GEOLOGIC AND HYDROLOGIC REPORT
FOR
CONSTRUCTION AND DEMOLITION PHASE III
LANDFILL EXPANSION

ANDERSON CREEK LANDFILL - NC SWS PERMIT # 43-03

HARNETT COUNTY, NORTH CAROLINA

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1.0 *INTRODUCTION*

In accordance with Title 15A of the North Carolina Administrative Code (NCAC) Subchapter 13B.0538, CT Clayton, Sr., P.E., Inc. (CTC) and Patterson Exploration Services are submitting this Hydrogeologic Study on behalf of Harnett County, for the Phase III lateral expansion of a construction and demolition debris (C&D) landfill. The Anderson Creek C&D Landfill (ACLF) operates under Permit No. 43-03 issued by the North Carolina Department of Environment and Natural Resources (NC DENR). The purpose of this section is to characterize the hydrogeologic conditions in and around the Phase III waste footprint and compliance boundary. The study will also provide the relationship of the site groundwater flow regime to local and regional hydrogeologic features, with emphasis on the relationship of C&D landfill units to potential groundwater receptors and groundwater discharge features.

2.0 SITE DESCRIPTION

The ACLF is located approximately 15 miles southwest of Lillington, North Carolina. Access to the landfill is provided off of highway 27, via Poplar Road. The site consists of approximately 223 acres, of which, approximately 7 acres is currently permitted as the Phase I and II C&D waste units. The proposed Phase III waste unit will be approximately 5 acres. The site location, property boundaries, and surrounding topography are shown on Figure 1. The site is located in the western edge of the Coastal Plain physiographic province on gently sloped terrain.

McLeod Creek, which forms the western property boundary, is shown on Figure 1. Areas of wetlands are located along McLeod Creek on the west side of the property. Multiple storm water basins were constructed in the central part of the facility and a larger storm water basin was constructed to the south of the site during the construction of Phase I.

The eastern portion of the site mainly consisted of trees and heavy brush before Phases I & II of the C&D landfill were constructed. Now, most of the southern and central areas of the property consist of active and closed landfill operations. The western and northern portions of the site have historically been used for agricultural purposes or were natural forests. A solid waste transfer facility is now located along the eastern edge of the site. A large portion of the surrounding properties are forested, residential and agricultural.

2.1 Site Topography

The site area exhibits approximately 80 feet of relief. The highest elevation approximately 340 feet MSL, occurs at the northeast corner of the property near the entrance to the existing landfill facility. The land surface dips downward from east to west. Lowest elevations (260 MSL) occur in the far western region of the site. The site area is located within the Anderson Creek USGS Quadrangle.

2.2 Site Drainage

The site is located within the drainage basin of the Little River and its tributary, McLeod Creek which enters the Little River from the North. McLeod Creek is entrenched in its floodplain

and exhibits a meandering stream course within the landfill property. It forms the western boundary of the property, flowing south. McLeod Creek continues southward, emptying into Jumping Run Creek, then in turn the Little River approximately 6 miles southeast of the site.

The interior of the site will drain to existing and proposed drainage swales. Proposed perimeter slopes will drain directly into these existing drainage swales. A proposed swale will be installed to north of the expansion areas to carry northern perimeter slope drainage to the existing swales. All swales will empty the drainage at multiple sediment basins and traps located between the landfill and McLeod Creek.

ANDERSON CREEK LANDFILL
VICINITY MAP
NOT TO SCALE

General Notes

- LIMITS OF DISTURBANCE
- EXISTING MAJOR CONTOUR LINE
- EXISTING MINOR CONTOUR LINE
- P-PZ-28 PIEZOMETER LOCATION AND ID
- CDMW-3 MONITORING WELL LOCATION AND ID
- LIMITS OF WASTE
- WETLAND

THIS IS AN EXHIBIT DRAWING ONLY AS PART OF A REPORT DATED AND SEALED 03/20/2013.

NOT FOR CONSTRUCTION

GRAPHIC SCALE: 1" = 150'

0 75 150 300 450

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ANDERSON CREEK LANDFILL PHASE III EXPANSION

HARNETT COUNTY, NC

Project No: 03001C	File Name: 03001C ACLF EXPANSION 13 0308
Designed By: SBK	Drawn By: SBK
Checked By: RS	Proj. Eng.: CTC Jr.
Sheet Title: FACILITY PLAN	
Date: 10 JAN. 2012	FIGURE 1
Scale: 1" = 150'	

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3.0 *FIELD INVESTIGATIONS*

Field investigations were conducted by both site reconnaissance and subsurface investigation to verify the suitability of the subsurface conditions for cell construction. The following is a summary of the previous and current investigation for the ACLF.

3.1 Previous Investigations

Data obtained from other firms during the installation of several existing monitoring wells and piezometers located on-site was utilized during previous investigations. This included previously installed monitoring well CDMW-1, CDMW-2, CDMW-3, CDMW-4S, CDMW-4D and piezometers P-6B, P-7, P-8, and P-9. Patterson Exploration Services of Sanford, North Carolina installed the piezometers in March of 1996 and monitoring well CDMW-1 through CDMW-3 in February of 1997. Titan Atlantic Group of Winterville, North Carolina installed monitoring wells CDMW-4S and CDMW-4D in May of 2002 (these wells were removed in 2006). Information utilized in this report includes any boring logs, aquifer testing, and soil classification data that was available.

February 2004, ten (10) soil test borings identified as B-100 through B-109, were drilled during Phase II activities. The borings were located in the field by Draper Aden Associates using existing landmarks and site topography as references. Upon completion of drilling, the locations were surveyed by Streamline Land Surveying, Inc. to establish the actual locations and provide elevation data.

The borings were drilled using a Brainard Kilman Mud-Bug drill rig mounted on an all-terrain vehicle. Boring locations were selected to acquire a representative sampling of the site. Most of the soil test borings were advanced to a termination depth of 20 feet below the land surface. Shallow refusal conditions were not encountered at any of the sampling locations.

Hollow stem auger drilling methods were used to advance the borings through the soil. Standard Penetration Tests were performed at selected intervals during the drilling in accordance with ASTM D-1586-67 to provide an index for estimating soil strength and relative density. The samples were visually classified in the field according to the Unified Soil Classification System. Representative samples were placed in jars for laboratory testing.

Also, three (3) piezometers, identified as B-101, B-102, and B-104, were installed to determine stabilized groundwater levels across the site and to perform in-situ permeability testing of the surficial aquifer. The permeability testing was performed at each piezometer and the data was filtered and evaluated using the Bower and Rice approximation to estimate hydraulic conductivity of the materials within the piezometer.

3.2 Current Investigation

A reconnaissance of the site was performed by traversing the accessible portions of the expansion area to observe for unusual site conditions that could impact construction, such as any potentially soft or unstable areas. No such areas were identified.

3.2.1 Soil Test Borings

Twenty piezometers (PZ-10 thru PZ-29) were installed throughout the site to the north of the currently active cell from May 19, 2009, to May 29, 2009. Of the twenty piezometers eight (PZ-11, PZ-12, PZ-13, PZ-14, PZ-15, PZ-16, PZ-17, and PZ-18) are in and around the proposed Phase III footprint. J & L Inc. out of Four Oaks, North Carolina, performed drilling and well installation activities. The drilling equipment consisted of a drilling rig equipped with 2.25-inch inner diameter (ID) hollow-stem augers. Continuous split-spoon samples were obtained and logged for all of the boreholes. The boring logs for the newly installed piezometers are included in Appendix I. The piezometer construction data is summarized in Table 1 and the locations are provided on Figure 2. Well and piezometer construction was performed in accordance with the standards described in the *RCRA Technical Enforcement Guidance Document (1986) and the Draft North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities (1995).*

All piezometers were purged dry during development. Because of the small yields from each of the piezometers, approximately 7.5 to 17 gallons of water were purged from each piezometer during development. Any other piezometers that will be converted into permanent monitoring wells will be developed using similar procedures prior to the first sampling event.

Elevations and horizontal locations were referenced to the N.C. Grid Coordinate System and surveyed by Streamline Land Surveying Inc.

Table 1 Piezometer Construction Data Summary			
Piezometer	Y-Coor.	X- Coor.	TOC Elev.
PZ-10	561859.68	1999897.98	290.98
PZ-11	562078.16	2000712.64	336.96
PZ-12	561920.39	2000537.70	318
PZ-13	561842.86	2000362.61	307.23
PZ-14	561646.33	1999975.10	281.31
PZ-15	562290.63	2000730.97	338.42
PZ-16	562090.90	2000455.58	327.9
PZ-17	562009.56	2000244.64	315.49
PZ-18	561910.17	2000065.44	301.4
PZ-19	561845.13	1999206.31	248.13
PZ-20	562326.61	1998990.75	252.7
PZ-21	561971.72	1999608.00	268.27
PZ-22	562586.08	1999404.12	256
PZ-23	562355.02	1999903.44	293.86
PZ-24	562796.46	1999819.02	263.74
PZ-25	562523.75	2000426.34	302.02
PZ-26	562921.01	2000488.87	290.56
PZ-27	562417.40	2001125.33	332.53
PZ-28	562925.76	2001136.96	342.09
PZ-29	562411.75	2000934.26	337.41
TOC - Top Of Casing			

A historical summary of the groundwater elevations for all wells and piezometers is included in Table 2. When possible, static water level measurements were collected at the time of drilling, approximately 24 hours after construction, and on or about seven days after construction. Water levels were periodically measured for all existing site monitoring wells and Phase III investigation piezometers during additional site visits through February 2013 (see Table 4 further in the report).

Table2
Historical Groundwater Elevation Summary (2004-2009)

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	Date of Reading										
			2/9/2004	3/12/2004	5/2/2005	10/25/2006	4/30/2007	8/1/2007	5/15/2008	6/17/2009	7/22/2009	8/3/2009	10/8/2009
CDMW-1	300.42	297.84	263.5		264.09			286.03		286.51	286.4	286.44	286.16
CDMW-2	276.71	273.89	270.96		265.18	268.79	265.41	268.88	268.42	267.91	268.66	269.33	271.06
CDMW-3	268.17	265.73	255.97		251.24	253.45	250.96	252.95	252.22	252.22	252.6	253.09	255.05
CDMW-4S	335.95	332.77	299.74					328.20	destroyed	destroyed	destroyed	destroyed	destroyed
CDMW-4D	336.07	333.07	298.83					300.90	destroyed	destroyed	destroyed	destroyed	destroyed
CDMW-5	273.102	270.28					261.252		Locked	260.712	264.352	265.642	270.142
CDMW-6	338.69	335.67			303.73	304.15	304.69		Dry	304.02	303.59	303.44	303.57
P-4	312.02									303.52	302.72	302.84	302.19
PZ-6B	339.1	336.12	303.57	303.3				303.60					
PZ-7	293.61	290.44	280.41	280.71				281.26	282.39	281.03	280.4	280.96	279.93
PZ-8	288.39	284.95	277.24						destroyed	destroyed	destroyed	destroyed	destroyed
PZ-9	327.91	324.63	306.32	307.31					307.58	306.11	305.75	305.99	305.69
PZ-10	290.98	287.156								281.17	280.74	281.07	280.61
PZ-11	336.96	334.041								305.27	305.24	305.21	305.25
PZ-12	318	315.163								307.04	306.94	307.06	306.88
PZ-13	307.23	304.293								291.85	291.6	292.28	291.02
PZ-14	281.31	277.641								259.61	262.75	263.21	265.5
PZ-15	338.42	335.462								305.57	305.19	305.3	304.92
PZ-16	327.9	324.072								305.95	305.98	306.15	305.65
PZ-17	315.49	311.552								301.13	301.07	301.09	301.04
PZ-18	301.4	297.882								279.35	279.34	279.53	279.74
PZ-19	248.13	245.118								242.78	242.52	242.81	241.86
PZ-20	252.7	248.934								243.42	243.08	243.33	242.88
PZ-21	268.27	264.55								257.69	257.96	258.66	259.46
PZ-22	256	252.788								249.3	249.3	249.64	249.19
PZ-23	293.86	290.056								Dry	Dry	Dry	Dry
PZ-24	263.74	262.075								Dry	Dry	Dry	Dry
PZ-25	302.02	298.665								285.11	285.51	287.31	287.71
PZ-26	290.56	287.182								281.26	281.45	285.03	281.2
PZ-27	332.53	329.667								304.15	303.76	303.65	303.38
PZ-28	342.09	338.811								305.69	305.37	305.29	305.05
PZ-29	337.41	335.477								304.61	304.14	304.17	303.61

3.2.2 Soil Testing

Soil samples were collected from multiple piezometer locations during drilling activities. Standard penetration tests were performed continuously for each boring using a 2-foot long split spoon sampler. Soil samples from the split spoons were collected so that select samples could be reviewed at a later date or sent to a soil testing laboratory. Undisturbed soil samples were collected using Shelby Tubes at select boring locations to be analyzed at a soil testing laboratory. Bulk samples were collected from drilling cuttings at select piezometer locations to be analyzed by a soil testing laboratory. Soil samples were sent to the Draper Aden Associates Soil Testing Laboratory in Richmond, Virginia. Soil samples sent to the laboratory consisted of two Shelby Tubes (PZ-25 (20'-22' and 32'-34')) and fourteen bulk samples (PZ-11 (0'-20'), PZ-17 (2'-12'), B-1 (26'-28' and 36'-38'), PZ-14 (4'-6'), PZ-15 (20'-22' and 32'-34'), PZ-17 (8'-10'), PZ-18 (22'-24'), PZ-26 (18'-20'), PZ-27 (8'-10' and 20'-22'), and PZ-29 (22'-24' and 36'-38'). Samples were analyzed for gradation, Atterberg limits, USCS classification, permeability, total porosity, total unit weight, and moisture content. The results of the soil analysis are summarized in Table 3 and the laboratory report is provided as Appendix II.

Table 3
Soil Analysis Summary

Piezometer Number	*Sample Depth (Ft)*	*Type of Sample**	*Unified Soil Classification From Tests***	*Natural Moisture Content (%)*	Gradation Test***		Atterberg Limits	
					Percent Sand and Gravel	Percent Silt and Clay (percent finer then No. 200 sieve)	*LL*	*PI*
PZ-11	0'-20'	Bulk						
PZ-14	4'-6'	SS	SC	15.9%	78.7%	21.3%	25	10
PZ-15	20'-22'	SS	SM	9.1%	85.4%	14.6%	0	0
PZ-15	32'-34'	SS	CL	16.1%	33.7%	66.3%	49	26
PZ-17	2'-12'	Bulk						
PZ-17	8'-10'	SS	SP-SM	6.6%	94.3%	5.7%	0	0
PZ-18	22'-24'	SS	SC	26.1%	75.3%	24.7%	49	35
PZ-25	20'-22'	ST	CL	18.1%	37.4%	62.6%	38	23
PZ-25	32'-34'	ST	SC	15.4%	63.9%	36.1%	48	36
PZ-26	18'-20'	SS	SC	21.3%	59.4%	40.6%	52	33
PZ-27	8'-10'	SS	SM	12.2%	79.9%	20.1%	0	0
PZ-27	20'-22'	SS	SC	9.1%	84.0%	16.0%	39	19
PZ-29	22'-24'	SS	SM	10.1%	87.4%	12.6%	0	0
PZ-29	36'-38'	SS	SC	15.5%	55.9%	44.1%	45	28

SS - Split Spoon, ST - Shelby Tube * Graphic Presentation of these tests can be found in Appendix IV*

*** CL - Sandy Lean Clay, SC - Clayey Sand, CH - Sandy Fat Clay, SM - Silty Sand, SP-SM - Poorly Graded Sand with Silt*

Selective split spoon samples were submitted for classification testing to confirm the visual field classifications, to estimate the variability of soils within each of the geologic units, and to establish the engineering properties of the site soils. These tests included:

- Grain Size Determination ASTM D-422
- Natural Moisture Content ASTM D-2216
- Placticity Indices (Atterburg Limits) ASTM D-4318

The Shelby Tube samples (relatively undisturbed) were subjected to permeability testing to estimate hydraulic conductivities of the in-situ soils. These tests were performed in accordance with: Falling Head Permeability Test ASTM D-5084

3.2.3 Hydrogeologic Testing

The groundwater elevations of newly installed monitoring wells were measured at the time of well construction and approximately 24 hours and 7 days after well construction. The groundwater elevations of existing piezometers and newly installed piezometers were measured periodically and current data are summarized in Table 4. The measurements were collected using a decontaminated electric water level indicator. The surveyed point on the top of the well casing was used as reference, and the measurements were recorded to within 0.01 foot. The maximum groundwater elevation was calculated from this data and used to construct the groundwater surface contour map (Figure 3).

Table 4
Current Groundwater Elevation Summary (2009-2013)

Well or Piezometer	T.O.C. Elevation	MAX Groundwater Elevation*	Ground Surface Elevation	Groundwater Elevation as of 11/25/2009	Groundwater Elevation as of 1/4/2010	Groundwater Elevation as of 2/18/2010	Groundwater Elevation as of 3/10/2010	Groundwater Elevation as of 3/19/2010	Groundwater Elevation as of 9/9/2010	Groundwater Elevation as of 2/7/2011	Groundwater Elevation as of 9/30/2011	Groundwater Elevation as of 12/16/2011	Groundwater Elevation as of 3/03/2012	Groundwater Elevation as of 7/11/2012	Groundwater Elevation as of 11/20/2012	Groundwater Elevation as of 2/21/2013
PZ-10	290.98	284.28	287.156	281.83	283.62	284.28	283.63	283.79	279.78	280.49	280.28	277.056	281.18	280.43	282.60	281.18
PZ-11	336.96	306.15	334.041	305.19	305.2	305.9	306.14	306.15	305.16	Dry	Dry	Dry	Dry	Dry	305.40	305.16
PZ-12	318	307.92	315.163	307.2	307.52	307.92	307.61	307.67	306.85	306.82	307.05	304.263	306.9	306.59	307.40	306.9
PZ-13	307.23	294.53	304.293	292.1	293.82	294.53	294.17	294.14	289.83	289.13	290.16	287.593	289.93	290.13	292.60	289.93
PZ-14	281.31	268.58	277.641	267.58	268.58	268.01	267.20	266.83	263.51	267.39	264.56	263.991	267.81	265.68	266.92	267.81
PZ-15	338.42	306.53	335.462	303.71	Dry	306.08	306.52	306.53	304.84	Dry	305.17	302.112	304.72	304.67	305.99	304.72
PZ-16	327.9	307.63	324.072	306.75	306.48	307.63	307.13	307.18	305.65	305.2	306.3	302.322	306.1	305.46	306.55	306.1
PZ-17	315.49	304.04	311.552	301.33	302.31	304.04	303.74	303.75	301.01	301.09	301.14	297.252	301.29	300.92	302.66	301.29
PZ-18	301.4	281.65	297.882	279.33	280.94	281.65	280.95	280.98	278.23	277.1	279.35	274.982	277.9	278.09	279.98	277.9
PZ-19	248.13	244.41	245.118	243.75	243.98	244.41	244.15	244.12	239.68	243.75	242.75	240.468	243.63	242.40	243.35	243.63
PZ-20	252.7	246.40	248.934	244.58	245.4	246.4	245.7	245.62	241.45	245.01	243.3	240.174	244.6	243.36	244.93	244.6
PZ-21	268.27	260.11	264.55	259.49	260.11	259.66	259.07	258.9	257.38	255.93	258.87	255.1	257.07	257.21	258.51	257.07
PZ-22	256	251.34	252.788	250.38	250.66	251.34	251.49	251.25	247.7	250.61	250.3	246.388	250.3	249.42	250.51	250.3
PZ-23	293.86	284.71	290.056	Dry	Dry	284.71	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry
PZ-24	263.74	258.44	262.075	257.61	257.59	258.44	257.58	257.74	Dry	Dry	256.84	Dry	Dry	257.50	Dry	Dry
PZ-25	302.02	288.32	298.665	288.23	288.06	287.13	286.41	286.15	287.24	285.3	288.32	283.815	285.02	285.97	286.72	285.02
PZ-26	290.56	285.03	287.182	282.38	282.53	283.41	282.84	282.84	280.81	281.91	282.06	278.362	282.06	281.34	282.39	282.06
PZ-27	332.53	305.23	329.667	303.16	303.5	304.83	305.22	305.23	303.38	302.83	303.23	300.487	301.93	302.85	304.17	301.93
PZ-28	342.09	306.84	338.811	305.02	305.24	306.45	306.88	306.84	305.11	304.79	304.54	301.311	304.69	304.55	305.89	304.69
PZ-29	337.41	305.79	335.477	303.4	303.62	305.25	305.83	305.79	303.62	302.81	302.96	301.377	302.91	303.24	304.48	302.91
CDMW-2	276.71	271.90	273.89	271.14		270.07		269.16	270.31	LOCKED	269.78	270.05	270.12	269.81	269.74	269.21
CDMW-3	268.17	258.10	265.73	254.33		255.57		254.66	254.01	254.55	253.98	254.24	254.78	254.14	255.12	255.67
CDMW-5	273.102	270.14	270.28	267.742		264.622		262.352	269.352	265.082	270.102	265.68	266.54	267.37	268.46	264.002
CDMW-6	338.69	305.16	335.67	302.94	301.34	304.47		305.16	303.18	302.36	302.89	300.22	302.54	303.21	302.94	302.49
PZ-7	293.61	282.55	290.44	281.76	281.87	282.55		282.24	280.39	281.43	280.91	279.54	278.95	279.22	280.51	281.51
PZ-9	327.91	308.59	324.63	305.93	306.67			308.1	305.51	305.26	304.85	302.73	303.68	304.21	305.42	305.91

* Maximum groundwater elevation shown is from 9/30/1997 or date of installation through 2/21/2013

Following rigorous development, fourteen piezometers (PZ-10, PZ-11, PZ-12, PZ-13, PZ-15, PZ-16, PZ-17, PZ-18, PZ-20, PZ-25, PZ-26, PZ-27, PZ-28 and PZ-29) were chosen for aquifer testing (slug tests) during the field investigation. The purpose of the testing was to assess the values of horizontal hydraulic conductivity at various hydrogeologic units within the aquifer at the site. In situ rising- and falling-head slug tests were chosen for the assessment due to the relatively low well yields noted during well installation and development. Slug tests were conducted on June 8, 9, and 12, 2009, by CTC personnel. Piezometers (PZ-10, PZ-11, PZ-12, PZ-13, PZ-15, PZ-16, PZ-17, PZ-18, PZ-20, PZ-25, PZ-26, PZ-27, PZ-28 and PZ-29) were bailed dry and readings recorded. Prior to slug testing, the piezometers were opened and groundwater levels were allowed to equilibrate. Water level measurements were then collected using an electric water level indicator referenced to a point on the top of casing. The rising-head test was performed on each well with the same methodology with the exception that the PVC slug was removed simultaneously with the start of the test.

The Piezometer bail down method, as mentioned above, provides a quantitative estimate of horizontal hydraulic conductivity and a qualitative estimate of aquifer anisotropy in water-bearing units. The slug test data was analyzed using the Bouwer and Rice (1976 and 1989) equation, which is applicable to fully or partially penetrating wells in unconfined or confined aquifers. Piezometer specific aquifer thicknesses of 1.5 to 14.0 feet were assumed for the soil hydrogeologic unit based upon information available from the boring logs. A summary of aquifer testing performed at the site is included in Table 5. A geometric mean for hydraulic conductivity values for each of the hydrogeologic units was calculated as shown on Table 5.

Table 5 Aquifer Testing Summary		
	Hydraulic Conductivity (K)	
Piezometer	(m/s)	(cm/s)
PZ-10	2.50E-07	2.50E-05
PZ-11	1.52E-08	1.52E-06
PZ-12	2.91E-06	2.91E-04
PZ-13	7.38E-06	7.38E-04
PZ-14	NOT TESTED	
PZ-15	1.92E-05	1.92E-03
PZ-16	7.12E-07	7.12E-05
PZ-17	NOT TESTED	
PZ-18	6.91E-07	6.91E-05
PZ-19	1.41E-08	1.41E-06
PZ-20	2.33E-07	2.33E-05
PZ-21	5.00E-08	5.00E-06
PZ-22	7.66E-05	7.66E-03
PZ-23	dry	dry
PZ-24	dry	dry
PZ-25	3.49E-06	3.49E-04
PZ-26	NOT TESTED	
PZ-27	1.24E-06	1.24E-04
PZ-28	1.26E-06	1.26E-04
PZ-29	NOT TESTED	

4.0 *REGIONAL AND LOCAL GEOLOGY*

The landfill and the area permitted for expansion lies at the western edge of the Coastal Plain physiographic province. The Coastal Plain is located along the eastern third of the state and is characterized by gently rolling to subdued topography that was once generally covered by the Atlantic Ocean. The western half of the Coastal Plain is higher in elevation, exhibits rolling topography, and in general, is better drained. Southwestern Harnett County is located in the western half of the Coastal Plain. As would be anticipated, the location exhibits higher elevation and rolling topography.

USGS topographic maps for the Anderson Creek and Olivia quadrangles indicate that the site drains into tributaries of McLeod Creek and Red Hill Branch.

Local Relief in the western Coastal Plain ranges from less than 20 feet to 100 feet. Elevations range from 70 to 150 feet above MSL. Relief is greatest where the larger streams have cut through the Tertiary and Cretaceous aged unconsolidated sedimentary formations and exposed the underlying crystalline Raleigh Belt metamorphic rocks.

This area of Harnett County is generally drained by streams flowing from northwest to southeast. Tributary stream valleys have parallel alignment except where topographic influence of terraces affects the stream courses. Streams in the Coastal Plain become shallower and wider, gradients flatten, and the streams meander within their floodplain. Harnett County is drained by the tributaries of the Cape Fear River Drainage Basin. McLeod Creek, Barbecue Swamp and Anderson Creek are the major stream tributaries in southwest Harnett County.

4.1 Regional Geology

The Anderson Creek C & D Landfill is located at the western edge of the Coastal Plain, consists of formations of unconsolidated sediments of Cretaceous and Tertiary age. The sediments are generally described as clays, silts, sands, and gravels with mixtures of each. The sediment contains scattered quartz pebbles.

4.2 Local Geology

Two formations, the Middendorf and the Cape Fear, are found on site. They are both of Cretaceous age. It is possible that Tertiary-aged Pinehurst Formation or terrace deposits and/or upland sediments overlie the above on certain parts of the landfill expansion area. The upland sediments generally consist of sands. Generally, the Middendorf consists of fine sandy clays grading into coarse clayey sand with depth. The Middendorf surficial aquifer appears to be perched atop the Cape Fear Formation sediments on site. The Cape Fear Formation generally consists of silty clays at this site. The Middendorf Formation sediments appear to be roughly thirty (30) to thirty-five (35) feet thick in places, generally higher elevations, and decrease at the lower elevations until they disappear.

The Cape Fear Formation consists generally of tan to gray silty clay with some lenses of clayey silts. This formation tends to dominate at lower elevations. Borings indicate that the thickness of the Cape Fear is in excess of fifty (50) feet at the site.

4.2.1 NRC Soil Mapping

Natural Resource Conservation (NRC), an agency of the U.S. Department of Agriculture, has data which is useful for site planning. Many of the soil characteristics and engineering properties of the surficial soils are outlined in tabular form. The NRC has mapped the major soil series occurring within Harnett County in a document entitled *Soil Survey of Harnett County, North Carolina.*

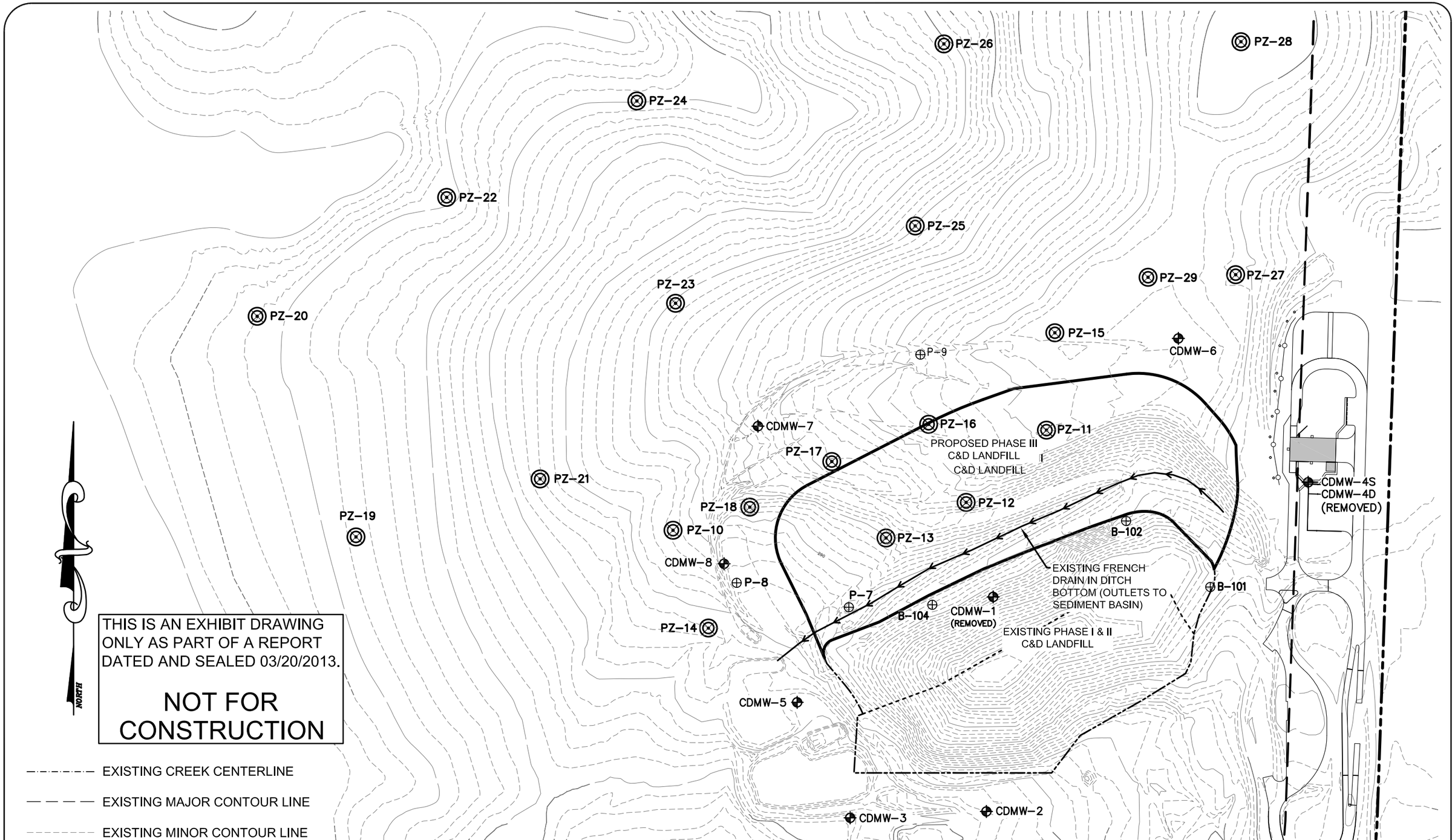
4.2.2 Site Lithology

The higher elevations on the site are covered by Blaney Loamy Sand (BnB) characterized by slopes of 2 to 8 percent. Lower elevations and side slopes are covered with Candor Sand (CaB) characterized by slopes from 0 to 8 percent. Small areas of Vaucluse Loamy Sand (VaB) characterized by a 2 to 8 percent slope, and Blaney Loamy Sand with 8 to 15 percent slope were also observed.

4.2.3 Geologic Sections

The boring data is presented graphically on a series of 4 borehole cross-sections and the associated modeled subsurface profiles. For this study we have implemented the three dimensional (3-D) subsurface modeling software RockWorks2006 by Rockware, Inc., Colorado. As shown on the following pages, four cross-sections (A through D) are represented with both a 3-D model of surface contours and profile view in Figures 4 - 12, respectively, for a total of eight exhibits. Borehole data is graphically represented with the existing ground surface and seasonal high water table surface as labeled lines for each cross section.

Cross-sections A and B are oriented roughly parallel to the topographic lines and follow the apparent direction of groundwater flow. Cross-section C and D are oriented to bisect the site for proposed future landfill expansion in two areas, including the Phase III expansion cell.



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NOT FOR CONSTRUCTION

EXISTING CREEK CENTERLINE

EXISTING MAJOR CONTOUR LINE

EXISTING MINOR CONTOUR LINE

P-PZ-28 PIEZOMETER LOCATION AND ID

CDMW-3 MONITORING WELL LOCATION AND ID

B-104 OLDER PIEZOMETER OR BORING

GRAPHIC SCALE: 1" = 200'

0 100 200 400 600

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License No. C-2570 - www.ctclayton.com

ANDERSON CREEK LANDFILL
PHASE III EXPANSION

HARNETT COUNTY, NC.

Date: 10 JAN. 2012	Sheet Title: WELL & PIEZOMETER LOCATION MAP
Project #: 03002C	
Drawn By: SBK	Scale: 1" = 200'
Designed By: SBK	Prvs. Eng.: CTC Jr.
Checked By: RS	File Name: 03001C ACLF EXPANSION 13 0308
FIGURE	2

P:\003 Harnett County\03001C ACLF C&D Phase 3\CAD\03001C ACLF Expansion 13 0308.dwg

Cross-section A

This cross-section is oriented roughly east-northeast to west-southwest and runs parallel through the proposed Phase III expansion area requested to be permitted. Changes in the land surface are indicated as the elevation drops from piezometer PZ-27 at the northeast end of the section to piezometer PZ-14 at the southwest end of the section. PZ-14 is located in the lower region of the area to be requested for permitting. Surface elevation drop through the section is approximately 52 feet. Sandy clay and clayey sands are dominant from PZ-27 to PZ-14. Groundwater in the upper reaches of the section (PZ-11, 15, 27, and 29) is consistently between twenty-five (25) and thirty (30) feet below ground surface. At the locations of PZ-10, 12, 13, 14, 16, and 18, groundwater elevations rise to only two (2) to seventeen (17) feet below ground levels as lower, wet areas are approached. Groundwater levels would appear to be controlled by the topographic drop in elevation in the direction of groundwater flow. Refer to Figure 5 for a model of the topographic elevations of the existing surface in relation to the location of cross-section A and Figure 6 for a profile of the subsurface for this cross-section.

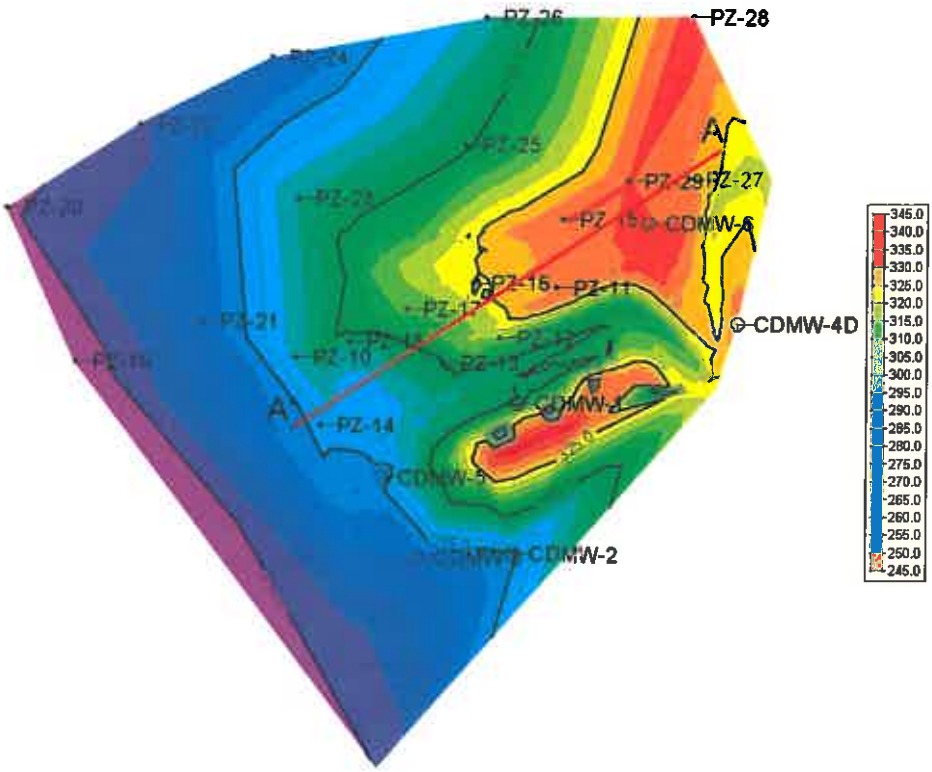


Figure 5 – Cross-section 'A' Surface Elevation

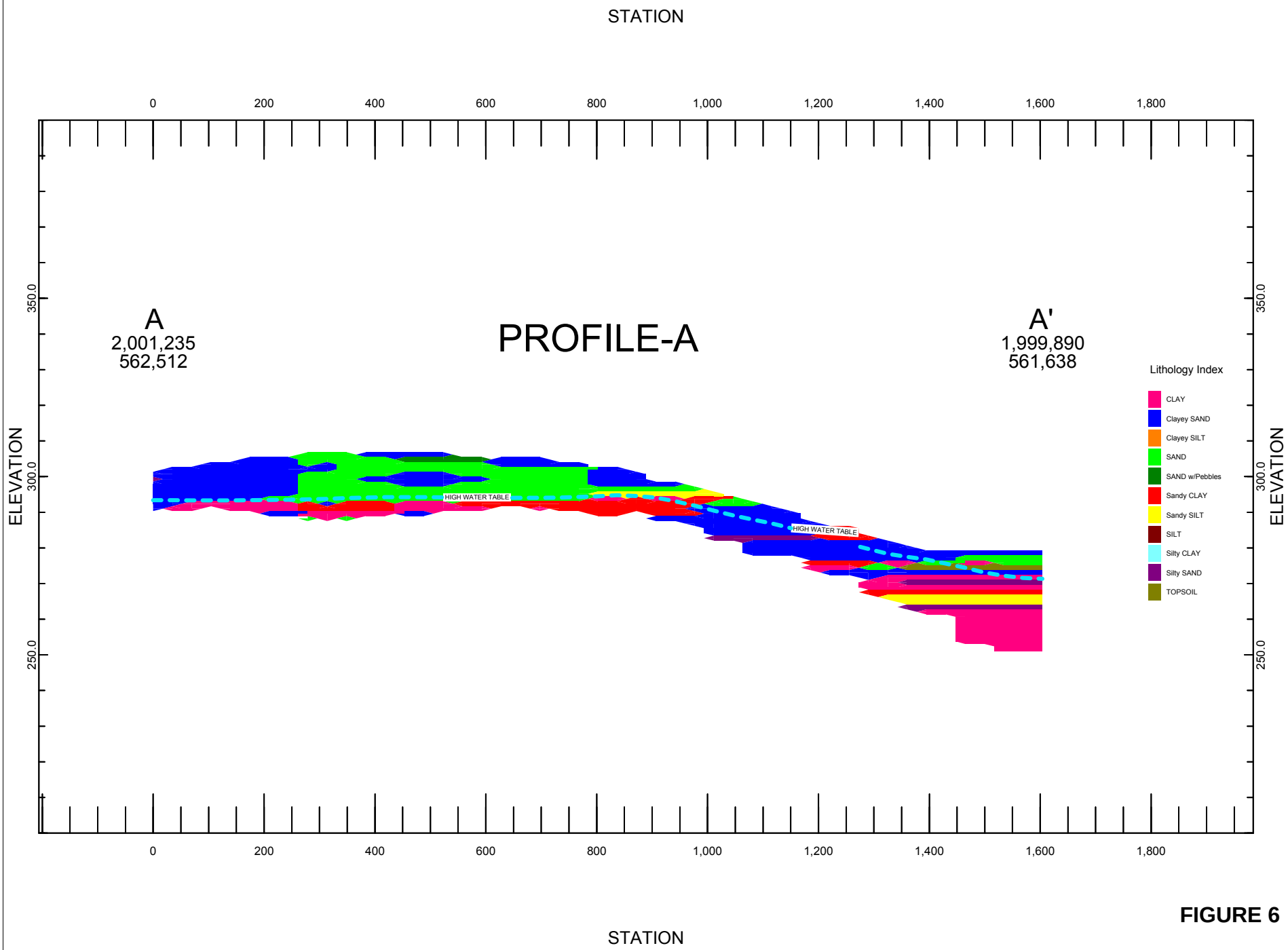

STATION
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
A
2,001,235
562,512
PROFILE-A
A'
1,999,890
561,638
Lithology Index
CLAY
Clayey SAND
Clayey SILT
SAND
SAND w/Pebbles
Sandy CLAY
Sandy SILT
SILT
Silty CLAY
Silty SAND
TOPSOIL
HIGH WATER TABLE
HIGH WATER TABLE
ELEVATION
350.0
300.0
250.0
STATION

FIGURE 6

Cross-section B

This cross-section is oriented roughly east-northeast to west-southwest and runs parallel next to the proposed Phase III expansion area requested to be permitted. Changes in the land surface are indicated as the elevation drops from piezometer PZ-28 at the northeast end of the section to a location approximately halfway between piezometer PZ-19 and PZ-20 at the southwest end of the section. PZ-19 and PZ-20 are located in the lower region of the area for future expansion but outside the area to be requested for permitting at this time. Surface elevation drop through the section is approximately 71 feet. Clay, Sand and clayey sands are dominant throughout the geology of this cross-section. The groundwater of this section (PZ-20, 21, 23, 25, and 26) is consistently between two (2) to ten (10) feet below ground levels. Groundwater levels would appear to be controlled by the topographic drop in elevation in the direction of groundwater flow. Refer to Figure 7 for a model of the topographic elevations of the existing surface in relation to the location of cross-section B and Figure 8 for a profile of the subsurface for this cross-section.

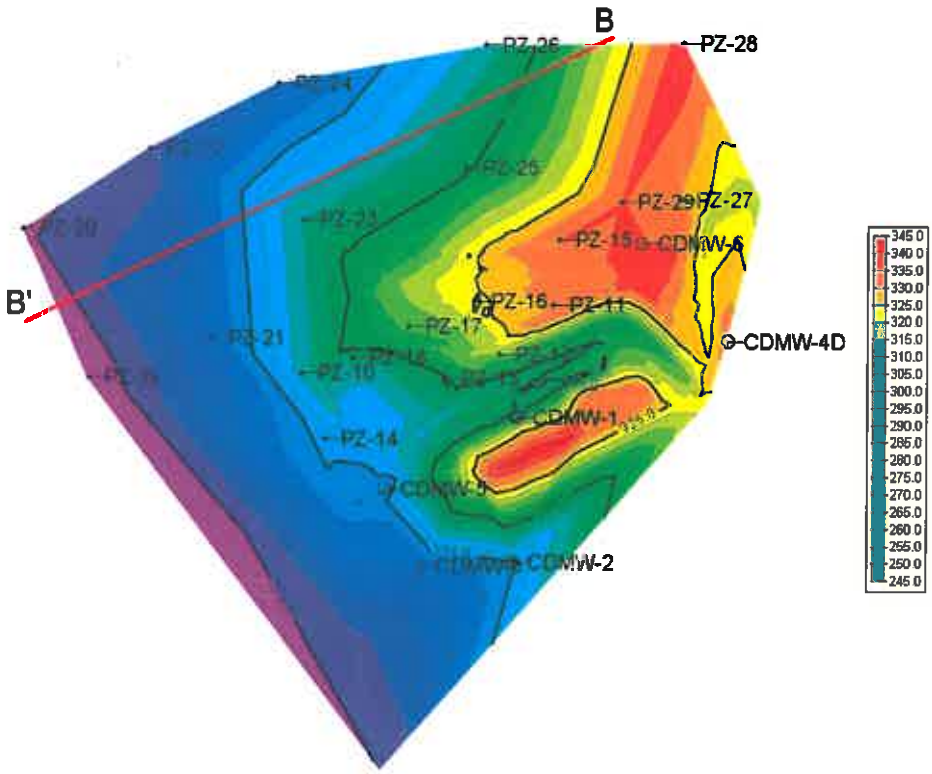


Figure 7 – Cross-section 'B' Surface Elevation

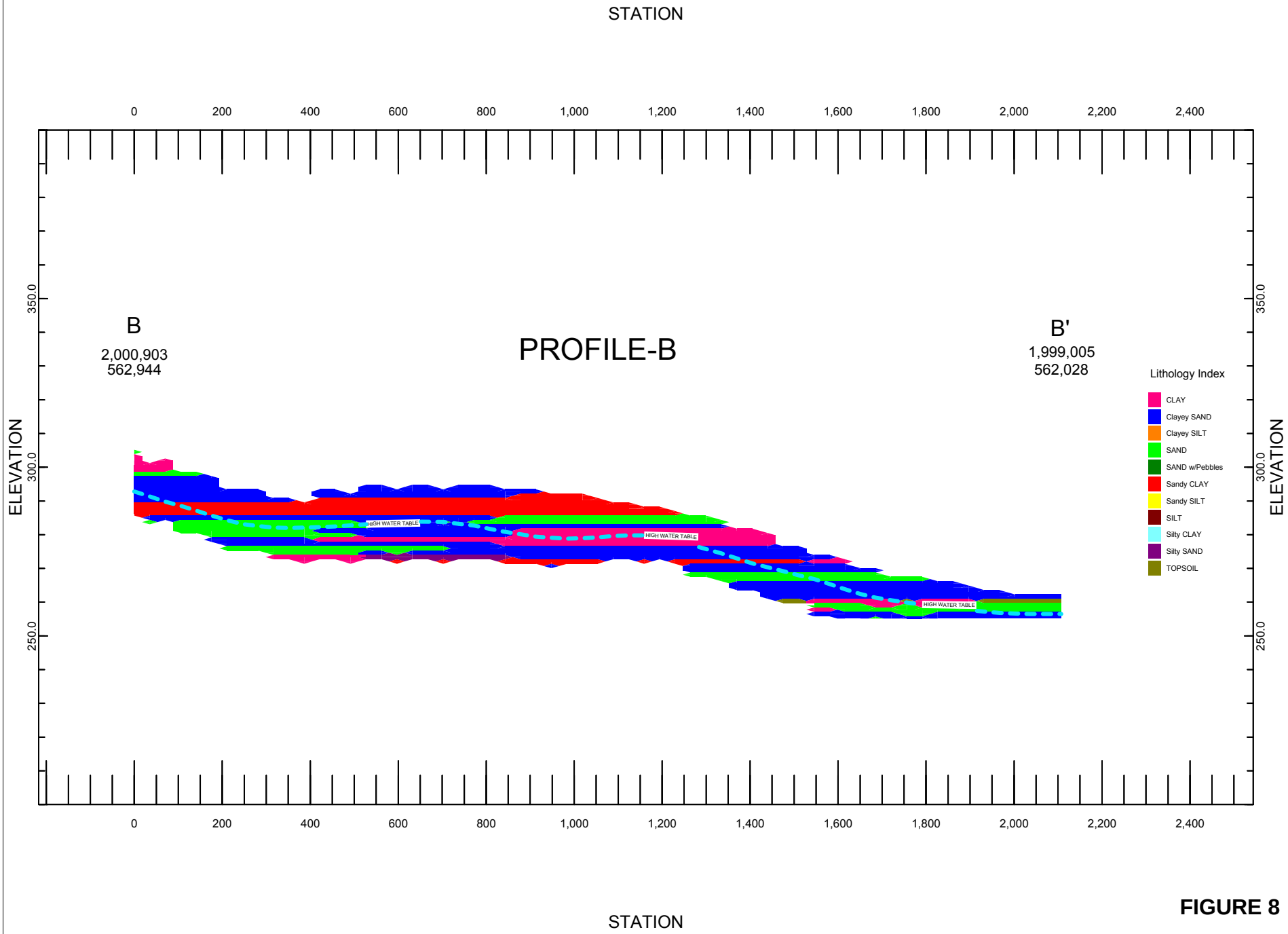

STATION
0
200
400
600
800
1,000
1,200
1,400
1,600
1,800
2,000
2,200
2,400
ELEVATION
350.0
300.0
250.0
B
2,000,903
562,944
PROFILE-B
B'
1,999,005
562,028
HIGH WATER TABLE
HIGH WATER TABLE
HIGH WATER TABLE
Lithology Index
CLAY
Clayey SAND
Clayey SILT
SAND
SAND w/Pebbles
Sandy CLAY
Sandy SILT
SILT
Silty CLAY
Silty SAND
TOPSOIL
STATION

FIGURE 8

Cross-section C

This cross-section is oriented roughly north-northwest to south-southeast and partially bissects the proposed Phase III expansion area requested to be permitted. Changes in the land surface are indicated as the elevation drops from piezometer PZ-24 at the northwest end of the section to piezometer PZ-13 at the southeast end of the section. PZ-24 is located in the lower region of the area but outside the proposed Phase III expansion area to be requested for permitting. Surface elevation drop through the section is approximately 21 feet. Clay and clayey sands are dominant from PZ-24 to PZ-13. The groundwater of this section (PZ-13, 17, 23, and 24) is consistently between three (3) to ten (10) feet below ground levels. Groundwater levels would appear to be controlled by the topographic drop in elevation in the direction of groundwater flow. Refer to Figure 9 for a model of the topographic elevations of the existing surface in relation to the location of cross-section C and Figure 10 for a profile of the subsurface for this cross-section.

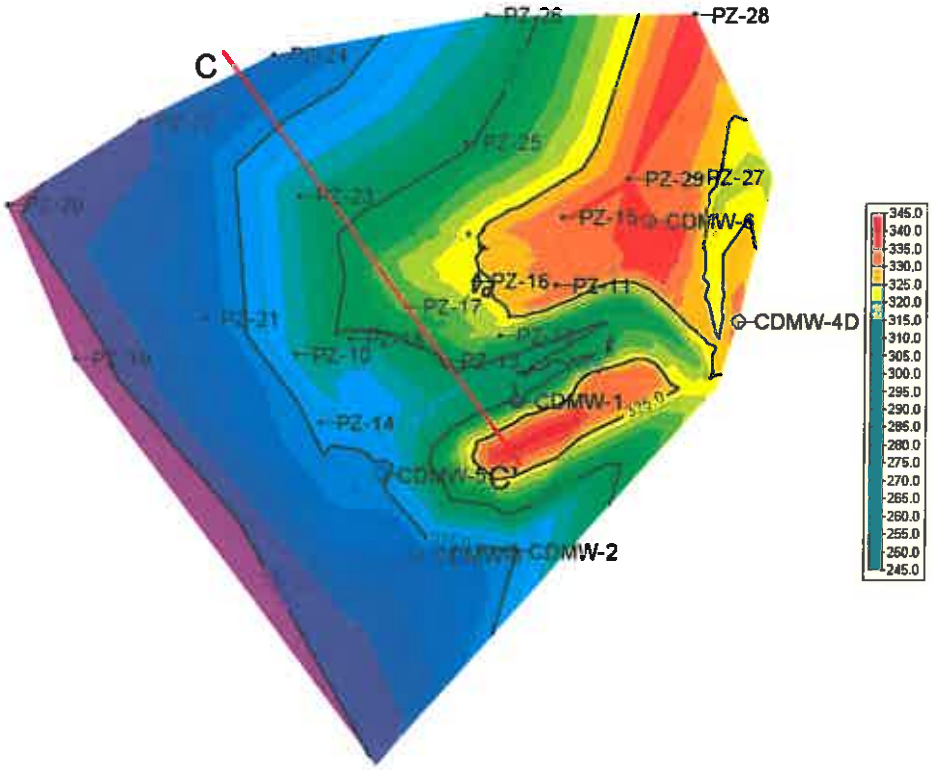
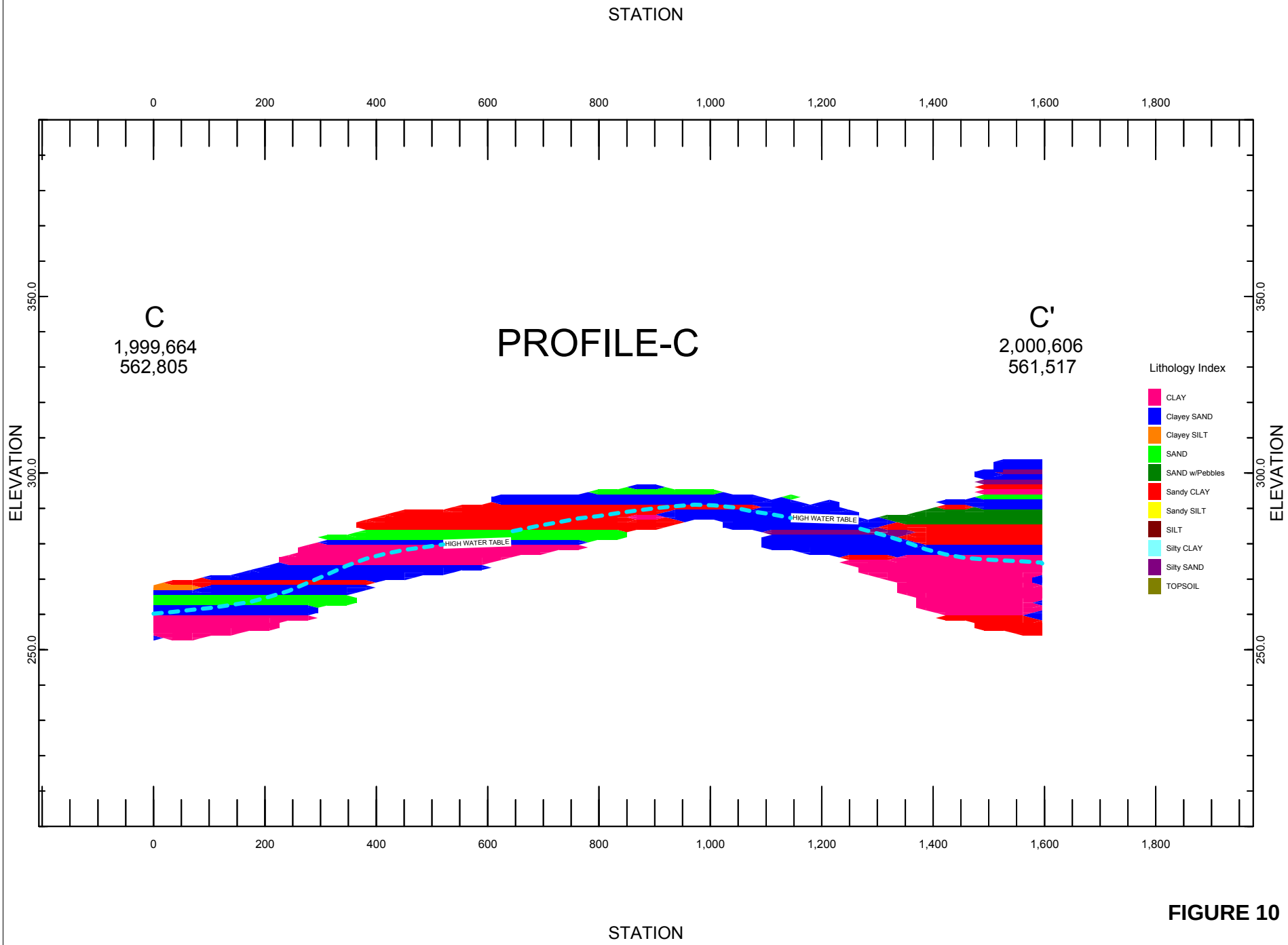


Figure 9 – Cross-section 'C' Surface Elevation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800
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1,800
C
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562,805
PROFILE-C
C'
2,000,606
561,517
Lithology Index
CLAY
Clayey SAND
Clayey SILT
SAND
SAND w/Pebbles
Sandy CLAY
Sandy SILT
SILT
Silty CLAY
Silty SAND
TOPSOIL
HIGH WATER TABLE
HIGH WATER TABLE
ELEVATION
350.0
300.0
250.0
STATION

FIGURE 10

Cross-section D

This cross-section is oriented roughly north-northwest to south-southeast and bissects the proposed Phase III expansion area requested to be permitted. Changes in the land surface are indicated as the elevation drops from piezometer PZ-26 at the northwest end of the section to B-101 at the southeast end of the section. PZ-26 is located in the lower region of the area but outside the proposed Phase III expansion area to be requested for permitting. Surface elevation drop through the section is approximately 53 feet. Sandy clay, sand and clayey sands are dominant from PZ-26 to B-101. The groundwater of this section (PZ-11, 15, 25, and 26) is consistently between three (3) to twenty eight (28) feet below ground levels. Groundwater levels would appear to be controlled by the topographic drop in elevation in the direction of groundwater flow. Refer to Figure 11 for a model of the topographic elevations of the existing surface in relation to the location of cross-section D and Figure 12 for a profile of the subsurface for this cross-section.

