap/trench will provide. The following paragraphs discuss what the data requirements are to sufficiently estimate these flows and what field tasks are proposed to obtain the required data.

To understand the data requirements, the domain and resolution of the modeling task must be defined. The proposed 3-D model's domain (areal) will include the entire Area A Landfill (i.e., from the dike to the racquetball building); areas upgradient of the landfill which will extend upgradient to a distance which provides a sufficient buffer zone between the model boundary and any flux condition (i.e., wells, trenches or discharge points) within the model; and areas downgradient of the landfill within the wetland which will extend downgradient to a distance which provides a sufficient buffer zone between the model boundary and toe of the landfill (i.e., area where Q_F is discharging). In the vertical direction, the model domain will include the fill material, dredge spoil, alluvium, and bedrock. Based on existing information, the use of a 3-D model with this domain will provide a more comprehensive evaluation of the hydrogeologic conditions at the Area A Landfill than a 2-D model can provide and it will allow for a more complete and straight-forward estimate of the overall Q_F than a 2-D model can provide.

Based on the objectives of the modeling task (i.e., estimate the thickness of the saturated fill and the overall leachate flow rate from the fill to the wetland under existing and proposed conditions) a high areal resolution model is not necessary. High resolution models are necessary if the task requires critical information in a local area (e.g., wellhead protection) and this type of task usually requires extensive data. However, a lower resolution model can be created with less extensive data and is sufficient for this task because the final goal is to provide more general information (i.e., the overall water table elevation and total flow rates). It is acceptable in a lower resolution model to have more interpolated information between existing data points to provide reasonable or conservative estimates of model parameters without compromising the integrity of the model's results or the achievement of the modeling objectives.

2.2 Important Data for Modeling

The rate of infiltration, Q_I, will be estimated with the HELP model. In order to assess the infiltration and run-off characteristics, ground infiltration tests will be performed on 5 different identified ground surface types. The results of the test analyses will be vertical hydraulic conductivities of the near-surface unsaturated zone.

Based on the Draft Phase II RI groundwater monitoring results, it is known that there are upward gradients from the bedrock toward the fill. It is not known whether bedrock groundwater actually moves from the bedrock into the dredge spoil and out into the wetland, or if the groundwater is confined to the bedrock by limited fracturing or the potentially confining dredge spoil material. This effect can be measured as the hydraulic head difference between two wells: one that is screened across the water table in the fill and one that is screened exclusively in the dredge spoil. Monitoring well clusters have been proposed to observe the hydraulic head difference.

Hydraulic conductivities of the fill and dredge spoil will be estimated from proposed slug tests. Permeability testing of Shelby tube samples from the dredge spoil will provide estimates of the vertical hydraulic conductivity of the dredge spoil. The hydraulic conductivity estimates and water level measurements collected from the dredge spoil and fill material wells will provide the basis for estimating the flow, Q_D.

The flow, Q_S, is the groundwater flow from the upgradient hillside into the fill material. Along the hillside, it is known that there are upward gradients from the bedrock to the overburden. It is not known if the groundwater in the overburden, bedrock, or both significantly contribute to Q_S. Several overburden and bedrock well clusters that currently exist along the upgradient portion of the landfill will be used to estimate Q_S.

Finally, the boundary conditions of the recharge zone to the landfill and the wetland downgradient of the discharge zone (i.e., toe area where Q_F discharges) from the landfill need to be understood. The hydraulic head in the recharge zone at the top of the hillside is not expected to change from the existing condition

once the landfill cap and trench are installed. Wells will be installed on the hillside to observe the hydraulic head and set boundary conditions. Likewise in the wetland downgradient of the discharge zone, the hydraulic head is not expected to change from the existing condition once the landfill cap is installed. Staff gauges and piezometers will be installed along the wetland boundary to observe the hydraulic head and set boundary conditions. Additionally, water level measurements from the staff gauges and piezometers will allow an assessment of the strength of the upward flow gradient at the wetland boundary. This assessment will provide an understanding for the ability of the landfill cap/trench design to lower the water table and reduce the saturated flow from the fill, Q_F, into the wetland.

3.0 SUMMARY OF EXISTING DATA AND DATA GAPS

Existing data from the Final Phase I RI, Draft Phase II RI, Final Focused Feasibility Study, and Geotechnical Investigation for Area A Landfill Remedial Design will be used in the modeling effort. These data points are shown on Figure 3-1 of the Letter Work Plan. A color-coded version of this figure has been enclosed to highlight existing monitoring wells, soil borings, and geoprobe points. Table 1 summarizes the existing data and provides a reference for each data point. Table 2 provides an itemization of these data and other relevant information from the boring logs and the geoprobe test results. Additionally, Table 3 summarizes available aquifer properties estimated from the Final Phase I RI and Draft Phase II RI slug test and pumping tests.

Existing borings and geoprobe points will provide the ground surface elevation and interface depths of the fill, dredge spoil, alluvium, and bedrock. This information will be used to define geological boundaries in the 3-D model. Proposed water level data will be used to calibrate the model, because it will be the most complete set of data. Existing water level data will be used to set calibration criteria, validate the model, and investigate possible trends in groundwater flow data. Existing topographic, bedrock surface, and potentiometric maps from the Draft Phase II RI report will be used for preliminary conceptualization of the model. The landfill design drawings and database will be used to delineate the landfill boundary and the proposed landfill cap/trench boundaries. In the database, the ground surface for the existing and proposed

cap configurations are defined by contours (triangulated data). Also, the bedrock surface is defined in the upgradient hillside area.

Additional data needs were identified by defining the modeling objectives and technical approach to be taken, identifying the data needed to adequately address the objectives and technical approach, and comparing the data needs against the existing database. The existing boring logs will provide sufficient geologic information for defining the model layer boundaries in the western and central portions of the landfill. In the eastern portion of the landfill, there is an upgradient well cluster (2LMW20S/20D) and a well cluster on the eastern edge (2WMW3S/3D) that can provide the interface boundaries and the elevation of the bedrock surface. It is recommended that one proposed dredge spoil boring/well in this area be advanced to bedrock before the well is installed to define the bedrock surface from these two wells toward the wetland.

Existing estimated aquifer properties for the fill and bedrock wells will be used in the model (Refer to Table 3). Slug tests of the proposed fill and bedrock wells will provide a more comprehensive spatial coverage of hydraulic conductivity. The dredge spoil hydraulic conductivity value from 2WMW5S, located in the wetland, can be used to define the dredge spoil hydraulic conductivity at the model boundary. Slug tests at the proposed dredge spoil wells will provide estimates of hydraulic conductivity of the dredge spoil under the landfill.

The existing monitoring well clusters at the upgradient edge of the landfill can provide some of the required information to estimate Q_S and Q_D. Because, none of the existing monitoring wells are screened exclusively in the dredge spoil material, estimates of Q_S and Q_D cannot be made in the downgradient flow direction. The proposed monitoring wells, slug test analyses, piezometers, staff gauges, and permeability tests (for vertical hydraulic conductivity in the dredge spoil) will provide sufficiently the required information to estimate Q_S and Q_D. Permeability tests in the vadose zone and the HELP model will provide the required information to estimate Q_I. Estimates of Q_I, Q_S, and Q_D will enable the calculation of Q_F under the existing condition and the proposed landfill cap/trench.

4.0 JUSTIFICATION FOR PROPOSED DATA COLLECTION LOCATIONS

In the Letter Work Plan, it is proposed that the field effort collect geologic and hydrogeologic information in the downgradient direction in three general areas of the landfill. The three cross-sections, A-A', B-B', and C-C' were generated to describe each of the three general areas and to assess potential geologic and hydrogeologic differences across the landfill. These cross-sections also provide a preliminary conceptualization of the model area.

One of the objectives of this study is to assess the reduction of Q_F at the wetland boundary by the landfill cap/trench configuration. The other objective is to assess the thickness and variation in thickness of the saturated fill in the landfill to evaluate how much groundwater will still be exposed to contaminated fill material. Both of these aspects require an analysis of groundwater flow components in the downgradient direction of groundwater flow. The collection of data along the downgradient flow direction is recommended, because the landfill is located in an area of groundwater discharge from the upgradient hillside. It is expected that the upward flow gradient would weaken across the landfill if there is a strong hydraulic connection between the bedrock and the dredge spoil and fill. This implies that the flow from the dredge spoil to the fill, Q_D, varies from the upgradient portion of the landfill to the downgradient portion of the landfill. Two well clusters and a piezometer were placed along the downgradient direction in each cross-section to allow an assessment of the variability of Q_D.

Also, it is expected that the hydraulic gradient in the fill (water table) varies (flattens toward the wetland). The fill well at each cluster and the staff gauge will provide a means to assess where the reduction in the water table gradient is occurring and an estimate of the saturated fill thickness along the downgradient flow direction.

Based on a review of the Final Phase I RI and Draft Phase II reports, the geology and hydrogeology across the landfill is generally similar (refer to Draft Phase II RI topographic map, bedrock surface map, and groundwater flow maps). Based on existing information, the noticeable differences in the geology and hydrogeology are primarily between the areas of A-A' and B-B'. The main difference is that there is bedrock

valley along B-B' that is filled with alluvium. The higher hydraulic conductivity and expected higher storativity of the alluvium makes this area more sensitive to hydraulic head changes. This is confirmed by two comprehensive rounds of water level measurements during the Draft Phase II RI, which indicated a larger change in the water table between March and August in the area of B-B'. Also, the area of B-B' has surface water present along the wetland boundary throughout the year. In the area of C-C', there is the least amount of existing geologic and hydrogeologic data. The proposed field data will be used to confirm the preliminary conceptualization of this area. Given the relatively minor geologic and hydrogeologic differences which exist in the landfill area, data collected along the downgradient flow direction in three general areas will provide sufficient coverage to represent the actual conditions at the landfill in a final conceptual model with the accuracy and resolution to meet the modeling objectives.

REFERENCES

Phase I Remedial Investigation Report for Naval Submarine Base, New London, Groton, Connecticut, Atlantic Environmental Services, Inc, August, 1992.

Draft Phase II Remedial Investigation Report for Naval Submarine Base, New London, Groton, Connecticut, Halliburton NUS, February, 1995.

Final Focused Feasibility Study, Area A Landfill, Installation and Restoration Program, Naval Submarine Base, New London, Groton, Connecticut, Atlantic Environmental Services, Inc, May, 1995.

Geotechnical Field Investigation Report for Area A Landfill Remedial Design for Naval Submarine Base, New London, Groton, Connecticut, May, 1995.

Draft Groundwater/Leachate Modeling Study Letter Work Plan, Area A Landfill Design, Naval Submarine Base New London, Groton, Connecticut, September, 1995.

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TABLE 1

SUMMARY OF EXISTING AREA A LANDFILL DATA
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE - NEW LONDON, GROTON, CONNECTICUT

ITEM	TOTAL NUMBER	REFERENCE
Monitoring wells	31	Final Phase I RI and Draft Phase II RI
Soil borings	38	Final Phase I RI and Draft Phase II RI
Soil borings	23	Final Focused Feasibility Study
Soil borings	6	Geotechnical Field Investigation
Geoprobes	24	Atlantic Environmental Design Document, reference to be determined.
Comprehensive water levels (March and August, 1994)	31 wells	Draft Phase II RI, Table 4-1
10 Monthly water levels (March through December, 1994)	10 wells	Draft Phase II RI, Table 4-6
Daily precipitation data for Groton, Connecticut	-	Northeast Regional Climate Center, Ithaca, New York
Aquifer Test Results	9 wells	Final Phase I RI and Draft Phase II RI (refer to Table 3)
Site-wide maps	topographic, bedrock surface, potentiometric	Draft Phase II RI
Database and design drawings for landfill cap/trench	-	Halliburton NUS

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TABLE 2

SUMMARY OF EXISTING AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
Area A Landfill Phase I and II RI - Monitoring Wells									
1MW2S	86.02	X	--	--	--	--	14.0	4.0-14.0	Fill
2LMW7S	82.80	X	--	X	X	30.2	50.0	11.65-21.65	Fill/Dredge
2LMW7D	83.10	X	--	X	X	28.5	43.59	33.5-43.6	BR(1)
2LMW8S	86.40	X	--	--	X	--	20.0	5.5-15.5	Fill
2LMW8D	87.10	X	--	--	X	41.5	124.4	46.5-124.4	BR
2LMW9S	85.30	X	--	X	X	--	42.5	8.24-18.24	Fill/Dredge
2LMW9D	85.40	X	--	X	X	42.0	59.74	47.0-59.74	BR
2LMW13S	86.90	X	--	--	--	--	36.0	6.46-16.46	Fill
2LMW13D	86.80	X	--	--	--	19.5	60.03	24.5-60.03	BR
2LMW14D	91.90	X	--	--	X	13.5	27.0	18.5-27.0	BR
2LMW17S	82.48	X	--	X	--	--	18.5	7.75-17.75	Fill/Dredge
2LMW17D	82.62	X	--	X	--	18.0	39.0	28.1-39.0	BR
2LMW18S	77.94	X	--	X	X	--	33.5	5.74-15.74	Fill/Dredge

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2LMW18D	77.67	X	--	X	X	--	49.03	41.0-49.03	BR
2LMW19S	93.50	--	--	--	X	17.5	25.0	15.0-25.0	Fill/BR
2LMW19D	93.90	--	--	--	X	20.0	120.0	28.0-120.0	BR
2LMW20S	87.35	X	--	--	X	--	26.0	9.0-19.0	Fill
2LMW20D	87.55	X	--	--	X	39.0-69.0	80.0	74.0-80.0	BR
2LPW1S	86.25	X	--	X	--	--	15.0	4.0-14.0	Fill
2LOW1S	86.26	X	--	X	--	--	15.0	4.0-14.0	Fill
2LOW1D	86.88	X	--	X	X	29.3	29.5	23.75-28.75	Alluvium
2LOW2S	86.69	X	--	X	--	--	15.0	4.0-14.0	Fill
2LOW3S	85.50	X	--	X	--	--	14.0	3.0-13.0	Fill
2LOW4S	86.83	X	--	X	--	--	14.0	4.0-14.0	Fill
2WMW3S	87.80	X	--	X	X	--	41.5	7.79-22.79	Fill/Dredge
2WMW3D	81.68	X	--	X	X	73.0	127.1	78.0-127.1	BR
4MW1S	127.91	--	X	--	--	2.5	18.5	8.5-18.5	BR
4MW2S	96.65	--	X	X	--	6.5	14.5	4.5-14.5	Dredge/BR
4MW3S	100.55	--	X	--	--	4.5	13.5	3.5-13.5	Till/BR

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
4MW4S	107.80	--	X	--	--	4.5	14.5	4.5-14.5	Till/BR
4MW4D	107.29	--	X	--	--	8.5	40.0	30.0-40.0	BR
Area A Landfill Phase I and II RI and FFS - Soil Borings									
1TB1	--	X	--	--	X	--	14.5	--	--
1TB3	--	X	--	X	--	--	14.0	--	--
4TB1	--	X	--	--	X	12.0	12.0	--	--
4TB2	--	--	--	--	X	3.5	3.5	--	--
2LTB1	84.0	X	--	X	--	20.0	20.0	--	--
2LTB2	84.6	X	--	X	X	24.0	24.0	--	--
2LTB3	84.6	X	--	X	--	18.0	18.0	--	--
2LTB4	88.2	X	--	X	--	17.0	17.0	--	--
2LTB5	88.0	X	--	--	--	10.0	10.0	--	--
2LTB6	88.4	X	--	X	X	--	21.0	--	--
2LTB7	87.4	X	--	X	--	12.2	12.2	--	--
2LTB8	87.4	X	--	--	--	14.7	14.7	--	--
2LTB9	87.0	X	--	--	--	6.0	6.0	--	--

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2LTB10	87.2	X	--	X	--	--	16.0	--	--
2LTB11	87.1	X	--	X	--	--	16.0	--	--
2LTB12	86.0	X	--	X	--	--	16.0	--	--
2LTB13	87.8	X	--	X	--	--	16.0	--	--
2LTB14	88.1	X	--	--	--	--	16.0	--	--
2LTB15	87.7	X	--	--	--	5.5	5.5	--	--
2LTB16	87.8	X	--	--	--	6.0	6.0	--	--
2LTB17	87.8	X	--	X	--	--	16.0	--	--
2LTB18	88.1	X	--	X	--	--	16.0	--	--
2LTB19	87.8	X	--	--	--	--	16.0	--	--
2LTB20	88.6	X	--	X	--	--	16.0	--	--
2LTB21	88.7	X	--	X	--	--	16.0	--	--
2LTB22	89.6	X	--	X	--	--	16.0	--	--
2LTB23	88.4	X	--	X	--	--	16.0	--	--
2LTB24	90.0	X	--	X	--	13.83	13.83	--	--
2LTB25	88.4	X	--	--	--	4.0	4.0	--	--

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2LTB26	89.7	X	--	--	--	5.16	5.16	--	--
2LTB27	90.6	X	--	--	--	9.66	9.66	--	--
2LTB28	88.1	X	--	X	--	--	16.0	--	--
2LTB29	87.1	X	--	X	--	--	16.0	--	--
2LTB30	88.4	X	--	--	--	3.16	3.16	--	--
2LTB31	88.1	X	--	X	--	--	16.0	--	--
2WTB1	67.5	--	--	X	X	--	32.0	--	--
2WTB2	68.2	--	--	X	X	--	32.0	--	--
2WTB4	83.5	--	--	--	X	0.83	0.83	--	--
Area A Landfill FFS - Soil Borings									
2GB1	75.1	X	--	X	X	--	22.0	--	--
2GB2	75.1	X	--	X	--	17.0	17.0	--	--
2GB3	78.2	X	--	X	X	22.0	22.0	--	--
2GB4	--	X	--	--	--	3.5	7.8	--	--
2GB5	--	X	--	--	X	--	9.0	--	--
2GB6	83.4	X	--	--	--	3.0	8.0	--	--

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SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2GB7	80.3	X	--	--	--	10.0	10.0	--	--
2GB8	82.8	X	--	--	--	4.0	8.0	--	--
2GB9	84.4	X	--	--	X	2.5	2.5	--	--
2GB10	85.9	X	--	--	X	9.0	14.0	--	--
2GB11	--	--	--	--	X	--	8.3	--	--
2GB12	92.0	--	--	--	X	5.0	10.0	--	--
2GB13	91	X	--	--	--	5.0	5.0	--	--
2GB14	94.4	--	--	--	X	0.5	5.4	--	--
2GB15	--	--	--	--	--	GS(2)	--	--	--
2GB16	--	--	--	--	X	4.0	8.8	--	--
2GB17	92.4	X	--	--	--	4.2	4.2	--	--
2GB18	92.5	--	--	--	X	18.8	23.16	--	--
2GB19	92.4	--	--	X	--	--	11.1	--	--
2GB20	95.0	X	--	--	X	7	11.5	--	--
2GB21	--	X	--	X	--	22	26.3	--	--

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2GB22	80.7	X	--	X	--	--	12.0	--	--
2GB23	77.8	X	--	--	--	--	17.0	--	--
Area A Landfill - Geotech Borings									
LF-SB01	79.3	X	--	X	X	52.0	52.0	--	--
LF-SB02	87.3	X	--	X	X	33	38.5	--	--
LF-SB03	84.5	X	--	X	X	70	70	--	--
LF-SB04	91.0	X	--	--	X	--	16	--	--
LF-SB05	90.8	X	--	--	X	23	23	--	--
LF-SB06	79.4	X	--	X	X	22.5	32.0	--	--
Area A Landfill Cap Design - Geoprobes									
GP1	96.0	--	--	--	--	90.5 ft msl	--	--	--
GP2	100.8	--	--	--	--	99.1 ft msl	--	--	--
GP3	103.8	--	--	--	--	102.7 ft msl	--	--	--
GP4	99.6	--	--	--	--	98.3 ft msl	--	--	--
GP5	97.4	--	--	--	--	92.7 ft msl	--	--	--
GP6	92.1	--	--	--	--	87.3 ft msl	--	--	--

DRAFT

TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
GP7	99.1	--	--	--	--	93.2 ft msl	--	--	--
GP8	100.2	--	--	--	--	98.0 ft msl	--	--	--
GP9	90.0	--	--	--	--	88.9 ft msl	--	--	--
GP10	87.9	--	--	--	--	84.4 ft msl	--	--	--
GP11	106.5	--	--	--	--	105.2 ft msl	--	--	--
GP12	90.1	--	--	--	--	87.7 ft msl	--	--	--
GP13	105.6	--	--	--	--	100.5 ft msl	--	--	--
GP14	95.9	--	--	--	--	89.5 ft msl	--	--	--
GP15	102.6	--	--	--	--	101.6 ft msl	--	--	--
GP16	101.2	--	--	--	--	94.6 ft msl	--	--	--
GP17	95.0	--	--	--	--	88.1 ft msl	--	--	--
GP18	96.9	--	--	--	--	88.5 ft msl	--	--	--
GP19	107.2	--	--	--	--	104.9 ft msl	--	--	--
GP20	100.0	--	--	--	--	86.0 ft msl	--	--	--
GP21	97.8	--	--	--	--	93.4 ft msl	--	--	--
GP22	110.2	--	--	--	--	108.6 ft msl	--	--	--

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
GP23	100.6	--	--	--	--	95.6 ft msl	--	--	--
GP24	98.3	--	--	--	--	90.2 ft msl	--	--	--

Notes:

ft msl - feet mean sea level
ft bgs - feet below ground surface
X - Denotes geologic unit encountered during boring installation
-- - No data available
(1) BR - Bedrock
(2) GS - Ground Surface

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TABLE 3

ESTIMATED AQUIFER PROPERTIES
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE - NEW LONDON, GROTON, CONNECTICUT

Material	Test Type	Well	Hydraulic Conductivity (ft/day)	Aquifer Thickness (assumed) (ft)	Transmissivity (ft^2/day)	Specific Yield
Fill	Slug	2WMW3S	4.8	-	-	-
	Slug	2LMW8S	2.3	-	-	-
	Pumping	2LOW1S	3.5	21	74	-
	Pumping	2LOW2S	2.1	21	43	0.24
Dredge Spoil	Slug	2WMW5S	1.0	-	-	-
Overburden/ Bedrock	Slug	4MW2S	3.4	-	-	-
Bedrock	Slug	2WMW3D	0.03	150	4.6	-
	Slug	2LMW7D	0.46	150	69	-
	Slug	2LMW18D	1.4	150	216	-

Foster Plaza VII
661 Andersen Drive
Pittsburgh, PA 15220-2745

Brown & Root Environmental

A Division of Halliburton NUS Corporation

(412) 921-7090
FAX: (412) 921-4040

C-49-10-5-222
October 19, 1995
Project Number 5082

Mr. Mark Evans
Northern Division (Code 1823)
Naval Facilities Engineering Command
Mail Stop 82, 10 Industrial Highway
Lester, PA 19113-2090

Reference: CLEAN Contract N62472-90-D-1298
Contract Task Order No. 203

Subject: Corrected Tables For Work Plan Addendum
Groundwater/Leachate Modeling Study
Area A Landfill Design
Naval Submarine Base New London, Groton, Connecticut

Dear Mr. Evans:

Please find attached a corrected Table 2 for the Work Plan Addendum submitted last October 5 for the Groundwater/Leachate Modeling Study. As a result of an internal review of this table and the boring logs for each of the concerned wells, Brown & Root Environmental (B&R Environmental) discovered several inconsistencies between the information shown on Table 2 and that indicated in the boring logs. In particular, several wells which were shown on Table 2 as having been screened in a single geological unit were in fact screened in two units. Table 2 has been corrected to reflect the proper information as provided in the boring logs. The corrections have been highlighted to make reviewing easier.

B&R Environmental apologizes for these errors and believes that the balance of the information in Table 2 as previously submitted is correct.

Copy of the attached corrected Table 2 is also being sent today via facsimile to Kymberlee Keckler at U.S. EPA Region I and Dale Weiss at TRC Environmental Corporation in preparation for tomorrow's phone conference. Additional copies are also being sent today via regular mail to Mark Lewis at the Connecticut Department of Environmental Protection (CTDEP), Jim Briggs at NORTHDIV Civil Design and Andy Stackpole at NSB NLON Environmental Department.

Very truly yours,

Jean-Luc Glorieux, P.E.
Project Manager

JLG/jlg

Attachment

cc: Mr. Roger Boucher, NORTHDIV (letter only)
Mr. Jim Briggs, NORTHDIV (1 copy)
Mr. Andrew Stackpole, Environmental Department, NSB NLON (1 copy)
Mr. John Trepanowski, Brown & Root Environmental, Wayne (1 copy)
Mr. Daryl Hutson, Brown & Root Environmental, Pittsburgh (letter only)
File 5082

Brown & Root Environmental

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FAX: (412) 921-4040

C-49-10-5-224
October 19, 1995
Project Number 5082

Ms. Kymberlee Keckler
Remedial Project Manager
U.S. Environmental Protection Agency - Region I
Waste Management Division - HAN-CAN1
J.F.K. Federal Building
Boston, Massachusetts 02203-2211

Reference: CLEAN Contract N62472-90-D-1298
Contract Task Order No. 203

Subject: Corrected Table For Work Plan Addendum
Groundwater/Leachate Modeling Study
Area A landfill Remedial Design
Naval Submarine Base New London, Groton, Connecticut

Dear Ms. Keckler:

On behalf of the U.S. Navy, Northern Division Naval Facilities Engineering Command (the Navy), Brown & Root Environmental (B&R Environmental), a division of Halliburton NUS Corporation, is pleased to submit to the U.S. Environmental Protection Agency Region I (USEPA) one (1) copy of a corrected Table 2 for the Work Plan Addendum submitted last October 5 for the Groundwater/Leachate Modeling Study.

As a result of an internal review of this table and the boring logs for each of the concerned wells, Brown & Root Environmental (B&R Environmental) discovered several inconsistencies between the information shown on Table 2 and that indicated in the boring logs. In particular, several wells which were shown on Table 2 as having been screened in a single geological unit were in fact screened in two units. Table 2 has been corrected to reflect the proper information as provided in the boring logs. The corrections have been highlighted to make reviewing easier. B&R Environmental apologizes for these errors and believes that the balance of the information in Table 2 as previously submitted is correct.

Copy of the attached corrected Table 2 is also being sent today via facsimile to Mr. Dale Weiss at TRC Environmental Corporation in preparation for tomorrow's phone conference.

Sincerely yours,

Jean-Luc Glorieux, P.E.
Project Manager

Attachment
JLG/jlg

cc: Mr. Dale Weiss, TRC Environmental Corporation (1 copy)
Mr. Roger Boucher, NORTHDIV (letter only)
Mr. Mark Evans, NORTHDIV (letter only)
Mr. James Briggs, NORTHDIV (letter only)
Mr. Andrew Stackpole, NSB NLON, Environmental (letter only)
Mr. John Trepanowski, Brown & Root Environmental, Wayne (letter only)
Mr. Daryl Hutson, Brown & Root Environmental, Pittsburgh (letter only)
File 5082

Brown & Root Environmental

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C-49-10-5-226
October 19, 1995
Project Number 5082

Mr. Mark Lewis
Environmental Analyst 2
Connecticut Department of Environmental Protection
Bureau of Water Management - PERD
79 Elm Street
Hartford, Connecticut 06106-5127

Reference: CLEAN Contract N62472-90-D-1298
Contract Task Order No. 203

Subject: Corrected Table For Work Plan Addendum
Groundwater/Leachate Modeling Study
Area A landfill Remedial Design
Naval Submarine Base New London, Groton, Connecticut

Dear Mr. Lewis:

On behalf of the U.S. Navy, Northern Division Naval Facilities Engineering Command (the Navy), Brown & Root Environmental (B&R Environmental), a division of Halliburton NUS Corporation, is pleased to submit to the Connecticut Department of Environmental Protection (CTDEP) one (1) copy of a corrected Table 2 for the Work Plan Addendum submitted last October 5 for the Groundwater/Leachate Modeling Study.

As a result of an internal review of this table and the boring logs for each of the concerned wells, Brown & Root Environmental (B&R Environmental) discovered several inconsistencies between the information shown on Table 2 and that indicated in the boring logs. In particular, several wells which were shown on Table 2 as having been screened in a single geological unit were in fact screened in two units. Table 2 has been corrected to reflect the proper information as provided in the boring logs. The corrections have been highlighted to make reviewing easier. B&R Environmental apologizes for these errors and believes that the balance of the information in Table 2 as previously submitted is correct.

Sincerely yours,

Jean-Luc Glorieux, P.E.
Project Manager

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Mr. John Trepanowski, Brown & Root Environmental, Wayne (letter only)
Mr. Daryl Hutson, Brown & Root Environmental, Pittsburgh (letter only)
File 5082

TABLE 2

SUMMARY OF EXISTING AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
Area A Landfill Phase I and II RI - Monitoring Wells									
1MW2S	86.02	X	--	X	--	--	14.0	4.0-14.0	Fill/Dredge
2LMW7S	82.80	X	--	X	X	30.2	50.0	11.65-21.65	Fill/Dredge
2LMW7D	83.10	X	--	X	X	28.5	43.59	33.5-43.6	BR[1]
2LMW8S	86.40	X	--	--	X	--	20.0	5.5-15.5	Fill/ Alluvium
2LMW8D	87.10	X	--	--	X	41.5	124.4	46.5-124.4	BR
2LMW9S	85.30	X	--	X	X	--	42.5	8.24-18.24	Fill/Dredge
2LMW9D	85.40	X	--	X	X	42.0	59.74	47.0-59.74	BR
2LMW13S	86.90	X	--	--	--	--	36.0	6.46-16.46	Fill
2LMW13D	86.80	X	--	--	--	19.5	60.03	24.5-60.03	BR
2LMW14D	91.90	X	--	--	X	13.5	27.0	18.5-27.0	BR
2LMW17S	82.48	X	--	X	--	--	18.5	7.75-17.75	Fill/Dredge
2LMW17D	82.62	X	--	X	--	18.0	39.0	28.1-39.0	BR
2LMW18S	77.94	X	--	X	X	--	33.5	5.74-15.74	Fill

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2LMW18D	77.67	X	--	X	X	36.0	49.03	41.0-49.03	BR
2LMW19S	93.50	--	--	--	X	17.5	25.0	15.0-25.0	Alluvium/ BR
2LMW19D	93.90	--	--	--	X	17.5	120.0	28.0-120.0	BR
2LMW20S	87.35	X	--	--	X	--	26.0	9.0-19.0	Fill/ Alluvium
2LMW20D	87.55	X	--	--	X	39.0-69.0	80.0	74.0-80.0	BR
2LPW1S	86.25	X	--	X	--	--	15.0	4.0-14.0	Fill/Dredge
2LOW1S	86.26	X	--	X	--	--	15.0	4.0-14.0	Fill/Dredge
2LOW1D	86.88	X	--	X	X	29.3	29.5	23.75-28.75	Dredge/ Alluvium
2LOW2S	86.69	X	--	X	--	--	15.0	4.0-14.0	Fill/Dredge
2LOW3S	85.50	X	--	X	--	--	14.0	3.0-13.0	Fill/Dredge
2LOW4S	86.83	X	--	X	--	--	14.0	4.0-14.0	Fill/Dredge
2WMW3S	87.80	X	--	X	X	--	41.5	7.79-22.79	Fill/Dredge
2WMW3D	81.68	X	--	X	X	73.0	127.1	78.0-127.1	BR
4MW1S	127.91	--	X	--	--	2.5	18.5	8.5-18.5	BR

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
4MW2S	96.65	--	X	X	--	6.5	14.5	4.5-14.5	Dredge/BR
4MW3S	100.55	--	X	--	--	4.5	13.5	3.5-13.5	Till/BR
4MW4S	107.80	--	X	--	--	4.5	14.5	4.5-14.5	Till/BR
4MW4D	107.29	--	X	--	--	8.5	40.0	30.0-40.0	BR
Area A Landfill Phase I and II RI and FFS - Soil Borings									
1TB1	--	X	--	--	X	--	14.5	--	--
1TB3	--	X	--	X	--	--	14.0	--	--
4TB1	--	X	--	--	X	12.0	12.0	--	--
4TB2	--	--	--	--	X	3.5	3.5	--	--
2LTB1	84.0	X	--	X	--	20.0	20.0	--	--
2LTB2	84.6	X	--	X	X	24.0	24.0	--	--
2LTB3	84.6	X	--	X	--	18.0	18.0	--	--
2LTB4	88.2	X	--	X	--	17.0	17.0	--	--
2LTB5	88.0	X	--	--	--	10.0	10.0	--	--
2LTB6	88.4	X	--	X	X	--	21.0	--	--
2LTB7	87.4	X	--	X	--	12.2	12.2	--	--

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2LTB8	87.4	X	--	--	--	14.7	14.7	--	--
2LTB9	87.0	X	--	--	--	6.0	6.0	--	--
2LTB10	87.2	X	--	X	--	--	16.0	--	--
2LTB11	87.1	X	--	X	--	--	16.0	--	--
2LTB12	86.0	X	--	X	--	--	16.0	--	--
2LTB13	87.8	X	--	X	--	--	16.0	--	--
2LTB14	88.1	X	--	--	--	--	16.0	--	--
2LTB15	87.7	X	--	--	--	5.5	5.5	--	--
2LTB16	87.8	X	--	--	--	6.0	6.0	--	--
2LTB17	87.8	X	--	X	--	--	16.0	--	--
2LTB18	88.1	X	--	X	--	--	16.0	--	--
2LTB19	87.8	X	--	--	--	--	16.0	--	--
2LTB20	88.6	X	--	X	--	--	16.0	--	--
2LTB21	88.7	X	--	X	--	--	16.0	--	--
2LTB22	89.6	X	--	X	--	--	16.0	--	--
2LTB23	88.4	X	--	X	--	--	16.0	--	--

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2LTB24	90.0	X	--	X	--	13.83	13.83	--	--
2LTB25	88.4	X	--	--	--	4.0	4.0	--	--
2LTB26	89.7	X	--	--	--	5.16	5.16	--	--
2LTB27	90.6	X	--	--	--	9.66	9.66	--	--
2LTB28	88.1	X	--	X	--	--	16.0	--	--
2LTB29	87.1	X	--	X	--	--	16.0	--	--
2LTB30	88.4	X	--	--	--	3.16	3.16	--	--
2LTB31	88.1	X	--	X	--	--	16.0	--	--
2WTB1	67.5	--	--	X	X	--	32.0	--	--
2WTB2	68.2	--	--	X	X	--	32.0	--	--
2WTB4	83.5	--	--	--	X	0.83	0.83	--	--
Area A Landfill FFS - Soil Borings									
2GB1	75.1	X	--	X	X	--	22.0	--	--
2GB2	75.1	X	--	X	--	17.0	17.0	--	--
2GB3	78.2	X	--	X	X	22.0	22.0	--	--
2GB4	--	X	--	--	--	3.5	7.8	--	--

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TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2GB5	--	X	--	--	X	--	9.0	--	--
2GB6	83.4	X	--	--	--	3.0	8.0	--	--
2GB7	80.3	X	--	--	--	10.0	10.0	--	--
2GB8	82.8	X	--	--	--	4.0	8.0	--	--
2GB9	84.4	X	--	--	X	2.5	2.5	--	--
2GB10	85.9	X	--	--	X	9.0	14.0	--	--
2GB11	--	--	--	--	X	--	8.3	--	--
2GB12	92.0	--	--	--	X	5.0	10.0	--	--
2GB13	91	X	--	--	--	5.0	5.0	--	--
2GB14	94.4	--	--	--	X	0.5	5.4	--	--
2GB15	--	--	--	--	--	GS[2]	--	--	--
2GB16	--	--	--	--	X	4.0	8.8	--	--
2GB17	92.4	X	--	--	--	4.2	4.2	--	--
2GB18	92.5	--	--	--	X	18.8	23.16	--	--
2GB19	92.4	--	--	X	--	--	11.1	--	--
2GB20	95.0	X	--	--	X	7	11.5	--	--

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NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
2GB21	--	X	--	X	--	22	26.3	--	--
2GB22	80.7	X	--	X	--	--	12.0	--	--
2GB23	77.8	X	--	--	--	--	17.0	--	--
Area A Landfill - Geotech Borings									
LF-SB01	79.3	X	--	X	X	52.0	52.0	--	--
LF-SB02	87.3	X	--	X	X	33	38.5	--	--
LF-SB03	84.5	X	--	X	X	70	70	--	--
LF-SB04	91.0	X	--	--	X	--	16	--	--
LF-SB05	90.8	X	--	--	X	23	23	--	--
LF-SB06	79.4	X	--	X	X	22.5	32.0	--	--
Area A Landfill Cap Design - Geoprobes									
GP1	96.0	--	--	--	--	90.5 ft msl	--	--	--
GP2	100.8	--	--	--	--	99.1 ft msl	--	--	--
GP3	103.8	--	--	--	--	102.7 ft msl	--	--	--
GP4	99.6	--	--	--	--	98.3 ft msl	--	--	--
GP5	97.4	--	--	--	--	92.7 ft msl	--	--	--

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Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
GP6	92.1	--	--	--	--	87.3 ft msl	--	--	--
GP7	99.1	--	--	--	--	93.2 ft msl	--	--	--
GP8	100.2	--	--	--	--	98.0 ft msl	--	--	--
GP9	90.0	--	--	--	--	88.9 ft msl	--	--	--
GP10	87.9	--	--	--	--	84.4 ft msl	--	--	--
GP11	106.5	--	--	--	--	105.2 ft msl	--	--	--
GP12	90.1	--	--	--	--	87.7 ft msl	--	--	--
GP13	105.6	--	--	--	--	100.5 ft msl	--	--	--
GP14	95.9	--	--	--	--	89.5 ft msl	--	--	--
GP15	102.6	--	--	--	--	101.6 ft msl	--	--	--
GP16	101.2	--	--	--	--	94.6 ft msl	--	--	--
GP17	95.0	--	--	--	--	88.1 ft msl	--	--	--
GP18	96.9	--	--	--	--	88.5 ft msl	--	--	--
GP19	107.2	--	--	--	--	104.9 ft msl	--	--	--
GP20	100.0	--	--	--	--	86.0 ft msl	--	--	--
GP21	97.8	--	--	--	--	93.4 ft msl	--	--	--

DRAFT

TABLE 2
SUMMARY OF EXISTING AREA LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs)	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened
		Fill	Till	Dredge Spoil	Weathered Bedrock/ Alluvium				
GP22	110.2	--	--	--	--	108.6 ft msl	--	--	--
GP23	100.6	--	--	--	--	95.6 ft msl	--	--	--
GP24	98.3	--	--	--	--	90.2 ft msl	--	--	--

Notes:

ft msl - feet mean sea level
ft bgs - feet below ground surface
X - Denotes geologic unit encountered during boring installation
-- - No data available
(1) BR - Bedrock
(2) GS - Ground Surface

DRAFT

APPENDIX A.3

FIELD INVESTIGATION MODIFICATIONS

Brown & Root Environmental

A Division of Halliburton NUS Corporation

Foster Plaza VII
661 Andersen Drive
Pittsburgh, PA 15220-2745

(412) 921-7090
FAX: (412) 921-4040

C-49-10-5-303

October 25, 1995

Project Number 5082

Mr. Mark Evans
Northern Division (Code 1823)
Naval Facilities Engineering Command
Mail Stop 82, 10 Industrial Highway
Lester, Pennsylvania 19113-2090

Reference: CLEAN Contract N62472-90-D-1298
Contract Task Order No. 203

Subject: Field Investigation Modifications
Groundwater/Leachate Modeling Study
Area A landfill Remedial Design
Naval Submarine Base New London, Groton, Connecticut

Dear Mr. Evans:

As a result of the October 20, 1995 telephone conference held between the Navy, U.S. EPA Region I (USEPA), their oversight contractor TRC Environmental Corporation (TRC), and Brown & Root Environmental (B&R Environmental), it was agreed to modify the field investigation proposed in support of the Groundwater/Leachate Modeling Study as described in the Letter Work Plan, dated September 6, 1995, and the Letter Work Plan Addendum, dated October 5, 1995. Also, based on a site reconnaissance and utility interference check performed by B&R Environmental during the week of October 16, 1995, some proposed data points have been slightly relocated. The field investigation modifications as itemized below are reflected on attached Figure 3-1. Table A-2, which was first presented in Field Sampling Plan (FSAP) appended to the September 6 Letter Work Plan, has also been revised to reflect the agreed-upon field investigation modifications and a copy of revised Table A-2 is attached to this letter.

The following field investigation modifications will be implemented:

- Proposed well cluster 2LMW32F/2LMW32DS will be moved north about 100 feet toward the wetland boundary to determine groundwater elevations in the dredge spoil and fill near the downgradient edge of the landfill.

- A bedrock well, designated 2LMW32B, will be added to the to the 2LMW32F/2LMW32DS well cluster to establish a better estimate of the bedrock surface, hydraulic conductivity in the bedrock, and hydraulic potential in the bedrock at the northeast corner of the landfill.

- Proposed dredge spoil piezometer 2LPZ3DS will be moved to the wetland boundary.

- Proposed test boring 2LTB32DS will be converted to a dredge spoil monitoring well, re-designated 2LMW34DS, and moved to the southern edge of crane test pad near the existing 2LMW18 well cluster. This new well, together with the existing 2LMW18 cluster, will establish the hydraulic conductivity and hydraulic pot ntial in the dredge spoil between transects B-B' and C-C'.

- Proposed upgradient bedrock well 2LMW34B will be re-designated as 2LMW36B to account for the conversion of proposed test boring 2LTB32DS to dredge spoil well 2LMW34DS.

- An additional piezometer drive point 2LPZ1F will be installed in the fill near proposed staff gauge SG-11 to determine groundwater elevation in the fill/overburden along the wetland boundary between transects B-B' and C-C'.

- An additional piezometer drive point 2LPZ2F will be installed in the fill near existing soil boring 2GB13 to determine groundwater elevation in the fill/overburden at the upgradient, western portion of landfill.

- Proposed dredge spoil piezometer drive points 2LPZ1DS through 2LPZ3DS will be relocated and three additional dredge spoil piezometer drive points, 2LPZ4DS through 2LPZ6DS will be installed. These drive points will be coupled with proposed staff gauges, SG-7, SG-8, and SG-10 through SG-13 to ensure an estimate of the hydraulic potential in the wetland dredge spoil given that the wetland is presently dry.

- Proposed well cluster 2LMW29F/2LMW29DS will be moved south toward the hillside to obtain hydraulic data in the dredge spoil and fill closer to the upgradient boundary of the landfill.

- Proposed well cluster 2LMW31F/2LMW31DS will be moved south off the landfill service road as determined by the B&R Environmental site reconnaissance.

At this time, B&R Environmental is planning to initiate field work on October 31, 1995 and it is anticipated that all field activities will be completed around November 22, 1995.

This information is also being sent today to Ms. Kymberlee Keckler at USEPA (via express mail), to Mr. Dale Weiss at TRC (via express mail), and to Mr. Mark Lewis at the Connecticut Department Of Environmental Protection (CTDEP) (via regular mail). Copies of this letter and the attached figure and table are also being sent today in accordance with the distribution list shown below.

If you have any questions or comments regarding the proposed field investigation modifications, please contact me at (412) 921-8568 or Corey Rich at (412) 921-8244.

Sincerely yours,

Jean-Luc Glorieux, P.E.
Project Manager

Attachment
JLG/jlg
cc: Mr. Roger Boucher, NORTHDIV (letter only)
Mr. James Briggs, NORTHDIV (1 copy)
Mr. Andrew Stackpole, NSB NLON, Environmental (1 copy)
Mr. John Trepanowski, Brown & Root Environmental, Wayne (1 copy)
Mr. Daryl Hutson, Brown & Root Environmental, Pittsburgh (letter only)
File 5082

APPENDIX B

BROWN & ROOT ENVIRONMENTAL FIELD LOGS

B.1 Drilling Activities Log
B.2 OBDA Seep Sampling and Flow Measurement Log

APPENDIX B.1

DRILLING ACTIVITIES LOG

TITLE NSB-NLON
Oct. 30, 1995

PROJECT NO. 5082
BOOK NO. 1243

Work continued from Page

— Initiate Modeling Investigation —

0730 @ Pittsburgh Airport - Check bags go to gate check-in with Ticket agent.

0830 Depart Pittsburgh Airport via USAir
1000 Arrive in Providence RI. Pick up car/luggage & travel to NSB-NLON
11:00 Check into Hotel have Lunch
1150 - ON-SITE - Get base pass proceed to B&RE Trailer
12:15 - UNPACK FED-EX Discuss boring locations w. Stan Conti
12:45 - At ALPHA AREA LANDFILL:
- Place Pin Flags @ proposed locations
- Note that 2LPW1S is in wrong location
- Note 1-2 GPM Flow into catch basin ~ 40' west of 2LMW31F proposed location

2:30 Call Jean-Luc & Lori Grass to inform them of the above observations I inform Lori that 2LPW1S is ≥75' west of where it is shown on the map. She informs me to keep the proposed drilling locations as is for X-section A-A'. I inform her of flow to catch basin and she requests a map showing location.

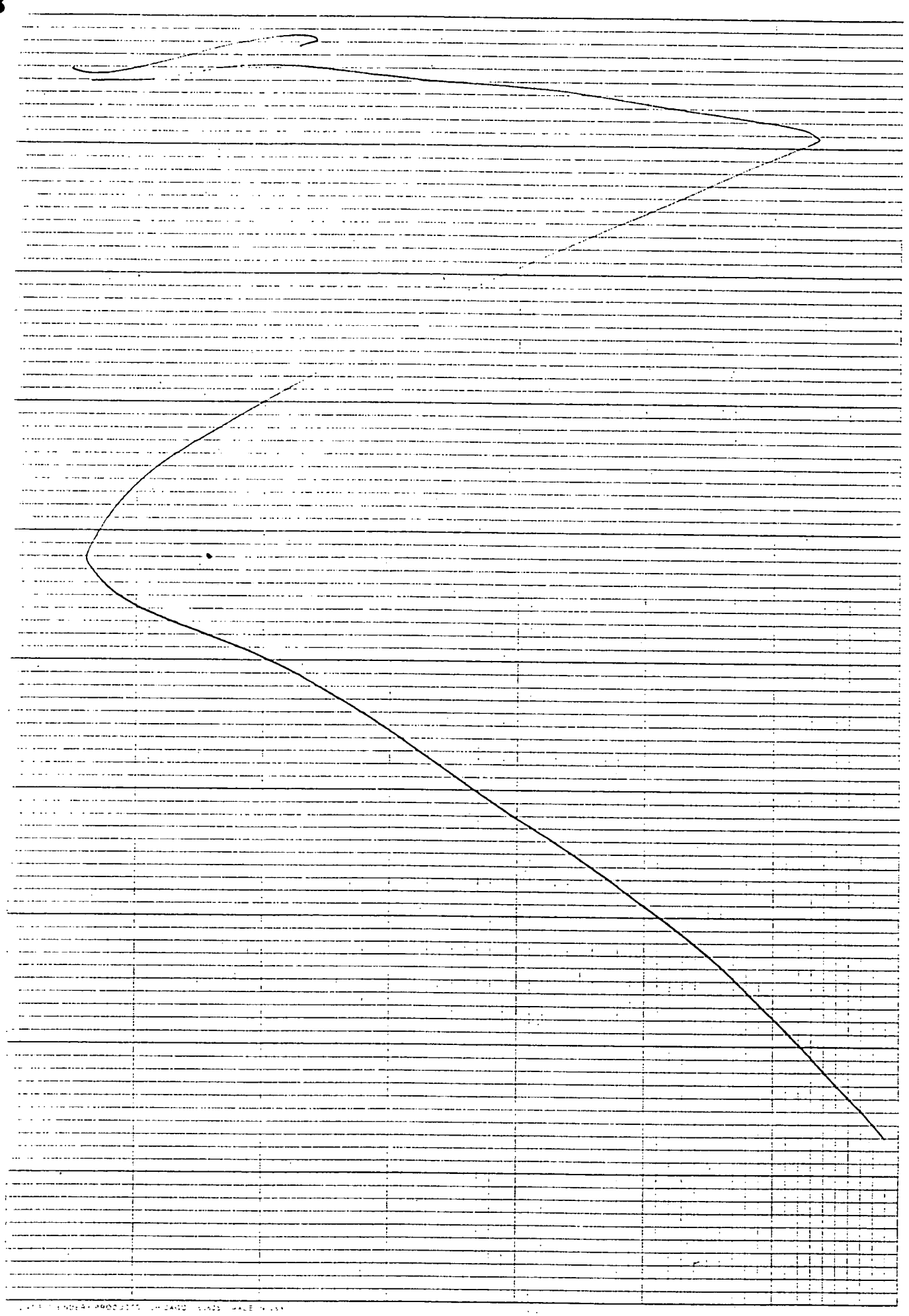
3:30 OFF-SITE

3:30 - 5:30 Review H&S, workplan and drawings

6:00 Call Lori Grass to discuss surface water & drilling to bedrock at crane test area. She says not to drill to bedrock and that the surface water at proposed location 2LMW31F will not effect well location

Thomas E. [illegible]

10/30/95



TITLE NSB-NLON

Oct 31, 1995

PROJECT NO 5082

BOOK NO 1243

Work continued from Page

Weather 55°F overcast lt rain

0700 ON-SITE, Calibrate H-Nu, pick-up supplies

0720-830 Drillers on-site: Discuss Health & Safety show drillers locations for wells, discuss approach. They recommend coring in brush area

830-900 Talk to Stan Conti & Kathy Swipson regarding coring with CME-75. Talk to Safety re: access to deployed Park

900 Meet w. Dick Cummel of base environmental at Wahoo Ave. He is walking along Ave. downwind a diesel spill on the uphill side. Give him the heads up regarding access to deployed Park. Safety will give us access to deployed Weds Nov 1 from 0700 to 1800 hours will have provide oversight while on-site. Drillers Steam clean & prep for drilling

0915 Prep to drill 2LMW28DS

1030 Complete installation of 2LMW28DS

12:30-1:00 Lunch

1:00-1:30 Prep for drilling 2LMW28F

1:30-2:00 Move supplies & set-up on 2LMW28F and Complete Note electric manhole behind trailers Review cuttings dumping at 2LMW29F

2:00-4:00 Drill and install 2LMW28F. Note thin DS Layer. Decide to backfill hole to 8.5' and install Fill monitor rather than dredge spoil monitor

4:00-4:30 Call Cory Rich inform him of thin "DS" Layer and of deep water table at 2LMW2

4:30-5:30 Stake 2LMW30 location. Talk w. Security regarding departure time Supervise Steam cleaning at Drilling Eq. 5:35 off site.

5:30-6:30 review notes & days work

CONTINUED ON Page

SIGNATURE

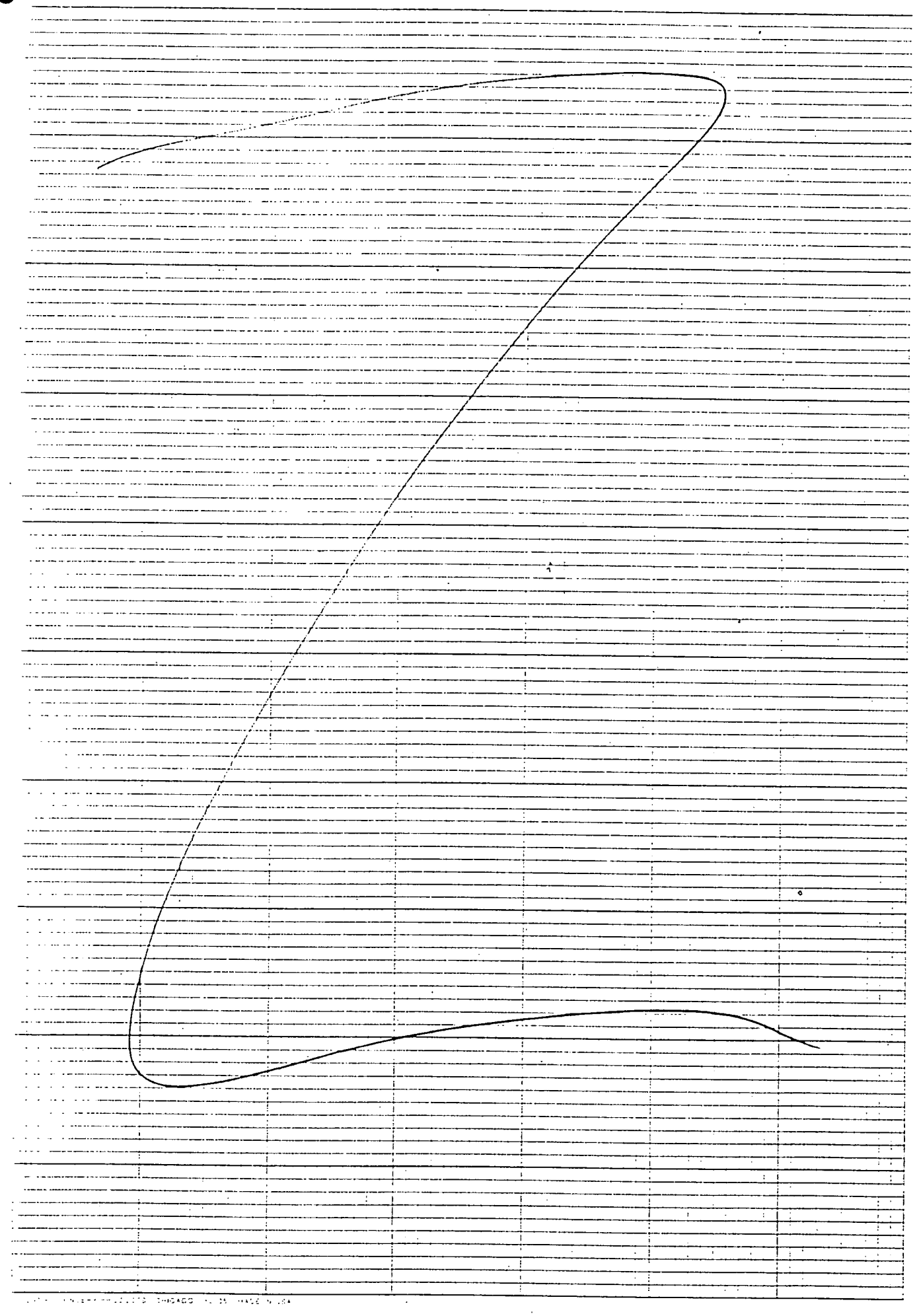
DATE 10/31/95

PREPARED AND UNDERSTOOD BY

DATE

WITNESS

DATE



TITLE NSB-NLON AREA A LANDFILL Nov. 1, 1995

PROJECT NO. 5082

BOOK NO 1243

Work continued from Page

0640 ONSITE CALIBRATE HNU. Check supplies

0655 At Area A Landfill Gate

0700 Navy opens gate, placed to deployed parking area gate await security to open gate and drillers

0722 Drillers on-site call security to enquire as to the whereabouts ON STANDBY

0805 Navy opens gate. drillers change 1 hr Standby Prep and drill 2LMW30DS Note petro contamination from 6' to within the dredge spoils.

1030 Complete 2LMW30DS tremie grout to surface while I call Jean-Luc/Cory Rich Inform them of Petro contamination at 2LMW30DS Discuss access problems at 2LMW32 and 2LMW33. Inform them that G. Casabetta of Assoc. has agreed to help with Pace tests at no additional charge. Recommended using CME75 for installing bedrock monitor at 2LMW32 Location. Informed them of observations at 2LMW28 and 2LMW29 They inform me to install 2LMW29DS in dredge spoil or native soils beneath dredge spoils if spoils are of insufficient thickness

1100 Call Dick Connant and discuss access problems He agrees to meet me at 1300 at deployed parking in Alpha Area LF.

1130 Start drilling 2LMW30F

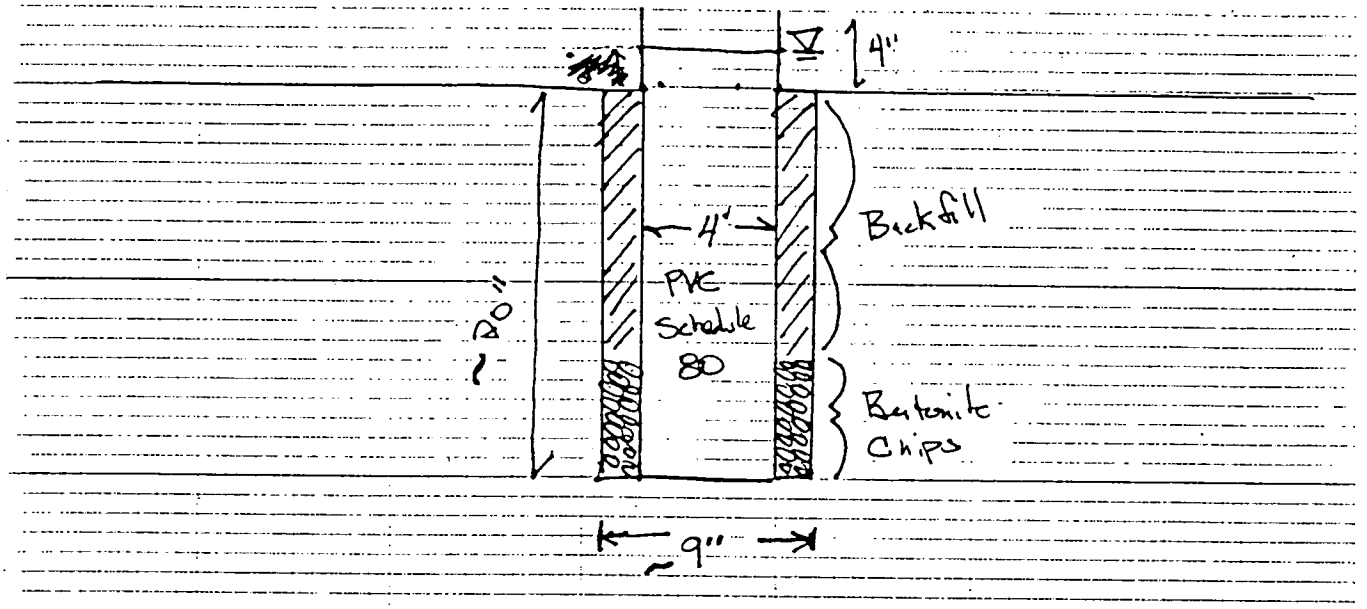
1250 Complete 2LMW30F (sand & seal)

1300 Drillers break for Lunch Meet w. Dick Connant regarding access to Brushy Area (2LMW32)

Work continued on Page

SIGNATURE DATE

WITNESSED TO AND UNDERSTOOD BY WITNESS DATE


4"
4"
Backfill
PVC
Schedule
80
Bentonite
Chips
9"

TITLE NSB-NLON

PROJECT NO. 5082

BOOK NO. 1243

Work continued from Page 71

1330 Dick Cornett requested that B&RE confirm verbally that the will assume responsibility for taking down and putting up the fence. He requested that we temporarily put up the fence at the completion of each days work. He stated that he will inform security and Public works regarding our intentions

1330 Call Cory Rich to relay above message Drillers grouting 2LM30DS and F.

1330-1430 = Grout 2LM30F

1430 - 15:15 = Infiltration tests at 2LIT1 and 2LIT2 (inside deployed Parking)

15:15 Steam clean augers, rods, spoons etc.

15:30 Navy Personnel lock deployed Parking Area Gate

15:30 - 17:00 Continue infiltration tests at 2LIT3, 2LIT4, 2LIT5, 2LIT6

1735 off site - 3 hours standby time for drillers.

1800 - 1900 Reduce infiltration data, create boring log table

~~Entered~~

Work continued to Page

SIGNATURE

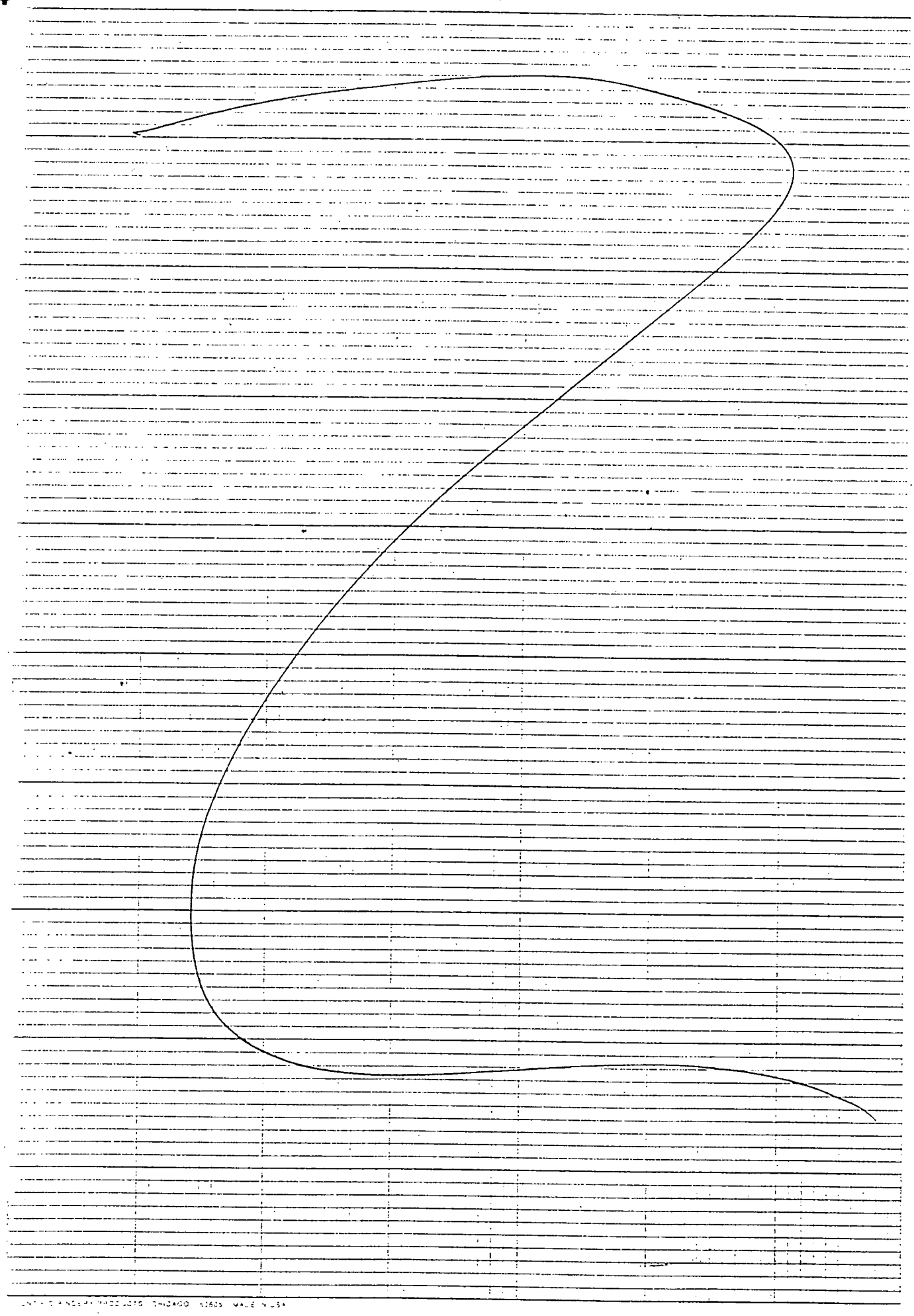
DATE 11/1/95

DISCLOSED TO AND UNDERSTOOD BY

DATE

WITNESS

DATE



TITLE NSB-NLON

Nov. 2, 1995

PROJECT NO. 5082

BOOK NO.

Work continued from Page

Weather 50°F RAIN

6:30 ON-SITE, Calibrate H-Nu, pick up water level meter go to Landfill gate and await drillers and Navy to open gate

705 DRILLERS ONSITE - Gate Locked await Navy

7:20 Navy unlocks Gate

7:45 Start/set up on 2LMW29DS

900 Augering completed, well installed. Start grouting 2LMW29DS/F

1000 Move to 2LMW31DS Auger and install monitoring well in dredge spoil. Due to relatively thin dredge spoil layer, we install a three foot screen. ~~Finish~~

1230 Break for Lunch

1300 Call Lori Gross with progress report

1330 Back on-site. Grout 2LMW31DS Auger and install 2LMW31F as a temp. well with 3 foot screen

1345 Alternator on drillers ~~st~~ truck fails. Take drillers helper to parts store for replacement

1500 - 2LMW31F Complete mob rig & equip to ~~pad~~ decon pad Steam clean rig, augers, spoons etc.

16:30 Driller goes to fill up drilling rig water tank helper drums cuttings and decon water.

17:30 Drop Shelby tube & equipment off @ trailer

17:35 offsite

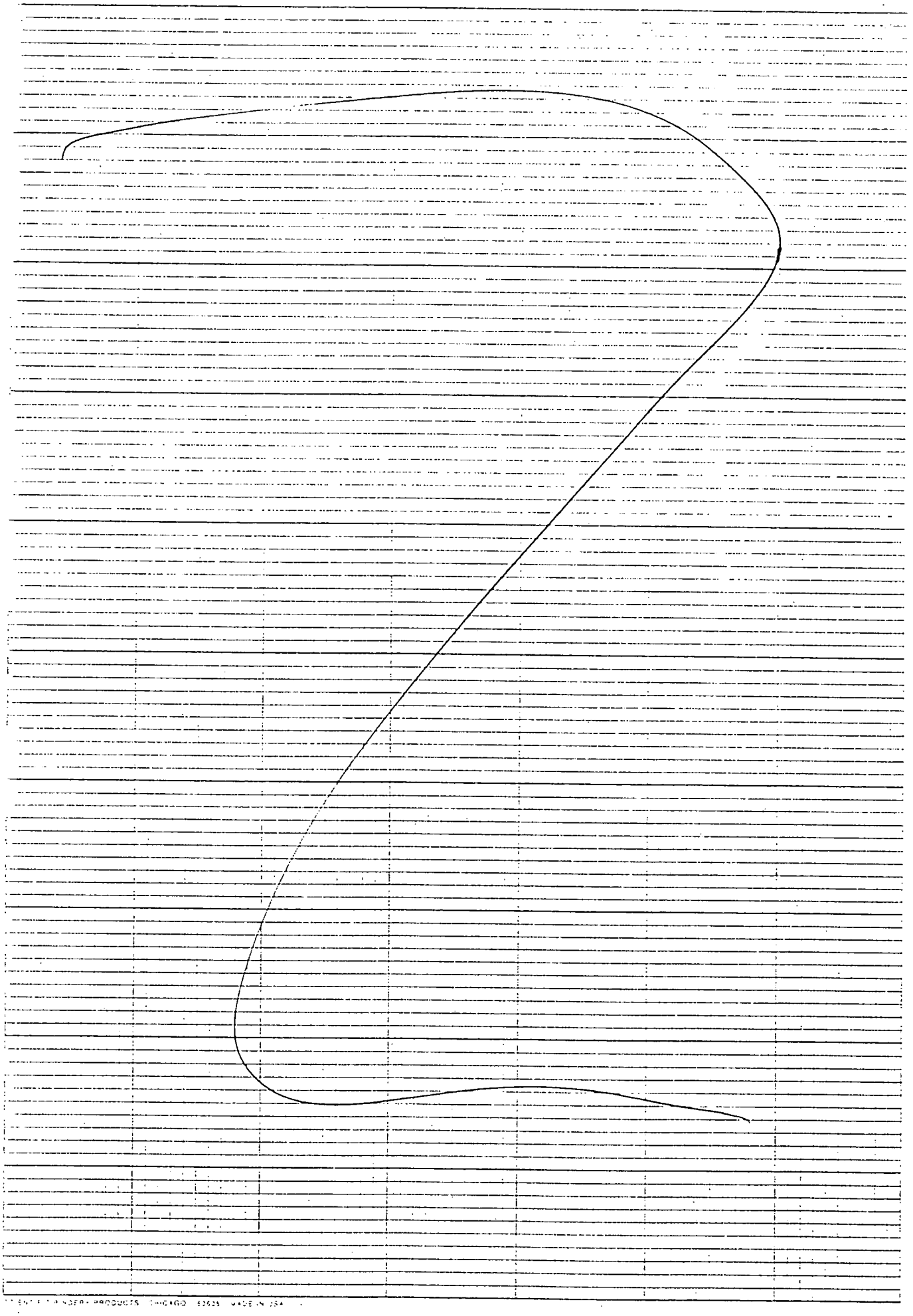
18:30-1900 Red/put data in tabular format

Work continued to Page

SIGNATURE

DATE 11/2/95

DISCLOSED TO AND UNDERSTOOD DATE WITNESS DATE


PRODUCTS CHICAGO 60625 MADE IN USA

TITLE AREA N LANDFILL NSB-NLON

PROJECT NO 5082

BOOK NO 1243

November 3, 1995

Work continued from Page

Weather Foggy 60°

~~Jet~~ Steve Parson 716 633 7094
Other John Chance 703-676-4326

0640 ONSITE

0715 NAVY OPENS GATE

0725 DRILLERS ON-SITE; Go to tennis court area, take down fence. Drillers change standby

8:00 Bulldozer operator arrives. Show him area where we requiring clearing. Operator = Scott Russoni

0930 Put fence back up temporarily

0950 Mob rig to 2LMW34D3

1055 Bull dozer off site. George Cambell Arrives to inspect brushy area & fence

1250 Complete 2LMW34D3 mix grout

13:30 Grouting complete. Go to Lunch

14:00-14:30 Call Sean-Lee and Lori Gross regarding program, access to brushy area near tennis courts, the use of the air rotary rig etc.

1440 Andy Stakpol on-site to check progress and report that a package arrived for Keith Simpson

1500 Set up drill and install 2LDZ1F

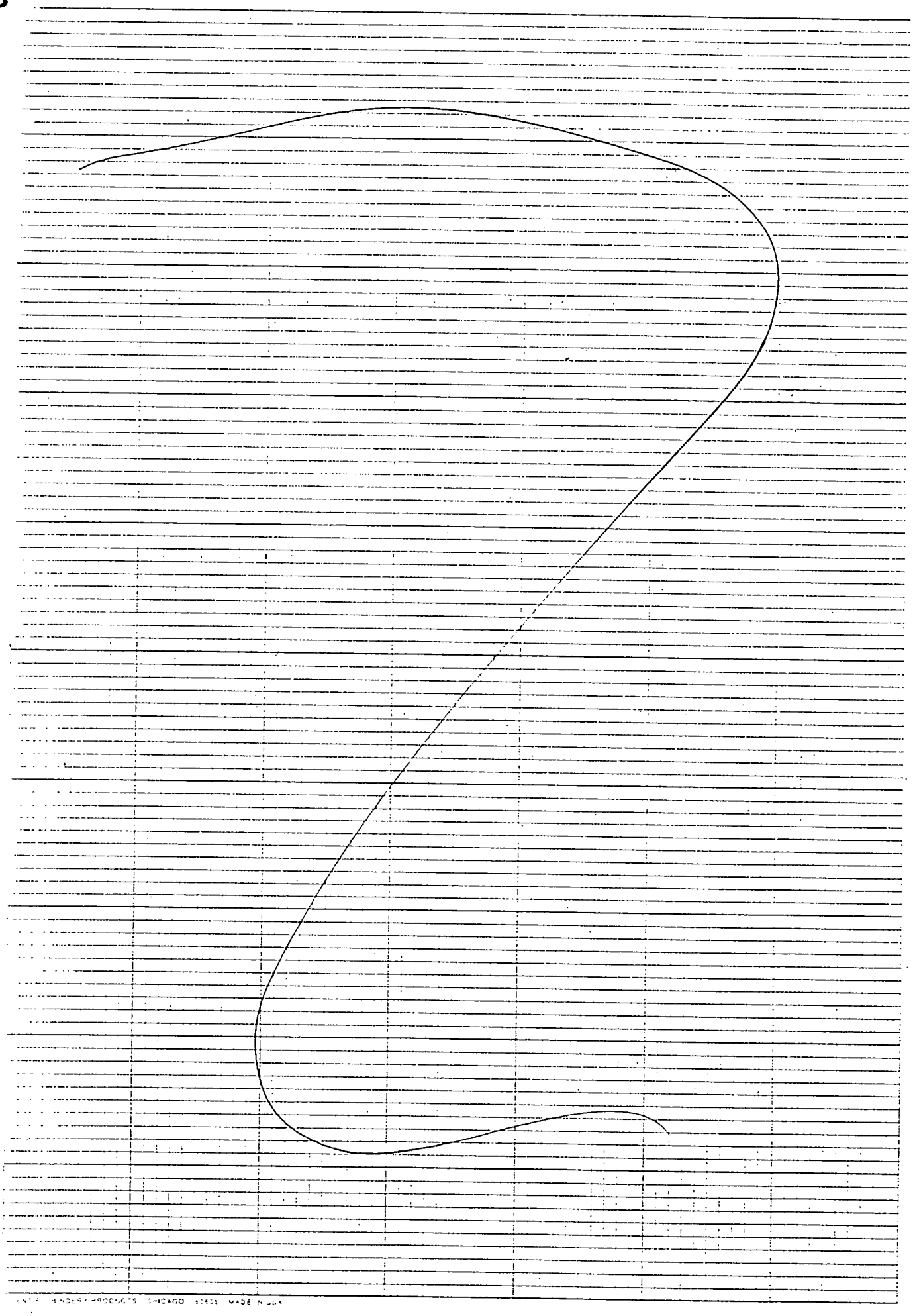
1600 Set up drill and install 2LDZ2F

1630- Install 2 pvc pipes at infiltration test locations 2LIT7 & 2LIT

1700-1720 Drillers down & offsite

NAME OF CONTRACTOR OR REP.

DATE 11/3/95


MADE IN USA

NSB NLON
AREA A INVEST.
Nov 4, 1995

PROJECT NO. 3082
BOOK NO 1243

continued from Page

weather 40° WINDY SUNNY

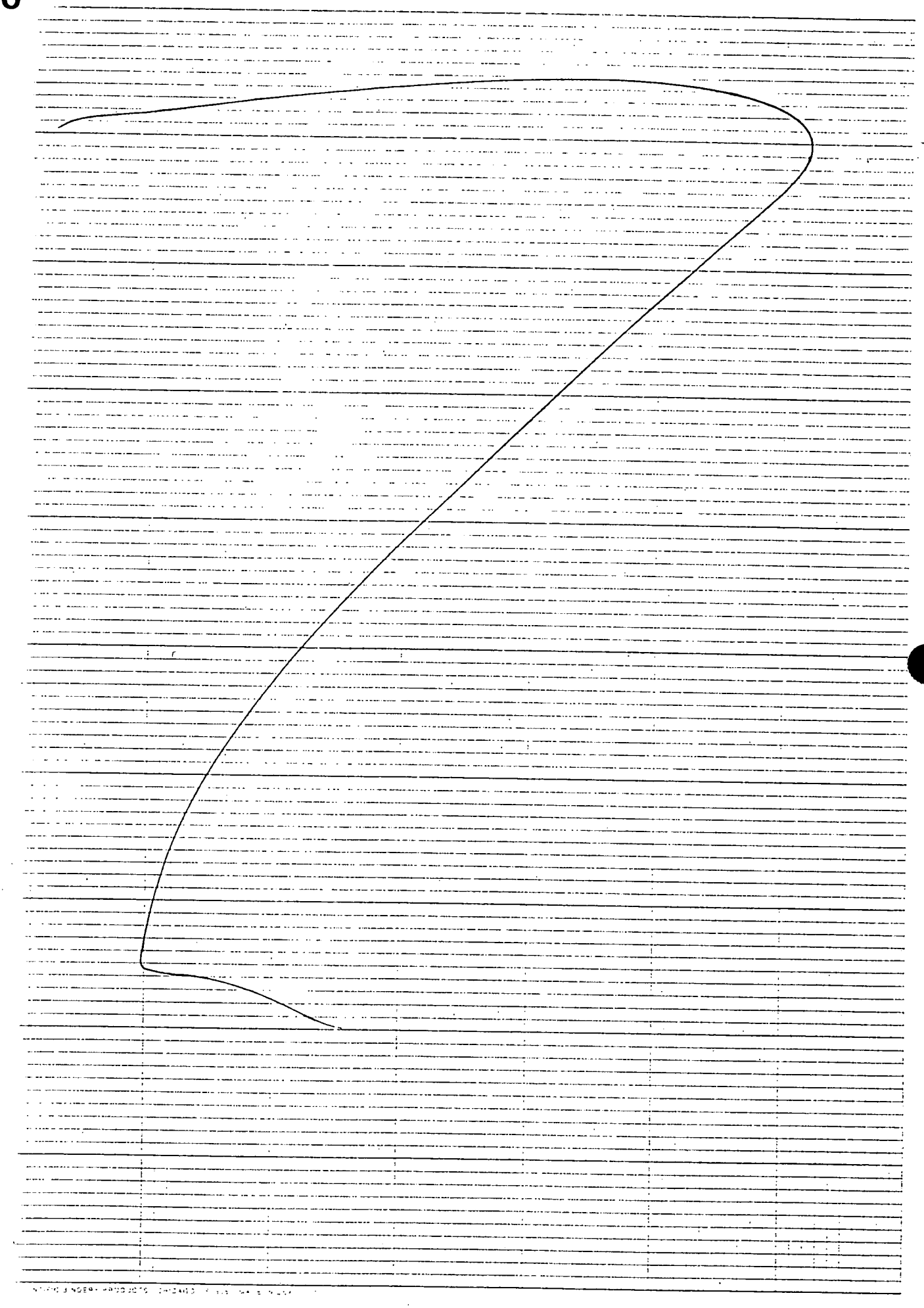
0640 ONSITE - Calibrate equipment get supplies
0700 at Area A Landfill gate await Navy to open gate
0720 Drillers on-site
Gate not open proceed to security building on Strait Avenue
0800 Security opens backgate move down pad
MOB rig/equipment to brushy area of Area A Landfill.
Drillers get water perform infiltration tests on 2LIT7/2LIT8
0840 Set up at 2LIT7 water level falls extremely slow. Ground may be saturated from heavy rain
0855 MOB to 2LMW33DS
1030 Drillers shear off lead auger and bend Rod
Switch to auger/trixone
1510 2LMW33DS completed; drillers repair fence - opposite
1600 Measure from references to infiltration sites

Standby 1 hr as a result of waiting for Navy to open gate
½ hr taking down and putting up fence as requested by Navy

NOT CONTINUED ON Page

DATE 11/4/95

DATE TIME



TITLE NSB-NLON
AREA A LANDFILL Investigation
11/5/95

PROJECT NO. 5082
BOOK NO. 1043

Work continued from Page

Weather 30°F Sunny light breeze

0645 ON-SITE Calibrate H-Nu proceed to site
0715 Drillers on-site await Navy to open gate to get supplies
0830 Navy opens gate
0830-1030 Auger and spin casing at 2LMW33D. Install well
1030 - 1345 Spin casing for 10' at 2LMW32DS
1345- Prep rig for cold weather, drain hoses secure rig for the day
Drillers drive shaft shut on tender truck
14:30 Drillers off site
15:00 inform security we are out of Area A landfill and that they need to lock gate

SIGNATURE OF CONTRACTOR REP

DATE 11/5/95

TITLE NSB-NLON
AREA A LANDFILL
11/6/95

PROJECT NO. 5082
DOC. NO. 1243

Work continued from page

weather: 25°F Sunny

0645 ONSITE Calibrate HNU gather equipment mob to 2LMW32D3 location

0717 Drillers on-site spin casing to 17' @ 2LMW32DS. Installed @ 24'

1140 Complete 2LMW32DS move and set up @ 2LMW32F

1150 - 1220 Lunch

1220 - 1250 Call Jim Lee - Lori Gross with progress report. Call Contaminant Exp.

1250 - 1615 Drill/spin casing at location 2LMW32F. Note thick dredge spoil layer at 10'-15'; sand at 15-22 and dredge spoil @ 22' below grade. Water table appears to be at 10-12' bgs. Call Craig Rick and inform him of geologic conditions. He informs me to install a well in the sand fill at 15-22' and install another well in the non sandfill dredge spoil.

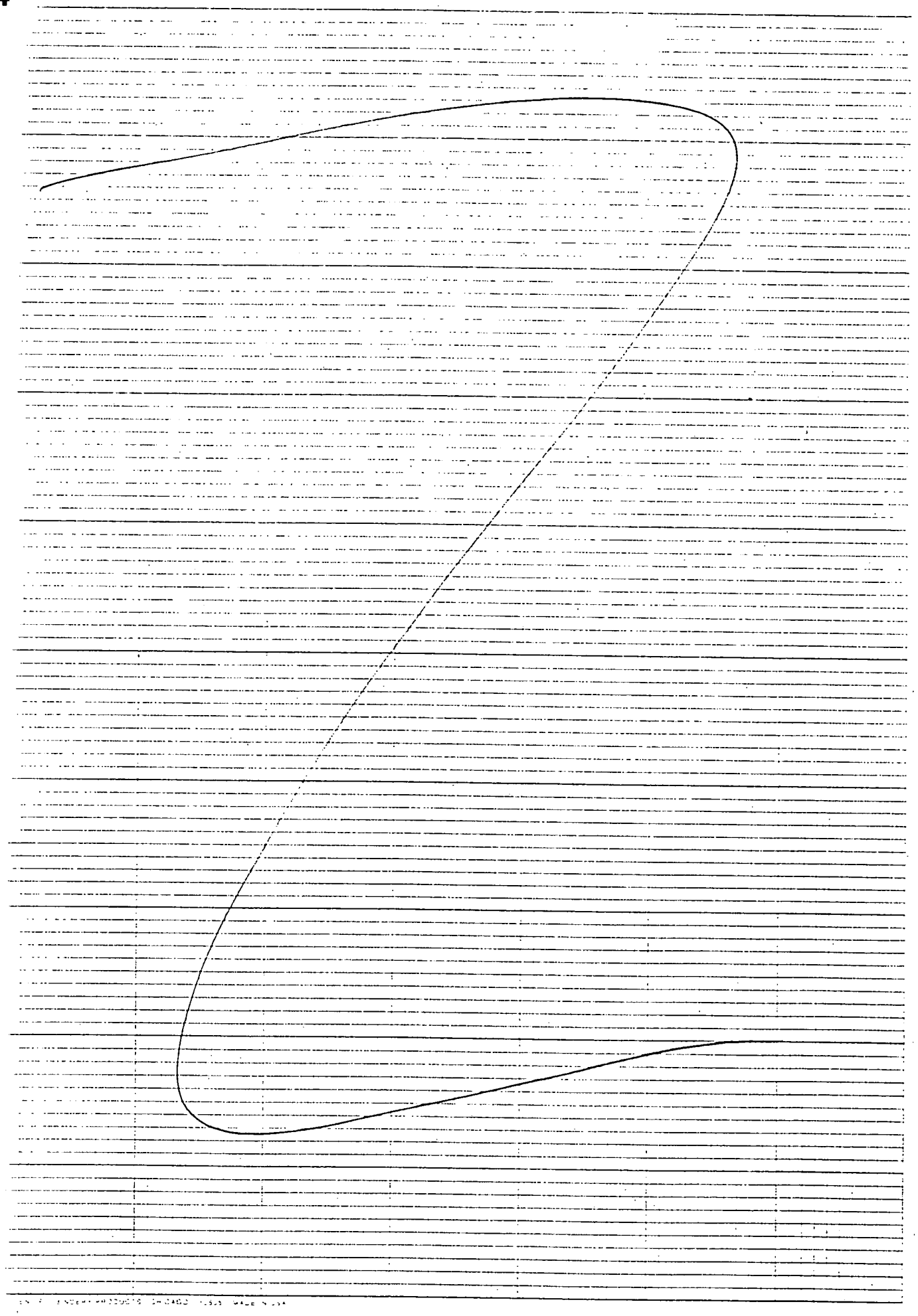
1615 - 1700 Drillers drain pumps and hoses, secure rig and prep for cold weather.

1700 - 1720 Put up fence and de-mob from site (drillers)

1720 - 1810 Prep Shelby tube samples for pick up.

1810 off site

11/6/95



TITLE NSB-NLON
AREA A
November 7, 1995

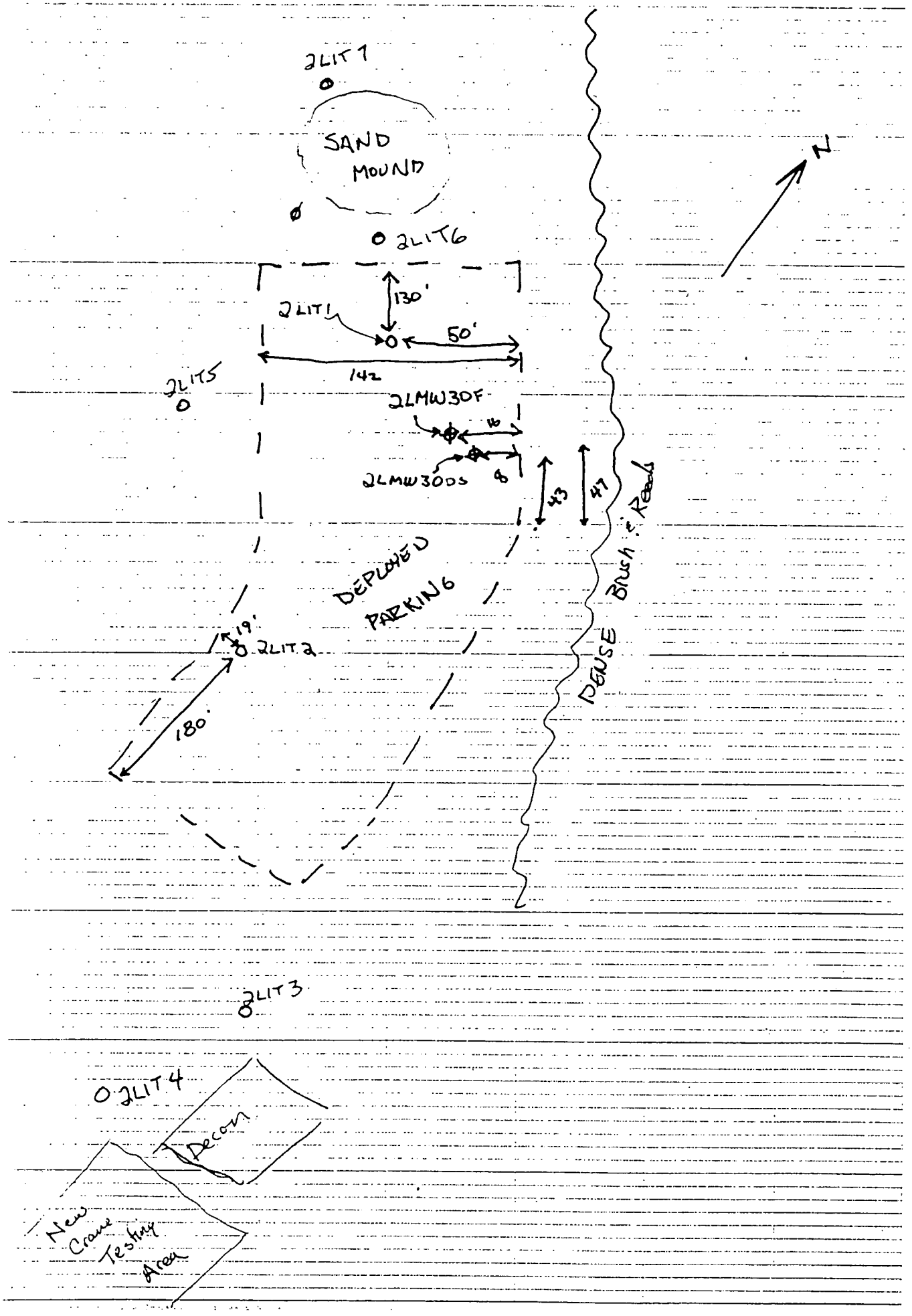
PROJECT NO 5082
BOOK NO 1243

Work continued from Page

Weather: Sunny 20°F warming to 50°F and changing to rain by afternoon

0630 ON SITE Calibrate H-Nu fill out Chain of custody forms
0715 Drillers on-site
0730 Prep to install well at borehole Location 2LMW32F. Start 2LMW32P2
0930 Call Andy Stokpole @ Base Environmental and give progress report
1250 Complete 2LMW32P2. Note boulders to 13 feet. Deliver S.T.'s to Geotechnical
12:50 - 1:30 Lunch
1:30 - 2:00 Call Mark Schultz at Public Works and give him progress report. Call Jeff Orient of Brown & Root & give progress report.
2:00 Moderate rain begins. Drillers fill tanks with water to perform peak tests. Meet w. Navy CO's at Alpha Area and discuss progress. Go to security and arrange for deployed parking to be opened up 11/8
2:30 Attempt infiltration tests near sand pile and front gate of Area A Landfill. Bentonite appears to have sealed the pipe. Will re-dig tomorrow
2:30 - 4:30 Convert production casings into place at 2LMW28DS/F, 2LMW31DS.
4:30 Put fence back up in the vicinity of 2LMW32 and 2LMW33 north.
4:50 Rig Sand and fence put up temporarily. Go to trailer to put H-Nu on charge.
5:10 Off site

DATE 11/7/95


2LIT 1
SAND MOUND
2LIT6
130'
2LIT1
50'
142
2LIT5
2LMW30F
16
2LMW30DS
8
43
47
DEPLOYED PARKING
Brush & Reeds
DENSE
N
19'
2LIT2
180'
2LIT3
2LIT4
Decon
New Crane Testing Area

TITLE NSB-NLDN
Area A

PROJECT NO. 5082
BOOK NO. 1243

November 8, 1995

CONTINUED FROM PAGE:

Weather: Overcast 40°F

0640 ON-SITE, Calibrate H-Nu pick up forms / equipment at Hinkler

0705 At 2LMW32 Next; await drillers

0700 Drillers arrive at 7:30

Go to drill pre test locations in the vicinity of 2LMW32DS

0900 Drill rig gets stuck

0930 Drill gets out mob to decon pad install surface protective casing and develope 2LMW34DS, 2LMW30DS, 2LMW30F

Label IDW drums

1040 Develope and cement protective casing (cont.)

1130 - 1200 Lunch

1200 - 1500 Pre test 2LIT7 and 2LIT8. Note Strong leachate odor at 2LIT7 (near sand pile).

1500 mob to Providence Airport

16:30 Arrive at airport, check bags settle rental car account

17:40 Leave Providence via US Air flight 538

19:15 arrive in Pittsburgh.

11/8/95

TITLE NSB-NLON
AREA A INVESTIGATION
Nov 12, 1995

PROJECT NO. 5082
BOOK NO. 1243

Work continued from Page

1530 @ Pittsburgh Airport. Had to be re-ticketed as a result of leaving ½ day early. This results in an additional cost of $661.00

1625 Leave via USAir to Providence, RI

1915 Arrive in Groton, CT

Work continued on Page

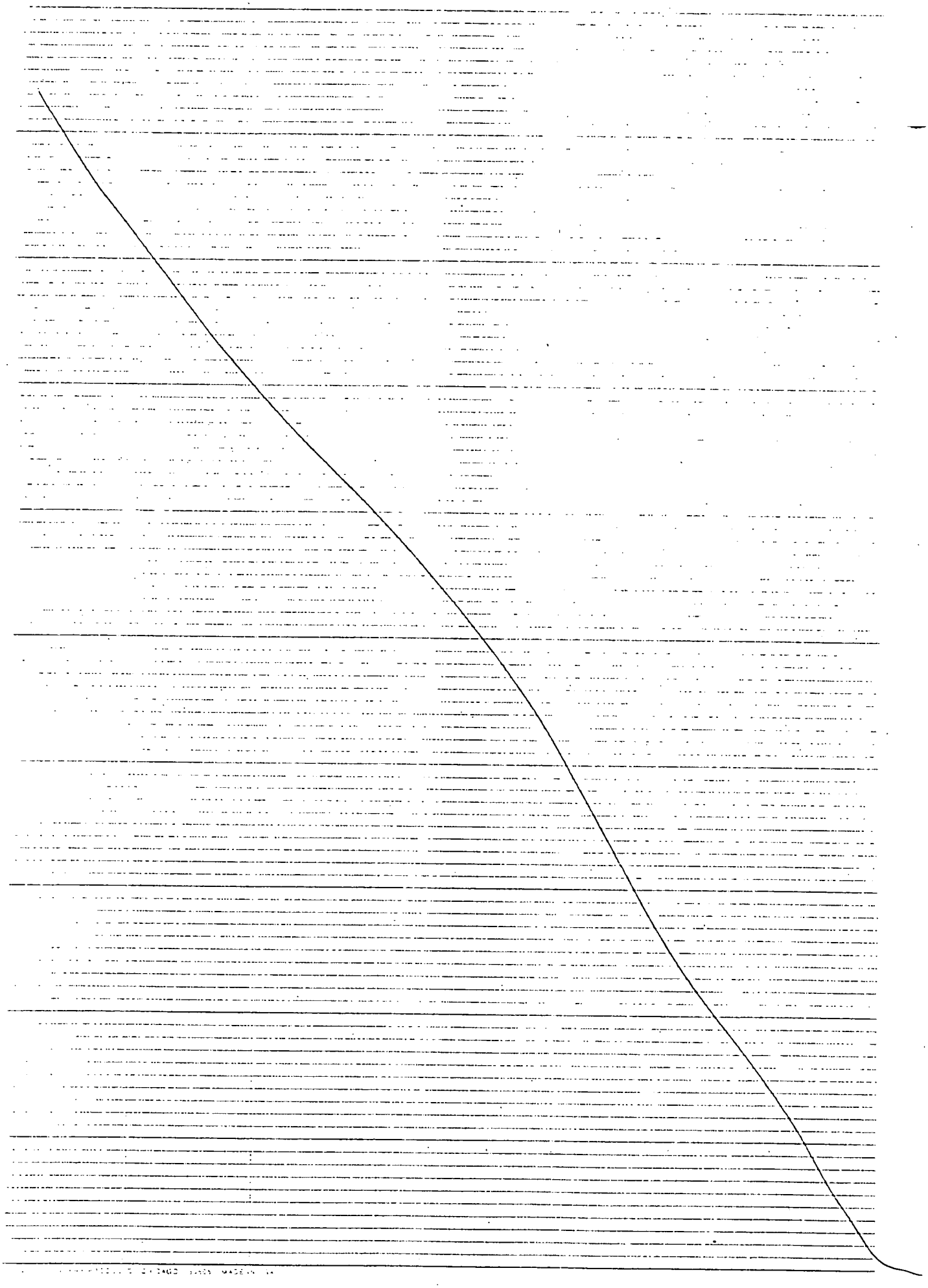
SIGNATURE

DATE 11/12/95

ISSUED BY UNDERSIGNED

BY WITNESS

DATE



NSB-NLON
AREA LANDFILL INVEST.

PROJECT NO 5082

Nov 13, 1995

BOOK NO 1243

Work continued from Page

Weather 25°F Sunny becomes overcast and 38°F in afternoon.

0645 ON-SITE, gather equipment calibrate H-Nu

0705 Drillers on-site (Associated) Wait for Air Rotary Rig to arrive and for Navy to open Alpha Area Gate

0730 Air Rotary Rig arrives set up on 2LMW35B Take drillers to look at 2LMW32B location. Concerned that it is too soft and that they will get stuck due to weight of rig. Recommend using CME to complete.

1130 Air Rotary work completed for the day. Two casings set at 2LMW35B and 2LMW36B. Mix grout set casings at each location Driller = Bob Mayo; Helper = Frank (Bud) Stallton Company = LaFrambroise

1200 - 1230 Lunch

1230 1300 Call Jean-Luc to inform him of progress. He informs me that the additional work at Polaris park has been postponed I inform drillers and they initiate getting a 8 inch bit on-site for tomorrow for 2LMW32B.

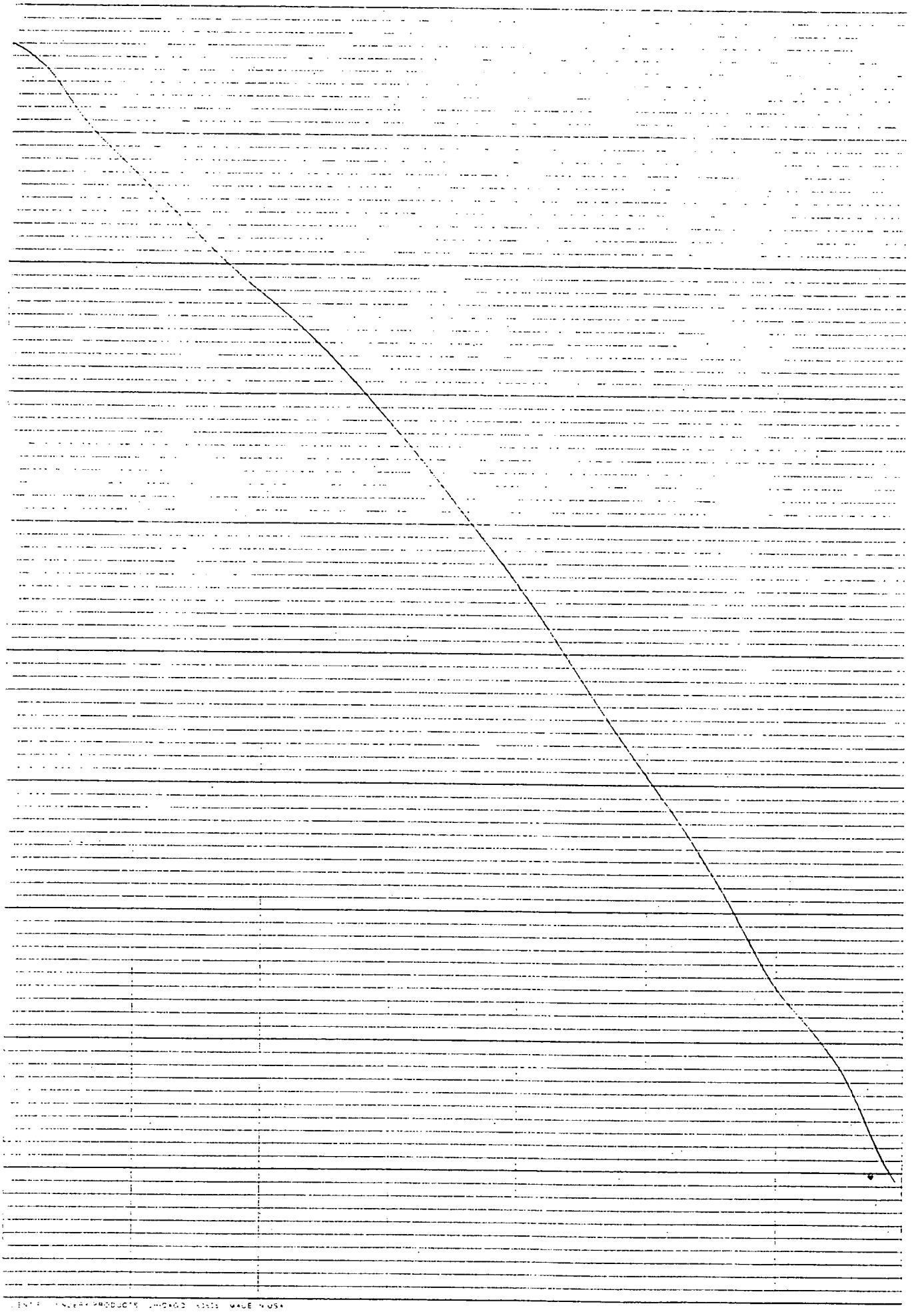
1300 Re-develope wells in northern area of the landfill. Note foam and gas in 2LMW28DS. Note petroleum odor in 2LMW31DS and 2LMW31F

1535 drillers mob rig to 2LMW32B put up temp. fence and offsite. Go to trailer, put H-Nu on charge

1600 Go to pass office to update vehicle pass

1610 offsite

11/13/95



TITLE NSB-NLON
Area A Invest.
November 14, 1995

PROJECT NO. 5682
BOOK NO. 1243

Work continued from Page

weather: 30°F overcast changes to 40° moderate rain and wind. Changes to heavy rain and high wind gusts

0625 on-site; Go to location 2LMW36B await air rotary drilling crew.

0638 Drillers on-site

0700 Auger Crew on-site await Mng to open Area A Gate

0805 Complete 2LMW36B in water table but producing less than 1 GPM Mob to 2LMW35B. Stem Conti Stops by. Work completed. Noted flow rate of 105 GPM at seep location.

1200 Complete 2LMW35B Wait ½ hour to check water infiltration rate Auger crew returns from developing 2LMW32 and 2LMW33 meets

1230 Blow well water out. Very little volume of water noted.

1315 Break out of hole. Air Rotary rig demobs from site

1330 Help drillers clean-up cuttings at 2LMW35B break for lunch

1400 Drillers containerize cuttings from two air rotary observation wells Weather deteriorates. Put off starting 2LMW32B due to weather

1500 Put up fence at brushy area secure supplies at decon area

1510 Drillers off site

1520 Return to trailer

1540 off site

1600-1700 Create table for future slug tests

Thomas E. [illegible]

11/11/95

CONTINUED FROM PAGE November 15, 1995 - Wednesday

Weather Partly cloudy, 48°F

0630 ON-Site calibrate H-NU, locate hammer & water level meter mob to new bedrock well locations.

0640 measure water level @ 2LMW36B = 51.30' from T.O.C.

0650 measure water level @ 2LMW35B = 80.36

0705 await arrival of drillers at 2LMW32B

0715 drillers arrive.
Set up and spin casing. Hit boulders at 0.3 ft below surface

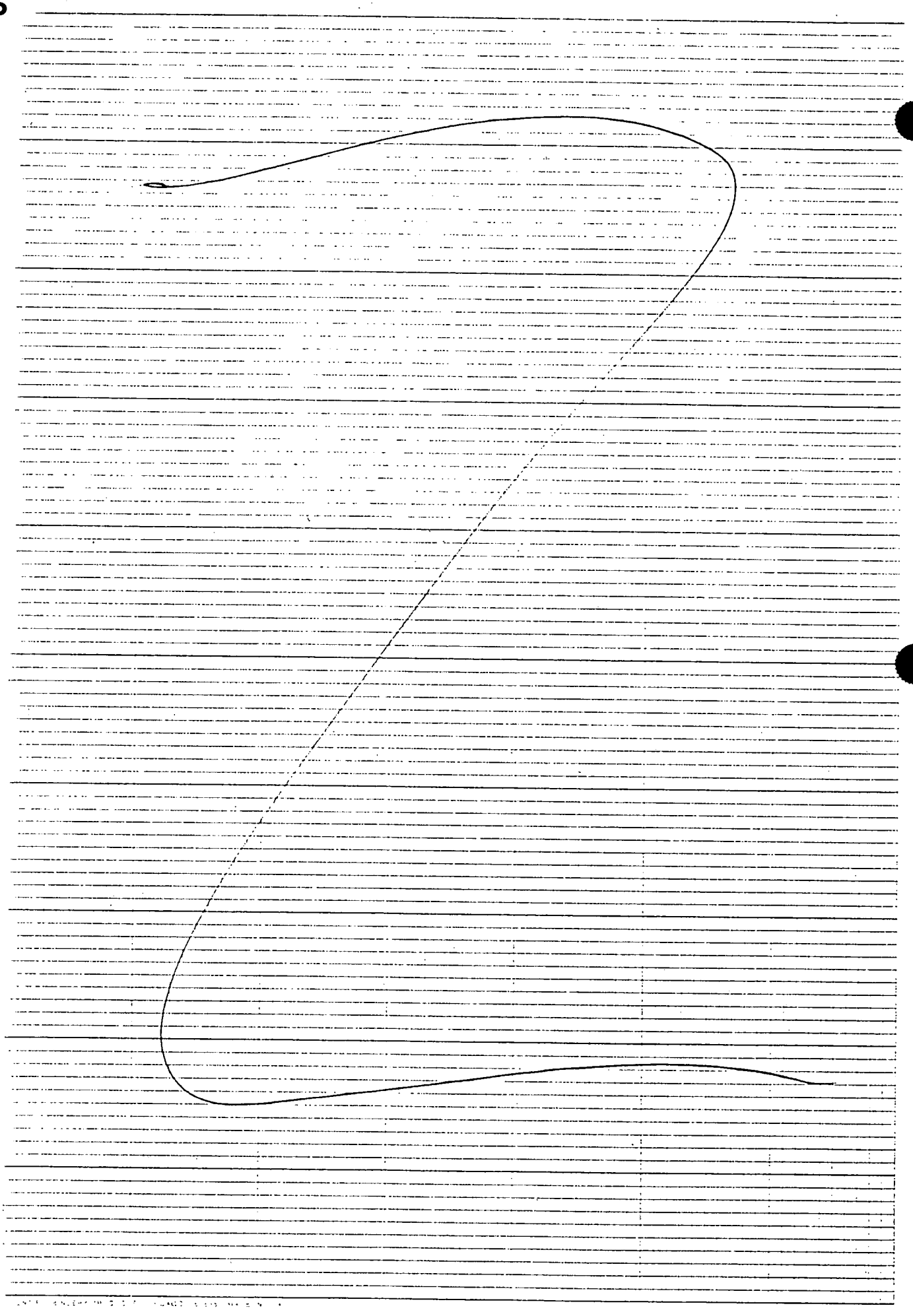
0900 Irregular boulder surface removes teeth on auger. Driller recommends using a tricone bit locked ahead of 4" casing to get through the boulder zone and continue to bedrock. Call Cory Rich and Matt Cochran for advice to proceed as specified by driller. They ask about availability of Air Rotary Rig. I inform them that the Air Rotary operator was extremely reluctant to drill at location 2LMW35B due to soft soil conditions (sinking and undermining during drilling were his concerns). The air rotary operator was willing to try it if he had more time but was scheduled to work in Stamford, CT from today through Thanksgiving. Matt recommends that we proceed as recommended by Associated Drilling Co. driller (Mark Schock).

1010 Return to site and inform driller of decision. They secure rig and take equipment necessary to retool rig for drilling Thursday.

1045 Drillers put locking caps on 2LMW35B and 2LMW36B.

1100 Drillers off site for the day.
Go to equipment rental (Feldman Bros.) and rent gas powered brush cutter to clear path for Staff gauges and Piezometers

1500 Meet Stan Conti at Area A Landfill.



FOR continued from p. 96 Nov. 15, 1995 continued

1515 Stan shows me the Piezometer/Staff gauge installed at 2LPZ1DS/SG7. Stan informs me that he purchased additional piezometers and pipe wrenches for the installation of temporary piezometers.

1515 – 1630 continue clearing at 2LPZ2DS, SG-9, 2LPZ3DS, 2LPZ4DS, 2LPZ6DS

1630 Return to trailer drop off equipment and demonstrate the proper usage of brush cutter.

1645 Off site

11/15/95

NSB- NLON
Area A Invest

PROJECT NO. 5082
1243

Nov 16, 1995
Weather: 30°F, Sunny. Becomes overcast in afternoon, 45°F.

0630 on-site - calibrate H-Nu

0700 Measure water levels in the air strip bedrock observation wells
2LMW36B 12.87 feet below top of casing
2LMW35B 34.94 feet below top of casing

0715 At location 2LMW32B. Drillers at location/on-site.

0715-1240 Set up and drill to 42' bgs at 2LMW32B

1240-1310 - Lunch

1310-1330 Progress report to Sam-Loi and Jeff Orient

1330-1600 Sample Spin casing and tricone to 56'. Hard drilling suggests bedrock. Spin casing 1 foot into rock.

1600 Call for progress report. Talk to Cory Rich regarding completion depth. Suggest that since the well is only to be used as an observation well that we ~~would~~ only need to complete a minimal distance into bedrock (10 feet). Cory agrees.

1615 Tricone drilling into rock begins. surface

1630 Encounter soft zone at 59' below. Take split spoon sample ~~and~~ at 60' bgs. Observe Sand and gravel. Drillers call to arrange for more casing.

1700 Drain hoses secure, rig, and put up fence

1715 drillers off site. Return H-Nu to trailer and put on charge

1730 off site.

Thomas E.

11/17/95

NSB-NLON
Area A Investigation

5082
1243

November 17, 1995, Friday
weather: 25°F, Sunny

0635 ON-site. calibrate H-Nu go to collect water level information at air rotary w
0645 12.82' below top of casing = W.L. @ 2LMW36B
0650 16.61' " " " " = W.L. @ 2LMW35B
0655 @ 2LMW32B await arrival of drillers
0705 drillers on-site
Start drilling into bedrock @ 2LMW32B. Encounter 10" drop in frame pit. Suspect void or weathered bedrock zone. Call office w. this information. Talk to
1015 Cory Rich. He suggests that we continue drilling from the suspected void/weathered bedrock zone (72'-73' below ground surface) until we are in competent rock. We continue drilling until @ 86' below
1330 ground surface (13' into competent rock). Set 10' PVC screen and tremie in thick bentonite slurry ~~to~~ from 74' 10" to 64' Mix grout (cement and bentonite)
1430 and tremie into annulus. Pull casing and insert hole plug (2 bags) into near surface boulder zone (1-7 feet below ground surface).

1530 Start draining hoses and securing drilling rig

1730 Return H-Nu to trailer, off-site.

11/17/95

Nov. 18, 1995 overcast 30°F; 45°F Lt. rain in afternoon

0730 ONSITE

0735 17.12' below top of casing = W.L. @ 2LMW35B
0740 12.87' below top of casing = W.L. @ 2LMW36B
0745 Drillers on-site
0800 Set up and dig final hole for perc. test. (2LIFD)
0900 Secure fence around drumming area. Go to decon pad and load supplies and steam cleaner.
1100 Drillers offsite. Meet with Stan Conti at location 2LMW29F/DS and develope/slug test observation wells
1230 Break for Lunch
1300 – 1400 Dispose of liquid IDW in drums, label drums
1400 – 1500 Slug test 2LMW29F, Continue measuring response @ 2LMW29DS
1500 – 1630 Continue measuring response at 2LMW29DS
1630 Complete slug test @ 2LMW29DF. Stan Conti decides to leave Hermit and transducer in 2LMW31DS due to slow recovery. He takes water level at 2LMW34DS. Notes gas in well (J-plug shoots off well during gaining access).
1645 Off Site

11/23/95

NSB-NLON
AREA A INVEST.

5082
1243

Nov ~~18~~ 19, 1995 Sunday
Weather: 40°F Light rain.

0650 ON-SITE, Proceed to trailer. Construct Table of construction (well) details for permeability

0730 Meet with Stan Conti at trailer
0810 At Landfill. Measure water level at 2LMW29F = 8.54' below top of casing at 18 hrs 20 min past start of Slug test.

	W.L.	Time	TO	Comment
2LMW30DS	14.90	0904		Gas Pressure noted
2LMW30F				Very Fast Recover

1000 Go to 2LMW33/2LMW32 Nests. Note that 2LMW33F is dry. 2LMW33DS is extremely slow to recover. 2LMW32DS is extremely slow to recover. 2LMW32F is very fast to recovers H_2S odor noted in both 2LMW33DS and 2LMW32DS. Decide to slug test using Hermit and transducers at each nest. Stan Conti records water levels. Dave Samano Assi.
1200 Go to lunch
1300 Go to hardware store and purchase PVC pipe and collars for water levels at certain well locations. Go to Wallmart and purchase AA batteries ~~[illegible]~~ for water level meters
1420 On-site go to trailer get tools. Cut PVC pipe into 2', 3' and 5' sections. Change batteries in two water level meters
1500 Stan Conti reports that 2LMW32PZ is extremely fast recovering after slug removal. 2LMW32DS and 2LMW33DS are extremely slow. Stans field notes include all information. Ask Stan Conti about getting clean water level meter for residential wells. He informs me that I must decon my water level meter in my hotel bathtub using alconox.
1645 Meet Tom [illegible] with Simpson, Stan Conti and Dave Samano at trailer. Drop bottles in all the wells.

Area A Invest.

1243

105 Nov. 19, 1995 cont.

1715 Meet with Stan Conti who gives me water level record sheets, wrenches and maps.

1735 Office.

1830 Clean water level meter in bath tub using warm water and figure. Unspool cable and unwind entire length twice. Clean spooler and re-spool.

11/23/95

NSB - NLON
Area A L.F. Invest.

5082
1243

Nov. 20, 1995 Overcast 40°F, Mist by afternoon

0640 MOB to Plumbing Supply store on Rt. 184
0650 @ Store; purchase 10' section of 6" Schedule 40 PVC to place on flowing monitoring well in deployed parking
0715 @ NSB-NLON wait for security to open gate to Area A L.F.
0730 Navy arrives gate opened. Call security to open deployed parking gate. Deployed parking gate opened
0830 meet with Dick Connant of Sub base environmental Go to off-site wells and measure water levels and relative elevations, Mr. Smith report is to Chloroox W.L. note
1320 Drop Dick off at his office. One offsite well to measure.
1340 Call Jean-Luc to give progress report
1400 Call Gary Rich / Ray Cerwonac to get surveyor update
1404 Start taking water levels at upgradient observation well locations. Put five feet of extra riser on 4MW4D
1500 Wait for Navy to open Deployed Parking Gate Navy does not arrive
1530 Pick-up Dick Connant go to OSC3 location
1610 Back on base go to Area A L.F. and start taking water levels
1 Dec. Keith Simpson and Tom Dixon on-site Assistance in taking water levels
17:00 Return survey equipment to trailer
17:30 o/f site.

11/20/95

NSB-NLON
AREA A L.F.

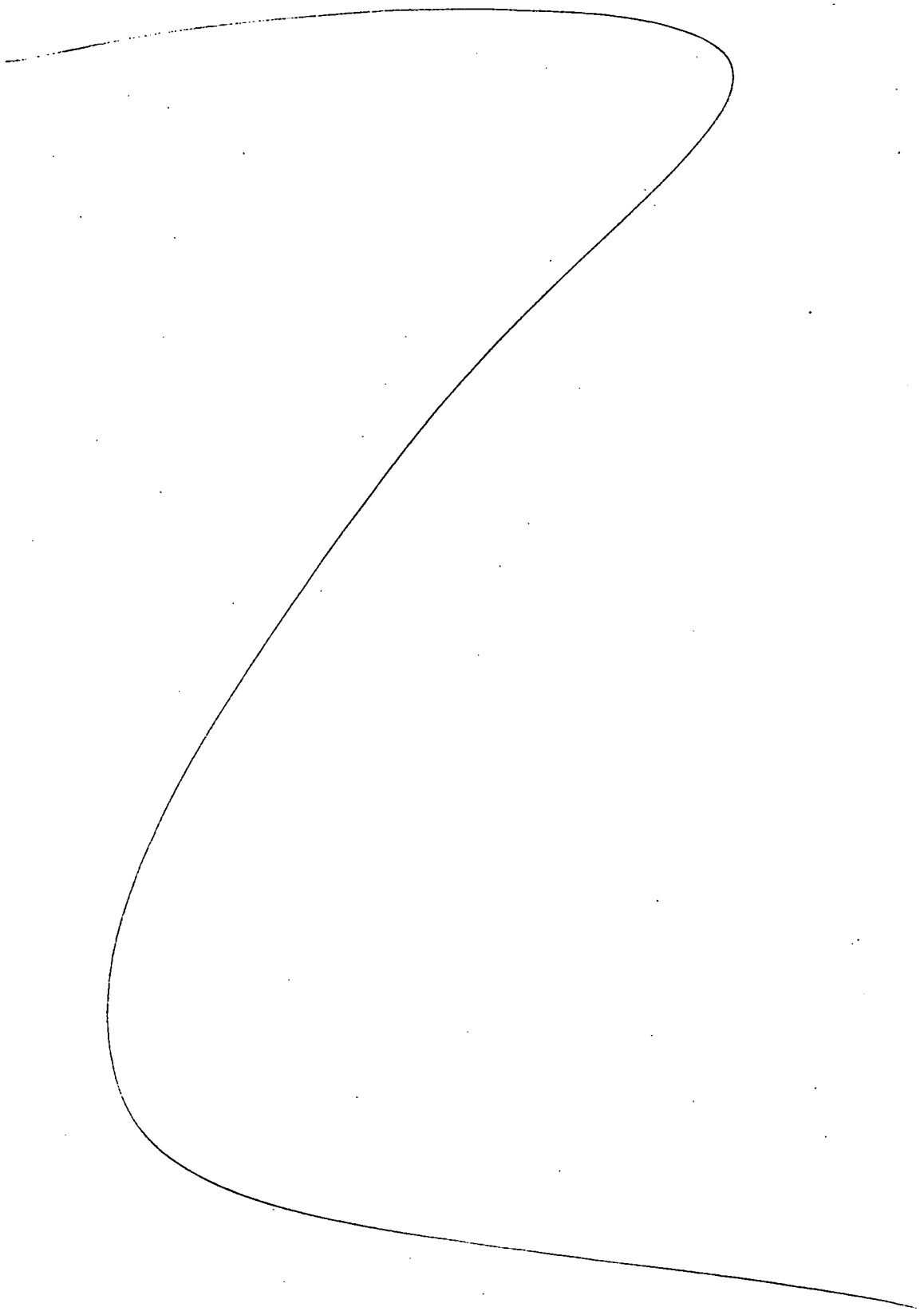
5082
1243

Nov 21, 1995 48° overcast, Light mist.

0640 ON-SITE Measure water levels
0800 Security opens deployed Parking gate
0830 Surveyors on-site - John
Roseanne
0845 Have them set up and shoot QLMW 30F/DS as the gate is open. Then show them the locations to be surveyed in
1300 meet w. Dave Summe. We get our surveying equipment and survey OW locations - Bring elevations to East and North Gates.
1700 Survey terminated due to darkness
1730 Go back to trailer, unload equipment put seat in Van,
1740 Close back gate to Alpha Area L.F. Call security to express them that we are ~~so~~ finished for the day in the area. Request that security lock gates.
1745 Offsite.

Thomas E.

11/21/95



NSB-NLON
AREA A L.F.

5082
1243

Nov. 22 - Wednesday Sunny 40° Becomes Breezy and Cooler by P.M.

0750 ON-SITE Go to Area A Landfill and examine deep monitor 4LMW4D.

0845 Surveyors on-site Set-up near racketball center and shoot elevations at staff gauges and piezometers in brush. Show surveyors OW elevation locations.

1050 Call Jean-Luc with progress report. Surveyors set up to shoot east gate elevation for OW well elevations. Surveyors will call east Gate shot station 3000 North gate shots will be stations 3001 & 3002

1140 Surveyors move inside fenced Area to Landfill Proper.

1330 Survey 2LMW28, 2LMW29, 2LPZ10S, 2LP22DS. Move station to bedrock outcrop in the vicinity of 2LMW31F/DS and deployed parking. Show surveyor remaining piezometer and staff gauge locations. Remind Surveyors of two bedrock monitoring well locations in the vicinity of the Hospital. Show them locations on map. I instruct surveyors to shoot elevations for 2 damaged monitoring wells as per Cory Rich instructions

Drop off 6" ID PVC extension pipe at decon area. Leave 2" ID PVC extension pipe at 4LMW4D location for future water levels.

1430 OFFSITE MOB to Providence Airport

1600 Check Baggage

1720 Depart Providence Via US Air

11/23/15

APPENDIX B.2

OBDA SEEP SAMPLING AND FLOW MEASUREMENT LOG

TITLE NSB NLON 4626

WED NOV 8 1995 2288

Work continued from Page AT SITE SJC/KES/TD

AM: CLOUDY, COLD WINDY - TO SUNNY

PM: " " " "

0700 - AT SITE CALL FED EX FOR PICK UP (GONA 31)

0730 AT HNUS 12 - PREPARE FOR SLUG TEST. RAN TWO RH TESTS

0840 AT HNUS 22 - WILL RUN RISING TEST HERE ALSO.

1000 AT HNUS 18 - WELL RUN RETEST HERE ALSO.

1100 BACK AT TRAILER - UNLOAD VAN, ETC.

1230 LU SITE FOR AIRPORT

1500 FLT CANCELED TAKE

1745 THIS FLIGHT AT 1745.

2000 ARRIVE AIRPORT IN PGH.

VOID SJC.

Work continued to Page

SJ Conte

DATE 11-8-95

TITLE NSB NLON 5082 ~~4626~~

MON NOV 13 1995 2288

Work continued from Page AT SITE. SJC/DS.

AM: CLOUDY, COLD

PM PARTLY CLDY, COLD

0700 AT PGH AIRPORT FOR FLT TO PROVIDENCE.

0825 FLT. TO PROV. - DELAYED - 35 MIN DUE TO SNOW.

1045 ARR. PROV.

1200 ARR MOTEL - TAKE LUNCH

1230 GET PASS, ETC.

UNLOAD EQUIP INTO VAN. GO PURCHASE 10" Φ PIPE FOR INSTALLING WEIR AT AREA A LANDFILL.

1345 RETURN TO SITE - TAKE PIPE AND MATS TO SEEP.

1430 GET BENTONITE, ETC LOAD INTO VAN.

1530 TALK TO TOM J RE SEEP AND TOMORROWS DRILLING ACTIVITIES. HE MAY NEED HELP TOMORROW ON ROTARY RIG.

1630 AT TRAILER - GET SUPPLIES, TOOLS READY FOR WEIR

1730 LU SITE

Work continued to Page

SJ Conte

DATE 11/13/95

NSB NLON

TUE NOV 14 1995

2288

AT SITE: SJC / DS

AM: CLOUDY COLD, WINDY

PM: " " " START 1430 HRS W/ HEAVY RAIN

0700 AT SITE - GET EQUIP TO CONSTRUCT "WEIR"

0730 BEGIN TO CONSTRUCT - CHANNEL PIPELINE NEAR AREA "A" LANDFILL. USING 10" Ø PIPE X 10' LONG AND BENT PELLETS TO SEAL WATER

0840 Trial 1 2.85 / 5 gal = 105 GPM

Trial 2 2.88 / 5 gal = 104 GPM

$\frac{5 \text{ gal}}{2.85 \text{ sec}} \times \frac{60 \text{ sec}}{\text{min}}$ = GPM

AVE 106

Trial 3 2.82 = 106 GPM

Trial 4 2.80 = 107 GPM

Trial 5 2.79 = 107 GPM

USED 5 GAL BUCKET AND STOPWATCH, TO MEASURE FLOW - NO VISIBLE EVIDENCE OF ANY WATER NOT FLOWING THRU PIPE. ie NO % LOST TO OVERFLOW OR SEEPAGE BEYOND THE PIPE.

0930 Call Jean Luc - Gave him the above data.

1000 talk to Tom Jordan - First Bedrock well is down 100' but not making water as yet. SJC/DS go sample last sediment From Manhole at

1045 Museum parking Lot. [SSSD04] See SLS.

S J Conti 11-14-95

NSB NLON

TUES (Continued)

2288

1115 Finish logging in catch basin and filling out sample log sheets.

1130 Go for Film, etc.

John Gee (Wayne) 610 971 0900

1200 LUNCH

1230 ON SITE - CHECK IN W/ T. JORDAN.

1300 Take more flow measurements from the Landfill A "seep.

Trial 6 2.87 sec/5 gal = 105 G

" 7 2.70 " = 111

" 8 2.79 " = 108

" 9 2.77 " = 108

1400 D. CONANT CALLS - IS WORKING ON GETTING APPROVAL FOR TAKING WATER LEVELS OF RES WELLS - TENTATIVE DATE IS MONDAY 11/20/95

1500 AT TRAILER - TAKE RB25 USING SS BEAKER FOR THE 1 - SD SAMPLE WE TOOK TODAY

1530 BEGIN TO PACKAGE SAMPLES THAT WERE TAKEN TODAY AND YESERDAY. ie SD04 + TPH SAMPLES FROM Fuel Pipeline (Geoprobe)

1630 FED TAKES SAMPLE - CLEAN UP TRAILER

1730 LV SITE

S J Conti 11-14-95

TITLE NSB NLON PROJECT NO. ~~4626~~ 5082

BOOK 2288

WED NOV 15 1995

Work continued from Page

AT SITE: SJC/DS.

