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Received SEP 2007 Solid Waste Section

# Assessment of Corrective Measures

*Prepared for*

Lenoir County Landfill - Permit #54-03
La Grange, Lenoir County, North Carolina

**MESCO Project Number: G07062.0**

Completed on 8/30/2007

Municipal Services Garner, NC
Engineering Company, P.A. Boone, NC
Municipal Engineering Services Company, P.A.
Garner, Boone and Morehead City, North Carolina

OPERATION/CONSTRUCTION QA/QC

**Municipal Services**

CIVIL/SANITARY ENGINEERS

**Engineering Company, P.A.**

August 31, 2007

Received
SEP 4 2007
Solid Waste Section

Mr. Bobby Lutfy, Hydrogeologist Permitting Branch
Solid Waste Section
Division of Waste Management
North Carolina Department of Environmental and Natural Resources
401 Oberlin Road, Suite 150
Raleigh, NC 27605

Re: Assessment of Corrective Measures
Wayne County #96-01, Greene County #40-02, and Lenoir County #54-03

Dear Mr. Lutfy:

Enclosed you will find the Assessment of Corrective Measures for Wayne County permit #96-01, Greene County Permit #40-02, and Lenoir County Permit #54-03. As per request by Jaclynne Drummond, one hard copy and one electronic copy for the above landfills are included.

Fill free to contact us by phone at (919) 772-5393, should you have any questions or comments regarding this report.

Sincerely,
MUNICIPAL ENGINEERING SERVICES CO., P.A.

Ethan J. Caldwell, P.G.
Professional Geologist

Enclosures

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**TABLE OF CONTENTS**

**1 INTRODUCTION 1**

1.1 Site Background ..... 1
1.1.1 Site History ..... 1
1.1.2 Sampling History ..... 1
1.2 Site Characteristics ..... 2
1.2.1 Site Description ..... 2
1.2.1 Geology ..... 2
1.2.2 Hydrogeology ..... 3
1.2.3 Hydrology ..... 4
Potable Sources ..... 4
Groundwater Regime ..... 4
Groundwater Flow Components ..... 4
1.3 Site Conceptual Model ..... 5
Boundaries ..... 6
Model Calibration ..... 7

**2 CONTAMINATION CHARACTERIZATION 7**

2.1 Contamination of Concern ..... 7
2.1.1 Inorganic Constituents ..... 7
2.1.2 Organic Constituents ..... 8
2.2 Contamination Distribution ..... 10
2.3 Source Control Measures ..... 10
2.3.1 MT3D[96] Modeling ..... 11
2.3.2 Sorption ..... 11
2.4 Groundwater End Use ..... 12
2.5 Exposure Pathways ..... 12
2.6 Human Health Risk Assessment ..... 13
2.6.1 Carcinogenic ..... 13
2.6.2 Non-Carcinogenic ..... 14
2.7 Adult Risk ..... 14
2.8 Child Risk ..... 14
2.9 Sensitivity Receptor Pathways ..... 15

**3 CORRECTIVE MEASURES SCREENING AND EVALUATION 15**

3.1 Overview ..... 15
3.2 Institutional Controls ..... 15
3.3 Infiltration Controls ..... 16
3.4 Landfill Gas Controls ..... 16
3.5 Groundwater Technologies ..... 16
3.5.1 Monitored Natural Attenuation ..... 16
3.5.2 Vapor Extraction System/Bioventing ..... 17
3.5.3 Air Sparging ..... 17
3.5.4 Enhanced Bioremediation ..... 17
3.5.5 Phytoremediation ..... 18
3.5.6 Constructed Wetland ..... 18

**4 SUMMARY CONCLUSIONS 18**

4.1 Conclusions ..... 18
4.2 Public Meeting ..... 19

**REFERENCES 20**

**TABLES**

Table 1 ..... Well Construction Details
Table 2 ..... Historical Groundwater Elevation Data
Table 3 ..... Slug Tests Results
Table 4 ..... Summary of Geologic Soil Properties
Table 5 ..... Summary of Field Parameters
Table 6 ..... Historical Inorganic Groundwater Results
Table 7 ..... Historical Inorganic Surface Water Results
Table 8 ..... Statistically Significant Inorganics
Table 9 ..... Historical Organic Groundwater Results
Table 10 ..... Statistically Significant Organics
Table 11 ..... Flow Rate Calculations
Table 12 ..... Non-Carcinogenic Toxicity Values for Oral Ingestion Exposure
Table 13 ..... Non-Carcinogenic Toxicity Values for Inhalation Exposure

Table 14 ..... Non-Carcinogenic Toxicity Values for Dermal Exposure
Table 15 ..... Remediation Alternatives
Table 16 ..... Summary of Water Supply Well Inventory

**PLATES**

Plate 1 ..... Topographic Map with Site Location
Plate 2 ..... Site Map – Facility Map
Plate 3 ..... Site Map with Sampling Locations
Plate 4 ..... Potentiometric Map
Plate 5 ..... Cross-sections
Plate 6 ..... Isoconcentration Map Total VOC's
Plate 7 ..... Tax Map

**APPENDIX**

Appendix A ..... Boring Logs and Monitoring Well Construction Diagrams
Appendix B ..... Sampling History
Appendix C ..... Groundwater Modeling
Appendix D ..... Sampling and Analysis Plan

# 1 INTRODUCTION

## 1.1 Site Background

### 1.1.1 Site History

The Lenoir County Sanitary landfill is located on Hodges Farm Road (SR 1524), La Grange, Lenoir County, North Carolina. A topographical map showing the location of the site is included as Plate 1. Lenoir County landfill operates under permit #54-03. Prior to operation as a C&D landfill the site operated as a Municipal Solid Waste (MSW) unlined sanitary landfill. A small area of the MSW, located in the southern portion of the facility stopped receiving waste prior to October 1994 and was closed with a 24 inch soil cover. The remainder of the sanitary landfill was closed prior to October 1998. This unit was closed with a cohesive cap of 18 inches of soil with a permeability of 1 x $10^{-5}$ cm/sec, and 18 inches of erosive layer, as part of the transition plan.[20] The C&D landfill was constructed and is operating on top of the MSW unit. In 1980 S&ME completed a geotechnical investigation of the soils per the City of Kinston's request. The geotechnical investigation is included in the transition plan. The geotechnical investigation included nine soil borings. Observation wells were installed in soil borings B-8 and B-9 in October 1980. Adjacent to the C&D landfill and utilizing the same scale house is the existing Subtitle D MSW landfill, which operates under permit #54-09. A facility map showing the locations of both permitted facilities is included as Plate 2.

### 1.1.2 Sampling History

Observation wells B-8 and B-9 were renamed to monitoring wells MW-2 and MW-1, respectively. Initial sampling of these monitoring wells occurred on March 3, 1989 and included pH, Biological Oxygen Demand, Chemical Oxygen Demand, Nitrate Nitrogen, Total Organic Carbon, Chloride, Fluoride, Total Dissolved Residue, Arsenic, Barium, Cadmium, Copper, Total Chromium, Iron, Lead, Manganese, Mercury, Selenium, Silver, Zinc, Total Organic Halides, Sulfate, Conductivity, Temperature, and Static Water Level. Additional sampling occurred on March 22, 1990, March 14, 1991, March 5, 1992, March 9, 1993 and September 15, 1993. Sample results for these events are available in the Transition Plan. Monitoring wells MW-3 and MW-4 were installed in September 1991, and MW-5 was installed in May 1992. It is unclear when monitoring well MW-6 was installed. There is no information on MW-7. Verbal communication with field personnel implied that MW-7 was not installed. Boring Logs and/or well construction records for MW-6 and MW-7 could not be located.

The Ground and Surface Water Monitoring System (SAP) was prepared in February 1994 and submitted as part of the Transition Plan.[20] As part of the SAP, monitoring well MW-8, MW-9 and MW-10 were installed in August 1994. Appendix I sampling was initiated in September 1994 with Background sampling occurring

on September 9, 1994, October 28, 1994, January 6, 1995 and February 24, 1995. Appendix II sampling was performed on July 17, 1995 and July 25, 1996. Appendix I sampling was performed On January 23, 1996, January 14, 1997, July 11, 1997, and August 22, 1997. On January 21, 1998 Appendix II sampling was initiated on a semi annual schedule until January 10, 2002. MW-11 and MW-12 were installed in March of 1999. On January 10, 2002 Appendix II sampling was discontinued on select wells (MW-3, MW-6, MW-9). Semi annual Appendix I sampling was performed on the select wells. Beginning on July 8, 2002 Appendix II sampling was discontinued on the monitoring wells with the exception of MW-3. Monitoring wells were sampled semi annually for Appendix I. Starting January 22, 2003 Appendix II was only preformed on MW-3; with the addition of MW-1 on July 7, 2003, January 22, 2004, January 26, 2005 and July 14, 2005. Well borings and construction records are provided in Appendix A.

## 1.2 Site Characteristics

### 1.2.1 Site Description

The site lies within the Coastal Plain physiographic province that is characterized by flat or gently undulating topography dissected by drainage features with narrow to moderately sloped sides. Surface drainage flows northwest towards Fredricks Branch*, which flows northeast into Falling Creek and subsequently into the Neuse River. The site is generally bounded by NCSR 1524 on the west, Falling Creek on the east and Fredricks Branch on the north. The existing Subtitle D MSW landfill is adjacent to C&D area.

### 1.2.1 Geology

The geology, as addressed in the SAP, identified the site as having unnamed surficial sediments overlying the Cretaceous Peedee Formation. The surficial deposits from boring logs consisted of clayey sand, sandy clay, silty sand, and sand. The Peedee Formation consists of an overlying confining unit of clay, silty clay, and sandy clay which is approximately 25 feet thick; followed by fine to medium sand interbedded with clay and silt.[14]

Well construction records for monitoring wells are included in Appendix A. Lithological descriptions for older monitoring wells are limited. Lithology for MW-1(B-9) consists of yellow clayey fine sand and orange/tan/brown/gray silty sand. MW-2(B-8) consists of silty fine sand with trace clay. MW-3 and MW-4 primarily consists of silty sand/sandy silt. MW-8 consists of tan sand and orange-red sandy clay. MW-9 is composed of dark gray sand and orange-brown sandy clay. MW-10 is composed of brown sandy clay/clayey sand and tan sand. MW-11 is composed of brown-yellow sand with clayey sand and encountered the Peedee

* The name of the creek was referenced as Fredricks Branch in the Transition Plan. The creek is not named on USGS Topographical Maps.

confining layer at an elevation of 39.36 feet. MW-12 is composed of red-brown sand and clayey sand. Geologic cross sections were prepared showing the generalized subsurface geology and hydrology for the site.

The estimated elevation of the Peedee confining layer is approximately 37 feet amsl. The elevation is based on published estimations [14] and the fact that the confining layer was not encountered in any monitoring wells, with the exception of MW-11. The estimated elevation generally corresponds to the observed elevation in MW-11. Assuming a slight dip of the confining layer, MW-9 and MW-12 termination depths would have been close to the confining layer.

### 1.2.2 Hydrogeology

Hydrogeological properties of the monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-8, MW-9, and MW-10 were reported by GAI Consultants.[13] Hydrogeological properties of monitoring wells MW-11 and MW-12 were provided to NCDENR from MESCO on June 25, 1999. Slug tests were performed on the monitoring wells and are provided in Appendix A and Appendix D. A summary of slug test results is provided as Table 3. Values ranged from a high of 5.40 x $10^{-4}$ cm/sec in MW-4, to 6.55 x $10^{-6}$ cm/sec in MW-12, and an average of 2.58 x $10^{-4}$ cm/sec. A detailed hydrogeological investigation has been performed on the adjacent Subtitle D MSW landfill. Hydraulic conductivities were reviewed from these reports and were found to be consistent with SAP reported hydraulic conductivity values.

Porosities were calculated by GAI Consultants and summarized in Table 4.[13] Total porosity was calculated based on the following formula:

$$n = 1 - \frac{\gamma_d}{(G_s)(62.4)}$$

where: n = total porosity

$\gamma_d$ = dry density

$G_s$ = Specific Gravity

62.4 = unit weight of water

The calculations are included in Appendix D. Values of total porosity ranged from a high of 43.0% in MW-8 to a low of 32.2% in MW-1.

Effective porosity values were taken from published values for soil and rocks. Effective porosity was reported at 20% for all monitoring wells. A detailed investigation of effective porosities was performed as part of the adjacent Site Hydrogeological Study. Effective porosities for Silty Sand/Sandy Silt were report at 26.3% and 6% for Clayey Sand. Included in Appendix A is the summary table from the Site Hydrogeological Study.

### 1.2.3 Hydrology

**Potable Sources**

The receptor survey performed as part of the transition plan identified 3 potable water supply wells and 1 non-potable water supply well within 2000 feet of the facility. An updated receptor survey was performed in 2007. Lenoir County has since purchased two of those properties. Connections to those potable water supply wells have been removed and the properties have been demolished or are in the process of being demolished. The status of the third water supply well is unknown. Property owners were unavailable; the well was not visually observed nor was a water meter visually observed. This potential well is located approximately 2000 feet south of the facility. Municipal water is available to the surrounding area.

The non-potable water supply well is located at the facility. The well is used for equipment washing. The well is 1 inch diameter pvc encased in 3 inch pvc. The depth of the well was reported to be 155 feet with a screen interval from 75-100 feet. A summary of the water supply wells is included as Table 16.

**Groundwater Regime**

Regionally the first aquifer occurs in unconsolidated soil that overlie several regional confined aquifers. In the area near LaGrange, the aquifer overlies the Peedee aquifer. The surficial and Peedee aquifer are separated by a confining layer composed of clay, silty clay and sandy clay.

Locally, groundwater exhibits flow dynamics that are primarily controlled by the local drainage features of Fredricks Branch and Falling Creek. Groundwater elevations have been recorded during sampling events. A summary of Historical Groundwater Elevation Data is included in Table 2. Water elevations are fairly consistent. Water elevations are generally 10 to 15 feet below ground surface around the landfill. Depth to groundwater below ground surface for MW-3, MW-4 and MW-9, which are located near the creeks, is generally less than 5 feet below ground surface. Groundwater flow is generally east/northeast. A potentiometeric map is provided as Plate 4.

**Groundwater Flow Components**

The potentiometeric map was used to calculate the average linear velocity defined as:

$$v_x = \frac{K}{n_e}\frac{dh}{dl}$$

where

$v_x$ is the average linear velocity

K is the hydraulic conductivity

$n_e$ is the effective porosity

$\frac{dh}{dl}$ is the hydraulic gradient

The hydraulic gradient was calculated graphically by first drawing a line from each monitoring well to a perpendicular of the equipotential line. The elevations of the hydraulic head (*dh*) were calculated by subtracting the elevation of equipotential from the groundwater elevation for the corresponding piezometer. The lateral distance (*dl*) is the horizontal length of the line. *dl* values are further denoted on Plate 4. Calculation of the hydraulic gradient at a given piezometer location was determined by dividing *dh* by *dl*. Table 11 shows the results of the flow rate calculations in units of feet per year and the parameters used in the calculations.

### 1.3 Site Conceptual Model

A conceptual model of the site was developed with Visual MODFLOW designed by Waterloo Hydrogeologic, Inc. The visual MODFLOW package includes the USGS developed MODFLOW, the accompanying particle tracking program, MODPATH, as well as the contamination transport package MT3D[96] developed by Papadopulos and Associates, Inc.

The model grid consisted of an area 2800 feet x 3400 feet. The area was divided into 140 rows, 120 columns and 5 layers. To approximate the aquifer characteristics each layer was defined with distinct hydraulic properties.

Layer 1 – Sand/Silty Sand
Layer 2 – Orange Sandy Clay
Layer 3 – Silty Sand
Layer 4 – Confining Layer of the Peedee Formation
Layer 5 – Peedee Formation.

Estimated hydraulic properties for each lithology were obtained from the SAP[20], Site Hydrogeologic Study[21], or the Simulation of Ground-Water Flow in the Coastal Plain Aquifer System of North Carolina.[14]

*Hydraulic properties*

| | **Hydraulic Conductivity cm/sec** | **Total Porosity** | **Effective Porosity** |
|---|---|---|---|
| Layer 1 | $9.11 \times 10^{-4}$ | 35 | 26.3 |
| Layer 2 | $4.50 \times 10^{-4}$ | 40.1 | 6 |
| Layer 3 | $9.11 \times 10^{-4}$ | 35 | 26.3 |
| Layer 4 | $7.71 \times 10^{-5}$ | 37.6 | 9 |
| Layer 5 | $1.19 \times 10^{-2}$ | 51.7 | 20 |

Hydraulic properties of the waste and cohesive cap were not applied as they are addressed in boundary conditions.

**Boundaries**

The integrity of Visual MODFLOW depends largely on the accurate definition of boundary conditions. The model was developed to simulate the observed hydrologic conditions. A generalized hydrologic cycle uses ground water recharge as the result of precipitation, surface water inflow, evapotranspiration, surface water outflow, and change in aquifer storage. Precipitation data at the *Goldsboro 4 SE* station was reviewed on the State Climate Office of North Carolina web site.[26] The *Goldsboro 4 SE* is located approximately 14.8 miles from the site. Annually, *Goldsboro 4 SE* receives an average of 49.8 inches. There is no surface water inflow onto the site. The site drainage features are tributary Fredricks Branch and Falling Creek. Evapotranspiration is estimated at 33 inches per year, which was derived in Simulation of Ground-Water Flow in the Coastal Plain Aquifer System of North Carolina.[14] Aquifer "storativity, S, [was] developed primarily for the analysis of well hydraulics in confined aquifers." [12][page 61] Change in aquifer storage in an unconfined aquifer system results in an increase/decrease in water level.[11] Change in aquifer storage in considered negligible due to the unconfined nature of the system and the assumption that the system is under steady state conditions. [12][page 205] Estimation of overland run off to the drainage features is dependent on topography. Overland run off is estimated at 5 inches per year.[14] Based on these estimations, groundwater recharge is estimated at 12 inches per year. The recharge area is limited due to landfill activities, structures, and roads and was applied to areas that have limited impact.

Drainage features which act as constant head features were simulated as rivers. River stage and bed elevations were estimated from topographical and potentiometric maps. Conductance was calculated from parameters in Visual MODFLOW.

**Model Calibration**

Calibration of the model was a trial and adjustment procedure. Alternative model parameters were run utilizing varied model input. The process was repeated to minimize the difference between the computed and observed values. The site conceptual model represents the most accurate conceptual model.

A graph of simulated heads versus observed heads is included in Appendix C. The calibration for the model is believed to be successful for the conditions at this site. Head variation was limited to a root mean square of 3.40 feet. The simulated heads show a linear relationship with the observed heads at a slightly higher elevation. These estimations may be due in part to the site not receiving the estimated 12 inches per year of recharge. Recharge is controlled by seasonal fluctuations, which wasn't accounted for in MODFLOW.

# 2 CONTAMINATION CHARACTERIZATION

## 2.1 Contamination of Concern

### 2.1.1 Inorganic Constituents

Inorganic constituents Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Manganese, Mercury, Nickel, Selenium, Tin, Vanadium, and Zinc, have all been detected in groundwater samples. Included in Table 6 is a summary of Historical Inorganic Groundwater Results. Constituents that have been identified as being statistically significant include Arsenic, Chromium, Cobalt, Lead, Mercury, Tin, Vanadium, and Zinc. While all these constituents have been detected as statistically significant at least one time, only Chromium, Vanadium and Zinc have been detected with consistency. A summary of statistically significant inorganics is provided in Table 8. Inorganic constituents detected above 2L include Cadmium, Chromium, Lead, Manganese, Mercury, and Zinc. Inorganic constituents Cadmium, Chromium, Lead, Nickel, Selenium, Vanadium, and Zinc have been detected in Surface water samples. A summary of Historical Surface water inorganics is provided in Table 7.

Sampling results are used to identify if detected inorganics are the result of the waste disposal activities. Ground and surface water samples are collected as unfiltered samples. Unfiltered samples represent the total concentration of inorganics. Often "(s)tatistical analysis of total metal concentrations may not provide an accurate representation of contamination at the facility."[23][page 79] In addition, sampling techniques play a role in the detection of inorganic constituents. Too high a purge velocity can increase the turbidity of the sample, causing an over estimation of sampling results.[8]

Background sampling detected Arsenic, Beryllium, Chromium, Cobalt, Lead, and Zinc with only Lead occurring above 2L levels. A summary of background sampling results is provided in Appendix B. Sampling

results from the Subtitle D landfill were reviewed. Inorganic constituents Barium, Cadmium, Chromium, Cobalt, Copper, Lead, Vanadium, and Zinc have been detected in multiple wells including the background well. Historical inorganic detections for the Subtitle D landfill are provided in Appendix B. Geochemistry of sediments for the USGS Falling Creek Quadrangle was retrieved from the USGS National Uranium Resources Evaluation (NURE)[28] database. The presence of metals in NURE soil samples include, but are not limited to, Manganese, Thallium, and Vanadium.

The presence of metals occurring in the background samples, surface water samples, Subtitle D landfill samples, and NURE sediment samples indicate that Arsenic, Beryllium, Cadmium, Chromium, Cobalt, Lead, Manganese, Nickel, Selenium, and Zinc are all naturally occurring and don't represent contamination associated with the landfill.

Tin was only detected during one sampling event in MW-3, MW-8, MW-9 and MW-10. The single detection can be attributed to a false positive result. Mercury has been detected in monitoring well MW-3, MW-4, MW-5, MW-8, MW-10 and MW-12 from 1995 until 2007. Given that we cannot attribute it to false positive or natural occurrence implies that Mercury is the result of landfill disposal activities and is an inorganic constituent of concern.

### 2.1.2 Organic Constituents

Organic constituents have been detected in the groundwater from numerous sampling events. A sampling history is provided in Appendix B. A summary of detected Historical Organic Groundwater Results is included as Table 9. Table 10 shows constituents which have historically been detected as statistically significant. They are 1,1-Dichloroethane, Dichlorodifluoromethane, Benzene, Chlorobenzene, Cis-1,2-Dichloroethene, 1,4-Dichlorobenzene, Vinyl Chloride, Trichloroethylene, Bis(2-ethylhexyl) phthalate, 1,1,2,2-tetrachloroethane, 1,2-Dichloroethane and 1,3-Dichlorobenzene. Organic constituents detected above 2L include 1,1-Dichloroethane, 1,2-Dichloropropane, Benzene, Chloroethene, cis-1,2-Dichloroethylene, Ethylene dichloride, Methylene chloride, p-Dichlorobenzene, Tetrachloroethene and Trichloroethene.

Recent sampling has observed a steady decrease in the frequency numbers of detectable organic constituents. <u>There were no organic detects in the January 2007 sampling for Lenoir County</u>. Included below is a summary of detected organic constituents.

*Constituents of Summary*

| Constituent | Number of Sampling Events | Number of Sampling Events with Detections | Total Number Detects | Last date of Detect | Monitoring Wells Constituent Detected In |
|---|---|---|---|---|---|
| **APPENDIX I VOC'S** | | | | | |
| Chlorobenzene | 29 | 13 | 13 | 1/10/2002 | MW-8 |
| Xylenes | 29 | 6 | 7 | 1/21/1998 | MW-8, MW-10 |
| 1,1-Dichloroethane | 29 | 19 | 46 | 7/13/2006 | MW-3, MW-4, MW-5, MW-7, MW-8, MW-10 |
| Ethylbenzene | 29 | 1 | 1 | 1/6/1995 | MW-10 |
| Chloroethene (Vinyl Chloride) | 29 | 15 | 33 | 1/10/2002 | MW-5, MW-7, MW-8, MW-10 |
| 1,1,2-Trichloroethane | 29 | 1 | 1 | 7/17/1995 | MW-10 |
| Chloroethane | 29 | 8 | 12 | 1/14/1997 | MW-8, MW-10 |
| Benzene | 29 | 17 | 28 | 1/10/2002 | MW-8, MW-10 |
| cis-1,2-Dichloroethylene | 29 | 16 | 40 | 1/10/2002 | MW-5, MW-7, MW-8, MW-10 |
| 1,1,2,2-Tetrachloroethane | 29 | 1 | 1 | 1/27/2000 | MW-8 |
| Methylbenzene (Toluene) | 29 | 3 | 3 | 7/17/1998 | MW-3, MW10 |
| Trans-1,2-Dichloroethylene | 29 | 1 | 1 | 1/21/1998 | MW-10 |
| 1,2-dichloropropane | 29 | 1 | 1 | 1/23/1996 | MW-8 |
| Ethylene dichloride | 29 | 3 | 5 | 1/23/1996 | MW-5, MW-8, MW-10 |
| Methyl chloroform | 29 | 1 | 1 | 1/21/1998 | MW-4 |
| Methylene chloride | 29 | 7 | 14 | 8/22/1997 | MW-3, MW-8, MW-10 |
| p- dichlorobenzene | 29 | 12 | 19 | 1/10/2002 | MW-8, MW-10 |
| tetrachloroethene | 29 | 8 | 8 | 8/22/1997 | MW-5, MW-10 |
| trichloroethene | 29 | 12 | 15 | 1/10/20002 | MW-8, MW-10 |
| **APPENDIX II – SVOC'S** | | | | | |
| Bis(2-ethylhexyl)phthalate | 21 | 2 | 2 | 7/11/2001 | MW1, MW-12 |
| 1,3-Dichlorobenzene | 21 | 1 | 2 | 6/22/1999 | MW-8, MW-10 |
| **APPENDIX II – VOC** | | | | | |
| Dichlorodifluromethane | 21 | 6 | 6 | 7/8/2002 | MW-3, MW-4, MW-8 |

The preceding table indicates that many of the detected organic constituents don't appear to be constituents of concern because they have been detected infrequently or have not been detected for a significant period of time. For example Xylene has not been detected since January 1998. 1,1-Dichloroethane is statistically significant and was last detected on July 13, 2006; therefore, it is the only constituents of concern.

The only Appendix II constituents detected were 1,3-Dichlorobenzene, Bis(2-ethylhexyl)phthalate, and Dichlorodifluoromethane. 1,3-Dichlorobenzene was only detected on June 29, 1999. Bis(2-ethylhexyl)phthalate has only had two detections occurring on July, 17 2000 and July 11, 2001. Dichlorodifluoromethane has not been detected since 2002. Semi annual sampling occurs for Appendix I and Appendix II on selected wells. A sampling history table is included in Appendix B.

## 2.2 Contamination Distribution

Current contamination of concern consists of 1,1-Dichloroethane and Mercury. 1,1-Dichloroethane is a halogenated aliphatic organic compound.[25] Mercury is an inorganic heavy metal. The current extent of VOC contamination is shown on Plate 6. With the confining layer of the Peedee Formation contamination is limited to shallow contamination.

*Physical Characteristics of Constituents of Concern*

| Constituent | Density ($g/cm^3$ at 20°C) | Henry's Constant ($atm\text{-}m^3/mol$ 20°C) | Water Solubility (mg/l at 20°C) | Octanol/Water Partitioning Coefficient (log $K_{ow}$) | Soil - Water Partitioning Coefficient $K_{oc}$ (mL/g) | Mobility Class[2] |
|---|---|---|---|---|---|---|
| Mercury | 13.5 [3] | 0.002 [3] | 60 [3] | - | 6310 [4] | - |
| 1,1-Dichloroethane | 1.176 [1] | 0.0043 [1] | 400 [1] | 1.8 [1] | 49 [2] | Very high |

[1] *Data obtained from Environmental Biotechnology: Principles and Applications* [25]

[2] *Data obtained from Applied hydrogeology 3rd ed.*[11]

[3] *Data obtained from EPA Technical Factsheet on: MERCURY.*[10]

[4] *Data obtained from Partitioning Coefficients For Metals in Surface Water, Soil and Waste.*[1]

1,1-Dichloroethane mobility class characterized by Fetter (1994) is very high. The nature of Mercury in groundwater is essentially immobile. "(M)ercury appear to bind to dissolved matter or fine particulates."[10] The low Henry's Constants for both 1,1-Dichloroethane and Mercury allows for ready volatilization of the contamination.

## 2.3 Source Control Measures

The first unit of the landfill stopped receiving MSW by October 1994 and was closed with a 24 inch final soil cover. The second unit was closed with a cohesive cap of 18 inches of soil with a permeability of $1 \times 10^{-5}$ cm/sec, and 18 inches of erosive layer. Lenoir County owns and controls an extensive buffer around the waste. Northeast of the waste is a borrow site and the transfer station. North of the waste is the flood plain consisting of unused property owned by Lenoir County. East of the property is the borrow site for the Subtitle D landfill. South of the property, across Hodges Road and up gradient, is private property that is being used for storage of construction trailers.

A gas venting system for methane extraction/collection was installed as part of the transition plan. The permanent probes were installed by October 1994, and are monitored quarterly. It is uncertain if the methane system has had any affect on the local contamination.

### 2.3.1 MT3D[96] Modeling

MODFLOW with transport package MT3D[96] was used to simulate a release. Modeling parameters assumed leakage occurred prior to installation of the cap systems. Similar to the process used for development of the model in MODFLOW, MT3D[96] transport was calibrated using a trial and adjustment procedure. The plume model was calibrated to time periods 1995, 2000, 2001 and 2002. The initial simulation period was selected to begin in 1990. Target step periods of 5 years (1995), 10 years (2000), 11 years (2001), 12 years (2002), 25 years (2015), 35 years (2025), 45 years (2035), and 50 years (2040) were simulated.

MT3D[96] modeling does not allow for remediation implementation at a specified time period during the modeling simulation, nor does it allow for enhanced biological or radiometric decay at specified time periods. Included in Appendix C is the estimated extent of the plume for the simulated time periods that would have resulted from groundwater movement without enhanced remediation, biological or radiometric decay. Modeling indicates that advection flow contamination is within the relevant point of compliance (250 feet from the waste limit) and is not anticipated to reach the relevant point of compliance.

### 2.3.2 Sorption

The sorption (retardation) coefficients (R) used to calculate the expected migration rates for the constituents were calculated based on constituent specific soil water partitioning coefficient ($K_d$)

$$R = 1 + \frac{\rho_d}{n} K_d$$ [11][page 464]

where

R is the retardation coefficient

$\rho_d$ is dry bulk density of the soil (g/cm$^3$)

n is the porosity (unit less)

$K_d$ is the distribution coefficient (mL/g)

The dry bulk density was calculated from laboratory dry unit weights collected as part of the Phase 1 Design Hydrogeological Study where the average dry unit weight was 111.1 pcf (1.78 g/cm$^3$). The distribution coefficient ($K_d$) can be estimated as the Soil – Water Partitioning Coefficient $K_{oc}$ times the fraction of organic carbon in the soil. [11] An overly conservative soil organic carbon was estimated to be 1%. "Soils vary in the amount of soil organic carbon they contain, ranging from less than 1 percent in many sandy soils to greater than 20 percent in soils found in wetlands and bogs."[19]

*Coefficient of Retardation*

| Constituent | R |
|---|---|
| Mercury | 303.7 |
| 1,1-Dichloroethane | 3.4 |

The transport velocity of the contamination is

$$v_c = \frac{v_x}{R} \text{ [9]}$$

$v_c$ is the velocity of the solute front (ft/yr)

$v_x$ is the average linear velocity (ft/yr)

R is the retardation coefficient

*Constituent Velocity*

| | | | Time to relevant point of compliance (approx. 250 ft from Monitoring Wells) | |
|---|---|---|---|---|
| **Monitoring Well** | **Mercury** | **1,1-Dichloroethane** | **Mercury** | **1,1-Dichloroethane** |
| MW-3 | 0.022 ft/year | 1.95 ft/year | 11363 years | 128.2 years |
| MW-8 | 0.04 ft/year | 3.59 ft/year | 6250 years | 69.6 years |
| MW-10 | 0.014 ft/year | 1.24 ft/year | 17857 years | 201.6 years |

Linear velocity was obtained from Table 11.

## 2.4 Groundwater End Use

Groundwater flow is toward the drainage features where it discharges into Fredricks Branch[†], which flows northeast into Falling Creek and subsequently into the Neuse River. There are no known current users of groundwater for potable consumption within 2000 feet of the property.

## 2.5 Exposure Pathways

Evaluation of exposure pathways is designed to establish how a population is at risk of contamination exposure. If there is no method of exposure, there is no risk for adverse effects. There are four components that comprise the exposure pathways: (1) source and mechanism of constituent release into the environment, (2) retention and transport system, (3) exposure point, and (4) route of exposure to receptor at determined exposure point.

[†] The name of the creek was referenced as Fredricks Branch in the Transition Plan. The creek is not named on USGS Topographical Maps.

(1) Source of release has been identified as the landfill site. Mechanism of the release was the result of water percolating through the waste, thus picking up contamination and encountering the groundwater.
(2) Mechanism for transport of the contamination includes groundwater flow and vapor migration.
(3) Exposure points are the pathways in which contamination can be contacted - water supply wells, surface water, and vapor contact.
(4) Route of exposure is the method of contact at the exposure points – ingestion, inhalation and dermal.

Possible exposure pathways are assessed based on completeness, plausibility, and importance in relation to human health and the environment. The pathways for population exposure are limited to ingestion of contaminated groundwater through drinking, absorption of contaminated groundwater through dermal contact and inhalation of vapors. Source control measures limit direct contact with the contamination.

### 2.6 Human Health Risk Assessment

Human health was assessed for possible risk factors for contamination associated with the landfill. An evaluation of toxicity levels, presence of carcinogenic vs. non-carcinogenic constituents, as well as lifetime average daily dose calculations were computed for the constituents of concern. The primary purpose of toxicity assessment is to identify susceptible populations and lifestyles.

#### 2.6.1 Carcinogenic

Cancer is caused through a complex series of reactions and processes, that may produce tumors at the point of contact or throughout the body in other tissues once they have been dispersed throughout the system of the host.[5] Various chemicals elicit different responses and different doses of the same chemical can create different responses. The USEPA has five recommended hazard descriptors, “Carcinogenic to humans”, “Likely to be carcinogenic to humans”, “Suggestive evidence of Carcinogenic Potential”, “Inadequate information to assess carcinogenic potential”, “Not likely to be carcinogenic to humans”.[5] For the purpose of this report focus will be placed on the first two descriptors.

The current guidelines approach the situation with the assumption that any exposure to a known carcinogen has a possibility of causing cancer. The EPA’s Integrated Risk Information System (IRIS) was queried to evaluate carcinogenic risks for the constituents of concern, 1,1 dichloroethane and mercury.[4] 1,1 dichloroethane is considered to have “suggestive evidence of carcinogenic potential”, based only on limited animal analysis.[4] Due to the lack of supporting evidence, for this report we grouped 1,1 dichloroethane as a non-carcinogen. Mercury is considered not likely to be carcinogenic to humans. [4]

### 2.6.2 Non-Carcinogenic

The non-carcinogenic effects typically require overcoming the body's ability of resistance, therefore, creating a threshold below which effects will not occur. Similarly to carcinogenic effects, constituents may educe adverse effects based on dose, exposure rate, duration, and the individual susceptibility. Also like cancer, they can show up at the point of contact or spread throughout the system affecting tissue sporadically. Most chemicals can produce a range of effects depending on the aforementioned variables.

Human health risk assessment for non-carcinogenic effects was developed by the USEPA based on a series of toxicity studies to calculate the risk for non-carcinogenic effects. These constituent specific reference dose (RfD) values represent daily exposure levels that are not harmful to human health over a lifetime. These values for constituents of concern are shown on Table 12 for oral ingestion, Table 13 for inhalation, and Table 14 for dermal exposure.

## 2.7 Adult Risk

Adults can potentially be exposed to contamination of concern through consumption of contaminated water, bathing in contaminated water or inhalation of vapors arising from contaminated groundwater. Risk assessments were performed assuming adults would consume 2 liters of water each day with an exposure duration of 30 years.[‡] Dermal exposure risks assumed contact through bathing based on one 15 minute bath per day. Inhalation exposure assumed 20 cubic meters of air per day.[∂] Risk assessment is based on worst case scenario, where exposure is to the maximum observed concentrations and the current concentrations for the contamination of concern.

The contaminants of concern are not listed as having carcinogenic properties. Non-carcinogenic Lifetime Average Daily Dose (LADD) values were calculated for the constituents of concern and compared to RfD values by generating hazard index values. If a hazard index is greater than 1, there may be a concern for remedial action. Hazard index values for adults were shown on Table 12, Table 13, and Table 14, to be less than 1. Risk associated with contact with the contamination is considered minimal based on historic and current concentrations and with the limited location of contamination within the facilities boundaries.

## 2.8 Child Risk

Children can potentially be exposed to contamination of concern through consumption of contaminated water, bathing in contaminated water, or inhalation of vapors arising from contaminated groundwater. Risk

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[‡] Non-Carcinogenic values assume a 30 year exposure. Carcinogenic values assume a 70 year exposure.

[∂] Assumed values based on EPA published values. [5][6][7][8]

assessments were performed assuming children would consume 1 liter of water each day with an exposure duration of 8 years. Dermal exposure risks assumed contact through bathing based on one 15 minute bath per day. Inhalation exposure assumed 12 cubic meters of air per day.[∂] Risk assessment is based on worst case scenario, where exposure is to the maximum observed concentrations and the current concentrations for the contaminants of concern.

The contaminants of concern are not listed as having carcinogenic properties. Non-carcinogenic, LADD values were calculated and compared to RfD values by generating hazard index values. If a hazard index is greater than 1, there may be a concern for remedial action. Hazard index values for children were shown on Table 12, Table 13, and Table 14, to be less than 1. Risk associated with contact with the contamination is considered minimal based on historic and current concentrations and the contamination limited to within the facilities boundaries.

### 2.9 Sensitivity Receptor Pathways

Current human exposure to the contamination at the site is very minimal or non-existent. Institutional controls, as discussed in Section 3.2, limit access to the site. There are no identified potable groundwater users within 2000 feet of the facility. Contamination is within the relevant point of compliance. The site can be considered low risk.

## 3 CORRECTIVE MEASURES SCREENING AND EVALUATION

### 3.1 Overview

A remediation system needs to be designed that will be both cost effective and efficient in properly cleaning up the contamination. Contaminants of concern are halogenated aliphatic organic compounds and heavy metals. Biotransformation through cometabolism of 1-1 Dichloroethane has been shown to occur in both anaerobic and aerobic environments.[25] Biotransformation of Mercury occurs through reduction. "Reduction of $Hg^{2+}$ to elemental mercury occurs quite readily."[25][Page 683]

### 3.2 Institutional Controls

Several institutional control measures have been implemented to restrict and control access to the site and possible contact with contamination. Public access to the site is limited during operation hours. A chain link fence controls vehicle access off Hodges Farm Road. Heavy vegetation and the floodplain limit access from other areas. Lenoir County owns the majority of the property surrounding the facility. Public water is available to the surrounding area and there are no known users of groundwater within 2000 feet of the facility. Access to groundwater at the facility is controlled by locked monitoring wells.

### 3.3 Infiltration Controls

Prior to the facility becoming a C&D landfill, the first unit of the sanitary landfill was closed with a 24 inch soil cap and vegetative cover. The vegetative cover acts as an erosion control measure and also aides in the evapotranspiration process to reduce infiltration. "(T)he natural evapotranspiration process of vegetation has been recognized and harnessed as an alternative cover method to reduce landfill infiltration."[22][page 392] The second unit was closed with a cohesive cap of 18 inches of soil with a permeability of 1 x $10^{-5}$ cm/sec, and 18 inches of erosive layer. Surface water is diverted and is not impounded on the landfill.

### 3.4 Landfill Gas Controls

A passive horizontal gas venting system for methane extraction/collection was installed as part of the transition plan.

### 3.5 Groundwater Technologies

Various methods are available for remediation of contaminated groundwater. These methods include:

- Removal processes that physically remove the contamination or contaminated medium.
- Extraction processes that remove the contamination from the impacted medium.
- Destructive processes that chemically or biologically destroy the contaminant.
- Encapsulation processes that prevent the contamination from migrating.

Each type of remediation process has specific advantages and disadvantages. The process should be tailored to meet the site specific requirements. While the mobility class of 1-1-Dichloroethane is listed as very high, this is limited by that fact that groundwater velocity is slow. Biotranformation for both contaminants of concern occurs in an anaerobic reducing environment. In addition contaminants of concern have low Henry's constants that would make them susceptible to air stripping.

A number of corrective measures meet the above requirements and will be examined herein. Several common methods were not addressed due to their limitations. Physical removal of the contaminated medium through pump and treat was not addressed. Pump and treat is limited because it utilizes water as a carrier and is not effective at totally removing the contamination.[22] Permeable Treatment Barriers, which require groundwater to flow past the barrier, were not addressed due to the low velocity of the groundwater.

#### 3.5.1 Monitored Natural Attenuation

Monitored Natural Attenuation (MNA) consists of monitoring the natural attenuation process to demonstrate that contamination is degrading prior to reaching the relevant point of compliance. While MNA passively treats the contamination, it does not provide contamination containment, nor does it address the source area of

contamination. In addition MNA is not appropriate as a remediation alternative if there is a threat to human health. Natural Attenuation is achieved through processes of dilution, sorption, volatilization, dispersion and degradation of contamination. MNA has been shown to degrade 1,1-Dichloroethane through reductive dechlorination[9] and anaerobic biotransformation.[25]

### 3.5.2 Vapor Extraction System/Bioventing

Vapor Extraction (VE) and Bioventing induce air flow in the subsurface to volatilize the contamination. Vapor Extraction actively treats the contamination medium. This type of remediation more readily addresses contaminated soil and vadose contamination. To adequately strip contamination from the groundwater, the constituents of concern need to be susceptible to volatilization. A low Henry's Constant is favorable. In addition, site soil conditions must be favorable to allow for air flow. Air flow can be limited in clayey soils. Implementation of the system requires a pilot testing to adequately engineer an effective system.

### 3.5.3 Air Sparging

Air Sparging directly volatilized the contamination *in situ* and provides oxygen for biodegradation. Air sparging is performed by forcing air into the groundwater through injection wells. Typically, much of the mass removal of contamination occurs within the initial weeks/months of operation with biodegradation becoming more significant during long-term operation. Similar to VE systems, contamination and site soil conditions need to be favorable for sparging to be an adequate treatment alternative. Contamination of concern needs to readily volatilize and degrade under aerobic conditions. High clay content and tightly packed soils limit the effectiveness of air sparging, requiring more air injection wells. The system needs to be finely tuned to achieve break out pressure in wells and control air flow. Implementation of the system requires pilot testing to adequately engineer an effective system.

### 3.5.4 Enhanced Bioremediation

Enhanced Bioremediation (EB) is a unique, evolving, *in situ* treatment technology. EB introduces chemical compounds and/or organisms to stimulate and enhance the biodegradation process. The uniqueness of EB is that it can be tailored to the constituents of concern. Typical application is with injection of the chemical into the substrate. Application can utilize single injection points or permanent injection points.

Typically, injected compounds include HRC®, ORC®, emulsified edible oils (soy bean oil, molasses, EOS®), and hydrogen peroxide. Similar to VE and AS processes, site conditions need to be favorable for proper application. A dense formation limits the injection density and may require multiple closely spaced injection points. The life expectancy of compounds is generally less than a year and periodic re-injections may be

required to achieve desired results. Implementation of the system requires state regulation permitting prior to injection of chemicals.

### 3.5.5 Phytoremediation

Phytoremediation is the use of plants to remediate the contamination. Remediation is addressed through rizosphere biodegradation, phytoextraction, phytodegradation and phytostabilization. Rizosphere biodegradation is the microbiological breakdown of organic contamination in the soil. Phytoextraction is the uptake of organics and inorganics into the roots and above ground portions of the plants. Phytodegradation occurs within the plant where the contamination is either degraded within or volitalized from the plant. Phytostabilization immobilizes organic and inorganic contamination through absorption and accumulation of roots and precipitation in the rhizosphere Direct uptake of the plants is dependent on the relationship of the octanol-water partition coefficent ($K_{ow}$), where uptake is achieved when the log of $K_{ow}$ ranges from 0.5 to 3.5.[22]

### 3.5.6 Constructed Wetland

Constructed wetlands have been used for treatment of municipal waste water, industrial waste water, agricultural waste water and storm water. While constructed wetlands can be used for treatment of contaminated groundwater, the groundwater must be shallow or channeled into the wetland. Constructed wetlands passively purify contamination through enhancement of the natural processes of degradation, sorption, and phytoremediation.

# 4 SUMMARY CONCLUSIONS

## 4.1 Conclusions

Remediation alternatives are shown in Table 15. A number of factors influence selection of remediation alternatives.

- Contamination is below 2L levels.
- VOC's were not detected in the January 2007 sampling event.
- Contamination is within the relevant point of compliance.
- Contamination has been decreasing since installation of the soil caps. (See time series plot in Appendix B).
- There are no potable wells located within 2000 feet of the facility.
- Phytoremediation is occurring in the vegetated area north of MW-3.
- Constituent velocity is extremely slow.
- Contamination is below risk exposure levels.

- Contamination is limited to surficial aquifer.
- Modeling shows that contamination is maintained within the relevant point of compliance of the 250 feet from the waste limit.
- Direction of groundwater flow is owned and controlled by Lenoir County.
- Contamination has not reached MW-11 or MW-12 which are located approximately 150 feet from the waste.

Based the above factors, corrective action is not warranted. The most cost effective action would be to return to detection monitoring to assure the relevant point of compliance remains non-impacted.

### 4.2 Public Meeting

Upon acceptance of the remediation alternative, a public meeting will be conducted to discuss the results of the Assessment of Corrective Measures. Prior to the meeting, the ACM report will be made available for public review.

Respectfully submitted
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# TABLES

**Table 1:** Well Construction Details

| Monitoring Well | Date Installed | Ground Elevation | Datum Elevation | Northing | Easting | Well Diameter | Boring Diameter | Screen Interval (BGS) | Confining Layer | Status |
|---|---|---|---|---|---|---|---|---|---|---|
| MW-1 | 10/07/1980 | 100.17 | 98.34 | 563561.0457 | 2384799.9038 | 2 | 8 | ?-39.29 | - | Sampling Plan |
| MW-2 | 10/08/1980 | - | - | - | - | 2 | 8 | ?-39 | - | Not Sampled |
| MW-3 | 09/26/1991 | 60.71 | 63.87 | 565738.7089 | 2385774.3624 | 2 | 8 | 2-12 | - | Sampling Plan |
| MW-4 | 09/25/1991 | 65.86 | 68.03 | 565054.2711 | 2385971.0500 | 2 | 8 | 5-15 | - | Sampling Plan |
| MW-5 | 05/27/1992 | 83.97 | 86.15 | 564380.6554 | 2383976.4624 | 2 | 8 | 7-17 | - | Abandoned |
| MW-6 | Unknown | 84.93 | 85.56 | 564443.4953 | 2383917.3666 | 2 | 8 | - | - | Sampling Plan |
| MW-8 | 08/24/1994 | 85.39 | 88.29 | 565306.5563 | 2384693.6083 | 2 | 8 | 16.5-31.5 | - | Not Sampled |
| MW-9 | 08/24/1994 | 56.55 | 62.40 | 566503.8677 | 2385215.4900 | 2 | 8 | 4.8-19.8 | - | Sampling Plan |
| MW-10 | 08/24/1994 | 84.04 | 87.15 | 565578.3870 | 2384939.7968 | 2 | 8 | 16.5-31.5 | - | Not Sampled |
| MW-11 | 03/31/1999 | 75.36 | 78.26 | 565406.8257 | 2384608.2924 | 2 | 8 | 26-36 | - | Sampling Plan |
| MW-12 | 03/31/1999 | 74.65 | 77.46 | 565826.7160 | 2384981.6568 | 2 | 8 | 25-35 | - | Sampling Plan |

NOTE:
1. Ground and datum elevations in units of feet, diameter of well and boring in units of inches.

**Table 2:** Historical Groundwater Elevation Data

| WELL | 9/9/1994 | 10/28/1994 | 1/6/1995 | 2/24/1995 | 7/17/1995 | 1/23/1996 | 7/25/1996 | 1/14/1997 | 7/11/1997 | 1/21/1998 | 7/27/1998 | 1/6/1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-1 | 80.10 | 79.34 | 78.29 | 79.59 | 83.86 | 81.42 | 81.83 | 85.79 | 83.72 | 81.15 | 84.35 | 81.46 |
| MW-3 | 57.34 | 57.56 | 58.12 | 59.35 | 58.25 | 59.20 | 58.97 | 59.24 | 57.51 | 59.91 | 57.50 | 59.58 |
| MW-4 | 61.50 | 62.00 | 62.22 | 63.92 | 62.77 | 63.72 | 63.30 | 64.00 | 61.21 | 64.63 | 61.17 | 64.33 |
| MW-5 | - | 74.56 | 73.77 | 75.21 | 78.72 | 76.51 | 77.00 | 79.71 | 77.55 | 76.84 | - | - |
| MW-6 | - | - | - | - | - | - | - | - | - | - | 76.04 | 75.30 |
| MW-8 | 69.17 | 68.96 | 68.44 | 70.09 | 70.24 | 68.36 | 68.70 | 69.23 | 68.40 | 68.54 | 68.78 | 68.43 |
| MW-9 | 56.11 | 56.44 | 56.58 | 57.05 | 56.69 | 56.87 | 56.84 | 57.03 | 56.35 | 57.29 | 56.67 | 57.11 |
| MW-10 | 65.49 | 65.39 | 64.73 | 66.51 | 68.51 | 65.46 | 66.28 | 66.16 | 64.88 | 64.54 | 65.39 | 64.20 |
| MW-11 | - | - | - | - | - | - | - | - | - | - | - | - |
| MW-12 | - | - | - | - | - | - | - | - | - | - | - | - |

| WELL | 6/29/1999 | 1/27/2000 | 2/23/2000 | 7/17/2000 | 1/24/2001 | 7/11/2001 | 1/10/2002 | 7/8/2002 | 1/22/2003 | 7/7/2003 | 1/22/2004 | 7/12/2004 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-1 | 83.63 | 84.95 | - | 83.84 | 82.57 | 83.46 | 80.54 | 81.19 | 79.91 | 85.34 | 84.66 | 84.91 |
| MW-3 | 58.29 | 59.89 | - | 57.22 | 58.53 | 57.55 | 58.87 | 56.72 | 58.32 | 58.95 | 58.72 | 58.99 |
| MW-4 | 62.81 | 64.38 | - | 61.52 | 62.08 | 61.56 | 63.68 | 59.63 | 62.21 | 63.31 | 62.55 | 63.44 |
| MW-5 | - | - | - | - | - | - | - | - | - | - | - | - |
| MW-6 | 75.95 | 77.10 | - | 75.28 | 73.97 | 76.13 | 73.34 | 73.22 | 72.46 | 77.65 | 77.01 | 77.84 |
| MW-8 | 68.39 | 68.70 | - | 68.29 | 67.84 | 68.02 | 66.96 | - | - | - | - | - |
| MW-9 | 56.86 | 57.29 | - | 56.60 | 57.25 | 57.40 | 57.47 | 56.40 | 57.32 | 57.62 | 57.30 | 57.41 |
| MW-10 | 64.47 | 65.01 | - | 64.50 | 64.05 | 64.15 | 64.15 | - | - | - | - | - |
| MW-11 | - | - | 67.08 | 65.75 | 65.56 | 65.70 | 64.95 | 64.55 | 65.05 | 66.37 | 65.96 | 66.99 |
| MW-12 | - | - | 62.89 | 61.52 | 61.58 | 61.74 | 61.12 | 60.50 | 61.16 | 62.66 | 61.18 | 62.75 |

| WELL | 1/26/2005 | 7/14/2005 | 1/25/2006 | 7/13/2006 | 1/17/2007 | Observed High | Observed Low | Difference | Average |
|---|---|---|---|---|---|---|---|---|---|
| MW-1 | 82.31 | 82.01 | 82.21 | 81.34 | 84.78 | 85.79 | 78.29 | 7.50 | 82.45 |
| MW-3 | 58.92 | 56.80 | 60.08 | 54.44 | 59.05 | 60.08 | 54.44 | 5.64 | 58.35 |
| MW-4 | 62.93 | 60.76 | 64.58 | 58.53 | 63.25 | 64.63 | 58.53 | 6.10 | 62.57 |
| MW-5 | - | - | - | - | - | 79.71 | 73.77 | 5.94 | 76.65 |
| MW-6 | 75.18 | 73.91 | 74.99 | 71.73 | 76.78 | 77.84 | 71.73 | 6.11 | 75.21 |
| MW-8 | - | - | - | - | - | 70.24 | 66.96 | 3.28 | 68.64 |
| MW-9 | 57.24 | 56.57 | 57.45 | 53.79 | 57.45 | 57.62 | 53.79 | 3.83 | 56.87 |
| MW-10 | - | - | - | - | - | 68.51 | 64.05 | 4.46 | 65.22 |
| MW-11 | 65.85 | 65.09 | 66.47 | 62.23 | 66.68 | 67.08 | 62.23 | 4.85 | 65.62 |
| MW-12 | 61.88 | 61.09 | 62.49 | 58.23 | 62.93 | 62.93 | 58.23 | 4.70 | 61.58 |

**Table 3:** Slug Test Results

| Well | Screen Interval (BGS) | Initial DTW (BTOP) | Initial Head Change | K (cm/sec) | Lithology |
|---|---|---|---|---|---|
| MW-1* | Unknown | 18.87 | 18.87 | 4.30E-04 | Silty Sand |
| MW-3* | 2-12 | 7.49 | 4.49 | 1.30E-04 | Silty Sand |
| MW-4* | 5-15 | 8.79 | 8.79 | 5.40E-04 | Silty Sand |
| MW-5* | 7-17 | 11.27 | 8.27 | 5.30E-04 | Silty Sand |
| MW-8* | 16.5-31.5 | 19.25 | 9.25 | 2.20E-04 | Sandy Clay |
| MW-9* | 4.8-19.8 | 7.56 | 7.56 | 3.80E-04 | Sandy Clay |
| MW-10* | 16.5-31.5 | 22.15 | 7.15 | 6.90E-05 | Clayey Sand |
| MW-11# | 26-36 | 12.02 | 3.38 | 2.07E-05 | Sand |
| MW-12# | 25-35 | 15.46 | 2.84 | 6.55E-06 | Sand |

| Summary Statistics | | | |
|---|---|---|---|
| Mean | 2.58E-04 | Maximum | 5.40E-04 |
| Median | 2.20E-04 | Minimum | 6.55E-06 |
| Sandard Deviation | 2.15E-04 | Count | 9 |

* Information obtained from GAI Consultants, Inc, 1996, Responses to Review Comments Lenoir County Landfill Permit #54-03 LaGrange, North Carolina
# Information provided to NCDENR from MESCO on June 25, 1999.