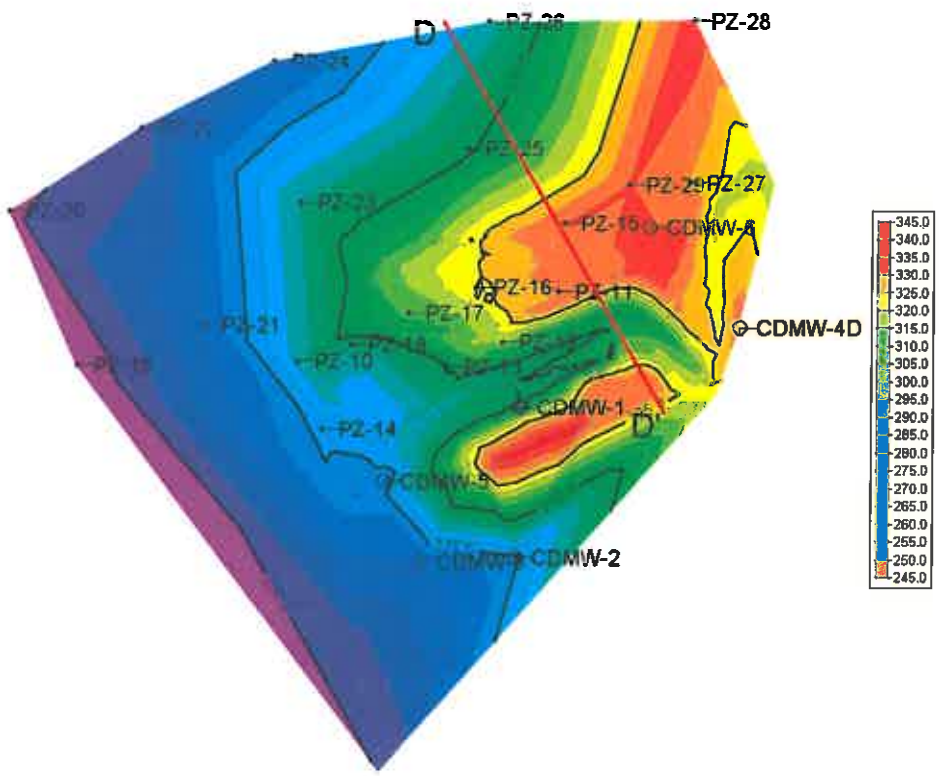
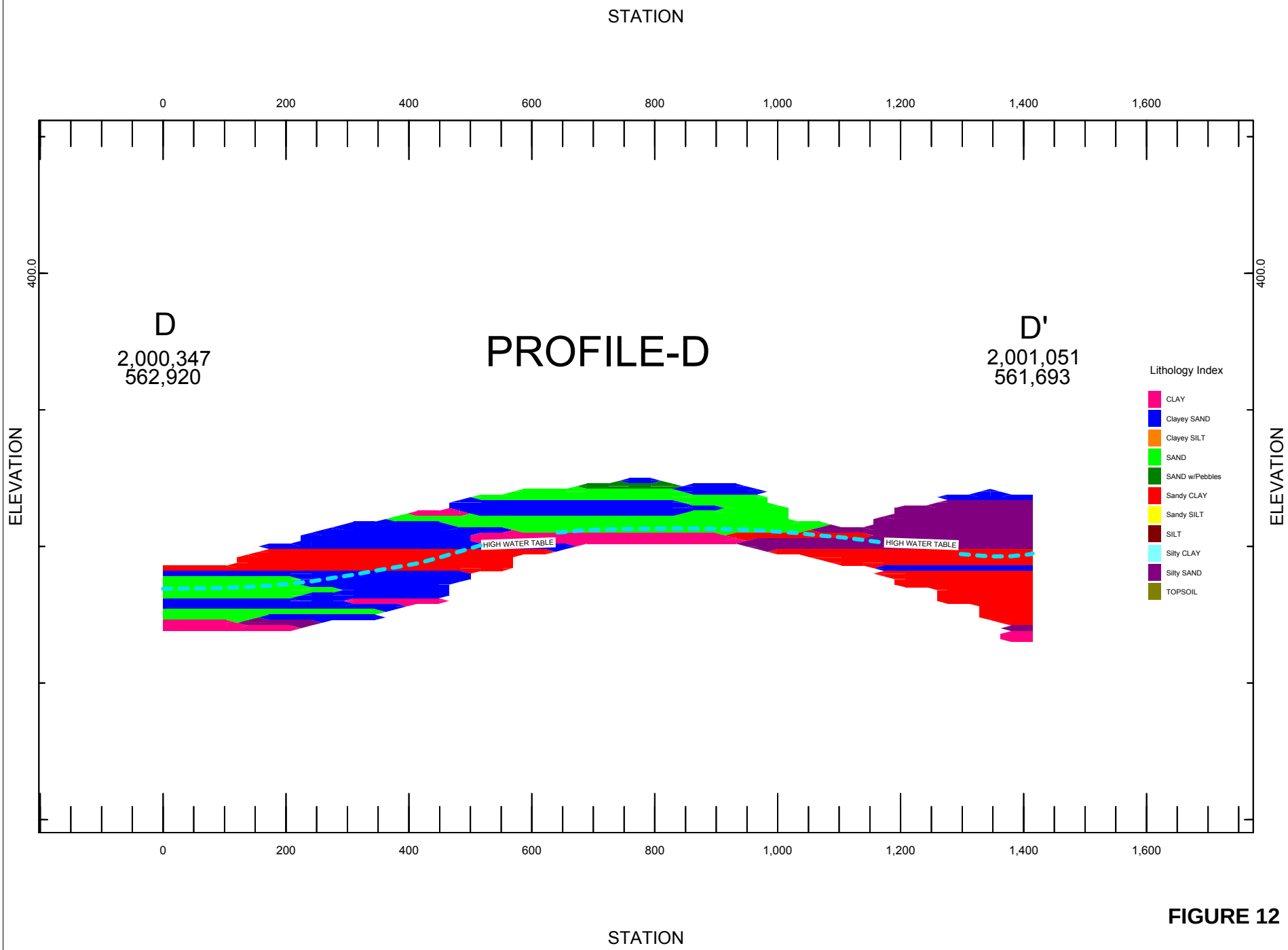


Figure 11 – Cross-section 'D' Surface Elevation


STATION
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400
600
800
1,000
1,200
1,400
1,600
400.0
ELEVATION
D
2,000,347
562,920
PROFILE-D
D'
2,001,051
561,693
Lithology Index
CLAY
Clayey SAND
Clayey SILT
SAND
SAND w/Pebbles
Sandy CLAY
Sandy SILT
SILT
Silty CLAY
Silty SAND
TOPSOIL
HIGH WATER TABLE
HIGH WATER TABLE
STATION

FIGURE 12

5.0 *SITE HYDROGEOLOGY*

As previously described, the two dominant formations found on site are the Middendorf and the Cape Fear. The Middendorf generally consists of sediments which range from silty clays to clayey sands and gravel. Clay lenses are common and may result in small pockets of perched groundwater. Zones containing more sand and gravel as opposed to silty clays will exhibit a higher hydraulic conductivity. The Cape Fear Formation is generally described as relatively impervious, tight, silty clay, and based on piezometer and boring data it is found to be fairly consistent across the site. The Cape Fear appears to be a confining unit which would tend to resist vertical hydraulic connectivity and groundwater flow downwards from the uppermost aquifer in the overlying sediments to a confined, deeper aquifer.

Data from pre-existing and newly-constructed piezometers and monitoring wells on the site provided information on subsurface conditions, particularly soils and groundwater, at the facility. Based on these data, a potentiometric map was produced which indicates measured and predicted groundwater elevations of the uppermost aquifer across the face of the proposed landfill expansion area as shown in Drawing 3. Based on rainfall data gathered from two nearby observation stations, it is assumed that seasonal variations in water table could have a bearing on elevation measurement readings. The groundwater elevation measurements were obtained just after periods of increased rainfall during the period of December 2009 through February 2010. However, it appears that these potentiometric levels represent a consistent pattern at the site.

In general, groundwater flow is directed from areas of high potential to areas of low potential. Based on the findings of this and previous studies at the site, groundwater flow generally follows surface topography. This is typical of the Coastal Plain and Piedmont regions of North Carolina where the Middendorf Formation sediments, the naturally-occurring overlying soils prior to excavations in the proposed expansion area.

Based on data compiled at the site from recent borings, piezometer installations, and monitoring wells, groundwater appears to be present in the region of the Cape Fear Formation sediments between the elevations of 270 and 290 feet in the proposed landfill expansion area.

Data from a previous site investigation determined that the direction of groundwater flow in the Cape Fear Formation sediments is slightly west of due south, and at a very slow rate.

5.1 Depth of Groundwater

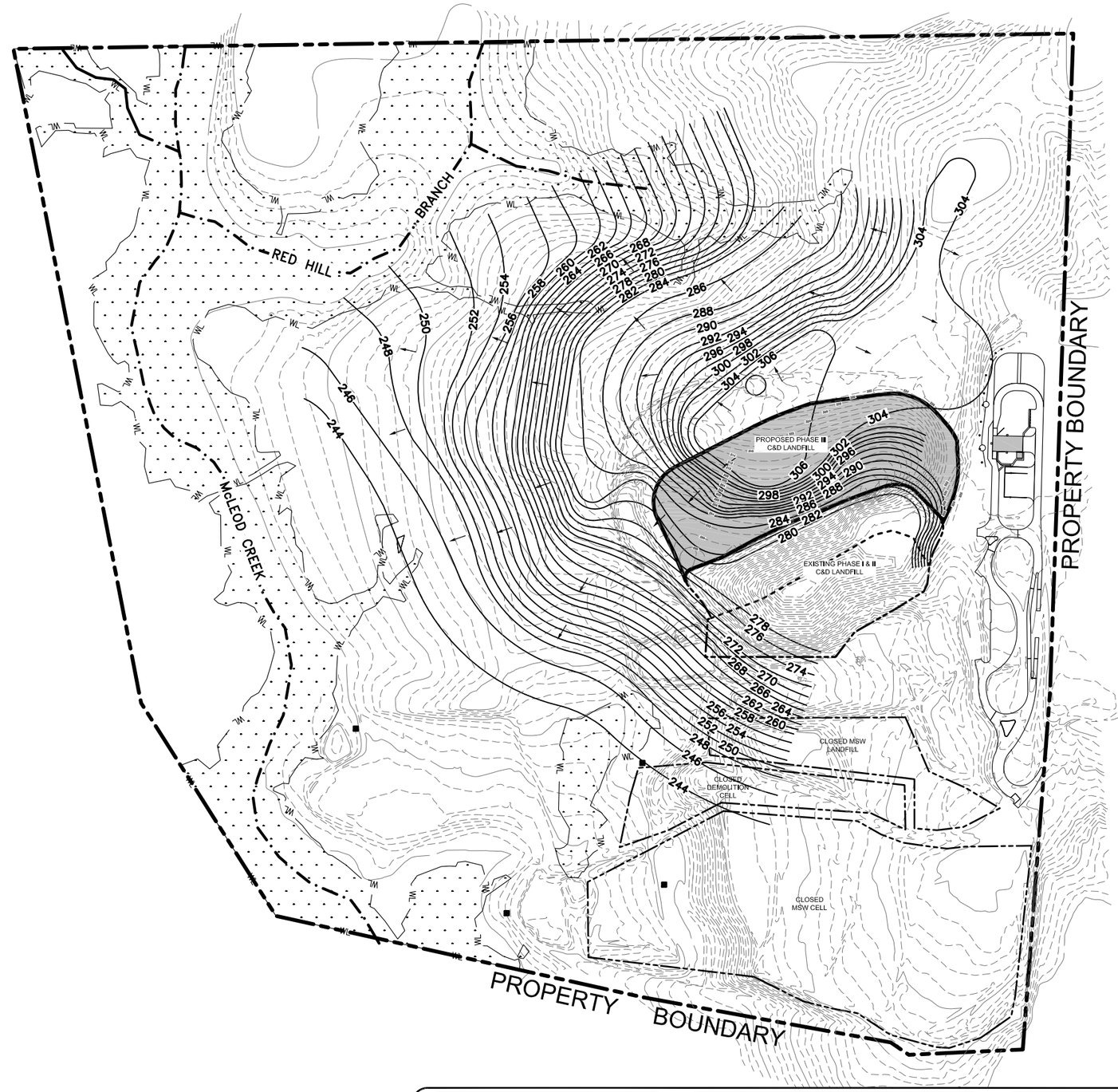
Based on water level measurements made in the piezometers during field work, the depth to water varies between 7.8 and 31.4 feet below the existing ground surface over the entire study area and between 10.8 and 31.4 feet below ground surface in the proposed landfill expansion area.

Maximum groundwater elevations, calculated based upon periodic well readings obtained by CTC, are graphically illustrated on Figure 3, the Groundwater Surface Contour Map. The groundwater contour map indicates the most current groundwater flow direction. The groundwater readings from the current and previous years show fairly good consistency over the time period of 2004 to 2013. This confirms that the calculated maximum groundwater elevation is a stabilized elevation based upon the consistency of the previous and current readings.

To better depict and understand the groundwater elevation in and around the Phase III expansion CTC incorporated data from four (4) wells/piezometers (CDMW1, B-101, B-102 and B-104). These wells were removed prior to construction of the Phase II cell; however, it is important to note that the last calculated maximum groundwater elevation for these wells (B1010 thru B-104 in 2004 and CDMW1 in 2006) occurred during a period in which the groundwater was at higher elevations due to abnormally high rates of precipitation which would make their readings suitable for this site study. Refer to Figure 2 for piezometer and well locations and Figure 3 for groundwater elevation contours.

5.2 Groundwater Flow Direction

Groundwater flows from areas of higher potential to areas of lower potential. Groundwater flow is also perpendicular to the potentiometric contours as surface water flow would be to topographic contours. The general direction of flow is downward/down gradient to the west/southwest; however, a small portion of flow is directed to the northwest. Ultimately all surface water discharges into a tributary of McLeod Creek. As noted in previous paragraphs that describe the sections, groundwater also flows laterally to discharge points as indicated by the



NORTH

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GRAPHIC SCALE: 1" = 400'

0 200 400 800 1200

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ANDERSON CREEK LANDFILL
PHASE III EXPANSION

HARNETT COUNTY, NC.

Date: 10 JAN. 2012		Sheet Title: **GROUNDWATER CONTOUR MAP**	
Project #: 03002C			
Drawn By: SBK	Scale: 1" = 400'	FIGURE 3	
Designed By: SBK	Proj. Eng.: CTC Jr.		
Checked By: RS	File Name: 03001C ACLF EXPANSION 13 0308		

P:\003 Harnett County\03001C ACLF C&D Phase 3\CAD\03001C ACLF Expansion 13 0308.dwg

curving contour lines into the drainage depressions where groundwater discharges as intermittent streams. Water levels on the geologic sections show groundwater flow to the tributary of McLeod Creek.

The ridges and areas of higher topography on the north part of the proposed landfill expansion site tend to act as groundwater recharge areas. Water infiltrates the ground surface and moves downward to the zone of saturation. Groundwater flows downward and laterally to discharge points to the south. The compositions of the sediments that are present on site tend to complicate groundwater flow. Where more or less granular sediments occur, groundwater will flow preferentially within more granular materials. Where the fine-grained sediments occur, such as silts and clays encountered in the soil borings and piezometer installations, groundwater will tend to flow on top of, or around, the clay due to its much lower conductivity. This condition was indicated by the piezometers which had more water in them after considerable rainfall, but water levels were lower when there was less rainfall. The deeper piezometers are more representative of the actual groundwater levels within the zone beneath the clay and within the lower sediment column.

5.3 Physical Features to Control Groundwater Flow

After construction of Phase II of the C&D landfill, the drainage ditch located on the northern side of Phase II that drains to the horseshoe shaped sediment basin on the western end of the C&D cell, experienced seasonal periods of extreme wetness. Due to the low slope of the constructed drainage feature, water tended to pond and keep the bottom of the ditch saturated due to the underlying natural clay substrate at this elevation. This wetness was in part due to periodic groundwater discharges from the northern slope above where clay lenses were exposed on the cut slope discharged groundwater during periods of high precipitation. Due to the wetness of the ditch bottom and the tendency for the water to stagnate, a sand and gravel bed was installed in the bottom of the ditch surrounding a 4 and 6 inch perforated pipe. This allowed the periodic groundwater discharges to flow and discharge in the sediment basin while not ponding in the ditch bottom and allowing easier site maintenance. This ground water control feature is shown on Figures 1 and 2.

5.4 Seasonal Water Table Variation

The groundwater readings obtained from 2004 to 2013 show significant variation in elevation in some of the borings. This is due to some of the borings being located in areas of groundwater recharges with the overlying materials being of a high permeability while other borings are located in areas between groundwater recharge and groundwater discharge where the overlying material is of a low permeability.

The groundwater readings for the borings located within and near the approximate footprint of the proposed C&D cell indicate a seasonal variation in the water table that ranges from 1 to 9 feet. This is considered to be within the normal seasonal variation due to fluctuations in precipitation and evapo-transpiration.

Two piezometers, PZ-12 and PZ-16, show water levels considerably higher in elevation than the surrounding piezometers. This is likely due to the subsurface confining unit also being at a higher elevation, the wells being located in a groundwater recharge area, and to probable localized perching conditions.

In an attempt to verify that the highest water levels recorded for the wells located within the footprint of the proposed C&D cell are an accurate prediction of the seasonal high water table, climatic data for Raven Rock State Park in Lillington North Carolina was analyzed. Raven Rock is located approximately 20 miles from the landfill and the climatic data for the State Park should provide an adequate comparison. Based on the groundwater data found in Table 2 and Table 4, the highest recorded groundwater elevations for the borings located within the proposed footprint were during mid to late 2009 and early 2010 for most of the data points. The climatic data for the State Park shows that precipitation from this same timeframe produced the most rainfall for 2009 and 2010 especially during the month of November 2009, with the actual rainfall total of 2.43 inches. The climatic data can be found in Appendix III.

In addition, the historical groundwater data was analyzed for two nearby NC Division of Water Resource wells located in Fayetteville and Fuquay Varina. This data shows the historical elevation of the water table with a focus from March 2009 until February 2010. The data sets for both these wells graphically show a peak water table elevation in during this time periord. This

data further supports that the seasonal high water table shown in Figure 3 is accurate. With the excessive drought period that North Carolina has experienced the past 2+ years the end of 2009 thru early 2010 still remains the peak water table elevation. This well data can be found in Appendix IV.

6.0 *CONCLUSION*

The report presented here summarizes a detailed investigation of the geologic and hydrogeologic features of the Anderson Creek landfill site and particularly the site of the proposed Phase III expansion to the C&D landfill cell. The required information, such as, subsurface soil information, groundwater depth, direction and rate of groundwater flow, is presented to allow for the adequate design of the landfill expansion and to assist in generating the required groundwater monitoring program for this expansion. The requirements found in 15A NCAC 13B.0538 have been addressed by this report.

APPENDIX I

BORING LOGS AND WELL INSTALLATION RECORDS

Project: ACLF C&D PHASE III | BORING: B-1 |

Drilling Co.: J&L | Date Started: 5/19/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/20/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 302.958 | Project #: 03001C

ELEVATION	DESCRIPTION	GRAPHIC LOG	N-VALUE	USCS SYMBOL	MOISTURE
	Clayey SAND Brown Red Grey Clayey SAND (medium) w/mica Organics in top 1'		5	SC	
			9		Damp
5			20		Damp
			15		
293.958			15		Damp
10	**CLAY** Grey Brown mottled CLAY		32	CL	
290.958					Damp
	Clayey SAND Grey Clayey SAND (medium) w/mica		21	SC	
15			14		Moist
286.958	**CLAY** Grey Black CLAY w/mica		28	CL	
284.958					Damp
	Sandy CLAY Dark Grey Sandy CLAY		47		
20			31	CH	Damp
			39		Damp
25			23		
			20		Damp
			34		
30					Damp

Boring Log

C.T. Clayton, Sr., P.E., Inc.
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Coats, NC 27521
Phone: 910-897-7070
Fax: 910-897-6767

Project: ACLF C&D PHASE III | BORING: B-1 | Page: 2 of 2

Drilling Co.: J&L | Date Started: 5/19/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/20/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 302.958 | Project #: 03001C

ELEVATION	DESCRIPTION	GRAPHIC LOG	N-VALUE	USCS SYMBOL	MOISTURE
			37	CH	Damp
			50 6"		
267.958			50 1"	SW	Damp
35 266.958	**SAND** Light Grey SAND (medium)				
264.958	**Sandy CLAY** Grey Brown Sandy CLAY (fine) w/mica		50 4"	CL	
40 260.958	**SAND** Grey SAND (fine to medium) w/mica		50 4.5"	SW	Damp
			50 5"		
45 256.958	**Sandy CLAY** Grey Red Brown Sandy CLAY w/mica		45	CL	Damp
			55		Damp
254.958	**Clayey SAND** Grey Brown Clayey SAND (medium) w/mica		50 6"	SC	Damp
50 251.958	**Sandy CLAY** Brown Blue Sandy CLAY (medium) w/mica		75	CL	
250.958	**CLAY** Dark Grey Clay w/mica		50 5"	CH	Damp
249.958	**Sandy CLAY** Blue Brown Green mottled Sandy CLAY (fine)		50 5.5"	SC	
248.958	**CLAY** Light Grey CLAY w/mica			CL	
55					
60					

Boring Log

C.T. Clayton, Sr., P.E., Inc.
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Fax: 910-897-6767

Project: Anderson Creek C&DLF Phase III BORING: PZ-10 Page: 1 of 1

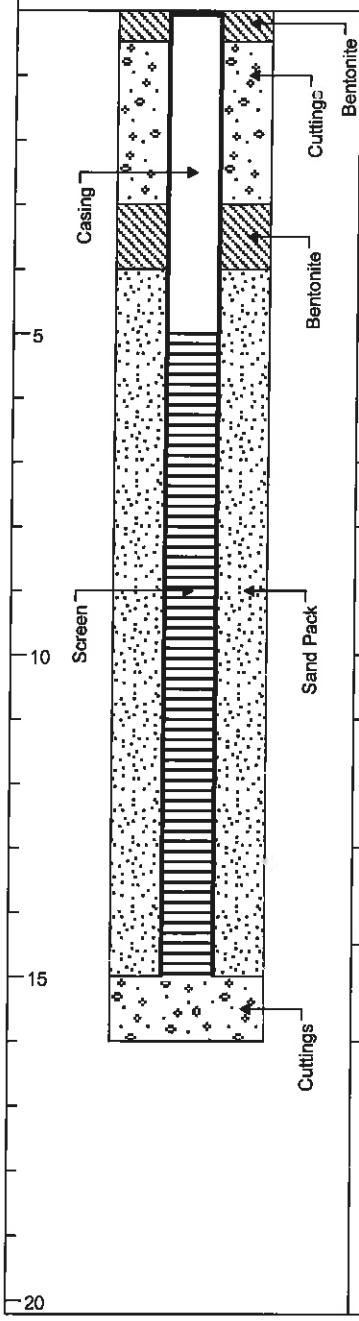
Drilling Co.: J&L Date Started: 5/26/09

Drilling Method: 2-1/4" HSA Date Completed: 5/26/09

Location: ACLF, Lillington, NC Logged By: JG

Surface Elev.: 287.156 TOC Elev.: 290.98 Project #: 03001C

WELL COMPLETION DETAILS



ELEVATION	DESCRIPTION	GRAPHIC LOG	N-VALUE	USCS SYMBOL	MOISTURE
	Sandy CLAY Red-Brown Sandy CLAY (fine to medium)		9	CL	Damp
285.156	**Clayey SAND** Tan Clayey SAND (medium to coarse) w/mica Changing to more Red		14	SC	Damp
			10		Moist
280.156	**SAND** Grey coarse SAND		16	SW	Wet
279.156	**Sandy CLAY** Grey mottled with red & brown Sandy CLAY (medium)		15	CL	Damp
277.156	**Sandy CLAY** Tan Sandy CLAY (fine)		16	SC	Moist
276.156	**Clayey SAND** Grey Clayey SAND (fine to medium)		17	CL	Wet
274.156	**Sandy CLAY** Grey Sandy CLAY (fine)		43	CL	Damp
272.656	**CLAY** Grey CLAY				
271.156					

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
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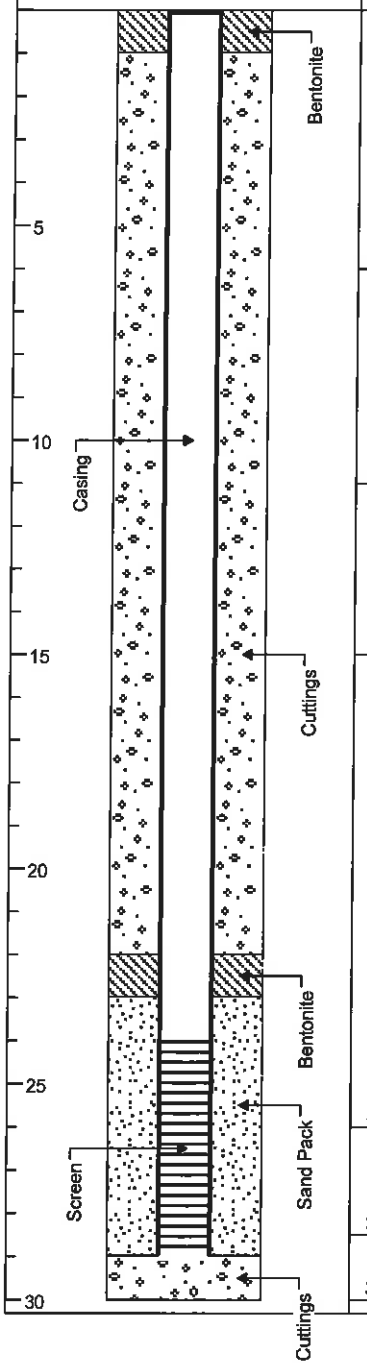
Project: ACLF C&D PHASE III | BORING: PZ-11 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/27/09

Drilling Method: 2 1/4 HSA | Date Completed: 5/27/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 334.041 | TOC Elev.: 336.96 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	Sandy CLAY Red Sandy CLAY (fine) w/mica	11		Damp
		10	CL	
		9		Damp
328.041	**Clayey SAND** Red Brown Purple Clayey SAND (meduim to course) w/mica	8		
		12	SC	Damp
323.041	**Clayey SAND** Light Brown Clayey SAND (fine) w/mica	7		
		9	SC	
319.041	**SAND** White red brown mottled SAND w/mica 6" of red SAND @ 22.5' Changes to Yellow white brown SAND @ 23'	11		Moist
		12		
		11		
		9	SW	Moist
		7		
308.041		7		Moist
	Clayey SAND Tan Brown purple Clayey SAND	5	SC	
305.541				Wet
	Sandy CLAY Grey Sandy CLAY	41	CL	Damp
304.041				

Boring Log and Well Construction Details

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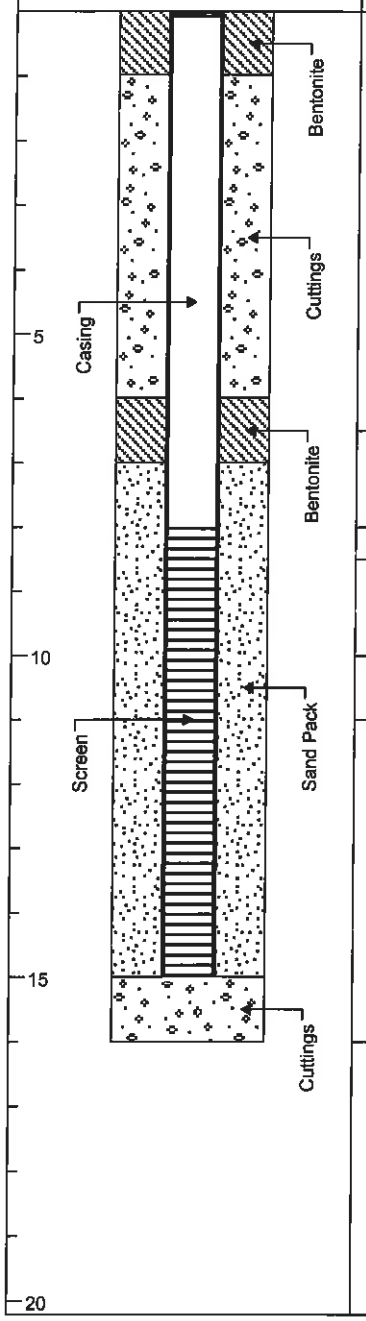
Project: ACLF C&D PHASE III | BORING: PZ-12 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/27/09

Drilling Method: 2 1/4 HSA | Date Completed: 5/27/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 315.163 | TOC Elev.: 318 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	Clayey SAND Red Brown Clayey SAND (fine) Changes to Red and then to Brown	10		Damp
		8	SC	
		7		Damp
308.663	**Sandy CLAY** Yellow Brown Sandy CLAY (fine) w/mica	10	CL	Moist
307.163				
306.663	**SAND** Grey Brown SAND (medium)		SW	Wet
	CLAY Grey Red Brown Mottled CLAY	31	CL	
305.163				Wet
	Clayey SAND Brown Grey Clayey SAND (medium)		SC	
304.163		43		
	Sandy CLAY Brown Grey Sandy CLAY (fine) 11' - 12.5' Grey Clayey Slurry with some Sand (medium) 12.5' - 13.5' Grey Brown Mottled Sandy CLAY (fine) 13.5 - 16		CL	Wet
		50 1"	CL	
				Wet
		52	CL	
299.163				Damp

Boring Log and Well Construction Details

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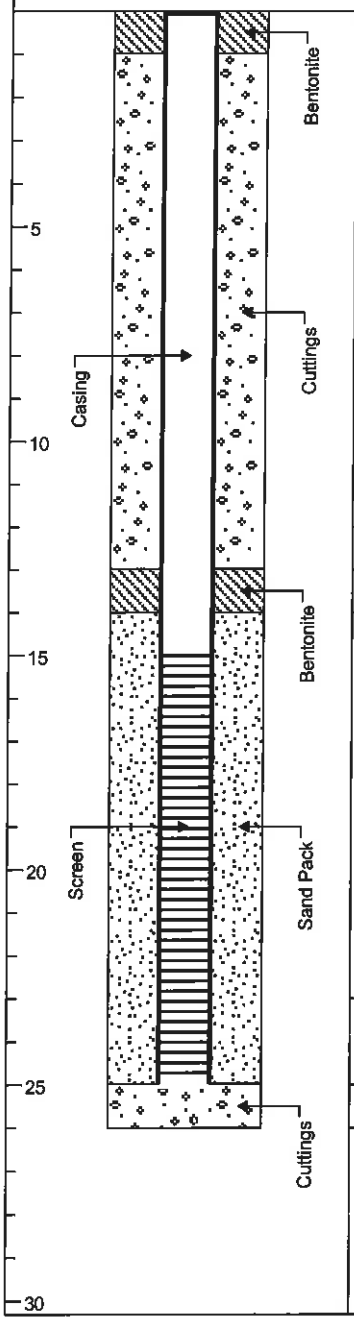
Project: ACLF C&D PHASE III | BORING: PZ-13 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/27/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/27/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 304.293 | TOC Elev.: 307.23 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
303.293	**SAND** White Brown SAND (medium)	9	SW	Moist
	Clayey SAND Brown Clayey SAND (medium) 1' to 7' 7' to 8' Red Brown (medium to coarse) 8' to 12' Grey (coarse with pebbles)	19		Damp
		19		Damp
		26	SC	
		23		Damp
		16		Moist
292.293				
291.293	**CLAY** Grey CLAY	32	CL	Damp
290.293	**Silty SAND** Grey Silty SAND (fine) w/mica		SM	Wet
	Clayey SAND Grey Brown mottled clayey SAND (fine) w/mica	18		
		11		Wet
		10	SC	
		17		Wet
281.293		14		
	Sandy CLAY Grey Brown mottled Sandy CLAY (fine)		CL	Damp
279.293		18		
278.293	**CLAY** Grey CLAY w/ mica		CL	

Boring Log and Well Construction Details

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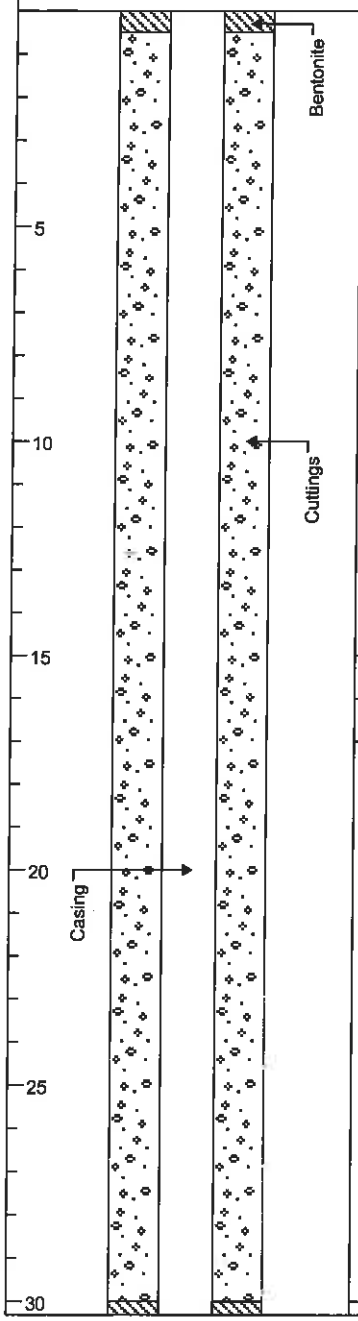
Project: ACLF C&D PHASE III | BORING: PZ-14 | Page: 1 of 2

Drilling Co.: J&L | Date Started: 5/20/09

Drilling Method: 2-1/4" HSA | Date Completed: 5/20/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 277.641 | TOC Elev.: 281.31 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
277.141	**TOPSOIL** Brown Topsoil			
275.641	**Clayey SAND** Brown Clayey SAND (medium)	6	SC	Damp
273.641	**CLAY** Brown-Red CLAY w Sand (medium to coarse)	9	CL	Moist
271.641	**Clayey SAND** Grey Red Brown mottled Clayey SAND (medium)	9	SC	Moist
269.641	**CLAY** Grey CLAY w Sand (medium to coarse)	6	CL	Moist
	Sandy CLAY Grey Brown Red mottled Sandy CLAY w/mica (medium to course)	15		Moist
		15	CL	Moist
		17		Damp
262.641		16		Moist
261.641	**Clayey SAND** Grey Clayey SAND w/mica		SC	
260.641	**CLAY** Brown Grey CLAY with sand (course)	10	CL	Moist
	CLAY Grey Blue CLAY with varying amounts of medium sand and mica	21		Damp
		20		Damp
		23		Damp
		48	CL	Damp
		50 6"		Damp
		75		Damp
247.641				

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
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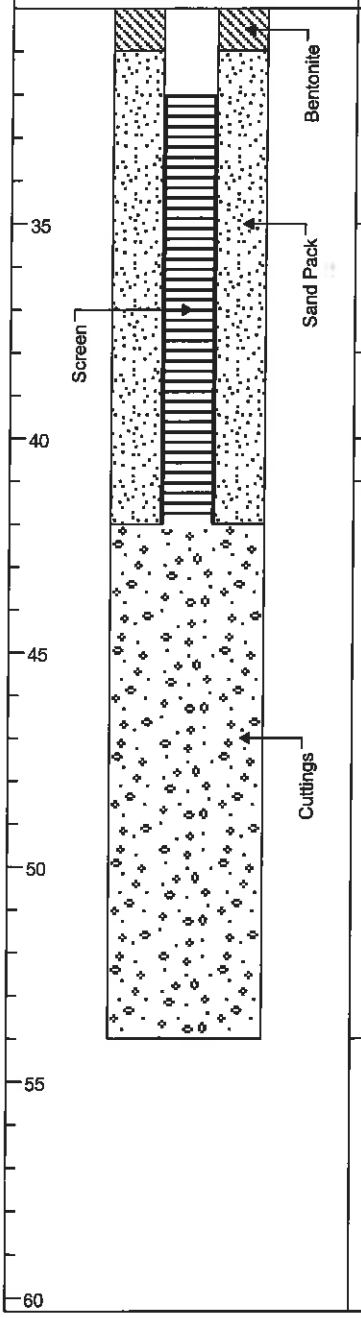
Project: ACLF C&D PHASE III | BORING: PZ-14 | Page: 2 of 2

Drilling Co.: J&L | Date Started: 5/20/09

Drilling Method: 2-1/4" HSA | Date Completed: 5/20/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 277.641 | TOC Elev.: 281.31 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	CLAY Brown Red Grey mottled CLAY w/mica	66	CL	Damp
		54		Damp
242.641		78		Damp
	Sandy CLAY Blue Green Sandy CLAY (medium) w/mica	58	CL	Damp
239.641				
	Clayey SAND Grey Clayey SAND (medium) w/mica	78	SC	Damp
237.641				
236.641	**CLAY** Grey Brown mottled CLAY w/fines and micaa	50 5"	CL	Damp
	Sandy CLAY Blue Green Sandy CLAY w/mica (varying medium to course)	50 6"		Damp
		42		Damp
		42	CL	Damp
		56		Damp
		50 4.5"		Damp
		50 4.5"		Damp
223.641				

Boring Log and Well Construction Details

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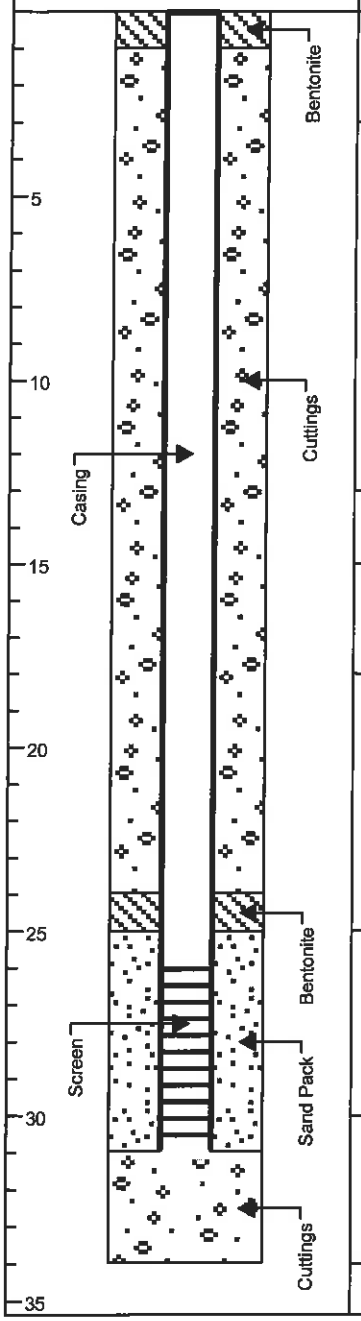
Project: ACLF C&D PHASE III | BORING: PZ-15 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/28/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/28/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 335.462 | TOC Elev.: 338.42 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Tan SAND (fine) w/organics	8	SW	Damp
332.462	**Clayey SAND** Red Clayey SAND (fine) w/organics 3' to 4' Tan to Red Clayey SAND (fine to medium) w/mica 4' to 13'	10		
		22		Damp
		30	SC	Damp
		16		
		27		Moist
322.462	**SAND w/Pebbles** Brown SAND (coarse w/pebbles)	14	SW	
320.462	**SAND** Yellow White SAND (medium)	17		Moist
317.462		7	SW	
	Silty SAND Varying colors of Clayey SAND (fine) Sand becoming more coarse 1" Red Gravel @ 23.5'	9		
		10	SM	Moist
		11		Moist
310.462	**SAND** White Yellow Brown SAND (medium to coarse)	8		
		8	SW	Wet
305.462		9		
	Sandy CLAY Grey Sandy CLAY (fine)	13	CL	Damp
301.462		50 6"	CL	Damp

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
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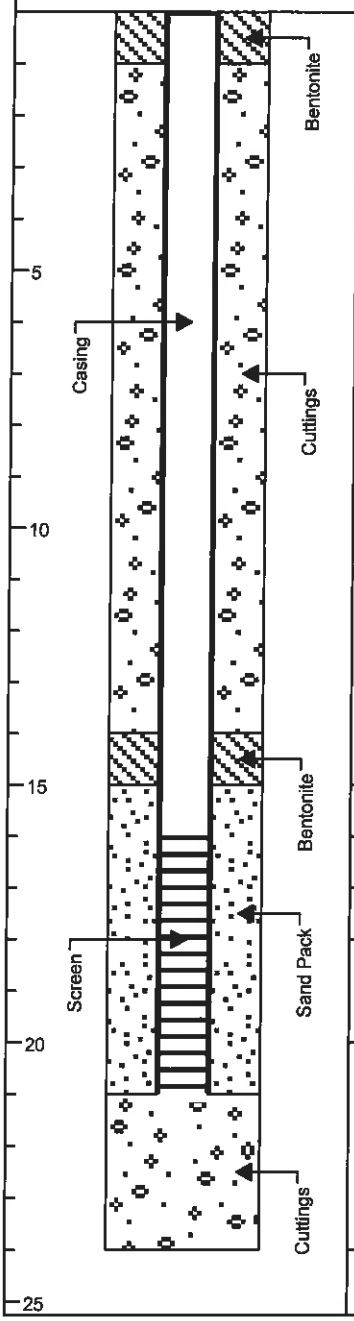
Project: ACLF C&D PHASE III | BORING: PZ-16 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/27/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/27/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 324.072 | TOC Elev.: 327.90 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND White Red Brown SAND (medium)	12	SW	
324.900				
323.900	**Clayey SAND** Red Brown Clayey SAND (fine)	15	SC	Damp
322.900	**Sandy CLAY** Grey Sandy CLAY		CL	
	Clayey SAND Varying colors of Clayey SAND (fine)	26		
		15		Damp
		8	SC	Moist
		9		
		6		Damp
312.900				
311.900	**Sandy CLAY** Red Brown Sandy CLAY w/pebbles	6	CL	Moist
310.900	**SILT** Grey SILT	27	ML	Wet
309.900	**SAND** Red Brown SAND (medium to coarse)		SW	
307.900	**Sandy SILT** Grey Purple Brown mottled Sandy SILT(fine)	20	ML	
	Sandy CLAY Brown Grey mottled Sandy CLAY (fine) w/mica	24	CL	Damp
303.900		59		Damp

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
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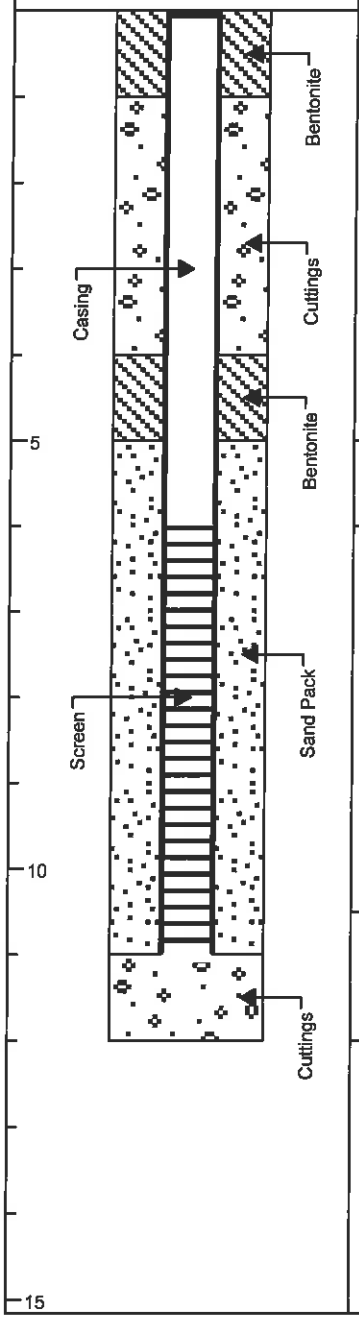
Project: ACLF C&D PHASE III | BORING: PZ-17 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5-22-09

Drilling Method: 2 1/4" HSA | Date Completed: 5-22-09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 311.552 | TOC Elev.: 315.49 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Tan SAND (fine to coarse)		SW	
310.552	**Silty SAND** Red Brown Silty SAND (medium) w/mica	16		
				Damp
		12	SM	
				Damp
306.552		13		
	SAND Red Brown mixed SAND (fine to coarse)		SW	
305.552				Damp
	Silty SAND Red Brown Silty SAND (coarse) w/mica	15		
				Moist
		17	SM	
301.052				
	Sandy CLAY Red Brown Grey mottled Sandy CLAY (fine) w/mica	24	CL	Wet
299.552				Damp

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
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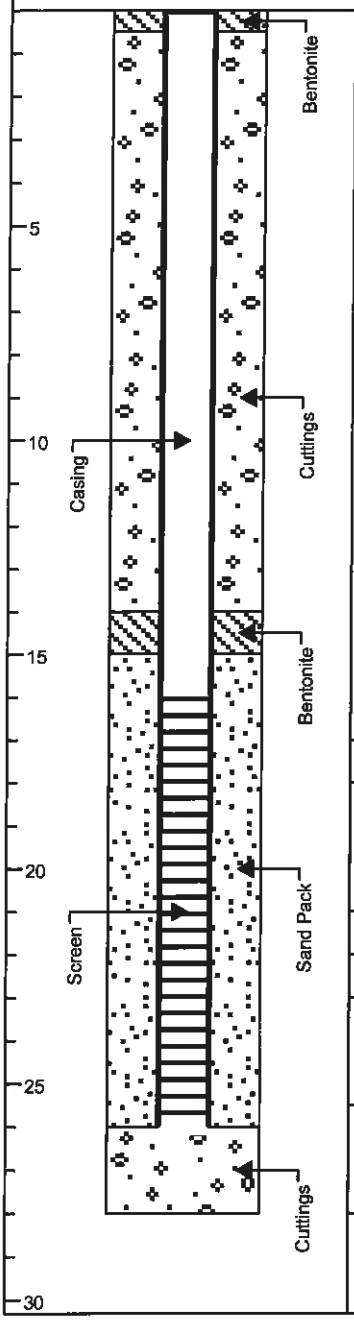
Project: ACLF C&D PHASE III | BORING: PZ-18 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/26/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/26/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 297.882 | TOC Elev.: 301.4 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
296.882	**SAND** Red Brown SAND (coarse)	9	SW	
295.882	**CLAY** Grey CLAY w/organics		CL	
	Sandy CLAY Varying colors of Sandy CLAY (medium)	16		Damp
		13	CL	Moist
		17		
289.882	**Clayey SAND** Grey Red Brown mottled Clayey SAND (fine) Changes to medium/coarse at 12' Mica at 15' Brown Clayey SAND (fine to medium) at 16'	24		Damp
		11	SC	Moist
		11		
		6		Wet
280.882		7		
279.882	**CLAY** Grey CLAY		CL	Wet
	Clayey SAND Red Brown Clayey SAND (medium to coarse)	11	SC	
276.882		24		Damp
275.882	**Clayey SAND** Grey Clayey SAND (fine)		SC	
274.882	**CLAY** Grey Brown CLAY	10	CL	
	Clayey SAND Grey Clayey SAND some pebbles		SC	Wet
272.382		17		
	CLAY Grey CLAY w/mica	27	CL	Damp
269.882				

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
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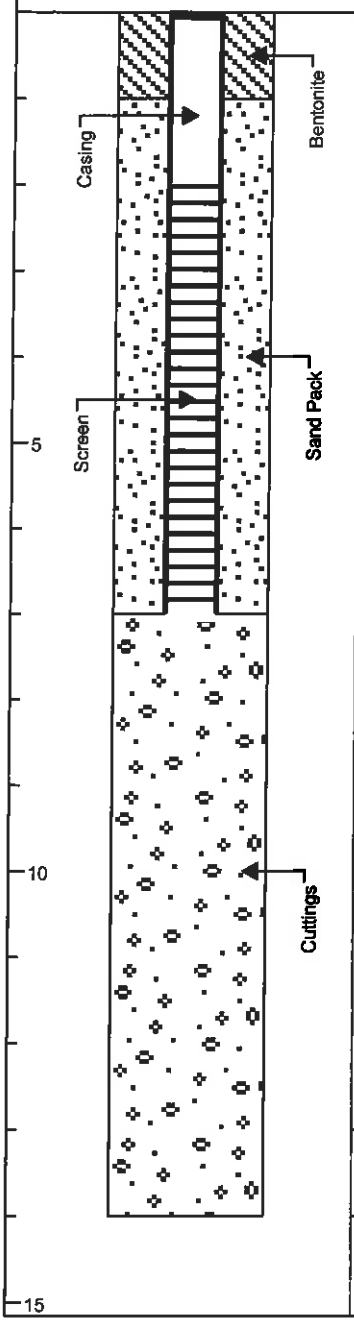
Project: ACLF C&D PHASE III | BORING: PZ-19 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/22/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/22/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 245.118 | TOC Elev.: 248.13 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Black Red Brown SAND (medium)	7	SW	
243.118	**Clayey SAND** Varying colors of Clayey SAND (medium to coarse) w/mica			Damp
		8		Moist
				Damp
		10	SC	
				Damp
		17		
				Damp
		25		
				Damp
		32		
				Damp
232.118	**Sandy CLAY** Blue Green Sandy CLAY	38	CL	
231.118				Damp

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
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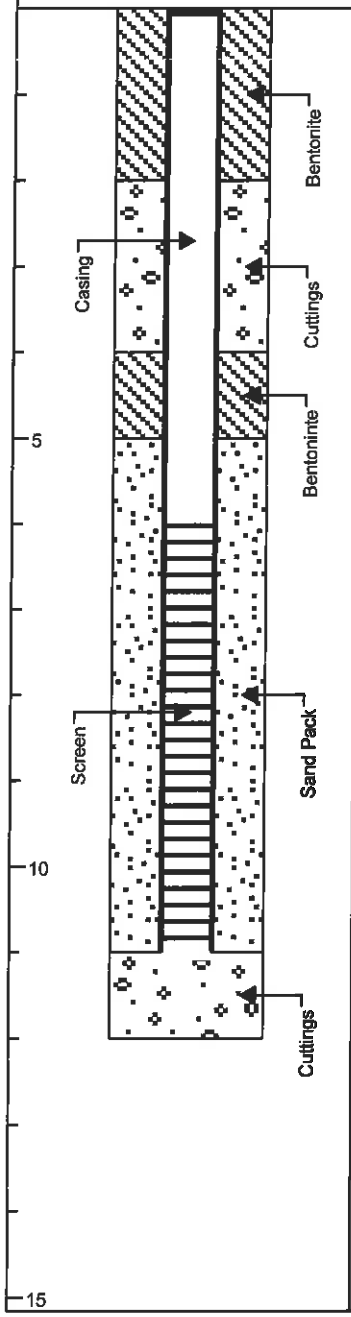
Project: ACLF C&D PHASE III	BORING: PZ-20	Page: 1 of 1
Drilling Co.: J&L		Date Started: 5/22/09
Drilling Method: 2 1/4" HSA		Date Completed: 5/22/09
Location: ACLF, Lillington, NC		Logged By: JG
Surface Elev.: 248.934	TOC Elev.: 252.70	Project #: 03001C

WELL COMPLETION DETAILS



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
248.434	**SAND** Tan SAND (fine)		SW	
	Clayey SAND Brown Clayey SAND (fine to medium) w/mica	5		
		13	SC	Damp
244.934	**Silty SAND** Grey Silty SAND (medium)	18	SM	Moist Wet
241.934	**Clayey SAND** Red Brown Clayey SAND (medium to coarse)	10		
		14	SC	Wet Wet
238.434	**Clayey SAND** Blue Grey Clayey SAND (fine to medium) w/mica	20	SC	Damp
236.934				

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
46 W. Washington St. Phone: 910-897-7070
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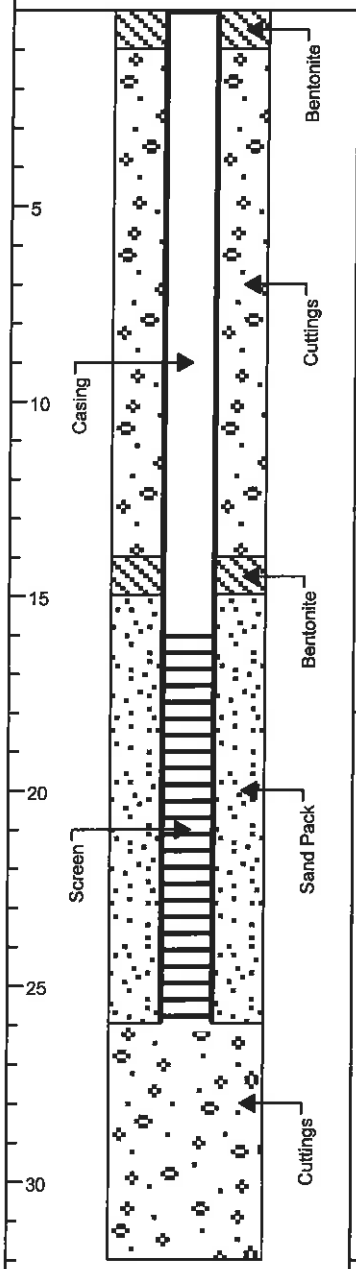
Project: ACLF C&D PHASE III | BORING: PZ-21 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/21/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/21/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 264.550 | TOC Elev.: 268.27 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Brown SAND (medium)	10	SW	Damp
261.550	**Clayey SAND** Red Brown Clayey SAND (medium) w/mica	7		
		13	SC	Moist
		11		Moist
		13		
253.550		15		
252.550	**CLAY** Dark Grey CLAY		CL	Damp
251.550	**Clayey SAND** Red Brown Clayey SAND (medium) w/mica	27	SC	
	CLAY Dark Grey CLAY w/mica Mottled with Red & Brown	24	CL	Damp
		30		
246.550	**Clayey SAND** Varying Colors of Sandy CLAY (medium to coarse) w/mica	45		Damp
		35	SC	Moist
		36		
		37		Damp
		33		
		41		Damo
232.550		31		

Boring Log and Well Construction Details

C.T. Clayton, Sr., P.E., Inc.
46 W. Washington St. Phone: 910-897-7070
Coats, NC 27521 Fax: 910-897-6767

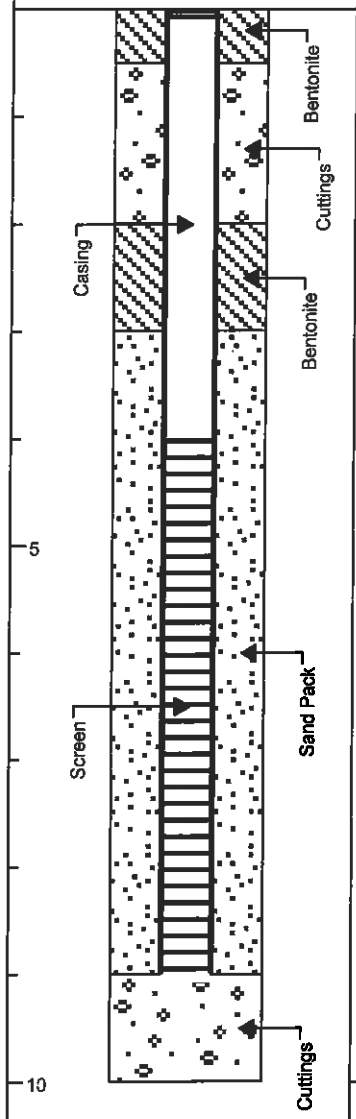
Project: ACLF C&D PHASE III | BORING: PZ-22 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/22/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/22/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 252.788 | TOC Elev.: 256 | Project #: 03001C

WELL COMPLETION DETAILS	ELEVATION	DESCRIPTION	GRAPHIC LOG	N-VALUE	USCS SYMBOL	MOISTURE
		**TOPSOIL** Organic TOPSOIL			OL	
	251.788	**Clayey SAND** Grey Clayey SAND (fine) w/mica Red Brown Clayey SAND (medium) 7' to 8'		10		
						Damp
				9		
				8		Damp
					SC	
				7		Moist
				29		Damp
	242.788					

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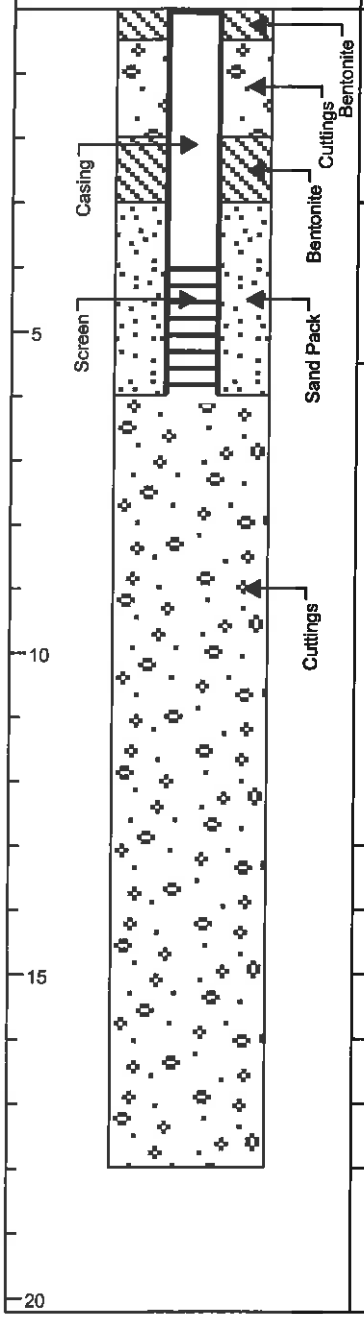
Project: ACLF C&D PHASE III | BORING: PZ-23 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/22/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/22/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 290.056 | TOC Elev.: 293.86 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Black changing to Tan SAND (fine)	6	SW	
287.056	**Clayey SAND** Red Brown Clayey SAND (fine to medium)	8		Damp
		8	SC	
284.556	**CLAY** Brown Red Grey CLAY w/mica			Damp
		12		
		19	CL	Damp
		18		
				Damp
277.056	**Clayey SAND** Grey Clayey SAND	28	SC	
276.056	**CLAY** Light Brown CLAY	69	CL	Damp
275.056	**Clayey SAND** Dark Grey Clayey SAND		SC	
274.056	**CLAY** Lt Brown mottled with Grey CLAY	56	CL	
273.056	**Clayey SAND** Dark Grey Clayey SAND		SC	
272.056				