AM: MOSTLY CLOUDY, COLD
PM: " " "

0700 AT SITE CALIB HORIBA - GET BOTTLE SET FOR SAMPLING SEEP 3MSP01 AT AREA "A" LANDFILL.

0800 TALK TO TOM JORDAN - RE: ANALYTICAL FOR ABOVE SAMPLE.

0900 SAMPLE THE Area A Seep 3MSP01 (Direct Fill)

0910	Trial	10	2.60	Sec/5 GAL	= 115
SEEP	"	11	2.70	"	= 111
READINGS	"	12	2.76	"	= 109
TODAY	"	13	2.55	"	= 118
	"	14	2.56	"	= 117
	"	15	2.70	"	= 111

AVE = 113.5

0930 POLARIS PARK - CONTACT - RUSTY POWELL - SUFFOLK CONSTRUCTION
MATT NEEDS HIS NUMBER. IF I CAN GET IT.

1015 WENT AFTER STAFF GAGE PIPE AND PAINT.

1100 TRY TO INSTALL DRIVE POINTS
NEED MORE SUPPLIES

Work continued to Page

SIGNATURE SJ Conti DATE 11-15-95

WITNESS DATE

TITLE NSB NLON PROJECT NO. ~~4626~~ 5082

BOOK 2288

WED (CONT)

Work continued from Page

1200 LUNCH
1230 ON SITE
1240 GONA 138 (FED EX PICK UP)

- More Drive Points?
- Caps

1330 GO AFTER PIPE WRENCHES, COUPLERS, CAPS AND WELL POINTS

1400 INSTALL 1-well Point
1-Staff Gage - SG# 7

1530 AT TRAILER BEGIN TO PACK SAMPLES COLLECTED TODAY.

1645 SAMPLES READY - FED EX ARRIVES. START TO CLEAN OUT BENEATH TRAILER AND PACK SOME EQUIP THAT IS NOT NEEDED.

1755 LU SITE

VOID SJC

Work continued to

SIGNATURE SJ Conti DATE 11-15-95

5082
~~4626~~

NSBNLON

THURS NOV 16 1995 2288

AT SITE SJC/DS

AM: SUNNY, COLD LO 40s
PM: " " "

0700 AT SITE. GO TO TRAILER - LOAD UP WEED WACKER.
0745 TALK TO TOM J. - GET MAP OF PIEZ. POINTS
0800 START TO INSTALL SG 8 AND PIEZ 2LPZ2DS
0845 INSTALL SG 9 - WL - 4.21 FROM TOP OF SG.
0900 INSTALLED SG10 AND 2LPZ3DS
↓ AS PER MAP.
1000 MOVE TO NEXT LOCATION.
↓ INSTALL SG 11 AND 2LPZ4DS
1045
↓
1115 INSTALL SG 12 AND 2LPZ5DS
↓
1145 " SG 13 " 2LPZ6DS
TAKE WEED CUTTER BACK
1230 LUNCH
1300 BACK ON SITE TO INSTALL SG 14 AND 2LPZ7DS

SJ Conti 11-16-95

5082
~~4626~~

NSBNLON

THUR (CONT) 2288

1430 AT WEIR TO TAKE FLOW RDGS USING 5 GAL BUCKET AND STOP WATCH

TRIAL	16	2.58	SEC/5 GAL	=	116 G
"	17	2.66	"	=	113
"	18	2.70	"	=	111
"	19	2.67	"	=	112
"	20	2.56	"	=	117

(" PRELIM WL AFTER INSTALLATION)

1440 - GO TAKE INFO FROM PIEZ. & SG. (114 A

	WL FROM TOP PIPE	TOTAL DEPTH	STICKUP (GS)	TOP WATER FROM TOP S.G. * Standing W
2LPZ1DS	6.06	7.56	3.45	
SG 7	—	—	—	4.88
2LPZ2DS	5.05	7.57	3.60	--
SG 8				DRY
SG 9			(TO WATER)	4.22
2LPZ3DS	2.39	7.45	2.37	—
SG 10	—	—	—	3.53
2LPZ4DS	2.67	~~2.45~~ 7.66	2.65	—
SG 11				3.05
2LPZ5DS	3.52	6.77	3.44	
SG 12				2.83
2LPZ6DS	2.92	6.94	3.20	
SG 13				3.37
2LPZ7DS	5.47	8.10	5.[illegible]	* 6.00

SJ Conti 11-15-95

TITLE NSB NLON
THURS (CONT)

PROJECT NO 5068 ~~4626~~
BOOK 2288

Work continued from Page

1630 FINISH MEAS. PIEZ. AND S.G.
GO TO TRAILER CLEAN UP - UNLOAD
VAN etc
1800 LV SITE

THURS SUMMARY.

1. Installed Piezometers & Staff Gauges
2. Took flow measurement
3. Return Wad Water

VOID
S.J.C 11/14/95

Work continued to Page

S.J. Conti 11-16-95

TITLE NSB NLON
FRI NOV 17 1995

PROJECT NO 5082 ~~4626~~
BOOK 2288

Work continued from Page

AT SITE SJC/DS

AM: SUNNY COLD
PM: " COLD

0700 AT SITE - GET SLUG TEST EQUIP
LOAD INTO VAN
0815 AT AREA A LANDFILL. SET UP AT
WELL 2LMW28F.

	WL	TD	(V) FROM TPVC	
2LMW28F	10.90	11.68	✓	
2LMW28DS	18.08	21.78	✓	
2LMW29DS	7.73	18.09	✓	Δ
2LMW29F	8.40	9.80	✓	
2LMW31DS	1.80	14.54	✓	Δ
2LMW31F	2.84	6.42	✓	Δ

DAVID STEIN (203) 399 5269
SURVEYOR
DUE TO LACK OF WATER IN SOME
OF THE WELLS - I CALLED JPO AND
WE DISCUSSED EITHER USING A
BAILER TO REMOVE A SLUG OF
WATER OR A PUMP TO EVALUATE

Work continued to Page

SIGNATURE S.J. Conti
DATE 11-17-95

THE WATER. HOWEVER TO DO THIS WE HAD TO GO TO TRAILER AND GET MORE EQUIP ie BAILERS, PUMP, SUCTION HOSE ETC.

1100 RAN TEST AT 28DS USING BAILER, BUT HAD PROBLES W/ M-SCOPE.
SET UP HERMIT 2000 ON ANOTHER WELL BUT WHEN INSERTED SLUG, IT IT IS VERY SLOW TO STABILIZE.

1200 LUNCH

1230 BACK ON SITE RUN SLUG TESTS ON 2 WELLS (HAND MEAS)
28F
28DS.

1600 SET UP TEST AT 31DS - HERMIT 2000, WILL LET IT RUN OVERNITE.

1620 AT TRAILER PACK UP SAMPLES THAT WERE COLLECTED BY GEOPROBE CREW.

1720 CLEAN OUT MORE OF TRAILER.

1800 LU SITE.

Sy Conte 11/17/95

AT SITE SUC/DS.

AM: MOSTLY SUNNY, COLD.
PM:

0700 AT TRAILER - GET SLUG TEST EQ. READY, WRITE UP NOTES FROM YESTERDAY TALK TO GEOPROBE CREW ABOUT SCHEDU

0745 GO TO AREA "A" LANDFILL - WAIT FOR GUARD TO OPEN GATE.

0810 AT WEIR TO TAKE MEAS.

TRIAL	21	2.58	SEC/5 GAL	=	116	GPM
"	22	2.49	" "	=	120	"
"	23	2.69	" "	=	111	"
"	24	2.58	" "	=	116	"
"	25	2.69	" "	=	111	"

115 AVE

0830 GO TO 31DS/31F RUN SLUG TEST ON 31F USING HERMIT 2000 AND 10 PSI XD, BU

1000 HAVING PROBLEMS W/ 10 PSI XD - HAD TO GO TO 50 PSI XD. RERAN TEST - ALSO RE RAN 31DS USING NEW XD'S. (50 PSI).

1045 AT 2LMW 29F - WELL WAS VERY SILTY HAD BAIL/PUMP TO "DEV" WELL AGAIN, EVEN HAD TO ADD WATER - HERMIT IS STILL AT 31DS.

Sy Conte 11-18-95

NSB NLON 5082

2288

1300 LUNCH

1330 [9.90] TD OF 29F AFTER DEV. WELLS OURSELVES - ≈ 5" SILT WAS TAKEN OUT

WL IS NOW = 8.97' FROM TPVC

WILL PUMP OUT WATER HERE MEAS REC

CONTINUED: SLUG TESTING REST OF AFTERNOON.

SEE SEPARATE DATA SHEETS FOR SLUG TEST THIS AFTERNOON

1800 LV SITE

VOID

SJC

Work continued to Page

SIGNATURE SJ Conti DATE 11-18-95

NSB NLON 5082

SUN NOV 19 1995 2288

AT SITE: SJC/DS/TJ

AM: CLOUDY, COLD

PM: " "

0700 AT TRAILER.

0800 AT AREA A LF. DUMP DATA FROM 31DS FROM HERMIT

0845 MOVE TO 34DS - ONLY ≈ 2' WATER HERE WILL PUMP OUT WATER, THEN TRY TO READ USING HERMIT.

8.5 MIN PUMP OUT 1.7' WATER (≈ 1 GAL REMOVED.

0902 START HERMIT 34DS

	WL	TD	FROM
2LMW30F	9.20	11.58	TPVC
2LMW30S			
2LMW33F	DRY	12.02	TPVC
2LMW33DS	12.42	20.09	TPVC

GO TO DEPLOYED PARKING - 30F RECOVERS TO FAST FOR HAD MEAS. ONLY HAS ≈ 2.5' water. 30DS - Recovers to slow - have to

Work continued to Page

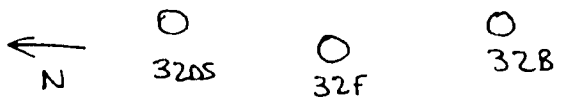
SIGNATURE SJ Conti DATE 11-19-95

NSB NLON 5082

SUN (CONT) 2288

Wait for recovery

		WL	TD	FRM
1115	2LMW 32 DS	10.79	26.86	TPVC
1118	2LMW 32 F	11.24	24.10	"
1121	" 32 B	6.23	≈86'	"
1123	" 32 PZ	10.44	15.78	"



1030 Well 33 F is Dry today - Cannot Slug test. 33DS recovers very slowly may have to wait until it recovers.

1100 Begin to take WL of the above wells 32DS - Pulled Slug w/ Bailer - recovery rate very slow - will check later. 32 F - will use hermit as it has enough water in well and recovery rate looks good.

1215 Lunch - get sockets for water Levels

1315 Dump Data From 34 DS. move to next location 32F

1330 RAN SLUG TEST USING HERMIT AND 50 PSI XD - REC VERY RAPID.

SJ Conta 11/19/95

NSB NLON 5082

2288

1400 WELL 32 B WAS 8.01'
6.23 THIS AM
1.78 - LESS THAN THE MORNING READING

THIS WELL IS APPARENTLY STILL TRYING TO STABILIZING FROM DRILLING ON FRIDAY. WILL NOT RUN SLUG TES AS YET.

1404 WELL 32 PZ WAS 10.47.
RUN SLUG TEST USING 50 PSI XD AND 2000 HAD TO RUN 2 TRIALS - SINCE IT SEEMS TO REC ALMOST INSTATANEOUSLY. 2ND TRIAL WAS SAME

1445 WL AT 32B WAS 8.24' SO THIS WELL IS STILL DROPPING.

1500 PULLED OFF OF THIS LOCATION.
32 PZ } DONE
32 F }

32 B IS STILL DROPPING.
32 DS IS " RECOVERING FROM THIS MORNING'S REMOVAL OF 1 L OF WATER.

1505 WELL 33DS WL WAS 13.66 NOT REC FROM EARLIER WL.

1530 PRINT OUT DATA. - NOTE THAT PRINT

SJ Conta 11-19-95

NSB NLON 5082
SUN (CONT) 2282

OUT FROM 32F WAS NOT ACCEPTABLE
PRINT OUT WAS IN ERROR. HAD TO
RE RUN 32F.
1630 RETURN TO TRAILER - GET READY
FOR WATER LEVELS - GIVE TJ AND
KES BLANK FORMS AND MAPS
FOR TOMORROWS WATER LEVELS
1730 LU SITE.

VOID
11/19/95

11-19-95

NSB NLON 9541C ~~5082~~
MON NOV 20 1995 2282
Continued from Page AT SITE SJC/DS

AM: CLOUDY COLD
PM:

(11 wells @ Goss Cove)
AT SITE: 0630 HRS - Prepare for Water Levels
CALL MUSEUM - GET PERMISSION TO WORK
0700 - Goss Cove Water Levels to 0800 (See Inv. Sheets)

	WELL NO		W Level	TOP PROD	
0805	HNUS	22	11.90		2" PVC
0811	ERM	1	5.25		2" PVC
0816	HNUS	1	4.87		"
0820	HNUS	2	4.67		" CAR PARK OVER W
0832	HNUS	20	7.22		"
0835	"	21	7.09		"
0839	MW	11	5.00		"
0842	HNUS	23	6.50		"
0851	HNUS	5	5.33		"
0854	ERM	19	5.69		"
0900	ERM	2	4.51		"
—	ERM	5	under water		
0904	ERM	15	4.90		"
0910	ERM	14	7.71		"
0913	ERM	13	7.91		"
0925	ERM	17	5.78		4" PVC
0930	HNUS	4	5.07		2" PVC

16 wells This Pg

11/20/95

NSB NLON 9594

MON NOV 20 1995 (CONT) 2288

Time	Well No	Water Level	Prod Level	Misc
0937	HNUS18	4.57		2" PVC
0940	HNUS17	3.73		2" PVC
0950	MW-7	5.51	3.85	2" PVC
1000	HNUS-16	4.70		2" "
1007	HNUS-24	10.74		2" "
1012	HNUS-7	7.98		"
1020	EEM-11	6.12		"
1023	HNUS-6	5.38		2" PVC
1027	HNUS-8	5.40		2"
1030	HNUS-9	4.95		2"
1035	HNUS-10	8.55		2"
1040	HNUS-11	7.92		2"
1045	HNUS-14	4.83		2"
1050	HNUS-15	5.10		2"
1057	HNUS-12	4.02		2"
1100	HNUS-13	4.68		2"

1100 Continue w/ WL - See Ind. Sheets for WL From this point on.
1230 Met for Lunch to discuss progress
1300 Continue w/ lower base water levels
1600 Done at LB except for areas where cars were parked.
1630 Finish up WL At LB.
1730 LV SITE.

SJ Conti 11-20-95

NSB NLON 5082

TUE NOV 21 1995 2288

AT SITE: SJC/DS.

AM: CLOUDY COLD 40°F
PM: " COLD 45 → 50°F

0700 AT SITE BEGIN TO DEMOB TRAILER AND EQUIP - TD/KES CLEAN UP GEOPROBE TRUCK.
PACK UP EQUIP FOR SENDING BACK TO WAREHOUSE, ALSO SEND BACK UNOPENED SAMPLE JARS TO SWLOK.
1200 HAVE ≈ 12 PACKAGES FOR TOM P AND 14 ± FOR SWLOK.
1230 LUNCH.
1300 BACK ON SITE - GO TO POLARIS PARK - TALK TO RUSTY POWELL - RE WORK THAT IS TO START ON MON - RE BACKHOE WORK.
1400 AT TRAILER TAKE SOME GEOPROBE TOOLS TO DICK CONANT.
1500 MEASURE FLOW RATE AT WEIR.

Trial 26	2.70 sec/5gal		111 GPM
27	2.56	"	117 "
28	2.66	"	113 "
29	2.63	"	114 "
30	2.63	"	114 "

≈ 114 GPM AVE

SJ Conti 11-21-95

NSB NLON 5082
TUES (CONT) 2288

1530 Return to trailer – TJordan and D. Simanic go shoot some elev of Residential Wells.
SJC/ T. Dickson resume cleaning up trailer – take purge water and Dump into drums in area "A".

MGC calls will send L. Marshall up with me next week to do - Polaris Park, Torpedo shop work, slug tests etc. Told him to make sure he get AT&T involved in cleaning lines at Torp shops.

1600 Most of packages to ship are now ready - Finish cleaning out trailer.

1730 LV SITE.

SJCorta 11-21-95

PMS-0173
WED 11/22/95 5082
WED 2288

AT SITE SJC/DS.

TAKE 0900 FLT TO PGH.

1130 ARRIVE AT ALEXIONS TO DISCUSS POLARIS PARK W/ MGC AND COREY RICH.

1300 ARRIVE AT OFFICE - GET PAPER WORK TOGETHER FOR POLARIS PARK. CONFERENCE CALL W/ MGC, CR, SJC AND JAY MALCOLM OF FRANKLIN ENV. TO DISCUSS NEXT WEEKS ACTIVITIES.

1400 LV - OFFICE

VOID SJC

SJCorta 11/22/95

NSB-NLON 5052

MON - 11/27/95 2288

1400 - LEAVE FOR AIRPORT

1800 - ARRIVE @ PROVIDENCE RI

1930 - ARRIVE @ GROTON CT

- CONFER W/STAN REGARDING JOB

11/27/95

NSB-NLON 5052

TUE - 11/28/95 2288

- ON SITE - SSC + LM

0700 - ON SITE

- CHECK POLARIS PARK

AM - PCLOUDY 50°

PM - SUNNY 60°

0800 - GET PERSONAL & VEHICLE PASSES

0900 - AT TRAILER; MOBING FOR SLUG TESTS

1100 - START SLUG TEST @ 2LMW36B

1230-1300 - LUNCH

- ASSIST STAN W/SAMPLE PACKING

1600 - START SLUG TEST @ 2LMW35B

1700 - LEAVE SITE

- WORK W/STAN PREPARING FOR NEXT DAYS ACTIVITIES

11/28/95

NSB - NLON 5082

WED - 11/29/95 2289

ON SITE: SJC & LM

AM: 3" SNOW ACCUMULATION, SNOW SHOWERS

PM: PARTLY CLOUDY, 35°

0700 - ARRIVE @ BASE
- SLIPPERY CONDITIONS
- ACCIDENTS DELAY ACCESS TO SLUG TEST SITE

0800 - PRINT & PLOT DATA FROM SLUG TESTS @ 2LMW35B & 2LMW36B

1000 - SET UP & SLUG TEST (RISING & FALLING) 2LMW8D

1230-1300 - LUNCH

1300 - SCOUT OUT LANDFILL WELLS FOR SLUGGING

1400 - SET UP & SLUG TEST - 2LMW33DS

1500 - SET UP FOR OVERNIGHT SLUG TESTS - 2LMW32DS & 2LMW32B

1700 - BACK @ TRAILER

1800 - LEAVE SITE

11/29/95

NSB-NLON 5082

THUR - 11/30/95 2288

ON SITE - SC & LM

AM: 25°, SUNNY

PM: 35°, "

0700 - ON SITE
- BREAK DOWN SLUG TESTS
- LEAVE 32DS - SLOW RECOVERY

0800 - SCOUT OUT LAST 3 WELLS TO SLUG TEST @ DEPLOYED PARKING

0900 - PRINT & PLOT SLUG TEST DATA

1130 - SET UP & RUN SLUG TEST @ 2LMW8D

1230-1300 - LUNCH

BEGIN TO DEMOB TRAILER

PRINT & PLOT SLUG TEST DATA

11/30/95

NSB-NLON 5082
FRI - 12/1/95 2288
ONSITE - LM & SC

AM: CLOUDY, BREEZY, 30°
PM: " " 40°

0700 - HERMIT 1000C DETERMINED TO BE DEFECTIVE
- MUST REDO TESTS DONE W/THAT HERMIT USING HERMIT 2000

- REDO SLUG TESTS
- TAKE DRUM INVENTORY
- PACK SOME SUPPLIES IN TRAILER

1700 - LEAVE SITE

12/1/95

NSB-NLON 5082
SAT - 12/2/95 2288
ONSITE - LM & SC

AM: SUNNY, BREEZY, 35°
PM: " " , 45°

0700 - ON SITE
- MEET W/STAN @ TRAILER
PULL SLUG TEST

0900 - ENTER AREA A TO DO 2 REMAINING SLUG TESTS

1100 - CALL STAN - SECURITY HAS NOT ARRIVED TO OPEN DEPLOYED PARKING
- STAN WILL TRY TO ROUSE THEM

1130 - SECURITY ARRIVES - ACCESS DEPLOYED PARKING
- SET UP & DO SLUG TEST @
- SET UP SLUG TEST FOR OVERNIGHT @

1230 - 1300 - LUNCH

1300 - 1700 - PACK SAMPLES & BEGIN TO DEMOB TRAILER

12/2/95

NSB-NLON 5082
SUN 12/3/95 2288
ON SITE - LM & SC

AM: SUNNY, 35°
PM: SUNNY, 45°

0700 - ON SITE
CONTINUE DEMOB OF TRAILER

0900 - PULL SLUG TEST

PRINT & PLOT DATA

1230 - 1300 LUNCH

CONTINUE TRAILER DEMOB

1730 - LEAVE SITE

12/3/95

NSB-NLON 5082
MON 12/4/95 2288
- ON SITE - LM & SC

AM: SUNNY, 40°
PM: " , 50°

0700 - ON SITE
0800 - PULL FINAL SLUG TEST

0900 - PRINT & PLOT SLUG TESTS

1030 - TAKE FLOW MSMTS @ AREA A WEIR

TRIAL 31	= 3.07	sec	@	Sg21	=	98
" 32	= 3.03	"	"	" "	=	99
" 33	= 3.11	"	"	" "	=	96
" 34	= 3.15	"	"	" "	=	95
" 35	= 3.17	"	"	" "	=	95
" 36	= 3.14	"	"	" "	=	96
" 37	= 3.18	"	"	" "	=	94
" 38	= 3.02	"	"	"	=	99
" 39	= 3.15		"		=	95
" 40	= 3.06		"		=	90

1230-1300-LUNCH
1300-1800-CLEAN UP IN & AROUND TRAILER
1800-OFFSITE

Work continued

DATE 12/4/95

NSB-NLON 5082
TUES-12/5/95 2288
ONSITE - GM & SC

AM: SUNNY, 35°
PM: " , 45°

0700 - ON SITE

0830 - AT POLARIS PARK
TANK 42
- WATCH DUFFORD CONSTRUCTION BACK FILL HOLE
- CLEAN FILL USED, 8 TO 12 INCH LIFTS
- 16 CY TRUCKS USED, FILL COMPACTED & TESTED EACH LIFT
- 2 TRUCKLOADS AS OF MY ARRIVAL
- PICK UP FAX @ HOTEL

1000 - TALK w/STAN REGARDING FAX & JOB

1030 - BACK @ POLARIS PARK
- 3 MORE TRUCK LOADS ARRIVE - TOTAL 5
- TAMPING & TESTING DONE w/MAN IN THE PIT!

1230-1300 - LUNCH

1500 1.51' 2LMW8D - NOT FLOWING
1502 3.08' 2LMW31F

12/5/95

NSB-NLON 5092
WED-12/6/95 2288
ON SITE - GM & SC

AM: SUNNY, 40°
PM: " , 50°

0700 - ON SITE
- TAKE WATER LEVELS
- DO DRUM INVENTORY] - SEE STAN'S BOOK

1000 - STOP @ POLARIS PARK
- TOO CONGESTED TO GET TO SITE

1030 - CHECK OUT OF HOTEL

1100 - RECHECK POLARIS PARK - SEE STAN'S LOGBOOK

1200 - LEAVE FOR PROVIDENCE RI
1230 - 1300 - LUNCH
1400 - ARRIVE @ PROVIDENCE AIRPORT

1500 - 1700 - FLIGHT TO PITTSBURGH PA

1700 - STOP IN @ B&R OFFICE

1800 - LEAVE FOR HOME

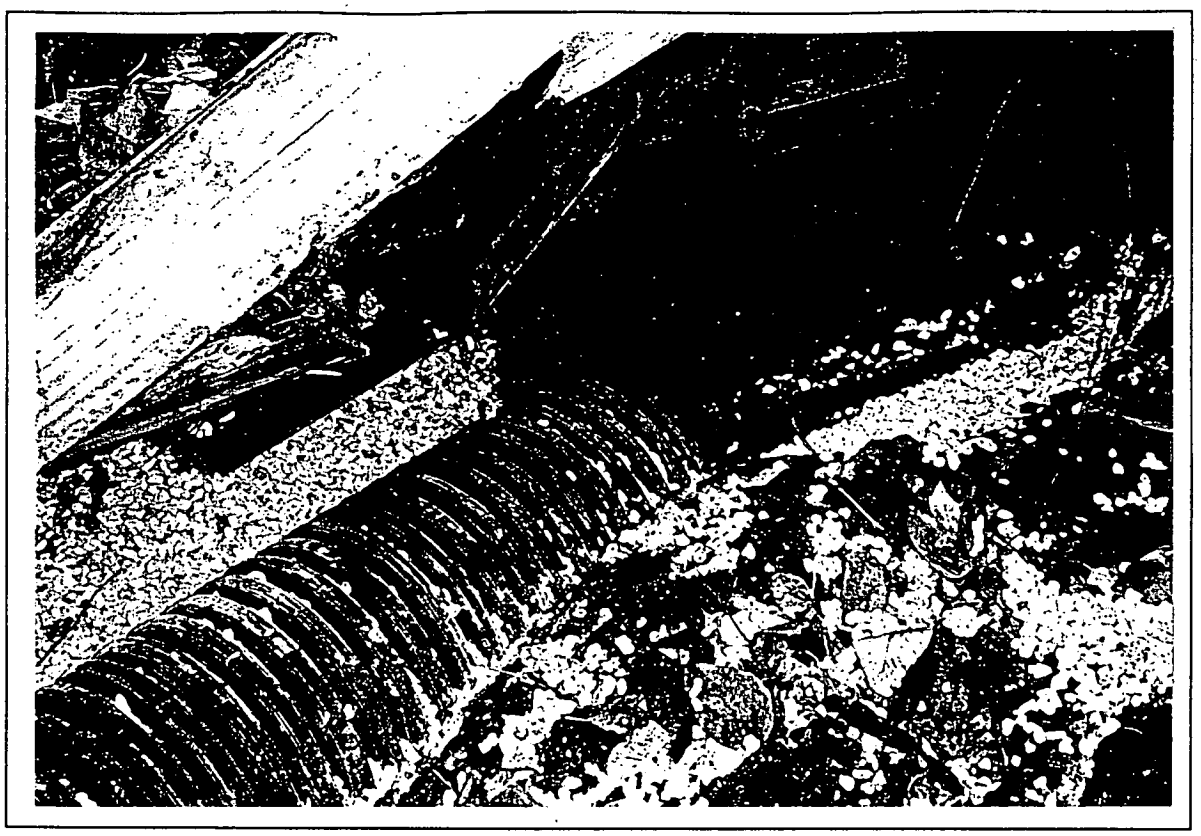
12/6/95

OBDA SEEP-AFTER WEIR CONSTRUCTION

OBDA SEEP-AFTER WEIR CONSTRUCTION

OBDA SEEP-PRIOR TO WEIR CONSTRUCTION

OBDA SEEP-SAME AS ABOVE-WIDER ANGLE



OBDA SEEP-AREA OF INFLOW

OBDA SEEP-AREA OF OUTFLOW

APPENDIX C

MONITORING WELL AND TEST BORING DATA

C.1 Overburden Well Drilling Logs and Construction Sheets
C.2 Bedrock Well Drilling Logs and Construction Sheets
C.3 Summary of Monitoring Well and Test Boring Data

APPENDIX C.1

OVERBURDEN WELL DRILLING LOGS AND CONSTRUCTION SHEETS

BORING LOG — **HALLIBURTON NUS**

PROJECT: ~~[illegible]~~ AREA A
BORING NO.: 2LPZ1
PROJECT NO.: ~~[illegible]~~ 5082
DATE: 11/3/95
DRILLER: GEO-TEK
ELEVATION:
FIELD GEOLOGIST: TOM JORDAN
WATER LEVEL DATA:
(Date, Time & Conditions) 60° Overcast Light rain/mist and Fog

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
							AUGER TO 4 feet		
1	4	11/14	16			Br	0-5" Br S and S		No odor Noted
	6	14/51				Wh	5"-7" Rock frags (Quartzite)		
						DkBr	7-11" SAND and Gravel		
						Wh	11-16" Quartzite Rk Frags		
2	6	50/5"	1"			DkBr	Sand & Gravel		wet
	8								No odor noted

REMARKS

BORING

PAGE ___ OF ___

* See Legend on Back

HALLIBURTON NUS
Environmental Corporation

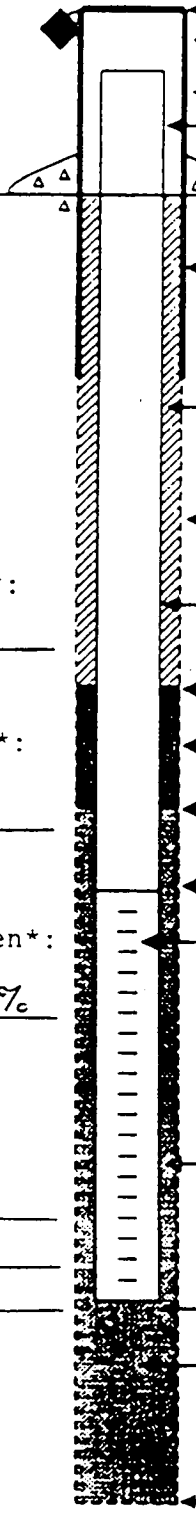
Well No.: 2LPZ1F

OVERBURDEN
MONITORING WELL SHEET

PROJECT
PROJECT NO. 5062
ELEVATION
FIELD GEOLOGIST TET

LOCATION Area A LF
BORING 2LPZ1F
DATE 11/3/95

DRILLER Mike Schock
DRILLING METHOD HSA
DEVELOPMENT METHOD



GROUND ELEVATION

Aquifer Type*:

Aquifer Name*:

Percent open area of screen*: %

Remarks*:

ELEVATION OF TOP OF SURFACE CASING: N/A
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: Soil
I.D. OF SURFACE CASING: N/A
TYPE OF SURFACE CASING: NONE
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL: Soil
ELEVATION / DEPTH TOP OF SEAL: 2'8"
TYPE OF SEAL: ENVIROPLUG Mud Chips
Elevation/End Depth of Seal: 4'8"
ELEVATION / DEPTH TOP OF SCREEN: 5'
TYPE OF SCREEN:
SLOT SIZE x LENGTH: 10 Slot - 3 feet
I.D. OF SCREEN: 2'
TYPE OF SAND PACK: #1 Sand
Filter Pack Length: 4 ft.
ELEVATION / DEPTH BOTTOM OF SCREEN: 8'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 8'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 8'

* Note: See other side for details.

BORING LOG **HALLIBURTON NUS**

PROJECT: ~~NOWACO~~ OR AREA A LANDFILL BORING NO.: 2LPZ2
PROJECT NO.: BT63 DATE: 11/3 DRILLER: GEO-TEK
ELEVATION: FIELD GEOLOGIST:
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	4	1/1	2"				Auger to 4'		
	6	1/1					~~Brown sandy fine sand~~		
							~~Sand~~		
						Br	~~Bl~~ SILT, sand f-c		Wet
							Sand, trace fine G		

REMARKS

BORING

PAGE OF

* See Legend on Back

HALLIBURTON NUS
Environmental Corporation

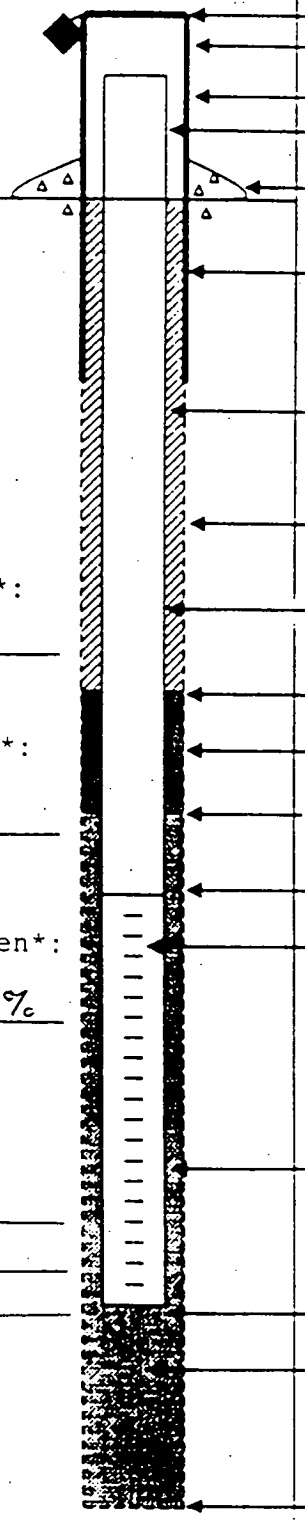
Well No.: 2LPZ2F

OVERBURDEN
MONITORING WELL SHEET

PROJECT: AREA A LF
PROJECT NO.: 5082
ELEVATION:
FIELD GEOLOGIST: TGJ

LOCATION: AREA A
BORING: 2LPZ2F
DATE: 11/7/95

DRILLER: Mark Shock
DRILLING METHOD: HSA
DEVELOPMENT METHOD:



ELEVATION OF TOP OF SURFACE CASING: N/A
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: N/A
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: Soil
I.D. OF SURFACE CASING: N/A
TYPE OF SURFACE CASING: NONE
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL: Soil
ELEVATION / DEPTH TOP OF SEAL: 1' /
TYPE OF SEAL: Enviroplug wood chips
Elevation/End Depth of Seal: 2'
ELEVATION / DEPTH TOP OF SCREEN: 3' /
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: #10 3'
I.D. OF SCREEN: 2'
TYPE OF SAND PACK: #1 Sand
Filter Pack Length: 4 ft.
ELEVATION / DEPTH BOTTOM OF SCREEN: 6 /
ELEVATION / DEPTH BOTTOM OF SAND PACK: 6 /
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 6 /

Aquifer Type*:

Aquifer Name*:

Percent open area of screen*: %

Remarks*:

* Note: See other side for details.

BORING LOG

PROJECT NAME: ~~[illegible]~~ Area A LF
PROJECT NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW28DS
DATE: 10/31
GEOLOGIST: TES

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
1	0	6/5	19"			Br	0-18 fine-med SAND		dry	0
	2	8/12					10-12 dk Br f-m SAND			
							tr f G			
							12-18 Br f-C SAND			
							tr f G			
							18-19 dk br Gravel			
							Possible Incinerator Ash			
2	0	9/11	11			Br	f-C SAND MUD		Moist	0
	4	7/10					f-M Gravel - Some		Boring Sample in	
							dk Br fly ash like Gravel		Big Lgt	
3	4	4/7	7"			Br	do. Concrete frags		dry-Moist	0
	6	7/5					noted		Lt Brn Starting	
						Br	do. Concrete frags		HNU affected	
4	6	8/8	7"				wood		Moist	
	6	5/7					frags in sample shoe		No odor Noted	
5	5	11/5	7"			GR	dk Gr f-C Sand and		wet-moist	
	10	3/4					Gravel in shoe		No odor noted	
6	10	16/1	10"			Br	do. Gravel and wood		No odor	
	12	4/2					frag in sample		Noted wet	
7	12	4/2	11"				shoe			
	14	1/2					0-3" do			
				DS			3"-11" Gr black Clayey		H_2S odor	
							SILT		Noted wet	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: X Yes ___ No:
WELL I.D.#: 2LMW28DS
REMARKS:

Signature(s):

BORING LOG

Page___ of___

PROJECT NAME: _____ BORING NUMBER: 26M478DS
PROJECT. NUMBER: _____ DATE : 10/31/95
DRILLING COMPANY: _____ GEOLOGIST: _____
WATER LEVEL DATA: _____

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	14	WH/WH	24"			GR	Clayey SILT		H_2S Noted	
	16	WH/1								
									Brass shelby	
	16								Tube 16-18'	
	18								24" recovery	
	18						Shelby tube		20.5" recovery	
	20									
	20	WH/2	8'				0-6" = do		Back fill 1'	
	22	Refusal	50/1"				6-8" = Granite		install at	
							rock frag		19' 7"	

*When rock coring enter rock brokeness.

CONVERTED TO WELL : ___ Yes ___ No; WELL I.D.#: _____
REMARKS: _____

Signature(s): _____

Brown & Root Environmental

BORING NO: 28DS

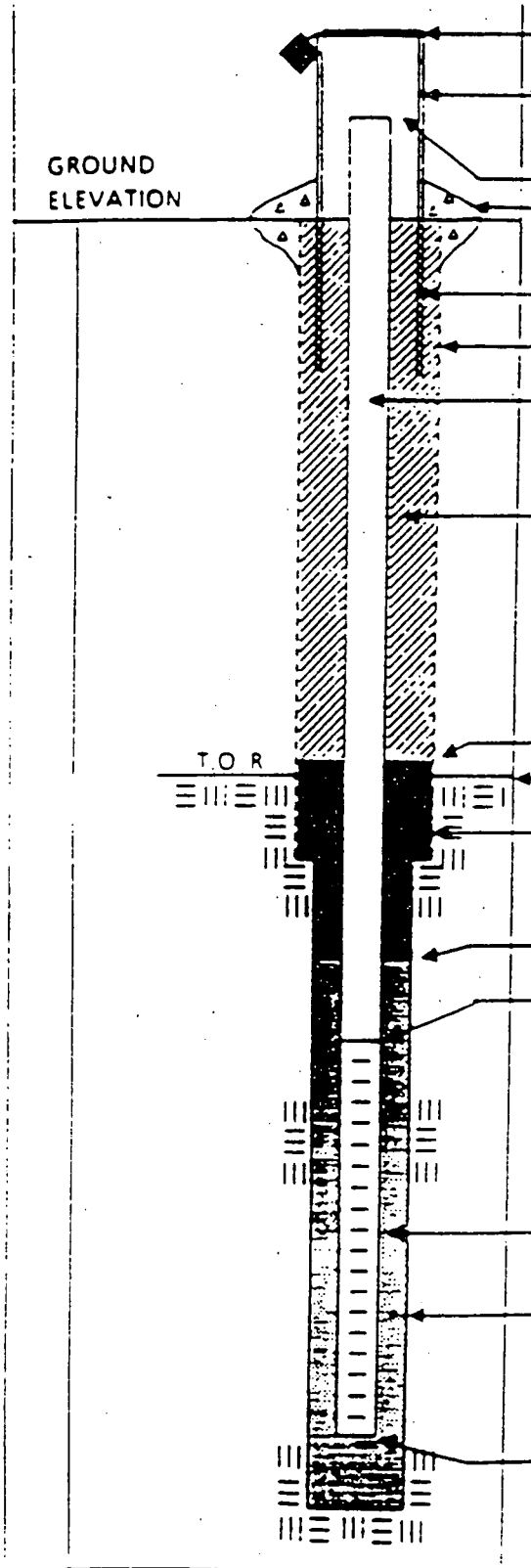
MONITORING WELL SHEET

WELL INSTALLED

PROJECT Area A L.F.
PROJECT NO. 5072
ELEVATION
FIELD GEOLOGIST TEJ

LOCATION
BORING 2LMW38DS
DATE 10/31

DRILLER Associated
DRILLING METHOD HSA
DEVELOPMENT METHOD pump



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL:

I.D. OF SURFACE CASING:

DIAMETER OF HOLE: 9"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: PVC

TYPE OF BACKFILL: Cement Bentonite

ELEVATION / DEPTH TOP OF SEAL: 12'

ELEVATION / DEPTH TOP OF BEDROCK

TYPE OF SEAL: Bentonite

ELEVATION / DEPTH TOP OF SAND: 14.0

ELEVATION / DEPTH TOP OF SCREEN: 14.7

TYPE OF SCREEN:

SLOT SIZE x LENGTH: 10 5'

I.D. SCREEN: 2

TYPE OF SAND PACK: 2 bag #1 Sand (NJ)

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM:

ELEVATION / DEPTH BOTTOM SCREEN: 19'9"

ELEVATION / DEPTH BOTTOM OF HOLE: 20' 1"

BORING LOG

PROJECT NAME: 5 AREA A LF
PROJECT. NUMBER: 5080
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2L MW28F
DATE: 10/31
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or RD Reading (ppm)
									Auger to	
									10'	
									Hard Augering	
									B. at 3-4'	
	10	0 / 5	12"	12"			0-5" Br f-c Sand		Moist	
	12	1 / 1					tr f G			
							5-12" Br-Bl Cy $			
							trace f S			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING NO. _____

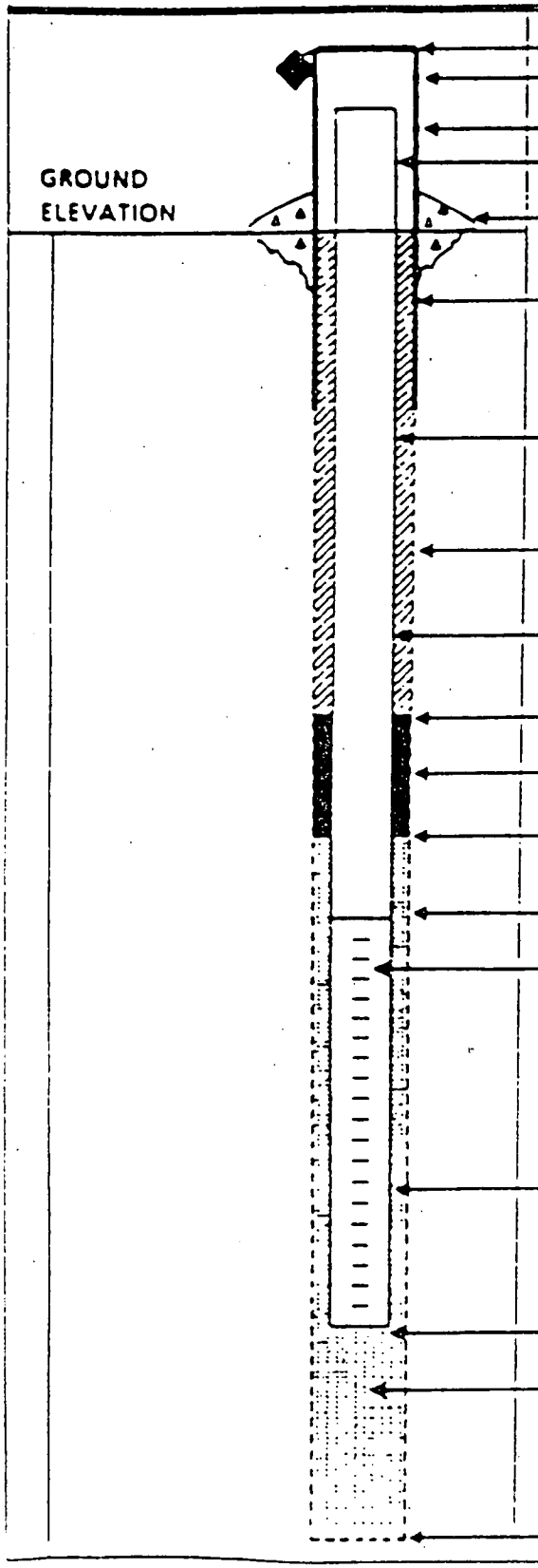
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT: ~~S~~ AREA A LF
PROJECT NO.: 5082
ELEVATION: _____
FIELD GEOLOGIST: TEJ

LOCATION: 2LMW28F
BORING: _____
DATE: 10/31/95

DRILLER: Mark Schaka
DRILLING METHOD: HSA
DEVELOPMENT METHOD: _____



ELEVATION OF TOP OF SURFACE CASING: _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK - UP TOP OF SURFACE CASING: _____
STICK - UP RISER PIPE: _____
TYPE OF SURFACE SEAL: _____
I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING: _____
RISER PIPE I.D.: 2
TYPE OF RISER PIPE: PVC Schedule 40
BOREHOLE DIAMETER: ~~8~~ 9"
TYPE OF BACKFILL: _____
ELEVATION / DEPTH TOP OF SEAL: 2'0"
TYPE OF SEAL: Bentonite Chips
DEPTH TOP OF SAND PACK: 4' 0"
ELEVATION / DEPTH TOP OF SCREEN: 4' 7"
TYPE OF SCREEN: ~~PD~~ PVC Slotted
SLOT SIZE x LENGTH: 10 / 5 ft
I.D. OF SCREEN: 2
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 9' 7"
ELEVATION / DEPTH BOTTOM OF SAND PACK: 10' 0"
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____
ELEVATION / DEPTH OF HOLE: 12

BORING LOG

PROJECT NAME: AREA A LANDFILL
PROJECT. NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW 29 ~~[illegible]~~A
DATE: 11/2
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
				Fill			Auger to 8 feet			
	8	6/5	20"				0-3" Br S-C SAND		wet	N/A
	10	5/3		D.S.			3"-20 Gray SILT and C		Heavy Rain	
				SAND FILTER						
	10	28/24					No Recovery		Sand in Auger	
	12	24/21							Plug	
	12	6/41/6"	8"				Brown Sand and Gravel		wet	
	14									
	14	29/34	16"				0-8" Brown Sand &		wet	
	16	30/36					Gravel			
							8"-16" Light Gray Coarse			
							Sand and Gravel			
							Set well at			
							16'			
							16'-10' = SAND			
							10-8' = Hole plug			
							Grout backfill to			
							5' screen 13' of			
							Riser			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No;
WELL I.D.#:
REMARKS:

Signature(s):

BORING LOG

Page___ of___

PROJECT NAME: Area A LANDFILL
PROJECT NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LAW29 ~~[illegible]~~ A
DATE: 11/2
GEOLOGIST: TGS

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/6" or RQD (%)	Sample Recovery/Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	8	6/2	30				Auger [illegible]			
	10	2/3					0-3 BRS			
							[illegible] G		wet	
							3-[illegible] SAND			
							[illegible]		very hard [illegible]	
							[illegible]		[illegible]	
							[illegible]		[illegible]	
									[illegible]	
									[illegible]	
									[illegible]	
									[illegible]	
	4	[illegible]/24								
	K	32/26								
							12-14 [illegible]			
							14-[illegible]			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING NO. 2LMW29DS A

LJD

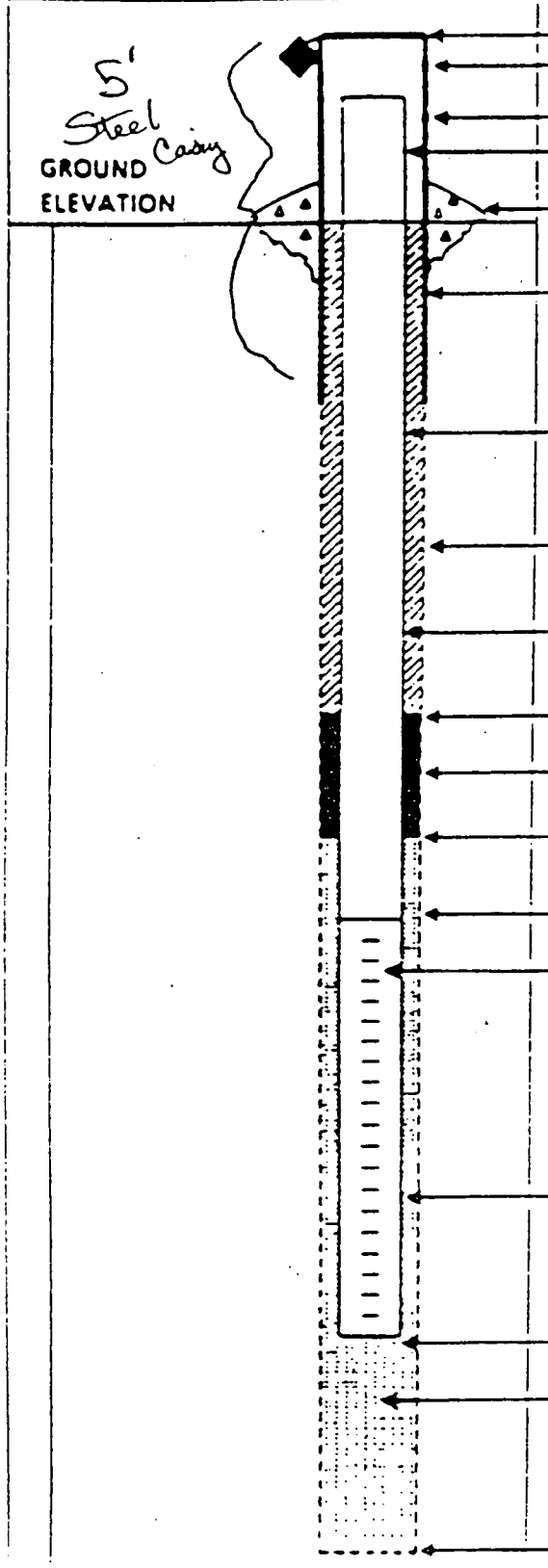
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT ABA LF
PROJECT NO. 5080
ELEVATION
FIELD GEOLOGIST TEJ

LOCATION ABA LF
BORING 2LMW29DS
DATE 11/7

DRILLER Mark Schaik
DRILLING METHOD HSA
DEVELOPMENT METHOD Pump



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL: Cement Bentonite Grout
ELEVATION / DEPTH TOP OF SEAL 8'
TYPE OF SEAL: Envirolplug med chips
DEPTH TOP OF SAND PACK: 10'
ELEVATION / DEPTH TOP OF SCREEN 11
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 x 5'
I.D. OF SCREEN: 2
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 16
ELEVATION / DEPTH BOTTOM OF SAND PACK
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE 16'

BORING LOG

PROJECT NAME: Area A LF
PROJECT. NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW29 ~~DS~~ F
DATE: 10/31
GEOLOGIST: TET

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Changes (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
SS	0	9/11	15"	FILL		Br	0-4" Br f-m S tr f G			N/A
	2	17/12					4-8 Brick frags		dry No	
							8-15 Br f-m S, some $		odor Noted	
							(→) Some f G.			
SS	2	8/4	6"			Br	Br f-m SAND, tr			N/A
	4	2/2					f G. Rock frags noted		in Sample.	
							wet in Sample shoe		No odor noted	
SS	4	1/1	4"				Br f-c SAND		wet	
	6	2/1					tr f Gravel		No odor Noted	N/A
SS	6	1/1	3"				Red-Brown (Rusty)		wet	N/A
	8	4/7					f-c SAND and		No Odor Noted	
							Gravel			
SS	8	2/1	9"				0-3" do			
	10	1/16					3-7 Black Cy $		wet	
							7-9 Gr Br f-m SAND		No odor	
							tr f G.		Noted	
SS	10	2/28	21				0-6" Gray Cly Silt			
	12	28/43					6-13 f-m SAND			
							13-20 Coarse SAND			
							Some Gravel			
							20-21 Granite Rock Frag			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING LOG

PROJECT NAME: Aen A Landfill
PROJECT. NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW29F
DATE: 10/31
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	12	34/45					0-8" Red Br f-m SAND		wet	
	14	47/50/5"					8-13 Tan Coarse SAND		No odor noted	
							13-18 Granite RK Frags		Suspect boulder	
							18-22 Bk SAND trace		@ depth	
							fine Gravel			
							22-24 - Br SAND & Gravel			
	14	26	8"				0-3 Gray f SAND			
	16	70/5"					3-8 Red Br Med C Sand		wet No Odor noted	
							weathered bedrock m		Auger Refusal	
							Shale		at 15.5'	
							Install well		Sheet metal	
									noted on	
									lead auger	
									upon removal	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: X Yes ___ No;
WELL I.D.#:
REMARKS:

Signature(s):

BORING NO. 2LMW29F

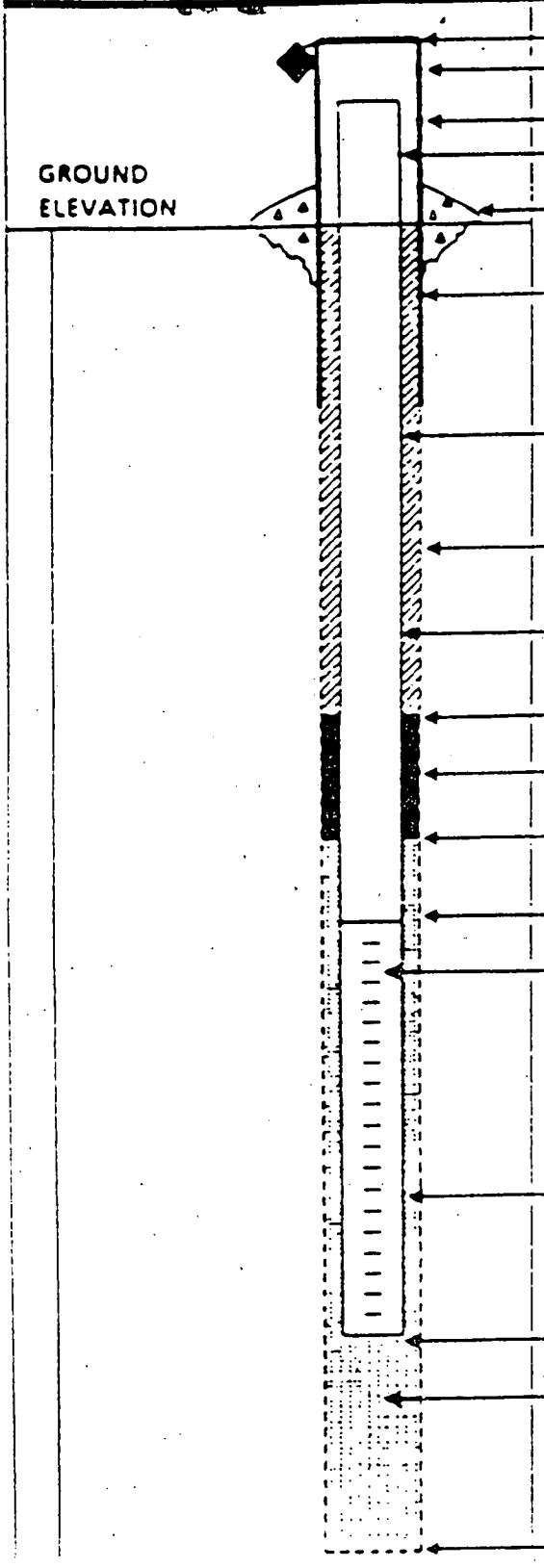
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT Area A LF
PROJECT NO. 5082
ELEVATION
FIELD GEOLOGIST TEJ

LOCATION 2LMW29F
BORING 2LMW29F
DATE 10/31

DRILLER Mark Schah
DRILLING METHOD HSA
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING:
TYPE OF SURFACE CASING:
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC Schedule 40
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL:
ELEVATION / DEPTH TOP OF SEAL 1' 6"
TYPE OF SEAL: Bentonite Chips
DEPTH TOP OF SAND PACK: 3'4"
ELEVATION / DEPTH TOP OF SCREEN 3'5"
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 - 5'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 8'5"
ELEVATION / DEPTH BOTTOM OF SAND PACK:
TYPE OF BACKFILL BELOW OBSERVATION WELL: 11-15.5 SAND
9-11 Bentonite
8½-9 sand
ELEVATION / DEPTH OF HOLE 15.5

BORING LOG

Page___ of___

PROJECT NAME: AREA A LF
PROJECT. NUMBER: 5082
DRILLING COMPANY: Associated Drilling
WATER LEVEL DATA:

BORING NUMBER: 2LMW 30DS
DATE: 10 11/
GEOLOGIST: TET

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: SOIL Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
SS	0	8/13	10"			Br	0-5" f-m Sand some		Overcast 30° occasional Ultra	0
	2	24/12					fine G		Moist	
SS	2	54/31	1"				5'-10' Br f-m Sand & Gravel			
	4						Gray Gravel some fine Sand		dry Hard Augering	
						GR	Rock frags in sample shoe		metallic debris	0
									on Auger flights.	
							Move 10' East Augur			
							do 4'			
3	4	17/14	7"				0-2 DK Br S & G			
	6	14/10					2-5" White ~~Concrete~~ Rock frags		dry No odor	0
							5-7" DK Br f-m S & G ~~trace~~		Noted	
4	6	4/5	15"				0-8" B f-c SAND trace			
	8	5/4					f G. some S		Petro odor	
	~~10~~	~~2/3~~	~~8~~				8-12" DK Br fine Sand &		noted	
		~~3/4~~					12-15" Br f-c S some		moist/wet	
							m-f G.			485
5	8	2/3	0				No Recovery Rock frag			
	10	3/4					in sample shoe		Petro odor noted	
6	10	1/3	7"				f-c SAND wood frags		wet	
	12	17/10					& Plastic noted			
	12	6/2	0				~~Br f-c Sand~~ wood		wet	8
	14	1/12					~~wood~~ frags in sample shoe		Petro odor noted	
	14	12/5	1"			BLK	Silt and ~~S~~ f-c		oily sheen	12
	16	1/3					Sand		noted	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:

REMARKS:

Signature(s):

BORING LOG

PROJECT NAME: Area A LF
PROJECT NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW30DS
DATE: 11/1
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	16	2/2	13			DK Br	Silt and Clay		Wet	60
	18	1/3							oily sheen odor	
									noted	
	18	3/2	16			DK Br	Silt some CLAY		H_2S and	30
	20	1/2							Petro odor noted	
	20	5/2	7"				do		oily sheen noted	26
	22	2/3								
ST	22						Push Shelby Tube		Install at 23	
	24						No Recovery			
									Sand bridge	
									during installation	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING NO. 2LMW300

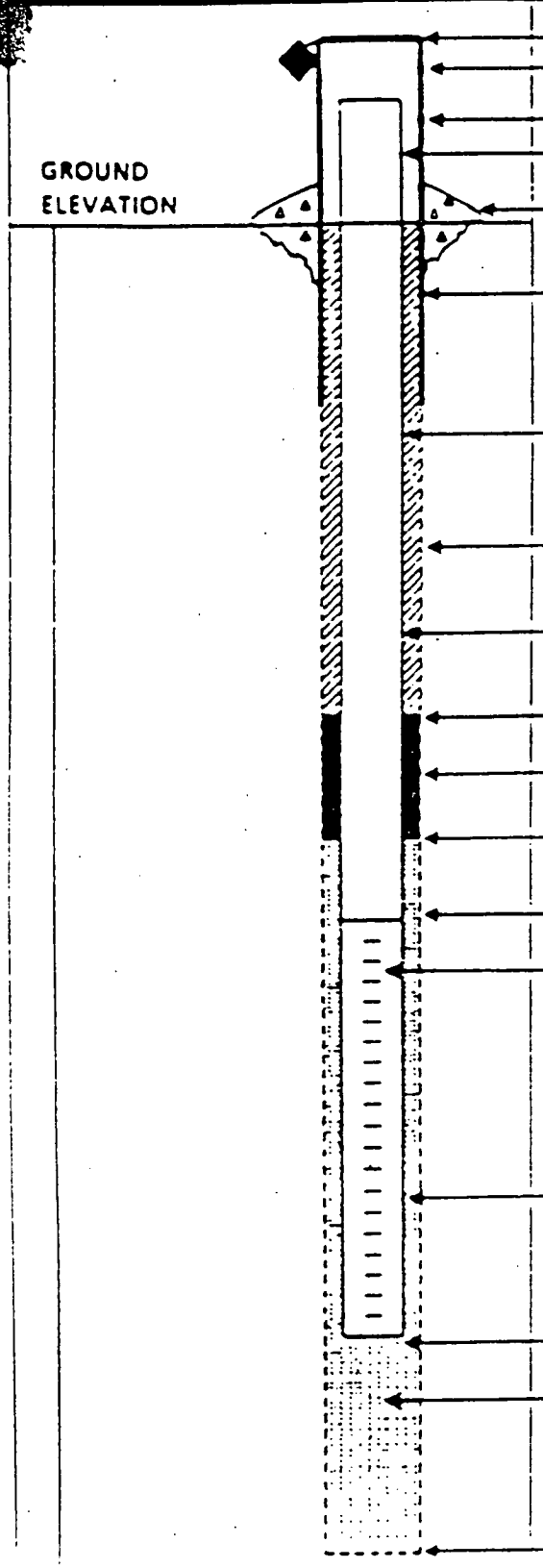
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT Area A Landfill
PROJECT NO. 5082
ELEVATION
FIELD GEOLOGIST JES

LOCATION 2LMW300S
BORING
DATE 11/1

DRILLER [redacted]
DRILLING METHOD HSA
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING
ELEVATION OF TOP OF RISER PIPE
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE :
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING:
TYPE OF SURFACE CASING
RISER PIPE I.D. 2
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL: Bentonite Grout
ELEVATION / DEPTH TOP OF SEAL 15'
TYPE OF SEAL: Bentonite
DEPTH TOP OF SAND PACK: 17'1"
ELEVATION / DEPTH TOP OF SCREEN 19'11"
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 5' #10
I.D. OF SCREEN: 2
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 22'11"
ELEVATION / DEPTH BOTTOM OF SAND PACK.
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE 23'

BORING LOG

Page___ of___

PROJECT NAME: Area A LF
PROJECT NUMBER: 5087
DRILLING COMPANY: Aquatech
WATER LEVEL DATA:

BORING NUMBER: 2LMW30F
DATE: 11/1
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
							Auger to 8'			
	8	50/1/34	3"				8 wood frag in sample			25
	10						Shoe			
	10	9/36	11			Br	f-c sand		wet	6
	12	16/4					Wood frags		Annulus = 7ppm	
							Complete @ 12:45			
							Install @ 12'			

* When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No;
WELL I.D.#:
REMARKS:

Signature(s):

BORING NO. 2LMW30F

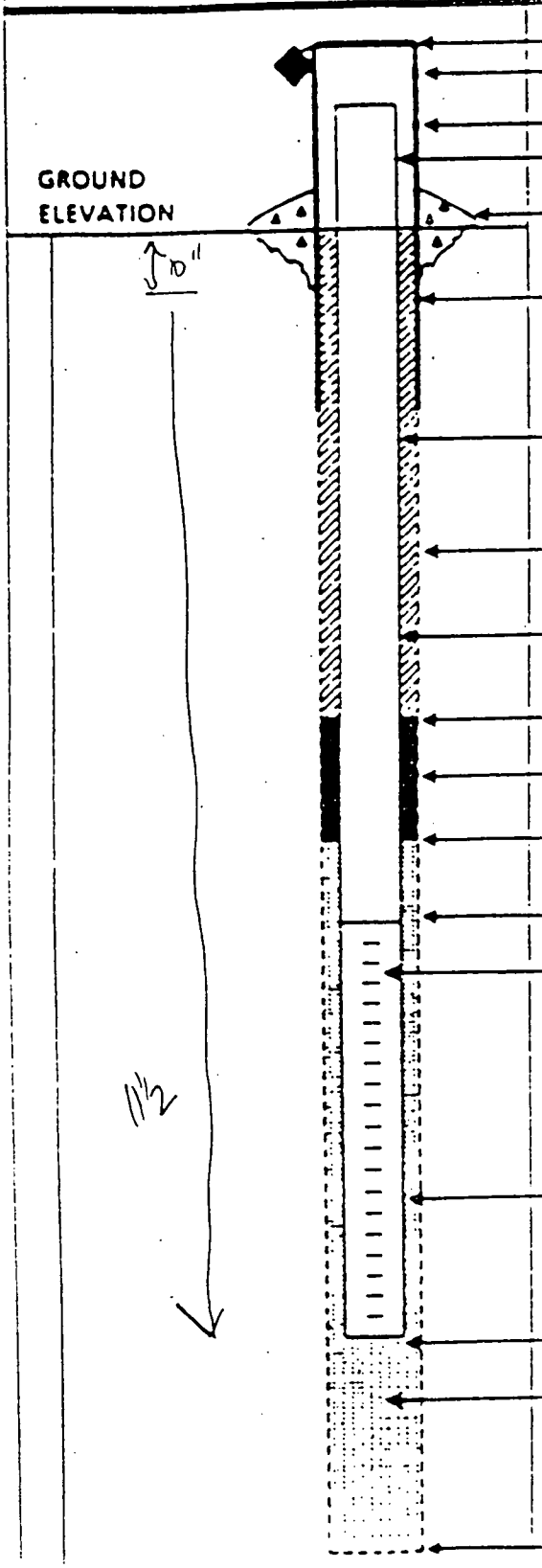
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT ABG A L.E.
PROJECT NO. 5082
ELEVATION
FIELD GEOLOGIST

LOCATION 2LMW30F
BORING
DATE

DRILLER 2LMW30F
DRILLING METHOD
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING: -10"
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING:
TYPE OF SURFACE CASING: Steel flush case
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL:
ELEVATION / DEPTH TOP OF SEAL: 4' 0"
TYPE OF SEAL: Enviroplug med size bentonite chips
DEPTH TOP OF SAND PACK: 5.9'
ELEVATION / DEPTH TOP OF SCREEN: 7'4"
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 5'
I.D. OF SCREEN: 2
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 12'4"
ELEVATION / DEPTH BOTTOM OF SAND PACK:
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 12'4"

BORING LOG

Page___ of___

PROJECT NAME: NSB NLON-AROA A
PROJECT. NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW31DS
DATE: 11/2
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	0	8/18	9"	SANDY FILL		Gr	0-7" Sy Sand a Gravel		Heavy Rain	
	2	9/6				Br	7"-9" f-c Sand and Gravel			
	2	10/7	7"			Br	0-5" Same as above		Petro odor noted	
	4	3/13				Gr	5-7 Gr Sy Sand and Gravel			
	4	6/13	11"			Br	fine - Coarse Sand & Gravel		Petro odor noted	
	6	2/2								
	6	1/2	24			Gr	0-9" Grey Sandy f G		Petro odor noted	
	8	1/1		DREDGE SPILL		Gr	9-24" Clayey SILT			
	8	WH/WH	24			Gr	c/o			
	10	WH/WH								
	10						Push Shelby Tube			
	12						Recovery = 26"			
	12	9/9	17"				0-11" Same as above		Plug 12'-14'	
	14	12/14		SANDY TILL			11"-17" Brown Sand and		w bentonite	
							frm black rock fragments		Install well	
							~~Plug~~		at 12'	
									Sand = 12'-8'2"	
									Seal = 8'2"-5'0"	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING NO. _____

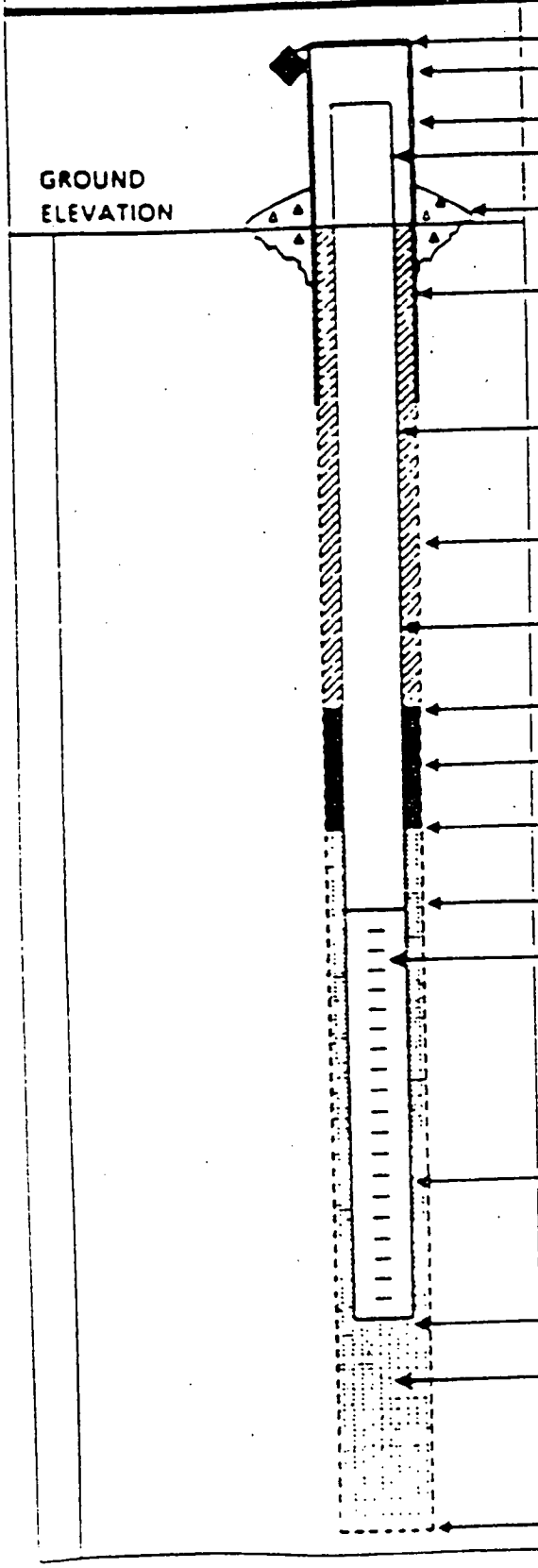
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT _____
PROJECT NO. _____
ELEVATION _____
FIELD GEOLOGIST _____

LOCATION 2LMW31DS
BORING _____
DATE 11/2

DRILLER M. Schaal
DRILLING METHOD HSA
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF SURFACE CASING: _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK - UP TOP OF SURFACE CASING: _____
STICK - UP RISER PIPE: _____
TYPE OF SURFACE SEAL: _____
I.D. OF SURFACE CASING: _____
TYPE OF SURFACE CASING _____
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL: Cement Bentonite Grout
ELEVATION / DEPTH TOP OF SEAL 6'
TYPE OF SEAL: _____
DEPTH TOP OF SAND PACK: 8'2"
ELEVATION / DEPTH TOP OF SCREEN 9'
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 x 3'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 12
ELEVATION / DEPTH BOTTOM OF SAND PACK: 12
TYPE OF BACKFILL BELOW OBSERVATION WELL: Bentonite Chips
ELEVATION / DEPTH OF HOLE 14

BORING LOG

Page___ of___

PROJECT NAME: Area A
PROJECT NUMBER: 5080
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2-MW 31F
DATE: 11/2
GEOLOGIST:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness*	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	4	4/10	8"				Auger to 4'		Rain	
	6	7/8					0-1" Br f-c(+) Sand	SG	wet	
							1-8" Gray f-c(+) Sand		Petro	
							some f Gravel ~~Fine~~ Silt		odor noted	
							Install 6' well with			
							3' screen & 4' riser pipe			
							Sand x 6-8'			
							bentonite to surface			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:

REMARKS:

Signature(s):

BORING NO. 2LMW31F

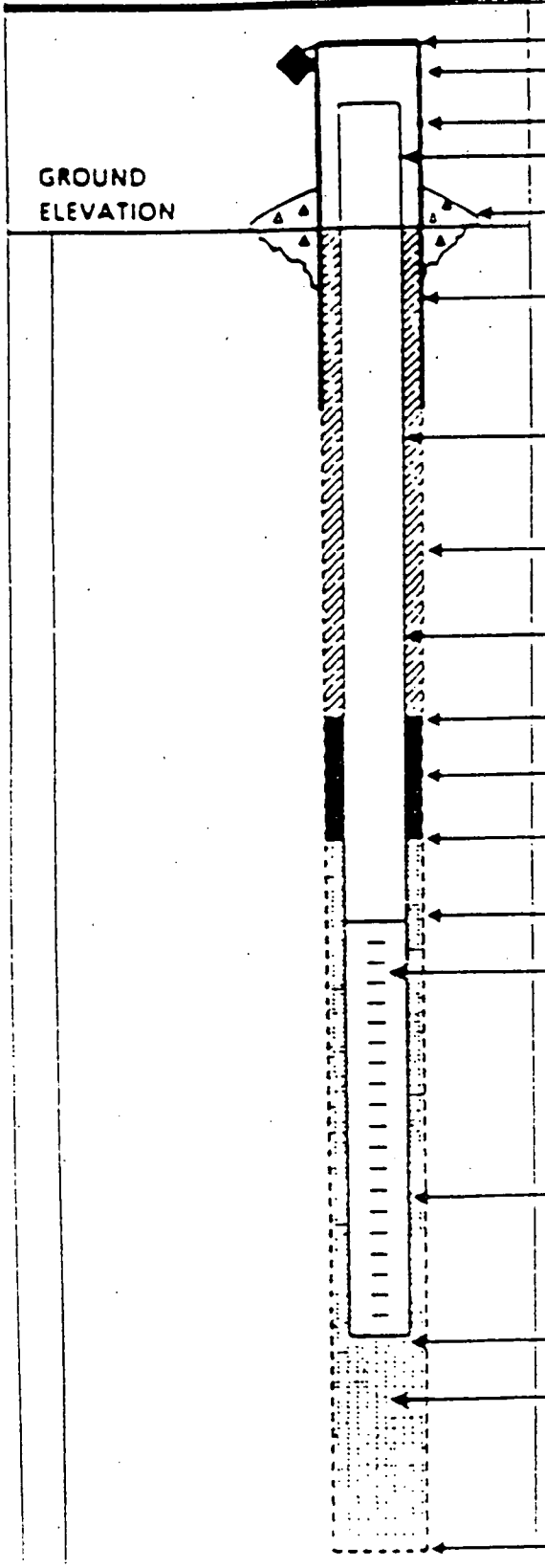
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT Area A Landfill
PROJECT NO. 5082
ELEVATION
FIELD GEOLOGIST TES

LOCATION 2LMW31F
BORING
DATE 11/2

DRILLER
DRILLING METHOD HSA
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: Bentonite
I.D. OF SURFACE CASING:
TYPE OF SURFACE CASING
RISER PIPE I.D. 2"
TYPE OF RISER PIPE:
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL: Bentonite
ELEVATION / DEPTH TOP OF SEAL 0
TYPE OF SEAL:
DEPTH TOP OF SAND PACK: 2
ELEVATION / DEPTH TOP OF SCREEN 3
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: #10 x 3'
I.D. OF SCREEN:
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 6
ELEVATION / DEPTH BOTTOM OF SAND PACK: 6
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE 6

BORING LOG

PROJECT NAME: AREA A LF
PROJECT NUMBER: 5083
DRILLING COMPANY: ASSOCIATED
WATER LEVEL DATA:

BORING NUMBER: QLMW33DS
DATE: 11/5
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
1	0	4/50/1"	4"		0-3	Br	f (+) m Sand and f-m G		Moist	
	2	/			3-4	wh	Quartzite rock fragment		H-Nu=0.0	
		/							No odor noted	
2	3	6/	9"			0-7	Br f-c SAND, some (c) FG		Auger to 1' hit	
	5	11/9					Becomes more Gravelly		obstruction set-up Casing	
		14/					towards bottom of Sample		(11:15) trimmed to 3'	
		/				7-9	Br f-m Gravel and			
		/					Sand. Gravel is subangular			
		/					Quartzite			
		/								
3	5	6/50/1"	4		Br	f-c	Sand and Fine Gravel		H-Nu=0.0	
	7	/					brick fragments in		Hard Tricing	
		/					Sample shoe		5½ to 6½	
		/							Hard tricing from	
		/							7 to 9	
4	11	1/1	1				Gr med-course SAND		Hard augering 9½-10½	
	13	1/1					Some f-med Gravel			
		/							Spun casing to	
		/							13' bgs	
		/								
5	13	3/3	11		0-7	Gr	Cly SILT		wet	
	15	5/5			7-11	Bl	coarse Sand and FG		Clay = 2.2 ppm	
		/							Sand = 0.0 ppm	
6	15	8/3	15		0-8	B	do wet		H-Nu=15 ppm	
	17	1/1			8-15	Gr	Cly SILT wet			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: X Yes ___ No; WELL I.D.#:

REMARKS:

Signature(s):

BORING LOG

PROJECT NAME: Area A LF
PROJECT NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW32DS
DATE: 11/6
GEOLOGIST: JEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	17	/	24				17-15 Shelby tube		Trying to 17	
	19	/					Gray Cy $		Take Shelby	
		/							Tube	
		/							24" Recovery	
		/							Possibly some washin	
	19	1/1	24			GR	Cly SILT		up end of Tube	
	21	2/2					HNU=52		wet	
		/								
	21	1/1	2			GR	do HNU=3.2		Spin casing to	
	23	1/1							17' install well	
		/							@ 24	
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								
		/								

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING NO. 2LMW33F

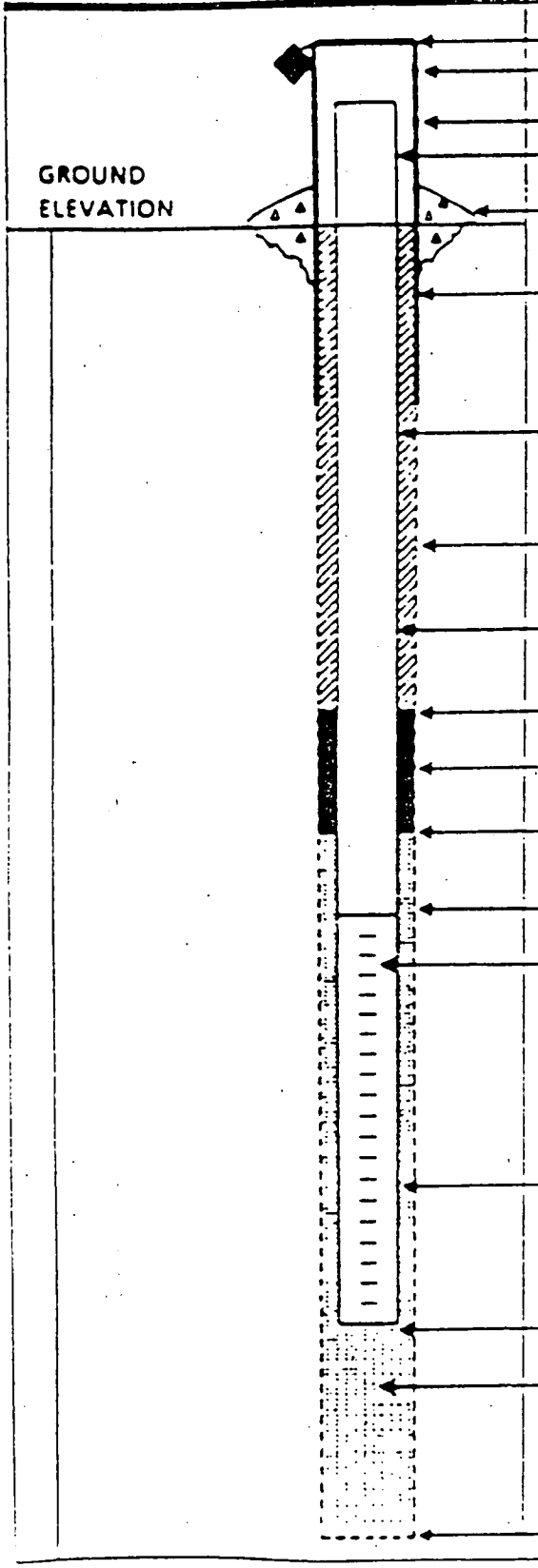
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT
PROJECT NO.
ELEVATION
FIELD GEOLOGIST

LOCATION
BORING 2LMW33F
DATE 11/5/95

DRILLER
DRILLING METHOD Spin Casing
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:

STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:

TYPE OF SURFACE SEAL:

I.D. OF SURFACE CASING:
TYPE OF SURFACE CASING

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: 2" Schedule 40 PVC

BOREHOLE DIAMETER: 4"

TYPE OF BACKFILL:

ELEVATION / DEPTH TOP OF SEAL 0.5'

TYPE OF SEAL: Enviroplug and Bent. Chips

DEPTH TOP OF SAND PACK: 3.9 feet

ELEVATION / DEPTH TOP OF SCREEN 4'11"

TYPE OF SCREEN: PVC Schedule 40

SLOT SIZE x LENGTH: #10 x 5 feet

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: #1 New Jersey

ELEVATION / DEPTH BOTTOM OF SCREEN: 9'11"

ELEVATION / DEPTH BOTTOM OF SAND PACK: 9'11"

TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION / DEPTH OF HOLE 9'11"

BORING LOG — **HALLIBURTON NUS**

PROJECT: ~~[illegible]~~ AREA A
BORING NO.: 2LMW34DS
PROJECT NO.: ~~[illegible]~~ 85082
DATE:
DRILLER: GEO-TEK
ELEVATION:
FIELD GEOLOGIST: TEJ
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1	0	8/10	19		0-10	Br	0-10' f(+)-c sand and		Rain/Fog
	2	16/10					fine Gravel		Becomes gravelly at 17'
					10-19	Gr	f-c(+) SAND and f-m G		
2	2	11/17	21		0-7	Br	f(+)-C Sand and f G		~~Fog~~ Wood Paper and
	4	38/29			7-21	Tan	Wood		Wood frags noted
3	4	50/2"	2"				Wood Frags in Sample Shoe		
	6								
4	6	4/3	0				NO RECOVERY		
	8	2/4							
5	8	5/7	12		0-10	Br	Brown mottled fine(+)-med Sand trace G		wet
	10	6/2			10-12	GR	Gr SILT, ~~trace f G~~		
6	10	2/2	2		0-2	Br	Fine SAND trace f G		
	12	2/16							
7	12	5/5	1"		0-1	GR	Fine-med SAND		wet
	14	3/3							
8	14	3/1	21		0-21	GR	SILT, some Clay		wet
	16	1/3							
	16						Push Shelby Tube		21" recovery
	18								
	18						Push Shelby Tube		No recovery
	20								
	20						Push Shelby Tube		18' recovery
	22								Install well
									at 22' bgs
									5' Screen 16/2 filter

REMARKS

BORING

PAGE ___ OF ___

* See Legend on Back

BORING NO. _____

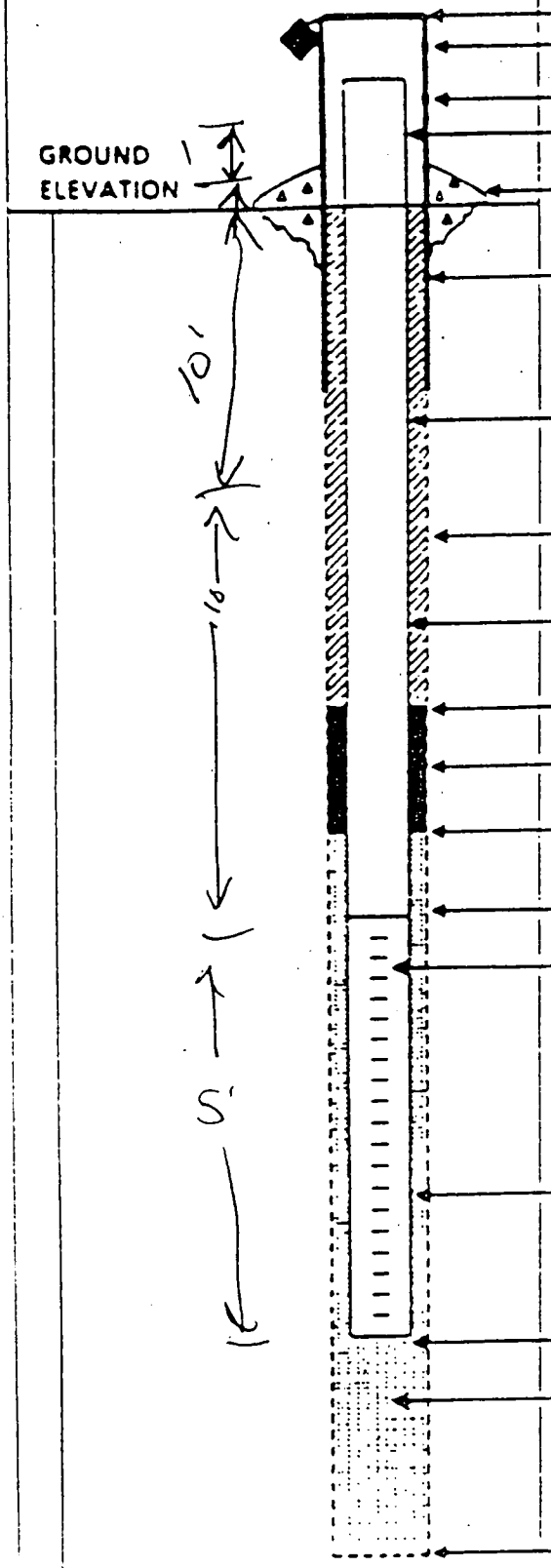
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT: AREA A
PROJECT NO.: 5082
ELEVATION: _____
FIELD GEOLOGIST: TEJ

LOCATION: _____
BORING: 2LMW32D5
DATE: 11/6/95

DRILLER: Mark Schaub
DRILLING METHOD: Spin Cutting
DEVELOPMENT METHOD: _____



ELEVATION OF TOP OF SURFACE CASING: _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK - UP TOP OF SURFACE CASING: _____
STICK - UP RISER PIPE: _____
TYPE OF SURFACE SEAL: _____
I.D. OF SURFACE CASING: 6
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 4"
TYPE OF BACKFILL: Cement bentonite Grout
ELEVATION / DEPTH TOP OF SEAL: ≈15.0
TYPE OF SEAL: Bentonite Slurry
DEPTH TOP OF SAND PACK: 17.4'
ELEVATION / DEPTH TOP OF SCREEN: A
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: #10 5'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 24'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 24'
TYPE OF BACKFILL BELOW OBSERVATION WELL: N/A
ELEVATION / DEPTH OF HOLE: 24'

BORING LOG — **HALLIBURTON NUS**

PROJECT: NOVACOR AREA A — BORING NO.: 2LMW32F
PROJECT NO.: 5082 — DATE: — DRILLER: GEO-TEK Ass.
ELEVATION: — FIELD GEOLOGIST: TCT
WATER LEVEL DATA: —
(Date, Time & Conditions) Sunny 55°F

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
							Spin Casing		Boulders and
							to 10'		cobbles to 10'
									very slow progress
	10	1 1	8				Br-Gray Cly $ wet		H-NU=0.0
	12	1 1					trace f Gravel		
	12	2 2	24			GR	Cly SILT		debris noted in sample shoe
	14	2 2							H-NU= 0.2
									trimme
	14	4 5	8			Gr	0-4 do		
	16	8 5					4-8 Br f-c Sand		H-NU=0
							and fine Gravel		
	16	9 6	0				No Recovery		
	18	5 3					Sand in trimme when advancing to 18'		
	18	9 9	1.0				Gray f-c(+)		H-NU = 0
	20	10 10					Sand, f-c Gravel		
	20	5 5	8						
	22	14 11					Br br f-c(+) Sand and		H-NU = 0
							f-Gravel		
	22	1 2	22			Br	Cly SILT		H-NU = 68
	24	3 1							
							Push Shelby tube		Spin Casing to
							24'-26'		20'
							Recovery = 24"		

REMARKS — BORING — PAGE ___ OF ___

* See Legend on Back

HALLIBURTON NUS
Environmental Corporation

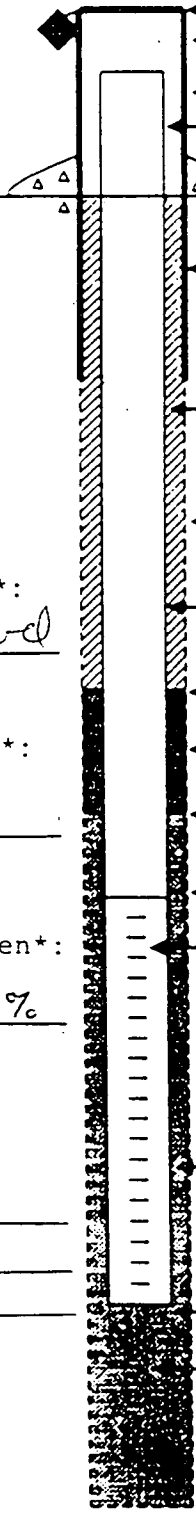
Well No.: 2LMW32F

OVERBURDEN
MONITORING WELL SHEET

PROJECT 5082
PROJECT NO.
ELEVATION
FIELD GEOLOGIST TCS

LOCATION
BORING
DATE 11/7/95

DRILLER Associated
DRILLING METHOD Spinning
DEVELOPMENT METHOD



GROUND ELEVATION

ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING: 3"
TYPE OF SURFACE CASING: Cast iron round
RISER PIPE I.D. 2"
TYPE OF RISER PIPE:
BOREHOLE DIAMETER: 4"
TYPE OF BACKFILL: Bentonite and Chips
ELEVATION / DEPTH TOP OF SEAL: /
TYPE OF SEAL: Bentonite and Chips
Elevation/End Depth of Seal: 15.7 ft
ELEVATION / DEPTH TOP OF SCREEN: 17 /
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1
Filter Pack Length: 6.8' ft.
ELEVATION / DEPTH BOTTOM OF SCREEN: 16.8/
ELEVATION / DEPTH BOTTOM OF SAND PACK: 22.5/
TYPE OF BACKFILL BELOW OBSERVATION WELL: Bentonite Chips
ELEVATION / DEPTH OF HOLE: 124

Aquifer Type*: Sand Gravel

Aquifer Name*:

Percent open area of screen*: %

Remarks*:

* Note: See other side for details.

BORING LOG — **HALLIBURTON NUS**

PROJECT: MOTOR AREA & LANDFILL — BORING NO.: 2LHW32PZ
PROJECT NO.: BT63 5082 — DATE: — DRILLER: GEOLITEK Associates
ELEVATION: — FIELD GEOLOGIST: TEJ
WATER LEVEL DATA: —
(Date, Time & Conditions) —

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
									Spin casing to
									Loose water
									return at 7.5 feet
	14	4 3	8"			Br	f-c(4) Sand and f(4)-m		Boulders to 13'
	16	3 6					Gravel		H-NU = 0.0
									Install @ 14' 7"
									Sand 14' 7" to
									8' 6"

REMARKS —

BORING —

PAGE ___ OF ___

* See Legend on Back

BORING NO. 2LMW32PZ

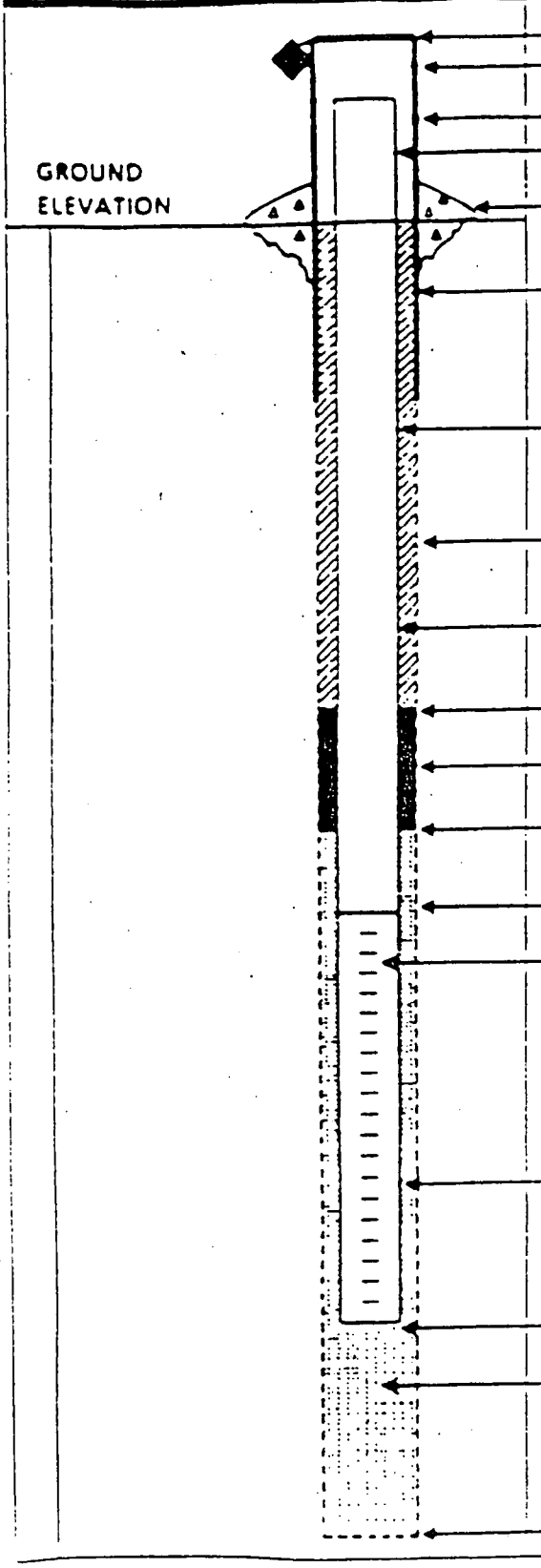
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT 5082
PROJECT NO.
ELEVATION
FIELD GEOLOGIST

LOCATION
BORING 2LMW32PZ
DATE 11/7/95

DRILLER Assoc
DRILLING METHOD Spin Casing
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING
ELEVATION OF TOP OF RISER PIPE
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE :
TYPE OF SURFACE SEAL:
I.D. OF SURFACE CASING:
TYPE OF SURFACE CASING
RISER PIPE I.D. 2"
TYPE OF RISER PIPE:
BOREHOLE DIAMETER: 4"
TYPE OF BACKFILL:
ELEVATION / DEPTH TOP OF SEAL
TYPE OF SEAL: Envirosplug 8'6" to surface
DEPTH TOP OF SAND PACK: 8'6"
ELEVATION / DEPTH TOP OF SCREEN 9'7"
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 x 5'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 14'7"
ELEVATION / DEPTH BOTTOM OF SAND PACK: 14'7"
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE 11'

BORING LOG **HALLIBURTON NUS**

PROJECT: ~~NORFOLK~~ AREA A BORING NO.: 2L MW33DS
PROJECT NO.: 8T63 DATE: 11/4/95 DRILLER: ~~GEOSCIENCE~~ Associ
ELEVATION: FIELD GEOLOGIST: TOM JORDAN
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (Ft.) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY SAMPLE LENGTH	LITHOLOGY CHANGE (Depth, Ft.)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
1	0	4/9	14		0-8	Br	f-c Sand some f G		wet/moist
	2	50/5"			8-4	Wh	Quartzite rock frags.		H-Nu= 0.0
2	2	19/15	11		0-4	~~Br~~ Wh	Quartzite rock frags		Quartzite rock frags
	4	30/36			4-8	Br	Br f-m Sand some f G		in shoe
					8-11	Wh	white Quartzite rk frags		dry-moist
3	4	18/13	12"		0-6	Br	f(+)-m Sand, some f-m G		moist
	6	22/15			6-8	Wh	Quartzite rock frags		
					8-12	Br	f(+)-c Sand and f-m G		wet
4	6	15/19	8"		0-8	Br	Sand with black		
	8	10/14					Gneiss rock fragments		
5	8	50/5"	2"		0-2	Wh	White Quartzite rock frags		Lead auger
	10								Shaves off
									carry through Rt Frag
									10:20
							Move 5' East Go. down		
							with casing		Spin Casing to
6	10	2/1	12						10' Sample, tricone
	12	1/1							Sample tricone
									Spin Casing to 12
7	12	1/2	20		0-3	Bl	f-c(+) Sand and f G		wet
	14	1/2			3-12	Bl	Cy SILT		HNu = 0.2
							do		HNu = 7.0
	14								
	16						Push Tube		23" Recovery

REMARKS 16/18 1/2 21 20" Gr Cy SILT, HNu = 8.8

BORING

PAGE OF

* See Legend on Back

BORING NO. _____

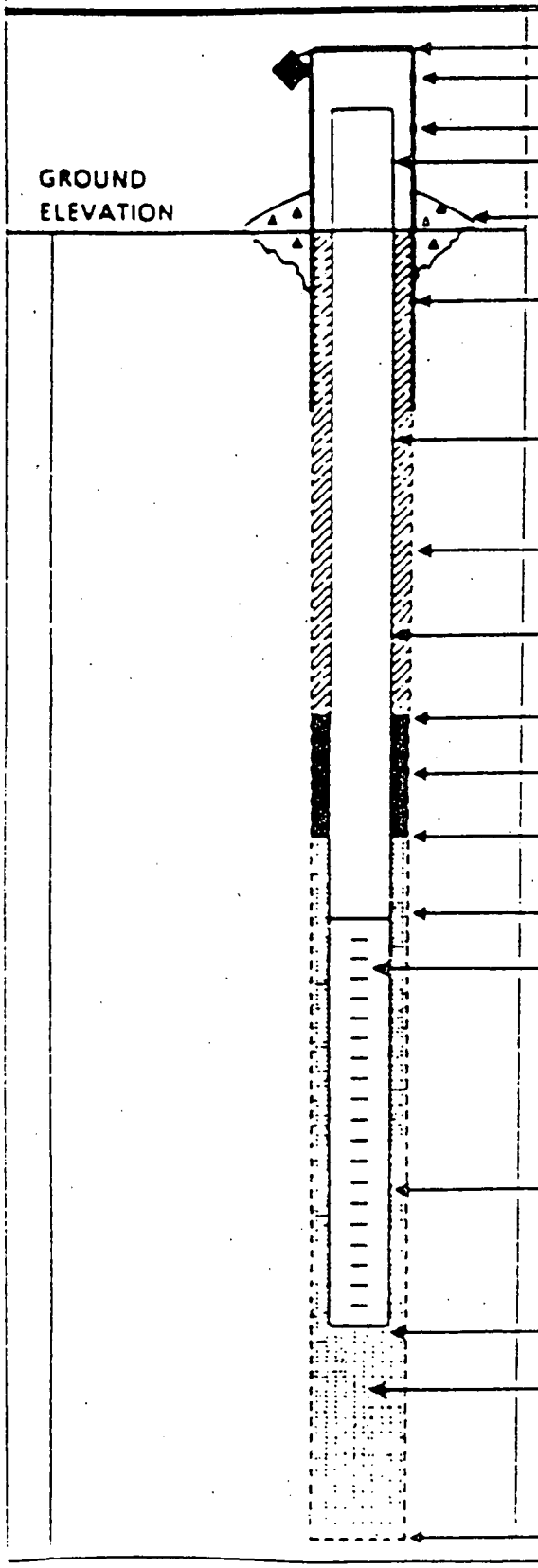
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT: AREA A LF
PROJECT NO.: 5052
ELEVATION: _____
FIELD GEOLOGIST: TOM TORDAN

LOCATION: 2L MW33DS
BORING: _____
DATE: 11/4/95

DRILLER: 2L MW33DS
DRILLING METHOD: ~~Direct Push~~ Spin Casing/Hrone
DEVELOPMENT METHOD: _____



ELEVATION OF TOP OF SURFACE CASING: _____
ELEVATION OF TOP OF RISER PIPE: _____
STICK - UP TOP OF SURFACE CASING: _____
STICK - UP RISER PIPE: _____
TYPE OF SURFACE SEAL: _____
I.D. OF SURFACE CASING: 4"
TYPE OF SURFACE CASING: Steel
RISER PIPE I.D.: 2"
TYPE OF RISER PIPE: PVC
BOREHOLE DIAMETER: 4 inch around screen/sand pack
TYPE OF BACKFILL: Enviroplug and chips
ELEVATION / DEPTH TOP OF SEAL: _____
TYPE OF SEAL: Enviroplug Med Chips
DEPTH TOP OF SAND PACK: 12
ELEVATION / DEPTH TOP OF SCREEN: 13
TYPE OF SCREEN: 10 Slot PVC
SLOT SIZE x LENGTH: #10 5 feet
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 18
ELEVATION / DEPTH BOTTOM OF SAND PACK: _____
TYPE OF BACKFILL BELOW OBSERVATION WELL: _____
ELEVATION / DEPTH OF HOLE: 18

BORING LOG

PROJECT NAME: AREA A L.F.
PROJECT. NUMBER: 5082
DRILLING COMPANY: Associated
WATER LEVEL DATA:

BORING NUMBER: 2LMW33F
DATE: 11/5
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
	8	3/6 3	8'				Auger to 3' but boulders		0-3.5 Br f-m Sand, trace G	
							set up to spin Casing			
									Boulder	
					0-4	wh	Quartzite rock frags		3.5-6.8'	
					4-8	Br	f-c Sand and f-m G		Boulder 8-9.5'	
					7-8	wh	Quartzite rock frags		wet H-Nu: 0.0	
									No odor noted	
									Spin casing to	
									10 feet	
									Install @ 9'11"	
									No wash water	
									returns	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ✓ Yes ___ No:
WELL I.D.#: 2LMW33F
REMARKS: 5' screen 6' Sand backfill to 0.5 below surface
boulders present across screen section

Signature(s):

BORING NO. 2LMW3405

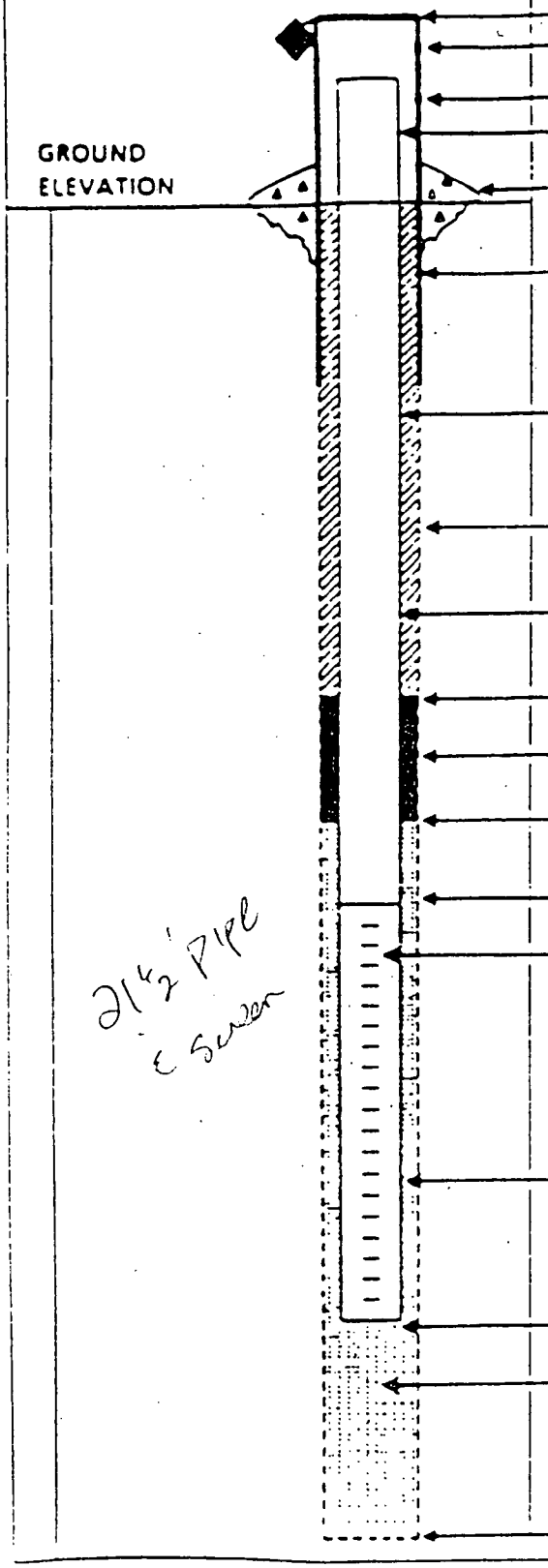
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT AREA A LF
PROJECT NO. 5082
ELEVATION
FIELD GEOLOGIST TES

LOCATION AREA A
BORING 2LMW3405
DATE 11/3/95

DRILLER Mark Schack
DRILLING METHOD HSA
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING
ELEVATION OF TOP OF RISER PIPE
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE :
TYPE OF SURFACE SEAL:
I.D OF SURFACE CASING: 2"
TYPE OF SURFACE CASING
RISER PIPE I.D. 2"
TYPE OF RISER PIPE:
BOREHOLE DIAMETER: 9"
TYPE OF BACKFILL: Cement Bentonite Grout
ELEVATION / DEPTH TOP OF SEAL 14
TYPE OF SEAL: Expanding Mud size Bentonite chips
DEPTH TOP OF SAND PACK: ~~20~~ 16
ELEVATION / DEPTH TOP OF SCREEN 17
TYPE OF SCREEN: PVC
SLOT SIZE x LENGTH: 10 - 5'
I.D OF SCREEN: 2
TYPE OF SAND PACK: #1
ELEVATION / DEPTH BOTTOM OF SCREEN: 22
ELEVATION / DEPTH BOTTOM OF SAND PACK: 22
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE 22

APPENDIX C.2

BEDROCK WELL DRILLING LOGS AND CONSTRUCTION SHEETS

BORING LOG

PROJECT NAME: Area A L.F.
PROJECT NUMBER: 5082
DRILLING COMPANY: Associated Drilling Co.
WATER LEVEL DATA:

BORING NUMBER: 2LMW32B
DATE: 11/15/95
GEOLOGIST: TJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
				0.3–	Br	f-c	(4) Sand with		Spin Casing (6")	
							f-c Gravel, cobbles		to	
				Boulders			and boulders		Boulder 0.3–	
							Hard drilling to		Loose center at	
				7.0'			7'		2' Break	
				Sandy			9' Wood fragments		casing but at	
			9.0	Gravel			Noted; Black silty		3.5 feet	
				SILT			cuttings returned		Go in with	
				w. wood					4" diameter	
				frags						
			11.0	SILT			Easy drilling 11-14'		casing to	
				DS						
			14							
				Sand			Moderately hard drilling			
				&			turn to brown return			
				Gravel						
				F						
			23							
				S						
				I						
				L						
				T						
				DS						

n rock coring enter rock brokeness.

VERTED TO WELL: ___ Yes ___ No; WELL I.D.#: ___

ARKS: ___

lure(s): ___

BORING LOG

PROJECT NAME: Area A L.F. Invest.
PROJECT NUMBER: 5082
DRILLING COMPANY: Associated Drilling
WATER LEVEL DATA:

BORING NUMBER: 2LMW32B
DATE: 11/15/95
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/6" or RQD (%)	Sample Recovery/Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
1	28	WH/2	24			Gr	Cly SILT		H-Nu = 9.2	
	30	2/2								
2	30	2/3	24		0-2"		do		wet	
	32	3/2			2"-8	Gr	Cly SILT, some fine G, trace f-c sand		wet H-Nu =	22
					8-24	Gr	Cly SILT some fine Sand			
3	32	3/3	24		0-24,	Gr	ditto		H-Nu = 16.8	
	34	3/4								
4	34	2/2								
	36	2/2	24			Gr	Cly SILT		H-Nu = 13.4	
5	36	WH/WH	22				dito		H-Nu = 8.6 (36-37)	
	38	2/5							H-Nu = 1.2 (37-38)	
6	38	2/4	24		0-10		do Shell frags noted			
	40	6/4			10-14		Br Silt with wood frags noted			
7	40	3/8	24		14-24	WH/Br	- Gr Silt and vf Sand		H-Nu = 7.2	
	42	24/9			0-14		Br-Gr Cly SILT — Shell frags noted		(Wash in) H-Nu = 4.4	
					14-24		light Gray SILT and very fine Sand mottled/Stained orang			

rock coring enter rock brokeness.

RTED TO WELL: ___ Yes ___ No;
S:

WELL I.D.#:

BORING LOG

PROJECT NAME: Area A L.F.
PROJECT NUMBER: 5082
DRILLING COMPANY: Associated Drilling Co
WATER LEVEL DATA:

BORING NUMBER: 2LMW32B
DATE: 11/15
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
8	42	1/2	24			Br	f(+)-m Sand, and Silt		wet	
	44	2/5					occasional orange		H-Nu = 0.0	
							Silty Sand seams			
9	44	6/8	19			Br	ditto occassional		wet	
	46	10/8					orange staining noted		H-Nu = 0.0	
10	46	7/4	21			Br	ditto		H-Nu = 0.0	
	48	5/7							wet	
11	48	6/5	20				ditto orange staining		wet	
	50	6/11					noted 14"-20"		H-Nu = 0.0	
12	50	14/13	17			Br	ditto orange		H-Nu = 0.0	
	52	15/17					staining noted		wet	
13	52	5/6	22			Br	do. trace orange		wet	
	54	7/7					staining noted		H-Nu = 0.0	
14	54	6/6				Br	do trace orange		H-Nu = 0.0	
	56	6/50/5"					staining		wet	
							SPW CASING TO 57'			
							Tricone to 60' - Encounter Soft zone sand seam			
	60	60/51				Br	f-m SAND some		wet	
	62	50/4"					angular gravel orange			
							staining present			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; 2LMW33D3 16.35 11.27 2LMW33F
WELL I.D.#:
REMARKS:

Signature(s):

15 11.03 = 2LMW32D5 11.16 = 2LMW32F 10.37 = 2LMW32

BORING LOG

Page___ of___

PROJECT NAME: Area A Invest.
PROJECT NUMBER: 5052
DRILLING COMPANY: Assoc. Drilling
WATER LEVEL DATA:

BORING NUMBER: 2LMW32B
DATE: 11/19
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/6" or RQD (%)	Sample Recovery/Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	FID or PID Reading (ppm)
									Welcome to 63' Sandy Gravel - easy drilling	
									Hard drilling 63.5 (+)	
				Lt Gray return water			0852-0901 65' - 66' =		rate = 1'/9 min	
							0901-0908 66' - 67' =		1'/7 min	
							0908-0916 67 - 68' =		1'/8 min	
							0925-0934 69-70' =		1'/9 min	
							0934-0942 70'-71'		1'/9 min	
							0948-0950 71-72		1'/8 min	
							0950-0952 72-73		Void/fracture 10" drop in tricone and rods	
									Suspect a boulder	
									Continue drilling	
					10:15		Call Greg Rich he instructs me to continue drilling			
					11:00		Helper goes for additional Riser Pipe			
				Med Gray return water	1134	1140	73'-74' = 6 minutes		73.8' = Some Rig chatter = Feldspar	
					1140 -	1143	74-75' = 3 minutes		Black mica, otz and	
					1143 -	1149	75-76 = 6 min		K-spar loaded up	
					1149	1155	76-77 = 6 min do (+)	K-spar		
					1155 -	12:00	77-77.8 = 5 min		— mica, A-spar, Qtz, K-spar	
					1205 -	1212	78-79 = 7 min			
					1212 -	1218	79-80 = 6 min			
					1218	1225	80-81 = 7 min		Finish hole	
					12:37	12:37	81-82 7 min			
					12:44	12:53	82-83 - 9 m		Cutting	
					12:53 -	1305	83-84 - 8			
									85 - 81 = 131	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No: WELL I.D.#:

REMARKS:

Signature(s):

Brown & Root Environmental

BORING NO : _____

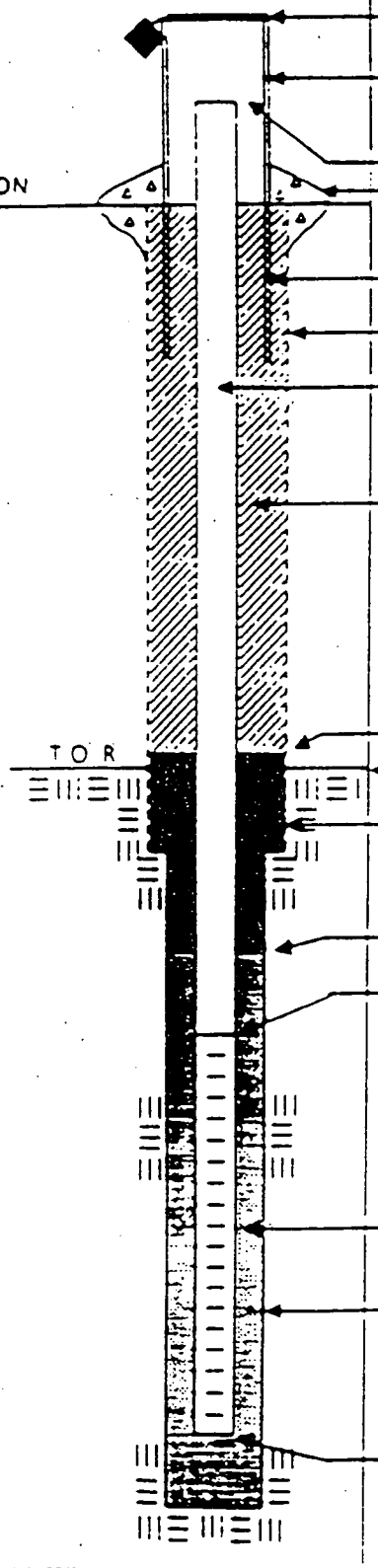
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT _____
PROJECT NO. _____
ELEVATION _____
FIELD GEOLOGIST _____

LOCATION 2LMW32B
BORING _____
DATE _____

DRILLER _____
DRILLING METHOD Spin Casing & Hole
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF SURFACE CASING _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

ELEVATION TOP OF RISER: _____

TYPE OF SURFACE SEAL: Cement

I.D. OF SURFACE CASING: _____

DIAMETER OF HOLE: 4"

RISER PIPE I.D.: 2"

TYPE OF RISER PIPE: PVC schedule 40

TYPE OF BACKFILL: Cement/bentonite to 10' tbtc plug 10'-2' bgs due to roads

ELEVATION / DEPTH TOP OF SEAL: 64.0

ELEVATION / DEPTH TOP OF BEDROCK: 63.5

TYPE OF SEAL: Bentonite slurry tremied in

104.6
-0
74.6

ELEVATION / DEPTH TOP OF SAND: 74.6

ELEVATION / DEPTH TOP OF SCREEN: 76.2

TYPE OF SCREEN: PVC

SLOT SIZE x LENGTH: 10 Slot 10'

I.D. SCREEN: 2"

TYPE OF SAND PACK: #1

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: 3½"

ELEVATION / DEPTH BOTTOM SCREEN: 86.2

ELEVATION / DEPTH BOTTOM OF HOLE: 86.5

BORING LOG

Page___ of___

Frank Stanton Bob Mayo

PROJECT NAME: Area A Landfill
PROJECT NUMBER: 5042
DRILLING COMPANY: La Franchaise
WATER LEVEL DATA:

BORING NUMBER: ALMW35B
DATE: 11/13/95
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/6" or RQD (%)	Sample Recovery/Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	FID or PID Reading (ppm)
GRAB				Overburden (?) SAND			Hammer to 6'		Dry	
					0-6'	Br	Br f-m C SAND		8½" bit	
							trace f. gravel G.		Rig, Loader & Pickup	
GRAB					6'-11'		Lt Gr Quartz, Feldspar		Set Casing (13')	
							minor (granite)		Hammer 2' into	
				Bedrock Granite					rock	

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:

REMARKS:

Signature(s):

BORING LOG

PROJECT NAME: Area A
PROJECT NUMBER: 5082
DRILLING COMPANY: LaFrambone
WATER LEVEL DATA:

BORING NUMBER: 2L MW35B
DATE: 11/13-11/14
GEOLOGIST:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
				Rod #1 0-30	0-6	Br	F-C(+) Sand and f-m G		Set 13' Long	
					6-11	Wh	Granite		Casing @ 11'	
									bit to set casing =	
									8½"	
						Zb				
					11-[redacted]		Granite 10% K-Spar			
							<10% mica		Nominal 6" bit	
							40% Qtz		for 13(1) feet	
							40% A-spar			
					26-31[redacted]		Gr-Black becomes micaceous			
					31		becomes granite			
					32		becomes micaceous		"Some" rig	
									chatter	
				Rod #2 30-55'	45		Granite			
					50		becomes micaceous			
						53	become Granite			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING LOG

PROJECT NAME: Area A LF Invest.
PROJECT NUMBER: 5082
DRILLING COMPANY: LeFrambaise
WATER LEVEL DATA:

BORING NUMBER: 2LMW35B
DATE: 11/13 - 11/14
GEOLOGIST: TKJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
				Rd 3 55-80'						
							65- becomes micaceous		dry/dusty	
							67 becomes granitic			
							70 becomes micaceous			
							71 becomes granitic			
							73 high % K-spar (pink)			
							76 becomes more white			
				Rd 4 80-105			80-87 becomes micaceous			
							87 become Granitic			
							93 becomes more pink			
							94 becomes more white			
							98 becomes micaceous			
							99 becomes granitic			
							101 becomes micaceous			
							TD = 103			
							Let sit for ½ hr			
							~~[illegible]~~ not seen			
							water blow at			
							of boring <<1 gpm			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No;
WELL I.D.#:
REMARKS:

Signature(s):

Brown & Root Environmental

BORING NO : 2LMW35B

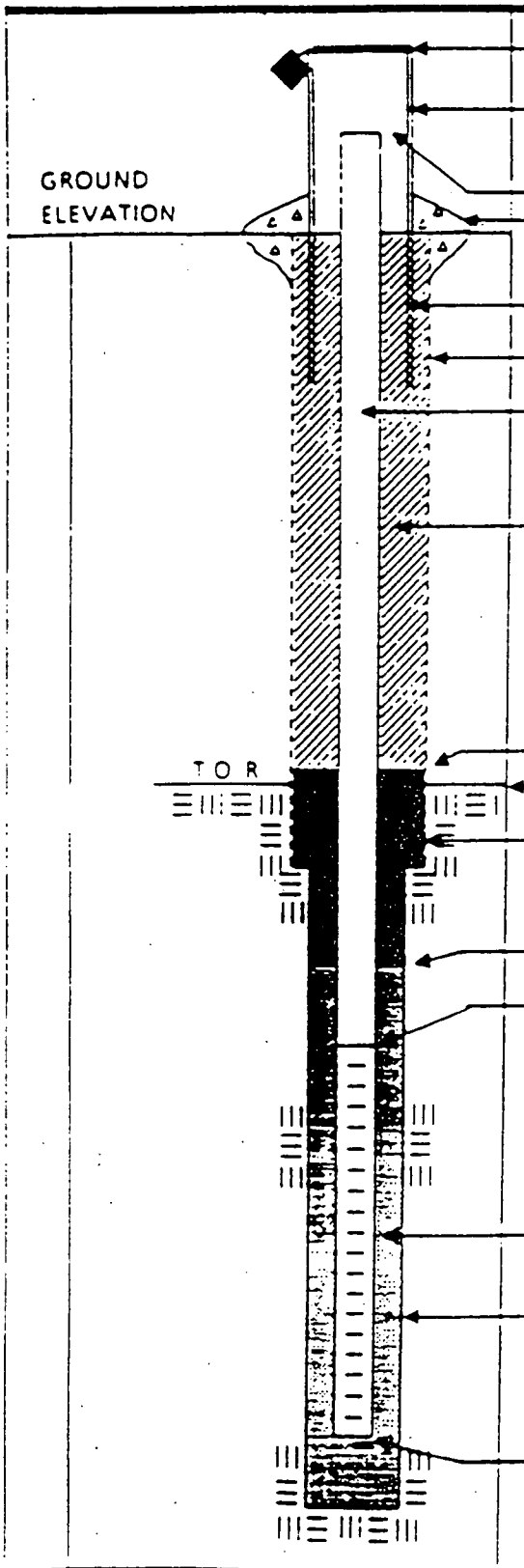
BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT Area A L.F.
PROJECT NO. 5082
ELEVATION
FIELD GEOLOGIST TEJ

LOCATION 2LMW35B
BORING
DATE 11/13 - 11/14

DRILLER La Frambaise
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING:

STICK UP OF CASING ABOVE GROUND SURFACE:

ELEVATION TOP OF RISER:

TYPE OF SURFACE SEAL:

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: ~~8'~~ 8 1/2"

RISER PIPE I.D.: 6"

TYPE OF RISER PIPE: Steel

TYPE OF BACKFILL: Cement Bentonite

ELEVATION / DEPTH TOP OF SEAL: Surface ~~8'~~

ELEVATION / DEPTH TOP OF BEDROCK: ~~8'~~ 7'

TYPE OF SEAL: Cement bentonite

ELEVATION / DEPTH TOP OF SAND: N/A

ELEVATION / DEPTH TOP OF SCREEN: 11'

TYPE OF SCREEN: Open hole

SLOT SIZE x LENGTH: N/A

I.D. SCREEN: N/A

TYPE OF SAND PACK: N/A

DIAMETER OF HOLE IN BEDROCK:

CORE / REAM: Air Rotary 6"

ELEVATION / DEPTH BOTTOM SCREEN: ~~N/A~~ 103

ELEVATION / DEPTH BOTTOM OF HOLE: 103'

BORING LOG

PROJECT NAME: Area A Landfill Invest.
PROJECT NUMBER: 5082
DRILLING COMPANY: LaFramboise Drilling
WATER LEVEL DATA:

BORING NUMBER: ALMW3613
DATE: 11/13 - 11/14
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
GRAB				0-30' 1st RQD	0-1'10"	Br	fine (+) - course Sand		dry	
							Some fine-med Gravel			
GRAB					1'10"-	Gr-Wh	K-spar 10%			
							A-spar 40		Place Casing at	
							Quartz 40		7' Casing Length	
							Mica 10		= 7'10"	
					27'	Gr-Bl	~~Mica~~ Becomes more		Rods = 25'	
							micaceous. Loose		Hammer 5'	
							K-spar 0%			
				30-55' 2nd Rod			A-spar 20			
							Qtz 30		Soft	
							Mica 50			
					30		Mica 70			
							K-spar 10%			
							other 20			
					36		Becomes more Granitic			
					40		Becomes more micaceous			
					42		Granitic Seam			
					44		Becomes more micaceous			
					55		Becomes more granitic			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No; WELL I.D.#:
REMARKS:

Signature(s):

BORING LOG

PROJECT NAME:
PROJECT NUMBER: 6083
DRILLING COMPANY:
WATER LEVEL DATA:

BORING NUMBER: 2LMW36B
DATE: 11/13-11/14
GEOLOGIST: TEJ

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows/ 6" or RQD (%)	Sample Recovery/ Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID or FID Reading (ppm)
				3rd Rod 55-80	56	Pink	Granite			
					65		becomes micaceous			
					67		becomes granite			
					75-77		Micaceous			
					77-80		Granite			
					86		Becomes more micaceous			
					88		Becomes Granite			
				Rod #4 80-105	100-103		becomes micaceous			

*When rock coring enter rock brokeness.