**Table 4:** Summary of Geologic Soil Properties

| Well | Lithology | Specific Gravity | Dry Density | Total Porosity (%) | Effective Porosity (%) |
|---|---|---|---|---|---|
| MW-1 | Silty Sand | 2.72 | 115 | 32.2 | 20 |
| MW-3 | Silty Sand | 2.70 | 110 | 34.7 | 20 |
| MW-4 | Silty Sand | 2.70 | 110 | 34.7 | 20 |
| MW-5 | Silty Sand | 2.71 | 105 | 37.9 | 20 |
| MW-8 | Sandy Clay | 2.67 | 95 | 43.0 | 20 |
| MW-9 | Sandy Clay | 2.68 | 105 | 37.2 | 20 |
| MW-10 | Clayey Sand | 2.67 | 100 | 40.4 | 20 |

Information obtained from GAI Consultants, Inc, 1996, Responses to Review Comments Lenoir County Landfill Permit #54-03 LaGrange, North Carolina

**Table 5:** Summary of Field Parameters

| | Name | 9/9/1994 | 10/28/1994 | 1/6/1995 | 2/24/1995 | 7/17/1995 | 1/23/1996 | 7/25/1996 | 1/14/1997 | 7/11/1997 | 1/21/1998 | 7/27/1998 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-1 | pH | 5.6 | 3.9 | 4.1 | 4 | 4.2 | 3.5 | 4.4 | 4.6 | 4.4 | 4.3 | 3.9 |
| | Temperature | 21 | 19 | 16 | 16 | 18 | 17 | 21 | 15 | 19 | 15 | 18 |
| | Conductivity | 87 | 83 | 82 | 83 | 82 | 110 | 81 | 82 | 73 | 73 | 66 |
| MW-3 | pH | 4.4 | 4.3 | 5.2 | 5.2 | 5.7 | 4.8 | 6 | 5.6 | 5.4 | 5.4 | 5.7 |
| | Temperature | 23 | 19 | 12 | 12 | 21 | 10 | 24 | 10 | 19 | 10 | 23 |
| | Conductivity | 160 | 120 | 58 | 58 | 76 | 75 | 59 | 74 | 270 | 48 | 340 |
| MW-4 | pH | 4.1 | 4.1 | 4.2 | 4.2 | 5.1 | 3.7 | 5.1 | 5.3 | 4.8 | 4.7 | 4.7 |
| | Temperature | 23 | 20 | 13 | 13 | 22 | 10 | 23 | 11 | 22 | 11 | 23 |
| | Conductivity | 110 | 100 | 87 | 87 | 110 | 200 | 130 | 180 | 120 | 160 | 200 |
| MW-5 | pH | - | 3.9 | 4 | 4 | 4.2 | 3.5 | 4.3 | 4.6 | 4.3 | 4.4 | - |
| | Temperature | - | 22 | 17 | 16 | 22 | 15 | 22 | 12 | 21 | 15 | - |
| | Conductivity | - | 110 | 110 | 100 | 100 | 95 | 85 | 90 | 71 | 63 | - |
| MW-6 | pH | - | - | - | - | - | - | - | - | - | - | 3.8 |
| | Temperature | - | - | - | - | - | - | - | - | - | - | 22 |
| | Conductivity | - | - | - | - | - | - | - | - | - | - | 170 |
| MW-8 | pH | 4 | 4.3 | 4.3 | 4.3 | 5 | 3.5 | 4.1 | 4.8 | 4.6 | 4 | 4 |
| | Temperature | 22 | 20 | 18 | 16 | 19 | 16 | 22 | 15 | 18 | 15 | 20 |
| | Conductivity | 50 | 63 | 41 | 47 | 52 | 200 | 190 | 51 | 51 | 57 | 78 |
| MW-9 | pH | 4.1 | 4.2 | 4.3 | 4.1 | 4.6 | 3.6 | 4.7 | 4.6 | 4.4 | 4.5 | 3.8 |
| | Temperature | 25 | 23 | 19 | 16 | 24 | 20 | 24 | 17 | 22 | 14 | 23 |
| | Conductivity | 190 | 170 | 140 | 150 | 190 | 200 | 160 | 180 | 150 | 150 | 170 |
| MW-10 | pH | 4.1 | 4.3 | 4.2 | 4.3 | 4.8 | 3.6 | 4.7 | 4.9 | 4.6 | 4.1 | 4 |
| | Temperature | 21 | 20 | 18 | 17 | 20 | 15 | 22 | 17 | 21 | 15 | 22 |
| | Conductivity | 51 | 48 | 48 | 48 | 56 | 54 | 69 | 60 | 55 | 42 | 54 |
| MW-11 | pH | - | - | - | - | - | - | - | - | - | - | - |
| | Temperature | - | - | - | - | - | - | - | - | - | - | - |
| | Conductivity | - | - | - | - | - | - | - | - | - | - | - |
| MW-12 | pH | - | - | - | - | - | - | - | - | - | - | - |
| | Temperature | - | - | - | - | - | - | - | - | - | - | - |
| | Conductivity | - | - | - | - | - | - | - | - | - | - | - |
| SW-1 | pH | 6.7 | 5.1 | 6 | 5.8 | - | 5 | 6.1 | 6.2 | 6.2 | 5.2 | 5.9 |
| | Temperature | 22 | 14 | 5 | 12 | - | 8 | 26 | 2 | 22 | 4 | 28 |
| | Conductivity | 100 | 84 | 80 | 95 | - | 83 | 150 | 85 | 180 | 81 | 79 |
| SW-2 | pH | 6.3 | 5.7 | 7.2 | 6.1 | - | 5.7 | 7 | 6.2 | 8.2 | 6.2 | 7.4 |
| | Temperature | 27 | 17 | 2 | 15 | - | 10 | 27 | 3 | 27 | 5 | 28 |
| | Conductivity | 93 | 65 | 130 | 92 | - | 180 | 170 | 490 | 170 | 180 | 170 |

**Table 5:** Summary of Field Parameters

| | Name | 1/6/1999 | 6/29/1999 | 1/27/2000 | 2/23/2000 | 7/17/2000 | 1/24/2001 | 7/11/2001 | 1/10/2002 | 7/8/2002 | 1/22/2003 | 7/7/2003 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-1 | pH | 4.6 | 4.8 | 6.8 | - | 4.8 | 4.1 | 4.8 | 4.2 | 4.4 | 4.5 | 4.5 |
| | Temperature | 12 | 19 | 15 | - | 18 | 12 | 19 | 18 | 19 | 14 | 20 |
| | Conductivity | 56 | 62 | 60 | - | 54 | 62 | 59 | 70 | 63 | 71 | 71 |
| MW-3 | pH | 5.6 | 5.6 | 6.1 | - | 5.2 | 4.8 | 5.6 | 5 | 5.7 | 4.9 | 5.3 |
| | Temperature | 9 | 21 | 8 | - | 21 | 11 | 22 | 11 | 20 | 10 | 22 |
| | Conductivity | 56 | 87 | 68 | - | 160 | 52 | 300 | 290 | 380 | 93 | 79 |
| MW-4 | pH | 4.9 | 4.8 | 5.8 | - | 5.4 | 4.7 | 4.8 | 4.6 | 4.8 | 5.6 | 5.3 |
| | Temperature | 11 | 22 | 9 | - | 21 | 12 | 20 | 14 | 19 | 11 | 24 |
| | Conductivity | 180 | 220 | 180 | - | 230 | 28 | 360 | 380 | 270 | 396 | 335 |
| MW-5 | pH | - | - | - | - | - | - | - | - | - | - | - |
| | Temperature | - | - | - | - | - | - | - | - | - | - | - |
| | Conductivity | - | - | - | - | - | - | - | - | - | - | - |
| MW-6 | pH | 4.3 | 4.9 | 6.5 | - | 3.7 | 4 | 4.1 | 4 | 4.1 | 4.2 | 5 |
| | Temperature | 17 | 20 | 16 | - | 21 | 11 | 20 | 18 | 20 | 15 | 21 |
| | Conductivity | 170 | 300 | 240 | - | 200 | 190 | 160 | 160 | 120 | 117 | 180 |
| MW-8 | pH | 4.7 | 4.5 | 5.6 | - | 4.3 | 4 | 4 | 3.9 | - | - | - |
| | Temperature | 13 | 21 | 16 | - | 19 | 17 | 24 | 19 | - | - | - |
| | Conductivity | 42 | 58 | 65 | - | 54 | 68 | 100 | 86 | - | - | - |
| MW-9 | pH | 4.7 | 4.4 | 5.6 | - | 4.4 | 4.8 | 5.8 | 5.4 | 5.7 | 5.6 | 5.7 |
| | Temperature | 17 | 21 | 17 | - | 22 | 12 | 23 | 12 | 21 | 16 | 23 |
| | Conductivity | 170 | 160 | 200 | - | 150 | 210 | 440 | 540 | 480 | 438 | 334 |
| MW-10 | pH | 4.8 | 4.6 | 5 | - | 4.4 | 4.2 | 4.1 | 4.1 | - | - | - |
| | Temperature | 15 | 22 | 19 | - | 22 | 19 | 20 | 19 | - | - | - |
| | Conductivity | 36 | 46 | 54 | - | 42 | 50 | 54 | 74 | - | - | - |
| MW-11 | pH | - | - | - | 5.5 | 4.2 | 3.9 | 4.1 | 4 | 4.1 | 4.3 | 4.5 |
| | Temperature | - | - | - | 18 | 19 | 17 | 21 | 18 | 19 | 16 | 20 |
| | Conductivity | - | - | - | 65 | 64 | 68 | 69 | 93 | 64 | 64 | 58 |
| MW-12 | pH | - | - | - | 5.2 | 4.7 | 4.5 | 4.4 | 5.6 | 4.7 | 4.7 | 4.5 |
| | Temperature | - | - | - | 20 | 23 | 19 | 24 | 22 | 22 | 20 | 24 |
| | Conductivity | - | - | - | 42 | 26 | 32 | 36 | 45 | 39 | 55 | 74 |
| SW-1 | pH | 6.8 | 6.3 | 6.7 | - | 5.8 | 5.1 | - | 5.6 | 5.6 | 5.8 | 6.2 |
| | Temperature | 2 | 26 | 3 | - | 29 | 6 | - | 8 | 20 | 5 | 28 |
| | Conductivity | 80 | 87 | 83 | - | 81 | 76 | - | 100 | 83 | 106 | 86 |
| SW-2 | pH | 5.8 | 6.7 | 6.4 | - | 6 | - | 6 | 5.1 | - | 7.1 | 7.5 |
| | Temperature | 4 | 27 | 1 | - | 30 | - | 30 | 7 | - | 3 | 31 |
| | Conductivity | 120 | 190 | 170 | - | 100 | - | 90 | 63 | - | 406 | 279 |

**Table 5:** Summary of Field Parameters

| | Name | 1/22/2004 | 7/12/2004 | 1/26/2005 | 7/14/2005 | 1/25/2006 | 7/13/2006 | 1/17/2007 |
|---|---|---|---|---|---|---|---|---|
| MW-1 | pH | 4.4 | 4.8 | 4.5 | 4.6 | 4.4 | 4.5 | 4.5 |
| | Temperature | 16 | 19 | 17 | 19 | 17 | 19 | 15 |
| | Conductivity | 75 | 70 | 68 | 76 | 79 | 76 | 72 |
| MW-3 | pH | 5.1 | 5.6 | 5.6 | 5.6 | 5.7 | 5.8 | 5.3 |
| | Temperature | 12 | 23 | 13 | 23 | 12 | 21 | 13 |
| | Conductivity | 65 | 44 | 52 | 363 | 60 | 422 | 59 |
| MW-4 | pH | 5 | 5.2 | 5.1 | 5.1 | 5.1 | 5.1 | 4.7 |
| | Temperature | 14 | 23 | 11 | 24 | 11 | 23 | 13 |
| | Conductivity | 307 | 278 | 201 | 156 | 149 | 121 | 113 |
| MW-5 | pH | - | - | - | - | - | - | - |
| | Temperature | - | - | - | - | - | - | - |
| | Conductivity | - | - | - | - | - | - | - |
| MW-6 | pH | 4.5 | 4.7 | 4.4 | 4.8 | 4.4 | 4.5 | 4.6 |
| | Temperature | 16 | 20 | 17 | 21 | 16 | 21 | 15 |
| | Conductivity | 172 | 132 | 137 | 116 | 145 | 117 | 121 |
| MW-8 | pH | - | - | - | - | - | - | - |
| | Temperature | - | - | - | - | - | - | - |
| | Conductivity | - | - | - | - | - | - | - |
| MW-9 | pH | 5.3 | 5.6 | 5.6 | 5 | 5.2 | 4.8 | 4.7 |
| | Temperature | 18 | 21 | 17 | 25 | 16 | 23 | 15 |
| | Conductivity | 255 | 291 | 274 | 128 | 173 | 124 | 98 |
| MW-10 | pH | - | - | - | - | - | - | - |
| | Temperature | - | - | - | - | - | - | - |
| | Conductivity | - | - | - | - | - | - | - |
| MW-11 | pH | 4 | 4.7 | 4.6 | 5.7 | 4.9 | 5 | 5.2 |
| | Temperature | 16 | 20 | 17 | 19 | 15 | 19 | 16 |
| | Conductivity | 94 | 51 | 54 | 57 | 60 | 62 | 57 |
| MW-12 | pH | 4.2 | 4.8 | 4.9 | 5 | 4.5 | 4.8 | 4.3 |
| | Temperature | 20 | 23 | 18 | 21 | 18 | 21 | 16 |
| | Conductivity | 107 | 80 | 68 | 73 | 74 | 63 | 106 |
| SW-1 | pH | 6 | 6 | 7.2 | 6.1 | 6.3 | 6.1 | 6 |
| | Temperature | 6 | 30 | 6 | 28 | 11 | 28 | 8 |
| | Conductivity | 111 | 79 | 189 | 91 | 114 | 83 | 107 |
| SW-2 | pH | 6.9 | 7.6 | 5.8 | 6.4 | 6.5 | 6.9 | 6.7 |
| | Temperature | 4 | 28 | 7 | 23 | 9 | 27 | 9 |
| | Conductivity | 497 | 139 | 96 | 181 | 200 | 129 | 274 |

**Table 6:** Historical Inorganic Groundwater Results

| Well ID | Parameter Name[1] | Sample Date | Result | Unit | PQL[2] | NCGW2L[3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-3 | Arsenic | 07/08/2002 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-3 | Arsenic | 01/22/2003 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-3 | Arsenic | 07/07/2003 | 0.021 | mg/l | 0.01 | 0.05 | |
| MW-4 | Arsenic | 07/27/1998 | 0.014 | mg/l | 0.01 | 0.05 | |
| MW-4 | Arsenic | 07/17/2000 | 0.01 | mg/l | 0.01 | 0.05 | |
| MW-4 | Arsenic | 07/08/2002 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-4 | Arsenic | 01/22/2003 | 0.017 | mg/l | 0.01 | 0.05 | |
| MW-4 | Arsenic | 07/07/2003 | 0.015 | mg/l | 0.01 | 0.05 | |
| MW-9 | Arsenic | 09/09/1994 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-9 | Arsenic | 07/08/2002 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-9 | Arsenic | 01/22/2003 | 0.014 | mg/l | 0.01 | 0.05 | |
| MW-9 | Arsenic | 01/22/2004 | 0.014 | mg/l | 0.01 | 0.05 | |
| MW-9 | Arsenic | 01/26/2005 | 0.028 | mg/l | 0.01 | 0.05 | |
| MW-3 | Beryllium, total | 07/17/1995 | 0.002 | mg/l | 0.002 | | |
| MW-4 | Beryllium, total | 07/17/1995 | 0.002 | mg/l | 0.002 | | |
| MW-4 | Beryllium, total | 07/17/2000 | 0.004 | mg/l | 0.002 | | |
| MW-8 | Beryllium, total | 01/06/1995 | 0.002 | mg/l | 0.002 | | |
| MW-8 | Beryllium, total | 07/17/1995 | 0.002 | mg/l | 0.002 | | |
| MW-9 | Beryllium, total | 09/09/1994 | 0.003 | mg/l | 0.002 | | |
| MW-9 | Beryllium, total | 07/17/1995 | 0.004 | mg/l | 0.002 | | |
| MW-9 | Beryllium, total | 07/25/1996 | 0.002 | mg/l | 0.002 | | |
| MW-9 | Beryllium, total | 07/17/2000 | 0.003 | mg/l | 0.002 | | |
| MW-3 | Cadmium, total | 01/26/2005 | 0.001 | mg/l | 0.001 | 0.0018 | |
| **MW-8** | **Cadmium, total** | **01/24/2001** | **0.002** | **mg/l** | **0.001** | **0.0018** | **0.0003** |
| MW-9 | Cadmium, total | 01/14/1997 | 0.001 | mg/l | 0.001 | 0.0018 | |
| MW-1 | Chromium, total | 01/06/1999 | 0.014 | mg/l | 0.01 | 0.05 | |
| MW-1 | Chromium, total | 01/27/2000 | 0.011 | mg/l | 0.01 | 0.05 | |
| MW-1 | Chromium, total | 01/10/2002 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 09/09/1994 | 0.033 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 07/17/1995 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 07/17/1997 | 0.017 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 01/21/1998 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 01/06/1999 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 06/29/1999 | 0.026 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 01/27/2000 | 0.022 | mg/l | 0.01 | 0.05 | |
| MW-10 | Chromium, total | 07/17/2000 | 0.013 | mg/l | 0.01 | 0.05 | |
| **MW-10** | **Chromium, total** | **07/11/2001** | **0.055** | **mg/l** | **0.01** | **0.05** | **0.005** |
| MW-11 | Chromium, total | 07/17/2000 | 0.023 | mg/l | 0.01 | 0.05 | |
| MW-12 | Chromium, total | 07/17/2000 | 0.027 | mg/l | 0.01 | 0.05 | |
| MW-12 | Chromium, total | 07/11/2001 | 0.019 | mg/l | 0.01 | 0.05 | |
| MW-12 | Chromium, total | 07/08/2002 | 0.016 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 01/06/1995 | 0.022 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 07/17/1995 | 0.02 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 07/27/1998 | 0.016 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 06/29/1999 | 0.027 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 01/27/2000 | 0.015 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 07/17/2000 | 0.024 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 07/11/2001 | 0.041 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 01/10/2002 | 0.028 | mg/l | 0.01 | 0.05 | |
| **MW-3** | **Chromium, total** | **07/08/2002** | **0.054** | **mg/l** | **0.01** | **0.05** | **0.004** |
| MW-3 | Chromium, total | 01/22/2003 | 0.046 | mg/l | 0.01 | 0.05 | |
| **MW-3** | **Chromium, total** | **07/07/2003** | **0.14** | **mg/l** | **0.01** | **0.05** | **0.09** |

**Table 6:** Historical Inorganic Groundwater Results

| Well ID | Parameter Name[1] | Sample Date | Result | Unit | PQL[2] | NCGW2L[3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-3 | Chromium, total | 01/22/2004 | 0.016 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 07/12/2004 | 0.014 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 09/09/1994 | 0.01 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 07/17/1995 | 0.042 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 07/25/1996 | 0.046 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 07/11/1997 | 0.029 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 01/21/1998 | 0.023 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 07/27/1998 | 0.039 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 01/06/1999 | 0.033 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 06/29/1999 | 0.04 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 01/27/2000 | 0.038 | mg/l | 0.01 | 0.05 | |
| **MW-4** | **Chromium, total** | **07/17/2000** | **0.139** | **mg/l** | **0.01** | **0.05** | **0.089** |
| **MW-4** | **Chromium, total** | **01/24/2001** | **0.105** | **mg/l** | **0.01** | **0.05** | **0.055** |
| MW-4 | Chromium, total | 07/11/2001 | 0.049 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 01/10/2002 | 0.02 | mg/l | 0.01 | 0.05 | |
| **MW-4** | **Chromium, total** | **07/08/2002** | **0.126** | **mg/l** | **0.01** | **0.05** | **0.076** |
| MW-4 | Chromium, total | 01/22/2003 | 0.049 | mg/l | 0.01 | 0.05 | |
| **MW-4** | **Chromium, total** | **07/07/2003** | **0.078** | **mg/l** | **0.01** | **0.05** | **0.028** |
| MW-4 | Chromium, total | 01/22/2004 | 0.019 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 01/26/2005 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-6 | Chromium, total | 01/06/1999 | 0.034 | mg/l | 0.01 | 0.05 | |
| MW-6 | Chromium, total | 01/27/2000 | 0.024 | mg/l | 0.01 | 0.05 | |
| MW-6 | Chromium, total | 07/17/2000 | 0.023 | mg/l | 0.01 | 0.05 | |
| MW-6 | Chromium, total | 01/22/2003 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-6 | Chromium, total | 01/22/2004 | 0.027 | mg/l | 0.01 | 0.05 | |
| MW-7 | Chromium, total | 07/11/1997 | 0.038 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 02/24/1995 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 07/17/1995 | 0.039 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 07/11/1997 | 0.029 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 07/27/1998 | 0.018 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 06/29/1999 | 0.021 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 01/27/2000 | 0.015 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 01/24/2001 | 0.024 | mg/l | 0.01 | 0.05 | |
| **MW-8** | **Chromium, total** | **07/11/2001** | **0.055** | **mg/l** | **0.01** | **0.05** | **0.005** |
| **MW-8** | **Chromium, total** | **01/10/2002** | **0.118** | **mg/l** | **0.01** | **0.05** | **0.068** |
| MW-9 | Chromium, total | 09/09/1994 | 0.021 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 07/17/1995 | 0.033 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 07/25/1996 | 0.023 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 01/14/1997 | 0.015 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 07/17/1997 | 0.014 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 01/21/1998 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 07/27/1998 | 0.018 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 01/06/1999 | 0.015 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 06/29/1999 | 0.017 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 01/27/2000 | 0.011 | mg/l | 0.01 | 0.05 | |
| **MW-9** | **Chromium, total** | **07/17/2000** | **0.063** | **mg/l** | **0.01** | **0.05** | **0.013** |
| MW-9 | Chromium, total | 01/24/2001 | 0.034 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 07/11/2001 | 0.04 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 07/08/2002 | 0.016 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 01/22/2003 | 0.015 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 07/07/2003 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 01/22/2004 | 0.011 | mg/l | 0.01 | 0.05 | |

**Table 6:** Historical Inorganic Groundwater Results

| Well ID | Parameter Name[1] | Sample Date | Result | Unit | PQL[2] | NCGW2L[3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-4 | Cobalt, total | 07/17/2000 | 0.01 | mg/l | 0.01 | | |
| MW-4 | Cobalt, total | 01/24/2001 | 0.011 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 09/09/1994 | 0.019 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 07/17/1995 | 0.017 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 07/25/1996 | 0.012 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 01/14/1997 | 0.012 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 01/27/2000 | 0.017 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 07/17/2000 | 0.013 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 01/24/2001 | 0.043 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 07/08/2002 | 0.049 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 01/22/2003 | 0.043 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 07/07/2003 | 0.057 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 01/22/2004 | 0.065 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 01/26/2005 | 0.033 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 07/14/2005 | 0.015 | mg/l | 0.01 | | |
| MW-9 | Cobalt, total | 01/25/2006 | 0.016 | mg/l | 0.01 | | |
| MW-10 | Lead, total | 01/23/1996 | 0.01 | mg/l | 0.01 | 0.015 | |
| **MW-3** | **Lead, total** | **10/28/1994** | **0.092** | **mg/l** | **0.01** | **0.015** | **0.077** |
| MW-3 | Lead, total | 01/06/1995 | 0.01 | mg/l | 0.01 | 0.015 | |
| MW-3 | Lead, total | 07/17/1995 | 0.011 | mg/l | 0.01 | 0.015 | |
| MW-3 | Lead, total | 07/17/2000 | 0.013 | mg/l | 0.01 | 0.015 | |
| MW-3 | Lead, total | 07/08/2002 | 0.012 | mg/l | 0.01 | 0.015 | |
| MW-3 | Lead, total | 01/22/2003 | 0.011 | mg/l | 0.01 | 0.015 | |
| **MW-3** | **Lead, total** | **07/07/2003** | **0.033** | **mg/l** | **0.01** | **0.015** | **0.018** |
| **MW-4** | **Lead, total** | **09/09/1994** | **0.054** | **mg/l** | **0.01** | **0.015** | **0.039** |
| **MW-4** | **Lead, total** | **07/17/1995** | **0.019** | **mg/l** | **0.01** | **0.015** | **0.004** |
| **MW-4** | **Lead, total** | **07/25/1996** | **0.021** | **mg/l** | **0.01** | **0.015** | **0.006** |
| **MW-4** | **Lead, total** | **07/11/1997** | **0.017** | **mg/l** | **0.01** | **0.015** | **0.002** |
| **MW-4** | **Lead, total** | **01/21/1998** | **0.016** | **mg/l** | **0.01** | **0.015** | **0.001** |
| **MW-4** | **Lead, total** | **07/27/1998** | **0.022** | **mg/l** | **0.01** | **0.015** | **0.007** |
| **MW-4** | **Lead, total** | **06/29/1999** | **0.016** | **mg/l** | **0.01** | **0.015** | **0.001** |
| MW-4 | Lead, total | 01/27/2000 | 0.011 | mg/l | 0.01 | 0.015 | |
| **MW-4** | **Lead, total** | **07/17/2000** | **0.022** | **mg/l** | **0.01** | **0.015** | **0.007** |
| **MW-4** | **Lead, total** | **01/24/2001** | **0.025** | **mg/l** | **0.01** | **0.015** | **0.01** |
| MW-4 | Lead, total | 07/11/2001 | 0.011 | mg/l | 0.01 | 0.015 | |
| **MW-4** | **Lead, total** | **07/08/2002** | **0.039** | **mg/l** | **0.01** | **0.015** | **0.024** |
| **MW-4** | **Lead, total** | **01/22/2003** | **0.022** | **mg/l** | **0.01** | **0.015** | **0.007** |
| **MW-4** | **Lead, total** | **07/07/2003** | **0.036** | **mg/l** | **0.01** | **0.015** | **0.021** |
| MW-5 | Lead, total | 10/28/1994 | 0.013 | mg/l | 0.01 | 0.015 | |
| MW-5 | Lead, total | 07/25/1996 | 0.012 | mg/l | 0.01 | 0.015 | |
| MW-5 | Lead, total | 07/11/1997 | 0.01 | mg/l | 0.01 | 0.015 | |
| **MW-5** | **Lead, total** | **01/21/1998** | **0.024** | **mg/l** | **0.01** | **0.015** | **0.009** |
| MW-6 | Lead, total | 01/27/2000 | 0.01 | mg/l | 0.01 | 0.015 | |
| MW-6 | Lead, total | 07/17/2000 | 0.014 | mg/l | 0.01 | 0.015 | |
| MW-6 | Lead, total | 01/22/2004 | 0.011 | mg/l | 0.01 | 0.015 | |
| **MW-7** | **Lead, total** | **07/11/1997** | **0.028** | **mg/l** | **0.01** | **0.015** | **0.013** |
| **MW-8** | **Lead, total** | **09/09/1994** | **0.027** | **mg/l** | **0.01** | **0.015** | **0.012** |
| MW-8 | Lead, total | 07/11/1997 | 0.011 | mg/l | 0.01 | 0.015 | |
| MW-8 | Lead, total | 01/10/2002 | 0.012 | mg/l | 0.01 | 0.015 | |
| MW-9 | Lead, total | 09/09/1994 | 0.01 | mg/l | 0.01 | 0.015 | |
| MW-9 | Lead, total | 07/17/1995 | 0.015 | mg/l | 0.01 | 0.015 | |
| MW-9 | Lead, total | 07/25/1996 | 0.012 | mg/l | 0.01 | 0.015 | |

**Table 6:** Historical Inorganic Groundwater Results

| Well ID | Parameter Name[1] | Sample Date | Result | Unit | PQL[2] | NCGW2L[3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-9 | Lead, total | 01/14/1997 | 0.011 | mg/l | 0.01 | 0.015 | |
| MW-9 | Lead, total | 01/21/1998 | 0.01 | mg/l | 0.01 | 0.015 | |
| **MW-9** | **Lead, total** | **07/17/2000** | **0.016** | **mg/l** | **0.01** | **0.015** | **0.001** |
| MW-9 | Lead, total | 01/24/2001 | 0.013 | mg/l | 0.01 | 0.015 | |
| MW-9 | Lead, total | 01/22/2003 | 0.013 | mg/l | 0.01 | 0.015 | |
| MW-9 | Lead, total | 07/07/2003 | 0.011 | mg/l | 0.01 | 0.015 | |
| MW-11 | Manganese | 01/17/2007 | 13 | ug/l | 10 | 50 | |
| MW-3 | Manganese | 01/17/2007 | 22 | ug/l | 10 | 50 | |
| **MW-4** | **Manganese** | **01/17/2007** | **56** | **ug/l** | **10** | **50** | **6** |
| MW-6 | Manganese | 01/17/2007 | 46 | ug/l | 10 | 50 | |
| **MW-9** | **Manganese** | **01/17/2007** | **287** | **ug/l** | **10** | **50** | **237** |
| MW-10 | Mercury | 07/17/1995 | 0.0006 | mg/l | 0.0005 | 0.0011 | |
| MW-10 | Mercury | 01/23/1996 | 0.0007 | mg/l | 0.0005 | 0.0011 | |
| MW-10 | Mercury | 01/14/1997 | 0.0007 | mg/l | 0.0005 | 0.0011 | |
| MW-12 | Mercury | 01/17/2007 | 0.2 | ug/l | 0.2 | 1.1 | |
| **MW-3** | **Mercury** | **07/07/2003** | **0.0012** | **mg/l** | **0.0005** | **0.0011** | **0.0001** |
| MW-4 | Mercury | 01/24/2001 | 0.0005 | mg/l | 0.0005 | 0.0011 | |
| **MW-5** | **Mercury** | **01/23/1996** | **0.002** | **mg/l** | **0.0005** | **0.0011** | **0.0009** |
| **MW-5** | **Mercury** | **01/14/1997** | **0.002** | **mg/l** | **0.0005** | **0.0011** | **0.0009** |
| MW-5 | Mercury | 01/21/1998 | 0.0006 | mg/l | 0.0005 | 0.0011 | |
| **MW-8** | **Mercury** | **07/17/1995** | **0.0013** | **mg/l** | **0.0005** | **0.0011** | **0.0002** |
| **MW-8** | **Mercury** | **01/23/1996** | **0.0017** | **mg/l** | **0.0005** | **0.0011** | **0.0006** |
| **MW-8** | **Mercury** | **07/25/1996** | **0.0023** | **mg/l** | **0.0005** | **0.0011** | **0.0012** |
| **MW-8** | **Mercury** | **01/14/1997** | **0.0017** | **mg/l** | **0.0005** | **0.0011** | **0.0006** |
| **MW-8** | **Mercury** | **01/21/1998** | **0.0012** | **mg/l** | **0.0005** | **0.0011** | **0.0001** |
| MW-8 | Mercury | 07/27/1998 | 0.0011 | mg/l | 0.0005 | 0.0011 | |
| MW-8 | Mercury | 06/29/1999 | 0.0011 | mg/l | 0.0005 | 0.0011 | |
| MW-8 | Mercury | 01/27/2000 | 0.0006 | mg/l | 0.0005 | 0.0011 | |
| **MW-8** | **Mercury** | **01/24/2001** | **0.0024** | **mg/l** | **0.0005** | **0.0011** | **0.0013** |
| **MW-8** | **Mercury** | **07/11/2001** | **0.0032** | **mg/l** | **0.0005** | **0.0011** | **0.0021** |
| **MW-8** | **Mercury** | **01/10/2002** | **0.0061** | **mg/l** | **0.0005** | **0.0011** | **0.005** |
| MW-1 | Nickel, total | 01/21/1998 | 0.011 | mg/l | 0.01 | 0.1 | |
| MW-10 | Nickel, total | 01/21/1998 | 0.044 | mg/l | 0.01 | 0.1 | |
| MW-2 | Nickel, total | 01/21/1998 | 0.035 | mg/l | 0.01 | 0.1 | |
| MW-3 | Nickel, total | 01/21/1998 | 0.034 | mg/l | 0.01 | 0.1 | |
| MW-4 | Nickel, total | 01/21/1998 | 0.027 | mg/l | 0.01 | 0.1 | |
| MW-5 | Nickel, total | 01/21/1998 | 0.033 | mg/l | 0.01 | 0.1 | |
| MW-8 | Nickel, total | 01/21/1998 | 0.031 | mg/l | 0.01 | 0.1 | |
| MW-9 | Nickel, total | 07/17/1995 | 0.051 | mg/l | 0.05 | 0.1 | |
| MW-9 | Nickel, total | 01/21/1998 | 0.029 | mg/l | 0.01 | 0.1 | |
| MW-9 | Nickel, total | 07/11/2001 | 0.079 | mg/l | 0.05 | 0.1 | |
| MW-9 | Selenium, total | 01/27/2000 | 0.02 | mg/l | 0.02 | 0.05 | |
| MW-10 | Tin, total | 07/11/2001 | 0.122 | mg/l | 0.1 | | |
| MW-3 | Tin, total | 07/11/2001 | 0.166 | mg/l | 0.1 | | |
| MW-8 | Tin, total | 07/11/2001 | 0.125 | mg/l | 0.1 | | |
| MW-9 | Tin, total | 07/11/2001 | 0.198 | mg/l | 0.1 | | |
| MW-10 | Vanadium | 01/27/2000 | 0.046 | mg/l | 0.04 | | |
| MW-10 | Vanadium | 07/11/2001 | 0.1 | mg/l | 0.04 | | |
| MW-12 | Vanadium | 07/17/2000 | 0.061 | mg/l | 0.05 | | |
| MW-3 | Vanadium | 07/17/1995 | 0.052 | mg/l | 0.04 | | |
| MW-3 | Vanadium | 07/11/2001 | 0.086 | mg/l | 0.04 | | |
| MW-3 | Vanadium | 01/10/2002 | 0.06 | mg/l | 0.04 | | |

**Table 6:** Historical Inorganic Groundwater Results

| Well ID | Parameter Name[1] | Sample Date | Result | Unit | PQL[2] | NCGW2L[3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-3 | Vanadium | 07/08/2002 | 0.09 | mg/l | 0.04 | | |
| MW-3 | Vanadium | 01/22/2003 | 0.094 | mg/l | 0.04 | | |
| MW-3 | Vanadium | 07/07/2003 | 0.26 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 07/17/1995 | 0.093 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 07/11/1997 | 0.074 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 01/06/1999 | 0.063 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 01/27/2000 | 0.062 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 07/17/2000 | 0.278 | mg/l | 0.05 | | |
| MW-4 | Vanadium | 01/24/2001 | 0.173 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 07/11/2001 | 0.08 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 07/08/2002 | 0.201 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 01/22/2003 | 0.095 | mg/l | 0.04 | | |
| MW-4 | Vanadium | 07/07/2003 | 0.15 | mg/l | 0.04 | | |
| MW-6 | Vanadium | 07/27/1998 | 0.101 | mg/l | 0.04 | | |
| MW-6 | Vanadium | 01/06/1999 | 0.062 | mg/l | 0.04 | | |
| MW-7 | Vanadium | 07/11/1997 | 0.065 | mg/l | 0.04 | | |
| MW-8 | Vanadium | 07/17/1995 | 0.045 | mg/l | 0.04 | | |
| MW-8 | Vanadium | 01/24/2001 | 0.044 | mg/l | 0.04 | | |
| MW-8 | Vanadium | 07/11/2001 | 0.085 | mg/l | 0.04 | | |
| MW-8 | Vanadium | 01/10/2002 | 0.233 | mg/l | 0.04 | | |
| MW-9 | Vanadium | 07/17/1995 | 0.096 | mg/l | 0.04 | | |
| MW-9 | Vanadium | 01/21/1998 | 0.049 | mg/l | 0.04 | | |
| MW-9 | Vanadium | 07/27/1998 | 0.059 | mg/l | 0.04 | | |
| MW-9 | Vanadium | 01/06/1999 | 0.049 | mg/l | 0.04 | | |
| MW-9 | Vanadium | 07/17/2000 | 0.154 | mg/l | 0.05 | | |
| MW-9 | Vanadium | 01/24/2001 | 0.09 | mg/l | 0.04 | | |
| MW-10 | Zinc | 09/09/1994 | 0.04 | mg/l | 0.05 | 1.05 | |
| MW-11 | Zinc | 07/11/2001 | 0.054 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 07/27/1998 | 0.179 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/06/1999 | 0.347 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 06/29/1999 | 0.662 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/27/2000 | 0.75 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/24/2001 | 0.324 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 07/11/2001 | 0.572 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/10/2002 | 0.225 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 07/08/2002 | 0.431 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/22/2003 | 0.28 | mg/l | 0.05 | 1.05 | |
| **MW-3** | **Zinc** | **07/07/2003** | **1.101** | **mg/l** | **0.05** | **1.05** | **0.051** |
| MW-3 | Zinc | 01/22/2004 | 0.208 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 07/12/2004 | 0.126 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/26/2005 | 0.087 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 07/14/2005 | 0.159 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/25/2006 | 0.057 | mg/l | 0.05 | 1.05 | |
| MW-3 | Zinc | 01/17/2007 | 89 | ug/l | 10 | 1050 | |
| MW-4 | Zinc | 06/29/1999 | 0.055 | mg/l | 0.05 | 1.05 | |
| MW-4 | Zinc | 01/27/2000 | 0.05 | mg/l | 0.05 | 1.05 | |
| **MW-4** | **Zinc** | **07/17/2000** | **1.122** | **mg/l** | **0.05** | **1.05** | **0.072** |
| MW-4 | Zinc | 01/24/2001 | 0.115 | mg/l | 0.05 | 1.05 | |
| MW-4 | Zinc | 07/08/2002 | 0.123 | mg/l | 0.05 | 1.05 | |
| MW-4 | Zinc | 01/22/2003 | 0.063 | mg/l | 0.05 | 1.05 | |
| MW-4 | Zinc | 07/07/2003 | 0.074 | mg/l | 0.05 | 1.05 | |
| MW-5 | Zinc | 10/28/1994 | 0.125 | mg/l | 0.05 | 1.05 | |

**Table 6:** Historical Inorganic Groundwater Results

| Well ID | Parameter Name[1] | Sample Date | Result | Unit | PQL[2] | NCGW2L[3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-6 | Zinc | 01/27/2000 | 0.059 | mg/l | 0.05 | 1.05 | |
| MW-6 | Zinc | 07/17/2000 | 0.056 | mg/l | 0.05 | 1.05 | |
| MW-6 | Zinc | 07/07/2003 | 0.051 | mg/l | 0.05 | 1.05 | |
| MW-6 | Zinc | 01/17/2007 | 13 | ug/l | 10 | 1050 | |
| MW-8 | Zinc | 09/09/1994 | 0.142 | mg/l | 0.05 | 1.05 | |
| MW-8 | Zinc | 01/10/2002 | 0.081 | mg/l | 0.05 | 1.05 | |
| MW-9 | Zinc | 09/09/1994 | 0.06 | mg/l | 0.05 | 1.05 | |
| MW-9 | Zinc | 07/17/1995 | 0.069 | mg/l | 0.05 | 1.05 | |
| MW-9 | Zinc | 01/14/1997 | 0.053 | mg/l | 0.05 | 1.05 | |
| MW-9 | Zinc | 07/17/2000 | 0.071 | mg/l | 0.05 | 1.05 | |
| MW-9 | Zinc | 07/11/2001 | 0.088 | mg/l | 0.05 | 1.05 | |

[1] Table only contains detected constituents.
[2] PQL = Practical Quantitation Limit
[3] NCGW2L = North Carolina Ground Water 2L Standard

**Table 7:** Historical Inorganic Surface Water Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | SWSTD [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| SW-1 | Cadmium, total | 07/12/2004 | 0.001 | mg/l | 0.001 | 0.002 | |
| SW-1 | Chromium, total | 06/29/1999 | 0.026 | mg/l | 0.01 | 0.05 | |
| SW-1 | Chromium, total | 01/26/2005 | 0.013 | mg/l | 0.01 | 0.05 | |
| SW-2 | Chromium, total | 01/27/2000 | 0.034 | mg/l | 0.01 | 0.05 | |
| SW-2 | Chromium, total | 07/17/2000 | 0.036 | mg/l | 0.01 | 0.05 | |
| SW-2 | Chromium, total | 01/22/2003 | 0.011 | mg/l | 0.01 | 0.05 | |
| SW-2 | Chromium, total | 07/14/2005 | 0.013 | mg/l | 0.01 | 0.05 | |
| SW-2 | Chromium, total | 01/25/2006 | 0.01 | mg/l | 0.01 | 0.05 | |
| SW-2 | Chromium, total | 01/17/2007 | 12 | ug/l | 10 | 50 | |
| SW-2 | Lead, total | 07/14/2005 | 0.021 | mg/l | 0.01 | 0.025 | |
| SW-2 | Lead, total | 01/17/2007 | 11 | ug/l | 10 | 25 | |
| SW-1 | Nickel, total | 01/21/1998 | 0.013 | mg/l | 0.01 | 0.025 | |
| SW-2 | Nickel, total | 01/21/1998 | 0.021 | mg/l | 0.01 | 0.025 | |
| **SW-2** | **Nickel, total** | **07/17/2000** | **0.094** | **mg/l** | **0.05** | **0.025** | **0.069** |
| **SW-1** | **Selenium, total** | **07/17/2000** | **0.02** | **mg/l** | **0.02** | **0.005** | **0.015** |
| SW-2 | Vanadium | 01/27/2000 | 0.057 | mg/l | 0.04 | | |
| **SW-1** | **Zinc** | **07/17/2000** | **0.09** | **mg/l** | **0.05** | **0.05** | **0.04** |
| **SW-2** | **Zinc** | **01/14/1997** | **0.071** | **mg/l** | **0.05** | **0.05** | **0.021** |
| **SW-2** | **Zinc** | **07/17/1997** | **0.071** | **mg/l** | **0.05** | **0.05** | **0.021** |
| SW-2 | Zinc | 07/17/2000 | 0.016 | mg/l | 0.05 | 0.05 | |
| SW-2 | Zinc | 01/17/2007 | 18 | ug/l | 10 | 50 | |

[1] Table only contains detected constituents.

[2] PQL = Practical Quantitation Limit

[3] SWSTD = North Carolina Surface Water Standard Class C or Class IV as applicable

**Table 8:** Statistically Significant Inorganics

| Sampling Event | Well | Statistically Significant Constituents | | | | |
|---|---|---|---|---|---|---|
| Jan-05 | MW-9 | Arsenic | | | | |
| Jan-04 | MW-3 | Chromium | | Zinc | | |
| | MW-4 | Chromium | | | | |
| | MW-6 | Chromium | | | | |
| | MW-9 | Cobalt | | | | |
| Jul-03 | MW-3 | Arsenic | Chromium | Lead | Vanadium | Zinc |
| | MW-4 | Chromium | Lead | Vanadium | Zinc | |
| | MW-6 | Zinc | | | | |
| | MW-9 | Cobalt | | | | |
| Jan-03 | MW-3 | Chromium | Vanadium | | Zinc | |
| | MW-4 | Chromium | Lead | Vanadium | Zinc | |
| | MW-9 | Chromium | | Cobalt | | |
| Jul-02 | MW-3 | Chromium | Vanadium | | Zinc | |
| | MW-4 | Chromium | Lead | Vanadium | Zinc | |
| | MW-9 | Chromium | | Cobalt | | |
| | MW-12 | Chromium | | | | |
| Jan-02 | MW-3 | Chromium | Vanadium | | Zinc | |
| | MW-4 | Chromium | | | | |
| | MW-8 | Chromium | Lead | Mercury | Vanadium | Zinc |
| Jul-01 | MW-3 | Chromium | Tin | Vanadium | Zinc | |
| | MW-4 | Chromium | | Vanadium | | |
| | MW-8 | Chromium | Mercury | Tin | Vanadium | |
| | MW-9 | Chromium | Nickel | Tin | Zinc | |
| | MW-10 | Chromium | Tin | | Vanadium | |
| | MW-11 | Zinc | | | | |
| | MW-12 | Chromium | | | | |
| Jan-01 | MW-4 | Chromium | | Lead | | |
| | MW-8 | Mercury | | | | |
| Jul-00 | MW-4 | Chromium | Lead | Vanadium | Zinc | |
| | MW-6 | Chromium | | Zinc | | |
| | MW-9 | Chromium | Vanadium | | Zinc | |
| | MW-11 | Chromium | | | | |
| | MW-12 | Chromium | | Vanadium | | |
| Jan-00 | MW-3 | Chromium | | Zinc | | |
| | MW-4 | Chromium | Vanadium | | Zinc | |
| | MW-6 | Chromium | Vanadium | | Zinc | |
| | MW-8 | Chromium | | | | |
| | MW-10 | Chromium | | Vanadium | | |

**Table 9:** Historical Organic Groundwater Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| **MW-10** | **1,1-Dichloroethane** | **09/09/1994** | **103** | **ug/l** | **5** | **70** | **33** |
| **MW-10** | **1,1-Dichloroethane** | **10/28/1994** | **77** | **ug/l** | **5** | **70** | **7** |
| **MW-10** | **1,1-Dichloroethane** | **01/06/1995** | **94** | **ug/l** | **5** | **70** | **24** |
| **MW-10** | **1,1-Dichloroethane** | **02/24/1995** | **90** | **ug/l** | **5** | **70** | **20** |
| **MW-10** | **1,1-Dichloroethane** | **07/17/1995** | **106** | **ug/l** | **5** | **70** | **36** |
| **MW-10** | **1,1-Dichloroethane** | **01/23/1996** | **96** | **ug/l** | **5** | **70** | **26** |
| MW-10 | 1,1-Dichloroethane | 07/25/1996 | 69 | ug/l | 5 | 70 | |
| **MW-10** | **1,1-Dichloroethane** | **01/14/1997** | **96** | **ug/l** | **5** | **70** | **26** |
| **MW-10** | **1,1-Dichloroethane** | **08/22/1997** | **76** | **ug/l** | **5** | **70** | **6** |
| MW-10 | 1,1-Dichloroethane | 07/27/1998 | 18 | ug/l | 5 | 70 | |
| MW-10 | 1,1-Dichloroethane | 01/06/1999 | 19 | ug/l | 5 | 70 | |
| MW-10 | 1,1-Dichloroethane | 06/29/1999 | 19 | ug/l | 5 | 70 | |
| MW-10 | 1,1-Dichloroethane | 07/17/2000 | 23 | ug/l | 5 | 70 | |
| MW-10 | 1,1-Dichloroethane | 01/24/2001 | 28 | ug/l | 5 | 70 | |
| MW-10 | 1,1-Dichloroethane | 07/11/2001 | 44 | ug/l | 5 | 70 | |
| MW-10 | 1,1-Dichloroethane | 01/10/2002 | 31 | ug/l | 5 | 70 | |
| MW-3 | 1,1-Dichloroethane | 08/22/1997 | 6 | ug/l | 5 | 70 | |
| MW-3 | 1,1-Dichloroethane | 07/11/2001 | 12 | ug/l | 5 | 70 | |
| MW-3 | 1,1-Dichloroethane | 01/10/2002 | 9.1 | ug/l | 5 | 70 | |
| MW-3 | 1,1-Dichloroethane | 07/14/2005 | 8.7 | ug/l | 5 | 70 | |
| MW-3 | 1,1-Dichloroethane | 07/13/2006 | 6.8 | ug/l | 5 | 70 | |
| MW-4 | 1,1-Dichloroethane | 01/21/1998 | 6.2 | ug/l | 5 | 70 | |
| MW-4 | 1,1-Dichloroethane | 07/17/2000 | 7.3 | ug/l | 5 | 70 | |
| MW-5 | 1,1-Dichloroethane | 01/06/1995 | 10 | ug/l | 5 | 70 | |
| MW-5 | 1,1-Dichloroethane | 07/17/1995 | 18 | ug/l | 5 | 70 | |
| MW-5 | 1,1-Dichloroethane | 01/23/1996 | 6 | ug/l | 5 | 70 | |
| MW-5 | 1,1-Dichloroethane | 01/14/1997 | 6 | ug/l | 5 | 70 | |
| MW-7 | 1,1-Dichloroethane | 01/23/1996 | 5 | ug/l | 5 | 70 | |
| MW-7 | 1,1-Dichloroethane | 08/22/1997 | 12 | ug/l | 5 | 70 | |
| **MW-8** | **1,1-Dichloroethane** | **09/09/1994** | **107** | **ug/l** | **5** | **70** | **37** |
| **MW-8** | **1,1-Dichloroethane** | **10/28/1994** | **73** | **ug/l** | **5** | **70** | **3** |
| **MW-8** | **1,1-Dichloroethane** | **01/06/1995** | **73** | **ug/l** | **5** | **70** | **3** |
| **MW-8** | **1,1-Dichloroethane** | **02/24/1995** | **89** | **ug/l** | **5** | **70** | **19** |
| MW-8 | 1,1-Dichloroethane | 07/17/1995 | 41 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 01/23/1996 | 59 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 07/25/1996 | 50 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 01/14/1997 | 47 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 08/22/1997 | 54 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 01/21/1998 | 52 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 07/27/1998 | 25 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 01/06/1999 | 26 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 06/29/1999 | 20 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 01/27/2000 | 9.6 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 07/17/2000 | 12 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 01/24/2001 | 9.2 | ug/l | 5 | 70 | |
| MW-8 | 1,1-Dichloroethane | 07/11/2001 | 14 | ug/l | 5 | 70 | |

**Table 9:** Historical Organic Groundwater Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-8 | 1,1-Dichloroethane | 01/10/2002 | 13 | ug/l | 5 | 70 | |
| MW-10 | 1,1,2-Trichloroethane | 07/17/1995 | 12 | ug/l | 5 | | |
| MW-8 | 1,1,2,2-Tetrachloroethane | 01/27/2000 | 18 | ug/l | 5 | | |
| **MW-8** | **1,2-Dichloropropane** | **01/23/1996** | **5** | **ug/l** | **5** | **0.51** | **4.49** |
| MW-10 | 1,3-Dichlorobenzene | 06/29/1999 | 5.1 | ug/l | 5 | 170 | |
| MW-8 | 1,3-Dichlorobenzene | 06/29/1999 | 14 | ug/l | 5 | 170 | |
| **MW-10** | **Benzene** | **01/06/1995** | **7** | **ug/l** | **5** | **1** | **6** |
| **MW-10** | **Benzene** | **02/24/1995** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-10** | **Benzene** | **07/17/1995** | **65** | **ug/l** | **5** | **1** | **64** |
| **MW-10** | **Benzene** | **01/23/1996** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-10** | **Benzene** | **07/25/1996** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-10** | **Benzene** | **01/14/1997** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-10** | **Benzene** | **08/22/1997** | **8** | **ug/l** | **5** | **1** | **7** |
| **MW-10** | **Benzene** | **01/21/1998** | **6.1** | **ug/l** | **5** | **1** | **5.1** |
| **MW-10** | **Benzene** | **06/29/1999** | **5.8** | **ug/l** | **5** | **1** | **4.8** |
| **MW-10** | **Benzene** | **07/17/2000** | **5.9** | **ug/l** | **5** | **1** | **4.9** |
| **MW-10** | **Benzene** | **01/24/2001** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-10** | **Benzene** | **07/11/2001** | **6.6** | **ug/l** | **5** | **1** | **5.6** |
| **MW-10** | **Benzene** | **01/10/2002** | **6.2** | **ug/l** | **5** | **1** | **5.2** |
| **MW-8** | **Benzene** | **09/09/1994** | **10** | **ug/l** | **5** | **1** | **9** |
| **MW-8** | **Benzene** | **01/06/1995** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-8** | **Benzene** | **02/24/1995** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-8** | **Benzene** | **07/25/1996** | **6** | **ug/l** | **5** | **1** | **5** |
| **MW-8** | **Benzene** | **01/14/1997** | **8** | **ug/l** | **5** | **1** | **7** |
| **MW-8** | **Benzene** | **08/22/1997** | **10** | **ug/l** | **5** | **1** | **9** |
| **MW-8** | **Benzene** | **01/21/1998** | **10** | **ug/l** | **5** | **1** | **9** |
| **MW-8** | **Benzene** | **07/27/1998** | **6.9** | **ug/l** | **5** | **1** | **5.9** |
| **MW-8** | **Benzene** | **01/06/1999** | **8.9** | **ug/l** | **5** | **1** | **7.9** |
| **MW-8** | **Benzene** | **06/29/1999** | **10.3** | **ug/l** | **5** | **1** | **9.3** |
| **MW-8** | **Benzene** | **01/27/2000** | **8.8** | **ug/l** | **5** | **1** | **7.8** |
| **MW-8** | **Benzene** | **07/17/2000** | **7.4** | **ug/l** | **5** | **1** | **6.4** |
| **MW-8** | **Benzene** | **01/24/2001** | **6.1** | **ug/l** | **5** | **1** | **5.1** |
| **MW-8** | **Benzene** | **07/11/2001** | **8.1** | **ug/l** | **5** | **1** | **7.1** |
| **MW-8** | **Benzene** | **01/10/2002** | **7.6** | **ug/l** | **5** | **1** | **6.6** |
| MW-1 | Bis(2-ethylhexyl)phthalate | 07/11/2001 | 43 | ug/l | 20 | | |
| MW-12 | Bis(2-ethylhexyl)phthalate | 07/17/2000 | 36 | ug/l | 20 | | |
| MW-8 | Chlorobenzene | 09/09/1994 | 15 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 02/24/1995 | 8 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 01/23/1996 | 13 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 01/14/1997 | 23 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 08/22/1997 | 25 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 01/21/1998 | 28 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 07/27/1998 | 20 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 01/06/1999 | 19 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 06/29/1999 | 23 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 07/17/2000 | 17 | ug/l | 5 | 50 | |

**Table 9:** Historical Organic Groundwater Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-8 | Chlorobenzene | 01/24/2001 | 19 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 07/11/2001 | 15 | ug/l | 5 | 50 | |
| MW-8 | Chlorobenzene | 01/10/2002 | 8.4 | ug/l | 5 | 50 | |
| MW-10 | Chloroethane | 09/09/1994 | 18 | ug/l | 10 | | |
| MW-10 | Chloroethane | 10/28/1994 | 16 | ug/l | 10 | | |
| MW-10 | Chloroethane | 01/06/1995 | 18 | ug/l | 10 | | |
| MW-10 | Chloroethane | 02/24/1995 | 12 | ug/l | 10 | | |
| MW-10 | Chloroethane | 07/17/1995 | 11 | ug/l | 10 | | |
| MW-10 | Chloroethane | 01/23/1996 | 13 | ug/l | 10 | | |
| MW-10 | Chloroethane | 07/25/1996 | 10 | ug/l | 10 | | |
| MW-10 | Chloroethane | 01/14/1997 | 13 | ug/l | 10 | | |
| MW-8 | Chloroethane | 09/09/1994 | 14 | ug/l | 10 | | |
| MW-8 | Chloroethane | 10/28/1994 | 11 | ug/l | 10 | | |
| MW-8 | Chloroethane | 01/06/1995 | 10 | ug/l | 10 | | |
| MW-8 | Chloroethane | 07/25/1996 | 10 | ug/l | 10 | | |
| **MW-10** | **Chloroethene** | **09/09/1994** | **24** | **ug/l** | **10** | **0.015** | **23.985** |
| **MW-10** | **Chloroethene** | **10/28/1994** | **28** | **ug/l** | **10** | **0.015** | **27.985** |
| **MW-10** | **Chloroethene** | **07/17/1995** | **28** | **ug/l** | **10** | **0.015** | **27.985** |
| **MW-10** | **Chloroethene** | **01/23/1996** | **57** | **ug/l** | **10** | **0.015** | **56.985** |
| **MW-10** | **Chloroethene** | **07/25/1996** | **36** | **ug/l** | **10** | **0.015** | **35.985** |
| **MW-10** | **Chloroethene** | **01/14/1997** | **57** | **ug/l** | **10** | **0.015** | **56.985** |
| **MW-10** | **Chloroethene** | **08/22/1997** | **37** | **ug/l** | **10** | **0.015** | **36.985** |
| **MW-10** | **Chloroethene** | **01/21/1998** | **43** | **ug/l** | **10** | **0.015** | **42.985** |
| **MW-10** | **Chloroethene** | **07/27/1998** | **23** | **ug/l** | **10** | **0.015** | **22.985** |
| **MW-10** | **Chloroethene** | **01/06/1999** | **25** | **ug/l** | **10** | **0.015** | **24.985** |
| **MW-10** | **Chloroethene** | **06/29/1999** | **30** | **ug/l** | **10** | **0.015** | **29.985** |
| **MW-10** | **Chloroethene** | **07/17/2000** | **48** | **ug/l** | **10** | **0.015** | **47.985** |
| **MW-10** | **Chloroethene** | **01/24/2001** | **44** | **ug/l** | **10** | **0.015** | **43.985** |
| **MW-10** | **Chloroethene** | **07/11/2001** | **38** | **ug/l** | **10** | **0.015** | **37.985** |
| **MW-10** | **Chloroethene** | **01/10/2002** | **40** | **ug/l** | **10** | **0.015** | **39.985** |
| **MW-5** | **Chloroethene** | **07/17/1995** | **27** | **ug/l** | **10** | **0.015** | **26.985** |
| **MW-5** | **Chloroethene** | **01/23/1996** | **33** | **ug/l** | **10** | **0.015** | **32.985** |
| **MW-5** | **Chloroethene** | **07/25/1996** | **16** | **ug/l** | **10** | **0.015** | **15.985** |
| **MW-5** | **Chloroethene** | **01/14/1997** | **21** | **ug/l** | **10** | **0.015** | **20.985** |
| **MW-5** | **Chloroethene** | **01/21/1998** | **10.3** | **ug/l** | **10** | **0.015** | **10.285** |
| **MW-7** | **Chloroethene** | **01/23/1996** | **10** | **ug/l** | **10** | **0.015** | **9.985** |
| **MW-7** | **Chloroethene** | **08/22/1997** | **26** | **ug/l** | **10** | **0.015** | **25.985** |
| **MW-8** | **Chloroethene** | **09/09/1994** | **44** | **ug/l** | **10** | **0.015** | **43.985** |
| **MW-8** | **Chloroethene** | **10/28/1994** | **46** | **ug/l** | **10** | **0.015** | **45.985** |
| **MW-8** | **Chloroethene** | **01/23/1996** | **21** | **ug/l** | **10** | **0.015** | **20.985** |
| **MW-8** | **Chloroethene** | **07/25/1996** | **11** | **ug/l** | **10** | **0.015** | **10.985** |
| **MW-8** | **Chloroethene** | **01/21/1998** | **16** | **ug/l** | **10** | **0.015** | **15.985** |
| **MW-8** | **Chloroethene** | **01/06/1999** | **12** | **ug/l** | **10** | **0.015** | **11.985** |
| **MW-8** | **Chloroethene** | **06/29/1999** | **18** | **ug/l** | **10** | **0.015** | **17.985** |
| **MW-8** | **Chloroethene** | **07/17/2000** | **31** | **ug/l** | **10** | **0.015** | **30.985** |
| **MW-8** | **Chloroethene** | **01/24/2001** | **22** | **ug/l** | **10** | **0.015** | **21.985** |

**Table 9:** Historical Organic Groundwater Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| **MW-8** | **Chloroethene** | **07/11/2001** | **21** | **ug/l** | **10** | **0.015** | **20.985** |
| **MW-8** | **Chloroethene** | **01/10/2002** | **22** | **ug/l** | **10** | **0.015** | **21.985** |
| MW-10 | cis-1,2-Dichloroethylene | 09/09/1994 | 13 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 01/06/1995 | 12 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 02/24/1995 | 11 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 07/17/1995 | 27 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 01/23/1996 | 24 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 07/25/1996 | 29 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 01/14/1997 | 24 | ug/l | 5 | 70 | |
| **MW-10** | **cis-1,2-Dichloroethylene** | **08/22/1997** | **79** | **ug/l** | **5** | **70** | **9** |
| MW-10 | cis-1,2-Dichloroethylene | 01/21/1998 | 41 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 07/27/1998 | 27 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 01/06/1999 | 41 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 06/29/1999 | 36 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 01/24/2001 | 50 | ug/l | 5 | 70 | |
| MW-10 | cis-1,2-Dichloroethylene | 07/11/2001 | 67 | ug/l | 5 | 70 | |
| **MW-10** | **cis-1,2-Dichloroethylene** | **01/10/2002** | **74** | **ug/l** | **5** | **70** | **4** |
| MW-5 | cis-1,2-Dichloroethylene | 01/06/1995 | 15 | ug/l | 5 | 70 | |
| MW-5 | cis-1,2-Dichloroethylene | 02/24/1995 | 5 | ug/l | 5 | 70 | |
| MW-5 | cis-1,2-Dichloroethylene | 07/17/1995 | 36 | ug/l | 5 | 70 | |
| MW-5 | cis-1,2-Dichloroethylene | 01/23/1996 | 9 | ug/l | 5 | 70 | |
| MW-5 | cis-1,2-Dichloroethylene | 01/14/1997 | 15 | ug/l | 5 | 70 | |
| MW-5 | cis-1,2-Dichloroethylene | 01/21/1998 | 5 | ug/l | 5 | 70 | |
| MW-7 | cis-1,2-Dichloroethylene | 08/22/1997 | 13 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 09/09/1994 | 44 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 10/28/1994 | 25 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 01/06/1995 | 20 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 02/24/1995 | 24 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 07/17/1995 | 32 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 01/23/1996 | 44 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 07/25/1996 | 55 | ug/l | 5 | 70 | |
| **MW-8** | **cis-1,2-Dichloroethylene** | **01/14/1997** | **72** | **ug/l** | **5** | **70** | **2** |
| **MW-8** | **cis-1,2-Dichloroethylene** | **08/22/1997** | **99** | **ug/l** | **5** | **70** | **29** |
| **MW-8** | **cis-1,2-Dichloroethylene** | **01/21/1998** | **105** | **ug/l** | **5** | **70** | **35** |
| MW-8 | cis-1,2-Dichloroethylene | 07/27/1998 | 67 | ug/l | 5 | 70 | |
| **MW-8** | **cis-1,2-Dichloroethylene** | **01/06/1999** | **71** | **ug/l** | **5** | **70** | **1** |
| **MW-8** | **cis-1,2-Dichloroethylene** | **06/29/1999** | **71** | **ug/l** | **5** | **70** | **1** |
| MW-8 | cis-1,2-Dichloroethylene | 01/27/2000 | 30 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 07/17/2000 | 46 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 01/24/2001 | 32 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 07/11/2001 | 29 | ug/l | 5 | 70 | |
| MW-8 | cis-1,2-Dichloroethylene | 01/10/2002 | 23 | ug/l | 5 | 70 | |
| MW-3 | Dichlorodifluoromethane | 07/27/1998 | 33 | ug/l | 5 | 1400 | |
| MW-3 | Dichlorodifluoromethane | 07/08/2002 | 14.3 | ug/l | 5 | 1400 | |
| MW-4 | Dichlorodifluoromethane | 07/17/2000 | 34 | ug/l | 5 | 1400 | |
| MW-8 | Dichlorodifluoromethane | 06/29/1999 | 17 | ug/l | 5 | 1400 | |