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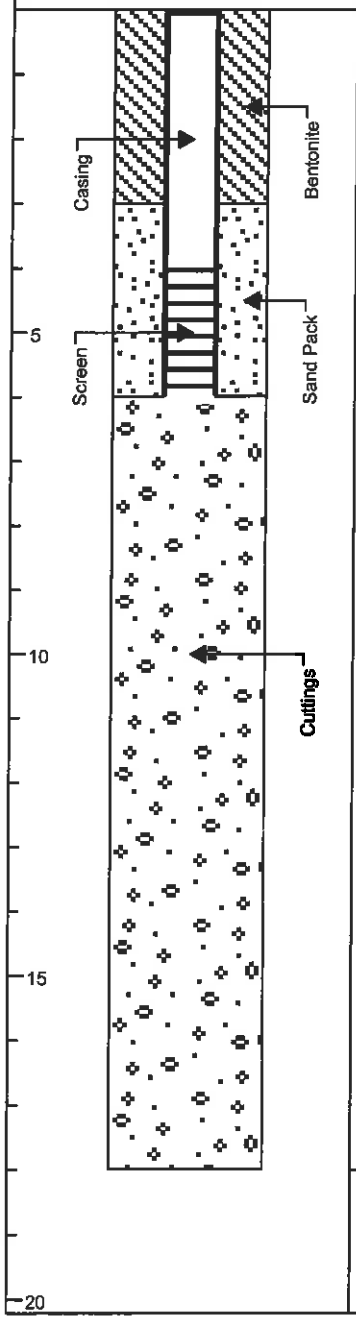
Project: ACLF C&D PHASE III | BORING: PZ-24 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/22/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/22/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 262.075 | TOC Elev.: 263.74 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Brown SAND (fine)		SW	
261.075	**Clayey SAND** Red Brown Grey Clayey SAND (medium)	8		
		12	SC	Damp
257.075	**CLAY** Grey Red Brown CLAY w/mica	11		
				Damp
		21		
		38		Damp
			CL	
				Damp
		44		
				Damp
		49		
244.075				

Boring Log and Well Construction Details

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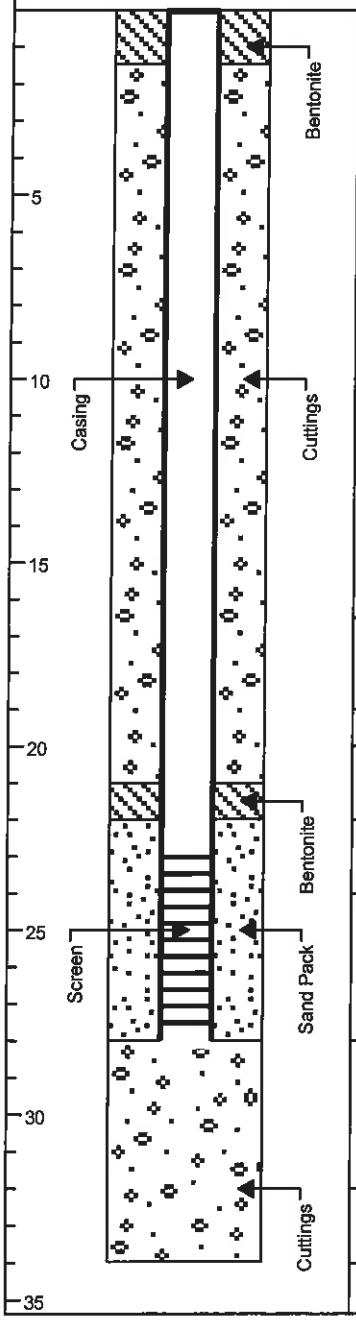
Project: ACLF C&D PHASE III | BORING: PZ-25 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/21/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/21/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 298.665 | TOC Elev.: 302.02 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	Sandy CLAY Red Brown Sandy CLAY (medium to coarse)	5		
		4	CL	Damp
		7		
292.165				Damp
	Clayey SAND Grey Clayey SAND w/mica (medium to coarse)	23		
		23		Damp
		23	SC	
		20		Moist
		24		Moist
282.165				
	CLAY Grey CLAY w/mica	15	CL	Damp
279.665				
278.665	**Clayey SAND** Grey Clayey SAND (medium)	20	SC	
	2' Shelby Tube Sample			
276.665				
	Clayey SAND Grey Clayey SAND (medium to coarse)	24	SC	Moist
274.665				
	Sandy CLAY Grey Sandy CLAY (medium)	26		
		14	CL	Wet
270.665				
	Clayey SAND Grey Clayey SAND (medium) w/mica	18		Moist
		27	SC	
266.665				
	2' Shelby Tube Sample			Damp
264.665				

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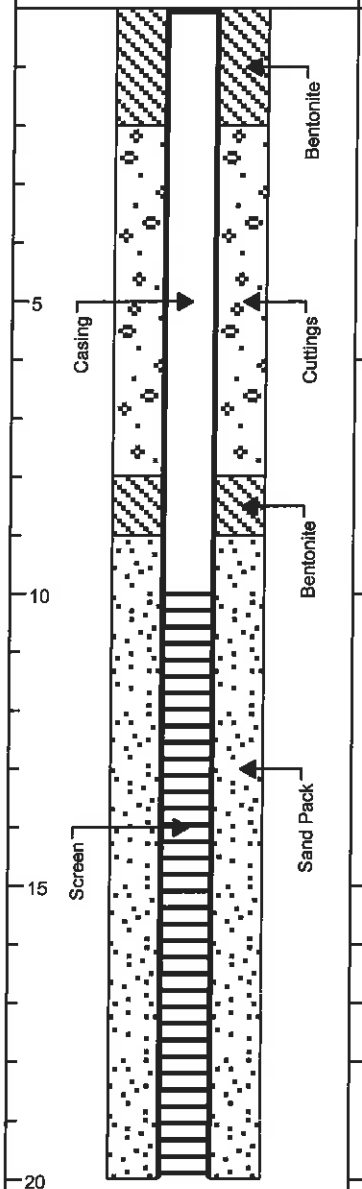
Project: ACLF C&D PHASE III | BORING: PZ-26 | Page: 1 of 1

Drilling Co.: J&L | Date Started: 5/19/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/19/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 287.182 | TOC Elev.: 290.56 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Red Brown SAND (medium)	2		
		7	SW	Damp
		10		
281.182	**Clayey SAND** Red Grey Tan Clayey SAND (medium)	3		Wet
		8	SC	Wet
277.182	**SAND** Grey SAND (medium)	8		Moist
		6	SW	
272.182		9		Wet
271.182	**CLAY** Grey CLAY		CL	
270.182	**SAND** Grey SAND (coarse)	26	SW	
269.182	**CLAY** Blue CLAY w/mica		CL	Moist
267.182	**Clayey SAND** Grey Clayey SAND	62	SC	

Boring Log and Well Construction Details

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46 W. Washington St. Phone: 910-897-7070
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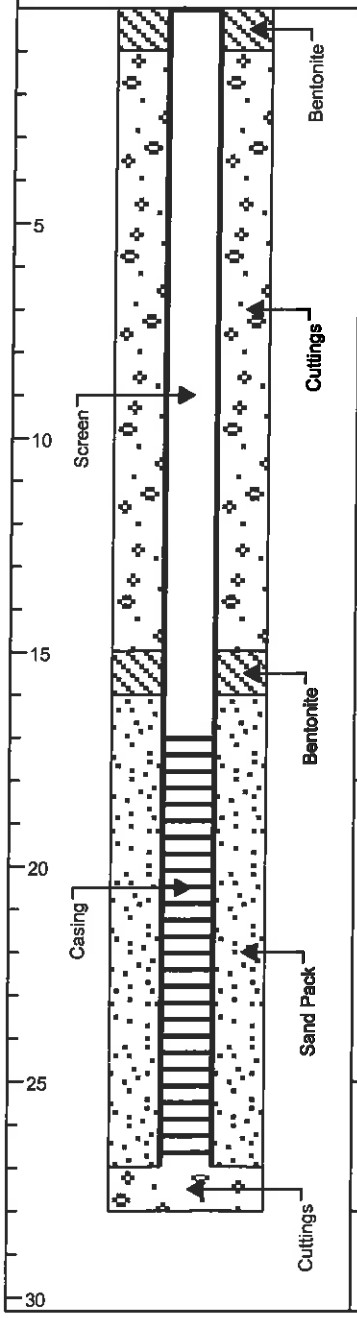
Project: ACLF C&D PHASE III | BORING: PZ-27 | Page: 329.667

Drilling Co.: J&L | Date Started: 5/29/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/29/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 329.667 | TOC Elev.: 332.53 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Light Brown SAND (fine)	11	SW	Damp
		7		
		8		Damp
322.667	**Silty SAND** Red Brown Silty SAND (fine) mica @ 12'	13	SM	Moist
		17		
		14		Moist
		13		
315.667	**Clayey SAND** Yellow Brown Clayey SAND (fine)	23	SC	Moist
		22		
311.667	**Clayey SAND** Varying colors of Clayey SAND (medium)	17	SC	Moist
		10		
		13		Wet
304.667	**CLAY** Grey Brown mottled CLAY	11	CL	Damp
		51		
301.667				

Boring Log and Well Construction Details

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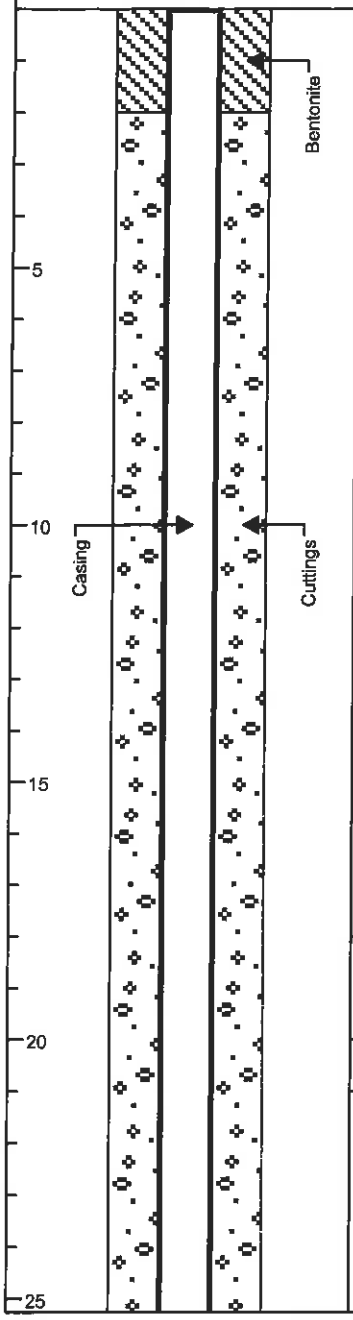
Project: ACLF C&D PHASE III | BORING: PZ-28 | Page: 1 of 2

Drilling Co.: J&L | Date Started: 5/19/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/19/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 338.811 | TOC Elev.: 342.09 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	CLAY Brown Red CLAY	8	CL	
336.811	**Sandy CLAY** Red Brown Sandy CLAY (fine-medium)	11	CL	Moist
334.811	**Clayey SAND** Red Brown Yellow Clayey SAND (medium) Organics @ 4' to 5'	20		
		10		Moist
		7	SC	Moist
		9		
		7		Moist
324.811	**SAND** Yellow White Orange SAND (coarse)	12		Moist
		7	SW	
320.811	**CLAY** Grey Red Brown CLAY	12	CL	Moist
318.811	**Clayey SAND** Brown Clayey SAND	17	SC	Damp
317.811	**CLAY** Grey Brown CLAY	18	CL	Moist
		19		Moist

Boring Log and Well Construction Details

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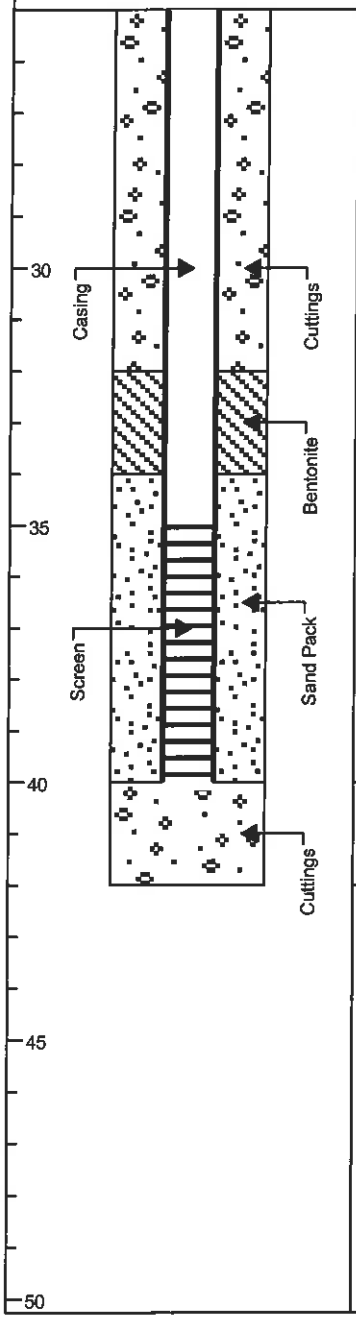
Project: ACLF C&D PHASE III	BORING: PZ-28	Page: 2 of 2
Drilling Co.: J&L		Date Started: 5/19/09
Drilling Method: 2 1/4" HSA		Date Completed: 5/19/09
Location: ACLF, Lillington, NC		Logged By: JG
Surface Elev.: 338.811	TOC Elev.: 342.09	Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
		19	CL	
311.811				
	SAND Red Brown SAND (fine)	14	SW	Damp
310.811				
	Clayey SAND Grey Clayey SAND (medium to coarse)	15		
		14		Moist
		12	SC	Moist
		13		
		4		Wet
		58		
298.811				
	Sandy CLAY Grey Brown Black Sandy CLAY w/mica	53	CL	Damp
296.811				

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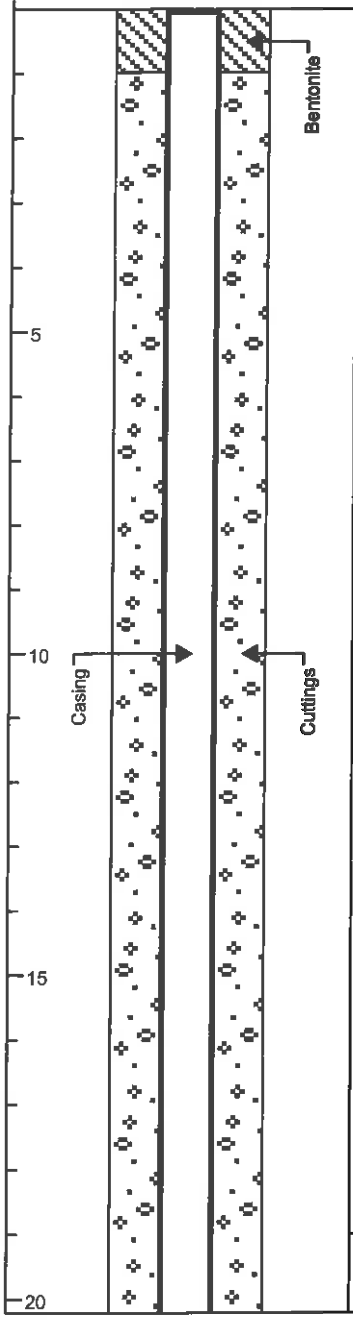
Project: ACLF C&D PHASE III | BORING: PZ-29 | Page: 1 of 2

Drilling Co.: J&L | Date Started: 5/28/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/28/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 335.477 | TOC Elev.: 337.41 | Project #: 03001C



ELEVATION	DESCRIPTION	N-VALUE	USCS SYMBOL	MOISTURE
	SAND Light Brown SAND (fine)	3	SW	
332.477	**Clayey SAND** Various colors of Clayey SAND (fine to medium)	13		Damp
		25		
		23		Damp
		18		Moist
		7		
		10	SC	Moist
		11		Moist
		11		
		9		Moist
316.477	**Silty SAND** White Silty SAND (fine) Changes to Red at 27'			

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Project: ACLF C&D PHASE III | BORING: PZ-29 | Page: 2 of 2

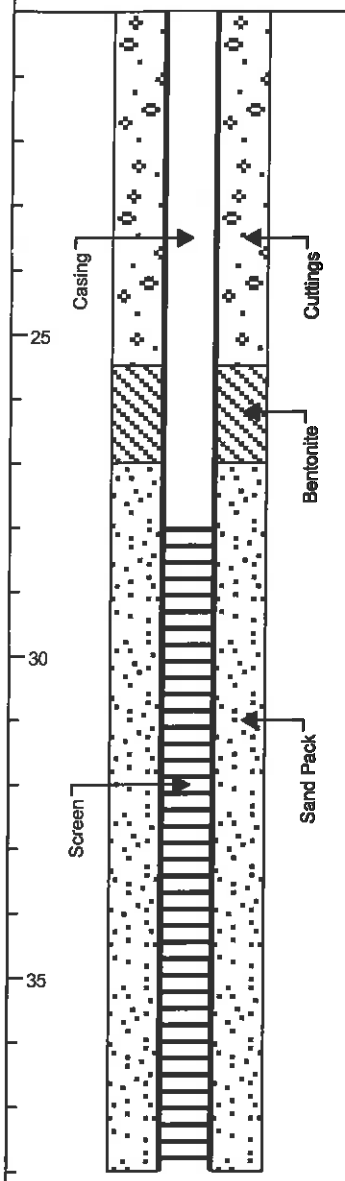
Drilling Co.: J&L | Date Started: 5/28/09

Drilling Method: 2 1/4" HSA | Date Completed: 5/28/09

Location: ACLF, Lillington, NC | Logged By: JG

Surface Elev.: 335.477 | TOC Elev.: 337.41 | Project #: 03001C

WELL COMPLETION DETAILS	ELEVATION	DESCRIPTION	GRAPHIC LOG	N-VALUE	USCS SYMBOL	MOISTURE
				10		Moist
				11		
				10	SM	Moist
				9		Moist
	307.477	**Clayey SAND** White Yellow Clayey SAND (medium) Changes to Red Brown at 31' (medium to coarse)		13		Wet
				8		
				23	SC	Damp
				50 6		
				50 5		Damp
	297.477					



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Richmond, Virginia 23228
Phone: (804) 264-2228
Fax: (804) 264-8773

Boring Log

B - 100

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson Creek Landfill Proposed Cells C+D

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	292.0		Lean CLAY: Grey-Red-White mottled, damp to dry	CL	8		
-1.0					19		
					34		
-2.0	290.0				55	89	
			Clayey SAND: Grey-Red-White mottled, damp	SC	14		
-3.0					19		
					31		
-4.0	288.0				39	70	
					5		
-5.0					15		
					19		
-6.0	286.0				21	40	
-7.0							Shelby Tube collected
-8.0	284.0		Fat CLAY with Sand: Orange-White mottled, moist	CH	7		
-9.0					18		
					24		
-10.0	282.0				36	60	
			Sandy Lean CLAY: Grey, moist	CL			
-11.0					5		
					8		
-12.0	280.0				10		
			Clayey SAND: Grey, wet	SC	12	22	
-13.0							Shelby Tube collected
-14.0	278.0						
			Clayey SAND: Grey, wet		5		
-15.0					5		
					5		
-16.0	276.0				7	12	
			Clayey SAND: Grey-Dark Brown, damp		3		

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Boring Log

B - 100

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson Creek Landfill Proposed Cells C+D
Date: 6/10/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-15.0					5		
					5		
					7	12	
-16.0	-16.0		Clayey SAND: Grey-Dark Brown, damp		3		
					6		
-17.0					9		
					11	18	
-18.0	-18.0		Clayey SAND: Dark Brown, moist	SC			
-19.0							Shelby Tube collected
-20.0	-20.0		Fat CLAY: Dark Brown, moist	CH	3		
					4		
-21.0					5		
					7	12	
-22.0	-22.0		Fat CLAY: Dark Brown - Grey, wet		4		
					5		
-23.0					8		
					12	20	
-24.0	-24.0				8		
					11		
-25.0			Clayey SAND: Gray, wet	SC	13		
					18	31	
-26.0	-26.0				10		
					10		
-27.0					10		
					15	35	
-28.0	-28.0		Fat CLAY with Sand: Gray-brown, damp	CH			
-29.0							

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Boring Log

B - 100

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson Creek Landfill Proposed Cells C+D
Date: 6/10/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
			Clayey SAND: Grey-Brown, with pebbles, damp. (Well Graded SAND with CLAY)				Shelby Tube collected
-30.0	-30.0			SW-SC	8		
					13		
-31.0					30		
					50	80	
-32.0	-32.0		Clayey SAND: Brown, damp		8		
					20		
-33.0					31		
					50/4	50/4	
-34.0	-34.0			SC	14		
					23		
-35.0					26		
					44	70	
-36.0	-36.0				10		
					15		
-37.0					20		
					31	51	
-38.0	-38.0				10		
					13		
-39.0					17		
					32	49	
-40.0	-40.0			SC	9		
					20		
-41.0					24		
					40	44	
-42.0	-42.0		Clayey SAND: Grey-Brown, damp		16		
					17		
-43.0					22		

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Boring Log

B - 100

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson Creek Landfill Proposed Cells C+D
Date: 6/10/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-44.0	-44.0		Sandy Lean CLAY: Grey-Brown, moist	CL	25	47	
					8		
-45.0					11		
					14		
-46.0	-46.0				15	29	
					7		
-47.0					11		
			Clayey SAND: Brown, dry		15		
-48.0	-48.0				49	74	
				SC	11		
-49.0					30		
					40		
-50.0	-50.0				50/4	50/4	
			Terminated: @ 50'				
-51.0							

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Boring Log
B - 101

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson County Landfill Proposed Cells C+D
Date: 6/10/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		Clayey SAND: Yellow-White-Red mottled, damp	SC	2, 6, 11, 10	21	
-1.0							
-2.0	-2.0		Clayey SAND: Yellow-White-Red mottled,	SC	10, 12, 13, 18	31	
-3.0							
-4.0	-4.0		Clayey SAND: Yellow-White-Red mottled, moist	SC	8, 11, 13, 13	26	
-5.0							
-6.0	-6.0		Clayey SAND: Yellow-White-Red mottled, wet	SC	7, 15, 16, 18	34	
-7.0							
-8.0	-8.0		Clayey SAND: Yellow-White-Red mottled, wet	SC	4, 10, 12, 17	29	Sand Pack set at 8' to 15'; Piezometer screen set at 10' to 15'
-9.0							
-10.0	-10.0		Clayey SAND: Yellow-Red, wet	SC	3, 7, 7, 14	21	
-11.0							
-12.0	-12.0		Clayey SAND: Yellow-Red-Grey, wet	SC	4, 6, 5, 7	9	
-13.0							
-14.0	-14.0		Sandy Lean CLAY: Yellow-Red-Grey, damp	CL	5		

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Boring Log

B - 101

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson County Landfill Proposed Cells C+D
Date: 6/10/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-15.0					13		
					23		
					40	63	
-16.0	-16.0		Terminated				Boring Terminated @ 16'
-17.0							
-18.0	-18.0						
-19.0							
-20.0	-20.0						

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Boring Log

B - 102

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson County Landfill Proposed Cells C+D
Date: 6/11/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		Fat CLAY: Grey-Red-Yellow mottled, dry	CH	10		
					31		
-1.0			Clayey SAND: Red-Yellow, damp	SC	40		
					47	87	
-2.0	-2.0		Clayey SAND: Red-Yellow-White mottled, damp		41		
					18		
-3.0					22		
			Clayey SAND: Grey, damp		30	52	
-4.0	-4.0		Clayey SAND: Grey, damp		10		
					18		
-5.0					19		
					20	39	
-6.0	-6.0		Clayey SAND: Grey, with mica, damp		6		
					8		
-7.0					10		
					16	26	
-8.0	-8.0		Fat CLAY with Sand: Grey, with mica, damp	CH	4		
					10		
-9.0					14		
					20	34	
-10.0	-10.0		Fat CLAY with Sand: Grey, with mica, damp				
-11.0							
-12.0	-12.0						Sand Pack set at 12' to 20'
-13.0							
-14.0	-14.0						Piezometer screen set at 14' to 19'
			Fat CLAY with Sand: Dark Brown, damp	CH	4		

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B - 102

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DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-15.0			Clayey SAND: Grey, wet	SC	5 4		
-16.0	-16.0		Fat CLAY with Sand: Dark Brown, moist	CH	6 3 8 12	10	
-17.0							
-18.0	-18.0		Clayey SAND: Grey, with mica, wet	SC	18	30	
-19.0			Sandy Fat CLAY: Brown-Grey mottled, with mica, moist to wet	CH	7 9 9 13	22	
-20.0	-20.0		Terminated				Boring Terminated @ 20'
-21.0							

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B - 103

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Project: Anderson County Landfill Proposed Cells C+D

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0			Sandy Fat CLAY: Red-Yellow-White, with mica, moist	CH	4		
					5		
-1.0	290.0				8		
					9	17	
-2.0			Clayey SAND: Grey, with mica, moist	SC	11		
					12		
-3.0	288.0				14		
					17	31	
-4.0			Fat CLAY with Sand: Grey, damp	CH	5		
					9		
-5.0	286.0				12		
					12	24	
-6.0			Clayey SAND: Grey, with mica, wet	SC	4		
					4		
-7.0	284.0				5		
					7	12	
-8.0			Clayey SAND: Grey, with mica, wet		2		
					2		
-9.0	282.0				4		
					5	9	
-10.0			Clayey SAND: Grey, with mica, damp		6		
					8		
-11.0	280.0		Fat CLAY: Brown, with mica, damp	CH	12		
					18	30	
-12.0			Clayey SAND: Grey, with mica, wet	SC	6		
					8		
-13.0	278.0		Clayey SAND: Brown, damp		12		
					18	31	
-14.0			Clayey SAND: Brown, with mica, damp		3		
					9		
-15.0	276.0			SC	14		
					17	20	
-16.0			Clayey SAND: Brown, with mica, damp		3		

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B - 103

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson County Landfill Proposed Cells C+D

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-17.0	274.0				6 8 12		
-18.0			Terminated				Boring Terminated @ 18'
-19.0	272.0						
-20.0							

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B - 104

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Date: 6/11/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		Clayey SAND: Grey-Orange, moist	SC	2		
-1.0					4		
					3		
					4	7	
-2.0	-2.0		Clayey SAND: Grey-Orange-Red, moist		3		
-3.0					3		
					3		
					5	8	
-4.0	-4.0		Clayey SAND: Grey-Orange-Red, moist		5		
-5.0					8		
					8		
					6	14	
-6.0	-6.0		Fat CLAY: Grey, moist	CH	1		
-7.0					3		
					3		
					6	9	
-8.0	-8.0		Clayey SAND: Grey, moist	SC	2		
-9.0					3		
			Clayey SAND: Grey-Red-Yellow mottled, moist		14		
					19	33	
-10.0	-10.0		Fat CLAY: Grey-Red-Orange mottled, moist	CH	3		Sand Pack set at 10' to 17'
-11.0			Clayey SAND: Grey, wet	SC	9		
					11		
					14	25	Piezometer screen set at 12' to 17'
-12.0	-12.0		Fat CLAY: Grey, wet	CH	5		
-13.0					5		
					7		
					7	14	
-14.0	-14.0		Clayey SAND: Grey, wet (Well Graded SAND	SW-SC	7		

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B - 104

Client: C.T. Clayton
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Project: Anderson County Landfill Proposed Cells C+D
Date: 6/11/03
DAA No. RA02108-02

Logged By: CTC
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Houff Drilling Inc.
Location: See Location Plan

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-15.0			with CLAY)		5		
			Clayey SAND: Grey-Brown, with mica, damp. (Well Graded SAND with CLAY)	SW-SC	9 14	23	
-16.0	-16.0		Clayey SAND: Grey-Brown, with mica, damp	SC	4 11 12 14	26	
-17.0							
-18.0	-18.0		Terminated				Boring Terminated @ 18'
-19.0							
-20.0	-20.0						

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Boring Log

B - 105

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson County Landfill Proposed Cells C+D

Logged By: CTC Jr.
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		Clayey SAND: Brown-Red-Grey mottled, damp	SC	3		
					4		
-1.0					2		No water accumilation at TOB
					2		
-2.0	-2.0			SC	2		
					2		
-3.0			Clayey SAND: Grey, damp	SC	2		
					4	6	
-4.0	-4.0		Clayey SAND: Grey-Brown-Red mottled coarse clayey sand, damp	SC	2		
					2		
-5.0					2		
					4	6	
-6.0	-6.0			SC	2		
					2		
-7.0			Sandy Fat CLAY: Red-Brown-White, damp	CH	3		
-8.0	-8.0		SAND: Grey-Red mottled coarse sand with some clay, moist	SP	3	6	
					9		
-9.0					9		
					10		
-10.0	-10.0		Clayey SAND: White, coarse clayes sand, damp	SC	12	22	
-11.0							
-12.0	-12.0						
-13.0							
-14.0	-14.0		Lean CLAY: Dark Brown-Red mottled, dry to damp	CL	11		
					21		
-15.0					28		
					50/6	78	
-16.0	-16.0						

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B - 105

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson County Landfill Proposed Cells C+D

Logged By: CTC Jr.
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-17.0							
-18.0	-18.0						
-19.0			Sandy Fat CLAY: Grey, damp to moist	CH	6 8 11 14	25	
-20.0	-20.0						
-21.0							
-22.0	-22.0						
-23.0							
-24.0	-24.0		SAND: Grey coarse sand with some clay, wet	SP	6 7 7		
-25.0			Clayey SAND: Dark Brown, moist to wet	SC	10	17	Boring Terminated @ 25.5'
-26.0	-26.0		Terminated				

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Boring Log

B - 106

Client: C.T. Clayton
PO Box 12794, 1248 Brices Creek, New Bern NC 28561
Project: Anderson County Landfill Proposed Cells C+D

Logged By: CTC Jr.
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		Clayey SAND: Grey clayey coarse sand, damp	SC	6 7 8 11		No water accumilation at TOB
-1.0							
-2.0	-2.0		Lean CLAY: Grey with some sand as depth increased, damp	CL	6 6 8 10	18	
-3.0							
-4.0	-4.0		Clayey SAND: Grey clayey coarse sand, wet	SC	8 10 20 28	48	
-5.0							
-6.0	-6.0		Clayey SAND: same as above with finer grains and less clay, wet	SC	7 10 9 9	18	
-7.0							
-8.0	-8.0				4 3 4 3	7	
-9.0							
-10.0	-10.0						
-11.0							
-12.0	-12.0						
-13.0							
-14.0	-14.0		Fat CLAY: Grey, moist	CH	2 3 4 5	9	
-15.0							
-16.0	-16.0						

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B - 106

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Logged By: CTC Jr.
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-17.0							
-18.0	-18.0						
-19.0				CH	6 8		
-20.0	-20.0		SAND: Grey coarse sand, with some clay, wet	SP	10 11	21	
-21.0							
-22.0	-22.0						
-23.0							
-24.0	-24.0		Fat CLAY: Grey-Brown mottled with trace of sand, damp	CH	6 9 13 17	30	Boring Terminated @ 25.5'
-25.0							
-26.0	-26.0		Terminated				

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B - 107

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Logged By: CTC Jr.
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		SAND: Red-Yellow-Grey mottled, damp	SW	6		
					6		
-1.0					8		No water accumilation at TOB
-2.0	-2.0				6	14	
				SW	6		
-3.0					5		
			Clayey SAND: Grey, damp	SC	6		
-4.0	-4.0				7	13	
			Fat CLAY: Grey, with some sand, damp	CH	4		
-5.0			Clayey SAND: Grey, coarse sand, wet	SC	4		
					4		
-6.0	-6.0				4	8	
			Fat CLAY: Dark Brown, increasing sand content with depth, damp to moist	CH	4		
-7.0					4		
					4		
-8.0	-8.0				5	9	
				CH	3		
-9.0					3		
					3		
-10.0	-10.0				5	8	
			Sandy Fat CLAY: Grey-Brown mottled, moist	SC	3		
-11.0					5		
					6		
-12.0	-12.0				7	13	
					3		
-13.0					7		
			Clayey SAND: Grey, coarse sand, decreasing clay content with depth, wet	SC	10		
-14.0	-14.0				13	23	
					3		
-15.0					5		
					7		
-16.0	-16.0				10	17	
					6		

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B - 107

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Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-17.0					8		
					8		
					8	16	
-18.0	-18.0		Fat CLAY: Dark Brown, with coarse sand, damp	CH	6		
-19.0					9		
					12		
					15	27	
-20.0	-20.0		Clayey SAND: Grey, wet	CH	8		
-21.0			Sandy Fat CLAY: Dark Brown-Grey mottled, with some silt, damp	SC-ML	13		
					15		
					22	37	
-22.0	-22.0				6		
-23.0			Sandy Fat CLAY: Dark Grey, with some pebbles, with some silt, damp	SC-ML	13		
					28		
					36	64	
-24.0	-24.0		Terminated				
-25.0							Boring Terminated @ 24.0'
-26.0	-26.0						

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Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		SAND: White-Red mottled, fine sand, with some clay, damp	SP	3, 4, 5, 4	9	No water accumilation at TOB
-1.0							
-2.0	-2.0		SAND: White, coarse sand, moist	SP	5, 6, 6		
-3.0							
			SAND: Red-Yellow mottled, moist	SW	7	13	
-4.0	-4.0		SAND: Grey-Brown-Red mottled, fine sand, damp	SP	5, 3		
-5.0			Fat CLAY: Red changing to Grey, damp	CH	4, 6	10	
-6.0	-6.0		Sandy Fat CLAY: Grey, damp	CH	2, 3, 4, 6	10	
-7.0							
-8.0	-8.0			SC	4, 3, 5, 7, 8	12	
-9.0							
-10.0	-10.0		SAND: Grey, coarse sand, with some clay, wet	SP	10, 9, 10, 5, 6, 8	19	
-11.0							
-12.0	-12.0						
-13.0							
			Silty CLAY: Grey-Brown, with some coarse	ML	10	18	
-14.0	-14.0		SAND: Grey, coarse sand, with some clay, wet	SP	6, 9		
-15.0			Sandy Fat CLAY: Dark Brown, with some silt, moist	SC-ML	13, 15	28	
-16.0	-16.0		Sandy Fat CLAY: Grey, increasing sand	CL	5		

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Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-17.0			content with depth, damp (some pebbles @23.5')	SC-ML	7		
					10		
-18.0	-18.0				13	26	
					4		
-19.0					7		
					10		
-20.0	-20.0				11	21	
					5		
-21.0					7		
					9		
-22.0	-22.0				10	19	
					3		
-23.0					6		
					6		
-24.0	-24.0		Terminated		9	15	
-25.0							Boring Terminated @ 24.0'
-26.0	-26.0						

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B - 109

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Logged By: CTC Jr.
Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
0.0	0.0		SAND: Red-Yellow-White, fine to coarse, with some clay, damp	SW	13		
					8		
-1.0					10		No water accumilation at TOB
					14	24	
-2.0	-2.0		SAND: White-Yellow, dry to damp	SW	6		
					6		
-3.0					8		
					10	18	
-4.0	-4.0		Fat CLAY: White-Red mottled, with sand lenses, damp	CH	3		
					3		
-5.0					9		
			SAND: White, medium, damp	SP	12	21	
-6.0	-6.0		SAND: Brown, coarse, with some clay, wet	SP	6		
					7		
-7.0					7		
					6	13	
-8.0	-8.0				5		
					5		
-9.0					5		
					3	8	
-10.0	-10.0				5		
					5		
-11.0			SAND: Dark Grey, coarse, with some clay, wet	SP	5		
					6	11	
-12.0	-12.0		Sandy Fat CLAY: Dark Grey, with coarse sand, with some pebbles at small intervals, damp to moist	CH	7		
					9		
-13.0					12		
					17	29	
-14.0	-14.0				5		
					7		
-15.0					8		
					12	20	
-16.0	-16.0				5		

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Drill Type: 2 1/4" Hollow Stem Auger, SPT
Drilled By: Drillers Temporary Service
Location: See Location Plan

DAA No. RA02108-02

Depth ft.	Elevation ft.	Legend	Description	USCS Symbol	SPT Blow Count	N-Value	Notes
-17.0					6		
					7		
-18.0	-18.0				10	17	
					3		
-19.0					4		
					5		
-20.0	-20.0				8	13	
					4		
-21.0					5		
					4		
-22.0	-22.0				7	11	
					5		
-23.0					6		
					9		
-24.0	-24.0		Terminated		13	22	
-25.0							Boring Terminated @ 24.0'
-26.0	-26.0						

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Quad. No._____ Serial No._____
Lat._____ Long._____ PC_____
Minor Basin_____
Basin Code_____
Header Ent._____ GW-1 Ent._____

WELL CONSTRUCTION RECORD
CDMW-1

DI ING CONTRACTOR Graham & Currie Well Drilling Co.

DRILLER REGISTRATION NUMBER 537

STATE WELL CONSTRUCTION PERMIT NUMBER n/a

1. Well Location: *(show sketch of the location below {on right})*

Nearest Town Spring Lake, North Carolina

S.R. 1116 - Doc's Road
(Road, Community, or Subdivision and Lot Number)

County Harnett

2. Owner Harnett County

Address Post Office Box 759, Lillington, North Carolina 27546
(Street or Route #) (City/Town) (State) (Zip Code)

3. Date Drilled 01/29/97 Use of Well Monitoring

4. Total Depth 63' Cuttings Collected ( )Yes (√)No

5. Does Well Replace Existing Well? ( )Yes (√)No

6. Static Water Level: 64.52 Feet ( )Above (√)Below Top of Casing
Top of Casing is 2.5 Feet Above Land Surface.

7. Yield *(gpm)* n/a Method of Test_____

8. ' 'er Zones *(depth)* n/a

9. rination → Type n/a Amount _____

Depth From	To	Drilling Log Formation Description
0 - 4'		Tan clayey SAND
4' - 12'		Tan moist sandy CLAY
12' - 17'		Tan moist clayey SAND
17' - 40'		Dull gray to brown CLAY
40 - 63'		Bluish-gray to gray sandy micaceous CLAY

If Additional Space Is Needed Use Back Of Form

10. CASING			
Depth	Diameter	Wall Thickness or weight/feet	Material
48' - +2.5'	2-inch	Sch.40	PVC

11. GROUT		
Depth	Material	Method
44' - 0'	Neat Cement	Tremie

12. SCREEN			
Depth	Diameter	Slot Size	Material
63' - 48'	2-inch	0.010	PVC

13. GRAVEL PACK		
Depth	Size	Material
63' - 46'	Medium-grained	Torpedo Sand

LOCATION SKETCH

Show direction and distance from at least "2" Two State Roads, or Other Map Reference Points

Please See Attached Maps

14. ''MARKS A bentonite seal was placed in this well from 44' to 46'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

:UBMIT ORIGINAL TO DIVISION OF ENVIRONMENTAL MANAGEMENT
AND A COPY TO THE WELL OWNER

R. Dennis Horlock 6/5/97
(Signature of Contractor or Agent) (Date)

Post Office Box 27687 • Raleigh • North Carolina • 27611
Phone (919) 733-5083

Quad. No._____ Serial No._____
Lat._____ Long._____ PC_____
Minor Basin_____
Basin Code_____
Header Ent._____ GW-1 Ent._____

WELL CONSTRUCTION RECORD
CDMW-2

D. ING CONTRACTOR Graham & Currie Well Drilling Co.

DRILLER REGISTRATION NUMBER 537

STATE WELL CONSTRUCTION PERMIT NUMBER n/a

1. Well Location: *(show sketch of the location below {on right})*

Nearest Town Spring Lake, North Carolina

S.R. 1116 - Doc's Road
(Road, Community, or Subdivision and Lot Number)

County Harnett

2. Owner Harnett County

Address Post Office Box 759, Lillington, North Carolina 27546
(Street or Route #) (City/Town) (State) (Zip Code)

3. Date Drilled 01/28/97 Use of Well Monitoring

4. Total Depth 40' Cuttings Collected ( )Yes (√)No

5. Does Well Replace Existing Well? ( )Yes (√)No

6. Static Water Level: 32.78 Feet ( )Above (√)Below Top of Casing
Top of Casing is 2.5 Feet Above Land Surface.

7. Yield *(gpm)* n/a Method of Test_____

8. Water Zones *(depth)* n/a

9. Chlorination → Type n/a Amount _____

Depth From	To	Drilling Log Formation Description
0 - 1.5'		Tan SAND
1.5' - 12.0'		Dark gray to black clayey loamy SAND
12.0' - 19.0'		Light gray wet clayey SAND
19.0' - 40.0'		Tan to bluish gray sandy CLAY

If Additional Space Is Needed Use Back Of Form

10. CASING

Depth	Diameter	Wall Thickness or weight/feet	Material
25' - +2.5'	2-inch	Sch.40	PVC

11. GROUT

Depth	Material	Method
21' - 0'	Neat Cement	Tremie

12. SCREEN

Depth	Diameter	Slot Size	Material
40' - 25'	2-inch	0.010	PVC

13. GRAVEL PACK

Depth	Size	Material
40' - 23'	Medium-grained	Torpedo Sand

LOCATION SKETCH

Show direction and distance from at least "2" Two State Roads, or Other Map Reference Points

Please See Attached Maps

14. REMARKS A bentonite seal was placed in this well from 21' to 23'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

SUBMIT ORIGINAL TO DIVISION OF ENVIRONMENTAL MANAGEMENT AND A COPY TO THE WELL OWNER

R. Dennis Holder 5/5/97
(Signature of Contractor or Agent) (Date)

Post Office Box 27687 • Raleigh • North Carolina • 27611
Phone (919) 733-5083

Quad. No.____ Serial No.____
Lat.____ Long.____ PC____
Minor Basin____
Basin Code____
Header Ent.____ GW-1 Ent.____

WELL CONSTRUCTION RECORD
CDMW-3

LING CONTRACTOR Graham & Currie Well Drilling Co.

DRILLER REGISTRATION NUMBER 537

STATE WELL CONSTRUCTION PERMIT NUMBER n/a

1. Well Location: *(show sketch of the location below (on right))*

Nearest Town Spring Lake, North Carolina

S.R. 1116 - Doc's Road
(Road, Community, or Subdivision and Lot Number)

County Harnett

2. Owner Harnett County

Address Post Office Box 759, Lillington, North Carolina 27546
(Street or Route #) (City/Town) (State) (Zip Code)

3. Date Drilled 01/28/97 Use of Well Monitoring

4. Total Depth 43' Cuttings Collected ( )Yes (✓)No

5. Does Well Replace Existing Well? ( )Yes (✓)No

6. Static Water Level: 38.73 Feet ( )Above (✓)Below Top of Casing
Top of Casing is 2.0 Feet Above Land Surface.

7. Yield *(gpm)* n/a Method of Test____

8. Water Zones *(depth)* n/a

9. orination → Type n/a Amount____

Depth From To	Drilling Log Formation Description
0 - 1.0'	Tan SAND
1.0' - 5.0'	Dark gray to black loamy SAND
5.0' - 10.0'	Tan to brown sandy CLAY
10.0' - 13.0'	Wet tan clayey SAND
13.0' - 16.0'	Tan moist sandy CLAY
16.0' - 43.0'	Light gray to medium gray sandy CLAY
If Additional Space Is Needed Use Back Of Form	

10. CASING

Depth	Diameter	Wall Thickness or weight/feet	Material
28' - +2.0'	2-inch	Sch.40	PVC

11. GROUT

Depth	Material	Method
24' - 0'	Neat Cement	Tremie

12. SCREEN

Depth	Diameter	Slot Size	Material
43' - 28'	2-inch	0.010	PVC

13. GRAVEL PACK

Depth	Size	Material
43' - 26'	Medium-grained	Torpedo Sand

LOCATION SKETCH

Show direction and distance from at least "2" Two State Roads, or Other Map Reference Points

Please See Attached Maps

4. REMARKS A bentonite seal was placed in this well from 24' to 26'

I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER

UBMIT ORIGINAL TO DIVISION OF ENVIRONMENTAL MANAGEMENT
ND A COPY TO THE WELL OWNER

R. Dennis Holder 5/5/97

(Signature of Contractor or Agent) (Date)

DEPTH (FT.)	DESCRIPTION	ELEV. (FT.)	N	MONITOR WELL
0.0	Brown yellow slightly silty fine to medium SAND (SP-SM).		9	Cement grout from 0.0' to 22.0' depth.
			11	
			19	
7.0	Yellow brown and light tan clayey fine to medium SAND (SC) with occational coarse sand.		32	
13.0	Yellow brown tan and gray slightly clayey fine to medium SAND (SP-SC) with trace coarse sand.		21	
17.0	Yellow brown and light tan slightly silty fine to medium SAND (SP-SM) with occational coarse sand.		13	Bentonite pellets from 22.0' to 23.0' depth.
			15	Medium well sand from 23.0' to 35.0' depth.
			13	Screened interval from 25.0' to 35.0' depth.
34.0	Very wet gray fine to medium sandy silty CLAY (CH).		50	
35.0	Boring terminated at 35 feet.			

Classified By: BOB NEEL, TITAN
Driller: CAROLINA DRILLING
Drill Rig: ROVER
Boring Type: HSA

GROUNDWATER READINGS

DATE	TIME	DEPTH	ELEVATION	STABILIZATION TIME
6/22/02	–	34.3'	--	71 DAYS

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS

MONITOR WELL INSTALLATION

WELL NUMBER	CDMW 4-S
DATE DRILLED	4/12/02
PROJECT NUMBER	20422-80
PROJECT	ANDERSON CREEK LANDFILL
PAGE 1 OF 1	

TITAN ATLANTIC GROUP

DEPTH (FT.)	DESCRIPTION	ELEV. (FT.)	N
0.0	Yellow brown slightly silty fine to medium SAND (SP-SM) with trace coarse sand.		6, 15
5.0	Yellow brown clayey fine to medium SAND (SC).		27, 29
12.0	Tan light gray and yellow brown silty fine to medium SAND (SM) with trace coarse sand.		35, 24, 16
27.0	Moist to wet light tan slightly silty fine to medium SAND (SP-SM) with trace coarse sand.		11, 18
37.0	Yellow brown and gray fine sandy CLAY (SC) with occational medium sand.		50/5"

MONITOR WELL

Cement grout from 0.0' to 40.0' depth.

Classified By: BOB NEEL, TITAN
Driller: CAROLINA DRILLING
Drill Rig: ROVER
Boring Type: HSA

GROUNDWATER READINGS

DATE	TIME	DEPTH	ELEVATION	STABILIZATION TIME
6/22/02	-	35.5'	-	72 DAYS

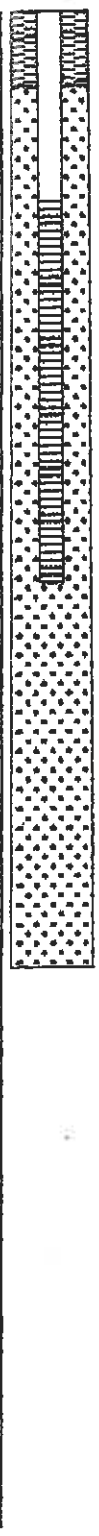
SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS

MONITOR WELL INSTALLATION

WELL NUMBER	CDMW 4-D
DATE DRILLED	4/11/02
PROJECT NUMBER	20422-80
PROJECT	ANDERSON CREEK LANDFILL
PAGE 1 OF 2	

TITAN ATLANTIC GROUP

DEPTH (FT.)	DESCRIPTION	ELEV. (FT.)	N
40.0	Yellow brown and gray fine sandy CLAY (SC) with occational medium sand.		
42.0	Gray fine to coarse sandy CLAY (CL).		40
			49
50.0	Dark gray slightly fine to medium sandy silty CLAY (CH).		34
			32
62.0	Light gray clayey silty fine to coarse SAND (SM).		30
65.0	Boring terminated at 65 feet.		



MONITOR WELL

Classified By: BOB NEEL, TITAN
Driller: CAROLINA DRILLING
Drill Rig: ROVER
Boring Type: HSA

GROUNDWATER READINGS

DATE	TIME	DEPTH	ELEVATION	STABILIZATION TIME
6/22/02	–	35.9'	–	72 DAYS

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVIATIONS

MONITOR WELL INSTALLATION

WELL NUMBER	CDMW 4-D
DATE DRILLED	4/11/02
PROJECT NUMBER	20422-80
PROJECT	ANDERSON CREEK LANDFILL
PAGE 1 OF 1	

TITAN ATLANTIC GROUP

PATTERSON
EXPLORATION SERVICES

P.O. BOX 3008 - SANFORD, N.C. 27331-3008 - (919) 774-3770
FAX: (919) 774-3510

TEST BORING FIELD REPORT

Job Name: Anderson Creek Landfill	**Job Number:** 030896	**Job Location:** S.R. 1116, Harnett County
Field Supervisor: Dennis Holder	**Date Drilled:** 04/02/96	**Boring or Well Number:** MW-4

SPT	1st 6	2nd 6	3rd 6	4th 6	BORING LOG	
					Depth	Formation Description
0' - 2'	1	1	1	2		
2' - 4'	1	1	2	4		
4' - 6'	5	5	4	4	0 - 1'	Brown to tan medium-grained **SAND**
6' - 8'	2	3	4	7	1' - 7.5'	Brown to gray silty clayey **SAND**
8' - 10'	1	2	2	1	7.5' - 9'	Tan coarse-grained wet **SAND**
10' - 12'	1	1	1	5	9' - 11.5'	Gray silty clayey **SAND**
12' - 14'	7	14	18	20	11.5' - 17'	Grayish blue silty sandy **CLAY**
14' - 16'	3	5	14	16		

PATTERSON EXPLORATION SERVICES

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FAX: (919) 774-3510

TEST BORING FIELD REPORT

Job Name: Anderson Creek Landfill	**Job Number:** 030896	**Job Location:** S.R. 1116, Harnett County
Field Supervisor: Dennis Holder	**Date Drilled:** 04/02/96	**Boring or Well Number:** MW-5

SPT	1st 6	2nd 6	3rd 6	4th 6	BORING LOG	
					Depth	Formation Description
0' - 2'	1	2	4	5		
2' - 4'	1	2	4	5		
4' - 6'	1	3	5	6	0 - 7'	Brown to gray silty clayey **SAND**
6' - 8'	1	2	4	6	7' - 9'	Grayish blue silty sandy **CLAY**
8' - 10'	2	2	2	3	9' - 9.5'	Gray moist **SAND**
10' - 12'	1	2	6	8	9.5' - 18'	Grayish to brown silty **CLAY**
12' - 14'	3	6	9	10		
14' - 16'	2	4	7	10		
16' - 18'	7	12	16	19		

PATTERSON EXPLORATION SERVICES

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FAX: (919) 774-3510

TEST BORING FIELD REPORT

Job Name: Anderson Creek Landfill	**Job Number:** 030896	**Job Location:** S.R. 1116, Harnett County
Field Supervisor: Dennis Holder	**Date Drilled:** 04/01/96	**Boring or Well Number:** P6-B

SPT	1st 6	2nd 6	3rd 6	4th 6	BORING LOG	
					Depth	Formation Description
0' - 2'	1	1	2	1		
2' - 4'	1	2	3	4		
4' - 6'	1	3	4	21	0 - 1'	Gray to black loamy **SAND**
6' - 8'	4	7	10	12	1' - 4'	Brown to tan **SAND**
8' - 10'	8	11	13	13	4' - 14'	Orange clayey silty **SAND**
10' - 12'	9	10	11	9	14' - 27'	Tan to white **SAND**
12' - 14'	5	7	8	8	27' - 33'	White wet **SAND**
14' - 16'	6	9	9	9	33' - 40'	Gray to grayish blue silty sandy **CLAY**
16' - 18'	6	8	8	9		
18' - 20'	5	6	6	6		
20' - 22'	2	5	5	3		
22' - 24'	3	2	2	2		
24' - 26'	2	1	2	2		
26' - 28'	1	2	2	3		
28' - 30'	3	5	5	6		
30' - 32'	3	6	6	9		
32' - 34'	2	8	8	14		
34' - 36'	3	3	16	17		
36' - 38'	4	16	13	9		
38' - 40'	4	12	20	24		

PATTERSON EXPLORATION SERVICES

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FAX: (919) 774-3510

TEST BORING FIELD REPORT

Job Name: Anderson Creek Landfill	**Job Number:** 030896	**Job Location:** S.R. 1116, Harnett County
Field Supervisor: Dennis Holder	**Date Drilled:** 04/01/96	**Boring or Well Number:** P-7

SPT	1st 6	2nd 6	3rd 6	4th 6	BORING LOG	
					Depth	**Formation Description**
0' - 2'	1	1	1	2		
2' - 4'	1	1	1	2		
4' - 6'	1	2	1	3	0 - 7'	Brown to tan SAND
6' - 8'	1	2	4	8	7' - 11'	Orange to tan silty clayey SAND
8' - 10'	3	3	8	6	11' - 12'	Orange to gray silty CLAY
10' - 12'	1	2	4	9	12' - 13'	White wet SAND
12' - 14'	1	2	3	5	13' - 21'	Orange to gray silty sandy CLAY interlayed with gray wet SAND
14' - 16'	1	2	9	12	21' - 26'	Gray silty sandy macaceous CLAY
16' - 18'	1	2	4	5		
18' - 20'	1	2	4	5		
20' - 22'	1	2	3	5		
22 - 24'	3	4	6	7		
24' - 26'	2	3	5	8		

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FAX: (919) 774-3510

TEST BORING FIELD REPORT

Job Name: Anderson Creek Landfill	**Job Number:** 030896	**Job Location:** S.R. 1116, Harnett County
Field Supervisor: Dennis Holder	**Date Drilled:** 03/27/96	**Boring or Well Number:** P-8

SPT	1st 6	2nd 6	3rd 6	4th 6	BORING LOG	
					Depth	Formation Description
0' - 2'	1	2	1	1		
2' - 4'	1	2	1	1		
4' - 6'	1	2	3	5		
6' - 8'	1	2	3	12		
8' - 10'	3	5	8	11	0 -.5'	Dark gray to black loamy **SAND**
10' - 12'	1	4	7	8	.5' - 4'	Tan moist to wet **SAND**
12' - 14'	2	6	10	13	4' - 7'	Tan to light gray clayey silty **SAND**
14' - 16'	1	4	8	10	7' - 30'	Orange to gray silty sandy micaceous **CLAY**
16' - 18'	2	5	5	7		
18' - 20'	1	2	6	7		
20' - 22'	1	4	7	7		
22' - 24'	1	2	5	6		
24' - 26'	1	2	5	6		
26' - 28'	2	5	8	10		
28' - 30'	6	11	13	20		

PATTERSON
EXPLORATION SERVICES

P.O. BOX 3008 - SANFORD, N.C. 27331-3008 - (919) 774-3770
FAX: (919) 774-3510

TEST BORING FIELD REPORT

Job Name: Anderson Creek Landfill	**Job Number:** 030896	**Job Location:** S.R. 1116, Harnett County
Field Supervisor: Dennis Holder	**Date Drilled:** 03/27/96	**Boring or Well Number:** P-9

SPT	1st 6	2nd 6	3rd 6	4th 6	BORING LOG	
					Depth	Formation Description
0' - 2'	1	1	2	3		
2' - 4'	1	3	2	4		
4' - 6'	1	2	7	7		
6' - 8'	3	4	4	3	0 -1'	Dark gray to black loamy **SAND**
8' - 10'	3	3	2	3	1' - 7'	Orange to tan silty clayey **SAND**
10' - 12'	3	3	3	3	7' - 17'	Tan moist **SAND**
12' - 14'	3	4	5	5	17' - 19'	White wet **SAND**
14' - 16'	3	4	7	7	19 - 26'	Tan to gray silty micaceous **CLAY**
16' - 18'	1	2	12	13		
20' - 22'	1	2	50			
22' - 24'	1	2	20	45		
24' - 26'	1	2	25	40		

APPENDIX II

SOIL SAMPLE ANALYTICAL RESULTS

Lab Data Summary
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared by: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample Data

Sample ID	PZ-25	PZ-25	PZ-11	PZ-17	B-1	B-1	PZ-14
Sample Depth	20'-22'	32'-34'	0'-20'	2'-12'	26'-28'	36'-38'	4'-6'
Classification Data							
Natural Moisture Content, %	18.1%	15.4%			19.0%	16.4%	15.9%
Liquid Limit	38	48			58	48	25
Plastic Limit	15	12			15	18	15
Plastic Index	23	36			43	30	10
Passing No. 200 Sieve, %	62.6%	36.1%			65.3%	59.7%	21.3%
USCS Group Symbol	CL	SC			CH	CL	SC
Standard Proctor Data							
Maximum Dry Density, pcf			122.9	124.3			
Optimum Moisture Content, %			10.5%	11.7%			
Permeability Data							
Dry Density, pcf	112.1	117.2					
Moisture Content, %	18.1%	15.4%					
Permeability, cm/sec	2.2E-08	5.6E-09					

Lab Data Summary
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared by: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample Data

Sample ID	PZ-15	PZ-15	PZ-17	PZ-18	PZ-26	PZ-27	PZ-27
Sample Depth	20'-22'	32'-34'	8'-10'	22'-24'	18'-20'	8'-10'	20'-22'
Classification Data							
Natural Moisture Content, %	9.1%	16.1%	6.6%	26.1%	21.3%	12.2%	9.1%
Liquid Limit		49		49	52		35
Plastic Limit	Non-Plastic	23	Non-Plastic	14	19	Non-Plastic	16
Plastic Index		26		35	33		19
Passing No. 200 Sieve, %	14.6%	66.3%	5.7%	24.7%	40.6%	20.1%	16.0%
USCS Group Symbol	SM	CL	SP-SM	SC	SC	SM	SC

Lab Data Summary

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared by: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample Data