CONVERTED TO WELL: ___ Yes ___ No:
WELL I.D.#:
REMARKS:

Signature(s):

Brown & Root Environmental

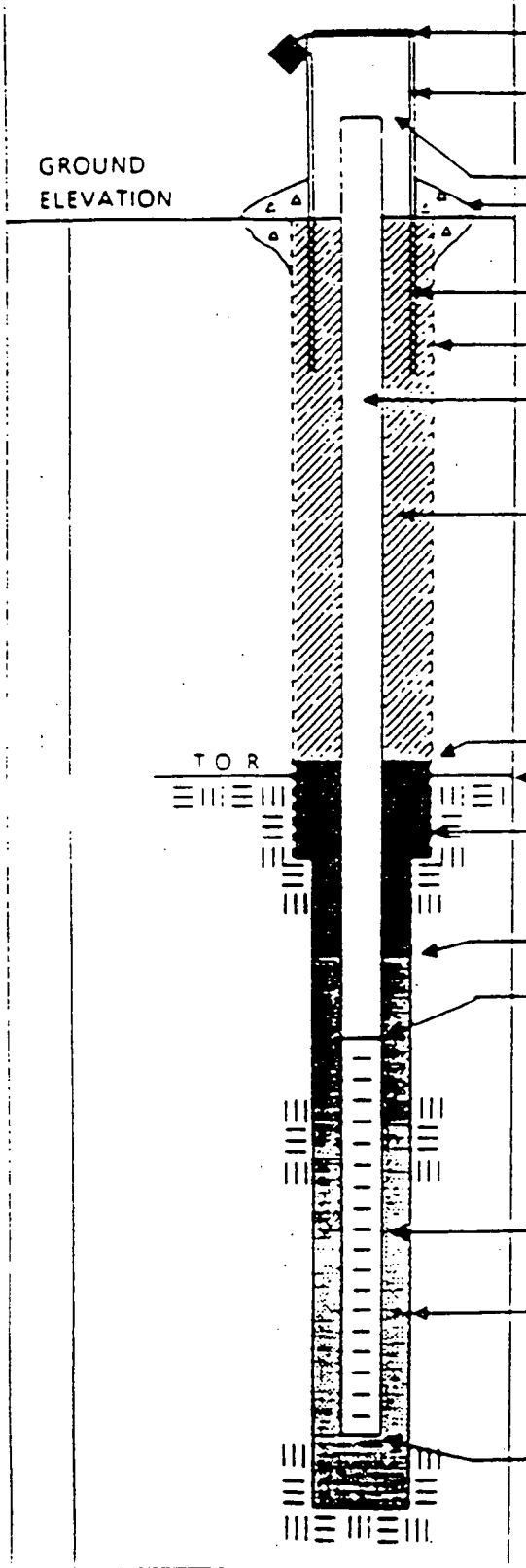
BORING NO: 2L MW 36B

BEDROCK MONITORING WELL SHEET

WELL INSTALLED IN BEDROCK

PROJECT _____ LOCATION _____
PROJECT NO. _____ BORING _____
ELEVATION _____ DATE _____
FIELD GEOLOGIST _____

DRILLER L. Farmhouse
DRILLING METHOD Air Rotary
DEVELOPMENT METHOD _____



ELEVATION OF TOP OF SURFACE CASING _____

STICK UP OF CASING ABOVE GROUND SURFACE: _____

ELEVATION TOP OF RISER: _____

TYPE OF SURFACE SEAL: _____

I.D. OF SURFACE CASING: 6"

DIAMETER OF HOLE: 8 1/2"

RISER PIPE I.D.: 6"

TYPE OF RISER PIPE: Steel

TYPE OF BACKFILL: _____

ELEVATION / DEPTH TOP OF SEAL: ~~4~~ Surface

ELEVATION / DEPTH TOP OF BEDROCK: 1'10"

TYPE OF SEAL: Cement

ELEVATION / DEPTH TOP OF SAND: _____

ELEVATION / DEPTH TOP OF SCREEN: ~~[illegible]~~

TYPE OF SCREEN: open hole

SLOT SIZE x LENGTH: N/A

I.D. SCREEN: 6"

TYPE OF SAND PACK: N/A

DIAMETER OF HOLE IN BEDROCK: _____

CORE / REAM: 6"

ELEVATION / DEPTH BOTTOM SCREEN: 103

ELEVATION / DEPTH BOTTOM OF HOLE: 103

APPENDIX C.3

SUMMARY OF MONITORING WELL AND TEST BORING DATA

099521/P

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
Area A Landfill Phase I and II RI - Monitoring Wells									
1MW2S	86.02	86.0	--	74.0	--	--	14.0	4.0-14.0	Fill/Alluv
2DMW11S	45.4	--	--	45.4	27.9	17.5*	17.5	2.5-12.5	Alluv
2DMW11D	51.5	--	--	51.5	34.5	17.0	25.55	19.5-25.55	Bedrock
2LMW7S	82.80	82.8	66.8	53.0	52.6	30.2	50.0	11.65-21.65	Fill/Dredge
2LMW7D	83.10	--	--	--	54.6	28.5	43.59	33.5-43.6	BR*
2LMW8S	86.40	86.4	--	76.4	--	--	20.5	5.5-15.5	Fill/Alluvium
2LMW8D	87.10	87.1	--	--	45.6	41.5	124.4	46.5-124.4	BR*
2LMW9S	85.30	85.3	73.3	57.5	42.8	42.5*	42.5	8.24-18.24	Fill/Dredge
2LMW9D	85.40	--	--	--	43.4	42.0	59.74	47.0-59.74	BR*
2LMW13S	86.90	86.9	--	70.9*	70.9	16.0	36.0	6.46-16.46	Fill

099521/P

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2LMW13D	86.80	--	--	67.3*	67.3	19.5	60.03	24.5-60.03	BR*
2LMW14S	91.9	91.9	--	87.9	78.9	13.0*	13.0	--	--
2LMW14D	91.90	--	--	--	78.4	13.5	27.0	18.5-27.0	BR*
2LMW17S	82.48	82.5	70.5	60.4*	64.0	18.5	18.5	7.75-17.75	Fill/Dredge
2LMW17D	82.62	--	--	64.6*	64.6	18.0	39.0	23.1-39.0	BR*
2LMW18S	77.94	77.9	59.9	48.4	44.4	33.5*	33.5	5.74-15.74	Fill
2LMW18D	77.67	--	--	--	41.7	36.0	49.03	41.0-49.03	BR*
2LMW19S	93.50	--	--	93.5	76.0	17.5	25.0	15.0-25.0	Alluvium/BR
2LMW19D	93.90	--	--	--	76.4	17.5	120.0	28.0-120.0	BR*
2LMW20S	87.35	87.3	--	77.4	--	--	26.0	9.0-19.0	Fill/Alluvium
2LMW20D	87.55	--	--	--	18.6	69.0	80.0	74.0-80.0	BR*
2LPW1S	86.25	86.3	76.3	--	--	--	15.0	4.0-14.0	Fill/Dredge

099521/P

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2LOW1S	86.26	86.3	74.3	--	--	--	15.0	4.0-14.0	Fill/Dredge
2LOW1D	86.88	86.9	74.9	61.5	57.6	29.3	29.5	23.75-28.75	Dredge/ Alluvium
2LOW2S	86.69	86.7	75.7	--	--	--	15.0	4.0-14.0	Fill/Dredge
2LOW3S	85.50	85.5	75.5	--	--	--	14.0	3.0-13.0	Fill/Dredge
2LOW4S	86.83	86.8	79.8	--	--	--	14.0	4.0-14.0	Fill/Dredge
2WMW3S	82.80	82.8	67.8	47.8	--	--	41.5	7.8-22	Fill/Dredge
2WMW3D	81.68	--	--	--	8.7	73.0	127.1	78.0-127.1	BR*
3MW12S	41.0	--	--	41.0	28.0	13.0*	13.0	2.5-12.5	Alluv
3MW12D	41.1	--	--	--	26.1	15.0	26.1	20-26.1	BR*
4MW1S	127.91	--	--	127.9	125.4	2.5	18.5	8.5-18.5	BR
4MW2S	96.65	--	--	96.7	91.5	6.5	15.3	4.5-14.5	Dredge/BR
4MW3S	100.55	--	--	100.6	96.1	4.5	13.5	3.5-13.5	Alluv/BR

099521/P

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
4MW4S	107.80	--	--	107.8	103.2	4.6	14.5	4.5-14.5	Alluv/BR
4MW4D	107.29	--	--	107.3	98.8	8.5	40.0	30.0-40.0	BR

Area A Landfill Phase I and II RI and FFS - Soil Borings

1TB1	85.98	86.0	--	76.0	--	--	14.5	--	--
1TB3	85.05	85.1	75.1	--	--	--	14.0	--	--
4TB1	128.6	128.6	--	118.6	117.6	11.0	12.5	--	--
4TB2	107.04	--	--	107.0	103.5	3.5*	3.5	--	--
2LTB1	84.0	84.0	72.0	64.0*	64.0	20.0*	20.0	--	--
2LTB2	84.6	84.6	72.2	62.6	60.6	24.0*	24.0	--	--
2LTB3	84.6	84.6	72.6	66.6*	66.6	18.0*	18.0	--	--
2LTB4	88.2	88.2	75.7	71.2*	71.2	17.0*	17.0	--	--
2LTB5	88.0	88.0	--	--	--	10.0	10.0	--	--

099521/P

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2LTB6	88.4	88.4	75.4	69.4	–	–	21.0	–	–
2LTB7	87.4	87.4	83.4	75.2*	75.2	12.2*	12.2	–	–
2LTB8	87.4	87.4	–	72.7*	72.7	14.7*	14.7	–	–
2LTB9	87.0	87.0	–	81.0*	81.0	6.0*	6.0	–	–
2LTB10	87.2	87.2	77.2	–	–	–	16.0	–	–
2LTB11	87.1	87.1	79.1	–	–	–	16.0	–	–
2LTB12	86.0	86.0	75.0	–	–	–	16.0	–	–
2LTB13	87.8	87.8	73.8	–	–	–	16.0	–	–
2LTB14	88.1	88.1	–	–	–	–	16.0	–	–
2LTB15	87.7	87.7	–	82.2*	82.2	5.5*	5.5	–	–
2LTB16	87.8	87.8	–	81.8*	81.8	6.0*	6.0	–	–
2LTB17	87.8	87.8	79.8	–	–	–	16.0	–	–

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2LTB18	88.1	78.6	--	--	--	--	16.0	--	--
2LTB19	87.8	87.8	--	--	--	--	16.0	--	--
2LTB20	88.6	88.6	78.6	--	--	--	16.0	--	--
2LTB21	88.7	88.7	74.7	--	--	--	16.0	--	--
2LTB22	89.6	89.6	77.6	--	--	--	16.0	--	--
2LTB23	88.4	88.4	75.4	--	--	--	16.0	--	--
2LTB24	90.0	90.0	82.0	76.2*	76.2	13.83*	13.83	--	--
2LTB25	88.4	88.4	--	84.4*	84.4	4.0*	4.0	--	--
2LTB26	89.7	89.7	--	84.5*	84.5	5.16*	5.16	--	--
2LTB27	90.6	90.6	--	80.9*	80.9	9.66*	9.66	--	--
2LTB28	88.1	88.1	76.6	--	--	--	16.0	--	--
2LTB29	87.1	87.1	74.1	--	--	--	16.0	--	--

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SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2LTB30	88.4	88.4	--	--	--	--	3.16	--	--
2LTB31	88.1	88.1	76.1	--	--	--	16.0	--	--
2WTB1	67.5	--	67.5	35.8	--	--	32.0	--	--
2WTB2	68.2	--	68.2	36.6	--	--	32.0	--	--
2WTB4	83.5	--	--	83.5	82.7	0.83*	0.83	--	--
Area A Landfill FFS - Soil Borings									
2GB1	75.1	75.1	70.1	60.1	--	--	22.0	--	--
2GB2	75.1	75.1	70.1	58.1*	58.1	17.0*	17.0	--	--
2GB3	78.2	78.2	73.2	63.2	56.2	22.0	22.0	--	--
2GB4	112.0	--	--	112.0	108.5	3.5	7.8	--	--
2GB5	89.0	89.0	--	--	--	--	9.0	--	--
2GB6	83.4	--	--	83.4	80.4	3.0	8.0	--	--

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2GB7	80.3	80.3	--	70.3*	70.3	10.0*	10.0	--	--
2GB8	82.8	82.8	--	78.8*	78.8	4.0	8.0	--	--
2GB9	84.4	--	--	84.4	81.9	2.5*	2.5	--	--
2GB10	85.9	85.9	--	80.9	76.9	9.0	14.0	--	--
2GB11	91.0	--	--	91.0	--	--	8.3	--	--
2GB12	92.0	--	--	92.0	87.0	5.0	10.0	--	--
2GB13	91.0	91.0	--	86.0*	86.0	5.0*	5.0	--	--
2GB14	94.4	--	--	94.4	93.9	0.5	5.4	--	--
2GB15	95.0	--	--	95.0*	95.0	Ground	--	--	--
2GB16	94.0	--	--	94.0*	90.0	4.0	8.8	--	--
2GB17	92.4	92.4	--	88.2*	88.2	4.2*	4.2	--	--
2GB18	92.5	--	--	92.5	73.7	18.8	23.16	--	--

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2GB19	92.4	--	--	92.4	--	--	11.1	--	--
2GB20	95.0	--	--	95.0	88.0	7.0	11.5	--	--
2GB21	85.0	85.0	75.0	63.0*	63.0	22	26.3	--	--
2GB22	80.7	80.7	70.7	--	--	--	12.0	--	--
2GB23	77.8	77.8	--	--	--	--	17.0	--	--

Area A Landfill - Geotech Borings and East End Investigation

LF-SB01	79.3	79.3	65.0	44.0	27.3	52.0*	52.0	--	--
LF-SB02	87.3	87.3	76.8	62.8	54.3	33	38.5	--	--
LF-SB03	84.5	84.5	73.6	47.2	14.5	70*	70	--	--
LF-SB04	91.0	91.0	--	--	--	--	16	--	--
LF-SB05	90.8	90.8	--	--	--	--	23	--	--
LF-SB06	79.4	79.4	69.4	64.9	56.9	22.5	32.0	--	--

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SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
SB06	84.7	84.7	--	--	--	--	20	--	--
SB07	90.5	90.5	66.5	64.5	--	--	28.5	--	--
SB08	85.9	85.9	71.9	54.4*	54.4	31.5*	31.5	--	--
B-1	92.0	92.0	86.0	78.0	63.5	28.5	33		
B-3	92.5	--	--	92.5	--	--	7		
B-3A	92.5	--	--	92.5	--	--	11		
B-3B	92.5	--	--	92.5	--	--	7		
B-4	92.0	92.0	--	--	--	--	8.5		
B-4A	92.0	92.0	86.0	69.0	60.0	32	38		
B-201	89.0	89.0	62.5	47.0*	47.0	42*	42		
B-202	89.0	89.0	68.5	51.0*	51.0	38*	38		
B-203	92.0	92.0	--	75.0	60.9	31.1*	31.1		

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SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
B-204	92.0	92.0	81.5	61.0*	61.0	31	43.5		
B-205	90.0	90.0	74.0	--	--	--	24.0		
B-205A	90.0	90.0	--	54.4*	54.4	35.6*	35.6		
Area A Landfill Cap Design - Geoprobes									
GP1	96.0	--	--	96.0	--	--	--	--	--
GP2	100.8	--	--	100.8	99.1	1.7	--	--	--
GP3	103.8	--	--	103.8	102.7	1.1	--	--	--
GP4	99.6	--	--	99.6	98.3	1.3	--	--	--
GP5	97.4	--	--	97.4	92.7	4.7	--	--	--
GP6	92.1	--	--	92.1	87.3	4.8	--	--	--
GP7	99.1	--	--	99.1	93.2	5.9	--	--	--
GP8	100.2	--	--	100.2	98.0	2.2	--	--	--

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SUMMARY OF AREA A LANDFILL
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FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
GP9	90.0	--	--	90.0	88.9	1.1	--	--	--
GP10	87.9	--	--	87.9	84.4	3.5	--	--	--
GP11	106.5	--	--	106.5	105.2	1.3	--	--	--
GP12	90.1	--	--	90.1	87.7	2.4	--	--	--
GP13	105.6	--	--	105.6	100.5	5.1	--	--	--
GP14	95.9	--	--	95.9	89.5	6.4	--	--	--
GP15	102.6	--	--	102.6	101.6	1.0	--	--	--
GP16	101.2	--	--	101.2	94.6	6.6	--	--	--
GP17	95.0	--	--	95.0	88.1	6.9	--	--	--
GP18	96.9	--	--	96.9	88.5	8.4	--	--	--
GP19	107.2	--	--	107.2	104.9	2.3	--	--	--
GP20	100.0	--	--	100.0	86.0	14.0	--	--	--

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
GP21	97.8	--	--	97.8	93.4	4.4	--	--	--
GP22	110.2	--	--	110.2	108.6	1.6	--	--	--
GP23	100.6	--	--	100.6	95.6	5.0	--	--	--
GP24	98.3	--	--	98.3	90.2	8.1	--	--	--

Area A Landfill Modeling/Leachate Study

2LPZ1F	78.8	78.8	--	--	--	--	8	5-8	Fill
2LPZ2F	90.0	90.0	--	--	--	--	6	3-6	Fill
2LMW28F	85.3	85.3	--	--	--	--	12	4.7-9.7	Fill
2LMW28DS	85.2	85.2	78.2	64.2*	64.2	21*	22	14.9-19.9	Dredge
2LMW29F	88.8	88.8	80.3	79.3	73.3	15.5*	15.5	3.5-8.5	Fill
2LMW29DS	88.7	88.7	--	--	--	--	16.0	11-16	Alluv
2LMW30F	81.2	81.2	--	--	--	--	12.3	7.3-12.3	Fill

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SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Well/ Boring	Ground Elevation (ft msl)	Material Encountered During Installation				Top of Bedrock (ft bgs) (*)2	Total Boring Depth (ft bgs)	Screened Interval (ft bgs)	Unit Screened (*)3
		Fill Elevation (ft msl)	Dredge Spoil Elevation (ft msl)	Alluvium Elevation (ft msl) (*)1	Bedrock Elevation (ft msl)				
2LMW30DS	80.7	80.7	66.7	<56*	<56	--	23	18-23	Dredge
2LMW31F	85.9	85.9	--	--	--	--	6	3-6	Fill
2LMW31DS	86.0	86.6	79.5	73.0	--	--	14	9-14	Dredge
2LMW32F	80.8	80.8	58.8	--	--	--	24	15.7-22.5	Lower Fill
2LMW32PZ	80.6	80.6	--	--	--	--	16	9.6-14.6	Fill/Dredge
2LMW32DS	80.8	80.8	--	--	--	--	23	19-24	Dredge
2LMW32B	80.6	80.6	57.6	39.6	17.1	63.5	86	76.2-86.2	BR
2LMW33F	81.0	81.0	--	--	--	--	10	5-10	Fill
2LMW33DS	79.4	79.4	67.4	--	--	--	18	13-18	Dredge
2LMW34DS	77.5	77.5	63.5	--	--	--	22	17-22	Dredge
2LMW35B	198.2	--	--	198.2	187.2	11.0	103	11-103	BR*
2LMW36B	212.3	--	--	212.3	210.5	1.8	103	1.8-103	BR*

SUMMARY OF AREA A LANDFILL
MONITORING WELL AND TEST BORING INFORMATION
FOR USE IN LEACHATE MODELING STUDY
NAVAL SUBMARINE BASE-NEW LONDON, GROTON, CONNECTICUT

Notes:

ft msl - feet mean sea level
ft bgs - feet below ground surface
-- - No data available (unit not identified in log, log not deep enough, or log not sampled over this interval)
*1 - Alluvium not identified in log. Elevation posted is the bedrock elevation.
*2 - Auger refusal.
*3 - Open hole.

APPENDIX D

HYDROGEOLOGIC ANALYSES

D.1 Infiltration Test Analyses
D.2 Slug Test Analyses
D.3 HELP Model Analysis
D.4 Analysis of Flood Conditions
D.5 Analysis of Contaminant Detections and Discharge Calculations

APPENDIX D.1

INFILTRATION TEST ANALYSES

CLIENT NSB-NLON	JOB NUMBER 5082 10185
SUBJECT AREA A LANDFILL INFILTRATION TEST RESULTS	
BASED ON FIELD TEST RESULTS 11/1/95	DRAWING NUMBER
BY L. GROSS / CHECKED BY CAR 12/5/95	APPROVED BY / DATE 12/4/95

A. ESTIMATE K (ft/day)[1]

$$K = \frac{Q}{5.5 \cdot r \cdot H}$$

FOR Q (gpm)
r (in)
H (in)

$$K = \frac{Q \ (gpm) \left(\frac{1\ ft^3}{7.48\ gal}\right)\left(\frac{60\ min}{hr}, \frac{24\ hr}{day}\right)}{5.5\ (r)(H)\ in^2 \left(\frac{1\ ft}{12\ in}\right)^2}$$

$$= 5040.4 \frac{Q}{rH} \ (ft/day)$$

1) 2LIT1: Q = 0.25 gpm, H = 22 in, r = 2 in

$$K = \frac{5040.4\ (0.25)}{(22)(2)}$$

$$= 28.6 \ ft/day$$

2) 2LIT2: Q = 0.06 gpm, H = 22 in, r = 2 in

$$K = \frac{5040.4\ (0.06)}{(22)(2)}$$

$$= 6.9 \ ft/day$$

[1] DESIGNATION E-18, "EARTH MANUAL", US DEPT OF INTERIOR, BUREAU OF RECLAMATION, 2ND ED, 1974 — REFER TO ATTACHED PAGES.

CLIENT NSB-NLON	JOB NUMBER 5082/0185
SUBJECT AREA A LANDFILL INFILTRATION TEST RESULTS	
BASED ON FIELD TEST RESULTS 11/1/95	DRAWING NUMBER
BY L. GROSS / CHECKED BY CAR 12/5/95	APPROVED BY / DATE 12/4/95

3) 2LIT3: $Q = 0.57$ gpm, $H = 21$ in, $r = 2$ in

$$K = \frac{5040.4(0.57)}{(21)(2)}$$

$$= 68.4 \text{ ft/day}$$

4) 2LIT4: $Q = 0.26$ gpm, $H = 18$ in, $r = 2$ in

$$K = \frac{5040.4(0.26)}{(18)(2)}$$

$$= 36.4 \text{ ft/day}$$

5) 2LIT5: $Q = 0.16$ gpm, $H = 21$ in, $r = 2$ in

$$K = \frac{5040.4(0.16)}{(21)(2)}$$

$$= 19.2 \text{ ft/day}$$

6) 2LIT6: $Q = 0.33$ gpm, $H = 21$ in, $r = 2$ in

$$K = \frac{5040.4(0.33)}{(21)(2)}$$

$$= 39.6 \text{ ft/day}$$

CLIENT	JOB NUMBER
NSB-NLON	5082 10185
SUBJECT: AREA A LANDFILL INFILTRATION TEST RESULTS	
BASED ON: FIELD TEST RESULTS 11/1/95	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
L. GROSS	CAR 12/5/95		12/4/95

7) 2LIT7: $Q = 0.10$ gpm, $H = 22$ in, $r = 2$ in

$$K = \frac{5040.4\,(0.10)}{(22)(2)}$$

$$= 11.5 \text{ ft/day}$$

8) 2LIT8: $Q = 1.0$ gpm, $H = 22$ in, $r = 2$ in

$$K = \frac{5040.4\,(1.0)}{(22)(2)}$$

$$= 115 \text{ ft/day}$$

9) 2LIT9: $Q = 0.09$ gpm, $H = 19$ in, $r = 2$ in

$$K = \frac{5040.4\,(0.09)}{(19)(2)}$$

$$= 11.9 \text{ ft/day}$$

10) 2LIT10: $Q = 0.10$ gpm, $H = 23$ in, $r = 2$ in

$$K = \frac{5040.4\,(0.10)}{(23)(2)}$$

$$= 11.0 \text{ ft/day}$$

CLIENT	JOB NUMBER
NSB-NLON	3082/0185
SUBJECT: AREA A LANDFILL INFILTRATION TEST RESULTS	
BASED ON: FIELD TEST RESULTS 11-1-95	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
L. GROSS	CAR 12/5/95		12/4/95

B) CALCULATE AVERAGE FOR EACH GROUND TYPE – GEOMETRIC MEAN

$$K_G = (K_1 \cdot K_2 \cdot \cdot K_n)^{1/n}$$

1) DEPLOYED PARKING 2LIT1, 2LIT2, 2LIT3
DENSE SAND & GRAVEL

$$K_G = (28.6 * 6.9 * 68.4)^{1/3}$$

$$= 23.8 \text{ ft/day}$$

2) ROAD – VERY DENSE SAND & GRAVEL
– 2LIT4 & 2LIT5

$$K_G = (36.4 * 19.2)^{1/2}$$

$$= 26.4 \text{ ft/day}$$

3) SAND PILE – LOOSE SAND & GRAVEL
– 2LIT6 & 2LIT7

$$K_G = (39.6 * 11.5)^{1/2}$$

$$= 21.3 \text{ ft/day}$$

CLIENT NSB-NLON	JOB NUMBER 5082 / 10185
SUBJECT AREA A LANDFILL INFILTRATION TEST RESULTS	
BASED ON FIELD TEST RESULTS 11-1-95	DRAWING NUMBER
BY L. GROSS / CHECKED BY CAR 12/5/95	APPROVED BY / DATE 12/4/95

5) BRUSHY AREA - EAST END - SAND & GRAVEL 2LIT9 & 2LIT10

$K_G = (11.9 * 11.0)^{1/2}$

$= 11.4$ ft/day

4) COBBLES / BOULDERS - 2LIT8

$K = 115$ ft/day

NUS CORPORATION AND SUBSIDIARIES	STANDARD CALCULATION SHEET

CLIENT: US NAVY	FILE NO.: 5082	BY: TEJ	PAGE OF
SUBJECT: AREA A LANDFILL		CHECKED BY:	DATE: 11/1

LOCATION	Q	H	r	K*	COMMENT
2LIT1	0.25 gal/min	22 in	2 in	(1.03×10^{-3})	DEPLOYED PARKING dense S&G
2LIT2	0.06 gal/min	22 in	2	(2.48×10^{-4})	DEPLOYED PARKING dense S&G
2LIT3	0.57 gal/min	21 in	2	(5.55×10^{-4})	GRAVEL PARKING dense S&G
2LIT4	0.26 gal/min	18	2	(1.30×10^{-3})	ROAD V. dense Sand & Gra
2LIT5	0.16 gal/min	21	2	(7.14×10^{-4})	ROAD V dense Sand & Grave
2LIT6	0.33 gal/min	21	2	(1.43×10^{-3})	SAND PILE Loose S and Gra
2LIT7	0.10 gal/min	22"	2		SAND - G PILE & LA AT OVER
2LIT8	1.00 gal/min	22"	2		East of Sentry Hut cobbles/boulders present
2LIT9	0.09 gal/min	19"	2		Brushy Area Near 2LMW33F V. Gravelly
2LIT10	0.10 gal/min	23"	2		Sand and Gravel with bricks and rock frags note (Near 2LMW32B

H = inches
r = inches
* gal/min/(in)^2

B. CALCULATION

porosity (n) = Vv/V

where:

Vv = Va + Vw

Va = volume of air, V - Vs - Vw

V = volume of specimen before drying

Vs = volume of solids = weight of solids (Ws)/Gs

Ws = weight of dry solids

Vw = volume of water = weight of water (Ww)/ Specific gravity of water (Gw)

III FIELD PERMEABILITY TEST

ref.: Designation E-18, "Earth Manual", US Dept. of Interior, Bureau of Reclamation, 2nd ed., 1974.

A. EQUIPMENT

1. Post hole digger
2. 4" dia. x 20" long pipe
3. Bentonite pellets
4. A minimum 10 gallon container equipped with a flange hole near the bottom.
5. Approx. 4 feet of flexible tubing that can be connected to th flange hole of the water container.
6. Adjustable hose clamp or tubing valve mechanism to control flow through the tubing.
7. Approximately 10 gallons of clean water

B. PROCEDURE (Vadose Zone Testing)

1. Excavate a 20" deep hole with the post hole digger.
2. Insert pipe into hole. Seal the bottom of the hole around the outside of the pipe with bentonite.
3. Fill the pipe with water to a predetermined level near the top of the pipe.
4. With the tubing and valve, adjust the flow of water into the pipe to maintain a constant level for 5 minutes.
5. Measure the constant flow rate of water into the pipe using a bucket and stopwatch.

C. CALCULATION

$$k = Q / 5.5 * r * H$$

where:

k = permeability

Q = constant flow rate into the hole

r = internal radius of pipe

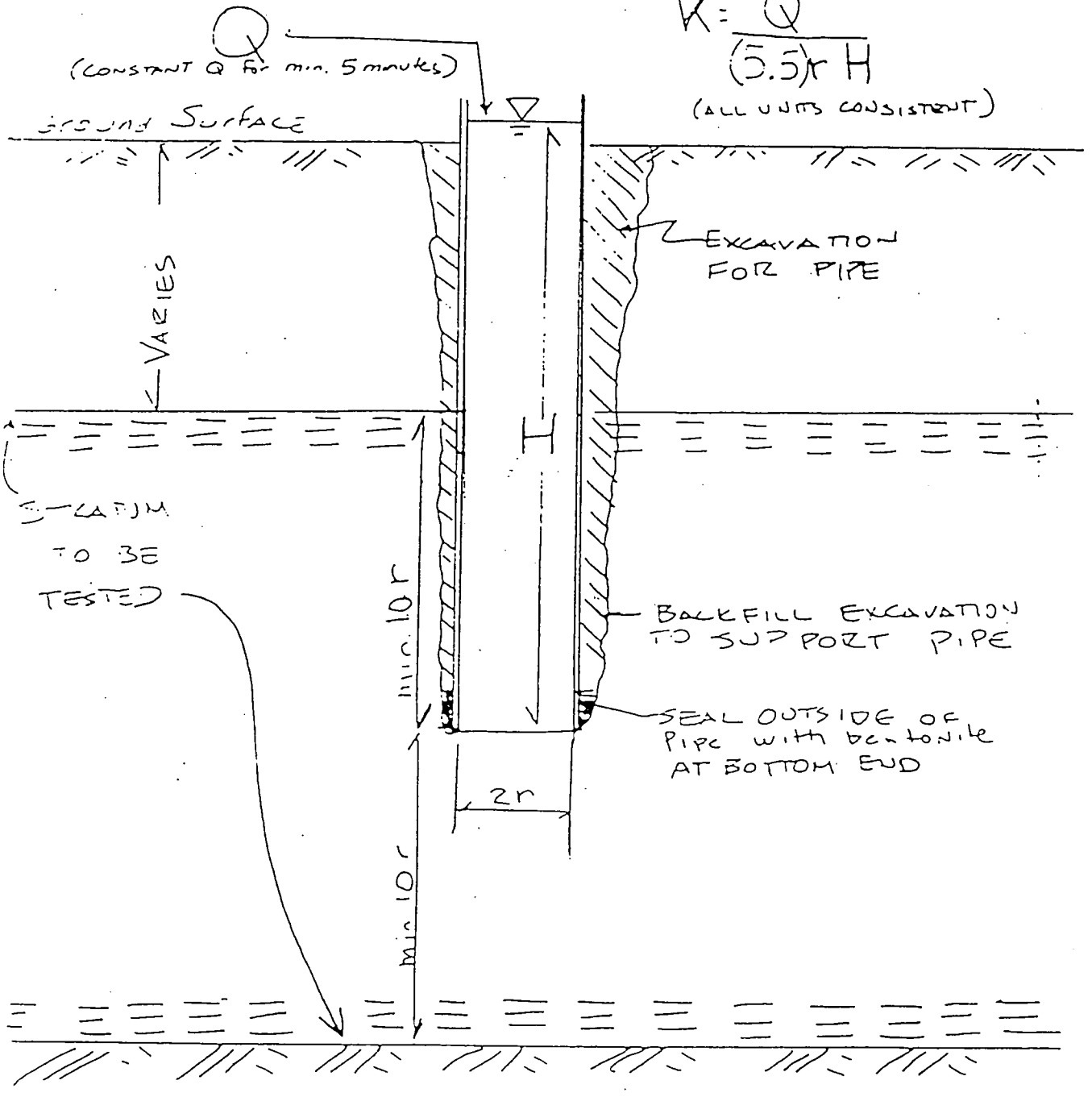
H = differential head of water (height of water level in pipe)

Note: all units consistent.

CLIENT: West Virginia DNR	FILE NO.: 8M30-03	BY: Paul Alessio	PAGE 3 OF 4
SUBJECT: Seneca Rocks Field Work		CHECKED BY: M.G.C.	DATE: 8/27

$$K = \frac{Q}{(5.5)rH}$$

(ALL UNITS CONSISTENT)



OPEN-END PIPE TEST FOR SOIL PERMEABILITY

(NOT TO SCALE)

APPENDIX D.2

SLUG TEST ANALYSES

(Hvorslev, 1951)

TOC = 87.45

W.L = 87.45 - 1.26 = 86.19

GND = 86.40

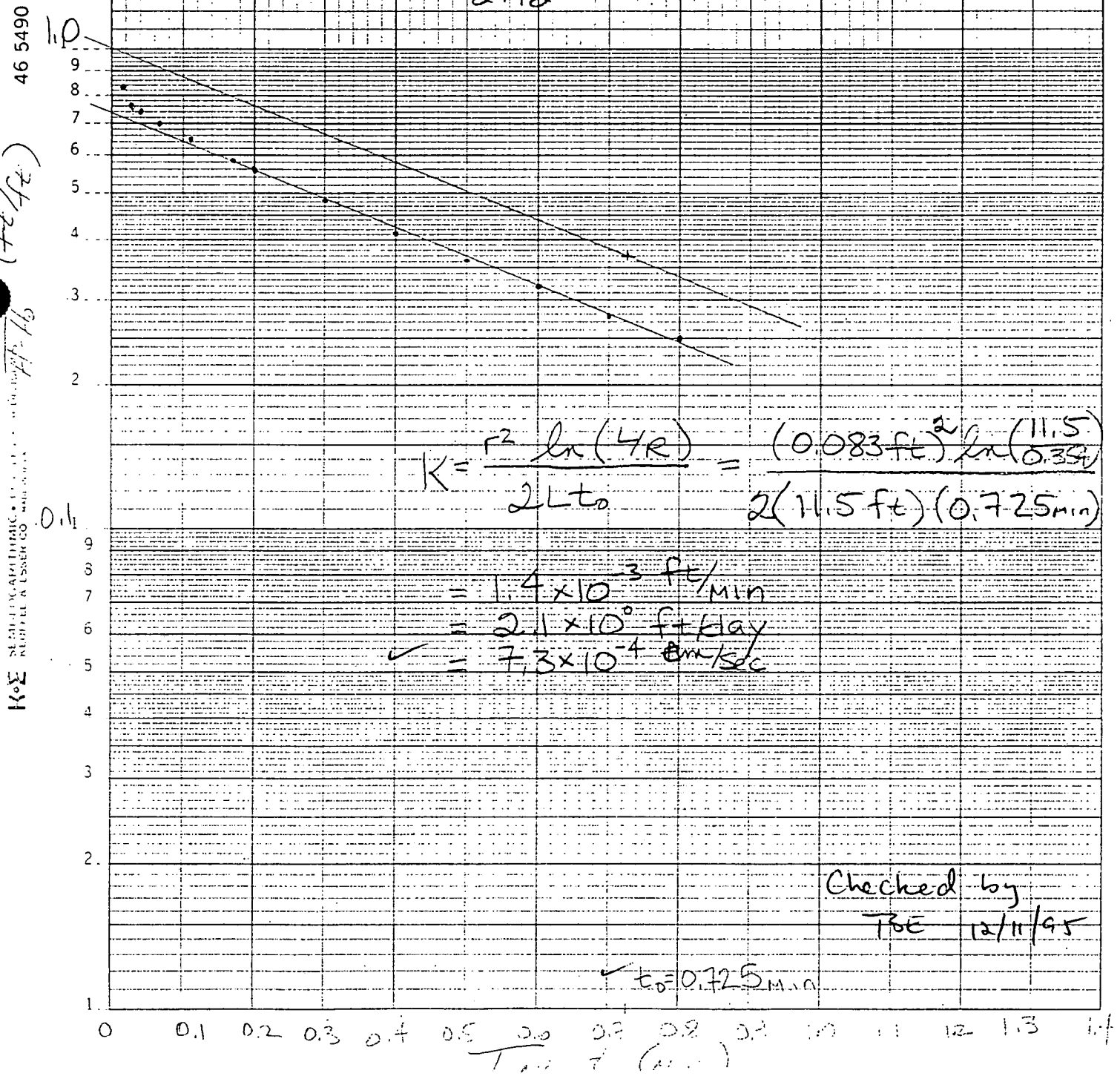
Top of sand = 86.4 - 4.0 = 82.4

w.l above sandpack

$L = 11.5'$

$R = \frac{8.5}{2*12} = 0.354\ ft$

$r = \frac{2}{2*12} = 0.083\ ft$



$$K = \frac{r^2 \ln(4R)}{2Lt_0} = \frac{(0.083\ ft)^2 \ln\left(\frac{11.5}{0.354}\right)}{2(11.5\ ft)(0.725\ min)}$$

$= 1.4 \times 10^{-3}\ ft/min$

$= 2.1 \times 10^{0}\ ft/day$

$= 7.3 \times 10^{-4}\ cm/sec$

Checked by TJE 12/11/95

$t_0 = 0.725\ min$

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: 2LMW8P5

PROJECT NO.: 5082 GEOLOGIST: MARSHALL

WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 6

STATIC WATER LEVEL (Depth/Elevation): 1.26 DATE: 12/1/95

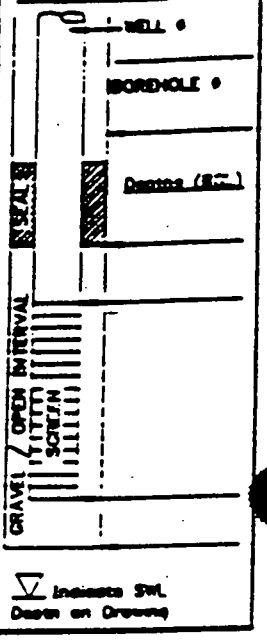
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

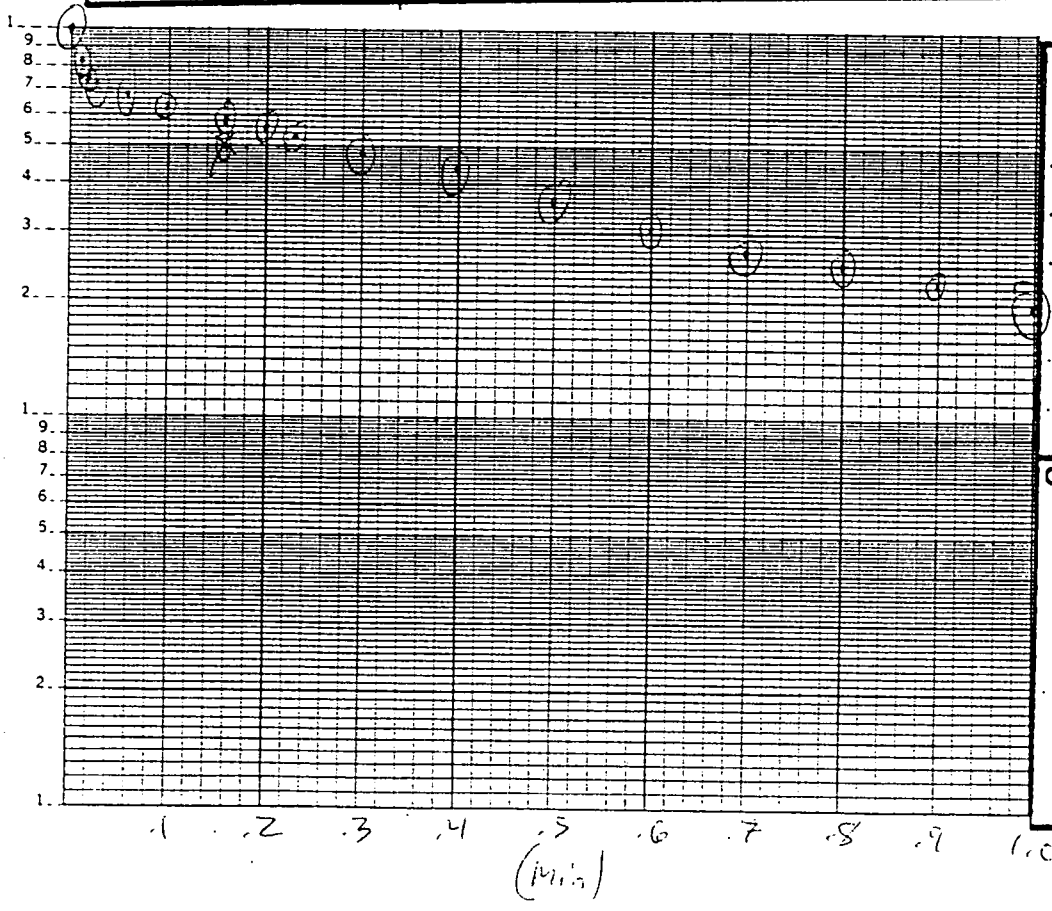
METHOD OF INDUCING WATER LEVEL CHANGE: REMOVE ONE LITER PAGE ___ OF ___

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.0000	0.000	0.0000	0.500	0.362	0.670
0.0083	1.000	1.851	0.600	0.319	0.590
0.0166	0.828	1.532	0.700	0.276	0.510
0.0250	0.759	1.404	0.800	0.250	0.462
0.0333	0.741	1.372	0.900	0.224	0.414
0.0666	0.698	1.292	1.00	0.198	0.367
0.1083	0.644	1.192	1.20		0.271
0.1666	0.586	1.085	2.00		0.111
0.2000	0.560	1.037	3.00		0.047
0.2250	0.534	0.989	4.00		0.031
0.3000	0.482	0.893	10.0		0.015
0.4000	0.414	0.766	14.0	0.000	0.00

WELL SCHEMATIC





REMARKS:

WATER @ Ground SURFACE

xD @ 10' Depth

CALCS.SKETCH MAPS, ETC.:

SE2000
Environmental Logger
12/01 11:39

Unit# 0 Test 0

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	2.436
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	-0.142
Delay mSEC	50.000

ZLMW 8D5 RISING HEAD

Step 0 12/01 11:11:28

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	1.851
0.0166	1.532
0.0250	1.404
0.0333	1.372
0.0416	1.340
0.0500	1.324
0.0583	1.308
0.0666	1.292
0.0750	1.276
0.0833	1.260
0.0916	1.228
0.1000	1.212
0.1083	1.196
0.1166	1.181
0.1250	1.165
0.1333	1.149
0.1416	1.133
0.1500	1.117
0.1583	1.101
0.1666	1.085
0.1750	1.069
0.1833	1.053
0.1916	1.053
0.2000	1.037
0.2083	1.021
0.2166	1.005
0.2250	0.989
0.2333	0.989
0.2416	0.973
0.2500	0.957
0.2583	0.941
0.2666	0.941
0.2750	0.925
0.2833	0.909

[illegible]	[illegible]
0.3083	0.877
0.3166	0.877
0.3250	0.861
0.3333	0.845
0.3500	0.829
0.3666	0.813
0.3833	0.797
0.4000	0.766
0.4166	0.750
0.4333	0.734
0.4500	0.718
0.4666	0.702
0.4833	0.686
0.5000	0.670
0.5166	0.654
0.5333	0.638
0.5500	0.622
0.5666	0.606
0.5833	0.606
0.6000	0.590
0.6166	0.574
0.6333	0.558
0.6500	0.542
0.6666	0.542
0.6833	0.526
0.7000	0.510
0.7166	0.510
0.7333	0.494
0.7500	0.494
0.7666	0.478
0.7833	0.478
0.8000	0.462
0.8166	0.446
0.8333	0.446
0.8500	0.430
0.8666	0.430
[illegible]	0.414
[illegible]	0.414
0.9166	0.398
0.9333	0.383
0.9500	0.383
0.9666	0.367
0.9833	0.367
1.0000	0.367
1.2000	0.271
1.4000	0.223
1.6000	0.175
1.8000	0.143
2.0000	0.111
2.2000	0.095
2.4000	0.079
2.6000	0.063
2.8000	0.063
3.0000	0.047
3.2000	0.047
3.4000	0.031
3.6000	0.031
3.8000	0.031
4.0000	0.031
4.2000	0.031
4.4000	0.031
[illegible]	0.015
[illegible]	0.015
[illegible]	0.015

5.4000	0.015
5.6000	0.015
5.8000	0.015
6.0000	0.015
6.2000	0.015
6.4000	0.015
6.6000	0.015
6.8000	0.015
7.0000	0.015
7.2000	0.015
7.4000	0.015
7.6000	0.015
7.8000	0.015
8.0000	0.015
8.2000	0.015
8.4000	0.015
8.6000	0.015
8.8000	0.000
9.0000	0.015
9.2000	0.015
9.4000	0.015
9.6000	0.015
9.8000	0.015
10.0000	0.015
12.0000	0.031
14.0000	0.000

END

SE10000
Environmental Logger
11/30 14:38

Unit# 00145 Test 0

INPUT 1: Level (F)

Reference	0.000
Linearity	0.120
Scale factor	20.110
Offset	0.000
Delay mSEC	50.000

Step 0 11/30 11:48:22

Elapsed Time	INPUT 1
0.0000	-0.076
0.0033	0.247
0.0066	-0.209
0.0100	-0.165
0.0133	-0.634
0.0166	-0.736
0.0200	0.603
0.0233	0.171
0.0266	-0.585
0.0300	-0.692
0.0333	-0.507
0.0366	-0.482
0.0400	-0.507
0.0433	-0.482
0.0466	-0.450
0.0500	-0.457
0.0533	-0.457
0.0566	-0.438
0.0600	-0.431
0.0633	-0.419
0.0666	-0.431
0.0700	-0.419
0.0733	-0.450
0.0766	-0.444
0.0800	-0.425
0.0833	-0.412
0.0866	-0.400
0.0900	-0.388
0.0933	-0.368
0.0966	-0.381
0.1000	-0.355
0.1033	-0.380
0.1066	-0.361
0.1100	-0.380
0.1133	-0.387
0.1166	-0.380
0.1200	-0.380
0.1233	-0.368
0.1266	-0.361
0.1300	-0.355

2LMW80 [illegible]
RISING HEAD
DTW = 1.26

REDO

0.1366	-0.355
0.1400	-0.355
0.1433	-0.355
0.1466	-0.355
0.1500	-0.342
0.1533	-0.336
0.1566	-0.330
0.1600	-0.323
0.1633	-0.323
0.1666	-0.311
0.1700	-0.292
0.1733	-0.292
0.1766	-0.304
0.1800	-0.412
0.1833	-0.400
0.1866	-0.400
0.1900	-0.380
0.1933	-0.380
0.1966	-0.368
0.2000	-0.361
0.2033	-0.355
0.2066	-0.349
0.2100	-0.342
0.2133	-0.342
0.2166	-0.336
0.2200	-0.323
0.2233	-0.323
0.2266	-0.311
0.2300	-0.298
0.2333	-0.298
0.2366	-0.292
0.2400	-0.292
0.2433	-0.279
0.2466	-0.273
0.2500	-0.273
0.2533	-0.260
0.2566	-0.260
0.2600	-0.253
0.2633	-0.253
0.2666	-0.247
0.2700	-0.241
0.2733	-0.234
0.2766	-0.222
0.2800	-0.215
0.2833	-0.209
0.2866	-0.203
0.2900	-0.198
0.2933	-0.190
0.2966	-0.177
0.3000	-0.177
0.3033	-0.171
0.3066	-0.165
0.3100	-0.158
0.3133	-0.158
0.3166	-0.139
0.3200	-0.139
0.3233	-0.126
0.3266	-0.120
0.3300	-0.114
0.3333	-0.107
0.3500	-1.174
0.3866	-1.269
0.3533	-1.301
0.4000	-1.301
[illegible] 166	-1.282

0.4500	-1.188
0.4666	-1.161
0.4833	-0.717
0.5000	-0.841
0.5166	-0.596
0.5333	-0.533
0.5500	-0.425
0.5666	-0.361
0.5833	-0.298
0.6000	-0.279
0.6166	-0.228
0.6333	-0.171
0.6500	-0.114
0.6666	-0.063
0.6833	-0.019
0.7000	0.019
0.7166	0.063
0.7333	0.101
0.7500	0.127
0.7666	0.158
0.7833	0.177
0.8000	0.215
0.8166	0.228
0.8333	0.254
0.8500	0.273
0.8666	0.285
0.8833	0.304
0.9000	0.317
0.9166	0.336
0.9333	0.349
0.9500	0.374
0.9666	0.381
0.9833	0.381
1.0000	0.387
1.2000	0.736
1.4000	0.876
1.6000	0.958
1.8000	1.080
2.0000	1.149
2.2000	1.270
2.4000	1.308
2.6000	1.320
2.8000	1.371
3.0000	1.403
3.2000	1.416
3.4000	1.422
3.6000	1.416
3.8000	1.428
4.0000	1.422
4.2000	1.435
4.4000	1.467
4.6000	1.486
4.8000	1.511
5.0000	1.511
5.2000	1.517
5.4000	1.505
5.6000	1.498
5.8000	1.467
6.0000	1.448
6.2000	1.448
6.4000	1.409
6.6000	1.403
6.8000	1.384
7.0000	1.371
7.2000	1.352

7.6000	1.301
7.8000	1.282
8.0000	1.276
8.2000	1.232
8.4000	1.251
8.6000	1.251
8.8000	1.257
9.0000	1.257
9.2000	1.244
9.4000	1.276
9.6000	1.282
9.8000	1.270
10.0000	1.289
12.0000	1.143
14.0000	1.289
16.0000	1.314
18.0000	1.282
20.0000	1.206
22.0000	1.181
24.0000	1.149
26.0000	1.136
28.0000	1.124
30.0000	1.117
32.0000	1.111
34.0000	1.085
36.0000	1.016
38.0000	0.965
40.0000	0.882
42.0000	0.762
44.0000	0.698
46.0000	0.565
48.0000	0.469
50.0000	0.419
52.0000	0.355
54.0000	0.292
56.0000	0.247
58.0000	0.203
60.0000	0.171
62.0000	0.127
64.0000	0.076
66.0000	0.038
68.0000	0.006
70.0000	-0.019
72.0000	-0.044
74.0000	-0.057
76.0000	-0.076
78.0000	-0.101
80.0000	-0.133
82.0000	-0.126
84.0000	-0.139
86.0000	-0.146
88.0000	-0.146
90.0000	-0.133
92.0000	-0.126
94.0000	-0.139
96.0000	-0.146
98.0000	-0.152
100.000	-0.139

END

10

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: NSB -NLON WELL/BORING NO.: ZLMW8D

PROJECT NO.: 5052 GEOLOGIST: MARSHALL

WELL DIAMETER: 6" SCREEN LENGTH/DEPTH: TEST NO.: 3

STATIC WATER LEVEL (Depth/Elevation): ~~10.96~~ 12.6 ~~12.5~~ DATE: 11/29/95

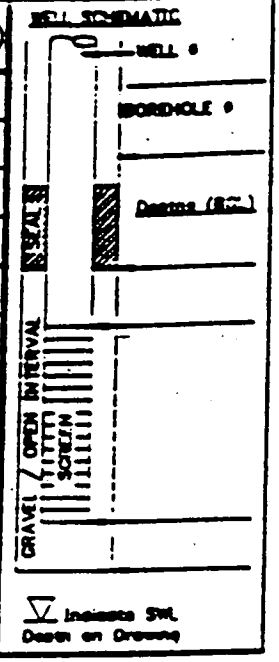
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

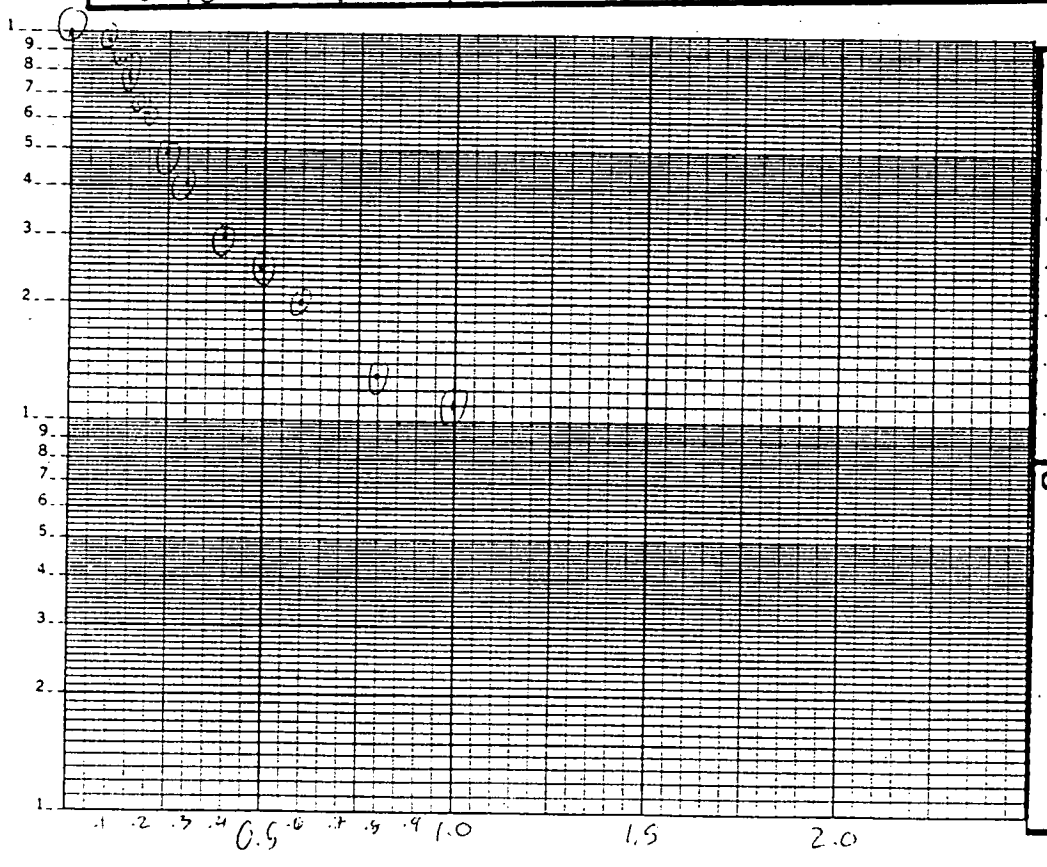
METHOD OF INDUCING WATER LEVEL CHANGE: 5', 2.5" ϕ SLUG PAGE ... OF ...

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): ToC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.0916	1.000	0.686	0.5	0.255	0.175
0.1000	0.977	0.670	0.6	0.208	0.143
0.1166	0.883	0.606	0.8	0.138	0.095
0.1250	0.860	0.590	1.0	0.115	0.079
0.1333	0.813	0.558	2.0	0.045	0.031
0.1416	0.790	0.542	5.2	0.022	0.015
0.150	0.767	0.526			
0.175	0.673	0.462			
0.200	0.628	0.431			
0.25	0.488	0.335			
0.30	0.418	0.287			
0.40	0.302	0.207			

WELL SCHEMATIC





REMARKS:

XD @ 25' Depth

CALCS.SKETCH MAPS, ETC.:

SE2000
Environmental Logger
11/29 11:58

Unit# 0 Test 3

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	6.069
SG	1.000
Linearity	0.113
Scale Factor	50.817
Offset	-0.142
Delay mSEC	50.000

2LMW 8D'S RJD
RISING HEAD TEST

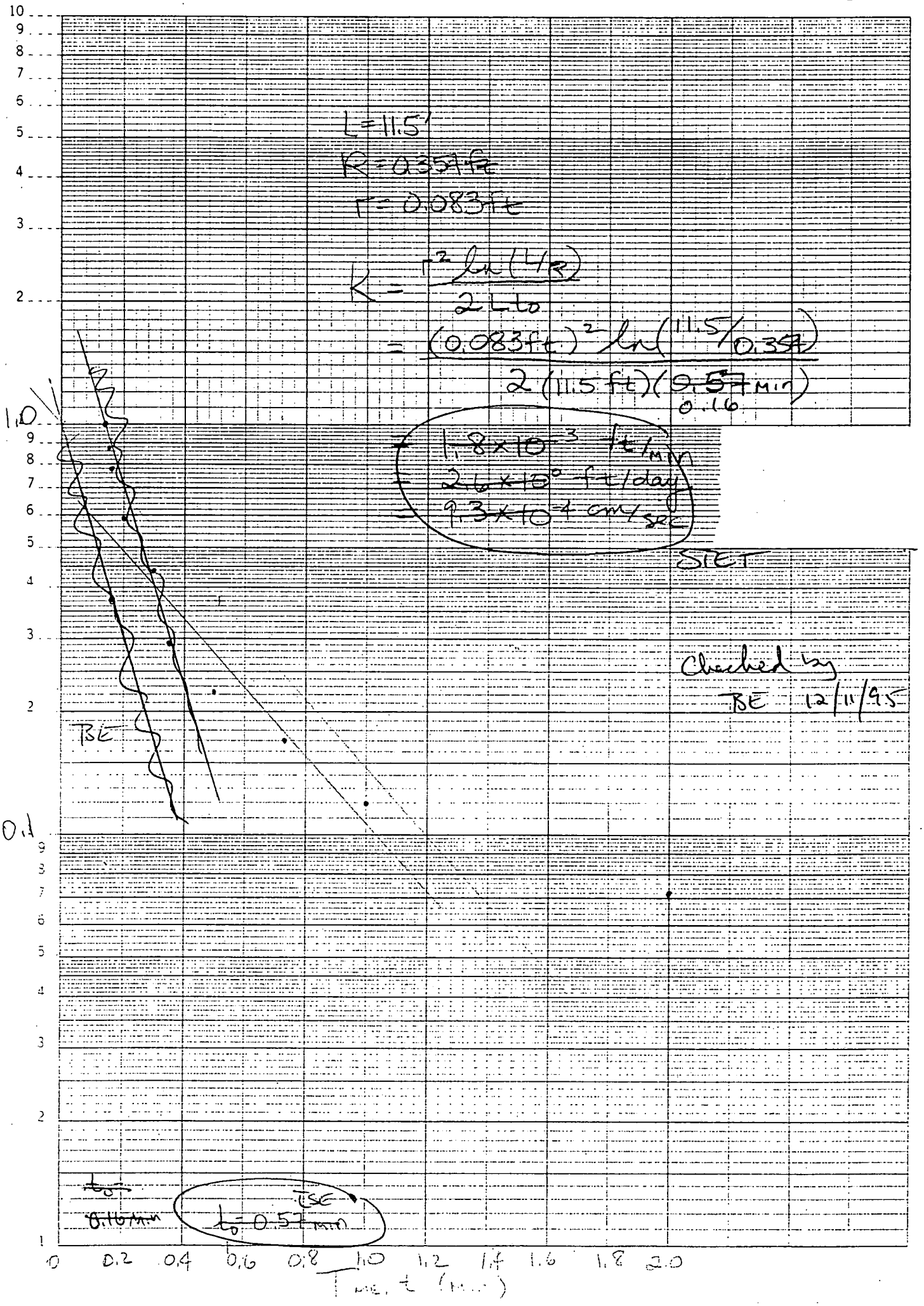
Step 0 11/29 11:27:39

Elapsed Time	INPUT 1
0.0000	0.223
0.0083	0.159
0.0166	-0.127
0.0250	-0.079
0.0333	-0.111
0.0416	0.031
0.0500	0.127
0.0583	0.127
0.0666	0.399
0.0750	0.606
0.0833	0.686
0.0916	0.686 ← START HERE
0.1000	0.670
0.1083	0.638
0.1166	0.606
0.1250	0.590
0.1333	0.558
0.1416	0.542
0.1500	0.526
0.1583	0.510
0.1666	0.494
0.1750	0.462
0.1833	0.462
0.1916	0.431
0.2000	0.431
0.2083	0.415
0.2166	0.399
0.2250	0.383
0.2333	0.367
0.2416	0.367
0.2500	0.351
0.2583	0.335
0.2666	0.335
0.2750	0.319
0.2833	0.319
0.2916	0.303
0.3000	0.287
0.3083	0.287

[illegible]	0.271
0.3333	0.271
0.3500	0.255
0.3666	0.239
0.3833	0.223
0.4000	0.207
0.4166	0.207
0.4333	0.191
0.4500	0.191
0.4666	0.175
0.4833	0.175
0.5000	0.175
0.5166	0.159
0.5333	0.159
0.5500	0.143
0.5666	0.143
0.5833	0.143
0.6000	0.143
0.6166	0.127
0.6333	0.127
0.6500	0.127
0.6666	0.127
0.6833	0.111
0.7000	0.111
0.7166	0.111
0.7333	0.111
0.7500	0.111
0.7666	0.111
0.7833	0.111
0.8000	0.095
0.8166	0.095
0.8333	0.095
0.8500	0.095
0.8666	0.095
0.8833	0.095
0.9000	0.095
0.9166	0.095
[illegible].9333	0.095
[illegible].9500	0.079
0.9666	0.079
0.9833	0.079
1.0000	0.079
1.0000	0.063
1.1000	0.047
1.2000	0.047
1.3000	0.047
1.4000	0.031
1.5000	0.031
1.6000	0.031
1.7000	0.031
1.8000	0.031
1.9000	0.031
[illegible]	0.015
[illegible]	0.015
[illegible]	0.015
[illegible]	0.015
[illegible]	0.015
[illegible]	0.015
4.4000	0.015
4.8000	0.015
4.9000	0.015
5.0000	0.015
5.1000	0.015

END

2LMW8J FALLING 15



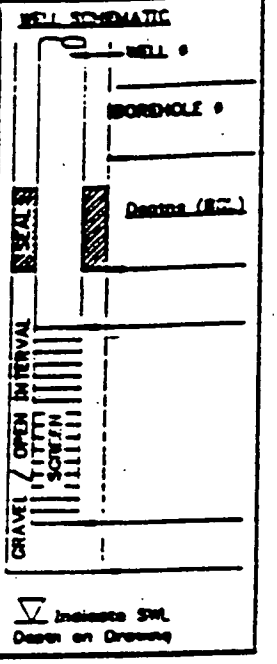
HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

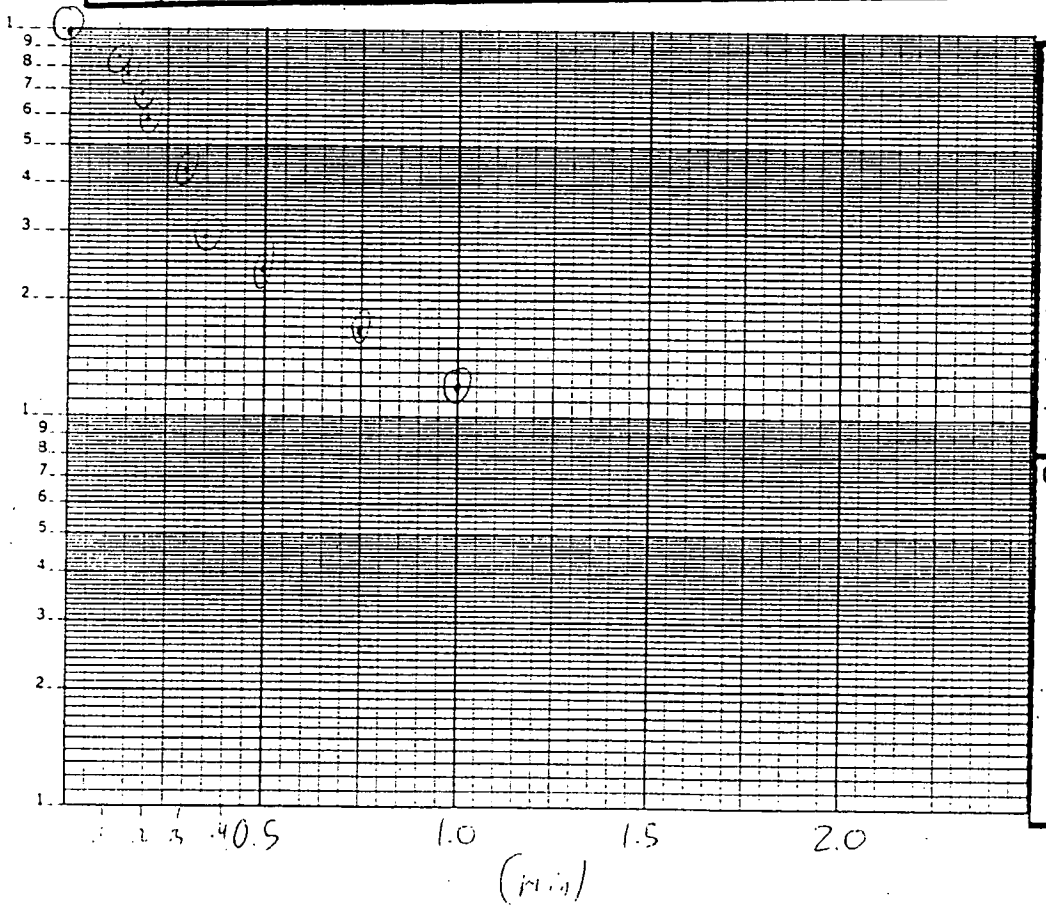
Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: 2LMW 8D S
PROJECT NO.: 5082 GEOLOGIST: MARSHALL
WELL DIAMETER: 6" SCREEN LENGTH/DEPTH: TEST NO.: 2
STATIC WATER LEVEL (Depth/Elevation): 1.96 1.96 DATE: 11/29/95
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: 5', 2.5" ϕ SLUG PAGE OF
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.1250	1.000	-0.654			
0.1333	0.853	-0.558			
0.1583	0.780	-0.510			
0.1833	0.683	-0.447			
0.2000	0.586	-0.383			
0.300	0.439	-0.287			
0.350	0.292	-0.191			
0.50	0.243	-0.159			
0.75	0.170	-0.111			
1.00	0.121	-0.079			
2.0	0.072	-0.047			
8.0	0.023	-0.015			

WELL SCHEMATIC





REMARKS:

XD @ 25' Depth
SLUG Bottom @ 20' Depth

CALCS, SKETCH MAPS, ETC.:

SE2000
Environmental Logger
11/29 11:55

Unit# 0 Test 2

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	6.062
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	-0.142
Delay mSEC	50.000

2LMW8D
FALLING HEADTEST

Step 0 11/29 11:18:34

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	0.000
0.0166	0.000
0.0250	0.000
0.0333	-0.303
0.0416	-0.654
0.0500	-0.510
0.0583	-0.702
0.0666	-0.542
0.0750	-0.782
0.0833	-0.670
0.0916	-0.806
0.1000	-0.838
0.1083	-0.399
0.1166	-0.431
0.1250	-0.654 ← START HERE
0.1333	-0.558
0.1416	-0.574
0.1500	-0.319
0.1583	-0.510
0.1666	-0.319
0.1750	-0.415
0.1833	-0.447
0.1916	-0.351
0.2000	-0.383
0.2083	-0.367
0.2166	-0.351
0.2250	-0.335
0.2333	-0.335
0.2416	-0.319
0.2500	-0.303
0.2583	-0.303
0.2666	-0.287
0.2750	-0.287
0.2833	-0.287
0.2916	-0.303

0.3166	-0.239
0.3250	-0.223
0.3333	-0.175
0.3500	-0.191
0.3666	-0.223
0.3833	-0.207
0.4000	-0.191
0.4166	-0.191
0.4333	-0.191
0.4500	-0.175
0.4666	-0.175
0.4833	-0.159
0.5000	-0.159
0.5166	-0.143
0.5333	-0.143
0.5500	-0.143
0.5666	-0.143
0.5833	-0.127
0.6000	-0.127
0.6166	-0.127
0.6333	-0.047
0.6500	-0.143
0.6666	-0.111
0.6833	-0.111
0.7000	-0.111
0.7166	-0.111
0.7333	-0.111
0.7500	-0.111
0.7666	-0.111
0.7833	-0.095
0.8000	-0.095
0.8166	-0.095
0.8333	-0.095
0.8500	-0.095
0.8666	-0.095
0.8833	-0.095
0.9000	-0.095
0.9166	-0.095
0.9333	-0.047
0.9500	-0.079
0.9666	-0.079
0.9833	-0.095
1.0000	-0.079
1.2000	-0.079
1.4000	-0.063
1.6000	-0.063
1.8000	-0.047
2.0000	-0.047
2.2000	-0.047
2.4000	-0.047
2.6000	-0.031
2.8000	-0.031
3.0000	-0.031
3.2000	-0.031
3.4000	-0.031
3.6000	-0.031
3.8000	-0.031
4.0000	-0.031
4.2000	-0.031
4.4000	-0.015
4.6000	-0.015
4.8000	-0.015
5.0000	-0.031
5.2000	-0.015

5.8000	-0.015
6.0000	-0.015
6.2000	-0.015
6.4000	-0.015
6.6000	-0.015
6.8000	-0.015
7.0000	-0.015
7.2000	-0.015
7.4000	-0.015
7.6000	-0.015
7.8000	-0.015
8.0000	-0.015

END

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF 3

CLIENT	NSB - NLON
JOB NUMBER	~~0185~~ 5082
SUBJECT	CTU 203 Slug Tests
BASED ON	Hvorslev
DRAWING NUMBER	
BY	T Evans
CHECKED BY	12/11/95
APPROVED BY	
DATE	

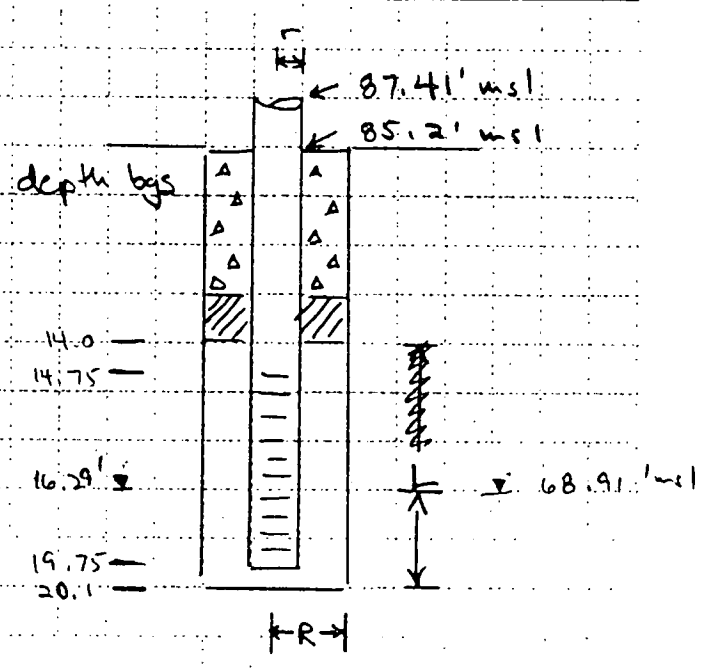
Well # 2LMW28DS
Rising

$r = 1'' = 0.083$ ft

$R = 4.5'' = 0.375$ ft

~~$L = 3.28$ ft~~

$t_0 = 15.10$ min



$L/R > 8$

$\therefore$

$$K = \frac{r^2 \ln(L/R)}{2Lt_0}$$

$L = (87.41 - 18.50) - (85.2 - 20.1)$
$= 3.81$ ft

$$K = \frac{(.083\,ft)^2 \ln(3.81\,ft / .375\,ft)}{2(3.81\,ft)(15.10\,min)}$$

$K = 1.4 \times 10^{-4}$ ft/min $\times$ 1440 min/day

$K = 2.0 \times 10^{-1}$ ft/day

$= 7.1 \times 10^{-5}$ cm/sec

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILL STUDY — WELL/BORING NO.: 2LMW28DS

PROJECT NO.: 5082 — GEOLOGIST: CONTI

WELL DIAMETER: 2" Φ — SCREEN LENGTH/DEPTH: — TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 18.50' TPVC (TD = 21.78) — DATE: 11/17/95

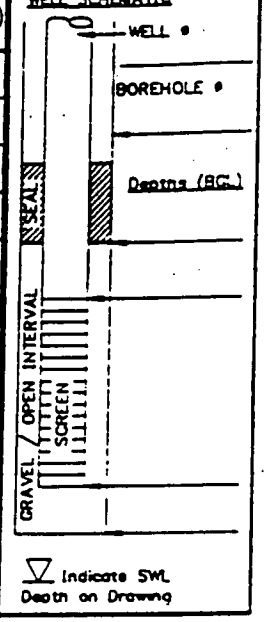
TEST TYPE (Rising/Falling/Constant Head): RISING — CHECKED:

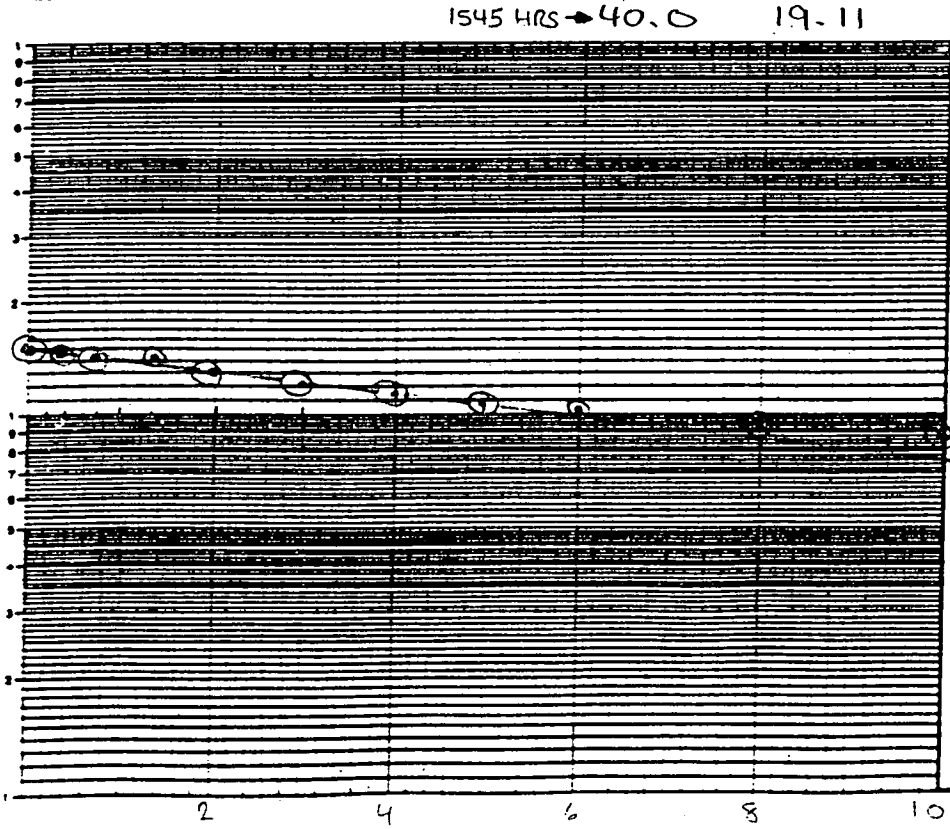
METHOD OF INDUCING WATER LEVEL CHANGE: BAILER (IL) — PAGE 1 OF

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0	20.00	1.50	4.0	19.64	1.14
10	19.98	1.48	5.0	19.58	1.08
20	—		6.0	19.52	1.02
30	—		7.0	19.48	.98
40	19.93	1.43	8.0	19.43	.93
50	—	—	9.0	—	
60	19.89	1.39	10.0	19.37	.87
1.5	19.83	1.33	12.0	19.31	.81
2.0	19.80	1.30	15.0	19.25	.75
2.5	19.76	1.26	20.0	19.20	.70
3.0	19.71	1.21	25.0	19.16	.66
3.5	—	—	30.0	19.14	.64
		1545 HRS →	40.0	19.11	50 min = 19.11

WELL SCHEMATIC





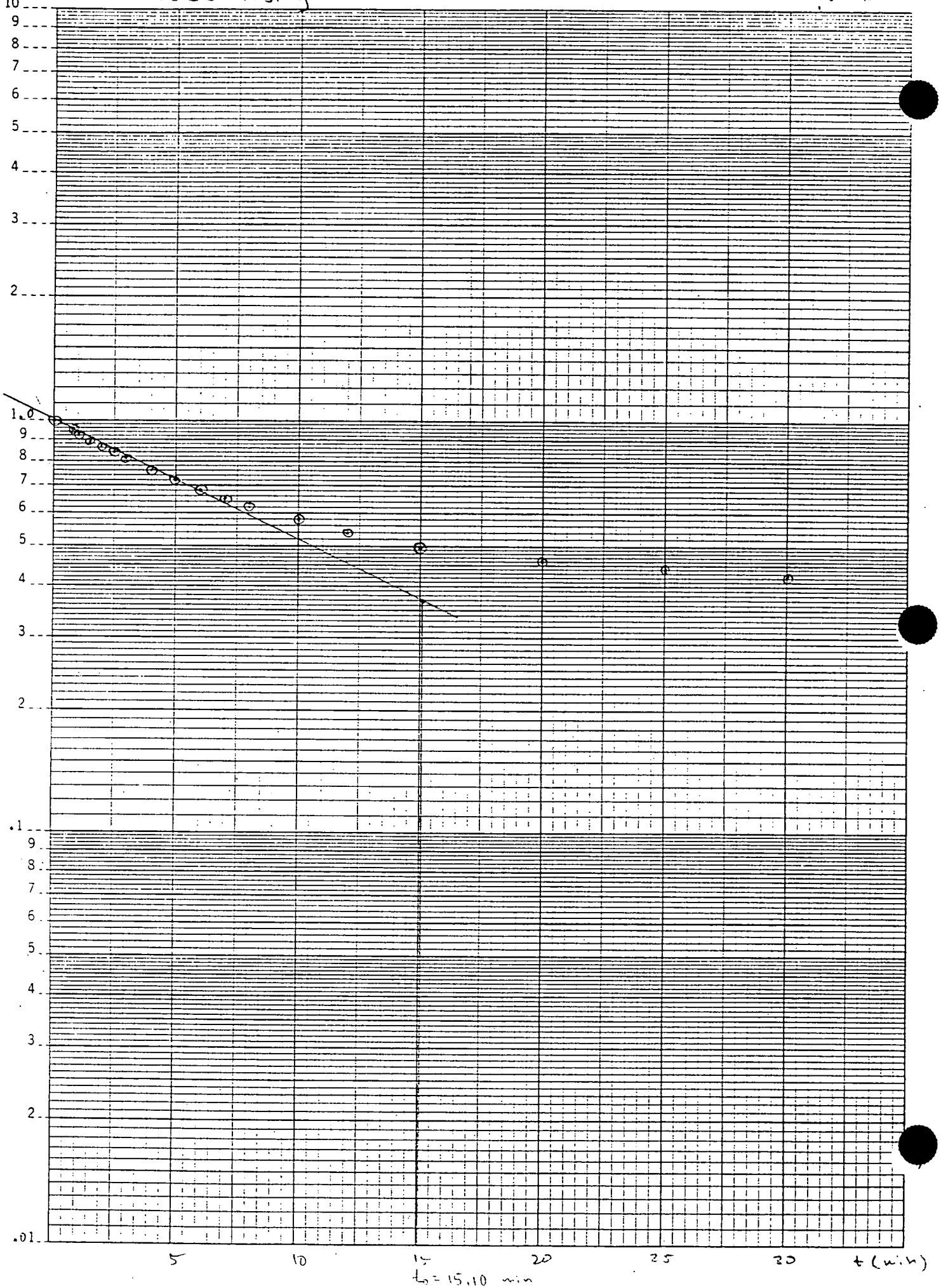
REMARKS:

Measure w/ M.Scope

CALCS, SKETCH MAPS, ETC.:

2LMW28DS Rising

12.11.95 BE



CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF

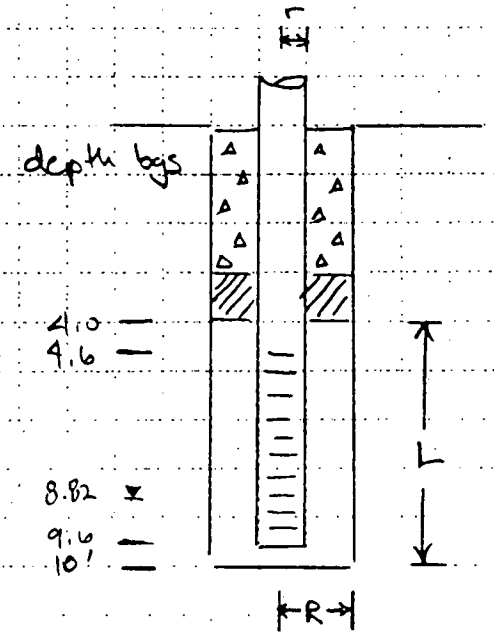
CLIENT	NSB - NLON	JOB NUMBER	~~0185~~ 5082
SUBJECT	CTO 203 Slug Tests		
BASED ON	Hvorslev	DRAWING NUMBER	
BY T Evans	CHECKED BY 12/11/95	APPROVED BY	DATE

Well # 2LMW28F
Rising

$r = 1'' = 0.083 ft$
$R = 4.5'' = .375 ft$
$L = 1.18 ft$

$t_0 = 6 min$

$L/R > 8$



$\therefore$

$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$$K = \frac{(.083 ft)^2 \ln(1.18 ft / .375 ft)}{2(1.18 ft)(6 min)}$$

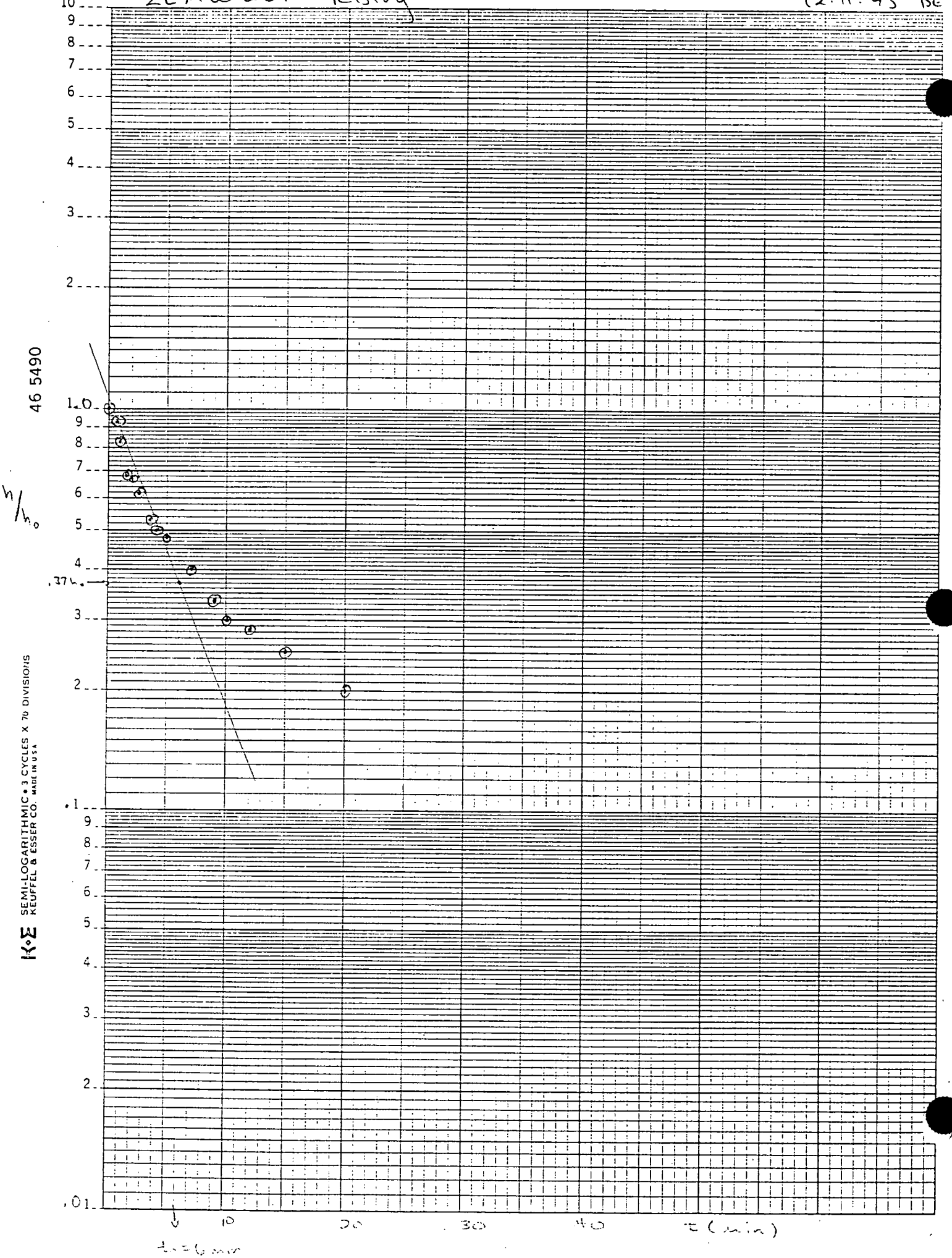
$K = 5.6 \times 10^{-4}$ ft/min $\times$ 1440 min/day

$K = 0.810$ ft/day

$= 2.8 \times 10^{-4}$ cm/sec

2c

2LMW28F Rising 12.11.95 BE



HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILL STUDY — WELL/BORING NO.: 2LMW28F

PROJECT NO.: 5082 — GEOLOGIST: CONTI

WELL DIAMETER: 2" — SCREEN LENGTH/DEPTH: — TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 10.90 TPVC (TD 11.68) — DATE: 11-17-95

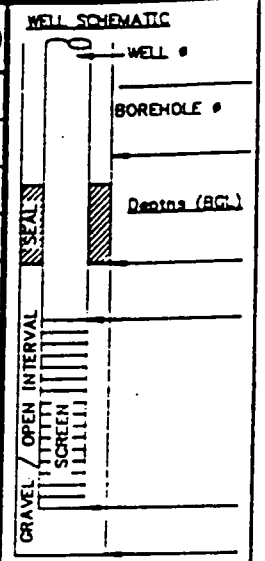
TEST TYPE (Rising/Falling/Constant Head): RISING — CHECKED:

METHOD OF INDUCING WATER LEVEL CHANGE: PERISTALTIC PUMP — PAGE 1 OF 1

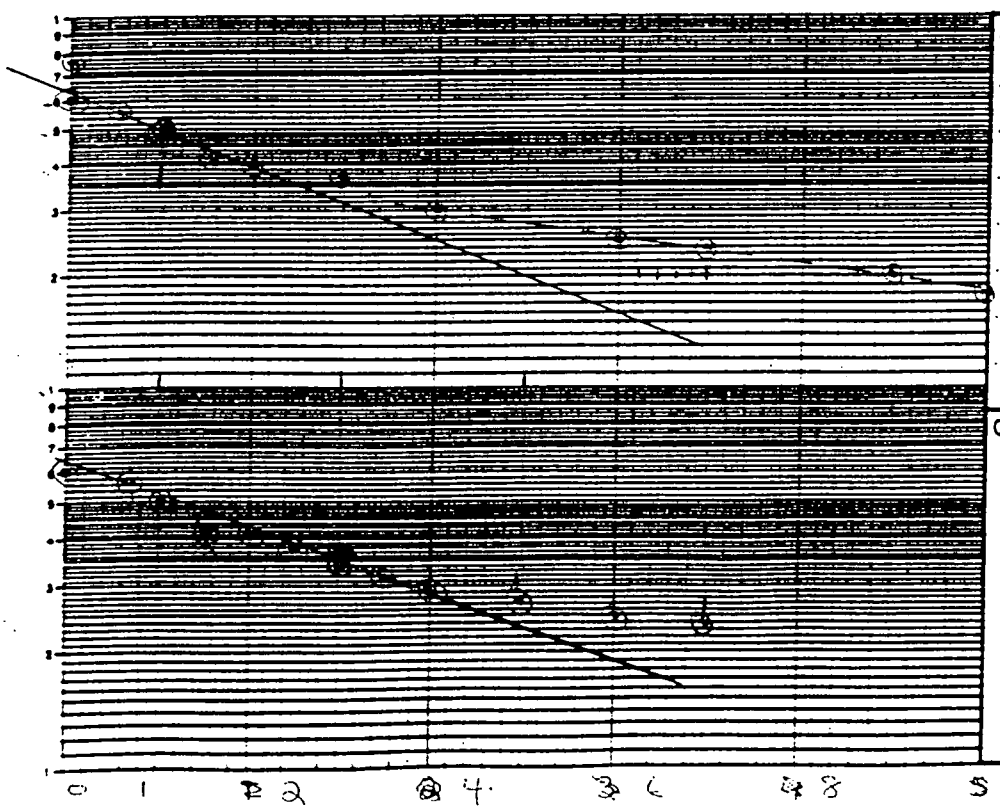
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0	~~11.50~~ 10.90	~~.80~~ .78	4.0	11.20	.30
~~10~~ 0	11.50	.60	5.0	11.17	.27
20	—		6.0	11.15	.25
~~30~~ ~~35~~ 40	11.46	.56	7.0	11.14	.24
40	—		9.0	11.10	.20
~~50~~ 60	11.40	.50	10.0	11.08	.18
~~60~~	11.38	.48	12.0	11.07	.17
1.5	11.31	.41	15.0	11.05	.15
2.0	11.30	.40	20.0	11.02	
2.5	11.27	.37	25.0	10.99	
3.0	11.24	.34	30.0	10.97	
3.5	11.22	.32	40.0	10.94	

WELL SCHEMATIC



▽ Indicate SWL Depth on Drawing



REMARKS:
USED PERISTALTIC PUMP TO REMOVE SLUG OF WATER
START MEAS AT 10 SEC = ORDG.

CALCS, SKETCH MAPS, ETC.:

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT	NSB - NLON	JOB NUMBER	~~0185~~ 5082
SUBJECT	CTU 203 Slug Tests		
BASED ON	Hvorslev	DRAWING NUMBER	
BY T Evans	CHECKED BY 12/11/95	APPROVED BY	DATE

Well # 2LMW29 ~~DS~~ A

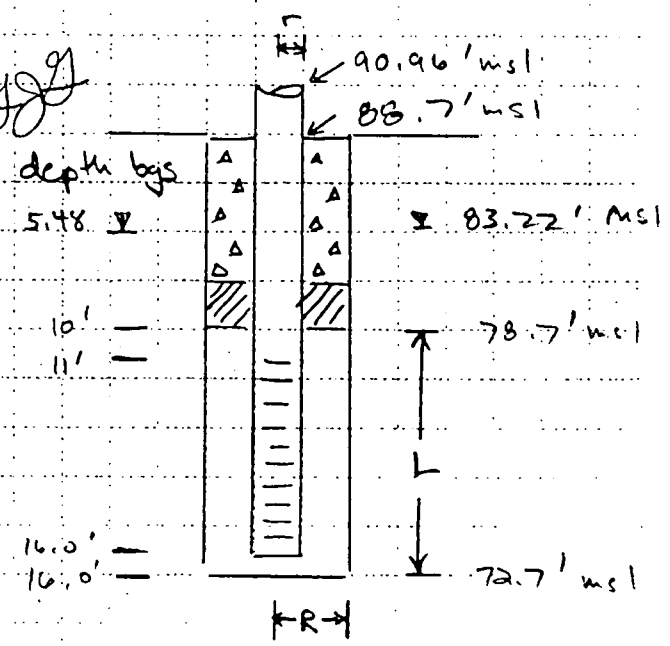
Rising

$r = 1'' = 0.083\,ft$

$R = 4.5'' = 0.375\,ft$

$L = 6.0\,ft$

$t_0 = 1.33\,min$



$L/r > 8$

$\therefore$

$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$$K = \frac{(0.083\,ft)^2 \ln(6.0\,ft / 0.375\,ft)}{2(6.0\,ft)(1.33\,min)}$$

$$K = 0.00121\ ft/min \times 1440\ min/day$$

$$K = 1.74\ ft/day$$

$$= 6.1 \times 10^{-4}\ cm/sec$$

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILLS — WELL/BORING NO.: 2LMW29D~~S~~A

PROJECT NO.: 5082 — GEOLOGIST: CONTI

WELL DIAMETER: 2"Φ — SCREEN LENGTH/DEPTH: — TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 7.74 (TPVC) — DATE: 11-18-95

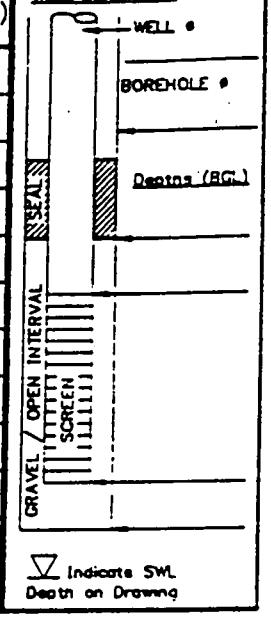
TEST TYPE (Rising/Falling/Constant Head): RISING TEST — CHECKED:

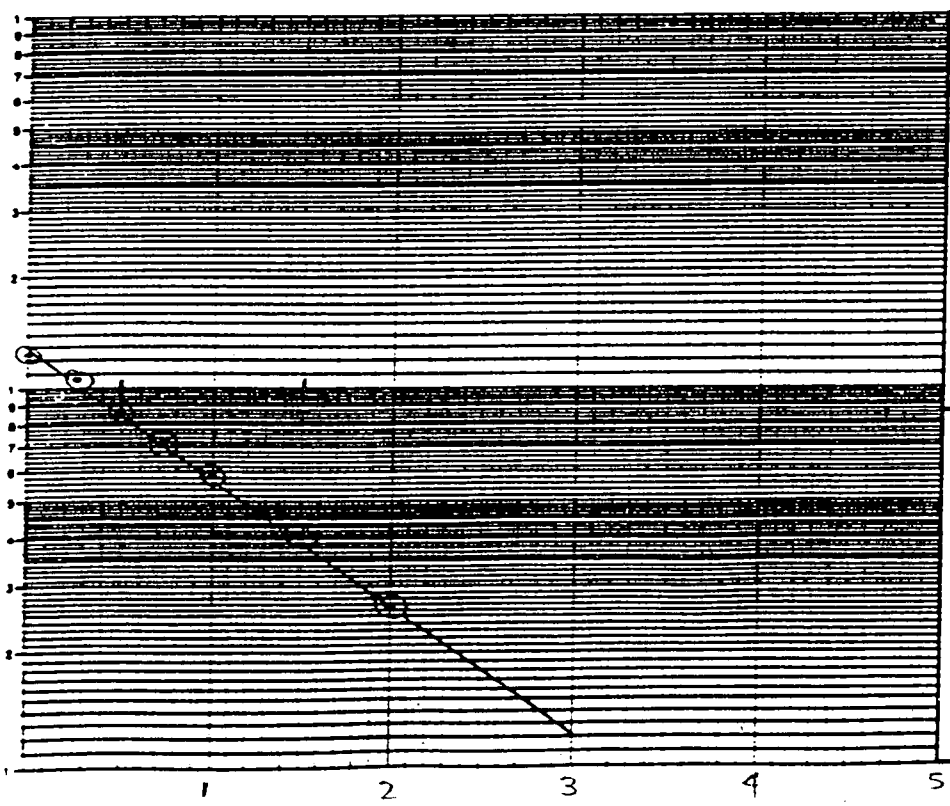
METHOD OF INDUCING WATER LEVEL CHANGE: BAILER (1 LITER) — PAGE ___ OF ___

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0	9.00	1.26	5.0	7.80	
15	8.79	1.05	5.5	7.79	
30	8.62	.88	6.0	7.79	
45	8.45	.71	7.0	7.78	
60	8.33	.59	8.0	7.78	
1.5	8.14	.40			
2.0	8.00	.26			
2.5	7.95	.21			
3.0	7.88	.14			
3.5	7.85	.11			
4.0	7.83	.09			
4.5	7.81	.07			

WELL SCHEMATIC





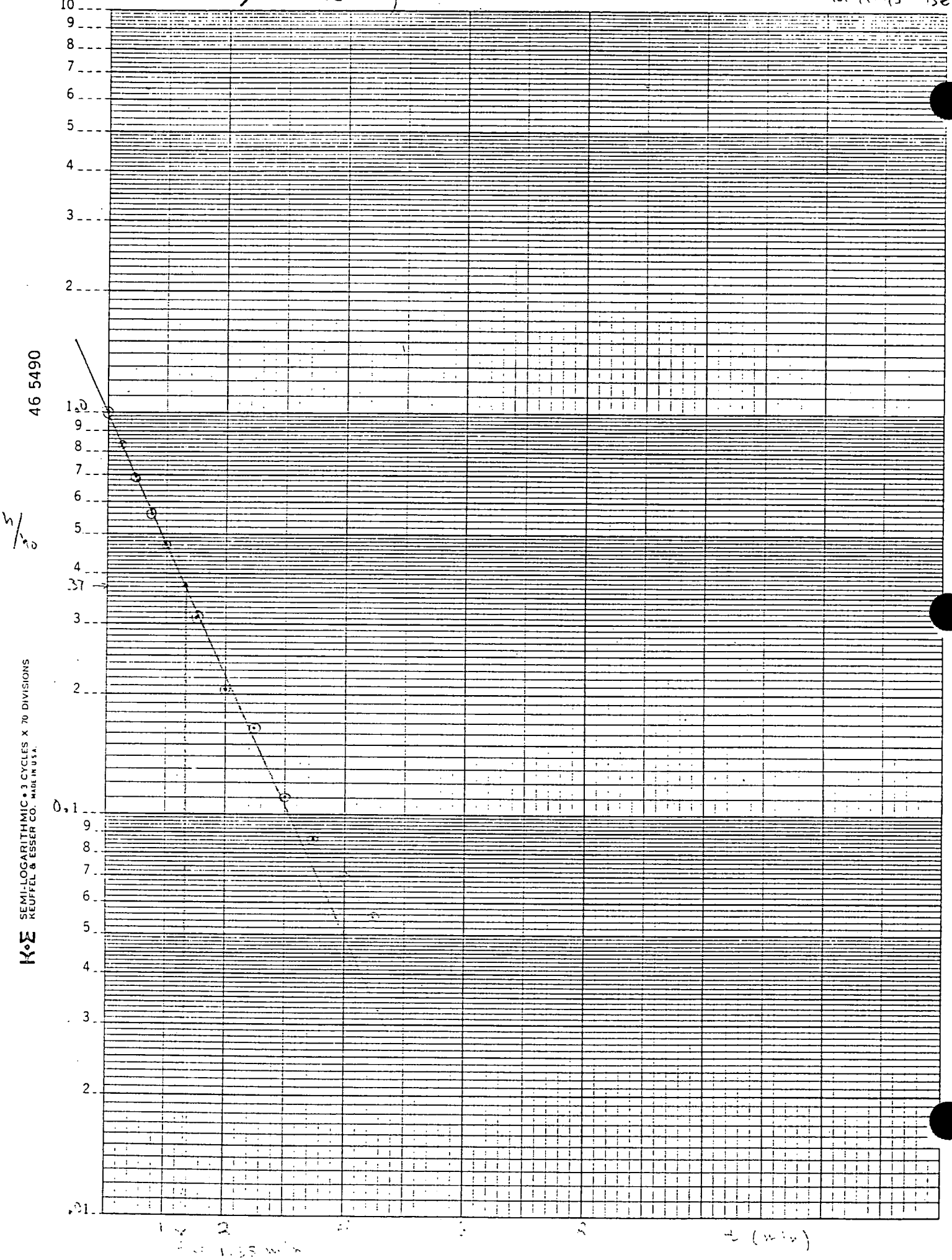
REMARKS:
Used 1L Bailer to remove slug of water, hand meas w/ M-Scope to full recovery. (SJC)

CALCS, SKETCH MAPS, ETC.:

2LMW29 ~~D~~ Rising

26

12-11-95 BE

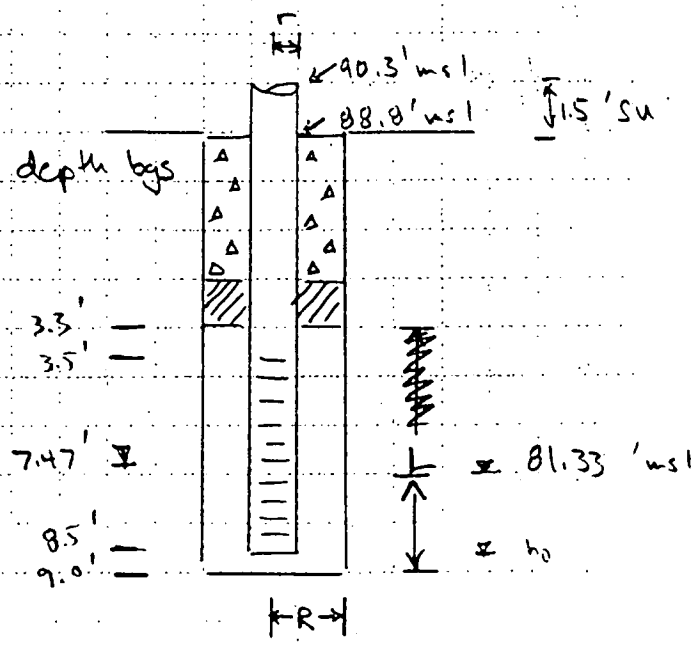


CLIENT	NSB - NLON
JOB NUMBER	~~0185~~ ~~0185~~ 5082
SUBJECT	CTU 203 Slug Tests
BASED ON	Hvorslev
DRAWING NUMBER	
BY	T Evans
CHECKED BY	12/11/95
APPROVED BY	
DATE	

Well # 2LMW29F
Rising

$r = 1'' = 0.083$ ft
$R = 4.5'' = 0.375$ ft
$L = 1.53$ ft ✓

$t_o = 77.5$ min



$L/R > 8$

$\therefore$

$$K = \frac{r^2 \ln(L/R)}{2 L t_o}$$

$$K = \frac{(0.083\text{ ft})^2 \ln(1.53\text{ ft}/0.375\text{ ft})}{2\,(1.53\text{ ft})(77.5\text{ min})}$$

$$K = 4.1 \times 10^{-5}\text{ ft/min} \times 1440\text{ min/day}$$

$$K = 5.9 \times 10^{-2}\text{ ft/day}$$

$$= 2.1 \times 10^{-5}\text{ cm/sec}$$

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILL — WELL/BORING NO.: 2LMW29F

PROJECT NO.: 5082 — GEOLOGIST: CONTI

WELL DIAMETER: 2" Φ — SCREEN LENGTH/DEPTH: 5' — TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 8.97 (TPVC) TD = 9.90 — DATE: 11-18-95

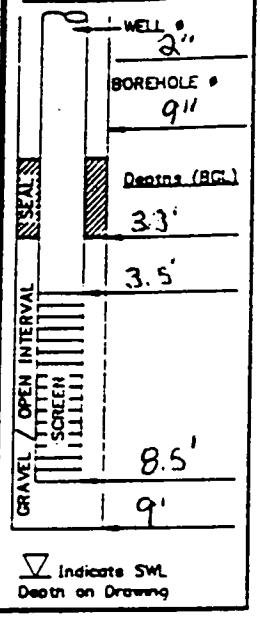
TEST TYPE (Rising/Falling/Constant Head): RISING — CHECKED:

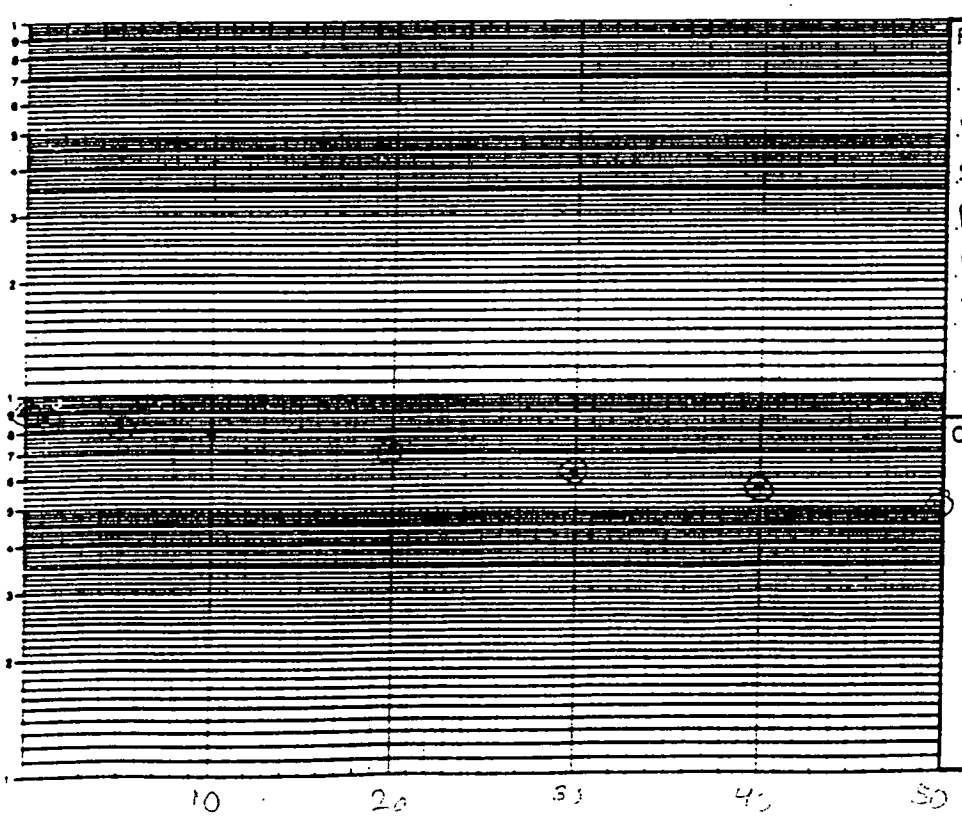
METHOD OF INDUCING WATER LEVEL CHANGE: PUMP — PAGE 1 OF

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOP OF CASING

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0	9.88	.91	15.0	9.72	
15	9.88		20.0	9.68	.71
30	9.87		25.0	9.63	
45	9.86		30.0	9.60	.63
60 sec	9.86	.89	40.0	9.54	.57
Min → 1.5	9.85		50.0	9.48	.51
2.0	9.85		60.0	9.42	.45
3.0	9.84		1 Hr 10	9.36	
4.0	9.83		1 Hr 30	9.25	.28
5.0	9.82	.85	2 Hr	9.13	
7.0	9.80		2 Hr 30	9.01	.04
10.0	9.77	.80			

WELL SCHEMATIC

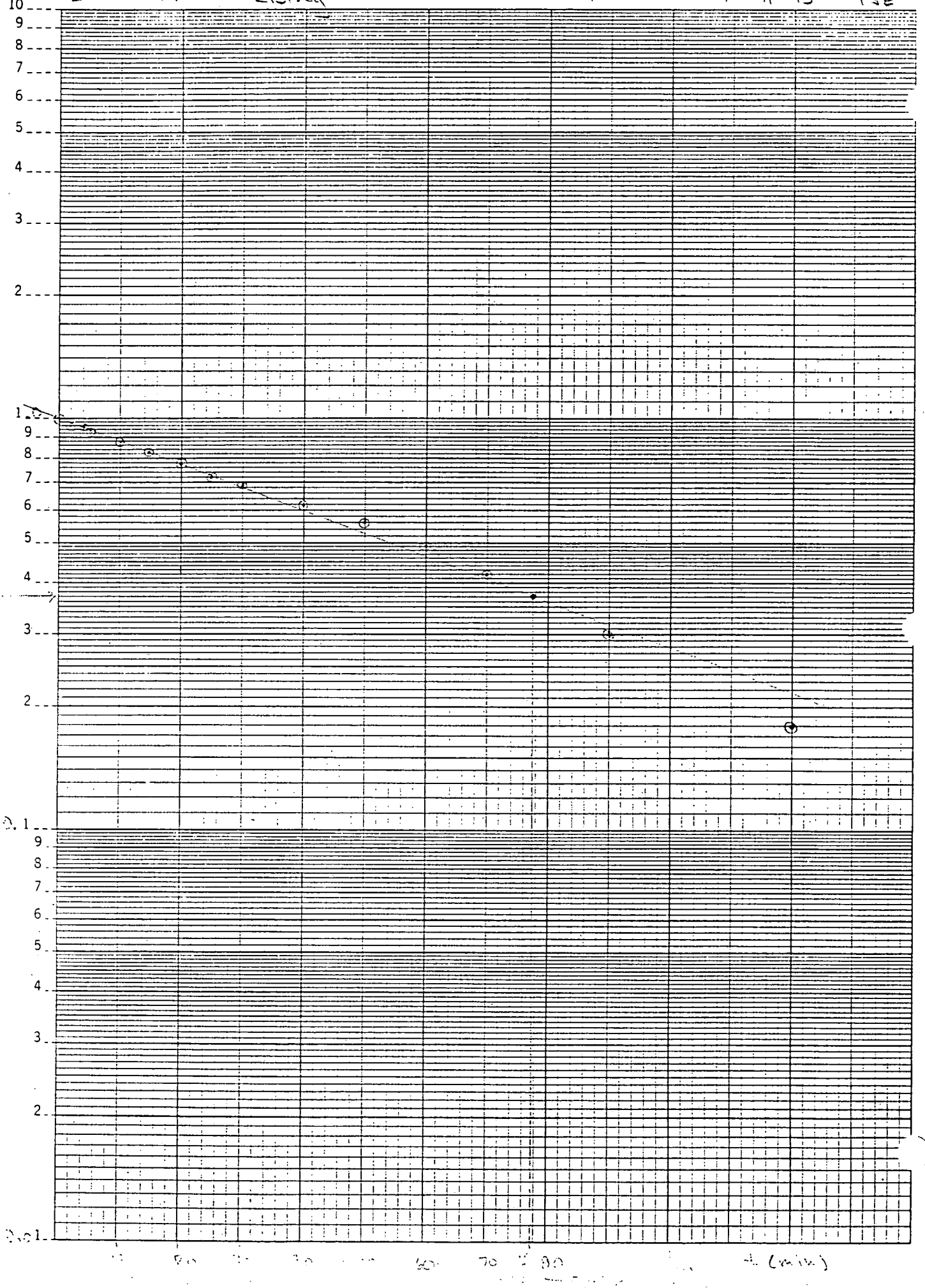




REMARKS:
Had to redevelop well, due to ≈ 6" of sand in bottom.
Pumped well Dry
1rst Meas was 0 BOG
Removed Slug w/ Pump
hand meas w/ M Scope

CALCS, SKETCH MAPS, ETC.:

2LMW29F Rising 12-11-95 TSE



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HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: 2LMW306

PROJECT NO.: 5082 GEOLOGIST: MARSHALL

WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 3

STATIC WATER LEVEL (Depth/Elevation): 9.69, TD = 23 DATE: 12/2/95

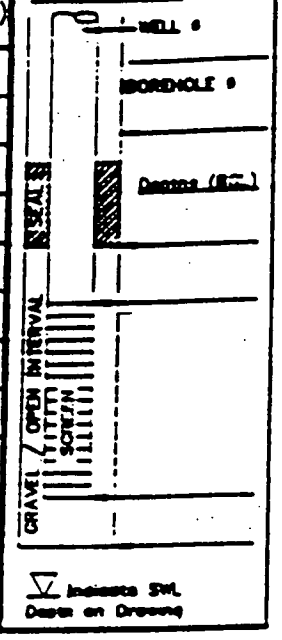
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:

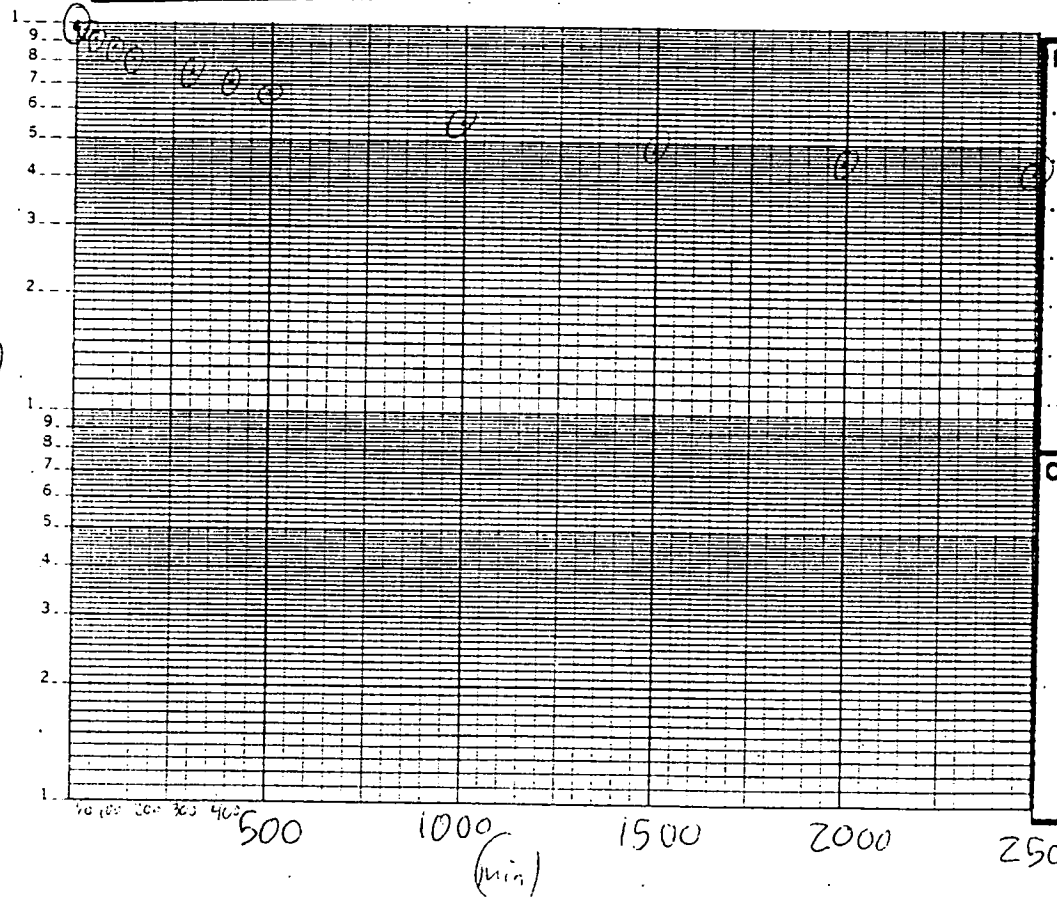
METHOD OF INDUCING WATER LEVEL CHANGE: 7', 1" ϕ SLUG PAGE ... OF ...