**Table 9:** Historical Organic Groundwater Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-8 | Dichlorodifluoromethane | 01/24/2001 | 8.8 | ug/l | 5 | 1400 | |
| MW-8 | Dichlorodifluoromethane | 01/10/2002 | 5.2 | ug/l | 5 | 1400 | |
| MW-10 | Ethylbenzene | 01/06/1995 | 6 | ug/l | 5 | 550 | |
| **MW-10** | **Ethylene dichloride** | **02/24/1995** | **31** | **ug/l** | **5** | **0.38** | **30.62** |
| **MW-5** | **Ethylene dichloride** | **01/06/1995** | **17** | **ug/l** | **5** | **0.38** | **16.62** |
| **MW-8** | **Ethylene dichloride** | **01/06/1995** | **47** | **ug/l** | **5** | **0.38** | **46.62** |
| **MW-8** | **Ethylene dichloride** | **02/24/1995** | **34** | **ug/l** | **5** | **0.38** | **33.62** |
| **MW-8** | **Ethylene dichloride** | **01/23/1996** | **6** | **ug/l** | **5** | **0.38** | **5.62** |
| MW-4 | Methyl chloroform | 01/21/1998 | 52 | ug/l | 5 | 200 | |
| MW-10 | Methylbenzene | 07/17/1995 | 6 | ug/l | 5 | 1000 | |
| MW-3 | Methylbenzene | 08/22/1997 | 8 | ug/l | 5 | 1000 | |
| MW-3 | Methylbenzene | 07/27/1998 | 6.4 | ug/l | 5 | 1000 | |
| **MW-10** | **Methylene chloride** | **09/09/1994** | **110** | **ug/l** | **10** | **4.6** | **105.4** |
| **MW-10** | **Methylene chloride** | **10/28/1994** | **76** | **ug/l** | **10** | **4.6** | **71.4** |
| **MW-10** | **Methylene chloride** | **01/06/1995** | **83** | **ug/l** | **10** | **4.6** | **78.4** |
| **MW-10** | **Methylene chloride** | **02/24/1995** | **93** | **ug/l** | **10** | **4.6** | **88.4** |
| **MW-10** | **Methylene chloride** | **07/17/1995** | **48** | **ug/l** | **10** | **4.6** | **43.4** |
| **MW-10** | **Methylene chloride** | **07/25/1996** | **10** | **ug/l** | **10** | **4.6** | **5.4** |
| **MW-10** | **Methylene chloride** | **08/22/1997** | **18** | **ug/l** | **10** | **4.6** | **13.4** |
| **MW-3** | **Methylene chloride** | **09/09/1994** | **25** | **ug/l** | **10** | **4.6** | **20.4** |
| **MW-3** | **Methylene chloride** | **10/28/1994** | **20** | **ug/l** | **10** | **4.6** | **15.4** |
| **MW-8** | **Methylene chloride** | **09/09/1994** | **34** | **ug/l** | **10** | **4.6** | **29.4** |
| **MW-8** | **Methylene chloride** | **10/28/1994** | **31** | **ug/l** | **10** | **4.6** | **26.4** |
| **MW-8** | **Methylene chloride** | **01/06/1995** | **35** | **ug/l** | **10** | **4.6** | **30.4** |
| **MW-8** | **Methylene chloride** | **02/24/1995** | **23** | **ug/l** | **10** | **4.6** | **18.4** |
| **MW-8** | **Methylene chloride** | **07/17/1995** | **12** | **ug/l** | **10** | **4.6** | **7.4** |
| **MW-10** | **p-Dichlorobenzene** | **09/09/1994** | **10** | **ug/l** | **5** | **1.4** | **8.6** |
| **MW-10** | **p-Dichlorobenzene** | **01/06/1995** | **7** | **ug/l** | **5** | **1.4** | **5.6** |
| **MW-10** | **p-Dichlorobenzene** | **02/24/1995** | **5** | **ug/l** | **5** | **1.4** | **3.6** |
| **MW-10** | **p-Dichlorobenzene** | **08/22/1997** | **12** | **ug/l** | **5** | **1.4** | **10.6** |
| **MW-10** | **p-Dichlorobenzene** | **01/21/1998** | **6.6** | **ug/l** | **5** | **1.4** | **5.2** |
| **MW-10** | **p-Dichlorobenzene** | **07/27/1998** | **5** | **ug/l** | **5** | **1.4** | **3.6** |
| **MW-10** | **p-Dichlorobenzene** | **07/17/2000** | **5.1** | **ug/l** | **5** | **1.4** | **3.7** |
| **MW-10** | **p-Dichlorobenzene** | **01/24/2001** | **11** | **ug/l** | **5** | **1.4** | **9.6** |
| **MW-10** | **p-Dichlorobenzene** | **07/11/2001** | **7.4** | **ug/l** | **5** | **1.4** | **6** |
| **MW-10** | **p-Dichlorobenzene** | **01/10/2002** | **6.8** | **ug/l** | **5** | **1.4** | **5.4** |
| **MW-8** | **p-Dichlorobenzene** | **08/22/1997** | **12** | **ug/l** | **5** | **1.4** | **10.6** |
| **MW-8** | **p-Dichlorobenzene** | **01/21/1998** | **14** | **ug/l** | **5** | **1.4** | **12.6** |
| **MW-8** | **p-Dichlorobenzene** | **07/27/1998** | **12** | **ug/l** | **5** | **1.4** | **10.6** |
| **MW-8** | **p-Dichlorobenzene** | **01/06/1999** | **12** | **ug/l** | **5** | **1.4** | **10.6** |
| **MW-8** | **p-Dichlorobenzene** | **01/27/2000** | **10** | **ug/l** | **5** | **1.4** | **8.6** |
| **MW-8** | **p-Dichlorobenzene** | **07/17/2000** | **10** | **ug/l** | **5** | **1.4** | **8.6** |
| **MW-8** | **p-Dichlorobenzene** | **01/24/2001** | **14** | **ug/l** | **5** | **1.4** | **12.6** |
| **MW-8** | **p-Dichlorobenzene** | **07/11/2001** | **9.2** | **ug/l** | **5** | **1.4** | **7.8** |
| **MW-8** | **p-Dichlorobenzene** | **01/10/2002** | **7.9** | **ug/l** | **5** | **1.4** | **6.5** |
| **MW-10** | **Tetrachloroethene** | **09/09/1994** | **14** | **ug/l** | **5** | **0.7** | **13.3** |

**Table 9:** Historical Organic Groundwater Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| **MW-10** | **Tetrachloroethene** | **01/06/1995** | **7** | **ug/l** | **5** | **0.7** | **6.3** |
| **MW-10** | **Tetrachloroethene** | **02/24/1995** | **7** | **ug/l** | **5** | **0.7** | **6.3** |
| **MW-10** | **Tetrachloroethene** | **01/23/1996** | **10** | **ug/l** | **5** | **0.7** | **9.3** |
| **MW-10** | **Tetrachloroethene** | **07/25/1996** | **11** | **ug/l** | **5** | **0.7** | **10.3** |
| **MW-10** | **Tetrachloroethene** | **01/14/1997** | **10** | **ug/l** | **5** | **0.7** | **9.3** |
| **MW-10** | **Tetrachloroethene** | **08/22/1997** | **7** | **ug/l** | **5** | **0.7** | **6.3** |
| **MW-5** | **Tetrachloroethene** | **07/17/1995** | **6** | **ug/l** | **5** | **0.7** | **5.3** |
| MW-10 | trans-1,2-Dichloroethylene | 01/21/1998 | 44 | ug/l | 5 | 100 | |
| **MW-10** | **Trichloroethene** | **09/09/1994** | **16** | **ug/l** | **5** | **2.8** | **13.2** |
| **MW-10** | **Trichloroethene** | **10/28/1994** | **11** | **ug/l** | **5** | **2.8** | **8.2** |
| **MW-10** | **Trichloroethene** | **01/06/1995** | **13** | **ug/l** | **5** | **2.8** | **10.2** |
| **MW-10** | **Trichloroethene** | **02/24/1995** | **12** | **ug/l** | **5** | **2.8** | **9.2** |
| **MW-10** | **Trichloroethene** | **07/17/1995** | **16** | **ug/l** | **5** | **2.8** | **13.2** |
| **MW-10** | **Trichloroethene** | **01/23/1996** | **13** | **ug/l** | **5** | **2.8** | **10.2** |
| **MW-10** | **Trichloroethene** | **07/25/1996** | **15** | **ug/l** | **5** | **2.8** | **12.2** |
| **MW-10** | **Trichloroethene** | **01/14/1997** | **13** | **ug/l** | **5** | **2.8** | **10.2** |
| **MW-10** | **Trichloroethene** | **08/22/1997** | **19** | **ug/l** | **5** | **2.8** | **16.2** |
| **MW-10** | **Trichloroethene** | **01/21/1998** | **9.3** | **ug/l** | **5** | **2.8** | **6.5** |
| **MW-10** | **Trichloroethene** | **07/11/2001** | **8.6** | **ug/l** | **5** | **2.8** | **5.8** |
| **MW-10** | **Trichloroethene** | **01/10/2002** | **5.9** | **ug/l** | **5** | **2.8** | **3.1** |
| **MW-8** | **Trichloroethene** | **01/06/1995** | **7** | **ug/l** | **5** | **2.8** | **4.2** |
| **MW-8** | **Trichloroethene** | **02/24/1995** | **8** | **ug/l** | **5** | **2.8** | **5.2** |
| **MW-8** | **Trichloroethene** | **07/25/1996** | **5** | **ug/l** | **5** | **2.8** | **2.2** |
| MW-10 | Xylenes | 09/09/1994 | 13 | ug/l | 5 | 530 | |
| MW-10 | Xylenes | 02/24/1995 | 6 | ug/l | 5 | 530 | |
| MW-10 | Xylenes | 01/23/1996 | 9 | ug/l | 5 | 530 | |
| MW-10 | Xylenes | 01/14/1997 | 9 | ug/l | 5 | 530 | |
| MW-10 | Xylenes | 08/22/1997 | 8 | ug/l | 5 | 530 | |
| MW-8 | Xylenes | 02/24/1995 | 5 | ug/l | 5 | 530 | |
| MW-8 | Xylenes | 01/21/1998 | 6.8 | ug/l | 5 | 530 | |

[1] Table only contains detected constituents.
[2] PQL = Practical Quantitation Limit
[3] NCGW2L = North Carolina Ground Water 2L Standard

**Table 10:** Statistically Significant Organics

| Sampling Event | Well | Statistically Significant Constituents | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Jul-06 | MW-3 | 1,1-Dichloroethane | | | | | | |
| Jul-05 | MW-3 | 1,1-Dichloroethane | | | | | | |
| Jul-02 | MW-3 | Dichlorodifluoromethane | | | | | | |
| Jan-02 | MW-3 | 1,1-Dichloroethane | | | | | | |
| | MW-8 | Benzene | Chlorobenzene | Cis-1,2-Dichloroethene | 1,1-Dichloroethane | 1,4-Dichlorobenzene | Dichlorodifluoromethane | Vinyl Chloride |
| | MW-10 | Benzene | Cis-1,2-Dichloroethene | 1,1-Dichloroethane | 1,4-Dichlorobenzene | Trichloroethylene | Vinyl Chloride | |
| Jul-01 | MW-3 | 1,1-Dichloroethane | | | | | | |
| | MW-8 | Benzene | Chlorobenzene | Cis-1,2-Dichloroethene | 1,1-Dichloroethane | 1,4-Dichlorobenzene | Vinyl Chloride | |
| | MW-10 | Benzene | Cis-1,2-Dichloroethene | 1,1-Dichloroethane | 1,4-Dichlorobenzene | Trichloroethylene | Vinyl Chloride | |
| Jan-01 | MW-8 | 1,1-Dichloroethane | 1,4-Dichlorobenzene | Benzene | Chlorobenzene | cis-1,2-Dichloroethene | Dichlorodifluoromethane | Vinyl chloride |
| | MW-10 | 1,1-Dichloroethane | 1,4-Dichlorobenzene | Benzene | | cis-1,2-Dichloroethene | Vinyl chloride | |
| Jul-00 | MW-4 | Dichlorodifluoromethane | | | 1,1-Dichloroethane | | | |
| | MW-8 | Benzene | Chlorobenzene | Cis-1,2-Dichloroethene | 1,1-Dichloroethane | 1,4-Dichlorobenzene | Vinyl Chloride | |
| | MW-10 | Benzene | | 1,1-Dichloroethane | | 1,4-Dichlorobenzene | | Vinyl Chloride |
| | MW-12 | Bis(2-ethylhexyl) phthalate | | | | | | |
| Jan-00 | MW-8 | 1,1,2,2-tetrachloroethane | | 1,2-Dichloroethane | 1,4-Dichlorobenzene | Benzene | Cis-1,2-Dichloroethene | |
| Jun-99 | MW-8 | 1,1-Dichloroethane | 1,1-Dichloroethane | | Benzene | Cis-1,2-Dichloroethene | | Vinyl Chloride |
| | MW-10 | 1,1-Dichloroethane | 1,3-Dichlorobenzene | | Benzene | Cis-1,2-Dichloroethene | | Vinyl Chloride |

**Table 11:** Flow rate calculations

| Well | $h_1$ (ft) | $h_2$ (ft) | dh (ft) | dl (ft) | i | K (cm/sec) | $n_e$ (%) | v (ft/yr) | Lithology |
|---|---|---|---|---|---|---|---|---|---|
| MW-1 | 82.45 | 80.00 | 2.45 | 234.42 | 0.0105 | 4.30E-04 | 20% | 23.25 | Silty Sand |
| MW-3 | 58.35 | 60.00 | 1.65 | 167.29 | 0.0099 | 1.30E-04 | 20% | 6.63 | Silty Sand |
| MW-4 | 62.57 | 65.00 | 2.43 | 232.97 | 0.0104 | 5.40E-04 | 20% | 29.14 | Silty Sand |
| MW-5 | 76.65 | 75.00 | 1.65 | 105.04 | 0.0157 | 5.30E-04 | 20% | 43.07 | Silty Sand |
| MW-8 | 68.64 | 65.00 | 3.64 | 164.30 | 0.0222 | 2.20E-04 | 20% | 25.21 | Sandy Clay |
| MW-9 | 56.87 | 60.00 | 3.13 | 449.05 | 0.0070 | 3.80E-04 | 20% | 13.70 | Sandy Clay |
| MW-10 | 65.22 | 60.00 | 5.22 | 441.67 | 0.0118 | 6.90E-05 | 20% | 4.22 | Clayey Sand |
| MW-11 | 65.62 | 65.00 | 0.62 | 37.08 | 0.0167 | 2.07E-05 | 20% | 1.79 | Sand |
| MW-12 | 61.58 | 60.00 | 1.58 | 224.39 | 0.0070 | 6.55E-06 | 20% | 0.24 | Sand |

NOTES:

1. Parameters *dh* and *dl* denote the difference in the hydraulic head and the horizontal distance, respectively, between two measurement points. A line is constructed from a piezometers to a perpendicular of the potentiometric contour in Plate 4 *Average day potentiometric map with flow directions.* The hydraulic head is the absolute value of the difference in the groundwater elevation at the piezometer, $h_1$, and the elevation of the corresponding potentiometric contour, $h_2$. The horizontal distance, *dl,* is the length of the line.
2. Parameter *i* denotes the hydraulic gradient associate with the line, and is defined by the equation:

$$i = \frac{dh}{dl}$$

3. Parameter $n_e$ denotes the effective porosity.
4. *K* denotes the hydraulic conductivity determined from field slug tests.
5. Parameter *v* denotes the average linear velocity. The average linear velocity, denoted by *v*, is defined by the equation:

$$v = -\frac{K}{n_e}\frac{dh}{dl}$$

**Table 12:** Non-Carcinogenic Toxicity Values for Oral Ingestion Exposure

| Contaminant | Well | Reference Dose | Maximum Concentration (ug/L) | LADD Maximum | | Concentration 7/13/2006 (ug/L) | LADD 7/13/2006 | | HI Risk Maximum | | HI Risk 7/13/2006 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Oral RfD (ug/kg-day) | | Adult (ug/kg-day) | Child (ug/kg-day) | | Adult (ug/kg-day) | Child (ug/kg-day) | Adult | Child | Adult | Child |
| 1,1 dichloroethane | MW-3 | 100 | 12.0 | 0.34 | 0.43 | 6.8 | 0.19 | 0.24 | 3.43E-03 | 4.26E-03 | 1.94E-03 | 2.41E-03 |
| | MW-4 | 100 | 7.3 | 0.21 | 0.26 | - | - | - | 2.09E-03 | 2.59E-03 | - | - |
| | MW-5 | 100 | 18.0 | 0.51 | 0.64 | - | - | - | 5.14E-03 | 6.38E-03 | - | - |
| | MW-7 | 100 | 12.0 | 0.34 | 0.43 | - | - | - | 3.43E-03 | 4.26E-03 | - | - |
| | MW-8 | 100 | 107.0 | 3.06 | 3.79 | - | - | - | 3.06E-02 | 3.79E-02 | - | - |
| | MW-10 | 100 | 106.0 | 3.03 | 3.76 | - | - | - | 3.03E-02 | 3.76E-02 | - | - |
| Mercury | MW-3 | 0.3 | 1.2 | 0.03 | 0.04 | - | - | - | 0.11 | 0.14 | - | - |
| | MW-4 | 0.3 | 0.5 | 0.01 | 0.02 | - | - | - | 0.05 | 0.06 | - | - |
| | MW-5 | 0.3 | 2.0 | 0.06 | 0.07 | - | - | - | 0.19 | 0.24 | - | - |
| | MW-8 | 0.3 | 6.1 | 0.17 | 0.22 | - | - | - | 0.58 | 0.72 | - | - |
| | MW-10 | 0.3 | 0.6 | 0.02 | 0.02 | - | - | - | 0.06 | 0.07 | - | - |
| | MW-12 | 0.3 | 0.2 | 0.01 | 0.01 | 0.2 | 0.01 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 |

NOTE:
1. LADD is lifetime average daily dose from ingested groundwater at the specified concentration.
2. RfD values taken from the Region 9 Risk Based Concentration Table. These values represent a daily exposure level that is not harmful to human health, over a lifetime.
3. During 7/13/2006 sampling "-" designates none of this constituent was detected.
4. HI is the Hazard Index Risk = LADD/RfD
5. Formula used for calculations:

LADD = (C*IR*ED)/(BW*AT)

C = Constituent Concentration (ug/L)

| | |
|---|---|
| IR = Ingestion Rate (L/day) | An ingestion rate of 2L/day was used for adults 1L/day for children |
| ED = Exposure Duration (days) | An exposure duration of 30 years was used for adults, 8 for children |
| BW = Body Weight (kg) | An average weight of 70 kg was used for adults, 28.2 kg for children |
| AT = Average Time (days) | Times of 30 years for adults and 8 for children were used |

**Table 13:** Non-Carcinogenic Toxicity Values for Inhalation Exposure

| Contaminant | Well | Reference Dose | Maximum Concentration (ug/L) | LADD Maximum | | Concentration 7/13/2006 (ug/L) | LADD 7/13/2006 | | HI Risk Maximum | | HI Risk 2/13/2006 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Inhalation RfD (ug/kg-day) | | Adult (ug/kg-day) | Child (ug/kg-day) | | Adult (ug/kg-day) | Child (ug/kg-day) | Adult | Child | Adult | Child |
| 1,1 dichloroethane | MW-3 | 140 | 12 | 1.71 | 2.55 | 6.8 | 9.71E-01 | 1.45E+00 | 0.01 | 0.02 | 6.94E-03 | 1.03E-02 |
| | MW-4 | 140 | 7 | 1.04 | 1.55 | - | - | - | 0.01 | 0.01 | - | - |
| | MW-5 | 140 | 18 | 2.57 | 3.83 | - | - | - | 0.02 | 0.03 | - | - |
| | MW-7 | 140 | 12 | 1.71 | 2.55 | - | - | - | 0.01 | 0.02 | - | - |
| | MW-8 | 140 | 107 | 15.29 | 22.77 | - | - | - | 0.11 | 0.16 | - | - |
| | MW-10 | 140 | 106 | 15.14 | 22.55 | - | - | - | 0.11 | 0.16 | - | - |
| Mercury | MW-3 | 0.86 | 12 | 1.71 | 2.55 | - | - | - | 1.99 | 2.97 | - | - |
| | MW-4 | 0.86 | 0.5 | 0.07 | 0.11 | - | - | - | 0.08 | 0.12 | - | - |
| | MW-5 | 0.86 | 2 | 0.29 | 0.43 | - | - | - | 0.33 | 0.49 | - | - |
| | MW-8 | 0.86 | 6 | 0.87 | 1.30 | - | - | - | 1.01 | 1.51 | - | - |
| | MW-10 | 0.86 | 7 | 1.00 | 1.49 | - | - | - | 1.16 | 1.73 | - | - |
| | MW-12 | 0.86 | 0.2 | 0.03 | 0.04 | 0.2 | 2.86E-02 | 4.26E-02 | 0.03 | 0.05 | 0.03 | 0.05 |

NOTE:
1. LADD is lifetime average daily dose from inhaled at the specified concentration.
2. RfD values taken from the Region 9 Risk Based Concentration Table. These values represent a daily exposure level that is not harmful to human health, over a lifetime.
3. During 7/13/2006 sampling "-" designates none of this constituent was detected.
4. HI is the Hazard Index Risk = LADD/RfD
5. Formula used for calculations:

LADD = (C*IR*ED*K)/(BW*AT)

| | |
|---|---|
| C = Constituent Concentration (ug/L) | |
| K = Volatilization Factor | A volatilization factor of 0.5L/$m^3$ was used based on EPA published values |
| IR = Inhalation Rate ($m^3$/day) | 20 $m^3$/day was used for adults and 12$m^3$/day was used for children |
| ED = Exposure Duration (days) | An exposure duration of 30 years was used for adults, 8 for children |
| BW = Body Weight (kg) | An average weight of 70 kg was used for adults, 28.2 kg for children |
| AT = Average Time (days) | Times of 30 years for adults and 8 for children were used |

**Table 14:** Non-Carcinogenic Toxicity Values for Dermal Exposure

| Contaminant | Well | Reference Dose | Maximum Concentration (ug/L) | LADD Maximum | | Concentration 7/13/2006 (ug/L) | LADD 7/13/2006 | | HI Risk Maximum | | HI Risk 7/13/2006 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Oral RfD (ug/kg-day) | | Adult (ug/kg-day) | Child (ug/kg-day) | | Adult (ug/kg-day) | Child (ug/kg-day) | Adult | Child | Adult | Child |
| 1,1 dichloroethane | MW-3 | 100 | 12.0 | 7.62E-04 | 2.36E-04 | 6.8 | 4.32E-04 | 1.34E-04 | 7.62E-06 | 2.36E-06 | 4.32E-06 | 1.34E-06 |
| | MW-4 | 100 | 7.3 | 4.63E-04 | 1.44E-04 | - | - | - | 4.63E-06 | 1.44E-06 | - | - |
| | MW-5 | 100 | 18.0 | 1.14E-03 | 3.54E-04 | - | - | - | 1.14E-05 | 3.54E-06 | - | - |
| | MW-7 | 100 | 12.0 | 7.62E-04 | 2.36E-04 | - | - | - | 7.62E-06 | 2.36E-06 | - | - |
| | MW-8 | 100 | 107.0 | 6.79E-03 | 2.10E-03 | - | - | - | 6.79E-05 | 2.10E-05 | - | - |
| | MW-10 | 100 | 106.0 | 6.73E-03 | 2.08E-03 | - | - | - | 6.73E-05 | 2.08E-05 | - | - |
| Mercury | MW-3 | 0.3 | 1.2 | 7.62E-05 | 2.36E-05 | - | - | - | 2.54E-04 | 7.86E-05 | - | - |
| | MW-4 | 0.3 | 0.5 | 3.17E-05 | 9.83E-06 | - | - | - | 1.06E-04 | 3.28E-05 | - | - |
| | MW-5 | 0.3 | 2.0 | 1.27E-04 | 3.93E-05 | - | - | - | 4.23E-04 | 1.31E-04 | - | - |
| | MW-8 | 0.3 | 6.1 | 3.87E-04 | 1.20E-04 | - | - | - | 1.29E-03 | 4.00E-04 | - | - |
| | MW-10 | 0.3 | 0.6 | 3.81E-05 | 1.18E-05 | - | - | - | 1.27E-04 | 3.93E-05 | - | - |
| | MW-12 | 0.3 | 0.2 | 1.27E-05 | 3.93E-06 | 0.2 | 1.27E-05 | 3.93E-06 | 4.23E-05 | 1.31E-05 | 4.23E-05 | 1.31E-05 |

NOTE:
1. LADD is lifetime average daily dose from dermal contact with contaminated groundwater at the specified concentration
2. RfD values taken from the Region 9 Risk Based Concentration Table. These values represent a daily exposure level that is not harmful to human health, over a lifetime.
3. During 7/13/2006 sampling "-" designates none of this constituent was detected.
4. Dermal Values used the same RfD values as those used for Oral.
5. HI is the Hazard Index Risk = LADD/RfD
6. Formula used for calculations:

LADD = (C*K*EV*ED*EF*SA)/(BW*AT)

| | |
|---|---|
| C = constituent concentration (ug/L) | |
| K = permeability coefficient (cm/day) | contaminant dependent |
| EV = event frequency | 15 min/day |
| ED = Exposure Duration (years) | 30 years for an adult, 8 years for a child |
| EF = Exposure Frequency (days/year) | 365 days per year |
| SA = skin surface area ($cm^2$) | 20,000$cm^2$ for adults and 9360 $cm^2$ for children |
| BW = Body weight (kg) | 70 kg was used for adults, 28.2 kg for children |
| AT = Average Time (days) | 30 years for adults and 8 for children |

**Table 15:** Remediation Alternatives

| Remediation Technology | Contamination Treatment | Advantages | Disadvantages | Site Specific Information | Costs |
|---|---|---|---|---|---|
| Monitored Natural Attenuation | Passively treats contaminated medium | ▪ Inexpensive and easy to implement<br>▪ Often applicable when low levels of contamination are present and low migration potential exists<br>▪ Often applicable on sites with low significant threats to public health and the environment exist | ▪ Other than natural biodegradation, minimal reduction in contamination levels.<br>▪ Provides no containment of groundwater<br>▪ Requires long-term monitoring<br>▪ Not appropriate for high risk sites | ▪ High retardation coefficient indicating high sorption rate<br>▪ Low potential of migration<br>▪ Low health risks<br>▪ Community water available | Already incorporated into facility operation |
| Vapor Extraction/Bioventing | Actively treats contaminated medium | ▪ Controls contamination migration | ▪ Contamination must be susceptible to air stripping<br>▪ Expensive start up cost and operation<br>▪ Focuses more on contaminated soil and the vadose zone.<br>▪ Need favorable soil conditions<br>▪ Pilot test required for adequate engineering design | ▪ Clay content would limit air flow | $100,000 Pilot test and engineering<br>$300,000 Installation and start up<br>$15,000 Annual operation and maintenance |
| Air Sparging | Actively treats contaminated medium | ▪ Controls contamination migration<br>▪ Immediate reduction of contamination during initial weeks/months | ▪ Contamination must be susceptible to volatilization<br>▪ Often used in conjunction with vapor extraction<br>▪ Need favorable soil conditions<br>▪ Long-term system operation<br>▪ Expensive start up cost and operation<br>▪ Extensive operation and maintenance<br>▪ Pilot test required for adequate engineering design | ▪ Contamination of concern degrades under anaerobic and aerobic conditions<br>▪ Clay content would limit injection radius of influence | $100,000 Pilot test and engineering<br>$300,000 Installation and start up<br>$15,000 Annual operation and maintenance |
| Enhanced Bioremediation | Actively treats contaminated medium | ▪ Can be tailored to fit the contamination of concern<br>▪ Minimally invasive<br>▪ Chemicals can be applied directly to the contamination<br>▪ Can be applied into fracture zones | ▪ Degradation of chemicals may require repeat applications<br>▪ Permitting requirements can be extensive | | $20,000 Design and permitting costs<br>$30,000 Installation of injection points and additional monitoring points<br>$80,000 Initial injection of compound<br>$80,000 Sub sequential injection of compound |
| Phytoremediation | Passively treats contaminated medium | ▪ Environmentally friendly<br>▪ Inexpensive and easy to implement<br>▪ Potential source of revenue | ▪ Does not work with deep groundwater contamination | ▪ Phytoremediation currently existing under natural conditions | Currently existing under natural conditions |
| Constructed Wetlands | Passively treats contaminated medium | ▪ Environmentally friendly<br>▪ Inexpensive and easy to implement | ▪ Does not work with deep groundwater contamination | ▪ Wetlands currently existing under natural conditions in the floodplain<br>▪ Groundwater is shallow | Currently existing under natural conditions |
| Passive Landfill Gas Ventilation System | Removes source area recharge contamination | ▪ Inactively controls contamination recharge<br>▪ Inexpensive implementation and operation | ▪ Generally not efficient for remediation of dissolved phase contamination | | $75,000 Design and installation |
| Active Landfill Gas Ventilation System | Actively removes source area recharge contamination | ▪ Actively controls contamination recharge<br>▪ Possible use as alternative energy source | ▪ Expensive start up cost and operation | | Currently in operation<br>~$750,000 Total turn key expense<br>~$50,000 annual operating expense |
| Pump and Treat | Actively removes source area contamination | ▪ Controls contamination migration | ▪ Total removal of contamination is limited<br>▪ Requires operation and maintenance of equipment<br>▪ Ineffective at treating sites with high soil – water partition coefficent | | |
| Permeable Treatment Barrier | Does not address source area contamination | ▪ Controls contamination migration | ▪ Impractical on large deep plumes.<br>▪ Relies on groundwater flow to treat contamination | | |

**Table 16:** Summary of Water Supply Well Inventory

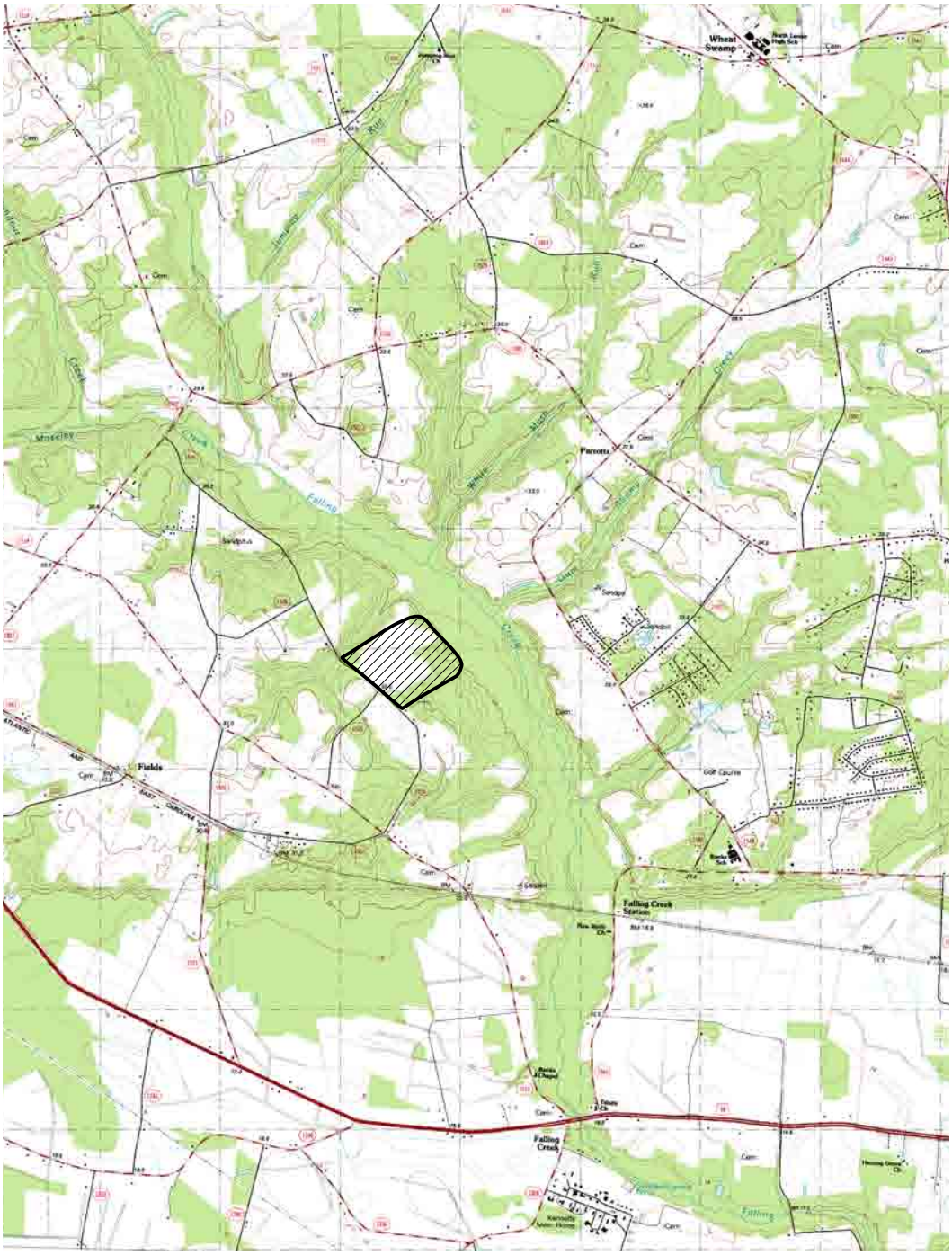
| Owner | Property Address | Well Confirmed/Observed | Well Details | Use | Potable water supply |
|---|---|---|---|---|---|
| Lenoir County | 2845 Hodges Farm Rd | Confirmed | Unknown | No power source | None |
| Lenoir County | Hodges Farm Rd | Confirmed | Unknown | No power source | None |
| Joseph Price | 2660 Hodges Farm Rd | Unknown | Unknown | Unknown | Unknown |
| Lenoir County | Facility | Confirmed | 1" Diameter PVC<br>3" PVC Outer Casing<br>155' Deep<br>75-100' Screen | Equipment Washing | Community |

# PLATES

# Topographic Map with Site Location

## Assessment of Corrective Measures

## PLATE 1 Lenoir County Sanitary Landfill




**QUADRANGLE LEGEND**

ROAD CLASSIFICATION

Primary highway, hard surface

Light-duty road, hard or improved surface

Secondary highway, hard surface

Unimproved road

Interstate Route

U. S. Route

State Route

| | |
|---|---|
| Date Completed | 5/31/2007 |
| Created By | M. Clement |
| Project Name | Assessment of Corrective Measures |
| Site Name | Lenoir County Sanitary Landfill |
| Project Number | G07062.0 |

Municipal Engineering Services Company, PA

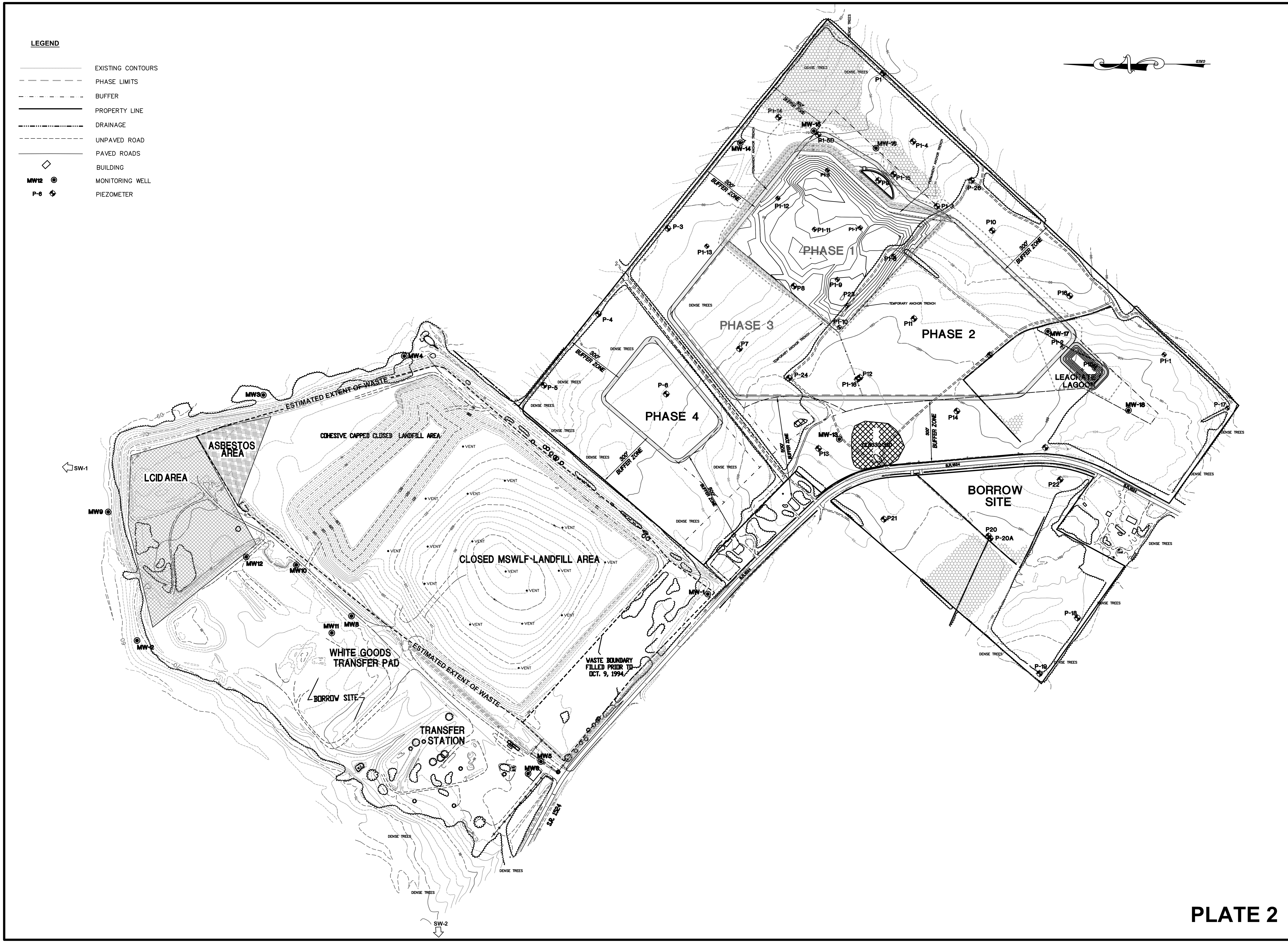



PLATE 2

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767
P.O. BOX 828 MOREHEAD CITY, N.C. 28557 (252) 726-9481

**MUNICIPAL SOLID WASTE LANDFILL FACILTIY**
**LENOIR COUNTY NORTH CAROLINA**

| DATE | BY | REV. | DESCRIPTION |
|---|---|---|---|
| | | | FACILTIY MAP |

| | |
|---|---|
| SCALE: | 1" =200' |
| DATE: | 8/27/2007 |
| DRWN. BY: | M. CLEMENT |
| CHKD. BY: | E. CALDWELL |
| PROJECT NUMBER | G07062.0 |
| DRAWING NO. | PLATE 2 |
| SHEET NO. | 1 OF 1 |

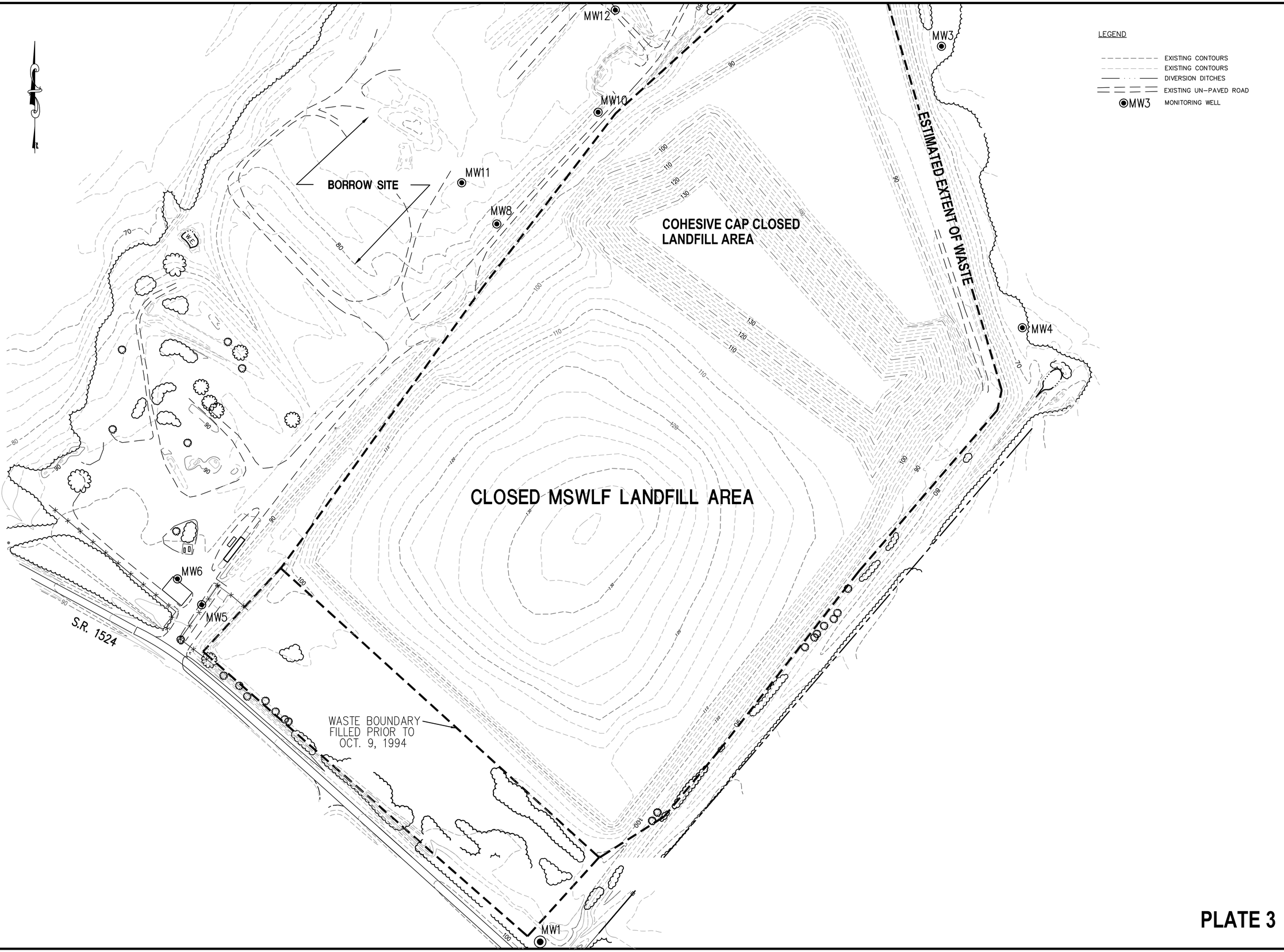



PLATE 3

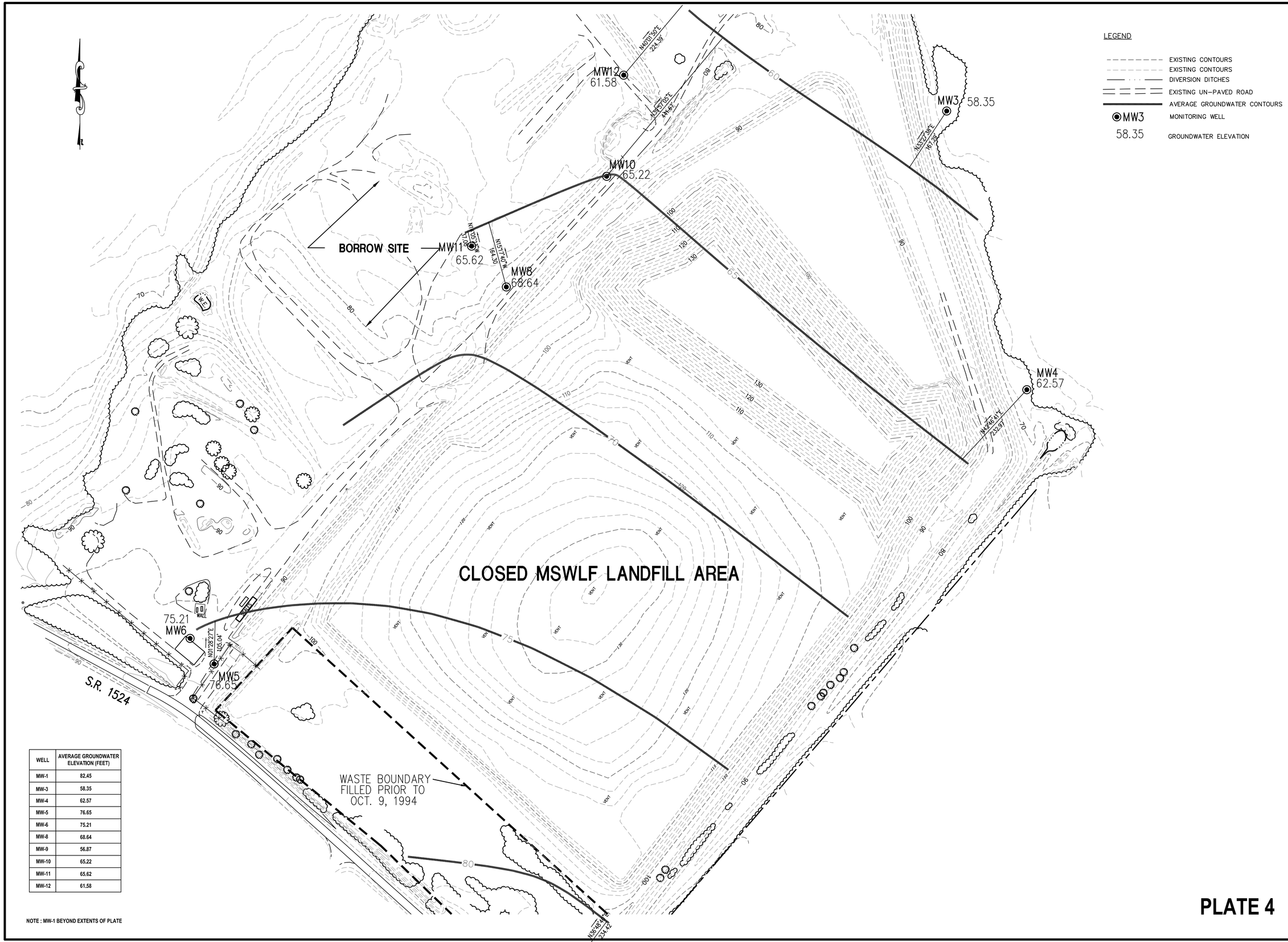
Municipal Services Engineering Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 349 BOONE, N.C. 28607 (828) 262-1767

CONSTRUCTION & DEMOLITION LANDFILL REVISION
LENOIR COUNTY NORTH CAROLINA

| DATE | BY | REV. | DESCRIPTION |
|---|---|---|---|

SITE MAP WITH SAMPLING LOCATIONS

| | |
|---|---|
| SCALE: | 1" = 100' |
| DATE: | 8/27/07 |
| DRWN. BY: | M. CLEMENT |
| CHKD. BY: | E. CALDWELL |
| PROJECT NUMBER | G07062.0 |
| DRAWING NO. | PLATE 3 |
| SHEET NO. | 1 OF 1 |




| WELL | AVERAGE GROUNDWATER ELEVATION (FEET) |
|---|---|
| MW-1 | 82.45 |
| MW-3 | 58.35 |
| MW-4 | 62.57 |
| MW-5 | 76.65 |
| MW-6 | 75.21 |
| MW-8 | 68.64 |
| MW-9 | 56.87 |
| MW-10 | 65.22 |
| MW-11 | 65.62 |
| MW-12 | 61.58 |

NOTE : MW-1 BEYOND EXTENTS OF PLATE

PLATE 4

Municipal Services Engineering Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 348 BOONE, N.C. 28607 (828) 262-1767

CONSTRUCTION & DEMOLITION LANDFILL REVISION
LENOIR COUNTY
NORTH CAROLINA

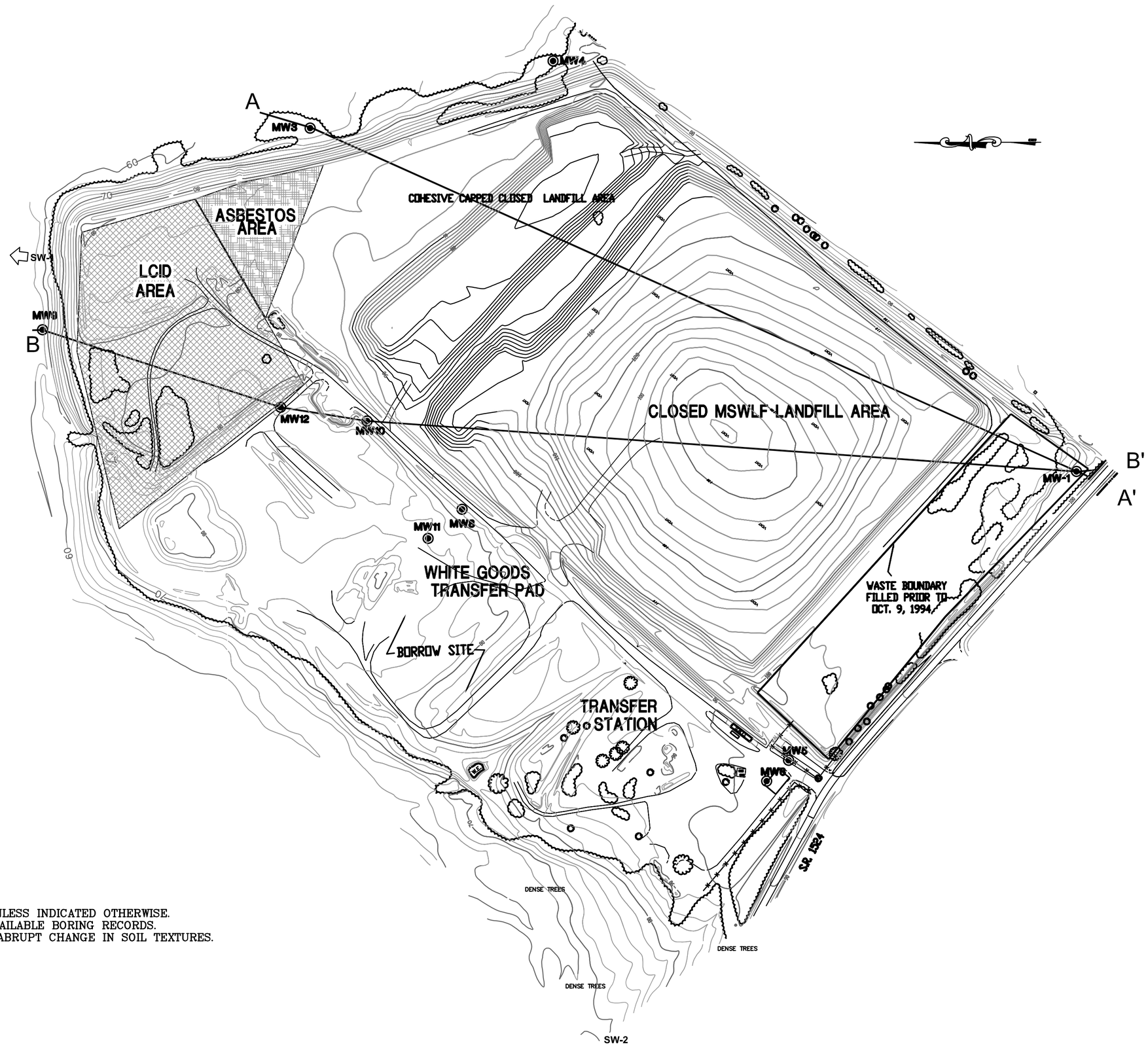
| DATE | BY | REV. | DESCRIPTION |
|---|---|---|---|

AVERAGE GROUNDWATER POTENTIOMETRIC MAP

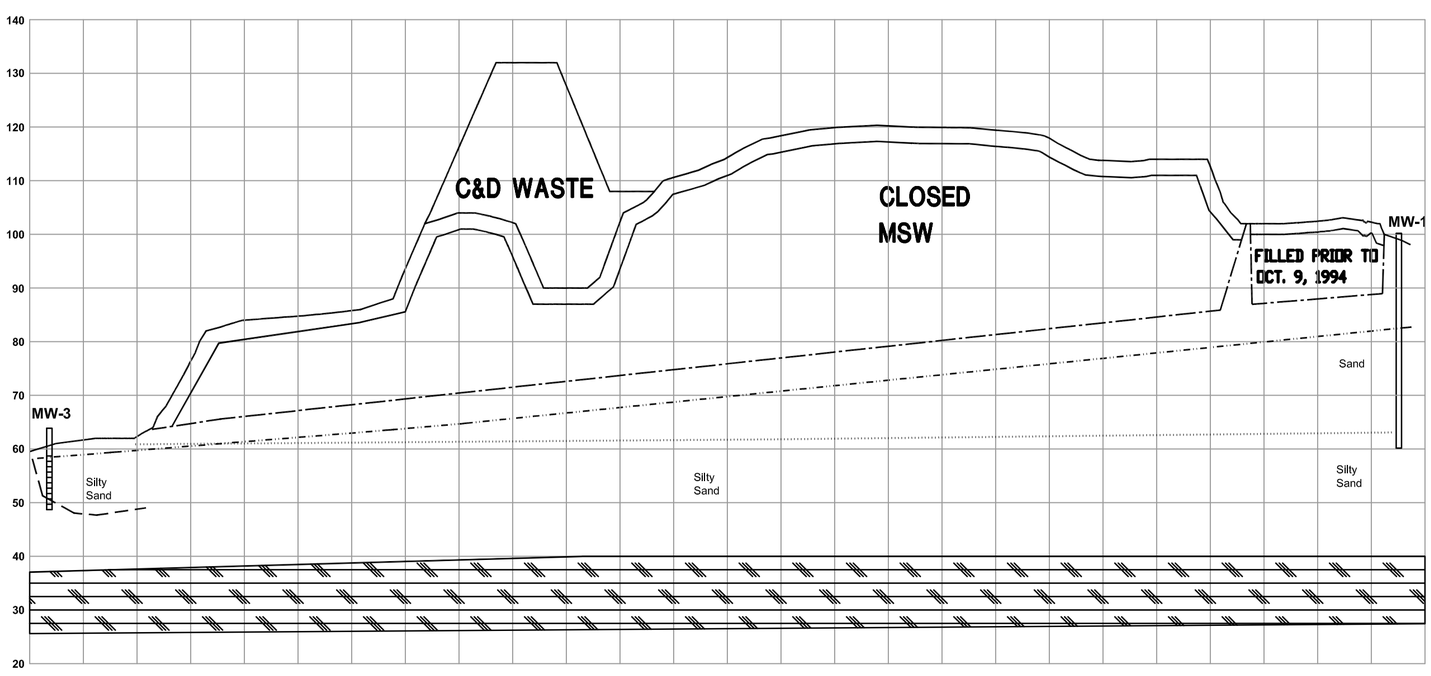
SCALE: 1" = 100'
DATE: 8/27/07
DRWN. BY: M. CLEMENT
CHKD. BY: E. CALDWELL
PROJECT NUMBER G07062.0
DRAWING NO. PLATE 4
SHEET NO. 1 OF 1

**LEGEND**

- EXISTING COUNTOURS
- PHASE LIMITS
- BUFFER
- PROPERTY LINE
- DRAINAGE
- UNPAVED ROAD
- PAVED ROADS
- BUILDING
- MW12 MONITORING WELL
- P-6 PIEZOMETER




NOTE:
- NUMBERS SHOWN IN THIS PLATE ARE IN UNITS OF FEET UNLESS INDICATED OTHERWISE.
- SOIL PROFILES SHOWN HEREIN ARE INTERPOLATED FROM AVAILABLE BORING RECORDS.
- SOIL PROFILE BOUNDARIES DO NOT NECESSARILY INDICATE ABRUPT CHANGE IN SOIL TEXTURES.