Sample ID	PZ-29	PZ-29
Sample Depth	22'-24'	36'-38'

Classification Data

Natural Moisture Content, %	10.1%	15.5%
Liquid Limit		45
Plastic Limit	Non-Plastic	17
Plastic Index		28
Passing No. 200 Sieve, %	12.6%	44.1%
USCS Group Symbol	SM	SC

Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-25
Sample Depth 20'-22'
Visual Sample Description Gray Sandy Lean CLAY

Natural Moisture Content: ASTM D 2216

Pan ID	13
Pan Wt	187.19 grams
Pan + Soil (wet)	421.40 grams
Pan + Soil (dry)	385.51 grams
Natural Moisture Content	*18.1%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	261.31 grams
Percent Passing No. 200 Sieve	62.6%
Pan + Soil retained on No. 4 sieve (dry)	187.19 grams
Percent Passing No. 4 Sieve	100.0%
Soil Classifies as	*Fine-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	19	26	33
Pan ID	6	12	65
Pan Wt	11.37	11.34	11.09
Pan + Soil (wet)	24.59	23.94	21.21
Pan + Soil (dry)	20.84	20.52	18.59
Moisture Content	40%	37%	35%
Liquid Limit	38	37	36
Liquid Limit	*38*		

Plastic Limit

Pan ID	35	42
Pan Weight	1.94	1.93
Pan + Soil (wet)	12.48	11.14
Pan + Soil (dry)	11.07	9.98
Moisture Content	15%	14%
Plastic Limit	*15*	
Plastic Index	*23*	

USCS Classification: ASTM D 2487

Group Symbol **CL**
Group Name **Sandy Lean CLAY**

Grain Size Distribution Calculations

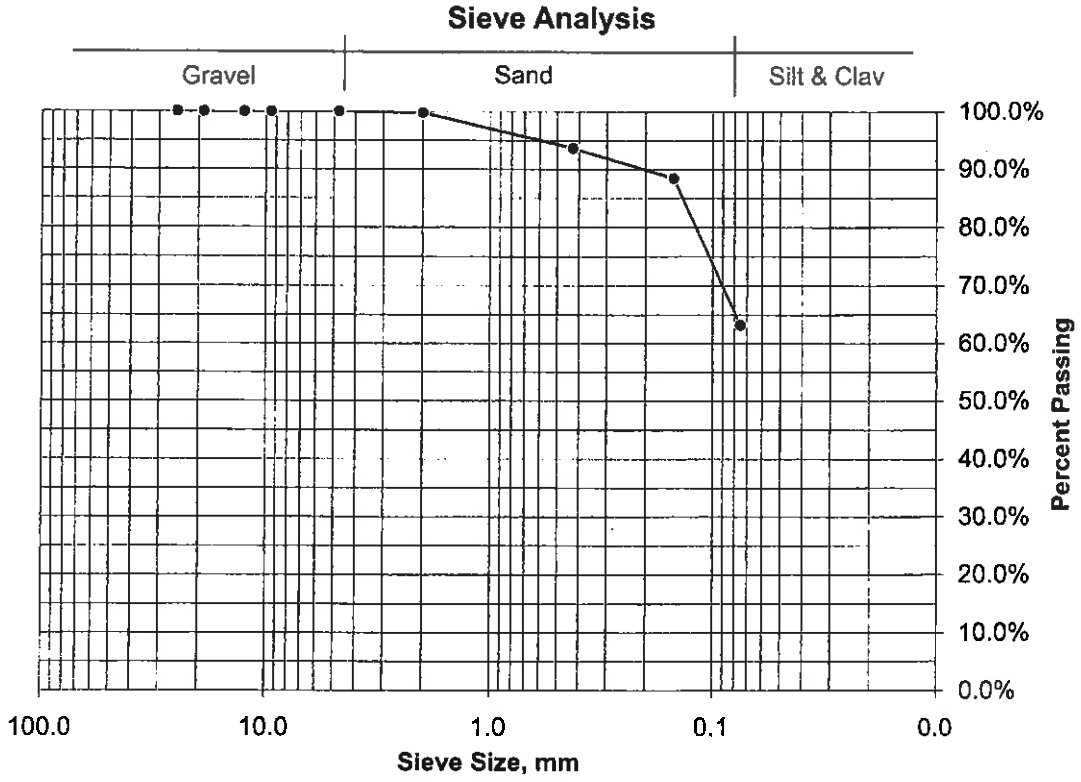
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-25
Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.41	0.2%	2.0	99.8%
No. 40	12.15	6.1%	0.425	93.7%
No. 100	10.28	5.2%	0.15	88.5%
No. 200	50.06	25.2%	0.075	63.2%
Pan	0.56	0.3%		
Total	73.46	36.8%		



Permeability Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID: PZ-25
Sample Depth: 20'-22'
Permeability Method: ASTM D5084
Sample Length, in: 3.55
Sample Diameter, in: 2.84
Sample Condition: Undisturbed

Moisture Content

Pan Wt	187.19	grams
Pan + Soil (wet)	421.40	grams
Pan + Soil (dry)	385.51	grams
Moisture Content	*18.1%*	

Dry Density

Soil (wet)	780.90	grams
Wet Density	132.3	pcf
Dry Density	*112.1*	pcf

Test Conditions

Backpressure, psi	40.0
Cell Pressure, psi	50.0
Influent Buret Area, cm^2	0.03142
Effluent Buret Area, cm^2	0.76712
Effective Stress, psi	10.0
Pearment Liquid Temp.(°C):	De-aired Water

Initial Data

Assumed Specific Gravity	2.65	
Percent Voids	32.2%	
Actual Volume of Voids	118.7	ml
Porosity	32.2%	
Saturation	100.0%	

Permeability Trials

Time min	Influent Head, cm	Influent Flow, cm^3	Effluent Head, cm	Effluent Flow, cm^3	Flow Deviation Ratio	Gradient mm-Hg	Permeability, k cm/sec
25-Jun 10:09	17.700		1.000				
25-Jun 10:10	17.550	0.005	1.006	0.005	1.00	23.24	8.3E-08
25-Jun 10:11	17.450	0.003	1.010	0.003	1.00	23.03	5.6E-08
25-Jun 10:13	17.350	0.003	1.014	0.003	1.00	22.88	2.8E-08
25-Jun 10:15	17.250	0.003	1.018	0.003	1.00	22.74	2.8E-08
25-Jun 10:17	17.150	0.003	1.023	0.003	1.00	22.59	2.8E-08
25-Jun 10:19	17.050	0.003	1.027	0.003	1.00	22.45	2.9E-08
25-Jun 10:22	16.950	0.003	1.031	0.003	1.00	22.30	1.9E-08
25-Jun 10:27	16.800	0.005	1.037	0.005	1.00	22.16	1.7E-08

Average Permeability 2.2E-08 cm/sec

Final Data

Assumed Specific Gravity	2.65	
Final Weight of Sample	780.40	grams
Final Moisture Content	18.0%	
Percent Voids	32.1%	
Actual Volume of Voids	117.9	ml
Porosity	32.1%	
Saturation	100.0%	

Final Sample Length, in:	3.56	
Final Sample Diameter, in:	2.83	
Wet Density	132.5	pcf
Dry Density	*112.3*	pcf

Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-25
Sample Depth	32'-34'
Visual Sample Description	Gray Clayey SAND

Natural Moisture Content: ASTM D 2216

Pan ID	10
Pan Wt	184.09 grams
Pan + Soil (wet)	496.90 grams
Pan + Soil (dry)	455.20 grams
Natural Moisture Content	*15.4%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	357.46 grams
Percent Passing No. 200 Sieve	36.1%
Pan + Soil retained on No. 4 sieve (dry)	186.16 grams
Percent Passing No. 4 Sieve	99.2%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	19	25	31
Pan ID	10	63	69
Pan Wt	11.35	10.90	11.07
Pan + Soil (wet)	21.69	23.37	22.26
Pan + Soil (dry)	18.22	19.30	18.72
Moisture Content	51%	48%	46%
Liquid Limit	49	48	47
Liquid Limit	*48*		

Plastic Limit

Pan ID	52	B
Pan Weight	2.40	2.42
Pan + Soil (wet)	12.19	11.02
Pan + Soil (dry)	11.13	10.10
Moisture Content	12%	12%
Plastic Limit	*12*	
Plastic Index	*36*	

USCS Classification: ASTM D 2487

Group Symbol	SC
Group Name	Clayey SAND

Grain Size Distribution Calculations

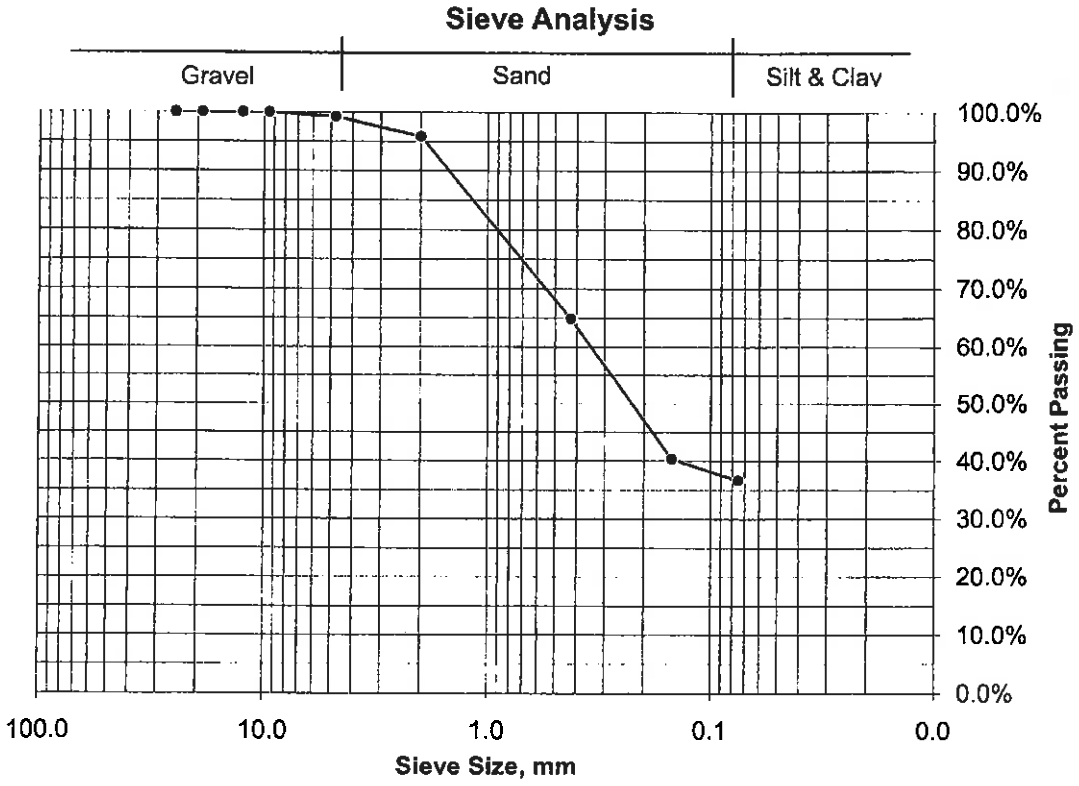
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-25
Sample Depth 32'-34'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
1"	0.00	0.0%	25.0	100.0%
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	2.07	0.8%	4.75	99.2%
No. 10	9.10	3.4%	2.0	95.9%
No. 40	84.03	31.0%	0.425	64.9%
No. 100	66.51	24.5%	0.15	40.4%
No. 200	9.88	3.6%	0.075	36.7%
Pan	0.92	0.3%		
Total	172.51	63.3%		



Permeability Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID: PZ-25
Sample Depth: 32'-34'
Permeability Method: ASTM D5084
Sample Length, in: 3.63
Sample Diameter, in: 2.83
Sample Condition: Undisturbed

Moisture Content

Pan Wt	184.09	grams
Pan + Soil (wet)	496.90	grams
Pan + Soil (dry)	455.20	grams
Moisture Content	*15.4%*	

Dry Density

Soil (wet)	813.40	grams
Wet Density	135.2	pcf
Dry Density	*117.2*	pcf

Test Conditions

Backpressure, psi	40.0
Cell Pressure, psi	50.0
Influent Buret Area, cm^2	0.03142
Effluent Buret Area, cm^2	0.76712
Effective Stress, psi	10.0
Pearment Liquid Temp.(°C):	Dc-aired Water

Initial Data

Assumed Specific Gravity	2.65
Percent Voids	29.2%
Actual Volume of Voids	109.5 ml
Porosity	29.2%
Saturation	99.1%

Permeability Trials

Time min	Influent Head, cm	Influent Flow, cm^3	Effluent Head, cm	Effluent Flow, cm^3	Flow Deviation Ratio	Gradient mm-Hg	Permeabilty, k cm/sec
25-Jun 10:34	16.900		1.000				
25-Jun 10:37	16.800	0.003	1.004	0.003	1.00	21.62	2.0E-08
25-Jun 10:40	16.750	0.002	1.006	0.002	1.00	21.48	1.0E-08
25-Jun 10:47	16.650	0.003	1.010	0.003	1.00	21.41	8.6E-09
25-Jun 10:52	16.600	0.002	1.012	0.002	1.00	21.27	6.1E-09
25-Jun 11:03	16.450	0.005	1.018	0.005	1.00	21.20	8.3E-09
25-Jun 11:09	16.400	0.002	1.020	0.002	1.00	20.99	5.1E-09
25-Jun 11:14	16.350	0.002	1.023	0.002	1.00	20.92	6.2E-09

Average Permeability 5.6E-09 cm/sec

Final Data

Assumed Specific Gravity	2.65		
Final Weight of Sample	816.90 grams		
Final Moisture Content	15.9%	Final Sample Length, in:	3.62
Percent Voids	29.4%	Final Sample Diameter, in:	2.84
Actual Volume of Voids	110.9 ml	Wet Density	135.2 pcf
Porosity	29.4%	*Dry Density*	*116.7* pcf
Saturation	100.0%		

Proctor Test Report
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared by LTW

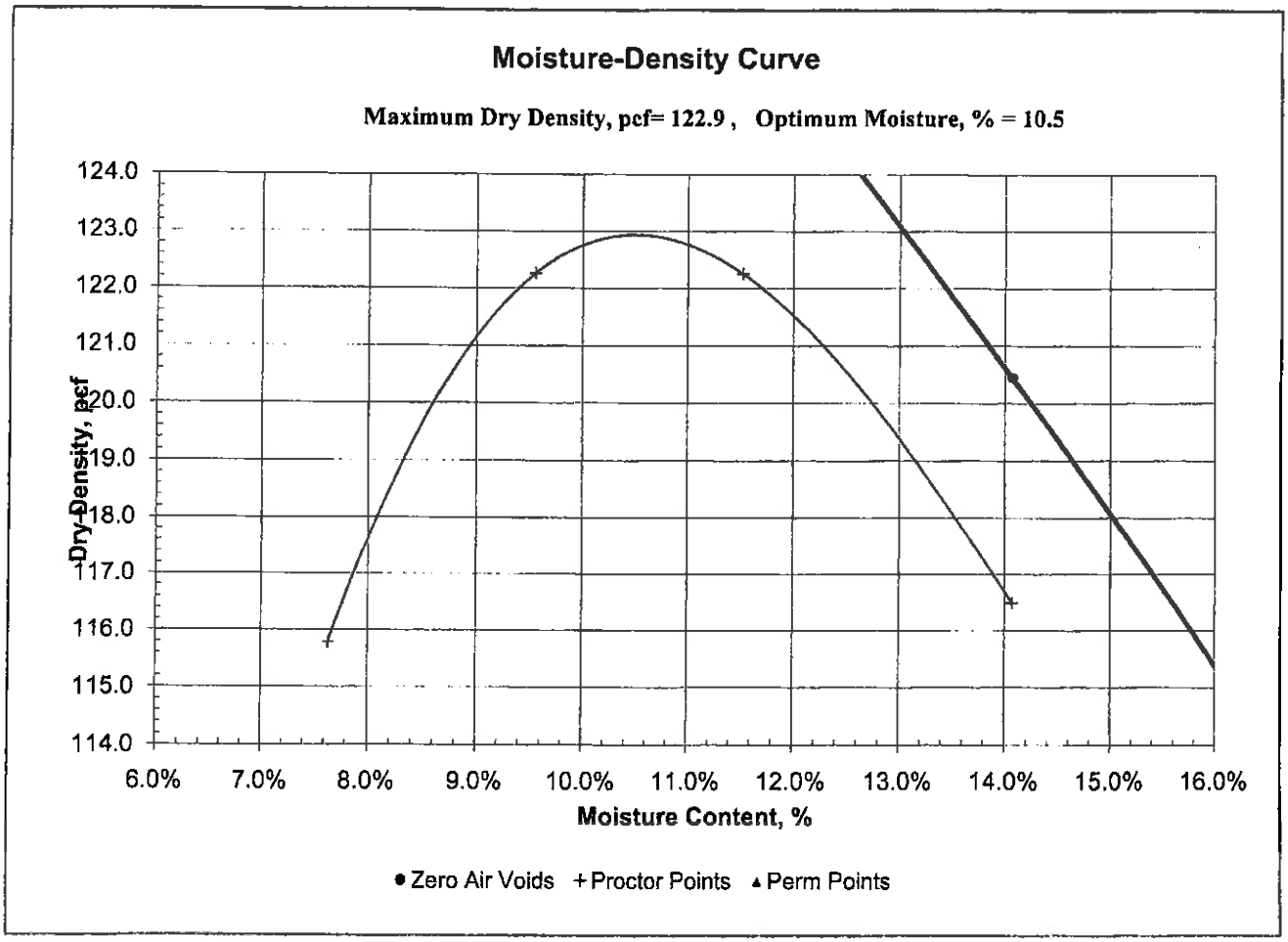
Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Soil and Test Method Data

Sample ID	PZ-11
Sample Depth	0'-20'
Sample Classification	N/A
USCS Group Symbol	N/A
Test Method	ASTM D698, Method B, with mechanical hammer
Sample Preparation	Air dried and sieved through a 3/8" sieve.
Mold Size, in	4.0

Test Data

	#1	#2	#3	#4	#5
Moisture Content	7.6%	9.6%	11.5%	14.1%	
Dry Density, pcf	115.8	122.3	122.2	116.5	



Proctor Test Report
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared by LTW

Draper Aden Associates
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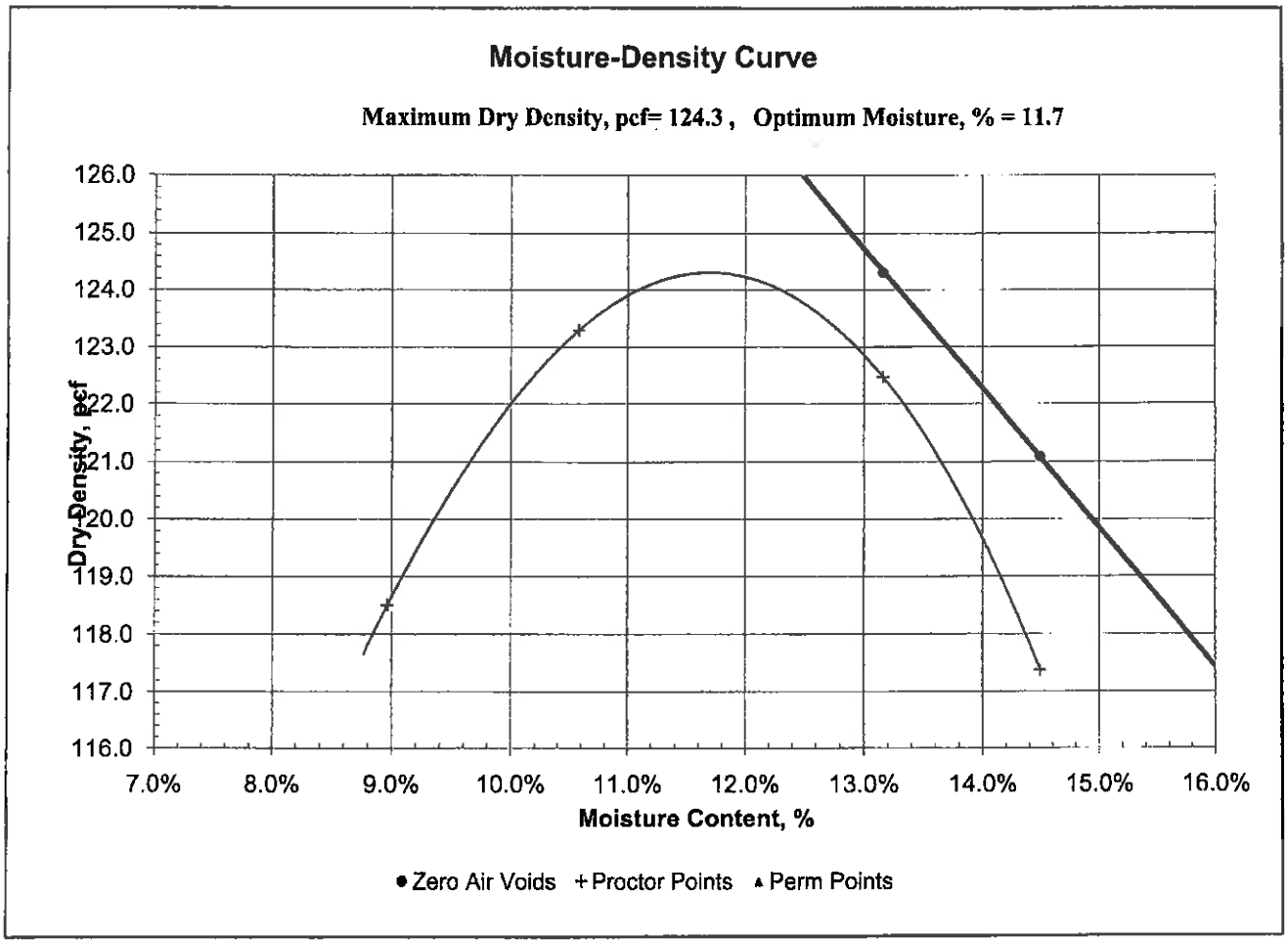
Soil and Test Method Data

Sample ID	PZ-17
Sample Depth	2'-12'
Sample Classification	N/A
USCS Group Symbol	N/A
Test Method	ASTM D698, Method B, with mechanical hammer
Sample Preparation	Air dried and sieved through a 3/8" sieve.
Mold Size, in	4.0

Test Data

	#1	#2	#3	#4	#5
Moisture Content	9.0%	10.6%	13.2%	14.5%	
Dry Density, pcf	118.5	123.3	122.5	117.4	



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID B-1
Sample Depth 26'-28'
Visual Sample Description Gray Sandy Fat CLAY

Natural Moisture Content: ASTM D 2216

Pan ID	32
Pan Wt	191.64 grams
Pan + Soil (wet)	389.88 grams
Pan + Soil (dry)	358.28 grams
Natural Moisture Content	*19.0%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	249.42 grams
Percent Passing No. 200 Sieve	65.3%
Pan + Soil retained on No. 4 sieve (dry)	191.92 grams
Percent Passing No. 4 Sieve	99.8%
Soil Classifies as	*Fine-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	19	28	35
Pan ID	97	105	107
Pan Wt	26.18	29.34	25.21
Pan + Soil (wet)	40.32	40.61	36.62
Pan + Soil (dry)	34.93	36.58	32.7
Moisture Content	62%	56%	52%
Liquid Limit	60	56	55
Liquid Limit	*58*		

Plastic Limit

Pan ID	68	E
Pan Weight	1.94	1.94
Pan + Soil (wet)	10.99	11.22
Pan + Soil (dry)	9.80	10.01
Moisture Content	15%	15%
Plastic Limit	*15*	
Plastic Index	*43*	

USCS Classification: ASTM D 2487

Group Symbol **CH**
Group Name **Sandy Fat CLAY**

Grain Size Distribution Calculations

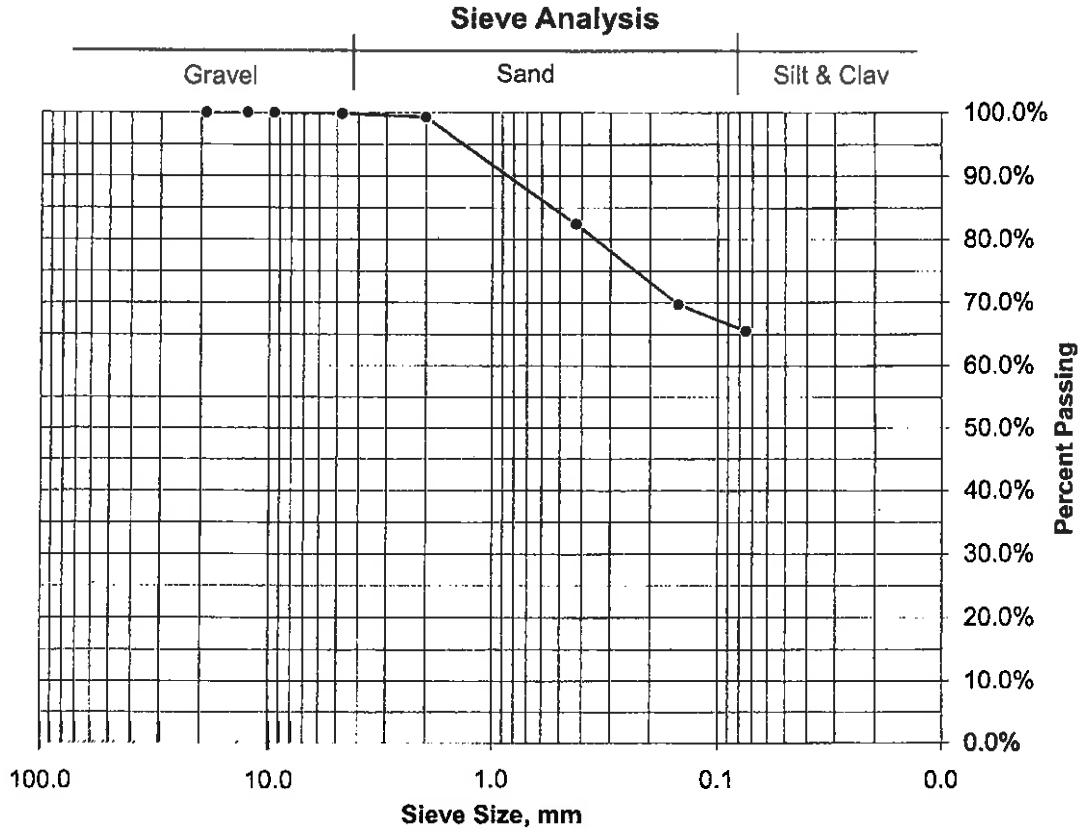
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID B-1
Sample Depth 26'-28'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.28	0.2%	4.75	99.8%
No. 10	0.89	0.5%	2.0	99.3%
No. 40	28.11	16.9%	0.425	82.4%
No. 100	21.20	12.7%	0.15	69.7%
No. 200	6.93	4.2%	0.075	65.5%
Pan	0.32	0.2%		
Total	57.73	34.5%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID B-1
Sample Depth 36'-38'
Visual Sample Description Dark Brown Sandy Lean CLAY

Natural Moisture Content: ASTM D 2216

Pan ID	41
Pan Wt	194.39 grams
Pan + Soil (wet)	392.36 grams
Pan + Soil (dry)	364.43 grams
Natural Moisture Content	*16.4%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	262.87 grams
Percent Passing No. 200 Sieve	59.7%
Pan + Soil retained on No. 4 sieve (dry)	194.39 grams
Percent Passing No. 4 Sieve	100.0%
Soil Classifies as	*Fine-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	17	28	36
Pan ID	7	9	71
Pan Wt	11.25	11.52	11.06
Pan + Soil (wet)	23.29	23.18	22.34
Pan + Soil (dry)	19.19	19.48	18.99
Moisture Content	52%	46%	42%
Liquid Limit	49	47	44
Liquid Limit	*48*		

Plastic Limit

Pan ID	29	A
Pan Weight	2.40	2.39
Pan + Soil (wet)	12.08	11.66
Pan + Soil (dry)	10.61	10.29
Moisture Content	18%	17%
Plastic Limit	*18*	
Plastic Index	*30*	

USCS Classification: ASTM D 2487

Group Symbol **CL**
Group Name **Sandy Lean CLAY**

Grain Size Distribution Calculations

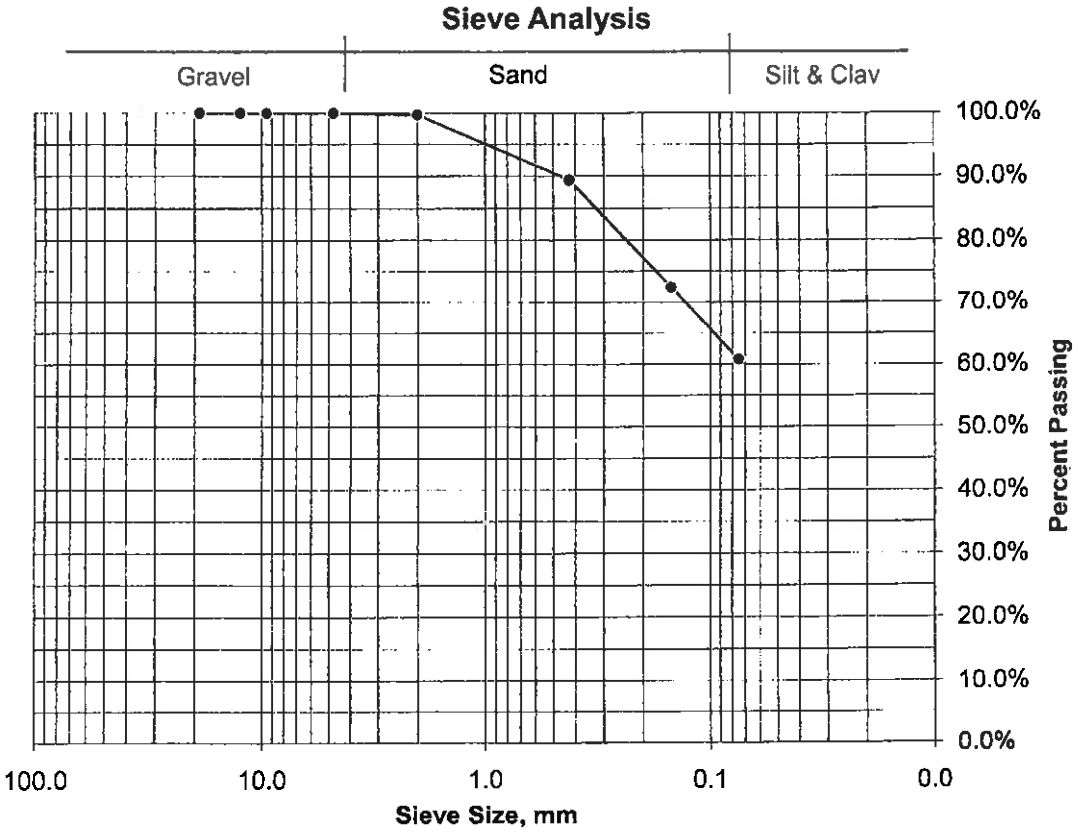
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID B-1
Sample Depth 36'-38'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.49	0.3%	2.0	99.7%
No. 40	17.48	10.3%	0.425	89.4%
No. 100	28.95	17.0%	0.15	72.4%
No. 200	19.73	11.6%	0.075	60.8%
Pan	1.52	0.9%		
Total	68.17	39.2%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-14
Sample Depth	4'-6'
Visual Sample Description	Gray Clayey SAND

Natural Moisture Content: ASTM D 2216

Pan ID	21
Pan Wt	193.68 grams
Pan + Soil (wet)	426.70 grams
Pan + Soil (dry)	394.66 grams
Natural Moisture Content	*15.9%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	351.90 grams
Percent Passing No. 200 Sieve	21.3%
Pan + Soil retained on No. 4 sieve (dry)	193.84 grams
Percent Passing No. 4 Sieve	99.9%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	15	28	33
Pan ID	1	70	72
Pan Wt	11.35	11.04	11.13
Pan + Soil (wet)	25.75	20.88	25.33
Pan + Soil (dry)	22.50	18.91	22.76
Moisture Content	29%	25%	22%
Liquid Limit	27	25	23
Liquid Limit	*25*		

Plastic Limit

Pan ID	58	41
Pan Weight	1.93	1.92
Pan + Soil (wet)	12.12	12.87
Pan + Soil (dry)	10.81	11.47
Moisture Content	15%	15%
Plastic Limit	*15*	
Plastic Index	*10*	

USCS Classification: ASTM D 2487

Group Symbol	**SC**
Group Name	**Clayey SAND**

Grain Size Distribution Calculations

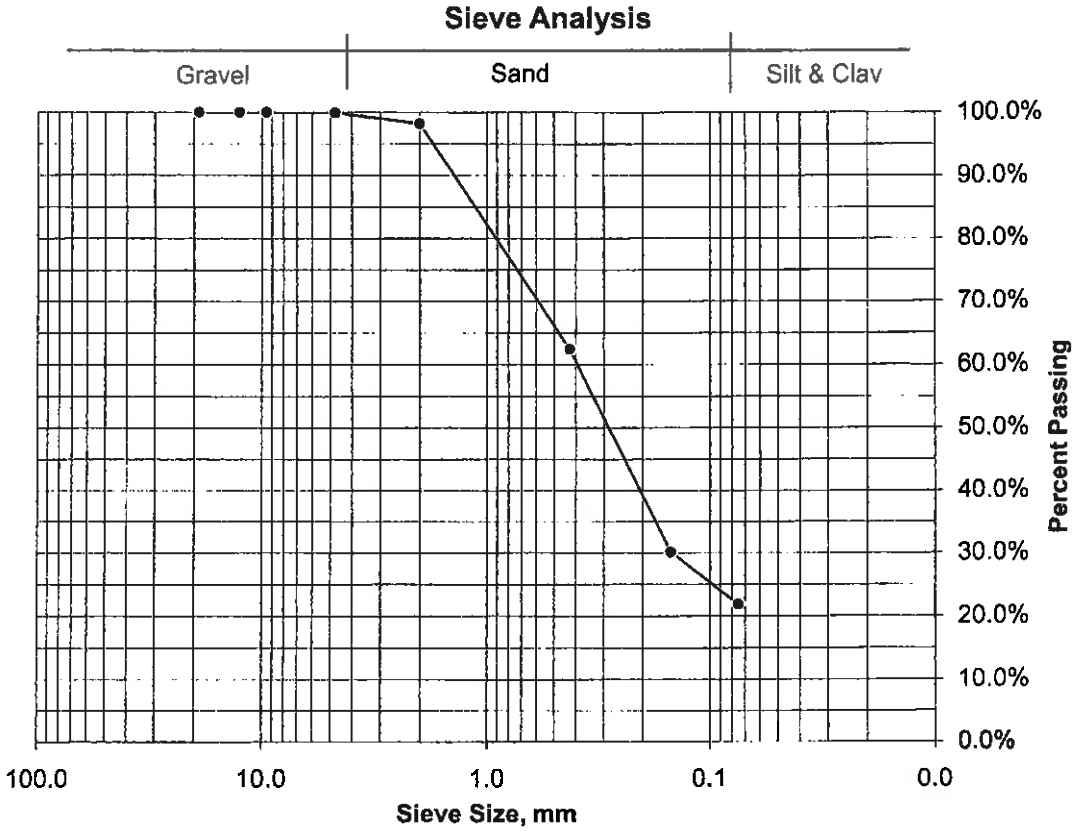
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-14
Sample Depth 4'-6'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.16	0.1%	4.75	99.9%
No. 10	3.35	1.7%	2.0	98.3%
No. 40	71.94	35.8%	0.425	62.5%
No. 100	64.88	32.3%	0.15	30.2%
No. 200	16.61	8.3%	0.075	21.9%
Pan	0.84	0.4%		
Total	157.78	78.1%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-15
Sample Depth	20'-22'
Visual Sample Description	Light Brown Silty SAND

Natural Moisture Content: ASTM D 2216

Pan ID	42
Pan Wt	192.20 grams
Pan + Soil (wet)	367.80 grams
Pan + Soil (dry)	353.09 grams
Natural Moisture Content	*9.1%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	329.58 grams
Percent Passing No. 200 Sieve	14.6%
Pan + Soil retained on No. 4 sieve (dry)	210.14 grams
Percent Passing No. 4 Sieve	88.8%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-Plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit	0	NA	NA
Liquid Limit	*0*		

Plastic Limit

Pan ID		
Pan Weight		
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content	0%	0%
Plastic Limit	*0*	
Plastic Index	*0*	

USCS Classification: ASTM D 2487

Group Symbol	SM
Group Name	Silty SAND

Grain Size Distribution Calculations

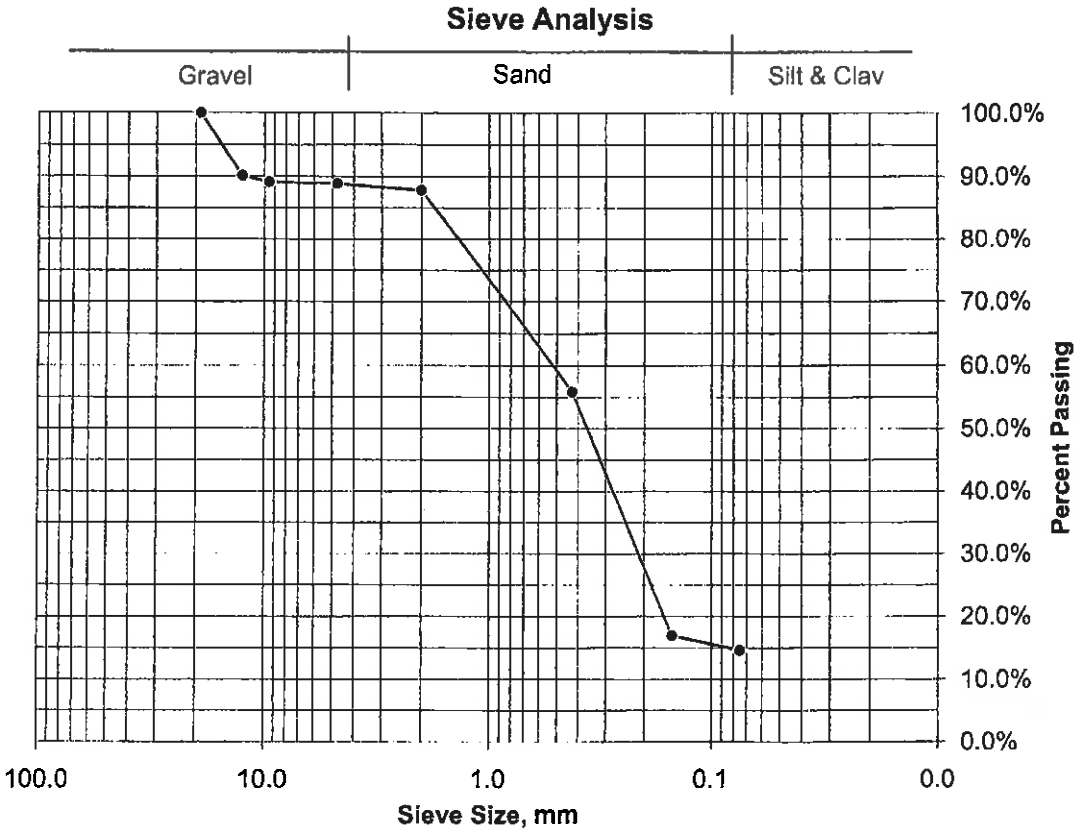
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-15
Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	15.89	9.9%	12.5	90.1%
3/8"	1.63	1.0%	9.5	89.1%
No. 4	0.42	0.3%	4.75	88.8%
No. 10	1.68	1.0%	2.0	87.8%
No. 40	51.37	31.9%	0.425	55.9%
No. 100	62.58	38.9%	0.15	17.0%
No. 200	3.71	2.3%	0.075	14.7%
Pan	0.28	0.2%		
Total	137.56	85.3%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-15
Sample Depth 32'-34'
Visual Sample Description Light Brown Sandy Lean CLAY

Natural Moisture Content: ASTM D 2216

Pan ID	33
Pan Wt	193.60 grams
Pan + Soil (wet)	373.40 grams
Pan + Soil (dry)	348.52 grams
Natural Moisture Content	*16.1%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	245.86 grams
Percent Passing No. 200 Sieve	66.3%
Pan + Soil retained on No. 4 sieve (dry)	193.60 grams
Percent Passing No. 4 Sieve	100.0%
Soil Classifies as	*Fine-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	19	28	35
Pan ID	1	70	72
Pan Wt	11.34	11.03	11.11
Pan + Soil (wet)	21.75	21.84	23.22
Pan + Soil (dry)	18.21	18.29	19.48
Moisture Content	52%	49%	45%
Liquid Limit	50	50	47
Liquid Limit	*49*		

Plastic Limit

Pan ID	41	58
Pan Weight	1.90	1.91
Pan + Soil (wet)	10.54	10.02
Pan + Soil (dry)	8.93	8.51
Moisture Content	23%	23%
Plastic Limit	*23*	
Plastic Index	*26*	

USCS Classification: ASTM D 2487

Group Symbol **CL**
Group Name **Sandy Lean CLAY**

Grain Size Distribution Calculations

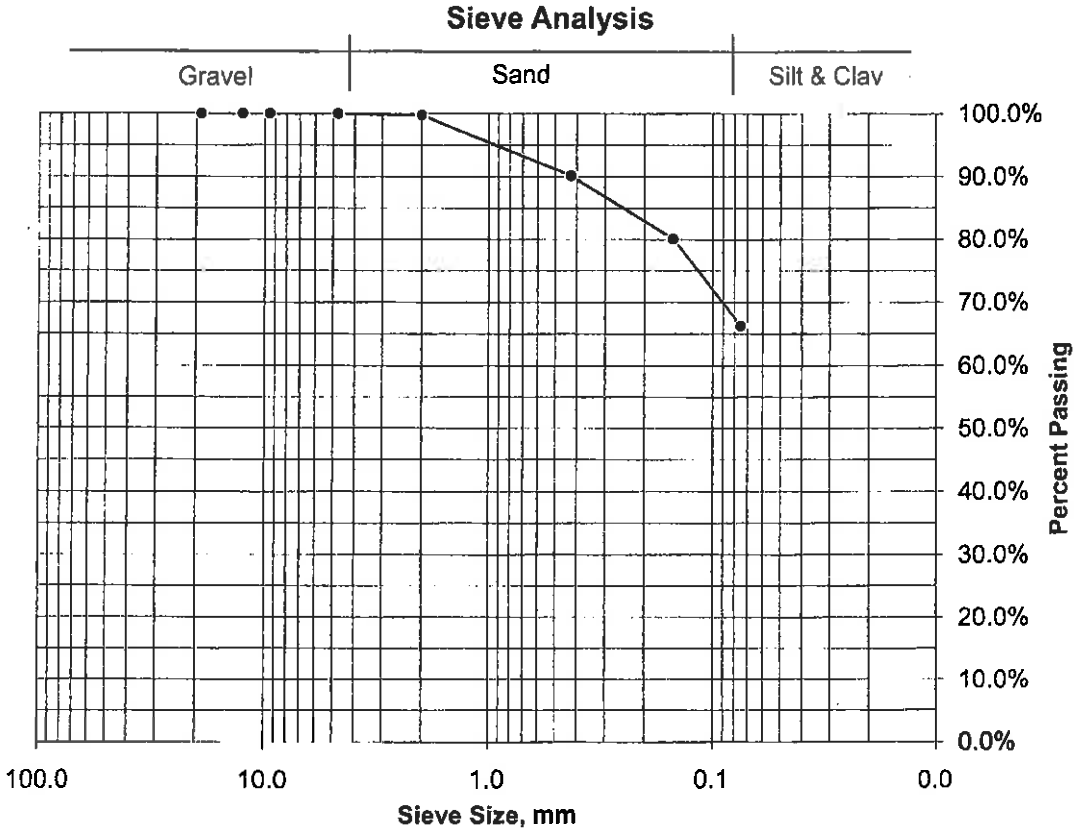
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-15
Sample Depth 32'-34'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.35	0.2%	2.0	99.8%
No. 40	14.83	9.6%	0.425	90.2%
No. 100	15.64	10.1%	0.15	80.1%
No. 200	21.38	13.8%	0.075	66.3%
Pan	0.01	0.0%		
Total	52.21	33.7%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-17
Sample Depth 8'-10'
Visual Sample Description Dark Brown Poorly Graded SAND with Silt

Natural Moisture Content: ASTM D 2216

Pan ID	4
Pan Wt	194.40 grams
Pan + Soil (wet)	384.70 grams
Pan + Soil (dry)	373.00 grams
Natural Moisture Content	*6.6%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	362.78 grams
Percent Passing No. 200 Sieve	5.7%
Pan + Soil retained on No. 4 sieve (dry)	195.02 grams
Percent Passing No. 4 Sieve	99.7%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-Plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit	0	NA	NA
Liquid Limit	*0*		

Plastic Limit

Pan ID		
Pan Weight		
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content	0%	0%
Plastic Limit	*0*	
Plastic Index	*0*	

USCS Classification: ASTM D 2487

Group Symbol **SP-SM**
Group Name **Poorly Graded SAND with Silt**

Grain Size Distribution Calculations

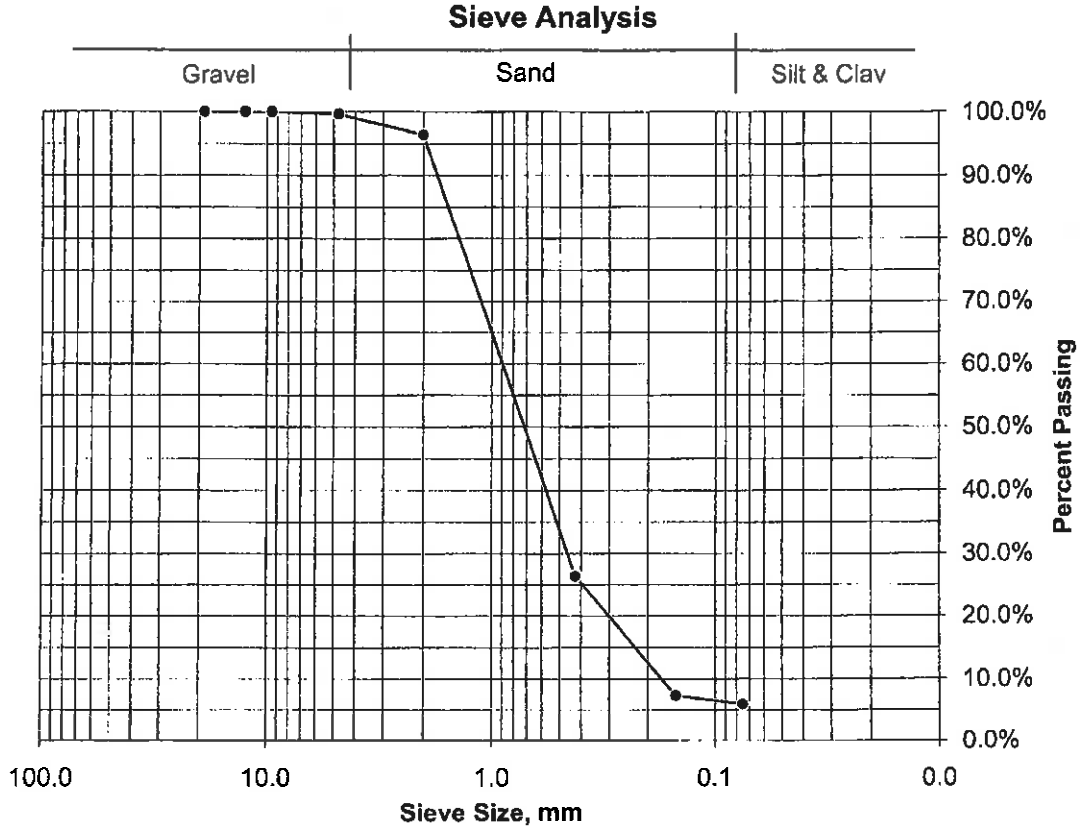
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-17
Sample Depth 8'-10'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.62	0.3%	4.75	99.7%
No. 10	5.83	3.3%	2.0	96.4%
No. 40	125.01	70.0%	0.425	26.4%
No. 100	34.03	19.1%	0.15	7.3%
No. 200	2.45	1.4%	0.075	6.0%
Pan	0.18	0.1%		
Total	168.12	94.0%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-18
Sample Depth	22'-24'
Visual Sample Description	Brown Clayey SAND

Natural Moisture Content: ASTM D 2216

Pan ID	1
Pan Wt	195.40 grams
Pan + Soil (wet)	458.40 grams
Pan + Soil (dry)	404.00 grams
Natural Moisture Content	*26.1%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	352.43 grams
Percent Passing No. 200 Sieve	24.7%
Pan + Soil retained on No. 4 sieve (dry)	195.40 grams
Percent Passing No. 4 Sieve	100.0%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	18	27	35
Pan ID	6	7	9
Pan Wt	11.36	11.23	11.5
Pan + Soil (wet)	25.18	24.59	25.38
Pan + Soil (dry)	20.43	20.25	21.09
Moisture Content	52%	48%	45%
Liquid Limit	50	49	47
Liquid Limit	*49*		

Plastic Limit

Pan ID	29	B
Pan Weight	2.38	2.40
Pan + Soil (wet)	13.52	13.11
Pan + Soil (dry)	12.16	11.80
Moisture Content	14%	14%
Plastic Limit	*14*	
Plastic Index	*35*	

USCS Classification: ASTM D 2487

Group Symbol	SC
Group Name	Clayey SAND

Grain Size Distribution Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
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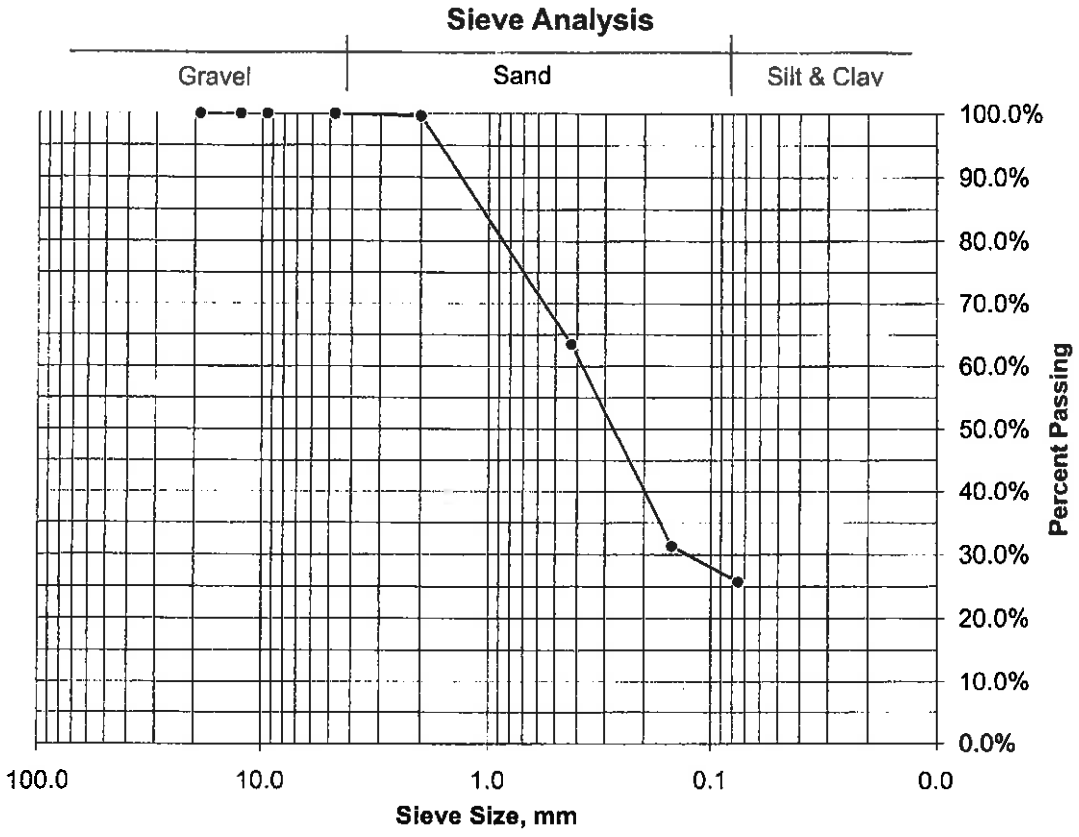
Sample ID PZ-18
Sample Depth 22'-24'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.79	0.4%	2.0	99.6%
No. 40	75.38	36.1%	0.425	63.5%
No. 100	67.04	32.1%	0.15	31.3%
No. 200	11.63	5.6%	0.075	25.8%
Pan	1.56	0.7%		
Total	156.40	74.2%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-26
Sample Depth	18'-20'
Visual Sample Description	Gray Clayey SAND

Natural Moisture Content: ASTM D 2216

Pan ID	3
Pan Wt	193.10 grams
Pan + Soil (wet)	333.01 grams
Pan + Soil (dry)	308.43 grams
Natural Moisture Content	*21.3%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	261.65 grams
Percent Passing No. 200 Sieve	40.6%
Pan + Soil retained on No. 4 sieve (dry)	193.10 grams
Percent Passing No. 4 Sieve	100.0%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	14	24	34
Pan ID	1	61	72
Pan Wt	11.35	11.05	11.14
Pan + Soil (wet)	22.26	20.83	23.03
Pan + Soil (dry)	18.31	17.47	19.11
Moisture Content	57%	52%	49%
Liquid Limit	53	52	51
Liquid Limit	*52*		

Plastic Limit

Pan ID	29	B
Pan Weight	2.40	2.43
Pan + Soil (wet)	10.70	11.51
Pan + Soil (dry)	9.35	10.09
Moisture Content	19%	19%
Plastic Limit	*19*	
Plastic Index	*33*	

USCS Classification: ASTM D 2487

Group Symbol	SC
Group Name	Clayey SAND

Grain Size Distribution Calculations

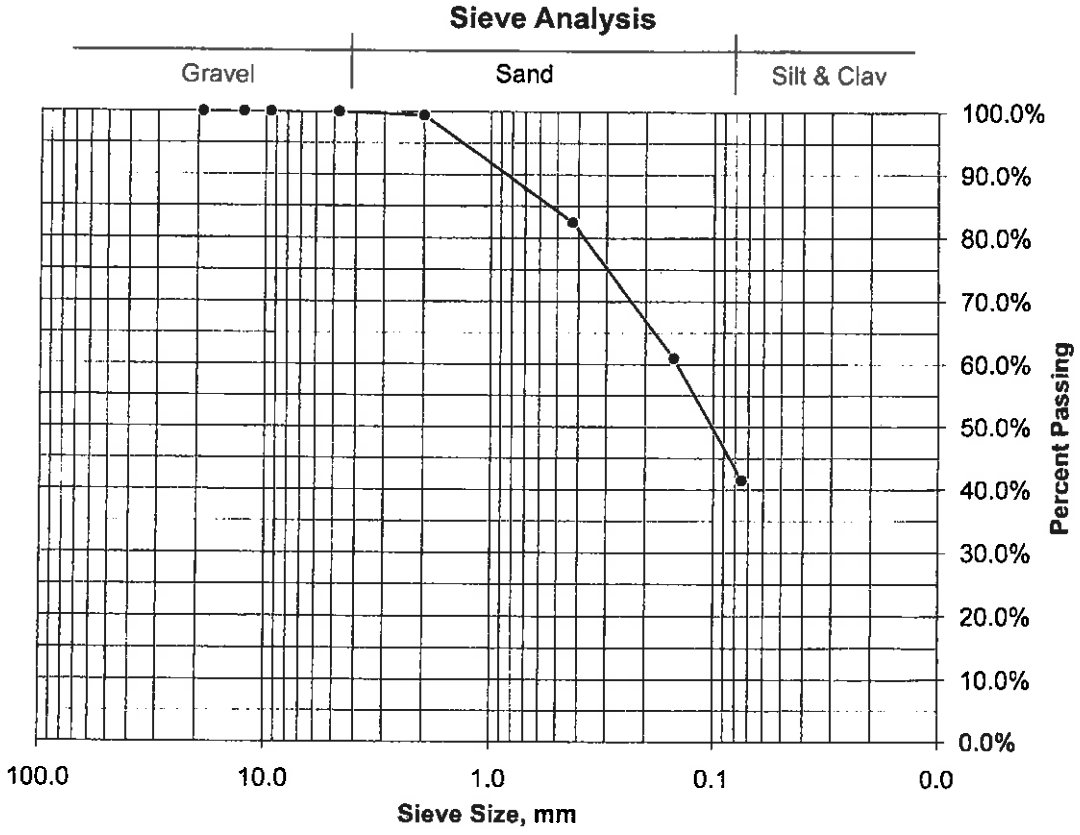
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-26
Sample Depth 18'-20'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	0.65	0.6%	2.0	99.4%
No. 40	19.62	17.0%	0.425	82.4%
No. 100	24.70	21.4%	0.15	61.0%
No. 200	22.51	19.5%	0.075	41.5%
Pan	1.02	0.9%		
Total	68.50	58.5%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-27
Sample Depth	8'-10'
Visual Sample Description	Brown Silty SAND

Natural Moisture Content: ASTM D 2216

Pan ID	24
Pan Wt	186.10 grams
Pan + Soil (wet)	379.50 grams
Pan + Soil (dry)	358.44 grams
Natural Moisture Content	*12.2%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	323.72 grams
Percent Passing No. 200 Sieve	20.1%
Pan + Soil retained on No. 4 sieve (dry)	204.04 grams
Percent Passing No. 4 Sieve	89.6%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-Plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit	0	NA	NA
Liquid Limit	*0*		