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.0000	0.000	0.0000	200	0.821	-1.979
0.2000	1.000	-2.410	300	0.768	-1.851
0.400	0.993	-2.394	400	0.729	-1.756
1.00	0.993	-2.394	500	0.689	-1.660
5.00	0.980	-2.362	1000	0.563	-1.356
10.0	0.973	-2.346	1500	0.483	-1.165
20.0	0.947	-2.282	2000	0.457	-1.101
30	0.934	-2.251	2500	0.430	-1.037
40	0.921	-2.219	2660	0.410	-0.989
50	0.914	-2.203			
60	0.907	-2.187			
100	0.874	-2.107			

WELL SCHEMATIC



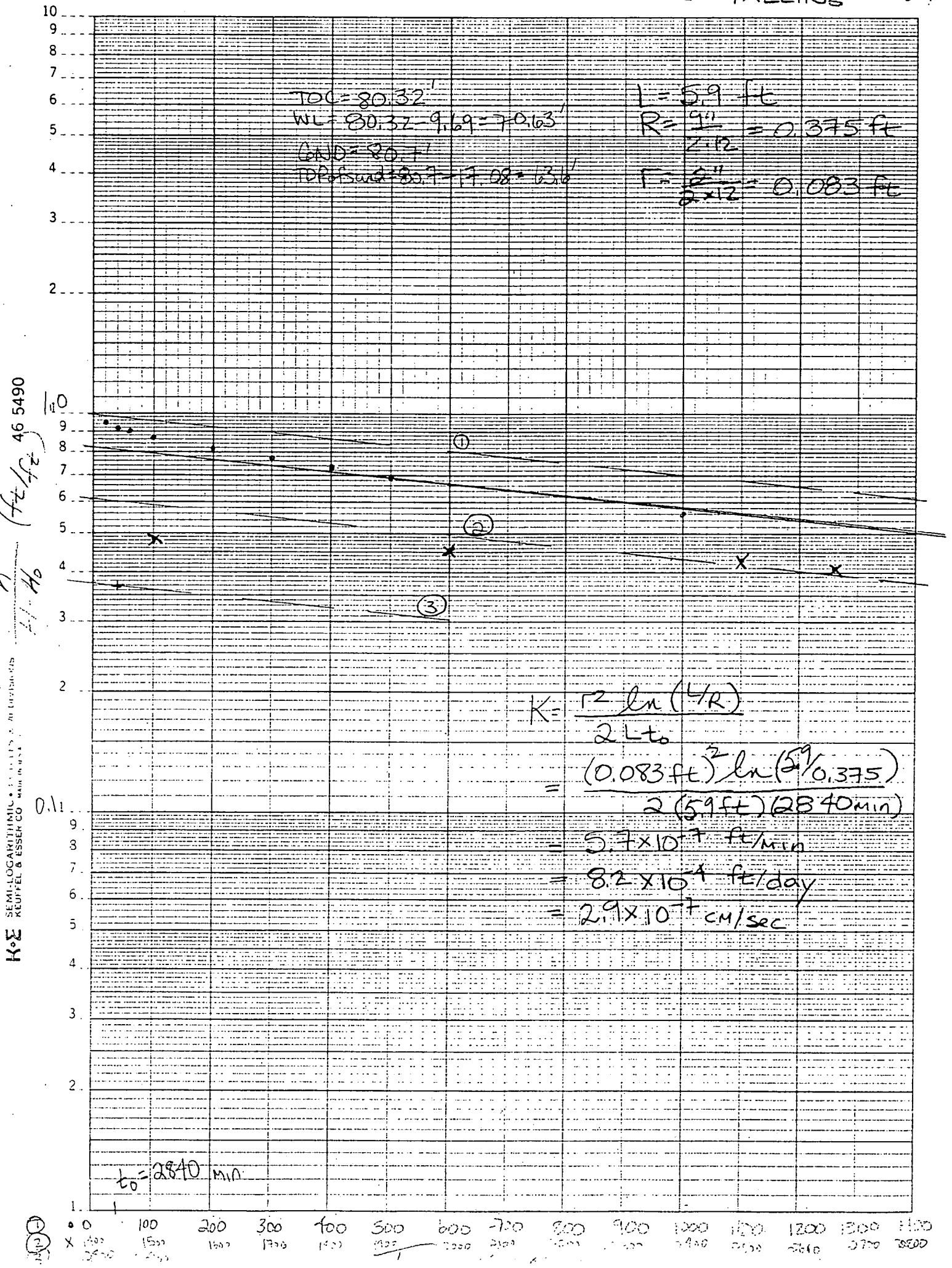


PD

REMARKS:

XD @ 20' Depth
Slug Bottom @ 15' Depth

CALCS, SKETCH MAPS, ETC.:


TOC = 80.32'
WL = 80.32 - 9.69 = 70.63'
GND = 80.7'
TD Pofsand = 80.7 - 17.08 = 63.6'
L = 5.9 ft
R = 9"/2×12 = 0.375 ft
r = 2"/2×12 = 0.083 ft
h/h0 (ft/ft)
K = r² ln(L/R) / 2Lt0
= (0.083 ft)² ln(5.9/0.375) / 2(5.9 ft)(2840 min)
= 5.7×10⁻⁷ ft/min
= 8.2×10⁻⁴ ft/day
= 2.9×10⁻⁷ cm/sec
t0 = 2840 min
K&E SEMI-LOGARITHMIC KEUFFEL & ESSER CO. MADE IN U.S.A.
46 5490

SE2000
Environmental Logger
12/04 08:41

Unit# 0 Test 3

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	5.148
SG	1.000
Linearity	0.113
Scale factor	50.817
Offset	-0.142
Delay mSEC	50.000

2LMW30DS
FALLING HEAD TEST

Step 0 12/02 11:50:09

Elapsed Time	INPUT 1
0.0000	0.015
0.0083	0.015
0.0166	-1.133
0.0250	-2.538
0.0333	-2.538
0.0416	-2.474
0.0500	-2.868
0.0583	-3.432
0.0666	-2.729
0.0750	-1.584
0.0833	-2.382
0.0916	-2.745
0.1000	-2.458
0.1083	-2.203
0.1166	-2.410
0.1250	-2.522
0.1333	-2.394
0.1416	-2.346
0.1500	-2.426
0.1583	-2.442
0.1666	-2.394
0.1750	-2.394
0.1833	-2.426
0.1916	-2.410
0.2000	-2.394
0.2083	-2.410 ← START HERE
0.2166	-2.410
0.2250	-2.410
0.2333	-2.410
0.2416	-2.410
0.2500	-2.410
0.2583	-2.410

0.2750	-2.410
0.2833	-2.410
0.2916	-2.410
0.3000	-2.410
0.3083	-2.410
0.3166	-2.410
0.3250	-2.410
0.3333	-2.410
0.3500	-2.394
0.3666	-2.410
0.3833	-2.394
0.4000	-2.394
0.4166	-2.410
0.4333	-2.410
0.4500	-2.410
0.4666	-2.410
0.4833	-2.394
0.5000	-2.394
0.5166	-2.394
0.5333	-2.410
0.5500	-2.394
0.5666	-2.394
0.5833	-2.394
0.6000	-2.394
0.6166	-2.394
0.6333	-2.394
0.6500	-2.394
0.6666	-2.394
0.6833	-2.394
0.7000	2.394
0.7166	2.394
0.7333	2.394
0.7500	2.394
0.7666	2.394
0.7833	2.394
0.8000	2.394
0.8166	2.394
0.8333	2.394
0.8500	2.394
0.8666	2.394
0.8833	2.394
0.9000	2.394
0.9166	2.394
0.9333	2.394
0.9500	2.394
0.9666	2.394
0.9833	2.394
1.0000	2.394
1.2000	2.394
1.4000	2.394
1.6000	2.394
1.8000	2.394
5.0000	2.394
2.2000	2.378
2.4000	2.394
2.6000	2.394
2.8000	2.378
3.0000	2.378
3.2000	2.378
3.4000	2.378
3.6000	2.378
3.8000	2.378
4.0000	-2.378
4.2000	-2.362
4.4000	-2.378

4.8000	-2.362
5.0000	-2.362
5.2000	-2.378
5.4000	-2.378
5.6000	-2.362
5.8000	-2.362
6.0000	-2.362
6.2000	-2.362
6.4000	-2.362
6.6000	-2.362
6.8000	-2.362
7.0000	-2.362
7.2000	-2.362
7.4000	-2.362
7.6000	-2.346
7.8000	-2.346
8.0000	-2.346
8.2000	-2.346
8.4000	-2.346
8.6000	-2.346
8.8000	-2.346
9.0000	-2.346
9.2000	-2.346
9.4000	-2.346
9.6000	-2.346
9.8000	-2.346
10.0000	-2.346
12.0000	-2.314
14.0000	-2.314
16.0000	-2.298
18.0000	-2.282
20.0000	-2.282
22.0000	-2.282
24.0000	-2.266
26.0000	-2.266
28.0000	-2.266
30.0000	-2.251
32.0000	-2.251
34.0000	-2.251
36.0000	-2.235
38.0000	-2.235
40.0000	-2.219
42.0000	-2.219
44.0000	-2.203
46.0000	-2.219
48.0000	-2.203
50.0000	-2.203
52.0000	-2.203
54.0000	-2.203
56.0000	-2.187
58.0000	-2.187
60.0000	-2.187
62.0000	-2.171
64.0000	-2.171
66.0000	-2.171
68.0000	-2.155
70.0000	-2.155
72.0000	-2.155
74.0000	-2.155
76.0000	-2.155
78.0000	-2.139
80.0000	-2.139
82.0000	-2.139
84.0000	-2.139
86.0000	-2.123

90.0000	-2.123
92.0000	-2.123
94.0000	-2.123
96.0000	-2.123
98.0000	-2.107
100.000	-2.107
110.000	-2.091
120.000	-2.075
130.000	-2.059
140.000	-2.043
150.000	-2.027
160.000	-2.027
170.000	-2.011
180.000	-1.995
190.000	-1.979
200.000	-1.979
210.000	-1.963
220.000	-1.947
230.000	-1.931
240.000	-1.915
250.000	-1.915
260.000	-1.899
270.000	-1.883
280.000	-1.867
290.000	-1.867
300.000	-1.851
310.000	-1.835
320.000	-1.835
330.000	-1.819
340.000	-1.819
350.000	-1.803
360.000	-1.788
370.000	-1.788
380.000	-1.772
390.000	-1.772
400.000	-1.756
410.000	-1.740
420.000	-1.740
430.000	-1.724
440.000	-1.724
450.000	-1.708
460.000	-1.692
470.000	-1.692
480.000	-1.692
490.000	-1.676
500.000	-1.660
510.000	-1.660
520.000	-1.644
530.000	-1.644
540.000	-1.628
550.000	-1.628
560.000	-1.612
570.000	-1.612
580.000	-1.596
590.000	-1.596
600.000	-1.580
610.000	-1.580
620.000	-1.564
630.000	-1.564
640.000	-1.548
650.000	-1.548
660.000	-1.532
670.000	-1.532
680.000	-1.532
690.000	-1.516

720.000	-1.500
730.000	-1.500
740.000	-1.484
750.000	-1.484
760.000	-1.484
770.000	-1.468
780.000	-1.468
790.000	-1.468
800.000	-1.452
810.000	-1.452
820.000	-1.452
830.000	-1.436
840.000	-1.436
850.000	-1.420
860.000	-1.420
870.000	-1.420
880.000	-1.404
890.000	-1.404
900.000	-1.404
910.000	-1.404
920.000	-1.404
930.000	-1.388
940.000	-1.388
950.000	-1.372
960.000	-1.372
970.000	-1.356
980.000	-1.356
990.000	-1.356
1000.00	-1.356
1010.00	-1.341
1020.00	-1.341
1030.00	-1.341
1040.00	-1.325
1050.00	-1.325
1060.00	-1.325
1070.00	-1.309
1080.00	-1.309
1090.00	-1.309
1100.00	-1.309
1110.00	-1.293
1120.00	-1.293
1130.00	-1.293
1140.00	-1.277
1150.00	-1.277
1160.00	-1.277
1170.00	-1.277
1180.00	-1.261
1190.00	-1.261
1200.00	-1.261
1210.00	-1.245
1220.00	-1.245
1230.00	-1.245
1240.00	-1.229
1250.00	-1.229
1260.00	-1.229
1270.00	-1.229
1280.00	-1.229
1290.00	-1.213
1300.00	-1.213
1310.00	-1.213
1320.00	-1.213
1330.00	-1.213
1340.00	-1.197
1350.00	-1.197

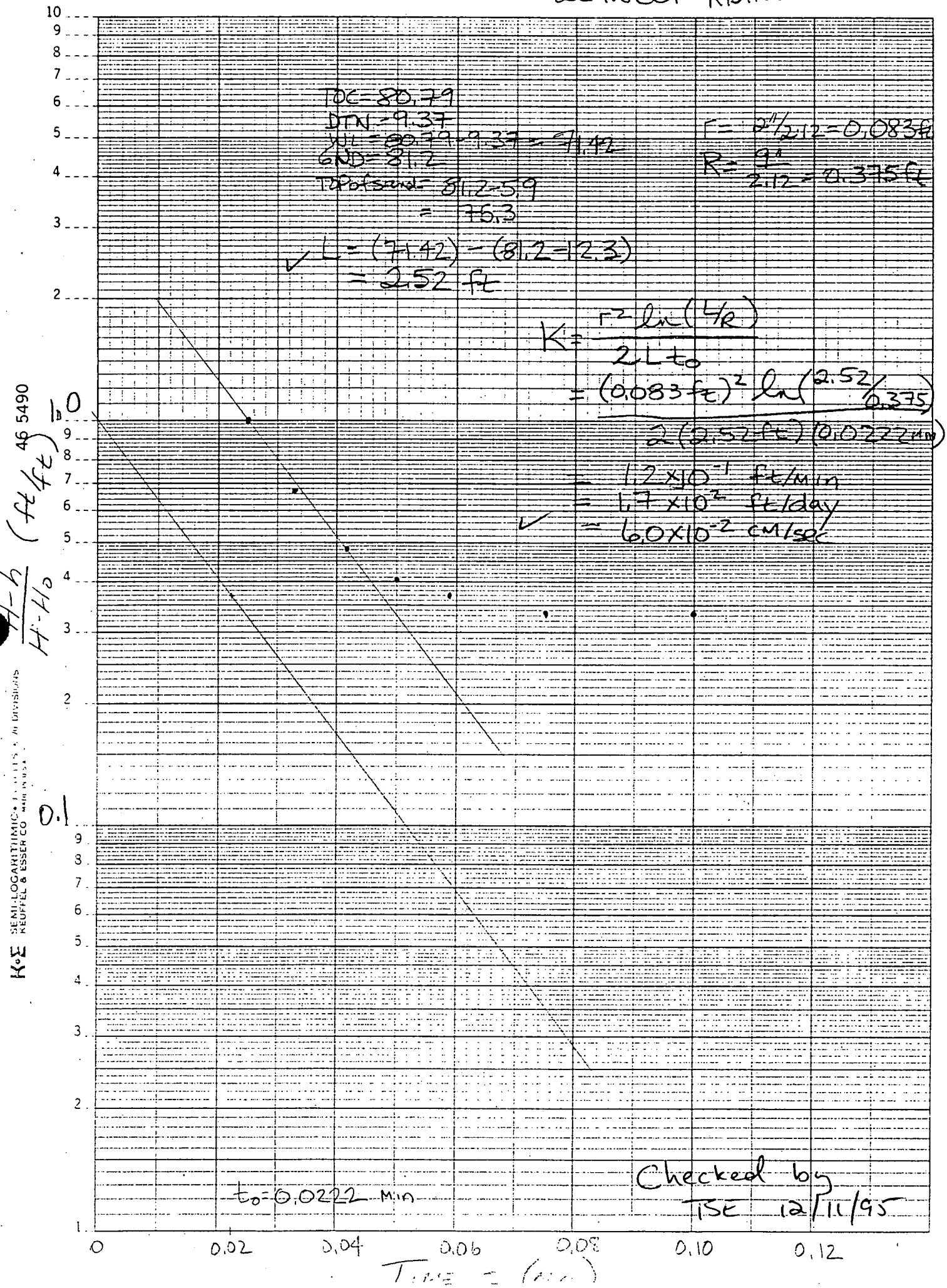
1370.00	-1.197
1380.00	-1.197
1390.00	-1.181
1400.00	-1.181
1410.00	-1.181
1420.00	-1.197
1430.00	-1.181
1440.00	-1.181
1450.00	-1.181
1460.00	-1.181
1470.00	-1.181
1480.00	-1.181
1490.00	-1.181
1500.00	-1.165
1510.00	-1.165
1520.00	-1.165
1530.00	-1.165
1540.00	-1.165
1550.00	-1.149
1560.00	-1.165
1570.00	-1.165
1580.00	-1.149
1590.00	-1.149
1600.00	-1.149
1610.00	-1.149
1620.00	-1.149
1630.00	-1.149
1640.00	-1.149
1650.00	-1.133
1660.00	-1.133
1670.00	-1.133
1680.00	-1.133
1690.00	-1.133
1700.00	-1.133
1710.00	-1.133
1720.00	-1.133
1730.00	-1.133
1740.00	-1.117
1750.00	-1.117
1760.00	-1.117
1770.00	-1.117
1780.00	-1.117
1790.00	-1.117
1800.00	-1.117
1810.00	-1.101
1820.00	-1.101
1830.00	-1.101
1840.00	-1.101
1850.00	-1.101
1860.00	-1.101
1870.00	-1.085
1880.00	-1.085
1890.00	-1.085
1900.00	-1.085
1910.00	-1.085
1920.00	-1.085
1930.00	-1.085
1940.00	-1.085
1950.00	-1.101
1960.00	-1.101
1970.00	-1.101
1980.00	-1.101
1990.00	-1.101
2000.00	-1.101
2010.00	-1.101

2030.00	-1.069
2040.00	-1.085
2050.00	-1.085
2060.00	-1.085
2070.00	-1.085
2080.00	-1.085
2090.00	-1.085
2100.00	-1.085
2110.00	-1.085
2120.00	-1.085
2130.00	-1.069
2140.00	-1.069
2150.00	-1.069
2160.00	-1.085
2170.00	-1.101
2180.00	-1.101
2190.00	-1.117
2200.00	-1.101
2210.00	-1.117
2220.00	-1.117
2230.00	-1.117
2240.00	-1.117
2250.00	-1.117
2260.00	-1.117
2270.00	-1.101
2280.00	-1.117
2290.00	-1.101
2300.00	-1.101
2310.00	-1.101
2320.00	-1.101
2330.00	-1.101
2340.00	-1.085
2350.00	-1.085
2360.00	-1.085
2370.00	-1.085
2380.00	-1.085
2390.00	-1.085
2400.00	-1.085
2410.00	-1.069
2420.00	-1.069
2430.00	-1.069
2440.00	-1.069
2450.00	-1.053
2460.00	-1.053
2470.00	-1.053
2480.00	-1.053
2490.00	-1.037
2500.00	-1.037
2510.00	-1.037
2520.00	-1.037
2530.00	-1.037
2540.00	-1.021
2550.00	-1.021
2560.00	-1.021
2570.00	-1.021
2580.00	-1.021
2590.00	-1.021
2600.00	-1.005
2610.00	-1.005
2620.00	-1.005
2630.00	-0.989
2640.00	-0.989
2650.00	-0.989
2660.00	-0.989

END

2LMW30F RISING

27



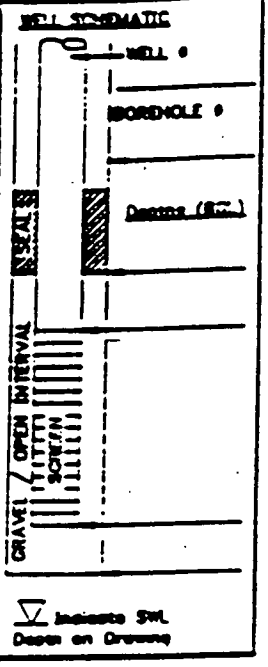
HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

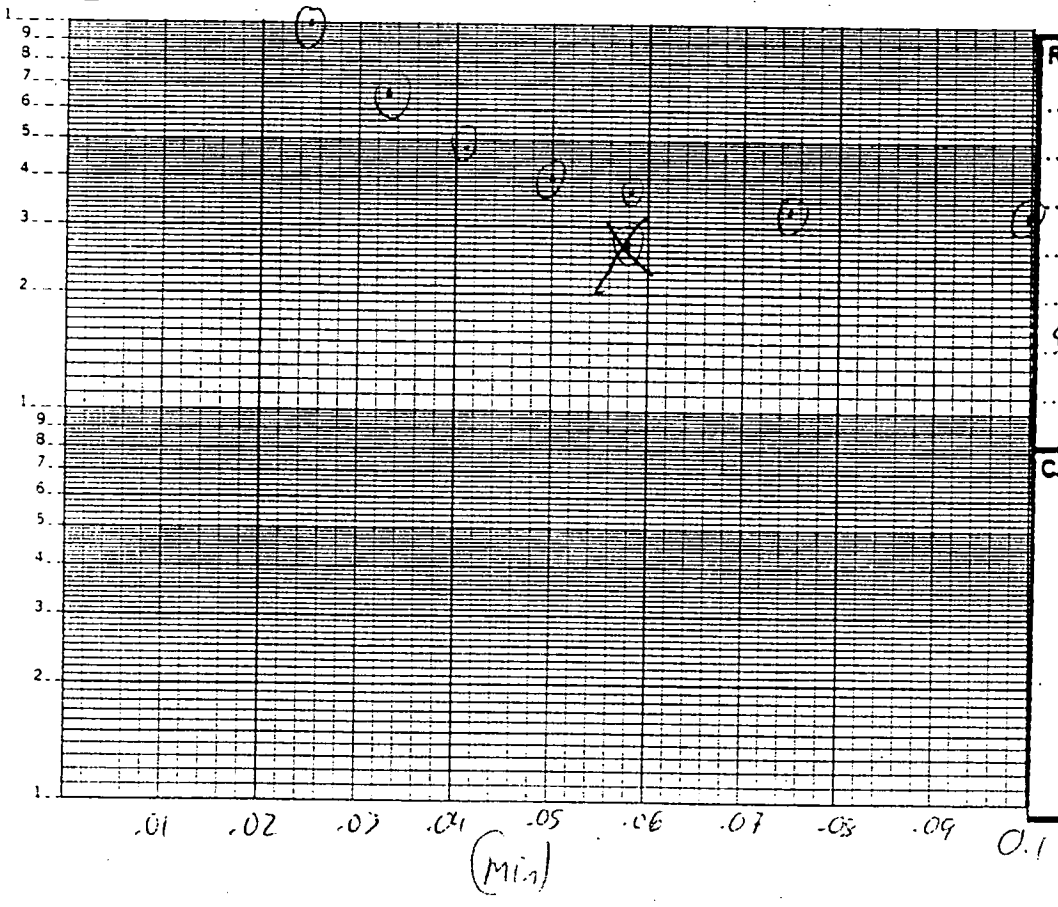
Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: ZLMW30F
PROJECT NO.: 5082 GEOLOGIST: MARSHALL
WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 2
STATIC WATER LEVEL (Depth/Elevation): 9.37, TD=11.6 DATE: 12/2/95
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: REMOVE 1/2 l w/BAILER PAGE OF
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.0000	0.000	0.0000			
0.0250	1.000	0.430			
0.0333	0.667	0.287			
0.0416	0.481	0.207			
0.0500	0.407	0.175			
0.0583	0.370	0.159			
0.0750	0.333	0.143			
0.1000	0.333	0.143			

WELL SCHEMATIC





REMARKS:

x0 @ 11.5

CALCS, SKETCH MAPS, ETC.:

quick recharge Flow > 1L / 1.5 min, visible oil sheen

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET **HALLIBURTON NUS CORPORATION**

PROJECT NAME: AREA A LANDFILL WELL/BORING NO.: 2LMW30F

PROJECT NO.: 5082 GEOLOGIST: CONTI

WELL DIAMETER: 2"Φ SCREEN LENGTH/DEPTH: TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 9.20' TPVC TD = 11.58 DATE: 11-19-95

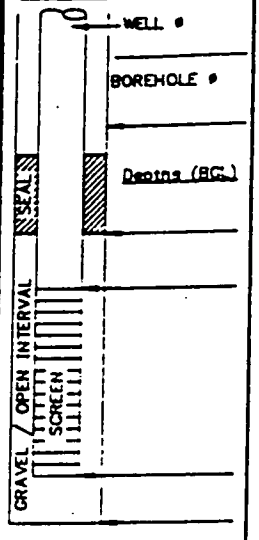
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

METHOD OF INDUCING WATER LEVEL CHANGE: BAILER PAGE 1 OF

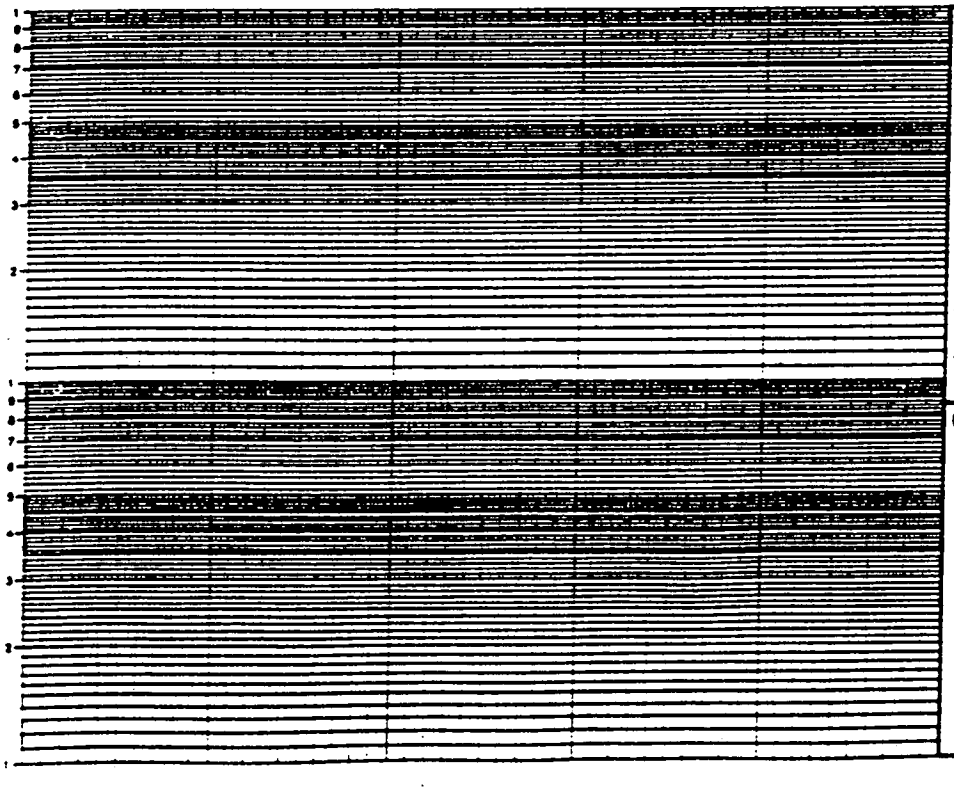
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0					
15					
30					
45					
60					
1.5					
2.0					
2.5					
3.0					
3.5					
4.0					
4.5					

WELL SCHEMATIC



▽ Indicate SWL Depth on Drawing



REMARKS:

Fast Rec.
Small Volume Water
How do we do it
- Ask LEE!

CALCS, SKETCH MAPS, ETC.:

SE2000
Environmental Logger
12/04 08:38

Unit# 0 Test 1

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	0.685
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	-0.142
Delay mSEC	50.000

2LMW 30F
RISING HEAD TEST

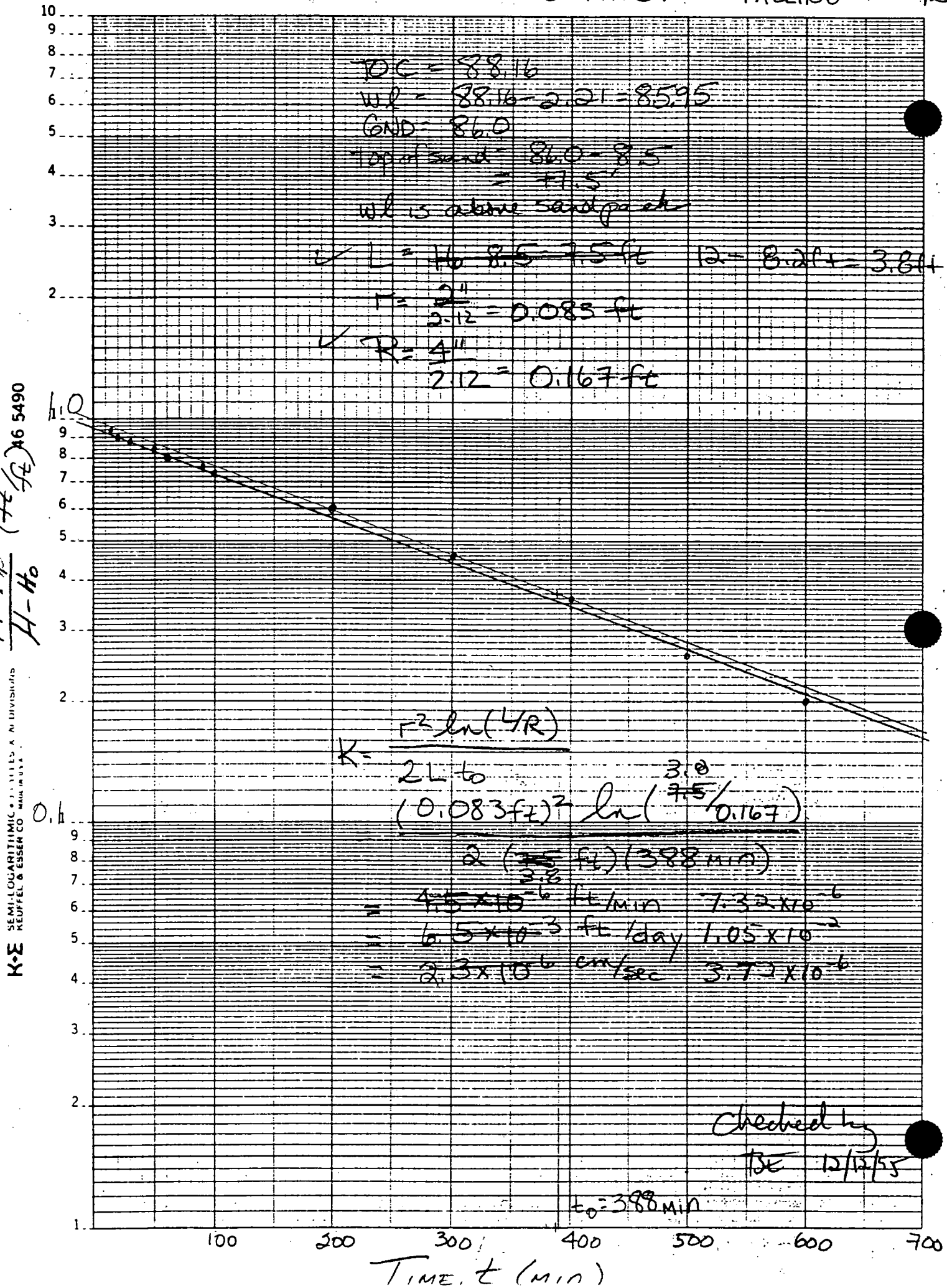
Step 0 12/02 11:37:47

Elapsed Time	INPUT 1
0.0000	0.015
0.0083	0.015
0.0166	0.015
0.0250	0.430 ← START
0.0333	0.287
0.0416	0.207
0.0500	0.175
0.0583	0.158
0.0666	0.127
0.0750	0.143
0.0833	0.143
0.0916	0.143
0.1000	0.143
0.1083	0.143
0.1166	0.143
0.1250	0.143
0.1333	0.143
0.1416	0.143
0.1500	0.143
0.1583	0.143
0.1666	0.143
0.1750	0.143
0.1833	0.143
0.1916	0.143
0.2000	0.143
0.2083	0.143
0.2166	0.143
0.2250	0.143
0.2333	0.143
0.2416	0.143
0.2500	0.143
0.2583	0.143
0.2666	0.143
0.2750	0.143
0.2833	0.143
0.2916	0.143

0.3083	0.143
0.3166	0.143
0.3250	0.143
0.3333	0.143
0.3500	0.143
0.3666	0.143
0.3833	0.143
0.4000	0.143
0.4166	0.143
0.4333	0.143
0.4500	0.143
0.4666	0.143
0.4833	0.127
0.5000	0.143
0.5166	0.143
0.5333	0.143
0.5500	0.143
0.5666	0.143
0.5833	0.143
0.6000	0.143
0.6166	0.143
0.6333	0.143
0.6500	0.143
0.6666	0.143
0.6833	0.143
0.7000	0.143
0.7166	0.143
0.7333	0.143
0.7500	0.143
0.7666	0.143
0.7833	0.143
0.8000	0.143
0.8166	0.143
0.8333	0.143
0.8500	0.143
0.8666	0.143
0.8833	0.143
0.9000	0.143
0.9166	0.143
0.9333	0.143
0.9500	0.143
0.9666	0.143
0.9833	0.143
1.0000	0.143
1.2000	0.143
1.4000	0.143
1.6000	0.143
1.8000	0.143
2.0000	0.143
2.2000	0.143
2.4000	0.143
2.6000	0.143
2.8000	0.143
3.0000	0.143
3.2000	0.143
3.4000	0.143
3.6000	0.143

END

2LMW31DS FALLING 42



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HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: AREA A LANDFILL STUDY WELL/BORING NO.: 2LMW31DS

PROJECT NO.: 5082 GEOLOGIST: CONTI

WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: ? TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 2.21 (TPVC) 14.54 TD DATE: 11-18-95

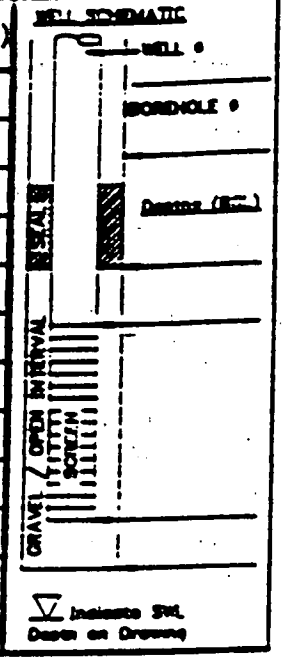
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:

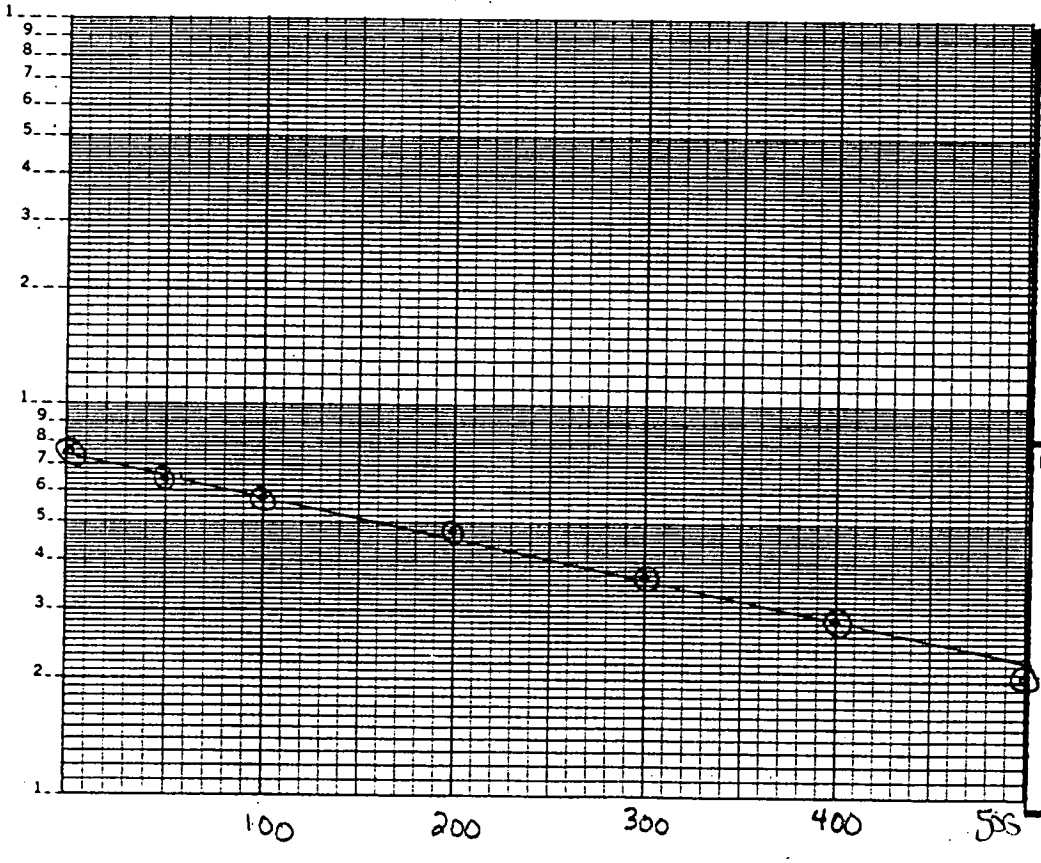
METHOD OF INDUCING WATER LEVEL CHANGE: 2" SLUG PAGE 1 OF

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.60	1.0		400	0.36	
2.2	0.98		500	0.26	
7.6	0.96		600	0.20	
12	0.94				
20	0.90				
30	0.88				
50	0.84				
60	0.80				
90	0.76				
100	0.74				
200	0.60				
300	0.46				

WELL SCHEMATIC





REMARKS:

XDC 9.000

CALCS.SKETCH MAPS, ETC.:

SE2000
Environmental Logger
11/19 08:14

Unit# 0 Test 0

INPUT 1: Level (F)

Reference	0.000
PSI at Ref.	3.898
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	0.142
Delay mSEC	50.000

2LMW31DS
FALLING HEAD
W/ 50 PSI XD

Step 0 11/18 10:10:57

Elapsed Time	INPUT 1
0.0000	0.814
0.0083	0.973
0.0166	0.494
0.0250	0.893
0.0333	0.766
0.0416	0.750
0.0500	0.798
0.0583	0.766
0.0666	0.782
0.0750	0.798
0.0833	0.750
0.0916	0.782
0.1000	0.766
0.1083	0.782
0.1166	0.766
0.1250	0.766
0.1333	0.782
0.1416	0.782
0.1500	0.766
0.1583	0.766
0.1666	0.766
0.1750	0.766
0.1833	0.766
0.1916	0.766
0.2000	0.766
0.2083	0.766
0.2166	0.766
0.2250	0.766
0.2333	0.766
0.2416	0.766
0.2500	0.766
0.2583	0.766
0.2666	0.766
0.2750	0.766
0.2833	0.766

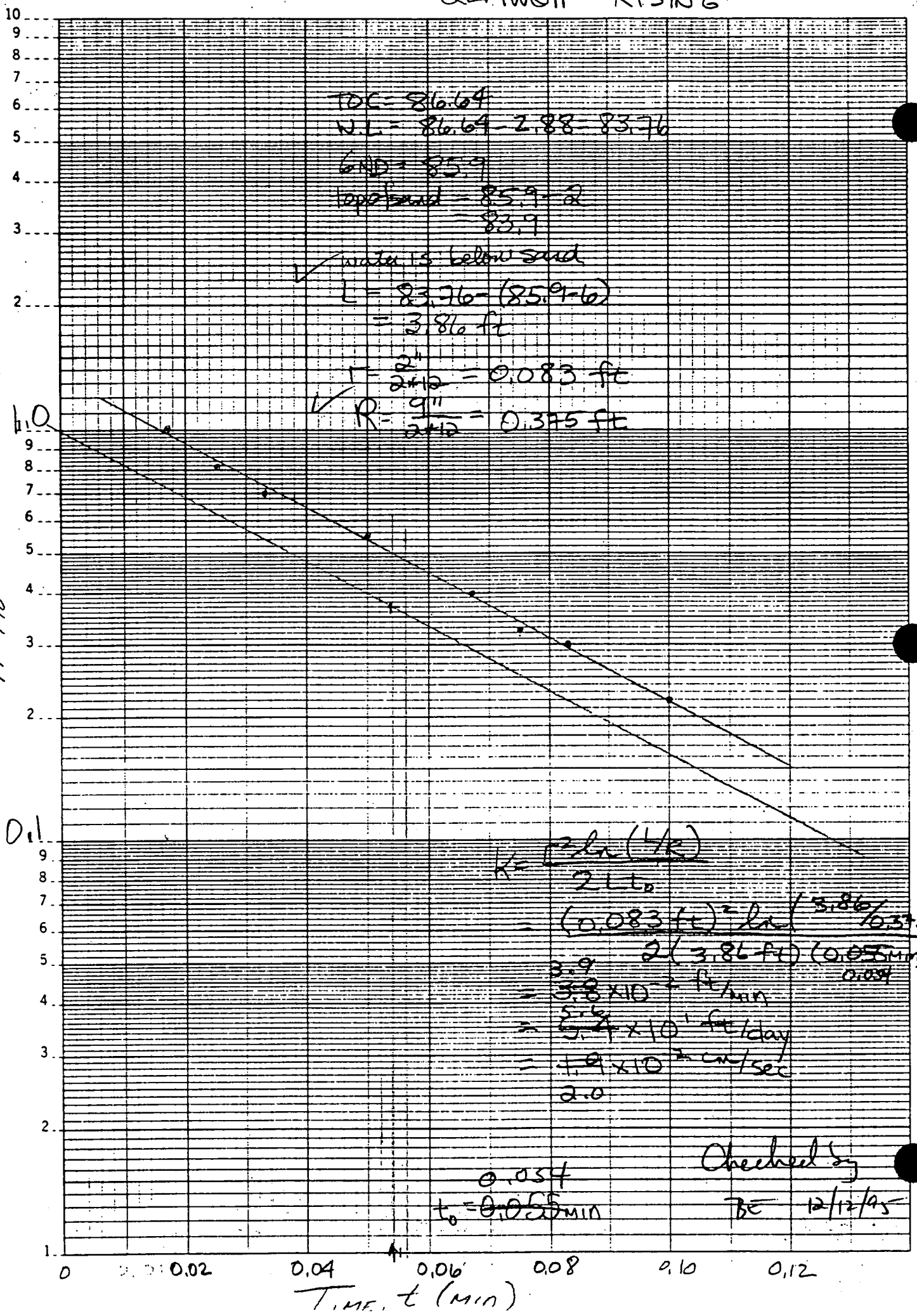
0.3000	0.766
0.3083	0.766
0.3166	0.766
0.3250	0.766
0.3333	0.766
0.3500	0.766
0.3666	0.766
0.3833	0.766
0.4000	0.782
0.4166	0.782
0.4333	0.782
0.4500	0.782
0.4666	0.782
0.4833	0.782
0.5000	0.782
0.5166	0.782
0.5333	0.782
0.5500	0.782
0.5666	0.782
0.5833	0.798
0.6000	0.798 START HERE
0.6166	0.798
0.6333	0.798
0.6500	0.798
0.6666	0.798
0.6833	0.798
0.7000	0.798
0.7166	0.798
0.7333	0.798
0.7500	0.798
0.7666	0.798
0.7833	0.798
0.8000	0.798
0.8166	0.798
0.8333	0.798
0.8500	0.798
0.8666	0.798
0.8833	0.798
0.9000	0.798
0.9166	0.798
0.9333	0.798
0.9500	0.798
0.9666	0.798
0.9833	0.798
1.0000	0.798
1.2000	0.798
1.4000	0.798
1.6000	0.798
1.8000	0.798
2.0000	0.798
2.2000	0.782
2.4000	0.782
2.6000	0.798
2.8000	0.798
3.0000	0.782
3.2000	0.798
3.4000	0.782
3.6000	0.782
3.8000	0.782
4.0000	0.782
4.2000	0.782
4.4000	0.782
4.6000	0.782
4.8000	0.782
5.0000	0.782

5.4000	0.782
5.6000	0.782
5.8000	0.782
6.0000	0.782
6.2000	0.782
6.4000	0.782
6.6000	0.782
6.8000	0.782
7.0000	0.782
7.2000	0.782
7.4000	0.782
7.6000	0.766
7.8000	0.766
8.0000	0.766
8.2000	0.766
8.4000	0.766
8.6000	0.766
8.8000	0.782
9.0000	0.766
9.2000	0.766
9.4000	0.766
9.6000	0.766
9.8000	0.766
10.0000	0.766
12.0000	0.750
14.0000	0.734
16.0000	0.734
18.0000	0.718
20.0000	0.718
22.0000	0.718
24.0000	0.718
26.0000	0.702
28.0000	0.702
30.0000	0.702
32.0000	0.686
34.0000	0.686
36.0000	0.686
38.0000	0.686
40.0000	0.686
42.0000	0.670
44.0000	0.670
46.0000	0.670
48.0000	0.670
50.0000	0.670
52.0000	0.654
54.0000	0.654
56.0000	0.654
58.0000	0.638
60.0000	0.638
62.0000	0.638
64.0000	0.638
66.0000	0.638
68.0000	0.638
70.0000	0.638
72.0000	0.654
74.0000	0.654
76.0000	0.622
78.0000	0.622
80.0000	0.622
82.0000	0.606
84.0000	0.606
86.0000	0.606
88.0000	0.606
90.0000	0.606
92.0000	0.606

96.0000	0.590
98.0000	0.590
100.000	0.590
120.000	0.558
140.000	0.526
160.000	0.510
180.000	0.494
200.000	0.478
220.000	0.446
240.000	0.430
260.000	0.399
280.000	0.383
300.000	0.367
320.000	0.351
340.000	0.351
360.000	0.319
380.000	0.303
400.000	0.287
420.000	0.271
440.000	0.255
460.000	0.239
480.000	0.223
500.000	0.207
520.000	0.207
540.000	0.191
560.000	0.175
580.000	0.159
600.000	0.159
620.000	0.143
640.000	0.143
660.000	0.127
680.000	0.111
700.000	0.111
720.000	0.095
740.000	0.095
760.000	0.079
780.000	0.079
800.000	0.063
820.000	0.063
840.000	0.063
860.000	0.047
880.000	0.047
900.000	0.047
920.000	0.047
940.000	0.031
960.000	0.031
980.000	0.031
1000.00	0.015
1030.00	0.015
1060.00	0.015
1090.00	0.000
1120.00	0.000
1150.00	0.000
1180.00	0.000
1210.00	-0.015
1240.00	-0.015
1270.00	-0.015
1300.00	-0.031

END

2LMW31F RISING



HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILL STUDY WELL/BORING NO.: 2LMW31F

PROJECT NO.: 5082 GEOLOGIST: CONTI

WELL DIAMETER: 2" Φ SCREEN LENGTH/DEPTH: TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 2.88' (TPVC) DATE: 11-18-95

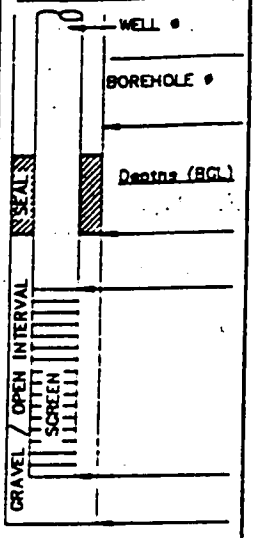
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

METHOD OF INDUCING WATER LEVEL CHANGE: 1 SEC SLUG PAGE ___ OF ___

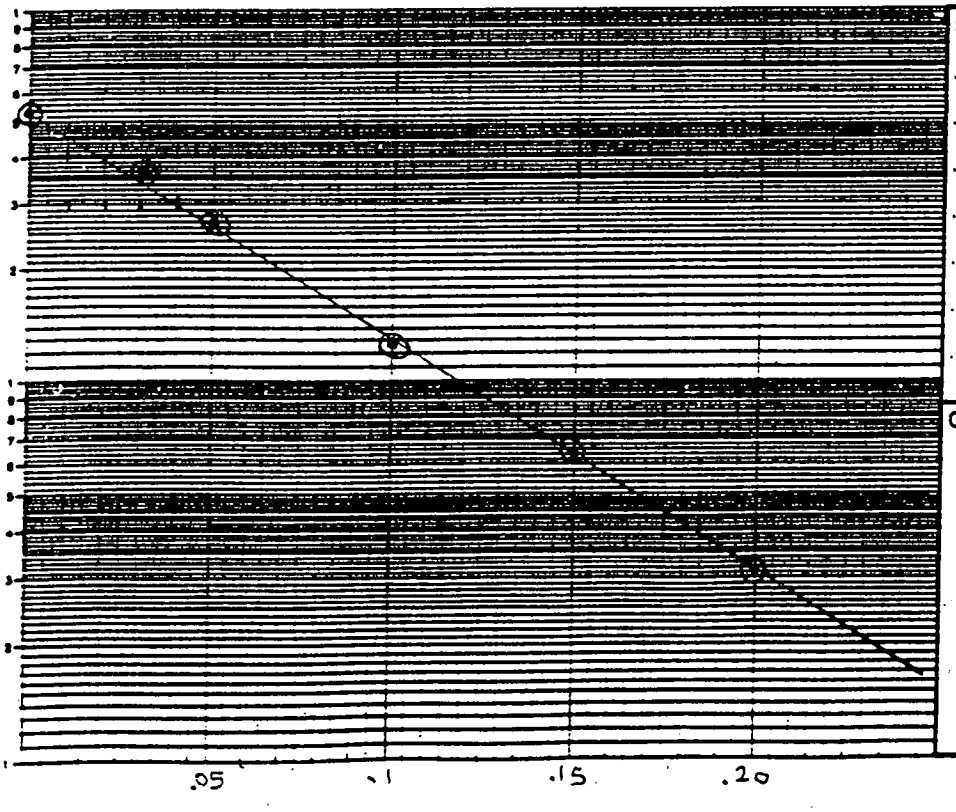
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): T PVC (2" Φ)

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.0166	1.0				
0.025	0.82				
0.033	0.698				
0.05	0.515				
0.0666	0.394				
0.075	0.333				
0.0833	0.303				
0.1	0.241				

WELL SCHEMATIC



▽ Indicate SWL Depth on Drawing



REMARKS:

3.485 XD Prior to Slug Insertion

CALCS, SKETCH MAPS, ETC.:

SE2000
Environmental Logger
11/18 09:47

Unit# 0 Test 0

INPUT 1: Level (F)

Reference	0.000
PSI at Ref.	1.511
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	0.142
Delay mSEC	50.000

Step 0 11/18 09:39:47

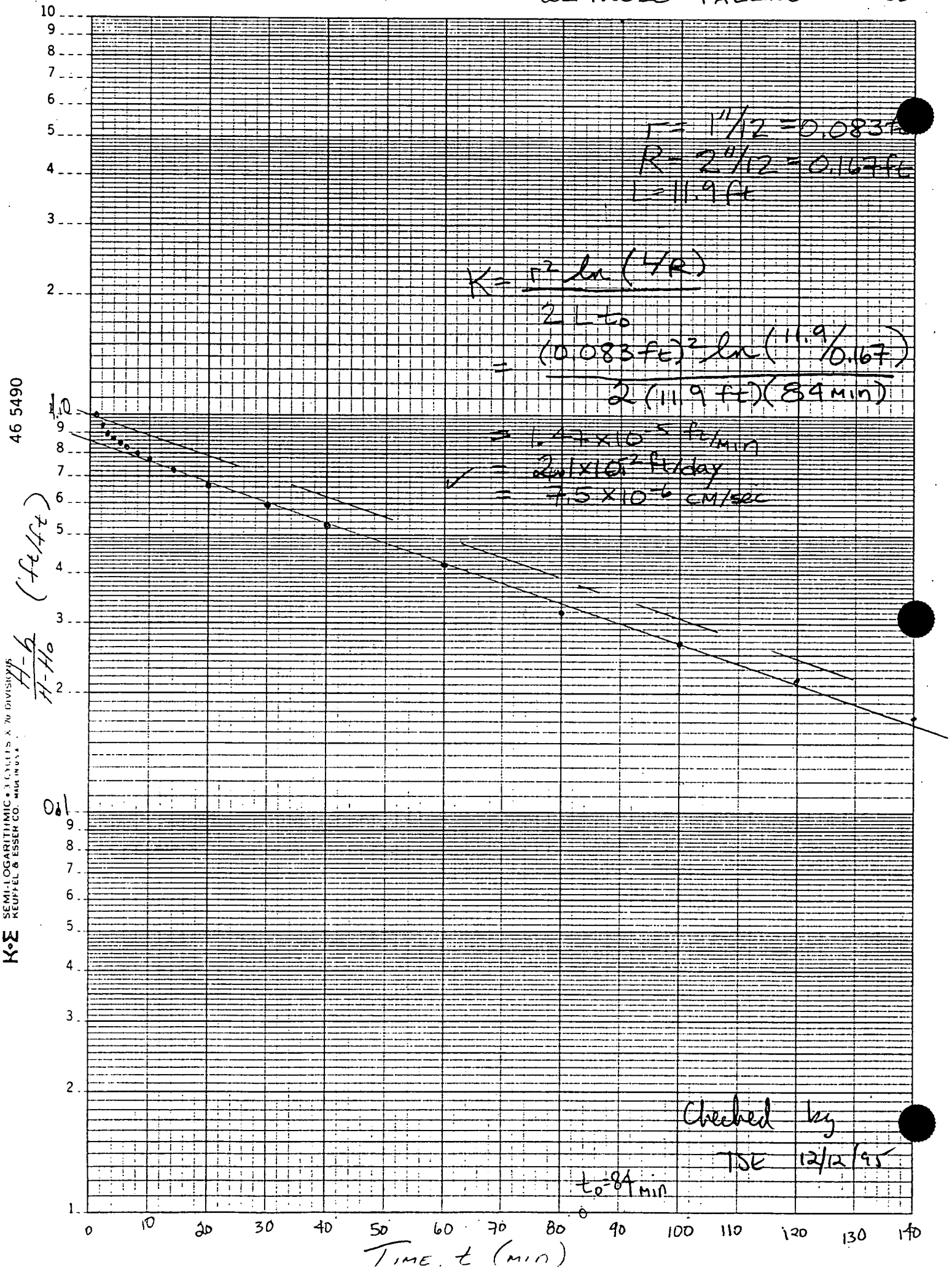
Elapsed Time	INPUT 1
0.0000	-0.031
0.0083	-0.526
0.0166	-0.526
0.0250	-0.430
0.0333	-0.367
0.0416	-0.319
0.0500	-0.271
0.0583	-0.239
0.0666	-0.207
0.0750	-0.175
0.0833	-0.159
0.0916	-0.143
0.1000	-0.127
0.1083	-0.111
0.1166	-0.111
0.1250	-0.095
0.1333	-0.079
0.1416	-0.063
0.1500	-0.063
0.1583	-0.063
0.1666	-0.047
0.1750	-0.047
0.1833	-0.047
0.1916	-0.047
0.2000	-0.031
0.2083	-0.031
0.2166	-0.031
0.2250	-0.031
0.2333	-0.031
0.2416	-0.031
0.2500	-0.031
0.2583	-0.031
0.2666	-0.031
0.2750	-0.031
0.2833	-0.015
0.2916	-0.031
0.3000	-0.015
0.3083	-0.015

2L MW 31 F
RISING HEAD TEST
ok

0.3250	-0.015
0.3333	-0.015
0.3500	-0.015
0.3666	-0.015
0.3833	-0.015
0.4000	-0.015
0.4166	-0.015
0.4333	-0.015
0.4500	-0.015
0.4666	-0.015
0.4833	-0.015
0.5000	-0.015
0.5166	-0.015
0.5333	-0.015
0.5500	-0.015
0.5666	-0.015
0.5833	-0.015
0.6000	-0.015
0.6166	-0.015
0.6333	-0.015
0.6500	-0.015
0.6666	-0.015
0.6833	-0.015
0.7000	-0.015
0.7166	-0.015
0.7333	-0.015
0.7500	-0.015
0.7666	-0.015
0.7833	-0.015
0.8000	-0.015
0.8166	-0.015
0.8333	-0.015
0.8500	-0.015
0.8666	-0.015
0.8833	-0.015
0.9000	-0.015
0.9166	-0.015
0.9333	-0.015
0.9500	-0.015
0.9666	-0.015
0.9833	-0.015
1.0000	-0.015
1.2000	-0.015
1.4000	-0.015
1.6000	-0.015
1.8000	-0.015
2.0000	0.000
2.2000	-0.015
2.4000	-0.015
2.6000	-0.015
2.8000	-0.015
3.0000	-0.015
3.2000	-0.015
3.4000	-0.015
3.6000	-0.015
3.8000	0.000
4.0000	-0.015
4.2000	0.000
4.4000	-0.015
4.6000	0.000
4.8000	-0.015
5.0000	-0.015
5.2000	-0.015

END

2LMW32B FALLING 52



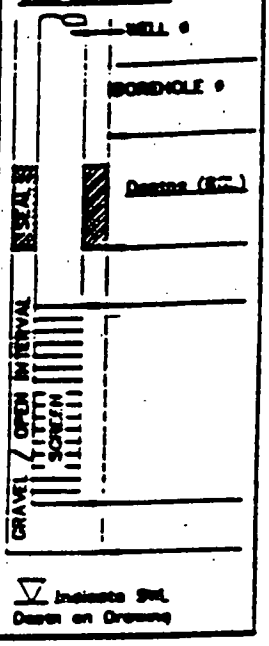
HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

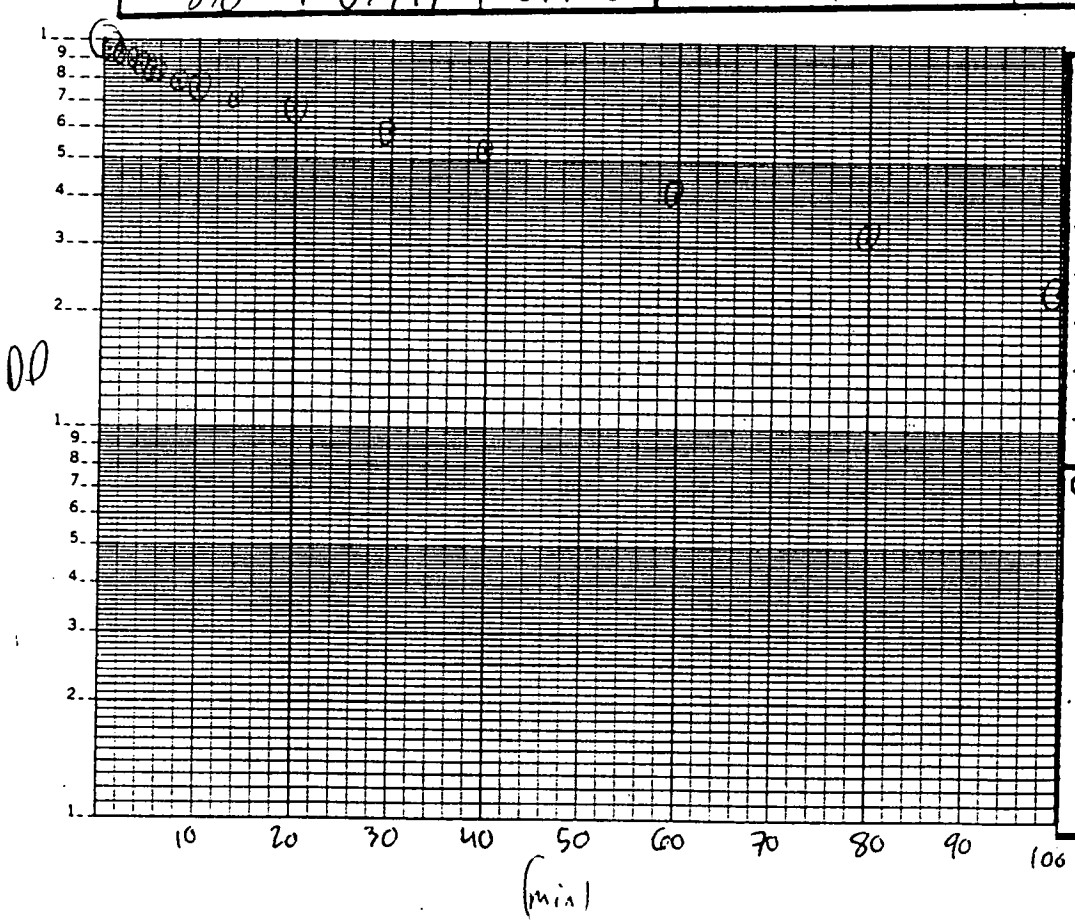
Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: 2LMW 32B
PROJECT NO.: 5082 GEOLOGIST: MARSHALL
WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 2
STATIC WATER LEVEL (Depth/Elevation): 9.47 DATE: 11/29/95
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: 7', 1" ϕ SLUG PAGE ___ OF ___
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet) %	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet) %	DRAWDOWN OR HEAD (ΔH) (feet)
0.0000	—	0.0000	10	0.775	2.679
1.0000	1.000	3.456	14	0.725	2.507
1.2000	0.967	3.341	20	0.670	2.316
1.400	0.961	3.322	30	0.595	2.055
1.60	0.952	3.290	40	0.530	1.832
1.80	0.945	3.265	60	0.420	1.450
2.0	0.939	3.246	80	0.341	1.177
3.0	0.902	3.119	100	0.265	0.916
4.0	0.873	3.017	120	0.217	0.750
5.0	0.851	2.940	140	0.173	0.598
6.0	0.830	2.870	160	0.136	0.470
8.0	0.799	2.762			

WELL SCHEMATIC





REMARKS:

XD @ 25' Depth
Slug Bottom @ 20'

CALCS, SKETCH MAPS, ETC.:

SE1000C
Environmental Logger
11/30 09:46

Unit# 00145 Test 2

INPUT 1: Level (F)

Reference	0.000
Linearity	0.120
Scale factor	20.110
Offset	0.000
Delay mSEC	50.000

Step 0 11/29 16:20:04

2LMW32B
FALLING HEAD TEST

Elapsed Time	INPUT 1
0.0000	0.000
0.0033	0.254
0.0066	0.362
0.0100	0.426
0.0133	0.776
0.0166	1.081
0.0200	2.049
0.0233	1.890
0.0266	2.705
0.0300	3.131
0.0333	2.717
0.0366	3.641
0.0400	3.603
0.0433	3.940
0.0466	3.934
0.0500	3.940
0.0533	3.940
0.0566	4.074
0.0600	3.838
0.0633	3.997
0.0666	3.978
0.0700	4.182
0.0733	3.966
0.0766	3.889
0.0800	3.501
0.0833	3.048
0.0866	3.896
0.0900	3.857
0.0933	3.456
0.0966	2.883
0.1000	3.660
0.1033	3.660
0.1066	3.698
0.1100	4.093
0.1133	2.927
0.1166	3.997
0.1200	3.711
0.1233	3.692

Irratic

0.1333	3.724
0.1366	3.730
0.1400	3.736
0.1433	3.736
0.1466	3.730
0.1500	3.730
0.1533	3.743
0.1566	3.743
0.1600	3.736
0.1633	3.749
0.1666	3.743
0.1700	3.749
0.1733	3.768
0.1766	3.736
0.1800	3.724
0.1833	3.698
0.1866	3.558
0.1900	3.889
0.1933	3.832
0.1966	3.794
0.2000	3.787
0.2033	3.781
0.2066	3.787
0.2100	3.794
0.2133	3.794
0.2166	3.762
0.2200	3.774
0.2233	3.787
0.2266	3.755
0.2300	3.787
0.2333	3.806
0.2366	3.819
0.2400	3.819
0.2433	3.825
0.2466	3.832
0.2500	3.825
0.2533	3.838
0.2566	3.883
0.2600	3.870
0.2633	3.883
0.2666	3.991
0.2700	3.921
0.2733	3.583
0.2766	3.692
0.2800	3.876
0.2833	3.883
0.2866	3.876
0.2900	3.857
0.2933	3.749
0.2966	3.864
0.3000	3.876
0.3033	3.883
0.3066	3.883
0.3100	3.876
0.3133	3.876
0.3166	3.883
0.3200	3.940
0.3233	3.876
0.3266	3.870
0.3300	3.883
0.3333	3.883
0.3500	3.405
0.3666	3.335
0.3833	3.335

0.4333	3.303
0.4500	3.310
0.4666	3.246
0.4833	3.227
0.5000	3.310
0.5166	3.246
0.5333	3.341
0.5500	3.329
0.5666	3.354
0.5833	3.348
0.6000	3.367
0.6166	3.348
0.6333	3.354
0.6500	3.367
0.6666	3.367
0.6833	3.367
0.7000	3.373
0.7166	3.367
0.7333	3.386
0.7500	3.380
0.7666	3.392
0.7833	3.399
0.8000	3.405
0.8166	3.405
0.8333	3.405
0.8500	3.418
0.8666	3.418
0.8833	3.424
0.9000	3.431
0.9166	3.443
0.9333	3.437
0.9500	3.443
0.9666	3.450
0.9833	3.456
1.0000	3.456
1.2000	3.341
1.4000	3.322
1.6000	3.290
1.8000	3.265
2.0000	3.246
2.2000	3.220
2.4000	3.195
2.6000	3.163
2.8000	3.138
3.0000	3.119
3.2000	3.093
3.4000	3.080
3.6000	3.055
3.8000	3.036
4.0000	3.017
4.2000	2.998
4.4000	2.978
4.6000	2.966
4.8000	2.947
5.0000	2.940
5.2000	2.915
5.4000	2.902
5.6000	2.896
5.8000	2.883
6.0000	2.870
6.2000	2.857
6.4000	2.845
6.6000	2.838
6.8000	2.819

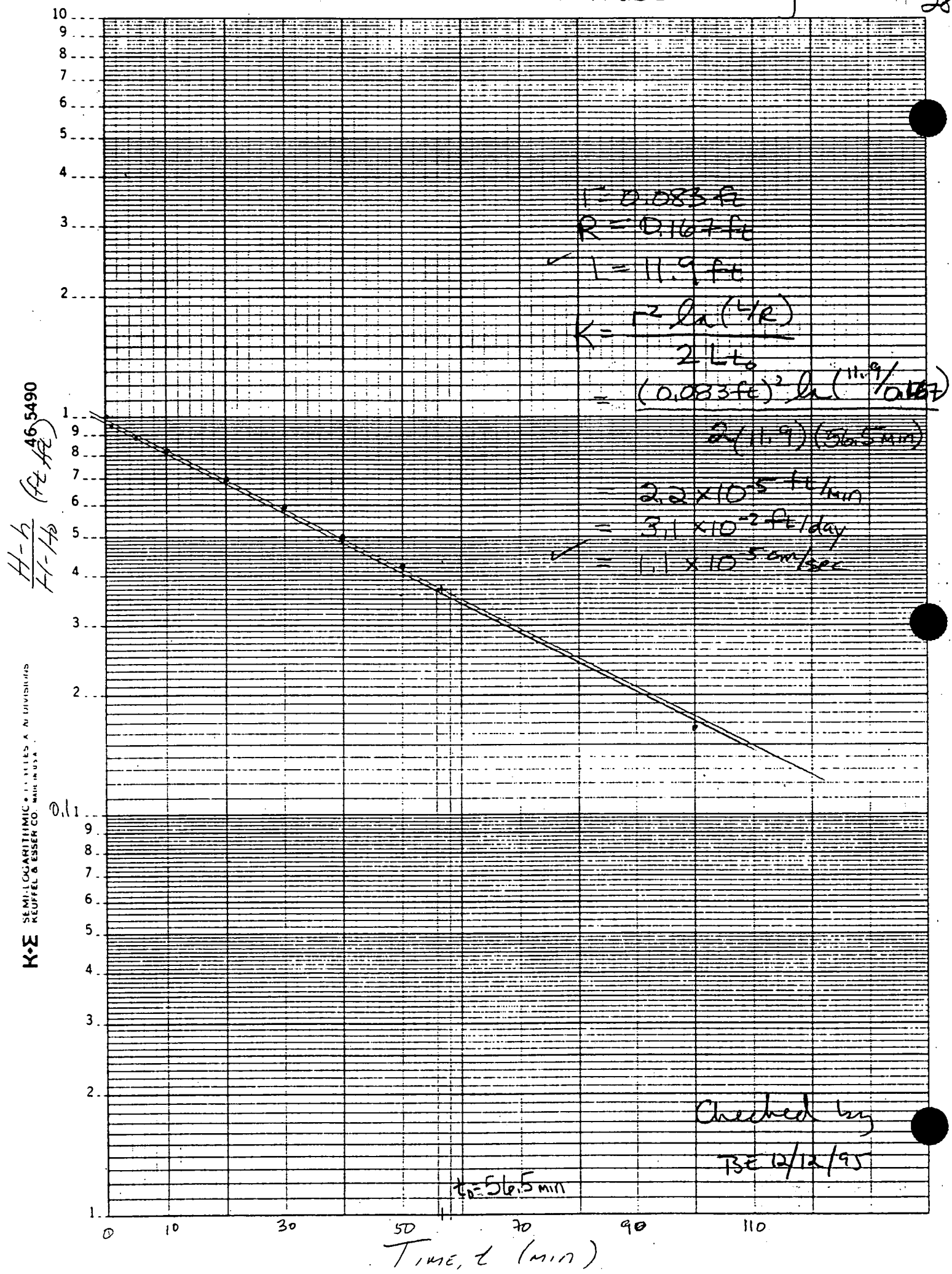
Start Here

Steady

7.4000	2.794
7.6000	2.781
7.8000	2.768
8.0000	2.762
8.2000	2.743
8.4000	2.736
8.6000	2.730
8.8000	2.724
9.0000	2.717
9.2000	2.705
9.4000	2.698
9.6000	2.686
9.8000	2.679
10.0000	2.679
12.0000	2.584
14.0000	2.507
16.0000	2.431
18.0000	2.361
20.0000	2.316
22.0000	2.253
24.0000	2.195
26.0000	2.144
28.0000	2.100
30.0000	2.055
32.0000	1.998
34.0000	1.960
36.0000	1.909
38.0000	1.864
40.0000	1.832
42.0000	1.788
44.0000	1.743
46.0000	1.705
48.0000	1.673
50.0000	1.629
52.0000	1.591
54.0000	1.552
56.0000	1.521
58.0000	1.482
60.0000	1.450
62.0000	1.412
64.0000	1.393
66.0000	1.361
68.0000	1.323
70.0000	1.298
72.0000	1.279
74.0000	1.247
76.0000	1.215
78.0000	1.183
80.0000	1.177
82.0000	1.139
84.0000	1.113
86.0000	1.088
88.0000	1.069
90.0000	1.043
92.0000	1.018
94.0000	0.992
96.0000	0.973
98.0000	0.948
100.000	0.916
110.000	0.827
120.000	0.750
130.000	0.668
140.000	0.598
150.000	0.528
[illegible]	0.470

2LMW32B falling

58



$r = 0.083$ ft

$R = 0.167$ ft

$L = 11.9$ ft

$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$$= \frac{(0.083\text{ ft})^2 \ln(11.9/0.167)}{2(11.9)(516.5\text{ min})}$$

$= 2.2 \times 10^{-5}$ ft/min

$= 3.1 \times 10^{-2}$ ft/day

$= 1.1 \times 10^{-5}$ cm/sec

Checked by

TJE 12/12/95

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: ZLMW32B

PROJECT NO.: 5082 GEOLOGIST: MARSHALL

WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 0

STATIC WATER LEVEL (Depth/Elevation): 9.49 DATE: 12/1/95

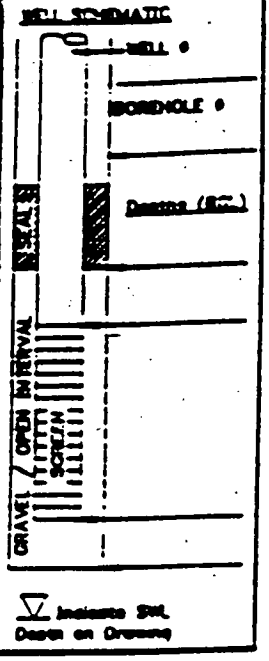
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:

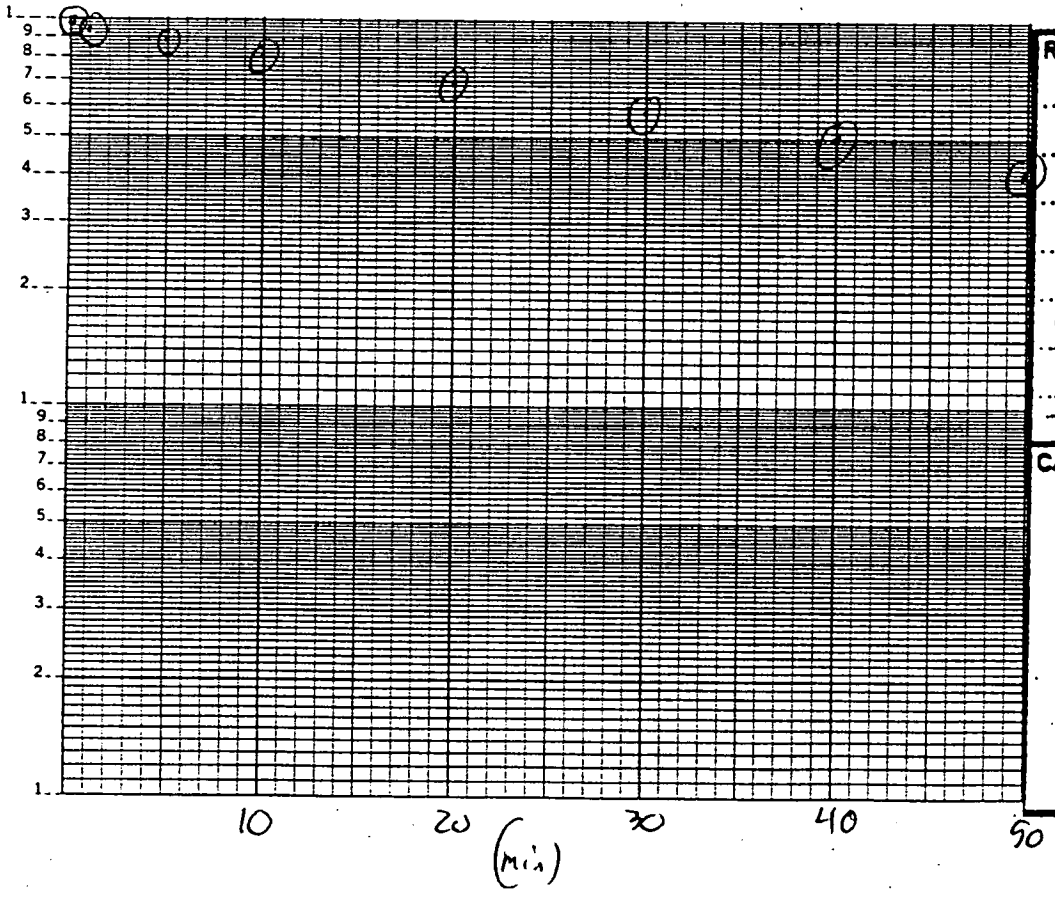
METHOD OF INDUCING WATER LEVEL CHANGE: 7' 1" ø SLUG PAGE ___ OF ___

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL % (feet)	D.F.	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)		DRAWDOWN OR HEAD (ΔH) (feet)
0.0000	0.0000		~~0.000~~ 12.944	100	0.165	0.479	-13.423
0.200	1.00	2.906	-15.850	200	—	—	-12.833
0.300	.972	2.826	-15.770				
0.400	.967	2.810	-15.754				
0.600	.961	2.794	-15.738				
1.00	.950	2.762	-15.706				
5.00	.890	2.587	-15.531				
10.0	.817	2.374	-15.323				
20	.692	2.012	-14.956				
30	.588	1.709	-14.653				
40	.500	1.453	-14.397				
50	.423	1.230	-14.174				

WELL SCHEMATIC





REMARKS:

XD @ 25' Depth
SLUG Bottom @ 20' Depth

-NOT REF. TO ZERO

CALCS, SKETCH MAPS, ETC.:

SE2000
Environmental Logger
12/04 08:35

Unit# 0 Test 0

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	0.865
SG	1.000
Linearity	0.113
Scale factor	50.817
Offset	-0.142
Delay mSEC	50.000

Step 0 12/01 13:27:14

Elapsed Time	INPUT 1
0.0000	-12.944
0.0083	-12.944
0.0166	-12.928
0.0250	-12.944
0.0333	-14.701
0.0416	-15:116
0.0500	-15.850
0.0583	-16.489
0.0666	-16.154
0.0750	-16.201
0.0833	-15.930
0.0916	-15.068
0.1000	-15.611
0.1083	-15.946
0.1166	-15.914
0.1250	-15.834
0.1333	-15.818
0.1416	-15.754
0.1500	-15.675
0.1583	-15.722
0.1666	-15.754
0.1750	-15.770
0.1833	-15.786
0.1916	-15.802
0.2000	-15.850 ← Start Here
0.2083	-15.834
0.2166	-15.786
0.2250	-15.786
0.2333	-15.786
0.2416	-15.770
0.2500	-15.770
0.2583	-15.770
0.2666	-15.770
0.2750	-15.770
0.2833	-15.770

2LMW 32B
FALLING HEAD TEST

-Not Referenced to Zero

0.3083	-15.754
0.3166	-15.770
0.3250	-15.754
0.3333	-15.754
0.3500	-15.770
0.3666	-15.754
0.3833	-15.754
0.4000	-15.754
0.4166	-15.754
0.4333	-15.754
0.4500	-15.754
0.4666	-15.754
0.4833	-15.754
0.5000	-15.754
0.5166	-15.738
0.5333	-15.738
0.5500	-15.738
0.5666	-15.786
0.5833	-15.754
0.6000	-15.738
0.6166	-15.738
0.6333	-15.738
0.6500	-15.738
0.6666	-15.738
0.6833	-15.738
0.7000	-15.738
0.7166	-15.738
0.7333	-15.722
0.7500	-15.738
0.7666	-15.722
0.7833	-15.722
0.8000	-15.722
0.8166	-15.722
0.8333	-15.722
0.8500	-15.722
0.8666	-15.722
0.8833	-15.722
0.9000	-15.722
0.9166	-15.722
0.9333	-15.722
0.9500	-15.722
0.9666	-15.722
0.9833	-15.722
1.0000	-15.706
1.2000	-15.706
1.4000	-15.706
1.6000	-15.691
1.8000	-15.659
2.0000	-15.659
2.2000	-15.643
2.4000	-15.627
2.6000	-15.627
2.8000	-15.611
3.0000	-15.611
3.2000	-15.595
3.4000	-15.595
3.6000	-15.579
3.8000	-15.579
4.0000	-15.563
4.2000	-15.563
4.4000	-15.547
4.6000	-15.547
4.8000	-15.531
5.0000	-15.531

5.6000	-15.499
5.8000	-15.499
6.0000	-15.483
6.2000	-15.467
6.4000	-15.467
6.6000	-15.451
6.8000	-15.451
7.0000	-15.435
7.2000	-15.435
7.4000	-15.419
7.6000	-15.419
7.8000	-15.403
8.0000	-15.403
8.2000	-15.387
8.4000	-15.387
8.6000	-15.371
8.8000	-15.371
9.0000	-15.355
9.2000	-15.355
9.4000	-15.339
9.6000	-15.339
9.8000	-15.323
10.0000	-15.323
12.0000	-15.243
14.0000	-15.164
16.0000	-15.100
18.0000	-15.036
20.0000	-14.956
22.0000	-14.892
24.0000	-14.828
26.0000	-14.780
28.0000	-14.717
30.0000	-14.653
32.0000	-14.605
34.0000	-14.541
36.0000	-14.493
38.0000	-14.445
40.0000	-14.397
42.0000	-14.349
44.0000	-14.301
46.0000	-14.254
48.0000	-14.206
50.0000	-14.174
52.0000	-14.142
54.0000	-14.094
56.0000	-14.046
58.0000	-14.014
60.0000	-13.966
62.0000	-13.934
64.0000	-13.902
66.0000	-13.870
68.0000	-13.838
70.0000	-13.806
72.0000	-13.775
74.0000	-13.743
76.0000	-13.711
78.0000	-13.679
80.0000	-13.663
82.0000	-13.631
84.0000	-13.615
86.0000	-13.583
88.0000	-13.567
90.0000	-13.535
92.0000	-13.503

90.0000	-13.471
98.0000	-13.439
100.000	-13.423
110.000	-13.327
120.000	-13.248
130.000	-13.184
140.000	-13.104
150.000	-13.040
160.000	-12.992
170.000	-12.944
180.000	-12.896
190.000	-12.864
200.000	-12.833
210.000	-12.801
220.000	-12.769
230.000	-12.753
240.000	-12.737
250.000	-12.721
260.000	-12.705
270.000	-12.689
280.000	-12.673
290.000	-12.657
300.000	-12.657
310.000	-12.641
320.000	-12.625
330.000	-12.625
340.000	-12.625
350.000	-12.609
360.000	-12.609
370.000	-12.609
380.000	-12.593
390.000	-12.593
400.000	-12.593
410.000	-12.577
420.000	-12.577
430.000	-12.577
440.000	-12.577
450.000	-12.577
460.000	-12.577
470.000	-12.577
480.000	-12.577
490.000	-12.561
500.000	-12.561
510.000	-12.561
520.000	-12.561
530.000	-12.561
540.000	-12.561
550.000	-12.561
560.000	-12.545
570.000	-12.545
580.000	-12.545
590.000	-12.545
600.000	-12.545
610.000	-12.545
620.000	-12.545
630.000	-12.545
640.000	-12.545
650.000	-12.545
660.000	-12.545
670.000	-12.545
680.000	-12.545
690.000	-12.545
700.000	-12.545
710.000	-12.545
720.000	-12.545

740.000	-12.545
750.000	-12.545
760.000	-12.529
770.000	-12.529
780.000	-12.529
790.000	-12.529
800.000	-12.529
810.000	-12.529
820.000	-12.529
830.000	-12.529
840.000	-12.529
850.000	-12.529
860.000	-12.529
870.000	-12.513
880.000	-12.529
890.000	-12.513
900.000	-12.529
910.000	-12.513
920.000	-12.529
930.000	-12.513
940.000	-12.529
950.000	-12.529
960.000	-12.513
970.000	-12.513
980.000	-12.513
990.000	-12.513
1000.00	-12.513
1010.00	-12.513
1020.00	-12.513
1030.00	-12.513
1040.00	-12.513
1050.00	-12.513
1060.00	-12.513
1070.00	-12.513
1080.00	-12.497
1090.00	-12.497
1100.00	-12.497
1110.00	-12.497

END

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF

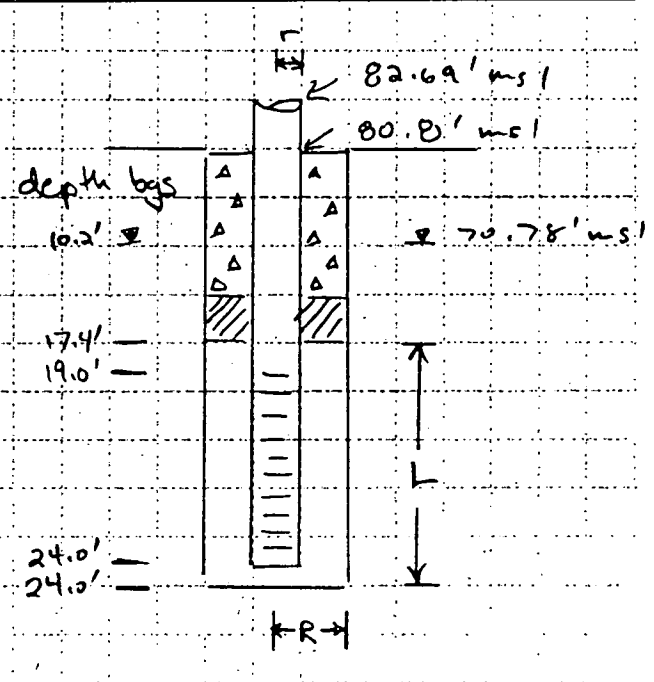
CLIENT	NSB - NLON	JOB NUMBER	~~0185~~ 5082
SUBJECT	CTU 203 Slug Tests.		
BASED ON	Hvorslev	DRAWING NUMBER	
BY T Evans	CHECKED BY 12/11/95	APPROVED BY	DATE

Well # 2LMW 32DS
Falling

$r = 1'' = 0.083$ ft
$R = 2'' = 0.167$ ft
$L = 6.6$ ft

$t_0 = 60$ min

$L/R > 8$



$\therefore$

$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$$K = \frac{(.083\text{ ft})^2 \ln(6.6\text{ ft}/.167\text{ ft})}{2(6.6\text{ ft})(60\text{ min})}$$

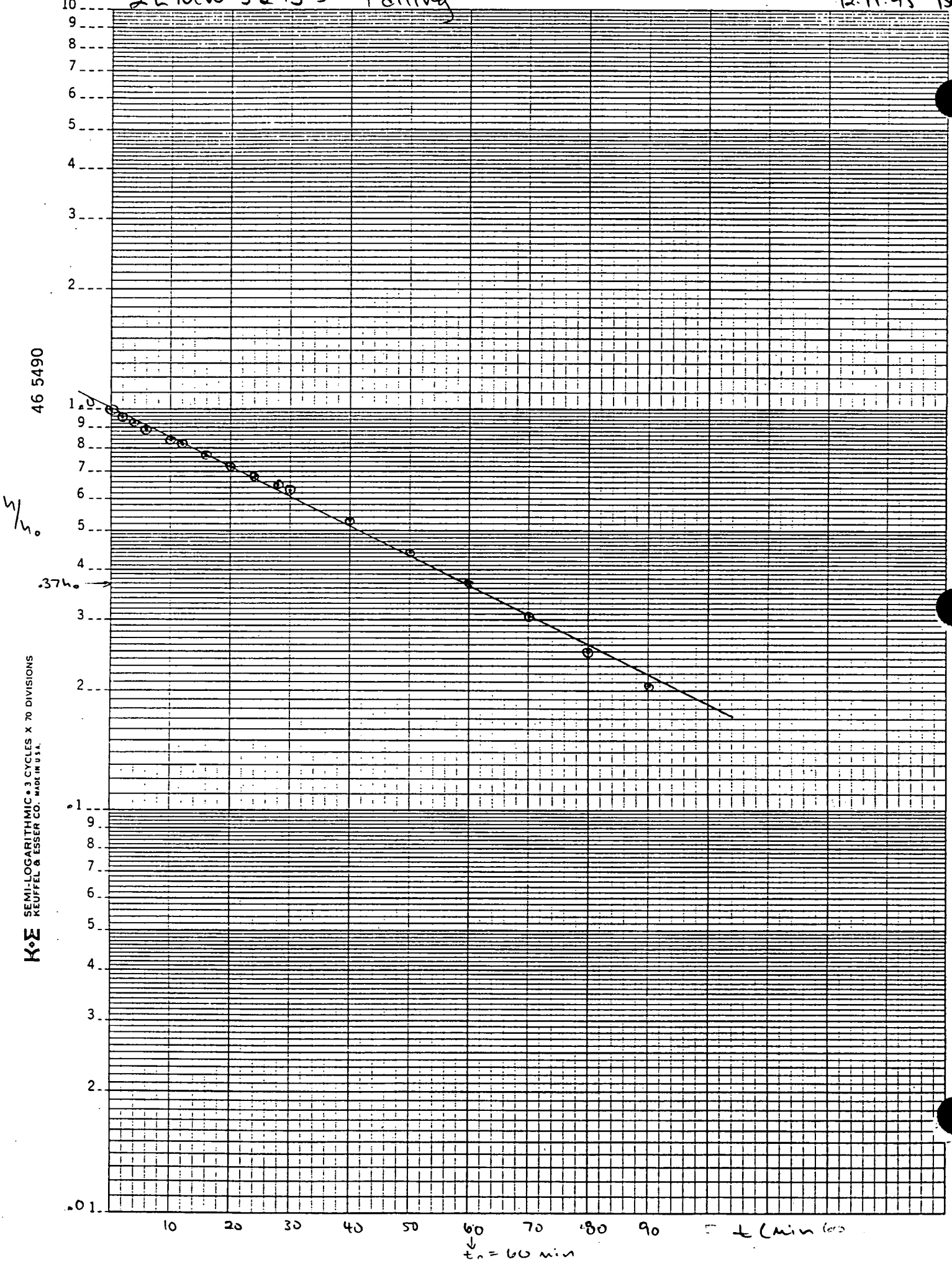
$K = 3.22 \times 10^{-5}$ ft/min $\times$ 1440 min/day

$K = 0.0464$ ft/day

$= 1.6 \times 10^{-5}$ cm/sec

2LMW32DS Falling

12.11.95 TSE



HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: ZUMW32DS

PROJECT NO.: 5082 GEOLOGIST: MARSHALL

WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 7

STATIC WATER LEVEL (Depth/Elevation): 11.91 DATE: 12/1/95

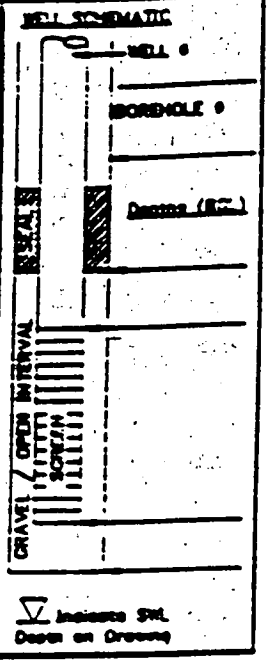
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:

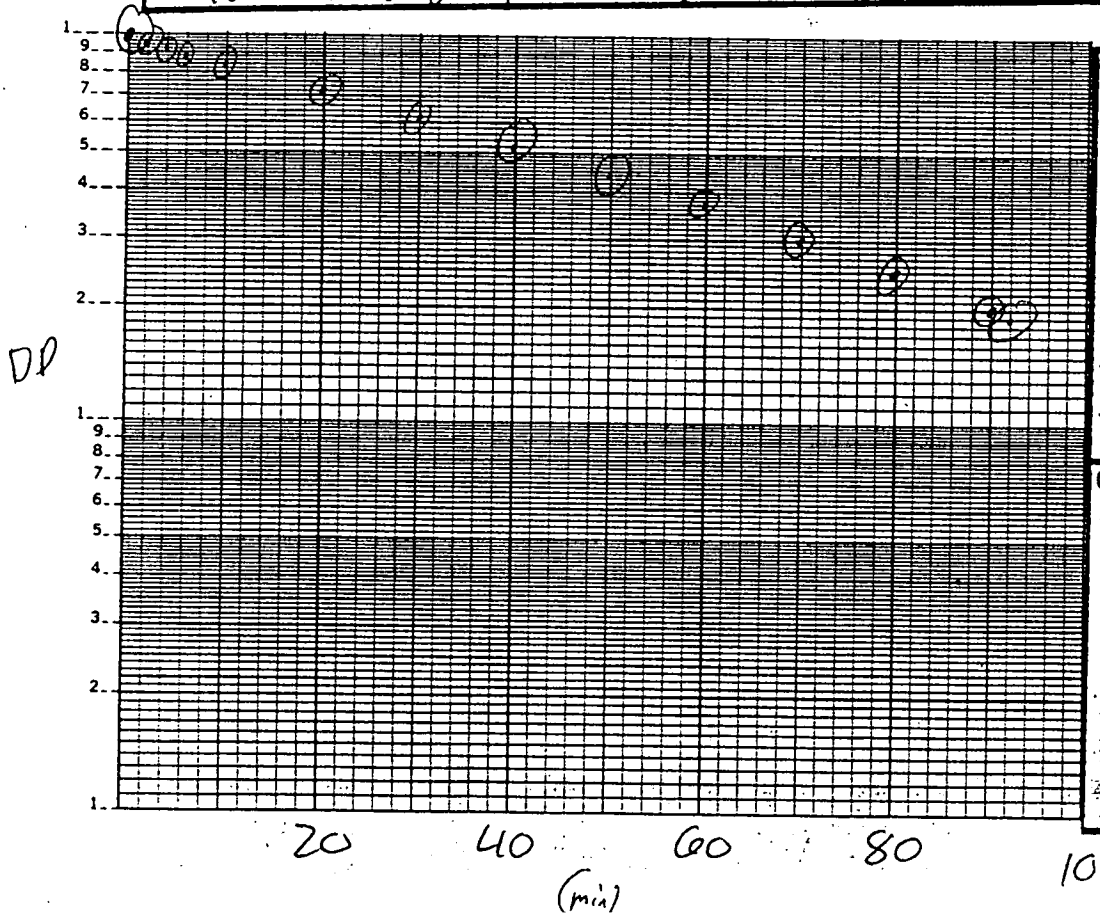
METHOD OF INDUCING WATER LEVEL CHANGE: 1"ϕ, 7' SLUG PAGE ___ OF ___

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.1333	1.000	-3.001	20	0.723	-2.171
0.1500	0.995	-2.985	30	0.617	-1.852
0.2250	0.989	-2.969	40	0.526	-1.580
0.500	0.984	-2.953	50	0.442	-1.325
0.800	0.979	-2.937	60	0.372	-1.117
1.20	0.973	-2.921	70	0.303	-0.910
2.00	0.958	-2.874	80	0.250	-0.750
3.00	0.942	-2.826	90	0.207	-0.622
4.00	0.926	-2.778	92	0.191	-0.574
5.00	0.910	-2.730			
6.0	0.899	-2.698			
10.0	0.840	-2.522			

WELL SCHEMATIC





REMARKS:

XD @ 25' Depth
SLUG Bottom @ 20' Depth

CALCS, SKETCH MAPS, ETC.:

SE2000
Environmental Logger
12/01 10:04

Unit# 0 Test 7

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	6.796
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	-0.142
Delay mSEC	50.000

2LMW32DS
FALLING HEAD TEST

Step 0 12/01 08:00:26

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	0.000
0.0166	-0.447
0.0250	-1.628
0.0333	-2.634
0.0416	-2.586
0.0500	-3.033
0.0583	-3.816
0.0666	-3.129
0.0750	-3.991
0.0833	-3.448
0.0916	0.542
0.1000	-3.560
0.1083	-3.177
0.1166	-2.985
0.1250	-2.985
0.1333	-3.001 ← START HERE
0.1416	-2.985
0.1500	-2.985
0.1583	-2.985
0.1666	-2.985
0.1750	-2.985
0.1833	-2.985
0.1916	-2.985
0.2000	-2.985
0.2083	-2.985

0.2333	-2.969
0.2416	-2.969
0.2500	-2.969
0.2583	-3.049
0.2666	-2.969
0.2750	-2.969
0.2833	-2.969
0.2916	-2.969
0.3000	-2.969
0.3083	-2.969
0.3166	-2.969
0.3250	-2.969
0.3333	-2.969
0.3500	-2.969
0.3666	-2.969
0.3833	-2.969
0.4000	-2.969
0.4166	-2.969
0.4333	-2.969
0.4500	-2.969
0.4666	-2.969
0.4833	-2.953
0.5000	-2.953 ← 0.834
0.5166	-2.969
0.5333	-2.953
0.5500	-2.953
0.5666	-2.953
0.5833	-2.953
0.6000	-2.953
0.6166	-2.953
0.6333	-2.953
0.6500	-2.953
0.6666	-2.953
0.6833	-2.953
0.7000	-2.953
0.7166	-2.953
0.7333	-2.953
0.7500	-2.953
0.7666	-2.953
0.7833	-2.937
0.8000	-2.937
0.8166	-2.937
0.8333	-2.937
0.8500	-2.937
0.8666	-2.937
0.8833	-2.937
0.9000	-2.953
0.9166	-2.937
0.9333	-2.937
0.9500	-2.937
0.9666	-2.937
0.9833	-2.937
1.0000	-2.937 ← 0.825
1.2000	-2.921
1.4000	-2.921
1.6000	-2.906
1.8000	-2.890
2.0000	-2.874
2.2000	-2.858
2.4000	-2.842
2.6000	-2.842
2.8000	-2.842
3.0000	-2.826
3.2000	-2.810
3.4000	-2.794

3.8000	-2.794
4.0000	-2.778
4.2000	-2.762
4.4000	-2.762
4.6000	-2.746
4.8000	-2.746
5.0000	-2.730
5.2000	-2.730
5.4000	-2.714
5.6000	-2.698
5.8000	-2.698
6.0000	-2.698
6.2000	-2.682
6.4000	-2.666
6.6000	-2.666
6.8000	-2.666
7.0000	-2.650
7.2000	-2.634
7.4000	-2.634
7.6000	-2.618
7.8000	-2.618
8.0000	-2.602
8.2000	-2.602
8.4000	-2.602
8.6000	-2.586
8.8000	-2.570
9.0000	-2.570
9.2000	-2.570
9.4000	-2.554
9.6000	-2.538
9.8000	-2.522
10.0000	-2.522
12.0000	-2.458
14.0000	-2.379
16.0000	-2.315
18.0000	-2.235
20.0000	-2.171
22.0000	-2.107
24.0000	-2.043
26.0000	-1.979
28.0000	-1.916
30.0000	-1.852
32.0000	-1.804
34.0000	-1.740
36.0000	-1.692
38.0000	-1.628
40.0000	-1.580
42.0000	-1.532
44.0000	-1.468
46.0000	-1.421
48.0000	-1.373
50.0000	-1.325
52.0000	-1.277
54.0000	-1.245
56.0000	-1.197
58.0000	-1.149
60.0000	-1.117
62.0000	-1.069
64.0000	-1.037
66.0000	-0.989
68.0000	-0.957
70.0000	-0.910
72.0000	-0.878
74.0000	-0.846

80.0000	-0.750
82.0000	-0.718
84.0000	-0.686
86.0000	-0.654
88.0000	-0.654
90.0000	-0.622
92.0000	-0.574

END

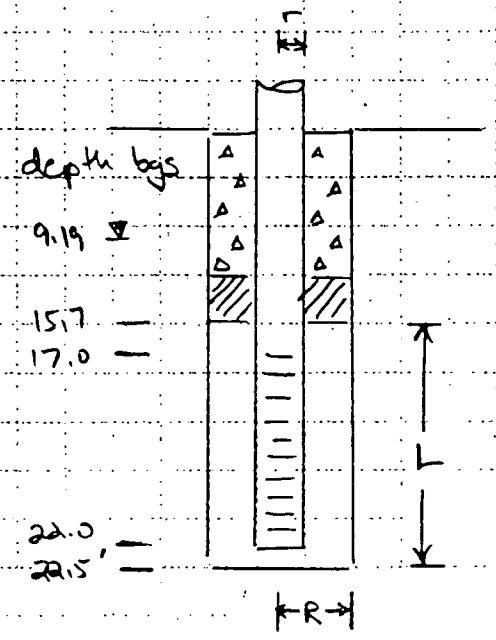
CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF

CLIENT	NSB - NLON	JOB NUMBER	~~0185~~ 5082
SUBJECT	CTU 203 Slug Tests		
BASED ON	Hvorslev	DRAWING NUMBER	
BY T Evans	CHECKED BY 12/11/95	APPROVED BY	DATE

Well # 2LMW32F
Rising

$r = 1'' = 0.083$ ft
$R = 2'' = 0.167$ ft
$L = 6.8$ ft

$t_0 = .158$ min



$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$$K = \frac{(.083\text{ft})^2 \ln(6.8\text{ft}/.167\text{ft})}{2(6.8\text{ft})(.158\text{min})}$$

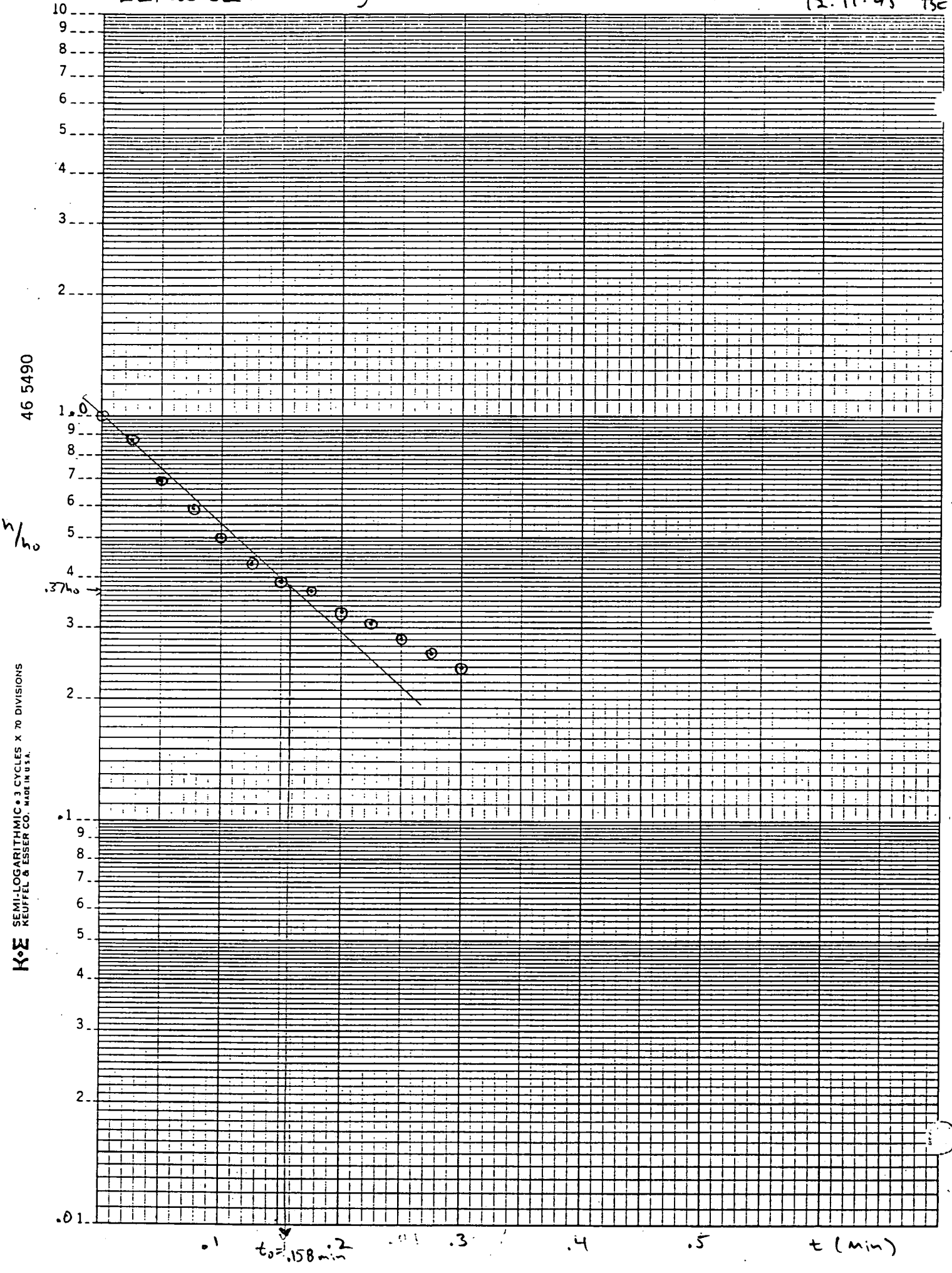
$K = 0.0120$ ft/min $\times$ 1440 min/day

$K = 17.3$ ft/day

$= 6.0 \times 10^{-3}$ cm/sec

2LMW 32F Rising

12.11.95 TBE



HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILL WELL/BORING NO.: 2LMW32F

PROJECT NO.: 5082 GEOLOGIST: CONTI

WELL DIAMETER: 2" Φ SCREEN LENGTH/DEPTH: 1 TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 11.29 (24.10 TD) DATE: 11-19-95

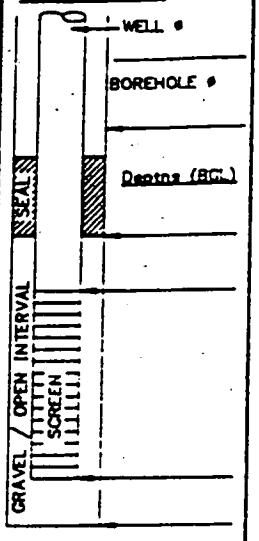
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

METHOD OF INDUCING WATER LEVEL CHANGE: 2" SLUG - 1 SECTION PAGE ___ OF ___

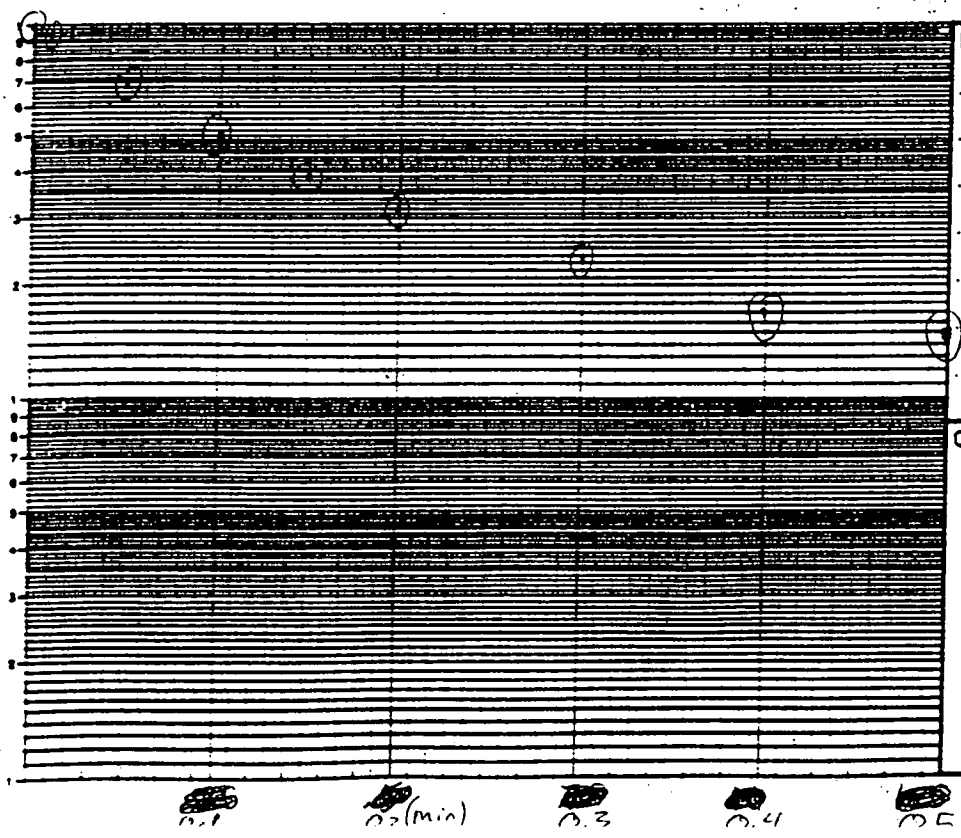
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.):

ELAPSED TIME (min. or sec.)	~~MEASURED WATER LEVEL (feet)~~ %	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0	1.000	-0.734			
0.01	0.913	-0.670			
0:05	0.695	-0.510			
0:10	0.500	-0.367			
0:15	0.391	-0.287			
0.20	0.326	-0.239			
0.30	0.238	-0.175			
0.40	0.173	-0.127			
0.50	0.151	-0.111			
1.00	0.086	-0.063			
2.00	0.064	-0.047			
5.00	0.042	-0.031			

WELL SCHEMATIC



▽ Indicate SWL Depth on Drawing



REMARKS:

XD @ 17.97

START ~ 1545

TEST (0) 11-19-95

Step 0

CALCS, SKETCH MAPS, ETC.:

PD

SE2000
Environmental Logger
11/19 16:06

Unit# 0 Test 0

INPUT 1: Level (F)

Reference	0.000
PSI at Ref.	3.469
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	0.142
Delay mSEC	50.000

Step 0 11/19 15:54:25

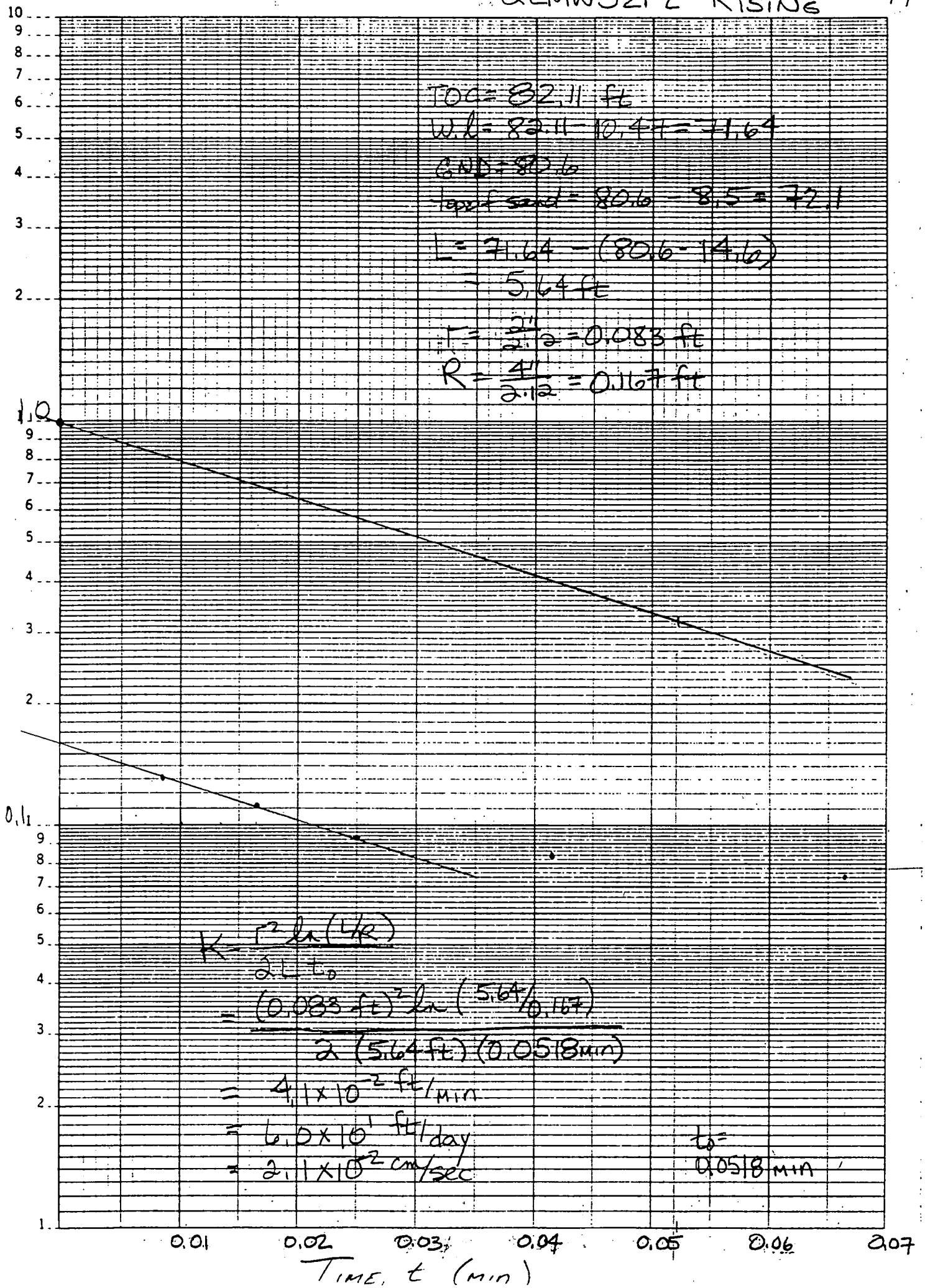
2LMW 32F
RISING HEAD
SLUG TEST
1 SECTION SLUG

HERMIT 2000 (50 PSI XD)

Elapsed Time	INPUT 1		h/h_o
0.0000	-0.734	← h_o	1.0
0.0083	-0.814		
0.0166	-0.670		
0.0250	-0.638	—	.86/.87
0.0333	-0.574		
0.0416	-0.542		
0.0500	-0.510	—	.69
0.0583	-0.478		
0.0666	-0.462		
0.0750	-0.430	—	.59
0.0833	-0.414		
0.0916	-0.383		
0.1000	-0.367	—	.50
0.1083	-0.351		
0.1166	-0.335		
0.1250	-0.319	—	.43
0.1333	-0.319		
0.1416	-0.303		
0.1500	-0.287	—	.39
0.1583	-0.287		
0.1666	-0.271		
0.1750	-0.271	—	.37
0.1833	-0.255		
0.1916	-0.239		
0.2000	-0.239	—	.32
0.2083	-0.239		
0.2166	-0.223		
0.2250	-0.223	—	.31
0.2333	-0.207		
0.2416	-0.207		
0.2500	-0.207	—	.28
0.2583	-0.191		
0.2666	-0.191		
0.2750	-0.191	—	.26
0.2833	-0.175		

0.3000	-0.175 - .24
0.3083	-0.159
0.3166	-0.159
0.3250	-0.159
0.3333	-0.159
0.3500	-0.143
0.3666	-0.143
0.3833	-0.143
0.4000	-0.127
0.4166	-0.127
0.4333	-0.127
0.4500	-0.127
0.4666	-0.111
0.4833	-0.111
0.5000	-0.111
0.5166	-0.111
0.5333	-0.095
0.5500	-0.111
0.5666	-0.095
0.5833	-0.095
0.6000	-0.095
0.6166	-0.095
0.6333	-0.095
0.6500	-0.079
0.6666	-0.095
0.6833	-0.079
0.7000	-0.079
0.7166	-0.079
0.7333	-0.079
0.7500	-0.079
0.7666	-0.079
0.7833	-0.079
0.8000	-0.079
0.8166	-0.079
0.8333	-0.079
0.8500	-0.079
0.8666	-0.079
0.8833	-0.063
0.9000	-0.063
0.9166	-0.063
0.9333	-0.063
0.9500	-0.063
0.9666	-0.063
0.9833	-0.063
1.0000	-0.063
1.2000	-0.063
1.4000	-0.047
1.6000	-0.047
1.8000	-0.047
2.0000	-0.047
2.2000	-0.047
2.4000	-0.047
2.6000	-0.047
2.8000	-0.031
3.0000	-0.031
3.2000	-0.031
3.4000	-0.031
3.6000	-0.031
3.8000	-0.031
4.0000	-0.031
4.2000	-0.031
4.4000	-0.031
4.6000	-0.031
4.8000	-0.031
5.0000	-0.031

2LMW32PZ RISING



HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILL WELL/BORING NO.: 2LMW32P7

PROJECT NO.: 5082 GEOLOGIST: CONTI

WELL DIAMETER: 2" Φ SCREEN LENGTH/DEPTH: TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 10.47 DATE: 11-19-95

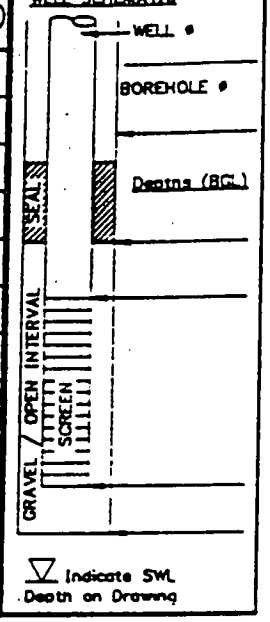
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

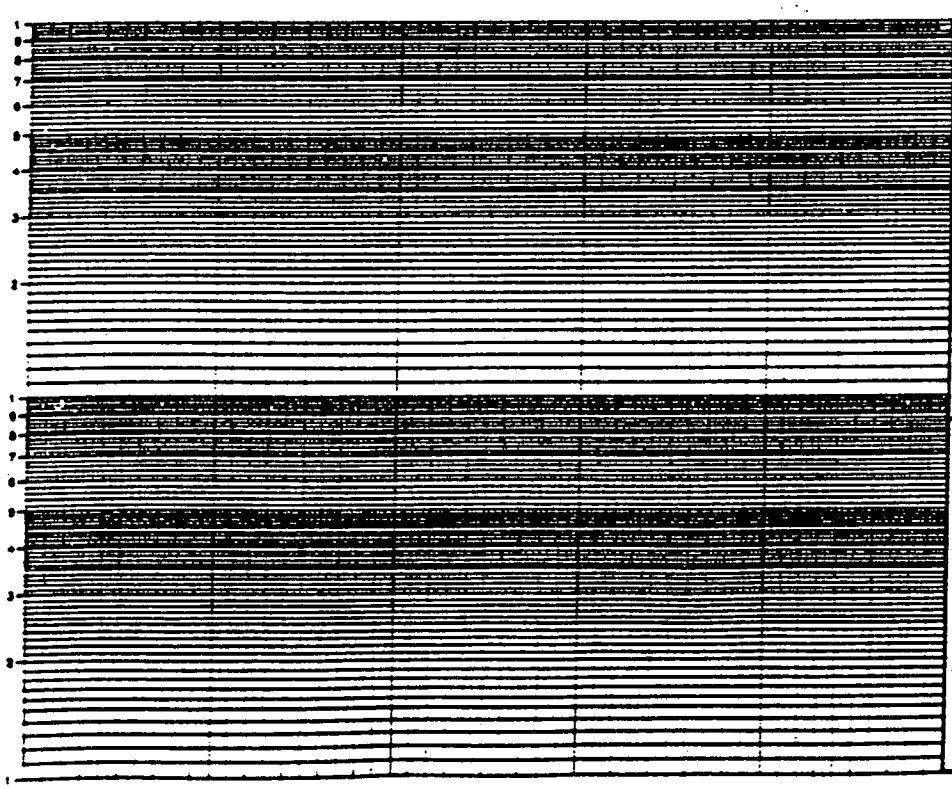
METHOD OF INDUCING WATER LEVEL CHANGE: 2" SLUG 1 SEC (2.56' Long) PAGE 1 OF

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)

WELL SCHEMATIC





REMARKS:

Used 50 psi XD and Hermit 2000 to record data.