**SECTION A-A'**

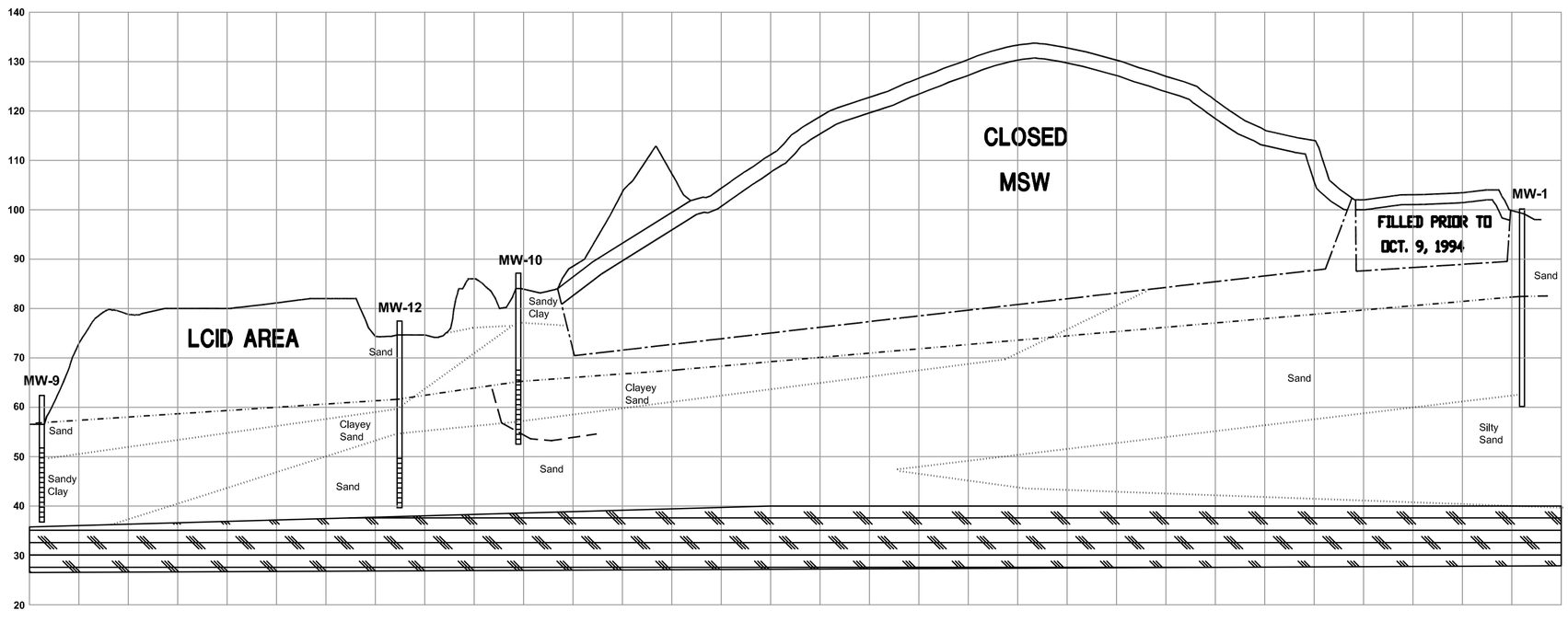
APPROX. SCALE HORIZ. 1" = 200'
VERT. 1" = 20'

LEGEND:

- NEW C&D WASTE
- TOP OF MSW WITH COVER
- ESTIMATED BASE OF MSW
- AVERAGE GROUNDWATER
- ESTIMATED STRATIGRAPHIC CONTENT
- ESTIMATED PEEDEE CONFINING LAYER
- ESTIMATED EXTENT OF VOC CONTAMINATION (JANUARY 10, 2002)

MW-12 — MONITORING WELL

SCREENED SECTION




**SECTION B-B'**

APPROX SCALE HORIZ. 1" = 200'
VERT. 1" = 20'

# PLATE 5

| | |
|---|---|
| DRAWING NO. | PLATE 5 |
| SHEET NO. | 1 OF 1 |
| PROJECT NUMBER | G07062.0 |
| CHKD. BY: | E. CALDWELL |
| DRWN. BY: | M. CLEMENT |
| DATE: | 8/28/07 |
| SCALE: | AS SHOWN |

| DATE | BY | REV. | DESCRIPTION |
|---|---|---|---|

CROSS SECTIONS

**LENOIR COUNTY CONSTRUCTION & DEMOLITION LANDFILL FACILITY NORTH CAROLINA**


Municipal Services
P.O. BOX 97 GARNER, N.C. 27529
(919) 772-5393

Engineering Company, P.A.
P.O. BOX 349 BOONE, N.C. 28607
(828) 262-1767
P.O. BOX 828 MOREHEAD CITY, N.C. 28557
(252) 726-9481

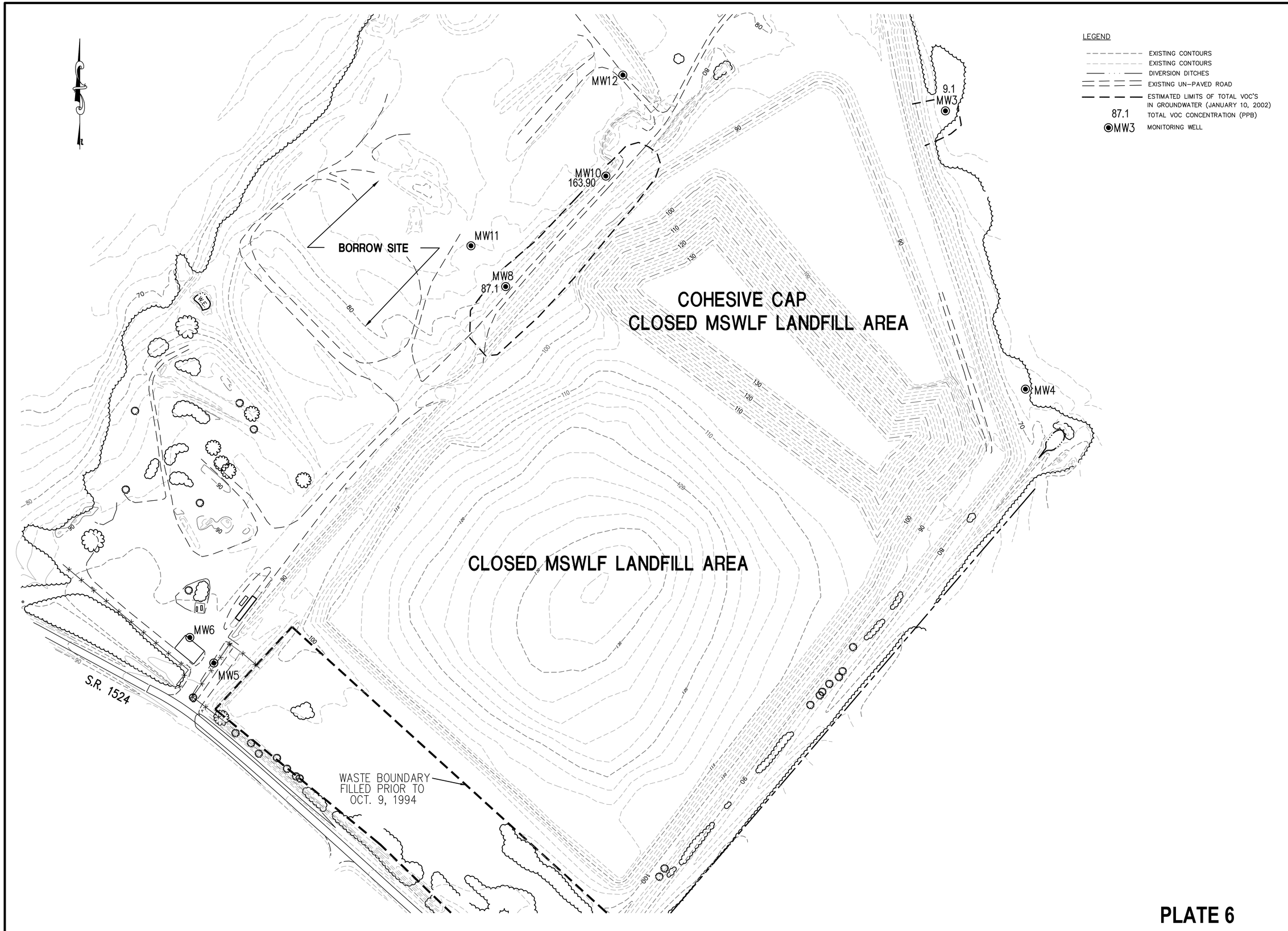



PLATE 6

Municipal Services Engineering Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
P.O. BOX 348 BOONE, N.C. 28607 (828) 262-1767

CONSTRUCTION & DEMOLITION LANDFILL REVISION
LENOIR COUNTY
NORTH CAROLINA

| DATE | BY | REV. | DESCRIPTION |
|---|---|---|---|

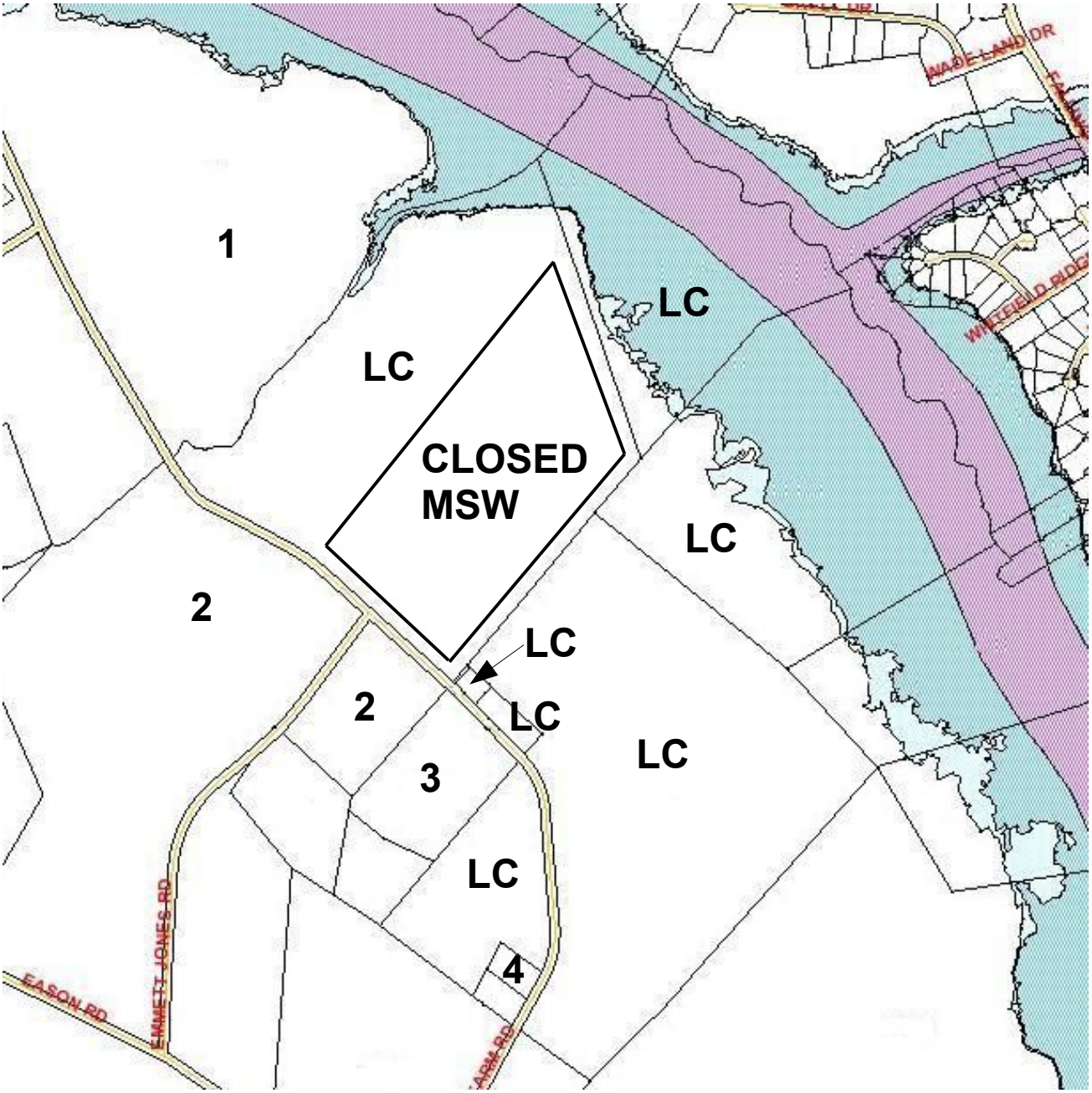
ISOCONCENTRATION MAP
TOTAL VOC'S

| | |
|---|---|
| SCALE: | 1" = 100' |
| DATE: | 8/27/07 |
| DRWN. BY: | M. CLEMENT |
| CHKD. BY: | E. CALDWELL |
| PROJECT NUMBER | G07062.0 |
| DRAWING NO. | PLATE 6 |
| SHEET NO. | 1 OF 1 |

PLATE 7

# Tax Map

## Assessment of Corrective Measures
## Lenoir County Sanitary Landfill



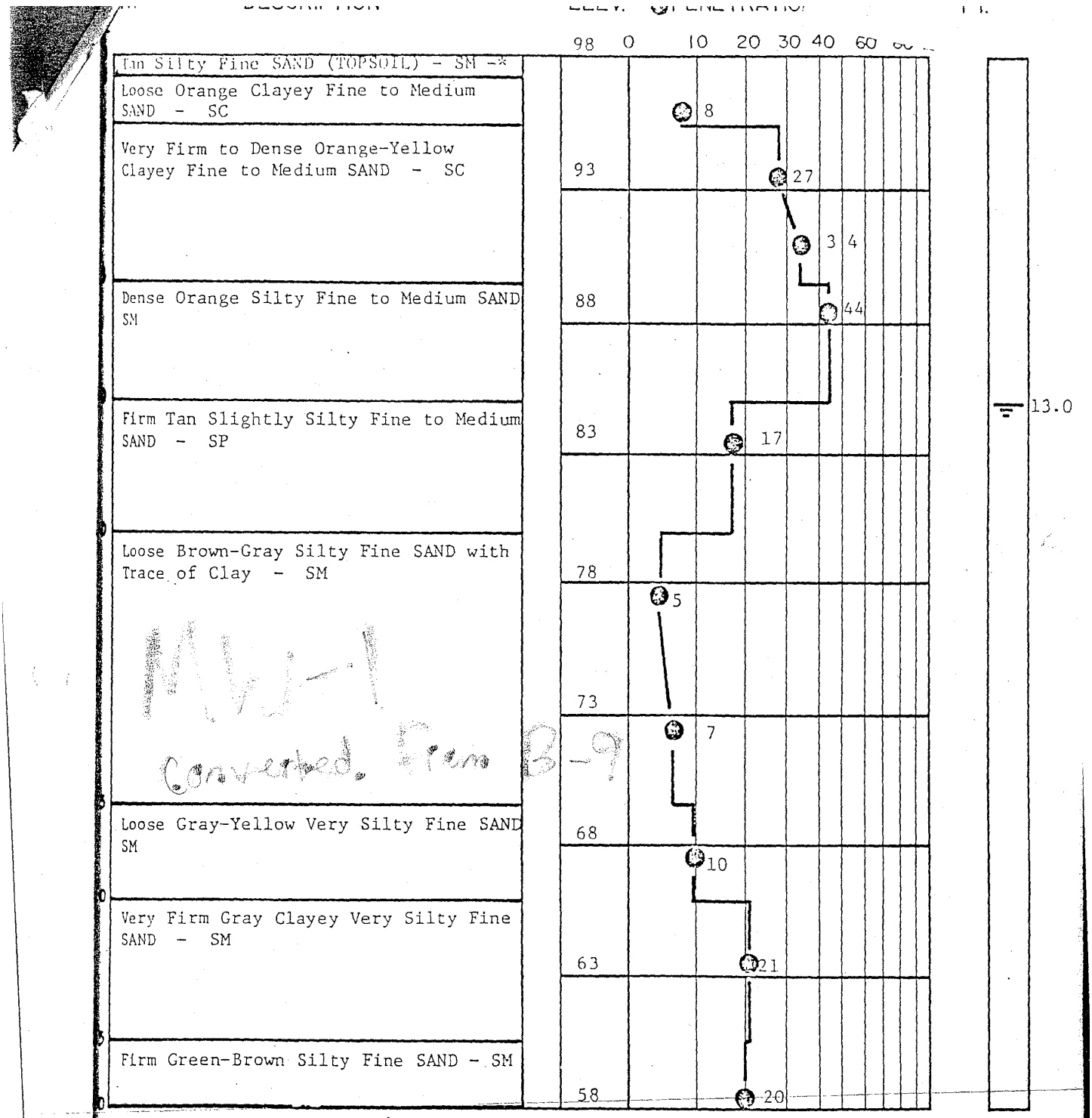

## LEGEND :

| Owner | ID |
|---|---|
| Lenoir County | LC |
| Charlotte Maxwell | 1 |
| Rouse Warren Properties Inc | 2 |
| John Sparrow | 3 |
| Joseph Price | 4 |

| | |
|---|---|
| Date Completed | 08/27/2007 |
| Created By | M. Clement |
| Project Name | Assessment of Corrective Measures |
| Site Name | Lenoir County |
| Project Number | G07062.0 |

Municipal Engineering Services Company, PA

# APPENDIX A




Boring Terminated at 40.0'
Groundwater Level at 13.0' on 10/20/80

RING AND SAMPLING MEETS ASTM D-1586
RE DRILLING MEETS ASTM D-2113

NETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
LLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24 HR.
WATER TABLE-1 HR.

*WOODED AREA

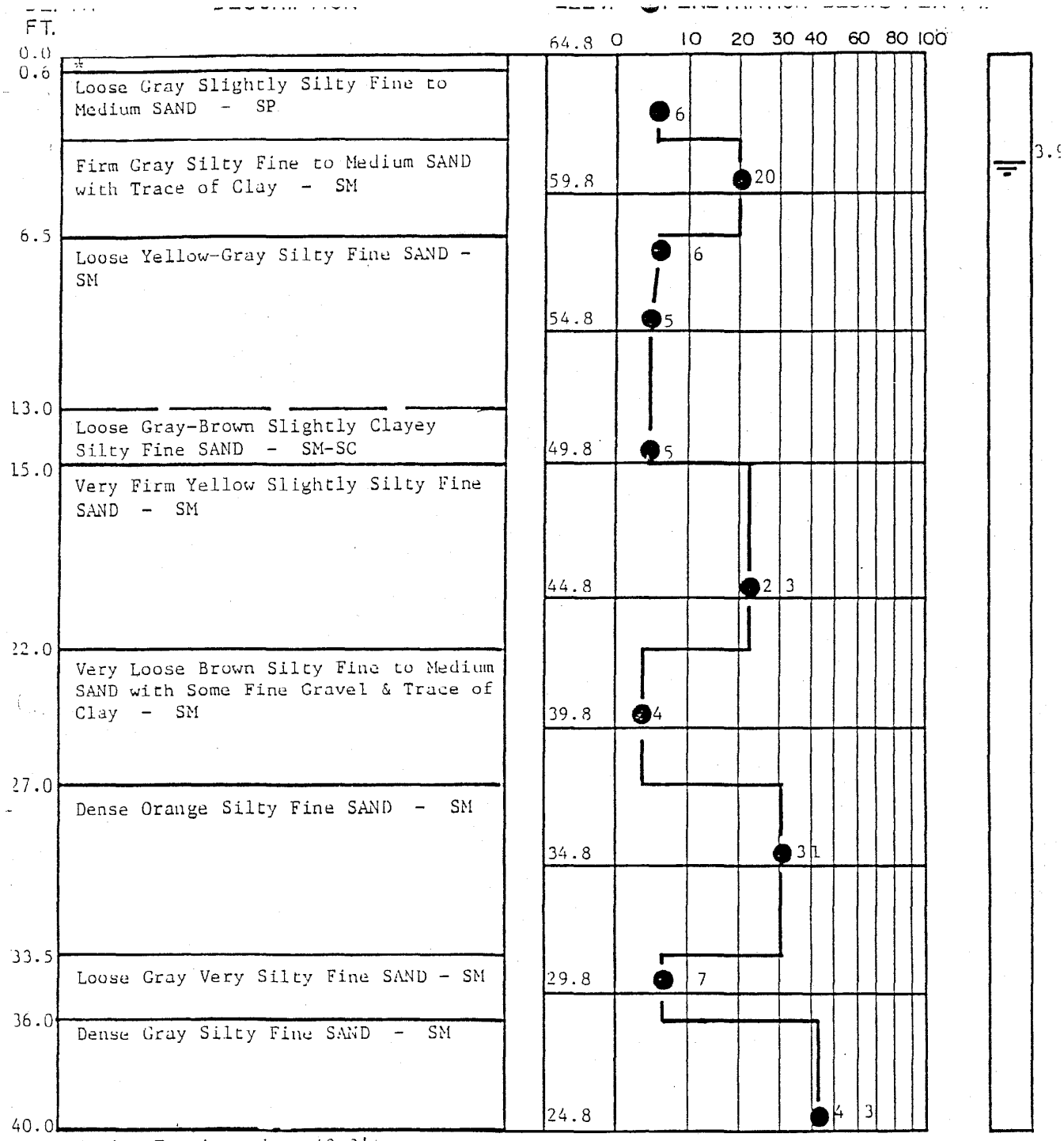
# TEST BORING RECORD

BORING NO. B-9
DATE DRILLED 10/7/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

Upgradient Well

ELL, INC., RALEIGH 680




Boring Terminated at 40.0'
Groundwater level at 3.9' on 10/20/80

Observation Well Screen Set @ 39.0'

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER
ING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

SM-14

UNDISTURBED SAMPLE
50 % ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

TEST BORING RECORD

BORING NO. B-8
DATE DRILLED 10/8/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

CA PARNELL, INC., RALEIGH 660

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent.

REVISED **WELL CONSTRUCTION RECORD** 02-22-94

DRILLING CONTRACTOR: GAI Consultants-NC, Inc.

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: 53-0246-WM-0115

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Kinston County: Lenoir
   NCSR 1524
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Lenoir County
   ADDRESS P.O. Box 757
   (Street or Route No.)
   Kinston (City or Town) North Carolina (State) 28501 (Zip Code)
3. DATE DRILLED 9-26-91 USE OF WELL GW Monitoring
4. TOTAL DEPTH 15.0 ft
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 5.5± FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 3.0 FT. Above Land Surface*
   * Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST _____
10. WATER ZONES (depth): 5.5 to bottom
11. CHLORINATION: Type N/A Amount _____

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 0 | 4 | Silty Sand |
| 4 | 6 | Sandy Silt |
| 6 | 12.5 | Silty Sand |

If additional space is needed use back of form

12. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | +3.0 | 2.0 | 2.0 | SCH 40 | PVC |
| | | | | | |
| | | | | | |

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
SEE BACK OF PAGE

13. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | +1.0 | 0 | Cement | Tremie |
| | 0 | 1.0 | Bentonite | Pellets |

14. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 2.0 | 12.0 | 2.0 in. | 0.010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

15. SAND/GRAVEL PACK:

| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 1.0 | 12.5 | NC #2S | Sand |
| | | | | |

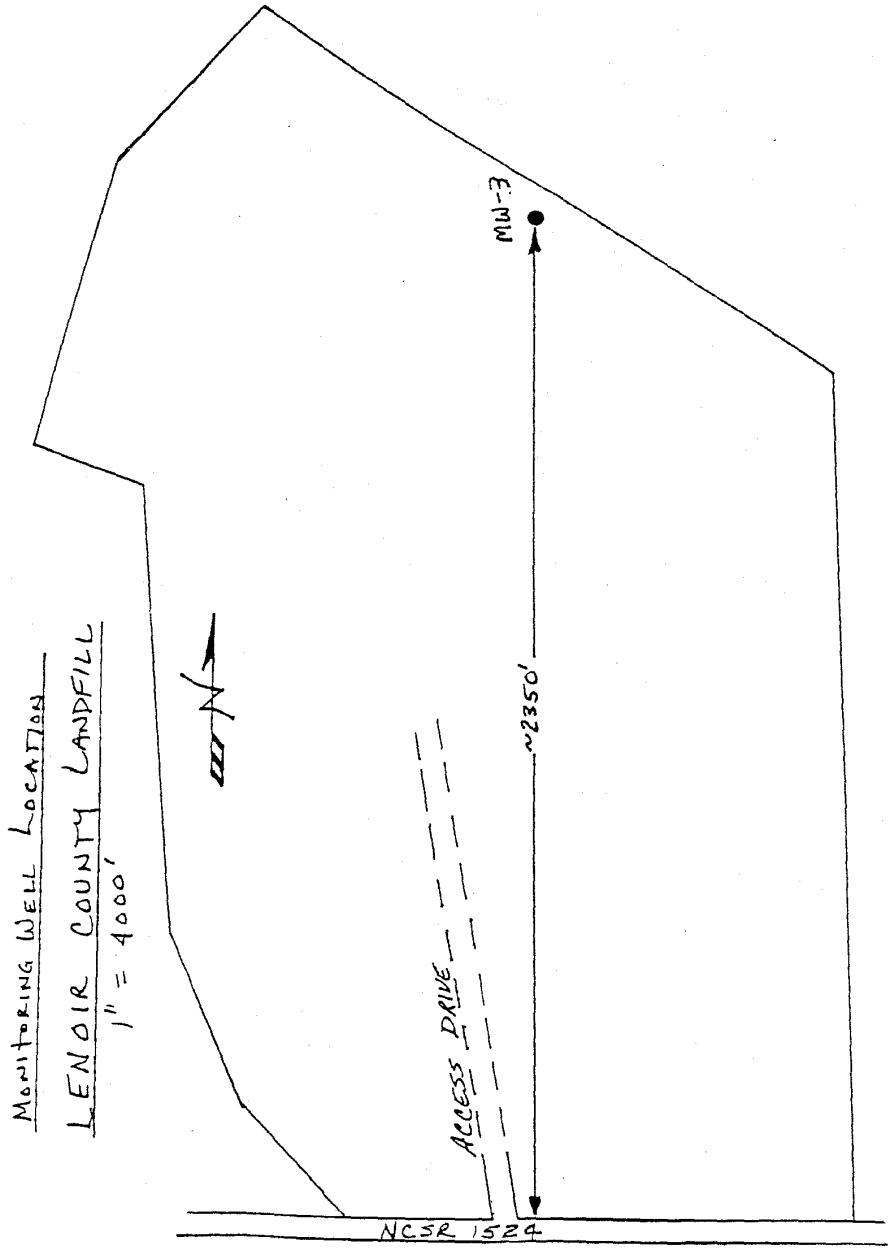
16. REMARKS: Water levels are at time of well installation.

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

[signature] GAI-NC 10-3-91
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 5/91

Submit original to Division of Environmental Management and copy to well owner


MONITORING WELL LOCATION
LENOIR COUNTY LANDFILL
1" = 4000'
N
ACCESS DRIVE
~2350'
MW-3
NCSR 1524

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

REVISED **WELL CONSTRUCTION RECORD** 02-22-94

DRILLING CONTRACTOR: GAI Consultants-NC, Inc.

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: 53-0246-WM-0115

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Kinston County: Lenoir
NCSR 1524
(Road, Community, or Subdivision and Lot No.)
2. OWNER Lenoir County
ADDRESS P.O. Box 757
(Street or Route No.)
Kinston (City or Town) North Carolina (State) 28501 (Zip Code)
3. DATE DRILLED 9-25-91 USE OF WELL GW Monitoring
4. TOTAL DEPTH 17.5 ft
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 9.5 FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.5 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST _____
10. WATER ZONES (depth): 9.5 to bottom
11. CHLORINATION: Type N/A Amount _____
12. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | +2.5 | 5.0 | 2.0 | SCH 40 | PVC |
| | | | | | |
| | | | | | |

13. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | 0 | 3.0 | Cement | Tremie |
| | 3.0 | 4.0 | Bentonite | Pellets |

14. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 5.0 | 15.0 | 2.0 in. | 0.010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

15. SAND/GRAVEL PACK:

| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 4.0 | 15.5 | NC #2S | Sand |
| | | | | |

16. REMARKS: Water levels are at time of well installation

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 0 | 4 | Silty Sand |
| 4 | 9 | Sandy Silt |
| 9 | 15.5 | Silty Sand |

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

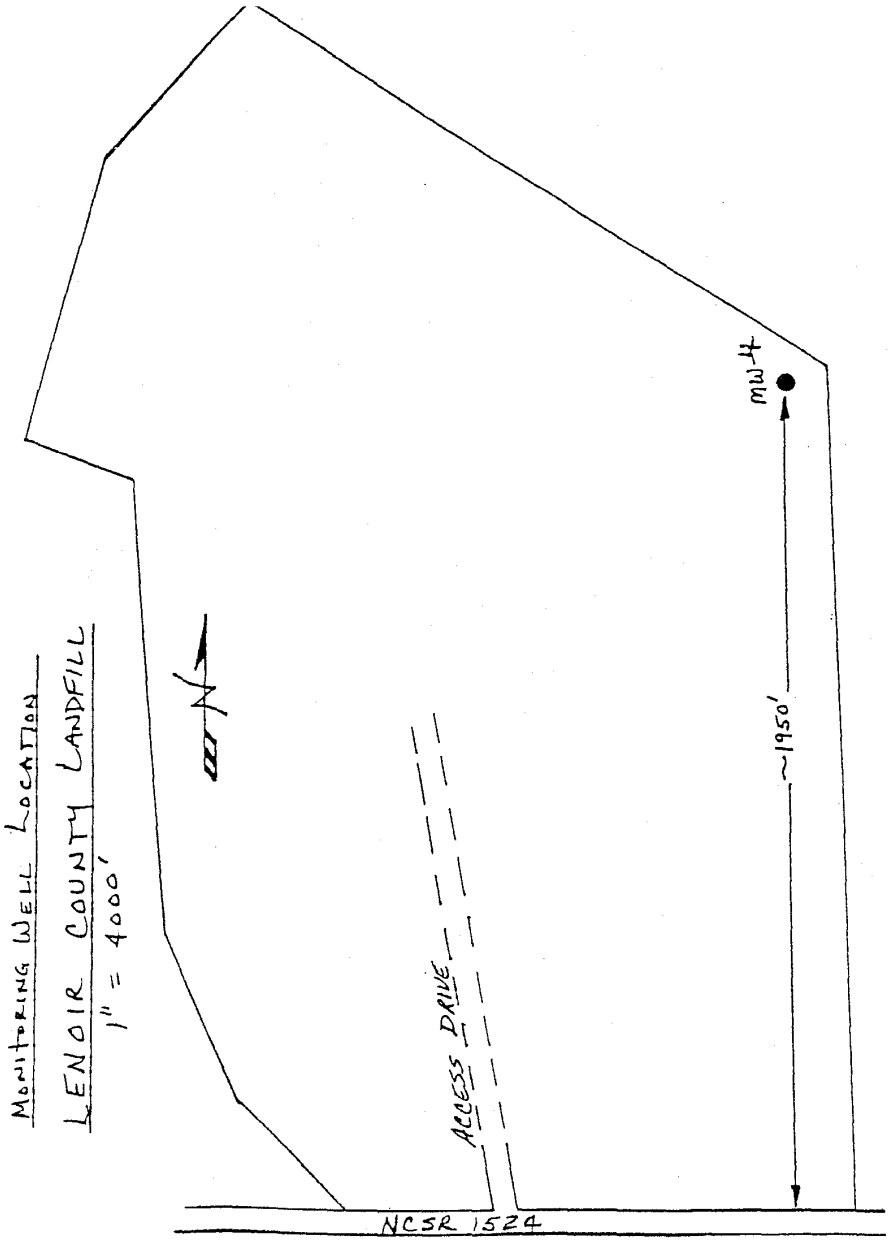
SEE BACK OF PAGE

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

[signature] GAI-NC 10-3-91
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 5-91

Submit original to Division of Environmental Management and copy to well owner


MONITORING WELL LOCATION
LENOIR COUNTY LANDFILL
1" = 400'
N
ACCESS DRIVE
NCSR 1524
~1950'
MW-4

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

## WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-NC

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: 53-0253-WM-0134

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: La Grange County: Lenoir
   NCSR 1524
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Lenoir County
   ADDRESS P.O. Box 757
   (Street or Route No.)
   Kinston North Carolina 28501
   City or Town State Zip Code
3. DATE DRILLED 5-27-92 USE OF WELL GW Monitoring
4. TOTAL DEPTH 19 ft
5. CUTTINGS COLLECTED YES ☐ NO ☒
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 11 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0 FT. Above Land Surface*

* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118

9. YIELD (gpm): N/A METHOD OF TEST _____
10. WATER ZONES (depth): 11 ft to bottom
11. CHLORINATION: Type N/A Amount _____
12. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | 0 | 7 | 2 | SCH 40 | PVC |
| | | | | | |
| | | | | | |

13. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | 0 | 3 | Cement | Tremie |
| | 3 | 5 | Bentonite | Pellets |

14. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 7 | 17 | 2 in. | 0.010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

15. SAND/GRAVEL PACK:

| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 5 | 19 | NC #2S | SAND |
| | | | | |

16. REMARKS: Casing terminated at land surface due to traffic activity

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 0 | 5' | Sand |
| 5' | 10' | Clayey Sand |
| 10' | 19' | Silty Sand |

If additional space is needed use back of form

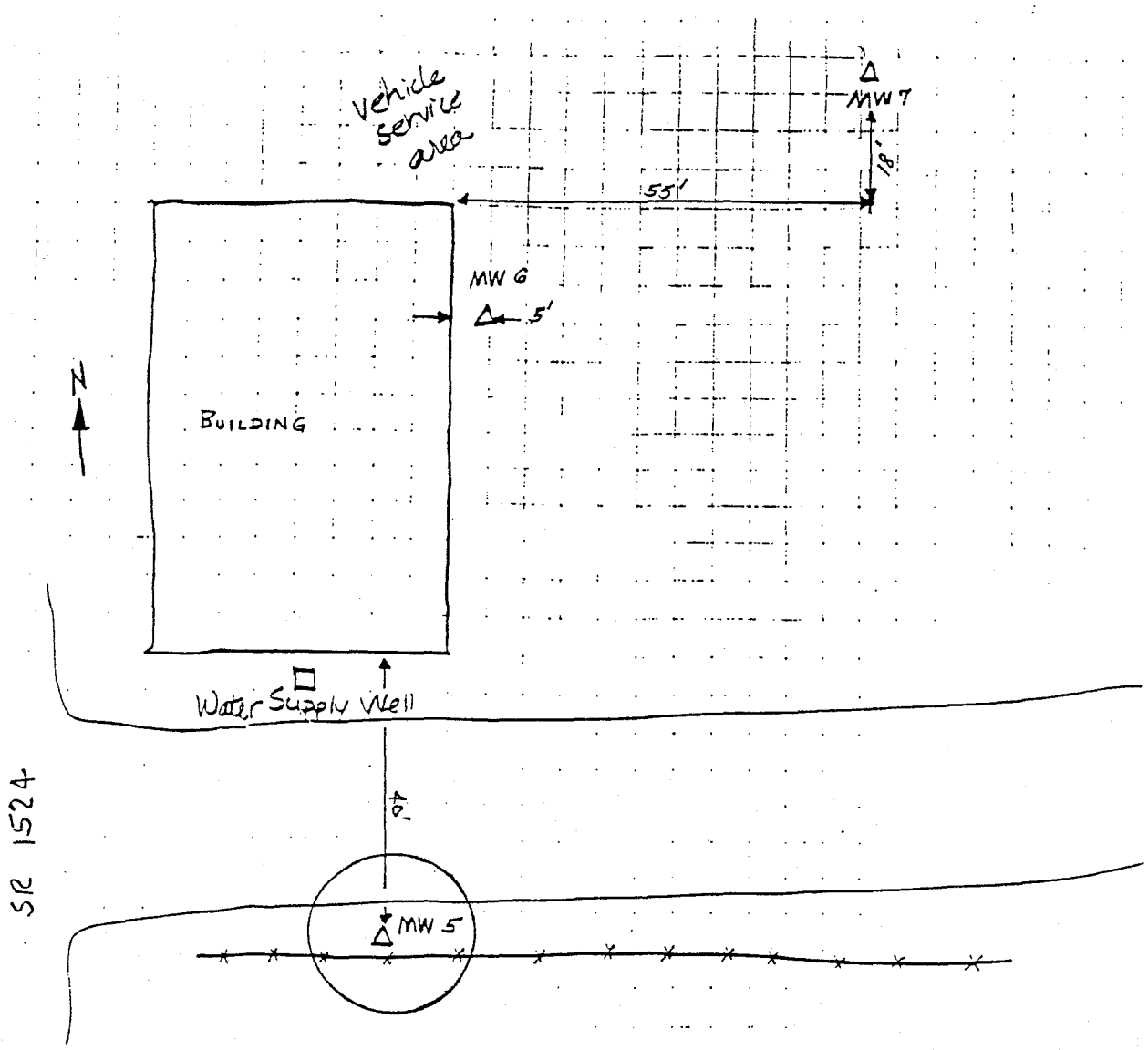
LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
(See other side of page)

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

Gary Sandage GAI Consultants, Inc. 6-2-92
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 5-91

Submit original to Division of Environmental Management and copy to well owner




Monitoring Wells scaled to NE and SE bldg corners

North arrow approx

Other features NTS

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

## WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: La Grange County: Lenoir
SR 1524
(Road, Community, or Subdivision and Lot No.)

2. OWNER Lenoir County Attn: Larry Jones
ADDRESS Rt 4 Box 187
(Street or Route No.)
La Grange NC 28551
City or Town State Zip Code

3. DATE DRILLED 8-24-94 USE OF WELL Monitoring
4. TOTAL DEPTH 32.5
5. CUTTINGS COLLECTED YES [x] NO [ ]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [x]
7. STATIC WATER LEVEL Below Top of Casing: 19.3 FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.5 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST _____
10. WATER ZONES (depth): to 31.5
11. CHLORINATION: Type N/A Amount _____
12. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | +2.5 | 16.5 | 2" | Sch 40 | PVC |
| | | | | | |
| | | | | | |

13. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | 0 | 12.2 | Cement | Grout |
| | 12.2 | 13.7 | Bentonite | Pellet |

14. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 16.5 | 31.5 | 2 in. | .010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

15. SAND/GRAVEL PACK:

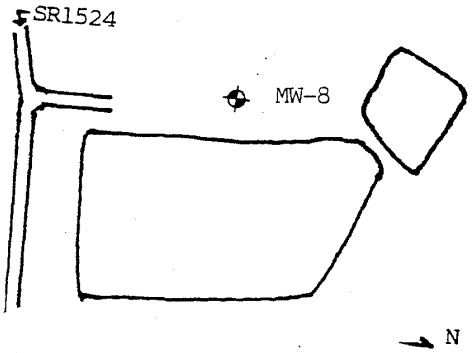
| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 13.7 | 32.5 | | Silica |
| | | | | |

16. REMARKS: Monitoring Well 8 16.75' water level after 24 hours

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 4.0 | 6.0 | Tan sand |
| 9.0 | 11.0 | Orange red sandy clay |
| 14.0 | 16.0 | Becomes orangish mottled olive brown |
| 18 | | Water |
| 19.0 | 21.0 | Orange brown sandy clay |
| 24.0 | 26.0 | Orange brown sandy clay |
| 29.0 | 32.5 | Orange brown sandy clay |

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)




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

Edward A Cuestas Jr 8-24-94
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV. 9/91

Submit original to Division of Environmental Management and copy to well owner

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

## WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: La Grange County: Lenoir
   SR 1524
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Lenoir County Attn: Larry Jones
   ADDRESS Rt 4 Box 187
   (Street or Route No.)
   La Grange NC 28551
   City or Town State Zip Code
3. DATE DRILLED 8-25-94 USE OF WELL Monitoring
4. TOTAL DEPTH 20.8
5. CUTTINGS COLLECTED YES [X] NO [ ]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 7.2 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.2 FT. Above Land Surface*
   * Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST _____
10. WATER ZONES (depth): N/A
11. CHLORINATION: Type N/A Amount _____

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 3 | 5 | Dark gray sand abundant organics |
| 8 | 10 | Orange brown faintly mottled clayey sand |
| 13 | 15 | Light brown sand grades to orange brown sandy clay |
| 18 | 20.8 | Orange brown sandy clay |

If additional space is needed use back of form

12. CASING:

| From | To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|
| +2.2 | 4.8 | 2" | Sch 40 | PVC |
| | | | | |
| | | | | |

13. GROUT:

| From | To | Material | Method |
|---|---|---|---|
| 0 | 2.0 | Cement | Grout |
| 2.0 | 3.0 | Bentonite | Pellets |

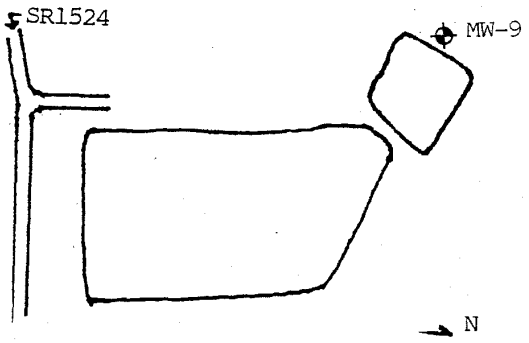
14. SCREEN:

| From | To | Diameter | Slot Size | Material |
|---|---|---|---|---|
| 4.8 | 19.8 | 2" | .010 | PVC |
| | | | | |
| | | | | |

15. SAND/GRAVEL PACK:

| From | To | Size | Material |
|---|---|---|---|
| 3.0 | 20.8 | #2 | Silica |
| | | | |

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)




16. REMARKS: Monitoring Well 9 4.89' water level after 24 hours

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

Edward A Austin Jr 8-25-94
SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to well owner

GW-1 REV. 9/91

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ RO _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

## WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: N/A

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: La Grange County: Lenoir
   SR 1524
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Lenoir County Attn: Larry Jones
   ADDRESS Rt 4 Box 187
   (Street or Route No.)
   La Grange NC 28551
   City or Town State Zip Code
3. DATE DRILLED 8-24-94 USE OF WELL Monitoring
4. TOTAL DEPTH 32.5
5. CUTTINGS COLLECTED YES [X] NO [ ]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 22.13 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.9 FT. Above Land Surface*
   * Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST _____
10. WATER ZONES (depth): 18.13 - 32.0
11. CHLORINATION: Type N/A Amount _____
12. CASING:

| Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|
| +3.0 | 16.5 | 2" | Sch 40 | PVC |
| | | | | |
| | | | | |

13. GROUT:

| Depth From | Depth To | Material | Method |
|---|---|---|---|
| 0 | 11.8 | Cement | Grout |
| 11.8 | 13.75 | Bentonite | Pellets |

14. SCREEN:

| Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|
| 16.5 | 31.5 | 2 in. | .010 in. | PVC |
| | | in. | in. | |
| | | in. | in. | |

15. SAND/GRAVEL PACK:

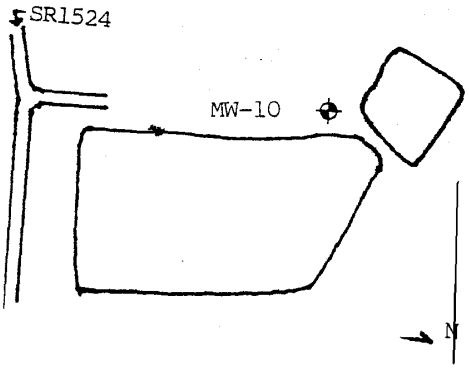
| Depth From | Depth To | Size | Material |
|---|---|---|---|
| 13.75 | 32.5 | | Silica |
| | | | |

16. REMARKS: Monitoring Well 10 18.13-water level after 24 hours

| DEPTH From - To | DRILLING LOG Formation Description |
|---|---|
| 3.5 - 5.5 | Light brown sandy clay |
| 8.5 - 10.5 | Orange brown clayey sand |
| 13.5 - 15.5 | Faint gray mottled olive brown clayey sand |
| 18.5 - 20.5 | Olive brown clayey sand |
| 23.5 - 25.5 | Olive brown clayey sand |
| 28.5 - 32.5 | Fairly clean sand |

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)




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

Edward L Cuesta Jr 8-24-94
SIGNATURE OF CONTRACTOR OR AGENT DATE

Submit original to Division of Environmental Management and copy to well owner

GW-1 REV. 9/91

## MONITORING WELL 8

PROJECT: Lenoir County Landfill
LaGrange, North Carolina
LOCATION: see Landfill Plans

| DEPTH, FT | SYMBOL | SAMPLES | DESCRIPTION | SPT VALUE |
|---|---|---|---|---|
| | | | Tan sand | |
| 5 | | X | | 16 |
| | | | Orange red sandy clay | |
| 10 | | X | | 20 |
| 15 | | X | -grades mottled orange olive brown | 6 |
| 20 | | X | -grades orange brown | 16 |
| 25 | | X | | 4 |
| 30 | | X | | 2 |
| | | | End of Boring | |
| 35 | | | | |
| 40 | | | | |
| 45 | | | | |

COMPLETION DEPTH: 32.5 ft DATE: 8-24-94
DEPTH TO WATER: 18.5 ft while drilling, 16.75 ft after 24 hrs

## MONITORING WELL 9

PROJECT: Lenoir County Landfill
LaGrange, North Carolina
LOCATION: see Landfill Plans

| DEPTH, FT | SYMBOL | SAMPLES | DESCRIPTION | SPT VALUE |
|---|---|---|---|---|
| | | | Dark gray sand with organics | |
| 5 | | X | -grades less organics | 16 |
| | | | Orange brown sandy clay | |
| 10 | | X | | 7 |
| 15 | | X | -grades light brown, with fine sand seams | 13 |
| 20 | | X | -grades orange brown | 43 |
| | | | End of Boring | |
| 25 | | | | |
| 30 | | | | |
| 35 | | | | |
| 40 | | | | |
| 45 | | | | |

COMPLETION DEPTH: 20.8 ft DATE: 8-25-94
DEPTH TO WATER: 3 ft while drilling, 4.89 ft after 24 hrs

**GAI CONSULTANTS**

## MONITORING WELL 10

PROJECT: Lenoir County Landfill
LaGrange, North Carolina
LOCATION: see Landfill Plans

| DEPTH, FT | SYMBOL | SAMPLES | DESCRIPTION | SPT VALUE |
|---|---|---|---|---|
| | | | Light brown sandy clay | |
| 5 | | | | 6 |
| | | | Orange brown clayey sand | |
| 10 | | | | 19 |
| 15 | | | -grades olive brown | 9 |
| 20 | | | | 6 |
| 25 | | | | 4 |
| | | | Tan medium sand | |
| 30 | | | | 2 |
| | | | End of Boring | |
| 35 | | | | |
| 40 | | | | |
| 45 | | | | |

COMPLETION DEPTH: 32.5 ft DATE: 8-24-94
DEPTH TO WATER: 18.5 ft while drilling, 18.13 ft after 24 hrs

**GAI CONSULTANTS**

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section
P.O. Box 29578 - Raleigh,N.C. 27626-0578-Phone (919) 733-3221

# WELL CONSTRUCTION RECORD

**DRILLING CONTRACTOR:** CAROLINA DRILLING
**DRILLER REGISTRATION #:** 1549
**STATE WELL CONSTRUCTION PERMIT#:**

1. **WELL USE** (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☒
Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:

2. WELL LOCATION: (Show sketch of the location below)
Nearest Town: LAGRANGE County: LENOIR
LENOIR COUNTY LANDFILL (SR 1524)
(Road, Community, or Subdivision and Lot No.)

3. OWNER LENOIR COUNTY
ADDRESS
(Street or Route No.)
City or Town State Zip Code

4. DATE DRILLED 3/31/99
5. TOTAL DEPTH 36.0'
6. CUTTINGS COLLECTED YES ☒ NO ☐
7. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
8. STATIC WATER LEVEL Below Top of Casing: ____ FT.
(Use "+" if Above Top of Casing)
9. TOP OF CASING IS 3.0 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0116
10. YIELD (gpm): — METHOD OF TEST —
11. WATER ZONES (depth): —
—
12. CHLORINATION: Type — Amount —
13. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | +3 | 26 | 2" | SCH40 | PVC |
| | | | | | |
| | | | | | |

14. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | 0 | 22 | CEMENT | TREMMIED |
| | 22 | 24 | BENTONITE | POUR |

15. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 26 | 36 | 2 in. | .010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

16. SAND/GRAVEL PACK:

| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 24 | 36 | NC#2 | SAND |
| | | | | |

17. REMARKS:

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| | | |

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

MW-11

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

FOR OFFICE USE ONLY
County
Date Rec'd

SIGNATURE OF CONTRACTOR OR AGENT DATE
Submit original to Division of Water Quality and copy to well owner.
GW-1 REV. 1/98

# LOG OF BORING NO. MW-11

PROJECT: Lenoir County
JOB NO.: G99004.0
TYPE: HSA; SS
LOCATION:

| DEPTH (ft) | BLOWS PER FT | SYMBOL | SAMPLES | DESCRIPTION OF MATERIAL |
|---|---|---|---|---|
| | 7 | | X | SAND (SM); brown to yellow; fine to medium grained quartz; some iron stained grains |
| | 13 | | X | |
| 5 | | | | |
| | 16 | | X | -grades fine grained, yellow and brown with trace gray clay |
| 10 | | | | |
| | 7 | | X | CLAYEY SAND (SC); gray clay, interlayered with brown to orange fine sand |
| 15 | | | | |
| | 6 | | X | SAND (SM); fine to medium grained; brown to yellow; some rust stained grains |
| 20 | | | | |
| | 7 | | X | -grades with trace clay and silt |
| 25 | | | | |
| | 15 | | X | -grades with more iron staining |
| 30 | | | | |
| | 49 | | X | |
| 35 | | | | |
| | 35 | | X | CLAY (CL); dark gray, dense, moldable, likely confining layer |
| | | | | End of Boring at 38 ft |
| 40 | | | | |

COMPLETION DEPTH: 36.0 ft
DATE: 3/31/99

DEPTH TO WATER IN BORING: 13 ft WD
SURFACE ELEVATION: 75.36 ft

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

# LOG OF BORING: MW-11

Project: LENOIR ASSESSMENT
Project No.
Type: HSA, SS

Drilling Contractor: CAROLINA DRILLING
Registration Number:

Surface Elevation: ft
Top of Casing: ft

| DEPTH (ft) | BLOWS PER FOOT | SYMBOL | SAMPLES | DESCRIPTION OF MATERIAL | IN BORROW PIT NEXT TO LCID MW ~~PIEZOMETER~~ DIAGRAM |
|---|---|---|---|---|---|
| | | | X | SAND; FINE TO MEDIUM, ORANGE + TAN; + r COARSE - REWORKED | |
| 5 | 5 4 4 7 | | X | | |
| 10 | 4 4 6 10 | | X | FINE SAND; SILT - YELLOW W/ BROWN; GRAY LAYERS - | |
| 15 | 3 3 3 4 | | X | COARSE SAND; GRAY CLAY INTERLAYERED WITH BROWN TO ORANGE SAND | GROUT 0-22 |
| 20 | 2 3 3 3 | | X | ~~SAME~~ MORE SAND - F TO MED | |
| 25 | 2 3 3 4 | | X | SANDIER; STILL SOME ~~FINES~~ FINES: MAINLY SILT + r CLAY | BENTONITE 22-24 SAND 24-36 |
| 30 | 7 6 10 5 | | X | SAND; RED → RUST STAINED - SOME CHERTS ROCK | SCREEN 26-36 |
| 35 | 16 23 21 17 | | | | |
| | | | X | CONTINUING LAYER | |
| 40 | 10 15 15 20 | | | | |

Completion Depth: ft 36
DATE:

Depth to Water: ft WD

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

I acknowledge that this record is true to the best of my knowledge: _____
Signature of Field Agent

North Carolina - Department of Environment and Natural Resources - Division of Water Quality - Groundwater Section
P.O. Box 29578 - Raleigh,N.C. 27626-0578-Phone (919) 733-3221

# WELL CONSTRUCTION RECORD

**DRILLING CONTRACTOR:** CAROLINA DRILLING
**DRILLER REGISTRATION #:** 1549
**STATE WELL CONSTRUCTION PERMIT#:**

1. **WELL USE** (Check Applicable Box): Residential ☐ Municipal ☐ Industrial ☐ Agricultural ☐ Monitoring ☒
   Recovery ☐ Heat Pump Water Injection ☐ Other ☐ If Other, List Use:
2. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: LaGRANGE County: LENOIR
   LENOIR COUNTY LANDFILL (SR 1524)
   (Road, Community, or Subdivision and Lot No.)
3. OWNER LENOIR COUNTY
   ADDRESS
   (Street or Route No.)
   City or Town State Zip Code
4. DATE DRILLED 3/31/99
5. TOTAL DEPTH 36.0'
6. CUTTINGS COLLECTED YES ☒ NO ☐
7. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
8. STATIC WATER LEVEL Below Top of Casing: _____ FT.
   (Use "+" if Above Top of Casing)
9. TOP OF CASING IS 3.0 FT. Above Land Surface*
   * Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
10. YIELD (gpm): — METHOD OF TEST —
11. WATER ZONES (depth): —
12. CHLORINATION: Type — Amount —
13. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | +3 | 26 | 2" | SCH40 | PVC |
| | | | | | |
| | | | | | |

14. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | 0 | 22 | CEMENT | TREMMIED |
| | 22 | 24 | BENTONITE | POUR |

15. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 26 | 36 | 2" in. | .010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

16. SAND/GRAVEL PACK:

| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 24 | 36 | NO#2 | SAND |
| | | | | |

17. REMARKS:

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| | | |

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

MW-12

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

FOR OFFICE USE ONLY

SIGNATURE OF CONTRACTOR OR AGENT DATE
Submit original to Division of Water Quality and copy to well owner.

GW-1 REV. 1/98

# LOG OF BORING NO. MW-12

**PROJECT: Lenoir County** | **JOB NO.: G99004.0**

**TYPE: HSA; SS** | **LOCATION:**

| DEPTH (ft) | BLOWS PER FT | SYMBOL | SAMPLES | DESCRIPTION OF MATERIAL |
|---|---|---|---|---|
| | | | | SAND (SM); red to brown; fine to medium grained quartz, trace coarse grains |
| | 67 | | X | |
| 5 | | | | |
| | 13 | | X | -grades brown, fine grained |
| 10 | | | | |
| | 13 | | X | |
| 15 | | | | CLAYEY SAND (SC); gray clay interlayered with brown to orange, medium grained sand |
| | 8 | | X | |
| 20 | | | | SAND (SM); brown to red, fine to medium grained, rust staining, trace clay |
| | 28 | | X | |
| 25 | | | | |
| | 46 | | X | -grades red, rust stained, interlayered with dark gray layers |
| 30 | | | | |
| | 11 | | X | -grades with thin, gray, clay layers |
| 35 | | | | |
| | 4 | | X | -grades coarse, rust stained |
| 40 | | | | |
| | 11 | | X | End of Boring at 43.0 feet |
| 45 | | | | |

COMPLETION DEPTH: 36.0 ft | DEPTH TO WATER IN BORING: 13 ft WD

DATE: 3/31/99 | SURFACE ELEVATION: 74.65 ft

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

# LOG OF BORING: MW-12

Project: LENOIR
Project No.
Type:

Drilling Contractor: CD
Registration Number:

Surface Elevation: ft
Top of Casing: ft

| DEPTH (ft) | BLOWS PER FOOT | SYMBOL | SAMPLES | DESCRIPTION OF MATERIAL | PIEZOMETER DIAGRAM |
|---|---|---|---|---|---|
| | 29·33·34 | | X | SAND W/ CLAY - RED TO BROWN; DENSE | |
| 5 | | | | | |
| | 5·7·6·7 | | X | CISCL; BROWN W/ ORANGE (RUST LAYERS) | |
| 10 | | | | | |
| | 4·6·6·7 | | X | SAND MOD YAND↑ | |
| 15 | | | | | |
| | 32·4·4 | | X | CISA/SACL ~~SOME~~ BROWN W/ CLAY | GROUT 0-21 |
| 20 | | | | | ~~BENT 21~~ |
| | 8·10·14 | | X | SAND / BR TO RED | SAND 23 |
| 25 | | | | | |
| | 15·21·25·21 | | X | SAND | |
| 30 | | | | | SCR 25-35 |
| | 5·7·6·5 | | X | THIN LAYERS (2mm) GRAY CLAY | |
| 35 | | | | | |
| | 2·2·2·2 | | X | | |
| 40 | | | | | |

Completion Depth: ~~40~~ 35 X 33.56
DATE: 3/31/89

Depth to Water: ft WD

MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

I acknowledge that this record is true to the best of my knowledge: _____
Signature of Field Agent

Bouwer and Rice (MW-11) (1)

Bail-Down Test Monitoring Well 11

Project Name Lenoir Sanitary Landfill

Initial Depth to Water (feet) (Ho 12.02
Depth to Water (feet) at to (H) 15.4
Initial Change in Head (feet), (y 3.38

| Time (h:mm:ss) | Time (mm:ss) | Time (sec) | Time Elapsed (sec) | DTW (ft) [H] | Change (ft) [H-Ho] |
|---|---|---|---|---|---|
| 14:31:06 | 00:00 | 0 | 0 | 14.40 | 2.38 |
| 14:31:10 | 00:04 | 4 | 4 | 14.20 | 2.18 |
| 14:31:15 | 00:05 | 5 | 9 | 14.00 | 1.98 |
| 14:31:18 | 00:03 | 3 | 12 | 13.90 | 1.88 |
| 14:31:21 | 00:03 | 3 | 15 | 13.80 | 1.78 |
| 14:31:24 | 00:03 | 3 | 18 | 13.70 | 1.68 |
| 14:31:28 | 00:04 | 4 | 22 | 13.60 | 1.58 |
| 14:31:32 | 00:04 | 4 | 26 | 13.50 | 1.48 |
| 14:31:37 | 00:05 | 5 | 31 | 13.40 | 1.38 |
| 14:31:42 | 00:05 | 5 | 36 | 13.30 | 1.28 |
| 14:31:49 | 00:07 | 7 | 43 | 13.20 | 1.18 |
| 14:31:56 | 00:07 | 7 | 50 | 13.10 | 1.08 |
| 14:32:04 | 00:08 | 8 | 58 | 13.00 | 0.98 |
| 14:32:10 | 00:06 | 6 | 64 | 12.95 | 0.93 |
| 14:32:15 | 00:05 | 5 | 69 | 12.90 | 0.88 |
| 14:32:21 | 00:06 | 6 | 75 | 12.85 | 0.83 |
| 14:32:28 | 00:07 | 7 | 82 | 12.80 | 0.78 |
| 14:32:36 | 00:08 | 8 | 90 | 12.75 | 0.73 |
| 14:32:45 | 00:09 | 9 | 99 | 12.70 | 0.68 |
| 14:32:56 | 00:11 | 11 | 110 | 12.65 | 0.63 |
| 14:33:11 | 00:15 | 15 | 125 | 12.60 | 0.58 |
| 14:33:27 | 00:16 | 16 | 141 | 12.55 | 0.53 |
| 14:33:52 | 00:25 | 25 | 166 | 12.50 | 0.48 |
| 14:34:19 | 00:27 | 27 | 193 | 12.45 | 0.43 |
| 14:35:02 | 00:43 | 43 | 236 | 12.40 | 0.38 |
| 14:35:35 | 00:33 | 33 | 269 | 12.37 | 0.35 |
| 14:35:52 | 00:17 | 17 | 286 | 12.36 | 0.34 |
| 14:36:06 | 00:14 | 14 | 300 | 12.35 | 0.33 |

Bouwer and Rice (MW-11) (1)

Bail-Down Calculations Monitoring Well 11

Project Name: Lenoir County Sanitary Landfill

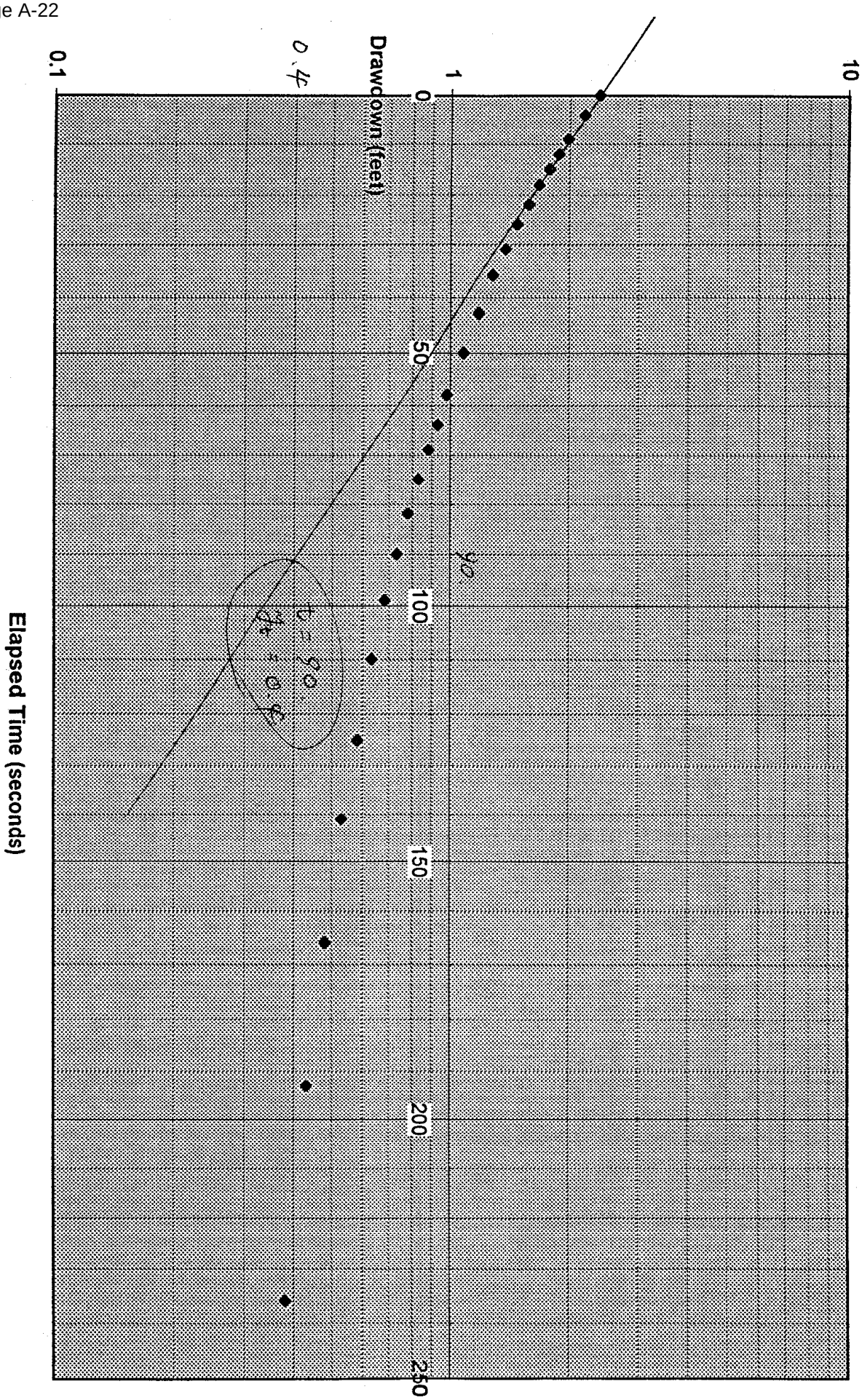
Lithology: Sandy Upper Unconfined Aquifer

Hydraulic Conductivity by Bouwer and Rice (1976)

| | | |
|---|---|---|
| | K | hydraulic conductivity |
| 0.0833 | rc | radius of the well casing (feet) |
| 0.3281 | rw | radius of the gravel pack (feet) |
| | Re | effective radius over which head is dissipated (feet) |
| 10 | Le | the open section of the well through which water can enter (feet) |
| 2.38 | yo | drawdown at time = 0 (seconds) |
| 0.4 | yt | drawdown time at t = t (seconds) |
| 90 | t | elapsed time between yo and yt |
| | A | dimensionless parameter |
| | B | dimensionless parameter |
| 2.3 | C | dimensionless parameter |
| 23.98 | Lw | initial water column in well |

ln(Re/rw)= 3.0141

| | | |
|---|---|---|
| K= | 2.07E-05 | feet/sec |
| | 0.000632 | cm/sec |
| | 653.47 | feet/year |
| | 199.18 | meter/year |


MW-11 (1)
Drawdown (feet)
Elapsed Time (seconds)
10
1
0.1
0
50
100
150
200
250
0.4
40
t = 50
Dt = 0.4

Bouwer and Rice (MW-12) (1)

Bail-Down Test Monitoring Well 11

Project Name Lenoir Sanitary Landfill

| | |
|---|---|
| Initial Depth to Water (feet) (Ho | 15.46 |
| Depth to Water (feet) at to (H) | 18.3 |
| Initial Change in Head (feet), (y | 2.84 |

| Time (h:mm:ss) | Time (mm:ss) | Time (sec) | Time Elapsed (sec) | DTW (ft) [H] | Change (ft) [H-Ho] |
|---|---|---|---|---|---|
| 15:46:18 | 00:00 | 0 | 0 | 18.30 | 2.84 |
| 15:46:23 | 00:05 | 5 | 5 | 18.00 | 2.54 |
| 15:46:30 | 00:07 | 7 | 12 | 17.70 | 2.24 |
| 15:46:32 | 00:02 | 2 | 14 | 17.60 | 2.14 |
| 15:46:35 | 00:03 | 3 | 17 | 17.50 | 2.04 |
| 15:46:38 | 00:03 | 3 | 20 | 17.40 | 1.94 |
| 15:46:41 | 00:03 | 3 | 23 | 17.30 | 1.84 |
| 15:46:44 | 00:03 | 3 | 26 | 17.20 | 1.74 |
| 15:46:48 | 00:04 | 4 | 30 | 17.10 | 1.64 |
| 15:46:51 | 00:03 | 3 | 33 | 17.00 | 1.54 |
| 15:46:56 | 00:05 | 5 | 38 | 16.90 | 1.44 |
| 15:47:00 | 00:04 | 4 | 42 | 16.80 | 1.34 |
| 15:47:04 | 00:04 | 4 | 46 | 16.70 | 1.24 |
| 15:47:11 | 00:07 | 7 | 53 | 16.60 | 1.14 |
| 15:47:16 | 00:05 | 5 | 58 | 16.50 | 1.04 |
| 15:47:23 | 00:07 | 7 | 65 | 16.40 | 0.94 |
| 15:47:31 | 00:08 | 8 | 73 | 16.30 | 0.84 |
| 15:47:40 | 00:09 | 9 | 82 | 16.20 | 0.74 |
| 15:47:48 | 00:08 | 8 | 90 | 16.15 | 0.69 |
| 15:47:55 | 00:07 | 7 | 97 | 16.10 | 0.64 |
| 15:48:00 | 00:05 | 5 | 102 | 16.05 | 0.59 |
| 15:48:08 | 00:08 | 8 | 110 | 16.00 | 0.54 |
| 15:48:19 | 00:11 | 11 | 121 | 15.95 | 0.49 |
| 15:48:30 | 00:11 | 11 | 132 | 15.90 | 0.44 |
| 15:48:43 | 00:13 | 13 | 145 | 15.85 | 0.39 |
| 15:49:03 | 00:20 | 20 | 165 | 15.80 | 0.34 |
| 15:49:29 | 00:26 | 26 | 191 | 15.75 | 0.29 |
| 15:50:04 | 00:35 | 35 | 226 | 15.70 | 0.24 |

B & R (MW-12) (1)

Bail-Down Calculations Monitoring Well 12

Project Name: Lenoir County Sanitary Landfill

Lithology: Sandy Upper Unconfined Aquifer

Hydraulic Conductivity by Bouwer and Rice (1976)

| | | |
|---|---|---|
| | K | hydraulic conductivity |
| 0.0833 | rc | radius of the well casing (feet) |
| 0.3281 | rw | radius of the gravel pack (feet) |
| | Re | effective radius over which head is dissipated (feet) |
| 10 | Le | the open section of the well through which water can enter (feet) |
| 2.84 | yo | drawdown at time = 0 (seconds) |
| 0.5 | yt | drawdown time at t = t (seconds) |
| 96 | t | elapsed time between yo and yt |
| 2.7 | A | dimensionless parameter |
| 0.4 | B | dimensionless parameter |
| 17.7 | Lw | initial water column in well |
| 32.54 | D* | aquifer thickness |

* This is based on the assumption that the confining layer is at the depth of 45 feet below the ground surface.

| | | |
|---|---|---|
| ln(Re/rw)= | 1.0438 | |
| | | feet/sec |
| K= | 6.55E-06 | cm/sec |
| | 0.0002 | feet/year |
| | 206.64 | meter/year |
| | 62.98 | |

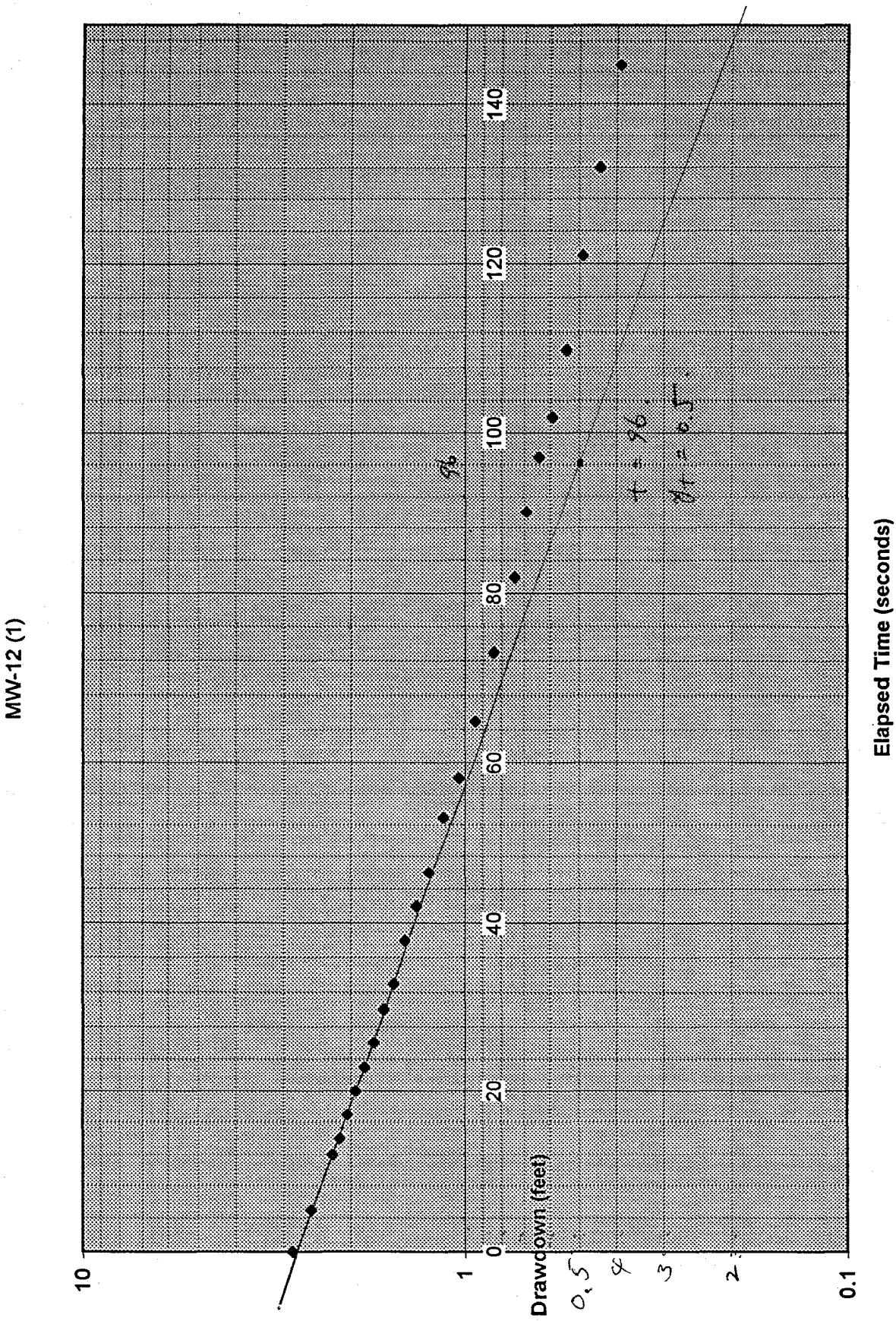

MW-12 (1)
Drawdown (feet)
10
1
0.1
0
20
40
60
80
100
120
140
Elapsed Time (seconds)

**Table 3.** Hydrologic Properties of Lithologic Units

| Lithologic Unit | Soil Description | Hydraulic Conductivity (cm/sec) | Total Porosity (%) | Effective Porosity (%) |
|---|---|---|---|---|
| I | Silty Sand / Sandy Silt | $9.13 \times 10^{-4}$ | 26% | 26.3% |
| II | Clayey Sand | $4.50 \times 10^{-4}$ | 31% | 6.0% |

**NOTE**

* Values displayed in this table are the avarage values for the listed lithologic units. Refer to Appendix B for detailed calculations.