Plastic Limit

Pan ID		
Pan Weight		
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content	0%	0%
Plastic Limit	*0*	
Plastic Index	*0*	

USCS Classification: ASTM D 2487

Group Symbol	SM
Group Name	Silty SAND

Grain Size Distribution Calculations

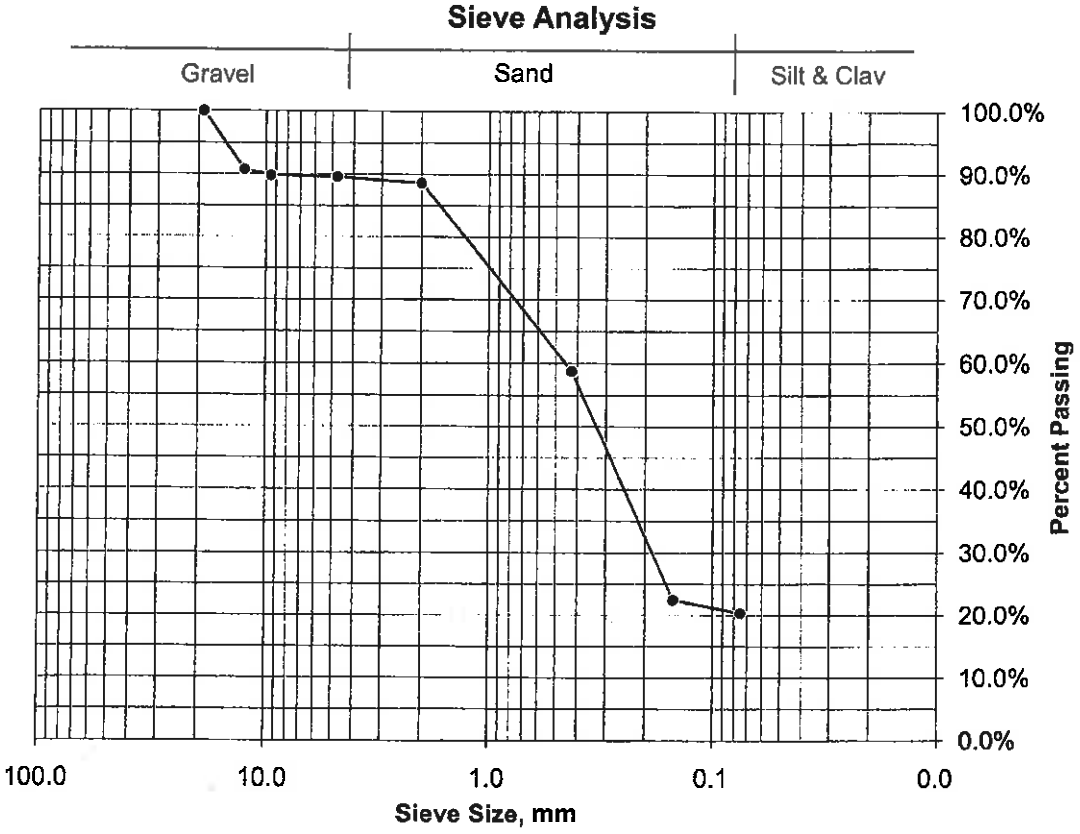
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-27
Sample Depth 8'-10'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	15.89	9.2%	12.5	90.8%
3/8"	1.63	0.9%	9.5	89.8%
No. 4	0.42	0.2%	4.75	89.6%
No. 10	1.68	1.0%	2.0	88.6%
No. 40	51.37	29.8%	0.425	58.8%
No. 100	62.58	36.3%	0.15	22.5%
No. 200	3.71	2.2%	0.075	20.3%
Pan	0.28	0.2%		
Total	137.56	79.7%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-27
Sample Depth	20'-22'
Visual Sample Description	Brown Clayey SAND

Natural Moisture Content: ASTM D 2216

Pan ID	17
Pan Wt	188.70 grams
Pan + Soil (wet)	315.40 grams
Pan + Soil (dry)	304.82 grams
Natural Moisture Content	*9.1%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	286.24 grams
Percent Passing No. 200 Sieve	16.0%
Pan + Soil retained on No. 4 sieve (dry)	188.75 grams
Percent Passing No. 4 Sieve	100.0%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	16	26	36
Pan ID	98	169	2000
Pan Wt	30.45	27.30	25.78
Pan + Soil (wet)	39.92	36.56	32.73
Pan + Soil (dry)	37.28	34.18	31.06
Moisture Content	39%	35%	32%
Liquid Limit	37	35	33
Liquid Limit	*35*		

Plastic Limit

Pan ID	30	52
Pan Weight	2.41	2.42
Pan + Soil (wet)	9.41	9.37
Pan + Soil (dry)	8.42	8.42
Moisture Content	16%	16%
Plastic Limit	*16*	
Plastic Index	*19*	

USCS Classification: ASTM D 2487

Group Symbol	**SC**
Group Name	**Clayey SAND**

Grain Size Distribution Calculations

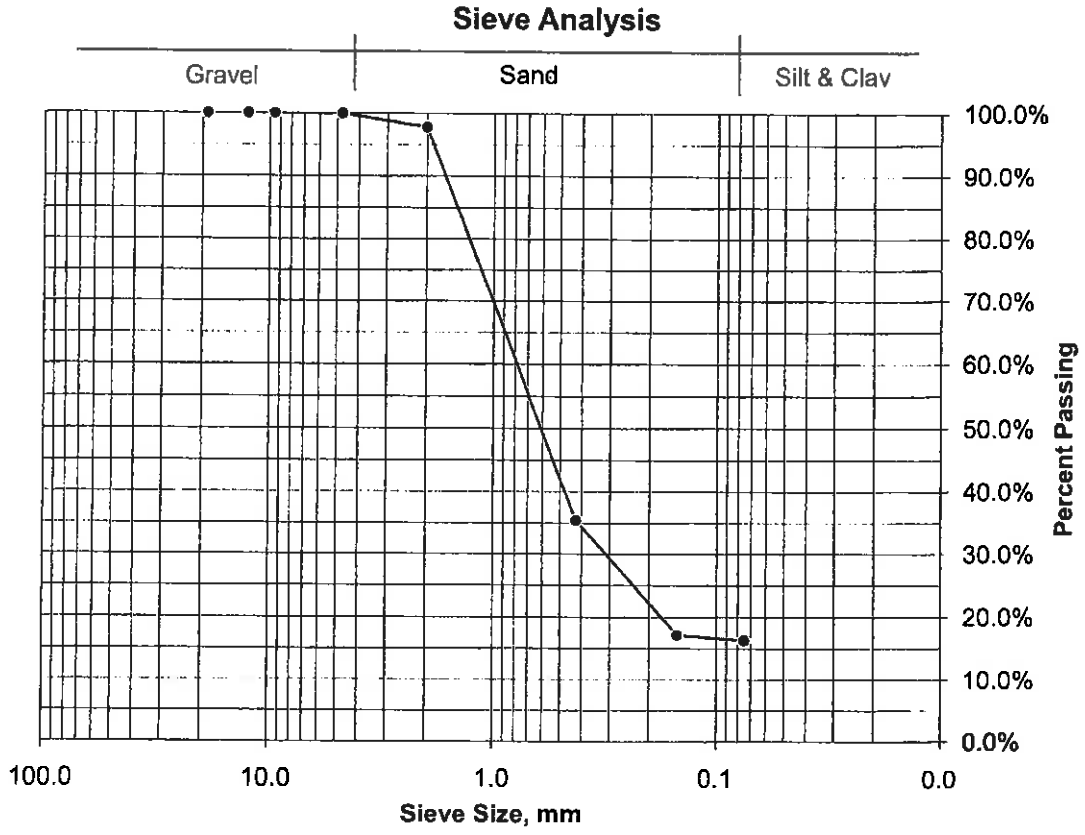
ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-27
Sample Depth 20'-22'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.05	0.0%	4.75	100.0%
No. 10	2.49	2.1%	2.0	97.8%
No. 40	72.42	62.4%	0.425	35.4%
No. 100	21.23	18.3%	0.15	17.2%
No. 200	0.99	0.9%	0.075	16.3%
Pan	0.17	0.1%		
Total	97.35	83.7%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID	PZ-29
Sample Depth	22'-24'
Visual Sample Description	Light Brown Silty SAND

Natural Moisture Content: ASTM D 2216

Pan ID	22
Pan Wt	189.00 grams
Pan + Soil (wet)	349.00 grams
Pan + Soil (dry)	334.37 grams
Natural Moisture Content	*10.1%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	316.11 grams
Percent Passing No. 200 Sieve	12.6%
Pan + Soil retained on No. 4 sieve (dry)	189.00 grams
Percent Passing No. 4 Sieve	100.0%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows			
Pan ID			
Pan Wt		Non-Plastic	
Pan + Soil (wet)			
Pan + Soil (dry)			
Moisture Content			
Liquid Limit	0	NA	NA
Liquid Limit	*0*		

Plastic Limit

Pan ID		
Pan Weight		
Pan + Soil (wet)		
Pan + Soil (dry)		
Moisture Content	0%	0%
Plastic Limit	*0*	
Plastic Index	*0*	

USCS Classification: ASTM D 2487

Group Symbol	**SM**
Group Name	**Silty SAND**

Grain Size Distribution Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
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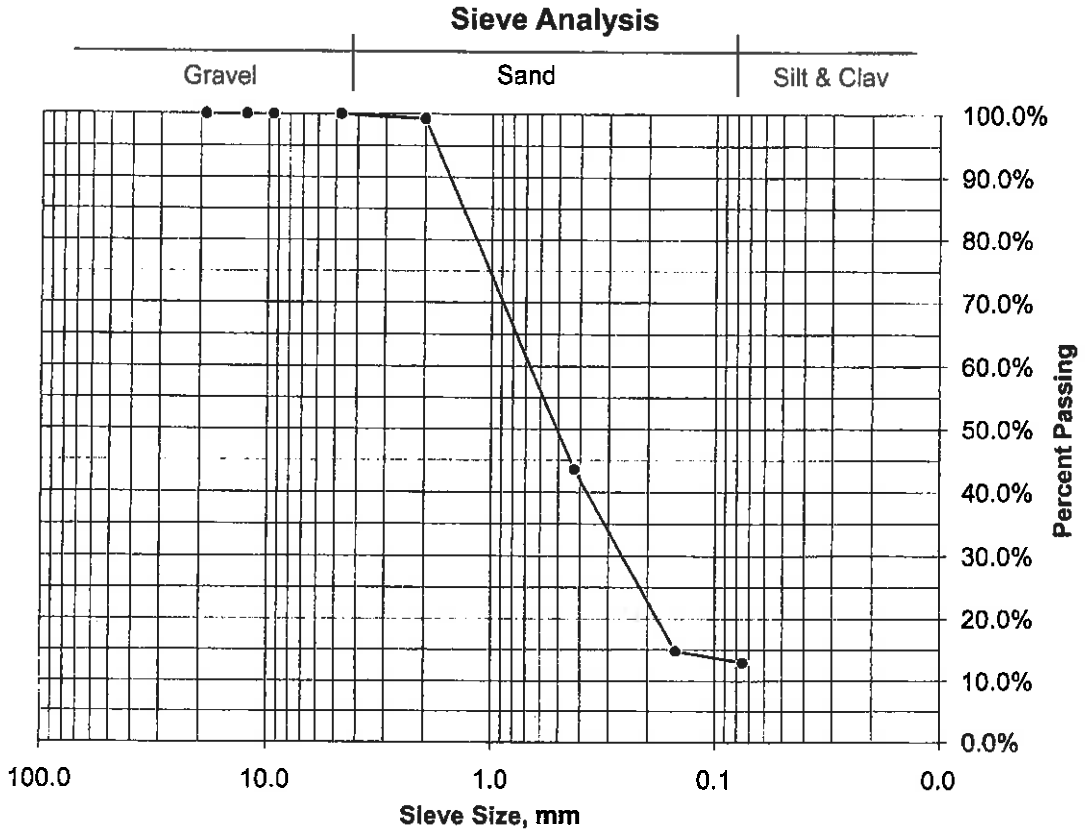
Sample ID PZ-29
Sample Depth 22'-24'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.00	0.0%	4.75	100.0%
No. 10	1.04	0.7%	2.0	99.3%
No. 40	81.03	55.7%	0.425	43.5%
No. 100	41.79	28.7%	0.15	14.8%
No. 200	2.68	1.8%	0.075	13.0%
Pan	0.05	0.0%		
Total	126.59	87.0%		



Soil Classification Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
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Sample ID	PZ-29
Sample Depth	36'-38'
Visual Sample Description	Gray Clayey SAND

Natural Moisture Content: ASTM D 2216

Pan ID	7
Pan Wt	192.30 grams
Pan + Soil (wet)	406.70 grams
Pan + Soil (dry)	377.95 grams
Natural Moisture Content	*15.5%*

Coarse or Fine Grained: ASTM D 422

Pan + Soil retained on No. 200 sieve (dry)	296.13 grams
Percent Passing No. 200 Sieve	44.1%
Pan + Soil retained on No. 4 sieve (dry)	193.24 grams
Percent Passing No. 4 Sieve	99.5%
Soil Classifies as	*Coarse-Grained Soil*

Atterberg Limits: ASTM D 4318

Liquid Limit

No of Blows	18	26	34
Pan ID	61	62	64
Pan Wt	11.06	11.05	11.12
Pan + Soil (wet)	19.51	21.72	21.51
Pan + Soil (dry)	16.78	18.43	18.47
Moisture Content	48%	45%	41%
Liquid Limit	46	45	43
Liquid Limit	*45*		

Plastic Limit

Pan ID	30	K
Pan Weight	2.41	2.39
Pan + Soil (wet)	11.74	12.18
Pan + Soil (dry)	10.36	10.73
Moisture Content	17%	17%
Plastic Limit	*17*	
Plastic Index	*28*	

USCS Classification: ASTM D 2487

Group Symbol	**SC**
Group Name	**Clayey SAND**

Grain Size Distribution Calculations

ACLF C&D Phase III - Lab
DAA # R09358R-01
Prepared By: ADC

Draper Aden Associates
Blacksburg • Richmond, Virginia
Engineering • Surveying • Environmental Services

Sample ID PZ-29
Sample Depth 36'-38'

Mechanical Sieve Analysis: ASTM D 422

Sieve Size	Weight Retained	Percent Retained	Sieve Size, mm	Percent Passing
3/4"	0.00	0.0%	19.0	100.0%
1/2"	0.00	0.0%	12.5	100.0%
3/8"	0.00	0.0%	9.5	100.0%
No. 4	0.94	0.5%	4.75	99.5%
No. 10	4.13	2.2%	2.0	97.3%
No. 40	59.20	31.9%	0.425	65.4%
No. 100	21.15	11.4%	0.15	54.0%
No. 200	17.67	9.5%	0.075	44.5%
Pan	0.82	0.4%		
Total	103.91	55.5%		

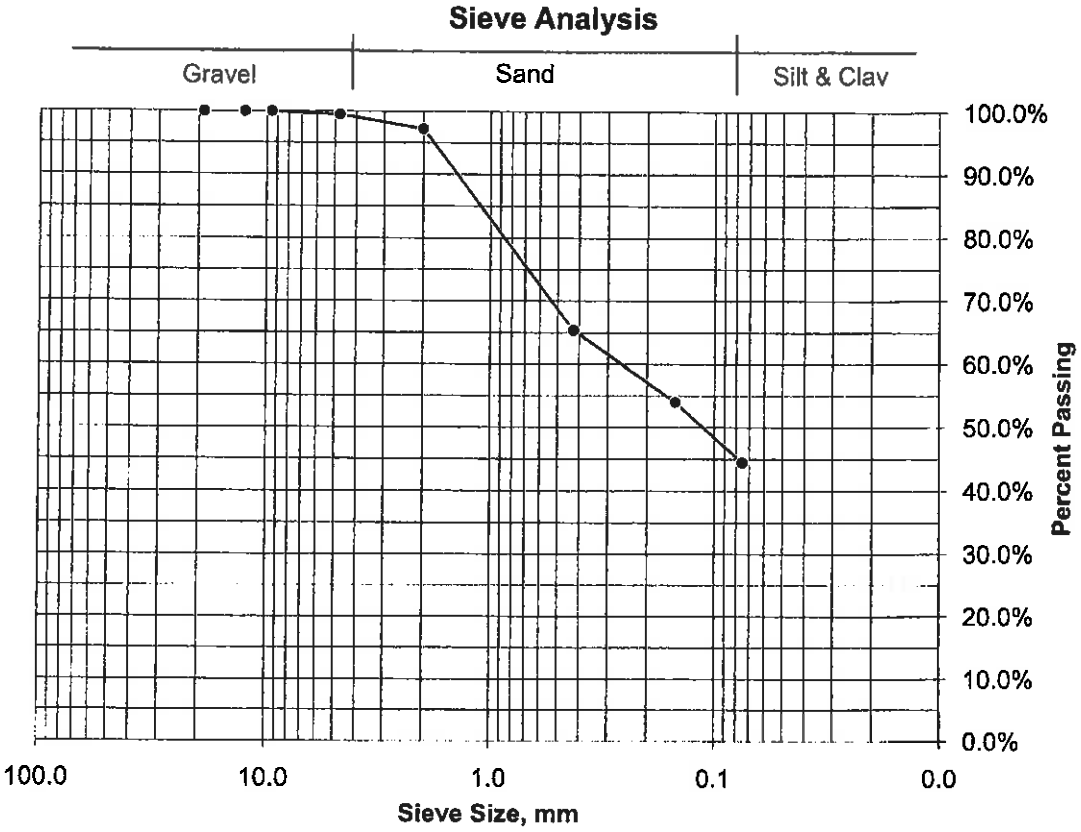

TABLE 1

MONITORING WELL STATIC WATER ELEVATIONS, HYDRAULIC CONDUCTIVITY, AND EFFECTIVE POROSITY.

ANDERSON CREEK LANDFILL

WELL NUMBER	GROUND SURFACE ELEV. (in feet)	TOP OF CASING ELEV. (in feet)	STATIC WATER ELEV. (in feet)	HYDRAULIC CONDUCTIVITY (in cm/sec)	EFFECTIVE POROSITY (%)
MW#4	252.18	254.85	249.64	0.4800	0.20-0.40
MW#5	249.35	251.77	242.61	0.0360	0.35-0.50
P-1	256.53	259.03	249.43	N/A	N/A
P-2	254.18	256.68	246.80	N/A	N/A
P-3	302.01	304.01	259.23	N/A	N/A
P-4	308.98	311.48	303.64	N/A	N/A
P-5	267.02	269.52	248.47	N/A	N/A
P-6	271.65	274.15	253.35	N/A	N/A
P6-B	336.12	339.12	305.02	0.3000	0.20-0.30
P-7	290.44	292.94	282.32	0.0280	0.15-0.35
P-8	284.95	287.95	265.87	0.0039	0.35-0.55
P-9	324.63	327.63	307.60	0.2500	0.20-0.40

APPENDIX III

CLIMATIC DATA

Table 1. Average monthly precipitation for selected North Carolina locations listed by station name. Data are for the period 1961-1990.

Station Name	COUNTY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Concord	Cabarrus	3.84	3.69	4.30	3.04	4.06	4.21	4.67	3.82	3.58	3.80	3.17	3.52	45.70
Conover Oxfrd Shoals	Catawba	3.57	4.00	4.57	3.29	4.65	4.44	4.39	3.92	4.09	3.57	3.39	3.73	47.61
Coweeta Exp Station	Macon	6.65	7.01	7.77	5.81	6.12	5.05	4.96	5.45	5.40	4.96	5.91	6.81	71.90
Cullowhee	Jackson	4.32	4.64	5.43	3.75	4.55	4.44	4.56	4.11	3.62	3.36	3.84	4.45	51.07
Danbury 1 NW	Stokes	3.44	3.43	4.40	3.70	4.44	3.90	4.83	3.99	4.02	4.22	3.45	3.56	47.38
Dunn 4 NW	Harnett	3.67	4.05	4.32	3.17	3.73	4.52	5.47	5.01	3.82	2.98	3.12	3.86	47.72
Durham	Durham	3.90	4.04	4.26	3.32	4.63	4.31	4.34	4.91	3.58	3.58	3.54	3.69	48.10
Eden	Rockingham	3.63	3.37	4.25	3.28	3.74	3.50	4.40	3.87	3.38	3.86	3.00	3.44	43.72
Edenton	Chowan	4.19	3.79	3.97	3.33	4.49	4.47	5.43	5.36	4.28	3.23	2.78	3.22	48.54
Elizabeth City	Pasquotank	4.18	3.68	4.05	3.04	4.23	4.29	5.67	5.45	4.50	3.38	2.91	3.10	48.48
Elizabeth City FAA	Pasquotank	4.15	3.66	3.95	3.02	4.55	4.08	5.47	5.26	4.52	3.08	3.01	3.26	48.01
Elizabethtown Lock 2	Bladen	3.78	3.54	4.17	2.90	3.84	4.41	6.23	5.37	3.69	2.65	2.74	3.16	46.48
Elkin	Surry	3.66	3.78	4.49	3.84	4.50	4.22	4.19	4.53	4.24	3.92	3.17	3.50	48.04
Enfield	Halifax	3.80	3.76	3.86	3.35	3.98	3.86	4.46	4.35	3.81	2.92	3.07	3.32	44.54
Enka	Buncombe	2.78	3.63	4.14	3.35	3.79	3.26	3.59	4.12	3.44	2.98	3.14	2.90	41.12
Fayetteville	Cumberland	3.74	3.77	4.07	2.93	3.52	4.22	5.52	5.61	4.25	2.86	2.92	3.31	46.72
Fletcher 4 E	Henderson	3.21	3.54	4.50	3.23	4.23	4.15	4.50	4.91	3.87	3.68	3.44	3.26	46.52
Fletcher 3 W	Henderson	3.61	4.21	5.23	3.59	4.80	4.62	4.94	5.62	4.11	3.97	3.95	3.91	52.26
Ft Bragg Water Plant	Cumberland	3.79	3.91	4.24	3.27	3.91	4.75	5.79	5.18	3.39	3.15	3.13	3.42	47.93
Franklin	Macon	4.46	4.88	5.67	4.11	4.49	4.13	4.30	4.50	4.29	3.47	3.98	4.61	52.89
Gastonia	Gaston	4.10	3.89	4.70	2.94	4.06	4.15	4.06	4.20	3.86	3.52	3.23	3.92	46.63
Glendale Springs	Ashe	3.62	4.11	5.14	4.51	5.39	4.97	5.07	4.58	4.98	5.27	4.73	3.57	55.94
Goldsboro 4 SE	Wayne	4.18	3.86	4.25	3.31	4.01	3.94	6.03	5.79	4.29	2.88	3.23	3.50	49.27
Graham	Alamance	3.69	3.61	3.96	2.97	4.13	3.89	4.49	3.95	3.33	3.36	3.05	3.38	43.81
Grandfather Mtn	Avery	4.03	4.64	5.43	4.85	5.91	6.20	5.52	5.88	5.94	5.40	4.59	3.89	62.28
Greensboro WSO AP	Guilford	3.17	3.32	3.72	2.84	4.02	3.81	4.51	3.88	3.52	3.50	2.97	3.36	42.62

Source: http://www.ces.ncsu.edu/depts/hort/hil/pdf/hil711a.pdf

DUNN 4 NW, HARNETT COUNTY, NORTH CAROLINA USA

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Weather station **DUNN 4 NW, HARNETT COUNTY** is at about 35.31°N 78.68°W. Height about 61m / 200 feet above sea level.

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	90.3	87.0	113.0	67.4	94.5	122.5	144.1	127.3	75.5	98.0	80.3	90.6	1191.6
inches	3.6	3.4	4.4	2.7	3.7	4.8	5.7	5.0	3.0	3.9	3.2	3.6	46.9

Source: DUNN 4 NW, HARNETT COUNTY data derived from NCDC Cooperative Stations. 22 complete years between 1962 and 1995

Map of the area around DUNN 4 NW, HARNETT COUNTY from tiger.census.gov.
Locations outside the continental US are not mapped.

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FAYETTEVILLE, CUMBERLAND COUNTY, NORTH CAROLINA USA

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Weather station **FAYETTEVILLE, CUMBERLAND COUNTY** is at about 35.06°N 78.86°W. Height about 29m / 95 feet above sea level.

Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	86.6	88.4	102.7	80.6	82.9	113.0	145.6	146.0	104.5	65.3	72.9	79.9	1169.6
inches	3.4	3.5	4.0	3.2	3.3	4.4	5.7	5.7	4.1	2.6	2.9	3.1	46.0

Source: FAYETTEVILLE, CUMBERLAND COUNTY data derived from NCDC Cooperative Stations. 59 complete years between 1931 and 1995

Map of the area around FAYETTEVILLE, CUMBERLAND COUNTY from tiger.census.gov.
Locations outside the continental US are not mapped.

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Horticulture Information Leaflet 711
10/96 -- Author Reviewed 10/96

AVERAGE MONTHLY PRECIPATION FOR SELECTED NORTH CAROLINA LOCATIONS

Katharine B. Perry, Professor and Department Extension Leader

Precipitation in North Carolina is usually well distributed throughout the year. There are no pronounced rainy and dry seasons. Greatest amounts typically fall in July and August while October and November are the driest months. The amount of precipitation can vary widely from the average in some years. Rainfall is usually adequate for agriculture in the winter and spring, but is often deficient for growing crops during the summer.

Thunderstorms occur on the average between 40 and 50 days per year. They are somewhat more numerous in the mountains and in the southern coastal plain than in the other sections.

Hail falls somewhere within most counties on an average of once or twice each year, but is rare on the Outer Banks. Snow and sleet fall rarely in the southern coastal plain. However, the frequency and amount of snowfall increases inland to the mountains. The southern coastal counties have an average of less than 2 inches total snowfall and sleet per year; the amount increases to 5 or 6 inches in the northern coastal counties and 8 to 10 inches over most of the piedmont. Usually the snow fall melts quickly and covers the ground for only a short period of time. Snowfall varies considerably in the mountains, depending on elevation and exposure. It ranges from 7 to 9 inches per year in some southern valleys to near 40 inches and sometimes much more, on some higher peaks. The snow remains on the ground for extended periods of time at the higher elevations.

There are several published references for North Carolina climate data. These references are available from the North Carolina State University Department of Agricultural Communications, Publications, Box 7603, Raleigh, NC 27695-7603; (919) 515-3173.

Weather and Climate in North Carolina AG-375 ($2.50)
Probabilities of Dry Periods in North Carolina AG-411 ($2.00)
Risk of Frost and Freeze Damage for North Carolina Fruit Crops AG-403 (free)
Low-Temperature Probability Data for North Carolina AG-403S ($3.00)
Growing Degree Days in North Carolina AG-236 ($3.00)

Click Here For Data

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North Carolina Cooperative Extension Service
NORTH CAROLINA STATE UNIVERSITY
COLLEGE OF AGRICULTURE & LIFE SCIENCES

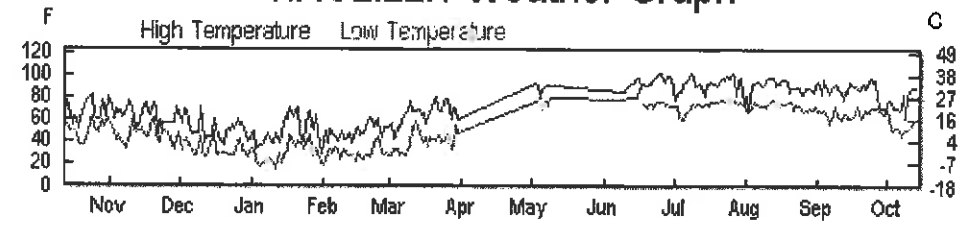
History for KNCLILLI1

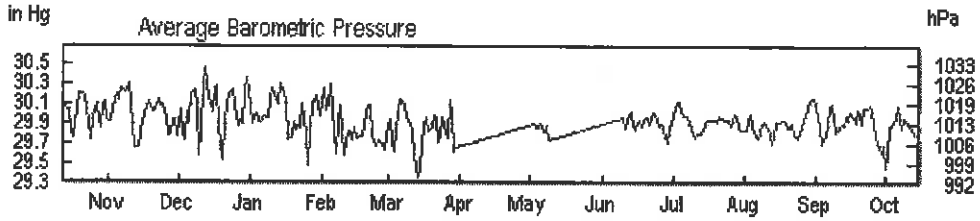
Raven Rock State Park, Lillington, NC — [illegible]

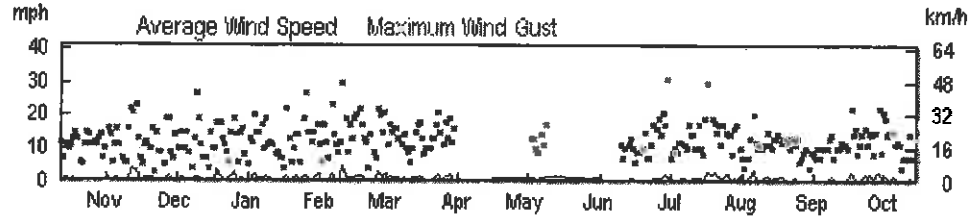
Daily Summary for October 12, 2009 - October 13, 2010

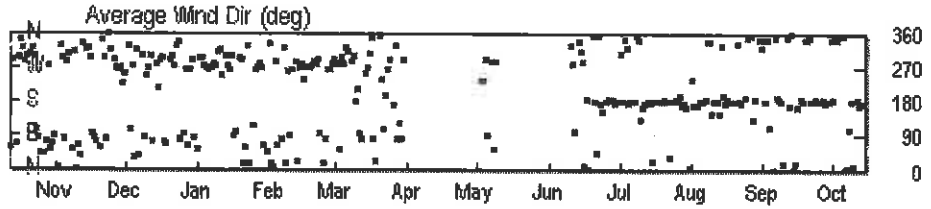
	High:	Low:	Average:
Temperature:	101.0 °F	0.0 °F	60.0 °F
Dew Point:	80.6 °F	-0.3 °F	49.3 °F
Humidity:	100.0%	14.0%	71.2%
Wind Speed:	31.0mph from the SW	-	0.8mph
Wind Gust:	31.0mph from the SW	-	-
Wind:	-	-	SSW
Pressure:	30.55in	29.28in	-
Precipitation:	35.03in		

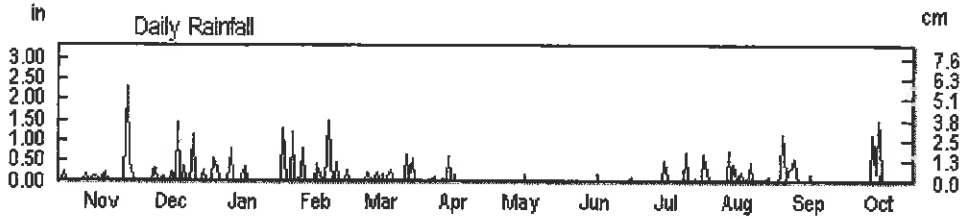
KNCLILLI1 Weather Graph











Weather Underground

Custom Date Range's Tabular Data

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
October	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	73	60	51	57	51	47	91	75	48	30.02	-	29.90	-	-	-	9	0	9	0.00
2	75	64	52	65	58	51	96	84	61	29.94	-	29.79	-	-	-	7	0	7	0.00
3	80	68	59	65	59	47	98	77	38	29.85	-	29.75	-	-	-	9	0	9	0.01
4	71	60	50	61	51	45	92	75	44	30.02	-	29.85	-	-	-	6	0	6	0.00
5	62	60	57	59	57	52	96	91	75	30.05	-	29.93	-	-	-	5	0	5	0.25
6	68	63	60	63	61	59	97	94	85	29.93	-	29.80	-	-	-	6	0	6	0.13
7	81	68	58	71	60	47	98	78	36	29.95	-	29.71	-	-	-	21	1	21	0.01
8	72	60	47	54	48	43	92	66	38	30.15	-	29.96	-	-	-	9	0	9	0.00
9	84	69	55	72	64	51	94	83	60	30.07	-	29.80	-	-	-	11	0	11	0.00
10	82	74	65	74	68	58	95	82	61	30.02	-	29.77	-	-	-	12	0	12	0.00
11	70	61	55	60	55	52	94	81	59	30.16	-	30.02	-	-	-	10	0	10	0.11
12	60	58	55	56	54	52	95	89	78	30.22	-	30.06	-	-	-	12	0	12	0.10
13	75	62	54	62	57	53	96	84	57	30.11	-	30.00	-	-	-	7	1	7	0.00
14	62	53	48	58	49	46	95	89	73	30.10	-	29.97	-	-	-	11	1	11	0.24
15	54	50	46	52	49	45	100	95	91	29.97	-	29.63	-	-	-	10	0	10	0.07
16	62	54	48	52	49	45	96	84	66	29.83	-	29.66	-	-	-	11	0	11	0.01
17	57	50	46	45	43	41	89	77	60	29.95	-	29.82	-	-	-	13	1	13	0.00
18	51	45	38	44	39	35	92	80	67	30.14	-	29.90	-	-	-	15	1	15	0.00
19	60	49	36	43	38	33	93	68	41	30.25	-	30.13	-	-	-	13	1	13	0.00
20	70	51	35	49	41	34	95	73	32	30.24	-	30.14	-	-	-	6	0	6	0.00
21	74	57	41	53	46	39	93	70	34	30.20	-	30.09	-	-	-	5	0	5	0.00
22	76	61	44	62	53	43	95	79	52	30.11	-	29.95	-	-	-	11	0	11	0.00
23	80	68	57	66	62	56	98	82	58	29.98	-	29.81	-	-	-	15	1	15	0.00
24	80	70	62	71	67	60	96	92	70	29.83	-	29.64	-	-	-	14	0	14	0.16
25	62	55	50	60	49	44	95	79	63	30.12	-	29.77	-	-	-	11	0	11	0.01
26	60	53	46	55	50	44	95	87	70	30.15	-	30.03	-	-	-	12	0	12	0.04
27	61	57	54	60	56	53	97	95	85	30.04	-	29.79	-	-	-	11	1	11	0.14
28	74	67	58	70	63	56	98	89	63	29.97	-	29.72	-	-	-	13	1	13	0.13

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
29	68	57	51	56	53	49	97	86	60	30.17	-	29.97	-	-	-	14	1	14	0.01
30	62	59	55	57	56	53	95	87	81	30.18	-	30.03	-	-	-	6	0	7	0.00
31	78	67	59	72	64	57	98	92	73	30.03	-	29.81	-	-	-	10	0	10	0.10

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
November	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	70	58	50	68	56	46	97	93	88	30.04	-	29.78	-	-	-	16	1	16	0.24
2	59	52	46	50	47	44	95	85	66	30.07	-	30.01	-	-	-	14	0	14	0.00
3	68	55	40	53	47	39	97	77	45	30.17	-	30.03	-	-	-	6	0	6	0.01
4	65	56	45	52	46	34	95	71	51	30.27	-	30.11	-	-	-	11	1	11	0.00
5	66	50	40	46	40	31	97	72	29	30.19	-	30.09	-	-	-	16	1	16	0.01
6	60	49	37	39	33	26	87	58	28	30.29	-	30.19	-	-	-	11	1	11	0.00
7	66	48	32	43	37	30	92	70	32	30.29	-	30.14	-	-	-	7	0	7	0.00
8	75	56	41	50	43	38	90	66	27	30.28	-	30.16	-	-	-	6	0	6	0.00
9	74	61	42	60	52	41	94	74	42	30.34	-	30.24	-	-	-	6	0	6	0.00
10	67	61	57	63	58	55	96	91	76	30.24	-	29.96	-	-	-	16	1	16	1.13
11	59	54	48	58	52	47	96	95	91	29.96	-	29.73	-	-	-	22	3	22	2.31
12	49	48	46	47	46	44	96	93	85	29.73	-	29.57	-	-	-	21	4	21	0.44
13	56	52	48	52	49	45	94	89	82	29.74	-	29.57	-	-	-	23	3	23	0.06
14	67	57	50	55	52	48	97	86	64	29.87	-	29.71	-	-	-	13	1	13	0.00
15	72	54	44	57	50	43	99	85	49	29.96	-	29.86	-	-	-	7	0	7	0.01
16	73	57	42	54	49	41	98	79	44	30.00	-	29.94	-	-	-	5	0	5	0.01
17	64	54	44	53	49	43	98	83	62	30.11	-	29.97	-	-	-	11	1	11	0.00
18	63	58	52	60	54	50	95	88	81	30.15	-	30.06	-	-	-	12	1	12	0.00
19	74	65	59	65	62	57	98	90	70	30.06	-	29.95	-	-	-	10	1	10	0.02
20	66	56	44	58	48	42	95	75	46	30.07	-	29.98	-	-	-	16	1	16	0.00
21	46	42	40	43	41	39	96	94	91	30.09	-	30.03	-	-	-	3	0	3	0.00
22	58	48	38	49	42	36	95	81	56	30.17	-	30.08	-	-	-	4	1	15	0.23
23	53	52	50	52	51	49	97	96	96	30.10	-	30.02	-	-	-	7	0	9	0.31
24	55	52	49	50	49	48	97	91	79	30.12	-	30.01	-	-	-	9	0	9	0.00
25	56	52	46	51	49	45	96	90	78	30.02	-	29.89	-	-	-	5	0	5	0.01

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
26	56	47	42	50	44	40	98	92	80	29.89	-	29.65	-	-	-	19	0	19	0.10
27	55	43	33	41	34	27	93	73	46	29.88	-	29.69	-	-	-	19	2	19	0.00
28	55	39	31	36	30	25	87	70	40	30.00	-	29.88	-	-	-	9	0	9	0.00
29	70	52	41	45	39	33	81	62	33	30.01	-	29.86	-	-	-	7	0	7	0.00
30	64	57	47	56	48	35	92	73	60	29.93	-	29.63	-	-	-	6	0	14	0.20

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
December	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	56	43	30	36	31	26	92	66	35	30.12	-	29.93	-	-	-	6	0	10	0.00
2	68	53	39	67	50	36	98	91	74	30.08	-	29.48	-	-	-	15	1	15	1.44
3	66	56	42	65	49	36	98	77	55	29.97	-	29.49	-	-	-	15	1	15	0.00
4	56	46	35	46	39	33	94	79	54	30.09	-	29.91	-	-	-	10	0	10	0.03
5	48	44	37	47	43	34	96	94	90	30.07	-	29.75	-	-	-	15	1	15	0.38
6	45	36	28	34	30	27	95	80	51	30.31	-	30.07	-	-	-	9	0	9	0.01
7	47	37	28	38	33	26	95	85	64	30.29	-	30.16	-	-	-	4	0	4	0.01
8	46	41	33	42	37	32	96	86	69	30.29	-	29.76	-	-	-	13	1	13	0.38
9	71	55	43	63	50	41	98	85	53	29.76	-	29.39	-	-	-	27	1	27	1.14
10	57	47	31	42	25	14	60	43	24	30.08	-	29.53	-	-	-	19	1	19	0.00
11	38	31	25	20	11	3	77	45	24	30.46	-	30.08	-	-	-	11	0	11	0.00
12	43	34	25	30	18	9	80	54	26	30.55	-	30.37	-	-	-	7	0	7	0.00
13	44	41	36	43	40	27	97	95	65	30.37	-	29.93	-	-	-	7	0	7	0.29
14	45	42	40	44	41	38	98	98	97	30.13	-	30.01	-	-	-	3	0	4	0.01
15	58	53	48	58	52	39	98	95	64	30.11	-	29.91	-	-	-	3	0	15	0.01
16	49	39	29	38	26	19	84	60	33	30.32	-	30.14	-	-	-	2	0	10	0.00
17	46	34	27	24	19	11	86	58	27	30.34	-	30.21	-	-	-	2	0	10	0.00
18	39	36	30	35	31	22	94	82	57	30.20	-	29.49	-	-	-	18	3	18	0.55
19	36	34	29	35	31	27	96	90	76	29.70	-	29.37	-	-	-	18	1	18	0.30
20	47	36	29	34	30	25	94	78	50	30.07	-	29.69	-	-	-	13	0	13	0.01
21	49	36	26	32	27	23	89	72	44	30.14	-	30.03	-	-	-	11	0	11	0.00
22	48	36	27	31	27	25	91	74	42	30.21	-	30.12	-	-	-	9	0	9	0.00
23	53	38	26	34	30	24	93	75	41	30.26	-	30.15	-	-	-	6	0	6	0.01

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
24	50	38	27	31	27	22	93	67	35	30.29	-	30.15	-	-	-	15	2	15	0.00
25	59	49	38	59	46	30	99	90	72	30.18	-	29.71	-	-	-	19	3	19	0.82
26	54	46	40	53	42	34	97	86	67	29.97	-	29.77	-	-	-	14	1	14	0.00
27	55	41	31	37	33	24	96	74	33	30.02	-	29.84	-	-	-	6	0	6	0.00
28	48	39	31	32	25	15	85	60	31	29.99	-	29.77	-	-	-	15	1	15	0.00
29	44	33	27	23	17	9	80	54	27	30.39	-	29.98	-	-	-	16	1	16	0.00
30	40	32	25	32	18	12	92	56	36	30.50	-	30.20	-	-	-	8	0	8	0.13
31	45	38	33	43	37	31	97	95	90	30.20	-	29.94	-	-	-	2	0	5	0.36

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
January	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	48	42	31	44	37	22	98	85	59	29.93	-	29.85	-	-	-	13	0	13	0.00
2	32	27	24	24	16	7	77	64	34	30.02	-	29.90	-	-	-	12	1	12	0.00
3	33	27	18	9	5	0	63	39	25	30.05	-	29.92	-	-	-	20	2	20	0.00
4	36	26	16	15	11	8	76	55	33	29.97	-	29.86	-	-	-	15	1	15	0.00
5	36	27	19	16	14	12	80	58	37	29.96	-	29.88	-	-	-	15	1	15	0.00
6	41	29	22	19	16	13	75	58	36	30.04	-	29.92	-	-	-	17	1	17	0.00
7	47	34	21	24	17	11	80	53	24	30.08	-	29.83	-	-	-	10	0	10	0.00
8	42	32	23	36	17	4	92	56	31	30.09	-	29.80	-	-	-	19	2	19	0.02
9	37	26	21	14	10	6	69	51	31	30.19	-	30.09	-	-	-	11	1	11	0.00
10	38	27	20	14	10	3	73	51	24	30.32	-	30.18	-	-	-	12	1	12	0.00
11	47	31	14	18	11	5	76	47	24	30.30	-	30.05	-	-	-	11	0	11	0.00
12	37	33	29	22	19	15	70	56	43	30.14	-	30.03	-	-	-	8	0	8	0.00
13	46	32	20	18	16	14	81	56	28	30.36	-	30.20	-	-	-	2	0	9	0.00
14	56	38	24	27	23	17	75	56	30	30.26	-	30.18	-	-	-	1	0	7	0.00
15	61	43	30	31	24	15	85	52	17	30.26	-	30.17	-	-	-	1	0	7	0.00
16	59	52	30	41	30	23	81	46	28	30.24	-	30.00	-	-	-	4	0	4	0.00
17	70	56	44	63	53	40	98	93	70	30.00	-	29.47	-	-	-	22	1	22	1.31
18	61	52	40	50	44	37	98	75	47	29.93	-	29.58	-	-	-	13	1	13	0.00
19	66	50	34	46	38	31	97	70	30	29.96	-	29.84	-	-	-	6	0	6	0.00
20	69	54	39	48	43	34	91	68	42	29.89	-	29.77	-	-	-	10	0	10	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
21	47	40	38	40	36	34	96	88	73	30.01	-	29.73	-	-	-	14	2	14	1.18
22	41	39	38	39	38	37	97	94	89	30.01	-	29.69	-	-	-	11	1	14	0.03
23	39	35	32	38	34	31	97	96	94	30.17	-	29.99	-	-	-	6	0	6	0.01
24	65	52	39	61	48	35	94	85	73	30.07	-	29.51	-	-	-	4	2	19	0.11
25	66	56	45	63	41	26	94	59	37	29.62	-	29.33	-	-	-	21	2	27	0.79
26	52	42	32	31	26	20	84	56	32	30.01	-	29.62	-	-	-	15	1	15	0.00
27	51	38	27	32	24	21	84	61	34	30.23	-	30.00	-	-	-	15	0	15	0.00
28	63	46	32	35	30	25	82	57	27	30.21	-	30.00	-	-	-	12	0	12	0.00
29	47	37	29	28	20	15	92	51	38	30.27	-	30.08	-	-	-	15	1	15	0.00
30	29	24	20	26	21	16	91	88	84	30.13	-	29.80	-	-	-	17	2	17	0.00
31	38	27	18	16	13	6	84	59	29	30.24	-	29.93	-	-	-	9	1	11	0.43

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
February	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	49	35	22	24	19	11	89	58	22	30.33	-	30.18	-	-	-	6	0	6	0.22
2	37	35	30	36	32	22	97	89	67	30.18	-	29.87	-	-	-	17	0	17	0.23
3	51	39	32	37	33	28	97	80	46	30.23	-	29.92	-	-	-	12	1	12	0.00
4	46	38	30	34	29	25	86	71	50	30.36	-	30.23	-	-	-	7	0	7	0.00
5	43	38	33	42	35	27	97	88	65	30.24	-	29.34	-	-	-	23	2	23	1.49
6	39	35	31	38	31	24	96	85	71	29.83	-	29.36	-	-	-	14	1	14	0.53
7	44	33	24	26	22	17	91	68	38	30.00	-	29.83	-	-	-	11	0	11	0.00
8	48	35	24	30	24	18	89	66	39	30.12	-	30.00	-	-	-	9	0	9	0.00
9	41	37	32	38	33	27	97	86	66	30.10	-	29.53	-	-	-	12	1	12	0.46
10	42	35	28	41	20	9	98	58	30	29.72	-	29.42	-	-	-	30	5	30	0.02
11	47	35	28	24	20	17	71	54	35	29.89	-	29.72	-	-	-	19	2	19	0.00
12	38	33	28	29	20	16	94	62	43	29.95	-	29.68	-	-	-	8	0	9	0.00
13	42	33	27	29	25	18	94	74	45	29.82	-	29.63	-	-	-	17	1	17	0.25
14	48	34	22	22	17	12	81	54	27	29.90	-	29.81	-	-	-	13	1	13	0.00
15	52	41	30	42	32	18	87	71	55	29.86	-	29.62	-	-	-	19	1	19	0.01
16	44	33	25	22	17	12	78	52	30	29.82	-	29.68	-	-	-	20	2	20	0.00
17	46	33	24	20	17	13	75	53	30	29.82	-	29.71	-	-	-	22	2	22	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
18	51	37	27	25	21	16	74	54	32	29.96	-	29.79	-	-	-	17	2	17	0.00
19	56	40	26	27	22	14	86	53	21	30.06	-	29.95	-	-	-	13	1	13	0.00
20	61	42	25	25	17	10	78	42	14	30.12	-	30.02	-	-	-	12	1	12	0.00
21	59	36	28	30	22	17	77	58	28	30.10	-	30.05	-	-	-	4	0	4	0.00
22	52	46	37	52	42	31	97	85	58	29.92	-	29.60	-	-	-	3	0	14	0.23
23	58	48	43	48	44	42	97	86	55	29.72	-	29.60	-	-	-	2	0	9	0.04
24	46	42	37	45	39	36	97	89	76	29.78	-	29.67	-	-	-	1	0	7	0.01
25	43	35	29	36	18	12	95	51	33	29.78	-	29.62	-	-	-	22	3	22	0.01
26	52	37	27	23	18	14	64	47	24	29.74	-	29.63	-	-	-	20	2	20	0.23
27	51	39	28	26	21	18	70	50	30	29.68	-	29.60	-	-	-	15	1	15	0.01
28	52	39	27	26	23	21	82	56	31	29.90	-	29.64	-	-	-	20	2	21	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
March	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	55	40	27	30	26	22	84	60	32	29.98	-	29.87	-	-	-	11	0	11	0.00
2	42	37	32	35	30	26	95	77	57	29.90	-	29.46	-	-	-	17	2	17	0.10
3	42	37	32	35	32	27	96	83	64	29.74	-	29.47	-	-	-	15	1	15	0.15
4	52	40	32	30	26	19	89	61	33	29.92	-	29.74	-	-	-	16	1	16	0.25
5	51	39	27	24	20	13	75	49	25	30.08	-	29.92	-	-	-	16	1	16	0.12
6	57	42	28	26	21	16	73	47	21	30.17	-	30.08	-	-	-	13	1	13	0.00
7	64	46	27	27	20	12	82	43	14	30.19	-	30.00	-	-	-	11	0	11	0.00
8	67	50	33	35	27	16	71	44	20	30.02	-	29.89	-	-	-	14	1	14	0.00
9	75	55	34	41	35	30	88	52	23	29.96	-	29.85	-	-	-	10	0	10	0.00
10	66	57	52	53	45	38	96	65	43	29.92	-	29.85	-	-	-	9	0	9	0.08
11	67	58	49	62	56	49	98	94	76	29.90	-	29.75	-	-	-	6	0	6	0.66
12	67	61	58	61	59	57	98	93	75	29.76	-	29.39	-	-	-	10	1	10	0.07
13	68	58	46	57	47	37	97	70	36	29.43	-	29.28	-	-	-	15	1	15	0.58
14	63	52	42	46	39	32	96	67	32	29.56	-	29.36	-	-	-	17	1	17	0.00
15	64	52	38	43	38	36	92	62	39	29.79	-	29.56	-	-	-	18	1	18	0.00
16	55	50	43	41	38	36	86	65	56	30.00	-	29.79	-	-	-	13	1	13	0.00
17	62	49	34	42	35	24	95	64	23	30.02	-	29.87	-	-	-	8	0	8	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
18	64	50	44	44	38	26	86	66	23	29.87	-	29.75	-	-	-	10	0	10	0.00
19	75	58	42	39	32	22	80	44	14	29.94	-	29.77	-	-	-	2	0	10	0.00
20	79	60	39	40	35	25	80	44	19	30.01	-	29.94	-	-	-	2	0	13	0.00
21	69	59	45	57	48	38	85	66	49	30.03	-	29.82	-	-	-	3	1	13	0.01
22	67	57	45	60	46	32	94	67	39	29.80	-	29.64	-	-	-	3	1	17	0.09
23	67	56	38	41	37	32	89	52	34	29.89	-	29.65	-	-	-	21	2	21	0.10
24	75	59	40	42	38	33	89	51	23	30.02	-	29.89	-	-	-	15	1	15	0.00
25	77	62	45	52	44	38	85	56	27	29.98	-	29.63	-	-	-	11	0	11	0.00
26	68	56	41	57	48	34	97	75	43	30.01	-	29.50	-	-	-	18	2	18	0.06
27	59	50	32	36	31	26	92	51	28	30.26	-	30.01	-	-	-	9	2	13	0.00
28	70	54	38	59	45	33	92	75	50	30.22	-	29.71	-	-	-	19	2	19	0.04
29	68	61	53	60	53	48	96	77	51	29.71	-	29.53	-	-	-	12	1	12	0.59
30	59	50	46	48	46	42	95	88	54	29.71	-	29.60	-	-	-	16	1	16	0.04

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
May	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
2	92	85	75	72	68	67	83	58	45	29.93	-	29.83	-	-	-	2	1	13	0.00
3	89	82	75	72	69	65	82	65	49	29.91	-	29.78	-	-	-	2	1	13	0.01
4	79	77	72	69	67	62	90	71	62	29.88	-	29.80	-	-	-	1	0	10	0.02
5	86	80	68	66	61	52	92	53	32	29.92	-	29.85	-	-	-	2	0	9	0.00
6	90	84	76	67	57	52	74	40	28	29.87	-	29.75	-	-	-	2	1	14	0.00
7	90	86	72	64	58	53	64	40	35	29.94	-	29.79	-	-	-	2	1	11	0.00
8	90	86	79	69	64	62	65	47	41	29.79	-	29.65	-	-	-	4	2	17	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
June	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
9	84	80	76	71	65	60	77	59	51	30.03	-	29.85	-	-	-	1	0	11	0.00
10	88	83	79	77	71	68	83	68	52	29.89	-	29.80	-	-	-	1	0	7	0.00
11	89	85	78	72	68	64	68	58	45	30.04	-	29.88	-	-	-	3	1	10	0.00
12	92	85	80	73	68	63	75	58	38	30.07	-	29.94	-	-	-	2	0	11	0.00
13	94	87	78	77	72	68	95	63	53	29.94	-	29.79	-	-	-	2	1	13	0.00
14	96	92	79	80	76	69	80	59	53	29.85	-	29.79	-	-	-	2	1	10	0.02

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
15	96	90	87	80	74	69	67	61	46	29.96	-	29.84	-	-	-	6	0	6	0.14
16	88	83	0	76	72	0	83	69	57	29.99	-	29.89	-	-	-	9	0	9	0.00
17	91	81	73	74	70	65	93	71	44	29.91	-	29.84	-	-	-	9	0	9	0.00
18	90	77	70	70	68	64	91	74	46	30.00	-	29.90	-	-	-	10	0	10	0.00
19	92	81	73	73	71	69	92	74	48	30.01	-	29.88	-	-	-	3	0	15	0.00
20	92	83	74	73	71	68	92	70	50	29.93	-	29.84	-	-	-	3	0	7	0.00
21	95	86	71	71	66	56	92	53	31	30.00	-	29.90	-	-	-	7	1	7	0.00
22	96	82	72	77	71	65	87	71	39	30.05	-	29.96	-	-	-	11	0	11	0.04
23	98	84	75	74	70	63	87	66	33	30.04	-	29.93	-	-	-	17	1	17	0.00
24	100	87	75	74	70	63	86	60	33	29.94	-	29.81	-	-	-	16	1	16	0.00
25	96	85	75	74	71	68	86	65	42	29.94	-	29.84	-	-	-	19	1	19	0.00
26	93	81	72	74	70	66	86	71	50	29.92	-	29.78	-	-	-	14	1	14	0.00
27	99	84	73	73	69	61	89	65	32	29.80	-	29.68	-	-	-	21	2	21	0.00
28	99	85	72	74	69	60	91	62	30	29.77	-	29.65	-	-	-	17	2	17	0.00
29	96	80	72	74	70	67	93	73	41	29.92	-	29.77	-	-	-	31	1	31	0.51
30	78	75	72	73	72	70	95	90	82	30.04	-	29.89	-	-	-	6	0	7	0.05

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
July	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	80	71	71	69	69	60	93	93	92	30.09	-	30.01	-	-	-	9	0	9	0.00
2	83	71	60	62	54	44	92	60	27	30.16	-	30.08	-	-	-	7	1	10	0.00
3	84	72	59	60	55	50	92	60	32	30.17	-	30.03	-	-	-	8	0	9	0.00
4	89	66	59	62	56	54	92	74	32	30.07	-	29.95	-	-	-	2	0	12	0.00
5	93	79	64	68	61	56	93	58	29	30.03	-	29.93	-	-	-	3	1	12	0.00
6	96	87	69	69	63	54	86	47	26	30.02	-	29.93	-	-	-	11	1	11	0.00
7	101	86	70	69	64	53	84	53	23	29.96	-	29.84	-	-	-	10	0	10	0.00
8	97	81	74	78	70	66	94	72	37	29.88	-	29.79	-	-	-	17	0	17	0.73
9	90	81	72	75	72	69	95	77	52	29.87	-	29.72	-	-	-	12	0	14	0.03
10	90	81	74	74	71	69	90	73	52	29.80	-	29.72	-	-	-	12	1	14	0.00
11	92	82	74	73	69	62	93	68	38	29.84	-	29.76	-	-	-	10	1	10	0.00
12	84	77	71	76	71	68	93	82	64	29.83	-	29.74	-	-	-	17	1	17	0.09

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
13	80	74	73	73	72	71	95	91	78	29.86	-	29.79	-	-	-	10	1	10	0.00
14	92	85	74	73	71	66	91	64	45	29.93	-	29.84	-	-	-	8	0	8	0.00
15	92	81	72	75	71	64	94	72	43	29.98	-	29.88	-	-	-	19	1	19	0.00
16	94	83	75	76	73	71	93	74	49	29.99	-	29.87	-	-	-	30	3	30	0.66
18	89	83	75	76	73	70	94	72	57	29.98	-	29.90	-	-	-	19	2	19	0.03
19	91	82	76	76	73	69	92	76	50	29.95	-	29.85	-	-	-	18	2	18	0.00
20	95	84	78	76	73	68	89	70	47	30.01	-	29.92	-	-	-	15	2	15	0.00
21	96	84	76	78	73	70	86	71	45	30.01	-	29.90	-	-	-	17	2	17	0.02
22	95	84	75	76	73	67	92	70	41	29.99	-	29.91	-	-	-	11	0	11	0.00
23	98	86	77	78	74	71	91	70	44	29.98	-	29.90	-	-	-	17	1	17	0.00
24	97	86	78	79	76	74	89	72	51	29.99	-	29.89	-	-	-	15	2	15	0.00
25	100	88	79	78	75	71	85	67	43	29.95	-	29.80	-	-	-	14	2	14	0.00
26	96	85	76	75	72	69	89	69	44	29.96	-	29.85	-	-	-	14	1	14	0.00
27	80	77	75	76	73	68	94	88	75	30.03	-	29.95	-	-	-	8	0	8	0.76
28	92	80	73	77	74	71	96	82	54	30.02	-	29.92	-	-	-	16	1	16	0.00
29	96	84	74	78	74	72	95	76	48	29.94	-	29.75	-	-	-	17	0	17	0.40
30	74	73	73	72	72	71	95	94	93	29.84	-	29.83	-	-	-	10	2	10	0.05
31	81	73	68	69	67	64	92	80	57	29.87	-	29.80	-	-	-	4	0	7	0.05