Test 1, Step 0

XDC 4.618

CALCS, SKETCH MAPS, ETC.:

@<

SE2000
Environmental Logger
11/19 15:19

Unit# 0 Test 1

INPUT 1: Level (F)

Reference	0.000
PSI at Ref.	2.064
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	0.142
Delay mSEC	50.000

Step 0 11/19 14:43:03

Elapsed Time	INPUT 1	
0.0000	-1.707	
0.0083	-0.223	0.131
0.0166	-0.191	0.112
0.0250	-0.159	0.093
0.0333	-0.159	
0.0416	-0.143	0.084
0.0500	-0.143	
0.0583	-0.143	
0.0666	-0.127	0.0744
0.0750	-0.127	
0.0833	-0.127	
0.0916	-0.127	
0.1000	-0.127	
0.1083	-0.127	
0.1166	-0.127	
0.1250	-0.127	
0.1333	-0.127	
0.1416	-0.127	
0.1500	-0.127	
0.1583	-0.127	
0.1666	-0.127	
0.1750	-0.127	
0.1833	-0.127	
0.1916	-0.127	
0.2000	-0.127	
0.2083	-0.127	
0.2166	-0.127	
0.2250	-0.127	
0.2333	-0.127	
0.2416	-0.127	
0.2500	-0.127	
0.2583	-0.127	
0.2666	-0.127	
0.2750	-0.127	
0.2833	-0.127	

2LMW32PZ
RISING HEAD
SLUG TEST
1 SECTION SLUG

HERMIT 2000 (50 PSI XD)

0.3000	-0.127
0.3083	-0.127
0.3166	-0.127
0.3250	-0.127
0.3333	-0.127
0.3500	-0.127
0.3666	-0.127
0.3833	-0.127
0.4000	-0.127
0.4166	-0.111
0.4333	-0.127
0.4500	-0.127
0.4666	-0.127
0.4833	-0.127
0.5000	-0.127
0.5166	-0.127
0.5333	-0.127
0.5500	-0.127
0.5666	-0.111
0.5833	-0.127
0.6000	-0.111
0.6166	-0.127
0.6333	-0.127
0.6500	-0.127
0.6666	-0.111
0.6833	-0.127
0.7000	-0.111
0.7166	-0.111
0.7333	-0.111
0.7500	-0.111
0.7666	-0.127
0.7833	-0.111
0.8000	-0.127
0.8166	-0.127
0.8333	-0.127
0.8500	-0.111
0.8666	-0.111
0.8833	-0.111
0.9000	-0.111
0.9166	-0.111
0.9333	-0.111
0.9500	-0.111
0.9666	-0.111
0.9833	-0.127
1.0000	-0.127
1.2000	-0.111
1.4000	-0.111
1.6000	-0.111
1.8000	-0.111
2.0000	-0.111
2.2000	-0.111
2.4000	-0.111
2.6000	-0.111
2.8000	-0.111
3.0000	-0.111
3.2000	-0.111
3.4000	-0.111
3.6000	-0.111
3.8000	-0.111
4.0000	-0.111
4.2000	-0.111
4.4000	-0.111
4.6000	-0.111
4.8000	-0.111
5.0000	-0.111

5.4000	-0.111
5.6000	-0.111
5.8000	-0.111
6.0000	-0.111
6.2000	-0.111
6.4000	-0.111
6.6000	-0.111
6.8000	-0.111
7.0000	-0.111
7.2000	-0.111
7.4000	-0.111
7.6000	-0.111
7.8000	-0.111
8.0000	-0.111
8.2000	-0.111
8.4000	-0.111
8.6000	-0.111
8.8000	-0.111
9.0000	-0.111
9.2000	-0.111
9.4000	-0.111
9.6000	-0.111
9.8000	-0.111
10.0000	-0.111
12.0000	-0.127

END

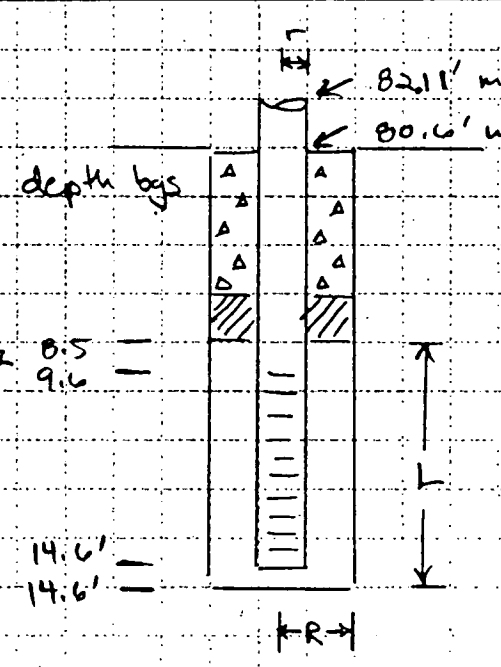
CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF

CLIENT	NSB - NLON
JOB NUMBER	~~0185~~ 5082
SUBJECT	CTU 203 Slug Tests
BASED ON	Hvorslev
DRAWING NUMBER	
BY	T Evans
CHECKED BY	12/11/95
APPROVED BY	
DATE	

Well # 2LMW32 PZ
Rising

$r = 1'' = 0.083$ ft
$R = 2'' = 0.167$ ft
$L = 14.6\text{ ft} - 9.15' = 5.45\text{ ft}$ ✓

$t_0 = .013$ min



$$K = \frac{r^2 \ln(L/R)}{2Lt_0}$$

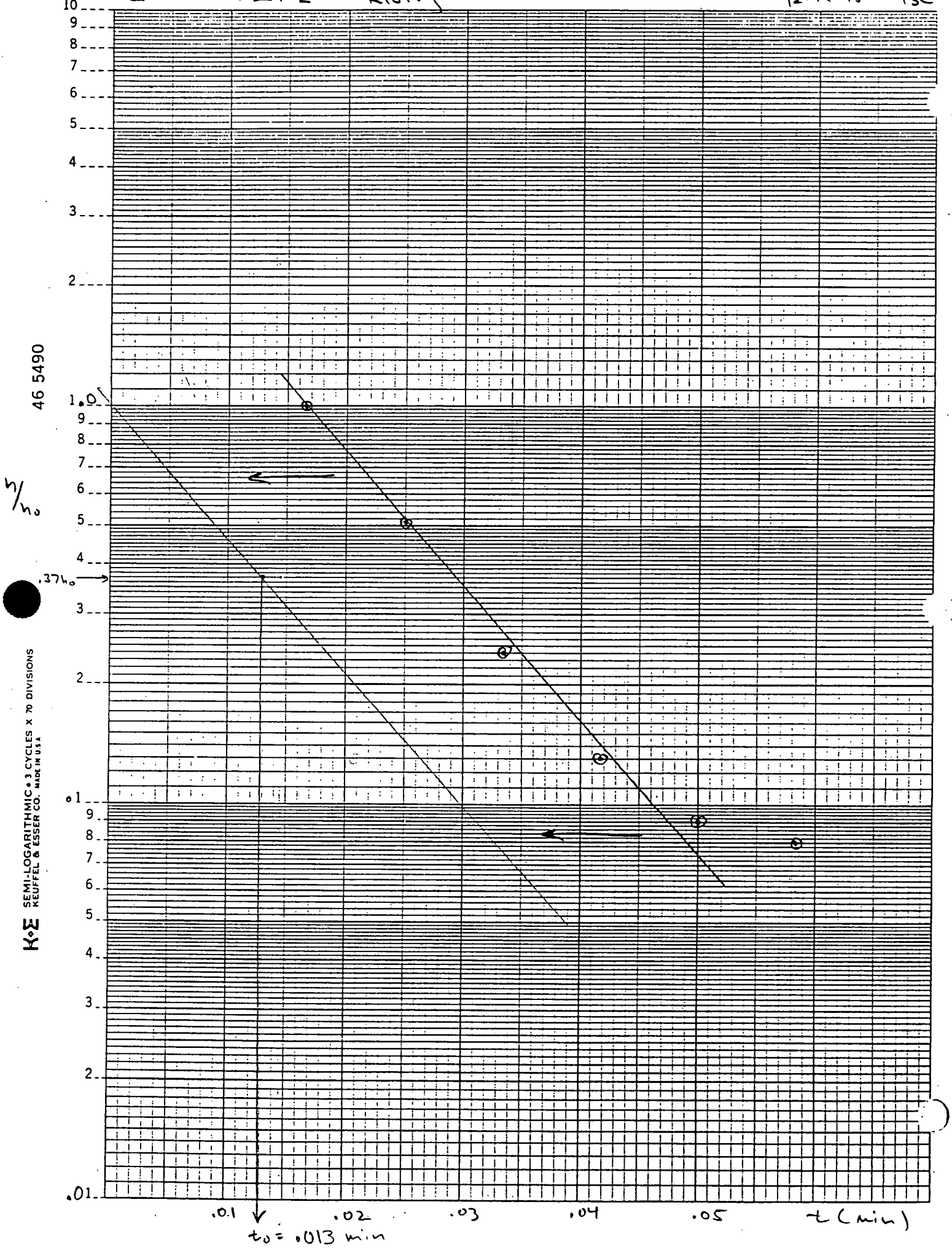
$$K = \frac{(.083\text{ ft})^2 \ln(5.45\text{ ft}/.167\text{ ft})}{2(5.45\text{ ft})(.013\text{ min})}$$

$K = 0.171$ ft/min $\times$ 1440 ft/day

$K = 246$ ft/day

$= 8.6 \times 10^{-2}$ cm/sec

2L MW 32PZ Rising 12.11.95 TBE 8:



HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: ZLMW32A2

PROJECT NO.: 5082 GEOLOGIST: MARSHALL

WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 6

STATIC WATER LEVEL (Depth/Elevation): 10.66 DATE: 12/1/95

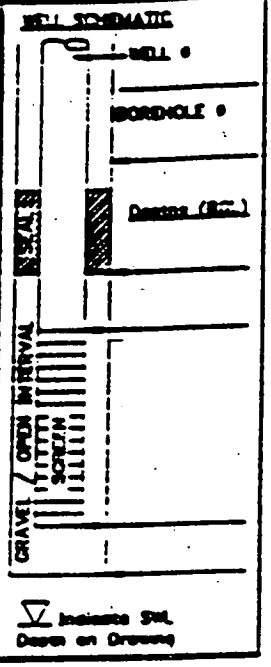
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

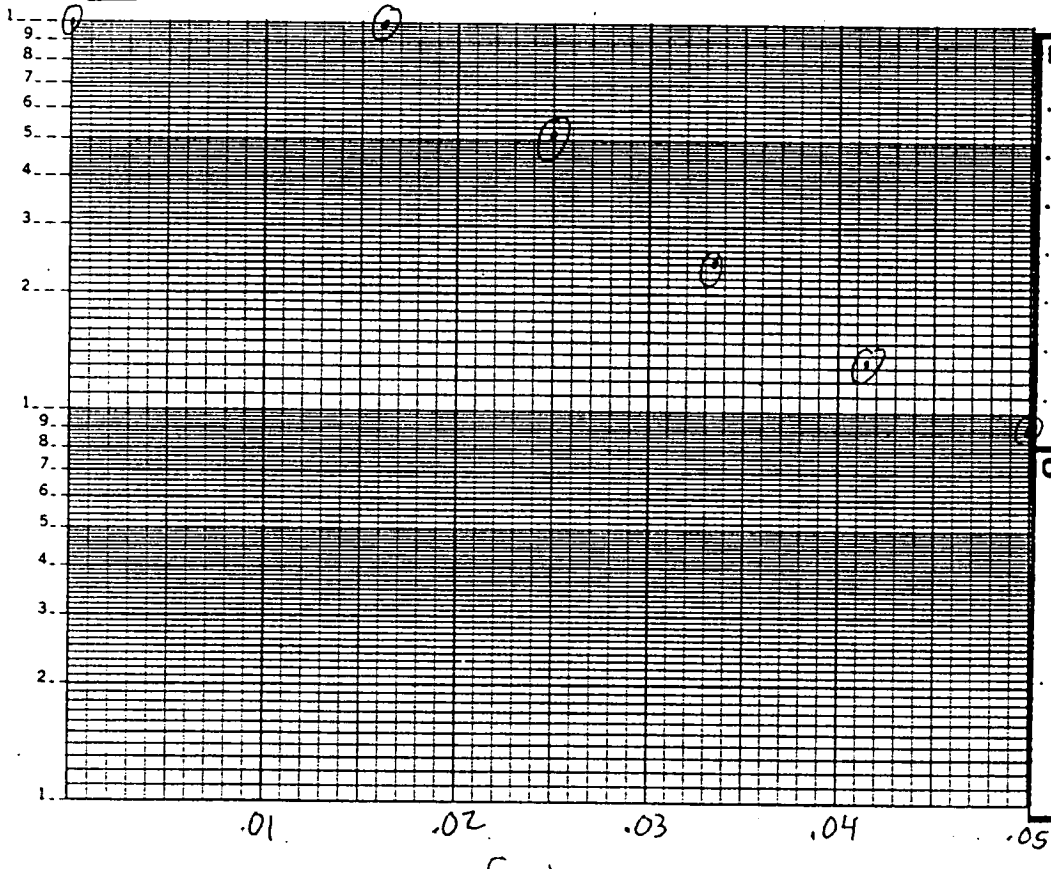
METHOD OF INDUCING WATER LEVEL CHANGE: REMOVE ONE LITER PAGE ___ OF ___

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.0000	0.0000	0.0000			
0.0166	1.000	1.180			
0.0250	0.514	0.606			
0.0333	0.243	0.287			
0.0416	0.135	0.159			
0.0500	0.094	0.111			
0.0583	0.081	0.095			
0.0666		0.079			
0.0916		0.063			
0.1333		0.047			
0.3500		0.031			
2.0000		0.031			

WELL SCHEMATIC





REMARKS:

XD @ 15'

CALCS.SKETCH MAPS, ETC.:

SE2000
Environmental Logger
12/01 10:02

Unit# 0 Test 6

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	2.138
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	-0.142
Delay mSEC	50.000

ZLMW32PZ
RISING HEAD TEST

Step 0 12/01 07:55:56

Elapsed Time	INPUT 1	h/h₀
0.0000	0.000	
0.0083	0.000	
0.0166	1.180 ← h_0	1.0
0.0250	0.606	.51
0.0333	0.287	.24
0.0416	0.159	.13
0.0500	0.111	.09
0.0583	0.095	.08
0.0666	0.079	
0.0750	0.079	
0.0833	0.079	
0.0916	0.063	
0.1000	0.063	
0.1083	0.063	
0.1166	0.063	
0.1250	0.063	
0.1333	0.047	
0.1416	0.047	
0.1500	0.047	
0.1583	0.047	
0.1666	0.047	
0.1750	0.047	
0.1833	0.047	
0.1916	0.047	
0.2000	0.047	
0.2083	0.047	
0.2166	0.047	
0.2250	0.047	
0.2333	0.047	
0.2416	0.047	
0.2500	0.047	
0.2583	0.047	
0.2666	0.047	
0.2750	0.031	
0.2833	0.047	

0.3083	0.047
0.3166	0.031
0.3250	0.031
0.3333	0.047
0.3500	0.031
0.3666	0.031
0.3833	0.031
0.4000	0.031
0.4166	0.031
0.4333	0.031
0.4500	0.031
0.4666	0.031
0.4833	0.031
0.5000	0.031
0.5166	0.031
0.5333	0.031
0.5500	0.031
0.5666	0.031
0.5833	0.031
0.6000	0.031
0.6166	0.031
0.6333	0.031
0.6500	0.031
0.6666	0.031
0.6833	0.031
0.7000	0.031
0.7166	0.031
0.7333	0.031
0.7500	0.031
0.7666	0.031
0.7833	0.031
0.8000	0.031
0.8166	0.031
0.8333	0.031
0.8500	0.031
0.8666	0.031
0.8833	0.031
0.9000	0.031
0.9166	0.031
0.9333	0.031
0.9500	0.031
0.9666	0.031
0.9833	0.031
1.0000	0.031
1.2000	0.031
1.4000	0.031
1.6000	0.031
1.8000	0.031
2.0000	0.031

END

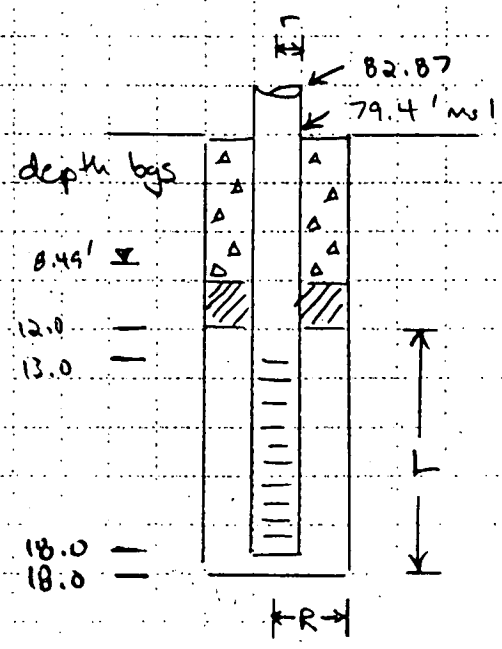
CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF

CLIENT	NSB - NLON	JOB NUMBER	0185
SUBJECT	CTO 203 Slug Tests		
BASED ON	Hvorslev	DRAWING NUMBER	
BY T Evans	CHECKED BY 12/11/95	APPROVED BY	DATE

Well # 2LMW33DS
Rising

$r = 1'' = 0.083$ ft
$R = 2'' = 0.167$ ft
$L = 6.0$ ft

$t_0 = 2330$ min

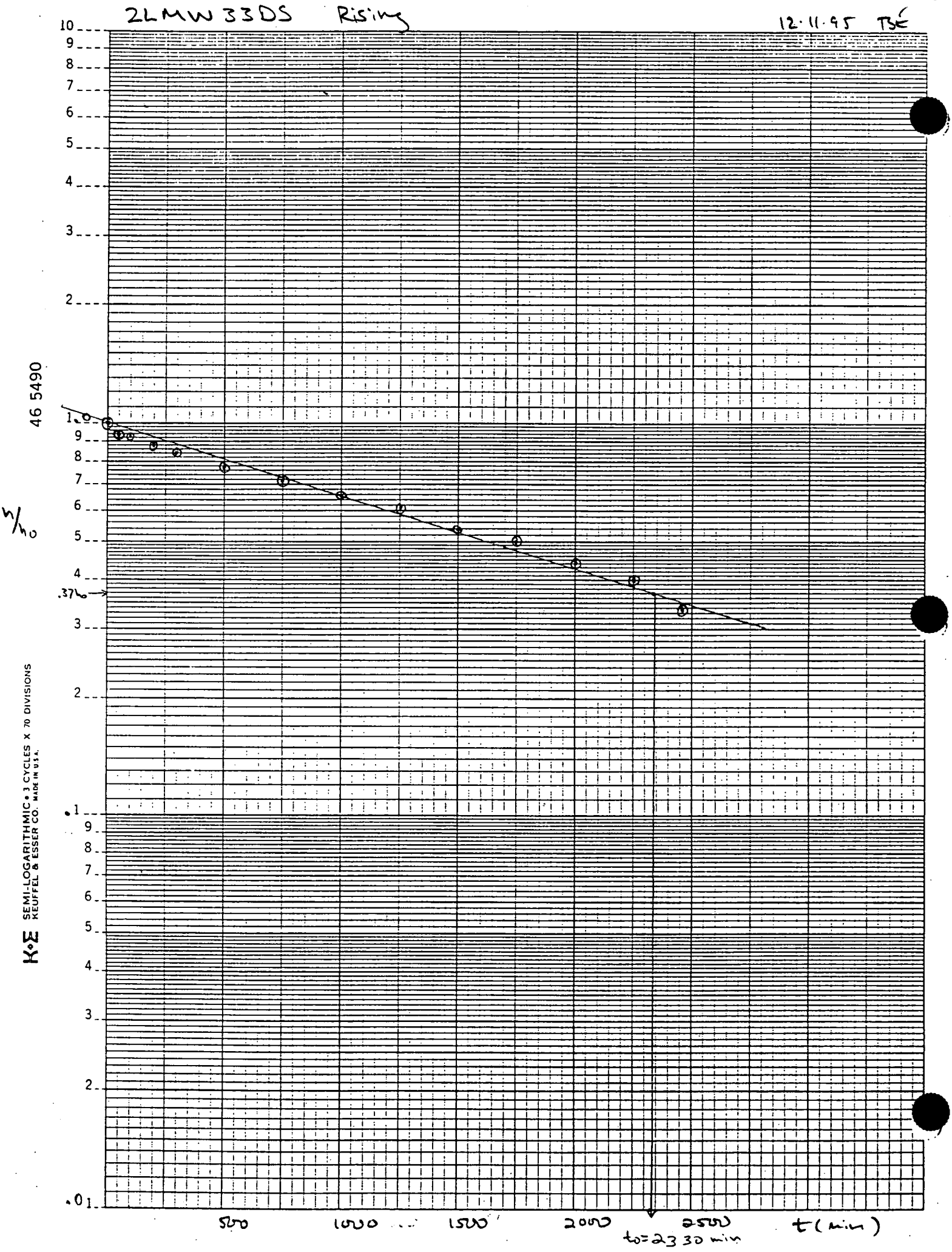


$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$$K = \frac{(.083\,ft)^2 \ln(6.0\,ft / .167\,ft)}{2(6.0\,ft)(2330\,min)}$$

$$K = 8.90 \times 10^{-7}\ ft/min \times 1440\ min/day$$

$$K = 0.00128\ ft/day$$
$$= 4.5 \times 10^{-7}\ cm/sec$$


2LMW 33DS Rising
12·11·95 TBE
46 5490
h/h0
.37h0
500
1000
1500
2000
2500
t (min)
to=2330 min
K+E SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

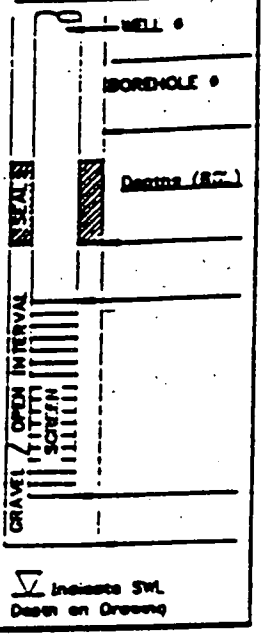
HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

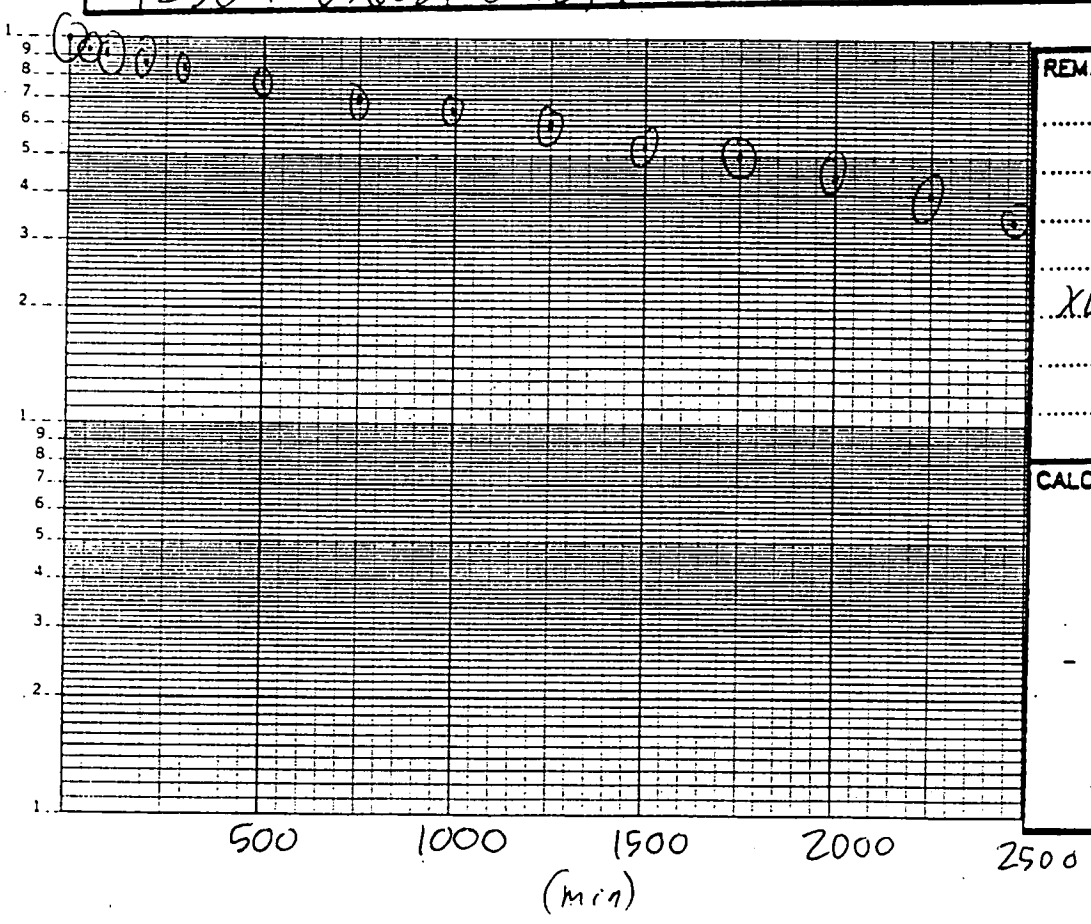
Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: 2LMW33DS
PROJECT NO.: 5082 GEOLOGIST: MARSHALL
WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 4
STATIC WATER LEVEL (Depth/Elevation): 11.96 DATE: 12/1/95
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: REMOVE ONE LITER PAGE ... OF ...
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	~~MEASURED WATER LEVEL (feet)~~ %	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	~~MEASURED WATER LEVEL (feet)~~ %	DRAWDOWN OR HEAD (ΔH) (feet)
0.1000	1.000	1.627	1500	0.539	0.877
0.5000	0.990	1.611	1750	0.500	0.813
2.000	0.980	1.595	2000	0.441	0.718
10.00	0.970	1.579	2250	0.402	0.654
50.0	0.942	1.532	2460	0.343	0558
100	0.922	1.500			
200	0.883	1.436			
300	0.843	1.372			
500	0.774	1.260			
750	0.706	1.149			
1000	0.657	1.069			
1250	0.608	0.989			

WELL SCHEMATIC





REMARKS:

XD @ 15'

CALCS.SKETCH MAPS, ETC.:

90

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: AREA A LANDFILL WELL/BORING NO.: 2LMW 33DS

PROJECT NO.: 5082 GEOLOGIST: CONTI

WELL DIAMETER: 2" SCREEN LENGTH/DEPTH: TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 12.42' TPVC. DATE: 11-19-95

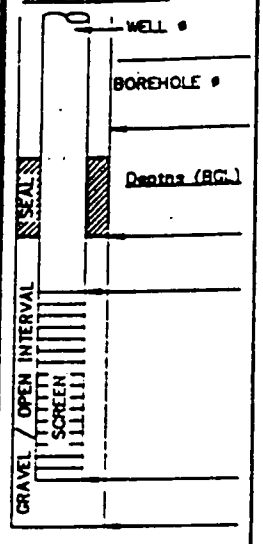
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

METHOD OF INDUCING WATER LEVEL CHANGE: BAILER PAGE ___ OF ___

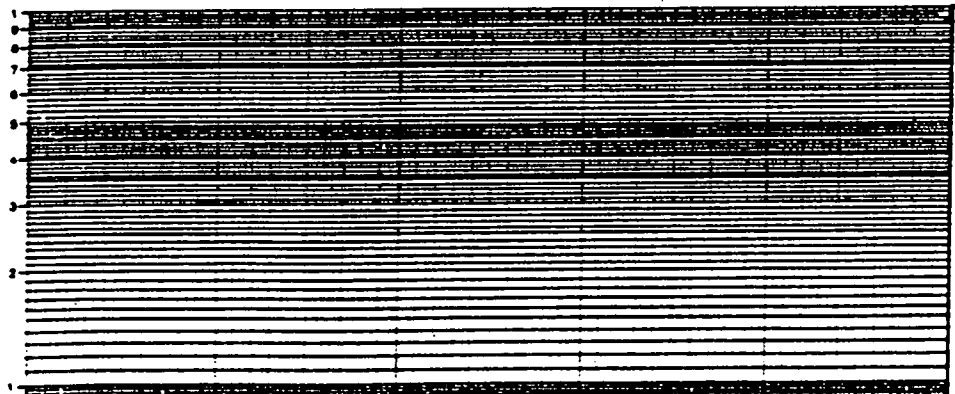
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

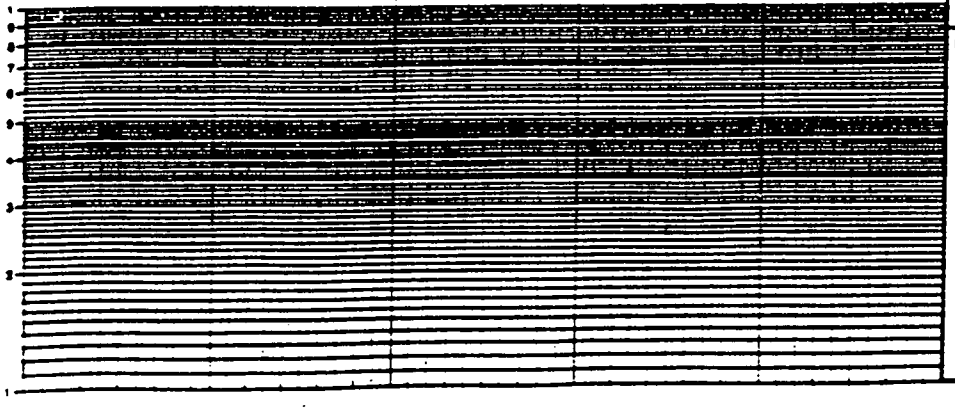
ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0					

WELL SCHEMATIC



▽ Indicate SWL Depth on Drawing





REMARKS:

Needs Done

CALCS, SKETCH MAPS, ETC.:

SE2000
Environmental Logger
12/01 09:56

Unit# 0 Test 4

INPUT 1: Level (F) TOC

2LMW 33DS
RISING HEAD TEST

Reference	0.000
PSI at Ref.	1.827
SG	1.000
Linearity	0.113
Scale factor	50.817
Offset	-0.142
Delay mSEC	50.000

Step 0 11/29 14:26:10

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	0.271
0.0166	1.516
0.0250	1.659
0.0333	1.627
0.0416	1.611
0.0500	1.611
0.0583	1.627
0.0666	1.627
0.0750	1.627
0.0833	1.627
0.0916	1.627
0.1000	1.627
0.1083	1.627
0.1166	1.627
0.1250	1.627
0.1333	1.627
0.1416	1.627
0.1500	1.627
0.1583	1.627
0.1666	1.627
0.1750	1.627
0.1833	1.627
0.1916	1.627
0.2000	1.627
0.2083	1.627
0.2166	1.627
0.2250	1.627
0.2333	1.627
0.2416	1.627
0.2500	1.627
0.2583	1.627
0.2666	1.627

0.2833	1.627
0.2916	1.627
0.3000	1.627
0.3083	1.611
0.3166	1.627
0.3250	1.627
0.3333	1.611
0.3500	1.611
0.3666	1.611
0.3833	1.611
0.4000	1.611
0.4166	1.627
0.4333	1.611
0.4500	1.611
0.4666	1.611
0.4833	1.611
0.5000	1.611
0.5166	1.611
0.5333	1.611
0.5500	1.611
0.5666	1.611
0.5833	1.611
0.6000	1.611
0.6166	1.611
0.6333	1.611
0.6500	1.611
0.6666	1.611
0.6833	1.611
0.7000	1.611
0.7166	1.595
0.7333	1.611
0.7500	1.611
0.7666	1.595
0.7833	1.611
0.8000	1.611
0.8166	1.611
0.8333	1.595
0.8500	1.611
0.8666	1.611
0.8833	1.611
0.9000	1.595
0.9166	1.611
0.9333	1.595
0.9500	1.595
0.9666	1.595
0.9833	1.595
1.0000	1.611
1.2000	1.595
1.4000	1.595
1.6000	1.595
1.8000	1.595
2.0000	1.595
2.2000	1.595
2.4000	1.595
2.6000	1.595
2.8000	1.595
3.0000	1.579
3.2000	1.579
3.4000	1.579
3.6000	1.579
3.8000	1.579
4.0000	1.579
4.2000	1.579
4.4000	1.579

5.0000	1.579
5.2000	1.579
5.4000	1.579
5.6000	1.579
5.8000	1.579
6.0000	1.579
6.2000	1.579
6.4000	1.563
6.6000	1.579
6.8000	1.595
7.0000	1.595
7.2000	1.595
7.4000	1.595
7.6000	1.595
7.8000	1.595
8.0000	1.595
8.2000	1.595
8.4000	1.595
8.6000	1.595
8.8000	1.595
9.0000	1.595
9.2000	1.595
9.4000	1.595
9.6000	1.595
9.8000	1.595
10.0000	1.579
12.0000	1.579
14.0000	1.579
16.0000	1.579
18.0000	1.563
20.0000	1.563
22.0000	1.563
24.0000	1.563
26.0000	1.563
28.0000	1.547
30.0000	1.563
32.0000	1.563
34.0000	1.547
36.0000	1.547
38.0000	1.547
40.0000	1.547
42.0000	1.547
44.0000	1.532
46.0000	1.532
48.0000	1.532
50.0000	1.532
52.0000	1.532
54.0000	1.516
56.0000	1.532
58.0000	1.532
60.0000	1.532
62.0000	1.532
64.0000	1.516
66.0000	1.516
68.0000	1.516
70.0000	1.516
72.0000	1.516
74.0000	1.516
76.0000	1.516
78.0000	1.516
80.0000	1.516
82.0000	1.516
84.0000	1.516
86.0000	1.500
88.0000	1.516

92.0000	1.500
94.0000	1.500
96.0000	1.500
98.0000	1.500
100.000	1.500
110.000	1.500
120.000	1.484
130.000	1.484
140.000	1.468
150.000	1.468
160.000	1.468
170.000	1.452
180.000	1.452
190.000	1.452
200.000	1.436
210.000	1.436
220.000	1.420
230.000	1.420
240.000	1.420
250.000	1.404
260.000	1.404
270.000	1.388
280.000	1.388
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300.000	1.372
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320.000	1.372
330.000	1.372
340.000	1.356
350.000	1.356
360.000	1.340
370.000	1.340
380.000	1.340
390.000	1.324
400.000	1.324
410.000	1.324
420.000	1.308
430.000	1.308
440.000	1.308
450.000	1.292
460.000	1.292
470.000	1.276
480.000	1.276
490.000	1.260
500.000	1.260
510.000	1.260
520.000	1.260
530.000	1.260
540.000	1.244
550.000	1.244
560.000	1.244
570.000	1.228
580.000	1.228
590.000	1.228
600.000	1.212
610.000	1.212
620.000	1.196
630.000	1.196
640.000	1.196
650.000	1.196
660.000	1.196
670.000	1.180
680.000	1.180
690.000	1.180

720.000	1.164
730.000	1.149
740.000	1.149
750.000	1.149
760.000	1.133
770.000	1.133
780.000	1.133
790.000	1.133
800.000	1.133
810.000	1.133
820.000	1.117
830.000	1.117
840.000	1.101
850.000	1.101
860.000	1.101
870.000	1.101
880.000	1.101
890.000	1.085
900.000	1.085
910.000	1.085
920.000	1.085
930.000	1.085
940.000	1.085
950.000	1.085
960.000	1.085
970.000	1.085
980.000	1.069
990.000	1.069
1000.00	1.069
1010.00	1.069
1020.00	1.053
1030.00	1.069
1040.00	1.053
1050.00	1.053
1060.00	1.053
1070.00	1.053
1080.00	1.053
1090.00	1.053
1100.00	1.037
1110.00	1.037
1120.00	1.037
1130.00	1.037
1140.00	1.037
1150.00	1.037
1160.00	1.037
1170.00	1.037
1180.00	1.037
1190.00	1.037
1200.00	1.021
1210.00	1.021
1220.00	1.005
1230.00	1.005
1240.00	1.005
1250.00	0.989
1260.00	0.989
1270.00	0.973
1280.00	0.973
1290.00	0.973
1300.00	0.973
1310.00	0.973
1320.00	0.957
1330.00	0.957
1340.00	0.957
1350.00	0.941
1360.00	0.941

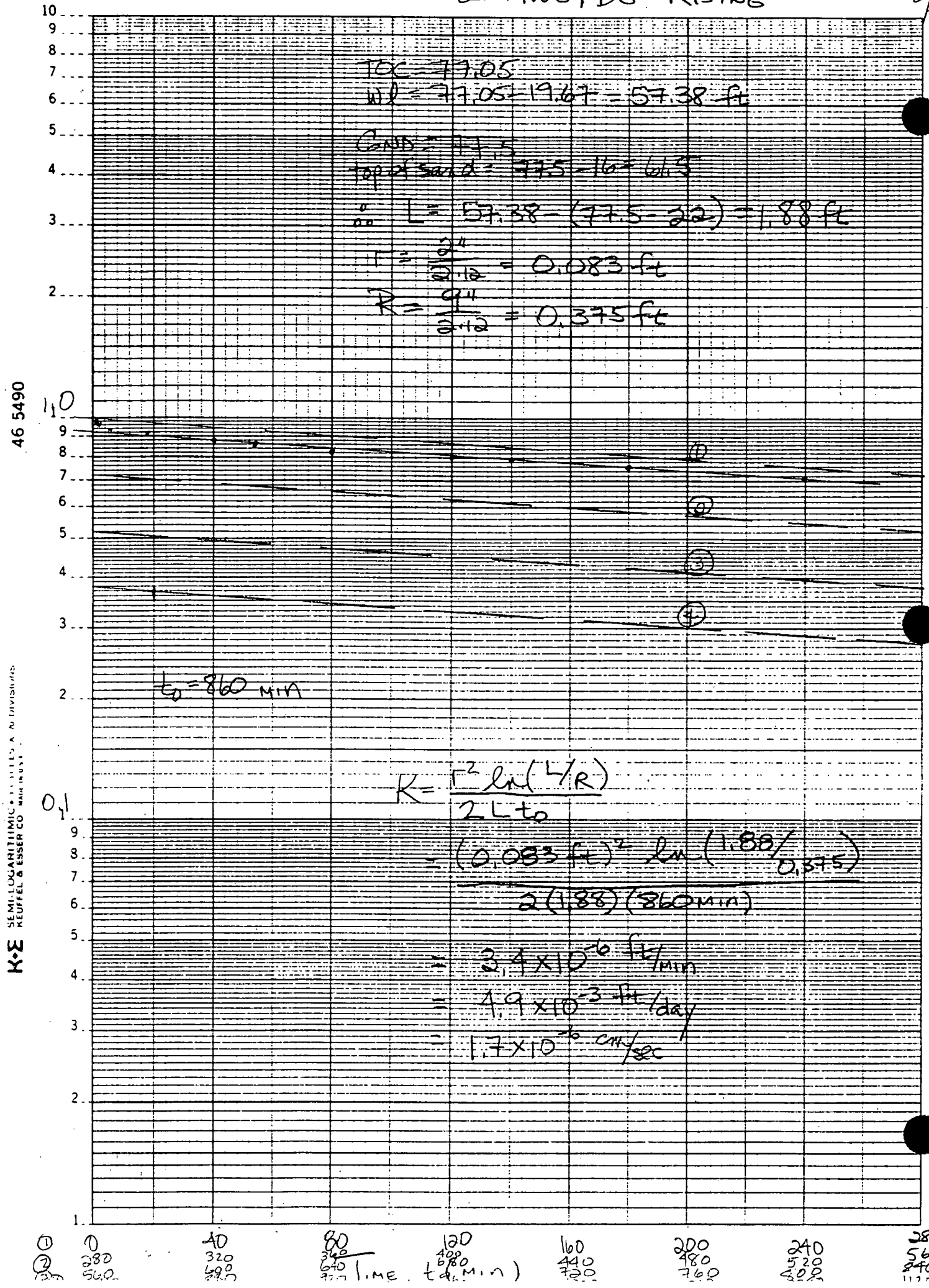
1380.00	0.925
1390.00	0.925
1400.00	0.909
1410.00	0.909
1420.00	0.909
1430.00	0.893
1440.00	0.893
1450.00	0.893
1460.00	0.893
1470.00	0.893
1480.00	0.877
1490.00	0.877
1500.00	0.877
1510.00	0.877
1520.00	0.877
1530.00	0.877
1540.00	0.877
1550.00	0.861
1560.00	0.861
1570.00	0.861
1580.00	0.845
1590.00	0.861
1600.00	0.861
1610.00	0.845
1620.00	0.861
1630.00	0.861
1640.00	0.845
1650.00	0.845
1660.00	0.845
1670.00	0.845
1680.00	0.845
1690.00	0.845
1700.00	0.845
1710.00	0.829
1720.00	0.829
1730.00	0.829
1740.00	0.813
1750.00	0.813
1760.00	0.813
1770.00	0.813
1780.00	0.813
1790.00	0.797
1800.00	0.813
1810.00	0.797
1820.00	0.797
1830.00	0.797
1840.00	0.797
1850.00	0.797
1860.00	0.797
1870.00	0.797
1880.00	0.781
1890.00	0.781
1900.00	0.781
1910.00	0.766
1920.00	0.766
1930.00	0.750
1940.00	0.750
1950.00	0.750
1960.00	0.750
1970.00	0.734
1980.00	0.734
1990.00	0.718
2000.00	0.718
2010.00	0.718
2020.00	0.702

2040.00	0.702
2050.00	0.686
2060.00	0.686
2070.00	0.670
2080.00	0.654
2090.00	0.654
2100.00	0.654
2110.00	0.638
2120.00	0.638
2130.00	0.622
2140.00	0.622
2150.00	0.606
2160.00	0.606
2170.00	0.606
2180.00	0.606
2190.00	0.590
2200.00	0.590
2210.00	0.638
2220.00	0.638
2230.00	0.670
2240.00	0.654
2250.00	0.654
2260.00	0.638
2270.00	0.638
2280.00	0.606
2290.00	0.606
2300.00	0.590
2310.00	0.574
2320.00	0.558
2330.00	0.574
2340.00	0.558
2350.00	0.654
2360.00	0.654
2370.00	0.654
2380.00	0.654
2390.00	0.622
2400.00	0.622
2410.00	0.606
2420.00	0.590
2430.00	0.590
2440.00	0.574
2450.00	0.558
2460.00	0.558

END

2LMW34DS Rising

97



TOC = 77.05

wl = 77.05 − 19.67 = 57.38 ft

Gnd = 77.5

top of sand = 77.5 − 16 = 61.5

∴ L = 57.38 − (77.5 − 22) = 1.88 ft

$r = \frac{2''}{2 \cdot 12} = 0.083$ ft

$R = \frac{9''}{2 \cdot 12} = 0.375$ ft

$t_0 = 860$ min

$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$$= \frac{(0.083\ \text{ft})^2 \ln(1.88/0.375)}{2(1.88)(860\ \text{min})}$$

$$= 3.4 \times 10^{-6}\ \text{ft/min}$$

$$= 4.9 \times 10^{-3}\ \text{ft/day}$$

$$= 1.7 \times 10^{-6}\ \text{cm/sec}$$

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET — HALLIBURTON NUS CORPORATION

PROJECT NAME: Area A Landfill WELL/BORING NO.: 34DS

PROJECT NO.: 5082 GEOLOGIST: CONTI

WELL DIAMETER: 2" Φ SCREEN LENGTH/DEPTH: 21.66' TEST NO.:

STATIC WATER LEVEL (Depth/Elevation): 19.67 TPVC DATE: 11-19-95

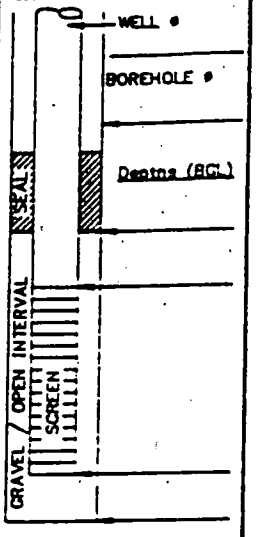
TEST TYPE (Rising/Falling/Constant Head): RISING CHECKED:

METHOD OF INDUCING WATER LEVEL CHANGE: Pump PAGE ..... OF .....

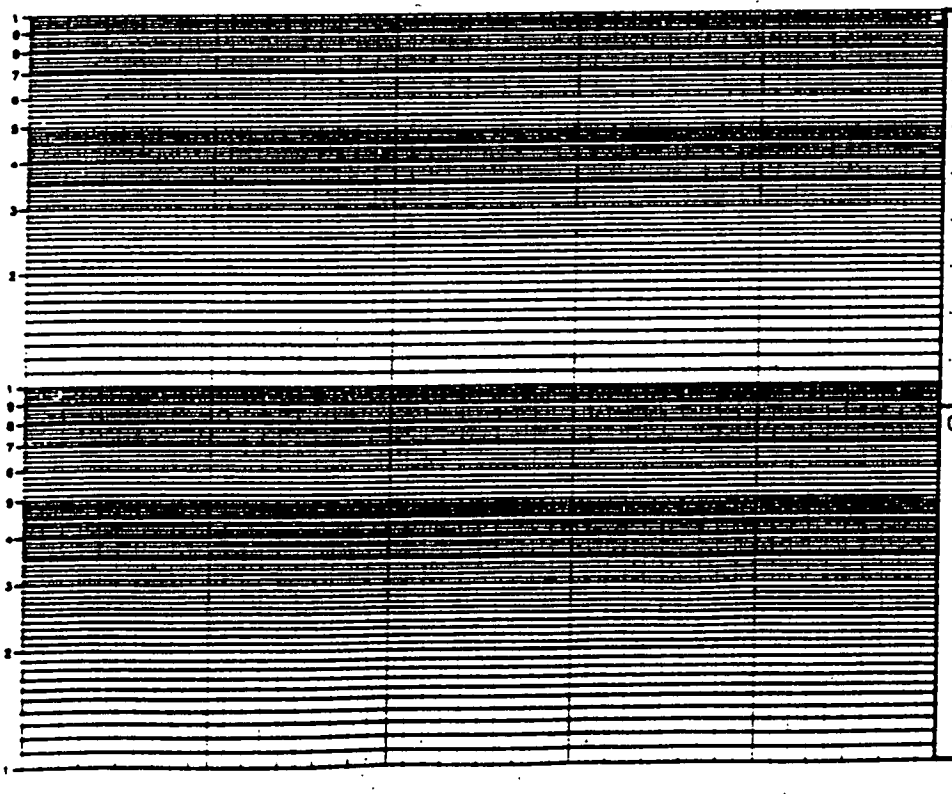
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TPVC

ELAPSED TIME (min. or sec.)	MEASURED-WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
	19.55				
1.5	19				

WELL SCHEMATIC



▽ Indicate SWL Depth on Drawing



REMARKS:
Remove Slug w/ Pump
Hermit to collect
readings

CALCS, SKETCH MAPS, ETC.:

SE2000
Environmental Logger
11/19 13:15

Unit# 0 Test 0

INPUT 1: Level (F)

Reference	0.000
PSI at Ref.	0.037
SG	1.000
Linearity	0.113
Scale factor	50.817
Offset	0.142
Delay mSEC	50.000

Step 0 11/19 09:01:57

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	0.000
0.0166	0.000
0.0250	0.000
0.0333	0.000
0.0416	0.000
0.0500	0.000
0.0583	0.000
0.0666	0.000
0.0750	0.000
0.0833	0.000
0.0916	0.000
0.1000	0.000
0.1083	0.000
0.1166	0.000
0.1250	0.000
0.1333	0.000
0.1416	0.000
0.1500	0.000
0.1583	0.000
0.1666	0.015
0.1750	0.000
0.1833	0.000
0.1916	0.000
0.2000	0.000
0.2083	0.000
0.2166	0.015
0.2250	0.000
0.2333	0.015
0.2416	0.000
0.2500	0.015
0.2583	0.015
0.2666	0.015
0.2750	0.015
0.2833	0.015

2LMW 34 DS

Remove Slug of Water w/ Pump.
Start Hermit when WL nears Bottom of Well.

This well only has ≈ 2' water in Well.

Removed ≈ 1.7' water – This sheet shows How $\frac{\text{fast}}{\text{slow}}$ it recovered in 240 min.

Decided to move Hermit to another location

TOC = 77.05
WL = 77.05 − 19.67 = 57.38

$$\begin{array}{r} 57.38 \\ 1.7 \\ \hline 55.68 \end{array} \leftarrow \qquad \Delta h = 1.7$$

0.3000	0.015	
0.3083	0.000	
0.3166	0.015	
0.3250	0.015	
0.3333	0.015	
0.3500	0.015	
0.3666	0.015	
0.3833	0.015	
0.4000	0.015	
0.4166	0.015	
0.4333	0.015	
0.4500	0.015	
0.4666	0.015	
0.4833	0.015	
0.5000	0.015	
0.5166	0.015	
0.5333	0.015	
0.5500	0.015	
0.5666	0.031	
0.5833	0.015	
0.6000	0.015	
0.6166	0.015	
0.6333	0.031	
0.6500	0.031	0,982
0.6666	0.031	
0.6833	0.031	
0.7000	0.031	
0.7166	0.031	
0.7333	0.031	
0.7500	0.031	
0.7666	0.031	
0.7833	0.031	
0.8000	0.031	
0.8166	0.031	
0.8333	0.031	
0.8500	0.031	
0.8666	0.031	
0.8833	0.031	
0.9000	0.031	
0.9166	0.031	
0.9333	0.031	
0.9500	0.031	
0.9666	0.031	
0.9833	0.031	
1.0000	0.031	
1.2000	0.047	0,972
1.4000	0.047	
1.6000	0.047	
1.8000	0.063	0,963
2.0000	0.063	
2.2000	0.063	
2.4000	0.063	
2.6000	0.063	
2.8000	0.063	
3.0000	0.079	
3.2000	0.079	
3.4000	0.079	
3.6000	0.079	
3.8000	0.079	
4.0000	0.079	
4.2000	0.079	
4.4000	0.095	
4.6000	0.095	
4.8000	0.095	
5.0000	0.095	

5.4000	0.095	
5.6000	0.095	
5.8000	0.095	
6.0000	0.095	
6.2000	0.111	0.935
6.4000	0.111	
6.6000	0.111	
6.8000	0.111	
7.0000	0.111	
7.2000	0.111	
7.4000	0.111	
7.6000	0.111	
7.8000	0.111	
8.0000	0.111	
8.2000	0.111	
8.4000	0.127	
8.6000	0.127	
8.8000	0.127	
9.0000	0.127	
9.2000	0.127	
9.4000	0.127	
9.6000	0.127	
9.8000	0.127	
10.0000	0.127	
12.0000	0.111	
14.0000	0.127	
16.0000	0.127	
18.0000	0.143	0.916
20.0000	0.143	
22.0000	0.159	
24.0000	0.159	
26.0000	0.175	
28.0000	0.175	
30.0000	0.175	
32.0000	0.175	
34.0000	0.191	
36.0000	0.191	
38.0000	0.191	
40.0000	0.207	0.878
42.0000	0.207	
44.0000	0.207	
46.0000	0.223	
48.0000	0.223	
50.0000	0.223	
52.0000	0.223	
54.0000	0.239	0.859
56.0000	0.239	
58.0000	0.239	
60.0000	0.239	
62.0000	0.239	
64.0000	0.255	
66.0000	0.255	
68.0000	0.255	
70.0000	0.255	
72.0000	0.255	
74.0000	0.271	
76.0000	0.287	
78.0000	0.303	0.822
80.0000	0.303	
82.0000	0.287	
84.0000	0.287	
86.0000	0.287	
88.0000	0.287	
90.0000	0.287	
92.0000	0.287	

96.0000	0.303	
98.0000	0.303	
100.000	0.303	
120.000	0.335	0.803
140.000	0.366	0.785
160.000	0.382	
180.000	0.414	0.757
200.000	0.446	
220.000	0.478	
240.000	0.494	0.709

END

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF

CLIENT	NSB - NLON
JOB NUMBER	~~0185~~ 5082
SUBJECT	CTO 203 Slug Tests
BASED ON	Hvorslev
DRAWING NUMBER	
BY	T Evans
CHECKED BY	12/11/95
APPROVED BY	
DATE	

Well # 2LMW35B
Falling

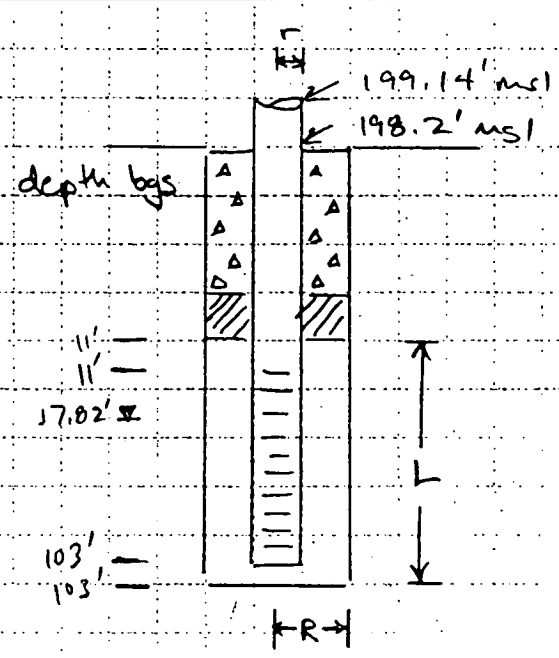
$r = 3'' = .25 ft$

$R = 3'' = .25 ft$ (h_0)

~~$L = 17.82 ft + 0.75 ft = 18.57 ft$~~

$t_0 = 300$ min

$L/R > 8$



$\therefore$

$$K = \frac{r^2 \ln(L/R)}{2 L t_0}$$

$L = (199.14 - 18.76) - (198.2 - 103)$
$= 85.18$ ft

$$K = \frac{(.25 ft)^2 \ln(85.18 ft / .25 ft)}{2(85.18 ft)(300 min)}$$

$K = 7.11 \times 10^{-6}$ ft/min $\times$ 1440 min/day

$K = 1.0 \times 10^{-2}$ ft/day

$= 3.6 \times 10^{-6}$ cm/sec

HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: 2LMW35B

PROJECT NO.: 5082 GEOLOGIST: MARSHALL

WELL DIAMETER: 6" SCREEN LENGTH/DEPTH: TEST NO.: 1

STATIC WATER LEVEL (Depth/Elevation): 18.76 DATE: 11/28/95

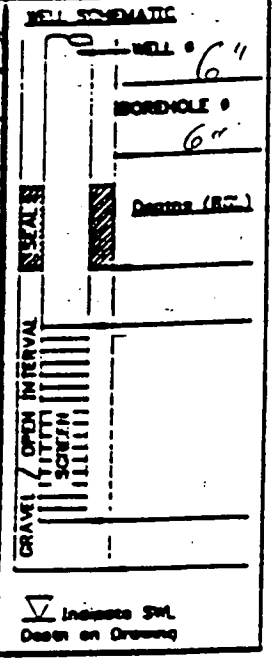
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:

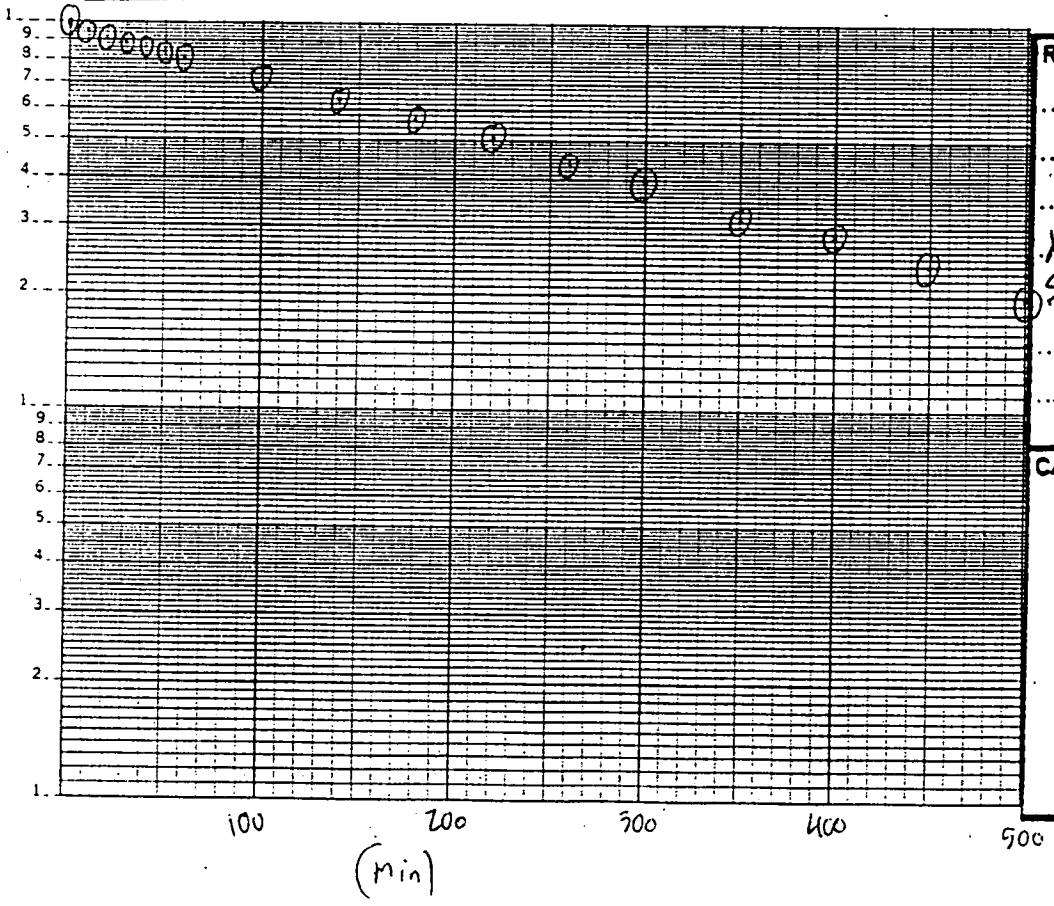
METHOD OF INDUCING WATER LEVEL CHANGE: 5', 25'# SLUG PAGE ___ OF ___

REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	~~MEASURED WATER LEVEL (feet)~~ D/D	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	~~MEASURED WATER LEVEL (feet)~~ D/D	DRAWDOWN OR HEAD (ΔH) (feet)
0.2833	1.000	-0.718	220.0	0.511	-0.367
1.0000	1.000	-0.718	260.0	0.444	-0.319
5.000	0.955	-0.686	300.0	0.400	-0.287
10.00	0.955	-0.686	350.0	0.333	-0.239
20.00	0.911	-0.654	400.0	0.288	-0.207
30.00	0.889	-0.638	450.0	0.244	-0.175
40.00	0.866	-0.622	500.0	0.199	-0.143
50.00	0.844	-0.606	550.0	0.155	-0.111
60.00	0.822	-0.590	600.0	0.110	-0.079
100.00	0.733	-0.526	650.0	0.065	-0.047
140.00	0.643	-0.462	700.0	0.043	-0.031
180.00	0.578	-0.415	770.0	0.000	0.000

WELL SCHEMATIC





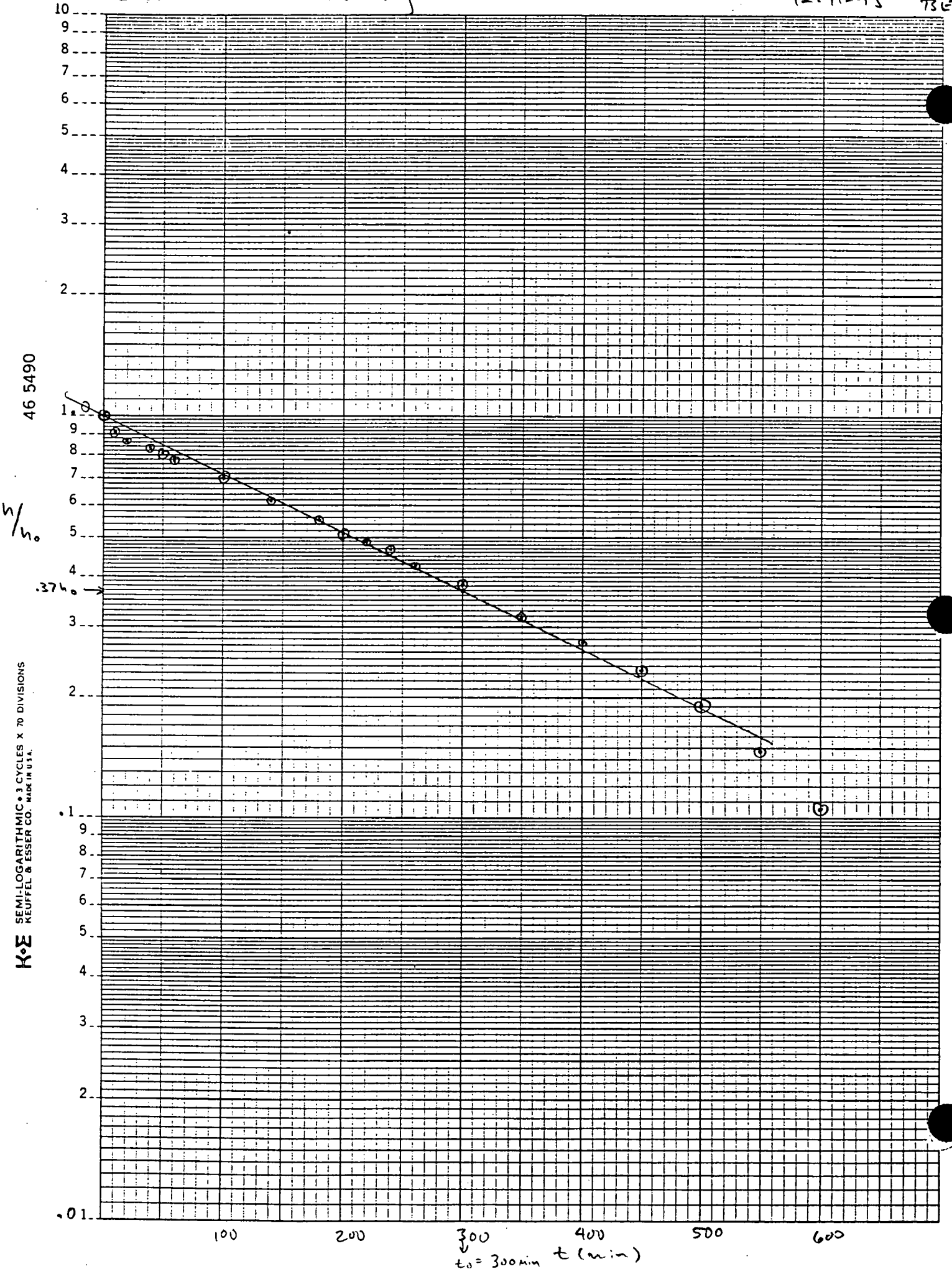
REMARKS:

XD @ 30' (m)
SLUG Bottom @ 25'

CALCS, SKETCH MAPS, ETC.:

2L MW 35 B Falling

12.11-95 BE



SE2000™
Environmental Logger
11/29 08:56

Unit# 0 Test 1

2LMW35B
FALLING HEAD TEST

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	5.052
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	-0.142
Delay mSEC	50.000

Step 0 11/28 16:42:36

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	0.000
0.0166	0.000
0.0250	0.000
0.0333	0.000
0.0416	0.000
0.0500	0.000
0.0583	0.000
0.0666	0.015
0.0750	0.000
0.0833	0.000
0.0916	0.015
0.1000	0.000
0.1083	-0.015
0.1166	-0.175
0.1250	-0.271
0.1333	-0.335
0.1416	-0.367
0.1500	-0.510
0.1583	-0.558
0.1666	-0.638
0.1750	-0.638
0.1833	-0.750
0.1916	-0.734
0.2000	-0.686
0.2083	-0.750
0.2166	-0.718
0.2250	-0.638
0.2333	-0.686
0.2416	-0.734
0.2500	-0.654
0.2583	-0.750 ← h_o
0.2666	-0.702
0.2750	-0.734
0.2833	-0.718 ← ~~START~~
0.2916	-0.718

h/h_o

1.0

0.3083	-0.718
0.3166	-0.718
0.3250	-0.718
0.3333	-0.718
0.3500	-0.718
0.3666	-0.718
0.3833	-0.718
0.4000	-0.718
0.4166	-0.718
0.4333	-0.718
0.4500	-0.718
0.4666	-0.718
0.4833	-0.718
0.5000	-0.718
0.5166	-0.718
0.5333	-0.718
0.5500	-0.718
0.5666	-0.734
0.5833	-0.718
0.6000	-0.718
0.6166	-0.718
0.6333	-0.718
0.6500	-0.718
0.6666	-0.718
0.6833	-0.718
0.7000	-0.718
0.7166	-0.718
0.7333	-0.718
0.7500	-0.718
0.7666	-0.718
0.7833	-0.718
0.8000	-0.718
0.8166	-0.718
0.8333	-0.718
0.8500	-0.718
0.8666	-0.718
0.8833	-0.718
0.9000	-0.718
0.9166	-0.718
0.9333	-0.718
0.9500	-0.718
0.9666	-0.718
0.9833	-0.718
1.0000	-0.718
1.2000	-0.718
1.4000	-0.718
1.6000	-0.718
1.8000	-0.718
2.0000	-0.718
2.2000	-0.718
2.4000	-0.718
2.6000	-0.718
2.8000	-0.718
3.0000	-0.702
3.2000	-0.702
3.4000	-0.686
3.6000	-0.702
3.8000	-0.702
4.0000	-0.702
4.2000	-0.686
4.4000	-0.686
4.6000	-0.686
4.8000	-0.686
5.0000	-0.686 ← .915
5.2000	-0.686

5.6000	-0.686	
5.8000	-0.686	
6.0000	-0.686	
6.2000	-0.686	
6.4000	-0.686	
6.6000	-0.686	
6.8000	-0.686	
7.0000	-0.686	
7.2000	-0.686	
7.4000	-0.686	
7.6000	-0.686	
7.8000	-0.686	
8.0000	-0.686	
8.2000	-0.686	
8.4000	-0.686	
8.6000	-0.686	
8.8000	-0.686	
9.0000	-0.686	
9.2000	-0.686	
9.4000	-0.686	
9.6000	-0.670	
9.8000	-0.686	
10.0000	-0.686 ←	.915
12.0000	-0.702	
14.0000	-0.670	
16.0000	-0.670	
18.0000	-0.670	
20.0000	-0.654 ←	.872
22.0000	-0.654	
24.0000	-0.654	
26.0000	-0.654	
28.0000	-0.638	
30.0000	-0.638	
32.0000	-0.638	
34.0000	-0.638	
36.0000	-0.638	
38.0000	-0.622	
40.0000	-0.622 ←	.829
42.0000	-0.622	
44.0000	-0.622	
46.0000	-0.606	
48.0000	-0.606	
50.0000	-0.606 ←	.808
52.0000	-0.606	
54.0000	-0.590	
56.0000	-0.590	
58.0000	-0.590	
60.0000	-0.590 ←	.787
62.0000	-0.590	
64.0000	-0.590	
66.0000	-0.574	
68.0000	-0.574	
70.0000	-0.574	
72.0000	-0.574	
74.0000	-0.574	
76.0000	-0.558	
78.0000	-0.558	
80.0000	-0.558	
82.0000	-0.558	
84.0000	-0.542	
86.0000	-0.542	
88.0000	-0.542	
90.0000	-0.542	
92.0000	-0.526	
94.0000	-0.526	

98.0000	-0.526	
100.000	-0.526 ←	.701
110.000	-0.510	
120.000	-0.494	
130.000	-0.478	
140.000	-0.462 ←	.616
150.000	-0.446	
160.000	-0.431	
170.000	-0.431	
180.000	-0.415 ←	.553
190.000	-0.399	
200.000	-0.383 ←	.511
210.000	-0.383	
220.000	-0.367 ←	.489
230.000	-0.351	
240.000	-0.351 ←	.468
250.000	-0.335	
260.000	-0.319 ←	.425
270.000	-0.319	
280.000	-0.303	
290.000	-0.303	
300.000	-0.287 ←	.383
310.000	-0.271	
320.000	-0.271	
330.000	-0.255	
340.000	-0.255	
350.000	-0.239 ←	.319
360.000	-0.239	
370.000	-0.223	
380.000	-0.223	
390.000	-0.207	
400.000	-0.207 ←	.276
410.000	-0.191	
420.000	-0.191	
430.000	-0.191	
440.000	-0.175	
450.000	-0.175 ←	.233
460.000	-0.159	
470.000	-0.159	
480.000	-0.143	
490.000	-0.143	
500.000	-0.143 ←	.191
510.000	-0.127	
520.000	-0.127	
530.000	-0.127	
540.000	-0.111	
550.000	-0.111 ←	.148
560.000	-0.111	
570.000	-0.095	
580.000	-0.095	
590.000	-0.079	
600.000	-0.079 ←	.105
610.000	-0.079	
620.000	-0.063	
630.000	-0.063	
640.000	-0.063	
650.000	-0.047	
660.000	-0.047	
670.000	-0.047	
680.000	-0.047	
690.000	-0.031	
700.000	-0.031	
710.000	-0.031	
720.000	-0.031	
730.000	-0.015	

750.000	-0.015
760.000	-0.015
770.000	0.000
780.000	0.000
790.000	0.000
800.000	0.015
810.000	0.015
820.000	0.015
830.000	0.015
840.000	0.015
850.000	0.031
860.000	0.031
870.000	0.031
880.000	0.031
890.000	0.031
900.000	0.047
910.000	0.047

END

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE 1 OF

CLIENT	NSB - NLON
JOB NUMBER	~~0185~~ 5082
SUBJECT	CTO 203 Slug Tests.
BASED ON	Hvorslev
DRAWING NUMBER	
BY	T Evans
CHECKED BY	12/11/95
APPROVED BY	
DATE	

Well # 2LMW36B

Falling

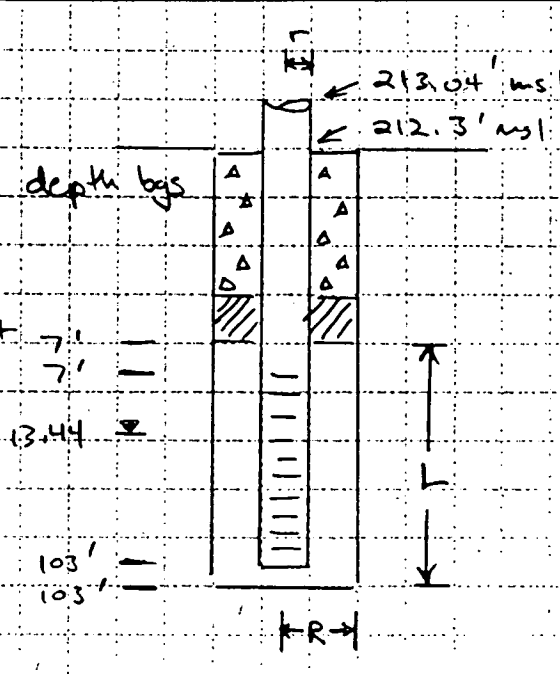
$r = 3'' = .25$ ft

$R = 3'' = .25$ ft

$L = \cancel{13.44 \text{ ft} + .702 \text{ ft} = 14.14 \text{ ft}}$

$t_o = 270$ min

$L/R > 8$



$\therefore$

$$K = \frac{r^2 \ln(L/R)}{2 L t_o}$$

$L = (213.04 - 14.18) - (212.3 - 103) = 89.56$ ft

$$K = \frac{(.25 \text{ ft})^2 \ln(89.56 \text{ ft}/.25 \text{ ft})}{2(89.56 \text{ ft})(270 \text{ min})}$$

$K = 7.6 \times 10^{-6}$ ft/min $\times$ 1440 min/day

$K = 1.1 \times 10^{-2}$ ft/day

$= 3.9 \times 10^{-6}$ cm/sec

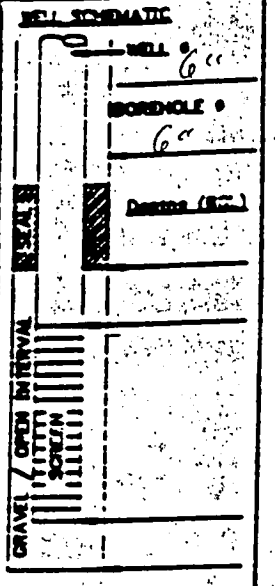
HYDRAULIC CONDUCTIVITY TESTING DATA SHEET

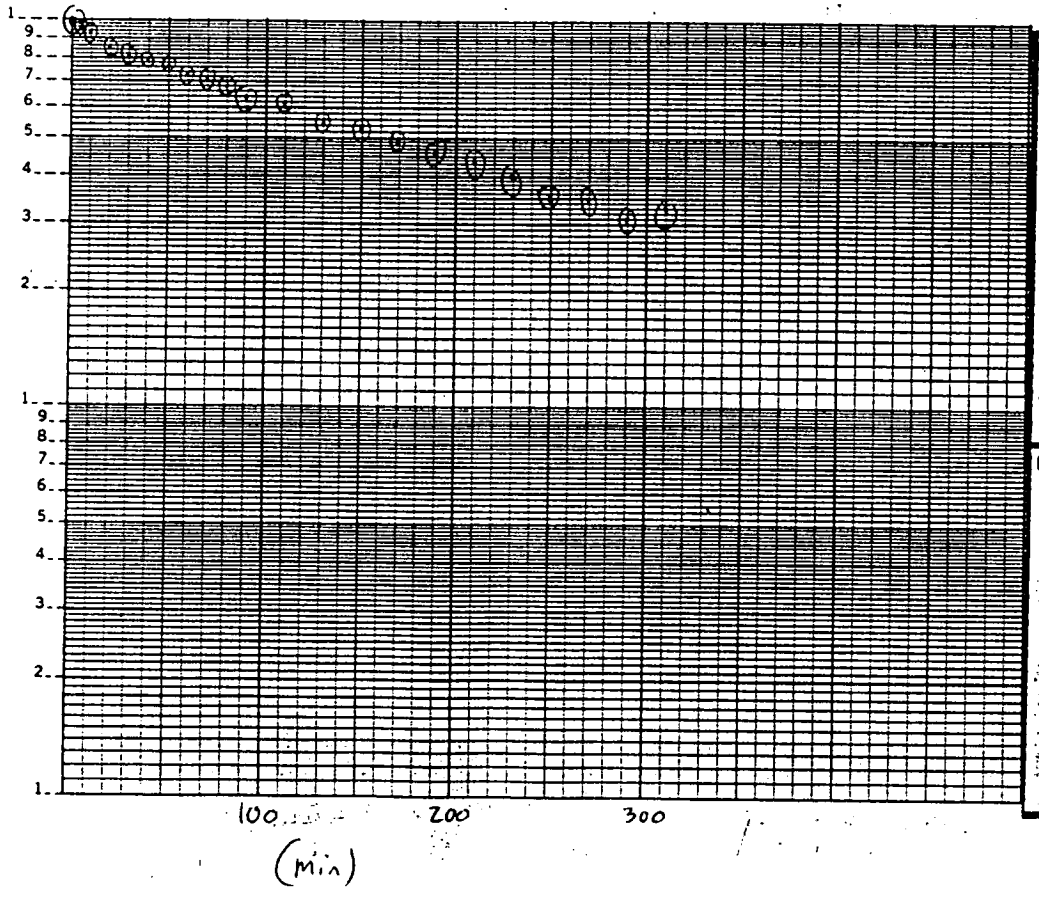
Brown & Root Environmental

PROJECT NAME: NSB-NLON WELL/BORING NO.: 2LMW36B
PROJECT NO.: 5082 GEOLOGIST: MARSHALL
WELL DIAMETER: 6" SCREEN LENGTH/DEPTH: TEST NO.: 0
STATIC WATER LEVEL (Depth/Elevation): 14.18 DATE: 11/28/95
TEST TYPE (Rising/Falling/Constant Head): FALLING CHECKED:
METHOD OF INDUCING WATER LEVEL CHANGE: 5', 2.5" ϕ SLUG PAGE ___ OF ___
REFERENCE PT. FOR WL MEAS. (Top of Casing, Transducer, etc.): TOC

ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)	ELAPSED TIME (min. or sec.)	MEASURED WATER LEVEL (feet)	DRAWDOWN OR HEAD (ΔH) (feet)
0.9000	1.000	-0.718	110.0	0.621	-0.446
1.000	0.978	-0.702	130.0	0.556	-0.399
5.000	0.955	-0.686	150.0	0.533	-0.383
10.000	0.933	-0.670	170.0	0.489	-0.351
20.000	0.866	-0.622	190.0	0.467	-0.335
30.000	0.822	-0.590	210.0	0.444	-0.319
40.000	0.799	-0.574	230.0	0.400	-0.287
50.000	0.777	-0.558	250.0	0.355	-0.255
60.000	0.733	-0.526	270.0	0.355	-0.255
70.00	0.710	-0.510	290.0	0.311	-0.223
80.00	0.688	-0.494	310.0	0.333	-0.239
90.00	0.643	-0.462			

WELL SCHEMATIC





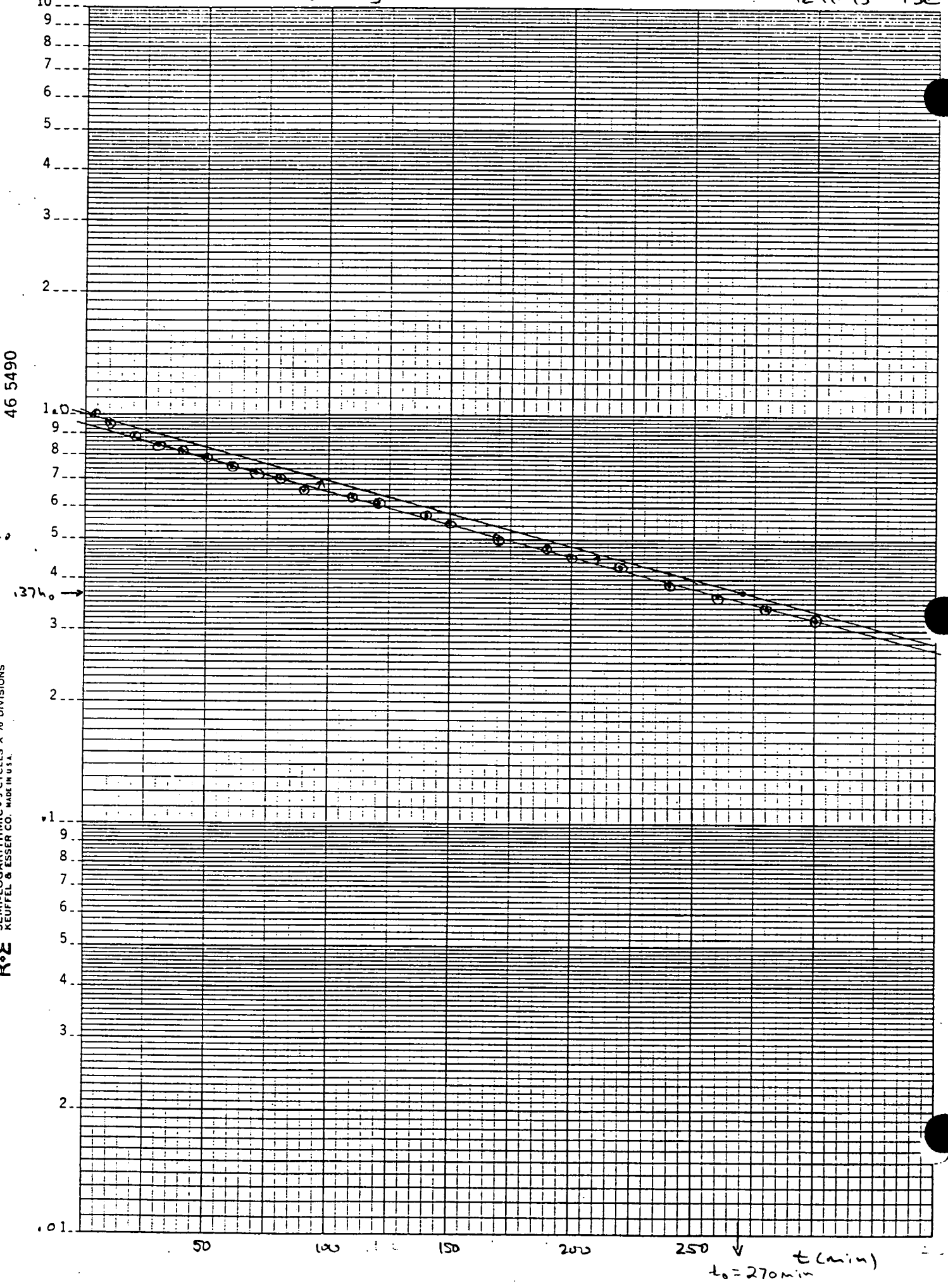
REMARKS:

XD @ 25' Depth
Slug Bottom @ 20' Depth

CALCS, SKETCH MAPS, ETC.:

2LMW36B Falling

12-11-95 TSE



SE2000
Environmental Logger
11/29 08:45

Unit# 0 Test 0

INPUT 1: Level (F) TOC

Reference	0.000
PSI at Ref.	4.629
SG	1.000
Linearity	0.113
Scale factor	50.617
Offset	-0.142
Delay mSEC	50.000

Step 0 11/28 11:03:59

Elapsed Time	INPUT 1
0.0000	0.000
0.0083	0.000
0.0166	0.000
0.0250	0.000
0.0333	0.000
0.0416	0.000
0.0500	0.000
0.0583	0.000
0.0666	0.000
0.0750	0.000
0.0833	-0.031
0.0916	-0.239
0.1000	-0.383
0.1083	-0.383
0.1166	-0.622
0.1250	-0.654
0.1333	-0.766
0.1416	-0.702
0.1500	-0.702
0.1583	-0.622
0.1666	-0.718
0.1750	-0.718
0.1833	-0.718
0.1916	-0.734
0.2000	-0.702
0.2083	-0.702
0.2166	-0.702
0.2250	-0.718 ←
0.2333	-0.702
0.2416	-0.702
0.2500	-0.702
0.2583	-0.702
0.2666	-0.702
0.2750	-0.702
0.2833	-0.702
0.2916	-0.702
0.3000	-0.702
0.3083	-0.702
0.3166	-0.702
0.3250	-0.702

2LMW36B
FALLING HEAD TEST

0.3500	-0.702	
0.3666	-0.702	
0.3833	-0.702	
0.4000	-0.718	
0.4166	-0.718	
0.4500	-0.702	
0.4666	-0.702	
0.4833	-0.702	
0.5000	-0.702	
0.5166	-0.702	
0.5333	-0.702	
0.5500	-0.702	
0.5666	-0.702	
0.5833	-0.702	
0.6000	-0.702	
0.6166	-0.718	
0.6333	-0.702	
0.6500	-0.702	
0.6666	-0.702	
0.6833	-0.702	
0.7000	-0.702	
0.7166	-0.702	
0.7333	-0.702	
0.7500	-0.702	
0.7666	-0.702	
0.7833	-0.702	
0.8000	-0.702	
0.8166	-0.702	
0.8333	-0.702	
0.8500	-0.702	
0.8666	-0.702	
0.8833	-0.702	
0.9000	-0.718	START
0.9166	-0.702	
0.9333	-0.702	
0.9500	-0.702	
0.9666	-0.702	
0.9833	-0.702	
1.0000	-0.702	
1.2000	-0.702	
1.4000	-0.702	
1.6000	-0.702	
1.8000	-0.702	
2.0000	-0.702	
2.2000	-0.702	
2.4000	-0.702	
2.6000	-0.702	
2.8000	-0.702	
3.0000	-0.702	
3.2000	-0.702	
3.4000	-0.702	
3.6000	-0.702	
3.8000	-0.702	
4.0000	-0.702	
4.2000	-0.702	h/h_o
4.4000	-0.702	
4.6000	-0.702	h_o 1.0
4.8000	-0.686	
5.0000	-0.686	
5.2000	-0.686	
5.4000	-0.686	
5.6000	-0.686	
5.8000	-0.686	
6.0000	-0.686	
6.2000	-0.686	

6.8000	-0.686	
7.0000	-0.686	
7.2000	-0.686	
7.4000	-0.686	
7.6000	-0.686	
7.8000	-0.686	
8.0000	-0.686	
8.2000	-0.686	
8.4000	-0.670	
8.6000	-0.670	
8.8000	-0.670	
9.0000	-0.686	
9.2000	-0.670	
9.4000	-0.670	
9.6000	-0.670	
9.8000	-0.670	
10.0000	-0.670 ←	.954
12.0000	-0.638	
14.0000	-0.638	
16.0000	-0.638	
18.0000	-0.622	
20.0000	-0.622 ←	.886
22.0000	-0.606	
24.0000	-0.606	
26.0000	-0.606	
28.0000	-0.606	
30.0000	-0.590 ←	.840
32.0000	-0.590	
34.0000	-0.606	
36.0000	-0.574	
38.0000	-0.574	
40.0000	-0.574 ←	.818
42.0000	-0.574	
44.0000	-0.558	
46.0000	-0.558	
48.0000	-0.558	
50.0000	-0.558 ←	.795
52.0000	-0.542	
54.0000	-0.542	
56.0000	-0.542	
58.0000	-0.526	
60.0000	-0.526 ←	.749
62.0000	-0.526	
64.0000	-0.526	
66.0000	-0.510	
68.0000	-0.526	
70.0000	-0.510 ←	.726
72.0000	-0.510	
74.0000	-0.510	
76.0000	-0.494	
78.0000	-0.494	
80.0000	-0.494 ←	.703
82.0000	-0.478	
84.0000	-0.478	
86.0000	-0.478	
88.0000	-0.478	
90.0000	-0.462 ←	.658
92.0000	-0.462	
94.0000	-0.478	
96.0000	-0.462	
98.0000	-0.462	
100.000	-0.462 ←	.658
110.000	-0.446 ←	.635
120.000	-0.431 ←	.614

150.000	-0.383 ←	.506
160.000	-0.367	.546
170.000	-0.351 ←	.50
180.000	-0.351	
190.000	-0.335 ←	.477
200.000	-0.319 ←	.454
210.000	-0.319	
220.000	-0.303 ←	.432
230.000	-0.287	
240.000	-0.271 ←	.386
250.000	-0.255	
260.000	-0.255 ←	.363
270.000	-0.255	
280.000	-0.239 ←	.340
290.000	-0.223	
300.000	-0.223 ←	.318
310.000	-0.239	

END

APPENDIX D.3

HELP MODEL ANALYSIS

```
******************************************************************************
******************************************************************************
**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:      C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:        C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\uphill.D10
OUTPUT DATA FILE:             C:\HELP3\uphill.OUT


TIME:  13:17     DATE:   2/14/1996


******************************************************************************

     TITLE:  Hillside-Vegetated with Steeper Slope

******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =     30.00   INCHES
          POROSITY                     =      0.4610 VOL/VOL
          FIELD CAPACITY               =      0.3600 VOL/VOL
          WILTING POINT                =      0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2812 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.141000003000E-02 CM/SEC


                                  LAYER  2
```

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	30.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3164	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.141000003000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM A USER-SPECIFIED CURVE NUMBER OF 90.0, A SURFACE SLOPE OF 50.% AND A SLOPE LENGTH OF 200. FEET.

SCS RUNOFF CURVE NUMBER	=	91.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	36.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	10.596	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.596	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	7.308	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	17.930	INCHES
TOTAL INITIAL WATER	=	17.930	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00	
START OF GROWING SEASON (JULIAN DATE)	=	83	
END OF GROWING SEASON (JULIAN DATE)	=	296	
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA FOR NEW HAVEN CONNECTICUT WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING

COEFFICIENTS FOR NEW HAVEN CONNECTICUT

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
35.20	32.60	42.20	49.50	63.10	69.00
78.30	78.50	69.80	55.30	44.80	32.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR NEW HAVEN CONNECTICUT

STATION LATITUDE = 41.30 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1977 THROUGH 1981

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.72	2.87	5.39	4.49	4.34	2.69
	3.88	3.03	3.97	4.76	3.87	4.70
STD. DEVIATIONS	6.11	2.11	3.53	1.82	2.08	1.47
	2.89	2.12	1.66	2.16	1.71	2.35
RUNOFF						
TOTALS	2.399	0.976	1.056	0.727	0.472	0.113
	1.005	0.329	0.435	0.699	0.311	1.109
STD. DEVIATIONS	3.815	1.472	0.809	0.620	0.489	0.105
	1.309	0.353	0.252	0.808	0.331	0.688
EVAPOTRANSPIRATION						
TOTALS	1.329	1.391	2.129	2.548	4.226	2.744
	2.804	2.773	2.674	2.506	1.300	0.860
STD. DEVIATIONS	0.191	0.165	0.399	0.249	0.509	1.045
	1.375	1.453	0.621	0.497	0.292	0.178
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	2.8070	0.7691	1.8035	1.9528	1.0063	0.6731
	0.2421	0.1412	0.0955	0.4674	0.7710	2.1023
STD. DEVIATIONS	2.7091	0.5954	1.3854	1.1314	0.2316	0.4388
	0.0544	0.0197	0.0084	0.6843	0.9984	1.9176

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1977 THROUGH 1981

	INCHES		CU. FEET	PERCENT
PRECIPITATION	49.71	(6.473)	180432.7	100.00
RUNOFF	9.630	(3.2505)	34956.93	19.374
EVAPOTRANSPIRATION	27.284	(2.1243)	99039.30	54.890
PERCOLATION/LEAKAGE THROUGH LAYER 2	12.83132	(4.71449)	46577.707	25.81444
CHANGE IN WATER STORAGE	-0.039	(1.2729)	-141.16	-0.078

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PEAK DAILY VALUES FOR YEARS 1977 THROUGH 1981

	(INCHES)	(CU. FT.)
PRECIPITATION	5.20	18876.000
RUNOFF	3.066	11131.0088
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.487639	5400.12891
SNOW WATER	3.68	13344.2305

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3600
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1967

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FINAL WATER STORAGE AT END OF YEAR 1981

LAYER	(INCHES)	(VOL/VOL)
1	8.7863	0.2929
2	8.9489	0.2983
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:        C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\gp.D10
OUTPUT DATA FILE:             C:\HELP3\gp.OUT


TIME:  14:33     DATE:   2/14/1996


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     TITLE:  Gravel Parking and Unpaved Roadways

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      36.00   INCHES
          POROSITY                     =       0.4610 VOL/VOL
          FIELD CAPACITY               =       0.3600 VOL/VOL
          WILTING POINT                =       0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT   =       0.2569 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.846699998000E-02 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3184	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.141000003000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	85.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	36.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	9.250	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.596	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	7.308	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	35.994	INCHES
TOTAL INITIAL WATER	=	35.994	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00	
START OF GROWING SEASON (JULIAN DATE)	=	83	
END OF GROWING SEASON (JULIAN DATE)	=	296	
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA FOR NEW HAVEN CONNECTICUT
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW HAVEN CONNECTICUT

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
35.20	32.60	42.20	49.50	63.10	69.00
78.30	78.50	69.80	55.30	44.80	32.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR NEW HAVEN CONNECTICUT

STATION LATITUDE = 41.30 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1977 THROUGH 1981

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.72	2.87	5.39	4.49	4.34	2.69
	3.88	3.03	3.97	4.76	3.87	4.70
STD. DEVIATIONS	6.11	2.11	3.53	1.82	2.08	1.47
	2.89	2.12	1.66	2.16	1.71	2.35
RUNOFF						
TOTALS	1.745	0.930	0.387	0.288	0.113	0.009
	0.573	0.109	0.099	0.250	0.064	0.732
STD. DEVIATIONS	3.105	1.494	0.286	0.277	0.134	0.010
	0.887	0.162	0.064	0.367	0.087	0.712
EVAPOTRANSPIRATION						
TOTALS	1.272	1.218	1.839	2.122	3.459	2.643
	2.769	2.509	2.716	2.561	1.301	0.862
STD. DEVIATIONS	0.236	0.315	0.568	0.431	0.555	1.242
	1.418	1.436	0.757	0.380	0.292	0.215
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	3.1785	1.7311	2.1112	2.5995	1.9220	1.2748
	0.7150	0.6717	0.4970	0.9886	1.2517	2.2668
STD. DEVIATIONS	2.5024	1.3492	1.3257	1.5615	0.7293	0.6714
	0.1304	0.3262	0.1454	0.8195	0.9796	2.0336

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1977 THROUGH 1981

	INCHES		CU. FEET	PERCENT
PRECIPITATION	49.71	(6.473)	180432.7	100.00
RUNOFF	5.299	(3.1056)	19235.18	10.661
EVAPOTRANSPIRATION	25.270	(2.1175)	91730.67	50.839
PERCOLATION/LEAKAGE THROUGH LAYER 2	19.20809	(5.96868)	69725.359	38.64340
CHANGE IN WATER STORAGE	-0.071	(1.6809)	-258.45	-0.143

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PEAK DAILY VALUES FOR YEARS 1977 THROUGH 1981

	(INCHES)	(CU. FT.)
PRECIPITATION	5.20	18876.000
RUNOFF	2.070	7513.2559
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.064027	3862.41650
SNOW WATER	3.68	13344.2305

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3600
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1956

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FINAL WATER STORAGE AT END OF YEAR 1981

LAYER	(INCHES)	(VOL/VOL)
1	9.6203	0.2672
2	26.0180	0.3097
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:        C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\gp.D10
OUTPUT DATA FILE:             C:\HELP3\gp.OUT


TIME:  14:34     DATE:   2/14/1996


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     TITLE:  Gravel Parking and Unpaved Roadways

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =     36.00   INCHES
          POROSITY                     =      0.4610 VOL/VOL
          FIELD CAPACITY               =      0.3600 VOL/VOL
          WILTING POINT                =      0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2569 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.846699998000E-02 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2907	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.600000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	85.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	36.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	9.250	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.596	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	7.308	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	33.673	INCHES
TOTAL INITIAL WATER	=	33.673	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00	
START OF GROWING SEASON (JULIAN DATE)	=	83	
END OF GROWING SEASON (JULIAN DATE)	=	296	
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA FOR NEW HAVEN CONNECTICUT
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW HAVEN CONNECTICUT

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
35.20	32.60	42.20	49.50	63.10	69.00
78.30	78.50	69.80	55.30	44.80	32.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR NEW HAVEN CONNECTICUT

STATION LATITUDE = 41.30 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1977 THROUGH 1981

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.72	2.87	5.39	4.49	4.34	2.69
	3.88	3.03	3.97	4.76	3.87	4.70
STD. DEVIATIONS	6.11	2.11	3.53	1.82	2.08	1.47
	2.89	2.12	1.66	2.16	1.71	2.35
RUNOFF						
TOTALS	1.745	0.930	0.387	0.288	0.113	0.009
	0.573	0.109	0.099	0.250	0.064	0.732
STD. DEVIATIONS	3.105	1.494	0.286	0.277	0.134	0.010
	0.887	0.162	0.064	0.367	0.087	0.712
EVAPOTRANSPIRATION						
TOTALS	1.272	1.218	1.839	2.122	3.459	2.643
	2.769	2.509	2.716	2.561	1.301	0.862
STD. DEVIATIONS	0.236	0.315	0.568	0.431	0.555	1.242
	1.418	1.436	0.757	0.380	0.292	0.215
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	3.2127	1.6192	2.2203	2.5561	1.8962	1.2193
	0.6670	0.6401	0.4679	1.0520	1.2687	2.3682
STD. DEVIATIONS	2.6505	1.2506	1.4071	1.5333	0.7195	0.7031
	0.1218	0.3449	0.1487	0.9239	1.0317	2.0351

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1977 THROUGH 1981

	INCHES		CU. FEET	PERCENT
PRECIPITATION	49.71	(6.473)	180432.7	100.00
RUNOFF	5.299	(3.1056)	19235.18	10.661
EVAPOTRANSPIRATION	25.270	(2.1175)	91730.67	50.839
PERCOLATION/LEAKAGE THROUGH LAYER 2	19.18765	(5.90892)	69651.164	38.60228
CHANGE IN WATER STORAGE	-0.051	(1.6330)	-184.25	-0.102

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PEAK DAILY VALUES FOR YEARS 1977 THROUGH 1981

	(INCHES)	(CU. FT.)
PRECIPITATION	5.20	18876.000
RUNOFF	2.070	7513.2559
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.056456	3834.93555
SNOW WATER	3.68	13344.2305

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3600
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1956

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FINAL WATER STORAGE AT END OF YEAR 1981

LAYER	(INCHES)	(VOL/VOL)
1	9.6203	0.2672
2	23.7985	0.2833
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:        C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\gp.D10
OUTPUT DATA FILE:             C:\HELP3\gp.OUT


TIME:  14:37     DATE:   2/14/1996


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     TITLE:  Gravel Parking and Unpaved Roadways

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      36.00   INCHES
          POROSITY                     =       0.4610 VOL/VOL
          FIELD CAPACITY               =       0.3600 VOL/VOL
          WILTING POINT                =       0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT   =       0.2569 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.846699998000E-02 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2527	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.599999987000E-01	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	85.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	36.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	9.250	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.596	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	7.308	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	30.479	INCHES
TOTAL INITIAL WATER	=	30.479	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00	
START OF GROWING SEASON (JULIAN DATE)	=	83	
END OF GROWING SEASON (JULIAN DATE)	=	296	
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA FOR NEW HAVEN CONNECTICUT
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW HAVEN CONNECTICUT

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
35.20	32.60	42.20	49.50	63.10	69.00
78.30	78.50	69.80	55.30	44.80	32.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR NEW HAVEN CONNECTICUT

STATION LATITUDE = 41.30 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1977 THROUGH 1981

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.72	2.87	5.39	4.49	4.34	2.69
	3.88	3.03	3.97	4.76	3.87	4.70
STD. DEVIATIONS	6.11	2.11	3.53	1.82	2.08	1.47
	2.89	2.12	1.66	2.16	1.71	2.35
RUNOFF						
TOTALS	1.745	0.930	0.387	0.288	0.113	0.009
	0.573	0.109	0.099	0.250	0.064	0.732
STD. DEVIATIONS	3.105	1.494	0.286	0.277	0.134	0.010
	0.887	0.162	0.064	0.367	0.087	0.712
EVAPOTRANSPIRATION						
TOTALS	1.272	1.218	1.839	2.122	3.459	2.643
	2.769	2.509	2.716	2.561	1.301	0.862
STD. DEVIATIONS	0.236	0.315	0.568	0.431	0.555	1.242
	1.418	1.436	0.757	0.380	0.292	0.215
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	3.2657	1.4351	2.4085	2.4711	1.8440	1.1463
	0.5963	0.6043	0.4224	1.1850	1.2674	2.5173
STD. DEVIATIONS	2.8815	1.1002	1.5084	1.4910	0.7006	0.7484
	0.1246	0.4037	0.1504	1.1312	1.0760	2.0501

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1977 THROUGH 1981

	INCHES		CU. FEET	PERCENT
PRECIPITATION	49.71	(6.473)	180432.7	100.00
RUNOFF	5.299	(3.1056)	19235.18	10.661
EVAPOTRANSPIRATION	25.270	(2.1175)	91730.67	50.839
PERCOLATION/LEAKAGE THROUGH LAYER 2	19.16342	(5.83521)	69563.203	38.55353
CHANGE IN WATER STORAGE	-0.027	(1.5917)	-96.31	-0.053

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PEAK DAILY VALUES FOR YEARS 1977 THROUGH 1981

	(INCHES)	(CU. FT.)
PRECIPITATION	5.20	18876.000
RUNOFF	2.070	7513.2559
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.965812	3505.89893
SNOW WATER	3.68	13344.2305

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3600
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1956

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FINAL WATER STORAGE AT END OF YEAR 1981

LAYER	(INCHES)	(VOL/VOL)
1	9.6203	0.2672
2	20.7259	0.2467
SNOW WATER	0.000	

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:        C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\gp2.D10
OUTPUT DATA FILE:             C:\HELP3\gp2.OUT


TIME:  14:40      DATE:   2/14/1996


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     TITLE:  Vegetated area with minimal slope

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                       TYPE 1 - VERTICAL PERCOLATION LAYER
                           MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      36.00   INCHES
          POROSITY                     =       0.4610 VOL/VOL
          FIELD CAPACITY               =       0.3600 VOL/VOL
          WILTING POINT                =       0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT   =       0.2741 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.423000008000E-02 CM/SEC


                                  LAYER  2
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TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3176	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.141000003000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	85.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	36.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	9.867	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.596	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	7.308	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	36.543	INCHES
TOTAL INITIAL WATER	=	36.543	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00	
START OF GROWING SEASON (JULIAN DATE)	=	83	
END OF GROWING SEASON (JULIAN DATE)	=	296	
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA FOR NEW HAVEN CONNECTICUT
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW HAVEN CONNECTICUT

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
35.20	32.60	42.20	49.50	63.10	69.00
78.30	78.50	69.80	55.30	44.80	32.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR NEW HAVEN CONNECTICUT

STATION LATITUDE = 41.30 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1977 THROUGH 1981

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.72	2.87	5.39	4.49	4.34	2.69
	3.88	3.03	3.97	4.76	3.87	4.70
STD. DEVIATIONS	6.11	2.11	3.53	1.82	2.08	1.47
	2.89	2.12	1.66	2.16	1.71	2.35
RUNOFF						
TOTALS	1.774	0.932	0.398	0.289	0.115	0.009
	0.575	0.112	0.101	0.255	0.064	0.744
STD. DEVIATIONS	3.132	1.496	0.295	0.279	0.136	0.010
	0.888	0.167	0.066	0.373	0.087	0.723
EVAPOTRANSPIRATION						
TOTALS	1.316	1.244	1.884	2.323	3.862	2.754
	2.868	2.684	2.769	2.594	1.331	0.850
STD. DEVIATIONS	0.202	0.277	0.556	0.337	0.560	1.262
	1.434	1.418	0.776	0.379	0.287	0.211
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	3.0673	1.8254	1.9706	2.5363	1.7954	1.1806
	0.6685	0.5642	0.4093	0.7329	1.0925	2.1274
STD. DEVIATIONS	2.3463	1.4680	1.2787	1.5507	0.7135	0.5459
	0.1611	0.1552	0.0956	0.5195	0.9402	2.1625

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1977 THROUGH 1981

	INCHES		CU. FEET	PERCENT
PRECIPITATION	49.71	(6.473)	180432.7	100.00
RUNOFF	5.368	(3.1395)	19486.53	10.800
EVAPOTRANSPIRATION	26.476	(2.0945)	96106.80	53.265
PERCOLATION/LEAKAGE THROUGH LAYER 2	17.97031	(5.95494)	65232.227	36.15321
CHANGE IN WATER STORAGE	-0.108	(1.6251)	-392.82	-0.218

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PEAK DAILY VALUES FOR YEARS 1977 THROUGH 1981

	(INCHES)	(CU. FT.)
PRECIPITATION	5.20	18876.000
RUNOFF	2.071	7518.1016
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.910484	3305.05542
SNOW WATER	3.68	13344.2305

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3600

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.1934

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FINAL WATER STORAGE AT END OF YEAR 1981

LAYER	(INCHES)	(VOL/VOL)
1	10.0179	0.2783
2	25.9837	0.3093
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**              HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                 **
**                 DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                   USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:        C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\gp2.D10
OUTPUT DATA FILE:             C:\HELP3\gp2.OUT


TIME:  14:44     DATE:   2/14/1996


******************************************************************************

     TITLE:  Vegetated area with minimal slope

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                  LAYER  1
                                  --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          THICKNESS                  =      36.00   INCHES
          POROSITY                   =       0.4610 VOL/VOL
          FIELD CAPACITY             =       0.3600 VOL/VOL
          WILTING POINT              =       0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT =       0.2741 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.423000008000E-02 CM/SEC


                                  LAYER  2
```

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2896	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.600000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	85.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	36.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	9.867	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.596	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	7.308	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	34.191	INCHES
TOTAL INITIAL WATER	=	34.191	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00	
START OF GROWING SEASON (JULIAN DATE)	=	83	
END OF GROWING SEASON (JULIAN DATE)	=	296	
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA FOR NEW HAVEN CONNECTICUT
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW HAVEN CONNECTICUT

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
35.20	32.60	42.20	49.50	63.10	69.00
78.30	78.50	69.80	55.30	44.80	32.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR NEW HAVEN CONNECTICUT

STATION LATITUDE = 41.30 DEGREES

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1977 THROUGH 1981

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.72	2.87	5.39	4.49	4.34	2.69
	3.88	3.03	3.97	4.76	3.87	4.70
STD. DEVIATIONS	6.11	2.11	3.53	1.82	2.08	1.47
	2.89	2.12	1.66	2.16	1.71	2.35
RUNOFF						
TOTALS	1.774	0.932	0.398	0.289	0.115	0.009
	0.575	0.112	0.101	0.255	0.064	0.744
STD. DEVIATIONS	3.132	1.496	0.295	0.279	0.136	0.010
	0.888	0.167	0.066	0.373	0.087	0.723
EVAPOTRANSPIRATION						
TOTALS	1.316	1.244	1.884	2.323	3.862	2.754
	2.868	2.684	2.769	2.594	1.331	0.850
STD. DEVIATIONS	0.202	0.277	0.556	0.337	0.560	1.262
	1.434	1.418	0.776	0.379	0.287	0.211
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	3.1454	1.6884	2.0593	2.5269	1.7492	1.1269
	0.6148	0.5296	0.3811	0.7778	1.1143	2.2310
STD. DEVIATIONS	2.5172	1.3457	1.3260	1.5492	0.6796	0.5747
	0.1441	0.1697	0.0929	0.6310	0.9708	2.2087

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1977 THROUGH 1981

	INCHES		CU. FEET	PERCENT
PRECIPITATION	49.71	(6.473)	180432.7	100.00
RUNOFF	5.368	(3.1395)	19486.53	10.800
EVAPOTRANSPIRATION	26.476	(2.0945)	96106.80	53.265
PERCOLATION/LEAKAGE THROUGH LAYER 2	17.94481	(5.88943)	65139.672	36.10191
CHANGE IN WATER STORAGE	-0.083	(1.5586)	-300.24	-0.166

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PEAK DAILY VALUES FOR YEARS 1977 THROUGH 1981

	(INCHES)	(CU. FT.)
PRECIPITATION	5.20	18876.000
RUNOFF	2.071	7518.1016
PERCOLATION/LEAKAGE THROUGH LAYER 2	0.899461	3265.04468
SNOW WATER	3.68	13344.2305

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3600
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1934

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****

FINAL WATER STORAGE AT END OF YEAR 1981

LAYER	(INCHES)	(VOL/VOL)
1	10.0179	0.2783
2	23.7600	0.2829
SNOW WATER	0.000	

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:      C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:        C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:    C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:      C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:    C:\HELP3\gp2.D10
OUTPUT DATA FILE:             C:\HELP3\gp2.OUT


TIME:  14:45     DATE:   2/14/1996


******************************************************************************

     TITLE:  Vegetated area with minimal slope

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                   LAYER  1
                                   --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      36.00   INCHES
          POROSITY                     =       0.4610 VOL/VOL
          FIELD CAPACITY               =       0.3600 VOL/VOL
          WILTING POINT                =       0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT   =       0.2741 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.423000008000E-02 CM/SEC


                                   LAYER  2
```

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2521	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.599999987000E-01	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	85.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	36.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	9.867	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	16.596	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	7.308	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	31.046	INCHES
TOTAL INITIAL WATER	=	31.046	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00	
START OF GROWING SEASON (JULIAN DATE)	=	83	
END OF GROWING SEASON (JULIAN DATE)	=	296	
AVERAGE ANNUAL WIND SPEED	=	12.00	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	69.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	70.00	%

NOTE: PRECIPITATION DATA FOR NEW HAVEN CONNECTICUT
WAS ENTERED FROM THE DEFAULT DATA FILE.

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR NEW HAVEN CONNECTICUT

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
35.20	32.60	42.20	49.50	63.10	69.00
78.30	78.50	69.80	55.30	44.80	32.00

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING COEFFICIENTS FOR NEW HAVEN CONNECTICUT

STATION LATITUDE = 41.30 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1977 THROUGH 1981

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	5.72	2.87	5.39	4.49	4.34	2.69
	3.88	3.03	3.97	4.76	3.87	4.70
STD. DEVIATIONS	6.11	2.11	3.53	1.82	2.08	1.47
	2.89	2.12	1.66	2.16	1.71	2.35
RUNOFF						
TOTALS	1.774	0.932	0.398	0.289	0.115	0.009
	0.575	0.112	0.101	0.255	0.064	0.744
STD. DEVIATIONS	3.132	1.496	0.295	0.279	0.136	0.010
	0.888	0.167	0.066	0.373	0.087	0.723
EVAPOTRANSPIRATION						
TOTALS	1.316	1.244	1.884	2.323	3.862	2.754
	2.868	2.684	2.769	2.594	1.331	0.850
STD. DEVIATIONS	0.202	0.277	0.556	0.337	0.560	1.262
	1.434	1.418	0.776	0.379	0.287	0.211
PERCOLATION/LEAKAGE THROUGH LAYER 2						
TOTALS	3.2234	1.5172	2.2140	2.4794	1.6936	1.0542
	0.5395	0.4847	0.3393	0.8702	1.1549	2.3577
STD. DEVIATIONS	2.7465	1.2012	1.4267	1.5611	0.6302	0.6151
	0.1192	0.2021	0.0910	0.8094	1.0419	2.1960

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1977 THROUGH 1981

	INCHES		CU. FEET	PERCENT
PRECIPITATION	49.71	(6.473)	180432.7	100.00
RUNOFF	5.368	(3.1395)	19486.53	10.800
EVAPOTRANSPIRATION	26.476	(2.0945)	96106.80	53.265
PERCOLATION/LEAKAGE THROUGH LAYER 2	17.92814	(5.81149)	65079.152	36.06837
CHANGE IN WATER STORAGE	-0.066	(1.5004)	-239.73	-0.133

****

****

PEAK DAILY VALUES FOR YEARS 1977 THROUGH 1981

	(INCHES)	(CU. FT.)
PRECIPITATION	5.20	18876.000
RUNOFF	2.071	7518.1016
PERCOLATION/LEAKAGE THROUGH LAYER 2	1.023859	3716.60962
SNOW WATER	3.68	13344.2305

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3600
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1934

****

****

FINAL WATER STORAGE AT END OF YEAR 1981

LAYER	(INCHES)	(VOL/VOL)
1	10.0179	0.2783
2	20.6983	0.2464
SNOW WATER	0.000	

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**                                                                          **
 *                                                                          **
 *              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**               HELP MODEL VERSION 3.03  (31 DECEMBER 1994)                **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                    USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
******************************************************************************
******************************************************************************


PRECIPITATION DATA FILE:     C:\HELP3\NEW4.D4
TEMPERATURE DATA FILE:       C:\HELP3\NEW7.D7
SOLAR RADIATION DATA FILE:   C:\HELP3\NEW13.D13
EVAPOTRANSPIRATION DATA:     C:\HELP3\NEW11.D11
SOIL AND DESIGN DATA FILE:   C:\HELP3\CAP.D10
OUTPUT DATA FILE:            C:\HELP3\capout.OUT


TIME:  14:34     DATE:   1/29/1996



******************************************************************************

     TITLE:  Cap

******************************************************************************



     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                     TYPE 1 - VERTICAL PERCOLATION LAYER
                         MATERIAL TEXTURE NUMBER  0
          THICKNESS                  =     36.00   INCHES
          POROSITY                   =      0.4610 VOL/VOL
          FIELD CAPACITY             =      0.3600 VOL/VOL
          WILTING POINT              =      0.2030 VOL/VOL
          INITIAL SOIL WATER CONTENT =      0.3502 VOL/VOL
          EFFECTIVE SAT. HYD. COND.  =  0.100000001000E-06 CM/SEC