# APPENDIX B

**Lenoir County Sanitary Landfill Sampling History**

| Date | Action |
|---|---|
| October 7, 1980 | MW-1 installed |
| October 8, 1980 | MW-2 installed |
| September 25, 1991 | MW-4 installed |
| September 26, 1991 | MW-3 installed |
| May 27, 1992 | MW-5 installed |
| February 1994 | Completed Ground and Surface Water Monitoring System |
| August 24, 1994 | MW-8, MW-10 installed (MW-6?) |
| August 25, 1994 | MW-9 installed |
| September 9, 1994 | Background Sampling – Appendix I |
| October 28, 1994 | Background Sampling – Appendix I |
| January 6, 1995 | Background Sampling – Appendix I |
| February 24, 1995 | Background Sampling – Appendix I |
| July 17, 1995 | Sampling – Appendix II |
| January 23, 1996 | Sampling – Appendix I |
| July 25, 1996 | Sampling – Appendix II |
| January 14, 1997 | Sampling – Appendix I |
| July 11, 1997 | Sampling – Appendix I |
| August 22, 1997 | Sampling – Appendix I |
| January 21, 1998 | Sampling – Appendix II |
| February 27, 1998 | MW-5 abandoned |
| July 27, 1998 | Sampling – Appendix II |
| January 6, 1999 | Sampling – Appendix II |
| March 31, 1999 | MW-11, MW-12 installed |
| June 29, 1999 | Sampling – Appendix II |
| January 27, 2000 | Sampling – Appendix II |
| February 23, 2000 | Sampling – Appendix II (MW-11, MW-12) |
| July 17, 2000 | Sampling – Appendix II |
| January 24, 2001 | Sampling – Appendix II |
| July 11, 2001 | Sampling – Appendix II |
| January 10, 2002 | Sampling – Appendix I (MW-3, MW-6, MW-9) Appendix II (MW-1, MW-4, MW-8, MW-10, MW-11, MW-12) |
| July 8, 2002 | Sampling – Appendix I (MW-1, MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-3) |
| January 22, 2003 | Sampling – Appendix I (MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-3) |
| July 7, 2003 | Sampling – Appnedix I (MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-1, MW-3) |
| January 22, 2004 | Sampling – Appendix I (MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-1, MW-3) |
| July 12, 2004 | Sampling – Appendix I (MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-1, MW-3) |
| January 26, 2005 | Sampling – Appendix I (MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-1, MW-3) |
| July 14, 2005 | Sampling – Appendix I (MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-1, MW-3) |
| January 25, 2006 | Sampling – Appendix I (MW-1, MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-3) |
| July 13, 2006 | Sampling – Appendix I (MW-1, MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-3) |
| January 17, 2007 | Sampling – Appendix I (MW-1, MW-4, MW-6, MW-9, MW-11, MW-12) Appendix II (MW-3) |

Background Sample Summary

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| MW-9 | Arsenic | 09/09/1994 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-8 | Beryllium, total | 01/06/1995 | 0.002 | mg/l | 0.002 | | |
| MW-9 | Beryllium, total | 09/09/1994 | 0.003 | mg/l | 0.002 | | |
| MW-10 | Chromium, total | 09/09/1994 | 0.033 | mg/l | 0.01 | 0.05 | |
| MW-3 | Chromium, total | 01/06/1995 | 0.022 | mg/l | 0.01 | 0.05 | |
| MW-4 | Chromium, total | 09/09/1994 | 0.01 | mg/l | 0.01 | 0.05 | |
| MW-8 | Chromium, total | 02/24/1995 | 0.012 | mg/l | 0.01 | 0.05 | |
| MW-9 | Chromium, total | 09/09/1994 | 0.021 | mg/l | 0.01 | 0.05 | |
| MW-9 | Cobalt, total | 09/09/1994 | 0.019 | mg/l | 0.01 | | |
| **MW-3** | **Lead, total** | **10/28/1994** | **0.092** | **mg/l** | **0.01** | **0.015** | **0.077** |
| MW-3 | Lead, total | 01/06/1995 | 0.01 | mg/l | 0.01 | 0.015 | |
| **MW-4** | **Lead, total** | **09/09/1994** | **0.054** | **mg/l** | **0.01** | **0.015** | **0.039** |
| MW-5 | Lead, total | 10/28/1994 | 0.013 | mg/l | 0.01 | 0.015 | |
| **MW-8** | **Lead, total** | **09/09/1994** | **0.027** | **mg/l** | **0.01** | **0.015** | **0.012** |
| MW-9 | Lead, total | 09/09/1994 | 0.01 | mg/l | 0.01 | 0.015 | |
| MW-10 | Zinc | 09/09/1994 | 0.04 | mg/l | 0.05 | 1.05 | |
| MW-5 | Zinc | 10/28/1994 | 0.125 | mg/l | 0.05 | 1.05 | |
| MW-8 | Zinc | 09/09/1994 | 0.142 | mg/l | 0.05 | 1.05 | |
| MW-9 | Zinc | 09/09/1994 | 0.06 | mg/l | 0.05 | 1.05 | |

[1] Table only contains detected constituents.

[2] PQL = Practical Quantitation Limit

[3] NCGW2L = North Carolina Ground Water 2L Standard

Historical Subtitle D Inorganic Soil Sample Results

| Well ID | Parameter Name [1] | Sample Date | Result | Unit | PQL [2] | NCGW2L [3] | Exceedance |
|---|---|---|---|---|---|---|---|
| LAGOON | Barium, total | 01/24/2007 | 82 | ug/l | 60 | 2000 | |
| MW-13 | Barium, total | 01/17/2007 | 91 | ug/l | 60 | 2000 | |
| MW-17 | Barium, total | 01/17/2007 | 64 | ug/l | 60 | 2000 | |
| SW-3 | Barium, total | 01/17/2007 | 150 | ug/l | 60 | 2000 | |
| SW-3 | Cadmium, total | 01/25/2006 | 0.001 | mg/l | 0.001 | 0.0018 | |
| SW-3 | Cadmium, total | 01/17/2007 | 1 | ug/l | 1 | 1.75 | |
| MW-13 | Chromium, total | 07/12/2004 | 0.034 | mg/l | 0.01 | 0.05 | |
| MW-13 | Chromium, total | 01/26/2005 | 0.034 | mg/l | 0.01 | 0.05 | |
| MW-15 | Chromium, total | 07/12/2004 | 0.026 | mg/l | 0.01 | 0.05 | |
| MW-15 | Chromium, total | 01/26/2005 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-16 | Chromium, total | 07/12/2004 | 0.048 | mg/l | 0.01 | 0.05 | |
| MW-16 | Chromium, total | 09/16/2004 | 0.014 | mg/l | 0.01 | 0.05 | |
| MW-17 | Chromium, total | 07/12/2004 | 0.024 | mg/l | 0.01 | 0.05 | |
| MW-17 | Chromium, total | 01/26/2005 | 0.013 | mg/l | 0.01 | 0.05 | |
| MW-18 | Chromium, total | 07/12/2004 | 0.033 | mg/l | 0.01 | 0.05 | |
| MW-18 | Chromium, total | 09/16/2004 | 0.031 | mg/l | 0.01 | 0.05 | |
| SW-3 | Chromium, total | 01/25/2006 | 0.014 | mg/l | 0.01 | 0.05 | |
| SW-3 | Chromium, total | 01/17/2007 | 14 | ug/l | 7 | 50 | |
| LAGOON | Cobalt, total | 01/26/2005 | 0.01 | mg/l | 0.01 | | |
| MW-13 | Cobalt, total | 05/12/2004 | 0.012 | mg/l | 0.01 | | |
| MW-16 | Copper | 05/12/2004 | 0.27 | mg/l | 0.2 | 1 | |
| MW-18 | Copper | 05/12/2004 | 0.88 | mg/l | 0.2 | 1 | |
| MW-13 | Lead, total | 05/12/2004 | 0.014 | mg/l | 0.01 | 0.015 | |
| MW-13 | Lead, total | 07/12/2004 | 0.011 | mg/l | 0.01 | 0.015 | |
| MW-13 | Lead, total | 01/26/2005 | 0.012 | mg/l | 0.01 | 0.015 | |
| MW-15 | Lead, total | 07/12/2004 | 0.014 | mg/l | 0.01 | 0.015 | |
| MW-15 | Lead, total | 09/16/2004 | 0.012 | mg/l | 0.01 | 0.015 | |
| **MW-16** | **Lead, total** | **07/12/2004** | **0.028** | **mg/l** | **0.01** | **0.015** | **0.013** |
| MW-18 | Lead, total | 07/12/2004 | 0.011 | mg/l | 0.01 | 0.015 | |
| MW-18 | Lead, total | 09/16/2004 | 0.011 | mg/l | 0.01 | 0.015 | |
| **SW-3** | **Lead, total** | **01/25/2006** | **0.032** | **mg/l** | **0.01** | **0.015** | **0.017** |
| **SW-3** | **Lead, total** | **01/17/2007** | **28** | **ug/l** | **6** | **15** | **13** |
| MW-13 | Vanadium | 07/12/2004 | 0.063 | mg/l | 0.04 | | |
| MW-13 | Vanadium | 01/26/2005 | 0.069 | mg/l | 0.04 | | |
| MW-15 | Vanadium | 07/12/2004 | 0.041 | mg/l | 0.04 | | |
| MW-16 | Vanadium | 07/12/2004 | 0.077 | mg/l | 0.04 | | |
| MW-18 | Vanadium | 07/12/2004 | 0.052 | mg/l | 0.04 | | |
| MW-18 | Vanadium | 09/16/2004 | 0.05 | mg/l | 0.04 | | |
| SW-3 | Vanadium | 01/17/2007 | 31 | ug/l | 25 | | |
| MW-16 | Zinc | 05/12/2004 | 0.082 | mg/l | 0.05 | 1.05 | |
| MW-16 | Zinc | 07/12/2004 | 0.066 | mg/l | 0.05 | 1.05 | |
| MW-18 | Zinc | 05/12/2004 | 0.23 | mg/l | 0.05 | 1.05 | |
| MW-18 | Zinc | 09/16/2004 | 0.067 | mg/l | 0.05 | 1.05 | |
| MW-18 | Zinc | 01/17/2007 | 18 | ug/l | 10 | 1050 | |
| SW-3 | Zinc | 01/17/2007 | 23 | ug/l | 10 | 1050 | |

[1] Table only contains detected constituents.

[2] PQL = Practical Quantitation Limit

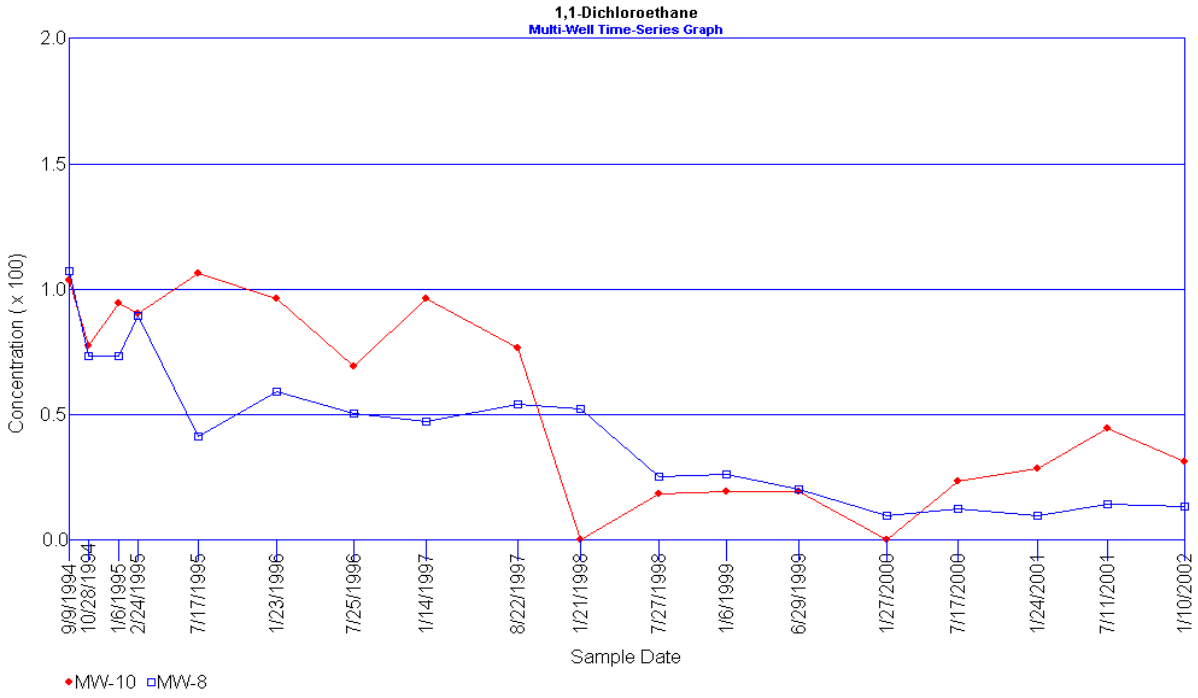
[3] NCGW2L = North Carolina Ground Water 2L Standard

NURE Soil Results

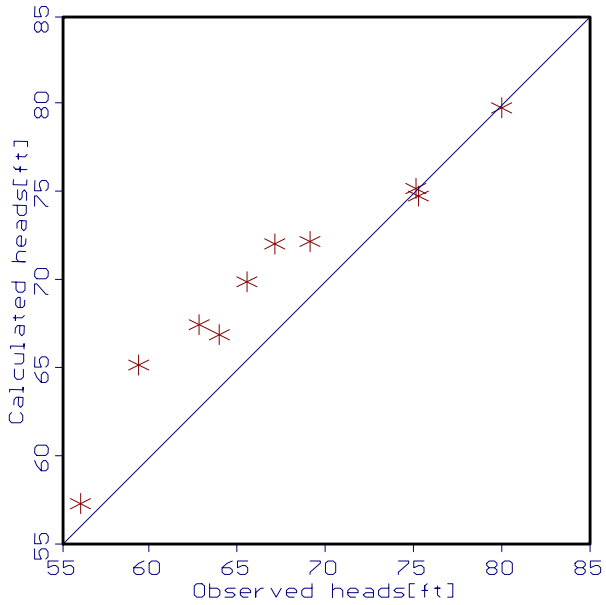
| REC_NO | PRIME_ID | LATITUDE | LONGITUDE | SRLID | SMPMEDIA | SAMPSRC | SEDCOND | SAMPDAT | SEDTYPE | SEDCOLR | Distance to Site Miles |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5298849 | NCLN028S1 | 35.3438 | -77.7389 | NCLN028S1 | SEDIMENT | STREAM | WET | 5/7/1978 | SAND | BROWN | 4.0 |
| 5298851 | NCLN030S1 | 35.2532 | -77.701 | NCLN030S1 | SEDIMENT | STREAM | WET | 5/8/1978 | MUCK | BROWN | 2.9 |
| 5298852 | NCLN031S1 | 35.3014 | -77.6958 | NCLN031S1 | SEDIMENT | STREAM | WET | 5/8/1978 | SAND | WHITE/BUFF | 0.9 |
| 5298853 | NCLN032S1 | 35.3223 | -77.6757 | NCLN032S1 | SEDIMENT | STREAM | WET | 5/8/1978 | SAND | WHITE/BUFF | 2.7 |
| 5298854 | NCLN033S1 | 35.3333 | -77.7147 | NCLN033S1 | SEDIMENT | STREAM | WET | 5/8/1978 | MUCK | BROWN | 2.7 |

| REC_NO | AL_PCT | CE_PPM | DY_PPM | MN_PPM | NA_PCT | SC_PPM | SM_PPM | TH_PPM | TI_PPM | V_PPM |
|---|---|---|---|---|---|---|---|---|---|---|
| 5298849 | 0.95 | 37 | | 210 | 0.02 | 1 | 3 | 8 | 9800 | 40 |
| 5298851 | 2.67 | 31 | 2.6 | 70 | 0.11 | 4.1 | 3 | 5 | 3500 | 30 |
| 5298852 | 0.63 | 81 | 5 | 250 | 0.01 | 1.3 | 5 | 20 | 11600 | 30 |
| 5298853 | 0.53 | 86 | 5.4 | 230 | 0.02 | 2.5 | 6 | 19 | 10400 | 30 |
| 5298854 | 2.42 | 40 | 3.9 | 80 | 0.03 | 3.3 | 4 | 6 | 5500 | 40 |

Time Series Plot



# APPENDIX C




Period: 1

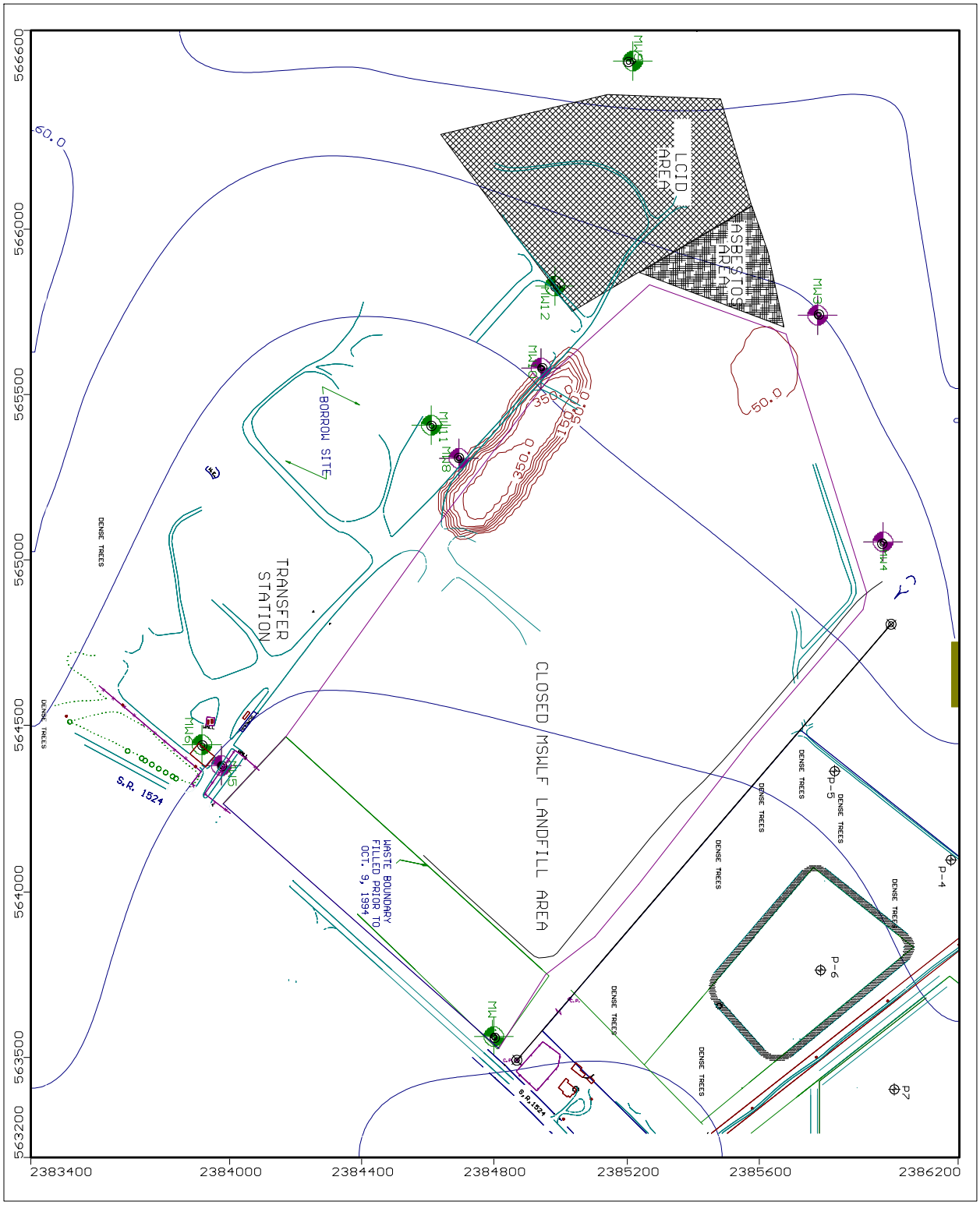
Step: 1

Mean error: 2.55808

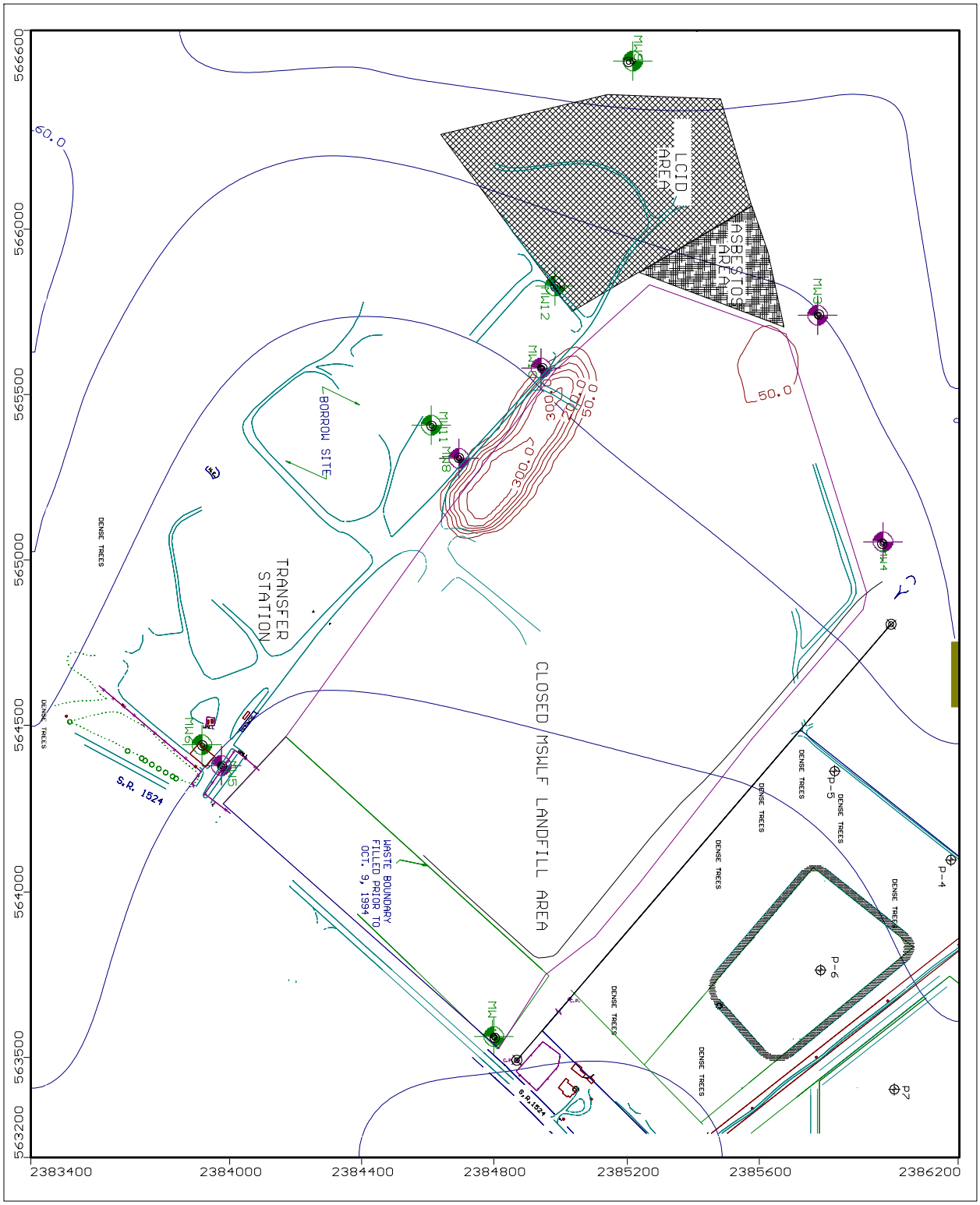
Mean abs. err: 2.74533

RMS error: 3.39692

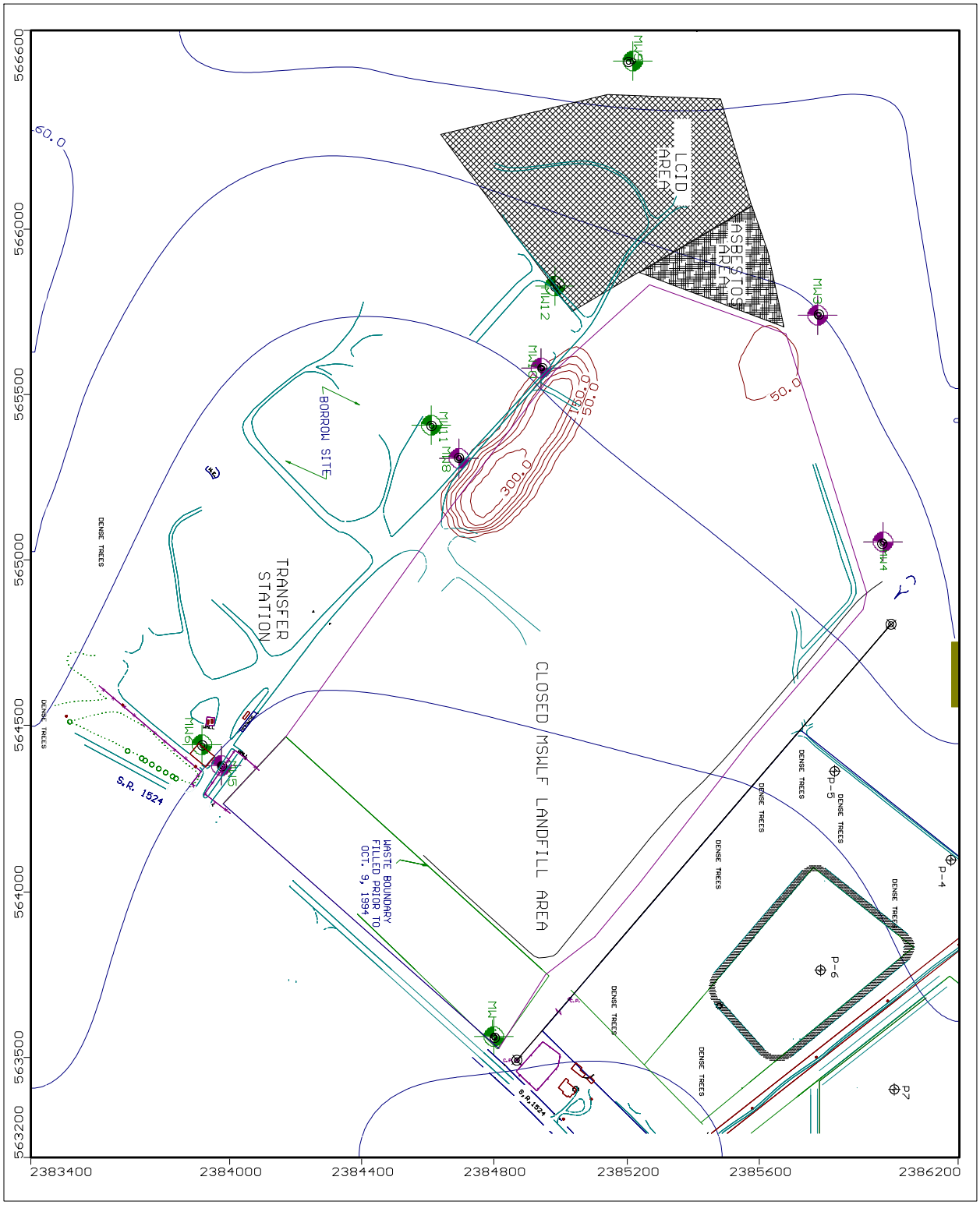
Scaled RMS: 14.1597



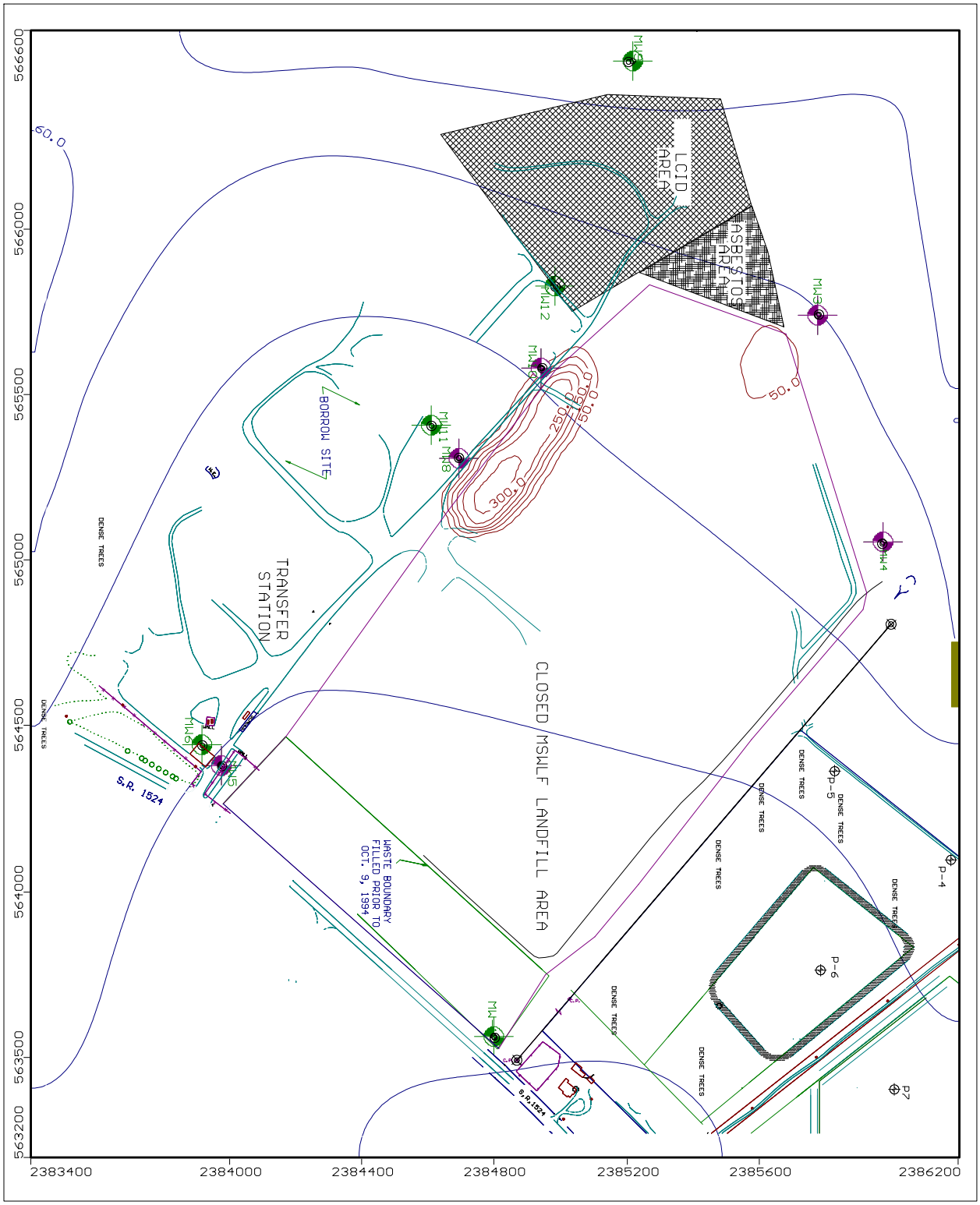

MODFLOW 5 Year Simulation
1995 VOC Concentration



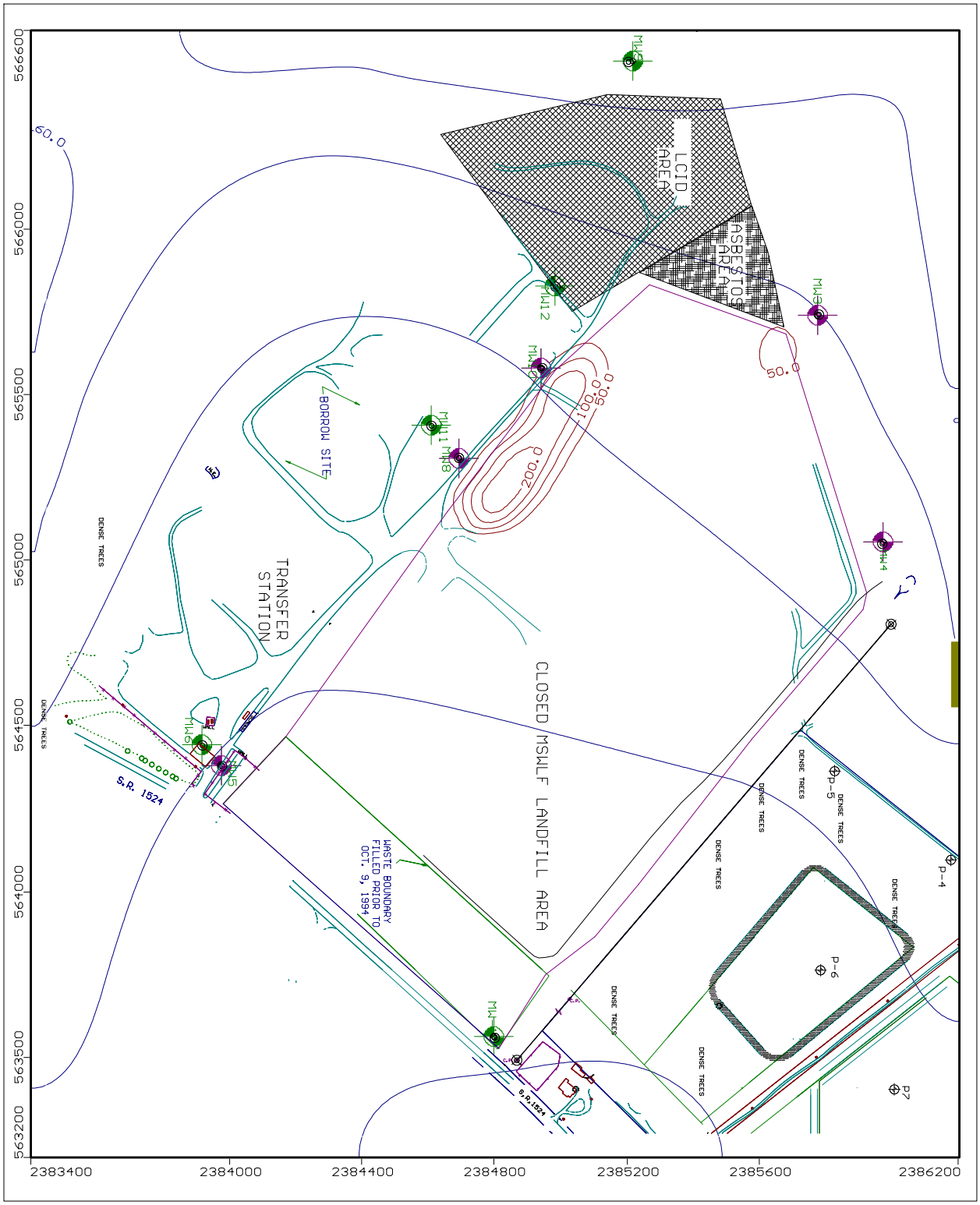

MODFLOW 10 Year Simulation
2000 VOC Concentration



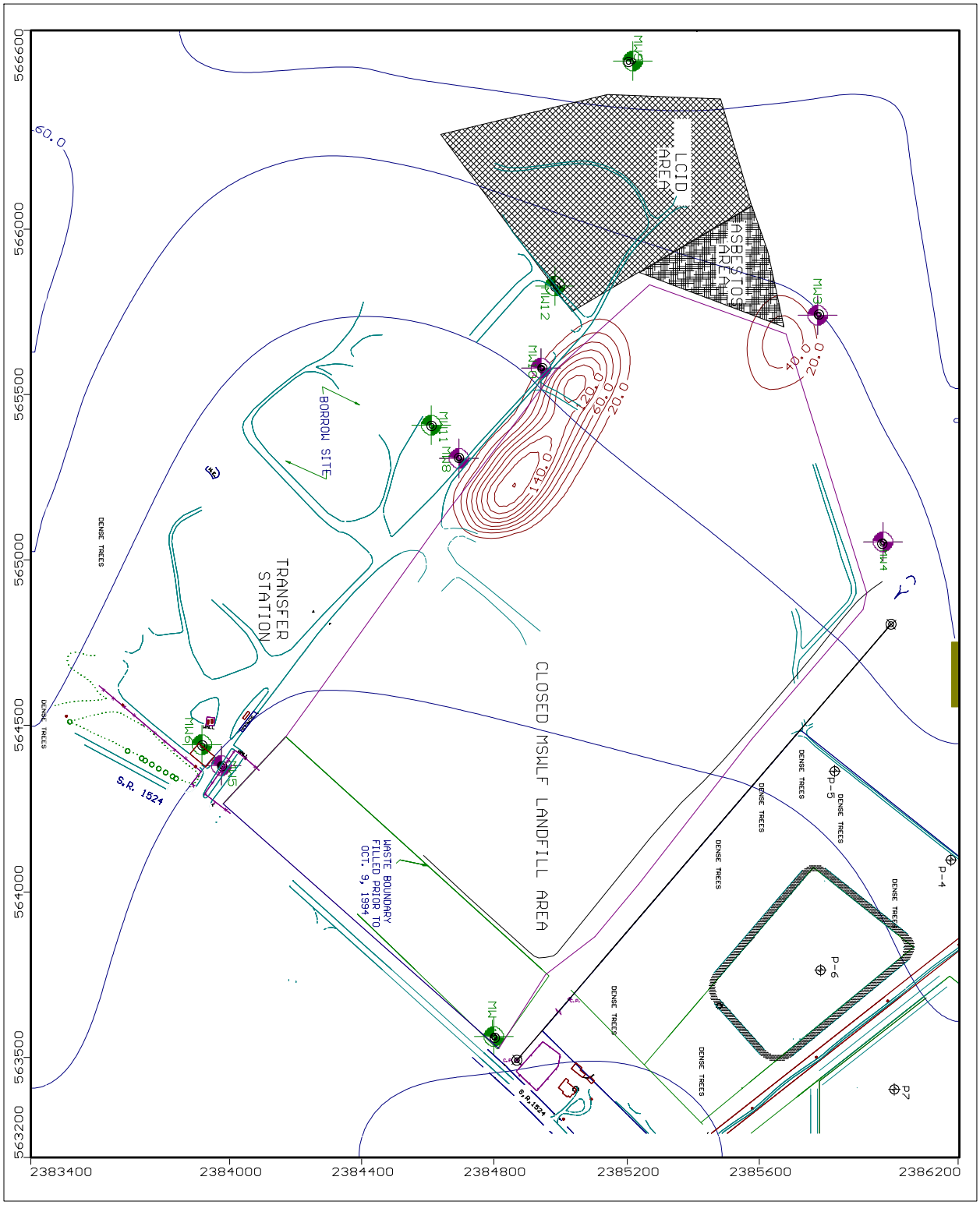

MODFLOW 11 Year Simulation
2001 VOC Concentration



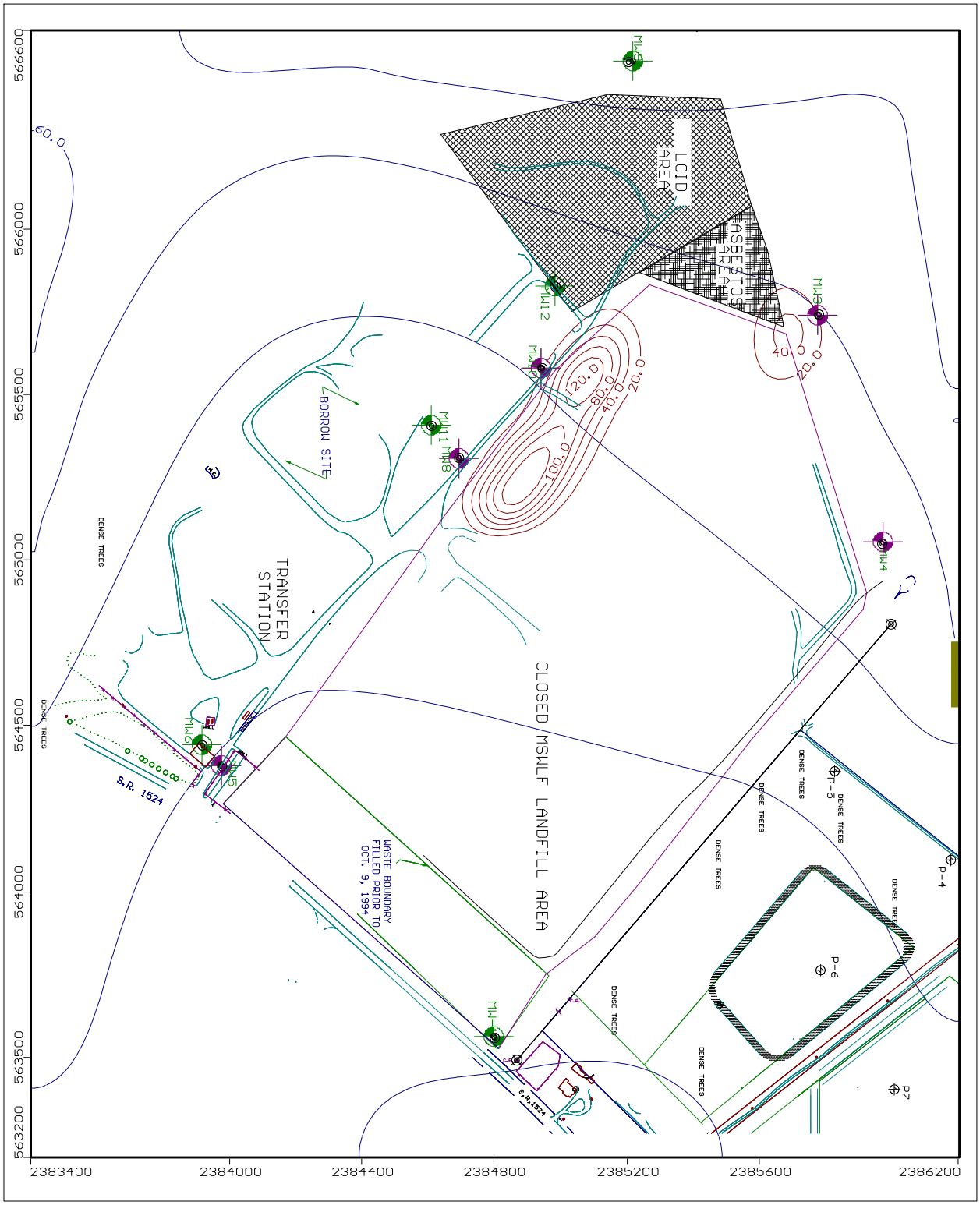

MODFLOW 12 Year Simulation
2002 VOC Concentration



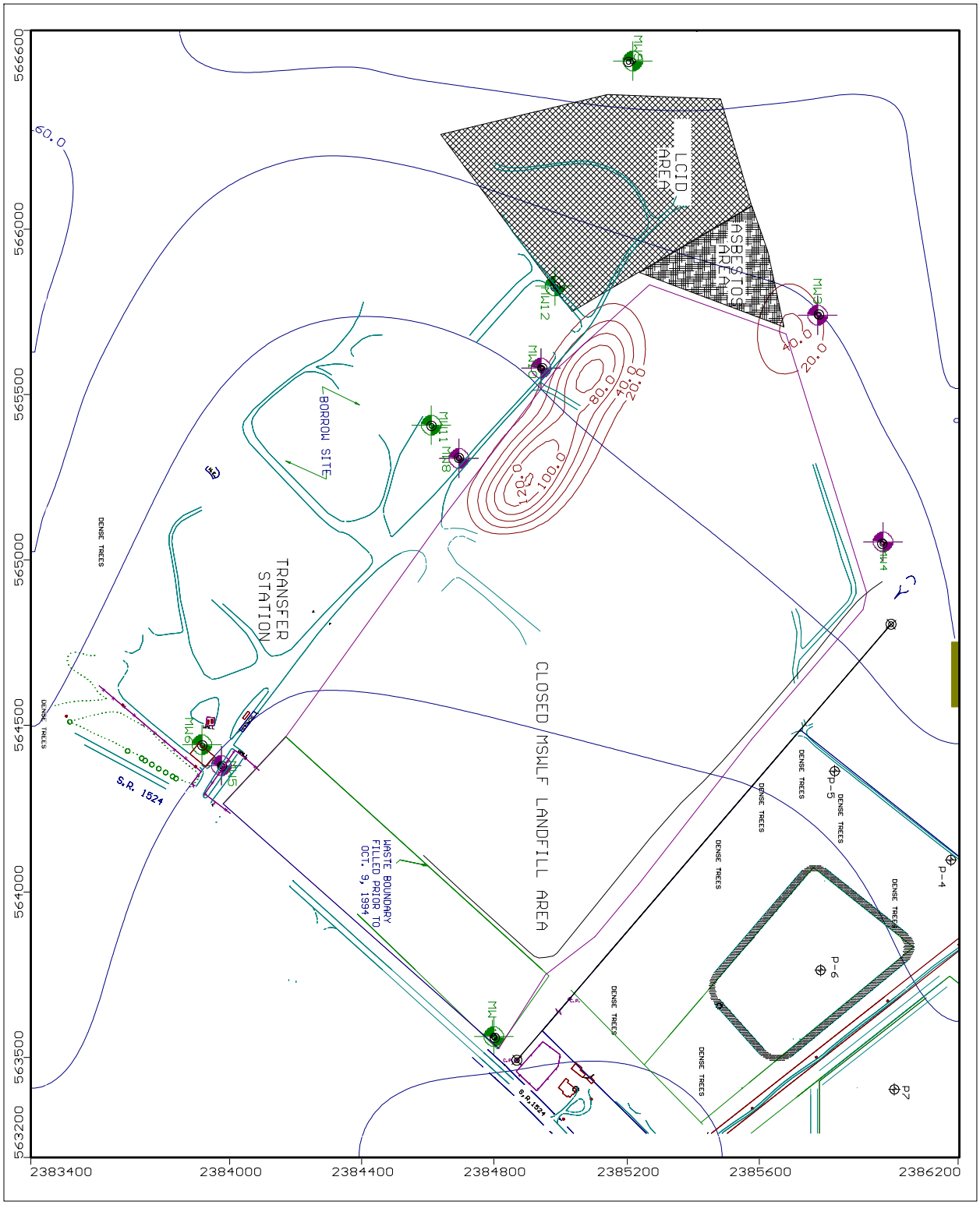

MODFLOW 25 Year Simulation
2015 VOC Contamination




MODFLOW 35 Year Simulation
2025 VOC Contamination




MODFLOW 45 Year Simulation
2035 VOC Contamination




MODFLOW 50 Year Simulation
2040 VOC Contamination

# APPENDIX D

# WATER

# QUALITY

# MONITORING

# PLAN

GAI CONSULTANTS

MUNICIPAL ENGINEERING
RECEIVED
FEB 25 1994
SERVICES COMPANY

# GROUND AND SURFACE WATER MONITORING SYSTEM
# LENOIR COUNTY LANDFILL
# LA GRANGE, NORTH CAROLINA

FOR

MUNICIPAL ENGINEERING SERVICES COMPANY
RALEIGH, NORTH CAROLINA

PROJECT NO. 94104.02

FEBRUARY 1994

GAI CONSULTANTS

GAI Consultants-NC, Inc.

4000 Blue Ridge Road
Suite 500
Raleigh, NC 27612
919/783-4783
FAX 919/783-0241

February 22, 1994

Mr. Wayne Sullivan
Municipal Engineering Services Company, P.A.
Post Office Box 97
Garner, North Carolina 27529

Re: Ground and Surface Water Monitoring System
Lenoir County Landfill
La Grange, North Carolina
Project No. 94104.02

Dear Mr. Sullivan:

## INTRODUCTION

The groundwater monitoring system at the municipal landfill of Lenoir County, North Carolina, east of La Grange and west of Kinston, North Carolina, is being evaluated as a part of the transition from previous North Carolina regulations to current North Carolina regulations (Subtitle D). This report presents data and information pertaining to the existing groundwater monitoring system, discusses the geology of the area, and makes recommendations for improving the groundwater monitoring system.

## GEOLOGY

The landfill is located in the Coastal Plain physiographic province east of La Grange, North Carolina on State Road 1524. The land surface is characterized by slightly rolling topography with approximately 30 feet of relief across the landfill site. Surface drainage is to the northwest toward Fredricks Branch that flows northeast to Falling Creek and subsequently southeast into the Neuse River. Unnamed surficial sediments overlie the Cretaceous Peedee Formation in the area of the landfill. The sediments dip to the southeast at less than 0.5 degree.

The surficial deposits vary in thickness within the county from 6 to 60 feet and consist of white to gray, light-yellow, yellowish-orange, or grayish-red, silty, clayey, fine to medium sand; and/or silt, clay (Pusey, 1960). The unconfined surficial aquifer, comprised of the surficial deposits, varies in thickness from 25 feet to the west at La Grange to 53 feet to the east at Falling Creek (Winner and Coble, 1989). These deposits are at least 32 feet thick on the property based on boring logs in a report prepared by Soil & Material

Engineers, Inc. (Browning and Marks, 1980). The surficial deposits are a combination of Pleistocene and/or Pliocene deposition and a product of weathering of Pleistocene sediments and/or Pliocene Yorktown Formation (Johnson and Peebles, 1986).

The Peedee Formation varies in thickness across the county from 40 to the west to over 100 feet to the east. These generally unconsolidated Cretaceous deposits consist of gray to greenish gray, fine to medium sand, interbedded with gray to black clay and silt (LeGrand, 1960). Glauconite is abundant and locally calcareous sandstone and/or impure limestone may be present (Sohl and Owens, 1991). The top of the Peedee Formation contains approximately 15 feet of clay, silty clay, or sandy clay that acts as a confining unit separating the Peedee Aquifer from the overlying surficial aquifer (Winner and Coble, 1989).

There are no reported Holocene Faults at or in the vicinity of the site (Howard, et al, 1978). The landfill is not in a seismic impact zone (Algermissen, et al, 1990).

A geologic map was not prepared because the entire site is covered by surficial deposits. References used in the geologic study are listed in Table 1.

## SITE REVIEW

Groundwater Monitoring Wells 1, 2, 3, and 4, at the approximate locations shown on Plate 1, were reviewed on January 28, 1994. Groundwater Monitoring Wells 1 and 2 were probably installed as Borings B-9 and B-8, respectively, while Wells 3 and 4 were installed for monitoring groundwater at the landfill. Boring logs for Wells 1 and 2 and well construction records for Wells 3 and 4 are presented in Appendix A. A copy of the Soil & Material Engineer, Inc. report is in Appendix B. Installation data for the wells, including depth of groundwater, are presented in Table 2. Table 3 presents information on the current condition of wells 1, 2, 3, and 4.

Groundwater Monitoring Wells 1 and 2 have steel screw on caps, 4 inch diameter round steel casings and no PVC caps with grout inside and outside around a two inch diameter PVC stand pipe well. Wells 3 and 4 have aluminum caps, 4 inch square aluminum casing and unvented PVC caps with grout inside and outside around a two inch diameter PVC stand pipe well. Well 4 was the only well locked, tagged, and numbered. Wells 1 and 2 may have been constructed in accordance with North Carolina Regulations based

on surficial appearance and information presented in the Soil & Material Engineers' report (Browning and Marks, 1980). However, no data is available concerning screen length or the presence of a bentonite seal. Wells 3 and 4 were constructed in accordance with North Carolina Regulations based on well construction records and surficial appearance.

## MODIFICATIONS TO MONITORING SYSTEM

Modifications to the existing groundwater monitoring system are proposed based on a review of the boring logs, the potentiometric map, and the relationship between the cells, property boundaries, and streams. Groundwater Monitoring Well 5 at the location shown on Plate 1 was installed by GAI as an up-gradient groundwater monitoring well for an area where an underground fuel storage tank was removed. Well 5 was constructed in accordance with North Carolina Regulations. The well construction record for Well 5 is presented in Appendix A. Installation data for Well 5 is presented in Table 1. Well 5 should be used as one of the wells in the groundwater monitoring system for the landfill.

An approximate groundwater potentiometric map, shown on Plate 1, was prepared using groundwater depths in the wells measured on January 28, 1994, and estimated surface elevations of the wells. The groundwater contours were developed using linear interpolation between data points, and modified using the existing topography and stream locations. The map indicates that groundwater flows northwesterly toward Fredricks Branch.

Groundwater Monitoring Well 5 along with two additional groundwater monitoring wells, Groundwater Monitoring Wells 8 and 9, at the locations shown on Plate 1, should be included in the groundwater monitoring system for the landfill. These three additional wells will be located within 250 feet of the landfill, and between the fill area and Fredricks Branch. The inclusion of Well 5 in the plan is planned to detect any unexpected development of a plume of contamination within 250 feet of the landfill prior to entering Fredricks Branch. Well 5 will also allow a better determination of direction of groundwater flow in the western part of the landfill. Well 8 is also proposed to detect any unexpected development of a plume of contamination within 250 feet of the landfill prior to it entering Fredricks Branch. Well 9 is proposed for the same reason as Well 8. However, Well 9 will also be located in the most down-gradient (groundwater) part of the landfill area. Table 4 presents recommended installation data for Wells 8 and 9.

**Mr. Wayne Sullivan**
**February 22, 1994**
**Page 4**

The wells should be installed in general accordance with North Carolina regulations. Well construction should be in accordance with attached Plate 2, which shows a typical monitoring well schematic as recommended by the state of North Carolina. Groundwater monitoring wells should be constructed considering actual static groundwater levels, soil and rock types, and conditions encountered during well installation. All wells must be tagged, labeled, and provided with locks, vented inner PVC caps, and drain holes at ground level in the outer casing. The location of all groundwater monitoring wells should be surveyed.

Fredricks Branch and its tributaries flow by the landfill. Surface water sampling should be done upstream and downstream of the landfill in the general area of the surface water sampling locations shown on Plates 1 and 3. Surface Water Location SW-1 is downstream of the landfill. Surface Water Location SW-2 is upstream of the landfill. The actual field locations should be determined based on access and their relationship to the landfill. Permanent stakes should be placed on the adjacent stream bank with the sample location number.

Respectfully submitted,
GAI Consultants - NC, Inc.