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
August	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	69	68	67	67	66	65	95	93	88	29.87	-	29.80	-	-	-	4	0	4	0.24
3	92	80	71	75	72	68	94	77	52	30.05	-	29.93	-	-	-	1	0	7	0.00
4	92	82	75	76	74	72	93	78	58	29.95	-	29.79	-	-	-	4	2	13	0.00
5	94	83	74	76	74	71	92	74	53	29.84	-	29.69	-	-	-	8	4	20	0.45
6	92	80	72	77	73	71	95	82	57	29.80	-	29.70	-	-	-	4	1	12	0.02
7	89	80	72	74	71	70	94	77	56	29.88	-	29.75	-	-	-	3	0	10	0.00
8	91	81	72	75	71	66	94	74	45	29.93	-	29.84	-	-	-	1	0	11	0.00
9	93	86	71	74	70	66	93	61	43	29.95	-	29.88	-	-	-	10	0	10	0.00
10	97	85	74	75	72	68	94	69	42	29.93	-	29.82	-	-	-	11	1	11	0.00
11	97	86	78	76	74	72	87	69	47	29.87	-	29.73	-	-	-	15	2	15	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
12	96	86	77	77	74	70	92	71	45	29.77	-	29.62	-	-	-	11	0	11	0.06
13	90	81	74	76	74	71	95	80	57	29.87	-	29.67	-	-	-	10	1	10	0.10
14	92	82	73	74	71	69	89	72	49	29.96	-	29.86	-	-	-	13	1	13	0.00
15	92	82	72	72	69	65	91	68	43	29.96	-	29.84	-	-	-	13	1	13	0.00
16	95	85	73	72	68	59	89	59	31	29.95	-	29.85	-	-	-	14	1	14	0.00
17	95	84	74	74	71	66	89	67	43	29.97	-	29.87	-	-	-	12	1	12	0.00
18	93	82	76	81	74	72	92	79	53	29.96	-	29.84	-	-	-	13	1	13	0.21
19	84	78	75	76	74	72	94	87	72	29.91	-	29.78	-	-	-	13	0	13	1.13
20	88	79	74	75	72	66	96	81	49	29.90	-	29.79	-	-	-	11	0	11	0.81
21	89	78	68	74	69	64	96	76	46	29.94	-	29.82	-	-	-	10	0	10	0.00
22	88	79	73	78	74	71	95	86	64	29.86	-	29.72	-	-	-	13	1	13	0.28
23	88	78	72	75	72	69	95	85	54	29.79	-	29.70	-	-	-	11	1	11	0.36
24	83	73	68	72	69	67	96	89	62	29.84	-	29.73	-	-	-	13	0	13	0.54
25	82	73	67	73	68	65	96	85	62	29.91	-	29.83	-	-	-	6	0	6	0.15
26	88	76	68	73	67	57	96	77	38	29.97	-	29.89	-	-	-	7	0	7	0.00
27	88	77	67	72	67	64	96	76	45	30.02	-	29.94	-	-	-	9	0	9	0.00
28	88	77	69	73	70	66	96	79	50	30.11	-	30.02	-	-	-	5	0	10	0.00
29	84	73	68	72	68	66	95	87	61	30.19	-	30.11	-	-	-	3	0	4	0.00
30	90	83	71	71	67	60	89	61	40	30.21	-	30.10	-	-	-	9	0	9	0.00
31	93	79	66	72	67	60	93	69	34	30.13	-	30.01	-	-	-	8	0	8	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
September	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	91	79	68	71	66	57	94	68	33	30.03	-	29.92	-	-	-	7	0	7	0.00
2	83	74	66	70	66	62	95	77	53	29.96	-	29.73	-	-	-	7	0	10	0.00
3	94	80	69	69	63	55	89	61	27	29.74	-	29.64	-	-	-	7	0	7	0.00
4	86	75	63	65	56	44	78	54	26	29.84	-	29.69	-	-	-	10	0	10	0.00
5	82	68	56	59	54	48	89	64	34	29.97	-	29.84	-	-	-	10	0	10	0.00
6	88	73	59	66	61	56	91	69	39	30.12	-	29.97	-	-	-	10	0	10	0.00
7	89	76	64	70	64	60	92	70	42	30.17	-	30.02	-	-	-	13	1	13	0.00
8	91	78	71	74	69	65	92	75	44	30.03	-	29.81	-	-	-	14	2	14	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
9	88	74	63	67	57	44	92	62	22	29.88	-	29.75	-	-	-	7	0	7	0.00
10	83	70	59	59	54	45	89	59	27	29.89	-	29.80	-	-	-	10	0	10	0.00
11	78	71	65	70	62	54	92	74	57	29.94	-	29.84	-	-	-	10	0	10	0.04
12	86	75	65	70	64	55	95	73	41	29.91	-	29.81	-	-	-	12	0	12	0.00
13	84	72	60	63	56	46	94	61	29	30.02	-	29.91	-	-	-	11	0	11	0.00
14	93	76	60	61	54	47	81	53	21	29.99	-	29.87	-	-	-	11	0	11	0.00
15	91	80	61	63	55	47	85	46	24	30.06	-	29.96	-	-	-	10	0	10	0.00
16	90	78	65	66	60	50	93	60	26	30.02	-	29.87	-	-	-	20	3	22	0.00
17	88	79	72	69	65	61	79	64	44	29.96	-	29.86	-	-	-	14	1	14	0.00
18	86	75	66	67	62	59	86	67	44	30.09	-	29.95	-	-	-	16	1	16	0.00
19	88	73	61	66	61	57	94	70	38	30.07	-	29.91	-	-	-	8	0	8	0.00
20	92	80	62	67	61	56	93	58	31	29.92	-	29.86	-	-	-	10	0	11	0.00
21	88	77	67	64	61	57	79	59	38	30.11	-	29.97	-	-	-	5	1	14	0.00
22	94	84	66	69	65	60	85	56	37	30.12	-	29.98	-	-	-	14	2	16	0.00
23	96	82	70	71	66	61	86	62	33	30.13	-	30.01	-	-	-	11	1	11	0.00
24	94	81	70	68	62	53	86	56	27	30.12	-	29.95	-	-	-	15	2	15	0.00
25	94	78	69	69	64	57	91	66	30	29.99	-	29.75	-	-	-	10	2	14	0.00
26	79	73	69	68	66	62	85	77	66	29.82	-	29.78	-	-	-	6	0	8	0.00
27	72	70	68	70	68	66	96	95	91	29.77	-	29.61	-	-	-	15	2	15	1.13
28	70	68	65	69	66	62	96	94	86	29.66	-	29.58	-	-	-	22	3	22	0.20
29	68	67	64	67	65	62	96	95	89	29.78	-	29.57	-	-	-	9	0	9	1.49
30	74	71	68	73	68	66	97	92	82	29.57	-	29.33	-	-	-	21	2	21	1.15

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
October	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	77	68	63	66	59	55	91	74	52	29.68	-	29.49	-	-	-	19	2	19	0.00
2	74	62	50	54	50	48	92	69	41	29.91	-	29.81	-	-	-	2	0	14	0.00
3	70	59	51	56	52	49	94	79	54	29.94	-	29.80	-	-	-	3	1	15	0.00
4	70	63	52	52	50	48	94	63	48	30.04	-	29.91	-	-	-	15	2	15	0.01
5	68	59	48	52	45	41	94	63	41	30.13	-	30.01	-	-	-	11	0	11	0.00
6	70	56	44	49	43	39	87	65	35	30.06	-	29.85	-	-	-	11	0	12	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
7	82	64	49	55	49	44	86	62	31	29.92	-	29.79	-	-	-	11	0	11	0.00
8	60	55	51	53	48	46	86	79	73	30.01	-	29.90	-	-	-	4	0	4	0.00
9	82	64	50	55	49	44	89	64	27	29.97	-	29.87	-	-	-	1	0	7	0.00
10	88	68	53	58	53	50	91	64	28	29.93	-	29.82	-	-	-	1	0	7	0.00
11	87	77	59	59	55	50	81	49	30	29.87	-	29.77	-	-	-	14	1	14	0.00
12	88	72	59	61	55	47	86	59	26	29.82	-	29.75	-	-	-	6	0	7	0.00

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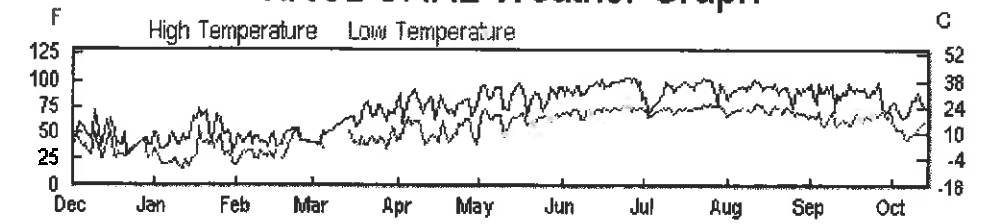
History for KNCDUNN2

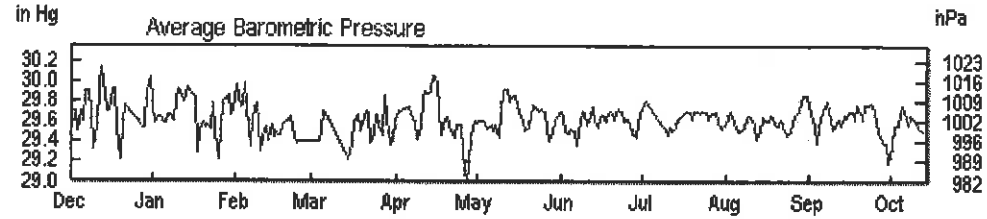
Dunn, NC — Current Conditions

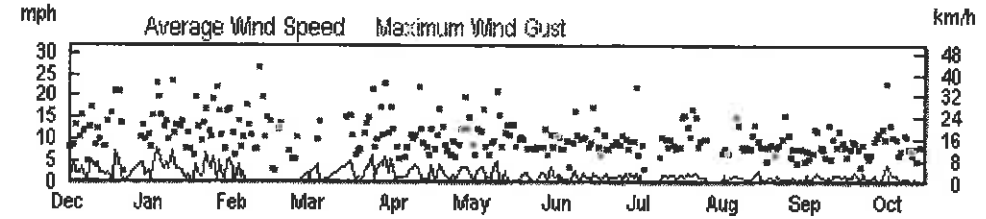
Daily Summary for December 1, 2009 - October 13, 2010

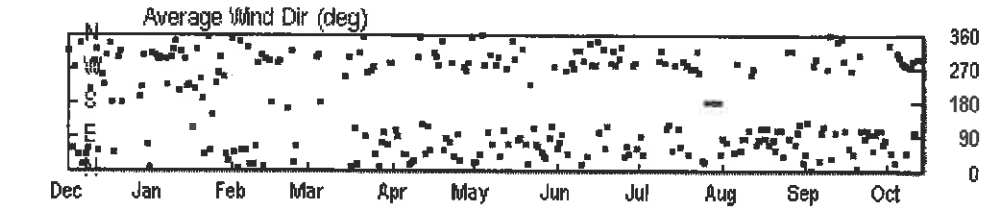
	High:	Low:	Average:
Temperature:	**103.6** °F	**16.2** °F	**62.0** °F
Dew Point:	**79.6** °F	**-99.9** °F	**32.5** °F
Humidity:	100.0%	4.0%	45.1%
Wind Speed:	**16.0**mph from the WNW	-	-
Wind Gust:	**26.6**mph from the WNW	-	-
Wind:	-	-	South
Pressure:	**30.24**in	**28.91**in	-
Precipitation:	**35.54**in		

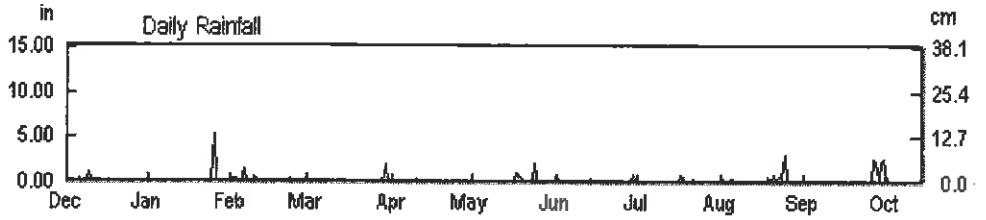
KNCDUNN2 Weather Graph











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Custom Date Range's Tabular Data

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
December	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	44	40	36	36	27	15	81	62	32	29.80	-	29.62	-	-	-	4	0	8	0.00
2	48	47	46	27	25	23	44	42	39	29.71	-	29.68	-	-	-	7	5	9	0.00
3	60	54	42	49	31	18	72	43	26	29.71	-	29.32	-	-	-	6	2	13	0.00
4	56	48	38	43	28	16	80	48	20	29.80	-	29.62	-	-	-	7	2	10	0.04
5	52	48	39	50	42	29	91	81	61	29.77	-	29.44	-	-	-	9	3	15	0.29
6	48	39	33	31	20	5	80	51	17	30.03	-	29.77	-	-	-	7	2	12	0.00
7	45	37	30	35	28	-100	91	74	35	29.97	-	29.85	-	-	-	2	0	5	0.00
8	50	43	37	47	34	23	98	74	38	29.91	-	29.47	-	-	-	8	3	13	0.17
9	70	60	50	62	53	46	94	78	41	29.47	-	29.18	-	-	-	11	5	17	1.00
10	52	44	36	6	-1	-5	17	15	13	29.77	-	29.32	-	-	-	6	3	9	0.00
11	36	32	25	18	-2	-7	68	25	17	30.15	-	29.77	-	-	-	8	4	12	0.00
12	42	35	25	24	7	-3	80	38	16	30.24	-	30.06	-	-	-	6	2	10	0.00
13	61	52	40	57	48	3	93	87	21	30.06	-	29.65	-	-	-	6	2	8	0.00
14	54	51	46	52	48	45	96	91	82	29.71	-	29.68	-	-	-	5	2	8	0.00
15	64	58	52	62	51	19	93	81	26	29.83	-	29.59	-	-	-	9	2	14	0.00
16	52	37	28	24	12	-2	81	41	15	30.00	-	29.83	-	-	-	9	1	16	0.00
17	36	30	26	26	19	-100	93	69	24	29.94	-	29.91	-	-	-	0	0	0	0.00
18	41	37	31	38	18	6	87	48	26	29.83	-	29.21	-	-	-	14	7	21	0.00
19	40	35	30	36	25	14	91	69	42	29.44	-	29.03	-	-	-	11	5	21	0.00
20	49	39	28	38	18	3	96	51	16	29.77	-	29.41	-	-	-	9	2	14	0.00
21	29	29	28	26	24	22	93	82	75	29.77	-	29.74	-	-	-	0	0	3	0.00
27	45	44	44	14	9	6	29	24	20	29.56	-	29.53	-	-	-	6	4	10	0.00
28	44	40	35	17	13	-5	40	32	16	29.65	-	29.44	-	-	-	8	4	13	0.00
29	38	30	25	4	-2	-6	35	22	16	30.06	-	29.74	-	-	-	5	1	10	0.00
30	39	33	26	17	-3	-6	50	20	16	30.18	-	29.91	-	-	-	7	3	11	0.00
31	49	39	35	47	35	19	93	88	52	29.91	-	29.62	-	-	-	6	1	8	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
January	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
1	49	39	33	48	19	0	94	49	22	29.65	-	29.53	-	-	-	11	3	15	0.00
2	35	29	24	2	-5	-9	25	19	17	29.74	-	29.56	-	-	-	14	8	23	0.00
3	35	27	20	-3	-8	-100	20	18	17	29.71	-	29.59	-	-	-	15	7	20	0.00
4	35	27	19	-3	-7	-10	25	19	17	29.65	-	29.56	-	-	-	9	4	15	0.00
5	38	28	21	0	-4	-8	34	22	16	29.65	-	29.53	-	-	-	8	3	13	0.00
6	43	33	22	1	-4	-7	33	19	15	29.74	-	29.59	-	-	-	9	4	14	0.00
7	50	37	22	5	-1	-6	40	19	14	29.80	-	29.53	-	-	-	7	3	10	0.00
8	42	34	25	17	-2	-8	41	21	16	29.77	-	29.44	-	-	-	13	7	24	0.00
9	40	28	20	6	-6	-10	50	21	16	29.88	-	29.74	-	-	-	8	4	11	0.00
10	39	28	18	7	-4	-10	54	24	16	30.00	-	29.85	-	-	-	10	3	13	0.00
11	48	36	16	14	-1	-6	67	23	14	29.97	-	29.74	-	-	-	8	3	13	0.00
12	42	33	23	14	0	-6	58	25	16	29.91	-	29.68	-	-	-	9	2	14	0.00
13	45	28	17	16	4	-100	71	38	15	30.03	-	29.85	-	-	-	5	1	8	0.00
14	55	36	21	17	7	0	66	33	13	29.97	-	29.83	-	-	-	7	1	11	0.00
15	64	40	26	30	12	-2	84	39	11	29.94	-	29.83	-	-	-	5	1	8	0.00
16	64	47	30	30	14	3	86	35	12	29.94	-	29.74	-	-	-	4	0	6	0.00
17	73	62	55	64	48	-100	93	68	23	29.35	-	29.21	-	-	-	14	4	20	0.00
18	65	53	42	47	29	9	92	51	13	29.65	-	29.35	-	-	-	9	2	13	0.00
19	70	52	40	49	31	13	98	58	12	29.65	-	29.53	-	-	-	6	1	10	0.00
20	71	55	42	40	26	12	78	39	12	29.62	-	29.47	-	-	-	8	2	14	0.00
21	47	42	39	46	31	-100	94	70	32	29.71	-	29.41	-	-	-	12	7	17	0.00
22	43	42	41	42	39	-100	97	91	79	29.71	-	29.35	-	-	-	8	4	12	0.00
23	53	45	35	38	20	5	94	48	16	29.88	-	29.68	-	-	-	7	3	10	0.00
24	67	58	42	54	41	31	77	57	27	29.65	-	29.29	-	-	-	11	6	19	0.00
25	62	54	49	58	19	-100	86	37	12	29.35	-	29.09	-	-	-	12	-2	22	5.16
26	52	44	35	23	1	-100	61	17	14	29.68	-	29.35	-	-	-	10	5	16	0.00
27	48	35	28	22	5	-100	65	32	14	29.94	-	29.68	-	-	-	7	2	11	0.00
28	51	39	32	29	14	-100	87	44	14	29.91	-	29.74	-	-	-	6	0	8	0.00
29	47	37	30	22	0	-100	68	24	14	29.97	-	29.77	-	-	-	10	5	16	0.00
30	30	26	22	24	19	11	81	72	58	29.85	-	29.50	-	-	-	11	6	17	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
31	40	30	19	13	-1	-6	66	29	16	29.97	-	29.62	-	-	-	8	3	11	0.12

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
February	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	47	32	22	28	9	-5	86	43	14	30.06	-	29.88	-	-	-	5	1	6	0.28
2	40	37	32	39	20	-1	98	58	19	29.88	-	29.59	-	-	-	11	4	14	0.43
3	40	37	33	36	24	14	98	62	35	29.91	-	29.62	-	-	-	6	1	8	0.04
4	44	38	32	18	13	9	52	36	25	30.06	-	29.91	-	-	-	6	2	10	0.00
5	50	37	34	49	18	-100	96	62	26	29.94	-	29.06	-	-	-	13	-31	18	1.38
6	39	31	32	32	2	-100	83	45	35	29.56	-	29.12	-	-	-	9	-77	13	0.00
7	47	31	25	23	-5	-100	83	32	14	29.71	-	29.56	-	-	-	7	-17	11	0.00
8	46	31	25	27	15	-100	91	61	15	29.85	-	29.71	-	-	-	5	-7	8	0.00
9	41	30	34	39	-1	-100	93	49	34	29.83	-	29.26	-	-	-	5	-47	8	0.59
10	42	27	31	41	-21	-100	94	25	16	29.44	-	29.18	-	-	-	16	-112	27	0.04
11	41	25	30	0	-29	-100	23	14	16	29.62	-	29.44	-	-	-	12	-	20	0.00
12	37	19	27	28	-39	-100	83	18	17	29.68	-	29.41	-	-	-	7	-	10	0.00
13	43	31	31	29	-3	-100	88	35	15	29.53	-	29.29	-	-	-	9	-26	15	0.12
14	50	24	25	3	-34	-100	32	13	14	29.62	-	29.50	-	-	-	9	-	14	0.00
15	36	8	34	3	-78	-100	25	5	22	29.59	-	29.32	-	-	-	3	-	3	0.00
16	36	0	200	-100	-100	-100	0	0	100	29.50	-	29.47	-	-	-	0	-	3	0.00
17	39	5	26	2	-85	-100	31	4	16	29.53	-	29.41	-	-	-	8	-	12	0.00
18	48	22	28	1	-43	-100	21	10	14	29.62	-	29.53	-	-	-	10	-	14	0.00
21	54	21	46	4	-56	-100	17	6	13	29.68	-	29.62	-	-	-	5	-	7	0.00
22	55	4	53	52	-88	-100	93	7	91	29.62	-	29.29	-	-	-	3	-	5	0.31
23	54	38	48	44	2	-100	86	42	26	29.41	-	29.35	-	-	-	5	-62	5	0.04
24	43	10	43	29	-70	-100	57	13	49	29.47	-	29.35	-	-	-	8	-	10	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
March	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
3	40	39	38	20	15	10	47	38	29	29.44	-	29.38	-	-	-	7	4	10	0.00
4	52	24	35	16	-37	-100	43	16	13	29.59	-	29.44	-	-	-	10	-	14	0.00
5	47	0	200	-100	-100	-100	0	0	100	29.74	-	29.65	-	-	-	0	-	0	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
14	65	58	53	12	11	7	18	15	13	29.29	-	29.18	-	-	-	9	4	15	0.00
15	65	56	41	36	18	10	78	28	13	29.47	-	29.26	-	-	-	10	5	15	0.00
16	55	51	41	33	18	10	76	28	18	29.71	-	29.50	-	-	-	6	3	11	0.00
17	59	47	38	40	24	4	96	53	12	29.74	-	29.59	-	-	-	4	0	6	0.00
18	65	54	47	28	14	6	47	23	11	29.59	-	29.41	-	-	-	5	1	7	0.00
19	77	56	40	42	22	7	87	36	10	29.71	-	29.47	-	-	-	5	1	8	0.00
20	81	62	40	46	21	9	92	32	9	29.77	-	29.62	-	-	-	6	2	11	0.00
21	71	63	43	42	28	9	77	31	14	29.77	-	29.59	-	-	-	9	3	14	0.00
22	64	54	47	61	20	4	89	33	14	29.44	-	29.35	-	-	-	9	4	15	0.12
23	68	55	40	24	13	4	50	21	12	29.62	-	29.35	-	-	-	13	6	22	0.00
24	76	55	41	44	24	9	92	39	10	29.74	-	29.59	-	-	-	6	0	8	0.00
25	76	62	46	34	22	-100	60	27	10	29.74	-	29.38	-	-	-	6	3	10	0.00
26	65	55	42	56	38	24	87	56	25	29.71	-	29.23	-	-	-	10	4	17	0.00
27	61	50	34	26	12	2	69	27	12	29.97	-	29.77	-	-	-	8	4	11	0.00
28	71	59	39	39	27	13	64	33	12	29.80	-	29.47	-	-	-	12	6	23	0.00
29	68	60	55	60	48	27	93	69	23	29.47	-	29.26	-	-	-	6	2	11	1.81
30	70	59	51	47	22	6	86	32	11	29.50	-	29.32	-	-	-	11	5	17	0.00
31	79	64	42	18	13	3	37	14	10	29.71	-	29.50	-	-	-	9	3	12	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
April	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	88	66	45	52	26	11	91	35	8	29.77	-	29.65	-	-	-	6	0	8	0.00
2	60	56	52	42	31	18	65	40	19	29.71	-	29.68	-	-	-	3	1	5	0.00
4	85	72	66	44	31	15	46	26	8	29.80	-	29.68	-	-	-	4	1	6	0.00
5	86	69	58	55	37	15	83	38	8	29.83	-	29.65	-	-	-	4	1	8	0.00
6	91	76	61	42	29	16	49	21	7	29.71	-	29.53	-	-	-	7	3	11	0.00
7	84	71	61	39	30	15	34	24	9	29.65	-	29.53	-	-	-	5	3	10	0.00
8	82	70	61	59	36	-100	86	39	9	29.53	-	29.32	-	-	-	6	4	11	0.00
9	69	58	49	48	22	5	75	29	12	29.71	-	29.38	-	-	-	10	3	22	0.39
10	75	59	38	39	20	9	89	31	11	29.97	-	29.71	-	-	-	6	1	12	0.00
11	79	66	40	53	22	11	97	26	10	29.97	-	29.85	-	-	-	6	1	9	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
12	84	64	47	55	29	12	96	39	9	29.91	-	29.85	-	-	-	5	1	8	0.00
13	81	63	48	57	34	14	96	44	9	29.97	-	29.85	-	-	-	4	1	6	0.00
14	62	55	46	47	32	23	92	45	24	30.15	-	29.97	-	-	-	8	4	12	0.00
15	77	55	40	52	33	-100	98	60	10	30.09	-	29.88	-	-	-	5	0	8	0.00
16	86	65	52	46	31	15	76	38	8	29.88	-	29.53	-	-	-	8	2	11	0.00
17	81	73	61	29	20	15	29	14	9	29.53	-	29.41	-	-	-	10	4	17	0.00
18	71	57	45	24	14	3	39	20	12	29.68	-	29.56	-	-	-	7	2	13	0.00
19	70	52	40	39	23	9	86	40	12	29.71	-	29.59	-	-	-	6	2	9	0.00
20	73	58	42	42	26	12	94	40	11	29.62	-	29.53	-	-	-	5	1	7	0.00
21	66	57	51	51	41	25	93	60	25	29.56	-	29.38	-	-	-	4	1	6	0.08
22	76	59	48	55	34	12	100	54	10	29.53	-	29.38	-	-	-	7	2	10	0.00
23	79	66	60	41	29	15	50	29	10	29.62	-	29.53	-	-	-	4	0	6	0.00
24	78	67	58	55	40	32	73	40	20	29.65	-	29.50	-	-	-	6	2	9	0.00
25	82	71	64	65	53	39	93	58	22	29.50	-	29.09	-	-	-	7	3	12	0.20
26	82	71	63	65	38	14	91	40	9	29.09	-	28.91	-	-	-	10	4	20	0.00
27	67	60	56	30	22	11	38	24	12	29.26	-	29.06	-	-	-	7	4	12	0.00
28	68	54	46	31	15	4	38	23	12	29.62	-	29.26	-	-	-	8	2	15	0.00
29	78	56	38	42	22	11	94	38	10	29.65	-	29.56	-	-	-	5	1	9	0.00
30	82	58	51	42	31	15	67	42	9	29.65	-	29.53	-	-	-	3	1	6	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
May	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	93	78	65	67	48	25	93	47	9	29.68	-	29.53	-	-	-	5	2	12	0.00
2	96	81	72	64	50	25	75	43	9	29.65	-	29.56	-	-	-	7	4	12	0.00
3	87	77	70	65	54	32	80	49	16	29.65	-	29.50	-	-	-	10	3	17	0.00
4	82	72	64	63	54	36	92	57	20	29.59	-	29.47	-	-	-	5	1	8	0.00
5	86	71	64	66	50	17	97	61	8	29.62	-	29.53	-	-	-	4	1	6	0.00
6	93	74	67	69	49	17	93	57	7	29.59	-	29.44	-	-	-	4	1	9	0.00
7	94	80	67	37	24	16	33	15	6	29.65	-	29.50	-	-	-	6	4	10	0.00
8	94	81	67	49	25	-100	48	16	6	29.56	-	29.32	-	-	-	12	5	21	0.00
9	73	54	50	19	-5	-100	30	11	11	29.85	-	29.56	-	-	-	10	-75	15	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
10	74	52	46	16	-5	-100	28	13	11	29.97	-	29.83	-	-	-	4	-	8	0.00
11	73	63	58	47	22	-100	54	24	11	30.00	-	29.85	-	-	-	8	3	11	0.00
12	88	64	64	55	11	-100	68	22	10	29.88	-	29.74	-	-	-	7	-75	13	0.00
13	88	68	66	63	31	-100	87	36	13	29.91	-	29.77	-	-	-	7	-35	11	0.00
14	96	77	66	66	36	-100	91	38	6	29.91	-	29.80	-	-	-	7	-3	13	0.00
15	98	67	68	62	22	-100	79	32	5	29.85	-	29.68	-	-	-	6	-25	8	0.00
16	90	75	68	67	44	-100	91	43	10	29.71	-	29.59	-	-	-	6	-12	10	0.98
17	82	72	63	72	65	47	94	82	30	29.68	-	29.53	-	-	-	7	2	10	0.55
18	67	63	58	60	52	43	94	71	43	29.56	-	29.47	-	-	-	5	1	10	0.47
19	80	68	61	59	50	37	90	60	22	29.59	-	29.50	-	-	-	5	2	8	0.00
20	84	68	59	65	43	-100	94	57	8	29.74	-	29.59	-	-	-	6	1	8	0.00
21	89	77	58	69	33	16	94	32	8	29.80	-	29.71	-	-	-	5	1	8	0.00
22	89	74	65	63	44	17	79	44	8	29.80	-	29.65	-	-	-	5	0	8	0.00
23	77	69	66	66	59	45	90	73	33	29.74	-	29.65	-	-	-	6	0	8	2.09
24	70	68	66	68	65	62	94	91	78	29.77	-	29.68	-	-	-	5	1	8	0.24
25	79	71	68	66	51	23	92	58	12	29.77	-	29.65	-	-	-	6	2	8	0.00
26	82	70	64	59	40	23	84	37	12	29.59	-	29.47	-	-	-	6	1	12	0.00
27	94	75	62	66	50	17	92	51	6	29.47	-	29.35	-	-	-	4	0	6	0.00
28	90	75	66	61	42	-100	75	39	10	29.56	-	29.41	-	-	-	8	3	11	0.00
29	84	77	70	60	50	39	73	42	21	29.65	-	29.59	-	-	-	4	2	8	0.00
30	93	79	66	70	50	25	93	47	9	29.71	-	29.59	-	-	-	6	1	11	0.00
31	93	80	69	73	50	25	91	44	9	29.77	-	29.65	-	-	-	5	2	10	0.04

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
June	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	85	75	69	72	63	49	92	70	30	29.71	-	29.53	-	-	-	5	1	8	0.24
2	93	78	71	74	63	41	92	68	17	29.56	-	29.47	-	-	-	4	1	8	0.04
3	90	76	68	71	60	41	91	65	18	29.53	-	29.44	-	-	-	5	1	10	0.00
4	87	79	73	70	58	44	90	52	22	29.56	-	29.50	-	-	-	1	0	4	0.00
5	96	86	73	73	50	32	90	37	11	29.56	-	29.47	-	-	-	5	1	9	0.00
6	96	87	71	69	42	22	80	29	6	29.44	-	29.29	-	-	-	8	3	16	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
7	87	76	64	66	33	-100	86	32	8	29.65	-	29.38	-	-	-	6	1	11	0.00
8	88	76	63	68	38	17	92	40	8	29.77	-	29.62	-	-	-	6	1	10	0.00
9	90	81	68	62	44	25	78	32	10	29.77	-	29.59	-	-	-	5	2	10	0.00
10	95	81	73	70	48	25	87	37	9	29.62	-	29.50	-	-	-	6	2	10	0.00
11	96	82	68	71	46	16	91	43	6	29.77	-	29.56	-	-	-	5	1	8	0.00
12	97	83	68	70	51	18	90	46	6	29.80	-	29.68	-	-	-	6	1	9	0.00
13	99	85	73	76	57	28	91	50	8	29.68	-	29.53	-	-	-	10	2	17	0.39
14	96	80	73	71	58	26	88	56	9	29.59	-	29.50	-	-	-	7	2	12	0.00
15	101	83	72	67	51	17	80	40	5	29.68	-	29.56	-	-	-	5	1	8	0.00
16	93	82	75	71	58	42	82	49	18	29.71	-	29.62	-	-	-	4	1	6	0.00
17	95	83	73	76	50	16	91	48	6	29.65	-	29.56	-	-	-	7	1	11	0.00
18	95	84	71	66	42	-100	78	30	6	29.74	-	29.62	-	-	-	5	2	8	0.00
19	100	82	73	75	54	-100	90	50	6	29.77	-	29.62	-	-	-	4	1	8	0.00
20	98	85	74	74	51	17	89	45	6	29.68	-	29.56	-	-	-	6	1	9	0.00
21	100	85	72	74	42	16	90	39	5	29.74	-	29.62	-	-	-	7	1	9	0.00
22	101	84	72	74	52	17	89	43	6	29.77	-	29.68	-	-	-	6	1	10	0.00
23	101	86	76	72	49	16	86	40	5	29.77	-	29.65	-	-	-	6	1	9	0.00
24	104	92	74	72	40	14	87	28	4	29.68	-	29.53	-	-	-	5	1	11	0.00
25	102	92	77	69	37	14	76	22	4	29.68	-	29.56	-	-	-	6	2	10	0.00
26	99	85	71	70	53	26	89	41	8	29.65	-	29.50	-	-	-	5	1	8	0.00
27	104	88	74	71	41	13	88	29	4	29.53	-	29.44	-	-	-	5	2	10	0.00
28	95	80	72	70	59	32	89	58	11	29.50	-	29.41	-	-	-	6	1	10	0.00
29	99	82	74	73	54	26	90	50	8	29.65	-	29.50	-	-	-	13	2	22	0.79
30	82	77	75	77	68	56	91	76	40	29.74	-	29.62	-	-	-	4	1	6	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
July	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	85	74	73	70	68	29	87	83	81	29.80	-	29.71	-	-	-	5	0	9	0.00
2	68	66	65	61	58	-52	83	76	57	29.80	-	29.80	-	-	-	1	0	3	0.00
8	87	79	74	64	54	38	71	46	18	29.59	-	29.56	-	-	-	4	0	6	0.00
9	99	85	73	69	46	-100	86	36	6	29.62	-	29.47	-	-	-	6	1	10	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
10	95	82	74	72	58	-100	86	53	11	29.53	-	29.41	-	-	-	7	2	10	0.08
11	96	83	70	76	46	17	91	44	6	29.59	-	29.50	-	-	-	5	1	8	0.04
12	90	80	70	74	61	42	91	61	19	29.56	-	29.47	-	-	-	6	2	10	0.08
13	95	81	74	74	63	43	91	62	17	29.59	-	29.50	-	-	-	5	1	9	0.00
14	95	80	74	74	59	17	89	60	6	29.68	-	29.56	-	-	-	5	1	8	0.08
15	99	84	74	78	55	23	91	50	6	29.71	-	29.62	-	-	-	6	1	8	0.00
16	99	85	76	74	56	26	89	50	8	29.74	-	29.62	-	-	-	6	2	15	0.00
17	97	80	73	71	58	-100	91	59	8	29.74	-	29.65	-	-	-	11	1	15	0.67
18	95	84	74	77	59	42	91	51	16	29.74	-	29.65	-	-	-	6	2	13	0.00
19	92	80	74	74	64	42	88	62	18	29.71	-	29.56	-	-	-	6	2	10	0.04
20	99	86	75	72	54	37	83	40	10	29.77	-	29.65	-	-	-	7	2	17	0.00
21	100	86	76	73	55	20	86	46	5	29.77	-	29.65	-	-	-	8	2	15	0.31
22	101	85	74	75	57	25	90	52	7	29.74	-	29.62	-	-	-	6	1	8	0.00
23	102	88	78	77	58	26	88	46	7	29.74	-	29.65	-	-	-	7	1	10	0.00
24	101	89	78	73	55	35	84	38	10	29.74	-	29.65	-	-	-	5	1	10	0.00
25	102	87	79	72	54	25	78	40	7	29.71	-	29.53	-	-	-	5	1	10	0.00
26	97	87	76	69	44	26	78	32	8	29.71	-	29.62	-	-	-	0	0	0	0.00
28	78	78	77	73	71	70	86	81	77	29.71	-	29.68	-	-	-	0	0	0	0.00
29	97	83	77	80	63	31	91	60	9	29.68	-	29.50	-	-	-	0	0	0	0.00
30	93	79	72	73	56	25	91	54	9	29.59	-	29.47	-	-	-	0	0	0	0.08
31	84	75	67	68	48	28	89	45	14	29.62	-	29.53	-	-	-	3	0	7	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
August	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	83	73	67	68	60	48	90	68	31	29.65	-	29.53	-	-	-	4	1	8	0.55
2	89	76	70	69	61	39	90	66	18	29.77	-	29.65	-	-	-	4	1	7	0.00
5	93	81	74	74	64	44	90	62	19	29.59	-	29.44	-	-	-	9	1	15	0.28
6	95	81	74	74	64	44	90	63	18	29.56	-	29.44	-	-	-	5	1	13	0.04
7	92	81	72	73	59	41	91	57	17	29.62	-	29.47	-	-	-	5	1	8	0.00
8	95	83	73	75	53	25	90	48	9	29.68	-	29.59	-	-	-	4	1	8	0.00
9	94	81	71	78	58	25	91	56	9	29.71	-	29.62	-	-	-	4	1	8	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
10	100	85	74	78	57	25	90	51	7	29.68	-	29.56	-	-	-	4	1	8	0.00
11	99	87	78	71	56	34	79	42	11	29.62	-	29.47	-	-	-	6	1	11	0.00
12	99	86	78	71	56	25	79	45	8	29.50	-	29.35	-	-	-	8	2	13	0.00
13	92	83	77	73	60	44	88	51	19	29.62	-	29.41	-	-	-	5	2	10	0.00
14	93	82	72	69	54	32	78	44	12	29.71	-	29.59	-	-	-	5	1	8	0.00
15	95	81	71	68	51	25	89	45	9	29.71	-	29.56	-	-	-	5	1	8	0.00
16	96	80	69	68	51	17	90	47	6	29.65	-	29.56	-	-	-	3	0	5	0.00
17	94	83	74	74	51	25	89	42	9	29.74	-	29.59	-	-	-	4	1	8	0.00
18	97	83	76	74	62	41	89	54	13	29.71	-	29.56	-	-	-	6	1	9	0.51
19	89	79	75	75	70	52	91	76	29	29.65	-	29.50	-	-	-	4	0	6	0.08
20	92	81	72	73	60	36	90	59	14	29.62	-	29.50	-	-	-	5	2	8	0.79
21	93	80	68	77	56	31	93	55	11	29.68	-	29.56	-	-	-	5	1	9	0.00
22	94	82	74	79	68	52	91	68	26	29.56	-	29.47	-	-	-	4	1	10	0.59
23	88	76	72	76	69	48	91	82	29	29.50	-	29.44	-	-	-	8	0	15	0.24
24	74	72	70	70	68	66	90	89	83	29.56	-	29.44	-	-	-	7	1	11	2.99
25	84	74	68	68	61	47	89	70	29	29.65	-	29.53	-	-	-	4	0	6	0.00
26	93	82	70	77	54	25	93	51	9	29.71	-	29.62	-	-	-	5	1	8	0.00
27	88	72	68	75	59	-100	92	72	28	29.74	-	29.65	-	-	-	3	-34	4	0.00
28	94	81	70	76	56	34	91	51	14	29.83	-	29.74	-	-	-	4	1	8	0.00
29	91	79	68	71	53	30	90	51	12	29.91	-	29.83	-	-	-	5	1	8	0.00
30	93	72	66	74	61	25	92	76	9	29.91	-	29.80	-	-	-	3	0	5	0.00
31	98	85	67	72	46	18	91	41	5	29.83	-	29.71	-	-	-	4	1	7	0.00

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
September	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	88	75	68	73	51	20	90	55	8	29.74	-	29.62	-	-	-	4	0	5	0.00
2	79	72	66	66	54	43	92	60	31	29.68	-	29.47	-	-	-	4	1	7	0.00
3	98	84	70	56	36	17	60	25	5	29.44	-	29.35	-	-	-	7	2	12	0.00
4	89	77	59	50	31	16	72	25	7	29.68	-	29.41	-	-	-	8	2	12	0.00
5	90	75	57	52	28	16	82	26	7	29.77	-	29.65	-	-	-	4	1	8	0.00
6	95	75	59	61	39	17	91	42	6	29.83	-	29.65	-	-	-	4	1	8	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
7	91	72	63	73	53	18	91	61	7	29.88	-	29.74	-	-	-	3	0	6	0.00
8	97	79	71	76	57	26	90	57	9	29.74	-	29.53	-	-	-	6	1	13	0.00
9	71	64	60	68	50	31	92	65	24	29.59	-	29.47	-	-	-	3	0	5	0.00
10	88	71	58	54	34	16	81	38	8	29.59	-	29.50	-	-	-	6	1	10	0.00
11	82	71	62	67	45	33	88	43	19	29.68	-	29.56	-	-	-	5	2	8	0.08
12	90	76	64	72	52	18	90	55	8	29.62	-	29.53	-	-	-	7	1	12	0.00
13	88	73	62	66	43	17	91	51	8	29.74	-	29.59	-	-	-	7	1	9	0.00
14	97	80	59	58	33	16	90	32	6	29.71	-	29.59	-	-	-	6	2	8	0.00
15	93	72	57	62	44	16	90	49	6	29.74	-	29.68	-	-	-	4	1	6	0.00
16	89	74	68	73	53	17	90	58	8	29.77	-	29.62	-	-	-	4	1	8	0.00
17	94	80	69	64	45	16	79	39	6	29.68	-	29.59	-	-	-	5	1	10	0.00
18	91	77	65	63	42	17	88	39	7	29.80	-	29.71	-	-	-	5	2	9	0.00
19	91	76	62	66	43	17	89	47	7	29.80	-	29.62	-	-	-	6	1	8	0.00
20	93	74	63	62	44	18	93	45	7	29.68	-	29.56	-	-	-	2	0	4	0.00
21	86	74	67	48	38	22	46	29	11	29.83	-	29.68	-	-	-	5	2	9	0.00
22	86	73	64	64	54	39	89	58	19	29.83	-	29.71	-	-	-	3	1	6	0.00
23	92	78	69	67	49	25	87	43	9	29.83	-	29.74	-	-	-	3	0	5	0.00
24	90	75	68	72	53	19	88	53	8	29.85	-	29.68	-	-	-	4	1	6	0.00
25	99	85	68	72	42	16	89	39	5	29.71	-	29.50	-	-	-	6	2	10	0.00
26	90	70	70	70	48	-100	90	61	19	29.56	-	29.47	-	-	-	7	-64	10	2.64
27	74	57	71	71	33	-100	90	70	87	29.53	-	29.38	-	-	-	8	-	11	2.05
28	72	69	65	68	60	46	88	76	41	29.47	-	29.32	-	-	-	7	1	12	0.35
29	71	69	66	68	64	60	89	86	75	29.50	-	29.29	-	-	-	5	2	10	2.05
30	78	73	71	73	69	66	89	88	84	29.29	-	29.09	-	-	-	10	4	23	2.48

2010	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
October	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	low	high	avg	high	sum
1	80	68	58	68	47	22	91	54	12	29.53	-	29.21	-	-	-	7	2	13	0.00
2	77	64	53	52	37	19	84	47	13	29.62	-	29.53	-	-	-	5	2	10	0.00
3	66	61	54	54	44	38	89	57	35	29.65	-	29.47	-	-	-	5	2	10	0.00
4	66	57	54	54	46	28	89	71	24	29.77	-	29.62	-	-	-	3	0	6	0.00

2009	Temp. (°F)			Dew Point (°F)			Humidity (%)			Sea Level Pressure (in)			Visibility (mi)			Wind (mph)		Gust Speed (mph)	Precip (in)
5	66	53	46	48	30	12	90	49	13	29.80	-	29.71	-	-	-	3	0	7	0.00
6	69	51	44	46	37	13	86	63	12	29.77	-	29.53	-	-	-	6	1	11	0.00
7	73	56	49	49	42	15	92	67	11	29.62	-	29.50	-	-	-	7	1	10	0.00
8	81	61	49	50	33	14	86	44	9	29.74	-	29.59	-	-	-	5	1	8	0.00
9	82	57	50	63	45	-100	93	74	9	29.68	-	29.59	-	-	-	4	0	6	0.00
10	91	72	53	67	36	17	92	42	7	29.65	-	29.56	-	-	-	4	0	8	0.00
11	83	66	58	53	43	17	82	49	9	29.59	-	29.50	-	-	-	3	0	5	0.00
12	74	66	62	63	54	33	88	68	23	29.56	-	29.47	-	-	-	3	0	8	0.00

Comma Delimited File

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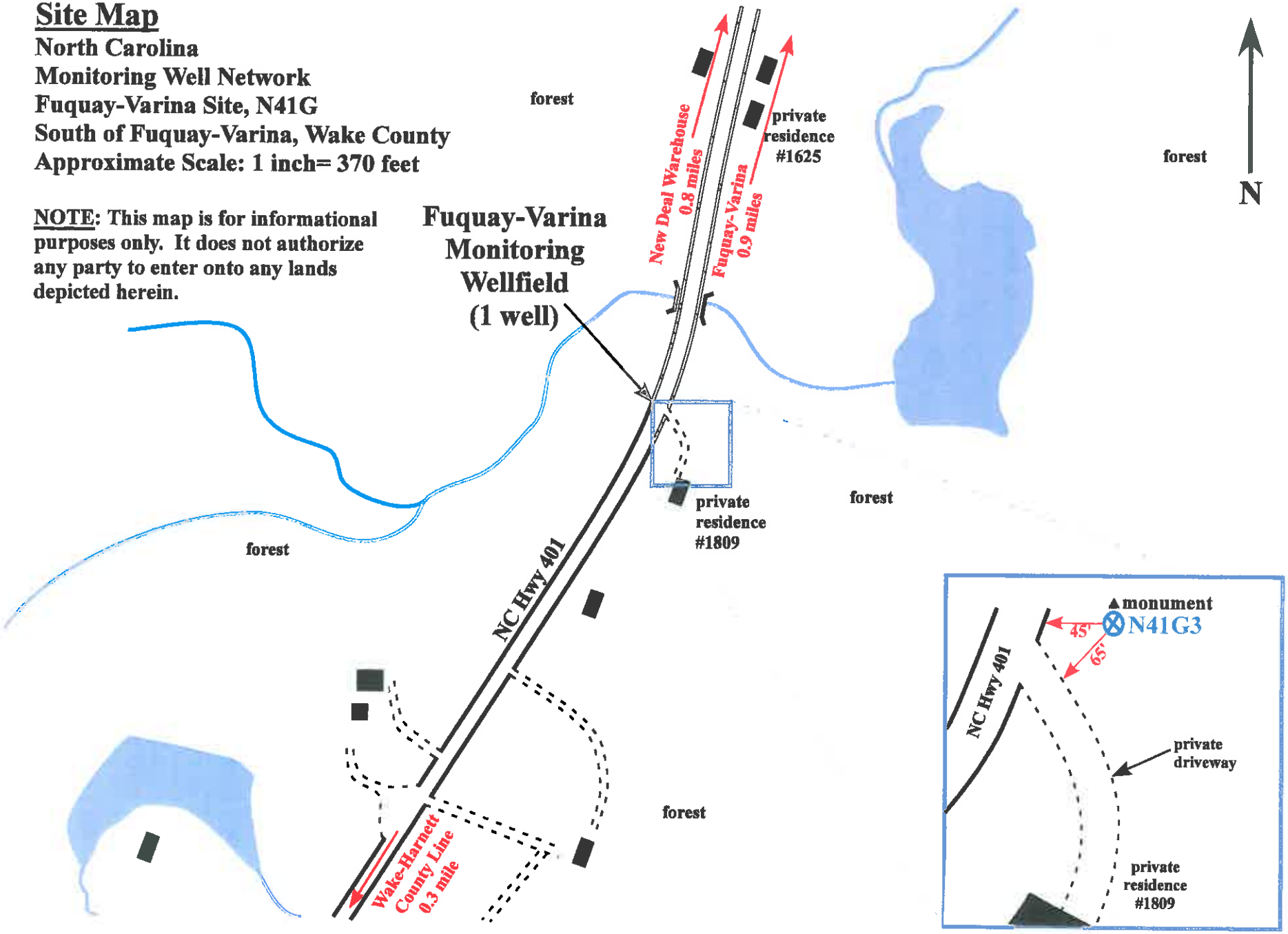
APPENDIX IV

NCDENR AREA WELL DATA

Site Map

North Carolina
Monitoring Well Network
Fuquay-Varina Site, N41G
South of Fuquay-Varina, Wake County
Approximate Scale: 1 inch= 370 feet

NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.



North Carolina Department of Environment and Natural Resources
Division of Water Resources

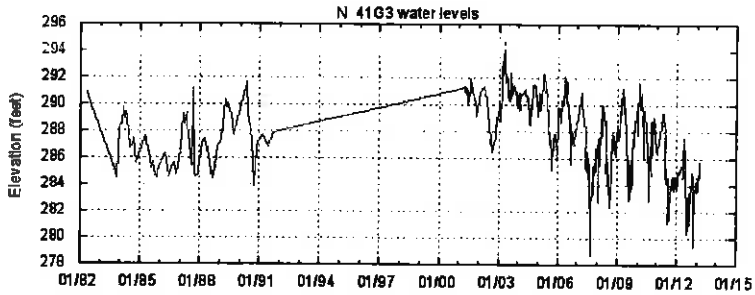
DWR Monitoring Database Detail for N 41G3

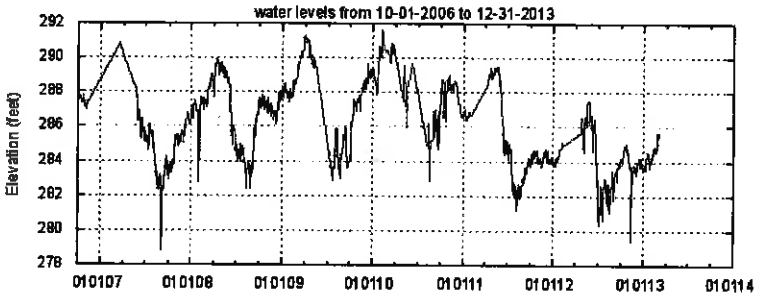
Show Map -- Monthly Statistics Plot -- Fuquay Varina Site Map.pdf -- Station Levels (may include USGS data)

Field	Data
County	Wake
Quad	N 41G3
Name	Fuquay Varina
Latitude	35.555441
Longitude	-78.808619
Location Accuracy	GPS
Netname (link to USGS data)	
USGS ID	
Aquifer	Bedrock
Land Surface NED elevation = 308.88 feet	308.88
Date Constructed	05/05/1982
Measuring Point (feet above land surface)	1.44
Depth	125.00
Diameter	6.25
Yield	1.00
Exists?	y
Recorder Box?	y
Top of Screen	23.00
Bottom of Screen	128.00
Number of Water Levels (date * feet below land surface * elevation) 05/05/1982 to 03/04/2013	3,398 ** 999.99 feet below land surface value indicates dry well

output file is tab-delimited text
National Elevation Dataset, 1/9 arc second value, ~3 X 3 meter grid

return to well table

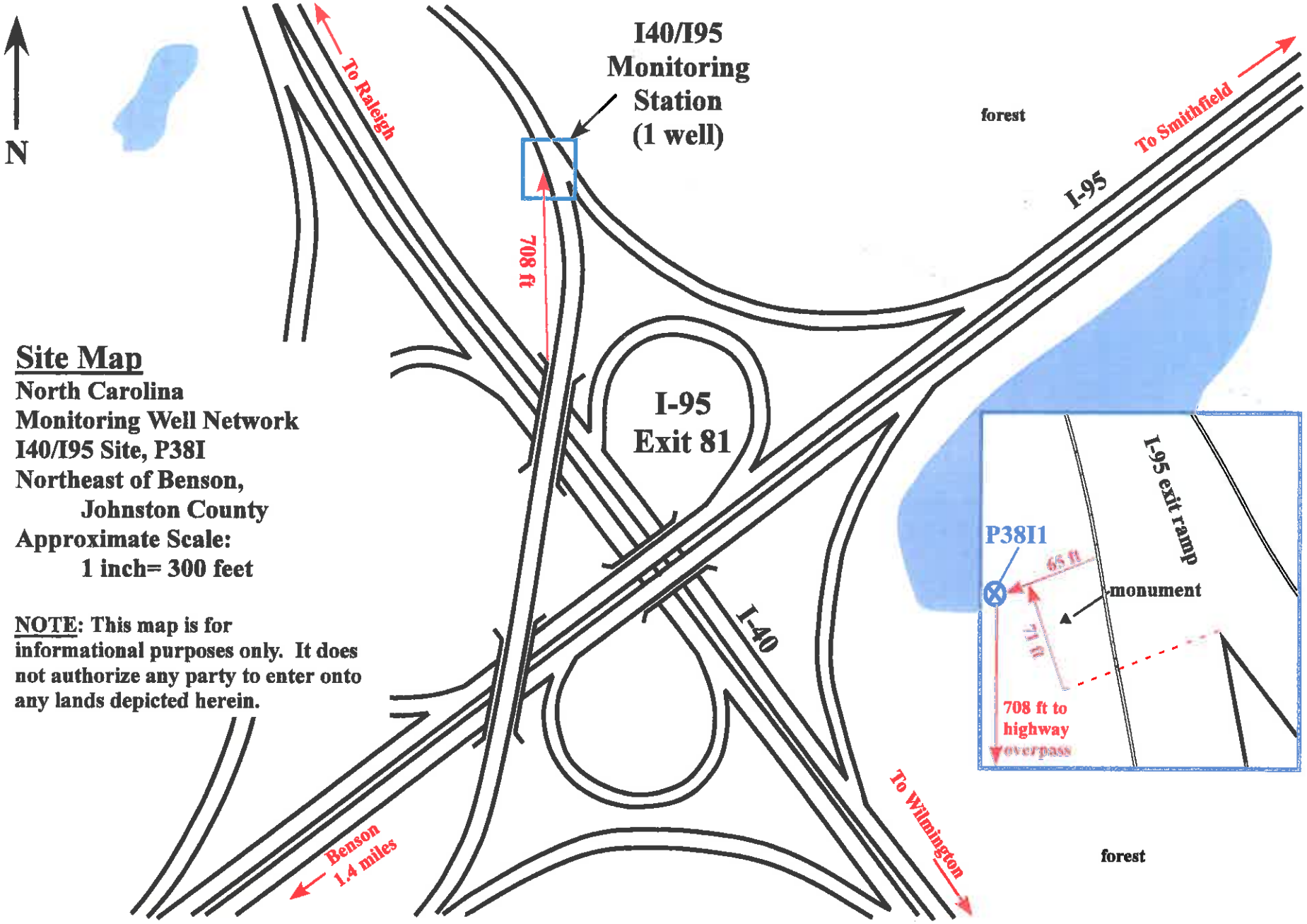




slope: -0.46 feet/year over this date range

Start Date: 10 01 2006 End Date: 12 31 2013 Replot

NC Division of Water Resources, DENR - 1611 Mail Service Center - Raleigh, NC 27699-1611
Phone: (919) 707-9000 - Fax: (919) 733-3558
Last Modified: 01.11.2013
Comments, questions, or problems? Please contact the DWR Webmaster.



Site Map

North Carolina
Monitoring Well Network
I40/I95 Site, P38I
Northeast of Benson,
Johnston County
Approximate Scale:
1 inch= 300 feet

NOTE: This map is for informational purposes only. It does not authorize any party to enter onto any lands depicted herein.

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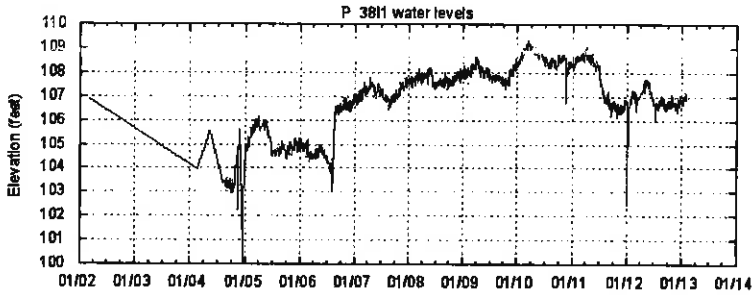
DWR Monitoring Database Detail for P 38I1

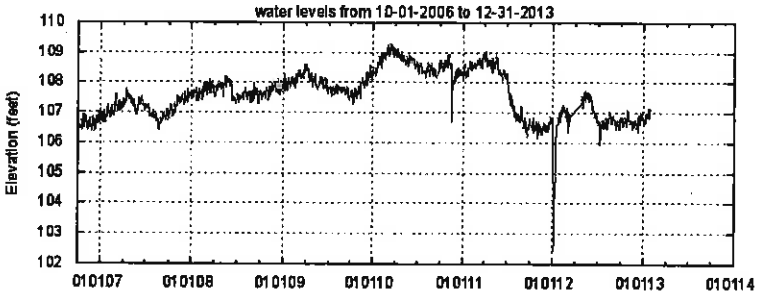
Show Map – Monthly Statistics Plot – I40I95 Site Map.pdf – Station Levels (may include USGS data)

Field	Data
County	Johnston
Quad	P 38I1
Name	I-40/I-95
Latitude	35.393419
Longitude	-78.519450
Location Accuracy	GPS
Netname (link to USGS data)	
USGS ID	
Aquifer	Bedrock
Land Surface NED elevation = 203.12 feet	206.93
Date Constructed	04/25/1989
Measuring Point (feet above land surface)	1.09
Depth	307.00
Diameter	6.00
Yield	100.00
Exists?	y
Recorder Box?	y
Top of Screen	163.00
Bottom of Screen	307.00
Number of Water Levels (date * feet below land surface * elevation) 03/13/2002 to 01/29/2013	3,024 ** 999.99 feet below land surface value indicates dry well

output file is tab-delimited text
National Elevation Dataset, 1/9 arc second value, ~3 X 3 meter grid

return to well table





slope: -0.01 feet/year over this date range

Start Date: 10 - 01 - 2006 End Date: 12 - 31 - 2013 Replot

NC Division of Water Resources, DENR - 1611 Mail Service Center - Raleigh, NC 27699-1611
Phone: (919) 707-9000 - Fax: (919) 733-3558
Comments, questions, or problems? Please contact the DWR Webmaster.