                                LAYER  2
```

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	36.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2391	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.850000046000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	84.00	INCHES
POROSITY	=	0.4610	VOL/VOL
FIELD CAPACITY	=	0.3600	VOL/VOL
WILTING POINT	=	0.2030	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2390	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.600000005000E-02	CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	92.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	2.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	0.404	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	0.922	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.406	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	41.291	INCHES
TOTAL INITIAL WATER	=	41.291	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
NEW HAVEN CONNECTICUT

MAXIMUM LEAF AREA INDEX	=	5.00
START OF GROWING SEASON (JULIAN DATE)	=	83
END OF GROWING SEASON (JULIAN DATE)	=	296
AVERAGE ANNUAL WIND SPEED	=	12.00 MPH

APPENDIX D.4

ANALYSIS OF FLOOD CONDITIONS

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: USN NORTHDIV	FILE NO.: 5082/0186	BY: J.D. CHIOU	PAGE 1 OF 2
SUBJECT: NSB NLON AREA A Landfill DESIGN FLOOD ANALYSIS		CHECKED BY: L.J. Gross	DATE: 3/13/96

Gradient $I = \frac{73.91 - 70}{100} = 0.0391$

- Length along the edge of the cap = 1750'
- Filled material thickness under the edge of the cap = 3'
- Total Capped area = 497,000 ft^2

Estimated hydraulic conductivity through the filled material = 56 ft/day

Estimated porosity of the filled material = 0.3

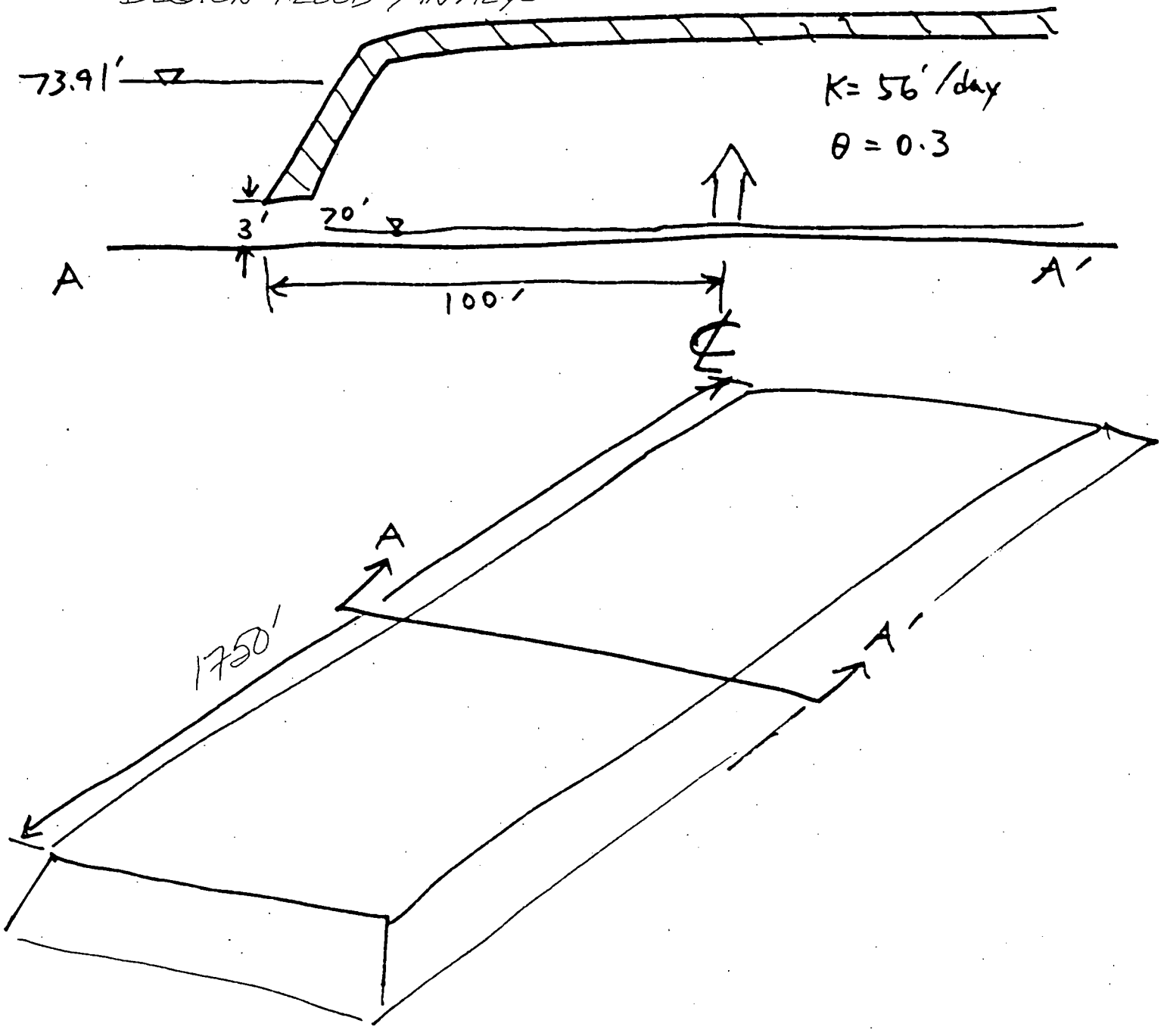
- Flow rate into the filled material:

$$Q = L \cdot H \cdot K \cdot I$$
$$= 1750' \times 3' \times 56'/day \times 0.0391$$
$$= 11,495 \ ft^3/day$$

Water table raising rate under the cap

$$\frac{Q}{A \cdot \theta} = \frac{11,495}{497,000 * 0.3} = 0.077 \ ft/day$$

NUS CORPORATION AND SUBSIDIARIES			STANDARD CALCULATION SHEET
CLIENT: USN NORTHDIV	FILE NO.: 5082/0186	BY: J.D. CHIOU	PAGE 2 OF 2
SUBJECT: NSB-NLON AREA A LANDFILL DESIGN FLOOD ANALYSIS		CHECKED BY: R.J. Ghosh	DATE: 3/13/96



APPENDIX D.5

ANALYSIS OF CONTAMINANT DETECTIONS AND DISCHARGE CALCULATIONS

Inorganic Analytes

Well Number	Groundwater Concentration (ug/L)	Unsaturated Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)	Kd (=Subsurface soil conc./ Groundwater conc.) (L/kg)	Unsaturated Groundwater Concentration (=Mean of Unsaturated Soil Conc./Geometric Mean of Kd) (ug/L)
Aluminum					
2LMW13S	89,300	13,600	15,100	169	
2LMW7S	3,960	--	4,450	1,124	
1MW2S	94.9	--	14,800	155,954	
2LMW18S	593	6,670	7,790	13,137	
Geometric Mean=	2,112			4,545	
Mean=		10,135			
					2,200
Antimony					
2LMW13S	77.4	--	--	--	
Arsenic					
2LMW13S	19.6	3.9	3.3	168	
2LMW9S	4.1	2.2	1.9	463	
2LMW7S	37	--	1.2	32	
2LMW17S	7.5	1.8	2.7	360	
1MW2S(1TB2)	3.5	--	5.4	1,543	
Geometric Mean=	9.5			270	
Mean=		2.6			
					9.8
Barium					
2LMW13S	418	44.8	47.2	113	
2LPW1S	956	--	--	--	
2LMW9S	251	62.3	47.2	188	
2LMW7S	61.5	--	25.4	413	
2LMW17S	34.5	57.5	57.5	1,667	
2LMW8S	45.6	--	42.5	932	
1MW2S	92.5	--	51.5	557	
2LMW18S	564	49.0	116	206	
Geometric Mean=	163			400	
Mean=		53.4			
					134
Beryllium					
2LMW13S	4.2	0.63	0.62	148	
2LPW1S	1.3	--	--	--	
2LMW7S	1.1	--	0.25	227	
Geometric Mean=	1.8			182	
Mean=		0.63			
					3.5

Inorganic Analytes

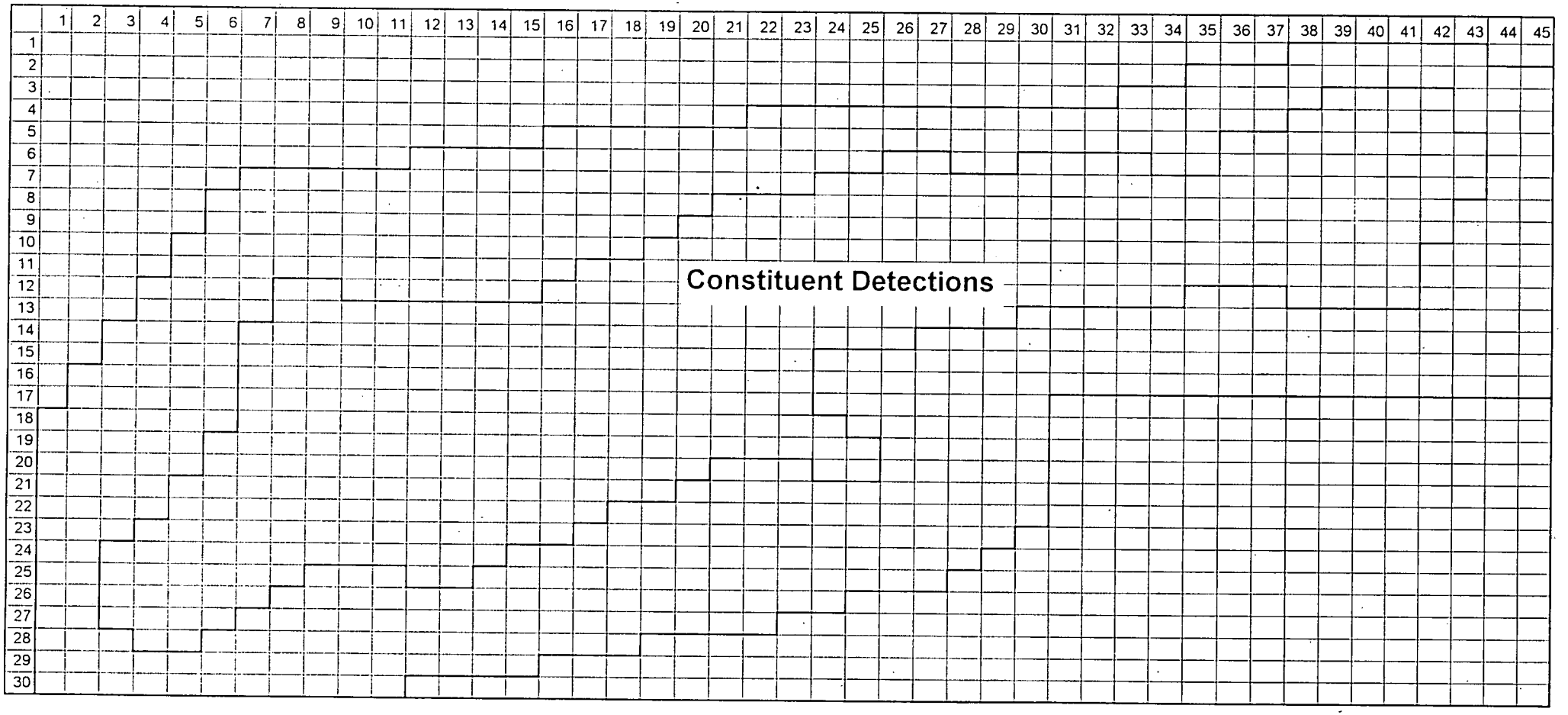
Well Number	Groundwater Concentration (ug/L)	Unsaturated Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)	Kd (=Subsurface soil conc./ Groundwater conc.) (L/kg)	Unsaturated Groundwater Concentration (=Mean of Unsaturated Soil Conc./Geometric Mean of Kd) (ug/L)
Boron					
2LPW1S	486	--	--	--	
2LMW7S	3,010	--	--	--	
2LMW18S	303	50.0	--	--	
1MW2S	130	--	--	--	
Geometric Mean=	490			(Literature Value) 3.0	
Mean=		50.0			
					16,667
Cadmium					
2LMW7S	2.42	--	2.3	950	
Chromium					
2LMW13S	142	22.0	22.7	160	
2LPW1S	7.9	--	--	--	
2LMW7S	23.2	--	8.8	379	
2LMW8S	3.2	--	40.2	12,563	
1MW2S	1.6	--	19.1	11,938	
2LMW18S	7.2	16.2	31.2	4,333	
Geometric Mean=	9.9			2,083	
Mean=		19.1			
					9.2
Iron					
2LMW13S	117,000	13,100	12,600	108	
2LMW9S	19,000	17,700	12,300	647	
2LMW7S	51,100	--	8,370	164	
2LMW17S	11,700	10,900	8,260	706	
2LMW8S	13,900	--	49,700	3,576	
1MW2S	27,600	--	15,700	569	
2LMW18S	193,000	9,890	20,000	104	
2LPW1S	11,700	--	--	--	
Geometric Mean=	32,185			402	
Mean=		12,898			
					32,076
Lead					
2LMW13S	51.1	5.9	5.5	108	
2LMW7S	13.9	--	7.6	547	
2LMW18S	84.0	95.8	277	3,298	
Geometric Mean=	39.1			588	
Mean=		50.9			
					86.5

Inorganic Analytes

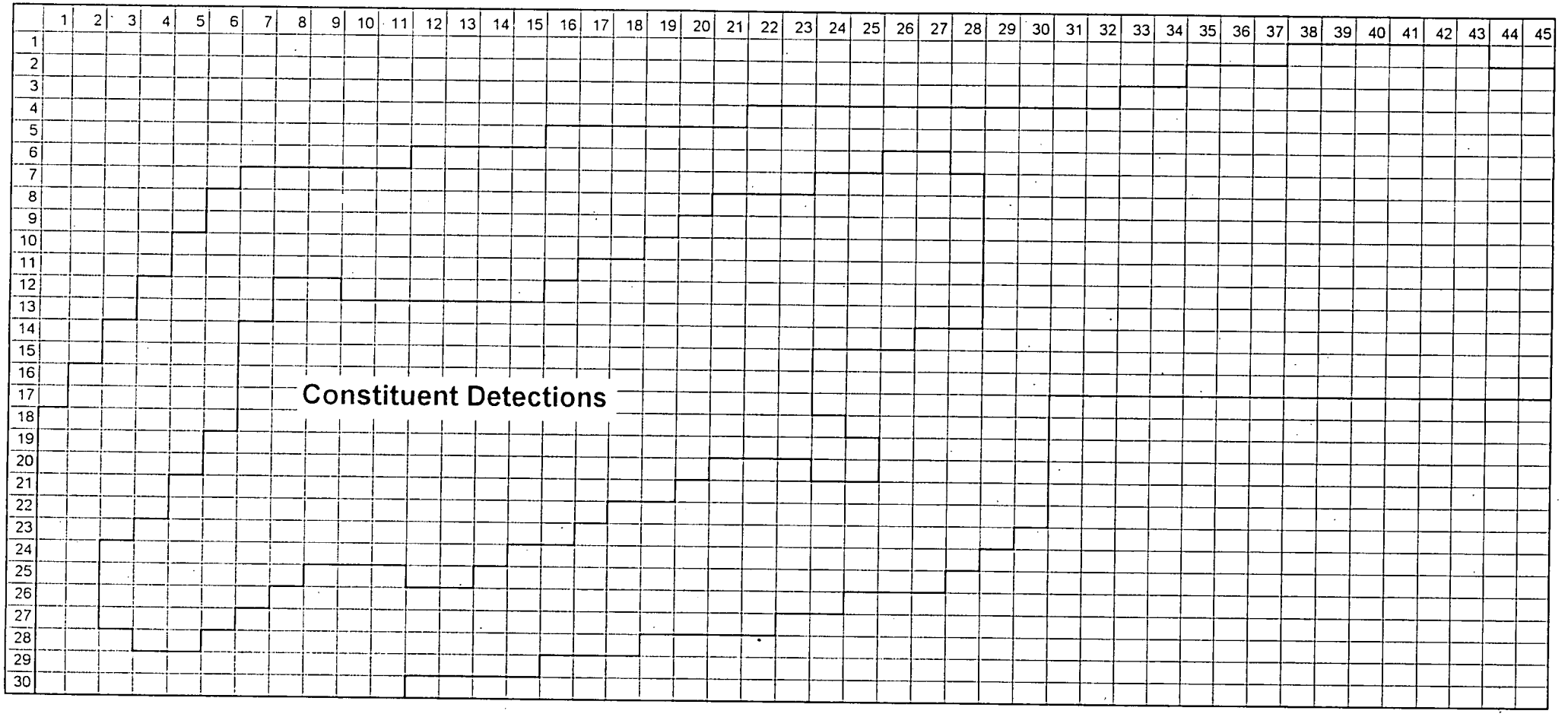
Well Number	Groundwater Concentration (ug/L)	Unsaturated Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)	Kd (=Subsurface soil conc./ Groundwater conc.) (L/kg)	Unsaturated Groundwater Concentration (=Mean of Unsaturated Soil Conc./Geometric Mean of Kd) (ug/L)
Manganese					
2LMW13S	2,570	134	157	61	
2LMW9S	646	241	241	373	
2LMW7S	175	--	109	623	
2LMW17S	387	144	101	261	
2LMW8S	420	--	332	790	
2LMW18S	668	132	288	431	
1MW2S	527	--	165	313	
2LPW1S	409	--	--	--	
Geometric Mean=	536			323	
Mean=		163			
					504
Nickel					
2LMW13S	79.5	16.2	14.2	179	
2LMW9S	16.8	76.2	44.6	2,655	
2LMW7S	9.3	--	9.6	1,032	
2LMW18S	30.8	36.3	159	5,162	
Geometric Mean=	24.9			1,266	
Mean=		42.9			
					33.9
Vanadium					
2LMW13S	182	29.8	33	181	
2LMW7S	24.7	--	16.2	656	
2LPW1S	4.5	--	--	--	
Geometric Mean=	27.2			345	
Mean=		29.8			
					86.4

Organic Compounds

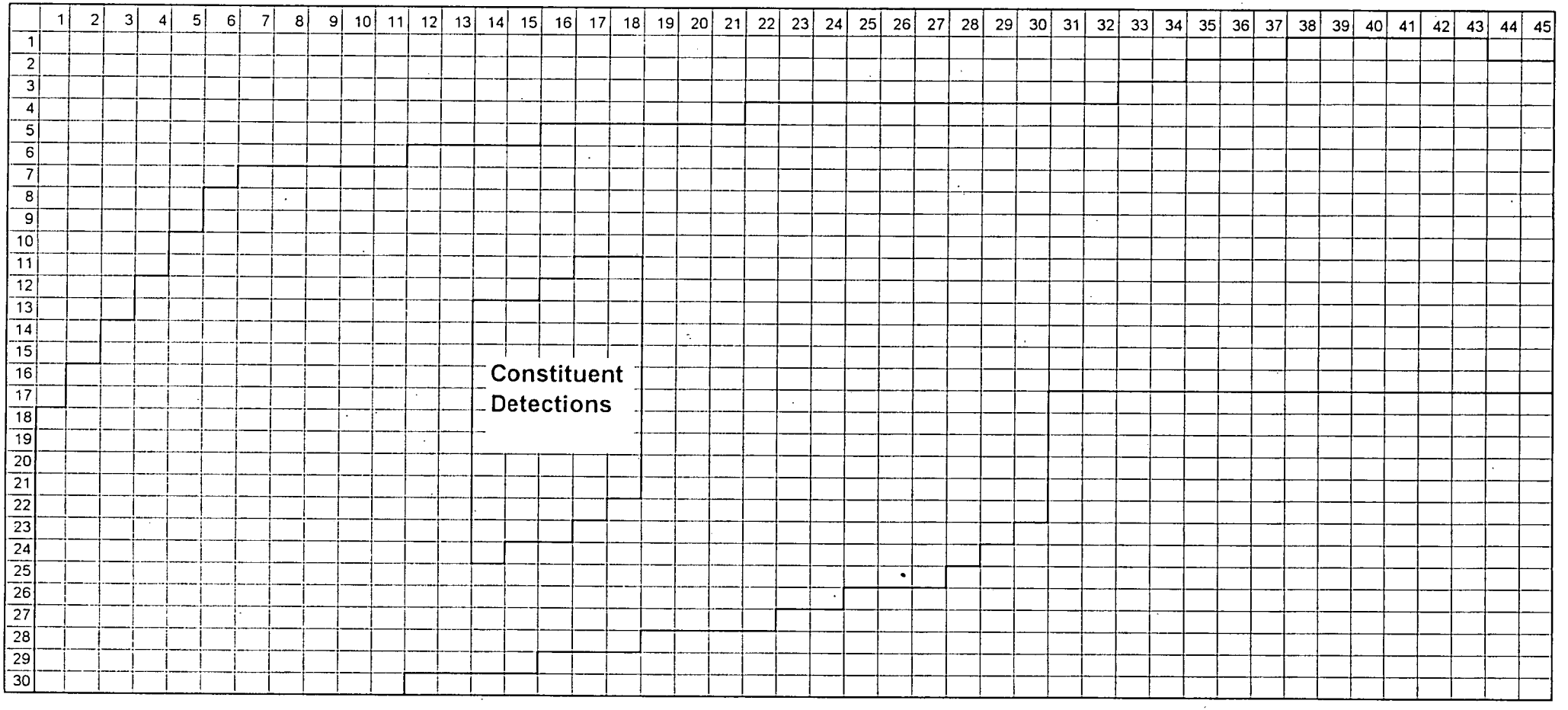
Well Number	Groundwater Concentration (ug/L)	Unsaturated Soil Concentration (ug/kg)	Subsurface Soil Concentration (ug/kg)	Kd (= Subsurface soil conc./ Groundwater conc.) (L/kg)	Unsaturated Groundwater Concentration (= Mean of Unsaturated Soil Conc./Geometric Mean of Kd) (ug/L)
Benzene					
2LMW7S	3	- -	- -	- -	
2LMW18S	32	- -	- -	- -	
Geometric Mean =	9.8			Literaure Value 0.17	
Chlorobenzene					
2LMW18S	1,200	- -	- -	Literature Value 0.87	
Trichlorobenzene					
2LMW18S	65	- -	- -	Literature Value 12.0	
Dichlorobenzene					
2LMW18S	55	- -	- -	Literature Value 3.1	
Bis(2-Ethylhexyl)phthalate					
2LMW9S	1	- -	1,900	1,900	
2LMW7S	62	- -	--	--	
2LMW18S	25	390	1,500	60	
Geometric Mean =	12			338	
Mean =		390			
					1.2
Arochlor 1016					
2LMW18S	7.5	- -	- -	Literature Value 2.4E+04	
Arochlor 1260					
2LMW18S	290	- -	- -	Literature Value 1.29E+06	



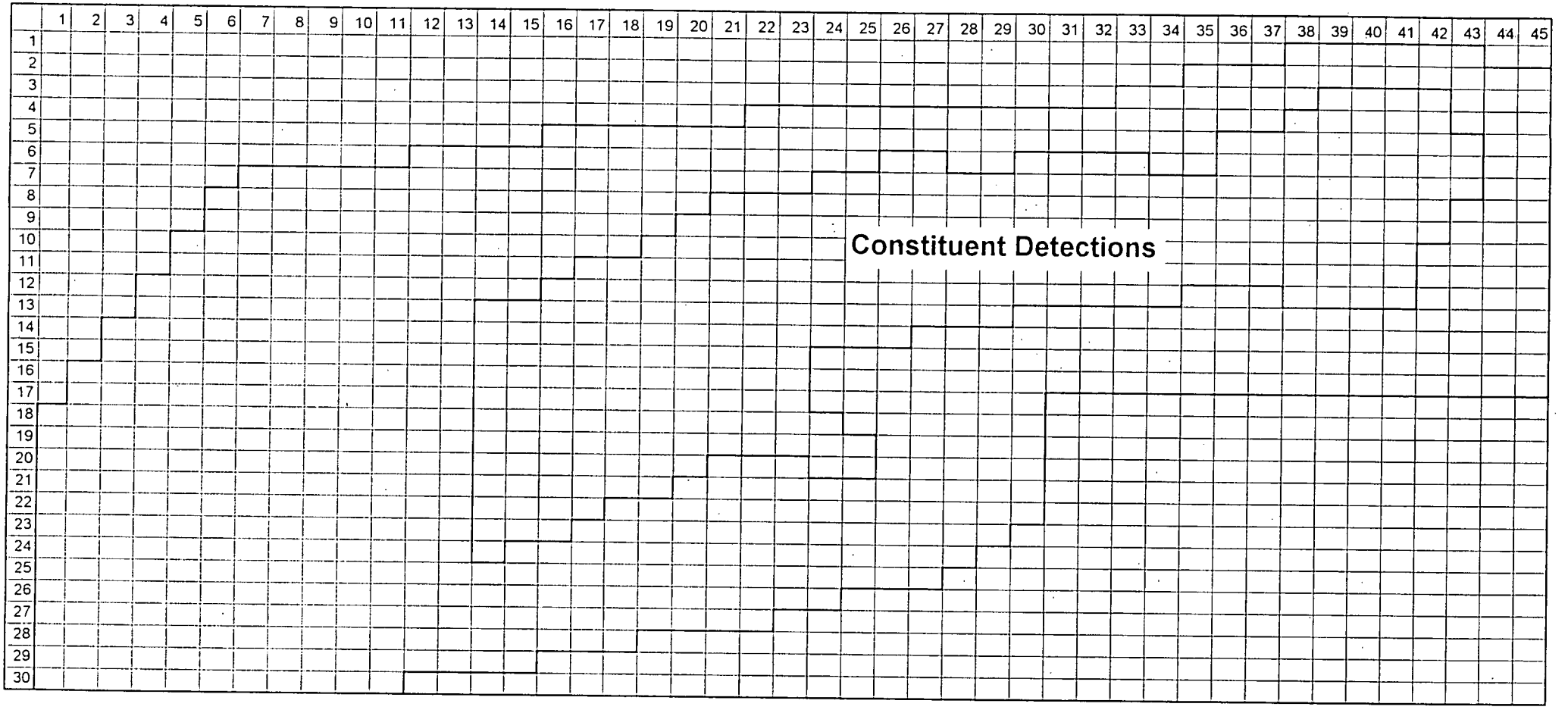
Area 1 - Constituent Detections



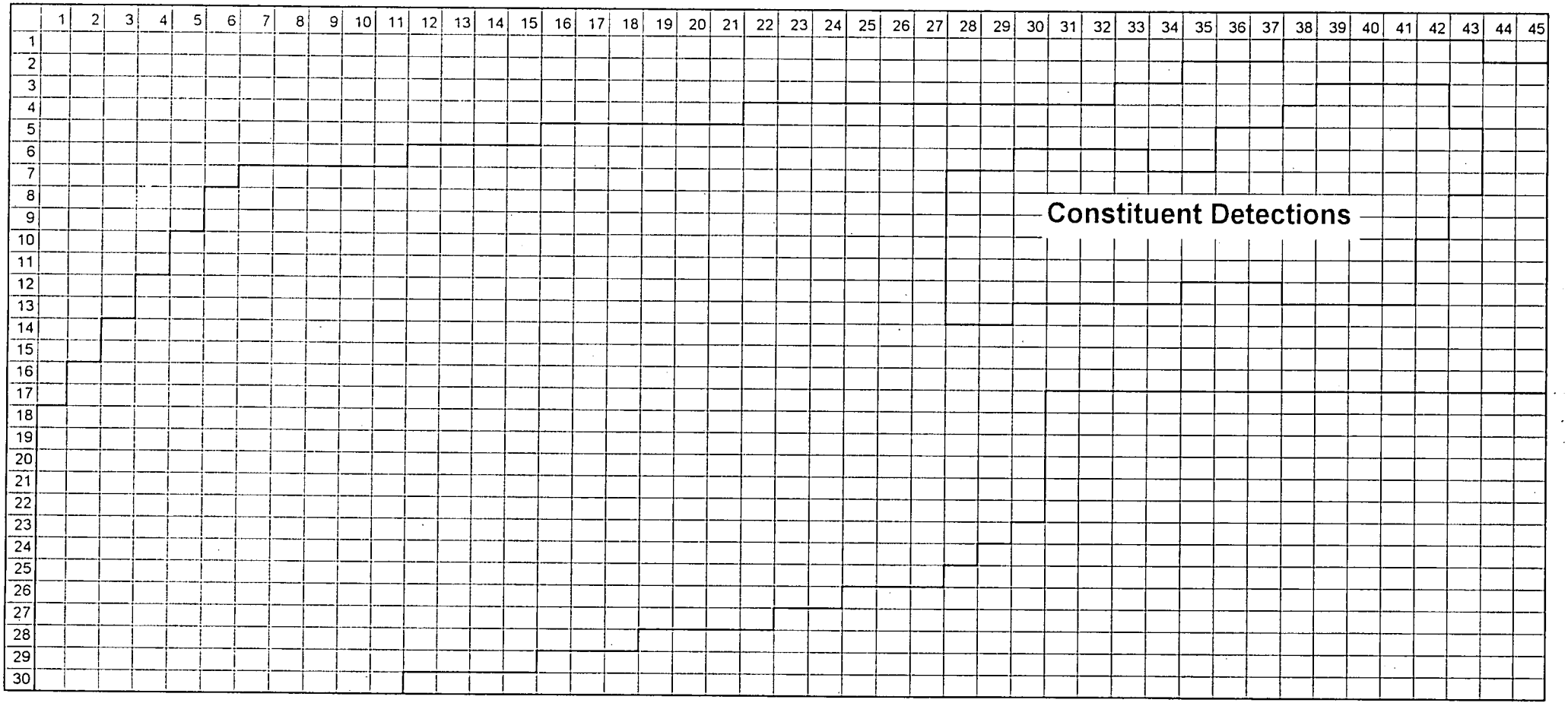
Area 2 - Constituent Detections



Area 3 - Constituent Detections



Area 4 - Constituent Detections



Area 5 - Constituent Detections

	Flow Rate (ft^3/day)	
	Calibration	Cap
Group 1	4.09E+03	3.08E+03
Group 2	2.45E+03	1.71E+03
Group 3	7.38E+02	3.35E+02
Group 4	3.93E+03	3.03E+03
Group 5	1.64E+03	1.38E+03

	Area (ft^2)
Group 1	497500
Group 2	350000
Group 3	72500
Group 4	447500
Group 5	147500

Flow Rate for Calibration (Group 1)

Row	Col	Water Elevation UpStream (ft)	Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
11	9	7.32E+01	7.07E+01	50.00	5.15E-02	4	1.56E+00	1.61E+01
12	10	7.44E+01	7.16E+01	50.00	5.48E-02	4	1.20E+00	1.32E+01
12	11	7.25E+01	7.11E+01	50.00	2.73E-02	4	1.43E+00	7.79E+00
12	12	7.17E+01	7.12E+01	50.00	8.52E-03	56	1.99E+00	4.76E+01
12	13	7.18E+01	7.13E+01	50.00	9.72E-03	56	2.79E+00	7.60E+01
12	14	7.34E+01	7.14E+01	50.00	3.87E-02	56	2.46E+00	2.67E+02
12	15	7.41E+01	7.15E+01	50.00	5.07E-02	56	1.16E+00	1.65E+02
11	16	7.26E+01	7.16E+01	50.00	2.04E-02	56	2.65E+00	1.52E+02
11	17	7.22E+01	7.15E+01	50.00	1.24E-02	56	2.62E+00	9.09E+01
11	18	7.24E+01	7.16E+01	50.00	1.55E-02	56	1.44E+00	6.25E+01
9	19	7.22E+01	7.16E+01	50.00	1.21E-02	170	1.74E+00	1.79E+02
8	20	7.20E+01	7.14E+01	50.00	1.18E-02	170	1.01E+00	1.02E+02
7	21	7.19E+01	7.13E+01	50.00	1.23E-02	170	1.46E+00	1.52E+02
7	22	7.20E+01	7.14E+01	50.00	1.24E-02	170	1.58E+00	1.66E+02
7	23	7.21E+01	7.15E+01	50.00	1.29E-02	170	1.65E+00	1.81E+02
6	24	7.20E+01	7.13E+01	50.00	1.40E-02	170	1.43E+00	1.71E+02
6	25	7.21E+01	7.13E+01	50.00	1.50E-02	170	1.47E+00	1.87E+02
5	26	7.17E+01	7.10E+01	62.50	1.16E-02	170	1.28E+00	1.27E+02
5	27	7.17E+01	7.10E+01	62.50	1.05E-02	170	1.21E+00	1.08E+02
6	28	7.20E+01	7.13E+01	50.00	1.48E-02	170	1.44E+00	1.81E+02
6	29	7.19E+01	7.13E+01	50.00	1.24E-02	170	2.76E+00	2.90E+02
5	30	7.17E+01	7.10E+01	62.50	1.08E-02	170	1.21E+00	1.11E+02
5	31	7.17E+01	7.10E+01	62.50	1.04E-02	170	1.18E+00	1.05E+02
5	32	7.16E+01	7.10E+01	62.50	9.39E-03	170	1.16E+00	9.30E+01
5	33	7.15E+01	7.11E+01	62.50	6.89E-03	170	1.19E+00	6.99E+01
6	34	7.17E+01	7.12E+01	50.00	9.68E-03	170	5.13E-01	4.22E+01
7	34	7.17E+01	7.12E+01	50.00	1.09E-02	17	4.57E-01	4.24E+00
4	36	7.17E+01	7.12E+01	87.50	5.79E-03	17	7.65E-01	3.76E+00
4	37	7.19E+01	7.14E+01	87.50	4.88E-03	17	2.61E-01	1.08E+00
3	38	7.16E+01	7.15E+01	100.00	1.02E-03	1000	1.34E+00	6.83E+01
2	39	7.16E+01	7.15E+01	100.00	1.42E-03	1000	1.58E+00	1.12E+02
2	40	7.17E+01	7.15E+01	100.00	2.06E-03	1000	1.61E+00	1.66E+02
2	41	7.18E+01	7.15E+01	100.00	2.81E-03	1000	1.66E+00	2.33E+02
2	42	7.19E+01	7.15E+01	100.00	3.90E-03	1000	1.71E+00	3.34E+02
4	43	7.23E+01	7.21E+01	87.50	2.11E-03	17	2.09E+00	3.74E+00
					1.46E-02		Total:	4.09E+03

Flow Rate for Calibration (Group 2)

Row	Col	Water Elevation UpStream (ft)	Water Elevation Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
11	9	7.32E+01	7.07E+01	50.00	5.15E-02	4	1.56E+00	1.61E+01
12	10	7.44E+01	7.16E+01	50.00	5.48E-02	4	1.20E+00	1.32E+01
12	11	7.25E+01	7.11E+01	50.00	2.73E-02	4	1.43E+00	7.79E+00
12	12	7.17E+01	7.12E+01	50.00	8.52E-03	56	1.99E+00	4.76E+01
12	13	7.18E+01	7.13E+01	50.00	9.72E-03	56	2.79E+00	7.60E+01
12	14	7.34E+01	7.14E+01	50.00	3.87E-02	56	2.46E+00	2.67E+02
12	15	7.41E+01	7.15E+01	50.00	5.07E-02	56	1.16E+00	1.65E+02
11	16	7.26E+01	7.16E+01	50.00	2.04E-02	56	2.65E+00	1.52E+02
11	17	7.22E+01	7.15E+01	50.00	1.24E-02	56	2.62E+00	9.09E+01
11	18	7.24E+01	7.16E+01	50.00	1.55E-02	56	1.44E+00	6.25E+01
9	19	7.22E+01	7.16E+01	50.00	1.21E-02	170	1.74E+00	1.79E+02
8	20	7.20E+01	7.14E+01	50.00	1.18E-02	170	1.01E+00	1.02E+02
7	21	7.19E+01	7.13E+01	50.00	1.23E-02	170	1.46E+00	1.52E+02
7	22	7.20E+01	7.14E+01	50.00	1.24E-02	170	1.58E+00	1.66E+02
7	23	7.21E+01	7.15E+01	50.00	1.29E-02	170	1.65E+00	1.81E+02
6	24	7.20E+01	7.13E+01	50.00	1.40E-02	170	1.43E+00	1.71E+02
6	25	7.21E+01	7.13E+01	50.00	1.50E-02	170	1.47E+00	1.87E+02
5	26	7.17E+01	7.10E+01	62.50	1.16E-02	170	1.28E+00	1.27E+02
5	27	7.17E+01	7.10E+01	62.50	1.05E-02	170	1.21E+00	1.08E+02
6	28	7.20E+01	7.13E+01	50.00	1.48E-02	170	1.44E+00	1.81E+02
							Total:	2.45E+03

Flow Rate for Calibration (Group 3)

		Water Elevation				conductivity	thickness	flow rate
Row	Col	UpStream (ft)	Downstream (ft)	Distance (ft)	Gradient	(ft/day)	(ft)	(ft^3/day)
12	14	7.34E+01	7.14E+01	50.00	3.87E-02	56	2.46E+00	2.67E+02
12	15	7.41E+01	7.15E+01	50.00	5.07E-02	56	1.16E+00	1.65E+02
11	16	7.26E+01	7.16E+01	50.00	2.04E-02	56	2.65E+00	1.52E+02
11	17	7.22E+01	7.15E+01	50.00	1.24E-02	56	2.62E+00	9.09E+01
11	18	7.24E+01	7.16E+01	50.00	1.55E-02	56	1.44E+00	6.25E+01
							Total:	7.38E+02

Flow Rate for Calibration (Group 4)

Row	Col	Water Elevation UpStream (ft)	Water Elevation Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
12	14	7.34E+01	7.14E+01	50.00	3.87E-02	56	2.46E+00	2.67E+02
12	15	7.41E+01	7.15E+01	50.00	5.07E-02	56	1.16E+00	1.65E+02
11	16	7.26E+01	7.16E+01	50.00	2.04E-02	56	2.65E+00	1.52E+02
11	17	7.22E+01	7.15E+01	50.00	1.24E-02	56	2.62E+00	9.09E+01
11	18	7.24E+01	7.16E+01	50.00	1.55E-02	56	1.44E+00	6.25E+01
9	19	7.22E+01	7.16E+01	50.00	1.21E-02	170	1.74E+00	1.79E+02
8	20	7.20E+01	7.14E+01	50.00	1.18E-02	170	1.01E+00	1.02E+02
7	21	7.19E+01	7.13E+01	50.00	1.23E-02	170	1.46E+00	1.52E+02
7	22	7.20E+01	7.14E+01	50.00	1.24E-02	170	1.58E+00	1.66E+02
7	23	7.21E+01	7.15E+01	50.00	1.29E-02	170	1.65E+00	1.81E+02
6	24	7.20E+01	7.13E+01	50.00	1.40E-02	170	1.43E+00	1.71E+02
6	25	7.21E+01	7.13E+01	50.00	1.50E-02	170	1.47E+00	1.87E+02
5	26	7.17E+01	7.10E+01	62.50	1.16E-02	170	1.28E+00	1.27E+02
5	27	7.17E+01	7.10E+01	62.50	1.05E-02	170	1.21E+00	1.08E+02
6	28	7.20E+01	7.13E+01	50.00	1.48E-02	170	1.44E+00	1.81E+02
6	29	7.19E+01	7.13E+01	50.00	1.24E-02	170	2.76E+00	2.90E+02
5	30	7.17E+01	7.10E+01	62.50	1.08E-02	170	1.21E+00	1.11E+02
5	31	7.17E+01	7.10E+01	62.50	1.04E-02	170	1.18E+00	1.05E+02
5	32	7.16E+01	7.10E+01	62.50	9.39E-03	170	1.16E+00	9.30E+01
5	33	7.15E+01	7.11E+01	62.50	6.89E-03	170	1.19E+00	6.99E+01
6	34	7.17E+01	7.12E+01	50.00	9.68E-03	170	5.13E-01	4.22E+01
7	34	7.17E+01	7.12E+01	50.00	1.09E-02	17	4.57E-01	4.24E+00
4	36	7.17E+01	7.12E+01	87.50	5.79E-03	17	7.65E-01	3.76E+00
4	37	7.19E+01	7.14E+01	87.50	4.88E-03	17	2.61E-01	1.08E+00
3	38	7.16E+01	7.15E+01	100.00	1.02E-03	1000	1.34E+00	6.83E+01
2	39	7.16E+01	7.15E+01	100.00	1.42E-03	1000	1.58E+00	1.12E+02
2	40	7.17E+01	7.15E+01	100.00	2.06E-03	1000	1.61E+00	1.66E+02
2	41	7.18E+01	7.15E+01	100.00	2.81E-03	1000	1.66E+00	2.33E+02
2	42	7.19E+01	7.15E+01	100.00	3.90E-03	1000	1.71E+00	3.34E+02
4	43	7.23E+01	7.21E+01	87.50	2.11E-03	17	2.09E+00	3.74E+00
							Total:	3.93E+03

Flow Rate for Calibration (Group 5)

		Water Elevation				conductivity	thickness	flow rate
Row	Col	UpStream (ft)	Downstream (ft)	Distance (ft)	Gradient	(ft/day)	(ft)	(ft^3/day)
6	29	7.19E+01	7.13E+01	50.00	1.24E-02	170	2.76E+00	2.90E+02
5	30	7.17E+01	7.10E+01	62.50	1.08E-02	170	1.21E+00	1.11E+02
5	31	7.17E+01	7.10E+01	62.50	1.04E-02	170	1.18E+00	1.05E+02
5	32	7.16E+01	7.10E+01	62.50	9.39E-03	170	1.16E+00	9.30E+01
5	33	7.15E+01	7.11E+01	62.50	6.89E-03	170	1.19E+00	6.99E+01
6	34	7.17E+01	7.12E+01	50.00	9.68E-03	170	5.13E-01	4.22E+01
7	34	7.17E+01	7.12E+01	50.00	1.09E-02	17	4.57E-01	4.24E+00
4	36	7.17E+01	7.12E+01	87.50	5.79E-03	17	7.65E-01	3.76E+00
4	37	7.19E+01	7.14E+01	87.50	4.88E-03	17	2.61E-01	1.08E+00
3	38	7.16E+01	7.15E+01	100.00	1.02E-03	1000	1.34E+00	6.83E+01
2	39	7.16E+01	7.15E+01	100.00	1.42E-03	1000	1.58E+00	1.12E+02
2	40	7.17E+01	7.15E+01	100.00	2.06E-03	1000	1.61E+00	1.66E+02
2	41	7.18E+01	7.15E+01	100.00	2.81E-03	1000	1.66E+00	2.33E+02
2	42	7.19E+01	7.15E+01	100.00	3.90E-03	1000	1.71E+00	3.34E+02
4	43	7.23E+01	7.21E+01	87.50	2.11E-03	17	2.09E+00	3.74E+00
							Total:	1.64E+03

Flow Rate for Cap (Group 1)

Row	Col	Water Elevation UpStream (ft)	Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
11	9	7.23E+01	7.06E+01	50.00	3.31E-02	4	1.22E+00	8.11E+00
12	10	7.26E+01	7.13E+01	50.00	2.64E-02	4	4.38E-01	2.31E+00
12	11	7.18E+01	7.10E+01	50.00	1.46E-02	4	1.29E+00	3.76E+00
12	12	7.12E+01	7.11E+01	50.00	2.48E-03	56	1.82E+00	1.26E+01
12	13	7.13E+01	7.11E+01	50.00	3.54E-03	56	2.57E+00	2.55E+01
12	14	7.23E+01	7.12E+01	50.00	2.17E-02	56	1.92E+00	1.17E+02
12	15	7.30E+01	7.13E+01	50.00	3.38E-02	56	5.57E-01	5.27E+01
11	16	7.19E+01	7.13E+01	50.00	1.22E-02	56	2.36E+00	8.08E+01
11	17	7.17E+01	7.13E+01	50.00	7.39E-03	56	2.37E+00	4.91E+01
11	18	7.20E+01	7.14E+01	50.00	1.07E-02	56	1.19E+00	3.54E+01
9	19	7.19E+01	7.14E+01	50.00	9.23E-03	170	1.53E+00	1.20E+02
8	20	7.18E+01	7.13E+01	50.00	9.53E-03	170	8.76E-01	7.09E+01
7	21	7.17E+01	7.12E+01	50.00	1.04E-02	170	1.37E+00	1.22E+02
7	22	7.19E+01	7.13E+01	50.00	1.08E-02	170	1.49E+00	1.37E+02
7	23	7.20E+01	7.14E+01	50.00	1.18E-02	170	1.57E+00	1.57E+02
6	24	7.19E+01	7.13E+01	50.00	1.31E-02	170	1.38E+00	1.54E+02
6	25	7.20E+01	7.13E+01	50.00	1.42E-02	170	1.42E+00	1.71E+02
5	26	7.17E+01	7.10E+01	62.50	1.09E-02	170	1.26E+00	1.17E+02
5	27	7.16E+01	7.10E+01	62.50	9.91E-03	170	1.20E+00	1.01E+02
6	28	7.20E+01	7.13E+01	50.00	1.42E-02	170	1.42E+00	1.71E+02
6	29	7.19E+01	7.13E+01	50.00	1.18E-02	170	2.73E+00	2.74E+02
5	30	7.16E+01	7.10E+01	62.50	1.02E-02	170	1.19E+00	1.03E+02
5	31	7.16E+01	7.10E+01	62.50	9.73E-03	170	1.16E+00	9.62E+01
5	32	7.15E+01	7.10E+01	62.50	8.61E-03	170	1.15E+00	8.40E+01
5	33	7.15E+01	7.11E+01	62.50	6.24E-03	170	1.17E+00	6.20E+01
6	34	7.16E+01	7.12E+01	50.00	8.69E-03	170	4.72E-01	3.49E+01
7	34	7.16E+01	7.12E+01	50.00	8.65E-03	17	4.19E-01	3.08E+00
4	36	7.15E+01	7.11E+01	87.50	3.93E-03	17	7.31E-01	2.44E+00
4	37	7.16E+01	7.14E+01	87.50	2.65E-03	17	2.10E-01	4.72E-01
3	38	7.16E+01	7.15E+01	100.00	5.25E-04	1000	1.30E+00	3.42E+01
2	39	7.16E+01	7.15E+01	100.00	9.44E-04	1000	1.55E+00	7.33E+01
2	40	7.17E+01	7.15E+01	100.00	1.55E-03	1000	1.59E+00	1.23E+02
2	41	7.17E+01	7.15E+01	100.00	2.33E-03	1000	1.63E+00	1.90E+02
2	42	7.18E+01	7.15E+01	100.00	3.47E-03	1000	1.69E+00	2.93E+02
4	43	7.21E+01	7.20E+01	87.50	7.85E-04	17	2.04E+00	1.36E+00
							Total:	3.08E+03

Flow Rate for Cap (Group 2)

Row	Col	Water Elevation UpStream (ft)	Water Elevation Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
11	9	7.23E+01	7.06E+01	50.00	3.31E-02	4	1.22E+00	8.11E+00
12	10	7.26E+01	7.13E+01	50.00	2.64E-02	4	4.38E-01	2.31E+00
12	11	7.18E+01	7.10E+01	50.00	1.46E-02	4	1.29E+00	3.76E+00
12	12	7.12E+01	7.11E+01	50.00	2.48E-03	56	1.82E+00	1.26E+01
12	13	7.13E+01	7.11E+01	50.00	3.54E-03	56	2.57E+00	2.55E+01
12	14	7.23E+01	7.12E+01	50.00	2.17E-02	56	1.92E+00	1.17E+02
12	15	7.30E+01	7.13E+01	50.00	3.38E-02	56	5.57E-01	5.27E+01
11	16	7.19E+01	7.13E+01	50.00	1.22E-02	56	2.36E+00	8.08E+01
11	17	7.17E+01	7.13E+01	50.00	7.39E-03	56	2.37E+00	4.91E+01
11	18	7.20E+01	7.14E+01	50.00	1.07E-02	56	1.19E+00	3.54E+01
9	19	7.19E+01	7.14E+01	50.00	9.23E-03	170	1.53E+00	1.20E+02
8	20	7.18E+01	7.13E+01	50.00	9.53E-03	170	8.76E-01	7.09E+01
7	21	7.17E+01	7.12E+01	50.00	1.04E-02	170	1.37E+00	1.22E+02
7	22	7.19E+01	7.13E+01	50.00	1.08E-02	170	1.49E+00	1.37E+02
7	23	7.20E+01	7.14E+01	50.00	1.18E-02	170	1.57E+00	1.57E+02
6	24	7.19E+01	7.13E+01	50.00	1.31E-02	170	1.38E+00	1.54E+02
6	25	7.20E+01	7.13E+01	50.00	1.42E-02	170	1.42E+00	1.71E+02
5	26	7.17E+01	7.10E+01	62.50	1.09E-02	170	1.26E+00	1.17E+02
5	27	7.16E+01	7.10E+01	62.50	9.91E-03	170	1.20E+00	1.01E+02
6	28	7.20E+01	7.13E+01	50.00	1.42E-02	170	1.42E+00	1.71E+02
							Total:	1.71E+03

Flow Rate for Cap (Group 3)

Row	Col	Water Elevation UpStream (ft)	Water Elevation Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
12	14	7.23E+01	7.12E+01	50.00	2.17E-02	56	1.92E+00	1.17E+02
12	15	7.30E+01	7.13E+01	50.00	3.38E-02	56	5.57E-01	5.27E+01
11	16	7.19E+01	7.13E+01	50.00	1.22E-02	56	2.36E+00	8.08E+01
11	17	7.17E+01	7.13E+01	50.00	7.39E-03	56	2.37E+00	4.91E+01
11	18	7.20E+01	7.14E+01	50.00	1.07E-02	56	1.19E+00	3.54E+01
							Total:	3.35E+02

Flow Rate for Cap (Group 4)

Row	Col	Water Elevation UpStream (ft)	Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
12	14	7.23E+01	7.12E+01	50.00	2.17E-02	56	1.92E+00	1.17E+02
12	15	7.30E+01	7.13E+01	50.00	3.38E-02	56	5.57E-01	5.27E+01
11	16	7.19E+01	7.13E+01	50.00	1.22E-02	56	2.36E+00	8.08E+01
11	17	7.17E+01	7.13E+01	50.00	7.39E-03	56	2.37E+00	4.91E+01
11	18	7.20E+01	7.14E+01	50.00	1.07E-02	56	1.19E+00	3.54E+01
9	19	7.19E+01	7.14E+01	50.00	9.23E-03	170	1.53E+00	1.20E+02
8	20	7.18E+01	7.13E+01	50.00	9.53E-03	170	8.76E-01	7.09E+01
7	21	7.17E+01	7.12E+01	50.00	1.04E-02	170	1.37E+00	1.22E+02
7	22	7.19E+01	7.13E+01	50.00	1.08E-02	170	1.49E+00	1.37E+02
7	23	7.20E+01	7.14E+01	50.00	1.18E-02	170	1.57E+00	1.57E+02
6	24	7.19E+01	7.13E+01	50.00	1.31E-02	170	1.38E+00	1.54E+02
6	25	7.20E+01	7.13E+01	50.00	1.42E-02	170	1.42E+00	1.71E+02
5	26	7.17E+01	7.10E+01	62.50	1.09E-02	170	1.26E+00	1.17E+02
5	27	7.16E+01	7.10E+01	62.50	9.91E-03	170	1.20E+00	1.01E+02
6	28	7.20E+01	7.13E+01	50.00	1.42E-02	170	1.42E+00	1.71E+02
6	29	7.19E+01	7.13E+01	50.00	1.18E-02	170	2.73E+00	2.74E+02
5	30	7.16E+01	7.10E+01	62.50	1.02E-02	170	1.19E+00	1.03E+02
5	31	7.16E+01	7.10E+01	62.50	9.73E-03	170	1.16E+00	9.62E+01
5	32	7.15E+01	7.10E+01	62.50	8.61E-03	170	1.15E+00	8.40E+01
5	33	7.15E+01	7.11E+01	62.50	6.24E-03	170	1.17E+00	6.20E+01
6	34	7.16E+01	7.12E+01	50.00	8.69E-03	170	4.72E-01	3.49E+01
7	34	7.16E+01	7.12E+01	50.00	8.65E-03	17	4.19E-01	3.08E+00
4	36	7.15E+01	7.11E+01	87.50	3.93E-03	17	7.31E-01	2.44E+00
4	37	7.16E+01	7.14E+01	87.50	2.65E-03	17	2.10E-01	4.72E-01
3	38	7.16E+01	7.15E+01	100.00	5.25E-04	1000	1.30E+00	3.42E+01
2	39	7.16E+01	7.15E+01	100.00	9.44E-04	1000	1.55E+00	7.33E+01
2	40	7.17E+01	7.15E+01	100.00	1.55E-03	1000	1.59E+00	1.23E+02
2	41	7.17E+01	7.15E+01	100.00	2.33E-03	1000	1.63E+00	1.90E+02
2	42	7.18E+01	7.15E+01	100.00	3.47E-03	1000	1.69E+00	2.93E+02
4	43	7.21E+01	7.20E+01	87.50	7.85E-04	17	2.04E+00	1.36E+00
							Total:	3.03E+03

Flow Rate for Cap (Group 5)

Row	Col	Water Elevation UpStream (ft)	Water Elevation Downstream (ft)	Distance (ft)	Gradient	conductivity (ft/day)	thickness (ft)	flow rate (ft^3/day)
6	29	7.19E+01	7.13E+01	50.00	1.18E-02	170	2.73E+00	2.74E+02
5	30	7.16E+01	7.10E+01	62.50	1.02E-02	170	1.19E+00	1.03E+02
5	31	7.16E+01	7.10E+01	62.50	9.73E-03	170	1.16E+00	9.62E+01
5	32	7.15E+01	7.10E+01	62.50	8.61E-03	170	1.15E+00	8.40E+01
5	33	7.15E+01	7.11E+01	62.50	6.24E-03	170	1.17E+00	6.20E+01
6	34	7.16E+01	7.12E+01	50.00	8.69E-03	170	4.72E-01	3.49E+01
7	34	7.16E+01	7.12E+01	50.00	8.65E-03	17	4.19E-01	3.08E+00
4	36	7.15E+01	7.11E+01	87.50	3.93E-03	17	7.31E-01	2.44E+00
4	37	7.16E+01	7.14E+01	87.50	2.65E-03	17	2.10E-01	4.72E-01
3	38	7.16E+01	7.15E+01	100.00	5.25E-04	1000	1.30E+00	3.42E+01
2	39	7.16E+01	7.15E+01	100.00	9.44E-04	1000	1.55E+00	7.33E+01
2	40	7.17E+01	7.15E+01	100.00	1.55E-03	1000	1.59E+00	1.23E+02
2	41	7.17E+01	7.15E+01	100.00	2.33E-03	1000	1.63E+00	1.90E+02
2	42	7.18E+01	7.15E+01	100.00	3.47E-03	1000	1.69E+00	2.93E+02
4	43	7.21E+01	7.20E+01	87.50	7.85E-04	17	2.04E+00	1.36E+00
							Total:	1.38E+03

APPENDIX E

DREDGE SPOIL GEOTECHNICAL TESTING RESULTS

E.1 Permeability Tests Results
E.2 Triaxial Compression Tests Results

APPENDIX E.1

PERMEABILITY TESTS RESULTS

Permeability by ASTM D5084

Client: Brown & Root Environmental
Project: Naval Sub Base
Project Location: Groton, CT

GTX #: 720
Date: 11/13/95

Sample ID: 2LMW31DS-P-1012
Container Type: Tube

Depth: 10-12 ft

Visual Description: Dark gray/black silty sludge
Sample Preparation: Sample extruded from tube, cut, trimmed and placed into permeameter at as received density and moisture content.

Sample Conditions:

Parameter	Before Test	After Test
Height, in	2.04	1.93
Diameter, in	2.85	2.77
Wet Density, pcf	95.2	99.4
Moisture Content, %	71.5	59.6
Dry Density, pcf	55.5	62.3

Permeating Conditions:

Total Confining Stress, psi	70.0
Effective Confining Stress, psi	7.0
Gradient	27.2
Permeability @ 20 °C, cm/sec	**1.1×10^{-7}**

Permeability by ASTM D5084

Client: Brown & Root Environmental
Project: Naval Sub Base
Project Location: Groton, CT

GTX #: 720
Date: 11/13/95

Sample ID: 2LMW33DS-P-1416
Container Type: Tube

Depth: 14-16 ft

Visual Description: Dark gray/black silty sludge
Sample Preparation: Sample extruded from tube, cut, trimmed and placed into permeameter at as received density and moisture content.

Sample Conditions:

Parameter	Before Test	After Test
Height, in	1.83	1.80
Diameter, in	2.85	2.79
Wet Density, pcf	94.1	96.0
Moisture Content, %	77.3	71.2
Dry Density, pcf	53.1	56.1

Permeating Conditions:

Total Confining Stress, psi	70.0
Effective Confining Stress, psi	8.0
Gradient	30.3
Permeability @ 20 °C, cm/sec	**1.7×10^{-7}**

Permeability by ASTM D5084

Client: Brown & Root Environmental
Project: Naval Sub Base
Project Location: Groton, CT

GTX #: 720
Date: 11/13/95

Sample ID: 2LMW32DS-P-1719
Container Type: Tube

Depth: 17-19 ft

Visual Description: Dark gray/black silty sludge
Sample Preparation: Sample extruded from tube, cut, trimmed and placed into permeameter at as received density and moisture content.

Sample Conditions:

Parameter	Before Test	After Test
Height, in	2.83	2.76
Diameter, in	2.86	2.79
Wet Density, pcf	96.4	99.4
Moisture Content, %	67.2	60.3
Dry Density, pcf	57.7	62.0

Permeating Conditions:

Total Confining Stress, psi	70.0
Effective Confining Stress, psi	9.0
Gradient	19.6
Permeability @ 20 °C, cm/sec	**2.0×10^{-7}**

Permeability by ASTM D5084

Client: Brown & Root Environmental
Project: Naval Sub Base
Project Location: Groton, CT

GTX #: 720
Date: 11/13/95

Sample ID: 2LMW28DS-P-1820
Container Type: Tube

Depth: 18-20 ft

Visual Description: Brown sandy silt
Sample Preparation: Sample extruded from tube, cut, trimmed and placed into permeameter at as received density and moisture content.

Sample Conditions:

Parameter	Before Test	After Test
Height, in	3.30	3.27
Diameter, in	2.86	2.83
Wet Density, pcf	114.4	116.8
Moisture Content, %	35.6	30.6
Dry Density, pcf	84.4	89.5

Permeating Conditions:

Total Confining Stress, psi	70.0
Effective Confining Stress, psi	9.0
Gradient	16.8
Permeability @ 20 °C, cm/sec	**8.3×10^{-7}**

Permeability by ASTM D5084

Client: Brown & Root Environmental
Project: Naval Sub Base
Project Location: Groton, CT

GTX #: 720
Date: 11/13/95

Sample ID: 2LMW34DS-P-2022
Container Type: Tube

Depth: 20-22 ft

Visual Description: Dark gray/black silty sludge
Sample Preparation: Sample extruded from tube, cut, trimmed and placed into permeameter at as received density and moisture content.

Sample Conditions:

Parameter	Before Test	After Test
Height, in	2.68	2.52
Diameter, in	2.87	2.75
Wet Density, pcf	91.0	95.8
Moisture Content, %	89.1	49.6
Dry Density, pcf	48.1	64.0

Permeating Conditions:

Total Confining Stress, psi	70.0
Effective Confining Stress, psi	11.0
Gradient	20.7
Permeability @ 20 °C, cm/sec	**1.2×10^{-7}**

Permeability by ASTM D5084

Client: Brown & Root Environmental
Project: Naval Sub Base
Project Location: Groton, CT

GTX #: 720
Date: 11/13/95

Sample ID: 2LMW32F-P-2224
Container Type: Tube

Depth: 22-24 ft

Visual Description: Dark gray/black silty sludge
Sample Preparation: Sample extruded from tube, cut, trimmed and placed into permeameter at as received density and moisture content.

Sample Conditions:

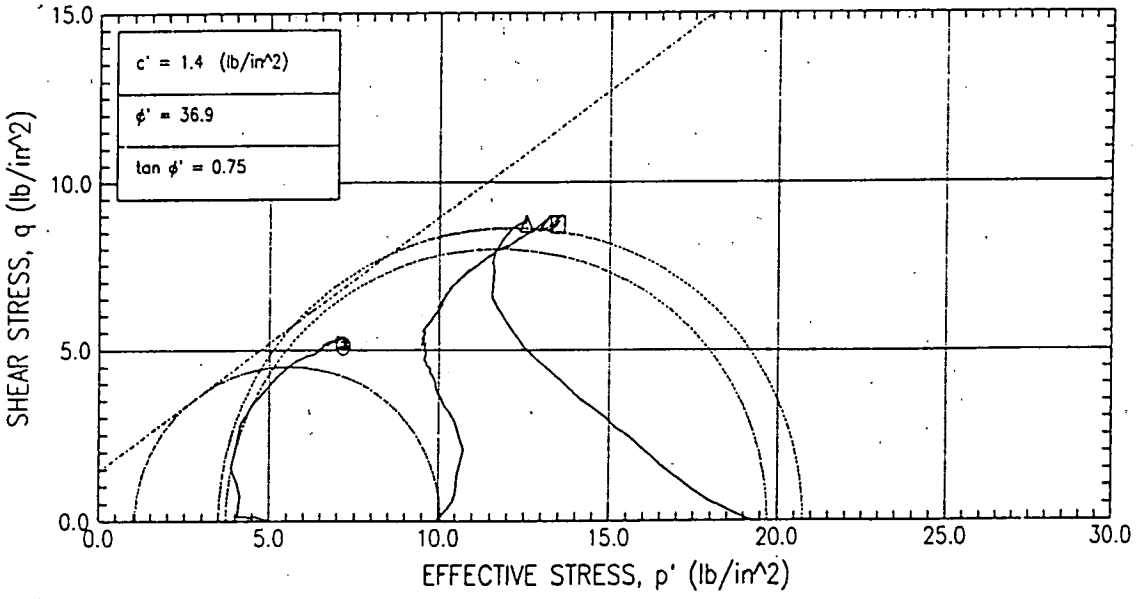
Parameter	Before Test	After Test
Height, in	3.03	2.99
Diameter, in	2.87	2.83
Wet Density, pcf	98.9	100.9
Moisture Content, %	63.2	59.2
Dry Density, pcf	60.6	63.4

Permeating Conditions:

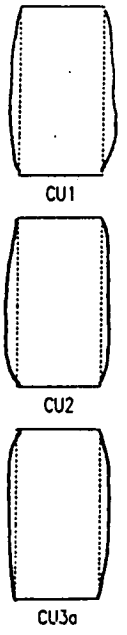
Total Confining Stress, psi	70.0
Effective Confining Stress, psi	10.0
Gradient	18.3
Permeability @ 20 °C, cm/sec	**1.2×10^{-7}**

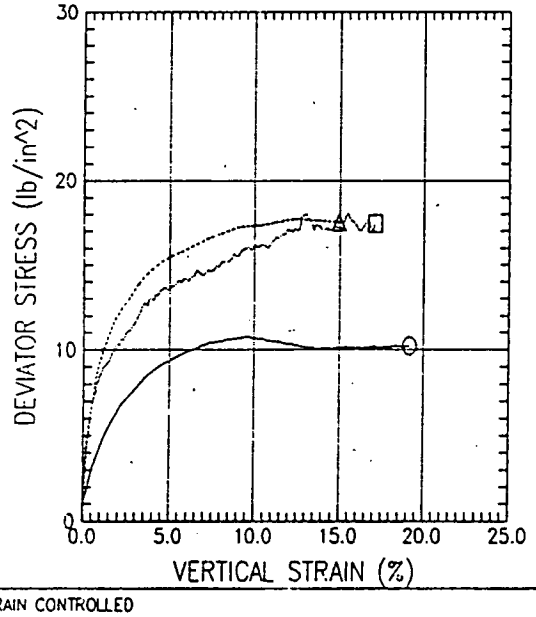
APPENDIX E.2

TRIAXIAL COMPRESSION TESTS RESULTS



FAILURE SKETCHES





SYMBOL		○	△	□	
TEST NO.		CU1	CU2	CU3a	
INITIAL	WATER CONTENT (%)	67.17	70.93	67.17	
	DRY DENSITY (lb/ft^3)	58.38	56.17	59.64	
	SATURATION (%)	97.14	96.69	100.42	
	VOID RATIO	1.833	1.944	1.773	
BEFORE SHEAR	WATER CONTENT (%)	65.36	62.46	58.43	
	DRY DENSITY (lb/ft^3)	58.87	59.16	59.64	
	SATURATION (%)	95.74	92.21	87.35	
	VOID RATIO	1.809	1.795	1.773	
	BACK PRESS. (lb/in^2)	35.02	28.37	101.07	
MINOR PRIN. STRESS (lb/in^2)		4.98	19.63	9.94	
MAX. DEV. STRESS (lb/in^2)		10.77	17.76	18.04	
TIME TO FAILURE (min)		107	127	171	
RATE OF STRAIN INCR (%/min)		0.10	0.10	0.10	
INITIAL DIAMETER (in)		2.87	2.87	1.38	
INITIAL HEIGHT (in)		6.04	6.25	2.81	
B-VALUE		0.95	0.95	0.95	

STRAIN CONTROLLED

DESCRIPTION OF SPECIMENS:

1) Gray organic silt w/ seashells & peat 2) Gray organic silt w/ seashells & peat 3) Gray organic silt w/ seashells & peat

LL	PL	PI	GS 2.65	TYPE OF SPECIMEN Tube	TYPE OF TEST CU (R)

REMARKS:

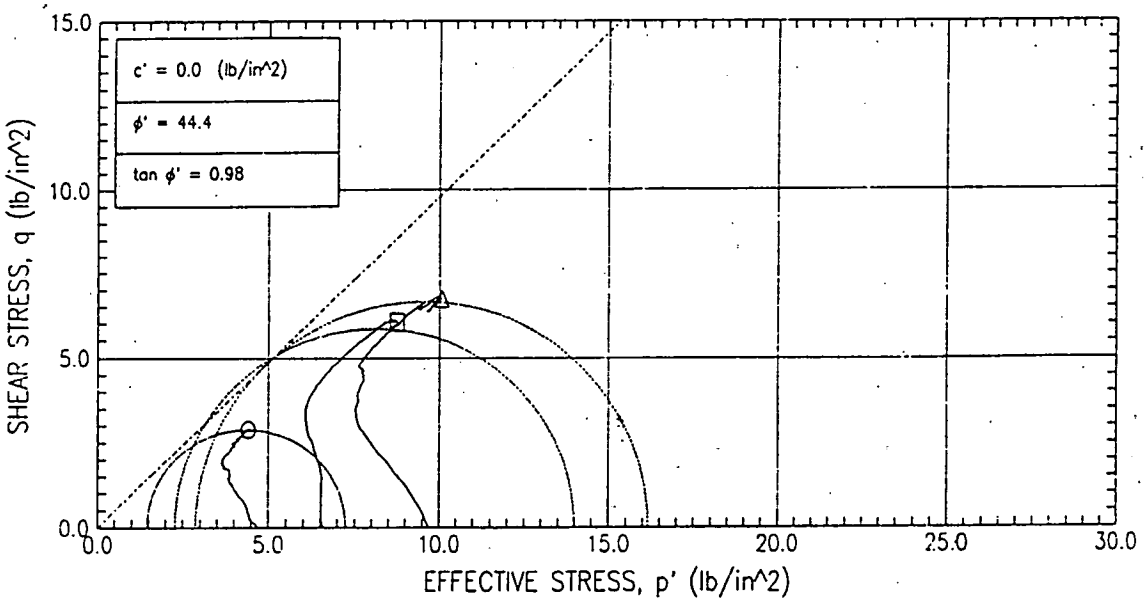
1) ---

2) Suspected incomplete saturation of specimen

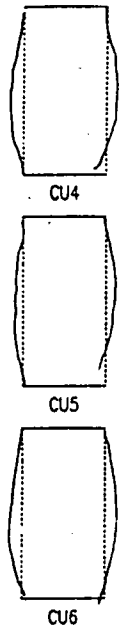
3) ---

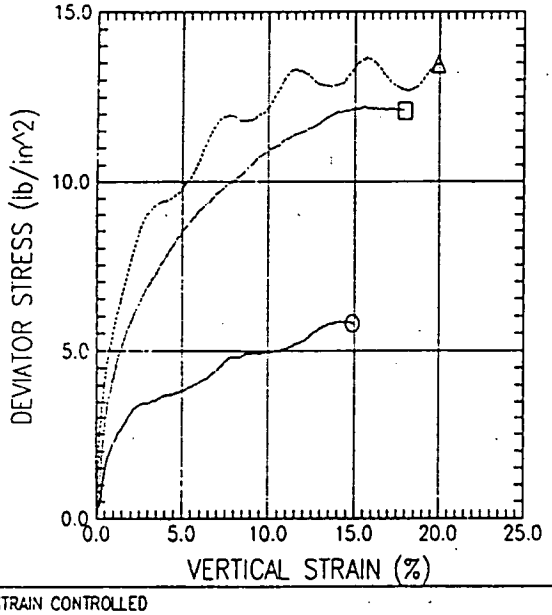
PROJECT Naval Sub Base					
PROJECT NO.GTX-720					
BORING NO. ---	SAMPLE NO.	2/2 LMW28D	2/2 LMW28D	2/2 LMW28D	
TECH. rh	DEPTH/ELEV	16' - 18'	16' - 18'	16' - 18'	
LABORATORY	DATE	11/21/95	11/21/95	11/28/95	

TRIAXIAL COMPRESSION TEST REPORT



FAILURE SKETCHES





SYMBOL		○	△	□	
TEST NO.		CU4	CU5	CU6	
INITIAL	WATER CONTENT (%)	81.78	66.73	66.72	
	DRY DENSITY (lb/ft^3)	47.62	58.33	58.44	
	SATURATION (%)	87.64	96.38	96.64	
	VOID RATIO	2.473	1.835	1.829	
BEFORE SHEAR	WATER CONTENT (%)	71.07	56.75	57.39	
	DRY DENSITY (lb/ft^3)	53.57	64.07	59.98	
	SATURATION (%)	90.26	95.12	86.56	
	VOID RATIO	2.087	1.581	1.757	
	BACK PRESS. (lb/in^2)	50.14	50.14	50.85	
MINOR PRIN. STRESS (lb/in^2)		4.73	9.77	19.15	
MAX. DEV. STRESS (lb/in^2)		5.83	13.66	12.22	
TIME TO FAILURE (min)		150	160	183	
RATE OF STRAIN INCR (%/min)		0.10	0.10	0.10	
INITIAL DIAMETER (in)		2.89	2.89	2.88	
INITIAL HEIGHT (in)		4.71	5.84	5.96	
B-VALUE		0.95	0.95	0.95	

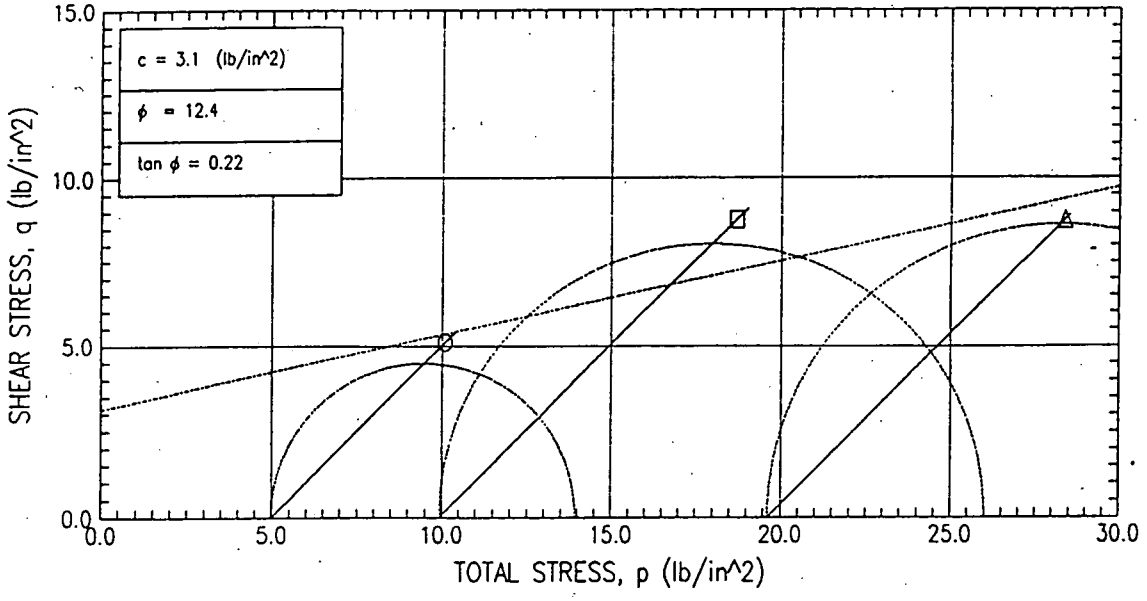
STRAIN CONTROLLED

DESCRIPTION OF SPECIMENS:

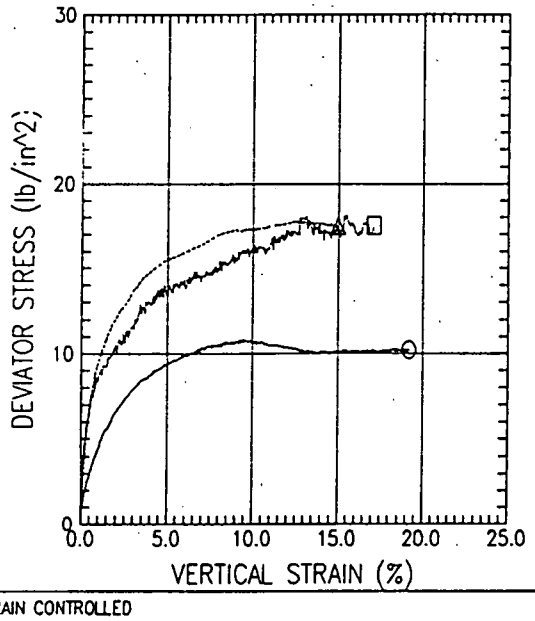
1) Very soft organic silt w/ seashells & peat 2) Gray organic silt w/ seashells & peat 3) Gray organic silt w/ seashells & peat

LL	PL	PI	GS 2.65	TYPE OF SPECIMEN Tube	TYPE OF TEST CU (R)

REMARKS:	PROJECT Naval Sub Base					
1) ---	PROJECT NO.GTX-720					
2) ---	BORING NO. ---	SAMPLE NO.	7/2 LMW34D	7/2 LMW34D	7/2 LMW34D	
3) ---	TECH. rh	DEPTH/ELEV	16' - 18'	16' - 18'	16' - 18'	
	LABORATORY	DATE	11/28/95	11/28/95	11/28/95	
	TRIAXIAL COMPRESSION TEST REPORT					



FAILURE SKETCHES



SYMBOL		○	△	□	
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TIME TO FAILURE (min)		107	127	171	
RATE OF STRAIN INCR (%/min)		0.10	0.10	0.10	
INITIAL DIAMETER (in)		2.87	2.87	1.38	
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B-VALUE		0.95	0.95	0.95	

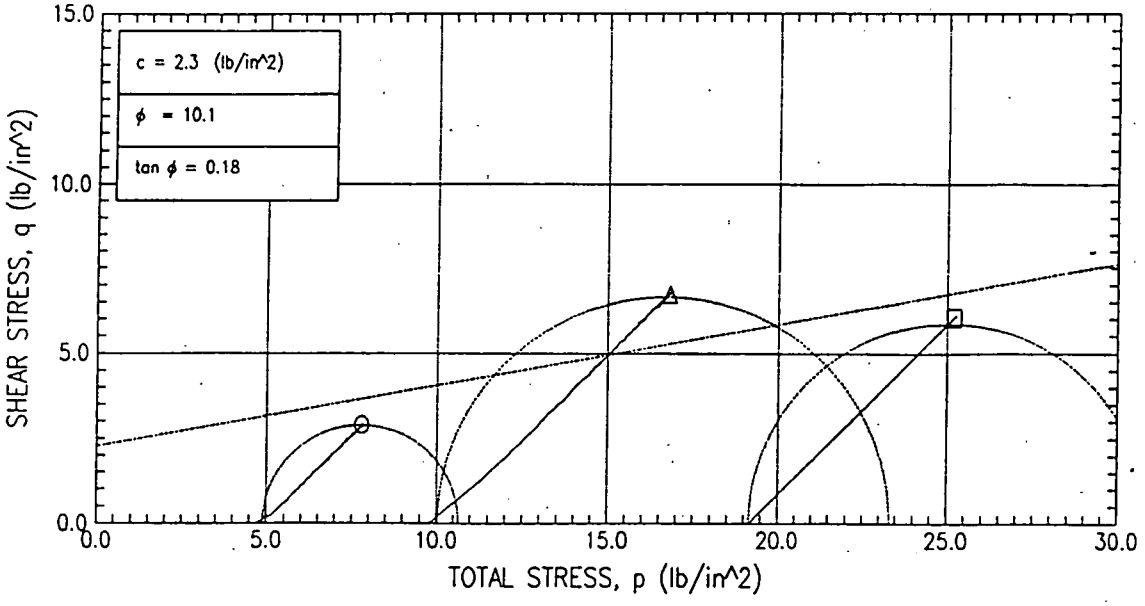
STRAIN CONTROLLED

DESCRIPTION OF SPECIMENS:

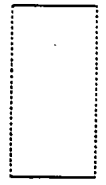
1) Gray organic silt w/ seashells & peat 2) Gray organic silt w/ seashells & peat 3) Gray organic silt w/ seashells & peat

LL	PL	PI	GS 2.65	TYPE OF SPECIMEN Tube	TYPE OF TEST CU (R)			
REMARKS:				PROJECT Naval Sub Base				
1) ---				PROJECT NO.GTX-720				
2) Suspected incomplete saturation of specimen				BORING NO. ---	SAMPLE NO.	2/2 LMW28D	2/2 LMW28D	2/2 LMW28D
3) ---				TECH. rh	DEPTH/ELEV	16' - 18'	16' - 18'	16' - 18'
				LABORATORY	DATE	11/21/95	11/21/95	11/28/95

TRIAXIAL COMPRESSION TEST REPORT

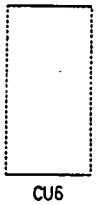


FAILURE SKETCHES

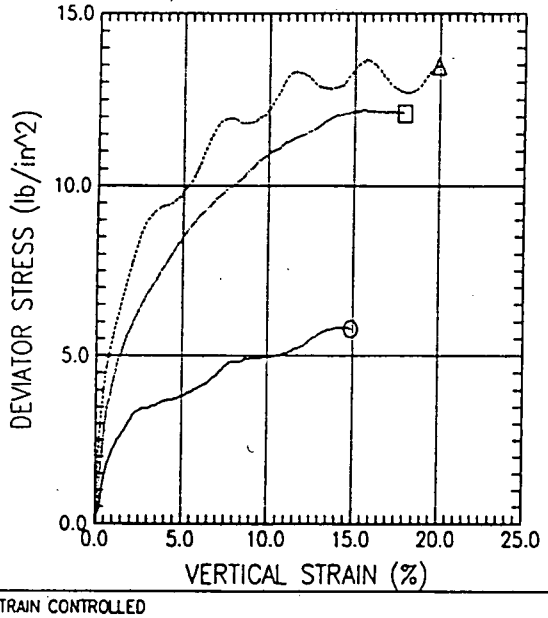


CU4

CU5



CU6



SYMBOL		○	△	□	
TEST NO.		CU4	CU5	CU6	
INITIAL	WATER CONTENT (%)	81.78	66.73	66.72	
	DRY DENSITY (lb/ft^3)	47.62	58.33	58.44	
	SATURATION (%)	87.64	96.38	96.64	
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	VOID RATIO	2.087	1.581	1.757	
	BACK PRESS. (lb/in^2)	50.14	50.14	50.85	
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MAX. DEV. STRESS (lb/in^2)		5.83	13.66	12.22	
TIME TO FAILURE (min)		150	160	183	
RATE OF STRAIN INCR (%/min)		0.10	0.10	0.10	
INITIAL DIAMETER (in)		2.89	2.89	2.88	
INITIAL HEIGHT (in)		4.71	5.84	5.96	
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LL	PL	PI	GS 2.65	TYPE OF SPECIMEN Tube	TYPE OF TEST CU (R)

REMARKS:	PROJECT Naval Sub Base					
1) ---	PROJECT NO.GTX-720					
2) ---	BORING NO. ---	SAMPLE NO.	7/2 LMW34D	7/2 LMW34D	7/2 LMW34D	
3) ---	TECH. rh	DEPTH/ELEV	16' - 18'	16' - 18'	16' - 18'	
	LABORATORY	DATE	11/28/95	11/28/95	11/28/95	
	TRIAXIAL COMPRESSION TEST REPORT					

APPENDIX F

REVISED GEOTECHNICAL ANALYSES

F.1 Revised Slope Stability Analyses
F.2 Revised Settlement Analyses

APPENDIX F.1

REVISED SLOPE STABILITY ANALYSES

CLIENT NEW LONDON AREA A LANDFILL		JOB NUMBER 5082-0185	
SUBJECT STABL SLOPE STABILITY			
BASED ON		DRAWING NUMBER	
BY RFD/DCW	CHECKED BY DCW 2/21/96	APPROVED BY	DATE February 21, 1996

OBJECTIVE

The purpose of this calculation is to determine the overall stability of the final, regraded surface of Area A Landfill at the Naval Subbase New London in Groton CT. Landfill A is an existing landfill which will be covered with a low permeability cap. In addition to the capping, the existing landfill side slope will be cut back to a 4:1 slope.

DESCRIPTION OF THE LANDFILL

The valley in which the landfill was constructed originally consisted of a thin layer of alluvial material overlying the bedrock. This alluvial material most closely resembles a type SP soil (poorly graded clean sands, sand-gravel mix) as classified using the Unified Soil Classification System (USCS). The valley was first filled with dredge spoils from the dredging of the Thames River. The dredge spoils were placed across the entire bottom of the valley and now form a wetland area. The dredge spoils are generally saturated. Boring logs indicate that this material is identified as soil type OL (organic silts and organic silt-clays of low plasticity). This type of material may be expected to have low strength characteristics.

Landfill material was placed along the south west side of the valley, on top of the original ground surface and the dredge spoil. The existing landfill extends from the south west side of the valley on top of the dredge spoil (or alluvium) to the north edge of the landfill which slopes steeply (approximate maximum of 2:1) down to the wetland area.

The conceptual model of the landfill consists of:

- the proposed landfill cap
- the waste material
- the weak dredge spoil
- the alluvium material
- the bedrock.

The proposed cap configuration is different for the steep (4:1 slope) and the top plateau portion (3-5% slope). The plateau portion of the cap is mostly paved to provide for a parking lot. Figure 1, page 14 shows both cap configurations.

APPROACH

The stability analysis conducted for landfill A considered the final completed cap conditions. After reviewing the final grading plans for the landfill cap, a critical section was chosen which would likely result in the lowest factor of safety for stability.

The stability analysis was conducted using PC STABL 5M computer code. The PC STABL 5M model is a two-dimensional limiting equilibrium slope stability program, capable of analyzing slope stability by the simplified Janbu, the simplified Bishop, and the Spencer method of slices (Ref 1). For this calculation, the simplified Bishop (circular failure) and sliding block methods were used for analyzing the landfill stability.

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SUBJECT STABL SLOPE STABILITY			
BASED ON		DRAWING NUMBER	
BY RFD/DCW	CHECKED BY DCW 2/21/96	APPROVED BY	DATE February 21, 1996

Both total and effective stress analyses were performed on the landfill to evaluate the factor of safety against slope failure. A total stress analysis is normally performed to evaluate saturated soil undergoing undrained loading. In applying a total stress analysis, the undrained strength should replace the effective stress cohesion intercept when calculating stresses along a failure surface (Ref 11). In addition, pore pressure should be taken as zero along any failure surface were undrained strength is used (Ref 11). In cases where a failure surface must pass partly through a free draining soil and partly through an undrained material, effective stress strength parameters along with the appropriate pore pressure apply along one portion of the surface, and the total stress parameters (with zero pore pressure) apply along the other (Ref 11).

For the landfill system discussed above, it has been assumed that only the dredge spoil layer will exhibit undrained conditions during loading. All other soils have been assumed to drain freely. Therefore, when total stress analyses were completed, the total stress parameters of the dredge spoil material were used in the model with no pore pressure acting along the failure surface of the dredge spoil material. Effective stress parameters with appropriate pore pressures were used for materials expected to exhibit drained conditions.

The strength parameters for the dredge spoil were determined by triaxial tests, due to the potential low strength and the uncertainty of the strength of this material. The soil strength parameters of the other materials used in the stability analysis were conservatively chosen from literature. Because of the varying strength properties of the cap materials, each soil layer in the cap was included in the stability calculations. The interface friction angles between soil layers and geotextiles and geomembranes were not considered in the STABL analysis for "deep" failure evaluations. The stability of the interfaces between cap components were determined using a separate infinite slope and veneer stability analysis.

ASSUMPTIONS

The following section describes assumptions made concerning the various input needed for the STABL model of the landfill. Required for the analysis are the strength parameters and densities for the various soil types in the landfill and the configuration of these soils in the critical section. Also required is the water table elevation under the proposed cap configuration.

CRITICAL SECTION

Using the Digital Terrain Model (DTM) created as part of the groundwater modeling study, several cross sections along the northern face of the landfill were investigated to determine the critical section most likley to result in the lowest factor of safety for stability. Several factors including maximum height of fill, the depth of waste, and the depth to bedrock were considered for each cross section. The critical cross section chosen is located in the northwest end of the landfill and is shown in plan view on Figure 2, page 15. Figure 3, page 16 shows the profile of the critical cross section and the subsurface stratigraphy as defined by the DTM. It should be noted that construction of the landfill cap at this location will occur inside of the assumed limit of waste material, and therefore, a layer of probable waste material will remain below the cap termination point and the dredge spoil layer.

CLIENT NEW LONDON AREA A LANDFILL		JOB NUMBER 5082-0185	
SUBJECT STABL SLOPE STABILITY			
BASED ON		DRAWING NUMBER	
BY RFD/DCW	CHECKED BY DCW 2/21/96	APPROVED BY	DATE February 21, 1996

WATER TABLE

Total Stress Analysis - For the purpose of total stress analysis, it was assumed that the pre-construction groundwater table will be present immediately after regrading and construction of the landfill cap. This is a conservative assumption since the water table will likely be lower as a result of temporary and/or permanent groundwater/surface water controls utilized during construction. The assumed physical water surface (i.e., elevation head) used in the stability calculations starts at the same elevation as the standing water in the wetlands. At the toe of the landfill, the physical water surface runs along the face of the landfill (i.e., seep) to the gabion basket/waste interface. From here, this surface continues at a constant elevation until the geomembrane termination point. Behind the geomembrane, the physical water surface resembles that which existed prior to construction. All soils above the geomembrane were assigned this surface when calculating pore pressures and soil driving forces.

In order account for the additional pore pressure acting on soils behind the geomembrane, a piezometric surface (inclusive of elevation head and pressure head) was used in the stability analysis. This surface was identical to the physical surface except that a constant head was assumed from the intersection of the geomembrane and the pre-construction groundwater table to the geomembrane termination point. This constant head was linearly reduced between the geomembrane termination point and the gabion basket/waste interface. All free draining soils located below the geomembrane were assigned this phreatic surface when calculating pore pressures, etc. A third phreatic surface was utilized specifically for the undrained dredge spoil materials. This phreatic surface was located along the bedrock boundary, in order to simulate zero pore pressure in the undrained material. Figure 4, page 17 shows the phreatic surfaces as defined in the total stress stability analysis.

Effective Stress Analysis - For the purpose of effective stress analysis, two phreatic surfaces were evaluated. These surfaces were based on the results of the groundwater modeling study (See Reference 9). The first surface depicts the steady state condition that would exist after capping and installation of an upgradient interceptor trench. The second depicts the steady state condition that would exist after capping and installation of an upgradient interceptor trench and toe drain (optional design approach to be evaluated). An effective stress analysis was conducted for both cases. Figure 5, page 18 shows the preatic surfaces as defined in the effective stress stability analysis.

BEDROCK

The bedrock surface was assumed to be the lower limit of any failure surfaces through the landfill.

ALLUVIUM

The layer of sand/gravel encountered below the dredge spoil material is assumed to be a SP type soil. Typical effective strength parameters for this type of soil are a cohesion of 0 psf and a friction angle of 37° (Ref 4). A typical dry unit weight is 110 pcf (Ref 4) and a typical void ratio for this type of soil is 0.50 (Ref 5). The saturated unit weight of the alluvium was calculated with the following equation (Ref 10):

$$\gamma_{sat} = W_s/V + [(e/(1+e)]\gamma_{water}$$

CLIENT NEW LONDON AREA A LANDFILL		JOB NUMBER 5082-0185	
SUBJECT STABL SLOPE STABILITY			
BASED ON		DRAWING NUMBER	
BY RFD/DCW	CHECKED BY DCW 2/21/96	APPROVED BY	DATE February 21, 1996

Where:

γ_{sat} = saturated unit weight of soil
W_s = dry weight of the soil (pcf)
V = volume of soil (1ft^3)
e = void ratio
γ_{water} = unit weight of water (62.4 pcf)

This equates to a saturated unit weight of 130.8 pcf. A value of 130 was used in the stability analyses.

DREDGE SPOIL

The total and effective stress strength parameters of the dredge spoil were determined by triaxial tests on samples of dredge spoil taken from under the landfill. The unit weight of the dredge spoil was also determined from test results.

Three samples were tested to determine both effective strength parameters and total strength parameters (cohesion and friction angle). The lowest cohesion and the lowest friction angle from each of the three results were used in the STABL runs to be conservative. The triaxial test results are listed below:

Sample No.	Cohesion (PSF)	Friction Angle (degrees)
Effective Stress		
LF-SB01-21	130	37.5
LF-SBO1-23	216	30.6
LF-SBO2-19	72	35.3
USE:	72	30.6
Total Stress		
LF-SB01-21	346	14.8
LF-SBO1-23	389	11.8
LF-SBO2-19	173	14.8
USE:	170	11.8

Based on observations of the characteristics of the dredge spoils in the wetlands noted in the boring logs (blow counts) as well as field observations, the strength of the dredge spoil in the wetland appeared to be less than triaxial test results. The strength of the dredge spoil may be higher under the landfill due to consolidation of the dredge spoil caused by the weight of the landfill. Based on this premise, the strength of the dredge spoil would be expected to decrease with decreasing landfill height. Conservative (low) strength parameters were assumed for the dredge spoil in the wetland area. It is likely that the strength of the dredge spoil does not change abruptly right at the edge of the landfill due to the gradual attenuation of consolidation stresses with distance. Therefore, two additional zones of dredge spoil strengths were incorporated into the STABL model of the landfill to "transition" from the assumed weak strength

CLIENT NEW LONDON AREA A LANDFILL		JOB NUMBER 5082-0185	
SUBJECT STABL SLOPE STABILITY			
BASED ON		DRAWING NUMBER	
BY RFD/DCW	CHECKED BY DCW 2/21/96	APPROVED BY	DATE February 21, 1996

properties in the wetlands to the stronger strength properties under the landfill determined with the triaxial testing.

Four sets of strength properties were used for the dredge spoil for both the effective and total stress analyses. The strengths are listed below:

Location	Cohesion (PSF)	Friction Angle (degrees)
Effective Stress:		
Wetland (assumed)	0	20
Transition 1	24	23
Transition 2	48	27
Test Results	72	30.6
Total Stress:		
Wetland (assumed)	100	0
Transition 1	120	4
Transition 2	145	8
Test Results	170	11.8

The line between the wetland strength parameters and the transition 1 parameters was chosen based on the existing landfill slope and extends downward to the bedrock surface at a 1 H : 2 V slope to the bedrock surface. This angle would roughly correspond to the area of influence of the additional fill load of the landfill material. The full consolidated strength of the landfill could be expected to be achieved at the top of the existing landfill side slope, where the landfill material reaches its full height. The various soil boundaries used in the STABL model of the landfill are shown in Figure 3, page 16.

Based on the test results of the dredge spoil, the dry unit weights of the dredge spoil ranges from 58.51 to 63.93 pcf. The dry unit weight of the dredge spoil was assumed to be as 61 pcf. The void ratio ranged from 1.587 to 1.823. The typical void ratio was assumed to be 1.69. The saturated unit weight is then calculated to be 100.2 pcf. A rounded value of 100 pcf was used in the stability analyses.

DREDGE SPOIL/WASTE INTERFACE LAYER

A portion of the waste layer defined by the DTM was modeled as a "dredge spoil/waste interface layer" to investigate the effect of varying strength parameters of this interface on the stability analysis. Each of the stability scenarios was evaluated twice: once using the strength parameters of the waste to define the dredge spoil/waste interface layer, and again using the strength parameters of the transition 2 dredge spoils to define the interface layer. Separate total stress and effective stress analyses were conducted to determine how the strength parameters of this "interface" layer affected overall stability.

WASTE MATERIAL

Due to the nature of waste materials (being a mixture of many types of material generally placed randomly

CLIENT NEW LONDON AREA A LANDFILL		JOB NUMBER 5082-0185	
SUBJECT STABL SLOPE STABILITY			
BASED ON		DRAWING NUMBER	
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and having varying amounts of compaction), the strength and weight parameters of the waste material may inherently have a high degree of variability. The weight and strength parameters for the waste material were based on typical values for municipal waste landfills. Because of the variability that can occur within the landfill (i.e., because of this variability, sample results may not be typical of the waste material) and the difficulty of determining strength parameters of waste in a laboratory, the waste parameters were chosen from typical literature values. Reference 2 lists a range of friction angle of 10° to 35° and a cohesion of range 200 to 1440 psf. Typical waste strength parameters of c' of 250 psf and a ϕ' of 25° were assumed for the analysis.

The unit weight of the waste was taken from typical values for well compacted residential waste with a range of 1000 to 1250 pcy with typical value being 1000 pcy (Ref 3). Since landfill A is an "older" landfill, a unit weight denser than typical was chosen to account for degradation and consolidation. A value of 1200 pcy was assumed, which corresponds to approximately 45 pcf. This will be used as the moist unit weight. For the saturated unit weight 80 pcf was assumed. This corresponds to the range of the highest wet unit weights given in Reference 2.

GRANULAR DRAINAGE MATERIAL

The granular drainage material in the cap system is assumed to be a poorly graded sand to provide adequate fluid flow. It is assumed that this same material will be used for the gas management layer. An SP soil, as classified by the USCS, represents a poorly graded clean sand, sand gravel mix with typical shear strength properties of 0 psf for cohesion and 37° for effective friction angle (Ref 4, see page 12). A dry unit weight of 110 pcf was judged to be representative for this material (Ref 4). The saturated unit weight was calculated using a typical void ratio of 0.50 for this type of material (Ref 5, see page 13). The saturated unit weight was calculated to be 130.8 pcf. The value of 131 pcf was used in the stability analysis.

RIPRAP

The one foot layer of riprap to be placed on the steep portion of the cap is assumed to have similar densities as the sand material in the cap system. The strength parameters of the riprap were assumed to be 0 pcf for cohesion and 41° for an effective friction angle. The internal friction angle was assumed to be similar to the angle of repose of riprap ("the angle of repose represents the angle of internal friction of the granular material at its loosest state", Ref 6). The riprap material is assumed to have a D_{50} of 3". From Chart 12 of Reference 7, the angle of repose for crushed rock to very angular riprap is approximately 41°

GABIONS

In previous calculations, it was determined that additional stone would be required at the toe of the landfill to provide an adequate factor of safety against buoyant uplift of the cap toe. A gabion basket design was incorporated at the toe to replace the riprap. The gabion backets serve two purposes; to provide additional weight on the toe, and to provide a material that would resist failure surfaces through the critical toe area. Since the gabions are wired together, it was assumed that the failure surface could not pass through the gabions. Limits were used in the model to prevent assumed failure surfaces from passing through the

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gabions. The unit weights of the gabion baskets were assumed to be the same as the riprap. For use in STABL, the rip rap soil strength parameters were used for the gabions, however, these values do not impact the final results since the failure surface was not allowed to pass through the gabion baskets.

SIDE SLOPE BEDDING SOIL

The six inch layer of cohesive soil beneath the geomembrane on the steep portion of the landfill cap is assumed to be either a SM or SC type of soil. Typical effective strength parameters for this type of soil are a cohesion of 300 psf and a friction angle of 33° (Ref 4). A typical dry unit weight for this type of soil is 120 pcf (Ref 4) and a typical void ratio is 0.41 (Ref 5). This equates to a saturated unit weight of 138 pcf.

ASPHALT PAVEMENT

The flat portion of the landfill cap will be paved to create a parking lot. The strength parameters of the asphalt paving will be conservatively assumed to be the same as the riprap with a cohesion of 0 pcf and a friction angle of 41°. In reality the asphalt will have a high cohesion, and an assumption of no cohesion will be conservative from a stability standpoint. The unit weight of the compacted asphalt paving is assumed to have a bulk specific gravity of 2.344 and a maximum specific gravity of 2.438 based on a typical pavement design in Reference 8. This corresponds to an approximate bulk unit weight of 146 pcf and a maximum unit weight of 152 pcf. A value of 150 pcf was assumed in the analysis.

The following table summarizes the unit weight and strength parameters used in the stability calculations.

Material	Unit Weight (pcf)	Saturated Unit Weight (pcf)	Effective Stress friction angle (degrees)	Effective Stress Cohesion (psf)	Total Stress Friction Angle (degrees)	Total Stress Cohesion (psf)
Alluvium	110	130	37	0	NA	NA
Dredge Spoil (Wetlands)	61	100	20	0	0	100
Dredge Spoil, Transition 1	61	100	23	24	4	120
Dredge Spoil, Transition 2	61	100	27	48	8	145

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Dredge Spoil, Under Landfill	61	100	30.6	72	11.8	170
Dredge Spoil/Waste Interface Layer	61/45	100/80	27/25	48/250	8/NA	145/NA
Waste Materials	45	80	25	250	NA	NA
Granular Drainage Material	110	131	37	0	NA	NA
Riprap/ Gabions	110	131	41	0	NA	NA
Sideslope Bedding Soil	120	138	33	300	NA	NA
Asphalt Paving	150	150	41	0	NA	NA

NA, total strength parameters were not available for these soils.

ANALYSIS

EFFECTIVE STRESS

Both a circular and a sliding block type failure were investigated using an effective stress analysis. For the effective stress analysis, the two steady-state groundwater conditions determined by the groundwater modeling study were used to evaluate slope stability. All soils above and below the groundwater surface were assigned the steady-state groundwater surface for calculating pore pressures and driving forces. In addition, the soil parameters of the dredge spoil/waste interface layer were varied to determine the effect on the factor of safety (see section above).

In analyzing the slope using circular failures, the failure plane initiation point, termination point, segment length, and initiation angle were varied to converge on the lowest factor of safety against circular slope failure. The results of the analyses indicate that the critical failure surface is at the toe of the landfill, starting above the gabion baskets and terminating outside the landfill toe. The minimum factor of safety obtained using the circular failure analysis in evaluating the cap and interceptor trench scenario was 1.6. This value was obtained when the dredge spoil/waste interface material was given the soil parameters representative of the weaker dredge spoil (transition 2) material. Using the higher strength parameters of

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the waste for the interface material raised the factor of safety to 1.8. Figures 6 and 7 show the effect of varying dredge spoil/waste interface layer properties on the critical failure surfaces for a circular failure with capping and interceptor trench construction. Inclusion of a toe drain to the previously discussed analysis served to slightly lower the groundwater table and slightly increase the factor of safety against failure to 1.7, assuming the dredge spoil/waste interface as the weak material. Substituting the strength parameters of the stronger waste material for the interface layer increased the factor of safety to 1.9. Figures 8 and 9 show the effects of various dredge spoil/waste interface layer properties on the critical failure surfaces for a circular failure with capping, interceptor trench construction, and toe drain construction.

A similar analysis was completed using sliding block failure surfaces to determine the factor of safety. The results of the analyses indicate that the critical failure surfaces occur in the same location as for the circular failures; at the toe of the landfill, starting above the gabion baskets and terminating outside the landfill toe. The minimum factor of safety obtained using the sliding block failure analysis in evaluating the cap and interceptor trench scenario was 1.4. This value was obtained when the dredge spoil/waste interface layer was given the soil parameters representative of the weaker dredge spoil (transition 2) material. Using the higher strength parameters of the waste for the interface layer raised the factor of safety to 1.6. Figures 10 and 11 show the effects of varying interface layer soil properties on the critical failure surfaces for a sliding block failure with capping and interceptor trench construction. Inclusion of a toe drain to the previously discussed analysis served to slightly lower the groundwater table and slightly increase the factor of safety against failure to 1.5, assuming the dredge spoil/waste interface as the weak material. Substituting the strength parameters of the stronger waste material for the interface layer increased the factor of safety to 1.7. Figures 12 and 13 show the effects of varying dredge spoil/waste interface soil parameters on the critical failure surfaces for a sliding block failure with capping, interceptor trench construction, and toe drain construction.

Additional analyses were conducted to determine the factor of safety against slope failure for deep circular failure that extended to the top of slope. The initiation and termination points for the circular failure surface were held at locations outside the toe and above the crest of the slope. The factor of safety for this deep failure was 2.8, assuming the dredge spoil/waste interface as the weak material. Figure 14 shows the critical failure surfaces for deep circular failure starting at the toe of the slope and extending past the top of slope.

Copies of the output files for the nine effective stress analyses are presented on pages 32 to 68.

TOTAL STRESS

The total stress analysis was similar to the effective stress analysis except that different strength parameters were used for the soils and different assumptions were made concerning the water table (see discussions above). Total stress strength parameters were only available for the dredge spoil materials. For the other soils types used in the analysis, the effective stress strength parameters were used, with the pre-construction groundwater table used to calculate pore pressures. The total stress strength parameters used for the dredge spoil already account for the pore water pressure in the soil, so the water table used for these soil types was set at the bottom of the dredge spoil layers, using a higher water table elevation

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would essentially account for the pore water pressures twice (see discussion above). However, the saturated unit weights of the dredge spoils were still used in the total stress analysis when calculating driving forces.

In analyzing the slope using circular failures, the failure plane initiation point, termination point, segment length, and initiation angle were varied to converge on the lowest factor of safety against circular slope failure. The results of the analyses indicate that the critical failure surface occurs in the same location as the effective stress analyses. The minimum factor of safety obtained using the circular failure analysis was 1.3. This value was obtained when the dredge spoil/waste interface layer was given the soil parameters representative of the weaker dredge spoil (transition 2) material. Using the higher strength parameters of the waste for the interface layer raised the factor of safety to 1.4. Figures 15 and 16 show the effect of various dredge spoil/waste interface layer properties on the critical failure surfaces for a circular failure total stress analysis.

A similar analysis was completed using sliding block failure surfaces to determine the factor of safety. The results of the analyses indicate that the critical failure surface occurs in the same location as for the circular failures; at the toe of the landfill, starting above the gabion baskets and terminating outside the landfill toe. The minimum factor of safety obtained using the sliding block failure analysis was 1.1. This value was obtained when the dredge spoil/waste interface layer was given the soil parameters representative of the weaker dredge spoil (transition 2) material. Using the higher strength parameters of the waste for the interface layer raised the factor of safety to 1.3. Figures 17 and 18 show the effects of varying interface soil properties on the critical failure surfaces for a sliding block failure.

Copies of the output files for the four total stress analyses are presented on pages 69 to 88.

CONCLUSIONS

The minimum static factor of safety for Area A landfill is 1.1, considering a total stress analysis and a sliding block type failure at the toe of the landfill. It should be noted that the low factor of safety at the toe of the slope is a direct result of the increased driving force associated with the gabion basket reinforcement. However, the calculated factor of safety should represent a worst case scenario since conservative assumptions were made throughout the analysis.

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BASED ON		DRAWING NUMBER	
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4) Design Manual-Soil Mechanics, Foundations and Earth Structures, NAVFAC DM-7, March 1971 (table attached, page 12 of 88).

5) U.S. Bureau of Reclamation, Design of Small Dams, U.S. Government Printing Office, Revised Reprint 1977 (table attached, page 13 of 88).

6) Holtz, and Kovacs, An Introduction to Geotechnical Engineering, Prentice-Hall, 1981, p. 492.

7) Federal Highway Administration, Hydraulic Engineering Circular No. 15, Design of Roadside Channels with Flexible Linings, Publication No. FHWA-IP-87-7, April 1988, p. 49.

8) The Asphalt Institute, Manual Series No.2 (MS-2), Mix Design Methods for Asphalt Concrete, May 1984, p. 72.

9) Groundwater/Leachate Modeling Study Report, Brown & Root Environmental, February 1996.

10) Lindeburg, Civil Engineering Reference Manual, Professional Publications, Belmont CA., 1992, p. 9-7.

11) Lambe and Whitman, Soil Mechanics, John Wiley & Sons, 1969, Chapter 31.

TABLE 1
Typical Properties of Compacted Soils

Group Symbol	Soil Type	Range of Maximum Dry Unit Weight, pcf	Range of Optimum Moisture, Percent	Typical Value of Compression: At 1.4 tsf (20 psi)	Typical Value of Compression: At 3.6 tsf (50 psi)	Typical Strength Characteristics: Cohesion (as compacted) psf	Typical Strength Characteristics: Cohesion (saturated) psf	Typical Strength Characteristics: φ (Effective Stress Envelope Degrees)	Typical Strength Characteristics: Tan φ	Typical Coefficient of Permeability ft./min.	Range of CBR Values	Range of Subgrade Modulus k lbs/cu in.
				Percent of Original Height								
GW	Well graded clean gravels, gravel-sand mixtures.	125 - 135	11 - 8	0.3	0.6	0	0	>38	>0.79	5×10^{-2}	40 - 80	300 - 500
GP	Poorly graded clean gravels, gravel-sand mix	115 - 125	14 - 11	0.4	0.9	0	0	>37	>0.74	10^{-1}	30 - 60	250 - 400
GM	Silty gravels, poorly graded gravel-sand-silt.	120 - 135	12 - 8	0.5	1.1	.....	.....	>34	>0.67	$>10^{-6}$	20 - 60	100 - 400
GC	Clayey gravels, poorly graded gravel-sand-clay.	115 - 130	14 - 9	0.7	1.6	.....	.....	>31	>0.60	$>10^{-7}$	20 - 40	100 - 300
SW	Well graded clean sands, gravelly sands.	110 - 130	16 - 9	0.6	1.2	0	0	38	0.79	$>10^{-3}$	20 - 40	200 - 300
SP	Poorly graded clean sands, sand-gravel mix.	100 - 120	21 - 12	0.8	1.4	0	0	37	0.74	$>10^{-3}$	10 - 40	200 - 300
SM	Silty sands, poorly graded sand-silt mix.	110 - 125	16 - 11	0.8	1.6	1050	420	34	0.67	$5 \times >10^{-5}$	10 - 40	100 - 300
SM-SC	Sand-silt clay mix with slightly plastic fines.	110 - 130	15 - 11	0.8	1.4	1050	300	33	0.66	$2 \times >10^{-6}$	5 - 30	100 - 300
SC	Clayey sands, poorly graded sand-clay-mix.	105 - 125	19 - 11	1.1	2.2	1550	230	31	0.60	$5 \times >10^{-7}$	5 - 20	100 - 300
ML	Inorganic silts and clayey silts.	95 - 120	24 - 12	0.9	1.7	1400	190	32	0.62	$>10^{-5}$	15 or less	100 - 200
ML-CL	Mixture of inorganic silt and clay.	100 - 120	22 - 12	1.0	2.2	1350	460	32	0.62	$5 \times >10^{-7}$	.....	
CL	Inorganic clays of low to medium plasticity.	95 - 120	24 - 12	1.3	2.5	1800	170	28	0.54	$>10^{-7}$	15 or less	50 - 200
OL	Organic silts and silt-clays, low plasticity.	80 - 100	33 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	50 - 100
MH	Inorganic clayey silts, elastic silts.	70 - 95	40 - 24	2.0	3.8	1500	420	25	0.47	$5 \times >10^{-7}$	10 or less	50 - 100
CH	Inorganic clays of high plasticity	75 - 105	36 - 19	2.6	3.9	2150	230	19	0.35	$>10^{-7}$	15 or less	50 - 150
OH	Organic clays and silty clays	65 - 100	43 - 21	.....	.....	.....	.....	.....	.....	.....	5 or less	25 - 100

Notes:

1. All properties are for condition of "Standard Proctor" maximum density, except values of k and CBR which are for "modified Proctor" maximum density.
2. Typical strength characteristics are for effective strength envelopes and are obtained from USBR data.
3. Compression values are for vertical loading with complete lateral confinement.
4. (>) indicates that typical property is greater than the value shown.
   (..) indicates insufficient data available for an estimate.

uncertainties that arise from sampling fluctuations, and they tend to vary from the true averages more widely if the number of observations is small. The plus or minus limits given are determined mathematically from the number of observations and from the standard deviation of the data used to determine the average. These limits imply that the true average, obtained by securing and testing more and more samples under the same essential conditions, lies within the plus or minus values 9 chances

er liquid limits than these will have inferior engineering properties.

(b) *Permeability.*—The voids in the soil mass provide passages through which water may move. Such passages are variable in size and the paths of flow are tortuous and interconnected. If, however, a sufficiently large number of paths of flow are considered as acting together, an average rate of flow for the soil mass can be determined under controlled conditions that will represent a property of the

TABLE 8.—*Average properties of soils*

Soil classification group	Proctor compaction		Void ratio, e_o	Permeability, k, feet per year	Compressibility		Shearing strength		
	Maximum dry density in pounds per cubic foot	Optimum water content, percent			@ 20 p.s.i., percent	@ 50 p.s.i., percent	C_o p.s.i.	C_{ss} p.s.i.	tan ϕ
GW	>119	<13.3	(*)	27,000±13,000	<1.4	(*)	(*)	(*)	>0.79
GP	>110	<12.4	(*)	64,000±34,000	<0.8	(*)	(*)	(*)	>0.74
GM	>114	<14.5	(*)	>0.3	<1.2	<3.0	(*)	(*)	>0.67
GC	>115	<14.7	(*)	>0.3	<1.2	<2.4	(*)	(*)	>0.60
SW	119±5	13.3±2.5	0.37±*	(*)	1.4±*	(*)	5.7±0.6	(*)	0.79±0.02
SP	110±2	12.4±1.0	0.50±0.03	>15.0	0.8±0.3	(*)	3.3±0.9	(*)	0.74±0.02
SM	114±1	14.5±0.4	0.48±0.02	7.5±4.8	1.2±0.1	3.0±0.4	7.4±0.9	2.9±1.0	0.67±0.02
SM-SC	119±1	12.8±0.5	0.41±0.02	0.8±0.6	1.4±0.3	2.9±1.0	7.3±3.1	2.1±0.8	0.66±0.07
SC	115±1	14.7±0.4	0.48±0.01	0.3±0.2	1.2±0.2	2.4±0.5	10.9±2.2	1.6±0.9	0.60±0.07
ML	103±1	19.2±0.7	0.63±0.02	0.59±0.23	1.5±0.2	2.6±0.3	9.7±1.5	1.3±*	0.62±0.04
ML-CL	109±2	16.8±0.7	0.54±0.03	0.13±0.07	1.0±0.2	2.2±0.0	9.2±2.4	3.2±*	0.62±0.06
CL	108±1	17.3±0.3	0.56±0.01	0.08±0.03	1.4±0.2	2.6±0.4	12.6±1.5	1.9±0.3	0.54±0.04
OL	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)
MH	82±4	36.3±3.2	1.15±0.12	0.16±0.10	2.0±1.2	3.8±0.8	10.5±4.3	2.9±1.3	0.47±0.05
CH	94±2	25.5±1.2	0.80±0.04	0.05±0.05	2.6±1.3	3.9±1.5	14.9±4.9	1.6±0.86	0.35±0.09
OH	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)	(*)

The ± entry indicates 90 percent confidence limits of the average value. * Denotes insufficient data, > is greater than, < is less than.

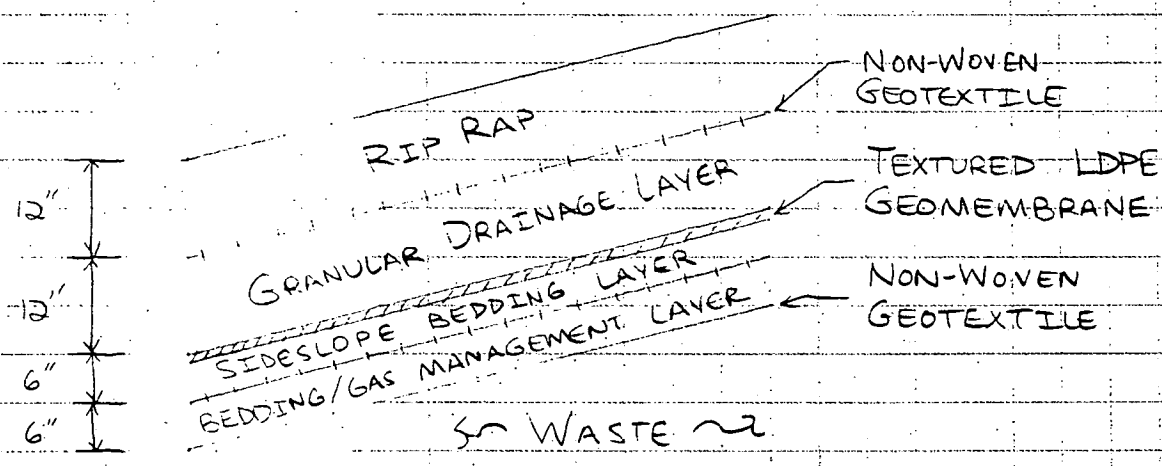
CLIENT	JOB NUMBER
NEW LONDON - AREA A LANDFILL	5083 - 0185

SUBJECT: STABL SLOPE STABILITY

BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
RFD			1/25/96

SIDESLOPE AREA CAP



PLATEAU AREA CAP

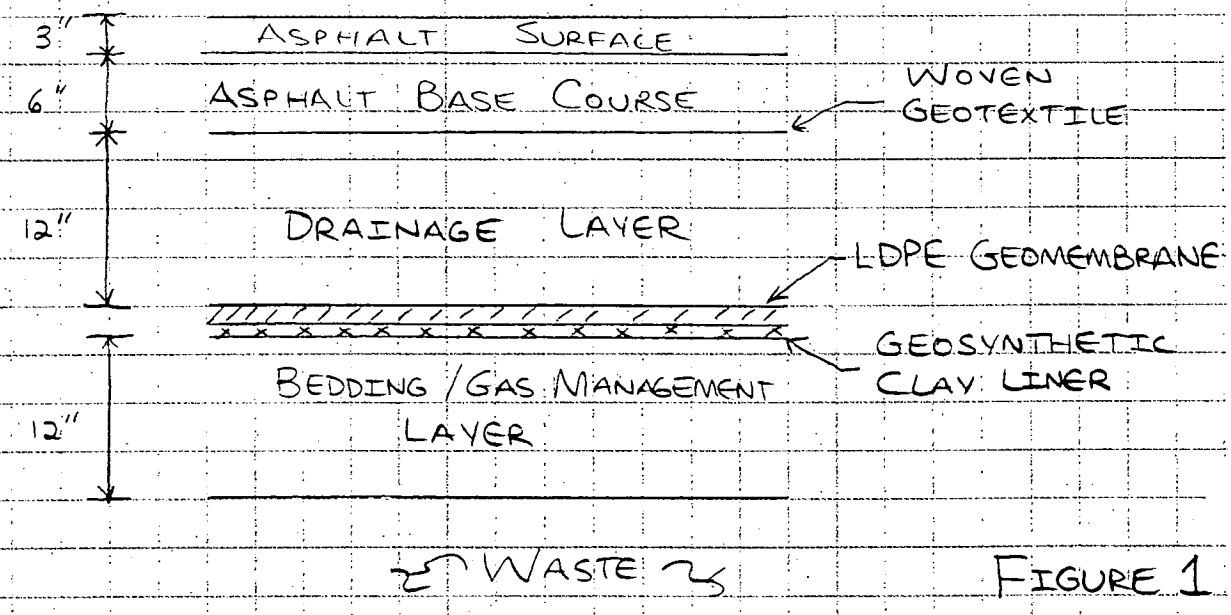


FIGURE 1

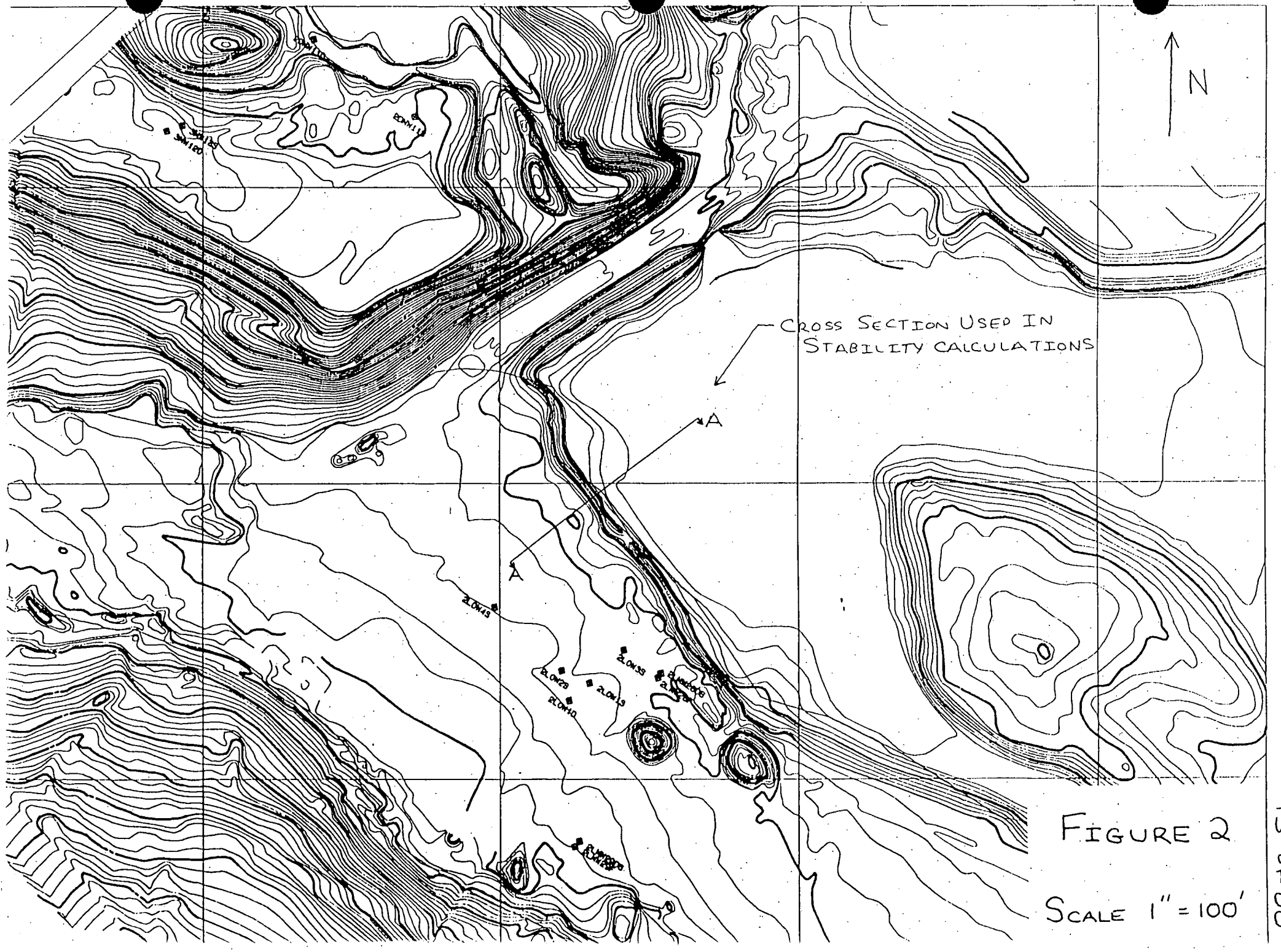
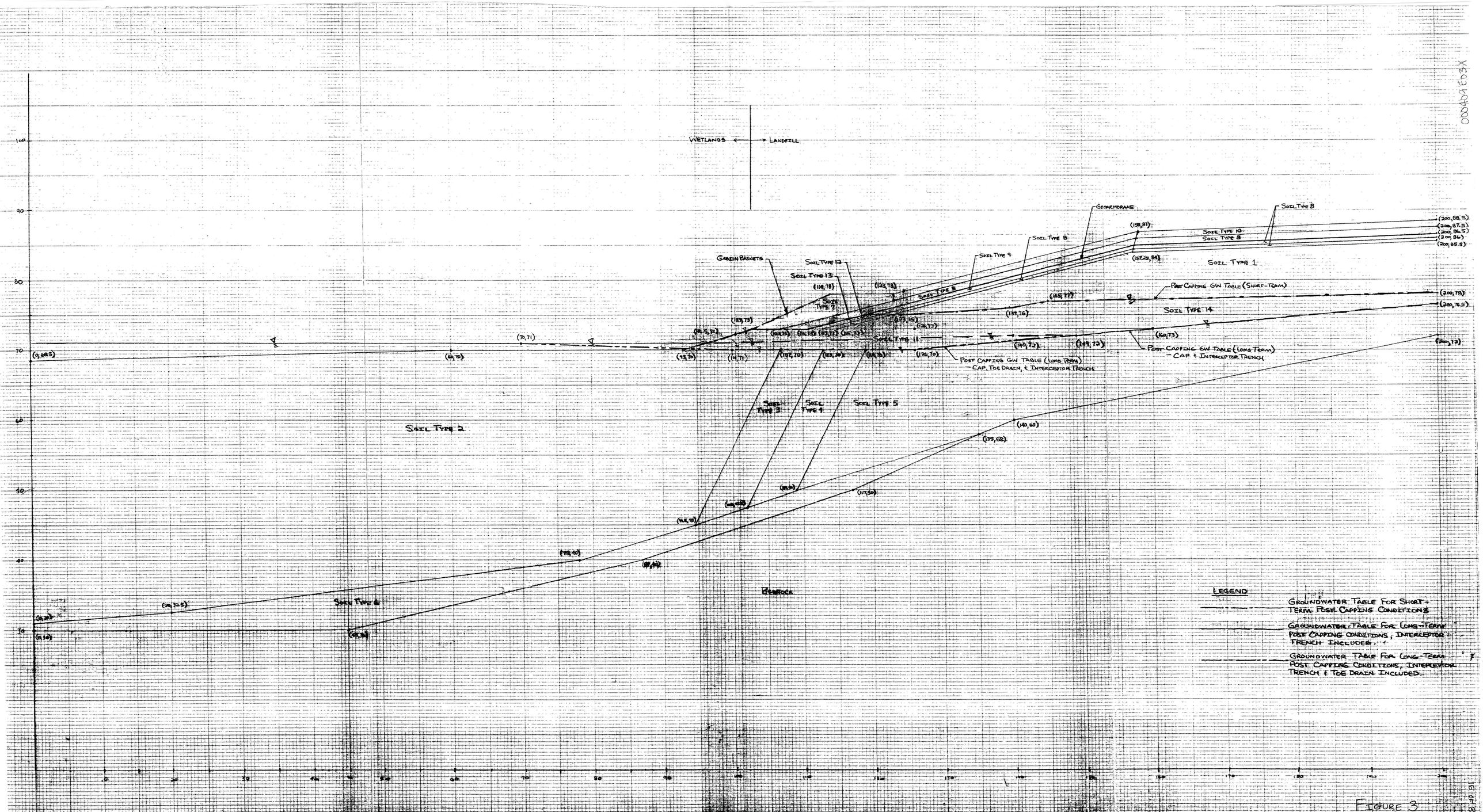


FIGURE 2

SCALE 1" = 100'


WETLANDS
LANDFILL
GEOMEMBRANE
SOIL TYPE 8
SOIL TYPE 10
SOIL TYPE 8
SOIL TYPE 9
SOIL TYPE 8
SOIL TYPE 1
GABION BASKETS
SOIL TYPE 12
SOIL TYPE 13
SOIL TYPE 7
SOIL TYPE 6
POST CAPPING GW TABLE (SHORT-TERM)
SOIL TYPE 14
SOIL TYPE 11
POST CAPPING GW TABLE (LONG TERM) - CAP, TOE DRAIN, & INTERCEPTOR TRENCH
POST CAPPING GW TABLE (LONG TERM) - CAP & INTERCEPTOR TRENCH
SOIL TYPE 3
SOIL TYPE 4
SOIL TYPE 5
SOIL TYPE 2
SOIL TYPE 6
BEDROCK
(200,88.5)
(200,87.5)
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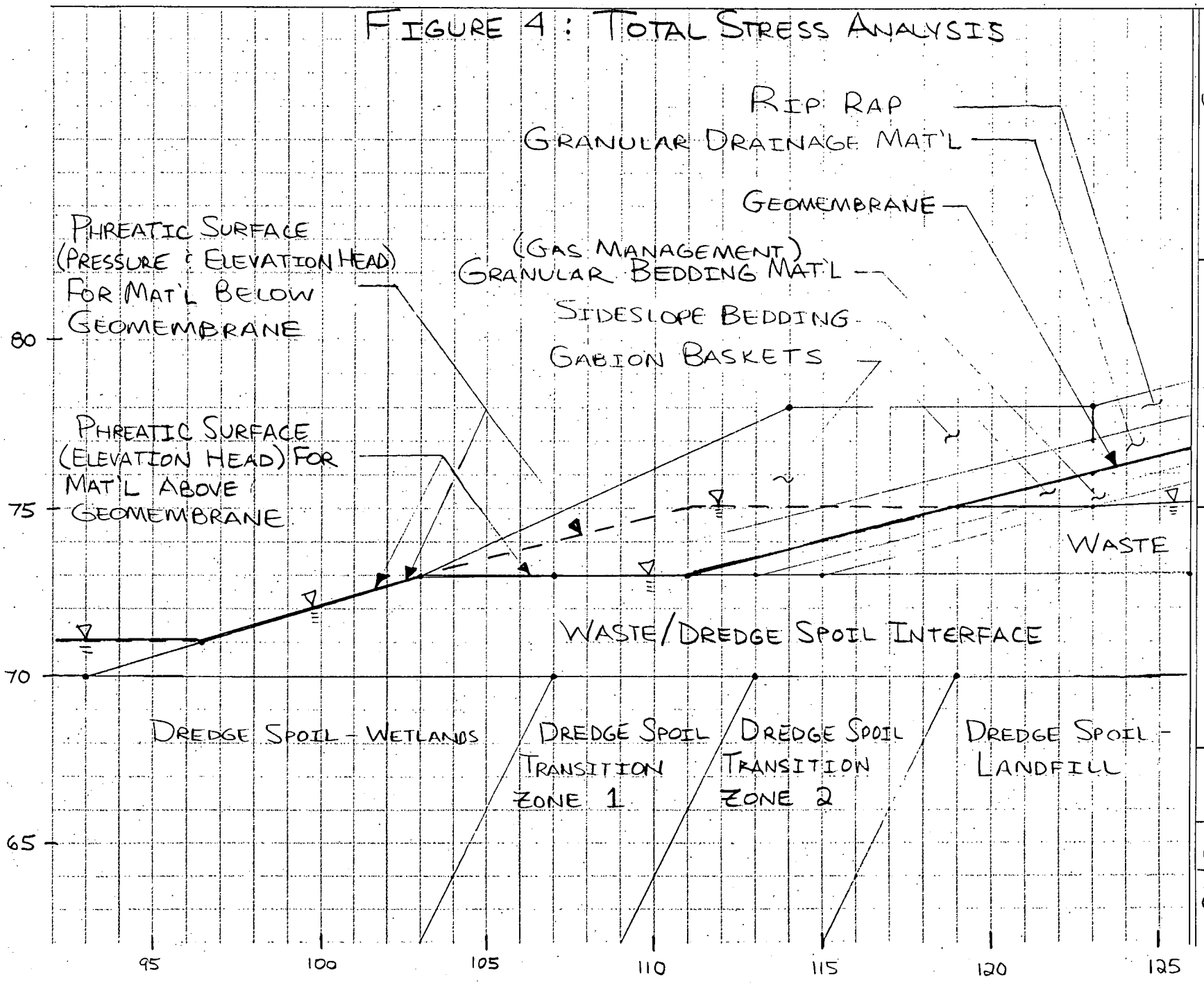
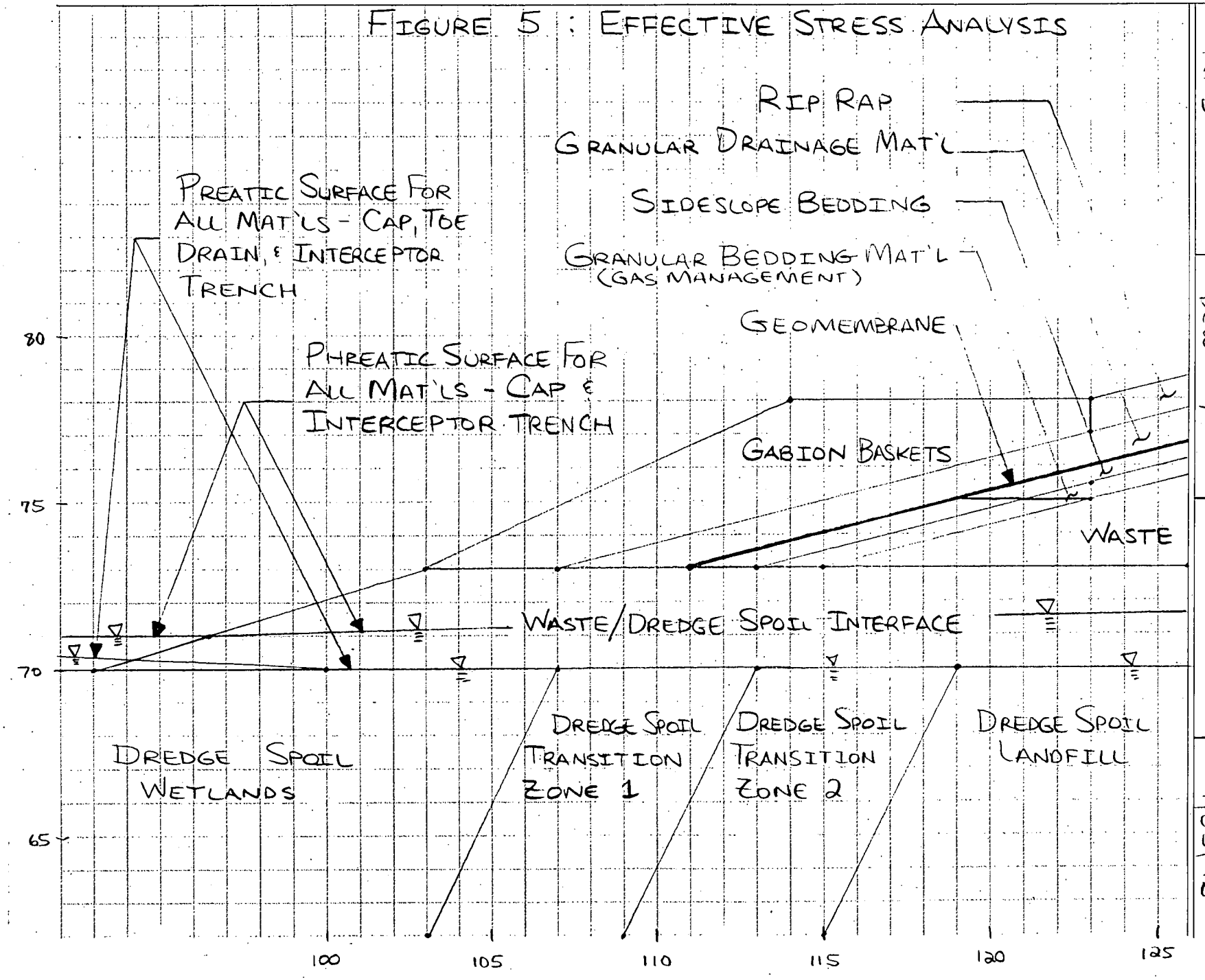
(117,50)
(116,48)
(98,44)
(78,40)
(29,33.5)
(0,30)
LEGEND
GROUNDWATER TABLE FOR SHORT-TERM POST CAPPING CONDITIONS
GROUNDWATER TABLE FOR LONG-TERM POST CAPPING CONDITIONS, INTERCEPTOR TRENCH INCLUDED.
GROUNDWATER TABLE FOR LONG-TERM POST CAPPING CONDITIONS, INTERCEPTOR TRENCH & TOE DRAIN INCLUDED.

FIGURE 3

FIGURE 4: TOTAL STRESS ANALYSIS





CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT: NEW LONDON - AREA A LANDFILL

SUBJECT: STABL SLOPE STABILITY

BASED ON:

BY: RFD

CHECKED BY: PCW 2/21/96

JOB NUMBER: 5082-0185

DRAWING NUMBER:

APPROVED BY:

DATE: 1/25/96

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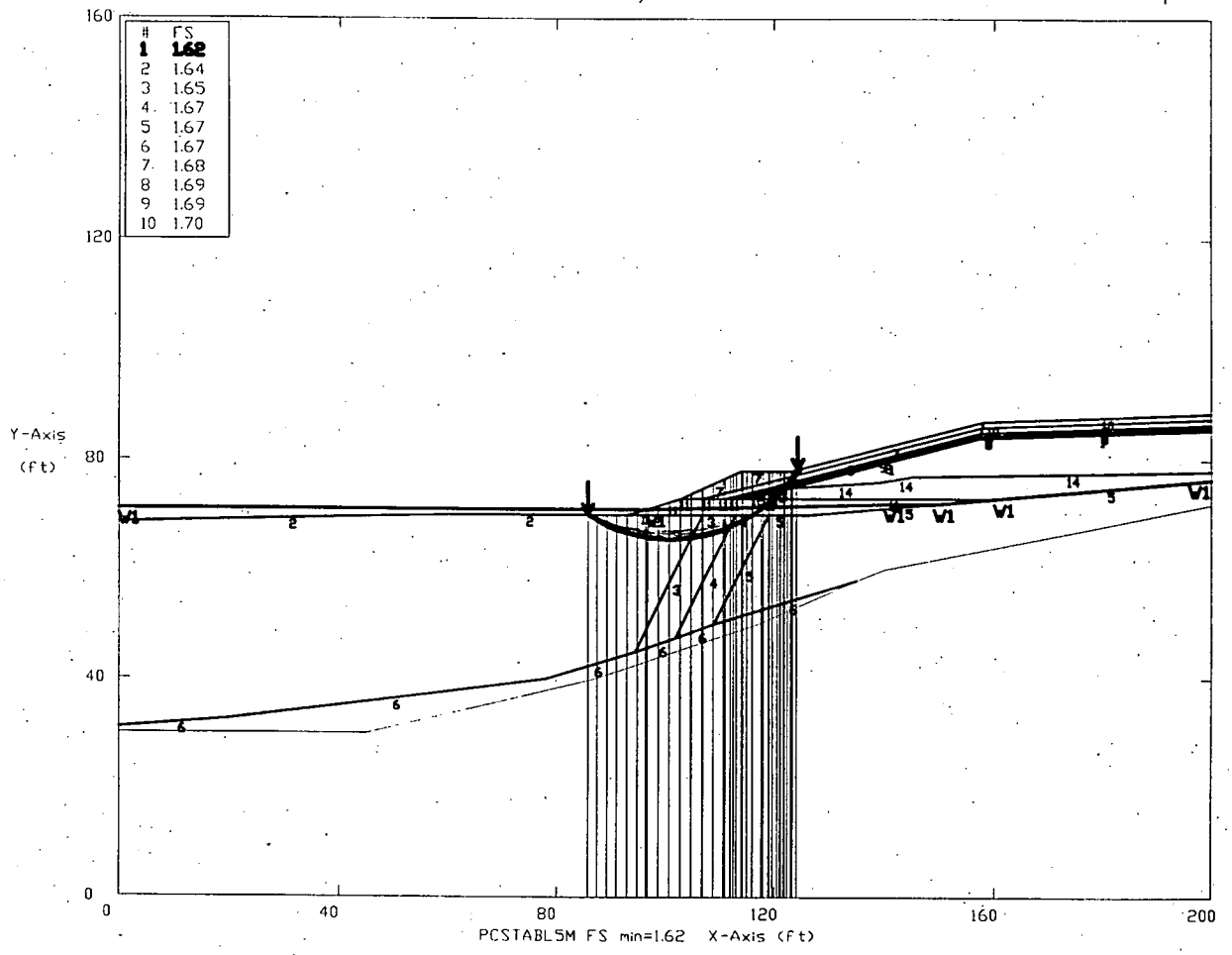
ACAD: O:\DATA\CADD\5082\5082CS01.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Circ. Failure, Final Cond. 1
Ten Most Critical. N:CE_FIN7.PLT By: Robert F. DeLisio 01-23-96 3:39pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	61	100	48	27	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

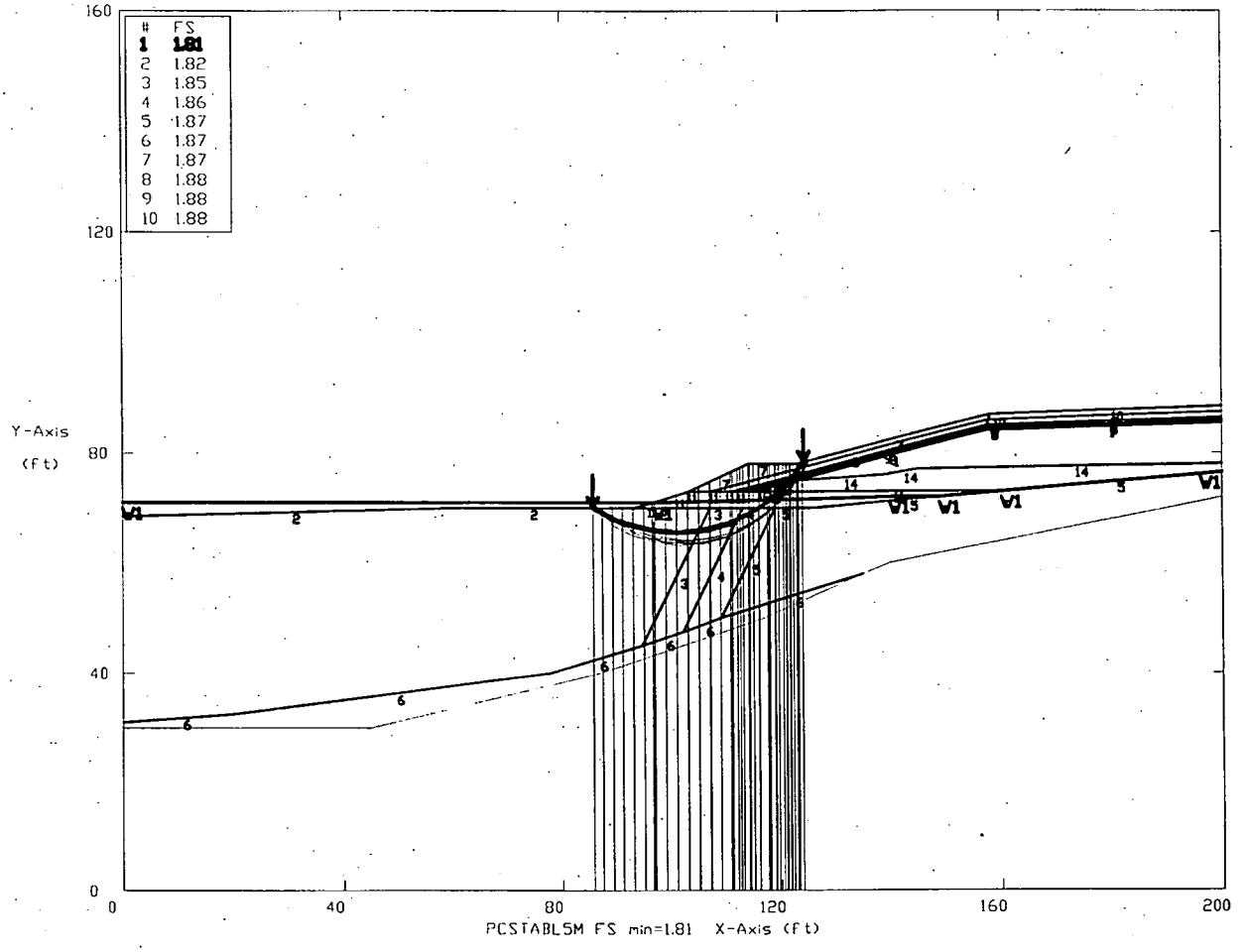
FIGURE 6

NLON, GROTN, CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS02.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Circ. Failure, Final Cond. 1
Ten Most Critical. N:CE_FIN6.PLT By: Robert F. DeLisio 01-23-96 2:58pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	45	80	250	25	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

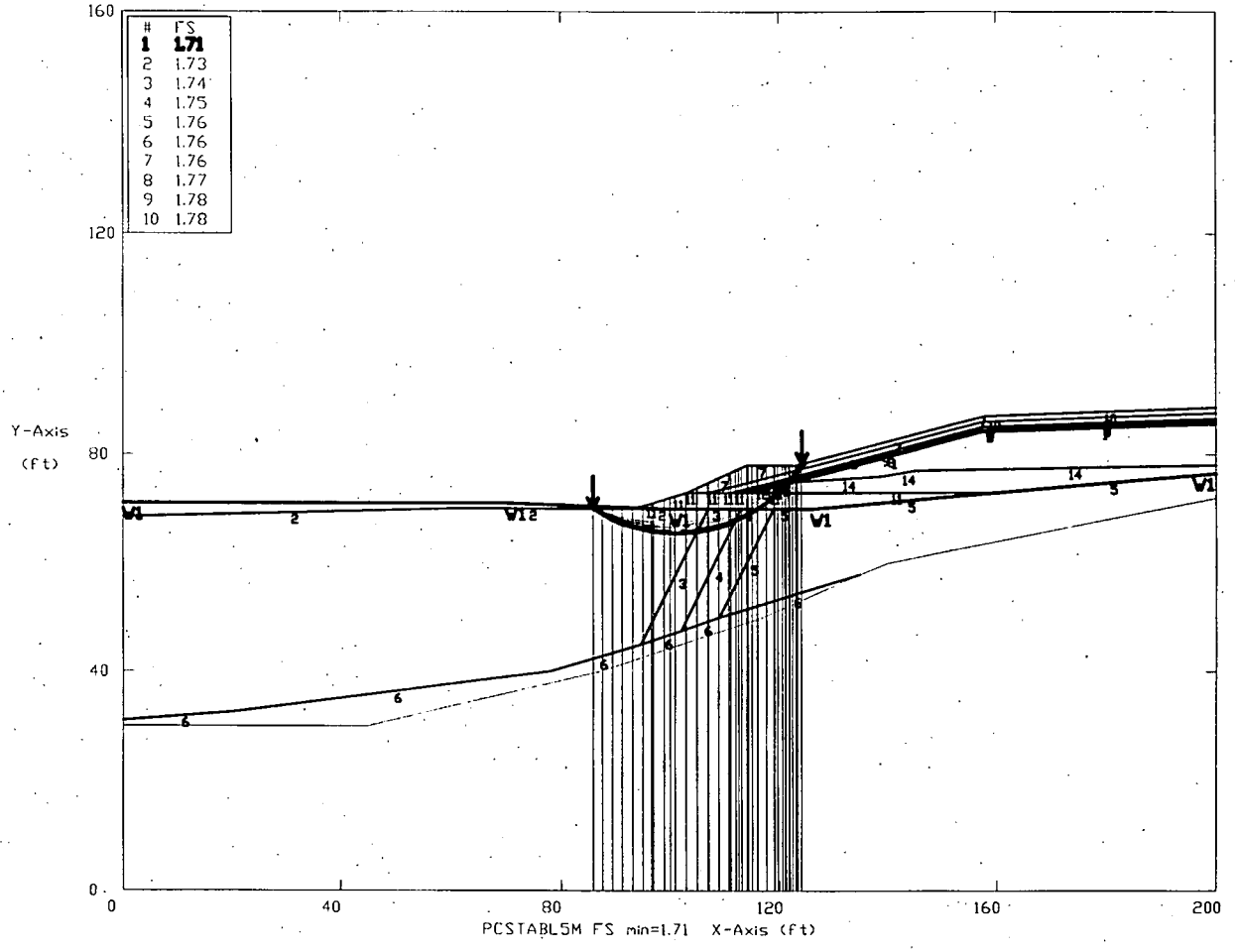
FIGURE 7

NLON, GROTN, CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082C503.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Circ. Failure, Final Cond. 2
Ten Most Critical N:CE_FIN13.PLT By: Robert F. DeLisio 01-25-96 8:36am



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	61	100	48	27	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

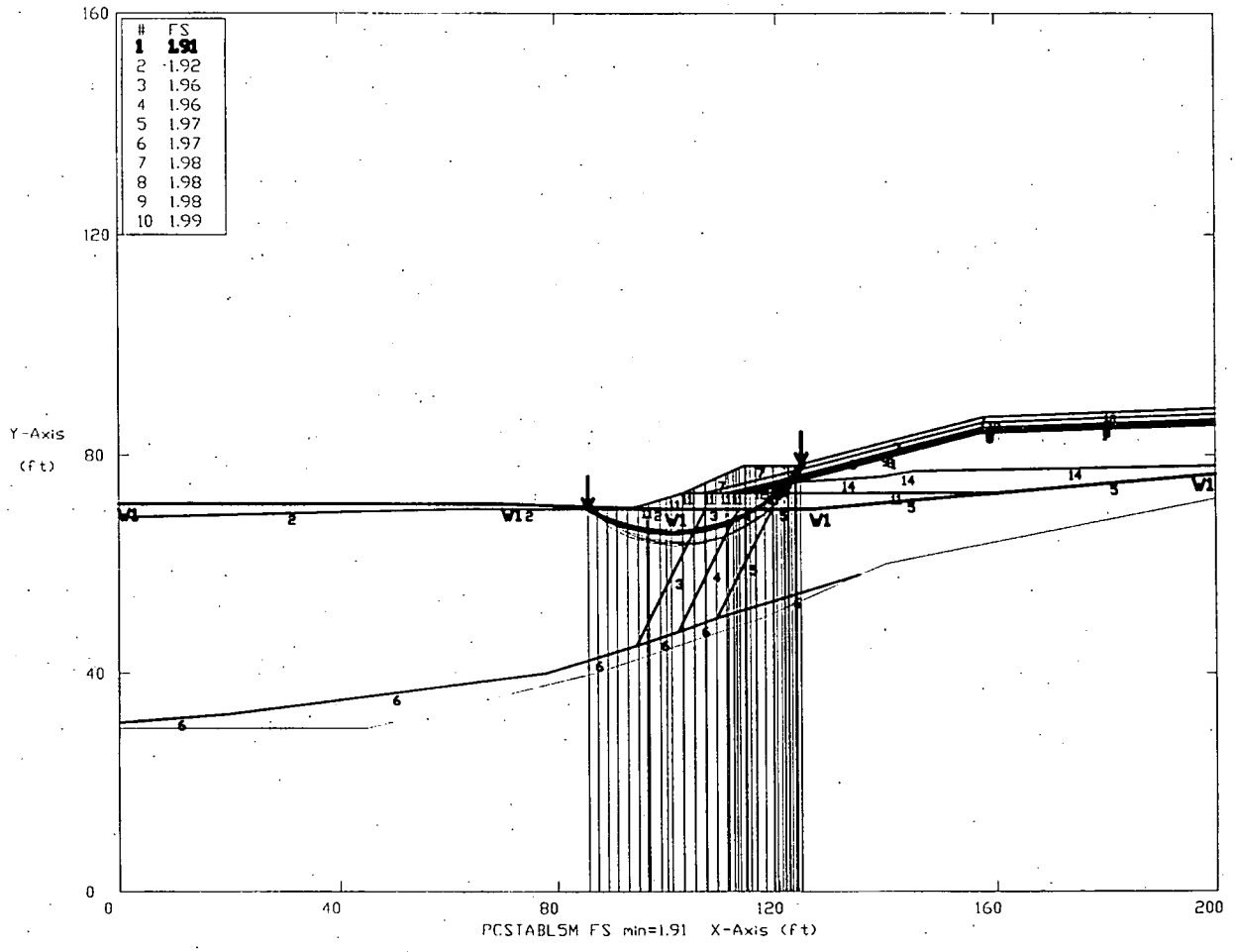
FIGURE 8

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS04.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Circ. Failure, Final Cond. 2
Ten Most Critical. N:CE_FIN19.PLT By: Robert F. DeLisio 01-25-96 9:27am



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	45	80	250	25	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

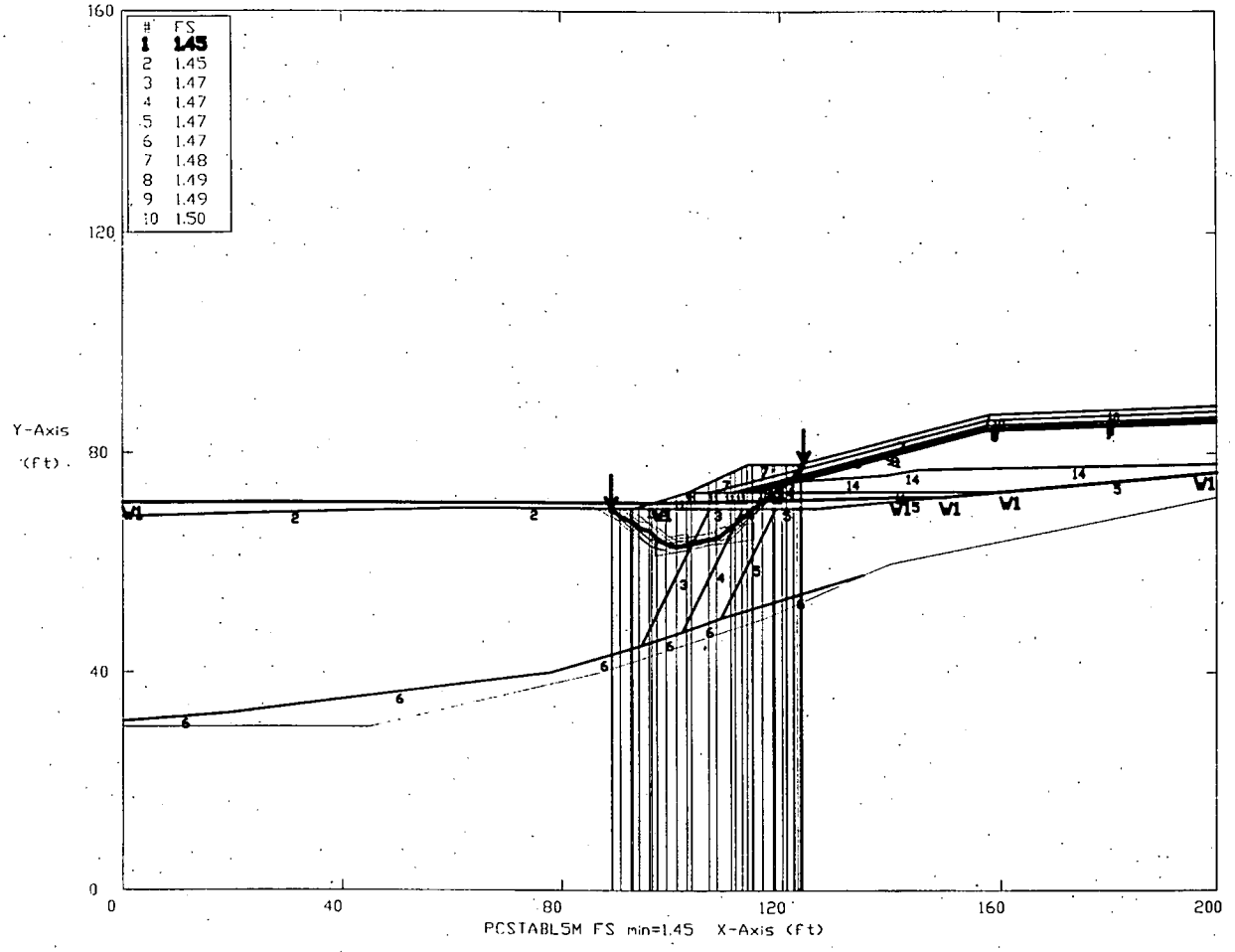
FIGURE 9

NLON, GROTN, CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS05.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Block Failure, Final Cond. 1
Ten Most Critical. N:BE_F.IN10.PLT By: Robert F. DeLisio 01-23-96 4:13pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	61	100	48	27	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

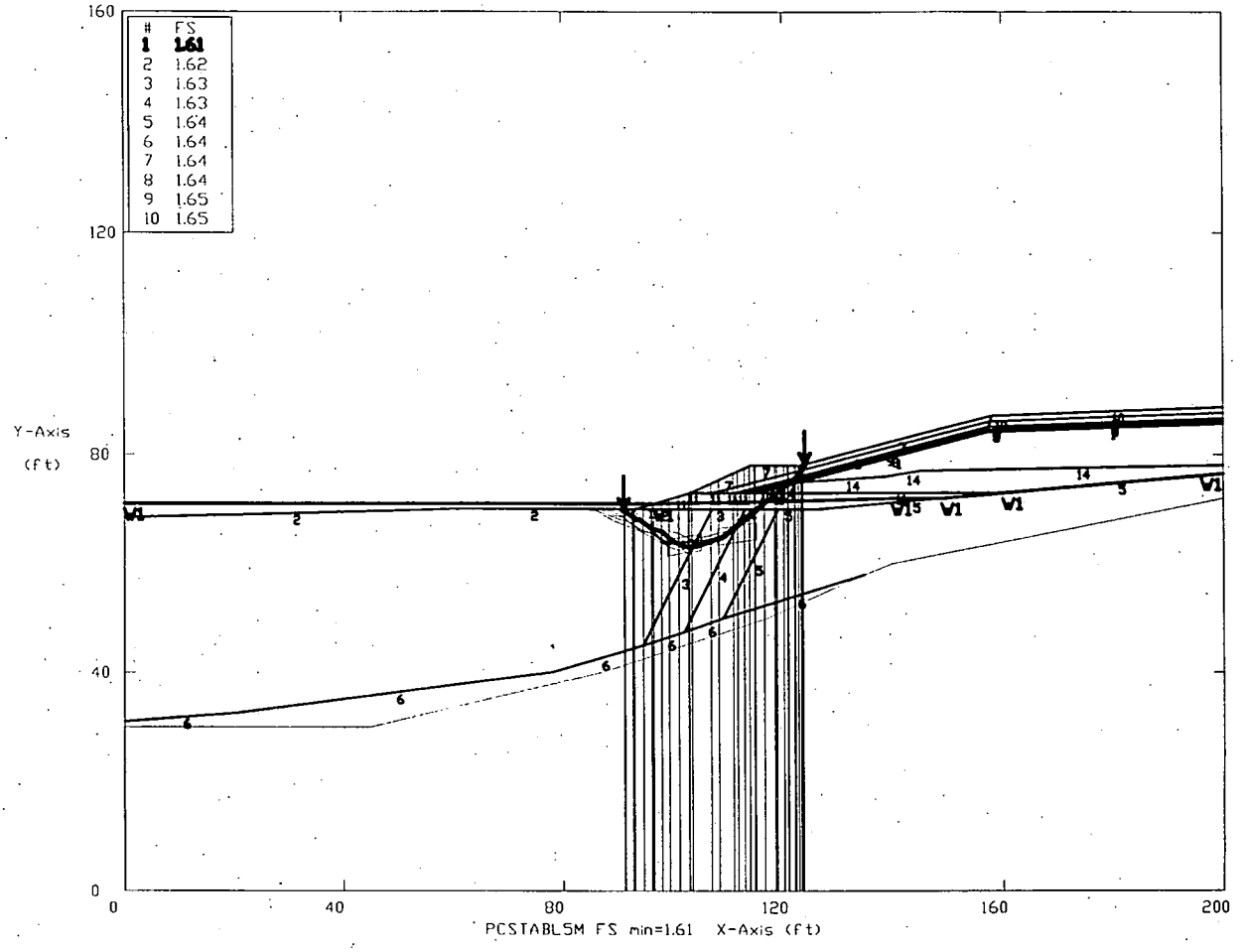
FIGURE 10

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS06.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Block Failure, Final Cond. 1
Ten Most Critical. N:BE_FIN4.PLT By: Robert F. DeLisio 02-10-96 9:22am



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	45	80	250	25	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

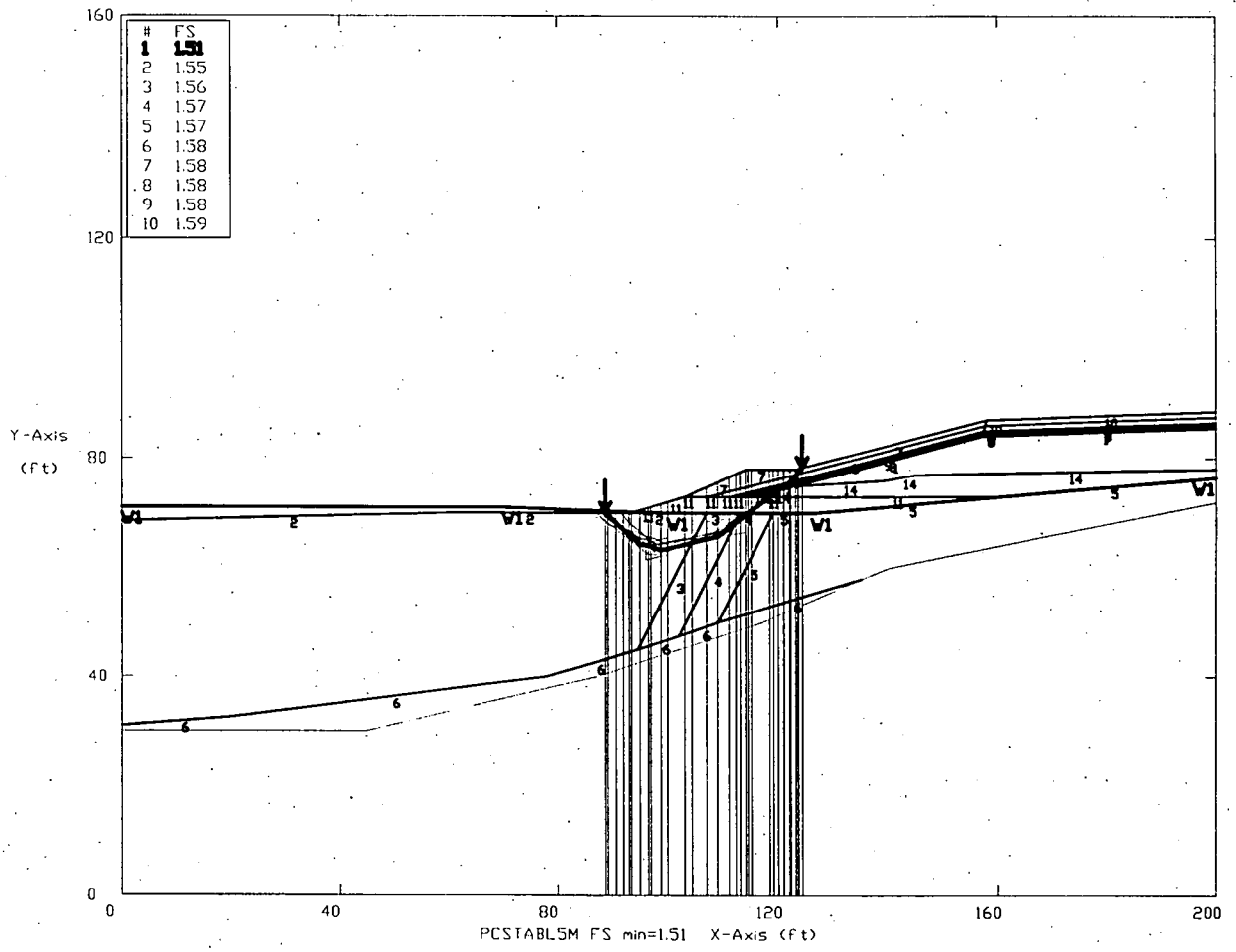
FIGURE 11

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082C507.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Block Failure, Final Cond. 2
Ten Most Critical. N:BE_FIN14.PLT By: Robert F. DeLisio 01-25-96 8:58am



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	61	100	48	27	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

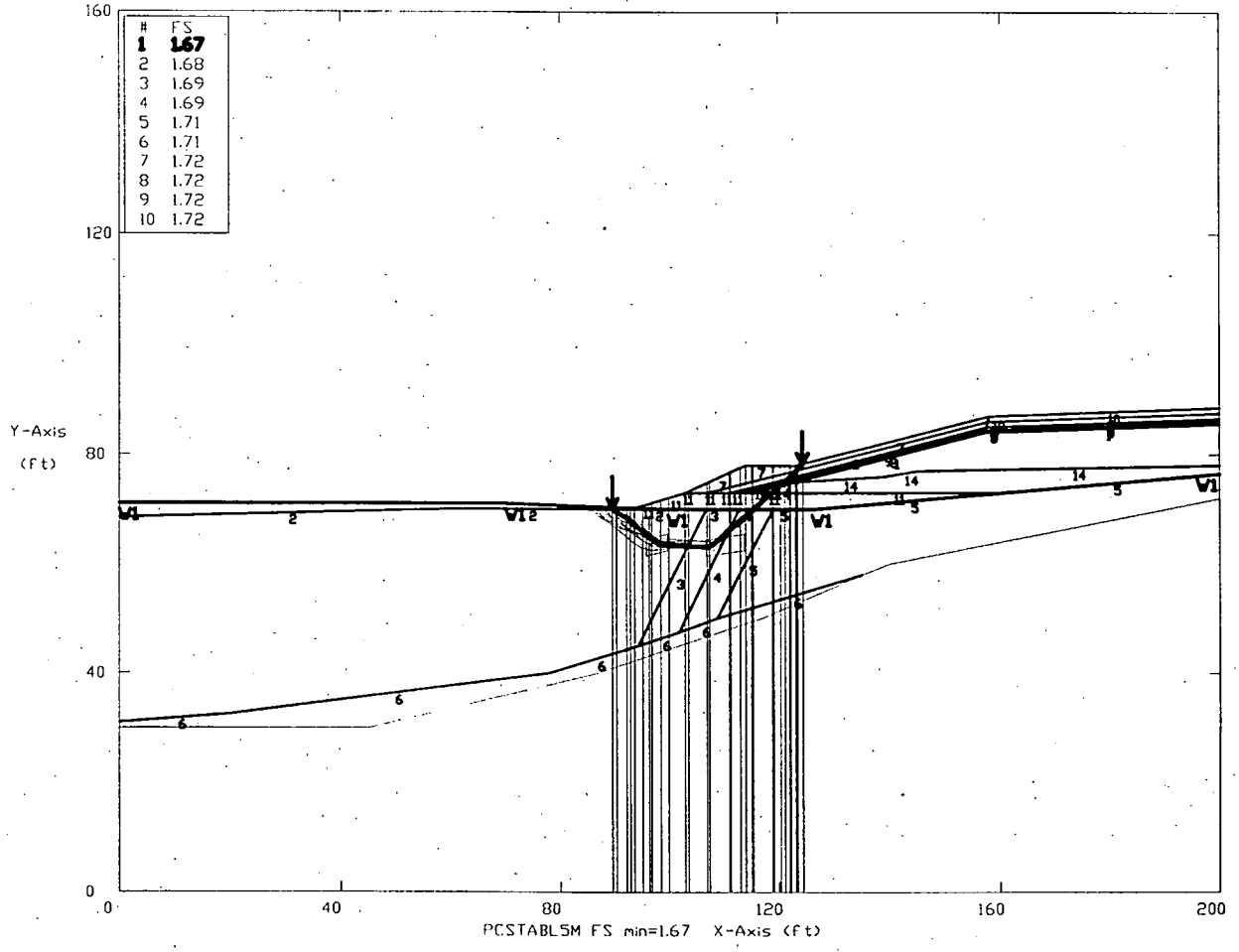
FIGURE 12

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS08.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Block Failure, Final Cond. 2
Ten Most Critical. N:BE_FIN19.PLT By: Robert F. DeLisio 01-25-96 9:37am



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	45	80	250	25	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

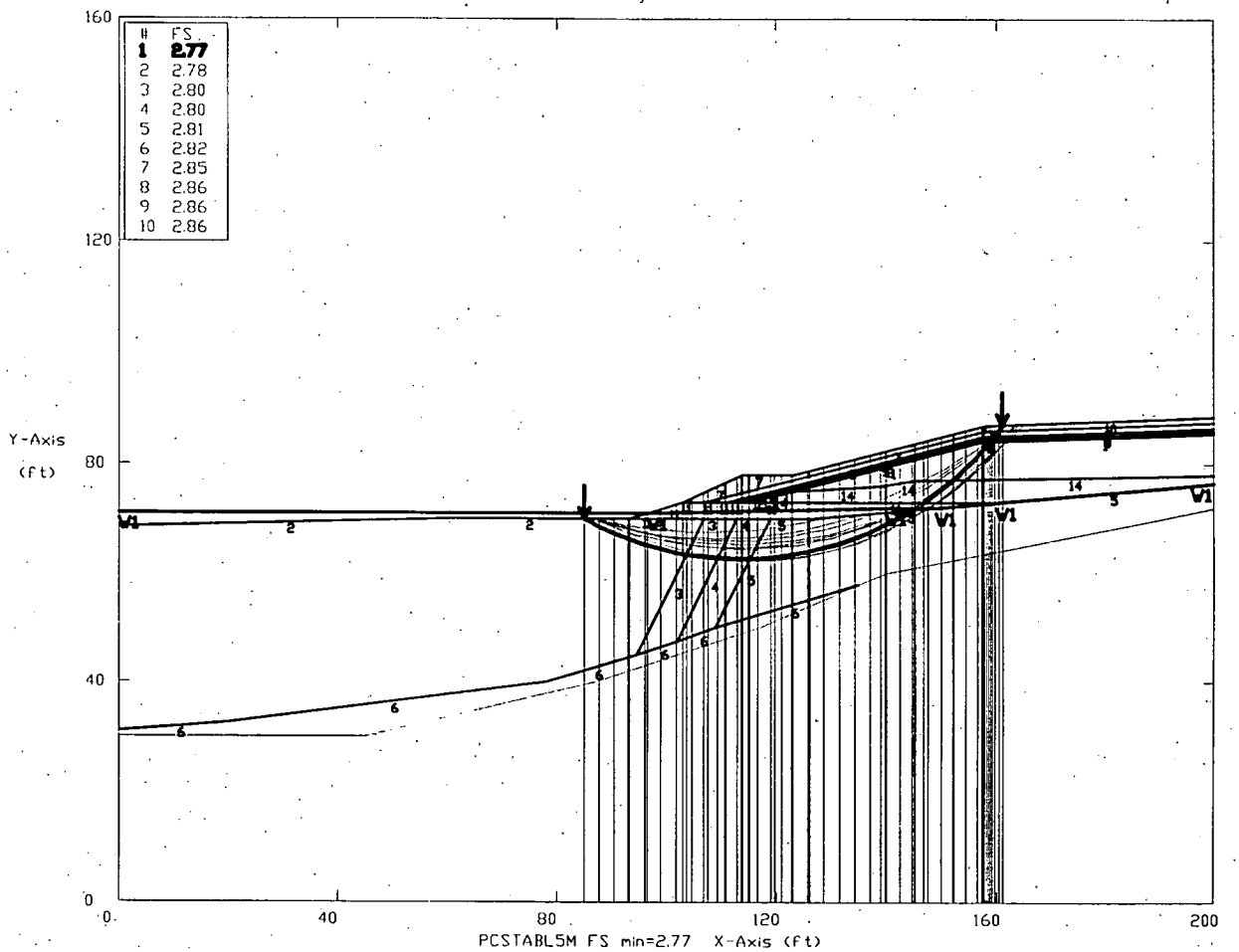
FIGURE 13

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS09.DWG 02/12/96 MJJ

New London Area A Landfill Eff. Stress Circ. Failure, Final Cond. 1
Ten Most Critical. N:CE_FIN8.PLT By: Robert F. DeLisio 01-23-96 3:43pm



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	1
2	61	100	0	20	0	0	1
3	61	100	24	23	0	0	1
4	61	100	48	27	0	0	1
5	61	100	72	30.6	0	0	1
6	115	130	0	37	0	0	1
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	1
10	150	150	0	41	0	0	1
11	61	100	48	27	0	0	1
12	120	138	300	33	0	0	1
13	110	131	0	37	0	0	1
14	45	80	250	25	0	0	1

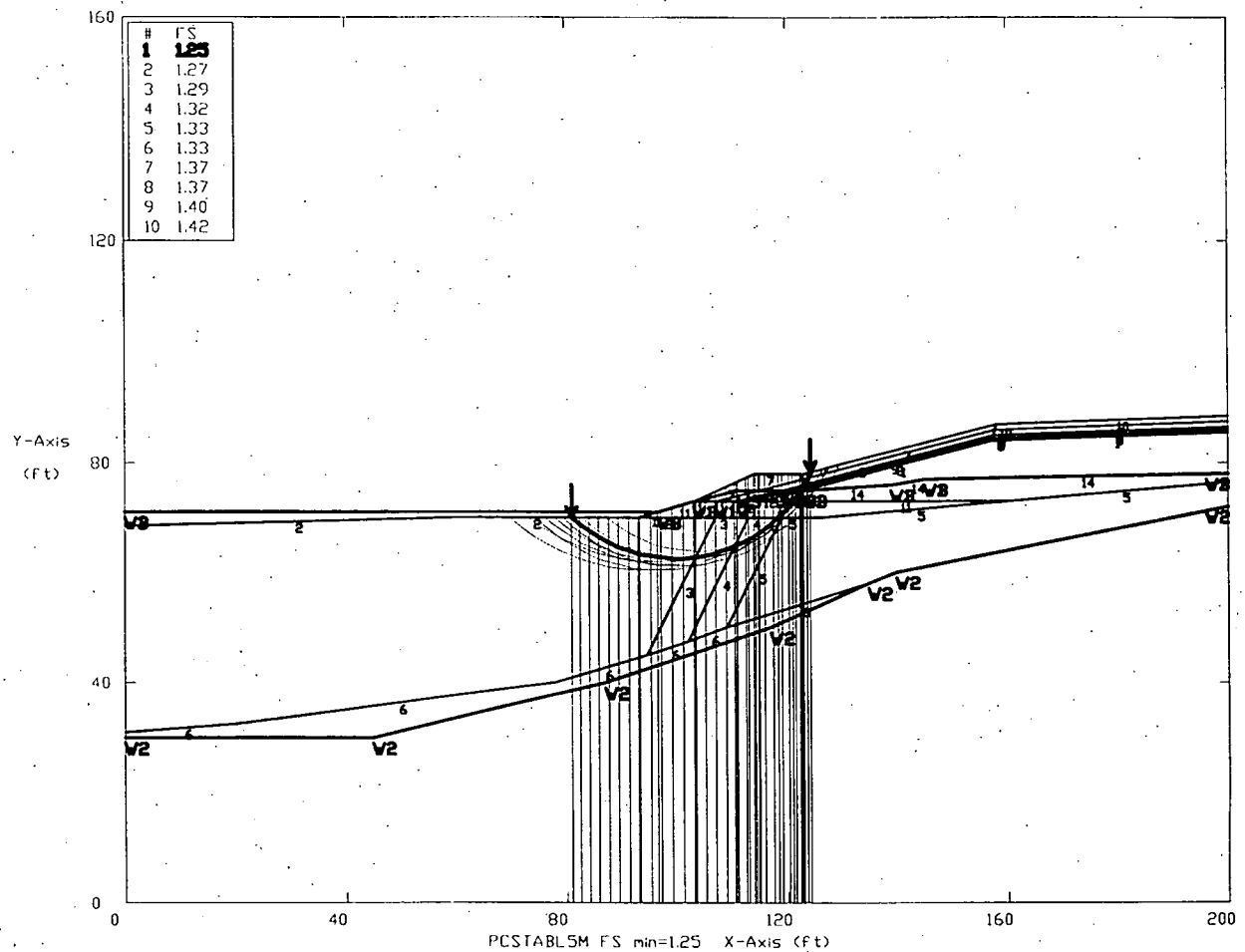
FIGURE 14

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS10.DWG 02/12/96 MJJ

New London Area A Landfill Total Stress Circ. Failure, Final Cond.
Ten Most Critical. N:CT_FIN98.PLT By: Robert F. DeLisio 02-10-96 7:55am



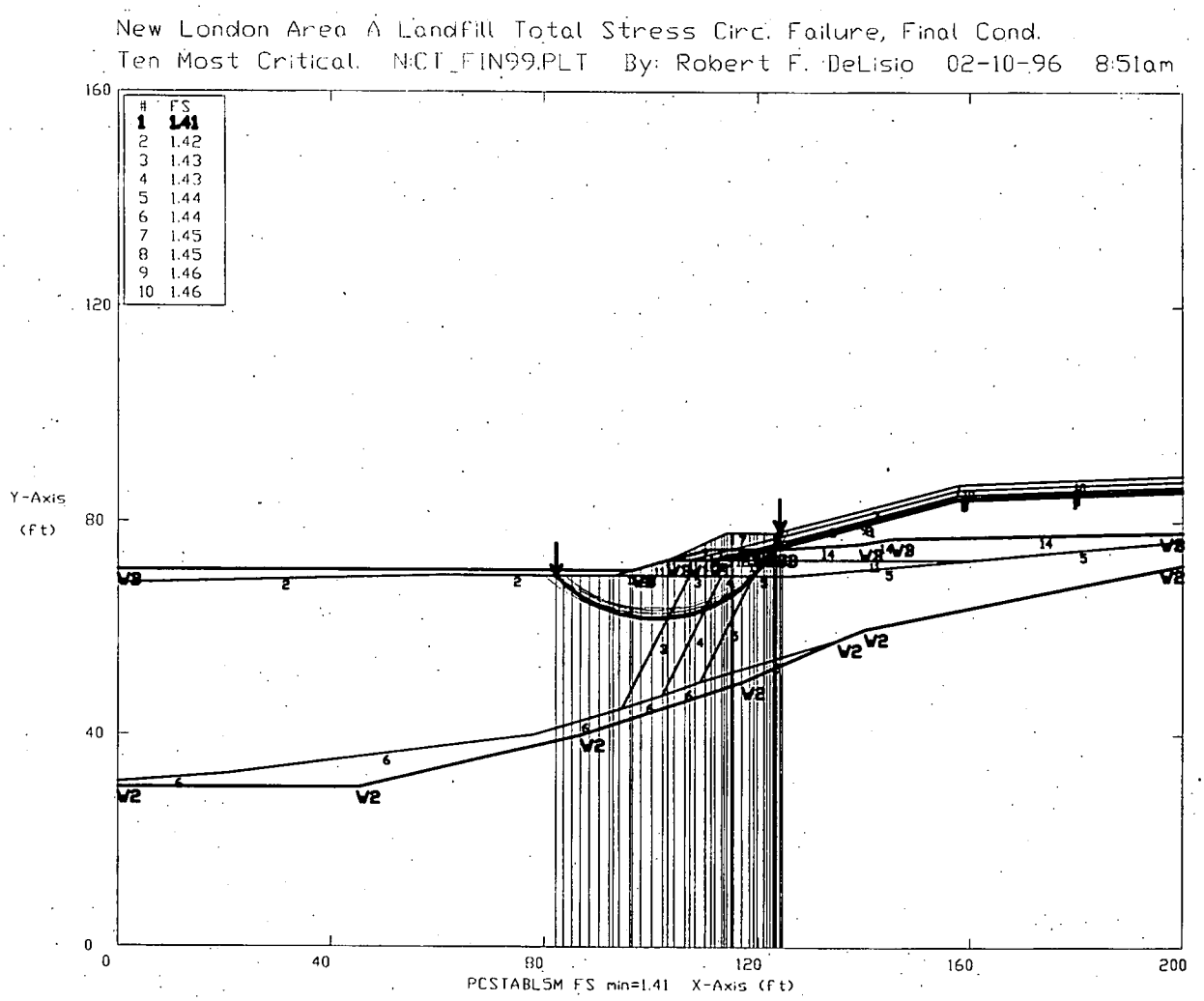
Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	3
2	100	100	100	0	0	0	2
3	100	100	120	4	0	0	2
4	100	100	145	8	0	0	2
5	100	100	170	11.8	0	0	2
6	115	130	0	37	0	0	3
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	3
10	150	150	0	41	0	0	1
11	100	100	145	8	0	0	2
12	120	138	300	33	0	0	3
13	110	131	0	37	0	0	3
14	45	80	250	25	0	0	3

FIGURE 15

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS11.DWG 02/12/96 MJJ



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	3
2	100	100	100	0	0	0	2
3	100	100	120	4	0	0	2
4	100	100	145	8	0	0	2
5	100	100	170	11.8	0	0	2
6	115	130	0	37	0	0	3
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	3
10	150	150	0	41	0	0	1
11	45	80	250	25	0	0	3
12	120	138	300	33	0	0	3
13	110	131	0	37	0	0	3
14	45	80	250	25	0	0	3

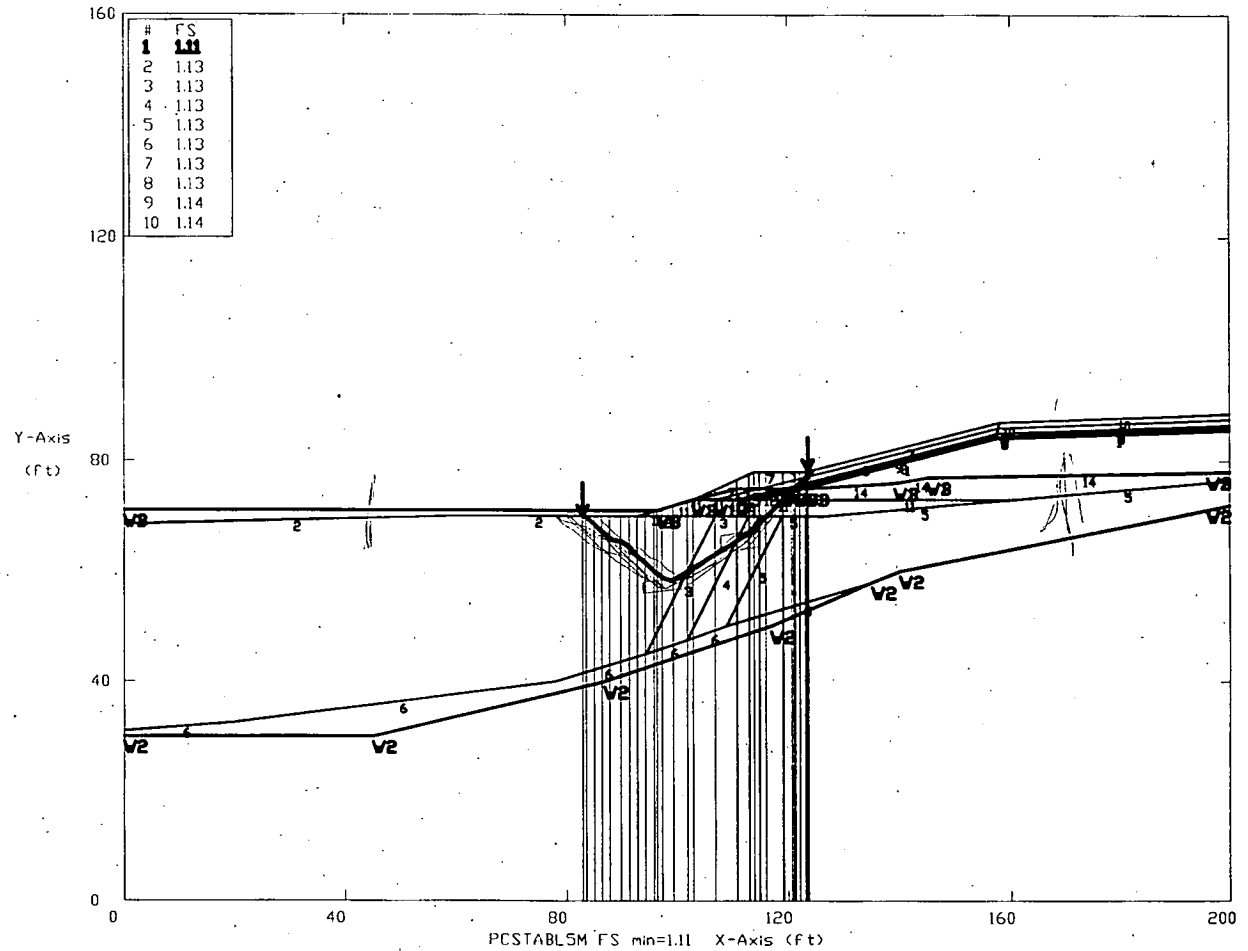
FIGURE 16

NLON, GROTN, CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS12.DWG 02/12/96 MJJ

New London Area A Landfill Total Stress Block Failure, Final Cond.
Ten Most Critical. N:BT_FIN98.PLT By: Robert F. DeLisio 02-10-96 9:15am



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	3
2	100	100	100	0	0	0	2
3	100	100	120	4	0	0	2
4	100	100	145	8	0	0	2
5	100	100	170	11.8	0	0	2
6	115	130	0	37	0	0	3
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	3
10	150	150	0	41	0	0	1
11	100	100	145	8	0	0	2
12	120	138	300	33	0	0	3
13	110	131	0	37	0	0	3
14	45	80	250	25	0	0	3

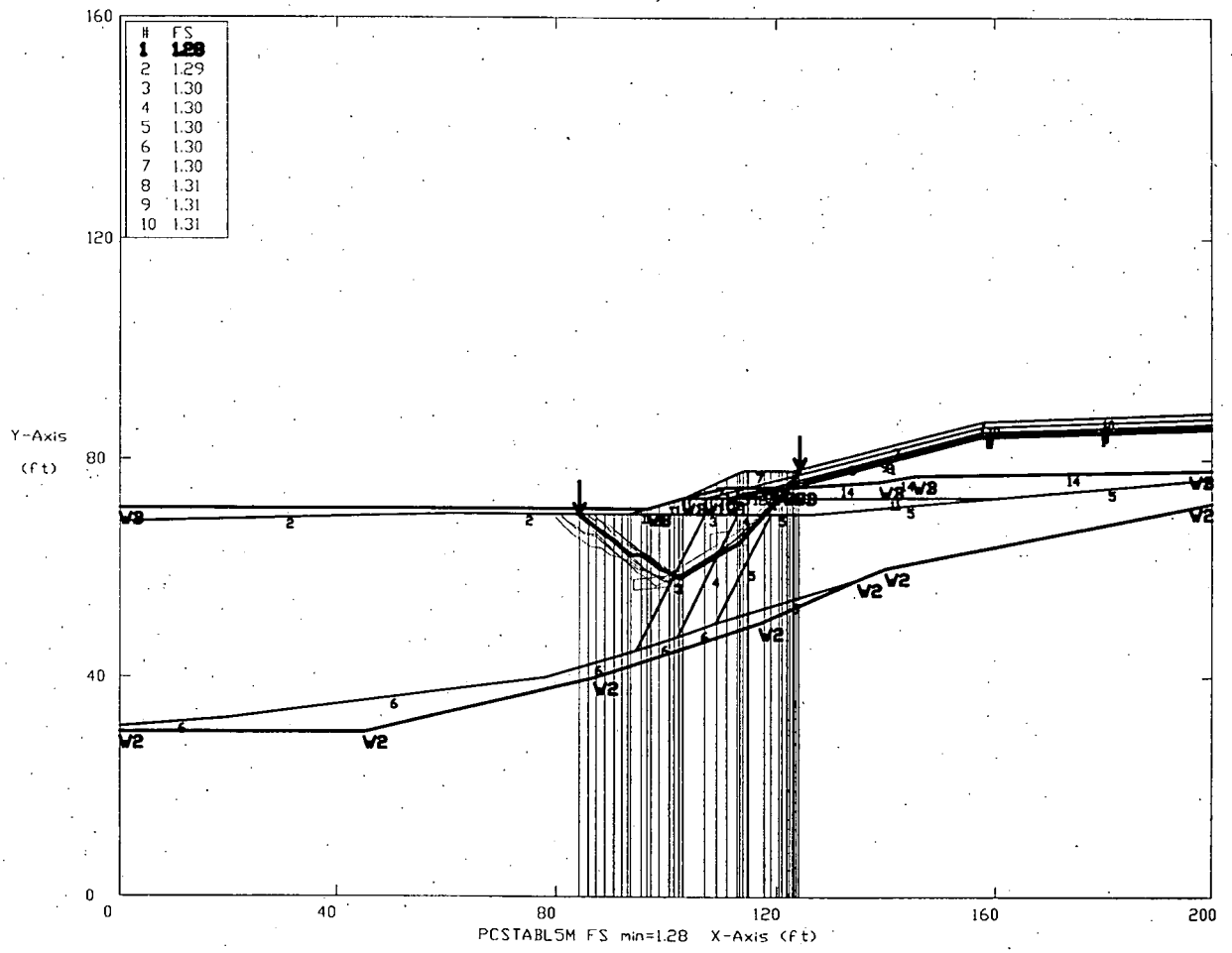
FIGURE 17

NLON. GROTN. CT

Brown & Root Environmental

ACAD: O:\DATA\CADD\5082\5082CS13.DWG 02/12/96 MJJ

New London Area A Landfill Total Stress Block Failure, Final Cond.
Ten Most Critical. N:BT_FIN99.PLT By: Robert F. DeLisio 02-10-96 9:18am



Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45	80	250	25	0	0	3
2	100	100	100	0	0	0	2
3	100	100	120	4	0	0	2
4	100	100	145	8	0	0	2
5	100	100	170	11.8	0	0	2
6	115	130	0	37	0	0	3
7	110	131	0	41	0	0	1
8	110	131	0	37	0	0	1
9	120	138	300	33	0	0	3
10	150	150	0	41	0	0	1
11	45	80	250	25	0	0	3
12	120	138	300	33	0	0	3
13	110	131	0	37	0	0	3
14	45	80	250	25	0	0	3

FIGURE 18

NLON, GROTN, CT

Brown & Root Environmental

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 01-23-96
Time of Run: 3:39pm
Run By: Robert F. DeLisio
Input Data Filename: N:CE_FIN7.IN
Output Filename: N:CE_FIN7.OUT
Plotted Output Filename: N:CE_FIN7.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Circ. Failure, Final Cond. 1

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	61.0	100.0	48.0	27.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	140.00	72.00
4	149.00	72.00
5	160.00	73.00
6	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 85.00 ft.
and X = 87.00 ft.

Each Surface Terminates Between X = 124.00 ft.
and X = 130.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 30.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.74	70.00
2	87.46	68.98
3	89.24	68.08
4	91.09	67.32
5	92.99	66.69
6	94.93	66.19
7	96.90	65.84
8	98.89	65.63
9	100.88	65.56
10	102.88	65.64
11	104.87	65.86
12	106.84	66.22
13	108.77	66.72
14	110.67	67.36
15	112.51	68.14
16	114.30	69.04
17	116.01	70.07
18	117.65	71.22
19	119.20	72.49
20	120.65	73.86
21	122.00	75.34
22	123.24	76.90
23	124.20	78.31

Circle Center At X = 100.8 ; Y = 93.4 and Radius, 27.8

*** 1.618 ***

Individual data on the 43 slices

Water	Water	Tie	Tie	Earthquake

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 01-23-96
Time of Run: 2:58pm
Run By: Robert F. DeLisio
Input Data Filename: N:CE_FIN6.IN
Output Filename: N:CE_FIN6.OUT
Plotted Output Filename: N:CE_FIN6.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Circ. Failure, Final Cond. 1

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	45.0	80.0	250.0	25.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	140.00	72.00
4	149.00	72.00
5	160.00	73.00
6	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 85.00 ft.
and X = 87.00 ft.

Each Surface Terminates Between X = 124.00 ft.
and X = 130.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 30.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.74	70.00
2	87.46	68.98
3	89.24	68.08
4	91.09	67.32
5	92.99	66.69
6	94.93	66.19
7	96.90	65.84
8	98.89	65.63
9	100.88	65.56
10	102.88	65.64
11	104.87	65.86
12	106.84	66.22
13	108.77	66.72
14	110.67	67.36
15	112.51	68.14
16	114.30	69.04
17	116.01	70.07
18	117.65	71.22
19	119.20	72.49
20	120.65	73.86
21	122.00	75.34
22	123.24	76.90
23	124.20	78.31

Circle Center At X = 100.8 ; Y = 93.4 and Radius, 27.8

*** 1.809 ***

Individual data on the 43 slices

Water	Water	Tie	Tie	Earthquake

Slice No.	Width Ft(m)	Weight Lbs(kg)	Force Top Lbs(kg)	Force Bot Lbs(kg)	Force Norm Lbs(kg)	Force Tan Lbs(kg)	Force Hor Lbs(kg)	Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	1.7	87.9	107.3	188.6	.0	.0	.0	.0	.0
2	1.8	262.9	111.6	308.3	.0	.0	.0	.0	.0
3	1.8	425.2	115.3	412.0	.0	.0	.0	.0	.0
4	1.9	569.3	118.4	499.1	.0	.0	.0	.0	.0
5	.0	3.3	.6	2.8	.0	.0	.0	.0	.0
6	1.9	729.4	90.7	566.5	.0	.0	.0	.0	.0
7	1.6	718.2	22.9	493.1	.0	.0	.0	.0	.0
8	.4	196.6	.0	129.0	.0	.0	.0	.0	.0
9	2.0	1048.0	.0	661.0	.0	.0	.0	.0	.0
10	2.0	1139.3	.0	684.0	.0	.0	.0	.0	.0
11	2.0	1196.7	.0	689.1	.0	.0	.0	.0	.0
12	.1	71.2	.0	40.3	.0	.0	.0	.0	.0
13	1.9	1211.0	.0	636.0	.0	.0	.0	.0	.0
14	.1	43.9	.0	21.7	.0	.0	.0	.0	.0
15	1.9	1364.9	.0	624.1	.0	.0	.0	.0	.0
16	.2	121.5	.0	52.2	.0	.0	.0	.0	.0
17	1.8	1373.3	.0	545.2	.0	.0	.0	.0	.0
18	1.9	1539.3	.0	531.6	.0	.0	.0	.0	.0
19	.3	274.9	.0	87.3	.0	.0	.0	.0	.0
20	1.0	820.2	.0	241.1	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 01-25-96
Time of Run: 8:36am
Run By: Robert F. DeLisio
Input Data Filename: N:CE_FIN13.IN
Output Filename: N:CE_FIN13.OUT
Plotted Output Filename: N:CE_FIN13.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Circ. Failure, Final Cond. 2

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	61.0	100.0	48.0	27.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	70.00	71.00
3	100.00	70.00
4	126.00	70.00
5	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 85.00 ft.
and X = 87.00 ft.

Each Surface Terminates Between X = 124.00 ft.
and X = 130.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 30.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.74	70.00
2	87.46	68.98
3	89.24	68.08
4	91.09	67.32
5	92.99	66.69
6	94.93	66.19
7	96.90	65.84
8	98.89	65.63
9	100.88	65.56