Edward S. Custer, Jr., Ph.D., P.G.
Staff Geologist

NORTH CAROLINA LICENSED SEAL 730 GEOLOGIST EDWARD S. CUSTER, JR.

Wendell W. Parker, Ph.D., P.E.
Vice President

NORTH CAROLINA PROFESSIONAL SEAL 15945 ENGINEER WENDELL W. PARKER

ESC/esc

cc: Mr. Bobby Lutfy, Division of Solid Waste

**TABLE 1**

**REFERENCES**

Algermissen, S. T., Perkins, D. M., Thenhaus, P. C., Hanson, S. L., and Bender, B. L., 1990, Probabilistic Earthquake Acceleration and Velocity Maps for the United States and Puerto Rico: U. S. Geological Survey Miscellaneous Field Studies Map MF-2120, scale 1:7,500,000.

Browning, J. R., and Marks, B. D., 1980, Geotechnical Investigation New Lenoir County Landfill Site, Lenoir County, North Carolina, S&ME Job No. RS-1467: Unpublished report prepared for City of Kinston by Soil & Material Engineers Inc., dated November 7, 1980.

Howard, K. A., Aaron, J. M., Brabb, E. E., Brock, M. R., Gower, H. D., Hunt, S. J., Milton, D. J., Muelhberger, W. R., Nagata, J. K., Plafker, G., Prowell, D. C., Wallace, R. E., and Witkind, I. J., 1978, Preliminary map of young faults in the United States as a guide to possible fault activity: U. S. Geological Survey Miscellaneous Field Studies Map MF-916, scale 1:5,000,000.

Johnson, G. H., and Peebles, P. C., 1986, Quaternary geologic map of the Hatteras 4° x 6° quadrangle, in Richmond, G. M., Fullerton, D. S., and Weide, D. L., eds., Quaternary Geologic Atlas of the United States: U. S. Geological Survey, Miscellaneous Investigations Series Map I-1420 (NI-18), scale 1:1,000,000.

Legrand, H. E., 1960, Geology and Ground-water Resources of Wilmington-New Bern Area: North Carolina Department of Water Resources, Division of Ground Water, Bulletin Number 1, 80 p.

Pusey, R. D., 1960, Geology and Ground Water in the Goldsboro Area, North Carolina: North Carolina Department of Water Resources, Division of Ground Water, Bulletin Number 2, 77 p.

Sohl, N. F., and Owens, J. P., 1991, Cretaceous Stratigraphy of the Carolina Coastal Plain, in Horton, J. W., Jr., and Zullo, V. A., eds., The Geology of the Carolinas: The University of Tennessee Press, p. 191-220.

Winner, M. D., and Coble, R. W., 1989, Hydrogeologic Framework of the North Carolina Coastal Plain Aquifer System: U. S. Geological Survey Open-File Report 87-690, 155 p.

# TABLES

TABLE 2

INSTALLATION DATA FOR ACTIVE GROUNDWATER MONITORING WELLS

| Well Number | Depth of Water Below Ground Surface (ft) | Total Depth Below Ground Surface (ft) |
|---|---|---|
| 1 | 13.0 | 40.0 |
| 2 | 3.9 | 40.0 |
| 3 | 2.5 | 12.5 |
| 4 | 7.0 | 15.5 |
| 5 | 11.0 | 19.0 |

Groundwater Monitoring Wells 1 and 2 were probably installed as Borings B-9 and B-8, respectively, based on their location and information included in a report prepared by Soil & Material Engineers, Inc. (Browning and Marks, 1980). Neither screen length or reference to an upper bentonite seal was provided in the report. Wells 3, 4, and 5 were reportedly installed with 10 foot screens, 2 inch diameter stand pipes, and bentonite seals between the sand pack and grout.

TABLE 3

INFORMATION ON CURRENT CONDITION OF GROUNDWATER MONITORING WELLS AS OF JANUARY 28, 1994

| Well Number | Depth of Water Below Ground Surface (ft) | Total Depth Below Ground Surface (ft) |
|---|---|---|
| 1 | 14.88 | 37.14 |
| 2 | 3.26 | 38.71 |
| 3 | 1.84 | 13.20 |
| 4 | 1.57 | 13.92 |
| 5 | Not Measured | Not Measured |

Groundwater Monitoring Wells 1, 2, 3 were not locked, were unnumbered, and did not have tags. Well 4 was locked, numbered, and had a tag. Reportedly, Well 3 had a tag and had been locked, however, persons unknown reportedly had removed the lock by shooting it off. This was evidenced by the numerous bullet holes in the lid. The lock reportedly will be replaced. There did not appear to be any damage to the 2 inch PVC stand pipe by the bullets. Wells 1 and 2 had 4 inch diameter round steel outer casings, threaded outer caps which could not be removed without a pipe wrench, and did not have PVC caps. Wells 3 and 4 had 4 inch square aluminum outer casings with flip-lids and inner unvented PVC caps. Well 5 was not inspected. None of the well locations reportedly have been surveyed, but surveying is scheduled for the near future.

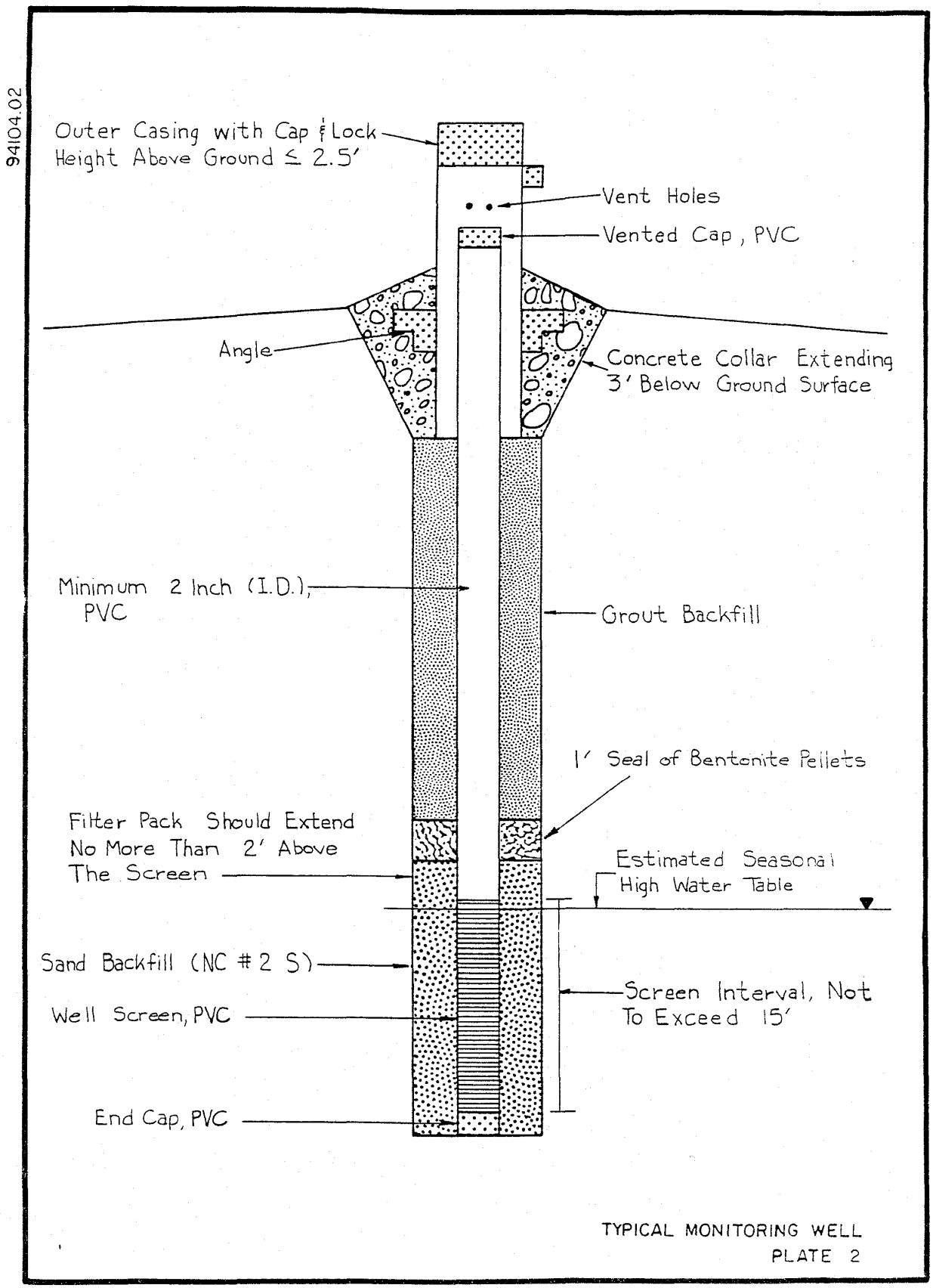
TABLE 4

PROPOSED GROUNDWATER MONITORING WELL INSTALLATIONS

| Proposed Groundwater Monitoring Well | Ground Surface Elevation (ft) | Groundwater Elevation (ft) | Screen Elevation (ft) Top | Bottom | Well Depth (ft) |
|---|---|---|---|---|---|
| 8 | 80 | 68 | 69 | 59 | 22 |
| 9 | 60 | 57 | 57 | 47 | 14 |

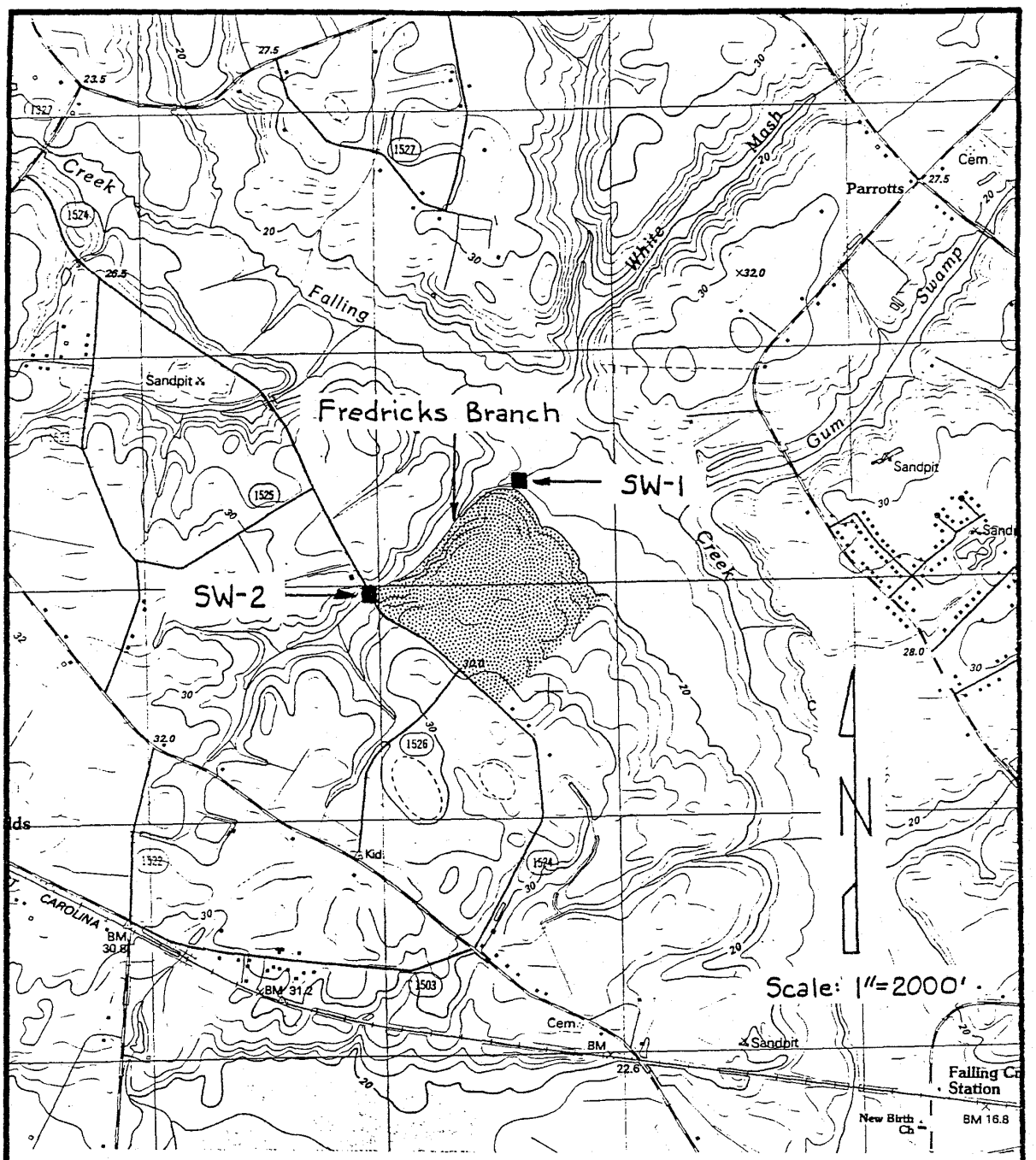
All elevations were estimated from a topographic map and groundwater levels are approximate based on field observations. Soil will be mounded around the wells, as required, to allow completion of the bentonite seal and grout.

# PLATES




TYPICAL MONITORING WELL
PLATE 2

94104.02



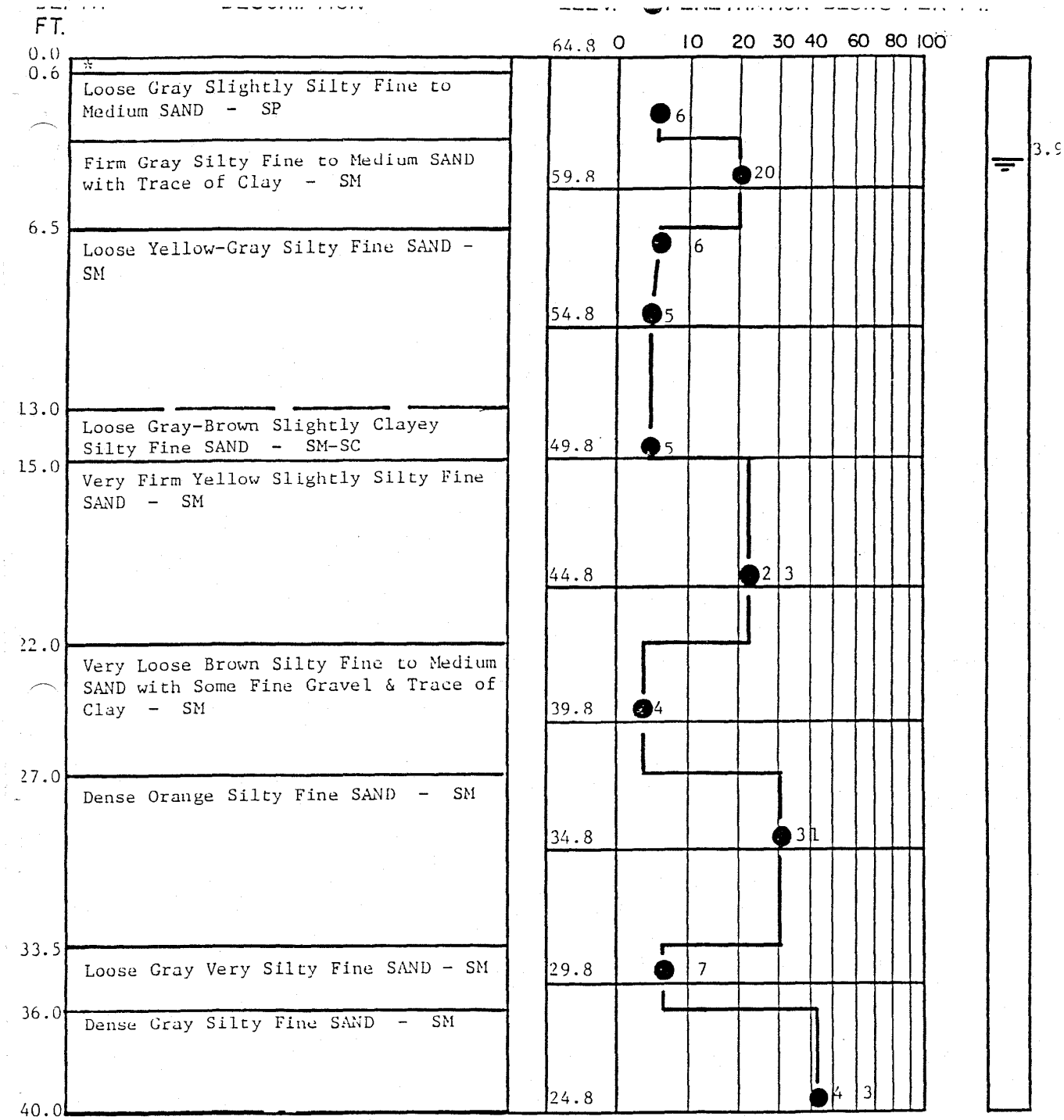

Approximate Location of Landfill

Surface Water Sampling Locations

Surface Water Monitoring Locations
Plate 3

# APPENDIX A

## WELL CONSTRUCTION RECORDS




Boring Terminated at 40.0'
Groundwater level at 3.9' on 10/20/80

Observation Well Screen Set @ 39.0'

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

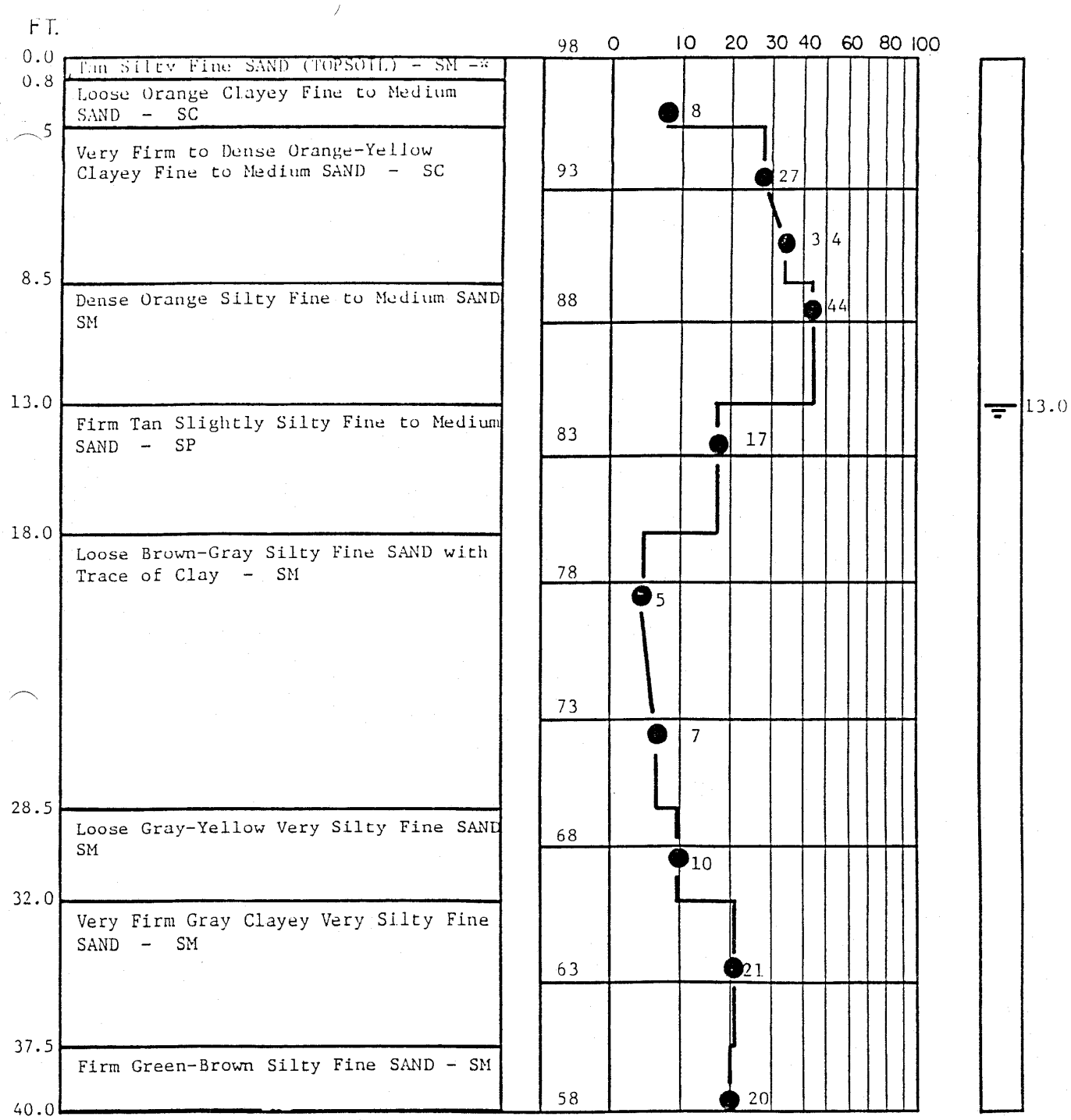
UNDISTURBED SAMPLE
50% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

# TEST BORING RECORD

BORING NO. B-8
DATE DRILLED 10/8/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

FARNELL, INC., RALEIGH 680




Boring Terminated at 40.0'
Groundwater Level at 13.0' on 10/20/80

*WOODED AREA

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50 % ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

TEST BORING RECORD

BORING NO. B-9
DATE DRILLED 10/7/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

AN-PARNELL, INC., RALEIGH 680

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent.

REVISED **WELL CONSTRUCTION RECORD** 02-22-94

DRILLING CONTRACTOR: GAI Consultants-NC, Inc.

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: 53-0246-WM-0115

1. WELL LOCATION: (Show sketch of the location below)
Nearest Town: Kinston County: Lenoir
NCSR 1524
(Road, Community, or Subdivision and Lot No.)

2. OWNER Lenoir County
ADDRESS P.O. Box 757
(Street or Route No.)
Kinston (City or Town) North Carolina (State) 28501 (Zip Code)

3. DATE DRILLED 9-26-91 USE OF WELL GW Monitoring
4. TOTAL DEPTH 15.0 ft
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 5.5± FT.
(Use "+" if Above Top of Casing)
8. TOP OF CASING IS: 3.0 FT. Above Land Surface*
* Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST
10. WATER ZONES (depth): 5.5 to bottom

11. CHLORINATION: Type N/A Amount

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 0 | 4 | Silty Sand |
| 4 | 6 | Sandy Silt |
| 6 | 12.5 | Silty Sand |

If additional space is needed use back of form

12. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | +3.0 | 2.0 | 2.0 | SCH 40 | PVC |
| | | | | | |
| | | | | | |

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
SEE BACK OF PAGE

13. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | +1.0 | 0 | Cement | Tremie |
| | 0 | 1.0 | Bentonite | Pellets |

14. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 2.0 | 12.0 | 2.0 in. | 0.010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

15. SAND/GRAVEL PACK:

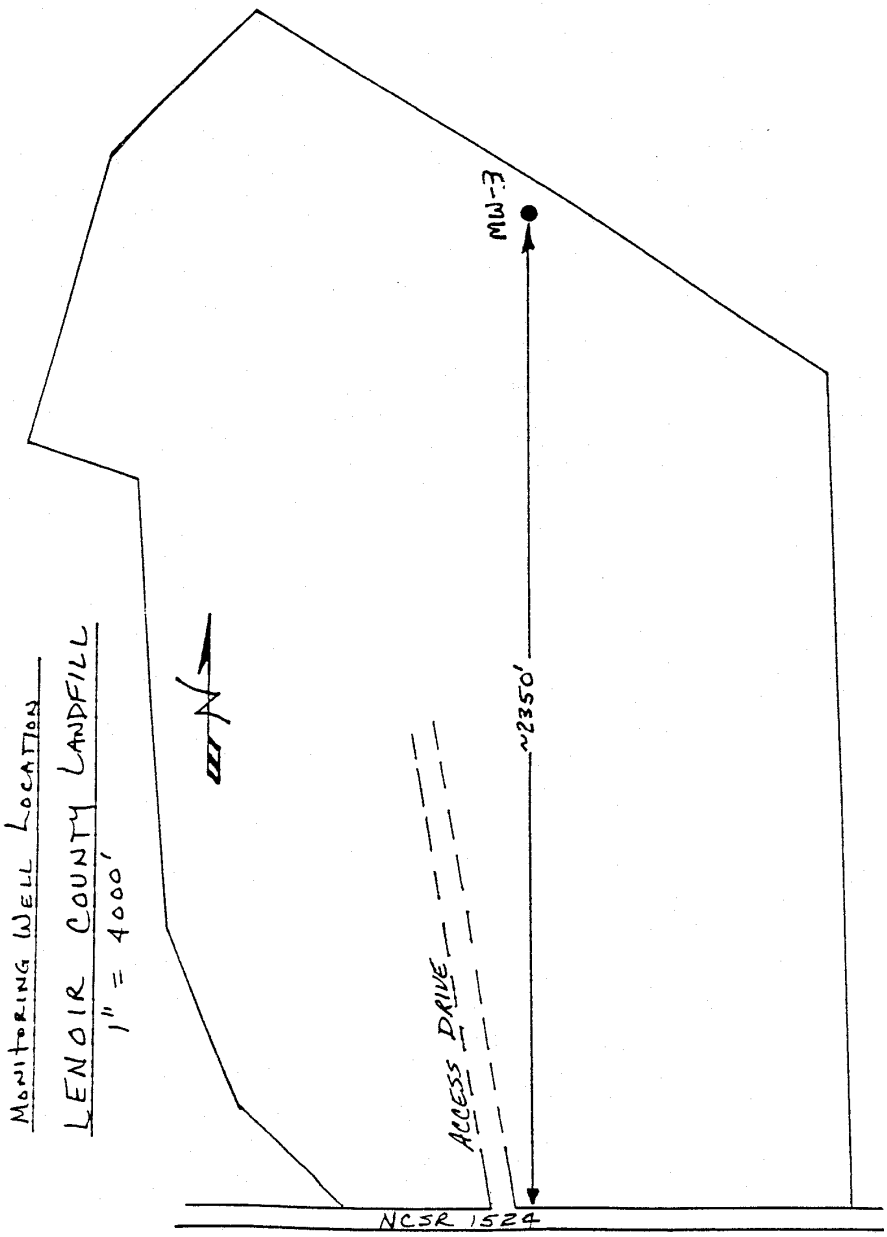
| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 1.0 | 12.5 | NC #2S | Sand |
| | | | | |

16. REMARKS: Water levels are at time of well installation.

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

[signature] GAI-NC 10-3-91
SIGNATURE OF CONTRACTOR OR AGENT DATE
Submit original to Division of Environmental Management and copy to well owner

GW-1 REV. 5/91


MONITORING WELL LOCATION
LENOIR COUNTY LANDFILL
1" = 4000'
N
ACCESS DRIVE
~2350'
MW-3
NCSR 1524

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

REVISED **WELL CONSTRUCTION RECORD** 02-22-94

**DRILLING CONTRACTOR:** GAI Consultants-NC, Inc.

**DRILLER REGISTRATION NUMBER:** 446

**STATE WELL CONSTRUCTION PERMIT NUMBER:** 53-0246-WM-0115

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: Kinston County: Lenoir
   NCSR 1524
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Lenoir County
   ADDRESS P.O. Box 757
   (Street or Route No.)
   Kinston (City or Town) North Carolina (State) 28501 (Zip Code)
3. DATE DRILLED 9-25-91 USE OF WELL GW Monitoring
4. TOTAL DEPTH 17.5 ft
5. CUTTINGS COLLECTED YES [ ] NO [X]
6. DOES WELL REPLACE EXISTING WELL? YES [ ] NO [X]
7. STATIC WATER LEVEL Below Top of Casing: 9.5 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 2.5 FT. Above Land Surface*
   * Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST
10. WATER ZONES (depth): 9.5 to bottom
11. CHLORINATION: Type N/A Amount
12. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | +2.5 | 5.0 | 2.0 | SCH 40 | PVC |
| | | | | | |
| | | | | | |

13. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | 0 | 3.0 | Cement | Tremie |
| | 3.0 | 4.0 | Bentonite | Pellets |

14. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 5.0 | 15.0 | 2.0 in. | 0.010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

15. SAND/GRAVEL PACK:

| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 4.0 | 15.5 | NC #2S | Sand |
| | | | | |

16. REMARKS: Water levels are at time of well installation

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 0 | 4 | Silty Sand |
| 4 | 9 | Sandy Silt |
| 9 | 15.5 | Silty Sand |

If additional space is needed use back of form

LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)

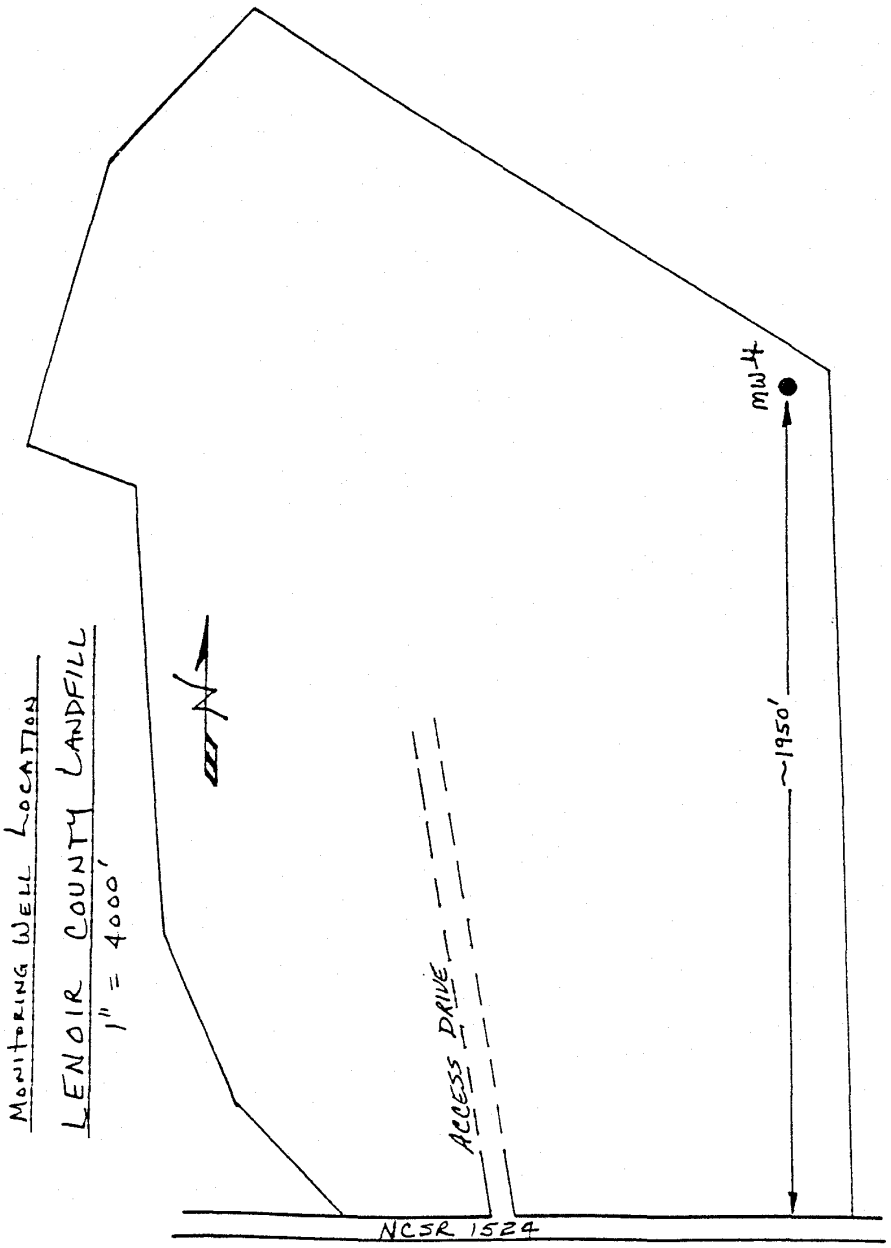
SEE BACK OF PAGE

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

Gary Sandoyo GAI-NC 10-3-91
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 5/91

Submit original to Division of Environmental Management and copy to well owner.


MONITORING WELL LOCATION
LENOIR COUNTY LANDFILL
1" = 4000'
N
ACCESS DRIVE
NCSR 1524
~1950'
MW4

North Carolina - Department of Environment, Health, and Natural Resources
Division of Environmental Management - Groundwater Section
P.O. Box 29535 - Raleigh, N.C. 27626-0535
Phone (919) 733-3221

FOR OFFICE USE ONLY
QUAD. NO. _____ SERIAL NO. _____
Lat. _____ Long. _____ Pc _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

## WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: GAI Consultants-NC

DRILLER REGISTRATION NUMBER: 446

STATE WELL CONSTRUCTION PERMIT NUMBER: 53-0253-WM-0134

1. WELL LOCATION: (Show sketch of the location below)
   Nearest Town: La Grange County: Lenoir
   NCSR 1524
   (Road, Community, or Subdivision and Lot No.)
2. OWNER Lenoir County
   ADDRESS P.O. Box 757
   (Street or Route No.)
   Kinston North Carolina 28501
   City or Town State Zip Code
3. DATE DRILLED 5-27-92 USE OF WELL GW Monitoring
4. TOTAL DEPTH 19 ft
5. CUTTINGS COLLECTED YES ☐ NO ☒
6. DOES WELL REPLACE EXISTING WELL? YES ☐ NO ☒
7. STATIC WATER LEVEL Below Top of Casing: 11 FT.
   (Use "+" if Above Top of Casing)
8. TOP OF CASING IS 0 FT. Above Land Surface*
   * Casing Terminated at/or below land surface is illegal unless a variance is issued in accordance with 15A NCAC 2C .0118
9. YIELD (gpm): N/A METHOD OF TEST _____
10. WATER ZONES (depth): 11 ft to bottom
11. CHLORINATION: Type N/A Amount _____
12. CASING:

| | Depth From | Depth To | Diameter | Wall Thickness or Weight/Ft. | Material |
|---|---|---|---|---|---|
| | 0 | 7 | 2 | SCH 40 | PVC |
| | | | | | |
| | | | | | |

13. GROUT:

| | Depth From | Depth To | Material | Method |
|---|---|---|---|---|
| | 0 | 3 | Cement | Tremie |
| | 3 | 5 | Bentonite | Pellets |

14. SCREEN:

| | Depth From | Depth To | Diameter | Slot Size | Material |
|---|---|---|---|---|---|
| | 7 | 17 | 2 in. | 0.010 in. | PVC |
| | | | in. | in. | |
| | | | in. | in. | |

15. SAND/GRAVEL PACK:

| | Depth From | Depth To | Size | Material |
|---|---|---|---|---|
| | 5 | 19 | NC #2S | Sand |
| | | | | |

16. REMARKS: Casing terminated at land surface due to traffic activity

| DEPTH From | DEPTH To | DRILLING LOG Formation Description |
|---|---|---|
| 0 | 5' | Sand |
| 5' | 10' | Clayey Sand |
| 10' | 19' | Silty Sand |

If additional space is needed use back of form

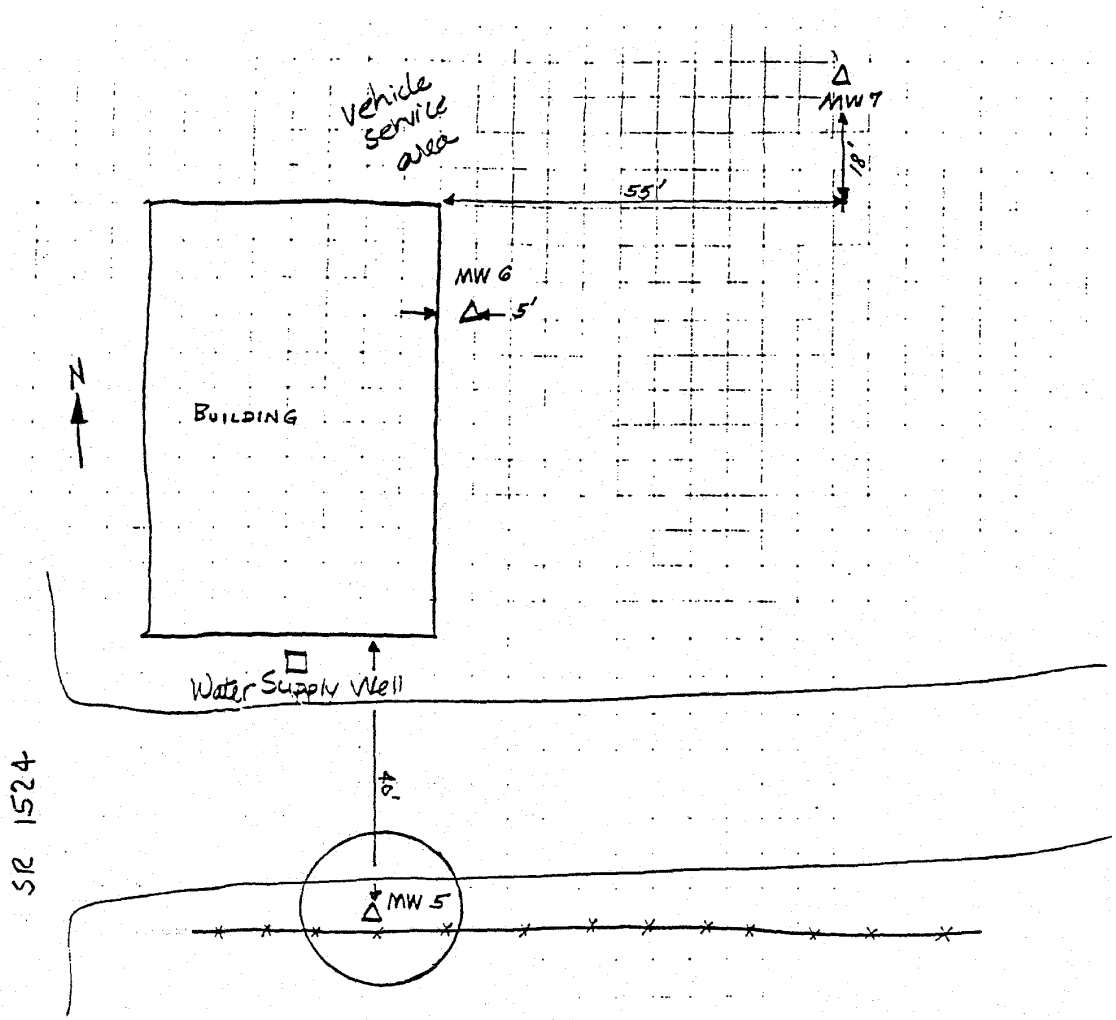
LOCATION SKETCH
(Show direction and distance from at least two State Roads, or other map reference points)
(See other side of page)

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

Gary Sandage GAI Consultants, Inc. 6-2-92
SIGNATURE OF CONTRACTOR OR AGENT DATE

GW-1 REV 5/91

Submit original to Division of Environmental Management and copy to well owner




Monitoring Wells scaled to NE and SE bldg corners

North arrow approx

Other features NTS

# APPENDIX B

# GEOTECHNICAL INVESTIGATION

SOIL & MATERIAL ENGINEERS INC. ENGINEERING-TESTING-INSPECTION

3109 Spring Forest Road, Box 58069, Raleigh, N.C. 27658 Phone (919) 872-2660

November 7, 1980

City of Kinston
P.O. Drawer 339
Kinston, North Carolina 28501

Attention: Mr. Clarence Lockamy, P.E.
City Engineer

Subject: Geotechnical Investigation
New Lenoir County Landfill Site
Lenoir County, North Carolina
S&ME Job No. RS-1467

Gentlemen:

Soil & Material Engineers, Inc. has completed the authorized soils investigation of the subject landfill site. The purpose of this investigation was to evaluate the suitability of this site for development into a sanitary landfill in regards to its subsurface conditions (soil and groundwater). The following engineering report presents our surface and subsurface findings, evaluation of the site, and final conclusions and recommendations. Included in this report are a Site Boring Plan, Generalized Soil Profiles, and the results of the test borings and laboratory work, all included in the Appendix.

SCOPE OF WORK

The subsurface investigation for this project included the following scope of work:

1. Site Reconnaissance - Initially, a site reconnaissance of the property was made to identify the general topographic features, drainage patterns, vegetation and land use.

2. Review of available geologic and agronomic literature of the Lenoir County area to establish the nature of the deposits underlying the site - The literature reviewed included U.S. Geological publications, groundwater bulletins published by the N.C. Department of Water Resources and the Soil Survey of Lenoir County published by the U.S. Department of Agriculture.

City of Kinston
November 7, 1980
Page 2

3. Field Testing - Investigation of the actual soil conditions at this particular site was performed by the drilling of eight test borings to depths of 20 to 40 feet. The location and elevation of the borings were determined by a survey made by the City of Kinston Engineering Department. The test boring locations are shown on the attached Site Boring Plan. The borings were drilled with a CME 45 drill rig mounted on an all terrain carrier using wash boring techniques. Split spoon soil samples were obtained in conjunction with standard penetration testing at regular intervals in accordance with procedures defined by ASTM D-1586. The samples were classified by a registered engineer after which final boring logs were developed. These logs show a plot of the soil stratigraphy and standard penetration values.

   Observation wells were installed at borings B-8 and B-9 for long-term monitoring of the groundwater quality. Determination of the present groundwater quality was beyond the scope of this investigation. The bottom of the well screens were set at approximately 38 feet below the ground surface. The wells consist of a gravel-packed slotted screen attached to a PVC standpipe. The annular space between the standpipe and borehole was filled with a cement grout. The standpipes were protected with a 4 inch diameter steel pipe, set in concrete, having a threaded pipe cap.

4. Laboratory Testing - Laboratory tests were performed to determine the general physical properties of representative soils which would directly influence the landfill development. The laboratory tests included mechanical grain size analysis and natural moisture contents. These tests were used to evaluate the soils general permeability characteristics, grading workability and trafficability characteristics, and suitability for cover material.

5. Evaluation and Conclusions - The above information was utilized for evaluation of the suitability of this site for use as a sanitary landfill. Conclusive remarks and recommendations pertinent to the design and operation of the landfill are included in this report.

SOIL & MATERIAL ENGINEERS INC.

SITE CONDITIONS

The proposed landfill site is located on the east side of NCSR 1524 near the community of Falling Creek in Lenoir County, North Carolina, and is approximately 8 miles from the City of Kinston. The site encompasses seven tracts of land ranging in size from 16 to 56 acres for a total of 166 acres. Approximately 77 acres are cleared (cultivated farmland) and the remaining 89 acres are wooded in pines and hardwoods. An east-west trending soil road transverses the central corridor of the site. Several abandoned barns and sheds presently exist on-site. At the time of our investigation, a corn crop had just been harvested. An inhabited residential structure is located adjacent to the southwest corner of the site (near boring B-9). The property owner has a private well located approximately 200 feet southeast of the site.

The site is bounded on the west by NCSR 1524 and the east and north by Falling Creek and Fredrick's Branch, respectively. The property drains to the east and north toward the above creeks. The land has two distinct topographic areas, the higher uplands and low floodplain area adjacent to Fredrick's Branch and Falling Creek. The higher uplands are basically defined by the cleared farmland or that land above elevation 80 feet, which encompasses approximately 77 acres. Within this area, the land slopes gently to the east and north with a maximum topographic relief of approximately 18 feet (elevations 98 to 80 feet). This area is moderately to well-drained due in part to the near surface sandy soils which allow rapid percolation of rainfall.

Beyond the limits of the upland area, the land slopes relatively sharply into the floodplain areas on the north and northeast sides of the property. The floodplain area adjacent to Fredrick's Branch is relatively narrow (100 to 200 feet wide) in comparison to the extensive floodplain area of Falling Creek, which is 1000 to 1500 feet wide. The Falling Creek floodplain is nearly level and poorly drained. At the time of the investigation, water was standing over a majority of the area. The near surface soils are typically highly organic (muck) and very soft. Based on preliminary Corps of Engineers information, the 100 year flood limits of Falling Creek will reach an elevation of approximately 65 feet (based on a 10 foot depth of water above the top of the streambank which is near elevation 55 feet). The majority of land tract #5 is within the floodplain topographic area.

REGIONAL AND SITE GEOLOGY

This site is located within the Atlantic Coastal Plain Geological Province which extends more than 100 miles inland from the coast. The Coastal Plain is underlain by beds of sands and clays which comprise various geological formations. The formations are inclined eastward at a rate only slightly greater than the slope of the land surface. During development of the Coastal Plain, the sea advanced and retreated several times with sediments being deposited in the sea and on land along lowland areas. The deposits tend to be preserved in nearly flatlying strata with a general dip eastward.

The geologic formations penetrated at this particular site consist of sands and clays of the Pleistocene and Recent Age overlying sands of the Pee Dee Formation. Invasion of the sea during Pleistocene time left a veneer of sand and clay on the order of 8 to 10 feet at the site. The Pee Dee formation (Upper Cretaceous period) consists chiefly of interbedded layers of green, gray and yellow silty and clayey sands with traces of mica. The Pee Dee formation was probably deposited in an estuarine or near-shore environment.

SUBSURFACE CONDITIONS

The general subsurface conditions presented below are based on the test borings and hand auger borings. The Generalized Soil Profiles depict the soil and groundwater conditions at the individual boring locations. Because of the wide boring spacing and highly complex interbedding of the sands and clays at this site, no interpretation of soil stratigraphy between borings has been made. Reference should be made to the individual test borings for more detailed subsurface information.

Several hand auger borings were performed within Land Tract #5 (Falling Creek floodplain area) since it was not possible for a drill rig to gain access to this area because of the wet, soft surface conditions. The borings were augered to depths of approximately 5 feet. These borings revealed that soft, highly organic soils (PT-OL*) overlie a majority of this area to depths of 12 to 42 inches. Gray or tan silty sands (SM) typically underlie these soils. The groundwater levels range from at the ground surface to 3 feet below.

In the upland areas, a tan sandy loam topsoil overlies the area with thicknesses of 8 to 12 inches. The deeper topsoil layer is typically found in the cultivated field areas which basically comprise the "plowed layer". Underlying the topsoil materials, the basic subsurface conditions consist of silty and clayey fine to medium sands (SM, SM-SC, and SC) with some interbedded 2 to 6 feet thick sandy clay layers (SC) and 1 to 2 feet thick gravel layers (GP and GC). The near surface soils (3 to 5 feet deep) in the areas of B-1, B-2, B-3, and B-8 are comprised of slightly silty fine to medium sands, having typical percent fines (passing the US #200 sieve) of 6 percent. The silty and clayey sands have typical percent fines of 14.4 to 26.6. The more clayey sands are characterized by 43.2 to 48.3 percent silt and clay fraction. The natural moisture contents of the above soils range from 15.3 to 21.2 percent for the silty and slightly silty sands (SM and SP) and 20.7 to 25.2 percent for the clayey sands (SC). Based on past experience, the standard Proctor maximum dry densities of similar soil types range from 105 to 120 pounds per cubic foot with optimum moisture contents in the lower and middle teens. The permeability of the soils is based on the density, grain size distribution, and percentage of fines (silty and clay), in

* Based on the Unified Soils Classification System

particular the proportion of clay. Based on the grain size analysis and past permeability testing of similar soil conditions, it is estimated that the in-place permeabilities of the soils will range from $10^{-3}$ to $10^{-5}$ centimeters per second (cm/sec.) for the very silty sands (low permeability) and $10^{-5}$ to $10^{-7}$ cm/sec. for the very clayey sands and sandy clays (very low permeability). The slightly silty to clean sands may have permeabilities of $10^{-2}$ to $10^{-3}$ cm/sec. A similar range of permeability values would be expected for recompacted samples of these soils assuming compaction on the order of 90 to 95 percent of the standard Proctor maximum dry density (ASTM D-698).

The greater volume of clayey soils (SC and SC-SM) existing above the groundwater table appear to exist in the southwestern portion of the site (borings B-2, B-4, and B-9). Other areas contain layers of clayey sands; however, they are typically thinner or below the groundwater table.

The groundwater levels in the boreholes were checked several days after completion of drilling to determine stabilized levels. These readings indicate that the present groundwater table ranges from 13.0 feet (elevation 85.0 feet) below the ground surface at B-9 (highest area of the site) to 3.9 feet (elevation 60.9 feet) at boring B-8. (Refer to Tabulation of Groundwater Levels in the Appendix). These groundwater level elevations indicate that the groundwater gradient is to the north and east (toward Fredrick's Branch and Falling Creek).

CONSIDERATIONS FOR LANDFILL SITE DEVELOPMENT

Several considerations must be evaluated in determining the suitability of a specific site for a sanitary landfill in regards to the subsurface conditions. Major considerations include:

1. The depth of the groundwater below the existing ground surface - Present State Regulations require that a separation of at least four feet be provided between the bottom of the landfill and high groundwater table. At the present groundwater levels at this site, the bottom of the landfill could extend to depths ranging from 9 feet below the ground surface in the southwest corner of the property (B-9), 4.5 to 9.0 feet in the central portion (B-3, B-4, and B-7), and approximately 2.0 feet to the ground surface in the eastern and northern edges of the upland portion. The lowlands, floodplains of the Fredrick's Branch and Falling Creek (majority of land tract #5), are considered unacceptable for landfill development because of the floodplain status and high groundwater conditions.

SOIL & MATERIAL ENGINEERS INC

The direction of groundwater flow from the site is also a major consideration in determining the direction of travel of any leachate which would enter the groundwater aquifer. Leachate is a solution containing dissolved and suspended solid matter and the primary source of water for leachate production is rainfall infiltration. This site is bounded on the east and north by two streams and the groundwater table elevations indicate that the groundwater gradient is towards these drainage features. Thus, there is a very low potential of contamination of groundwater of adjacent properties. Land buffers of several hundred feet between Fredrick's Branch and the landfill and greater than a thousand feet to Falling Creek would help minimize leachate effects on these waters due mainly to soil attenuation (purification).

2. The permeability of the subsoils below the design landfill bottom and of the cover material - The permeability is a measure of the ease at which water will flow through a soil. The permeability of the soil cover and the soils below the landfill is the major factor controlling whether leachate will enter the groundwater aquifer. Where sandy soils separate the bottom of the landfill from the groundwater table, the entrance of some leachate into the groundwater system is inevitable. Utilization of a natural or man-made clay liner will reduce infiltration of leachate; however, some seepage of leachate will occur even through clay liners. At this site, the soils which would separate the bottom of the landfill from the groundwater table consist of clayey and silty, fine to medium sands. The test borings do not indicate any continuous impermeable clay soil stratum beneath the site. However, the existing boundary soils do typically have an appreciable amount of fines of 14.4 to 48.3 percent and are considered to have low to very low permeabilities in the range of $10^{-4}$ to $10^{-7}$ centimeters per second. However, if leachate is generated in the landfill, percolation of some of the leachate through these soils into the groundwater would probably occur over a period of time.

The permeability of the soil cover plays a major role in controlling the percolation of surface water into the landfill which could generate leachate. If a low permeability soil cover (soil containing appreciable clay - SC or CL) is utilized and properly placed and compacted over the refuse on a daily basis, and if adequate site surface drainage is provided, surface water infiltration and consequently leachate production can be greatly minimized. At this site, the clayey sandy soil when properly compacted would provide a relatively impermeable cover material. These soils typically exist as interbedded layers (2 to 6 feet thick) within the silty sands. The greater volumes of these soils above the groundwater table appear to exist in the southwestern portion of the site. The extent and available volume of these soils on-site should be further investigated by some test pit work.

The permeability of the cover material also influences the movement of decomposition gas. A sandy material generally is sufficiently permeable for venting decomposition gas while a clayey soil serves as an effective barrier to gas movement. However, it is our understanding in past conversations with the state agency, that gas production generally is not a major problem in this state because the landfill depths generally are not of sufficient thickness to create dangerous gas levels.

3. Another consideration in the development of a landfill site is the workability, trafficability, and excavation characteristics of the subsoils. The sandy and clayey soils on this site are favorable in all of these regards. These sandy soils could be worked (excavated, placed, and compacted) during dry and inclement weather conditions. During rainy weather conditions, it would be advantageous to have a stockpile of drier clayey sands which could be more easily placed and compacted during such weather conditions. The on-site soils could serve as a roadbed for collection vehicles moving to and from the operating area of the fill. Some in-place compaction of the looser sandy soils may be required along these routes. For the main entrance road into the site, it may be advantageous to provide a surfacing of crushed stone (marl) or possibly a soil-cement mixture to provide an all weather roadbed and

City of Kinston
November 7, 1980
Page 8

to minimize road maintenance. The roadway should be properly drained by shoulder ditching. The soils above the groundwater table can be excavated with conventional grading equipment (dozers, pans, front end loaders, etc.). Compaction of the clayey sands could be achieved with a dozer, vibratory roller, or wide pad sheepsfoot roller.

CONCLUSIONS

As discussed above, the site has its advantages and disadvantages in regards to development into a sanitary landfill. However, as is typically the case, a site with no unfavorable conditions is rarely found in the Coastal Plain. In our opinion, the upland portion of this site (approximately 77 acres), can be developed into a workable landfill through proper design and long term management. The average relatively shallow depths of excavations possible across the site dictate that an areal cut and cover plus mounding landfill operation would be the most applicable. Utilization of the more clayey soils found on the site for daily cover material and proper site drainage will help to minimize infiltration of rainfall into the landfill. The groundwater gradients indicate that groundwater flow is towards Falling Creek and Fredrick's Branch, thus greatly reducing the potential of any contamination of groundwater on adjacent lands.

Soil & Material Engineers, Inc. appreciates the opportunity to be of service to the City of Kinston on this project. If we can provide additional information or be of further assistance as the design is developed, please feel free to contact us.

Very truly yours,

SOIL & MATERIAL ENGINEERS, INC.

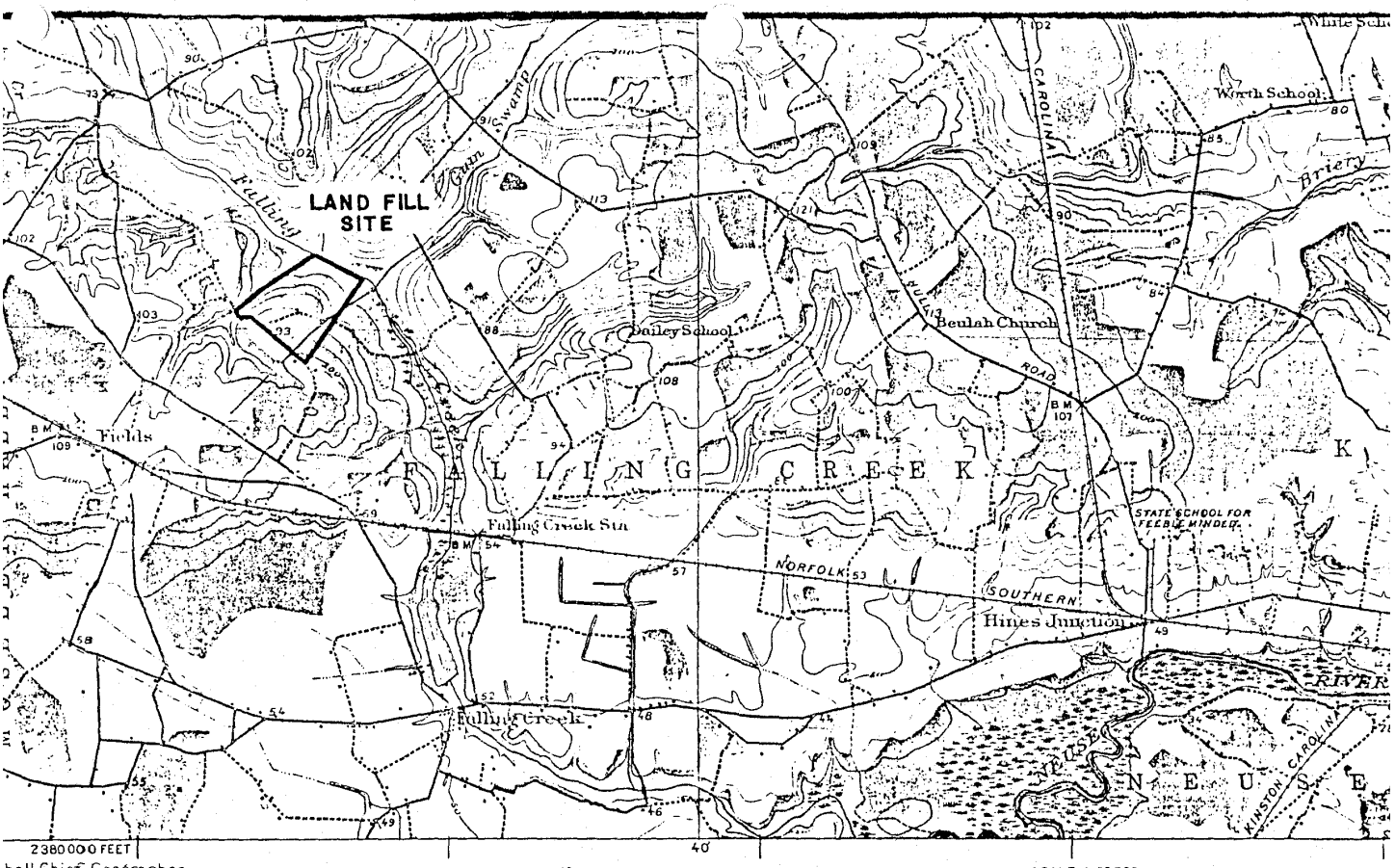
John R. Browning, P.E.