Last Modified: 01.11.2013

APPENDIX V

OVERALL GROUNDWATER READINGS FOR THE SITE 1997-2013

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	MAX	MIN	MEDIAN	AVG	9/30/1997	10/4/1999	4/17/2000
CDMW-1	300.42	297.84	271.85	254.50	267.07	266.2185714	263.12	269.47	271.85
CDMW-2	276.71	273.89	271.90	265.18	269.21	269.2238462	267.56	270.92	267.92
CDMW-3	268.17	265.73	258.10	239.27	254.08	253.63025	255.5	255.01	252.67
CDMW-4S	335.95	332.77	328.20	298.85	301.10	303.52			
CDMW-4D	336.07	333.07	300.90	298.32	299.81	299.629			
CDMW-5	273.102	270.28	270.14	260.71	265.66	265.83775			
CDMW-6	338.69	335.67	305.16	300.22	303.21	303.2068421			
P-4	312.02		304.88	302.19	302.84	303.1522222			
PZ-6B	339.1	336.12	306.55	303.30	303.60	304.4645455			
PZ-7	293.61	290.44	282.55	278.95	280.94	280.94			
PZ-8	288.39	284.95	280.14	274.57	277.61	277.4485714			
PZ-9	327.91	324.63	308.59	302.73	306.17	306.1461538			
PZ-10	290.98	287.156	284.28	277.06	281.17	281.396098			
PZ-11	336.96	334.041	306.15	305.16	305.25	305.4391667			
PZ-12	318	315.163	307.92	304.26	307.04	306.9772647			
PZ-13	307.23	304.293	294.53	287.59	291.60	291.4598137			
PZ-14	281.31	277.641	268.58	259.61	266.83	265.7025196			
PZ-15	338.42	335.462	306.53	302.11	305.17	305.0699267			
PZ-16	327.9	324.072	307.63	302.32	306.10	306.0338627			
PZ-17	315.49	311.552	304.04	297.25	301.14	301.5382745			
PZ-18	301.4	297.882	281.65	274.98	279.35	279.1374902			
PZ-19	248.13	245.118	244.41	239.68	243.35	242.9432941			
PZ-20	252.7	248.934	246.40	240.17	244.58	243.9901765			
PZ-21	268.27	264.55	260.11	255.10	258.51	258.1256863			
PZ-22	256	252.788	251.49	246.39	250.30	249.8871176			
PZ-23	293.86	290.056	284.71	284.71	284.71	284.71			
PZ-24	263.74	262.075	258.44	256.84	257.59	257.6142857			
PZ-25	302.02	298.665	288.32	283.82	286.41	286.4131863			
PZ-26	290.56	287.182	285.03	278.36	282.06	281.9960196			
PZ-27	332.53	329.667	305.23	300.49	303.38	303.3929314			
PZ-28	342.09	338.811	306.88	301.31	305.11	305.1407549			
PZ-29	337.41	335.477	305.83	301.38	303.62	303.8077353			

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	10/11/2000	4/18/2001	10/17/2001	3/7/2002	3/28/2002	4/4/2002	4/29/2002
CDMW-1	300.42	297.84	269.59	270.9	267.99	269.09	269.07	268.97	267.07
CDMW-2	276.71	273.89	271.12	267.4	270.96	268.56	268.05	268.98	267.21
CDMW-3	268.17	265.73	258.1	252.02	254.97	253.85	253.27	253.11	251.75
CDMW-4S	335.95	332.77							298.98
CDMW-4D	336.07	333.07							298.32
CDMW-5	273.102	270.28							
CDMW-6	338.69	335.67							
P-4	312.02								
PZ-6B	339.1	336.12							303.53
PZ-7	293.61	290.44							281.09
PZ-8	288.39	284.95							274.57
PZ-9	327.91	324.63							306.6
PZ-10	290.98	287.156							
PZ-11	336.96	334.041							
PZ-12	318	315.163							
PZ-13	307.23	304.293							
PZ-14	281.31	277.641							
PZ-15	338.42	335.462							
PZ-16	327.9	324.072							
PZ-17	315.49	311.552							
PZ-18	301.4	297.882							
PZ-19	248.13	245.118							
PZ-20	252.7	248.934							
PZ-21	268.27	264.55							
PZ-22	256	252.788							
PZ-23	293.86	290.056							
PZ-24	263.74	262.075							
PZ-25	302.02	298.665							
PZ-26	290.56	287.182							
PZ-27	332.53	329.667							
PZ-28	342.09	338.811							
PZ-29	337.41	335.477							

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	5/15/2002	10/15/2002	4/28/2003	5/12/2003	6/2/2003	6/11/2003	6/12/2003
CDMW-1	300.42	297.84	268.12	266.77	266.59	254.5	264.47		
CDMW-2	276.71	273.89	267.81	271.51	267.86	266.47	267.76		
CDMW-3	268.17	265.73	252.47	255.99	252.96	239.27	250.72		
CDMW-4S	335.95	332.77	298.85			302.6	302.35		
CDMW-4D	336.07	333.07	298.37			299.92	300.02		
CDMW-5	273.102	270.28							
CDMW-6	338.69	335.67							
P-4	312.02								
PZ-6B	339.1	336.12	303.57			306.55	306.12		
PZ-7	293.61	290.44	281.81			281.05	282.06		
PZ-8	288.39	284.95	274.59						
PZ-9	327.91	324.63	306.56			308.59	308.01		
PZ-10	290.98	287.156							
PZ-11	336.96	334.041							
PZ-12	318	315.163							
PZ-13	307.23	304.293							
PZ-14	281.31	277.641							
PZ-15	338.42	335.462							
PZ-16	327.9	324.072							
PZ-17	315.49	311.552							
PZ-18	301.4	297.882							
PZ-19	248.13	245.118							
PZ-20	252.7	248.934							
PZ-21	268.27	264.55							
PZ-22	256	252.788							
PZ-23	293.86	290.056							
PZ-24	263.74	262.075							
PZ-25	302.02	298.665							
PZ-26	290.56	287.182							
PZ-27	332.53	329.667							
PZ-28	342.09	338.811							
PZ-29	337.41	335.477							

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	6/18/2003	9/15/2003	10/15/2003	12/8/2003	1/16/2004	2/9/2004	3/12/2004
CDMW-1	300.42	297.84		270.46	260.96	261.37	262.64	263.5	
CDMW-2	276.71	273.89		271.06	271.9	271.73	270.96	270.96	
CDMW-3	268.17	265.73		255.35	255.96	255.52	255.92	255.97	
CDMW-4S	335.95	332.77		302.53	301.85	300.34	299.76	299.74	
CDMW-4D	336.07	333.07		300.72	300.47	299.69	299.05	298.83	
CDMW-5	273.102	270.28							
CDMW-6	338.69	335.67							
P-4	312.02								
PZ-6B	339.1	336.12		305.97	305.39	304.01	303.5	303.57	303.3
PZ-7	293.61	290.44		280.92	280.76	280.31	280.35	280.41	280.71
PZ-8	288.39	284.95		280.14	280.03	277.96	277.61	277.24	
PZ-9	327.91	324.63		307.44	306.94	306.23	306.41	306.32	307.31
PZ-10	290.98	287.156							
PZ-11	336.96	334.041							
PZ-12	318	315.163							
PZ-13	307.23	304.293							
PZ-14	281.31	277.641							
PZ-15	338.42	335.462							
PZ-16	327.9	324.072							
PZ-17	315.49	311.552							
PZ-18	301.4	297.882							
PZ-19	248.13	245.118							
PZ-20	252.7	248.934							
PZ-21	268.27	264.55							
PZ-22	256	252.788							
PZ-23	293.86	290.056							
PZ-24	263.74	262.075							
PZ-25	302.02	298.665							
PZ-26	290.56	287.182							
PZ-27	332.53	329.667							
PZ-28	342.09	338.811							
PZ-29	337.41	335.477							

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	5/2/2005	10/25/2006	4/30/2007	8/1/2007	5/15/2008	6/17/2009	7/22/2009
CDMW-1	300.42	297.84	264.09						
CDMW-2	276.71	273.89	265.18	268.79	265.41	268.88	268.42	267.91	268.66
CDMW-3	268.17	265.73	251.24	253.45	250.96	252.95	252.22	252.22	252.6
CDMW-4S	335.95	332.77				328.20			
CDMW-4D	336.07	333.07				300.90			
CDMW-5	273.102	270.28			261.252		Locked	260.712	264.352
CDMW-6	338.69	335.67	303.73	304.15	304.69		Dry	304.02	303.59
P-4	312.02							303.52	302.72
PZ-6B	339.1	336.12				303.60			
PZ-7	293.61	290.44				281.26	282.39	281.03	280.4
PZ-8	288.39	284.95					destroyed	destroyed	destroyed
PZ-9	327.91	324.63					307.58	306.11	305.75
PZ-10	290.98	287.156						281.17	280.74
PZ-11	336.96	334.041						305.27	305.24
PZ-12	318	315.163						307.04	306.94
PZ-13	307.23	304.293						291.85	291.6
PZ-14	281.31	277.641						259.61	262.75
PZ-15	338.42	335.462						305.57	305.19
PZ-16	327.9	324.072						305.95	305.98
PZ-17	315.49	311.552						301.13	301.07
PZ-18	301.4	297.882						279.35	279.34
PZ-19	248.13	245.118						242.78	242.52
PZ-20	252.7	248.934						243.42	243.08
PZ-21	268.27	264.55						257.69	257.96
PZ-22	256	252.788						249.3	249.3
PZ-23	293.86	290.056						Dry	Dry
PZ-24	263.74	262.075						Dry	Dry
PZ-25	302.02	298.665						285.11	285.51
PZ-26	290.56	287.182						281.26	281.45
PZ-27	332.53	329.667						304.15	303.76
PZ-28	342.09	338.811						305.69	305.37
PZ-29	337.41	335.477						304.61	304.14

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	8/3/2009	10/8/2009	11/25/2009	1/4/2010	2/18/2010	3/10/2010	3/19/2010
CDMW-1	300.42	297.84							
CDMW-2	276.71	273.89	269.33	271.06	271.14		270.07		269.16
CDMW-3	268.17	265.73	253.09	255.05	254.33		255.57		254.66
CDMW-4S	335.95	332.77							
CDMW-4D	336.07	333.07							
CDMW-5	273.102	270.28	265.642	270.142	267.742		264.622		262.352
CDMW-6	338.69	335.67	303.44	303.57	302.94	301.34	304.47		305.16
P-4	312.02		302.84	302.19	303.08		304.88		304.55
PZ-6B	339.1	336.12							
PZ-7	293.61	290.44	280.96	279.93	281.76	281.87	282.55		282.24
PZ-8	288.39	284.95	destroyed	destroyed	destroyed	destroyed	destroyed		
PZ-9	327.91	324.63	305.99	305.69	305.93	306.67			308.1
PZ-10	290.98	287.156	281.07	280.61	281.83	283.62	284.28	283.63	283.79
PZ-11	336.96	334.041	305.21	305.25	305.19	305.2	305.9	306.14	306.15
PZ-12	318	315.163	307.06	306.88	307.2	307.52	307.92	307.61	307.67
PZ-13	307.23	304.293	292.28	291.02	292.1	293.82	294.53	294.17	294.14
PZ-14	281.31	277.641	263.21	265.5	267.58	268.58	268.01	267.20	266.83
PZ-15	338.42	335.462	305.3	304.92	303.71	Dry	306.08	306.52	306.53
PZ-16	327.9	324.072	306.15	305.65	306.75	306.48	307.63	307.13	307.18
PZ-17	315.49	311.552	301.09	301.04	301.33	302.31	304.04	303.74	303.75
PZ-18	301.4	297.882	279.53	279.74	279.33	280.94	281.65	280.95	280.98
PZ-19	248.13	245.118	242.81	241.86	243.75	243.98	244.41	244.15	244.12
PZ-20	252.7	248.934	243.33	242.88	244.58	245.4	246.4	245.7	245.62
PZ-21	268.27	264.55	258.66	259.46	259.49	260.11	259.66	259.07	258.9
PZ-22	256	252.788	249.64	249.19	250.38	250.66	251.34	251.49	251.25
PZ-23	293.86	290.056	Dry	Dry	Dry	Dry	284.71	Dry	dry
PZ-24	263.74	262.075	Dry	Dry	257.61	257.59	258.44	257.58	257.74
PZ-25	302.02	298.665	287.31	287.71	288.23	288.06	287.13	286.41	286.15
PZ-26	290.56	287.182	285.03	281.2	282.38	282.53	283.41	282.84	282.84
PZ-27	332.53	329.667	303.65	303.38	303.16	303.5	304.83	305.22	305.23
PZ-28	342.09	338.811	305.29	305.05	305.02	305.24	306.45	306.88	306.84
PZ-29	337.41	335.477	304.17	303.61	303.4	303.62	305.25	305.83	305.79

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	9/9/2010	2/7/2011	9/30/2011	12/16/2011	3/3/2012	7/11/2012	11/20/2012
CDMW-1	300.42	297.84							
CDMW-2	276.71	273.89	270.31	LOCKED	269.78	270.05	270.12	269.81	269.74
CDMW-3	268.17	265.73	254.01	254.55	253.98	254.24	254.78	254.14	255.12
CDMW-4S	335.95	332.77							
CDMW-4D	336.07	333.07							
CDMW-5	273.102	270.28	269.352	265.082	270.102	265.68	266.54	267.37	268.46
CDMW-6	338.69	335.67	303.18	302.36	302.89	300.22	302.54	303.21	302.94
P-4	312.02		302.27	302.32					
PZ-6B	339.1	336.12							
PZ-7	293.61	290.44	280.39	281.43	280.91	279.54	278.95	279.22	280.51
PZ-8	288.39	284.95							
PZ-9	327.91	324.63	305.51	305.26	304.85	302.73	303.68	304.21	305.42
PZ-10	290.98	287.156	279.78	280.49	280.28	277.056	281.18	280.43	282.60
PZ-11	336.96	334.041	305.16	Dry	DRY	DRY	Dry	Dry	305.40
PZ-12	318	315.163	306.85	306.82	307.05	304.263	306.9	306.59	307.40
PZ-13	307.23	304.293	289.83	289.13	290.16	287.593	289.93	290.13	292.60
PZ-14	281.31	277.641	263.51	267.39	264.56	263.991	267.81	265.68	266.92
PZ-15	338.42	335.462	304.84	Dry	305.17	302.112	304.72	304.67	305.99
PZ-16	327.9	324.072	305.65	305.2	306.3	302.322	306.1	305.46	306.55
PZ-17	315.49	311.552	301.01	301.09	301.14	297.252	301.29	300.92	302.66
PZ-18	301.4	297.882	278.23	277.1	279.35	274.982	277.9	278.09	279.98
PZ-19	248.13	245.118	239.68	243.75	242.75	240.468	243.63	242.40	243.35
PZ-20	252.7	248.934	241.45	245.01	243.3	240.174	244.6	243.36	244.93
PZ-21	268.27	264.55	257.38	255.93	258.87	255.1	257.07	257.21	258.51
PZ-22	256	252.788	247.7	250.61	250.3	246.388	250.3	249.42	250.51
PZ-23	293.86	290.056	Dry	Dry	DRY	DRY	Dry	Dry	Dry
PZ-24	263.74	262.075	Dry	Dry	256.84	DRY	Dry	257.50	Dry
PZ-25	302.02	298.665	287.24	285.3	288.32	283.815	285.02	285.97	286.72
PZ-26	290.56	287.182	280.81	281.91	282.06	278.362	282.06	281.34	282.39
PZ-27	332.53	329.667	303.38	302.83	303.23	300.487	301.93	302.85	304.17
PZ-28	342.09	338.811	305.11	304.79	304.54	301.311	304.69	304.55	305.89
PZ-29	337.41	335.477	303.62	302.81	302.96	301.377	302.91	303.24	304.48

Anderson Creek Landfill Facility
Groundwater Readings
Harnett County, NC

Well or Piezometer	T.O.C. Elevation	Ground Surface Elevation	2/21/2013
CDMW-1	300.42	297.84	
CDMW-2	276.71	273.89	269.21
CDMW-3	268.17	265.73	255.67
CDMW-4S	335.95	332.77	
CDMW-4D	336.07	333.07	
CDMW-5	273.102	270.28	264.002
CDMW-6	338.69	335.67	302.49
P-4	312.02		
PZ-6B	339.1	336.12	
PZ-7	293.61	290.44	281.51
PZ-8	288.39	284.95	
PZ-9	327.91	324.63	305.91
PZ-10	290.98	287.156	281.18
PZ-11	336.96	334.041	305.16
PZ-12	318	315.163	306.9
PZ-13	307.23	304.293	289.93
PZ-14	281.31	277.641	267.81
PZ-15	338.42	335.462	304.72
PZ-16	327.9	324.072	306.1
PZ-17	315.49	311.552	301.29
PZ-18	301.4	297.882	277.9
PZ-19	248.13	245.118	243.63
PZ-20	252.7	248.934	244.6
PZ-21	268.27	264.55	257.07
PZ-22	256	252.788	250.3
PZ-23	293.86	290.056	Dry
PZ-24	263.74	262.075	Dry
PZ-25	302.02	298.665	285.02
PZ-26	290.56	287.182	282.06
PZ-27	332.53	329.667	301.93
PZ-28	342.09	338.811	304.69
PZ-29	337.41	335.477	302.91

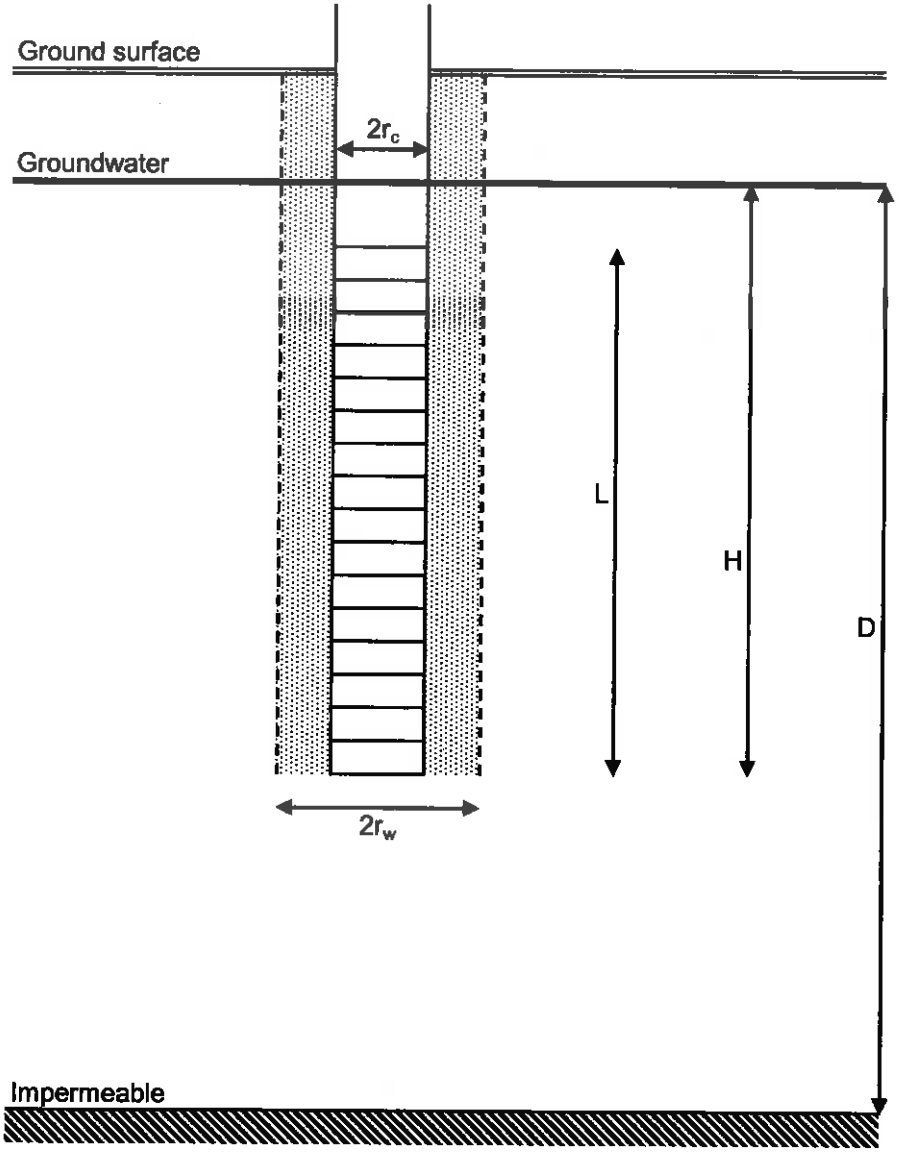
APPENDIX VI

SLUG TEST FOR NEW PIEZOMETERS

Anderson Creek MSW Landfill, Harnett County, North Carolina
Hydraulic Conductivity Summary
Based on Slug Out Tests
Bouwer and Rice Method (Water Resources Research, 1976)

Well or Piezometer	Hydraulic Conductivity (K)	
	(m/s)	(cm/s)
PZ-10	2.50E-07	2.50E-05
PZ-11	1.52E-08	1.52E-06
PZ-12	2.91E-06	2.91E-04
PZ-13	7.38E-06	7.38E-04
PZ-14	No test	0.00E+00
PZ-15	1.92E-05	1.92E-03
PZ-16	7.12E-07	7.12E-05
PZ-17	No test	0.00E+00
PZ-18	6.91E-07	6.91E-05
PZ-19	1.41E-08	1.41E-06
PZ-20	2.33E-07	2.33E-05
PZ-21	5.00E-08	5.00E-06
PZ-22	7.66E-05	7.66E-03
PZ-23	dry	dry
PZ-24	dry	dry
PZ-25	3.49E-06	3.49E-04
PZ-26	No test	0.00E+00
PZ-27	1.24E-06	1.24E-04
PZ-28	1.26E-06	1.26E-04
PZ-29	No test	0.00E+00

Diagram for Bouwer and Rice Inputs



L	Screen Length
H	Distance from static GW to bottom of well
D	Distance from static GW to bottom of aquifer
r_c	Inside radius of well casing
r_w	Radius of borehole

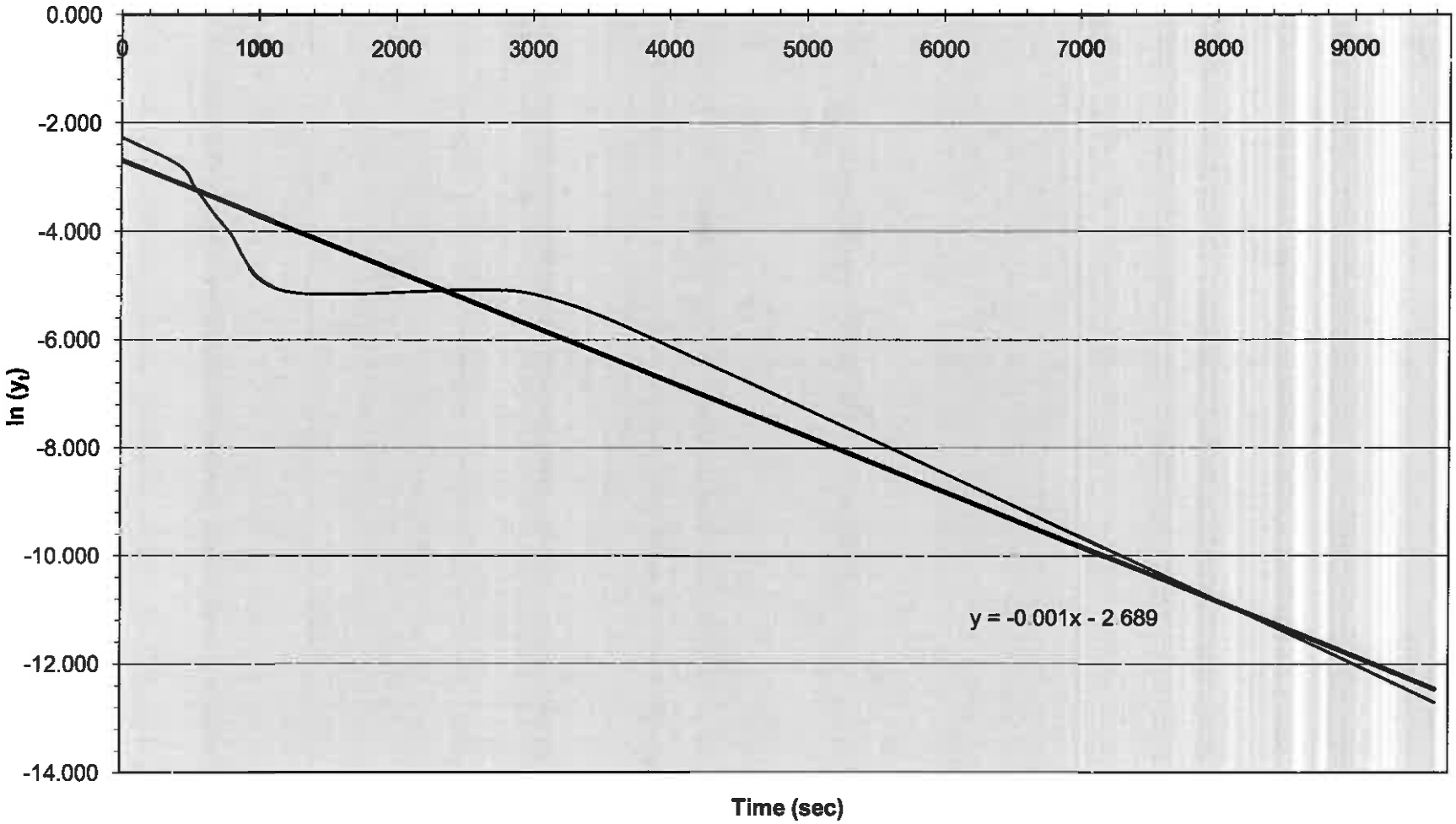
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ10

Static Water Level below TOC (ft): 7.09
Static Water Level below TOC (m): 2.16

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	7.43	2.26	0.10363	-2.267
420	7.29	2.22	0.06096	-2.798
540	7.22	2.20	0.03962	-3.228
780	7.15	2.18	0.01829	-4.002
1200	7.11	2.17	0.00610	-5.100
2880	7.11	2.17	0.00610	-5.100
3720	7.1	2.16	0.00305	-5.793
9600	7.09001	2.16	0.000003	-12.701

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ10



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ10 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y=\ln(y_t)$

$x=t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0010
$\ln(y_0)$	-2.6891

From slug test data

Max y_t	0.103632	m H_2O
Min y_t	0.000003	m H_2O
Static y	2.161032	m H_2O

			Feet	Meters
1	Distance from static water level to top of casing (TOC)		7.09	2.16
	Distance from bottom of well to TOC		15	4.57
2	Graph change in water level in natural log form [ln(yt)] vs. time			
3	Screen length (L)		10	3.05
	Distance from well center to filter pack (r_w) = 4.0 inches		0.333	0.101
	L/r_w =	30		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C			
	A =	2.5		
	B =	0.5		
	C =	2.2		
5	Inside radius of well casing (r_c) = 1 inch		0.083	0.025
	Porosity of sand pack (n)	n = 0.3		

Corrected r_c, referred to as cr_c, is not needed. All but one measurement was above top of screen

r_c =	0.083	0.025

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ10 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -1.00E-03 t -2.6891

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-2.6891	
y_0 =	0.07	(transformed out of ln form)
slope =	-1.00E-03	
ln ($y_{t=1000}$) =	-3.689	
$y_{t=1000}$ =	0.025	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 6.91 2.11
Distance from water table to bottom of casing (H) 7.91 2.41
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.378

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w] = 6.

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$

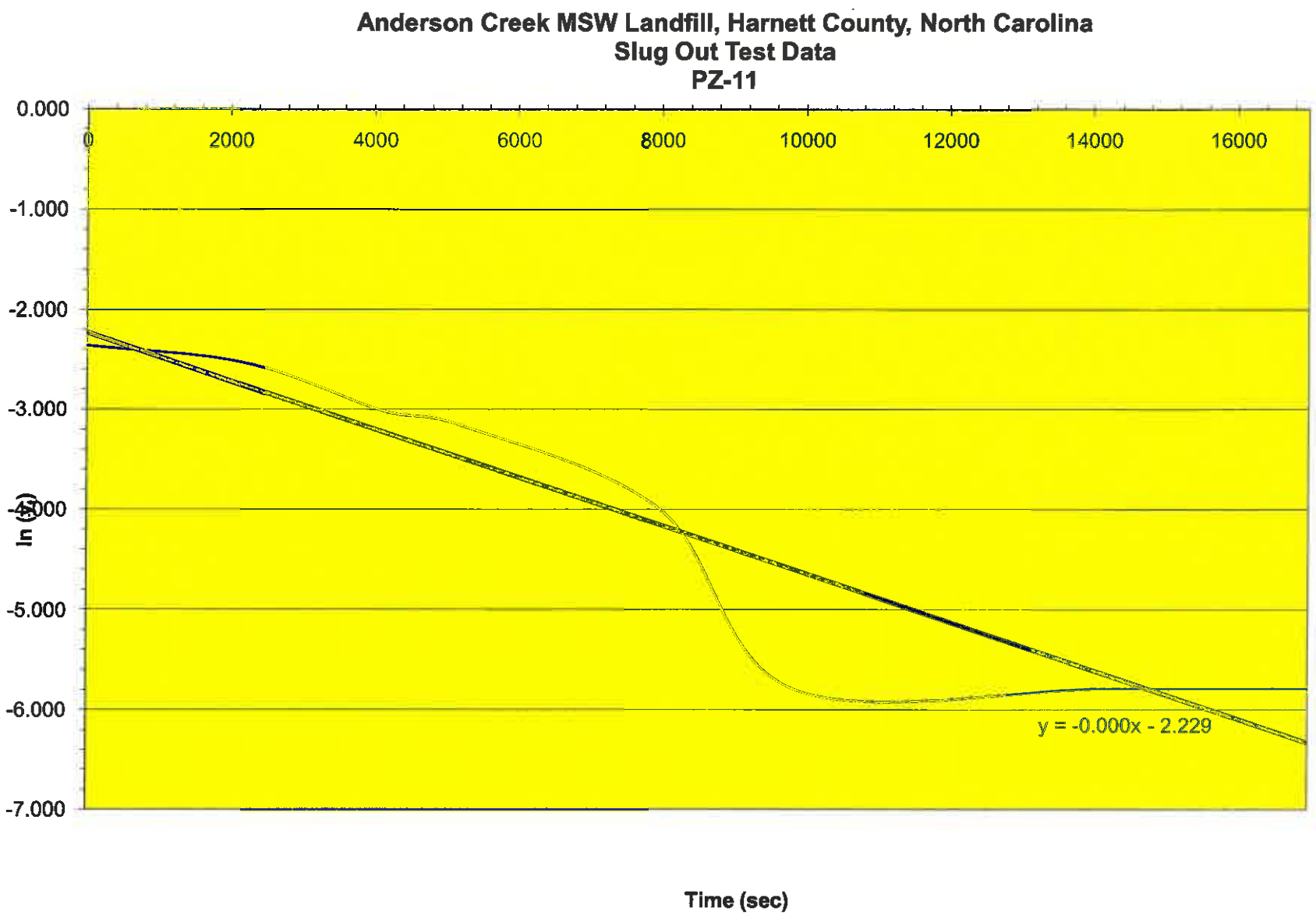
If D<=H then:	K =	2.497E-07	m/sec
	K =	2.497E-05	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ11

Static Water Level below TOC (ft): 28.7
Static Water Level below TOC (m): 8.74

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	29	8.84	0.0945	-2.359
2220	28.95	8.82	0.0792	-2.535
4140	28.85	8.79	0.0488	-3.021
5160	28.83	8.79	0.0427	-3.154
7980	28.75	8.76	0.0183	-4.002
9840	28.7	8.75	0.0030	-5.793
14160	28.7	8.75	0.0030	-5.793
17100	28.7	8.75	0.0030	-5.793

TOC = Top of Casing
y_t = distance from static water level to water level at time t


Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ-11
0.000
-1.000
-2.000
-3.000
-4.000
-5.000
-6.000
-7.000
0
2000
4000
6000
8000
10000
12000
14000
16000
ln (h)
y = -0.000x - 2.229
Time (sec)

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-11 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-2.00E-04
$\ln(y_0)$	-2.229

From slug test data

Max y_t	0.0945	m H_2O
Min y_t	0.0030	m H_2O
Static y	8.7447	m H_2O

			Feet	Meters
1	Distance from static water level to top of casing (TOC)		28.69	8.74
	Distance from bottom of well to TOC		29	8.84
2	Graph change in water level in natural log form [ln(yt)] vs. time			
3	Screen length (L)		5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches		0.333	0.101
		L/r_w = 15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C			
		A = 2		
		B = 0.25		
		C = 1.5		
5	Inside radius of well casing (r_c) = 1 inch		0.083	0.025
	Porosity of sand pack (n)	n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-11 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -2.00E-04 t -2.2292

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-2.2292	
y_0 =	0.11	(transformed out of ln form)
slope =	-2.00E-04	
ln ($y_{t=1000}$) =	-2.429	
$y_{t=1000}$ =	0.088	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 0.81 0.25
Distance from water table to bottom of casing (H) 0.31 0.09
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$$\ln (r_e/r_w) = [(1.1 / \ln (H/r_w)) + C / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = -0.065

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w] = 6.

$$\ln (r_e/r_w) = [(1.1 / \ln (H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = -0.066

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln (r_e/r_w)) / 2L] [1/t] [\ln (y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	1.521E-08	m/sec
	K =	1.521E-06	cm/sec
If D>H then:	**K =**	**1.525E-08**	**m/sec**
	K =	**1.525E-06**	**cm/sec**

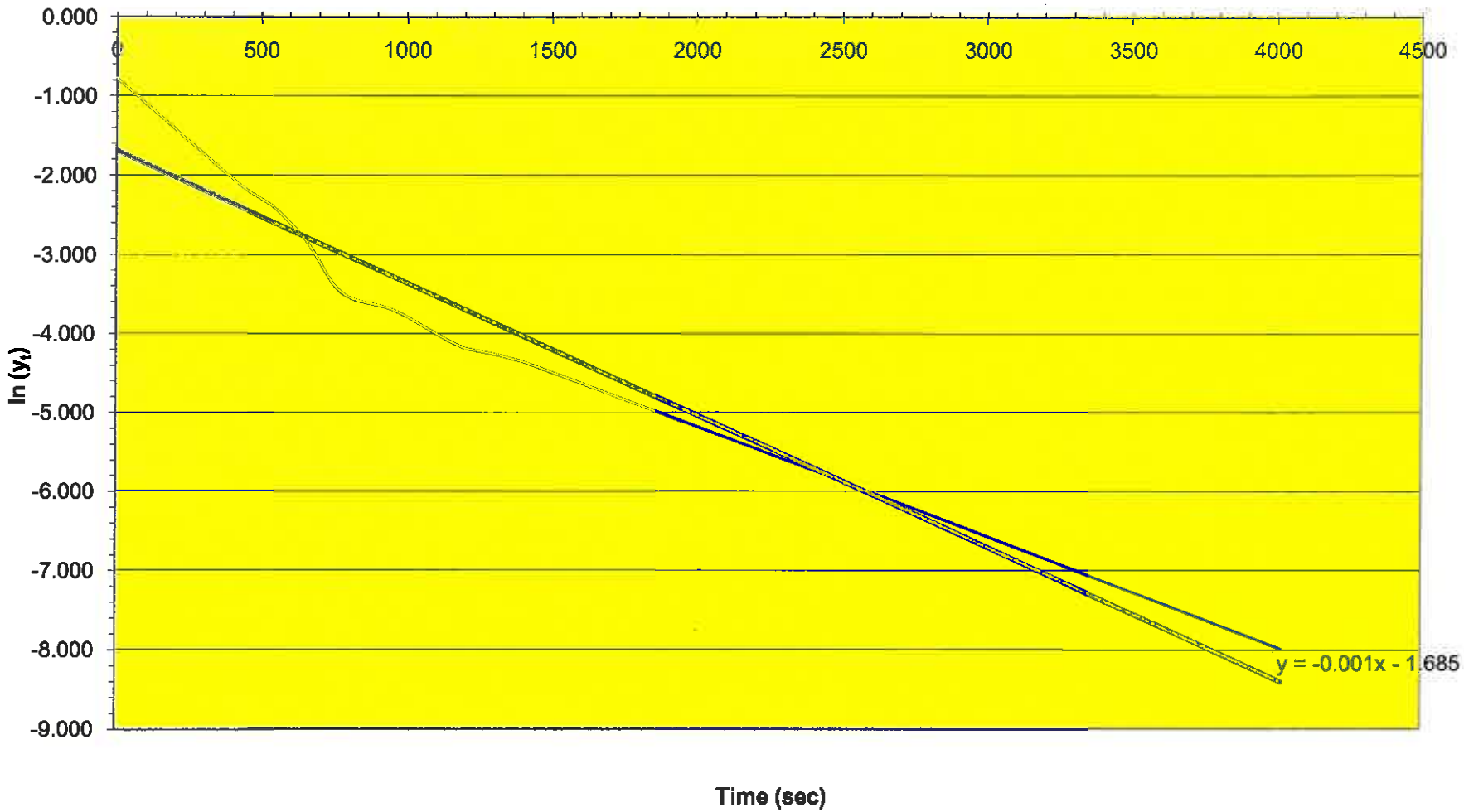
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ12

Static Water Level below TOC (ft): 8.15
Static Water Level below TOC (m): 2.48

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	9.65	2.94	0.46	-0.783
420	8.55	2.61	0.12	-2.104
540	8.45	2.58	0.09	-2.392
660	8.34	2.54	0.06	-2.849
780	8.25	2.51	0.03	-3.491
960	8.23	2.51	0.02	-3.714
1200	8.2	2.50	0.02	-4.184
1440	8.19	2.50	0.01	-4.407
4020	8.15	2.48	0.00	-7.990

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ12



Hydraulic Conductivity Calculations Based on a Slug Test
Dunn-Erwin MSW Landfill, Harnett County, North Carolina
MW13 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y=\ln(y_t)$

$x=t$

From equation of trendline

$\Delta Y/\Delta X$	-1.7E-03
$\ln(y_0)$	-1.6855

From slug test data

Max y_t	0.46	m H_2O
Min y_t	0.00034	m H_2O
Static y	2.48	m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	8.15	2.48
	Distance from bottom of well to TOC	15	4.57
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	7	2.13
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 21		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2.2		
	B = 0.3		
	C = 1.8		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Dunn-Erwin MSW Landfill, Harnett County, North Carolina
MW13 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t) =$ -1.70E-03 t + -1.6855

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-1.6855	
y_0 =	0.19	(transformed out of ln form)
slope =	-1.70E-03	
ln ($y_{t=1000}$) =	-3.386	
$y_{t=1000}$ =	0.034	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 7.85 2.39
Distance from water table to bottom of casing (H) 6.85 2.09
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.225

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w)] = 6.

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.066

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	3.137E-06	m/sec
	K =	3.137E-04	cm/sec
If D>H then:	**K =**	**2.912E-06**	**m/sec**
	K =	**2.912E-04**	**cm/sec**

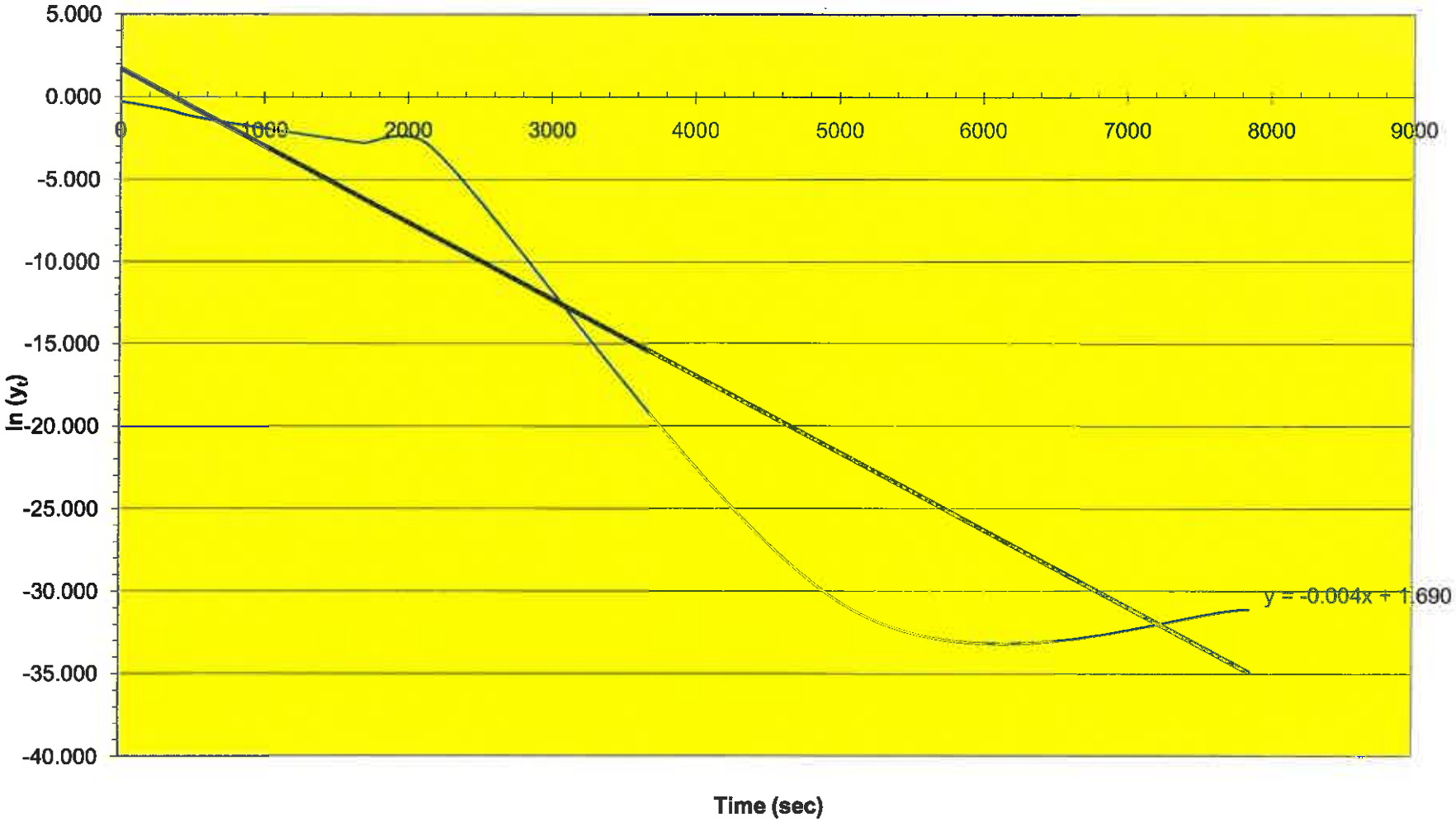
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ13

Static Water Level below TOC (ft): 11.95
Static Water Level below TOC (m): 3.64

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	14.40	4.39	0.75	-0.292
300	13.50	4.11	0.47	-0.750
480	12.99	3.96	0.32	-1.149
780	12.60	3.84	0.20	-1.619
1680	12.15	3.70	0.06	-2.798
2160	12.10	3.69	0.05	-3.085
5100	11.95	3.642	0.00	-31.131
7860	11.95	3.642	0.00	-31.131

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ13



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ13 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y=\ln(y_t)$

$x=t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0047
$\ln(y_0)$	1.6901

From slug test data

Max y_t	0.75 m H_2O
Min y_t	0.00 m H_2O
Static y	3.64 m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	11.95	3.64
	Distance from bottom of well to TOC	25	7.62
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	10	3.05
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 30		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2.5		
	B = 0.75		
	C = 2.1		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ13 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -4.70E-03 t + 1.6901

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	1.6901	
y_0 =	5.42	(transformed out of ln form)
slope =	-4.70E-03	
ln ($y_{t=1000}$) =	-3.010	
$y_{t=1000}$ =	0.049	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 13.05 3.98
Distance from water table to bottom of casing (H) 13.05 3.98
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.704

If D > H (Impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w] = 6.

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	7.378E-06	m/sec
	K =	7.378E-04	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

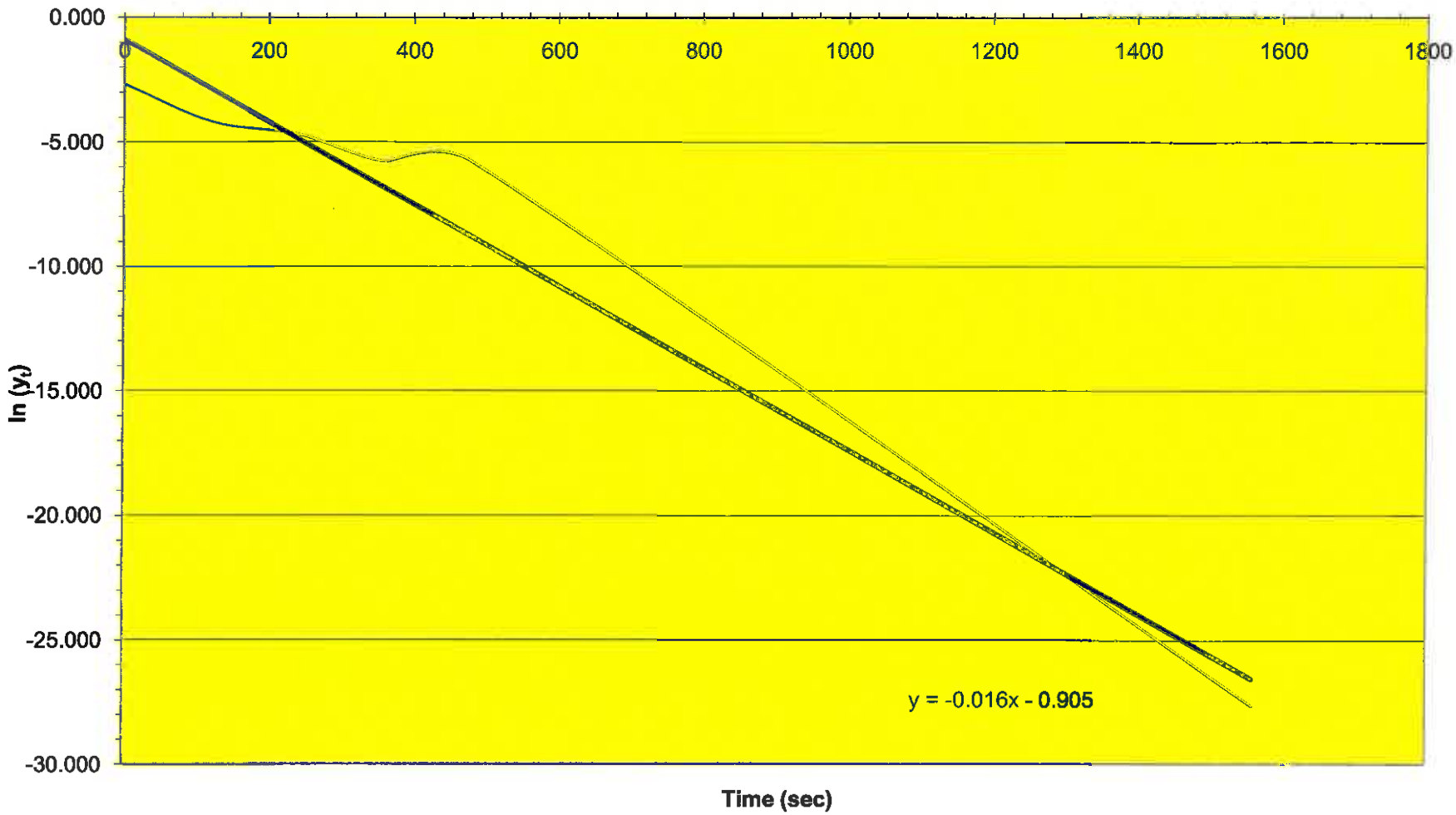
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ15

Static Water Level below TOC (ft): 29.77
Static Water Level below TOC (m): 9.07

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	29.99	9.14	0.07	-2.702
120	29.82	9.09	0.02	-4.184
240	29.80	9.08	0.01	-4.695
360	29.78	9.08	0.003	-5.793
480	29.78	9.08	0.003	-5.793
1560	29.77	9.07	0.000000	-27.631

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ15



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ15 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0164
$\ln(y_0)$	-0.9057

From slug test data

Max y_t	0.07 m H_2O
Min y_t	0.00 m H_2O
Static y	9.07 m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	29.77	9.07
	Distance from bottom of well to TOC	31	9.45
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2		
	B = 0.25		
	C = 1.5		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ15 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -1.64E-02 t -0.9057

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-0.9057	
y_0 =	0.40	(transformed out of ln form)
slope =	-1.64E-02	
ln ($y_{t=1000}$) =	-17.306	
$y_{t=1000}$ =	0.000	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 2.23 0.68
Distance from water table to bottom of casing (H) 1.23 0.37
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

ln (r_e/r_w) = $[(1.1 / \ln (H/r_w)) + C / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 1.062

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w)] = 6.

ln (r_e/r_w) = $[(1.1 / \ln (H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 1.007

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$K = [r_c^2 (\ln (r_e/r_w)) / 2L] [1/t] [\ln (y_0/y_t)]$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	**K =**	**2.022E-05**	**m/sec**
	K =	**2.022E-03**	**cm/sec**
If D>H then:	K =	1.917E-05	m/sec
	K =	1.917E-03	cm/sec

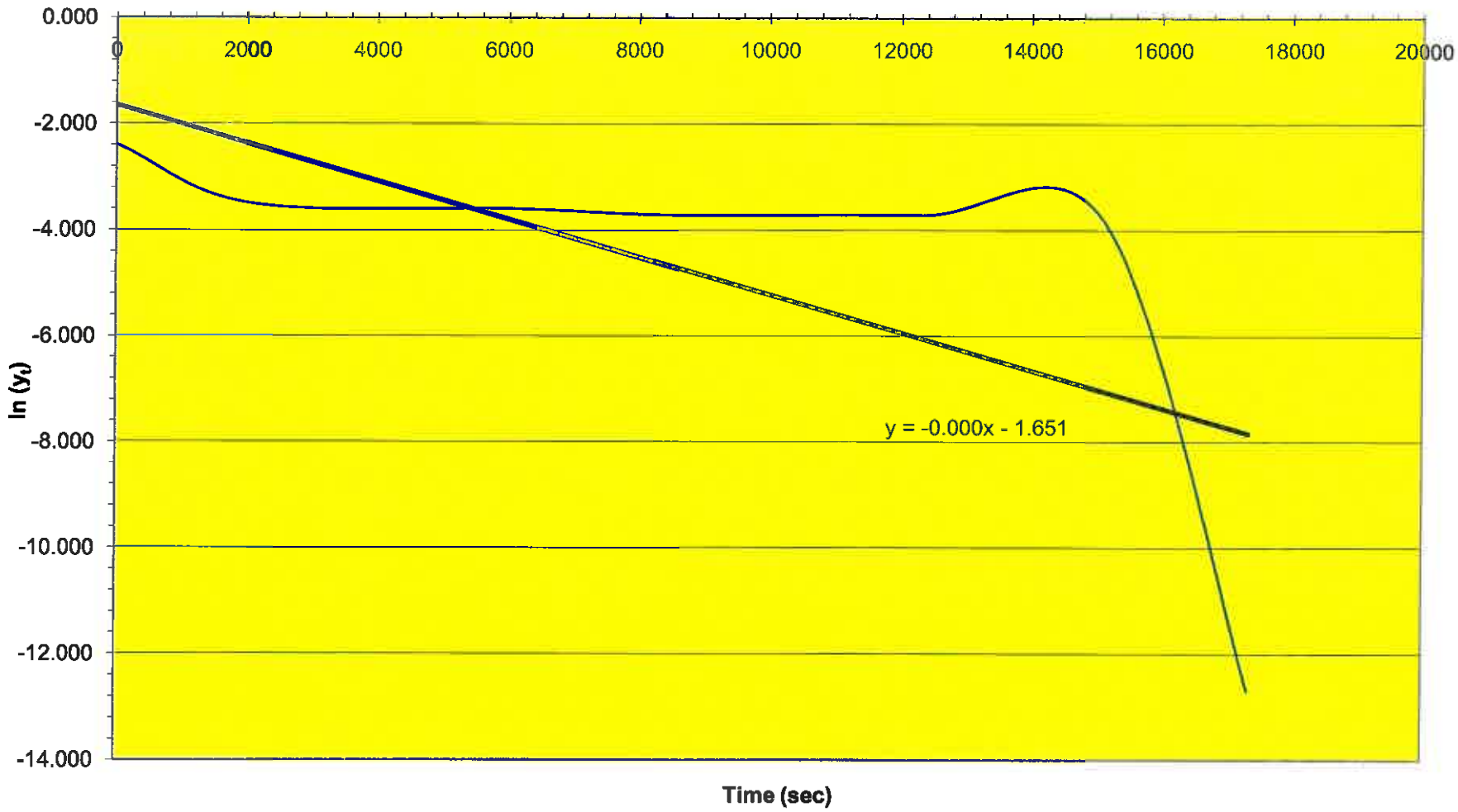
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ16

Static Water Level below TOC (ft): 18
Static Water Level below TOC (m): 5.49

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	18.3	5.58	0.09	-2.392
2040	18.1	5.52	0.03	-3.491
6060	18.09	5.51	0.03	-3.596
8460	18.08	5.511	0.02	-3.714
12300	18.08	5.511	0.024	-3.714
15120	18.07	5.508	0.021	-3.847
17340	18.00001	5.49	0.000003	-12.701

TOC = Top of Casing
y_t = distance from static water level to water level at time t

anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ16



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ16 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0004
$\ln(y_0)$	-1.652

From slug test data

Max y_t	0.09 m H_2O
Min y_t	0.000003 m H_2O
Static y	5.49 m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	18.00	5.49
	Distance from bottom of well to TOC	21	6.40
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2		
	B = 0.25		
	C = 1.5		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ16 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -4.00E-04 t -1.6516

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-1.6516	
y_0 =	0.19	(transformed out of ln form)
slope =	-4.00E-04	
ln ($y_{t=1000}$) =	-2.052	
$y_{t=1000}$ =	0.129	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 4.00 1.22
Distance from water table to bottom of casing (H) 3.00 0.91
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

ln (r_e/r_w) = $[(1.1 / \ln (H/r_w)) + C / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 1.666

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for $\ln[(D-H)/r_w] = 6$.

ln (r_e/r_w) = $[(1.1 / \ln (H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 1.534

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln (r_e/r_w)) / 2L] [1/t] [\ln (y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	**K =**	**7.736E-07**	**m/sec**
	K =	**7.736E-05**	**cm/sec**
If D>H then:	K =	7.123E-07	m/sec
	K =	7.123E-05	cm/sec

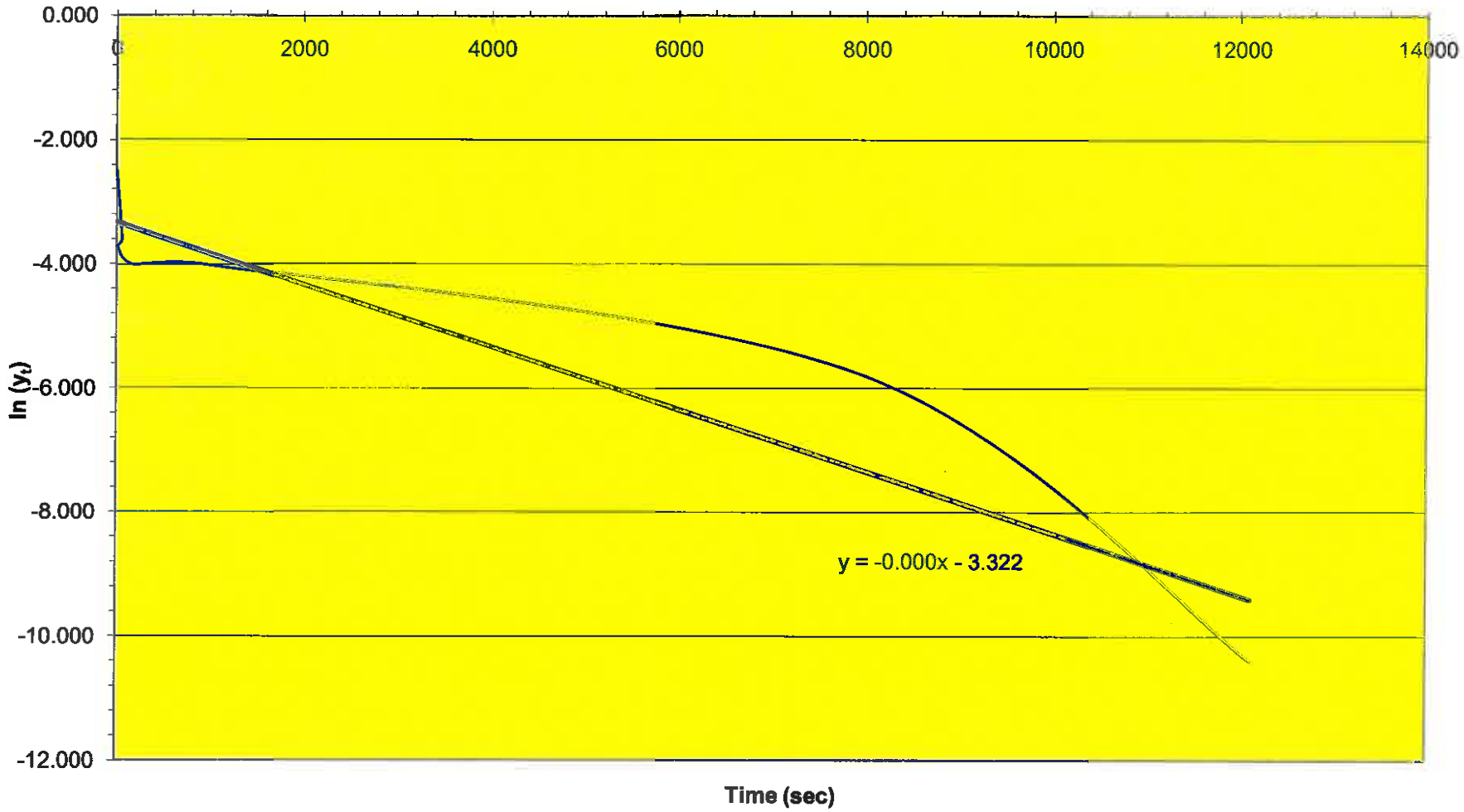
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ18

Static Water Level below TOC (ft): 18.51
Static Water Level below TOC (m): 5.64

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	18.79	5.73	0.09	-2.461
60	18.6	5.67	0.03	-3.596
12	18.59	5.67	0.02	-3.714
180	18.57	5.66	0.02	-4.002
960	18.57	5.66	0.02	-4.002
7980	18.52	5.645	0.003	-5.793
12120	18.5101	5.642	0.00003	-10.398

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ18



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ18 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0005
$\ln(y_0)$	-3.3227

From slug test data

Max y_t	0.085	m H_2O
Min y_t	0.00003	m H_2O
Static y	5.64	m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	18.51	5.64
	Distance from bottom of well to TOC	26	7.92
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	10	3.05
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101

L/r_w = 30

4 Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C

A =	2.4
B =	0.5
C =	2

5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ18 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -5.00E-04 t -3.3227

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-3.3227	
y_0 =	0.04	(transformed out of ln form)
slope =	-0.0005	
ln ($y_{t=1000}$) =	-3.823	
$y_{t=1000}$ =	0.022	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 6.49 1.98
Distance from water table to bottom of casing (H) 7.49 2.28
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.381

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w)] = 6.