10	102.88	65.64
11	104.87	65.86
12	106.84	66.22
13	108.77	66.72
14	110.67	67.36
15	112.51	68.14
16	114.30	69.04
17	116.01	70.07
18	117.65	71.22
19	119.20	72.49
20	120.65	73.86
21	122.00	75.34
22	123.24	76.90
23	124.20	78.31

Circle Center At X = 100.8 ; Y = 93.4 and Radius, 27.8

*** 1.706 ***

Individual data on the 43 slices

Water Force	Water Force	Tie Force	Tie Force	Earthquake Force	Surcharge

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 01-25-96
Time of Run: 9:27am
Run By: Robert F. DeLisio
Input Data Filename: N:CE_FIN19.IN
Output Filename: N:CE_FIN19.OUT
Plotted Output Filename: N:CE_FIN19.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Circ. Failure, Final Cond. 2

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

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25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
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34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
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42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	45.0	80.0	250.0	25.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	70.00	71.00
3	100.00	70.00
4	126.00	70.00
5	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 85.00 ft.
and X = 87.00 ft.

Each Surface Terminates Between X = 124.00 ft.
and X = 130.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 30.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.74	70.00
2	87.46	68.98
3	89.24	68.08
4	91.09	67.32
5	92.99	66.69
6	94.93	66.19
7	96.90	65.84
8	98.89	65.63
9	100.88	65.56
10	102.88	65.64
11	104.87	65.86
12	106.84	66.22
13	108.77	66.72
14	110.67	67.36
15	112.51	68.14
16	114.30	69.04
17	116.01	70.07
18	117.65	71.22
19	119.20	72.49
20	120.65	73.86
21	122.00	75.34
22	123.24	76.90
23	124.20	78.31

Circle Center At X = 100.8 ; Y = 93.4 and Radius, 27.8

*** 1.905 ***

Individual data on the 43 slices

Water Force	Water Force	Tie Force	Tie Force	Earthquake Force	Surcharge

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 01-23-96
Time of Run: 4:13pm
Run By: Robert F. DeLisio
Input Data Filename: N:BE_FIN10.IN
Output Filename: N:BE_FIN10.OUT
Plotted Output Filename: N:BE_FIN10.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Block Failure, Final Cond. 1

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	61.0	100.0	48.0	27.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	140.00	72.00
4	149.00	72.00
5	160.00	73.00
6	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 2.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)

1	97.00	63.00	103.00	64.00	3.00
2	108.00	65.00	115.00	66.00	3.00
3	122.00	75.00	124.00	76.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.02	70.00
2	89.25	69.85
3	90.69	68.47
4	92.59	67.83
5	94.11	66.53
6	96.00	65.89
7	97.44	64.50
8	99.15	63.47
9	101.09	62.96
10	108.38	64.75
11	122.47	76.09
12	123.78	77.60
13	124.00	78.26

*** 1.445 ***

Individual data on the 33 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	.2	1.7	14.3	18.2	.0	.0	.0	.0	.0
2	1.4	121.1	90.2	229.3	.0	.0	.0	.0	.0
3	1.9	350.3	118.2	355.6	.0	.0	.0	.0	.0
4	.4	97.4	25.9	114.0	.0	.0	.0	.0	.0
5	1.1	349.1	60.5	362.8	.0	.0	.0	.0	.0
6	1.9	829.0	50.8	597.8	.0	.0	.0	.0	.0
7	.5	263.6	2.3	231.8	.0	.0	.0	.0	.0
8	.9	576.5	.0	493.5	.0	.0	.0	.0	.0
9	1.7	1263.1	.0	880.4	.0	.0	.0	.0	.0
10	1.9	1642.7	.0	981.9	.0	.0	.0	.0	.0
11	1.9	1702.5	.0	975.5	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 02-10-96
Time of Run: 9:22am
Run By: Robert F. DeLisio
Input Data Filename: N:BE_FIN4.IN
Output Filename: N:BE_FIN4.OUT
Plotted Output Filename: N:BE_FIN4.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Block Failure, Final Cond. 1

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	45.0	80.0	250.0	25.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	140.00	72.00
4	149.00	72.00
5	160.00	73.00
6	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 2.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)

1	99.00	63.00	105.00	64.00	3.00
2	108.00	65.00	115.00	66.00	3.00
3	122.00	75.00	124.00	76.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	91.02	70.00
2	91.25	69.85
3	92.69	68.47
4	94.59	67.83
5	96.11	66.53
6	98.00	65.89
7	99.44	64.50
8	101.15	63.47
9	103.09	62.96
10	108.38	64.75
11	122.47	76.09
12	123.78	77.60
13	124.00	78.26

*** 1.607 ***

Individual data on the 33 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	.2	1.7	14.3	18.2	.0	.0	.0	.0	.0
2	1.4	121.1	90.2	229.3	.0	.0	.0	.0	.0
3	.3	48.8	19.3	52.5	.0	.0	.0	.0	.0
4	1.6	330.2	79.6	303.1	.0	.0	.0	.0	.0
5	1.5	510.6	32.6	476.7	.0	.0	.0	.0	.0
6	.4	168.8	1.4	117.6	.0	.0	.0	.0	.0
7	1.5	715.3	.0	481.8	.0	.0	.0	.0	.0
8	1.4	852.9	.0	730.7	.0	.0	.0	.0	.0
9	1.7	1263.6	.0	886.2	.0	.0	.0	.0	.0
10	1.8	1549.5	.0	942.0	.0	.0	.0	.0	.0
11	.1	76.2	.0	45.7	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer's Method of Slices

Run Date: 01-25-96
Time of Run: 8:58am
Run By: Robert F. DeLisio
Input Data Filename: N:BE_FIN14.IN
Output Filename: N:BE_FIN14.OUT
Plotted Output Filename: N:BE_FIN14.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Block Failure, Final Cond. 2

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	61.0	100.0	48.0	27.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	70.00	71.00
3	100.00	70.00
4	126.00	70.00
5	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 2.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	96.00	63.00	100.00	64.00	3.00

2	107.00	67.00	114.00	68.00	3.00
3	122.00	75.00	124.00	76.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 12 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.56	70.00
2	88.93	69.66
3	90.44	68.35
4	91.91	67.00
5	93.40	65.66
6	94.93	64.37
7	96.90	64.03
8	98.69	63.13
9	108.95	65.80
10	122.14	75.98
11	123.55	77.39
12	124.25	78.32

*** 1.512 ***

Individual data on the 31 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	.4	6.2	8.5	17.0	.0	.0	.0	.0	.0
2	1.5	150.9	32.5	167.0	.0	.0	.0	.0	.0
3	1.5	342.1	26.9	326.6	.0	.0	.0	.0	.0
4	1.1	379.2	16.9	340.6	.0	.0	.0	.0	.0
5	.4	169.4	4.4	147.7	.0	.0	.0	.0	.0
6	1.5	803.4	.0	645.9	.0	.0	.0	.0	.0
7	1.6	988.7	.0	587.6	.0	.0	.0	.0	.0
8	.4	264.7	.0	152.9	.0	.0	.0	.0	.0
9	1.8	1303.8	.0	810.1	.0	.0	.0	.0	.0
10	1.3	1032.3	.0	569.5	.0	.0	.0	.0	.0
11	3.0	2306.4	.0	1187.6	.0	.0	.0	.0	.0
12	1.3	1000.3	.0	465.4	.0	.0	.0	.0	.0
13	2.7	2223.7	.0	883.4	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 01-25-96
Time of Run: 9:37am
Run By: Robert F. DeLisio
Input Data Filename: N:BE_FIN19.IN
Output Filename: N:BE_FIN19.OUT
Plotted Output Filename: N:BE_FIN19.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Block Failure, Final Cond. 2

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	45.0	80.0	250.0	25.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 5 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	70.00	71.00
3	100.00	70.00
4	126.00	70.00
5	200.00	76.50

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

250 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 2.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	96.00	63.00	100.00	64.00	3.00

2	107.00	63.00	114.00	64.00	3.00
3	122.00	75.00	124.00	76.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 11 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	89.69	70.00
2	90.53	69.52
3	92.31	68.60
4	93.80	67.26
5	95.26	65.90
6	96.86	64.70
7	98.53	63.60
8	107.40	63.06
9	122.05	75.92
10	123.42	77.38
11	124.35	78.35

*** 1.667 ***

Individual data on the 30 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	.8	20.2	17.2	34.4	.0	.0	.0	.0	.0
2	1.8	167.5	31.6	153.3	.0	.0	.0	.0	.0
3	.7	118.8	10.5	113.6	.0	.0	.0	.0	.0
4	.8	197.1	5.4	173.5	.0	.0	.0	.0	.0
5	1.5	538.7	.0	448.9	.0	.0	.0	.0	.0
6	1.2	616.2	.0	454.1	.0	.0	.0	.0	.0
7	.4	204.6	.0	148.4	.0	.0	.0	.0	.0
8	1.7	1083.1	.0	739.6	.0	.0	.0	.0	.0
9	1.5	1073.0	.0	595.4	.0	.0	.0	.0	.0
10	3.0	2317.8	.0	1234.7	.0	.0	.0	.0	.0
11	.6	527.8	.0	269.2	.0	.0	.0	.0	.0
12	3.4	3130.2	.0	1429.9	.0	.0	.0	.0	.0
13	.4	416.4	.0	173.7	.0	.0	.0	.0	.0
14	3.6	3530.6	.0	1601.8	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 01-23-96
Time of Run: 3:43pm
Run By: Robert F. DeLisio
Input Data Filename: N:CE_FIN8.IN
Output Filename: N:CE_FIN8.OUT
Plotted Output Filename: N:CE_FIN8.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Eff. Stress Circ. Failure, Final Cond. 1

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	1
2	61.0	100.0	.0	20.0	.00	.0	1
3	61.0	100.0	24.0	23.0	.00	.0	1
4	61.0	100.0	48.0	27.0	.00	.0	1
5	61.0	100.0	72.0	30.6	.00	.0	1
6	115.0	130.0	.0	37.0	.00	.0	1
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	1
10	150.0	150.0	.0	41.0	.00	.0	1
11	61.0	100.0	48.0	27.0	.00	.0	1
12	120.0	138.0	300.0	33.0	.00	.0	1
13	110.0	131.0	.0	37.0	.00	.0	1
14	45.0	80.0	250.0	25.0	.00	.0	1

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

3.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 30 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	85.00	70.00
2	87.66	68.61
3	90.39	67.36
4	93.17	66.25
5	96.01	65.29
6	98.90	64.47
7	101.83	63.80
8	104.78	63.28
9	107.76	62.91
10	110.75	62.70
11	113.75	62.64
12	116.75	62.73
13	119.74	62.98
14	122.71	63.38
15	125.66	63.93
16	128.58	64.63
17	131.45	65.48
18	134.28	66.48
19	137.06	67.62
20	139.77	68.90
21	142.42	70.31
22	144.98	71.86
23	147.47	73.54
24	149.86	75.35
25	152.17	77.28
26	154.36	79.32
27	156.46	81.47
28	158.43	83.72
29	160.29	86.08
30	161.03	87.11

Circle Center At X = 113.4 ; Y = 121.2 and Radius, 58.5

*** 2.765 ***

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:	02-10-96
Time of Run:	7:55am
Run By:	Robert F. DeLisio
Input Data Filename:	N:CT_FIN98.IN
Output Filename:	N:CT_FIN98.OUT
Plotted Output Filename:	N:CT_FIN98.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Total Stress Circ. Failure, Final Cond.

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	3
2	100.0	100.0	100.0	.0	.00	.0	2
3	100.0	100.0	120.0	4.0	.00	.0	2
4	100.0	100.0	145.0	8.0	.00	.0	2
5	100.0	100.0	170.0	11.8	.00	.0	2
6	115.0	130.0	.0	37.0	.00	.0	3
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	3
10	150.0	150.0	.0	41.0	.00	.0	1
11	100.0	100.0	145.0	8.0	.00	.0	2
12	120.0	138.0	300.0	33.0	.00	.0	3
13	110.0	131.0	.0	37.0	.00	.0	3
14	45.0	80.0	250.0	25.0	.00	.0	3

3 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 11 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	107.00	73.00
5	111.00	73.00
6	119.00	75.00
7	121.00	75.00
8	123.00	75.00
9	139.00	76.00
10	145.00	77.00
11	200.00	78.00

Piezometric Surface No. 2 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	30.00
2	45.00	30.00
3	87.00	40.00
4	117.00	50.00
5	135.00	58.00
6	140.00	60.00
7	200.00	72.00

Piezometric Surface No. 3 Specified by 10 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	111.00	75.00
5	119.00	75.00
6	121.00	75.00
7	123.00	75.00
8	139.00	76.00
9	145.00	77.00

10	200.00	78.00

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

100 Trial Surfaces Have Been Generated.

5 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 70.00 ft.
and X = 100.00 ft.

Each Surface Terminates Between X = 124.00 ft.
and X = 140.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 30.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	81.05	70.00
2	82.55	68.68
3	84.15	67.47
4	85.83	66.38
5	87.58	65.43
6	89.40	64.60
7	91.28	63.91
8	93.20	63.36
9	95.16	62.95
10	97.14	62.69
11	99.14	62.57
12	101.14	62.61
13	103.13	62.79
14	105.11	63.11
15	107.05	63.59
16	108.95	64.20
17	110.81	64.95
18	112.60	65.84
19	114.32	66.86
20	115.96	68.00
21	117.52	69.26
22	118.97	70.63
23	120.32	72.10
24	121.56	73.67
25	122.68	75.33
26	123.68	77.07
27	124.28	78.33

Circle Center At X = 99.7 ; Y = 89.7 and Radius, 27.1

*** 1.251 ***

Individual data on the 47 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	1.5	99.2	.0	.0	.0	.0	.0	.0	.0
2	1.6	307.0	.0	.0	.0	.0	.0	.0	.0
3	1.7	515.9	.0	.0	.0	.0	.0	.0	.0
4	1.8	718.6	.0	.0	.0	.0	.0	.0	.0
5	1.8	908.4	.0	.0	.0	.0	.0	.0	.0
6	1.9	1078.8	.0	.0	.0	.0	.0	.0	.0
7	1.7	1090.1	.0	.0	.0	.0	.0	.0	.0
8	.2	134.9	.0	.0	.0	.0	.0	.0	.0
9	2.0	1406.9	.0	.0	.0	.0	.0	.0	.0
10	1.3	1064.0	.0	.0	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 01-24-96
Time of Run: 9:36am
Run By: Robert F. DeLisio
Input Data Filename: N:CT_FIN99.IN
Output Filename: N:CT_FIN99.OUT
Plotted Output Filename: N:CT_FIN99.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Total Stress Circ. Failure, Final Cond.

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	3
2	100.0	100.0	100.0	.0	.00	.0	2
3	100.0	100.0	120.0	4.0	.00	.0	2
4	100.0	100.0	145.0	8.0	.00	.0	2
5	100.0	100.0	170.0	11.8	.00	.0	2
6	115.0	130.0	.0	37.0	.00	.0	3
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	3
10	150.0	150.0	.0	41.0	.00	.0	1
11	45.0	80.0	250.0	25.0	.00	.0	3
12	120.0	138.0	300.0	33.0	.00	.0	3
13	110.0	131.0	.0	37.0	.00	.0	3
14	45.0	80.0	250.0	25.0	.00	.0	3

3 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 11 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	107.00	73.00
5	111.00	73.00
6	119.00	75.00
7	121.00	75.00
8	123.00	75.00
9	139.00	76.00
10	145.00	77.00
11	200.00	78.00

Piezometric Surface No. 2 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	30.00
2	45.00	30.00
3	87.00	40.00
4	117.00	50.00
5	135.00	58.00
6	140.00	60.00
7	200.00	72.00

Piezometric Surface No. 3 Specified by 10 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	111.00	75.00
5	119.00	75.00
6	121.00	75.00
7	123.00	75.00
8	139.00	76.00
9	145.00	77.00

10	200.00	78.00

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 80.00 ft.
and X = 85.00 ft.

Each Surface Terminates Between X = 124.00 ft.
and X = 135.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 30.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 27 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	82.37	70.00
2	83.78	68.59
3	85.31	67.29
4	86.93	66.12
5	88.64	65.08
6	90.43	64.19
7	92.28	63.44
8	94.19	62.84
9	96.14	62.40
10	98.12	62.11
11	100.12	61.98
12	102.11	62.02
13	104.11	62.21
14	106.07	62.56
15	108.01	63.07
16	109.89	63.74
17	111.72	64.55
18	113.48	65.51
19	115.15	66.60
20	116.73	67.82
21	118.21	69.17
22	119.58	70.63
23	120.82	72.20
24	121.94	73.86
25	122.91	75.61
26	123.75	77.42
27	124.06	78.27

Circle Center At X = 100.7 ; Y = 86.9 and Radius, 24.9

*** 1.412 ***

Individual data on the 47 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	1.4	100.0	.0	.0	.0	.0	.0	.0	.0
2	1.5	314.1	.0	.0	.0	.0	.0	.0	.0
3	1.6	534.5	.0	.0	.0	.0	.0	.0	.0
4	1.7	752.4	.0	.0	.0	.0	.0	.0	.0
5	1.8	959.3	.0	.0	.0	.0	.0	.0	.0
6	1.9	1147.3	.0	.0	.0	.0	.0	.0	.0
7	.7	479.7	.0	.0	.0	.0	.0	.0	.0
8	1.2	845.8	64.1	.0	.0	.0	.0	.0	.0
9	2.0	1536.2	48.3	.0	.0	.0	.0	.0	.0
10	.4	302.2	1.2	.0	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date:	02-10-96
Time of Run:	9:15am
Run By:	Robert F. DeLisio
Input Data Filename:	N:BT_FIN98.IN
Output Filename:	N:BT_FIN98.OUT
Plotted Output Filename:	N:BT_FIN98.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Total Stress Block Failure, Final Cond.

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	75.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	3
2	100.0	100.0	100.0	.0	.00	.0	2
3	100.0	100.0	120.0	4.0	.00	.0	2
4	100.0	100.0	145.0	8.0	.00	.0	2
5	100.0	100.0	170.0	11.8	.00	.0	2
6	115.0	130.0	.0	37.0	.00	.0	3
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	3
10	150.0	150.0	.0	41.0	.00	.0	1
11	100.0	100.0	145.0	8.0	.00	.0	2
12	120.0	138.0	300.0	33.0	.00	.0	3
13	110.0	131.0	.0	37.0	.00	.0	3
14	45.0	80.0	250.0	25.0	.00	.0	3

3 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 11 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	107.00	73.00
5	111.00	73.00
6	119.00	75.00
7	121.00	75.00
8	123.00	75.00
9	139.00	76.00
10	145.00	77.00
11	200.00	78.00

Piezometric Surface No. 2 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	30.00
2	45.00	30.00
3	87.00	40.00
4	117.00	50.00
5	135.00	58.00
6	140.00	60.00
7	200.00	72.00

Piezometric Surface No. 3 Specified by 10 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	111.00	75.00
5	119.00	75.00
6	121.00	75.00
7	123.00	75.00
8	139.00	76.00
9	145.00	77.00

10	200.00	78.00

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 2.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	94.00	57.00	103.00	58.00	2.00
2	108.00	65.00	115.00	66.00	3.00
3	122.00	75.00	124.00	76.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	83.07	70.00
2	83.70	69.83
3	85.21	68.51
4	86.64	67.12
5	88.05	65.70
6	90.03	65.42
7	91.64	64.23
8	93.05	62.82
9	94.47	61.41
10	95.95	60.06
11	97.42	58.70
12	99.37	58.26
13	113.23	67.10
14	122.10	75.91
15	123.42	77.41
16	123.59	78.15

*** 1.106 ***

Individual data on the 36 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	.6	5.5	.0	.0	.0	.0	.0	.0	.0
2	1.5	125.2	.0	.0	.0	.0	.0	.0	.0
3	1.4	312.8	.0	.0	.0	.0	.0	.0	.0
4	1.4	507.7	.0	.0	.0	.0	.0	.0	.0
5	2.0	878.6	.0	.0	.0	.0	.0	.0	.0
6	1.6	829.0	.0	.0	.0	.0	.0	.0	.0
7	1.4	880.8	.0	.0	.0	.0	.0	.0	.0
8	.1	37.9	.0	.0	.0	.0	.0	.0	.0
9	1.4	1151.2	.0	.0	.0	.0	.0	.0	.0
10	1.5	1459.6	.0	.0	.0	.0	.0	.0	.0
11	.6	614.7	.0	.0	.0	.0	.0	.0	.0
12	.9	1103.9	.0	.0	.0	.0	.0	.0	.0
13	2.0	2556.2	.0	.0	.0	.0	.0	.0	.0
14	2.6	3412.5	.0	.0	.0	.0	.0	.0	.0
15	1.0	1315.0	.0	.0	.0	.0	.0	.0	.0
16	4.0	4858.1	.0	.0	.0	.0	.0	.0	.0
17	3.8	4456.0	.0	.0	.0	.0	.0	.0	.0
18	.2	180.8	.0	.0	.0	.0	.0	.0	.0
19	2.0	2249.5	.0	.0	.0	.0	.0	.0	.0
20	.2	252.0	.0	.0	.0	.0	.0	.0	.0
21	.8	851.0	.0	.0	.0	.0	.0	.0	.0
22	.8	843.2	.0	.0	.0	.0	.0	.0	.0
23	.2	191.7	.0	.0	.0	.0	.0	.0	.0
24	1.1	1060.2	.0	.0	.0	.0	.0	.0	.0
25	2.9	2038.0	.0	.0	.0	.0	.0	.0	.0

** PCSTABL5M **

by
Purdue University

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

Run Date: 02-10-96
Time of Run: 9:18am
Run By: Robert F. DeLisio
Input Data Filename: N:BT_FIN99.IN
Output Filename: N:BT_FIN99.OUT
Plotted Output Filename: N:BT_FIN99.PLT

PROBLEM DESCRIPTION New London Area A Landfill
Total Stress Block Failure, Final Cond.

BOUNDARY COORDINATES

8 Top Boundaries
49 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	.00	68.50	60.00	70.00	2
2	60.00	70.00	93.00	70.00	2
3	93.00	70.00	96.50	71.00	11
4	96.50	71.00	103.00	73.00	11
5	103.00	73.00	114.00	78.00	7
6	114.00	78.00	123.00	78.00	7
7	123.00	78.00	158.00	87.00	7
8	158.00	87.00	200.00	88.50	10
9	103.00	73.00	107.00	73.00	11
10	107.00	73.00	157.75	86.00	8
11	157.75	86.00	158.00	87.00	10
12	157.75	86.00	200.00	87.50	8
13	107.00	73.00	111.00	73.00	11
14	111.00	73.00	119.00	75.00	12
15	119.00	75.00	157.50	85.00	9
16	157.50	85.00	157.75	86.00	8
17	157.50	85.00	200.00	86.50	8
18	119.00	75.00	121.00	75.00	12
19	111.00	73.00	113.00	73.00	11
20	113.00	73.00	121.00	75.00	13
21	121.00	75.00	157.38	84.50	8
22	157.38	84.50	157.50	85.00	8

23	157.38	84.50	200.00	86.00	8
24	121.00	75.00	123.00	75.00	13
25	113.00	73.00	115.00	73.00	11
26	115.00	73.00	123.00	75.00	14
27	123.00	75.00	157.25	84.00	1
28	157.25	84.00	157.38	84.50	8
29	157.25	84.00	200.00	85.50	1
30	123.00	75.00	139.00	76.00	14
31	139.00	76.00	145.00	77.00	14
32	145.00	77.00	200.00	78.00	14
33	115.00	73.00	126.00	73.00	11
34	126.00	73.00	160.00	73.00	11
35	93.00	70.00	107.00	70.00	2
36	107.00	70.00	113.00	70.00	3
37	113.00	70.00	119.00	70.00	4
38	119.00	70.00	126.00	70.00	5
39	126.00	70.00	160.00	73.00	5
40	160.00	73.00	200.00	76.50	5
41	94.50	45.00	107.00	70.00	3
42	102.00	47.50	113.00	70.00	4
43	109.00	50.00	119.00	70.00	5
44	.00	31.00	20.00	32.50	6
45	20.00	32.50	78.00	40.00	6
46	78.00	40.00	94.50	45.00	6
47	94.50	45.00	102.00	47.50	6
48	102.00	47.50	109.00	50.00	6
49	109.00	50.00	135.00	58.00	6

ISOTROPIC SOIL PARAMETERS

14 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	45.0	80.0	250.0	25.0	.00	.0	3
2	100.0	100.0	100.0	.0	.00	.0	2
3	100.0	100.0	120.0	4.0	.00	.0	2
4	100.0	100.0	145.0	8.0	.00	.0	2
5	100.0	100.0	170.0	11.8	.00	.0	2
6	115.0	130.0	.0	37.0	.00	.0	3
7	110.0	131.0	.0	41.0	.00	.0	1
8	110.0	131.0	.0	37.0	.00	.0	1
9	120.0	138.0	300.0	33.0	.00	.0	3
10	150.0	150.0	.0	41.0	.00	.0	1
11	45.0	80.0	250.0	25.0	.00	.0	3
12	120.0	138.0	300.0	33.0	.00	.0	3
13	110.0	131.0	.0	37.0	.00	.0	3
14	45.0	80.0	250.0	25.0	.00	.0	3

3 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 11 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	107.00	73.00
5	111.00	73.00
6	119.00	75.00
7	121.00	75.00
8	123.00	75.00
9	139.00	76.00
10	145.00	77.00
11	200.00	78.00

Piezometric Surface No. 2 Specified by 7 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	30.00
2	45.00	30.00
3	87.00	40.00
4	117.00	50.00
5	135.00	58.00
6	140.00	60.00
7	200.00	72.00

Piezometric Surface No. 3 Specified by 10 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	.00	71.00
2	96.50	71.00
3	103.00	73.00
4	111.00	75.00
5	119.00	75.00
6	121.00	75.00
7	123.00	75.00
8	139.00	76.00
9	145.00	77.00

10	200.00	78.00

Searching Routine Will Be Limited To An Area Defined By 9 Boundaries Of Which The First 6 Boundaries Will Deflect Surfaces Upward

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)
1	.00	30.00	45.00	30.00
2	45.00	30.00	87.00	40.00
3	87.00	40.00	117.00	50.00
4	117.00	50.00	135.00	58.00
5	135.00	58.00	140.00	60.00
6	140.00	60.00	200.00	72.00
7	103.00	73.00	107.00	73.00
8	107.00	73.00	123.00	77.00
9	123.00	77.00	123.10	78.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.

200 Trial Surfaces Have Been Generated.

3 Boxes Specified For Generation Of Central Block Base

Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 2.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	94.00	57.00	103.00	58.00	2.00
2	108.00	65.00	115.00	66.00	3.00
3	122.00	75.00	124.00	76.00	2.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	84.24	70.00
2	85.83	68.84
3	87.25	67.43
4	88.81	66.19
5	90.54	65.17
6	91.96	63.77
7	93.53	62.52
8	95.53	62.47
9	97.18	61.35
10	98.64	59.99
11	100.46	59.14
12	102.30	58.35
13	113.37	64.64
14	122.15	74.98
15	123.33	76.60
16	124.19	78.31

*** 1.280 ***

Individual data on the 36 slices

Slice No.	Width Ft(m)	Weight Lbs(kg)	Water Force Top Lbs(kg)	Water Force Bot Lbs(kg)	Tie Force Norm Lbs(kg)	Tie Force Tan Lbs(kg)	Earthquake Force Hor Lbs(kg)	Earthquake Force Ver Lbs(kg)	Surcharge Load Lbs(kg)
1	1.6	92.2	.0	.0	.0	.0	.0	.0	.0
2	1.4	263.5	.0	.0	.0	.0	.0	.0	.0
3	1.6	499.8	.0	.0	.0	.0	.0	.0	.0
4	1.7	744.8	.0	.0	.0	.0	.0	.0	.0
5	1.4	787.0	.0	.0	.0	.0	.0	.0	.0
6	1.0	689.9	.0	.0	.0	.0	.0	.0	.0
7	.5	386.8	31.7	.0	.0	.0	.0	.0	.0
8	2.0	1569.5	73.1	.0	.0	.0	.0	.0	.0
9	1.0	831.3	8.8	.0	.0	.0	.0	.0	.0
10	.7	622.4	.0	.0	.0	.0	.0	.0	.0
11	1.5	1512.1	.0	.0	.0	.0	.0	.0	.0
12	1.8	2139.9	.0	.0	.0	.0	.0	.0	.0
13	.9	1167.2	.0	.0	.0	.0	.0	.0	.0
14	.9	1230.4	.0	.0	.0	.0	.0	.0	.0
15	.7	953.0	.0	.0	.0	.0	.0	.0	.0
16	4.0	5404.1	.0	.0	.0	.0	.0	.0	.0
17	2.2	2969.1	.0	.0	.0	.0	.0	.0	.0
18	1.8	2326.1	.0	.0	.0	.0	.0	.0	.0
19	2.0	2620.8	.0	.0	.0	.0	.0	.0	.0
20	.4	483.8	.0	.0	.0	.0	.0	.0	.0
21	.6	813.9	.0	.0	.0	.0	.0	.0	.0
22	.8	989.6	.0	.0	.0	.0	.0	.0	.0
23	.2	224.8	.0	.0	.0	.0	.0	.0	.0
24	2.9	2847.9	.0	.0	.0	.0	.0	.0	.0
25	1.1	796.9	.0	454.3	.0	.0	.0	.0	.0

APPENDIX F.2

REVISED SETTLEMENT ANALYSES

U.S. NAVY CLEAN 5082

SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN

C. Farkos R.J. Ofsinn 2/23/96 02/23/96

SETTLEMENT ANALYSIS

AREA "A" LANDFILL CAP DESIGN

SUBMARINE BASE NEW LONDON

GROTON, CONNECTICUT

U.S. NAVY CLEAN 5082

SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN

C. Farkos RJ Defiaio 2/23/96 02/23/96

OBJECTIVE:

Determine the minimum design grade for the Area "A" Landfill Cap Design to maintain a final minimum grade of 3% after considering settlement.

APPROACH:

Settlement of a cohesive material occurs as a result of an increase in effective pressure exerted on that material. This increase results in a decrease in void ratio which yields settlement.

In order to determine the minimum design grade, settlement due to the increased effective pressure caused by the construction of the final cover system will be considered.

A Digital Terrain Model(DTM) of the subsurface strata was created from boring logs and data generated during a comprehensive characterization of the subsurface conditions at Landfill "A". This series of settlement calculations is based on the DTM and the results of the groundwater modeling study completed for Landfill "A" (See Ref 3). The various layer thicknesses comprising Landfill "A" were examined for 6 different cross-sections along the total length of Landfill "A". The location of these cross-sections is presented in Figure 1. It was determined from inspection of these illustrated cross-sections that cross-section E presented the most critical condition regarding differential settlement within the dredge spoils layer. The thickness of the dredge spoils layer illustrated in cross-section E is relatively the same across the entire section. In all other corss-sections examined for this analysis, the thickness of

the dredge spoils layer is relatively greater on the downgradient portion of the section when compared to the upgradient portion of the section. This condition of a greater dredge spoils layer on the downgradient portion of the section suggests that differential settling will favor increased sloping in the required direction. The consistent relative thickness of the dredge spoils layer across section E, therefore, represents the most critical differential settling condition since both the downgradient and upgradient portions of the section may settle an equal amount. Figure 2 and Figure 3 illustrate the subsurface conditions at cross-section E that were used in the supporting calculations.

U.S. NAVY CLEAN

5082

SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN

C. Farkos RJ Ofiso 2/23/96

02/22/96

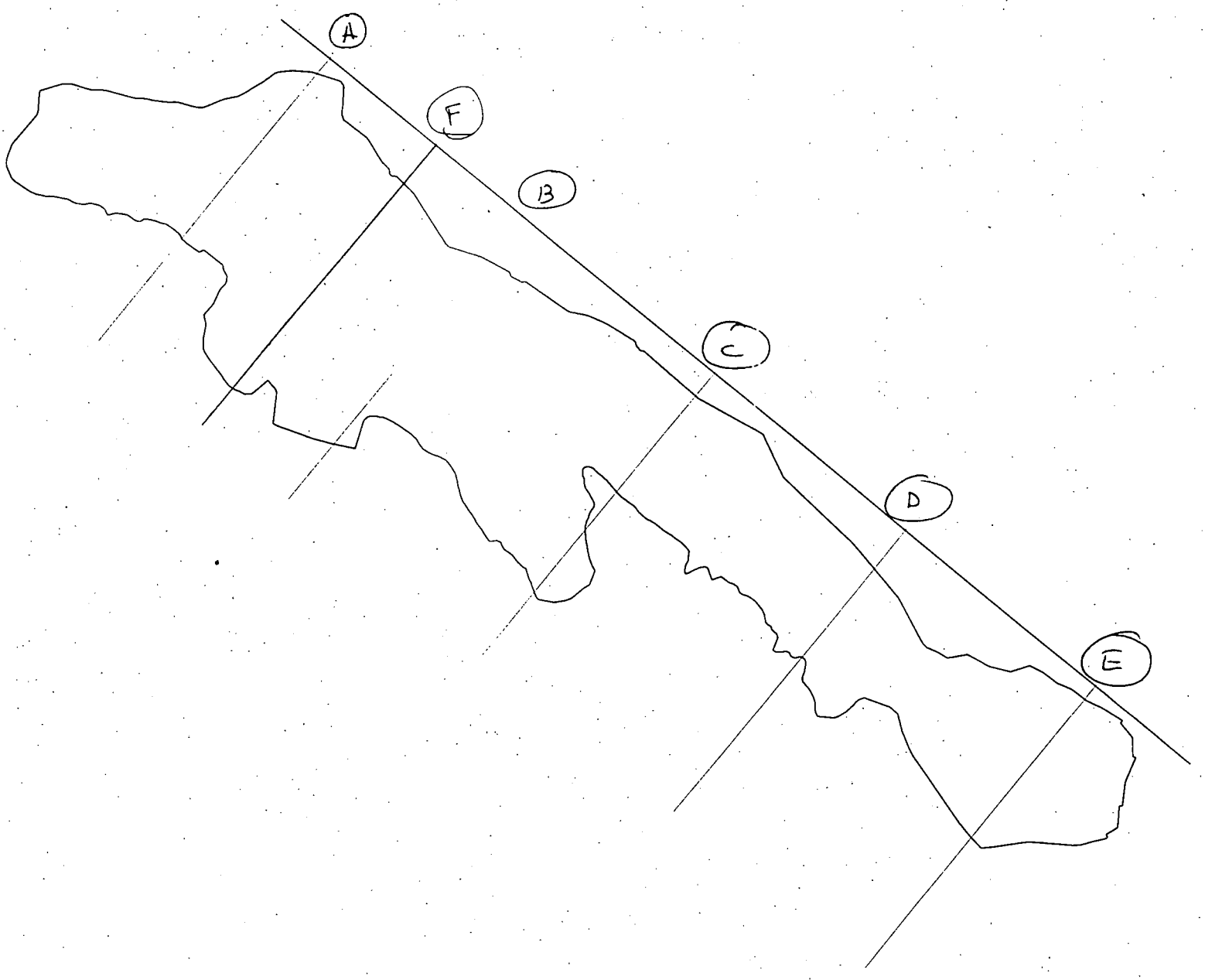


Figure 1 - Landfill Cross-Sections

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE ____ OF ____

CLIENT: US NAVY CLEAN	JOB NUMBER: 5082
SUBJECT: SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN	
BASED ON:	DRAWING NUMBER:
BY: C FAYHOS / CHECKED BY: RJ Olfiero	APPROVED BY: / DATE: 2/23/96

POINT (A)

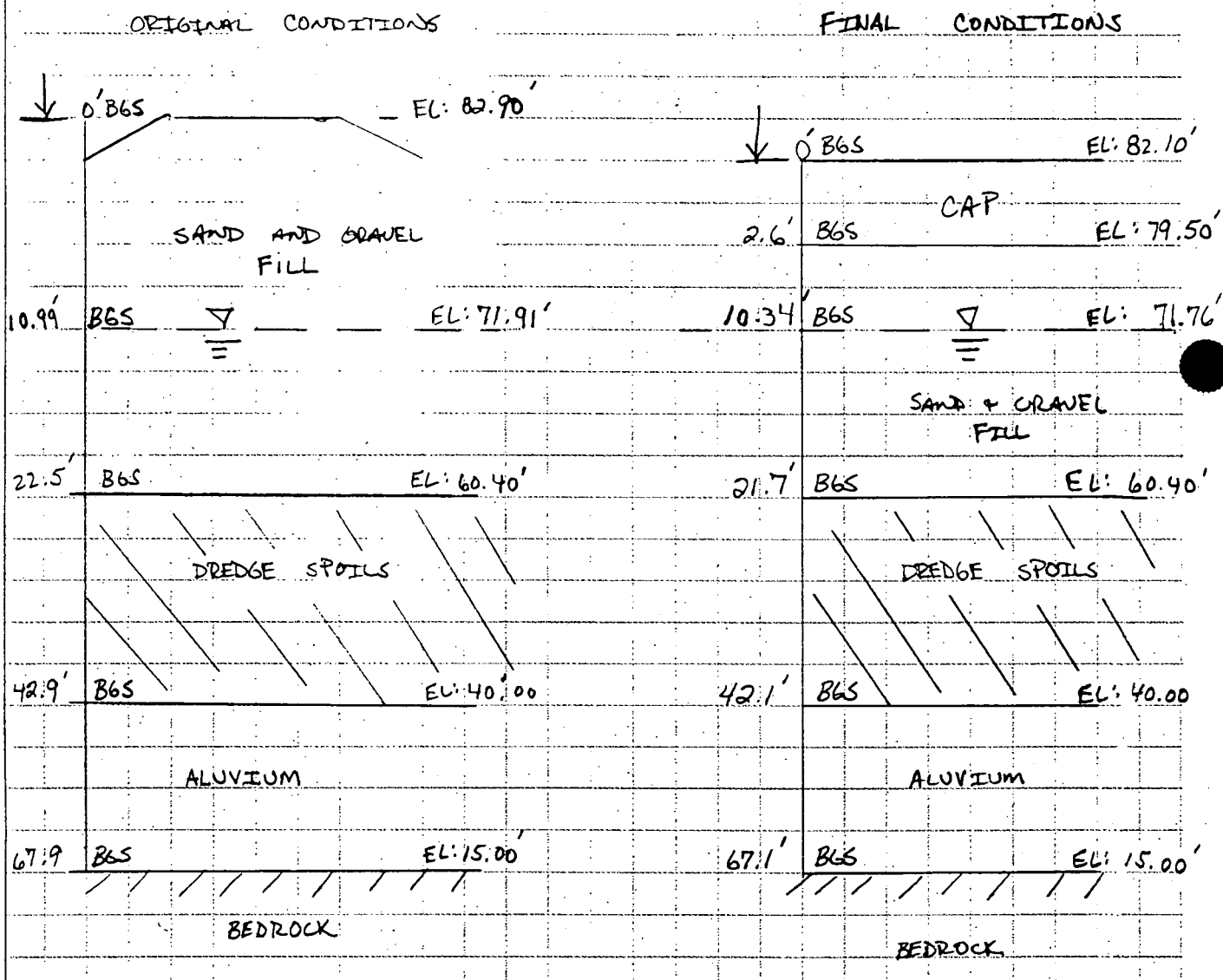


Figure 2 - Pt "A" at Cross-Section "E"

CALCULATION WORKSHEET Order No. 19116 (01-91) PAGE ____ OF ____

CLIENT: US NAVY CLEAN	JOB NUMBER: 5092
SUBJECT: SETTLEMENT ANALYSIS — LANDFILL "A" CAP DESIGN	
BASED ON:	DRAWING NUMBER:
BY: C FANKOS / CHECKED BY: R.J. Orfiano	APPROVED BY: / DATE: 2/23/96

POINT (B)

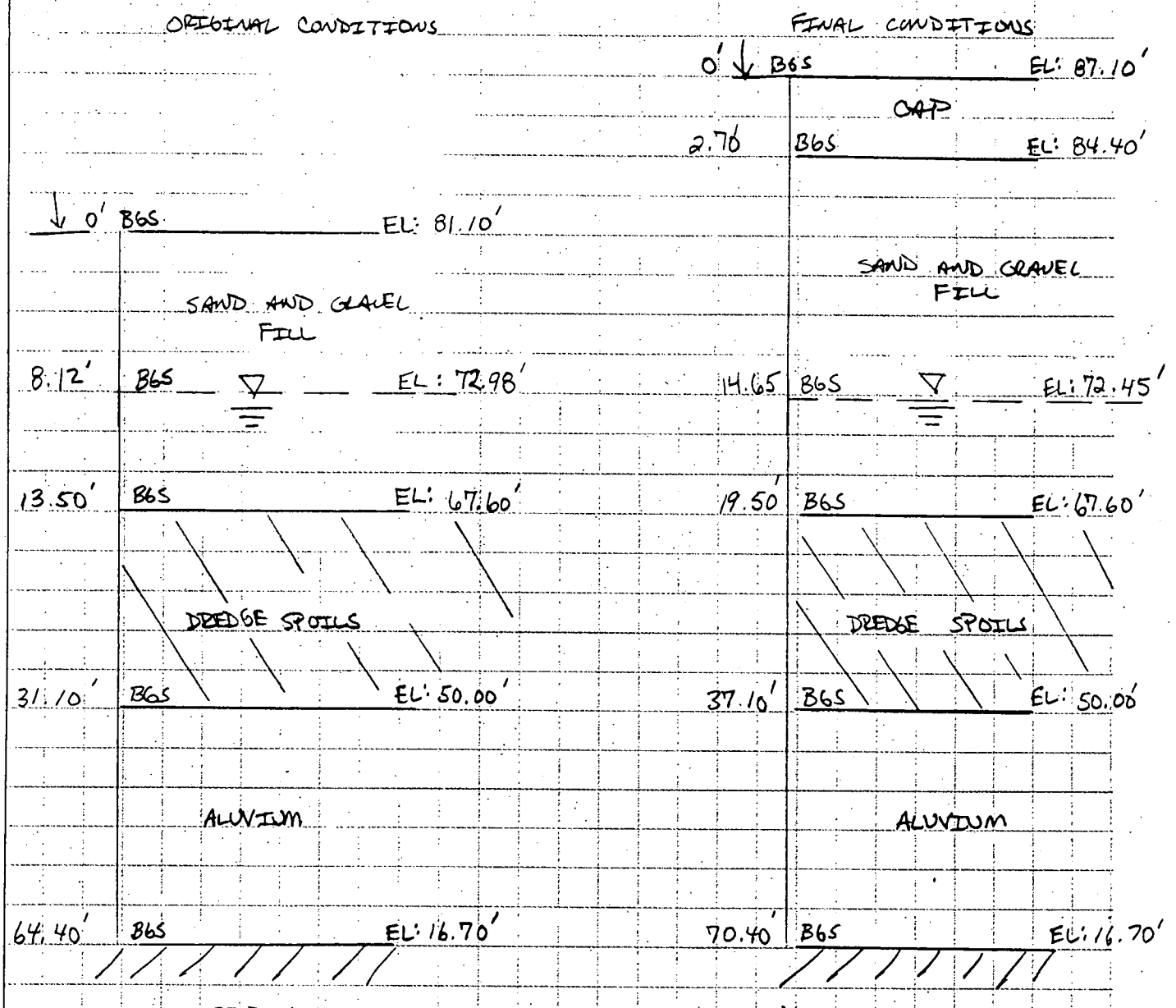


Figure 3 - Pt "B" at Cross-Section "E"

C. Farkos R. J. Orfano 02/23/96

APPROACH: (cont'd)
Subsequently, the minimum intitial slope to maintain a minimum 3% grade after settlement will be calculated from the differential settlement.

BACKGROUND:
A review of numerous soil borings revealed that, in general, the strata in the landfill consists of sand to sand and gravel fill (landfill contents) underlain by silty clay dredge spoil material. As the fill material (landfill contents) consists primarily of granular material, it is not anticipated that settlement in that strata will be significant, and therefore will not be considered. Settlement will only be calculated for the cohesive silty clay dredge spoil material. The dredge spoil layer will be divided evenly into 3 separate layers, for calculations, to better estimate the settlement in the entire layer.

Construction of the final cover system will introduce additional pressure on the underlying strata due to the placement of structural fill, regraded waste, and the final cover system. As the future anticipated use of the landfill area is consistent with its present use, loading from vehicles or material storage will not be considered.

In addition, the placement of the final cover system may serve to reduce infiltration and yield a reduction in the groundwater surface elevation. Construction of the final cover system on the plateau area of the landfill, in conjunction with the perimeter surface water diversion and

BACKGROUND: (cont'd)

ground water interception system, will serve to reduce the amount of infiltration into the landfill. In most cases, the reduction of infiltration can be expected to lower the ground water table from its pre-capped condition. In contrast, the construction of the final cover system on the northern sideslope portion of the landfill may attenuate the dissipation of the piezometric head within the landfill resulting from seasonal high ground water conditions, thus creating a slight increase of the water table elevation within the landfill. Since the settlement estimates will be greatest when a net lowering of the ground water table is assumed, (due to an increase in effective stress), the corresponding settlement calculations will be based upon this conservative assumption. These calculations will be based on the data generated in the DTM and groundwater modeling study . Effective stress increases (if any) within compressible soils beneath the landfill will be determined based upon the differential between the existing ground water table conditions (as determined from test borings) and the final ground water table conditions based on the modeling study.

U.S. NAVY CLEAN 5082

SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN

C. Farkos RJ DeFrisio 02/23/96

CALCULATIONS:

Settlement in the cohesive silty clay dredge spoil material will be calculated as outlined in Reference #1, Section 10.19. The following equations give the basis for the attached spreadsheet calculations.

Equation 1:

$$S = H\left(\frac{\Delta e}{1+e_o}\right)$$ Ref. 1, Eqn 10.39

where

S = settlement, ft

H = height of layer, ft

$\Delta e = e_f - e_o$

e_f = void ratio @ p_f

e_o = void ratio @ p_o

p_f = final effective pressure, psf

p_o = original effective pressure, psf

Equation 2:

$p_o = \gamma H$ (above water table) Ref. 1, Eqn 10.32

where

γ = layer density, pcf

Equation 3:

$p_o = (\gamma_{sat} - \gamma_{water})H$ (below water table) Ref. 1, Eqn 10.33

where

C. Farkos R J Ofrias 02/23/96

γ_{sat} = saturate soil density, pcf

γ_{water} = water density, pcf

Equation 4:

$$e_f = e_o - C_c \log\left(\frac{p_f}{p_o}\right)$$ Ref. 1, from Eqn 10.35

where

C_c = coefficient of consolidation

The density of the fill material was estimated to be 124 pcf based on typical soils. The dredge spoil layer density is approximately 98 pcf based on the results of laboratory testing.

The layer depths and elevations are noted on Figures 2 and 3 for both pre- and post-capping conditions. In addition, the assumed groundwater elevation is also shown.

Consolidation testing was performed on two samples of the dredge spoils. From this testing, the coefficient of consolidation for each test was determined from the consolidation curves. In addition, the original void ratio was determined for each sample. The average coefficient of consolidation (0.31) and the average original void ratio (1.724) were used in the spreadsheet calculations. The laboratory results of these test are given in Reference 2.

RESULTS:

The results of the settlement calculations at each location

are presented in attached spreadsheets. The results indicate post capping settlement in the vicinity of Pt. "A" of cross-section "E" to be -0.11 inches(-0.009 feet). This portion of the capped surface along cross-section E is expected to rise 0.11 inches. The post capping settlement in the vicinity of Pt. "B" of cross-section "E" is 4.35 inches(0.363 feet).

The differential settlement between the two locations is 4.36 inches(0.363 feet). The horizontal distance between the two points is approximately 153 feet. Based on the following equation and Figure 3, the design and final slopes are calculated:

RESULTS: (cont'd)

$$Slope = \left(\frac{\Delta elevation}{Length}\right)$$

Design:

$$Slope_d = \left(\frac{87.1\,ft - 82.1\,ft}{153\,ft}\right)$$

$$Slope_d \cong 3.3\%$$

Final:

$$Slope_f = \left(\frac{86.74\,ft - 82.11\,ft}{153\,ft}\right)$$

$$Slope_f \cong 3.0\%$$

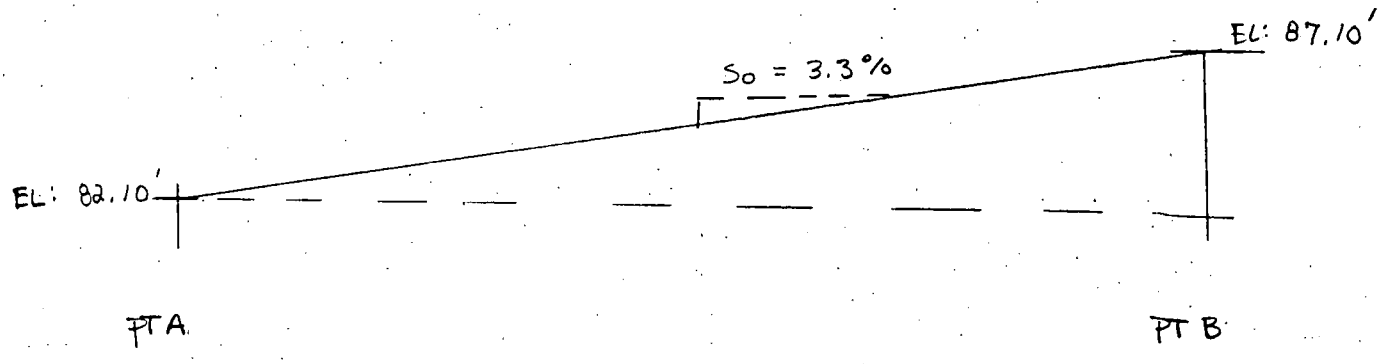
U.S. NAVY CLEAN

5082

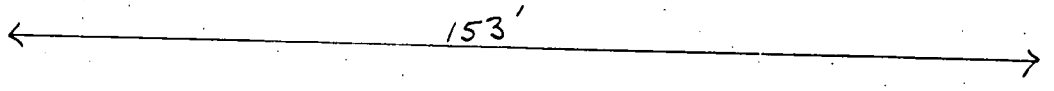
SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN

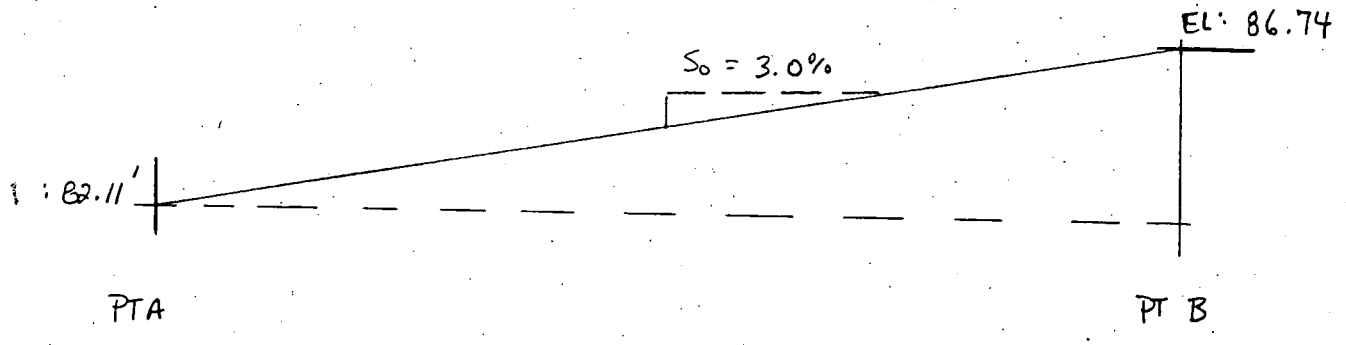
C. Farkos RJ Ofrias

02/23/96



PRE SETTLEMENT





POST SETTLEMENT

Figure 3 - Differential Settlement

U.S. NAVY CLEAN 5082

SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN

C. Farkos RJ Defrisco 02/23/96

CONCLUSIONS:

Based on the calculations presented, the design slope is acceptable considering settlement effects.

U.S. NAVY CLEAN 5082

SETTLEMENT ANALYSIS - LANDFILL "A" CAP DESIGN

C. Farkos RJ Orfino 02/23/96

REFERENCES:

1.) Lindeburg M.R, 1989, Civil Engineering Reference Manual, Sixth Edition, Professional Publications, Inc., Belmont, California.

2.) Laboratory consolidation results supplied by Atlantic Environmental Services Inc., April 8, 1994.

3.) Brown & Root Environmental, February 1995 Groundwater/Leachate Modeling Study Report for Area A Landfill Remedial Design, Naval Submarine Base New London, Groton, Connecticut.

RJ Office

SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

1.) DETERIMINE THE ORIGINAL LAYER COMPOSITION

From Point A of Cross-Section E

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Thickness. (ft)	0.00	0.00	22.50	6.80	6.80	6.80
Density (pcf)	150.0	120.0	124.0	98.0	98.0	98.0
Depth BGS (ft)	0.00	0.00	22.50	29.30	36.10	42.90

Depth to water	11.0	ft

2.) DETERMINE THE ORIGINAL EFFECTIVE PRESSURE, Po AT THE MID-HEIGHT OF EACH LAYER

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Total Layer Pressure	0.0	0.0	2790.0	666.4	666.4	666.4
Layer Pore Pressure	0.0	0.0	718.2	424.3	424.3	424.3
Original Effective Pressure per layer (psf)	0.0	0.0	2071.8	242.1	242.1	242.1

R3 Of

SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

Original Effective Pressure Per Layer @ Mid-Height (psf)	0.0	0.0	1035.9	2192.8	2434.9	2677.0

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SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

3.) DETERMINE THE FINAL LAYER COMPOSITION

From design drawings

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Thickness, H (ft)	2.60	0.0	19.1	6.80	6.80	6.80
Density (pcf)	150.0	120.0	124.0	98.0	98.0	98.0
Depth BGS (ft)	2.6	2.6	21.7	28.5	35.3	42.1

Depth to water	10.3	ft

4.) DETERMINE THE FINAL EFFECTIVE PRESSURE (Pf) AT THE MID-HEIGHT TO THE LAYER OF INTEREST

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Total Pressure (psf)	390.0	0.0	2368.4	666.4	666.4	666.4
Pore Pressure (psf)	0.0	0.0	708.9	424.3	424.3	424.3
Final Effective Pressure Per Layer (psf)	390.0	0.0	1659.5	242.1	242.1	242.1

RJ Ofi

SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

Final Effective Pressure Per Layer @ Mid-Height (psf)	195.0	390.0	1219.8	2170.6	2412.7	2654.7

RJ Ocfrio

SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

5.) DETERMINE THE UNCONSOLIDATED VOID RATIO (eo) AND THE COEFFICIENT OF CONSOLIDATION (Cc)

Based on results of geotechnical laboratory analysis

eo	1.724	Average unconsolidated void ratio
Cc	0.31	Average Coefficient of Consolidation

6.) DETERMINE THE INCREMENTAL SETTLEMENT IN EACH LAYER

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
eo	NA	NA	NA	1.724	1.724	1.724
Cc	NA	NA	NA	0.31	0.31	0.31
Po	0	0	1036	2192.8	2434.9	2677.0
Final Effective Pressure Per Layer @ Mid-Height (psf)	195	390	1220	2170.6	2412.7	2654.7
H	2.60	0.00	19.10	6.80	6.80	6.80
ef	NA	NA	NA	1.725	1.725	1.725
Incremental Settlement (dS)	**NA**	**NA**	**NA**	**-0.003**	**-0.003**	**-0.003**

7.) DETERMINE THE TOTAL SETTLEMENT IN THE DREDGE SPOILS

Sum of Settlement	**-0.009 (ft)**	**=**	**-0.11 (inches)**

RJ Oefis

SETTLE[illegible] ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

1.) DETERIMINE THE ORIGINAL LAYER COMPOSITION

From Point B of Cross-Section E

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Thickness. (ft)	0.00	0.00	13.50	5.87	5.87	5.87
Density (pcf)	150.0	120.0	124.0	98.0	98.0	98.0
Depth BGS (ft)	0.00	0.00	13.50	19.37	25.23	31.10

Depth to water	8.1	ft

2.) DETERMINE THE ORIGINAL EFFECTIVE PRESSURE, Po AT THE MID-HEIGHT OF EACH LAYER

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Total Layer Pressure	0.0	0.0	1674.0	574.9	574.9	574.9
Layer Pore Pressure	0.0	0.0	335.7	366.1	366.1	366.1
Original Effective Pressure per layer (psf)	0.0	0.0	1338.3	208.9	208.9	208.9

RJ Ocfisio

SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

Original Effective Pressure Per Layer @ Mid-Height (psf)	0.0	0.0	669.1	1442.7	1651.6	1860.4

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3.) DETERMINE THE FINAL LAYER COMPOSITION
From design drawings

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Thickness, H (ft)	2.70	0.0	16.8	5.87	5.87	5.87
Density (pcf)	150.0	120.0	124.0	98.0	98.0	98.0
Depth BGS (ft)	2.7	2.7	19.5	25.4	31.2	37.1

Depth to water	14.7	ft

4.) DETERMINE THE FINAL EFFECTIVE PRESSURE (Pf) AT THE MID-HEIGHT TO THE LAYER OF INTEREST
From design drawings

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
Total Pressure (psf)	405.0	0.0	2083.2	574.9	574.9	574.9
Pore Pressure (psf)	0.0	0.0	302.6	366.1	366.1	366.1
Final Effective Pressure Per Layer (psf)	405.0	0.0	1780.6	208.9	208.9	208.9

RJ. Orfino

SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

Final Effective Pressure Per Layer @ Mid-Height (psf)	202.5	405.0	1295.3	2290.0	2498.8	2707.7

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SETTLEMENT ANALYSIS
AREA "A" LANDFILL
SUBMARINE BASE NEW LONDON

5.) DETERMINE THE UNCONSOLIDATED VOID RATIO (eo) AND THE COEFFICIENT OF CONSOLIDATION (Cc)

Based on results of geotechnical laboratory analysis

eo	1.724	Average unconsolidated void ratio
Cc	0.31	Average Coefficient of Consolidation

6.) DETERMINE THE INCREMENTAL SETTLEMENT IN EACH LAYER

Layer	1	2	3	4	5	6
Description	CAP	STR. FILL	FILL	DREDGE SPOIL	DREDGE SPOIL	DREDGE SPOIL
eo	NA	NA	NA	1.724	1.724	1.724
Cc	NA	NA	NA	0.31	0.31	0.31
Po	0	0	669	1442.7	1651.6	1860.4
Final Effective Pressure Per Layer @ Mid-Height (psf)	203	405	1295	2290.0	2498.8	2707.7
H	2.70	0.00	16.80	5.87	5.87	5.87
ef	NA	NA	NA	1.662	1.668	1.673
Incremental Settlement (dS)	**NA**	**NA**	**NA**	**0.134**	**0.120**	**0.109**

7.) DETERMINE THE TOTAL SETTLEMENT IN THE DREDGE SPOILS

Sum f Settlement	**0.363 (ft)**	=	**4.35 (inches)**

APPENDIX G

OBDA SEEP WATER ANALYTICAL RESULTS AND DATA VALIDATION

G.1 Organics Data Package
G.2 Inorganics (Metals and Cyanide) Data Package

APPENDIX G.1

ORGANICS DATA PACKAGE

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-12-5-296

TO: J. L. GLORIEUX

DATE: JANUARY 31, 1996

FROM: ANNE K. BATTISTA

COPIES: DV FILE

SUBJECT: ORGANIC DATA VALIDATION - ORGANICS VOA/BNA/PEST/PCB
CTO #203, NEW LONDON NAVAL SUBMARINE BASE (NSB),
GROTON, CONNECTICUT
CASE NO. NUS, SDG 24070

SAMPLES: 2/Aqueous

3MSP01 TB30-111595

The sample set for the CTO 203 New London NSB site, Case NUS, SDG 24070, consists of one (1) aqueous environmental sample and one (1) aqueous trip blank (designated TB-). The environmental sample was analyzed for Target Compound List (TCL) volatile, semivolatile and pesticide/PCB organic compounds. The trip blank was analyzed for volatile compounds only. The field crew did not designate a sample for Matrix Spike/Matrix Spike Duplicate (MS/MSD) analysis, therefore, the laboratory analyzed Laboratory Control Spikes instead. No field duplicate pairs were included in this SDG.

The samples were collected by Brown & Root Environmental on November 11th, 1995 and analyzed by Southwest Laboratories of Oklahoma under Naval Energy and Environmental Support Activity (NEESA) Level D Quality Assurance/Quality Control (QA/QC) criteria. All analyses were conducted using the Contract Laboratory Program (CLP) Statement of Work (SOW) OLMO3.1 3/90 analytical and reporting protocols.

The data were evaluated based on the following parameters:

- * Data Completeness
- * Holding Times
- * GC/MS Tuning
- Calibrations
- Blanks
- * Surrogate Spike Recoveries
- Laboratory Control Spike/Laboratory Control Spike Duplicate Results
- * Internal Standards Performance
- * Instrument Performance
- * Compound Identification
- * Compound Quantitation
- * Tentatively Identified Compounds (TICs)

The asterisk (*) indicates that all quality control criteria were met for this parameter.

Qualified (if applicable) analytical results are summarized in Appendix A. Results as reported by the laboratory are presented in Appendix B. Appendix C contains Region I worksheets, and Appendix D contains the documentation to support the findings as discussed in this data validation report. The attached Table I summarizes the validation qualifications which were based on the following information:

CALIBRATIONS

The following tables summarize calibration non-compliances and corresponding actions. The key associated with these tables is presented in following the tables.

Volatiles

Compound	CC 11/17/95	CC 11/21/95	
Bromoform	X	X	
1,1,2,2-Tetrachloroethane	X	X	
Chloromethane			X
Acetone		X	
2-Butanone		X	
4-Methyl-2-Pentanone		X	
2-Hexanone		X	
Associated Samples:	TB30-111595, 3MSP01	None	

No action was necessary for the aforementioned volatile compounds since only positive results are affected by these noncompliances, and no positive results were reported for those compounds in the affected samples.

Semivolatile

Compound	CC 11/30/95
2,4-Dinitrophenol	XX
Hexachlorocylcopentadiene	X
4,6-Dinitro-2-methylphenol	X
Pentachlorophenol	X
Butylbenzylphthalate	X
Associated Samples:	3MSP01

The nondetected result reported for 2,4-dinitrophenol in the affected sample was qualified as estimated, (UJ), as a result of a %D > 50%. A positive result for butylbenzylphthalate was qualified as estimated, (J), due to the %D > 25%. No actions were necessary for any of the other remaining semivolatile compounds in which %Ds were greater than 25% since no positive results were reported for these compounds in the affected sample and nondetects are not considered compromised by these noncompliances.

Calibration Actions:

X - Percent RSD > 30; percent D > 25; Estimate (J) positive results.
XX - Percent RSD > 50; percent D > 50; Estimate (J) positive results and (UJ) nondetects.

BLANKS

The maximum concentration of contaminants found in associated low level laboratory method blank analyses are summarized below:

Compound	Maximum Concentration	Action Level
Methylene Chloride	4 µg/L	40 µg/L
Acetone	4 µg/L	40 µg/L
Diethylphthalate	2 µg/L	20 µg/L
Bis(2-ethylhexyl)phthalate	13 µg/L	130 µg/L

Affected Samples: ALL

Blank Actions:

- Value < Contract Required Quantitation Limit (CRQL); report CRQL followed by a U.
- Value > CRQL and < action level; report value followed by a U.
- Value > CRQL and > action level; report value unqualified.

Sample aliquot size and dilution factors were taken into consideration prior to the application of all action levels. No actions were taken for methylene chloride, acetone or diethylphthalate, since no positive results were reported for these compounds in the affected samples. A positive result for bis(2-ethylhexyl)phthalate was qualified in the manner indicated by the blank actions table.

LABORATORY CONTROL SPIKE/LABORATORY CONTROL SPIKE DUPLICATE RESULTS

Semivolatiles

The aqueous Laboratory Control Spike/Laboratory Control Spike Duplicate (LCS/LCSD) analyses yielded low Percent Recoveries (%Rs) for 1,4-dichlorobenzene and 1,2,4-trichlorobenzene. A high Relative Percent Differences (RPD) was also reported for 1,4-dichlorobenzene. Positive and nondetected results are affected by these noncompliance. Nondetected results for the aforementioned compounds were qualified as estimated, (UJ), in the affected sample.

Pesticides/PCBs

The aqueous LCS/LCSD samples LC1118WD and LD1118WD had low %Rs reported for gamma-BHC and Endrin on column DB-1701. No action was taken as a result of these marginally low %Rs since they were noncompliant on one column only.

ADDITIONAL COMMENTS

Positive results reported at concentrations below the Contract Required Quantitation Limit (CRQL) were qualified as estimated, (J).

No other problems were encountered in this case. The text of this report has been formulated to address only those problem areas affecting data quality.

OVERALL ASSESSMENT

Laboratory Performance: A continuing calibration %D greater than 50% was reported for 2,4-dinitrophenol. Continuing calibration %Ds greater than 25% were noted for several volatile and semivolatile compounds. Methylene chloride, acetone, diethylphthalate and bis(2-ethylhexyl)phthalate was detected in a laboratory method blank. 1,4-Dichlorobenzene, 1,2,4-trichlorobenzene, gamma-BHC and Endrin had low LCS/LCSD %Rs reported. A high LCS/LCSD RPD was noted for 1,4-dichlorobenzene.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA "Functional Guidelines for Organic Data Validation" (3/90). EPA Region I has not yet released Regional amendments updating th xisting EPA Region I 2/88 National Functional Guidelines modifications to address 3/90 analytical protocol. Quality requirements outlined in the NEESA guidelines document entitled "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program (NEESA 20.2-047B; 6/88) were also referenced.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NEESA Guidelines and the Quality Assurance Project Plan (QAPP)."

Anne K. Battista
Halliburton NUS Corporation

Anne K. Battista
Chemist/Data Validator

Halliburton NUS Corporation

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Regional Worksheets
4. Appendix D - Support Documentation

NEW LONDON NSB

CASE NUS, SDG 24070

TABLE I. Recommendation Summary

Sample ID	VOA	SVOA	PESTPCB
3MSP01 TB30-111959		A[1,2,3,4,5]	

If the field is left blank, the qualifier is A - accept all data.

A[1] - Accept data, but change a positive result for bis(2-ethylhexyl)phthalate to a revised detection limit and qualify as nondetected, (U), as a result of laboratory method blank contamination.

A[2] - Accept data, but qualify a nondetected result for 2,4-dinitrophenol as estimated, (UJ), as a result of a continuing calibration %D > 50%.

A[3] - Accept data, but qualify a positive result for butylbenzylphthalate as estimated, (J), as a result of a continuing calibration %D > 25%

A[4] - Accept data, but qualify nondetected results for 1,4-dichlorobenzene and 1,2,4-trichlorobenzene as estimated, (UJ), as a result of low LCS/LCSD recoveries.

A[5] - Accept data, but estimate (J), all positive results reported at concentrations below the CRQL.

NEW LONDON NSB

CASE NUS, SDG 24070

TABLE II. Tentatively Identified Compound Summary

TIC	3MSP01	TB30-111595
Cyclopentasiloxane, decamethyl-	X	

APPENDIX A

QUALIFIEDLABORATORYRESULTS

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

TB30-111595

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18546.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

TB30-111595

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18546.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
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30.					

FORM I VOA-TIC OLM03.0

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18547.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

3MSP01

'b Name: SWL-TULSA Contract:

Lab Code: SWOK Cas No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sampl wt/vol: 5.0 (g/mL) ML Lab File ID: L18547.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Numb r TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11226.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	bis(2-Chloroethyl)Ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	~~U~~ UJ
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	2,2'-oxybis(1-Chloropropane)	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	bis(2-Chloroethoxy)methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	~~U~~ UJ
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-Methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
95-95-4	2,4,5-Trichlorophenol	25	U
91-58-7	2-Chloronaphthalene	10	U
88-74-4	2-Nitroaniline	25	U
131-11-3	Dimethylphthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	25	U
83-32-9	Acenaphthene	10	U

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11226.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
51-28-5	2,4-Dinitrophenol	25	~~U~~ UJ
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethylphthalate	10	U
7005-72-3	4-Chlorophenyl-phenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-Nitrosodiphenylamine (1)	10	U
101-55-3	4-Bromophenyl-phenylether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butylphthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butylbenzylphthalate	0.5	~~J~~ J
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	bis(2-Ethylhexyl)phthalate	26	~~B~~ BL
117-84-0	Di-n-octylphthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenz(a,h)anthracene	10	U
191-24-2	Benzo(g,h,i)perylene	10	U

(1) - Cannot be separated from Diphenylamine

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

3MSP01

b Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Cas No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sampl ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11226.D

L vel: (low/med) LOW Date Received: 11/16/95

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.2

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 541-02-6	Cyclopentasiloxane, decameth	4.547	2	NJ
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1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

ab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: _____

% Moisture: _____ decanted: (Y/N) __ Date Received: 11/16/95

Extraction: (SepF/Cont/Sonc) SEPF Date Extracted: 11/18/95

Concentrated Extract Volume: 10000(uL) Date Analyzed: 11/26/95

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cl anup: (Y/N) N pH: 7.2 Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
319-84-6	alpha-BHC	0.050	U
319-85-7	beta-BHC	0.050	U
319-86-8	delta-BHC	0.050	U
58-89-9	gamma-BHC (Lindane)	0.050	U
76-44-8	Heptachlor	0.050	U
309-00-2	Aldrin	0.050	U
1024-57-3	Heptachlor epoxide	0.050	U
959-98-8	Endosulfan I	0.050	U
60-57-1	Dieldrin	0.10	U
72-55-9	4,4'-DDE	0.10	U
72-20-8	Endrin	0.10	U
33213-65-9	Endosulfan II	0.10	U
72-54-8	4,4'-DDD	0.10	U
1031-07-8	Endosulfan sulfate	0.10	U
50-29-3	4,4'-DDT	0.10	U
72-43-5	Methoxychlor	0.50	U
53494-70-5	Endrin ketone	0.10	U
7421-93-4	Endrin aldehyde	0.10	U
5103-71-9	alpha-Chlordane	0.050	U
5103-74-2	gamma-Chlordane	0.050	U
8001-35-2	Toxaphene	5.0	U
12674-11-2	Aroclor-1016	1.0	U
11104-28-2	Aroclor-1221	2.0	U
11141-16-5	Aroclor-1232	1.0	U
53469-21-9	Aroclor-1242	1.0	U
12672-29-6	Aroclor-1248	1.0	U
11097-69-1	Aroclor-1254	1.0	U
11096-82-5	Aroclor-1260	1.0	U

APPENDIX B

RESULTS AS REPORTED BY THE LABORATORY

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

TB30-111595

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18546.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column: DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

TB30-111595

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.01

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18546.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18547.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

3MSP01

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sampl wt/vol: 5.0 (g/mL) ML Lab File ID: L18547.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11226.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cl anup: (Y/N) N pH: 7.2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	bis(2-Chloroethyl)Ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	2,2'-oxybis(1-Chloropropane)	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	bis(2-Chloroethoxy)methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-Methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
95-95-4	2,4,5-Trichlorophenol	25	U
91-58-7	2-Chloronaphthalene	10	U
88-74-4	2-Nitroaniline	25	U
131-11-3	Dimethylphthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	25	U
83-32-9	Acenaphthene	10	U

1C
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11226.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethylphthalate	10	U
7005-72-3	4-Chlorophenyl-phenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-Nitrosodiphenylamine (1)	10	U
101-55-3	4-Bromophenyl-phenylether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butylphthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butylbenzylphthalate	0.5	J
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	bis(2-Ethylhexyl)phthalate	26	B
117-84-0	Di-n-octylphthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenz(a,h)anthracene	10	U
191-24-2	Benzo(g,h,i)perylene	10	U

(1) - Cannot be separated from Diphenylamine

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

3MSP01

b Name: SWL-TULSA Contract: NUS

Lab Cod : SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11226.D

Level: (low/med) LOW Date Received: 11/16/95

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.2

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 541-02-6	Cyclopentasiloxane, decameth	4.547	2	NJ
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27.				
28.				
29.				
30.				

FORM I SV-TIC 3/90

1D
PESTICIDE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

3MSP01

ab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: 24070.02

Sample wt/vol: 1000 (g/mL) ML Lab File ID: _____

% Moisture: _____ decanted: (Y/N) __ Date Received: 11/16/95

Extraction: (SepF/Cont/Sonc) SEPF Date Extracted: 11/18/95

Concentrated Extract Volume: 10000(uL) Date Analyzed: 11/26/95

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.2 Sulfur Cleanup: (Y/N) N

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
319-84-6	alpha-BHC	0.050	U
319-85-7	beta-BHC	0.050	U
319-86-8	delta-BHC	0.050	U
58-89-9	gamma-BHC (Lindane)	0.050	U
76-44-8	Heptachlor	0.050	U
309-00-2	Aldrin	0.050	U
1024-57-3	Heptachlor epoxide	0.050	U
959-98-8	Endosulfan I	0.050	U
60-57-1	Dieldrin	0.10	U
72-55-9	4,4'-DDE	0.10	U
72-20-8	Endrin	0.10	U
33213-65-9	Endosulfan II	0.10	U
72-54-8	4,4'-DDD	0.10	U
1031-07-8	Endosulfan sulfate	0.10	U
50-29-3	4,4'-DDT	0.10	U
72-43-5	Methoxychlor	0.50	U
53494-70-5	Endrin ketone	0.10	U
7421-93-4	Endrin aldehyde	0.10	U
5103-71-9	alpha-Chlordane	0.050	U
5103-74-2	gamma-Chlordane	0.050	U
8001-35-2	Toxaphene	5.0	U
12674-11-2	Aroclor-1016	1.0	U
11104-28-2	Aroclor-1221	2.0	U
11141-16-5	Aroclor-1232	1.0	U
53469-21-9	Aroclor-1242	1.0	U
12672-29-6	Aroclor-1248	1.0	U
11097-69-1	Aroclor-1254	1.0	U
11096-82-5	Aroclor-1260	1.0	U

APPENDIX C

REGIONAL WORKSHEETS

REGION I
Data Review Worksheets

Site Name NSB New London
Reference Number C-99-12-5-296

REGION I REVIEW OF ORGANIC CONTRACT LABORATORY DATA PACKAGE

The hardcopied (laboratory name) Southwest data package received at Region I has been reviewed and the quality assurance and performance data summarized. The data review included:

Case No. NUS
SDG No. 24070
No. of Samples 2

SAS No. —
Matrix aqueous

Sampling Date(s) 11/15/95
Shipping Date(s) 11/15/95
Date Rec'd by Lab 11/16/96

Traffic Report Nos: 3MSP01

Trip Blank No.: TB30-111595
Equipment Blank No.: None
Field Dup Nos: None

SOW No. _____ requires that specific analytical work be done and that associated reports be provided by the laboratory to the Regions, EMSL-LV, and SMO. The general criteria used to determine the performance were based on an examination of:

- Data Completeness
- Holding Times
- GC/MS Tuning
- Calibrations
- Blanks
- Surrogate Recoveries
- Matrix Spike/Matrix Spike Dup
- Field Duplicates
- Internal Standard Performance
- Pesticide Inst. Performance
- Compound Identification
- Compound Quantitation

Overall comments _____

Definitions and Qualifiers:

A - Acceptable data.
J - Approximate data due to quality control criteria.
R - Reject data due to quality control criteria.
U - Compound not detected.

Reviewer: Anne K. Battisto Date: Dec. 27 1995

REGION I
Data Review Worksheets

I. DATA COMPLETENESS

MISSING INFORMATION	DATE LAB CONTACTED	DATE REC'D

REGION I
Data Review Worksheets

II. HOLDING TIMES

Complete table for all samples and circle the fractions which are not within criteria.

SAMPLE ID	DATE SAMPLED	VOA DATE ANAL	BNA DATE EXTR	BNA DATE ANAL	PEST DATE EXTR	PEST DATE ANAL
TB30-111595	11/15/95	11/17/95	X	X	X	X
3MSP01	11/15/95	11/17/95	11/17/95	11/30	11/18	11/26

VOA - Unpreserved: Aromatic within 7 days, non-aromatic within 14 days of sample collection.
Preserved : Both within 14 days of sample collection.
Soils : Both within 14 days of sample collection.

BNA & PEST - Extracted within 7 days, analyzed within 40 days, soils & water.

ACTION:
1. If holding times are exceeded all positive results are estimated (J) and non-detects are estimated (UJ).
2. If holding times are grossly exceeded, the reviewer may determine that non-detects are unusable(*).

VOA - OK BNA - OK Pest - OK

REGION I
Data Review Worksheets

III. GC/MS TUNING

✓ The DFTPP performance results were reviewed and found to be within the specified criteria.

If no,
Samples affected: _____

✓ The BFB performance results were reviewed and found to be within the specified criteria.

If no,
Samples affected: _____

If mass calibration is in error refer to the Region guidelines for expanded criteria. If necessary, all associated data as unusable R.

REGION I
Data Review Worksheets

IV A. VOLATILE CALIBRATION VERIFICATION

Date of Initial Calibration : 9/18/95
Dates of Continuing Calibrations: 11/17, 11/21
Instrument ID : L
Matrix/Level : Aqueous/Low

DATE	CRITERIA OUT RF, %RSD, RF, %D	COMPOUND (VALUE)
IC		all criteria met.
	Samples Affected:	
11/17	%D > 25	Bromoform; 28.1, 1,1,2,2-Tetrachloro
	Samples Affected:	ethane; 30.9 (TB30-111595, 3MSP01)
11/21	%D > 25	Chloromethane; 26.6, Acetone; -40.0,
	Samples Affected:	2-Butanone; -34.8, Bromoform; 29.9, 4-Methyl-2-Pentanone; -28.7, 2-Hexanone; -36.0, 1,1,2,2-Tetrachloroethane-32.0,
	Samples Affected:	VBLK2, VHBLK1
	Samples Affected:	
	Samples Affected:	
	Samples Affected:	
	Samples Affected:	
	Samples Affected:	
	Samples Affected:	

1. All $\overline{RF}$'s, and RF's must be >0.05
2. All %RSD's must be<30%
3. All %D's must be <25%

ACTION:
1. If any compound has an initial $\overline{RF}$ or a continuing RF of <0.05:
   a. Flag positive results for that compound as estimated (J).
   b. Flag non-detects for that compound as unusable (R).

2. If any compound has a %RSD >30% or a %D >25%:
   a. Flag positive results for that compound as estimated (J).
   b. Flag non-detects for that compound as estimated (UJ) if the %RSD or %D is >50%.

A separate worksheet should be filled ut f r each initial curve.

No action - No positives reported.

REGION I
Data Review Worksheets

IV B. SEMIVOLATILE CALIBRATION VERIFICATION

Date of Initial Calibration : 11/14/95
Dates of Continuing Calibrations: 11/30/95
Instrument ID : V

	DATE	CRITERIA OUT RF, %RSD, RF, %D	COMPOUND
IC	11/14		All criteria met.
		Samples Affected:	
CC	11/30	%D > 50%	2,4-Dinitrophenol; 54.2 (15)
		Samples Affected:	3MSP01, SBLK1, LCS, LCSD
CC	11/30	%D > 25%	Hexachlorocyclopentadiene; 30.9,
		Samples Affected:	4,6-Dinitro-2-methylphenol; 41.9, Pentachlorophenol; 35.5, Butylbenzylphthalate 25.8, (5)
		Samples Affected:	Same as above.
		Samples Affected:	
		Samples Affected:	
		Samples Affected:	
		Samples Affected:	
		Samples Affected:	
		Samples Affected:	
		Samples Affected:	
		Samples Affected:	
		Samples Affected:	

See worksheet IV-A for criteria and actions.

A new worksheet should be filled out for each initial curve.

V A. BLANK ANALYSIS RESULTS (Sections 1 & 2)

List the contamination in the blanks below.

1. Laboratory Blanks

Level: Low

DATE	LAB ID	FRACTION/ MATRIX	COMPOUND	CONCENTRATION UNITS
11/17	VBLK1	VOA/aqueous	Methylene Chloride	4 ug/L
↓	↓	↓	Acetone	4 ug/L
11/30	SBLK1	SVOA/aqueous	Bis(2-ethylhexyl)phthalate	13 ug/L
↓	↓	↓	Diethylphthalate	2 ug/L

2. Equipment and Trip Blanks

DATE	TB #	FRACTION/ MATRIX	COMPOUND	CONCENTRATION/ UNITS

A separate worksheet should be used for low and medium level blanks.

V B. BLANK ANALYSIS RESULTS (Section 3)

3. Blank Actions

Action levels should be based upon the highest concentration of contaminant determined in any blank. The action level for samples which have been concentrated or diluted should be multiplied by the concentration/dilution factor. No positive sample result should be reported unless the concentration of the compound in the sample exceeds the action level of 10 x's the amount in the blank for the common contaminants, or 5 x's the amount for any other compound. Specific actions are as follows:

1. The concentration is less than the CRQL, report the CRQL.

2. The concentration is greater than the CRQL, but less than the action level, report the concentration found U.

3. The concentration is greater than the action level, report the concentration unqualified.

For examples refer to the Regional Guidelines.

Common contaminants = methylene chloride, acetone, 2-butanone, toluene, and phthalates.

LEVEL: Low

COMPOUND	MAX. CONC./ UNITS	ACTION LEVEL/ UNITS	CRQL
Methylene Chloride	4 ug/L	40 ug/L	10
Acetone	4 ug/L	40 ug/L	10
Diethylphthalate	2 ug/L	20 ug/L	10
Bis(2-ethylhexyl)phthalate	13 ug/L	130 ug/L	25

A separate worksheet should be used for low and medium level blanks.

REGION I
Data Review Worksheets

VI. SURROGATE SPIKE RECOVERIES

List the percent recoveries which do not meet the criteria for surrogate recovery.

Matrix: Aqueous

	VOA			B/N			A			BNA
CR #'s	TOL	BFB	DCE	NBZ	FBP	TPH	PHL	2FP	TBP	[illegible]
	All criteria met.				All criteria met.					
QC Limits										
	to	to	to	to	to	to	to	to	to	to

Surrogate Actions:

*-Advisory only

	PERCENT RECOVERY		
	<10%	10%-CRR	>CRR
Positive sample results	J	J	J
Non-detected results	R	UJ	A

CRR = Contract Required Recovery Range.
Surrogate action should be applied:

1. If at least two surrogates in a B/N or A fraction or one surrogate in the VOA fraction are out of specification, but have recoveries of >10%.
2. If any one surrogat in a fraction show <10% recovery.

REGION I – DATA VALIDATION WORKSHEETS ADDENDUM MATRIX: Aqueous

PESTICIDE/PCB CLP 3/90 SOW – SURROGATE SPIKE RECOVERIES

List th Percent Recoveries which do not meet the criteria for surrogate recovery.

TR #'S	TCX (column 1)	TCX (column 2)	DCB (column 1)	DCB (column 2)
all criteria met.				
*QC Limits	60 to 150	60 to 150	60 to 150	60 to 150

*Advisory

Data Review Worksheets

Laboratory Control
VII A. ~~MATRIX~~ SPIKE/~~MATRIX~~ SPIKE DUPLICATE

Laboratory Control
1. ~~Matrix~~ Spike/~~Matrix~~ Spike Duplicate Recoveries and Precision

TR Nos. LCS , LCSD Level: Low Matrix: Aqueous

List the percent recoveries and RPD's of compounds which do not meet the criteria stated on Form 3.

FRACTION/ MS OR MSD	COMPOUND	%REC/ RPD	QC LIMITS
VOA	all criteria met.		
SVOA/LCS	1,4- Dichlorobenzene	32% R	36-97 (UJ)
↓	1,2,4- Trichlorobenzene	36% R	39-98 (UJ)
~~SVOA/LCSD~~	~~1,4- Dichlorobenzene~~		
SVOA/LCSD	1,4- Dichlorobenzene	36% RPD	28

QUALIFICATION IS LIMITED TO THE UNSPIKED SAMPLE ONLY.

1. If any compound does not meet the Contract Required Recovery range (CRR) follow the actions stated below:

	PERCENT RECOVERY <10%	10% - CRR	>CRR
Positive Sample Results	J	J	J
Non-detected Results	R	A	A

2. If any compound does not meet the RPD criteria, flag positive results for that compound as estimated (J).

A separate worksheet should be used for each MS/MSD pair.

REGION I
Data Review Worksheets

IX. INTERNAL STANDARD PERFORMANCE

List the internal standard areas of samples which do not meet the criteria of +100% or -50% of the internal standard area in the assoc. continuing calibration standard.

SAMPLE ID	DATE	IS OUT	IS AREA/ID	ACCEPTABLE RANGE	ACTION
VOA	all	criteria	met		
SVOA	all	criteria	met		

ACTION:

1. If an IS area count is outside the criteria -50% or +100% of the associated standard:

   a. Positive results for compounds quantitated using that IS are flagged as estimated (J) for that sample fraction.
   b. Non-detects for compounds quantitated using that IS are flagged as estimated (UJ) for that sample fraction.
   c. If extremely low area counts are reported, or if performance exhibits a major drop-off, then a severe loss of sensitivity is indicated. Non-detects should then be flagged as unusable (R).

2. If an IS retention time varies more than 30 seconds, the chromatographic profile for that sample must be examined to determine if any false positives or negatives exist. For shifts of a large magnitude, the reviewer may consider partial or total rejection of the data for that sample fraction.

REGION I
Data Review Worksheets

X A. PESTICIDE INSTRUMENT PERFORMANCE (Section 1)

1. DDT Retention Time

List the DDT standards which have a retention time (RT) of less than 12 minutes on the packed column (except OV-1 or OV-101).

STANDARD ID	DATE/ TIME	RT	SAMPLES AFFECTED	ACTION
NA	See	addendum		

ACTION:

If the RT is less than 12 minutes, examine the chromatography to evaluate the separation. If adequate separation is not achieved, flag all affected compound data as unusable (R).

REGION 1
Data Review Worksheets

X B. PESTICIDE INSTRUMENT PERFORMANCE (Section 2)

2. Retention Time Windows

List the compounds which are not within the established windows.

COMPOUND	DATE (TIME)	RT	RT WINDOW	SAMPLES AFFECTED
All criteria met.				

Check the sample chromatograms of the samples analyzed after the last control standard for peaks within an expanded window. If n peaks ar present, there is usuall no effect on the data. Refer t Regional guidelines for information on qualifying data if peaks are present. peaks are present, discuss actions below:

REGION I
Data Review worksheets

XI A. PESTICIDE CALIBRATION (Sections 1 and 2)

1. Initial Calibration

List the compounds which did not meet the Relative Standard Deviation (RSD) criteria of less than 10% for the initial calibration on the quantitation column.

DATE	COMPOUND	%RSD	COLUMN	SAMPLES AFFECTED
	all criteria met.			

Flag all associated positive results as estimated (J) for samples which did not meet the %RSD criteria.

2. Analytical Sequence

Did the laboratory follow the correct 72 hour sequence described in the SOW? Yes or No

If no,

The data may be affected. The data reviewer must use professional judgement to determine the severity of the effect and qualify the data accordingly. Discuss any actions below:

_____

_____

_____

_____

REGION I
Data Review Worksheets

XI B. PESTICIDE CALIBRATION (Section 3)

3. Continuing Calibration

List the compounds which did not meet the percent difference (%D) criteria of <15% on the quantitation column or <20% on the confirmati for the continuing calibration.

DATE	COMPOUND	%D	COLUMN	SAMPLES AFFECTED
	All criteria	met.		

If the %D criteria is not met, flag all associated positive results as estimated (J).

REGION I
Data Review Worksheets

X C. PESTICIDE INSTRUMENT PERFORMANCE (Section 3)

3. DDT and Endrin Degradation

List the standards which have a DDT or Endrin breakdown of greater than 20%.

STANDARD ID	DDT OR ENDRIN	PERCENT BREAKDOWN	SAMPLES AFFECTED	DDD, DDE OR ENDRIN KETONE PRESENT
all criteria met.				

If the percent breakdown for DDT is greater than 20%:

1. Flag all positive results for DDT as estimated (J) for all samples following the last in control standard. If no DDT was present, but DDD and/or DDE are positive, then flag the quantitation limit for DDT as unusable (R).

2. Flag all positive results for DDD +/or DDE as estimated (J).

If the percent breakdown for Endrin is greater than 20%:

1. Flag all positive results for endrin as estimated (J) for all samples following the last in-control standard. If n endrin was detected, but endrin aldehyde and/or endrin ketone are positive, flag the quantitation limit for endrin as unusable

2. Flag all positive results for endrin ketone as estimated (J).

REGION I
Data Review Worksheets

X D. PESTICIDE INSTRUMENT PERFORMANCE (Section 4)

4. DBC Retention Time Check

List the percent difference for the DBC shift greater than 2% for pac columns, greater than 1.5% for wide-bore capillary columns, or greata than 0.3% for narrow-bore capillary columns.

TR #'S	DBC %DIFFERENCE	ACTIONS

If the DBC does not meet the retention time criteria, the analysis ma be flagged as unusable (R) for the affected samples, but qualificatio of the data is left up to the professional judgement of the reviewer. Discuss any qualification of the data below:

CLP 3/90 SOW PESTICIDE/PCB ADDENDUM TO REGION I WORKSHEETS

1. Pesticide Laboratory Control Sample Recovery (Form III - LCP):

Soil:

NA

Water:

Column 2 : LC1118WD: gamma-BHC 54% R
Endrin 41% R

Column 2: LD1118WD: Endrin 50% R

2. Pesticide Analyte Resolution Summary (Form VI - Pest 4):

all criteria met.

3. Pesticide Calibration Verification Summary (Form VII - Pest 1 (7D); RPD between nominal amounts and calculated amounts of PEM):

all criteria met

4. Pesticide Calibration Verification Summary (Form VII - Pest 2 (7E); RPD between nominal amounts and calculated amounts of IND A and IND B Mixtures):

No noncompliances.

5. Pesticide Florisil Cartridge Check (Form IX - Pest 1 (9A)):

all criteria

6. Pesticide Identification Summary of Single Component Analytes (Form X - Pest 1 (10A); %D between positive results on column 1 and column 2):

No positives reported in environmental sample.

REGION I
Data Review Worksheets

XII. SAMPLE QUANTITATION

In the space below, please show a minimum of one sample calculation :
fraction:

VOA: VBLK1 Acetone 4 ug/L

$$\frac{11172}{295194} \times \frac{50}{507} = 3.73 \text{ ug/L} \simeq 4 \text{ ug/L}$$

BNA: 3MSP01 Bis(2-ethylhexyl)phthalate 26 ug/L

$$\frac{176406}{123812} \times \frac{40 \text{ ng}}{1.089} \times \frac{1}{2.0 \text{ ml}} \times \frac{1000 \text{ ml}}{1000 \text{ ml}} = 26.1 \text{ ng/ml} \simeq 26 \text{ ug/L}$$

PEST/PCB:

LC1118WD Dieldrin 1.2 ug/L DB-1701

$$\frac{11254970}{91197375} \times \frac{10000 \text{ ml}}{1000 \text{ ml}} \times \frac{1}{1.0 \text{ ml}} = 1.234 \text{ ug/L} = 1.2 \text{ ug/L}$$

APPENDIX D

SUPPORT DOCUMENTATION

SOUTHWEST LABORATORY OF OKLAHOMA
1700 West Albany, Suite A / Broken Arrow, OK 74012
918-251-2858

SDG NARRATIVE
December 7, 1995

CLIENT: NUS

SDG No.: 24070

VOLATILE FRACTION

Two water samples were submitted for Volatile Organic analysis. The samples were analyzed by GC/MS following the OLM03.2 CLP Statement of Work.

Alternate columns used by Southwest Laboratory of Oklahoma for the analysis of volatile compounds by Method OLM03.2 are the Restek XTI-5 (bonded 5% phenyl-95% dimethyl polysiloxane), 30m, 0.25mm ID, 1um film thickness (Restek #12253) and the DB624, 75m, 0.53mmID Megabore, 3um film thickness (J&W

An alternate trap used for the analysis of volatile compounds by Method OLM03.2 is the Vocarb 3000 (Carbopack B/Carboxen 1000 & 1001; Tekmar #2-1066).

No major problems occurred during the analyses of these samples.

Blanks: VBLK1 contained low-level methylene chloride and acetone contamination less than CRQL.

surrogates: No problems.

Laboratory Control Spikes: No problems.

Internal Standards: No problems.

SEMIVOLATILE FRACTION

One water sample was submitted for Semivolatile Organic Analysis. The sampl was analyzed by GC/MS following the OLM03.2 CLP Organic Statement of Work.

The following column is used for the semivolatile analysis: Restek XTI-5 (bonded %5 phenyl-95% dimethyl polysiloxane), 30m, 0.25mm ID, 0.25um film thickness (Restek #12223).

No major problems occurred during the analyses of these samples.

Blanks: SBLK1 had low level phthalate contamination above CRQL at 13 ug/L, but below five times CRQL. Therefore blank was considered acceptable.

Surrogates: No problems.

Matrix Spikes: No matrix spikes were analyzed with this set of data, instead laboratory control spikes were analyzed and reported.

Laboratory Control Spikes: LCS had low recovery of 1,4-dichlorobenzene at 32% and 1,2,4-trichlorobenzene at 36% . The LCS/LCSD had high RPD for 1,4-dichlorobenzene at 36%.

Internal Standards: No problems.

Harry M. Borg

Harry M. Borg
Organic Program Manager

December 7, 1995

SDG Narrative
November 30, 1995

Case: NUS
SDG: 24070
Contract: PEST/PCB
Samples: 3MSP01.
Fraction: Pesticide/PCB

SDG 24070 consisted of 1 water sample which was analyzed for pesticide/PCBs. All samples, blanks and spikes were extracted and analyzed according to EPA SOW OLM03.2. The samples were analyzed on J&W Scientific dual analytical columns (30m x 0.32mm ID, 0.25µm film thickness, DB-17 and DB-1701). The DB-17 phase consists of (50%-Phenyl) Methylpolysiloxane and the DB-1701 phase consists of (14%-Cyanopropylphenyl) Methylpolysiloxane. These columns were specifically designed for pesticide/PCB separation as required by the EPA's SOW. All applicable manufacturer's instructions were followed for the analysis of pesticides/PCBs. Manufacturer provided information concerning the performance characteristics of the column are kept on site.

Surrogate recoveries of all method blanks, QC, and samples were within limits. The LC/LD118WD recoveries were high. The surrogate recoveries indicated acceptable extraction efficiency. The high recoveries may be due to a concentrated spike solution. The spike solution had been remade.

The following tables list the total nanograms injected on column for each calibration standard based upon amount injected on column, 1µL or 2µL:

RESOLUTION CHECK

Compounds	Total nanograms (1µL)	Total nanograms (2µL)
gamma-Chlordane	0.01	0.02
Endosulfan I	0.01	0.02
4,4'-DDE	0.02	0.04
Dieldrin	0.02	0.04
Endosulfan Sulfate	0.02	0.04
Endrin Ketone	0.02	0.04
Methoxychlor	0.1	0.2
Tetrachloro-m-xylene	0.02	0.04
Decachlorobiphenyl	0.02	0.04

PERFORMANCE EVALUATION

Compounds	Total nanograms (1µL)	Total nanograms (2µL)
gamma-BHC	0.01	0.02
alpha-BHC	0.01	0.02
4,4'-DDT	0.1	.02

CHAIN OF CUSTODY RECORD (CTO 203) * (NOTE DIFFERENT JOB NO.)

PROJECT NO.: 5082

SITE NAME: NSB NLON AREA A MODELING STUDY

SAMPLERS (SIGNATURE): S. Conti

STATION NO.	DATE 1995	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	40 ml VOA TCL Volatiles	1L Amber TCL SVOC	1L Amber PESI/PCBs	1L PE (HNO3) TAL METALS			REMARKS
TRIP BLANK	11/15	0730		✓	TB30-111595	2	2						Trip Blank
3M SEEP	"	0900		✓	3MSP01	7	2	2	2	1			From Area "A" Landfill Seep

*

RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
S. Conti	11/15/95 1630	FED EX			
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):	RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED BY (SIGNATURE):
RELINQUISHED BY (SIGNATURE):	DATE / TIME:	RECEIVED FOR LABORATORY BY (SIGNATURE):	DATE / TIME:	REMARKS: TO SW LAB OK	
		[illegible]	11/16/95 1000	AB # ~~661~~ 5462109973	

291

4:

70440 (0003)

5A

VOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
BROMOFLUOROBENZENE (BFB)

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Lab File ID: L17759.D BFB Injection Date: 09/18/95

Instrument ID: L BFB Injection Time: 1100

GC Column: DB624 ID: 0.53 (mm) Heated Purge: (Y/N) N

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	8.0 - 40.0% of mass 95	16.4
75	30.0 - 66.0% of mass 95	38.2
95	Base peak, 100% relative abundance	100.0
96	5.0 - 9.0% of mass 95	6.1
173	Less than 2.0% of mass 174	0.0 (0.0)1
174	50.0 - 120.0% of mass 95	61.4
175	4.0 - 9.0% of mass 174	3.8 (6.2)1
176	93.0 - 101.0% of mass 174	61.6 (100.3)1
177	5.0 - 9.0% of mass 176	4.6 (7.5)2

1-Value is % mass 174 2-Value is % mass 176

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	VSTD050L6	VSTD050L6	L17760.D	09/18/95	1123
02	VSTD100L6	VSTD100L6	L17762.D	09/18/95	1212
03	VSTD020L6	VSTD020L6	L17763.D	09/18/95	1237
04	VSTD010L6	VSTD010L6	L17764.D	09/18/95	1302
05	VSTD200L6	VSTD200L6	L17765.D	09/18/95	1352
06					
07					
08					
09					
10					
11					
12					
13					
14					
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6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

I Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Instrument ID: L Calibration Date(s): 09/18/95

Heated Purge: (Y/N) N Calibration Times: 1123 1352

GC Column:DB-624 ID: 0.53 (mm)

LAB FILE ID: RRF10 =L17764.D RRF20 =L17763.D
RRF50 =L17760.D RRF100=L17762.D RRF200=L17765.D

COMPOUND		RRF10	RRF20	RRF50	RRF100	RRF200	$\overline{RRF}$	% RSD
Chloromethane		0.873	0.975	1.157	1.193	1.003	1.040	12.8
Bromomethane	*	0.957	1.056	1.103	1.189	0.966	1.054	9.2*
Vinyl Chloride	*	0.971	1.133	1.316	1.391	1.160	1.194	13.7*
Chloroethane		0.703	0.830	0.927	0.936	0.780	0.835	11.8
Methylene Chloride		1.347	1.442	1.421	1.316	1.159	1.337	8.3
Acetone		0.563	0.531	0.548	0.482	0.427	0.510	10.9
Carbon Disulfide		4.363	4.868	5.189	4.388	4.222	4.606	8.8
1,1-Dichloroethene	*	1.391	1.550	1.645	1.559	1.523	1.533	5.9*
1,1-Dichloroethane	*	2.945	3.297	3.387	3.244	3.109	3.196	5.4*
1,2-Dichloroethene (total)		1.687	1.893	1.945	1.726	1.655	1.781	7.2
Chloroform	*	2.886	3.214	3.298	3.117	2.988	3.100	5.3*
1,2-Dichloroethane	*	1.527	1.727	1.726	1.519	1.428	1.586	8.5*
2-Butanone		0.812	0.872	0.821	0.797	0.725	0.805	6.6
1,1,1-Trichloroethane	*	0.474	0.536	0.521	0.484	0.469	0.497	6.0*
Carbon Tetrachloride	*	0.402	0.465	0.449	0.450	0.442	0.442	5.3*
Bromodichloromethane	*	0.430	0.474	0.469	0.432	0.412	0.443	6.0*
1,2-Dichloropropane		0.348	0.381	0.377	0.375	0.350	0.366	4.3
cis-1,3-Dichloropropene	*	0.428	0.478	0.486	0.433	0.413	0.448	7.1*
Trichloroethene	*	0.316	0.360	0.351	0.344	0.330	0.340	5.1*
Dibromochloromethane	*	0.293	0.330	0.323	0.304	0.293	0.309	5.6*
1,1,2-Trichloroethane	*	0.230	0.255	0.240	0.244	0.231	0.240	4.3*
Benzene	*	0.869	0.956	0.929	0.888	0.822	0.893	5.8*
trans-1,3-Dichloropropene	*	0.341	0.369	0.363	0.325	0.317	0.343	6.6*
Bromoform	*	0.158	0.181	0.170	0.168	0.155	0.167	6.2*
4-Methyl-2-Pentanone		0.424	0.449	0.370	0.359	0.345	0.390	11.4
2-Hexanone		0.318	0.372	0.302	0.310	0.284	0.317	10.3
Tetrachloroethene	*	0.387	0.431	0.416	0.371	0.358	0.393	7.7*
1,1,2,2-Tetrachloroethane	*	0.382	0.420	0.351	0.354	0.308	0.363	11.3*
Toluene	*	1.403	1.542	1.436	1.372	1.307	1.412	6.1*
Chlorobenzene	*	0.892	0.973	0.939	0.921	0.873	0.920	4.2*
Ethylbenzene	*	0.460	0.525	0.472	0.473	0.457	0.477	5.7*
Styrene	*	0.864	0.956	0.904	0.831	0.749	0.861	9.0*