B. Dan Marks, Ph.D., P.E.
Registered N.C. # 9631

JRB/BDM/ld

Enclosures

SOIL & MATERIAL ENGINEERS INC.




hall Chief Geographer.
tton, Geographer in charge.
hy by R.A.Kiger, J.B.Metcalfe, Jr., and Roscoe Reeves.
y Siedge Tatum, Geo.T.Hawkins, Oscar Jones, and C.W.Arnold.
in 1914.

ced from Kinston 15 minute
ngle, 1914

| | | |
|---|---|---|
| ECT<br>Landfill<br>County, N.C. | SOIL & MATERIAL ENGINEERS, INC.<br>RALEIGH, NORTH CAROLINA | SCALE: As Shown<br>JOB NO: RS-1467<br>FIG NO: 1 |

NELL, INC., RALEIGH 779

LEGEND FOR SOIL CLASSIFICATION*

TOPSOIL

Silty SAND (SM) or Slightly Clayey Silty SAND (SM-SC)

Clayey SAND (SC)

Silty or Sandy CLAY (CL)

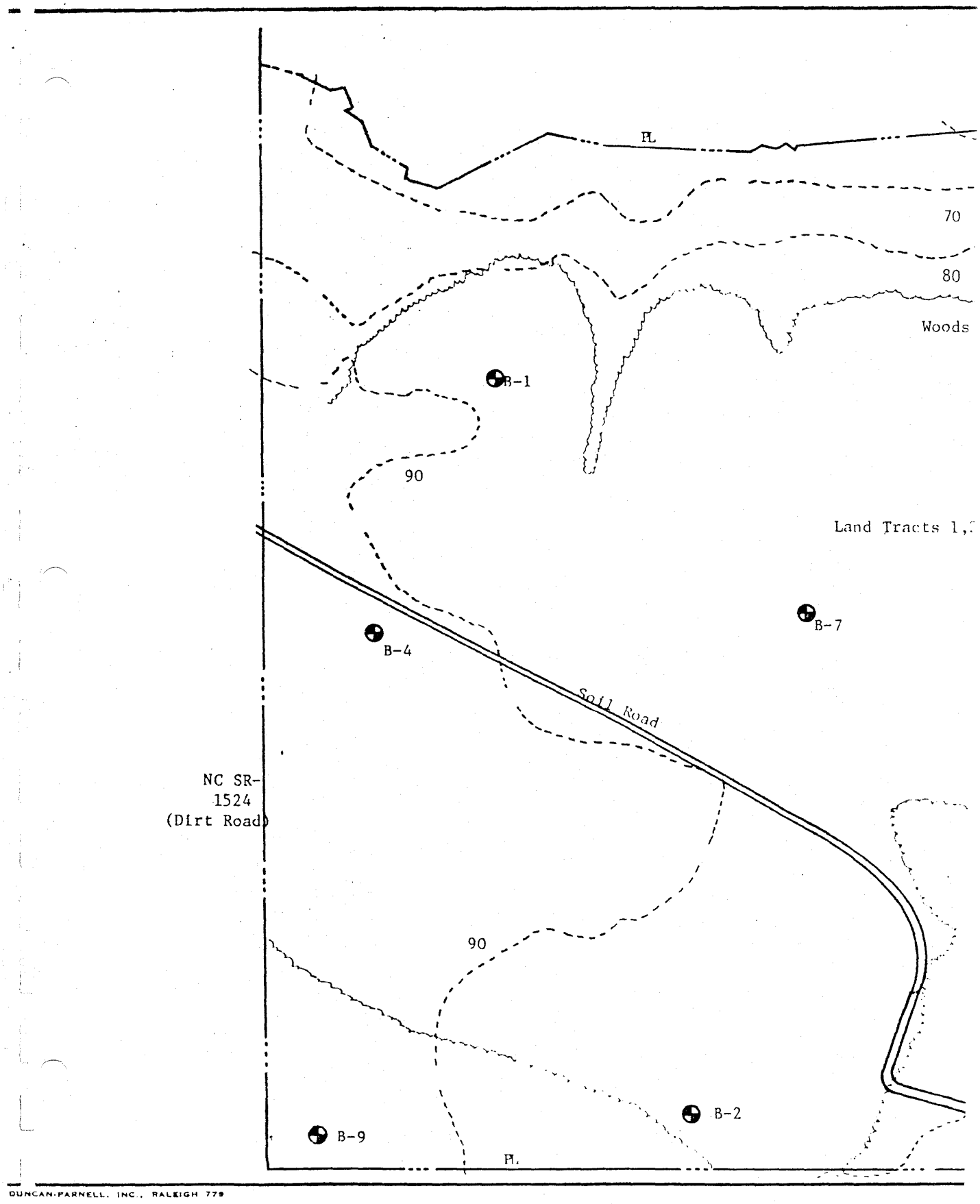
Poorly Graded SAND with Little or No Fines (SP)

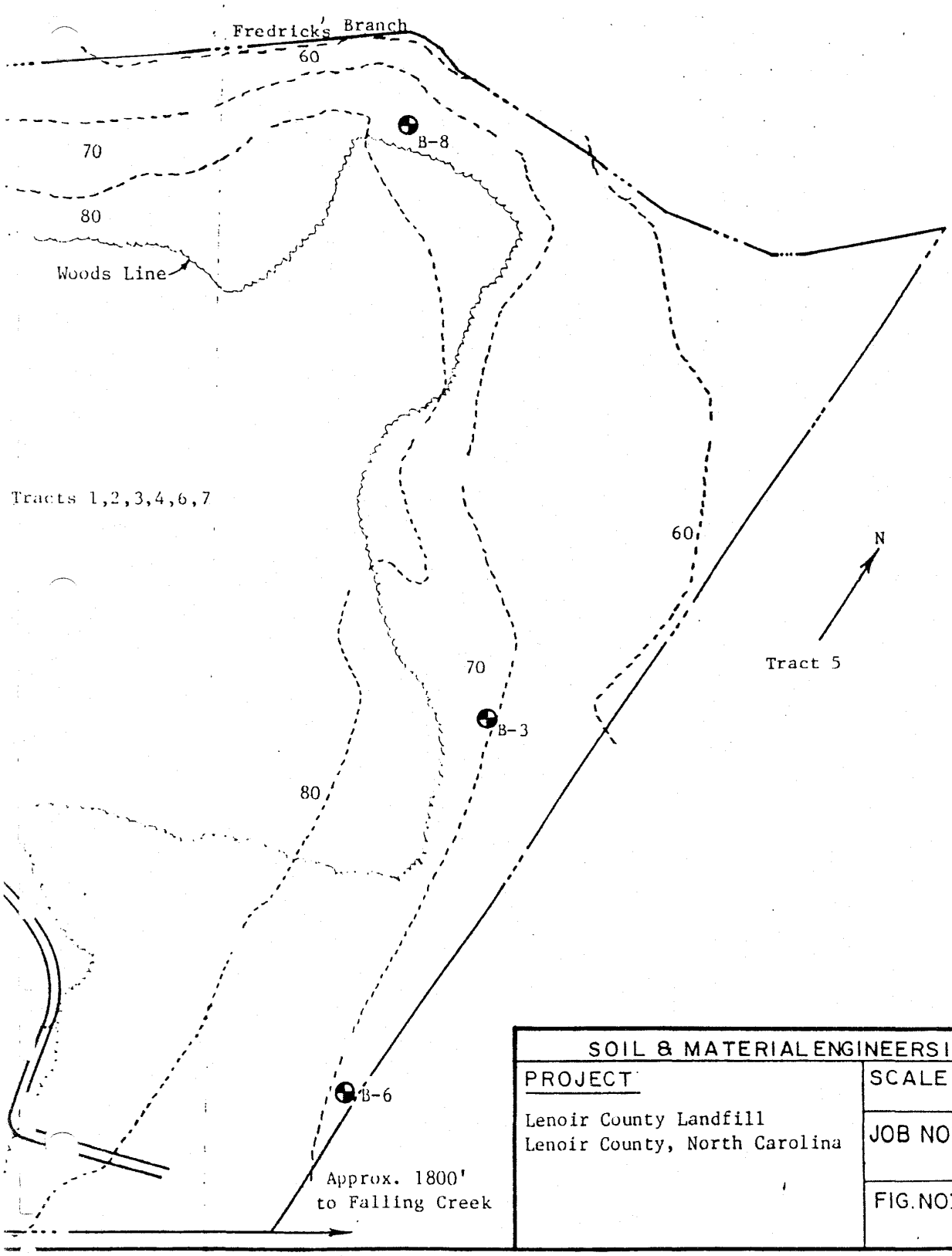
Poorly Graded Gravel with Little or No Fines (GP)

Clayey GRAVEL (GC)

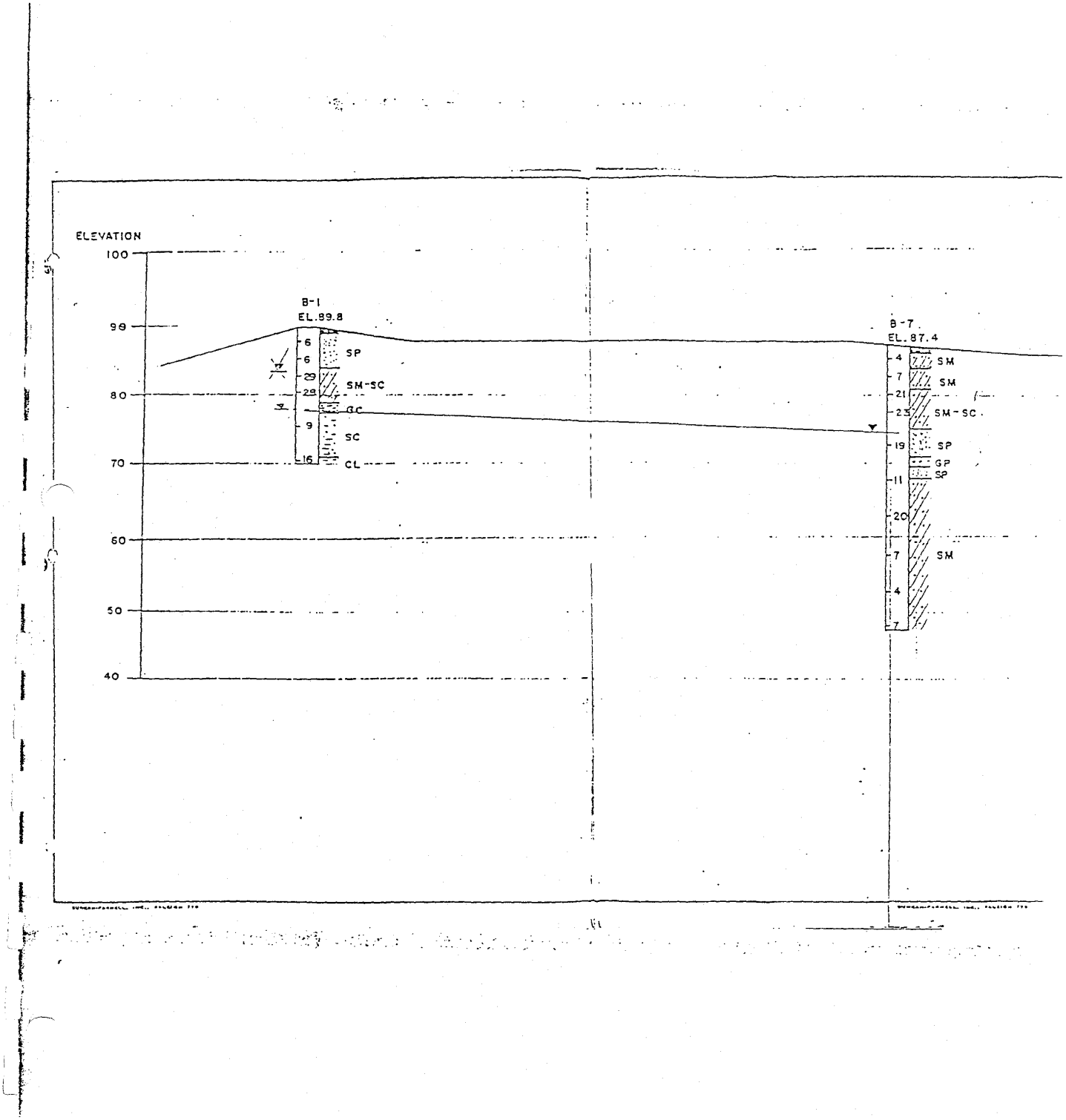
24+ Hour Groundwater Levels

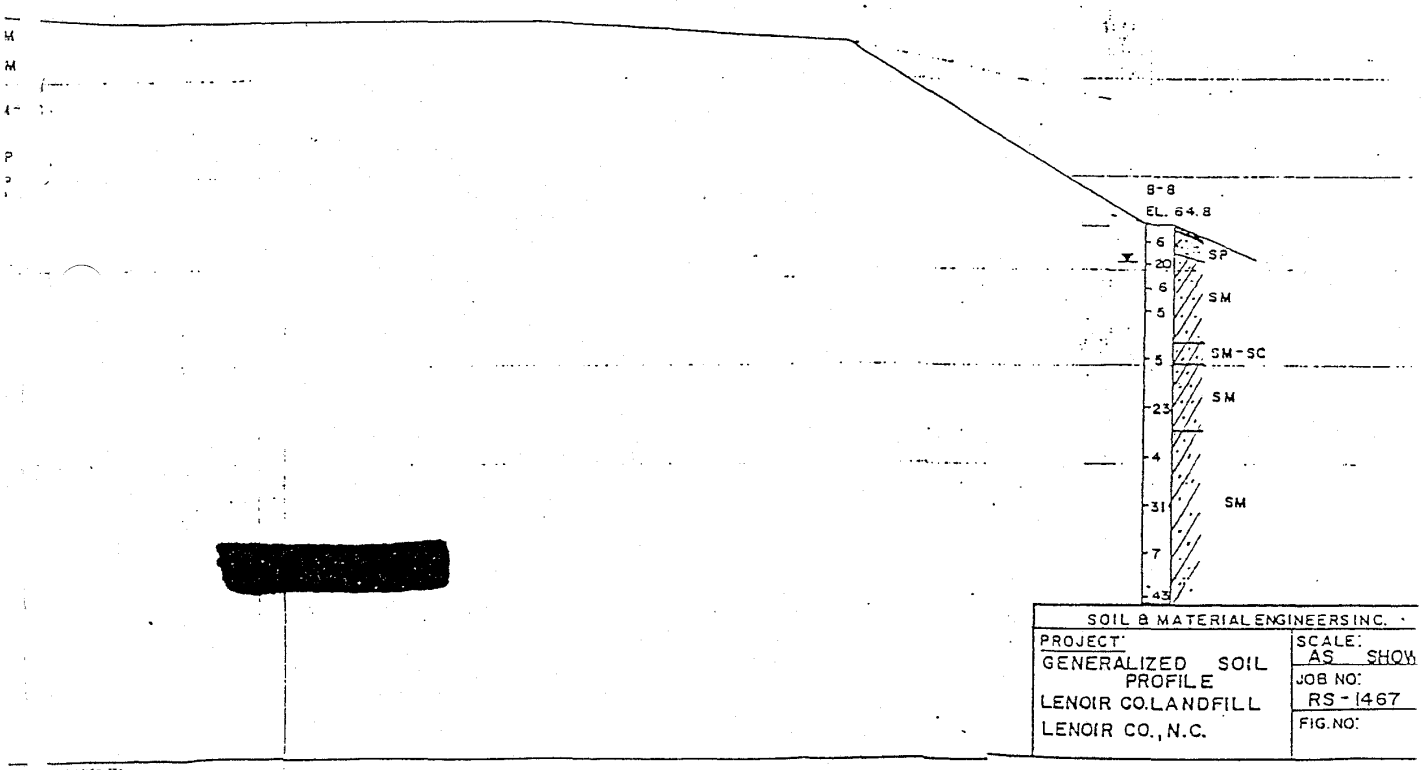
*Based on Unified Soil Classification System

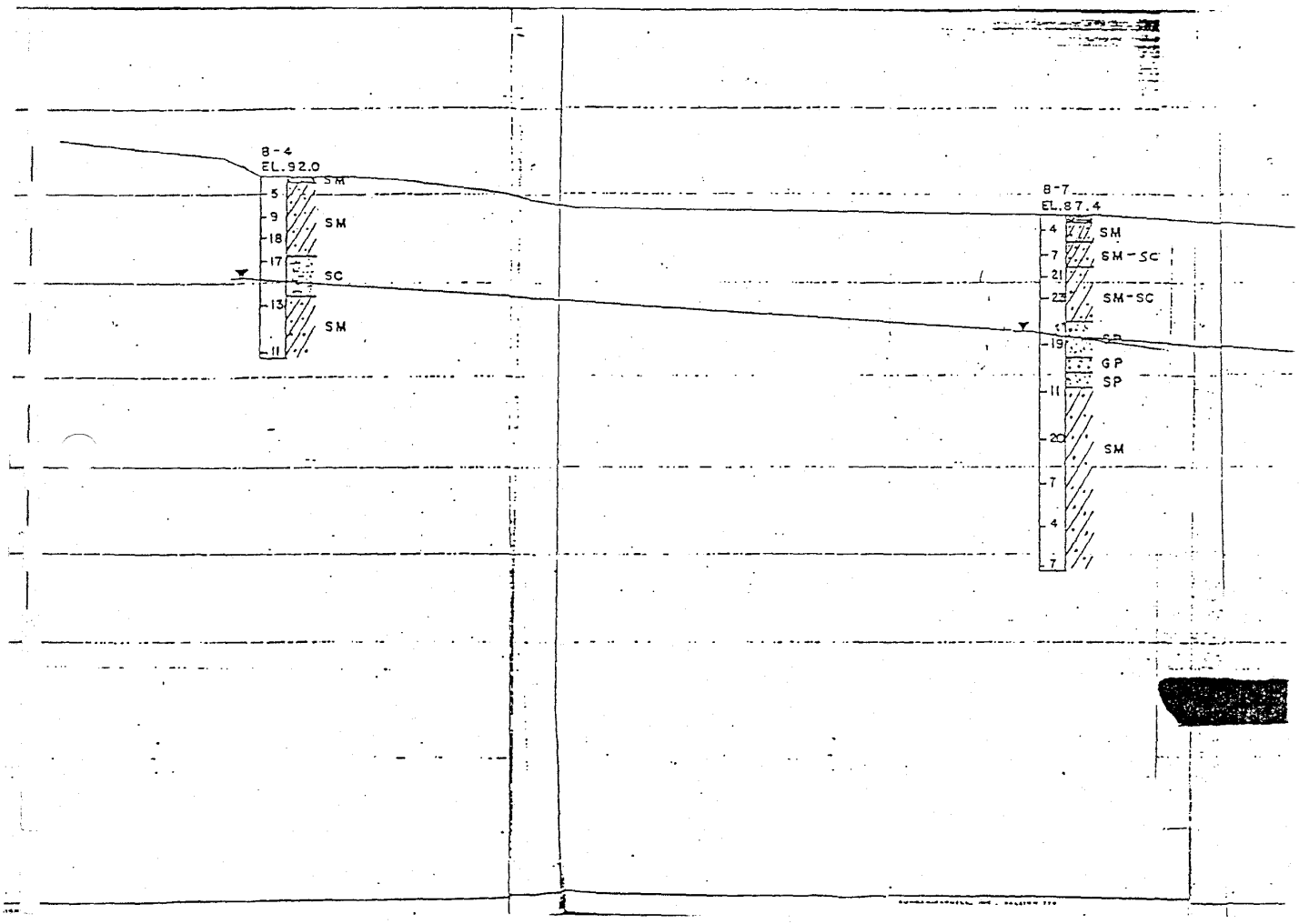

PL
70
80
Woods
B-1
90
Land Tracts 1,
B-7
B-4
Soil Road
NC SR-
1524
(Dirt Road)
90
B-2
B-9
PL
DUNCAN-PARNELL, INC., RALEIGH 779

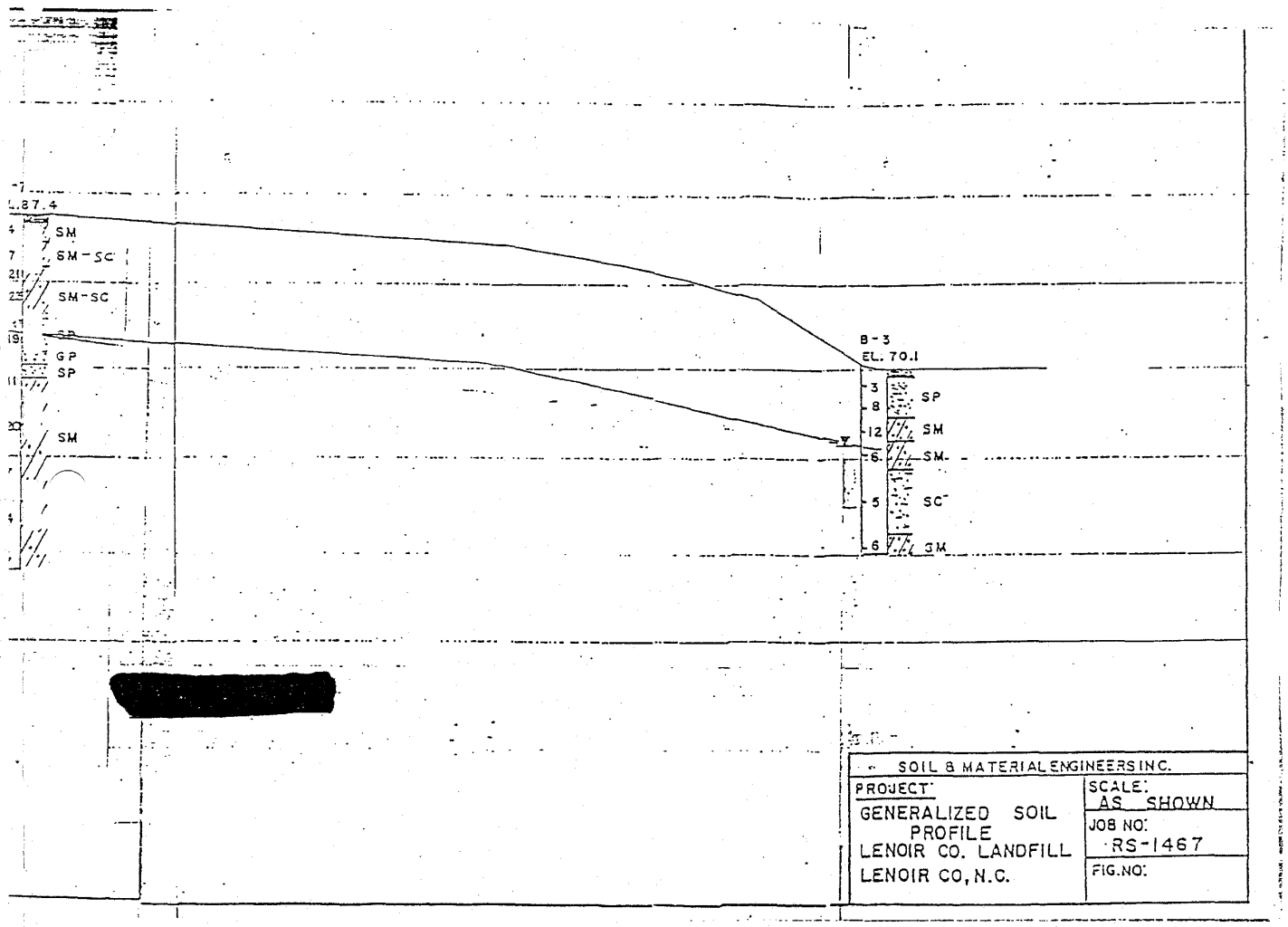


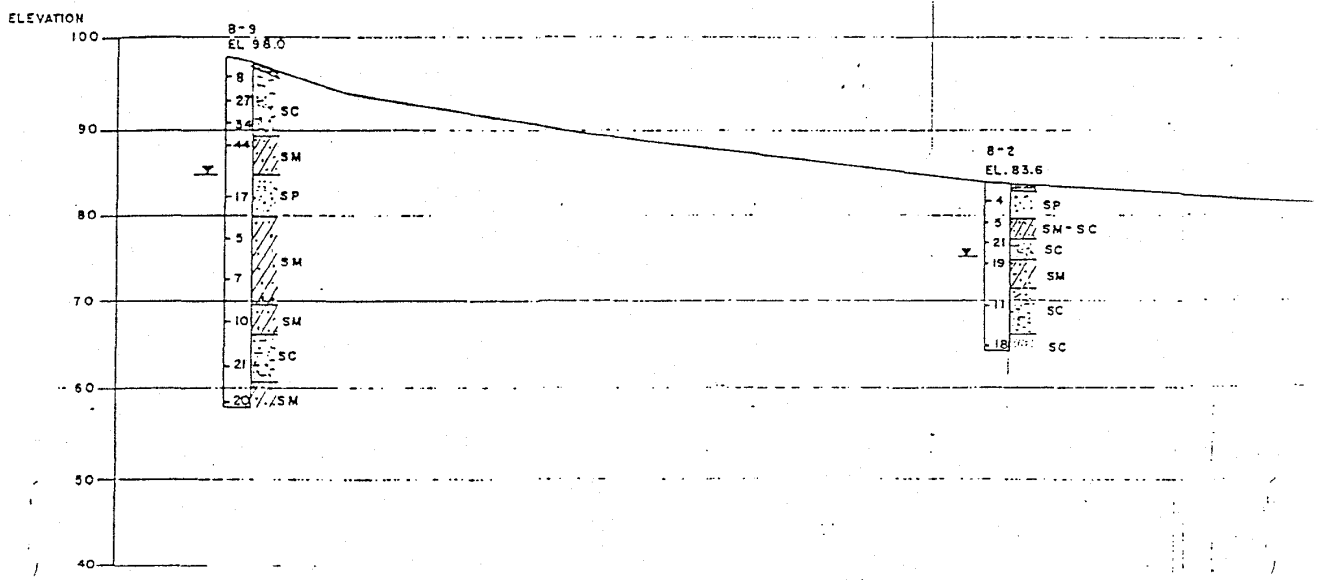

| SOIL & MATERIAL ENGINEERS INC. | | |
|---|---|---|
| PROJECT: Lenoir County Landfill<br>Lenoir County, North Carolina | SCALE: | Approx. 1" = 235' |
| | JOB NO: | RS-1467 |
| | FIG. NO: | 2 |

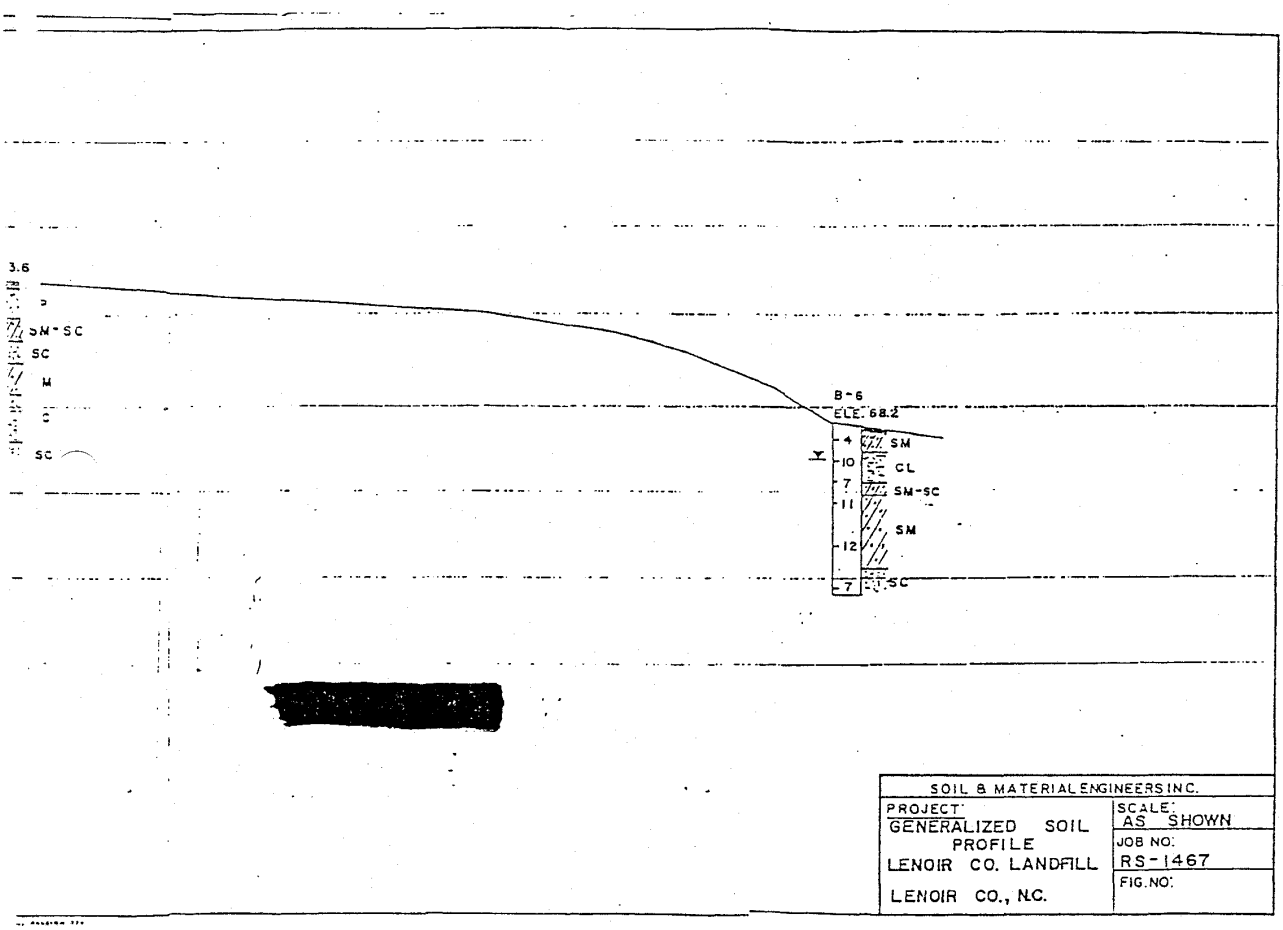

ELEVATION
100
90
80
70
60
50
40
B-1
EL.99.8
6
6
29
28
9
16
SP
SM-SC
GC
SC
CL
B-7
EL.87.4
4
7
21
23
19
11
20
7
4
7
SM
SM
SM-SC
SP
GP
SP
SM


B-8
EL. 64.8
6
20
6
5
5
23
4
31
7
43
SP
SM
SM-SC
SM
SM
SOIL & MATERIAL ENGINEERS INC.
PROJECT:
GENERALIZED SOIL PROFILE
LENOIR CO. LANDFILL
LENOIR CO., N.C.
SCALE:
AS SHOW
JOB NO:
RS-1467
FIG. NO:


B-4
EL.92.0
SM
5
9
18
17
SM
SC
13
SM
11
B-7
EL.87.4
4
SM
7
SM-SC
21
23
SM-SC
19
GP
SP
11
20
SM
7
4
7


SM
SM-SC
SM-SC
GP
SP
SM
B-3
EL. 70.1
3
8
12
6
5
6
SP
SM
SM
SC
SM
SOIL & MATERIAL ENGINEERS INC.
PROJECT:
GENERALIZED SOIL PROFILE
LENOIR CO. LANDFILL
LENOIR CO, N.C.
SCALE:
AS SHOWN
JOB NO:
RS-1467
FIG.NO:


ELEVATION
100
90
80
70
60
50
40
B-9
EL 98.0
8
27
34
44
17
5
7
10
21
20
SC
SM
SP
SM
SM
SC
SM
B-2
EL. 83.6
4
5
21
19
11
18
SP
SM - SC
SC
SM
SC
SC


3.6
SM-SC
SC
M
C
SC
B-6
ELE. 68.2
4
10
7
11
12
7
SM
CL
SM-SC
SM
SC
SOIL & MATERIAL ENGINEERS INC.
PROJECT:
GENERALIZED SOIL PROFILE
LENOIR CO. LANDFILL
LENOIR CO., N.C.
SCALE:
AS SHOWN
JOB NO:
RS-1467
FIG. NO:

| DEPTH FT. | DESCRIPTION | ELEV. | PENETRATION-BLOWS PER FT. 0 10 20 30 40 60 80 100 |
|---|---|---|---|
| 0.0 | Tan Silty Fine Sandy Loam (Topsoil) - SM - Cultivated Fill | 89.8 | |
| 1.0 | Loose Tan Fine to Medium SAND with trace of Silt - SP | 84.8 | 6, 6 |
| 6.0 | Very Firm Maroon Slightly Clayey Silty Fine to Medium SAND - SM-SC | 79.8 | 29, 28 |
| 9.0 | Very Firm Orange Clayey Fine to Medium SAND with Fine Rounded Gravel from 11 to 12 feet - SC | 74.8 | 9 |
| 12.0 | Loose Brown-Gray Silty Clayey Fine SAND - SC | 69.8 | 16 |
| 15.0 | Very Stiff Gray Silty Fine Sandy CLAY* | | |
| 20.0 | Boring Terminated at 20.0' | | |

Groundwater level at 6'-4" on 10/6/80

*(CL)

6'-4

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50 % ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

TEST BORING RECORD

BORING NO. B-1
DATE DRILLED 10/3/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

RNELL, INC., RALEIGH 680

| FT. | | ELEV. | PENETRATION-BLOWS PER FT. 0 10 20 30 40 60 80 100 |
|---|---|---|---|
| 0.0 | * | 83.6 | |
| 1.0 | Very Loose Tan-Gray Slightly Silty Fine to Medium SAND - SP | | 4 |
| 4.0 | Loose Gray Slightly Clayey Slightly Silty Fine to Medium SAND - SM-SC | 78.6 | 5 |
| 6.5 | Very Firm Gray-Tan Clayey Fine to Coarse SAND with some Fine Rounded ** | | 21 |
| 9.0 | Firm Green-Brown Silty Fine to Medium SAND with Trace of Clay-SM | 73.6 | 19 |
| 12.5 | Firm Orange Very Clayey Fine SAND - SC | 68.6 | 11 |
| 18.0 | Firm Orange Slightly Clayey Fine to Medium SAND - (SC) | 63.6 | 18 |
| 20.0 | Boring Terminated at 20.0' | | |

Groundwater level 8.5' on 10/20/80

*Tan Silty Fine Sandy Loam (TOPSOIL) - SM - Cultivated Fill

**Gravel

8.

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER F NG 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24 HR.
WATER TABLE-1 HR.

TEST BORING RECORD

BORING NO. B-2
DATE DRILLED 10/6/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

N ARNELL, INC., RALEIGH 680

| DEPTH FT. | DESCRIPTION | ELEV. | PENETRATION-BLOWS PER FT. 0 10 20 30 40 60 80 100 |
|---|---|---|---|
| 0.0 | Tan Silty Fine SAND (TOPSOIL)-SM- * | 70.1 | |
| 0.8 | Very Loose Tan Slightly Silty Fine to Medium SAND - SP | 65.1 | 3, 8 |
| 5.5 | Firm Green Silty Fine SAND - SM | | 12 |
| 8.0 | Loose Green-Brown Silty Fine SAND with Trace of Clay - SM | 60.1 | 6 |
| 11.0 | Loose Orange-Gray Silty Clayey Fine SAND - SC | 55.1 | 5 |
| 18.0 | Loose Orange-Gray Silty Fine SAND with Trace of Clay - SM | 50.1 | 6 |
| 20.0 | Boring Terminated at 20.0' | | |

Groundwater level at 8.5' on 10/20/80

*Wooded Area

8.5

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

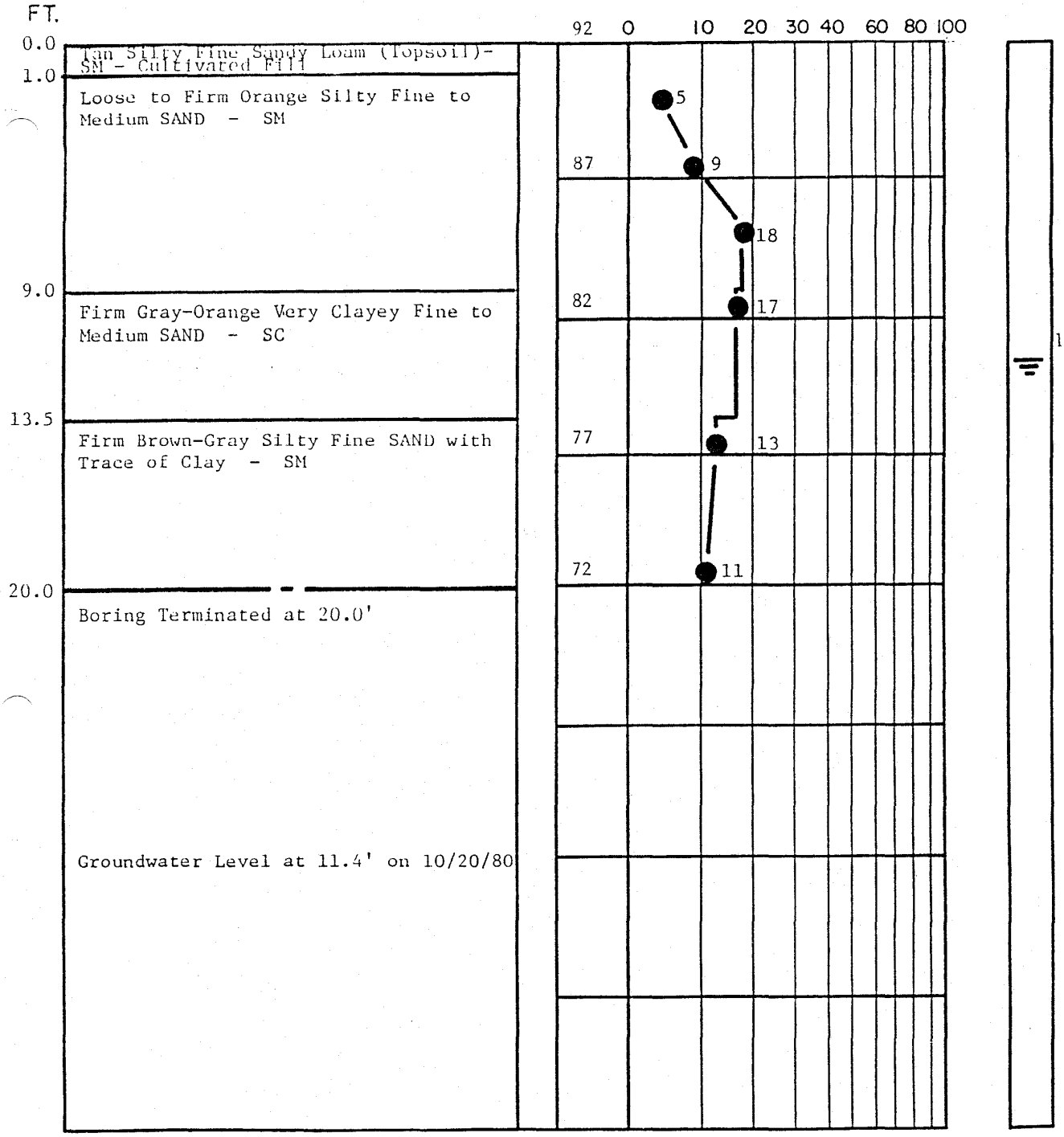
SM-14

# TEST BORING RECORD

BORING NO. B-3
DATE DRILLED 10/7/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

NC -PARNELL, INC., RALEIGH 680




BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50 % ROCK CORE RECOVERY
◀ LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

SM-14

ICAN-PARNELL, INC., RALEIGH 680

## TEST BORING RECORD

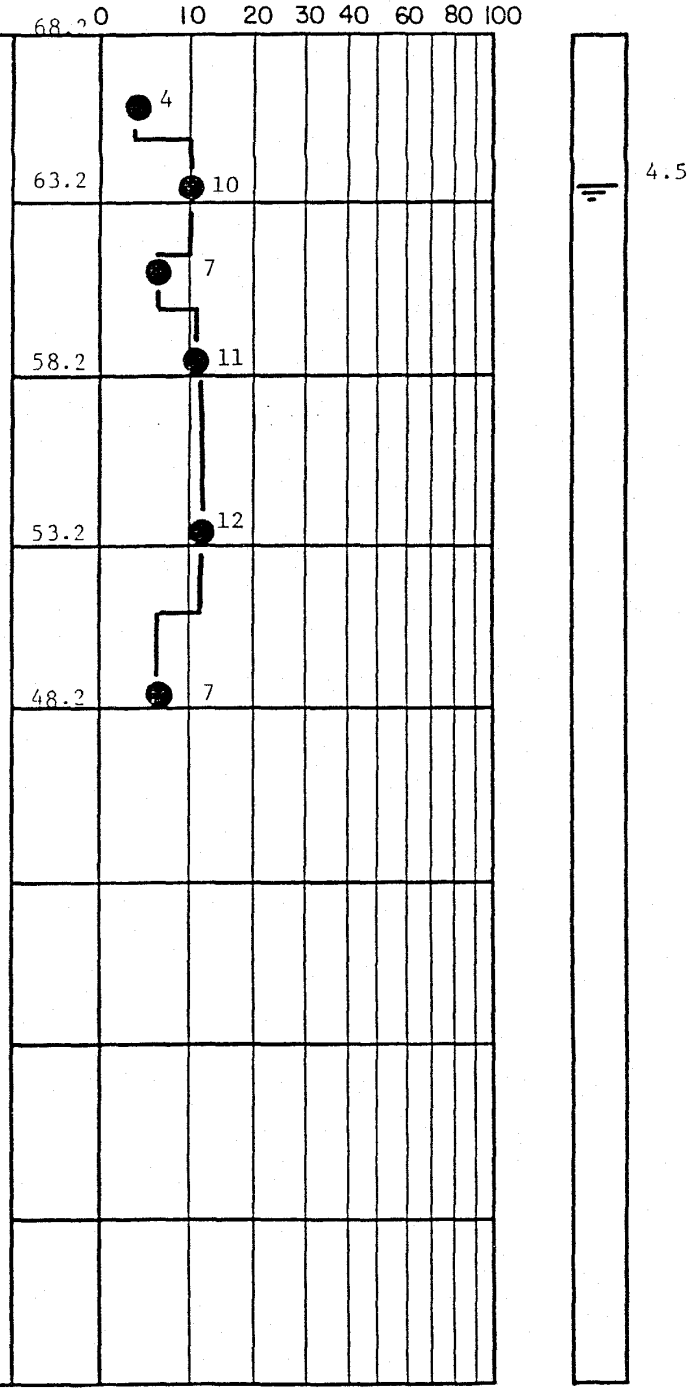
BORING NO. B-4
DATE DRILLED 10/7/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

| DEPTH FT. | DESCRIPTION |
|---|---|
| 0.0 | Tan Silty Fine to Medium SAND * |
| 0.8 | Very Loose Orange Silty Fine to Medium SAND with Trace of Clay - SM |
| 3.[illegible] | Stiff Orange-Gray Fine Sandy CLAY CL |
| 6.5 | Loose Orange Slightly Clayey Silty Fine SAND - SM-SC |
| .0 | Firm Green-Orange Silty Fine SAND - SM |
| 17.0 | Loose Orange-Gray Silty Clayey Fine SAND - SC |
| 20.0 | Boring Terminated at 20.0' |

Groundwater level at 4.5' on 10/20/80

*(TOPSOIL) - SM - Wooded Area




BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

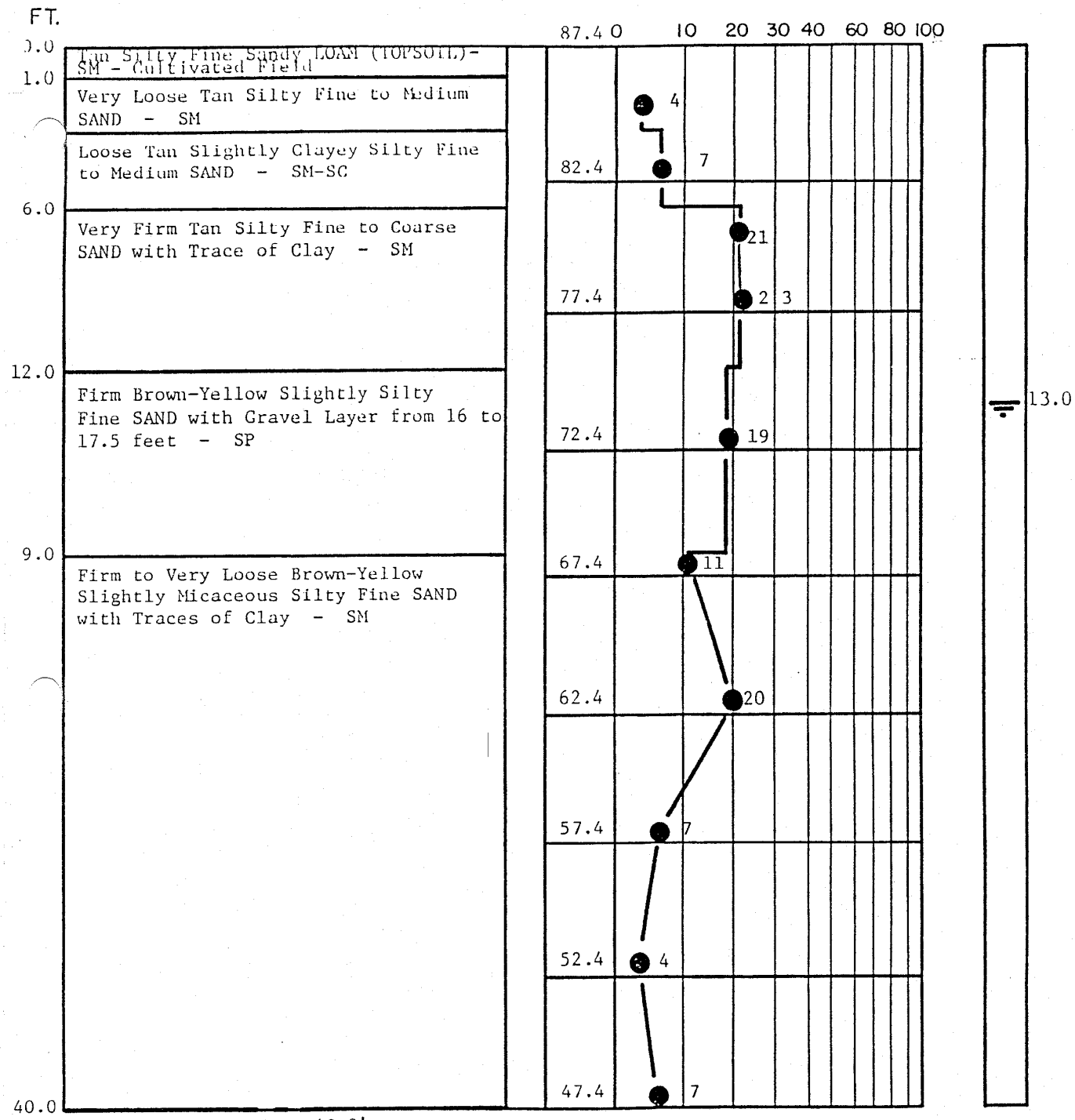
UNDISTURBED SAMPLE
50 % ROCK CORE RECOVERY
◀ LOSS OF DRILLING WATER
WATER TABLE-24 HR.
WATER TABLE-1 HR.

CAR[illegible]ARNELL, INC., RALEIGH 680

## TEST BORING RECORD

BORING NO. B-6
DATE DRILLED 10/7/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.




Boring Terminated at 40.0'
Groundwater level at 13.0' on 10/20/80

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50 % ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

SM-14

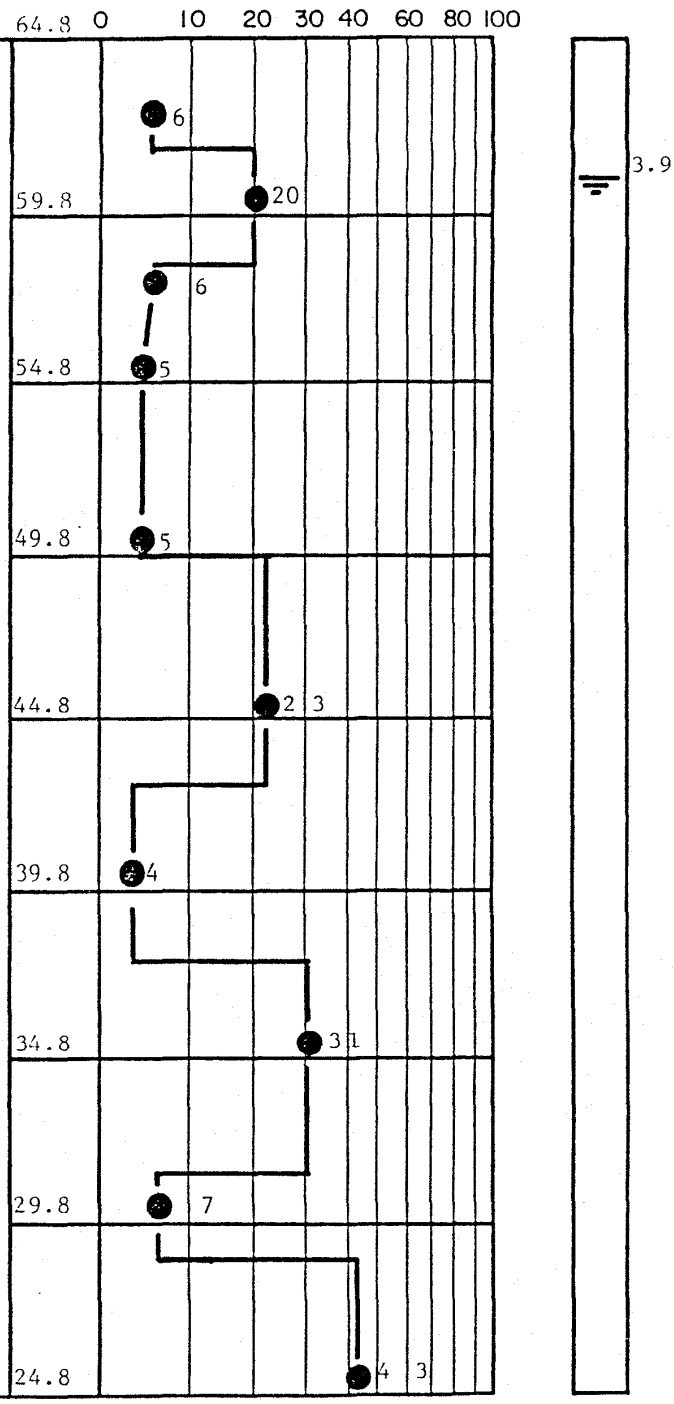
NC PARNELL, INC., RALEIGH 680

## TEST BORING RECORD

BORING NO. B-7
DATE DRILLED RS-1467
JOB NO. 10/6/80

SOIL & MATERIAL ENGINEERS, INC.

| DEPTH FT. | DESCRIPTION | ELEV. | PENETRATION-BLOWS PER FT. |
|---|---|---|---|
| 0.0 | | 64.8 | |
| 0.6 | Loose Gray Slightly Silty Fine to Medium SAND - SP | | |
| | Firm Gray Silty Fine to Medium SAND with Trace of Clay - SM | 59.8 | |
| 6.5 | Loose Yellow-Gray Silty Fine SAND - SM | 54.8 | |
| 13.0 | Loose Gray-Brown Slightly Clayey Silty Fine SAND - SM-SC | 49.8 | |
| 15.0 | Very Firm Yellow Slightly Silty Fine SAND - SM | 44.8 | |
| 22.0 | Very Loose Brown Silty Fine to Medium SAND with Some Fine Gravel & Trace of Clay - SM | 39.8 | |
| 27.0 | Dense Orange Silty Fine SAND - SM | 34.8 | |
| 33.5 | Loose Gray Very Silty Fine SAND - SM | 29.8 | |
| 36.0 | Dense Gray Silty Fine SAND - SM | 24.8 | |
| 40.0 | | | |




Boring Terminated at 40.0'
Groundwater level at 3.9' on 10/20/80

Observation Well Screen Set @ 39.0'

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

UNDISTURBED SAMPLE
50% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

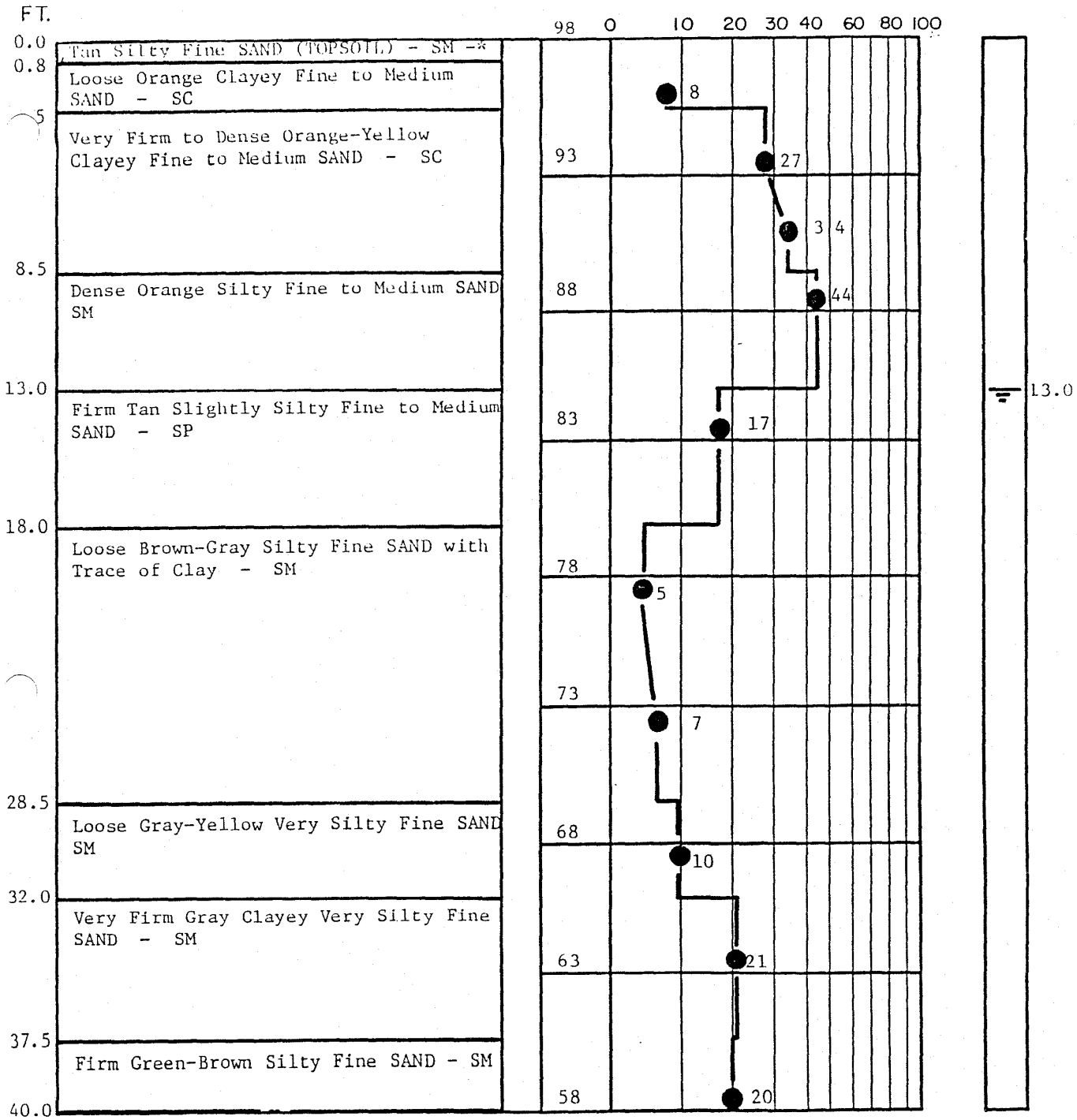
## TEST BORING RECORD

BORING NO. B-8
DATE DRILLED 10/8/80
JOB NO. RS-1467

SOIL & MATERIAL ENGINEERS, INC.

SM-14

PARNELL, INC., RALEIGH 880




Boring Terminated at 40.0'
Groundwater Level at 13.0' on 10/20/80

*WOODED AREA

# TEST BORING RECORD

BORING AND SAMPLING MEETS ASTM D-1586
CORE DRILLING MEETS ASTM D-2113

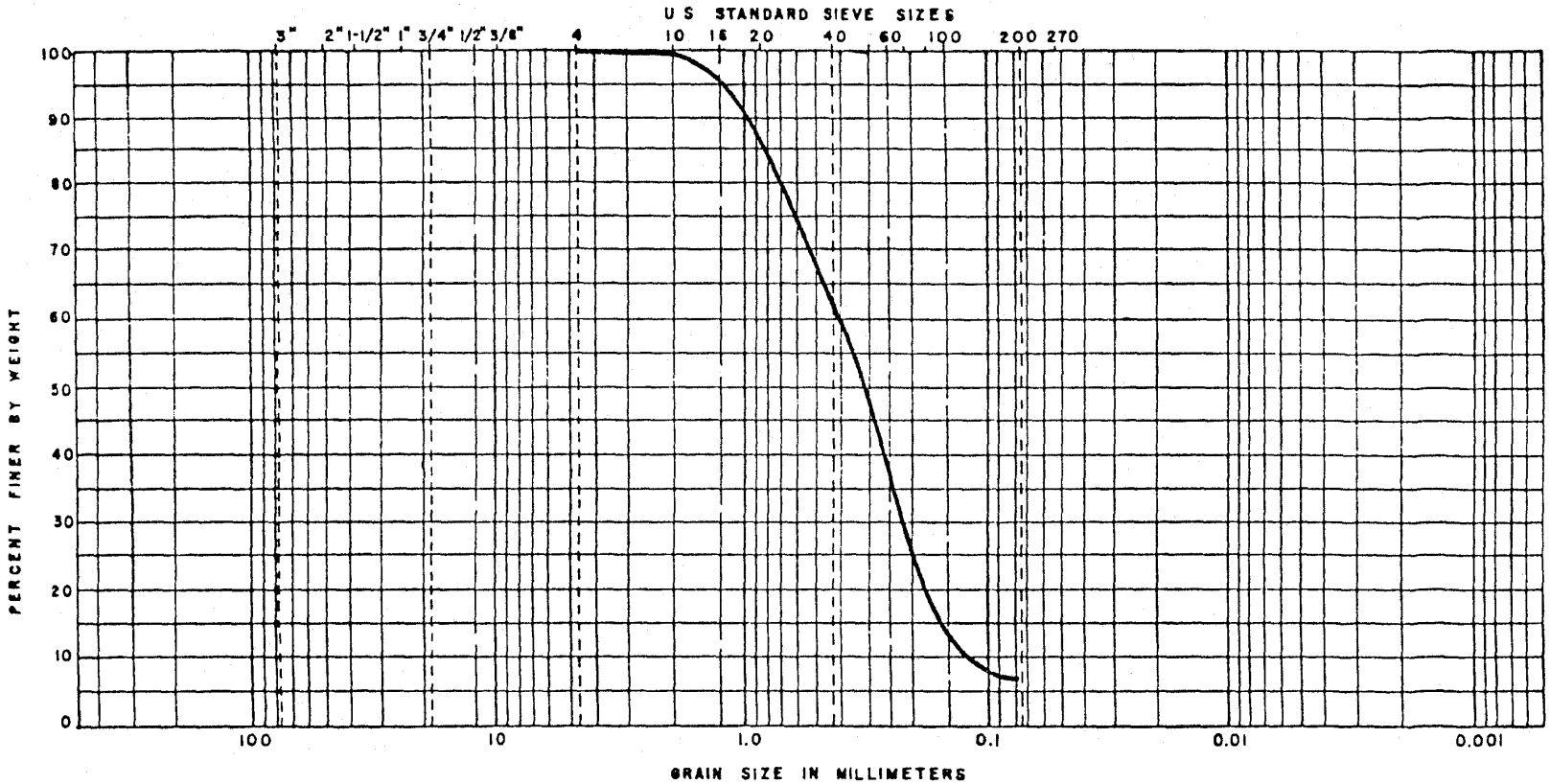
PENETRATION IS THE NUMBER OF BLOWS OF 140 LB. HAMMER FALLING 30 IN. REQUIRED TO DRIVE 1.4 IN. I.D. SAMPLER 1 FT.

BORING NO. B-9
DATE DRILLED 10/7/80
JOB NO. RS-1467

UNDISTURBED SAMPLE
50% ROCK CORE RECOVERY
LOSS OF DRILLING WATER
WATER TABLE-24HR.
WATER TABLE-1HR.

SOIL & MATERIAL ENGINEERS, INC.