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	6.911E-07	m/sec
	K =	6.911E-05	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ19

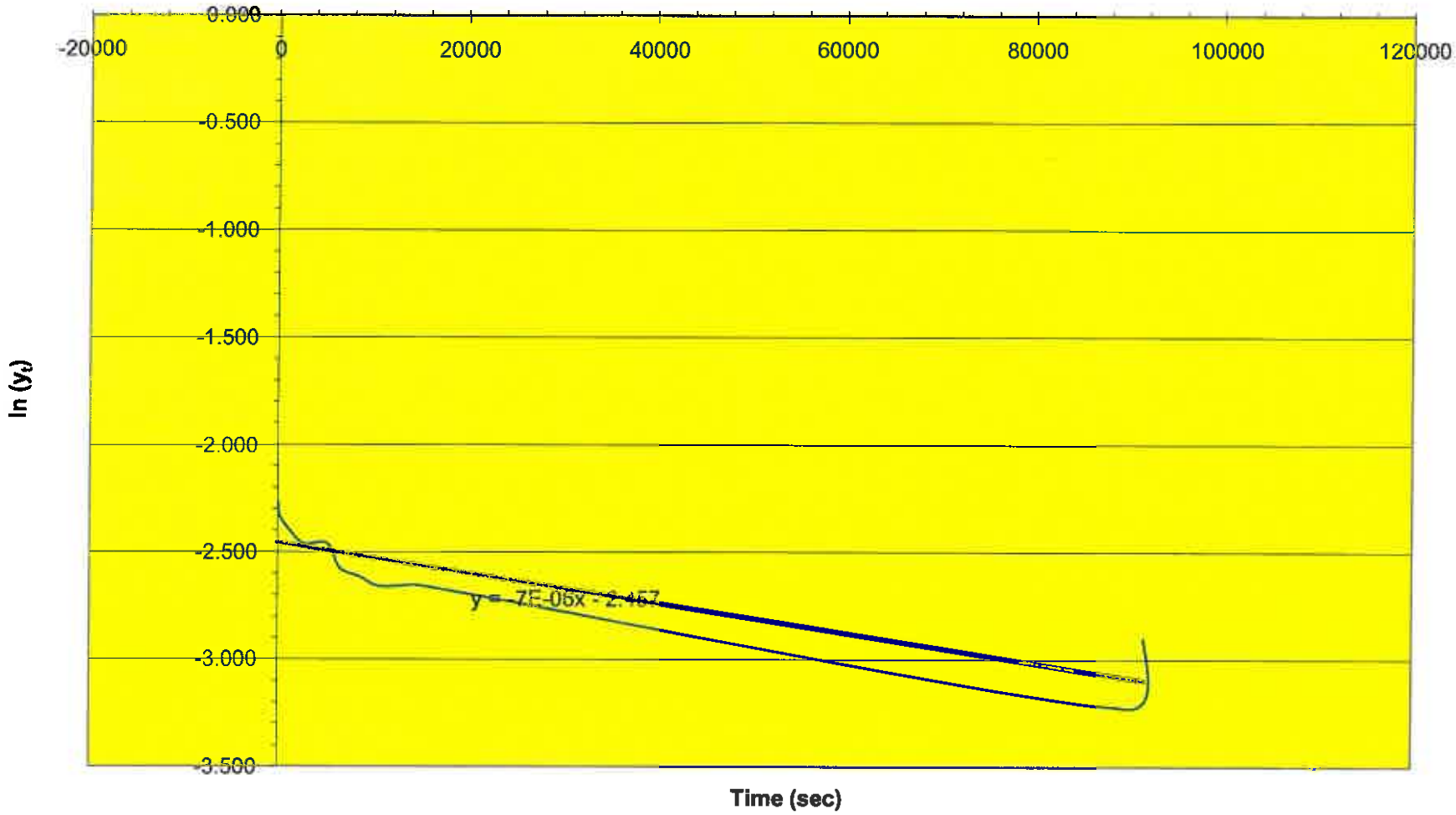
Static Water Level below TOC (ft): 2.57
Static Water Level below TOC (m): 0.78

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	2.91	0.89	0.10	-2.267
120	2.89	0.88	0.10	-2.328
1080	2.87	0.87	0.09	-2.392
2700	2.85	0.87	0.09	-2.461
5220	2.85	0.87	0.09	-2.461
6540	2.82	0.86	0.08	-2.574
8640	2.81	0.86	0.07	-2.615
10500	2.8	0.85	0.07	-2.658
13020	2.8	0.85	0.07	-2.658
15300	2.8	0.85	0.07	-2.658
90000	2.7	0.82	0.04	-3.228
91620	2.75	0.84	0.05	-2.903
93360	2.7	0.82	0.04	-3.228

0	0
2	120
18	1080
45	2700
87	5220
109	6540
144	8640
175	10500
217	13020
255	15300
1500	90000
1527	91620
1556	93360

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ19



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ19 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.000007
$\ln(y_0)$	-2.4576

From slug test data

Max y_t	0.104 m H_2O
Min y_t	0.04 m H_2O
Static y	0.78 m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	2.57	0.78
	Distance from bottom of well to TOC	7	2.13
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2		
	B = 0.25		
	C = 1.5		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ19 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t) = -7.00E-06\ t \quad -2.4576$

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-2.4576	
y_0 =	0.09	(transformed out of ln form)
slope =	0.0000	
ln ($y_{t=1000}$) =	-2.465	
$y_{t=1000}$ =	0.085	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 5.43 1.66
Distance from water table to bottom of casing (H) 4.43 1.35
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 1.905

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w)] = 6.

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 1.734

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	1.548E-08 m/sec
	K =	1.548E-06 cm/sec
If D>H then:	**K =**	**1.410E-08 m/sec**
	K =	**1.410E-06 cm/sec**

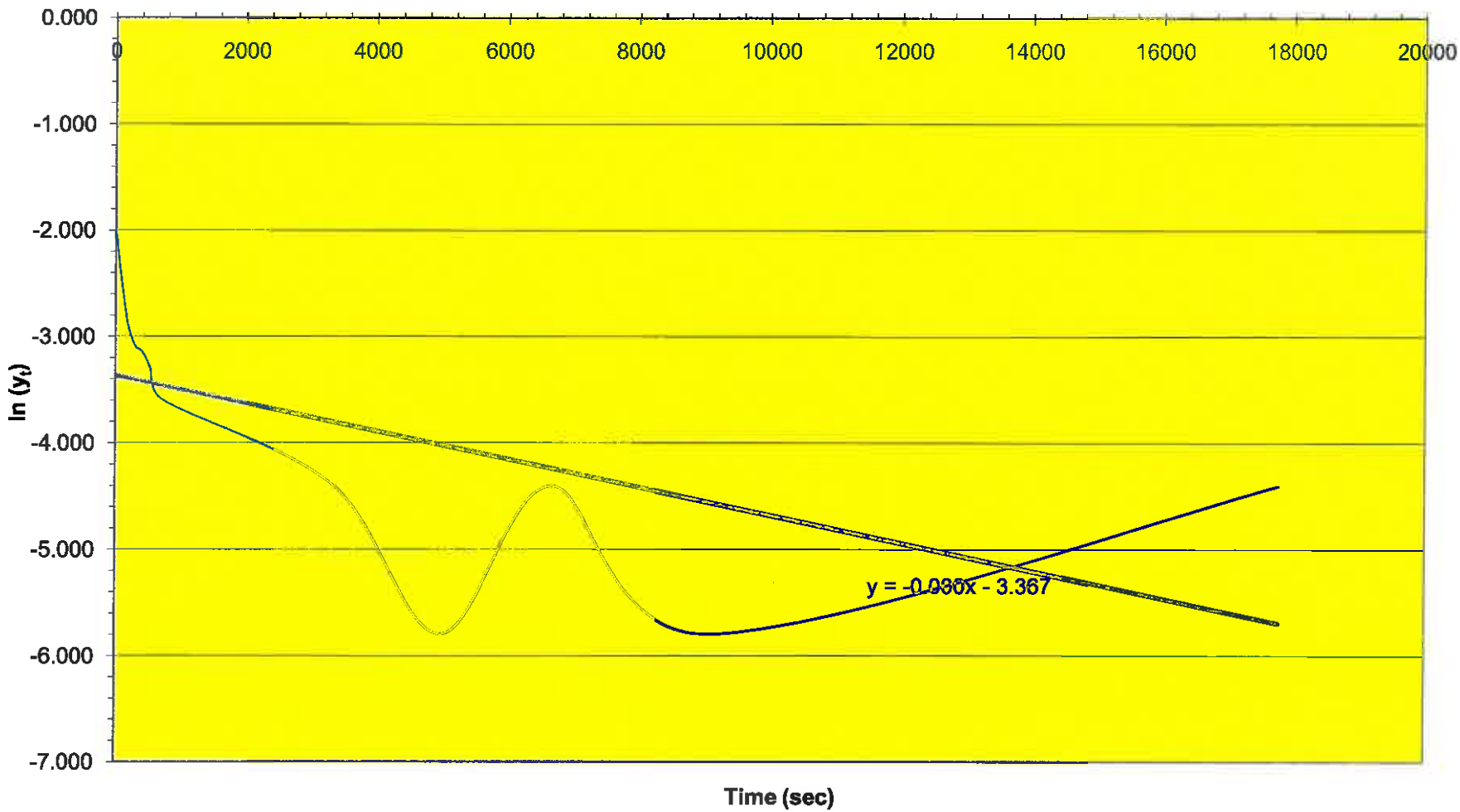
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ20

Static Water Level below TOC (ft): 5.76
Static Water Level below TOC (m): 1.76

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	6.2	1.89	0.13	-2.009
180	5.95	1.81	0.06	-2.849
300	5.91	1.80	0.05	-3.085
420	5.9	1.80	0.04	-3.154
540	5.88	1.79	0.04	-3.308
720	5.85	1.78	0.03	-3.596
3360	5.8	1.77	0.01	-4.407
4980	5.77	1.76	0.00	-5.793
6660	5.8	1.77	0.01	-4.407
9060	5.77	1.76	0.00	-5.793
17760	5.8	1.77	0.01	-4.407

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ20



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ20 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y=\ln(y_t)$

$x=t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0001
$\ln(y_0)$	-3.3677

From slug test data

Max y_t	0.134	m H_2O
Min y_t	0.00	m H_2O
Static y	1.76	m H_2O

			Feet	Meters
1	Distance from static water level to top of casing (TOC)		5.76	1.76
	Distance from bottom of well to TOC		11	3.35
2	Graph change in water level in natural log form [ln(yt)] vs. time			
3	Screen length (L)		5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches		0.333	0.101
	L/r_w =	15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C			
	A =	2		
	B =	0.25		
	C =	1.5		
5	Inside radius of well casing (r_c) = 1 inch		0.083	0.025
	Porosity of sand pack (n) n =	0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ20 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -1.00E-04 t -3.3677

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-3.3677	
y_0 =	0.03	(transformed out of ln form)
slope =	-0.0001	
ln ($y_{t=1000}$) =	-3.468	
$y_{t=1000}$ =	0.031	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 5.15 1.57
Distance from water table to bottom of casing (H) 5.24 1.60
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.004

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w)] = 6.

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	2.326E-07	m/sec
	K =	2.326E-05	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

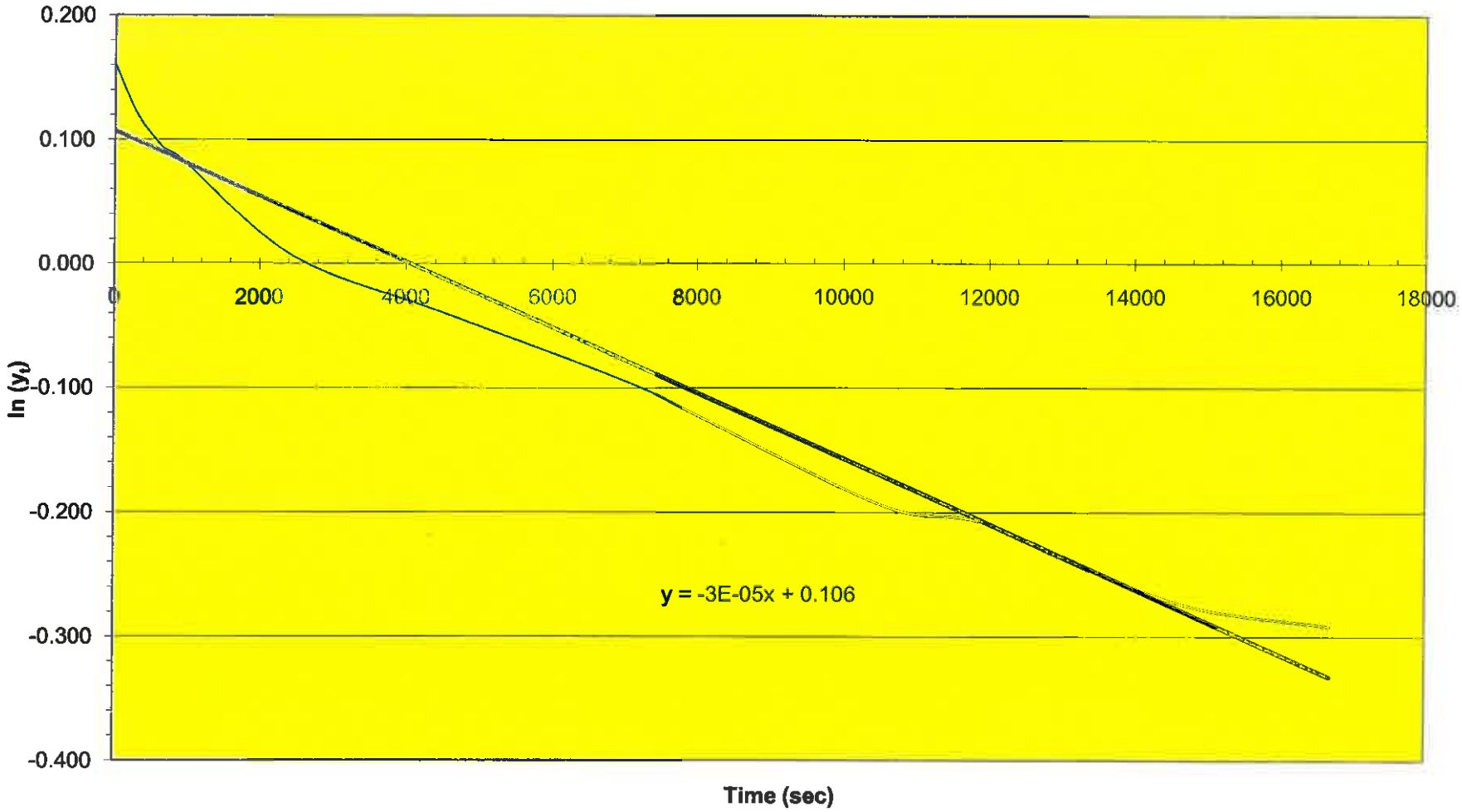
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ-21

Static Water Level below TOC (ft): 9.5
Static Water Level below TOC (m): 2.90

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	13.35	4.07	1.17	0.160
300	13.2	4.02	1.13	0.120
660	13.1	3.99	1.10	0.093
900	13.07	3.98	1.09	0.084
2460	12.8	3.90	1.01	0.006
4560	12.65	3.86	0.96	-0.041
7080	12.48	3.80	0.91	-0.096
8040	12.4	3.78	0.88	-0.123
10560	12.2	3.72	0.82	-0.195
12000	12.16	3.71	0.81	-0.210
14520	12	3.66	0.76	-0.272
16680	11.95	3.64	0.75	-0.292
18120	11.84	3.61	0.71	-0.338
20100	11.75	3.58	0.69	-0.377
21780	11.68	3.56	0.66	-0.409
91500	9.501	2.90	0.00	-8.096
93060	9.501	2.90	0.00	-8.096
94800	9.501	2.90	0.00	-8.096

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ-21



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-21 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.00003
$\ln(y_0)$	0.1069

From slug test data

Max y_t	1.173	m H_2O
Min y_t	0.0003	m H_2O
Static y	2.90	m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	9.50	2.90
	Distance from bottom of well to TOC	26	7.92
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	10	3.05
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101

L/r_w = 30

4 Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C

A =	2.4
B =	0.5
C =	2

5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-21 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -3.00E-05 t 0.1069

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	0.1069	
y_0 =	1.11	(transformed out of ln form)
slope =	0.0000	
ln ($y_{t=1000}$) =	0.077	
$y_{t=1000}$ =	1.080	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 15.50 4.72
Distance from water table to bottom of casing (H) 16.50 5.03
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.870

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w] = 6.

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	4.998E-08	m/sec
	K =	4.998E-06	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

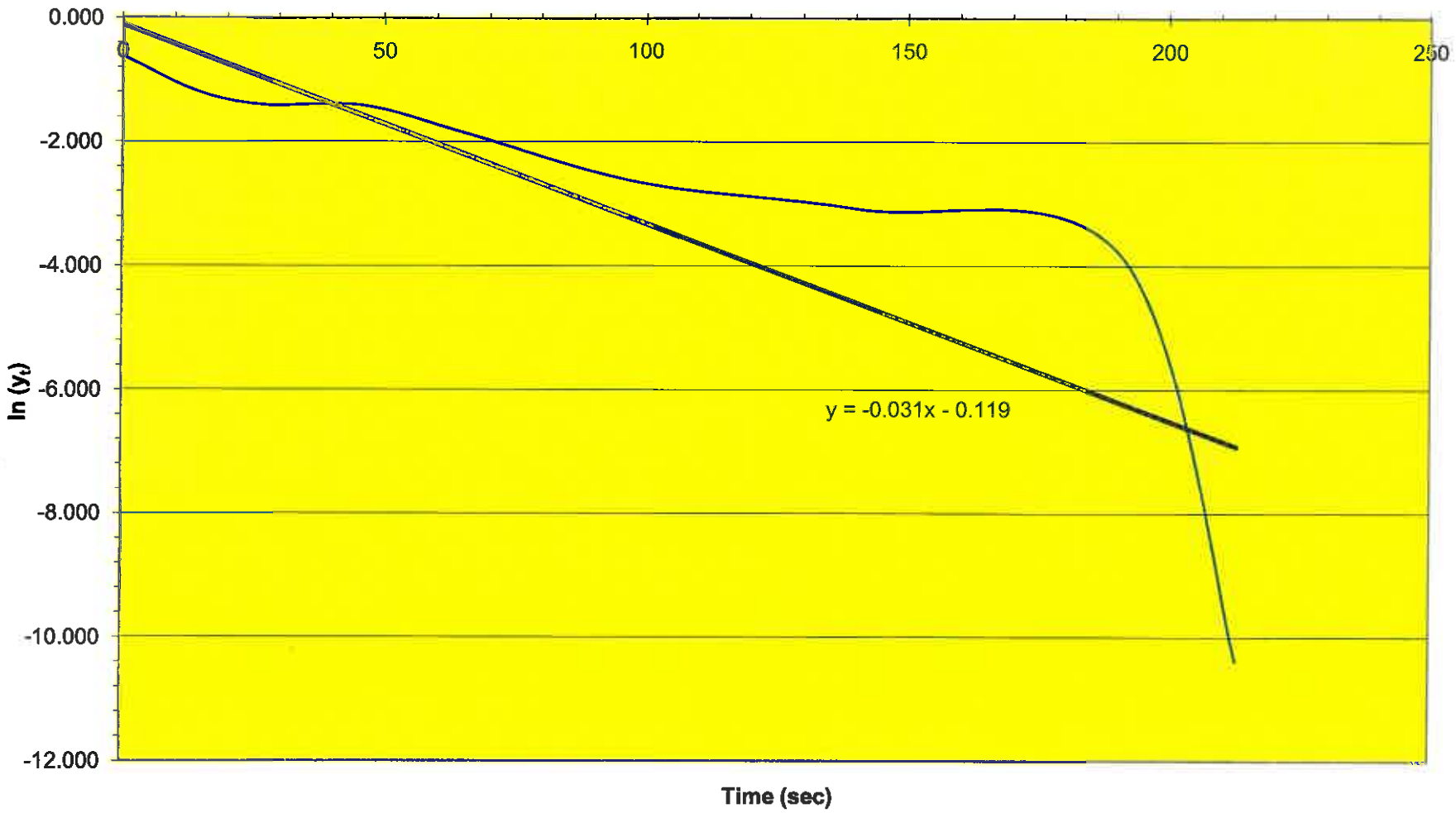
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ-22

Static Water Level below TOC (ft): 3.1499
Static Water Level below TOC (m): 0.96

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	4.9	1.49	0.53	-0.628
14	4.15	1.26	0.30	-1.188
27	3.95	1.20	0.24	-1.411
46	3.94	1.20	0.24	-1.424
66	3.65	1.11	0.15	-1.881
99	3.38	1.03	0.07	-2.657
141	3.3	1.01	0.05	-3.085
191	3.22	0.98	0.02	-3.846
213	3.15	0.96	0.00003	-10.398

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ-22



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-22 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0319
$\ln(y_0)$	-0.1196

From slug test data

Max y_t	0.533	m H_2O
Min y_t	0.00003	m H_2O
Static y	0.96	m H_2O

			Feet	Meters
1	Distance from static water level to top of casing (TOC)		3.15	0.96
	Distance from bottom of well to TOC		9	2.74
2	Graph change in water level in natural log form [ln(yt)] vs. time			
3	Screen length (L)		5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches		0.333	0.101
	L/r_w =	15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C			
	A =	2		
	B =	0.25		
	C =	1.5		
5	Inside radius of well casing (r_c) = 1 inch		0.083	0.025
	Porosity of sand pack (n) n =	0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-22 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -3.19E-02 t -0.1196

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-0.1196	
y_0 =	0.89	(transformed out of ln form)
slope =	-0.0319	
ln ($y_{t=1000}$) =	-32.020	
$y_{t=1000}$ =	0.000	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 5.85 1.78
Distance from water table to bottom of casing (H) 5.85 1.78
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.067

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w)] = 6.

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	7.656E-05	m/sec
	K =	7.656E-03	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

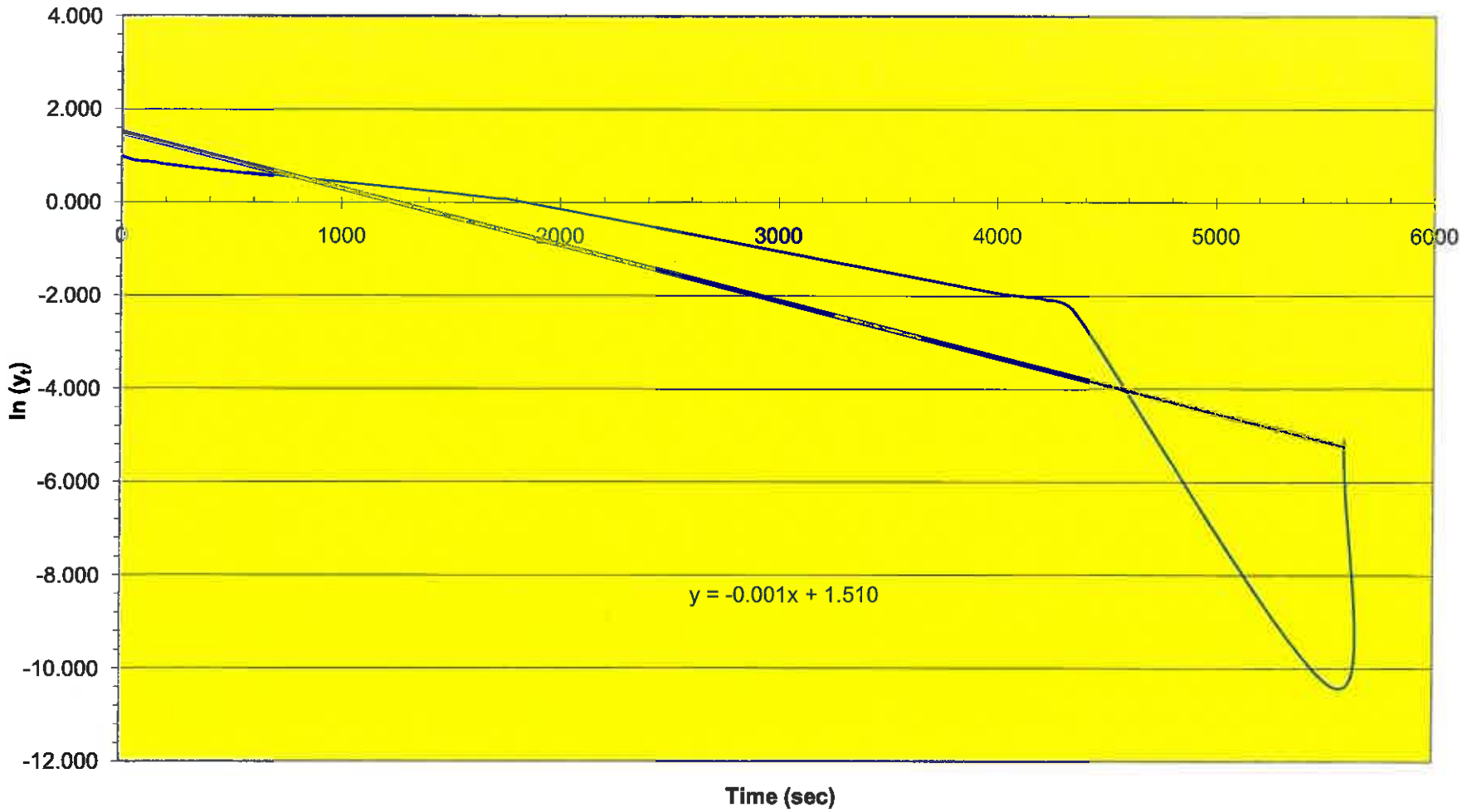
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ-25

Static Water Level below TOC (ft): 14.88
Static Water Level below TOC (m): 4.54

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	23.8	7.25	2.72	1.000
46	23.22	7.08	2.54	0.933
81	22.98	7.00	2.47	0.904
151	22.75	6.93	2.40	0.875
176	22.52	6.86	2.33	0.845
253	22.17	6.76	2.22	0.798
306	21.95	6.69	2.15	0.768
326	21.87	6.67	2.13	0.756
1480	18.92	5.77	1.23	0.208
1553	18.77	5.72	1.19	0.170
1680	18.51	5.64	1.11	0.101
1716	18.44	5.62	1.09	0.082
1754	18.42	5.61	1.08	0.076
3982	15.36	4.68	0.15	-1.922
4126	15.32	4.67	0.13	-2.009
4224	15.29	4.66	0.12	-2.080
4349	15.2	4.63	0.10	-2.328
5545	14.8801	4.54	0.00003	-10.398
5594	14.9	4.54	0.01	-5.100
5627	14.9	4.54	0.01	-5.100

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ-25



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-25 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0012
$\ln(y_0)$	1.5104

From slug test data

Max y_t	2.719	m H_2O
Min y_t	0.00003	m H_2O
Static y	4.54	m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	14.88	4.54
	Distance from bottom of well to TOC	28	8.53
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2		
	B = 0.25		
	C = 1.5		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-25 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -1.20E-03 t 1.5104

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	1.5104	
y_0 =	4.53	(transformed out of ln form)
slope =	-0.0012	
ln ($y_{t=1000}$) =	0.310	
$y_{t=1000}$ =	1.364	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 13.12 4.00
Distance from water table to bottom of casing (H) 13.12 4.00
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$$\ln (r_e/r_w) = [(1.1 / \ln (H/r_w)) + C / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.504

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w] = 6.

$$\ln (r_e/r_w) = [(1.1 / \ln (H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln (r_e/r_w)) / 2L] [1/t] [\ln (y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	3.489E-06	m/sec
	K =	3.489E-04	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

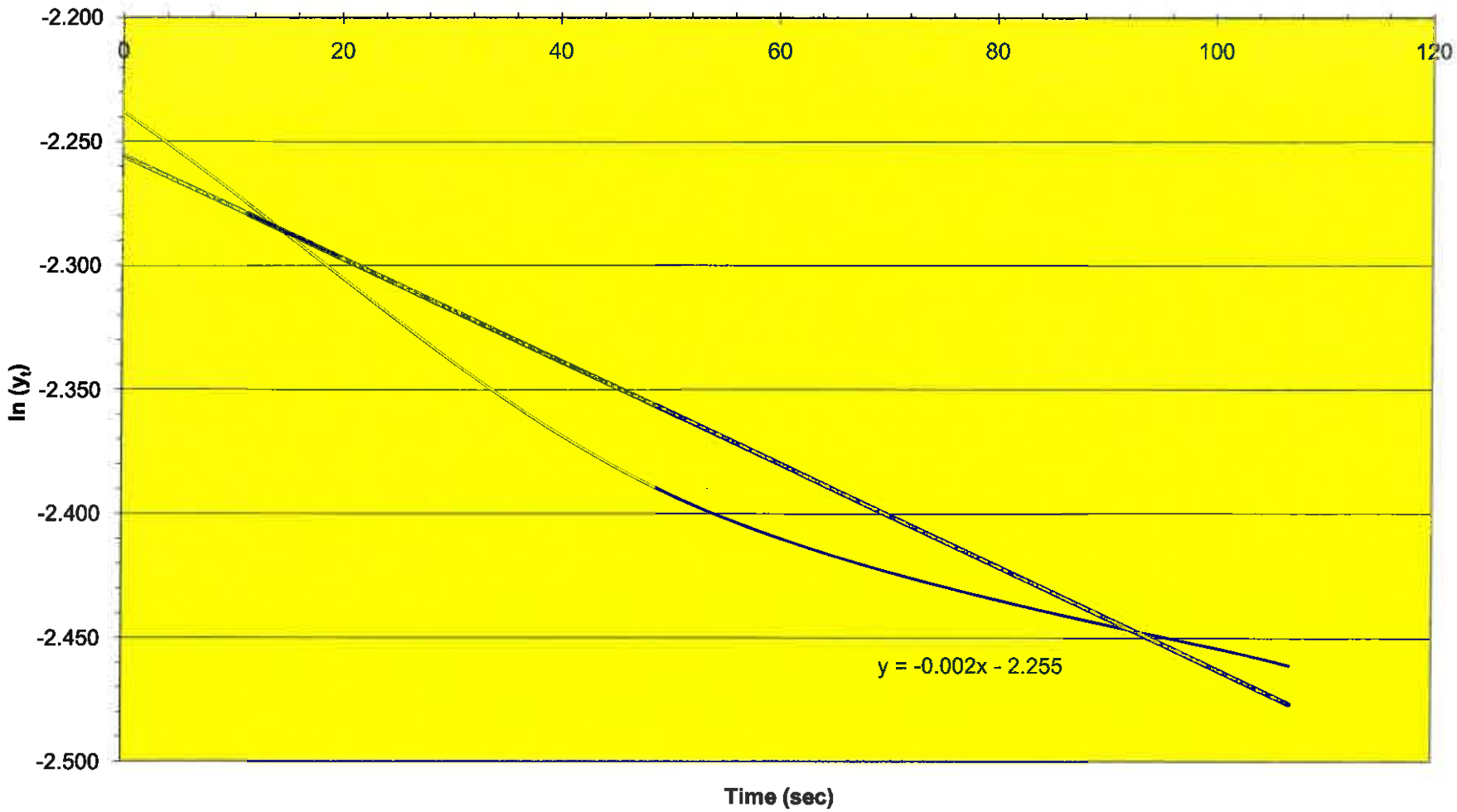
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ-27

Static Water Level below TOC (ft): 25.9
Static Water Level below TOC (m): 7.89

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	26.25	8.00	0.107	-2.238
50	26.2	7.99	0.091	-2.392
107	26.18	7.98	0.085	-2.461

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ-27



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-27 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0021
$\ln(y_0)$	-2.2556

From slug test data

Max y_t	0.107 m H_2O
Min y_t	0.09 m H_2O
Static y	7.89 m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	25.90	7.89
	Distance from bottom of well to TOC	27	8.23
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	10	3.05
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 30		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2.4		
	B = 0.5		
	C = 2		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-27 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -2.10E-03 t -2.2556

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-2.2556	
y_0 =	0.10	(transformed out of ln form)
slope =	-0.0021	
ln ($y_{t=1000}$) =	-4.356	
$y_{t=1000}$ =	0.013	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 1.10 0.34
Distance from water table to bottom of casing (H) 1.10 0.34
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

$\ln(r_e/r_w)$ = 1.013

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w)] = 6.

$$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	1.235E-06	m/sec
	K =	1.235E-04	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

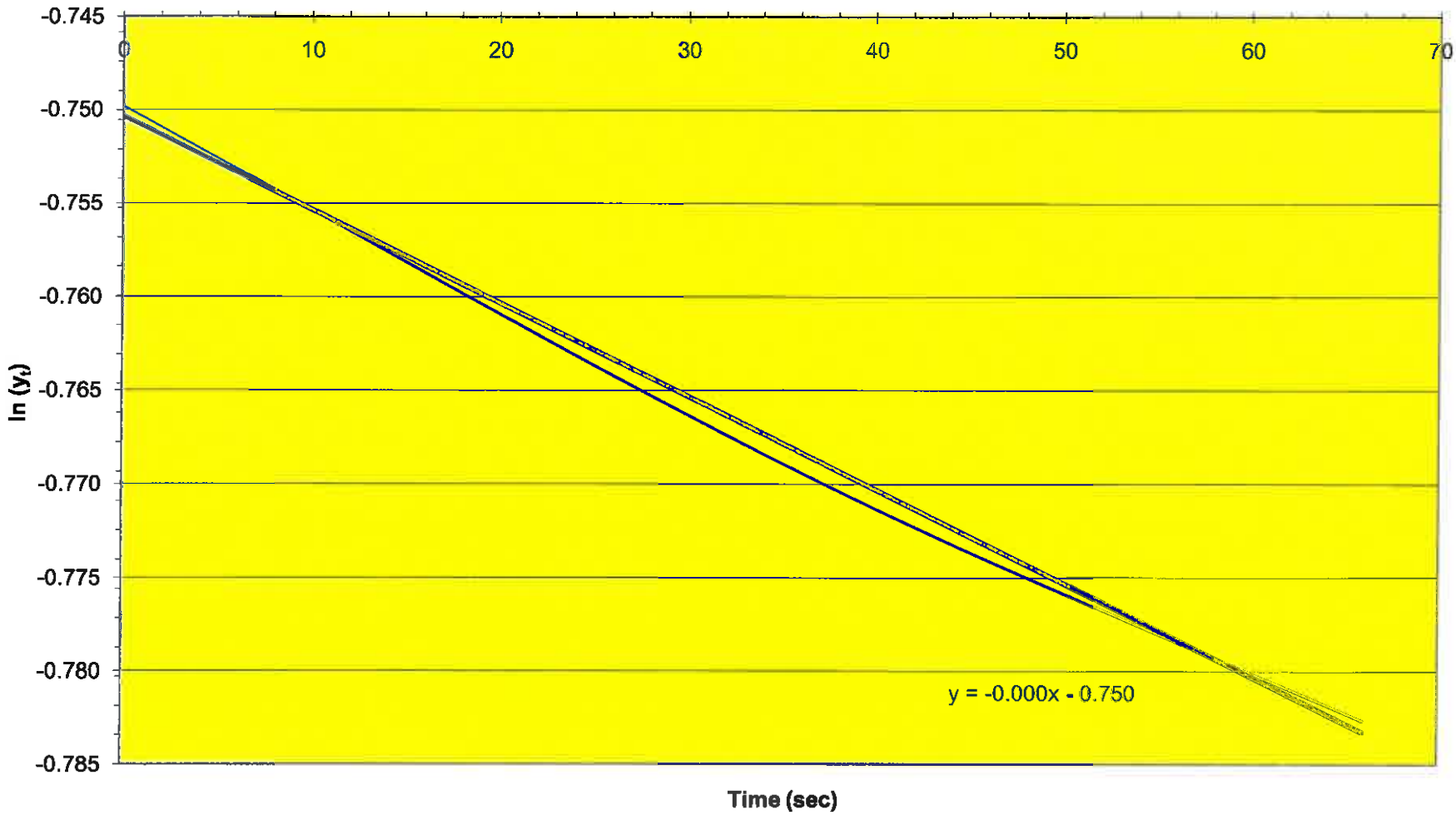
Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test
PZ-28

Static Water Level below TOC (ft): 33
Static Water Level below TOC (m): 10.06

Elapsed Time (sec)	Depth (ft)	Depth (m)	y_t (m)	ln (y_t) -
0	34.55	10.53	0.472	-0.750
36	34.52	10.52	0.463	-0.769
66	34.5	10.52	0.457	-0.783

TOC = Top of Casing
y_t = distance from static water level to water level at time t

Anderson Creek MSW Landfill, Harnett County, North Carolina
Slug Out Test Data
PZ-28



Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-28 - Slug Out

Best fit line from graph of $\ln(y_t)$ vs time

$y = mx + y_0$

Where $m = \Delta y/\Delta x$

$y = \ln(y_t)$

$x = t$

From equation of trendline

$\Delta Y/\Delta X$	-0.0005
$\ln(y_0)$	-0.7503

From slug test data

Max y_t	0.472 m H_2O
Min y_t	0.457 m H_2O
Static y	10.06 m H_2O

		Feet	Meters
1	Distance from static water level to top of casing (TOC)	33.00	10.06
	Distance from bottom of well to TOC	40	12.19
2	Graph change in water level in natural log form [ln(yt)] vs. time		
3	Screen length (L)	5	1.52
	Distance from well center to filter pack (r_w) = 4.0 inches	0.333	0.101
	L/r_w = 15		
4	Use L/r_w value and coefficient relationship curves from Fig. 3 on p. 426 in Bouwer and Rice paper to determine values for A, B and C		
	A = 2		
	B = 0.25		
	C = 1.5		
5	Inside radius of well casing (r_c) = 1 inch	0.083	0.025
	Porosity of sand pack (n) n = 0.3		

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

calculation for cr_c = $[(r_c)^2 + n[(r_w)^2 - (r_c)^2]]^{1/2}$

cr_c =	0.195	0.059

Hydraulic Conductivity Calculations Based on a Slug Test
Anderson Creek MSW Landfill, Harnett County, North Carolina
PZ-28 - Slug Out

6 Obtain best fit line by regression for graph of ln(yt) vs. Time.
Enter y-intercept (y_0) and calculate slope of regression line.
Eqn of regression line: $\ln(y_t)$= -5.00E-04 t -0.7503

Enter arbitrary time t (t = 1000 seconds)

t =	1000	(time in seconds)
ln (y_0) =	-0.7503	
y_0 =	0.47	(transformed out of ln form)
slope =	-0.0005	
ln ($y_{t=1000}$) =	-1.250	
$y_{t=1000}$ =	0.286	(transformed out of ln form)

7 Distance from water table to impermeable layer (D) 7.00 2.13
Distance from water table to bottom of casing (H) 7.00 2.13
If D <= H (confining layer is encountered at or above well bottom), calculate ln (r_e/r_w) using this equation:

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + C / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = 2.169

If D > H (impermeable layer is present below well bottom), calculate ln (r_e/r_w) using this equation:
Maximum value for ln[(D-H)/r_w] = 6.

$\ln(r_e/r_w) = [(1.1 / \ln(H/r_w)) + (A + B \ln[D-H]/r_w) / (L/r_w)]^{-1}$
(from Bouwer and Rice, p. 425)

ln (r_e/r_w) = #NUM!

8 Calculate hydraulic conductivity (K)
Units will be m/sec; multiply by 100 for cm/sec

$K = [r_c^2 (\ln(r_e/r_w)) / 2L] [1/t] [\ln(y_0/y_t)]$

Use corrected r_c, referred to as cr_c, if the porosity of sand pack surrounding the well is greater than porosity of the aquifer formation.

If D<=H then:	K =	1.259E-06	m/sec
	K =	1.259E-04	cm/sec
If D>H then:	**K =**	**#NUM!**	**m/sec**
	K =	**#NUM!**	**cm/sec**

Applied Hydrogeology

Third Edition

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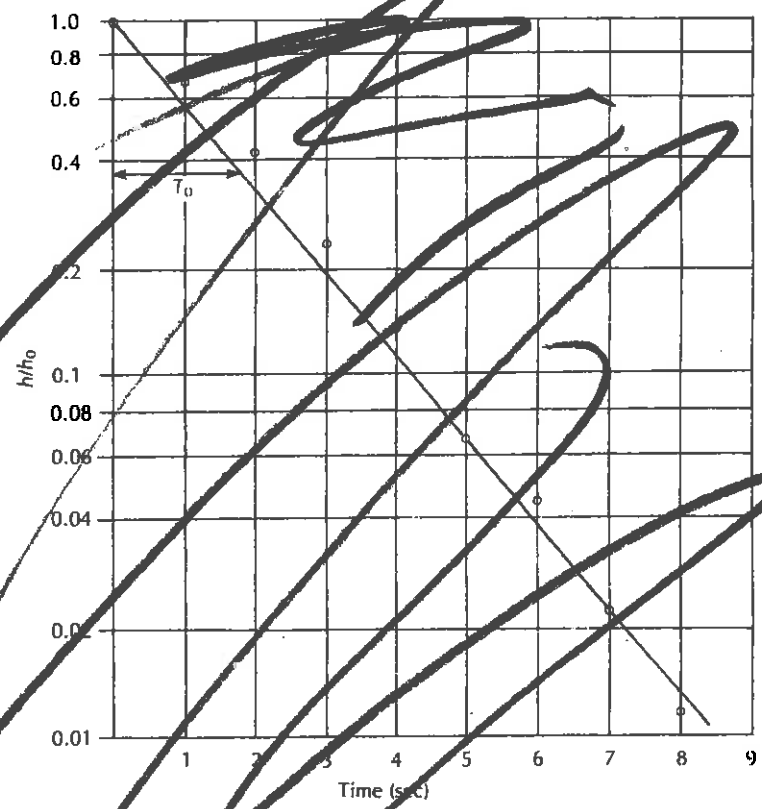

FIGURE 7.23 Plot of h/h_0 versus t for Example Problem of Hvorslev method.

$$K = \frac{r^2 \ln(L_e/R)}{2LT_0}$$

$$= \frac{(0.083\ \text{ft})^2 \times \ln(10\ \text{ft}/0.083\ \text{ft})}{2 \times 10\ \text{ft} \times 1.8\ \text{s}}$$

$$= 9.17 \times 10^{-4}\ \text{ft/s} \times 8.64 \times 10^4\ \text{s/day}$$

$$= 79\ \text{ft/day}$$

7.5.4 Bouwer and Rice Slug-Test Method

A very useful slug-test method was developed by H. Bouwer (Bouwer & Rice 1976; Bouwer 1989). This test can be performed on open boreholes or screened wells. The wells can be fully or partially penetrating. Although the test was originally developed for unconfined aquifers, it can be used in confined aquifers if the top of the well screen is some distance below the bottom of the confining layer.

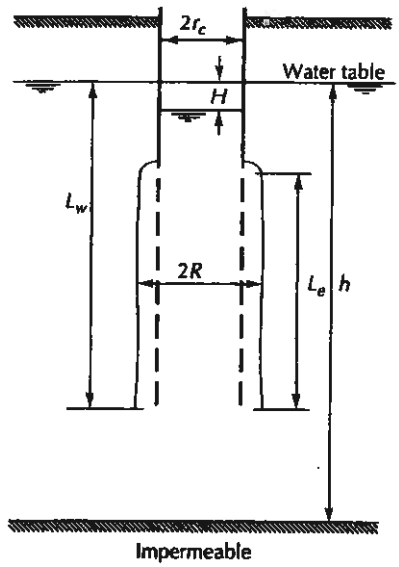

FIGURE 7.24 Geometry and symbols for a slug test on a partially penetrating screened well in an unconfined aquifer with a gravel pack around the screen. Source: Herman Bouwer, *Ground Water* 27 (1989): 304–309. Used with permission. © 1989, Ground Water Publishing Company.

The geometry of the borehole for the Bouwer and Rice slug test is shown in Figure 7.24. In this diagram the parameter r_c is the radius of the well casing in which the water level is rising and R is the radius of the gravel pack or developed area around the well screen.

The Bouwer and Rice equation is:

$$K = \frac{r_c^2 \ln(R_e/R)}{2L_e} \frac{1}{t} \ln\left(\frac{H_o}{H_t}\right) \tag{7-86}$$

where

K is hydraulic conductivity (L/T; ft/day, m/day, or cm/sec)

r_c is the radius of the well casing (L; ft, m, or cm)

R is the radius of the gravel envelope (L; ft, m, or cm)

R_e is the effective radial distance over which head is dissipated (L; ft, m, or cm) (This is also the distance away from the well over which the average value of K is being measured.)

L_e is the length of the screen or open section of the well through which water can enter (L; ft, m, or cm)

H_0 is the drawdown at time $t = 0$ (L; ft, m, or cm)
H_t is the drawdown at time $t = t$ (L; ft, m, or cm)
t is the time since $H = H_0$ (T; day or s)

The effective distance over which the induced head is dissipated, R_e, is also the distance away from the well that the average value of K is being measured. However, there is no way to know what the value of R_e is for a given well. Bouwer (Bouwer & Rice 1976; Bouwer 1989) has presented a method of estimating the dimensionless ratio $\ln(R_e/R)$ found in Equation 7–86.

If L_w is less than h, the saturated thickness of the aquifer, then

$$\ln \frac{R_e}{R} = \left[\frac{1.1}{\ln(L_w/R)} + \frac{A + B \ln[(h - L_w)/R]}{L_e/R}\right]^{-1} \tag{7–87}$$

If L_w is equal to h, then

$$\ln \frac{R_e}{R} = \left[\frac{1.1}{\ln(L_w/R)} + \frac{C}{L_e/R}\right]^{-1} \tag{7–88}$$

where A, B, and C are dimensionless numbers that can be found from Figure 7.25, where they are plotted as a function of L_e/R.

The value of H_t as a function of t is plotted on semilogarithmic paper, with H_t on the logarithmic axis. The data pairs will fall on a straight line from small

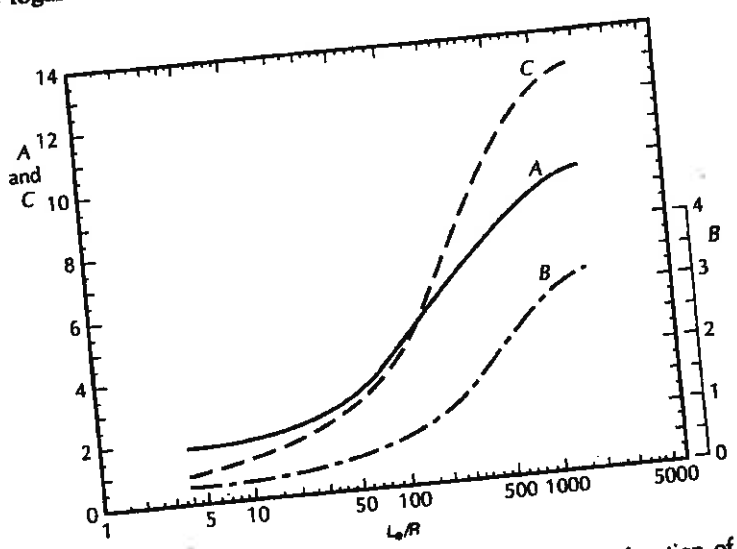

FIGURE 7.25 Dimensionless parameters A, B, and C plotted as a function of L_e/R. These parameters are used in the determination of $\ln(R_e/R)$ in Equations 7–87 and 7–88. Source: Herman Bouwer, Ground Water 27 (1989): 304–309. Used with permission. © 1989, Ground Water Publishing Company.

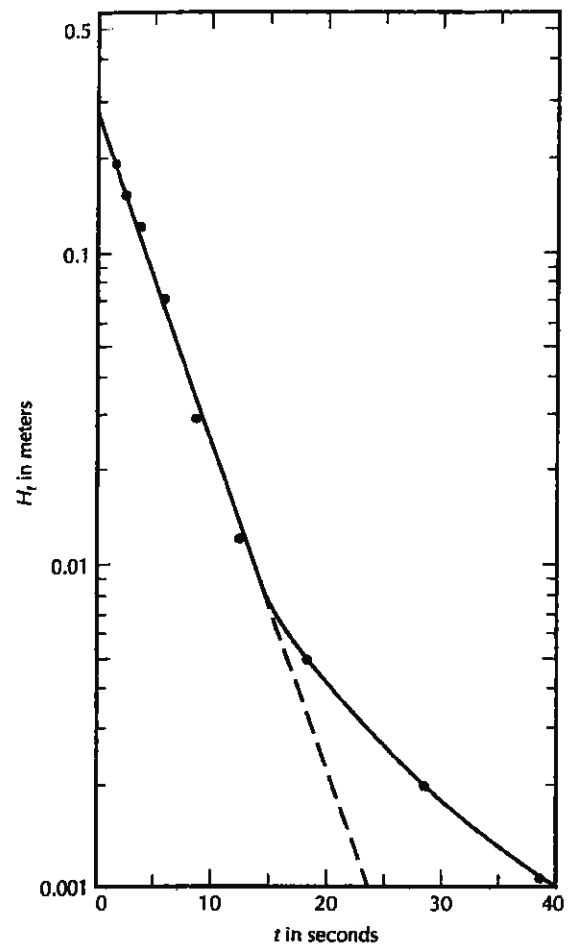

FIGURE 7.26 Head in a borehole as a function of time. Note that the data form on a straight line during the early part of the test but eventually deviate from the straight line. Source: Herman Bouwer, *Ground Water* 27 (1989): 304–309. Used with permission. © 1989, Ground Water Publishing Company.

values of time and large values of head. As the head dissipates and the time increases, the points may not follow the straight line. A plot of H_t versus time is shown in Figure 7.26.

The value of $(1/t)\ln(H_0/H_t)$ may be obtained from a figure such as Figure 7.26. Two points are picked on the straight-line portion of the graph. Although Equation 7–86 calls for H_0 and H_t, we can use any two points on the graph. At one point we have values H_1 and t_1 and at the other point we have H_2 and t_2. Under these conditions $(1/t)\ln(H_0/H_t) = (1/(t_2 - t_1))\ln(H_1/H_2)$.

In some cases the plot of head versus time will yield a curve with two straight-line segments. This case is illustrated in Figure 7.27. Such a situation

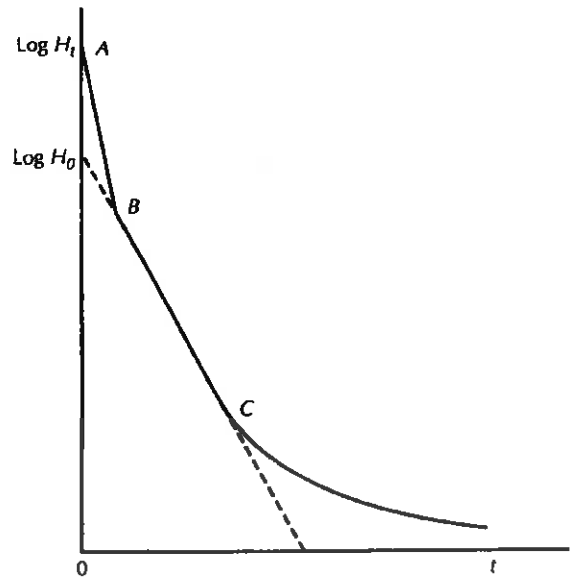

FIGURE 7.27 Head in a borehole as a function of time where two straight-line segments are formed during the early part of the test but eventually deviate from the straight line. Source: Herman Bouwer, *Ground Water* 27 (1989): 304–309. Used with permission. © 1989, Ground Water Publishing Company.

occurs when the water in the gravel pack drains rapidly into the well. Once the water level in the gravel pack equals the water level in the well, then the second straight-line segment forms. This reflects the hydraulic conductivity of the undisturbed aquifer. If a double straight line forms, the second segment should be used to find $(1/t)\ln(H_0/H_t)$. If the water level in the well is not lowered to the level of the gravel pack or if the gravel pack is so permeable that it will drain at the same rate that the water level is lowered, then the double straight-line effect should not develop.

The Bouwer and Rice slug test was developed as a bail-down test; that is, the water level is lowered by bailing or pumping so that water flows from the aquifer into the well. The method can also be used when water is added to the well and heads in the casing fall, provided that the static water level is above the well screen or open borehole. If this is not the case, then water would drain from the well into the vadose zone as well as the saturated aquifer. This would result in an overestimate of the permeability of the saturated aquifer.

Some studies have been performed that compared results of slug-test data analyzed by two or more methods. In one study in highly permeable sands (Fetter 1985), comparable results were obtained by using either the Bouwer and Rice method (Bouwer & Rice 1976) or the Hvorslev method (Hvorslev 1951). Another study, performed on a fractured glacial till (Herzog & Morse 1984), compared the results of the Cooper-Bredehoeft-Papadopulos method (Cooper, Bredehoeft, &

Papadopulos 1967; Papadopulos, Bredehoeft, & Cooper 1973) and the Nguyen and Pinder method (Nguyen & Pinder 1984) and found both methods yielded similar results. Methods may vary in the type of wells for which they are applicable and the length of time over which the data may need to be collected.

7.6 ESTIMATING AQUIFER TRANSMISSIVITY FROM SPECIFIC CAPACITY DATA

There is a large body of data on the specific capacity of water wells. Aquifer tests are usually not performed when production wells are installed. However, the well is normally test pumped for at least a few hours and the yield and maximum drawdown are recorded. The yield of the well divided by the drawdown is called the **specific capacity.** Typical units are ft^3/day/ft of drawdown or m^3/day/m of drawdown.

Theis (1963) proposed a way of estimating the transmissivity of an aquifer from the specific capacity of a well. For a confined aquifer, one can rearrange Equation 7–50 to yield:

$$T = \frac{Q}{(h_0 - h)} \frac{2.3}{4\pi} \log \frac{2.25Tt}{r^2 S} \tag{7–89}$$

where

$Q/(h_0 - h)$	is the specific capacity of the well (L^2/T; ft^3/day/ft or m^3/day/m)
t	is the period of pumping (T; day)
r	is the radius of the pumping well (L; ft or m)
T	is aquifer transmissivity (L^2/T; ft^2/day or m^2/day)
S	is aquifer storativity (dimensionless)

Notice that T appears in both the arithmetic and the logarithmic portions of Equation 7–89. In order to solve this equation for T when $Q/(h_0 - h)$ is known, we must make an initial guess of the value of T, substitute it into the equation, and solve for $Q/(h_0 - h)$. The value of T is then adjusted until the calculated value of $Q/(h_0 - h)$ is reasonably close to the measured value.

This procedure has two flaws. First, we must estimate a value for S. This means that the estimate of T is based on an estimate of S—a somewhat dubious situation. Second, the assumption is made that the well is 100% efficient. In the real world in which the specific capacity is measured, the well will not be 100% efficient; that is, drawdown within the well will be greater than the drawdown in the aquifer just outside the well. This is due to turbulent friction losses as the water passes into the well.

Bradbury and Rothschild (1985) developed a computer program to estimate T from specific-capacity data. They utilized a method of correcting the