Xylene (Total)	*	0.532	0.597	0.562	0.555	0.501	0.550	6.4*
Toluene-d8		1.099	1.087	1.256	1.194	1.289	1.185	7.6
Bromofluorobenzene	*	0.508	0.492	0.571	0.548	0.543	0.532	5.9*
1,2-Dichloroethane-d4		1.236	1.191	1.415	1.373	1.453	1.334	8.5

Compounds with required minimum RRF and maximum %RSD values.
All other compounds must meet a minimum RRF of 0.010.

FORM VI VOA OLM03.0

5A
VOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
BROMOFLUOROBENZENE (BFB)

b Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Lab File ID: L18529.D BFB Injection Date: 11/17/95

Instrument ID: L BFB Injection Time: 0906

GC Column:DB624 ID: 0.53 (mm) Heated Purge: (Y/N) N

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	8.0 - 40.0% of mass 95	17.9
75	30.0 - 66.0% of mass 95	38.6
95	Base peak, 100% relative abundance	100.0
96	5.0 - 9.0% of mass 95	6.9
173	Less than 2.0% of mass 174	0.0 (0.0)1
174	50.0 - 120.0% of mass 95	57.2
175	4.0 - 9.0% of mass 174	4.5 (7.8)1
176	93.0 - 101.0% of mass 174	57.0 (99.6)1
177	5.0 - 9.0% of mass 176	3.5 (6.2)2

1-Value is % mass 174 2-Value is % mass 176

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	VSTD050LE	VSTD050LE	L18530.D	11/17/95	0933
02	VBLK1	L951117A	L18532.D	11/17/95	1045
03	LCS1	LCS1	L18533.D	11/17/95	1125
04	LCSD1	LCSD1	L18534.D	11/17/95	1152
05	TB30-111595	24070.01	L18546.D	11/17/95	1825
06	3MSP01	24070.02	L18547.D	11/17/95	1852
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7A
VOLATILE CONTINUING CALIBRATION CHECK

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Instrument ID: L Calibration Date: 11/17/95 Time: 0933

Lab File ID: L18530.D Init. Calibration Date(s): 09/18/95

Heated Purge: (Y/N) N Init. Calibration Times: 1123 1352

GC Column:DB-624 ID: 0.53 (mm)

COMPOUND	$\overline{RRF}$	RRF50	MIN RRF	%D	MAX %D
Chloromethane	1.040	0.820		-21.2	
Bromomethane	1.054	1.026	0.100	-2.7	25.0
Vinyl Chloride	1.194	1.302	0.100	9.0	25.0
Chloroethane	0.835	0.916		9.7	
Methylene Chloride	1.337	1.578		18.0	
Acetone	0.510	0.507		-0.6	
Carbon Disulfide	4.606	4.652		1.0	
1,1-Dichloroethene	1.533	1.665	0.100	8.6	25.0
1,1-Dichloroethane	3.196	3.484	0.200	9.0	25.0
1,2-Dichloroethene (total)	1.781	1.810		1.6	
Chloroform	3.100	3.283	0.200	5.9	25.0
1,2-Dichloroethane	1.586	1.484	0.100	-6.4	25.0
2-Butanone	0.805	0.798		-0.9	
1,1,1-Trichloroethane	0.497	0.465	0.100	-6.4	25.0
Carbon Tetrachloride	0.442	0.419	0.100	-5.2	25.0
Bromodichloromethane	0.443	0.435	0.200	-1.8	25.0
1,2-Dichloropropane	0.366	0.384		4.9	
cis-1,3-Dichloropropene	0.448	0.452	0.200	0.9	25.0
Trichloroethene	0.340	0.332	0.300	-2.4	25.0
Dibromochloromethane	0.309	0.274	0.100	-11.3	25.0
1,1,2-Trichloroethane	0.240	0.229	0.100	-4.6	25.0
Benzene	0.893	0.894	0.500	0.1	25.0
trans-1,3-Dichloropropene	0.343	0.324	0.100	-5.5	25.0
Bromoform	0.167	0.120	0.100	-28.1	25.0
4-Methyl-2-Pentanone	0.390	0.378		-3.1	
2-Hexanone	0.317	0.329		3.8	
Tetrachloroethene	0.393	0.386	0.200	-1.8	25.0
1,1,2,2-Tetrachloroethane	0.363	0.251	0.300	-30.9	25.0
Toluene	1.412	1.489	0.400	5.5	25.0
Chlorobenzene	0.920	0.882	0.500	-4.1	25.0
Ethylbenzene	0.477	0.448	0.100	-6.1	25.0
Styrene	0.861	0.677	0.300	-21.4	25.0
Xylene (Total)	0.550	0.450	0.300	-18.2	25.0
T luene-d8	1.185	1.447		22.1	
Bromofluorobenzene	0.532	0.502	0.200	-5.6	25.0
1,2-Dichloroethane-d4	1.334	1.441		8.0	

All other compounds must meet a minimum RRF of 0.010.

FORM VII VOA OLM03.0

5A

VOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
BROMOFLUOROBENZENE (BFB)

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Lab File ID: L18589.D BFB Injection Date: 11/21/95

Instrument ID: L BFB Injection Time: 0852

GC Column: DB624 ID: 0.53 (mm) Heated Purge: (Y/N) N

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	8.0 - 40.0% of mass 95	18.0
75	30.0 - 66.0% of mass 95	38.7
95	Base peak, 100% relative abundance	100.0
96	5.0 - 9.0% of mass 95	6.4
173	Less than 2.0% of mass 174	0.0 (0.0)1
174	50.0 - 120.0% of mass 95	59.2
175	4.0 - 9.0% of mass 174	4.2 (7.2)1
176	93.0 - 101.0% of mass 174	57.4 (97.0)1
177	5.0 - 9.0% of mass 176	3.7 (6.5)2

1-Value is % mass 174 2-Value is % mass 176

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	VSTD050LH	VSTD050LH	L18590.D	11/21/95	1103
02	VBLK2	L951121A	L18591.D	11/21/95	1232
03	VHBLK1	VHBLK1	L18598.D	11/21/95	1625
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7A
VOLATILE CONTINUING CALIBRATION CHECK

b Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Instrument ID: L Calibration Date: 11/21/95 Time: 1103

Lab File ID: L18590.D Init. Calibration Date(s): 09/18/95

Heated Purge: (Y/N) N Init. Calibration Times: 1123 1352

GC Column:DB-624 ID: 0.53 (mm)

COMPOUND	$\overline{RRF}$	RRF50	MIN RRF	%D	MAX %D
Chloromethane	1.040	0.763		-26.6	
Bromomethane	1.054	0.900	0.100	-14.6	25.0
Vinyl Chloride	1.194	1.206	0.100	1.0	25.0
Chloroethane	0.835	0.874		4.7	
Methylene Chloride	1.337	1.285		-3.9	
Acetone	0.510	0.306		-40.0	
Carbon Disulfide	4.606	4.861		5.5	
1,1-Dichloroethene	1.533	1.700	0.100	10.9	25.0
1,1-Dichloroethane	3.196	3.630	0.200	13.6	25.0
1,2-Dichloroethene (total)	1.781	1.867		4.8	
Chloroform	3.100	3.354	0.200	8.2	25.0
1,2-Dichloroethane	1.586	1.528	0.100	-3.7	25.0
2-Butanone	0.805	0.525		-34.8	
1,1,1-Trichloroethane	0.497	0.488	0.100	-1.8	25.0
Carbon Tetrachloride	0.442	0.430	0.100	-2.7	25.0
Bromodichloromethane	0.443	0.423	0.200	-4.5	25.0
1,2-Dichloropropane	0.366	0.367		0.3	
cis-1,3-Dichloropropene	0.448	0.444	0.200	-0.9	25.0
Trichloroethene	0.340	0.338	0.300	-0.6	25.0
Dibromochloromethane	0.309	0.257	0.100	-16.8	25.0
1,1,2-Trichloroethane	0.240	0.218	0.100	-9.2	25.0
Benzene	0.893	0.883	0.500	-1.1	25.0
trans-1,3-Dichloropropene	0.343	0.314	0.100	-8.5	25.0
Bromoform	0.167	0.117	0.100	-29.9	25.0
4-Methyl-2-Pentanone	0.390	0.278		-28.7	
2-Hexanone	0.317	0.200		-36.9	
Tetrachloroethene	0.393	0.402	0.200	2.3	25.0
1,1,2,2-Tetrachloroethane	0.363	0.247	0.300	-32.0	25.0
Toluene	1.412	1.455	0.400	3.0	25.0
Chlorobenzene	0.920	0.854	0.500	-7.2	25.0
Ethylbenzene	0.477	0.448	0.100	-6.1	25.0
Styrene	0.861	0.712	0.300	-17.3	25.0
Xylene (Total)	0.550	0.459	0.300	-16.5	25.0
Toluene-d8	1.185	1.187		0.2	
Bromofluorobenzene	0.532	0.423	0.200	-20.5	25.0
1,2-Dichloroethane-d4	1.334	1.211		-9.2	

All other compounds must meet a minimum RRF of 0.010.

FORM VII VOA OLM03.0

4A
VOLATILE METHOD BLANK SUMMARY

EPA SAMPLE NO.

VBLK1

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Lab File ID: L18532.D Lab Sample ID: L951117A

Date Analyzed: 11/17/95 Time Analyzed: 1045

GC Column:DB-624 ID: 0.53 (mm) Heated Purge: (Y/N) N

Instrument ID: L

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
01	LCS1	LCS1	L18533.D	1125
02	LCSD1	LCSD1	L18534.D	1152
03	TB30-111595	24070.01	L18546.D	1825
04	3MSP01	24070.02	L18547.D	1852
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COMMENTS:

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

VBLK1

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: L951117A

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18532.D

Level: (low/med) LOW Date Received: / /

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	4	J
67-64-1	Acetone	4	J
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (Total)	10	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

VBLK1

Lab Name: SWL-TULSA Contract:

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: L951117A

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: L18532.D

Level: (low/med) LOW Date Received: / /

% Moisture: not dec. _____ Date Analyzed: 11/17/95

GC Column:DB-624 ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _____(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
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FORM I VOA-TIC OLM03.0

5B
SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Lab File ID: V11006.D DFTPP Injection Date: 11/14/95

Instrument ID: V DFTPP Injection Time: 0629

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 80.0% of mass 198	42.8
68	Less than 2.0% of mass 69	0.0 (0.0)1
69	Mass 69 relative abundance	57.0
70	Less than 2.0% of mass 69	0.4 (0.7)1
127	25.0 - 75.0% of mass 198	49.5
197	Less than 1.0% of mass 198	0.0
198	Base peak, 100% relative abundance	100.0
199	5.0 to 9.0% of mass 198	7.0
275	10.0 - 30.0% of mass 198	24.5
365	Greater than 0.75% of mass 198	4.54
441	Present, but less than mass 443	11.2
442	40.0 - 110.0% of mass 198	74.7
443	15.0 - 24.0% of mass 442	14.3 (19.2)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	SSTD050VV	SSTD050VV	V11007.D	11/14/95	0711
02	SSTD020VV	SSTD020VV	V11008.D	11/14/95	0744
03	SSTD080VV	SSTD080VV	V11009.D	11/14/95	0814
04	SSTD120VV	SSTD120VV	V11010.D	11/14/95	0844
05	SSTD160VV	SSTD160VV	V11011.D	11/14/95	0915
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6B

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

L Name: SWL-TULSA Contract: NUS

b Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

nstrument ID: V Calibration Date(s): 11/14/95

Calibration Times: 0711 0915

LAB FILE ID: RRF20 =V11008.D RRF50 =V11007.D
RRF80 =V11009.D RRF120=V11010.D RRF160=V11011.D

COMPOUND	RRF20	RRF50	RRF80	RRF120	RRF160	$\overline{RRF}$	% RSD
Phenol *	1.626	1.134	1.085	1.302	1.270	1.283	16.5*
bis(2-Chloroethyl)Ether *	1.194	1.096	0.996	0.888	0.995	1.034	11.2*
2-Chlorophenol *	1.392	1.244	1.109	1.141	1.135	1.204	9.7*
1,3-Dichlorobenzene *	1.602	1.456	1.529	1.398	1.307	1.458	7.8*
1,4-Dichlorobenzene *	1.526	1.330	1.633	1.517	1.334	1.468	8.9*
1,2-Dichlorobenzene *	1.555	1.449	1.394	1.121	1.188	1.341	13.5*
2-Methylphenol *	1.061	0.855	1.059	0.833	0.870	0.936	12.2*
2,2'-oxybis(1-Chloropropane)	1.102	0.921	0.917	0.944	0.930	0.963	8.1
4-Methylphenol *	1.179	0.873	0.792	1.097	0.889	0.966	16.9*
N-Nitroso-di-n-propylamine *	0.826	0.765	0.747	0.722	0.689	0.750	6.8*
Hexachloroethane *	0.904	0.780	0.710	0.607	0.633	0.727	16.5*
Nitrob nzene *	0.507	0.485	0.419	0.499	0.429	0.468	8.7*
Isophorone *	0.908	0.847	0.798	0.816	0.847	0.843	4.9*
^ Nitrophenol *	0.240	0.236	0.235	0.207	0.209	0.226	7.1*
-Dimethylphenol *	0.376	0.388	0.378	0.391	0.378	0.382	1.7*
bis(2-Chloroethoxy)methane *	0.449	0.417	0.385	0.393	0.393	0.407	6.4*
?,4-Dichlorophenol *	0.349	0.349	0.346	0.330	0.361	0.347	3.1*
,2,4-Trichlorobenzene *	0.415	0.415	0.415	0.404	0.422	0.414	1.5*
aphthalene *	1.064	1.069	1.051	1.032	1.179	1.079	5.3*
4-Chloroaniline	0.458	0.468	0.414	0.445	0.432	0.443	4.8
Hexachlorobutadiene	0.308	0.325	0.307	0.295	0.313	0.310	3.5
4-Chloro-3-Methylphenol *	0.365	0.366	0.333	0.324	0.347	0.347	5.4*
2-Methylnaphthalene *	0.695	0.683	0.683	0.688	0.752	0.700	4.2
Hexachlorocyclopentadiene	0.464	0.529	0.521	0.532	0.547	0.519	6.1
2,4,6-Trichlorophenol *	0.393	0.437	0.394	0.422	0.410	0.411	4.5*
2,4,5-Trichlorophenol *	0.000	0.469	0.397	0.385	0.402	0.413	9.1*
2-Chloronaphthalene *	1.110	1.126	1.051	1.003	1.045	1.067	4.7*
2-Nitroaniline	0.000	0.418	0.403	0.390	0.371	0.396	5.0
Dimethylphthalate	1.346	1.368	1.273	1.252	1.257	1.299	4.1
Acenaphthylene *	1.891	1.839	1.762	1.672	1.740	1.781	4.8*
2,6-Dinitrotoluene *	0.349	0.348	0.317	0.298	0.291	0.321	8.5*
3-Nitroaniline	0.000	0.313	0.291	0.261	0.276	0.285	7.7
Acenaphthene *	1.092	1.094	1.028	1.044	1.052	1.062	2.7*
2,4-Dinitrophenol	0.000	0.182	0.180	0.195	0.182	0.185	3.7
4-Nitrophenol	0.000	0.248	0.245	0.253	0.236	0.246	2.8
Dibenzofuran *	1.543	1.560	1.486	1.414	1.477	1.496	3.8*
2,4-Dinitrotoluene *	0.426	0.450	0.430	0.399	0.395	0.420	5.4*

* Compounds with required minimum RRF and maximum %RSD values.
'll other compounds must meet a minimum RRF of 0.010.

FORM VI SV-1 3/90

6C

SEMIVOLATILE ORGANICS INITIAL CALIBRATION DATA

I Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Cas No.: NUS SAS No.: SDG No.: 24070

Instrument ID: V Calibration Date(s): 11/14/95

Calibration Times: 0711 0915

LAB FILE ID: RRF20 =V11008.D RRF50 =V11007.D
RRF80 =V11009.D RRF120=V11010.D RRF160=V11011.D

COMPOUND	RRF20	RRF50	RRF80	RRF120	RRF160	$\overline{RRF}$	% RSD
Diethylphthalate	1.498	1.477	1.375	1.293	1.275	1.383	7.3
4-Chlorophenyl-phenylether *	0.518	0.517	0.517	0.529	0.522	0.521	0.9*
Fluorene *	1.119	1.168	1.089	1.099	1.146	1.124	2.9*
4-Nitroaniline	0.000	0.272	0.266	0.275	0.263	0.269	2.0
4,6-Dinitro-2-methylphenol	0.000	0.190	0.183	0.176	0.187	0.184	3.1
N-Nitrosodiphenylamine (1)	0.562	0.526	0.527	0.496	0.505	0.523	4.8
4-Bromophenyl-phenylether *	0.241	0.246	0.235	0.244	0.248	0.243	2.1*
Hexachlorobenzene *	0.354	0.351	0.353	0.351	0.367	0.355	1.9*
P ntachlorophenol *	0.000	0.180	0.184	0.188	0.195	0.187	3.4*
Phenanthrene *	1.125	1.099	1.067	1.052	1.123	1.093	2.9*
Anthracene *	1.035	0.996	0.969	0.937	0.984	0.984	3.6*
Carbazol	0.861	0.827	0.810	0.813	0.861	0.834	3.0
Di-n-butylphthalate	1.616	1.544	1.492	1.393	1.412	1.492	6.2
F'uoranthene *	0.905	0.938	0.952	0.950	0.975	0.944	2.7*
:ene *	2.107	1.992	1.889	1.800	1.858	1.929	6.3*
butylb nzylphthalate	1.213	1.186	1.104	1.017	1.032	1.110	7.9
3,3'-Dichlorobenzidine	0.327	0.390	0.406	0.482	0.487	0.418	16.0
Benzo(a)anthracene *	1.238	1.319	1.266	1.312	1.331	1.293	3.0*
Chrysene *	1.235	1.215	1.212	1.277	1.301	1.248	3.1*
bis(2-Ethylhexyl)phthalate	1.532	1.509	1.446	1.321	1.353	1.432	6.4
Di-n-octylphthalate	2.031	2.494	2.407	2.320	2.414	2.333	7.7
Benzo(b)fluoranthene *	1.132	1.228	1.247	1.292	1.408	1.261	7.9*
Benzo(k)fluoranthene *	1.233	1.402	1.390	1.422	1.369	1.363	5.5*
Benzo(a)pyrene *	1.009	1.141	1.112	1.164	1.203	1.126	6.5*
Indeno(1,2,3-cd)pyrene *	0.841	1.024	1.001	1.061	1.144	1.014	10.9*
Dibenz(a,h)anthracene *	0.720	0.926	0.901	0.970	1.021	0.908	12.5*
Benzo(g,h,i)perylene *	0.861	1.008	0.953	0.988	1.050	0.972	7.3*
Nitrobenzene-d5 *	0.565	0.516	0.497	0.478	0.487	0.509	6.7*
2-Fluorobiphenyl *	1.358	1.345	1.254	1.317	1.207	1.296	4.9*
Terphenyl-d14 *	1.185	1.230	1.215	1.174	1.272	1.215	3.2*
Phenol-d5 *	1.448	1.271	1.156	1.172	1.142	1.238	10.3*
2-Fluorophenol *	1.114	1.064	1.023	1.010	0.937	1.030	6.3*
2,4,6-Tribromophenol	0.162	0.184	0.186	0.185	0.200	0.183	7.2
2-Chlorophenol-d4 *	1.357	1.127	1.090	1.095	1.084	1.150	10.1*
1,2-Dichlorobenzene-d4 *	0.887	0.867	0.810	0.759	0.762	0.817	7.2*

(1) - Cannot be separated from Diphenylamine
* Compounds with required minimum RRF and maximum %RSD values.
(.l oth r compounds must meet a minimum RRF of 0.010.

FORM VI SV-2 3/90

5B
SEMIVOLATILE ORGANIC INSTRUMENT PERFORMANCE CHECK
DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

b Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Lab File ID: V11220.D DFTPP Injection Date: 11/30/95

Instrument ID: V DFTPP Injection Time: 0921

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
51	30.0 - 80.0% of mass 198	54.5
68	Less than 2.0% of mass 69	0.0 (0.0)1
69	Mass 69 relative abundance	71.4
70	Less than 2.0% of mass 69	0.0 (0.0)1
127	25.0 - 75.0% of mass 198	51.2
197	Less than 1.0% of mass 198	0.0
198	Base peak, 100% relative abundance	100.0
199	5.0 to 9.0% of mass 198	8.0
275	10.0 - 30.0% of mass 198	22.2
365	Greater than 0.75% of mass 198	4.69
441	Present, but less than mass 443	9.8
442	40.0 - 110.0% of mass 198	66.3
443	15.0 - 24.0% of mass 442	13.4 (20.2)2

1-Value is % mass 69 2-Value is % mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	SSTD050VF	SSTD050VF	V11221.D	11/30/95	0944
02	SBLK1	BL1117WD	V11223.D	11/30/95	1055
03	LCS	LC1117WD	V11224.D	11/30/95	1124
04	LCSD	LD1117WD	V11225.D	11/30/95	1153
05	3MSP01	24070.02	V11226.D	11/30/95	1222
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7B
SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Instrument ID: V Calibration Dat : 11/30/95 Time: 0944

Lab File ID: V11221.D Init. Calibration Date(s): 11/14/95

Init. Calibration Times: 0711 0915

COMPOUND	$\overline{RRF}$	RRF50	MIN RRF	%D	MAX %D
Phenol	1.283	1.090	0.800	15.1	25.0
bis(2-Chloroethyl)Ether	1.034	0.933	0.700	9.8	25.0
2-Chlorophenol	1.204	1.021	0.800	15.2	25.0
1,3-Dichlorobenzene	1.458	1.549	0.600	-6.2	25.0
1,4-Dichlorobenzene	1.468	1.395	0.500	5.0	25.0
1,2-Dichlorobenzene	1.341	1.293	0.400	3.6	25.0
2-Methylphenol	0.936	0.783	0.700	16.3	25.0
2,2'-oxybis(1-Chloropropane)	0.963	0.898		6.7	
4-Methylphenol	0.966	0.774	0.600	19.8	25.0
N-Nitroso-di-n-propylamine	0.750	0.580	0.500	22.6	25.0
Hexachloroethane	0.727	0.712	0.300	2.0	25.0
Nitrobenzene	0.468	0.554	0.200	-18.6	25.0
Isophorone	0.843	0.828	0.400	1.8	25.0
2-Nitrophenol	0.226	0.212	0.100	6.2	25.0
2,4-Dimethylphenol	0.382	0.422	0.200	-10.4	25.0
bis(2-Chloroethoxy)methane	0.407	0.473	0.300	-16.1	25.0
2,4-Dichlorophenol	0.347	0.365	0.200	-5.1	25.0
1,2,4-Trichlorobenzene	0.414	0.493	0.200	-19.0	25.0
Naphthalene	1.079	1.149	0.700	-6.5	25.0
4-Chloroaniline	0.443	0.423		4.5	
Hexachlorobutadiene	0.310	0.377		-21.8	
4-Chloro-3-Methylphenol	0.347	0.333	0.200	4.0	25.0
2-Methylnaphthalene	0.700	0.764	0.400	-9.1	25.0
Hexachlorocyclopentadiene	0.519	0.359		30.9	
2,4,6-Trichlorophenol	0.411	0.420	0.200	-2.2	25.0
2,4,5-Trichlorophenol	0.413	0.462	0.200	-11.8	25.0
2-Chloronaphthalene	1.067	1.179	0.800	-10.5	25.0
2-Nitroaniline	0.396	0.458		-15.8	
Dimethylphthalate	1.299	1.377		-6.0	
Acenaphthylene	1.781	1.818	0.900	-2.1	25.0
2,6-Dinitrotoluene	0.321	0.332	0.200	-3.4	25.0
3-Nitroaniline	0.285	0.303		-6.4	
Ac naphthene	1.062	1.068	0.900	-0.5	25.0
2,4-Dinitrophenol	0.185	0.085		54.2	
4-Nitrophenol	0.246	0.256		-4.1	
Dibenzofuran	1.496	1.575	0.800	-5.3	25.0
2,4-Dinitrotoluene	0.420	0.413	0.200	1.6	25.0

All other compounds must meet a minimum RRF of 0.010.

FORM VII SV-1 3/90

7C

SEMIVOLATILE CONTINUING CALIBRATION CHECK

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Instrument ID: V Calibration Date: 11/30/95 Time: 0944

Lab File ID: V11221.D Init. Calibration Date(s): 11/14/95

Init. Calibration Times: 0711 0915

COMPOUND	$\overline{RRF}$	RRF50	MIN RRF	%D	MAX %D
Di thylphthalate	1.383	1.508		-9.0	
4-Chlorophenyl-phenylether	0.521	0.567	0.400	-8.9	25.0
Fluorene	1.124	1.134	0.900	-0.9	25.0
4-Nitroaniline	0.269	0.274		-1.8	
4,6-Dinitro-2-methylphenol	0.184	0.107		42.9	
N-Nitrosodiphenylamine (1)	0.523	0.548		-4.7	
4-Bromophenyl-phenylether	0.243	0.251	0.100	-3.3	25.0
Hexachlorobenzene	0.355	0.364	0.100	-2.3	25.0
P ntachlorophenol	0.187	0.121	0.050	35.5	25.0
Phenanthrene	1.093	1.082	0.700	1.0	25.0
Anthracene	0.984	1.048	0.700	-6.5	25.0
Carbazole	0.834	0.931		-11.5	
Di-n-butylphthalate	1.492	1.508		-1.1	
Fluoranthene	0.944	1.029	0.600	-9.0	25.0
Pyr ne	1.929	1.495	0.600	22.5	25.0
Butylbenzylphthalate	1.110	0.824		25.8	
3,3'-Dichlorobenzidine	0.418	0.443		-5.8	
Benzo(a)anthracene	1.293	1.246	0.800	3.6	25.0
Chrysene	1.248	1.219	0.700	2.3	25.0
bis(2-Ethylhexyl)phthalate	1.432	1.089		23.9	
Di-n-octylphthalate	2.333	1.822		21.9	
Benzo(b)fluoranthene	1.261	1.287	0.700	-2.0	25.0
Benzo(k)fluoranthene	1.363	1.400	0.700	-2.7	25.0
Benzo(a)pyrene	1.126	1.110	0.700	1.4	25.0
Indeno(1,2,3-cd)pyrene	1.014	1.119	0.500	-10.4	25.0
Dibenz(a,h)anthracene	0.908	1.041	0.400	-14.7	25.0
Benzo(g,h,i)perylene	0.972	1.093	0.500	-12.4	25.0
Nitrobenzene-d5	0.509	0.619	0.200	-21.7	25.0
2-Fluorobiphenyl	1.296	1.494	0.700	-15.3	25.0
Terphenyl-d14	1.215	1.002	0.500	17.5	25.0
Phenol-d5	1.238	0.982	0.800	20.7	25.0
2-Fluorophenol	1.030	0.969	0.600	5.9	25.0
2,4,6-Tribromophenol	0.183	0.185		-0.7	
2-Chlorophenol-d4	1.150	0.963	0.800	16.3	25.0
1,2-Dichlorobenzene-d4	0.817	0.773	0.400	5.4	25.0

(1) Cannot be separated from Diphenylamine
All other compounds must meet a minimum RRF of 0.010.

FORM VII SV-2 3/90

4B
SEMIVOLATILE METHOD BLANK SUMMARY

EPA SAMPLE NO.

SBLK1

Lab Nam : SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Lab Fil ID: V11223.D Lab Sample ID: BL1117WD

Instrument ID: V Date Extracted: 11/17/95

Matrix: (soil/water) WATER Date Analyzed: 11/30/95

Level:(low/med) LOW Time Analyzed: 1055

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED
01	LCS	LC1117WD	V11224.D	11/30/95
02	LCSD	LD1117WD	V11225.D	11/30/95
03	3MSP01	24070.02	V11226.D	11/30/95
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COMMENTS:

1B

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLK1

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: BL1117WD

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11223.D

Level: (low/med) LOW Date Received: / /

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cl anup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
108-95-2	Phenol	10	U
111-44-4	bis(2-Chloroethyl)Ether	10	U
95-57-8	2-Chlorophenol	10	U
541-73-1	1,3-Dichlorobenzene	10	U
106-46-7	1,4-Dichlorobenzene	10	U
95-50-1	1,2-Dichlorobenzene	10	U
95-48-7	2-Methylphenol	10	U
108-60-1	2,2'-oxybis(1-Chloropropane)	10	U
106-44-5	4-Methylphenol	10	U
621-64-7	N-Nitroso-di-n-propylamine	10	U
67-72-1	Hexachloroethane	10	U
98-95-3	Nitrobenzene	10	U
78-59-1	Isophorone	10	U
88-75-5	2-Nitrophenol	10	U
105-67-9	2,4-Dimethylphenol	10	U
111-91-1	bis(2-Chloroethoxy)methane	10	U
120-83-2	2,4-Dichlorophenol	10	U
120-82-1	1,2,4-Trichlorobenzene	10	U
91-20-3	Naphthalene	10	U
106-47-8	4-Chloroaniline	10	U
87-68-3	Hexachlorobutadiene	10	U
59-50-7	4-Chloro-3-Methylphenol	10	U
91-57-6	2-Methylnaphthalene	10	U
77-47-4	Hexachlorocyclopentadiene	10	U
88-06-2	2,4,6-Trichlorophenol	10	U
95-95-4	2,4,5-Trichlorophenol	25	U
91-58-7	2-Chloronaphthalene	10	U
88-74-4	2-Nitroaniline	25	U
131-11-3	Dimethylphthalate	10	U
208-96-8	Acenaphthylene	10	U
606-20-2	2,6-Dinitrotoluene	10	U
99-09-2	3-Nitroaniline	25	U
83-32-9	Acenaphthene	10	U

1C
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.

SBLK1

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: BL1117WD

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11223.D

Level: (low/med) LOW Date Received: / /

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.0

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
51-28-5	2,4-Dinitrophenol	25	U
100-02-7	4-Nitrophenol	25	U
132-64-9	Dibenzofuran	10	U
121-14-2	2,4-Dinitrotoluene	10	U
84-66-2	Diethylphthalate	2	J
7005-72-3	4-Chlorophenyl-phenylether	10	U
86-73-7	Fluorene	10	U
100-01-6	4-Nitroaniline	25	U
534-52-1	4,6-Dinitro-2-methylphenol	25	U
86-30-6	N-Nitrosodiphenylamine (1)	10	U
101-55-3	4-Bromophenyl-phenylether	10	U
118-74-1	Hexachlorobenzene	10	U
87-86-5	Pentachlorophenol	25	U
85-01-8	Phenanthrene	10	U
120-12-7	Anthracene	10	U
86-74-8	Carbazole	10	U
84-74-2	Di-n-butylphthalate	10	U
206-44-0	Fluoranthene	10	U
129-00-0	Pyrene	10	U
85-68-7	Butylbenzylphthalate	10	U
91-94-1	3,3'-Dichlorobenzidine	10	U
56-55-3	Benzo(a)anthracene	10	U
218-01-9	Chrysene	10	U
117-81-7	bis(2-Ethylhexyl)phthalate	13	
117-84-0	Di-n-octylphthalate	10	U
205-99-2	Benzo(b)fluoranthene	10	U
207-08-9	Benzo(k)fluoranthene	10	U
50-32-8	Benzo(a)pyrene	10	U
193-39-5	Indeno(1,2,3-cd)pyrene	10	U
53-70-3	Dibenz(a,h)anthracene	10	U
191-24-2	Benzo(g,h,i)perylene	10	U

(1) - Cannot be separated from Diphenylamine

FORM I SV-2 3/90

1F

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

EPA SAMPLE NO.

SBLK1

Lab Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

Matrix: (soil/water) WATER Lab Sample ID: BL1117WD

Sample wt/vol: 1000 (g/mL) ML Lab File ID: V11223.D

Level: (low/med) LOW Date Received: / /

% Moisture: _____ decanted: (Y/N)___ Date Extracted: 11/17/95

Concentrated Extract Volume: 1000(uL) Date Analyzed: 11/30/95

Injection Volume: 2.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: 7.0

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
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29.				
30.				

3C

WATER SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

·b Name: SWL-TULSA Contract: NUS

Lab Code: SWOK Cas No.: NUS SAS No.: SDG No.: 24070

Matrix Spike - EPA Sample No.: LCS

COMPOUND	SPIKE ADDED (ug/L)	SAMPLE CONCENTRATION (ug/L)	MS CONCENTRATION (ug/L)	MS % REC #	QC. LIMITS REC.
Phenol	75	0	35	47	12-110
2-Chlorophenol	75	0	40	53	27-123
1,4-Dichlorobenzene	50	0	16	32*	36- 97
N-Nitroso-di-n-prop.(1)	50	0	24	48	41-116
1,2,4-Trichlorobenzene	50	0	18	36	39- 98
4-Chloro-3-Methylphenol	75	0	42	56	23- 97
Acenaphthene	50	0	23	46	46-118
4-Nitrophenol	75	0	47	63	10- 80
2,4-Dinitrotoluene	50	0	24	48	24- 96
Pentachlorophenol	75	0	45	60	9-103
Pyrene	50	0	21	42	26-127

COMPOUND	SPIKE ADDED (ug/L)	MSD CONCENTRATION (ug/L)	MSD % REC #	% RPD #	QC LIMITS RPD	QC LIMITS REC.
Phenol	75	50	67	35	42	12-110
2-Chlorophenol	75	58	77	37	40	27-123
1,4-Dichlorobenzene	50	23	46	36*	28	36- 97
N-Nitroso-di-n-prop.(1)	50	26	52	8	38	41-116
1,2,4-Trichlorobenzene	50	20	40	10	28	39- 98
4-Chloro-3-Methylphenol	75	39	52	7	42	23- 97
Acenaphthene	50	28	56	20	31	46-118
4-Nitrophenol	75	51	68	8	50	10- 80
2,4-Dinitrotoluene	50	27	54	12	38	24- 96
Pentachlorophenol	75	45	60	0	50	9-103
Pyrene	50	28	56	28	31	26-127

(1) N-Nitroso-di-n-propylamine

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: 1 out of 11 outside limits
Spike Recovery: 2 out of 22 outside limits

COMMENTS: _____

8D
PESTICIDE ANALYTICAL SEQUENCE

Lab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

GC Column: DB-17 ID: 0.32(mm) Init. Calib. Date(s): 11/24/95 11/24/95

Instrument ID: HP_02A

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

MEAN SURROGATE RT FROM INITIAL CALIBRATION
TCX: 7.51 DCB: 21.46

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT #	DCB RT #
01	RESC2Q	5-311-14	11/24/95	1645	7.51	21.46
02	PEM2Y	5-355-14	11/24/95	1716	7.51	21.46
03	AR16602H	5-348-14	11/24/95	1746	7.51	21.46
04	AR12212Q	5-349-14	11/24/95	1817	7.51	21.46
05	AR12322Q	5-350-14	11/24/95	1848	7.51	21.46
06	AR12422Q	5-351-14	11/24/95	1919	7.51	21.46
07	AR12482V	5-352-14	11/24/95	1949	7.51	21.46
08	AR12542V	5-353-14	11/24/95	2020	7.51	21.46
09	TOXAPH2Q	5-354-14	11/24/95	2051	7.51	21.46
10	INDAL2Q	8-62-5	11/24/95	2122	7.51	21.46
11	INDBL2Q	8-65-5	11/24/95	2152	7.51	21.46
12	INDAM2I	8-61-5	11/24/95	2223	7.51	21.46
13	INDBM2I	8-64-5	11/24/95	2254	7.51	21.46
14	INDAH2Q	8-60-5	11/24/95	2324	7.51	21.46
15	INDBH2Q	8-63-5	11/24/95	2355	7.51	21.46
16	PIBLK2Q	5-310-14	11/25/95	0026	7.51	21.46
17	PEM2Z	5-355-14	11/25/95	0057	7.51	21.46
18	PIBLK2S	5-310-14	11/25/95	1853	7.51	21.47
19	PEM2A	5-355-14	11/25/95	1924	7.51	21.47
20	PBLKWD	PBLKWD	11/25/95	1954	7.51	21.46
21	ZZZZZ	PBLKWA	11/25/95	2056	7.51	21.46
22	ZZZZZ	PBLKWJ	11/25/95	2158	7.51	21.46
23	LC1118WD	LC1118WD	11/25/95	2259	7.51	21.46
24	LD1118WD	LD1118WD	11/25/95	2330	7.51	21.46
25	ZZZZZ	LC1116WA	11/26/95	0001	7.51	21.46
26	ZZZZZ	LD1116WA	11/26/95	0032	7.51	21.46
27	3MSP01	24070.02	11/26/95	0103	7.51	21.46
28	ZZZZZ	24060.12	11/26/95	0134	7.51	21.46
29	ZZZZZ	24131.01	11/26/95	0235	7.51	21.46
30	ZZZZZ	24131.02	11/26/95	0306	7.51	21.46
31	PIBLK2T	5-310-14	11/26/95	0510	7.51	21.46
32	INDAM2K	8-61-5	11/26/95	0541	7.51	21.46

	QC LIMITS
TCX = Tetrachloro-m-xylene	(+/- 0.05 MINUTES)
DCB = Decachlorobiphenyl	(+/- 0.10 MINUTES)

Column to be used to flag retention time values with an asterisk.
* Values outside of QC limits

8D
PESTICIDE ANALYTICAL SEQUENCE

Lab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

GC Column: DB-17 ID: 0.32(mm) Init. Calib. Date(s): 11/24/95 11/24/95

Instrument ID: HP_02A

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

MEAN SURROGATE RT FROM INITIAL CALIBRATION
TCX: 7.51 DCB: 21.46

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT #	DCB RT #
01	INDBM2K	8-64-5	11/26/95	0611	7.51	21.46
02	ZZZZZ	PBLKSD	11/26/95	0713	7.51	21.46
03	ZZZZZ	LC1115SD	11/26/95	0815	7.51	21.45
04	ZZZZZ	LD1115SD	11/26/95	0846	7.51	21.45
05	ZZZZZ	24060.11	11/26/95	0917	7.51	21.48
06	PIBLK2U	5-310-14	11/26/95	1355	7.51	21.46
07	PEM2B	5-355-14	11/26/95	1426	7.51	21.46
08						
09						
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27						
28						
29						
30						
31						
32						

QC LIMITS
TCX = Tetrachloro-m-xylene (+/- 0.05 MINUTES)
DCB = Decachlorobiphenyl (+/- 0.10 MINUTES)

Column to be used to flag retention time values with an asterisk.
* Values outside of QC limits

8D
PESTICIDE ANALYTICAL SEQUENCE

ab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

GC Column: DB-1701 ID: 0.32(mm) Init. Calib. Date(s): 11/24/95 11/24/95

Instrument ID: HP_02B

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

MEAN SURROGATE RT FROM INITIAL CALIBRATION
TCX: 7.64 DCB: 20.19

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT #	DCB RT #
01	RESC2Q	5-311-14	11/24/95	1645	7.64	20.18
02	PEM2Y	5-355-14	11/24/95	1716	7.64	20.19
03	AR16602H	5-348-14	11/24/95	1746	7.64	20.19
04	AR12212Q	5-349-14	11/24/95	1817	7.64	20.19
05	AR12322Q	5-350-14	11/24/95	1848	7.64	20.19
06	AR12422Q	5-351-14	11/24/95	1919	7.64	20.19
07	AR12482V	5-352-14	11/24/95	1949	7.64	20.19
08	AR12542V	5-353-14	11/24/95	2020	7.64	20.19
09	TOXAPH2Q	5-354-14	11/24/95	2051	7.64	20.19
10	INDAL2Q	8-62-5	11/24/95	2122	7.64	20.19
11	INDBL2Q	8-65-5	11/24/95	2152	7.64	20.19
12	INDAM2I	8-61-5	11/24/95	2223	7.64	20.19
13	INDBM2I	8-64-5	11/24/95	2254	7.64	20.19
14	INDAH2Q	8-60-5	11/24/95	2324	7.64	20.18
15	INDBH2Q	8-63-5	11/24/95	2355	7.64	20.18
16	PIBLK2Q	5-310-14	11/25/95	0026	7.64	20.19
17	PEM2Z	5-355-14	11/25/95	0057	7.64	20.19
18	PIBLK2S	5-310-14	11/25/95	1853	7.64	20.19
19	PEM2A	5-355-14	11/25/95	1924	7.64	20.19
20	PBLKWD	PBLKWD	11/25/95	1954	7.65	20.18
21	ZZZZZ	PBLKWA	11/25/95	2056	7.64	20.18
22	ZZZZZ	PBLKWJ	11/25/95	2158	7.64	20.19
23	LC1118WD	LC1118WD	11/25/95	2259	7.64	20.18
24	LD1118WD	LD1118WD	11/25/95	2330	7.64	20.18
25	ZZZZZ	LC1116WA	11/26/95	0001	7.64	20.19
26	ZZZZZ	LD1116WA	11/26/95	0032	7.64	20.19
27	3MSP01	24070.02	11/26/95	0103	7.64	20.18
28	ZZZZZ	24060.12	11/26/95	0134	7.64	20.19
29	ZZZZZ	24131.01	11/26/95	0235	7.64	20.18
30	ZZZZZ	24131.02	11/26/95	0306	7.64	20.19
31	PIBLK2T	5-310-14	11/26/95	0510	7.64	20.19
32	INDAM2K	8-61-5	11/26/95	0541	7.64	20.19

	QC LIMITS
TCX = Tetrachloro-m-xylene	(+/- 0.05 MINUTES)
DCB = Decachlorobiphenyl	(+/- 0.10 MINUTES)

Column to be used to flag retention time values with an asterisk.
* Values outside of QC limits

8D
PESTICIDE ANALYTICAL SEQUENCE

ab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No.: NUS SAS No.: SDG No.: 24070

GC Column: DB-1701 ID: 0.32(mm) Init. Calib. Date(s): 11/24/95 11/24/95

Instrument ID: HP_02B

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

MEAN SURROGATE RT FROM INITIAL CALIBRATION
TCX: 7.64 DCB: 20.19

	EPA SAMPLE NO.	LAB SAMPLE ID	DATE ANALYZED	TIME ANALYZED	TCX RT #	DCB RT #
01	INDBM2K	8-64-5	11/26/95	0611	7.64	20.19
02	ZZZZZ	PBLKSD	11/26/95	0713	7.64	20.18
03	ZZZZZ	LC1115SD	11/26/95	0815	7.64	20.18
04	ZZZZZ	LD1115SD	11/26/95	0846	7.64	20.18
05	ZZZZZ	24060.11	11/26/95	0917	7.64	20.17
06	PIBLK2U	5-310-14	11/26/95	1355	7.64	20.19
07	PEM2B	5-355-14	11/26/95	1426	7.64	20.19
08						
09						
10						
11						
12						
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22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						

	QC LIMITS
TCX = Tetrachloro-m-xylene	(+/- 0.05 MINUTES)
DCB = Decachlorobiphenyl	(+/- 0.10 MINUTES)

Column to be used to flag retention time values with an asterisk.
* Values outside of QC limits

3LCC

WATER PESTICIDE LABORATORY CONTROL SPIKE RECOVERY FORM

Lab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No: NUS SDG No: 24070

Lab Sample ID: LC1118WD
LCS Aliquot: 1000 mL
Conc. Extract Volume: 10000 uL
Injection Vol: 1.00 uL
Sulfur Cleanup:(y/n) N

LCS Lot No: 5-264-14
Date Extracted: 11/18/95
Date Analyzed: 11/25/95
Dilution Factor: 1.00
pH: 7.00

Instrument ID(1) : HP_02A GC Column(1) :DB-17 ID:.32mm

COMPOUND	AMOUNT ADDED (ug/L)	AMOUNT RECOVERED (ug/L)	% REC #	QC LIMITS
gamma-BHC (Lindane)	1.00	.635	64	56-123
Heptachlor	1.00	.643	64	40-131
Aldrin	1.00	.569	57	40-120
Dieldrin	2.00	1.31	66	52-126
Endrin	2.00	1.48	74	56-121
4,4'-DDT	2.00	1.80	90	38-127

Instrument ID(2) : HP_02B GC Column(2) : DB-1701 ID:.32mm

COMPOUND	AMOUNT ADDED (ug/L)	AMOUNT RECOVERED (ug/L)	% REC #	QC LIMITS
gamma-BHC (Lindane)	1.00	.541	54 *	56-123
Heptachlor	1.00	.537	54	40-131
Aldrin	1.00	.492	49	40-120
Dieldrin	2.00	1.23	62	52-126
Endrin	2.00	.827	41 *	56-121
4,4'-DDT	2.00	1.50	75	38-127

Column to be used to flag recovery and RPD values with an asterisk
* Valu s outside of QC limits

LCS Recovery: 2 Outside limits out of 12 total.

COMMENTS: _____

FORM III LCP

3LCC

WATER PESTICIDE LABORATORY CONTROL SPIKE RECOVERY FORM

Lab Name: SWL-TULSA Contract: PEST/PCB

Lab Code: SWOK Case No: NUS SDG No: 24070

Lab Sample ID: LD1118WD
LCS Aliquot: 1000 mL
Conc. Extract Volume: 10000 uL
Injection Vol: 1.00 uL
Sulfur Cleanup:(y/n) N

LCS Lot No: 5-264-14
Date Extracted: 11/18/95
Date Analyzed: 11/25/95
Dilution Factor: 1.00
pH: 7.00

Instrument ID(1) : HP_02A GC Column(1) :DB-17 ID:.32mm

COMPOUND	AMOUNT ADDED (ug/L)	AMOUNT RECOVERED (ug/L)	% REC #	QC LIMITS
gamma-BHC (Lindane)	1.00	.719	72	56-123
Heptachlor	1.00	.704	70	40-131
Aldrin	1.00	.632	63	40-120
Dieldrin	2.00	1.50	75	52-126
Endrin	2.00	1.66	83	56-121
4,4'-DDT	2.00	2.01	101	38-127

Instrument ID(2) : HP_02B GC Column(2) : DB-1701 ID:.32mm

COMPOUND	AMOUNT ADDED (ug/L)	AMOUNT RECOVERED (ug/L)	% REC #	QC LIMITS
gamma-BHC (Lindane)	1.00	.642	64	56-123
Heptachlor	1.00	.595	60	40-131
Aldrin	1.00	.557	56	40-120
Dieldrin	2.00	1.40	70	52-126
Endrin	2.00	1.00	50 *	56-121
4,4'-DDT	2.00	1.69	85	38-127

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

LCS Recovery: 1 Outside limits out of 12 total.

COMMENTS: _____

FORM III LCP

APPENDIX G.2

INORGANICS (METALS AND CYANIDE) DATA PACKAGE

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-12-5-295

TO : J.L. GLORIEUX

DATE: DECEMBER 27, 1995

FROM: WILLIAM J. BROTZ

COPIES: DV FILE

SUBJECT: INORGANIC DATA VALIDATION - TAL METALS
CTO 203, SUBASE NEW LONDON, GROTON, CONNECTICUT
PROJECT NO. 5082, SDG 24070

1/Aqueous/ 3MSP01

Introduction

A validation was performed on the inorganic analytical data from CTO 203, Subase New London, SDG No. 24070; one (1) aqueous sample was included for these analyses. No field duplicate pairs were included with this SDG. This sample was analyzed for Target Analyte List (TAL) metals. The samples were collected by Brown and Root Environmental on November 15, 1995.

All analyses were performed by Southwest Laboratories of Oklahoma using Contract Laboratory Program (CLP) Statement of Work (SOW) ILM03.1 analytical and reporting protocols. These data are reported as NEESA Level D and were evaluated based on the following parameters:

* Data Completeness
* Holding Times
* Calibration Verifications
  Laboratory Blank Analyses
* ICP Interference Check Sample Results
* Laboratory Control Sample Results
* Laboratory Duplicate Results
* Detection Limits
* Sample Quantitation

* - All quality control criteria were met for this parameter.

The attached Table 1 summarizes the validation recommendations which were based on the following information:

Note: All analyses were conducted via Inductively Coupled Plasma methodology with the exception of mercury which was analyzed via Cold Vapor AA. Matrix Spike and ICP Serial Duplicate samples were not included in this SDG.

Laboratory Blank Analyses

The following contaminants were detected in the laboratory method and field quality control blanks at the maximum concentrations indicated below:

Analyte	Maximum Concentration (ug/L)	Action Level Aqueous
aluminum[1]	10.3 ug/L	51.5 ug/L
sodium	152.5 ug/L	763 ug/L
thallium[1]	3.1 ug/L	15.5 ug/L
zinc[1]	2.4 ug/L	12.0 ug/L

Samples affected : All

[1] Contaminant was detected at a maximum concentration in an associated laboratory preparation blank.

An action level of 5X the maximum positive concentration has been established to evaluate the sample data. Sample aliquot and dilution factors were considered prior to the application of the action levels. The positive result for aluminum within the action level is qualified as nondetected, "U". No actions were required for the remaining analytes as all results were either > action level or were nondetects.

Base line drifting (i.e., negative concentrations) and poor instrument response was noted for calcium in some laboratory method blanks. Negative concentrations > 2X IDL for this analyte were evident in these blanks. The positive result for calcium was qualified as estimated, "J".

Executive Summary

Laboratory Performance: The data are acceptable for use as qualified. Detection limits for several analytes were raised as a result of blank contamination. Base line drifting and poor instrument response was noted for calcium.

Other Factors Affecting Data Quality: None.

The data for these analysis were reviewed with reference to the "National Functional Guidelines for inorganic Data Validation", as amended for use within USEPA Region I; and the NEESA document entitled "Sampling and Chemical Analysis Quality Assurance requirements for the Navy Installation Restoration Program" (NEESA 20.2-047B; 6/88).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein was validated according to the agreed upon validation criteria as specified in the NEESA Guidelines and the Quality Assurance Project Plan (QAPP)."

Brown and Root Environmental
William J. Brotz
Chemist/Data Validator

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Regional Worksheets
3. Appendix C - Support Documentation

SUBASE NEW LONDON
SDG 24070

TABLE 1 - RECOMMENDATION SUMMARY

Aluminum	A[1]	Magnesium
Antimony		Manganese
Arsenic		Mercury
Barium		Nickel
Beryllium		Potassium
Cadmium		Selenium
Calcium	A[2]	Silver
Chromium		Sodium
Cobalt		Thallium
Copper		Vanadium
Iron		Zinc
Lead		Cyanide

If the field is left blank, the qualifier is A - Accept all data.

A[1] - Accept data but qualify as nondetected, "U", as a result of laboratory blank contamination.

A[2] - Accept data, but qualify positive result as estimated, "J", as a result of baseline drifting and poor instrument response.

APPENDIX A
QUALIFIED LABORATORY RESULTS

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

07002

Lab Name: SOUTHWEST_LAB_OF_OK Contract: _____
Lab Code: SWOK Case No.: 24070 SAS No.: _____ SDG No.: 24070
Matrix (soil/water): WATER Lab Sample ID: 2407002
Level (low/med): LOW Date Received: 11/16/95
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M	
7429-90-5	Aluminum	51.1	B		P	u
7440-36-0	Antimony	2.0	U		P	
7440-38-2	Arsenic	4.0	U		P	
7440-39-3	Barium	46.6	B		P	
7440-41-7	Beryllium	1.4	B		P	
7440-43-9	Cadmium	1.0	U		P	
7440-70-2	Calcium	22400			P	J
7440-47-3	Chromium	1.5	B		P	
7440-48-4	Cobalt	1.5	B		P	
7440-50-8	Copper	1.0	U		P	
7439-89-6	Iron	2760			P	
7439-92-1	Lead	2.0	U		P	
7439-95-4	Magnesium	8660			P	
7439-96-5	Manganese	605			P	
7439-97-6	Mercury	0.20	U		AV	
7440-02-0	Nickel	3.8	B		P	
7440-09-7	Potassium	5020			P	
7782-49-2	Selenium	2.0	U		P	
7440-22-4	Silver	2.0	U		P	
7440-23-5	Sodium	46800			P	
7440-28-0	Thallium	3.0	U		P	
7440-62-2	Vanadium	1.0	U		P	
7440-66-6	Zinc	42.6			P	
	Cyanide				NR	

Color Before: COLORLESS Clarity Before: CLEAR Texture:
Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:
CLIENT_ID = 3MSP01

APPENDIX B
REGIONAL WORKSHEETS

REGION I
Data Review Worksheets

Site Name NSB New London
Reference Number 24070

REGION I REVIEW OF INORGANIC CONTRACT LABORATORY DATA PACKAGE

The hardcopied (laboratory name) S.W. Labs of Oklahoma data package rece: at Region I has been reviewed and the quality assurance and performa: data summarized. The data review included:

Case No. _____ SAS No. _____ Sampling Date(s) 11-15-95
SDG. No. 24070 Matrix Aqueous Shipping Date(s) 11-15-95
No. of Samples 1 Aq. Date Rec'd by Lab 11-16-95

Traffic Report Nos: 3MSP01

Trip Blank No.: NA
Equipment Blank No.: NA
Field Dup Nos: NA

SOW No. _____ requires that specific analytical work be done and tr associated reports be provided by the laboratory to the Regions. SMS IV, and SMO. The general criteria used to determine the performance we based on an examination of:

- Data Completeness
- Holding Times
- Calibrations
- Blanks
- ICP Interference Check Results
- Matrix Spike Recoveries
- Laboratory Duplicates
- Field Duplicates
- Lab Control Sample Results
- Furnace AA Results
- ICP Serial Dilution Results
- Detection Limit Results
- Sample Quantitation

Overall Comments: _____

Definitions and Qualifiers:

A - Acceptable data.
J - Approximate data due to quality control criteria.
R - Reject data due to quality control criteria.
U - Analyte not detected.

Reviewer: William J. Beotz Date: 12/27/95

REGION I
Data Review Worksheets

I. DATA COMPLETENESS

MISSING INFORMATION	DATE LAB CONTACTED	DATE REC'D
DATA PACKAGE COMPLETE AS SUBMITTED		

II. HOLDING TIMES

Complete table for all samples and circle the analysis date for samples not within criteria.

SAMPLE ID	DATE SAMPLED	HG DATE ANALYSIS	CYANIDE DATE ANALYSIS	OTHERS DATE ANALYSIS	pH	ACTION
3MSP01	11-15-95	11-21-95	NA	11-21-95		None

METALS - 180 DAYS FROM SAMPLE COLLECTION
MERCURY - 28 DAYS FROM SAMPLE COLLECTION
CYANIDE - 14 DAYS FROM SAMPLE COLLECTION

ACTION:

1. If holding times are exceeded all positive results a estimated (J) and non-detects are estimated (UJ).

2. If holding times are grossly exceeded, the reviewer ma determine that non-detects are unusable (R).

III A. INSTRUMENT CALIBRATION (Section 1)

1. Recovery Criteria

List the analytes which did not meet the percent recovery (%R) criter for Initial or Continuing Calibration.

DATE	ICV/CCV#	ANALYTE	%R	ACTION	SAMPLES AFFECTED
All ICV/CCV within QC limits					

ACTIONS:

If any analyte does not meet the %R criteria follow the actions stat below:

For Positive Results:

	Accept	Estimate (J)	Reject (R)
Metals	90-110%R	75-89%R, 111-125%R	<75%R, >125%R
Mercury	80-120%R	65-79%R, 121-135%R	<65%R, >135%R
Cyanide	85-115%R	70-84%R, 116-130%R	<70%R, >130%R

For Non-detected Results:

	Accept	Estimate (UJ)	Reject (R)
Metals	90-125%R	75-89%R	<75%R, >125%R
Mercury	80-135%R	65-79%R	<65%R, >135%R
Cyanide	85-130%R	70-84%R	<70%R, >130%R

III B. INSTRUMENT CALIBRATION (Section 2)

2. Analytical Sequence

A. Did the laboratory use the proper number of standards for calibration as described in the SOW? Yes or

B. Were calibrations performed at the beginning of each analysis? Yes or

C. Were calibration standards analyzed at the beginning of sample analysis and at a minimum frequency of ten percent or every two hours during analysis, whichever is more frequent? Yes or

D. Were the correlation coefficients for the calibration curves for AA, Hg and CV ≥ 0.995? Yes or

E. Was a standard at 2xCRDL analyzed for all ICP analyses? Yes or

If No,

The data may be affected. Use professional judgement to determine the severity of the effect and qualify the data accordingly. Discuss any actions below and list the samples affected.

_____

_____

_____

_____

REGION I
Data Review Worksheet

IV A. BLANK ANALYSIS RESULTS (Sections 1-3)

List the blank contamination in Sections 1 & 2 below. A separ worksheet should be used for soil and water blanks.

1. Laboratory Blanks

MATRIX: Aq.

DATE	ICB/CCB#	PREP BY	ANALYTE	CONC./UNITS
11-21		✓	Aluminum	10.3 ug/L
11-21		✓	Sodium	152.5 ug/L
11-21		✓	Thallium	3.1 ug/L
11-21		✓	Zinc	2.4 ug/L

2. Equipment/Trip Blanks NA

DATE	SOURCE BLK	ANALYTE	CONC./UNITS

3. Frequency Requirements

A. Was a preparation blank analyzed for each matrix, for every 20 samples and for each digestion batch? Yes or

B. Was a calibration blank run every 10 samples or every 2 hours whichever is more frequent? Yes or

If No,

The data may be affected. Use professional judgement to deter the severity of the effect and qualify the data accordingly. Disc any actions below, and list the samples affected.

REGION I
Data Review Worksheets

IV B. BLANK ANALYSIS RESULTS (Section 4)

4. Blank Actions

The Action Levels for any analyte is equal to five times the highest concentration of that element's contamination in any blank. The action level for samples which have been concentrated or diluted should be multiplied by the concentration/dilution factor. No positive sample result should be reported unless the concentration of the analyte in the sample exceeds the Action Level (AL). Specific actions are as follows:

1. When the concentration is greater than the IDL, but less than the Action Level, report the sample concentration detected with a U.
2. When the sample concentration is greater than the Action Level, report the sample concentration unqualified.

MATRIX: Aqueous

ELEMENT	MAX. CONC./ UNITS	AL/ UNITS
Aluminum	10.3 ug/L	51.5 ug/L
Sodium	152.5 ug/L	763 ug/L
Thallium	3.1 ug/L	15.5 ug/L
Zinc	2.4 ug/L	12.0 ug/L

MATRIX: _____

ELEMENT	MAX. CONC./ UNITS	AL/ UNITS

NOTE: Blanks analyzed during a soil case must be converted to mg/kg in order to compare them with the sample results.

$$\text{Conc. in ug/L} \times \frac{\text{Volume diluted to (100ml)}}{\text{Weight digested (1gram)}} \times \frac{1L}{1000ml} \times \frac{1000gm}{1kg} \times \frac{1mg}{1000ug} = \text{mg/kg}$$

Multiplying this result by 5 to arrive at the action level gives a final result in mg/kg which can then be compared to sample results.

REGION I
Data Review W rksheets

V A. ICP INTERFERENCE CHECK SAMPLE (Sections 1 & 2) NA

1. Recovery Criteria

List any elements in the ICS AB solution which did not meet the criter for %R.

DATE	ELEMENT	%R	ACTION	SAMPLES AFFECTED

ACTIONS:

If an element does not meet the %R criteria , follow the actions state below:

	PERCENT RECOVERY		
	<50%	50-79%	>120%
Positive Sample Results	R	J	J
Non-detected Sample Results	R	UJ	A

2. Frequency Requirements

Were Interference QC samples run at the beginning and end of each sample analysis run or a minimum of twice per 8 hour working shift, whichever is more frequent? Yes or N

If no,

The data may be affected. Use professional judgement to determin the severity of the effect and qualify the data accordingly. Discus any actions below and list the samples affected.

REGION I
Data Review W rksheets

V B. ICP INTERFERENCE CHECK SAMPLE (Section 3)

3. Report the concentration of any elements detected in the IC solution > 2xIDL that should not be present.

ELEMENT	CONC. DETECTED IN THE ICS	CONC. OF INTERFERENTS IN THE ICS AL	CA	FE	MG
Selenium	-6 ug/L	434166			
Silver	30 ug/L		421510		
				171 53	
					460315

Estimate the concentration produced by the interfering element in affected samples. See guidelines for examples. List the sam affected by interferences below:

SAMPLE AFFECTED	ELEMENT AFFECTED	SAMPLE CONC. (ug/L)	SAMPLE INTERFERENT CONC. AL	CA	FE	MG	ESTIMATED INTERF. (ug/L)
None							

ACTIONS:

1. In general, the sample data can be accepted without qualificatio the sample concentrations of Al, Ca, Fe, and Mg are less than 50 their respective levels in the ICS solution.

2. Estimate (J) positive results for affected elements for samples levels of interferents 50% or more of that in the ICS solution.

3. Reject (R) positive results if the reported concentration is entirely to the interfering element.

4. Estimate (UJ) non-detected results for which false negatives suspect.

Give explanations for any actions taken below:

VI. MATRIX SPIKE No MS Included in this SDG.

TR # _____ MATRIX: _____

1. Recovery Criteria

List the percent recoveries for analytes which did not meet the required criteria.

S - amount of spike added
SSR - spikes sample result
SR - sample result

Analyte	SSR	SR	S	%R	Action

Matrix Spike Actions apply to all samples of the same matrix.

ACTIONS:

1. If the sample concentration exceeds the spike concentration by a factor of 4 or more, no action is taken.

2. If any analyte does not meet the %R criteria follow the actions stated below:

	PERCENT RECOVERY		
	<30%	30%-74%	>125%
Positive Sample Results	J	J	J
Non-detected Results	R	UJ	A

2. Frequency Criteria

A. Was a matrix spike prepared at the required frequency? Yes or No

B. Was a post digestion spike analyzed for elements that did not meet required criteria for matrix spike recovery? Yes or No

A separate worksheet should be used for each matrix spike pair.

VII. LABORATORY DUPLICATES SEE ATTACHED FORM VI

List the concentrations of any analyte not meeting the criteria for duplicate precision. For soil duplicates, calculate the CRDL in mg/kg using the sample weight, volume and percent solids data for the sample. Indicate what criteria was used to evaluate precision by circling either the RPD or CRDL for each element.

MATRIX: _____

Element	CRDL water ug/L	CRDL soil mg/kg	Sample #	Duplicate#	RPD	Action
Aluminum	200					
Antimony	60					
Arsenic	10					
Barium	200					
Beryllium	5					
Cadmium	5					
Calcium	5000					
Chromium	10					
Cobalt	50					
Copper	25					
Iron	100					
Lead	5					
Magnesium	5000					
Manganese	15					
Mercury	0.2					
Nickel	40					
Potassium	5000					
Selenium	5					
Silver	10					
Sodium	5000					
Thallium	10					
Vanadium	50					
Zinc	20					
Cyanide	10					

Laboratory Duplicate Actions should be applied to all other samples of the same matrix type.

ACTIONS:

1. Estimate (J) positive results for elements which have an RPD >20% for waters and >35% for soils.

2. If sample results are less than 5x the CRDL, estimate (J) positive results for elements whose absolute difference is >CRDL. (2xCRDL for soils). If both samples are non-detected, the RPD is not calculated (NC).

6
DUPLICATES

EPA SAMPLE NO.

LCSWD

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

Matrix (soil/water): WATER Level (low/med): _LOW__

% Solids for Sample: __0.0 % Solids for Duplicate: ___0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

Analyte	Control Limit	Sample (S)	C	Duplicate (D)	C	RPD	Q	M
Aluminum		1965.5610		1967.2280		0.1		P
Antimony		496.8800		499.7520		0.6		P
Arsenic		2055.8650		2061.2750		0.3		P
Barium		1919.8490		1914.2680		0.3		P
Beryllium		52.6640		52.6770		0.0		P
Cadmium		48.8880		48.4560		0.9		P
Calcium	5000.0	19315.5510		19388.9630		0.4		P
Chromium		193.3600		194.1700		0.4		P
Cobalt		472.6740		473.7530		0.2		P
Copper		244.8440		243.4580		0.6		P
Iron		984.9110		1156.2720		16.0		P
Lead		498.0440		490.2680		1.6		P
Magnesium	5000.0	20072.4570		20133.3610		0.3		P
Manganese		484.2060		484.8350		0.1		P
Mercury		1.0600		1.1100		4.6		AV
Nickel		486.7000		488.1930		0.3		P
Potassium	5000.0	16992.7320		16710.3610		1.7		P
Selenium		2103.2710		2125.5530		1.1		P
Silver	10.0	47.7210		48.4400		1.5		P
Sodium	5000.0	18233.4180		18185.8400		0.3		P
Thallium		1944.1180		1950.9610		0.4		P
Vanadium		481.8350		482.0900		0.1		P
Zinc		498.5810		499.0630		0.1		P
Cyanide								NR

VIII. FIELD DUPLICATES No Field Duplicates included in This SDG

List the concentrations of all analytes in the field duplicate pair. For soil duplicates, calculate the CRDL in mg/kg using the sample weig volume and percent solids data for the sample. Indicate what criter was used to evaluate the precision by circling either the RPD or CRDL : each element.

MATRIX: _____

Element	CRDL water ug/L	CRDL soil mg/kg	Sample #	Duplicate#	RPD	Action
Aluminum	200					
Antimony	60					
Arsenic	10					
Barium	200					
Beryllium	5					
Cadmium	5					
Calcium	5000					
Chromium	10					
Cobalt	50					
Copper	25					
Iron	100					
Lead	5					
Magnesium	5000					
Manganese	15					
Mercury	0.2					
Nickel	40					
Potassium	5000					
Selenium	5					
Silver	10					
Sodium	5000					
Thallium	10					
Vanadium	50					
Zinc	20					
Cyanide	10					

Field Duplicate Actions should be applied to all other samples of t same matrix type.

ACTIONS:

1. Estimate (J) positive results for elements which have an RPD >: for waters and >50% for soils.

2. If sample results are less than 5x the CRDL, estimate (J) positi results and (UJ) nondetected results for elements whose absolu difference is >2xCRDL. (4xCRDL for soils). If both samples are no detected, the RPD is not calculated (NC).

IX. LABORATORY CONTROL SAMPLE

1. Aqueous LCS All LCS Recoveries within QC limits.

List any LCS recoveries not within the 80-120% criteria and the sample affected.

DATE	ELEMENT	%R	ACTION	SAMPLES AFFECTED

2. Solid LCS (NA)

List any analytes that were not within the control windows set by the EPA for the solid LCS sample. The 80-120% criteria is not used to evaluate solid LCS results.

ELEMENT	LCS CONC.	CONTROL WINDOWS	ACTION	SAMPLES AFFECTED

ACTIONS:

AQUEOUS LCS	Percent Recovery <50%	51-79%	>120%
Positive Results	R	J	J
Non-detected Results	R	UJ	A

SOLID LCS	<EPA Control Windows	>EPA Control Windows
Positive Results	J	J
Non-detected Results	UJ	A

3. Frequency Criteria

A. Was an LCS analyzed for every matrix, every digestion batch, and every 20 samples? (Yes) or

X A. FURNACE ATOMIC ABSORPTION ANALYSIS

1. Duplicate Precision

✓ -------- Duplicate injections and one-point analytical spikes were performed for all samples: duplicate injections agreed within ± 20%.

-------- Duplicate injections and/or spikes were not performed for the following samples/elements: _____

_____

-------- Duplicate injections did not agree within ± 20% for samples/elements: _____

_____

2. Post Digestion Spike Recoveries

✓ -------- Spike recoveries met the 85-115% recovery criteria for all samples.

-------- Spike recoveries did not meet the 85-115% criteria but did not require MSA for the following samples/elements:

_____

_____

-------- MSA was used to quantitate analytical results when contractually required.

_____ Correlation coefficients ≥0.995, accept results.

_____ Correlation coefficients <0.995 for sample numbers/elements: _____

-------- Method of Standard Addition (MSA) was not performed as required for samples/elements: _____

ACTIONS:

1. Estimate (J) positive results if duplicate injections are outside ± 20 % RSD or CV.

2. If the sample absorbance is <50% of post digestion spike absorbance the following actions should be applied:

	PERCENT RECOVERY		
	<10%	11%-84%	>115%
Positive Sample Results	J or R	J	J
Non-detected Results	R	UJ	A

3. Estimate (J) sample results if MSA was required and not performed.

4. Estimate (J) sample results if correlation coefficient was <0.995.

ICP SERIAL DILUTION NOT INCLUDED IN THIS SDG

XI. INDUCTIVELY COUPLED PLASMA (ICP) SERIAL DILUTION ANALYSIS

_____ Serial Dilutions were performed for each matrix and results of the diluted sample analysis agreed within ten percent of the original undiluted analysis.

_____ Serial Dilutions were not performed for the following: _____

_____ Serial Dilutions were performed, but analytical results did not agree within 10% for analyte concentrations greater than 50x the IDL before dilution.

Report all results below that do not meet the required laboratory criteria for ICP serial dilution analysis.

MATRIX: _____

ELEMENT	IDL	50xIDL	SAMPLE RESULT	SERIAL DILUTION	%D	ACTION
Aluminum						
Barium						
Beryllium						
Cadmium						
Calcium						
Chromium						
Cobalt						
Copper						
Iron						
Lead						
Magnesium						
Manganese						
Nickel						
Potassium						
Silver						
Sodium						
Vanadium						
Zinc						

Actions apply to all samples of the same matrix.

ACTIONS:

1. Estimate (J) positive results if %D >15.

XII. DETECTION LIMIT RESULTS

1. Instrument Detection Limits

✓ Instrument Detection Limit results were present and found to less than the Contract Required Detection Limits.

_____ IDLs were not included in the data package on Form XI.

_____ IDLs were present, but the criteria was not met for the following elements: _____

2. Reporting Requirements

_____ Were sample results on Form I reported down to the IDL not the CRDL for all analytes? Yes or

_____ Were sample results that were analyzed by ICP for Se, Tl, As, or Pb at least 5x IDL. Yes or N

_____ Were sample weights, volumes, and dilutions taken into account when reporting detection limits on Form I. Yes or

If No,

The reported results may be inaccurate. Make the necessary changes on the data summary tables and request that the laboratory resubmit the corrected data.

REGION I
Data Review Worksheets

XIII. SAMPLE QUANTITATION

_____ Sample results fall within the linear range for ICP and within the calibrated range for all other parameters.

_____ Sample results were beyond the linear range/ calibration range of the instrument for the following samples/elements:

_____

In the space below, please show a minimum of one sample calculation per method:

ICP

FURNACE

MERCURY

Conc.	Abs.
0	-1945
0.2	4205
0.5	13585
1.0	19801
5.0	109513
10.0	221483

constant = -445.16
x-coeff : 22150.5
r : 0.9998

$X = (y-b)/m$

SAMPLE : LCS
Lab # 2405808

CYANIDE

Absorbance data not included in Raw Data.

For soil samples, the following equation may be necessary to convert raw data values (usually reported in ug/L) to actual sample concentrations (mg/kg):

The lab is required to use 1 gram sample (wet weight) to 200 ml.

Wet weight concentration =

$$\text{digest conc. in } \frac{ug}{L} \times \frac{200ml}{1\ gm} \times \frac{1L}{1000\ ml} \times \frac{1000gm}{1kg} \times \frac{1mg}{1000ug} = \frac{mg}{kg}$$

In addition the sample results are converted to dry weight using the percent solids calculations:

$$\frac{\text{Wet weight conc.}}{\%\text{solids}} \times 100 = \text{final concentration, dry weight (mg/kg)}$$

Region 1

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. 24070

SITE AREA A

LABORATORY SW. LABS OF OKLAHOMA

NO. OF SAMPLES/ MATRIX 1 / AQUEOUS

SDG# 24070

REVIEWER (IF NOT ESD) W. BROTZ / HNUS

SOW#

REVIEWER'S NAME

DPO: ACTION ____ FYI X

COMPLETION DATE 12-27-95

DATA ASSESSMENT SUMMARY

		ICP	AA	Hg	CYANIDE
1.	HOLDING TIMES	0	NA	0	NA
2.	CALIBRATIONS	0		0	
3.	BLANKS	X1, X2		0	
4.	ICS	0		0	
5.	LCS	0		0	
6.	DUPLICATE ANALYSIS	0		0	
7.	MATRIX SPIKE	NA		NA	
8.	MSA	NA		NA	
9.	SERIAL DILUTION	NA		NA	
10.	SAMPLE VERIFICATION	0		0	
11.	OTHER QC	0		0	
12.	OVERALL ASSESSMENT			0	

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.

ACTION ITEMS: X1 - SEVERAL CONTAMINANTS FOUND IN LABORATORY PREP BLANKS
X2 - NEGATIVE BLANK CONTAMINATION FOUND IN LAB BLANKS

AREAS OF CONCERN:

NOTABLE PERFORMANCE:

APPENDIX C
SUPPORT DOCUMENTATION

U.S. EPA - CLP

2A

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

Initial Calibration Source: EPA-LV_____

Continuing Calibration Source: IN.VEN._____

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	M
Aluminum	1000.0	994.87	99.5	5000.0	5090.19	101.8	5042.54	100.9	P
Antimony	500.0	519.73	103.9	500.0	507.99	101.6	504.90	101.0	P
Arsenic	250.0	258.94	103.6	500.0	502.14	100.4	501.77	100.4	P
Barium	1000.0	986.70	98.7	500.0	510.21	102.0	507.19	101.4	P
Beryllium	25.0	26.12	104.5	500.0	502.66	100.5	501.64	100.3	P
Cadmium	125.0	126.11	100.9	500.0	508.37	101.7	507.37	101.5	P
Calcium	2500.0	2466.62	98.7	5000.0	5045.57	100.9	5046.52	100.9	P
Chromium	100.0	99.95	99.9	500.0	505.66	101.1	504.77	101.0	P
Cobalt	250.0	249.60	99.8	500.0	503.10	100.6	498.56	99.7	P
pper	125.0	125.40	100.3	500.0	509.32	101.9	505.38	101.1	P
on	500.0	488.96	97.8	5000.0	5083.66	101.7	5092.00	101.8	P
ead	250.0	252.02	100.8	500.0	505.79	101.2	505.27	101.1	P
Magnesium	2500.0	2478.21	99.1	5000.0	5043.58	100.9	5032.03	100.6	P
Manganese	250.0	252.04	100.8	500.0	504.95	101.0	503.06	100.6	P
Mercury	4.9	5.67	115.7	5.0	5.19	103.8	5.18	103.6	AV
Nickel	250.0	249.91	100.0	500.0	509.05	101.8	507.99	101.6	P
Potassium	2500.0	2547.03	101.9	5000.0	5176.24	103.5	5134.15	102.7	P
Selenium	250.0	250.97	100.4	500.0	508.17	101.6	504.12	100.8	P
Silver	125.0	124.34	99.5	500.0	505.82	101.2	504.80	101.0	P
Sodium	2500.0	2706.31	108.3	5000.0	5377.29	107.5	5372.83	107.5	P
Thallium	250.0	250.65	100.3	500.0	505.41	101.1	502.89	100.6	P
Vanadium	250.0	254.71	101.9	500.0	506.82	101.4	505.20	101.0	P
Zinc	250.0	255.89	102.4	500.0	512.06	102.4	511.25	102.2	P
Cyanide									NR

(1) Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

FORM II (PART 1) - IN

U.S. EPA - CLP

2A
INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

Initial Calibration Source: EPA-LV_____

Continuing Calibration Source: IN.VEN._____

Concentration Units: ug/L

Analyte	Initial Calibration True	Initial Calibration Found	Initial Calibration %R(1)	Continuing Calibration True	Continuing Calibration Found	Continuing Calibration %R(1)	Continuing Calibration Found	Continuing Calibration %R(1)	M
Aluminum				5000.0	5078.53	101.6	5081.57	101.6	P
Antimony				500.0	508.24	101.6	509.13	101.8	P
Arsenic				500.0	504.90	101.0	510.15	102.0	P
Barium				500.0	513.18	102.6	512.23	102.4	P
Beryllium				500.0	504.66	100.9	505.01	101.0	P
Cadmium				500.0	510.90	102.2	512.50	102.5	P
Calcium				5000.0	5058.86	101.2	5071.20	101.4	P
Chromium				500.0	507.31	101.5	507.12	101.4	P
Cobalt				500.0	499.28	99.9	500.67	100.1	P
pper				500.0	514.15	102.8	512.14	102.4	P
ron				5000.0	5105.46	102.1	5112.21	102.2	P
Lead				500.0	506.84	101.4	508.87	101.8	P
Magnesium				5000.0	5055.13	101.1	5055.13	101.1	P
Manganese				500.0	506.29	101.3	506.10	101.2	P
Mercury				5.0	5.16	103.2	5.08	101.6	AV
Nickel				500.0	511.44	102.3	512.59	102.5	P
Potassium				5000.0	5221.58	104.4	5216.33	104.3	P
Selenium				500.0	506.90	101.4	510.04	102.0	P
Silver				500.0	508.65	101.7	507.75	101.5	P
Sodium				5000.0	5418.79	108.4	5392.27	107.8	P
Thallium				500.0	507.85	101.6	510.25	102.0	P
Vanadium				500.0	508.99	101.8	508.70	101.7	P
Zinc				500.0	515.49	103.1	515.59	103.1	P
Cyanide									NR

Control Limits: Mercury 80-120; Other Metals 90-110; Cyanide 85-115

FORM II (PART 1) - IN

2B
CRDL STANDARD FOR AA AND ICP

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

AA CRDL Standard Source: PLASMACHEM__

ICP CRDL Standard Source: IN.VEN._____

Concentration Units: ug/L

Analyte	CRDL Standard for AA			CRDL Standard for ICP				
	True	Found	%R	True	Initial Found	%R	Final Found	%R
Aluminum_								
Antimony_				120.0	125.02	104.2	124.99	104.2
Arsenic__				20.0	18.41	92.0	18.31	91.5
Barium___								
Beryllium				10.0	11.31	113.1	11.21	112.1
Cadmium__				10.0	10.27	102.7	10.29	102.9
Calcium__								
Chromium_				20.0	20.16	100.8	20.22	101.1
balt___				100.0	99.51	99.5	98.20	98.2
opper___				50.0	48.70	97.4	49.21	98.4
ron_____								
L ad_____				6.0	5.26	87.7	5.75	95.8
Magnesium								
Manganese				30.0	30.54	101.8	30.41	101.4
Mercury__	0.2	0.24	120.0					
Nickel___				80.0	81.78	102.2	81.93	102.4
Potassium								
Selenium_				10.0	10.03	100.3	9.12	91.2
Silver___				20.0	19.97	99.8	19.35	96.7
Sodium___								
Thallium_				20.0	22.96	114.8	20.87	104.3
Vanadium_				100.0	104.64	104.6	104.38	104.4
Zinc_____				40.0	42.13	105.3	42.57	106.4
Cyanide__								

3
BLANKS

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

Preparation Blank Matrix (soil/water): WATER

Preparation Blank Concentration Units (ug/L or mg/kg): UG/L_

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Prepa-ration Blank	C	M
Aluminum	8.0	U	8.0	U	8.0	U	8.0	U	10.260	B	P
Antimony	2.0	U	2.0	U	2.0	U	2.0	U	2.000	U	P
Arsenic	4.0	U	4.0	U	4.0	U	4.0	U	4.000	U	P
Barium	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Beryllium	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Cadmium	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Calcium	-9.5	B	-8.5	B	-9.8	B	-13.3	B	5.000	U	P
Chromium	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Cobalt	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
pper	-1.2	B	-1.1	B	-1.6	B	-1.8	B	1.000	U	P
ron	13.0	U	13.0	U	13.0	U	-14.7	B	13.000	U	P
Lead	2.0	U	2.0	U	2.0	U	2.0	U	2.000	U	P
Magnesium	8.0	U	8.0	U	8.0	U	-13.7	B	8.000	U	P
Manganese	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Mercury	0.2	U	0.2	U	0.2	U	0.2	U	0.200	U	AV
Nickel	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Potassium	41.0	U	41.0	U	41.0	U	41.0	U	41.000	U	P
S lenium	2.0	U	2.0	U	2.0	U	2.0	U	2.000	U	P
Silver	2.0	U	2.0	U	2.0	U	2.0	U	2.000	U	P
Sodium	10.0	U	10.0	U	10.0	U	10.0	U	152.454	B	P
Thallium	3.0	U	3.0	U	3.0	U	3.0	U	3.107	B	P
Vanadium	1.0	U	1.0	U	1.0	U	1.0	U	1.000	U	P
Zinc	1.0	U	1.0	U	1.0	U	1.0	U	2.371	B	P
Cyanide											NR

3
BLANKS

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

Preparation Blank Matrix (soil/water): _____

Preparation Blank Concentration Units (ug/L or mg/kg): _____

Analyte	Initial Calib. Blank (ug/L)	C	Continuing Calibration Blank (ug/L) 1	C	2	C	3	C	Prepa-ration Blank	C	M
Aluminum			8.1	B							P
Antimony			2.0	U							P
Arsenic			4.0	U							P
Barium			1.0	U							P
Beryllium			1.0	U							P
Cadmium			1.0	U							P
Calcium			-11.1	B							P
Chromium			1.0	U							P
Cobalt			1.0	U							P
pper			-1.8	B							P
ron			-17.8	B							P
ead			2.0	U							P
Magnesium			-12.6	B							P
Manganese			1.0	U							P
Mercury			0.2	U							P
Nickel			1.0	U							AV
Potassium			41.0	U							P
Selenium			2.0	U							P
Silver			2.0	U							P
Sodium			10.0	U							P
Thallium			3.0	U							P
Vanadium			1.0	U							P
Zinc			1.0	U							P
Cyanid											NR

4

ICP INTERFERENCE CHECK SAMPLE

Lab Name: SOUTHWEST_LAB_OF_OK Contract: _____

Lab Code: SWOK Case No.: 24070 SAS No: _____ SDG No.: 24070

ICP ID Number: TJA#2 ICS Source: EPA-LV91

Concentration Units: ug/L

Analyte	True Sol. A	True Sol. AB	Initial Found Sol. A	Initial Found Sol. AB	%R	Final Found Sol. A	Final Found Sol. AB	%R
Aluminum	500000	500000	447409	434166.4	86.8	445707	447734.1	89.5
Antimony	0	0	0	0.4		-1	-0.8	
Arsenic	0	0	-1	-2.9		0	-1.7	
Barium	0	500	0	466.0	93.2	0	487.0	97.4
Beryllium	0	500	1	436.9	87.4	1	455.8	91.2
Cadmium	0	1000	-1	844.0	84.4	-1	882.3	88.2
Calcium	500000	500000	434560	421510.4	84.3	436669	438653.2	87.7
Chromium	0	500	1	430.1	86.0	1	447.8	89.6
Cobalt	0	500	1	422.2	84.4	1	434.5	86.9
Copper	0	500	2	504.4	100.9	1	528.0	105.6
Iron	200000	200000	176814	171053.9	85.5	177833	178383.4	89.2
Lead	0	1000	-1	869.8	87.0	-1	906.0	90.6
Magnesium	500000	500000	475871	460315.0	92.1	477335	478801.8	95.8
Manganese	0	500	2	441.5	88.3	1	459.1	91.8
Mercury								
Nickel	0	1000	0	834.8	83.5	0	872.2	87.2
Potassium	0	0	-12	-33.0		-20	-20.1	
S lenium	0	0	-5	-5.8		-6	-8.9	
Silver	0	1000	0	957.8	95.8	-1	1002.1	100.2
Sodium	0	0	30	14.0		28	22.2	
Thallium	0	0	1	2.9		3	-4.3	
Vanadium	0	500	0	448.5	89.7	0	468.4	93.7
Zinc	0	1000	0	897.4	89.7	0	940.7	94.1
Cyanide								

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LABORATORY CONTROL SAMPLE

Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

Solid LCS Source: _____

Aqueous LCS Source: EPA0392_____

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Aluminum	2000.0	1965.56	98.3						
Antimony	500.0	496.88	99.4						
Arsenic	2000.0	2055.86	102.8						
Barium	2000.0	1919.85	96.0						
Beryllium	50.0	52.66	105.3						
Cadmium	50.0	48.89	97.8						
Calcium	20000.0	19315.55	96.6						
Chromium	200.0	193.36	96.7						
Cobalt	500.0	472.67	94.5						
Copper	250.0	244.84	97.9						
Iron	1000.0	984.91	98.5						
Lead	500.0	498.04	99.6						
gnesium	20000.0	20072.46	100.4						
anganese	500.0	484.21	96.8						
Mercury	1.0	1.06	106.0						
Nickel	500.0	486.70	97.3						
Potassium	20000.0	16992.73	85.0						
Selenium	2000.0	2103.27	105.2						
Silver	50.0	47.72	95.4						
Sodium	20000.0	18233.42	91.2						
Thallium	2000.0	1944.12	97.2						
Vanadium	500.0	481.83	96.4						
Zinc	500.0	498.58	99.7						
Cyanid									

7

LABORATORY CONTROL SAMPLE

Name: SOUTHWEST_LAB_OF_OK_____ Contract: _____

Lab Code: SWOK__ Case No.: 24070 SAS No.: _____ SDG No.: 24070_

Solid LCS Source: _____

Aqueous LCS Source: EPA0392_____

Analyte	Aqueous (ug/L) True	Found	%R	Solid (mg/kg) True	Found	C	Limits		%R
Aluminum	2000.0	1967.23	98.4						
Antimony	500.0	499.75	100.0						
Arsenic	2000.0	2061.27	103.1						
Barium	2000.0	1914.27	95.7						
Beryllium	50.0	52.68	105.4						
Cadmium	50.0	48.46	96.9						
Calcium	20000.0	19388.96	96.9						
Chromium	200.0	194.17	97.1						
Cobalt	500.0	473.75	94.8						
Copper	250.0	243.46	97.4						
Iron	1000.0	1156.27	115.6						
Lead	500.0	490.27	98.1						
gnesium	20000.0	20133.36	100.7						
anganese	500.0	484.83	97.0						
Mercury	1.0	1.11	111.0						
Nickel	500.0	488.19	97.6						
Potassium	20000.0	16710.36	83.6						
Selenium	2000.0	2125.55	106.3						
Silver	50.0	48.44	96.9						
Sodium	20000.0	18185.84	90.9						
Thallium	2000.0	1950.96	97.5						
Vanadium	500.0	482.09	96.4						
Zinc	500.0	499.06	99.8						
Cyanide									

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Instrument Detection Limits (Quarterly)

Name: SOUTHWEST_LAB_OF_OK
Lab Code: SWOK Case No.: 24070
ICP ID Number: TJA#2
Flame AA ID Number :
Furnace AA ID Number :

Contract:
SAS No.:
Date: 10/03/95

SDG No.: 24070

Analyte	Wave-length (nm)	Back-ground	CRDL (ug/L)	IDL (ug/L)	M
Aluminum	308.21		200	8.0	P
Antimony	206.83		60	2.0	P
Arsenic	189.04		10	4.0	P
Barium	493.41		200	1.0	P
Beryllium	313.04		5	1.0	P
Cadmium	226.50		5	1.0	P
Calcium	317.93		5000	5.0	P
Chromium	267.72		10	1.0	P
Cobalt	228.61		50	1.0	P
Copper	324.75		25	1.0	P
Iron	271.44		100	13.0	P
Lead	220.35		3	2.0	P
Magnesium	279.08		5000	8.0	P
Manganese	257.61		15	1.0	P
Mercury			0.2	0.2	~~NR~~ CV
Nickel	231.60		40	1.0	P
Potassium	766.49		5000	41.0	P
Selenium	196.02		5	2.0	P
Silver	328.07		10	2.0	P
Sodium	588.99		5000	10.0	P
Thallium	190.86		10	3.0	P
Vanadium	292.40		50	1.0	P
Zinc	213.86		20	1.0	P
Cyanide			10		NR

Comments:

CALIBRATION COEFFICIENT CALCULATIONS
SDG : 24070

MERCURY

Conc.	Abs.
0	-1945
0.2	4805
0.5	13585
1.0	19801
5.0	109513
10.0	221483

Constant = -445.16
X-coeff = 22150.5
r = 0.7998

APPENDIX H

LANDFILL TOE DRAIN SYSTEM EVALUATION

H.1 Toe Drain System Design Calculations
H.2 Toe Drain System Construction & Operation Co t Estimates

APPENDIX H.1

TOE DRAIN SYSTEM DESIGN CALCULATIONS

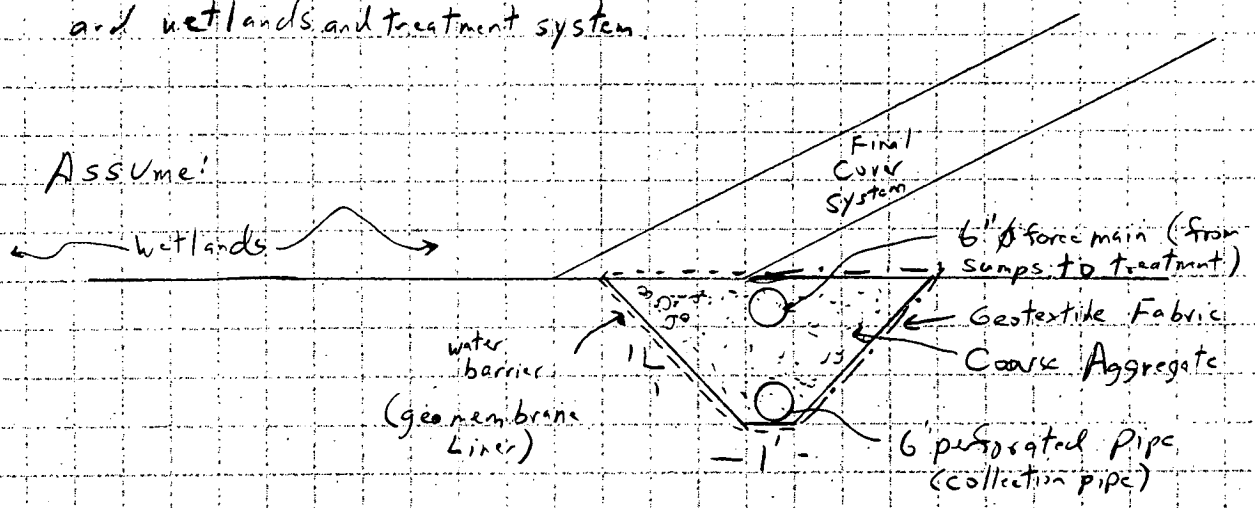
CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT	JOB NUMBER
Navy CTO 203 Subase New London	5082
SUBJECT: Leachate Drain	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
TJR	KMS 2/21/96		2/15/96 + 2/19

Determine Cost for leachate drain between landfill and wetlands and treatment system.

Assume:



Measured length between landfill + wetland = 1960' say 2000'

Set bottom elevation of drain between el. 70' + 68'

Place pipe + bottom of drain on 2% slope

Place sumps every 200'

Average excavation depth from el. 75'

Level D Safety Level during construction.

Excavated materials disposed on site at no additional cost.

Average flow from leachate drain is 10,300 ft³/d or 53.5 gpm

Groundwater encountered during excavation is 19,700 ft³/d or 60,000 gpd

Distance between leachate drain + treatment unit is equal to 1000' + distance between treatment unit and discharge is equal to 2400'

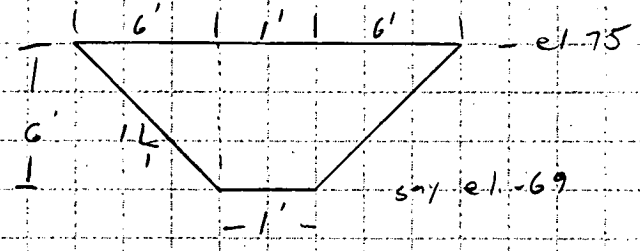
CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT	JOB NUMBER
Navy CTO 203 Subase New London	5082
SUBJECT: Leachate Drain	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
TJR	KMS 2/21/96		2/15/96 2/19

Caculations:

Aggregate + Excavation



$A = \frac{1}{2} bh \cdot 2 + 1' \cdot 6'$

$= \frac{1}{2}(6)(6) \cdot 2 + 1' \cdot 6' = 42 \text{ sq ft}$

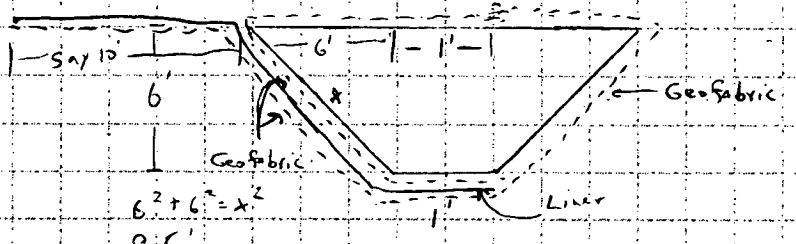
$Vol = 42 \text{ sq ft} \times 2000' \cdot \frac{1}{27} \text{ yd}^3/\text{ft}^3 = 3{,}111.11 \text{ say } 3{,}200 \text{ yd}^3$

See page 4 for dewatering

Collection pipe : 6" perforated pipe 2000 lf

Force main : 6" pipe from sumps to treatment 2000 lf + 1000 lf = 3000 lf

Geomembrane Liner (attach to liner in cover system)



$6^2 + 6^2 = x^2$

$8.5' = x$

$1' + 8.5' + 10' = 19.5 \text{ ft} \cdot 2000' = 39{,}000 \text{ sf}$

Geotextile Fabric

inside layer $= 1' + 8.5' + 13 + 8.5' = 31'$

outside layer $= 1' + 8.5' + 10' = 19.5$

$\rightarrow 50.5' \times 2000' \text{ lns} = 101{,}000 \text{ s.f}$

Sumps $2000' \div 200' = 10$ sumps

Treatment Plant for 77,000 g/d

Discharge 6" sewer line say 2400 lf

CALCULATION WORKSHEET Order No. 19116 (01-91)

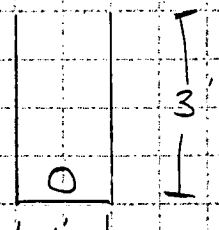
CLIENT	JOB NUMBER
Navy CTO 203 Subase New London	5082
SUBJECT: Leachate Drain	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
TJR	KMS 2/21/96		2/15/96 x 2/19

Force Main = 3000 lf

excavation for 2000 lf covered under leachate drain

Excavation for remaining 1000 lf



1'x3' = 3 sf/lf

1000 lf x 3 sf = 3,000 cf or

111.11 cy or 112 cy

Sump excavation say 6 cy each sump x 10 sumps = 60 cy

Treatment plant

77,000 g/d = 77,000 gal Say 1,000,000 installed

& 85,000 yr/0 km

Excavation for discharge pipe = 2400 lf x 3 sf = 7,200 cf or 267 cy

Electrical needs for pumps

assume all electric is at treatment plant

electric line from plant to leachate drain

3 #6 lines ∴ 1000' x 3 lines = 3000 lf ÷ 100'/CLF = 30 CLF

1 Transformer 10 kVA

1 Panelboard 240V - 18 circuits

10 Breakers 30 amp

1 Safety Switch 60 amp 10 Safety Switch 30 amp

electric line from panelboard to sumps 3 wire #12

1 at 100', 1 at 300', 1 at 500', 1 at 700', 1 at 900', 1 at 1100'

1 at 1300, 1 at 1500, 1 at 1700, 1 at 1900'

Total feet = 10,000' or 100 CLF

Excavation trench for electric wiring 3000 LF

CLIENT	JOB NUMBER
Navy CTU 203 Subase New London	5082
SUBJECT: Leachate Drain	
BASED ON	DRAWING NUMBER

BY	CHECKED BY	APPROVED BY	DATE
TJR	KMS 2/21/96		2/15/96 + 2/19

O&M for leachate drain say $5,000/yr

References

Means Site Work and Landscape Cost Data -1995
Means Electrical Cost Data -1995
Echos Environmental Restoration, Unit Cost Book -1995
NAVFAC Drawings Nos. 217564 thru 217597
" Area A Landfill Cap - 5/16/96

Dewatering

Flow over complete excavation = 10,700 ft³/d or 80,000 gpd

Say work in excavation 50' long for 2 days

$80,000 \text{ gpd} \times \frac{50' \text{ long excavation}}{2000' \text{ total ex}} = 2,000 \text{ gpd}/50' \text{ excavation}$

If 2000' excavation ÷ 50' day × 2 days = 80 days

Total gallons = 80 days × 2,000 gpd = 160,000 gallons ÷ 5,000 gal/truck = 32 trucks

Say disposal of waters at local POTW 10 miles away

32 trucks × 10 miles = 320 truck miles

APPENDIX H.2

TOE DRAIN SYSTEM CONSTRUCTION AND OPERATION COST ESTIMATES

CTO 203 COST ESTIMATE FOR LEACHATE DRAIN

Description	Cost Source	Quantity	Unit	Unit Cost	Item Cost
Excavation	M 022-254-0090	3200	cy	$3.19	$10,208
Dewatering - 2" Trash Pump	E 17-03-1002	80	day	$37.98	$3,038
Dewatering - Haul	E 33-19-0207	320	mi	$3.96	$1,267
Dewatering - Disposal	E 33-19-7102	160	kgal	$1.86	$298
Geotextile	E 33-08-0531	101000	sf	$1.15	$116,150
Geomembrane	E 33-08-0572	39000	sf	$1.53	$59,670
Aggregate - Purchase	M 026-012-0100	3200	cy	$17.73	$56,736
Aggregate - Compact	M 026-012-0500	3200	cy	$2.39	$7,648
6" Piping	M 027-111-0060	2000	lf	$1.75	$3,500
6" Force Main	M 026-678-2200	3000	lf	$7.94	$23,820
6" Force Main - Excavation for 1000'	M 022-254-0090	112	cy	$3.19	$357
6" Force Main - Backfill for 1000'	M 022-254-3020	112	cy	$1.28	$143
Misc. Piping Supplies		1	ls	$4,000.00	$4,000
Sumps	M 152-465-0740	10	ea	$1,029.00	$10,290
Sumps - Excavation	M 022-254-0090	60	cy	$3.19	$191
Electric - 3 #6 wire UF	ME 161-145-1950	300	clf	$107.00	$32,100
Electric - Transformer	ME 164-120-1100	1	ea	$830.00	$830
Electric - Panelboard	ME 163-245-0250	1	ea	$795.00	$795
Electric - Breaker 30amp	ME 163-250-0400	10	ea	$51.00	$510
Electric - Safety Switch 60amp	ME 163-360-0200	1	ea	$180.00	$180
Electric - Safety Switch 30amp	ME 163-360-0100	10	ea	$118.50	$1,185
Electric - 3 #12 wire UF	ME 161-145-1650	1000	clf	$120.00	$120,000
Electric - Excavation	ME 022-258-0200	3000	lf	$0.40	$1,200
Electric - Backfill & Compact	ME 022-258-1150	3000	lf	$0.54	$1,620
Treatment Plant	SEE ATTACHED	1	ea	$364,427.00	$364,427
6" Pipe for Plant Discharge	M 026-678-2200	2400	lf	$7.94	$19,056
6" Pipe - Excavation	M 022-254-0090	267	cy	$3.19	$852
6" Pipe - Backfill	M 022-254-3020	267	cy	$1.28	$342
				Subtotal	$840,414

Cost Source:
M : Means Site Work & Landscape Cost Data, 1995
ME : Means Electrical Cost Data, 1995
E : Echos Unit Cost Book, 1995

Cost Indexes for Connecticut at 10%	$84,041
Subtotal	$924,455
O & P at 30%	$277,337
Subtotal	$1,201,792
Engineering at 15%	$180,269
Contingencies at 20%	$240,358
Capital Cost	**$1,622,419**

NAVAL SUBMARINE BASE
New London
CTO# 203
Groton, Connecticut
Area "A" Landfill Toe Drain Treatment System
(NSBNLTS)
3/6/96

Item	Qty	Unit	Unit Cost Sub.	Unit Cost Mat.	Unit Cost Labor	Unit Cost Equip.	Total Cost Sub.	Total Cost Mat.	Total Cost Labor	Total Cost Equip.	Total Cost	Comments
1) Mobilization		LS			3000.00	3000.00			3000	3000	6000	
2) Clearing & Grubbing	1	AC			1165.00	1840.00			1165	1840	3005	
3) Earthwork Grading	600	CY			.24	.78			144	468	612	
4) Equalization Tank	1			5000.00	800.00			5000	800		5800	2500 gallon
5) Equalization Tank Mixer	1			4500.00	600.00			4500	600		5100	
6) Transfer Pumps	2			4000.00	400.00			8000	800		8800	70 gpm @ 100'tdh
7) Multiple Bag Filter System	1			30000.00	1500.00	1500.00		30000	1500	1500	33000	25 micron
8) Activated Carbon System incl. (2) 20000 lbs. Vessels, Piping, Valves	1			170000.00	8500.00	8500.00		170000	8500	8500	187000	
9) Interconnecting Piping												
a) 2"	50	LF		13.00	7.00			650	350		1000	
b) 3"	100	LF		19.50	10.50			1950	1050		3000	
c) 4"	50	LF		27.00	13.00			1350	650		2000	
10) Valves												
a) 3"	8			300.00	90.00			2400	720		3120	
b) 4"	2			450.00	110.00			900	220		1120	
11) Level Control System	1			2000.00	800.00			2000	800		2800	
12) Flow Control System	1			7000.00	1500.00			7000	1500		8500	
13) Treatment Building	1250	SF	30.00				37500				37500	25' x 50'
14) Building Foundation	60	CY		170.00	315.00	15.00		10200	18900	900	30000	
15) Equipment Foundation	20	CY		135.00	250.00	15.00		2700	5000	300	8000	
16) Electrical												
a) Power Supply		LS	1000.00				1000				1000	
b) #1 Starter	3			1350.00	550.00			4050	1650		5700	
c) Disconnect Switch	3			150.00	50.00			450	150		600	
d) Conduit, Cable, Control	3			655.00	735.00			1965	2205		4170	
e) Instrument Loop	2			500.00	700.00			1000	1400		2400	
f) Grounding		LS		600.00	600.00			600	600		1200	
g) Miscellaneous Wiring		LS		1500.00	1500.00			1500	1500		3000	
							38500	256215	53204	16508	364427	

NAVAL SUBMARINE BASE, NEW LONDON
Groton, Connecticut
CTO 203 Cost Estimate For Leachate Drain

PRESENT WORTH ANALYSIS

COST/YEAR COST OCCURS ($000'S)

COST COMPONENT	0	1	2	3	4	5	6	7	8	9	10	11
1. CAPITAL COST	1622.4											
2. O & M COSTS		90										
3. ANNUAL COSTS	1622.4	90	90	90	90	90	90	90	90	90	90	90
4. ANNUAL DISCOUNT RATE = 5%	1	0.952	0.907	0.864	0.823	0.784	0.746	0.711	0.677	0.645	0.614	0.585
PRESENT WORTH =	1622	86	82	78	74	71	67	64	61	58	55	53

	12	13	14	15	16	17	18	19	20	21	22	23
O & M COSTS	90	90	90	90	90	90	90	90	90	90	90	90
ANNUAL DISCOUNT RATE = 5%	0.557	0.53	0.505	0.481	0.458	0.436	0.416	0.396	0.377	0.359	0.342	0.326
PRESENT WORTH =	50	48	45	43	41	39	37	36	34	32	31	29

	24	25	26	27	28	29	30
O & M COSTS	90	90	90	90	90	90	90
ANNUAL DISCOUNT RATE = 5%	0.31	0.295	0.281	0.268	0.255	0.243	0.231
PRESENT WORTH =	28	27	25	24	23	22	21

TOTAL PRESENT WORTH (000'S)
$3,006