CAN-PARNELL, INC., RALEIGH 680




| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO | ELEV. OR DEPTH | NAT WC | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-1 | 3.5-5.0 | | | | | Tan Fine to Medium SAND with Trace of Silt (SP) |

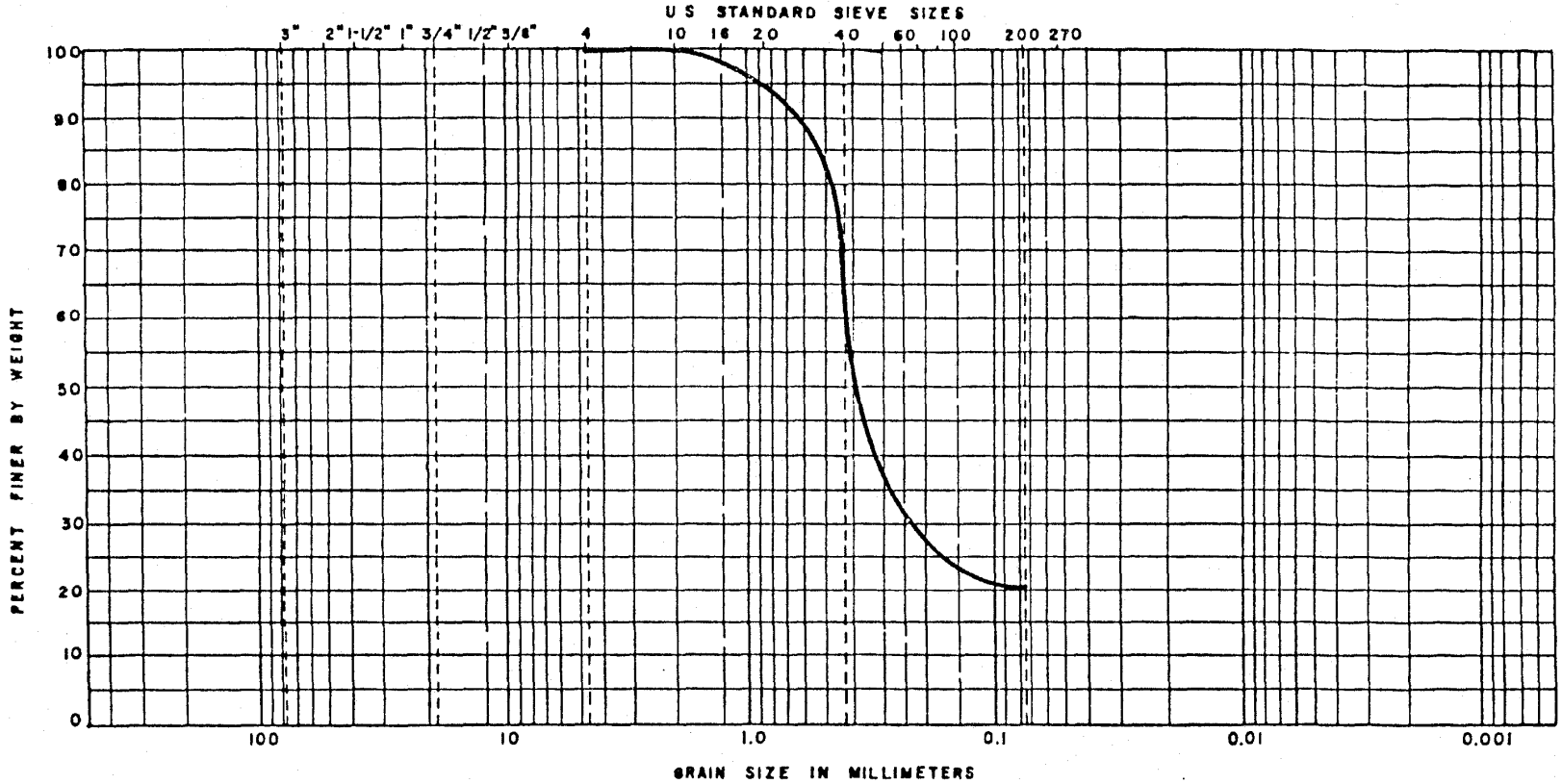
**GRAIN SIZE DISTRIBUTION**

JOB NO. RS-1437

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH 680

SM-19




| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO | ELEV. OR DEPTH | NAT WC | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-1 | 6.0-7.5 | | | | | Red Orange Slightly Clavey Silty Fine to Medium SAND (SC- SM) |

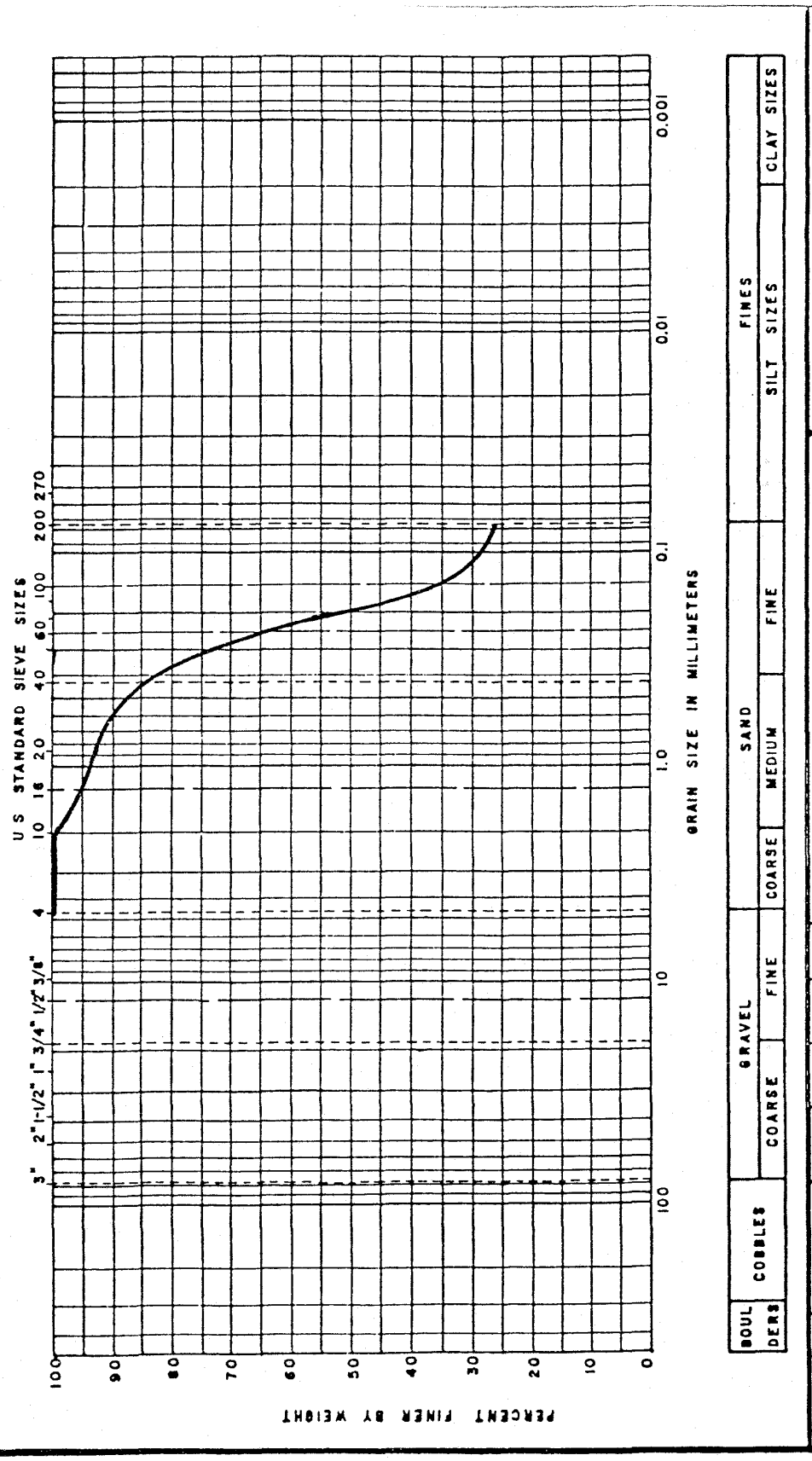
**GRAIN SIZE DISTRIBUTION**

JOB NO. RS-1437

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH 680

SM-19




# GRAIN SIZE DISTRIBUTION

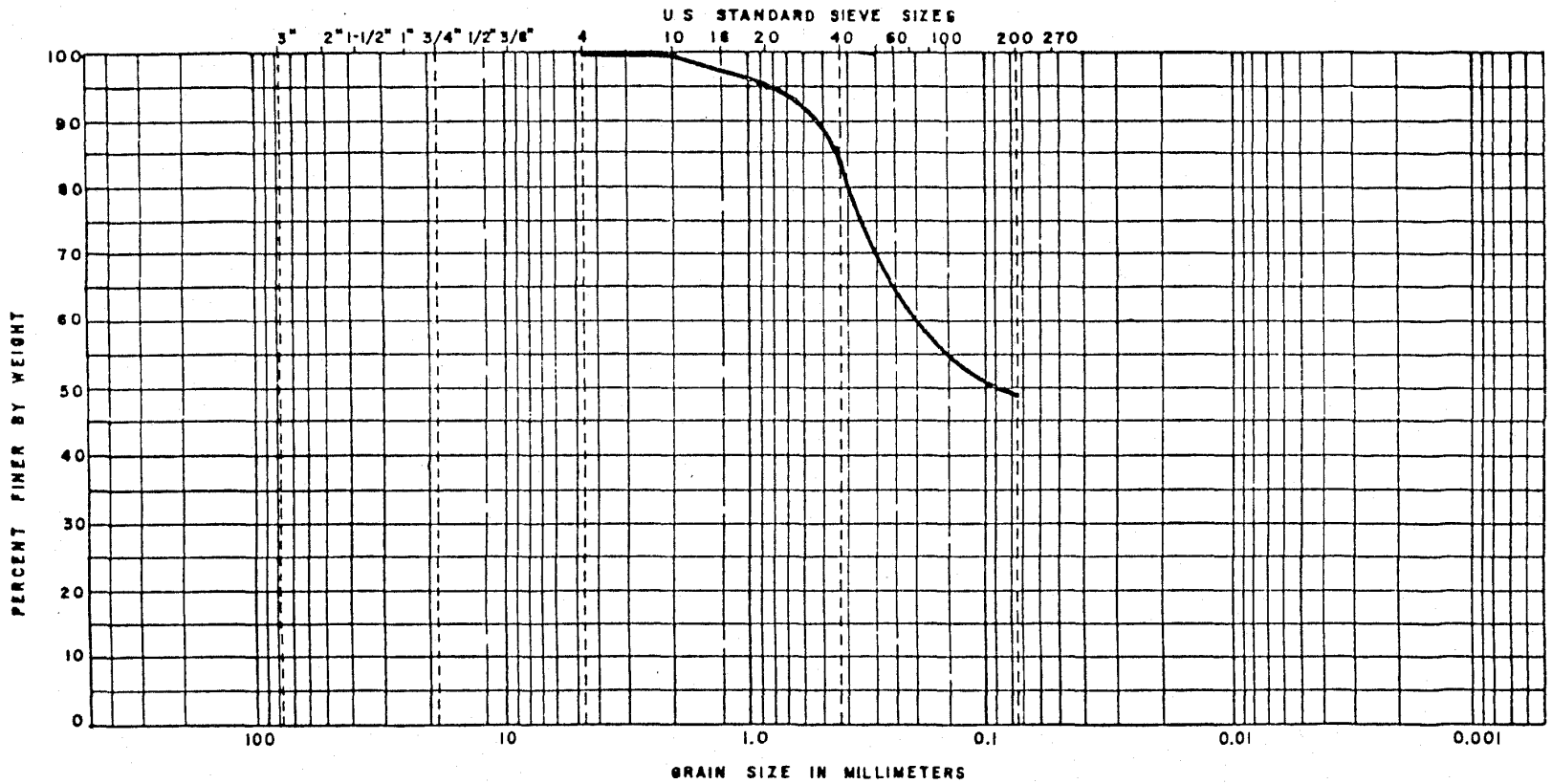
JOB NO. RS-1437

SOIL & MATERIAL ENGINEERS, INC.

| BORING NO | ELEV. OR DEPTH | NAT WC | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-4 | 3.5-5.0 | | | | | Orange Silty Fine to Medium SAND (SM) |

DUNCAN-PARNELL, INC., RALEIGH 680

SM-19




| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO | ELEV. OR DEPTH | NAT WC | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-4 | 8.5-10.0 | | | | | Gray-Orange Very Clayey Fine to Medium SAND (SC) |

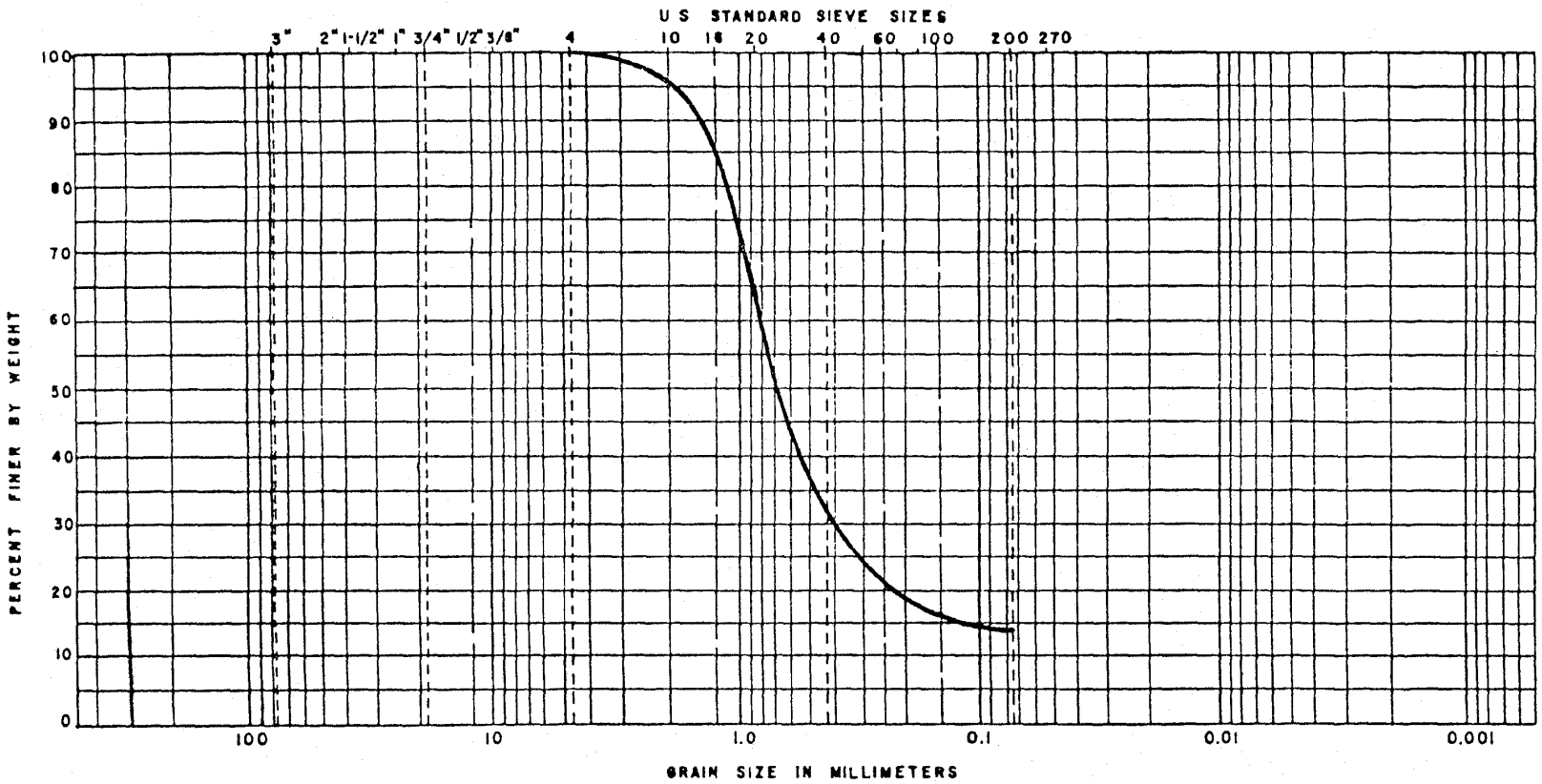
**GRAIN SIZE DISTRIBUTION**

JOB NO. RS-1437

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH 680

SM-19




| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO | ELEV. OR DEPTH | NAT WC | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-7 | 8.5-10.0 | | | | | Tan Silty Fine to Medium SAND with Trace of Coarse Sand - (SM) |

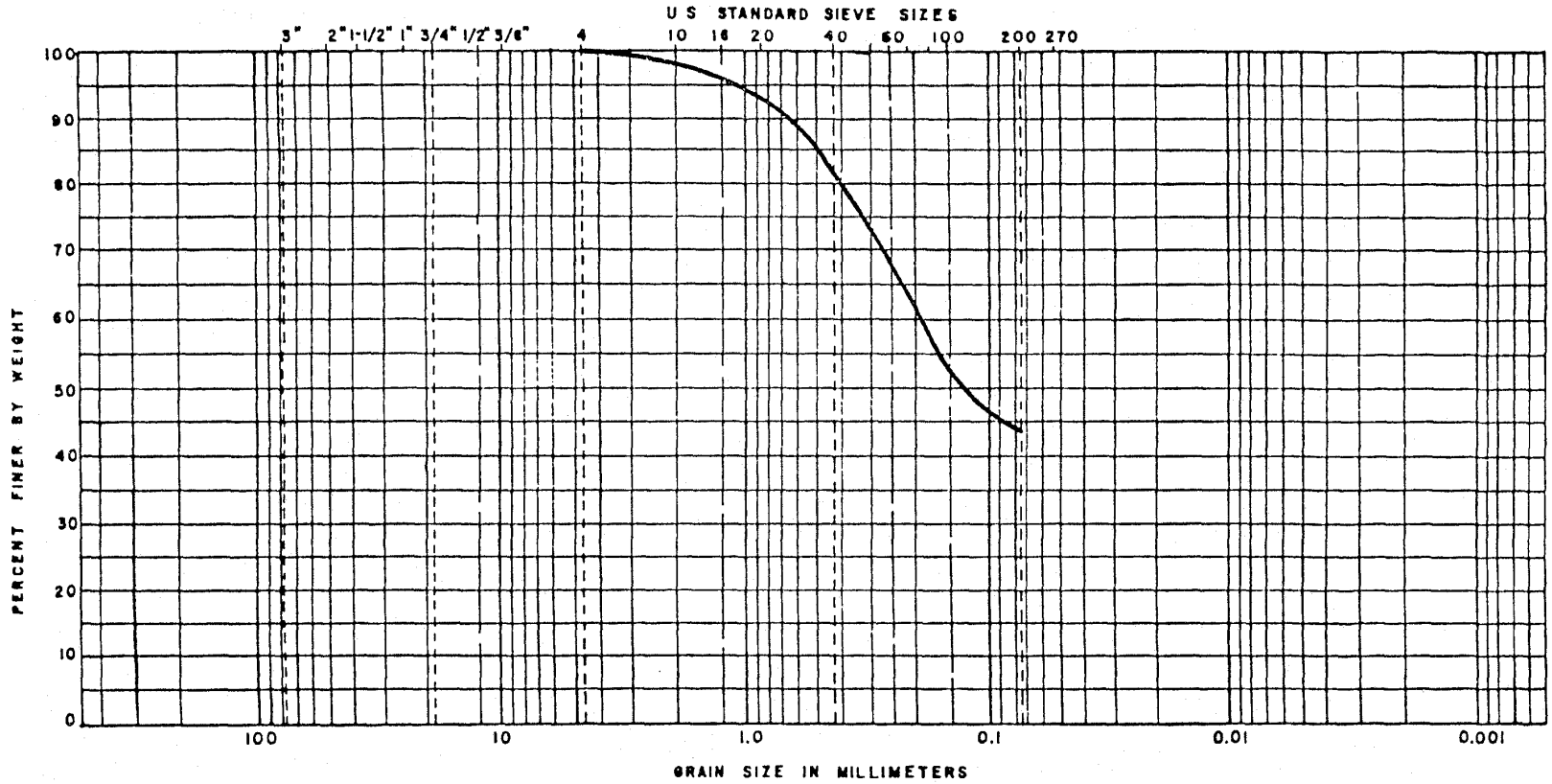
**GRAIN SIZE DISTRIBUTION**

JOB NO. RS-1437

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH 680

SM-19




| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO | ELEV. OR DEPTH | NAT WC | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-9 | 1.0-2.5 | | | | | Orange Clayey Fine to Medium SAND (SC) |

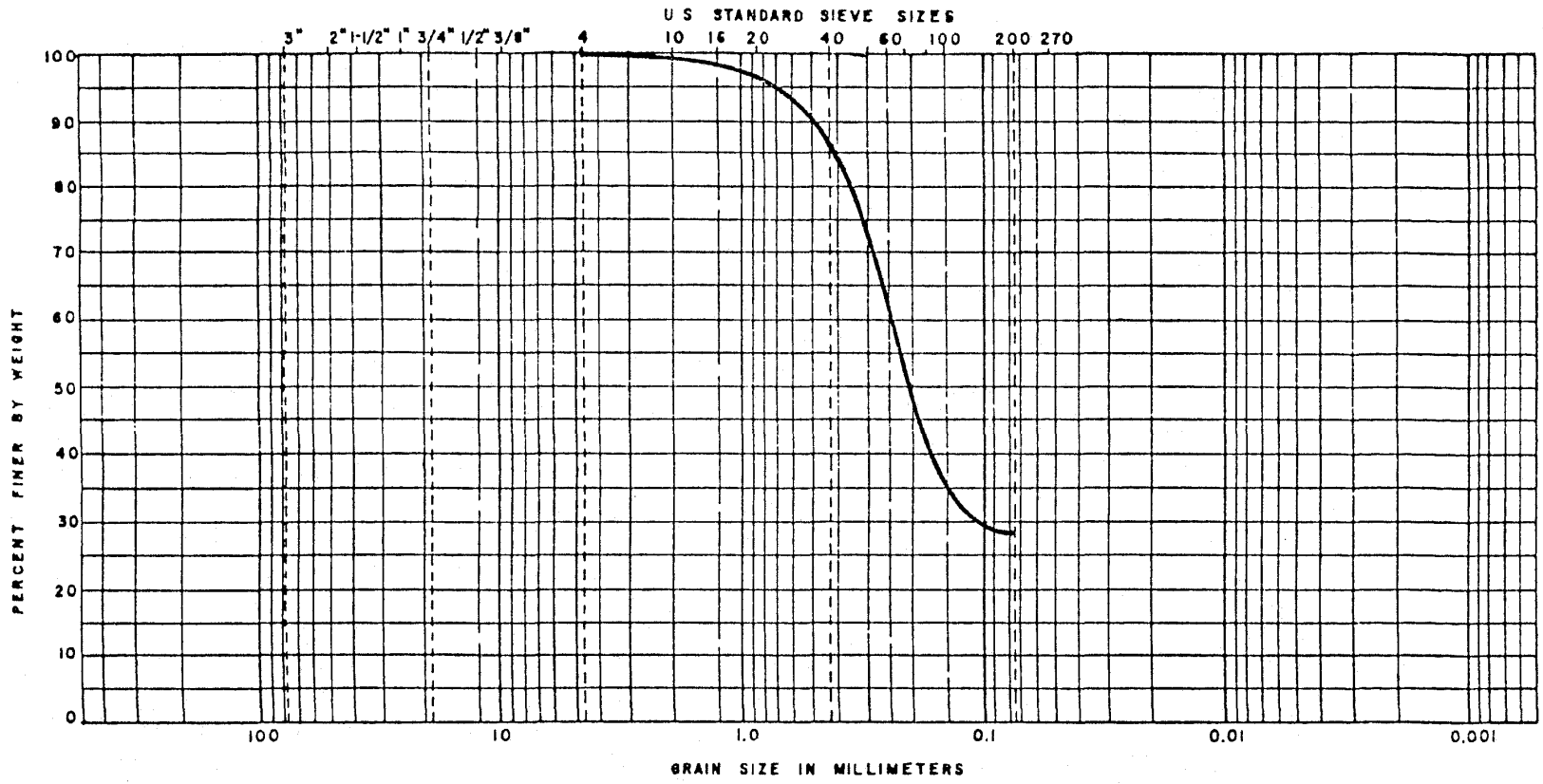
**GRAIN SIZE DISTRIBUTION**

JOB NO. RS-1437

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH 680

SM-19




| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT SIZES | CLAY SIZES |

| BORING NO | ELEV. OR DEPTH | NAT WC | LL | PL | PI | DESCRIPTION OR CLASSIFICATION |
|---|---|---|---|---|---|---|
| B-9 | 6.0-7.5 | | | | | Orange-Yellow Clayey Fine to Medium SAND (SC) |

**GRAIN SIZE DISTRIBUTION**

JOB NO. RS-1437

SOIL & MATERIAL ENGINEERS, INC.

DUNCAN-PARNELL, INC., RALEIGH 680

SM-19

TABLULATION OF NATURAL MOISTURE CONTENTS
LENOIR COUNTY LANDFILL

| Boring # | Sample Depth (Ft) | Natural Moisture Content (%) | Soil Classification |
|---|---|---|---|
| B-4 | 3.5-5 | 18.1 | Orange Silty Fine to Medium SAND - (SM) |
| B-4 | 8.5-10 | 25.2 | Orange-Gray Very Clayey Fine to Medium SAND - (SC) |
| B-1 | 3.5-5 | 17.6 | Tan Fine to Medium SAND With Trace of Silt -(SP) |
| B-1 | 6.0-7.5 | 21.2 | Red-Orange Slightly Clayey Silty Fine to Medium SAND-(SM) |
| B-7 | 8.5-10 | 15.3 | Tan Silty Fine to Medium SAND With Trace of Coarse Sand-(SM) |
| B-9 | 1-2.5 | 24.1 | Orange Clayey Fine to Medium SAND - (SC) |
| B-9 | 6.0-7.5 | 20.7 | Orange-Yellow Clayey Fine To Medium SAND - (SC) |

TABULATION OF GROUNDWATER LEVELS

LENOIR CO. LANDFILL

| Boring # | Ground Surface Elevation | Depth Below Ground Surface To Groundwater Level (Ft) | Elevation Of Groundwater Level (Ft) |
|---|---|---|---|
| B-1 | 89.8 | 6.3 | 83.5 |
| B-2 | 83.6 | 8.5 | 75.1 |
| B-3 | 70.1 | 8.5 | 61.6 |
| B-4 | 92.0 | 11.4 | 80.6 |
| B-6 | 68.2 | 4.5 | 63.7 |
| B-7 | 87.4 | 13.0 | 74.4 |
| B-8 | 64.8 | 3.9 | 60.9 |
| B-9 | 98.0 | 13.0 | 85.0 |

# WATER QUALITY SAMPLING AND ANALYSIS PLAN

GAI CONSULTANTS

# GROUND AND SURFACE WATER SAMPLING AND ANALYSIS PLAN

FOR INCLUSION IN

EXISTING MUNICIPAL SANITARY LANDFILL TRANSITION PLANS
NORTH CAROLINA

FEBRUARY 1994

# GROUND AND SURFACE WATER SAMPLING AND ANALYSIS PLAN

## INTRODUCTION

The objective of the ground and surface water sampling and analysis plan is to provide clear guidelines and procedures to be followed by field and laboratory personnel when obtaining and testing ground and surface water samples.

The goal of the sampling plan is to obtain the desired sample while neither adding nor subtracting any constituent to or from the sample or the monitoring well. The plan details described below, when followed, are considered adequate to eliminate any cross-contamination or contamination from external sources of the wells sampled. These guidelines are drawn, in part, directly from and are intended to be used in conjunction with the N.C. Water Quality Monitoring Guidance Document for Solid Waste Facilities (Guidance Document), copy enclosed.

The goal of the analysis plan is to test and detect, if present, selected chemical constituents (Appendix I constituents) in the ground and surface water. Testing will be conducted to the desired detection levels with accuracy and precision under controlled testing procedures such that chemical constituents not present are neither added to the water nor detected.

## SAMPLING EQUIPMENT

Groundwater samples will be obtained in the field using a dedicated, laboratory-cleaned, stainless steel bailer. Each bailer will be cleaned in a laboratory controlled environment prior to sampling in accordance with the following steps.

1. Completely disassemble bailer.
2. Phosphate-free, laboratory grade, soap and deionized or distilled water wash.
3. Deionized or distilled water rinse.
4. Isopropyl alcohol rinse.
5. Deionized or distilled water rinse.
6. Air dry.
7. Wrap bailer in aluminum foil, shiny side out.
8. Wrap bailer in plastic.

In addition to laboratory cleaned bailers for each well sampled, standard equipment necessary to conduct the sampling includes sample containers, including trip blanks and equipment blanks, wide-mouth container, at least two 600-ft spools of ¼-inch nylon rope, at least two boxes of latex gloves, one box of large plastic bags, temperature indicator, pH indicator, conductivity indicator, water level indicator, storage coolers, and ice. In case

of emergency, supplies to clean bailers as described above may also be brought to the site. If the total depth of all wells to be sampled exceeds 1200 feet, additional spools of rope will be obtained to complete the sampling. If the number of wells to be sampled exceeds one third of the number of pairs of gloves in stock, additional boxes of gloves will be obtained.

The bailers, wrapped in foil and plastic, will be transported between pieces of peaked foam rubber to prevent damage to the wrappings. Other equipment subject to damage and contamination will be transported in sealed, plastic bags. The water level indicator will be cleaned in accordance with Steps 3 through 5 described above prior to placement in a clean plastic bag.

## SAMPLE CONTAINERS

Various sample containers are required for a complete sampling and analysis effort. Routine groundwater and surface water monitoring may include the following:

- Volatile organic analysis (VOA),
- Total organic halogens (TOX), and
- Inorganic analysis, such as heavy metals or general chemistry.

Samples will be collected for the various analyses in the containers described below in the order listed.

Samples to be analyzed for VOA and/or TOX will be collected first in two 40-ml glass vials with teflon caps. The sample vials will be completely filled with no air left in the vials.

Samples to be analyzed for inorganic contamination will be collected next in two 1-quart/1-liter plastic containers.

Samples to be analyzed for complete organics, including acid-base neutrals, will be collected in a ½-gallon/2-liter glass jar with aluminum foil or teflon-lined caps.

Samples to be analyzed for radiologic parameters will be collected next in 1-gallon/4-liter plastic containers.

Samples to be analyzed for bacteriological parameters will be collected in one 120-ml plastic vial.

All sample containers will be obtained from an independent laboratory in a sterilized condition. Some of the containers will have a premeasured amount of preservative in them as necessary. In this event, care will be taken not to rinse the container or allow the preservative to wash out during sampling.

GROUNDWATER SAMPLING

Preparation. Sampling a groundwater monitoring well begins with unlocking and opening the locking cap and removing the PVC well cap. The depth to water will be determined using the water level indicator. Before storage and/or reuse, the water level indicator will be cleaned in accordance with Steps 3 through 5 described above and replaced in a clean plastic bag.

The total well depth read from the well tag and the measured depth to water will be used to compute the depth of water in the well. Using the chart in the Guidance Document, the quantity of water in the well will be determined. For example, if a two-inch well is 29 feet deep and has a measured depth to water of 10 feet, there are 19 feet of standing water or 3.3 gallons in the well. Each well will be purged three to five well volumes (quantity of water in the well), or until dry, prior to sampling. In the example, 10 gallons would be adequate. Purged water will be measured in 5-gallon buckets until the desired amount is purged. Care will be taken not to bring the bailer into contact with the bucket during purging.

Based on the number of wells to be sampled and their proximity to each other, all the wells may be purged one after another with sampling to follow. In this manner, if a well is purged dry, it will have time to recharge prior to sampling.

Purging. After the amount of water to be purged from a well is determined, the equipment necessary for purging will be assembled at the well including rope, 5-gallon bucket, bailer, and gloves. With the wrapped bailer maintained in a stable, upright position, the top portion of aluminum foil will be pulled away exposing only the eyelet used for securing the rope to the bailer. After the rope has been secured to the bailer with gloved hands, the bailer will be suspended as the aluminum foil and plastic are removed. The gloved hand used to remove the aluminum foil and plastic will be considered contaminated and may not come into contact with the bailer or rope. The bailer will be lowered slowly into the well using the uncontaminated, gloved hand that suspended the bailer until the bailer contacts the water. The rope will be cut to an adequate length and secured to prevent losing the bailer in the well. The gloves will be discarded and a new pair used during the purging.

In order not to allow the rope to touch the ground during purging, the rope will be gathered when raising the

bailer either by gathering in loops in one hand or by the wind mill method. The wind mill method requires hooking the rope with alternating thumbs as the rope is pulled from the well. When purging deep wells, the ground around the well head may be covered with a clean plastic bag or sheet of plastic with a slit cut to allow the plastic to slide over the well head. The plastic will be placed over the sampler's boots to allow the rope to fall on the plastic without contamination. Alternatively, the rope may be lowered into an open bag placed in a 5-gallon bucket beside the well head. In any case, the rope will not contact anything considered contaminated including ground, boots, dirtied plastic, etc.

If purging and sampling of a well is performed at separate times, the bailer will be left suspended in the well and the rope secured. The remaining rope will be doubled and grasped in a tight loop in one hand. With the free hand, the glove on the hand holding the rope will be removed by pulling away from the hand and over the rope in an inside-out position until rope is encased in the glove. The rope will be transferred to the opposite hand and the procedure repeated to cover any portion of rope remaining uncovered. The glove-encased rope will be set on top of the well head until time to sample. Alternatively, the rope remaining after securing may be gathered in a tight loop and pushed into the 2-inch PVC well pipe and left. If sampling immediately follows purging, new gloves will not be necessary.

Sampling. Prior to sampling the well, the necessary equipment will be assembled at the well, including pH, conductivity, and temperature indicators, sampling jars, a thoroughly cleansed wide mouthed container, and a box of latex gloves. An equipment blank will be prepared prior to sampling each well by rinsing distilled water through the bailer into the equipment blank container.

With gloves on, the bailer will be lowered into the well slowly. To avoid releasing any volatiles from the groundwater, care will be exercised while the bailer is lowered so that it does not splash or smack the water surface. Once full, the bailer will be retrieved and containers filled in the order described above. The containers will be filled by inverting the bailer until water issues from the small holes at the top of the bailer. In addition to collecting the samples, water will be collected in the wide-mouth container for pH, temperature, and conductivity measurements. Following completion of the sampling, the containers, including the equipment blank, will be stored and transported on ice. The used latex gloves and rope will be discarded.

## SURFACE WATER SAMPLING

Surface water samples will be obtained from adjacent rivers, streams or brooks upstream and downstream of the landfill at designated surface water sampling sites. Actual collection points for surface water sampling will

be selected with consideration given to minimal turbulence and aeration.

Surface water sample containers will be handled with one hand near the base. The container will be rinsed with the water to be sampled prior to filling the container unless the container contains a premeasured amount of preservative. When collecting surface water samples, sample containers will be dipped at location points with extreme caution in order to avoid contamination at the mouth of the container. The container will be pushed rapidly into the water to a depth of about six inches, mouth down, and tilted towards the stream current to fill. Care will be taken not to let the mouth of the container breech the surface while filling. If there is little current movement, the container will be moved slowly through the water laterally. During times of drought, if the water is not deep enough to allow submersion of the container, a pool may be scooped out of the bottom of the stream to obtain a sample. The pool will be allowed to clear before sampling. The container will be lifted from the water and sealed with the cap, leaving an airspace at the top of about ½ inch. Glass vial containers collected for VOA and TOX analyses will be filled completely as described above. The samples will be stored and transported on ice.

## SAMPLE TRANSPORT AND CHAIN-OF-CUSTODY

Sample containers will be clearly labeled as the samples are obtained and stored on ice along with the equipment blanks and trip blanks. Trip blanks will remain in the condition they are received from the laboratory and will not be opened or tampered with during the sampling. A chain-of-custody record will be completed for each day's samples, indicating the date and time, sample location, sample matrix (soil, water, etc.), and laboratory analyses to be conducted. In addition, a field sampling data sheet will be completed indicating the depth to water measured in each well sampled and the pH and temperature of the sample measured in the field. Sample copies of the chain-of-custody record and field sampling data sheet are enclosed.

## GROUND AND SURFACE WATER ANALYSIS

Water samples obtained in the field will be maintained in the sample containers on ice and transported to an approved laboratory for analysis. If the individual transporting the samples is different from the individual that did the sampling, the chain of custody forms will be used to document the transfer of custody from the water sampler to the water transporter. When the water samples reach the laboratory, they will be transferred to a sample custodian who will sign the chain of custody documentation for receipt of the samples. Internal control of the water samples in the laboratory will be in accordance with QA/QC procedures for the laboratory. Copies of QA/QC manuals for approved laboratories are on file with the Division of Solid Waste.

Ground and surface water samples will be analyzed for Subtitle D Appendix I constituents. Table 1 contains a list of the Appendix I constituents as well as a list of EPA methods to be utilized in detection of the constituents. References where these test methods are documented are also presented in Table 1. In addition, detection levels for each of the constituents and a list of the equipment that will be used in the laboratory testing are presented in Table 1. QA/QC procedures utilized during the testing will be in conformance with the laboratory QA/QC manual.

TABLE

**TABLE 1**
**GROUND AND SURFACE WATER ANALYSES METHODOLOGY**

| Inorganic Constituent | Test Method | Equipment | Detection Level, µg/L |
|---|---|---|---|
| Antimony | EPA 7041 | GF/AA | 2 |
| Arsenic | EPA 7060A | GF/AA | 1 |
| Barium | EPA 6010A | ICP | 1 |
| Beryllium | EPA 6010A | ICP | 1 |
| Cadmium | EPA 7131A | GF/AA | 0.2 |
| Chromium | EPA 6010A | ICP | 6 |
| Cobalt | EPA 6010A | ICP | 5 |
| Copper | EPA 6010A | ICP | 3 |
| Lead | EPA 7421 | GF/AA | 2 |
| Nickel | EPA 6010A | ICP | 20 |
| Selenium | EPA 7740 | GF/AA | 1 |
| Silver | EPA 6010A | ICP | 4 |
| Thallium | EPA 7841 | GF/AA | 1 |
| Vanadium | EPA 6010A | ICP | 5 |
| Zinc | EPA 6010A | ICP | 2 |
| Organic Constituent | | | |
| Acetone | EPA 8240A | GC/MS | 100 |
| Acrylonitrile | EPA 8240A | GC/MS | 200 |
| Benzene | EPA 8020A | GC/PID | 2.00 |
| Bromochloromethane | EPA 8240A | GC/MS | 5.00 |
| Bromodichloromethane | EPA 8010A | GC/ELCD | 1.00 |
| Bromoform | EPA 8010A | GC/ELCD | 2.00 |
| Carbon disulfide | EPA 8240A | GC/MS | 100 |
| Carbon tetrachloride | EPA 8010A | GC/ELCD | 1.00 |
| Chlorobenzene | EPA 8010A | GC/ELCD | 2.00 |
| Chloroethane | EPA 8021 | GC/ELCD | 1.00 |
| Chloroform | EPA 8010A | GC/ELCD | 0.50 |
| Dibromochloromethane | EPA 8010A | GC/ELCD | 1.00 |
| 1,2-Dibromo-3-chloropropane | EPA 8010A | GC/ELCD | 30.0 |

**TABLE 1**
(continued)

| Organic Constituent | Test Method | Equipment | Detection Level, µg/L |
|---|---|---|---|
| 1,2-Dibromoethane | EPA 8021 | GC/ELCD | 10.0 |
| 1,2-Dichlorobenzene | EPA 8021 | GC/ELCD | 0.50 |
| 1,4-Dichlorobenzene | EPA 8240A | GC/MS | 5.00 |
| Trans-1,4-dichloro-2-butene | EPA 8240A | GC/MS | 100 |
| 1,1-Dichloroethane | EPA 8021 | GC/ELCD | 0.50 |
| 1,2-Dichloroethane | EPA 8010A | GC/ELCD | 0.50 |
| 1,1-Dichloroethylene | EPA 8021 | GC/ELCD | 0.50 |
| Cis-1,2-dichloroethylene | EPA 8010A | GC/ELCD | 0.50 |
| Trans-1,2-dichloroethylene | EPA 8021 | GC/ELCD | 0.50 |
| 1,2-Dichloropropane | EPA 8010A | GC/ELCD | 0.50 |
| Cis-1,3-dichloropropene | EPA 8240 | GC/MS | 10.0 |
| Trans-1,3-dichloropropene | EPA 8010A | GC/ELCD | 5.00 |
| Ethylbenzene | EPA 8020A | GC/PID | 2.00 |
| 2-Hexanone | EPA 8240A | GC/MS | 50.0 |
| Methyl bromide | EPA 8021 | GC/ELCD | 10.0 |
| Methyl chloride | EPA 8021 | GC/ELCD | 10.0 |
| Methylene bromide | EPA 8240A | GC/MS | 10.0 |
| Methylene chloride | EPA 8010A | GC/ELCD | 5.00 |
| Methyl ethyl ketone | EPA 8240A | GC/MS | 100 |
| Methyl iodide | EPA 8240 A | GC/MS | 10.0 |
| 4-Methyl-2-pentanone | EPA 8240A | GC/MS | 100 |
| Styrene | EPA 8020A | GC/PID | 1.00 |
| 1,1,1,2-Tetrachloroethane | EPA 8010A | GC/ELCD | 0.50 |
| 1,1,2,2-Tetrachloroethane | EPA 8010A | GC/ELCD | 0.50 |
| Tetrachloroethylene | EPA 8021 | GC/ELCD | 0.50 |
| Toluene | EPA 8020A | GC/PID | 2.00 |
| 1,1,1-Trichloroethane | EPA 8240A | GC/MS | 5.00 |
| 1,1,2-Trichloroethane | EPA 8240A | GC/MS | 5.00 |
| Trichloroethylene | EPA 8010A | GC/ELCD | 1.00 |
| Trichlorofluoromethane | EPA 8240A | GC/MS | 5.00 |

**TABLE 1**
(continued)

| Organic Constituent | Test Method | Equipment | Detection Level, µg/L |
|---|---|---|---|
| 1,2,3-Trichloropropane | EPA 8021 | GC/ELCD | 5.00 |
| Vinyl acetate | EPA 8240A | GC/MS | 50.0 |
| Vinyl chloride | EPA 8240A | GC/MS | 10.0 |
| Xylenes | EPA 8020A | GC/PID | 5.00 |

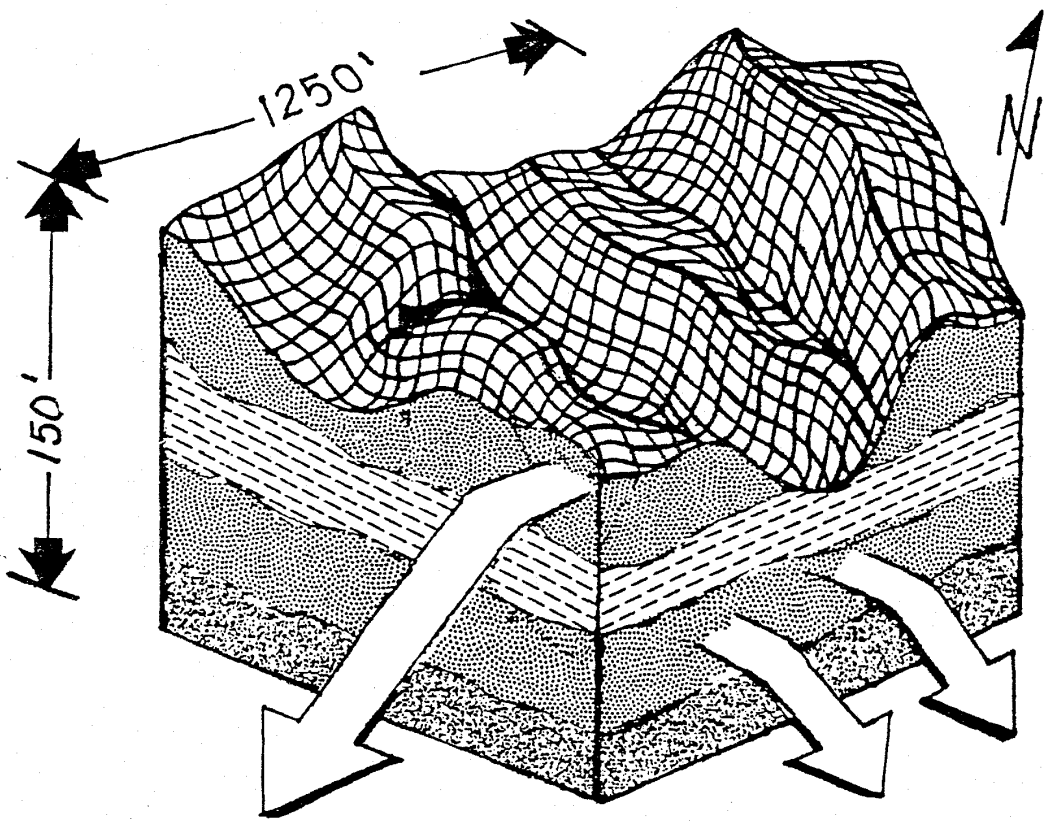
EPA Test Methods from "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. EPA Publication SW-846, 3rd Edition, September 1986, Amended by Update I, July 1992. Update I methods are designated with the letter "A" on the end of the method numbers. Update I was promulgated by 58 FR, August 31, 1993.

Equipment:

ICP Inductively Coupled Plasma - Atomic Emission Spectrophotometer
GF/AA Graphite Furnace - Atomic Absorption Spectrophotometer
GC/MS Gas Chromatograph - Mass Spectrometer
GC/PID Gas Chromatograph - Photoionization Detector
GC/ELCD Gas Chromatograph - Electrolytic Conductivity Detector

# APPENDIX A
# N.C. WATER QUALITY MONITORING GUIDANCE DOCUMENT

NORTH CAROLINA WATER QUALITY
MONITORING GUIDANCE DOCUMENT FOR SOLID WASTE FACILITIES




GROUND-WATER FLOW DIRECTION OF UPPER AQUIFER

GROUND-WATER FLOW DIRECTION OF LOWER AQUIFER

Prepared by the
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH
ENVIRONMENTAL HEALTH SECTION
DIVISION of HEALTH SERVICES
DEPARTMENT of HUMAN RESOURCES
1987
SW-1001-87

# NORTH CAROLINA WATER QUALITY
# MONITORING GUIDANCE DOCUMENT FOR SOLID WASTE FACILITIES

Prepared by the
SOLID & HAZARDOUS WASTE MANAGEMENT BRANCH
ENVIRONMENTAL HEALTH SECTION
DIVISION of HEALTH SERVICES
DEPARTMENT of HUMAN RESOURCES

1987

SW-1001-87

## LIST OF FIGURES

FIGURE PAGE

1. Typical Ground-Water Monitoring Well Schematic Diagram . . . . . .2
2. Graphical Plot of Standing Water Volumes . . . . . .4
3. Laboratory Analysis Request Sheet . . . . . 9
4. Chain of Custody Form . . . . . .10
5. Typical Ground-Water Monitoring Well Nest Schematic . . . . . .14

TABLE OF CONTENTS

PAGE

ACKNOWLEDGEMENTS . . . . . i
DEFINITIONS . . . . . ii
GENERAL INTRODUCTION . . . . . iii
INTRODUCTION . . . . . 1
SPECIFIC MONITORING WELL CONSTRUCTION REQUIREMENTS . . . . . 1
GROUND-WATER MONITORING . . . . . .5
PORTABLE MONITORING . . . . . .5
PURGING METHODS . . . . . .5
SAMPLING METHODS . . . . . .6
DEDICATED MONITORING . . . . . .7
EQUIPMENT CLEANING PROCEDURES . . . . . .7
SAMPLE CONTAINERS . . . . . 8
TRANSPORT AND STORAGE OF SAMPLES . . . . . 11
ADMINISTRATIVE PROCEDURES . . . . . .11
SURFACE WATER MONITORING . . . . . .12
FRACTURED WATER MONITORING . . . . . .13
REFERENCES CITED . . . . . .16

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Michael L. Babuin, 1987

DEFINITIONS

Monitoring Well - any well constructed for the primary or incidental purpose of obtaining subsurface samples of water or other liquids. This definition excludes lysimeters, tensiometers, and other devices used to investigate the characteristics of the unsaturated zone.

Observation Well - any well constructed for the purpose of obtaining ground-water level information only

Permittee - an individual, corporation, company, association, partnership, unit of local government, State agency, Federal agency or other legal entity upon which a permit to operate a sanitary landfill has been issued.

Water Table - the upper limit of the portion of the ground wholly saturated with water.

# GENERAL INTRODUCTION

The purpose of this report is to provide a simple, clear and thorough overview of acceptable methods regarding ground and surface-water monitoring at solid waste facilities. The procedures and techniques outlined in this report have been compiled in response to the need for reliable, accurate and consistent data for ground-water and surface-water quality evaluation of sanitary landfills. The standardization of these methods of data collection will undoubtedly clarify proper ground-water monitoring techniques required by the State for all solid waste facilities, and subsequently, minimize much of the subjectivity associated with landfill evaluation. Clearly, it is in the best interests of each facility to utilize these guidelines whereas the probability of contamination is significantly reduced by following the steps outlined in this document.

INTRODUCTION

In order to fully acknowledge the scope and purpose of ground-water monitoring, it is of the utmost importance to fully understand and define the difference between a ground-water monitoring well and a public water supply well. This distinction is very obvious when comparing well construction techniques characteristic of various geologic formations throughout the State. For instance, the western part of North Carolina is dominated by a series of crystalline and metamorfic rocks. Subsequently, water supply wells in these regions typically are constructed by drilling through the saprolite (weathered rock) and into very hard, resistant rock bodies below the true water table. Because of the resistant lithologic character of these units, many well drillers feel that it is unnecessary to case a well characteristic of these type of conditions. This rationale may hold true for drinking water supply wells but is clearly unacceptable for ground-water monitoring purposes due to contamination problems associated with uncased or partially-cased holes and to possible logistic problems. For instance, monitoring equipment may become entangled on the bottom of a well casing which does not span the entire depth of the borehole. Subsequently, this office requires completely cased boreholes in all ground-water monitoring wells.

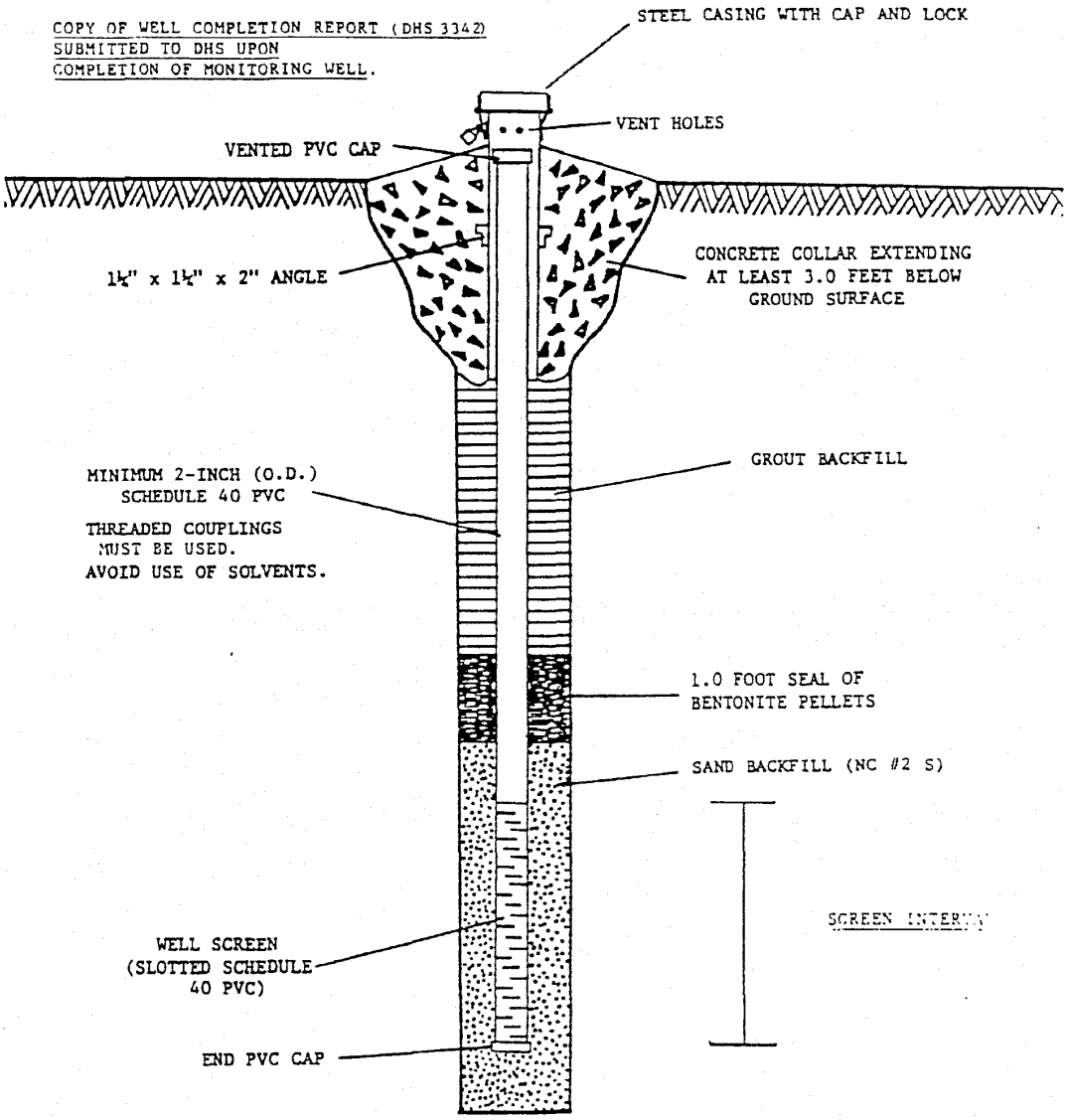
This office strongly urges all contractors and consultants to become familiar with well construction techniques and specifications illustrated on the ground-water monitoring well schematic (Figure 1). Further information regarding construction standards of other types of wells may be found in 15 NCAC 2C "Well Construction Standards: Criteria and Standards Applicable to Water Supply and Certain Other Types of Wells".

A. Specific Monitoring Well Construction Requirements

Because the location of ground-water monitoring wells at the proposed landfill is one of the most crucial phases of site development, the importance of a thorough hydrogeologic evaluation which clearly delineates ground water elevation and flow characteristics is of the highest significance. In order to assure consistent and thorough installation techniques which are in accordance with EPA regulations, all deviations to the following methods, or questions regarding materials, monitoring well locations or other techniques, should be directed to the Solid Waste Hydrogeologist at (919) 733-2178, c/o the Solid and Hazardous Waste Management Branch P.O. Box 2091 Raleigh, North Carolina 27602-2091. Additionally, the Solid and Hazardous Waste Management Branch reserves the right to evaluate in the field, the actual well installation techniques and procedures.

Drilling through the unsaturated soil mantle to the water bearing formation is a standard procedure with most consulting and well-drilling firms. Utmost caution and discretion in minimizing the use of drilling fluids (bentonite-gel mixture), flocculants (mixtures of sodium pyrophosphate) and excessive use of lubricants is highly recommended. If any of these products, or related products, are used in the drilling process the hole should be flushed to remove as much of the contaminants as possible

Installation of the monitoring well and subsequent placement of the well screen is critical to assure that the ground water sample represents the




Rev. 5/86

Figure 1. Typical ground-water monitoring well schematic diagram.

portion of the aquifer where contaminants may migrate. The minimum length of the screened interval is 10 feet and will be placed at a depth specified as a condition of the permit based upon hydrogeologic data collected during the site investigation. Recommended screen depths will be submitted by the applicant under the heading "proposed comprehensive ground-water monitoring plan" as part of the site plan application as per section .0504 (1)(G)(iv). Well-sorted sand used as a pre-screening of influent ground water should be washed to remove all fines and prevent clogging of the well screen. Finally, in connecting sections of PVC pipe, clamps or threaded pipe fittings are required whereas various types of epoxy cement and other PVC glues have the potential for contaminating the ground-water reservoirs. For these reasons they are not authorized for construction of ground-water monitoring wells.

Various drilling methods and casing sizes are available for installation of monitoring wells. Generally, the most common size bore holes include those which are drilled with an eight inch hollow-stem auger. The casings which are placed in these holes are typically 4" or 2" I.D., and composed of PVC, stainless steel or teflon materials. For reasons which are discussed later under the "Ground-Water Monitoring" heading, this office recommends the use of 2" I.D. casings for wells drilled 100' or less. Ground-water monitoring wells drilled to depths exceeding 100' such as wells designed to monitor water quality through possible fracture patterns, should be cased with a 4" or 6" I.D. casing to readily promote rapid purging via jet pumps. Casings and screens may be composed of PVC or stainless steel. Teflon casings and screens are relatively maleable and may not hold-up under various conditions.

As mentioned above, this office recommends the installation of 2" I.D. cased wells for shallow and semi-shallow ground-water monitoring purposes. The use of 2" I.D. casings readily promotes rapid purging via teflon bailers. For example, a 2" I.D, cased well drilled 20 feet deep may contain up to approximately 3.3 gallons of standing water. Because three to five times the volume must be purged to avoid contamination (EPA, 1977), it is foreseeable that 9.9 to 16.5 gallons of water must be purged prior to sampling (Figure 2) in the above example. Assuming a purging minimum of 9.9 gallons of water, and also assuming that a 3' long bailer (which holds 1-liter of water) will be used for purging of the wells, it will take approximately 40 bails of water to adequately purge this well. Comparatively, a 4" I.D. cased well drilled to an extremely shallow depth of 16' will contain approximately 10.5 gallons of water, and subsequently, require between 31.5 and 52.5 gallons of purged water. Attempts to purge 52.5 gallons of water with a 1-liter bailer will require 210 bails of water-- which will undoubtly displease the field personnel and more importantly, occupy additional hours of expensive and needless labor as well.

An obvious difference shown on the schematic of a typical ground-water monitoring well (Figure 1), compared to other types of wells, is the concrete collar surrounding the stick-up (or outer casing) above the ground surface. This collar should contain small angle-irons attached to the outer casing as outlined on the diagram (Figure 1). The purpose of this set-up is to prevent accidental (or willfull) damage to the well whereas the stick-up could otherwise be pulled loose at the surface without the use of angle-irons to support the collar.

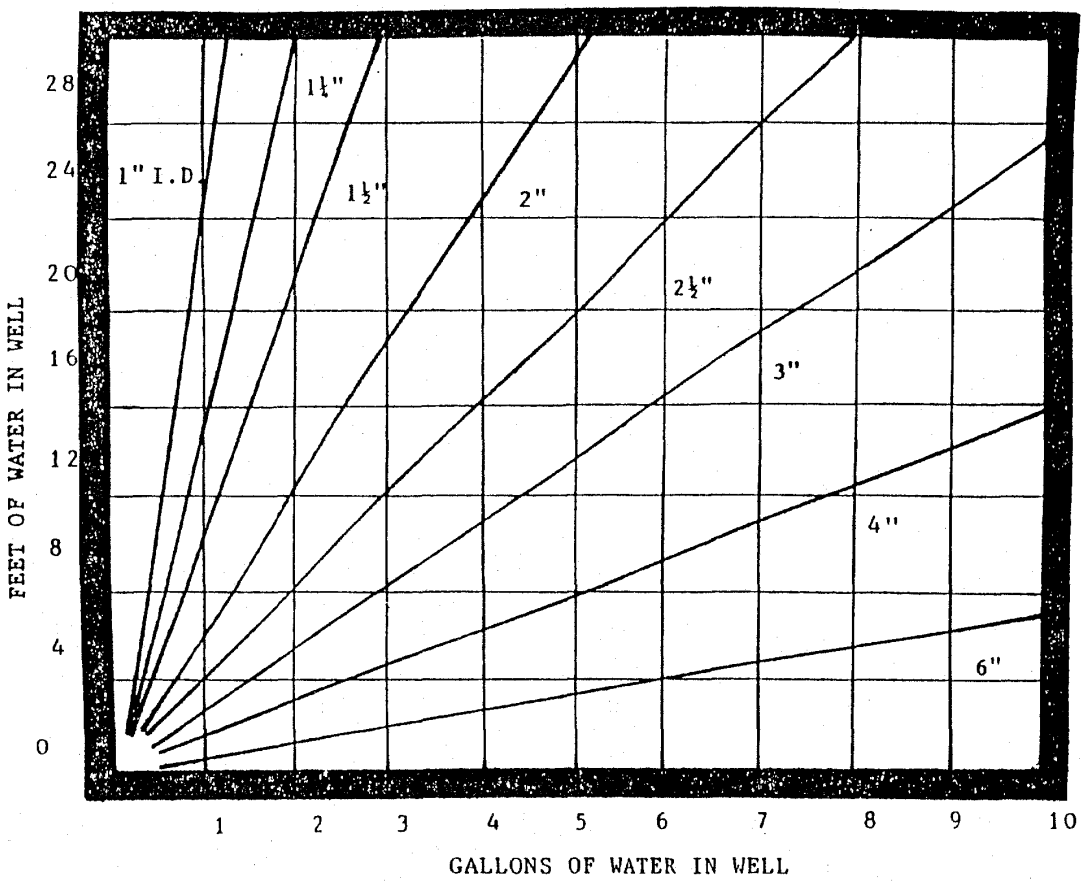



Figure 2. Graphical plot of standing volumes of water.

Because accidental or natural events may influence the status and condition of pre-existing ground-water monitoring wells, an on-going well inspection program is being conducted by personnel of the Solid andHazardous Waste Management Branch. Some of the items which must be regularily maintained by the facility after the wells are installed include: 1) ensuring that all caps are rust-free and locked at all times, 2) ensuring that all inner casings are securely fit with a threaded cap, 3) ensuring that the outer casing is upright and undamaged from equipment or vehicles which may inadvertently back-up into the well, 4) ensuring that a clear unobstructed path, free from dense vegetation exists leading to each well. These maintenance factors are critical to the implementation of proper ground-water monitoring.

B. Ground-Water Monitoring

Because a tremendous liability is associated with water quality data obtained from analytical laboratory results, it is of the utmost importance to ensure the validity and integrity of sampling techniques and methodology. Two distinct monitoring systems exist which may be used to purge and subsequently sample a monitoring well. These systems include the portable monitoring system and the dedicated monitoring system.

Portable Monitoring

The portable monitoring system is by far the most common method of monitoring ground-water quality. This method includes purging the total standing water within the well and subsequent sampling of a representative portion of the aquifer. Purging is required in all instances in order to avoid sampling of stagnant, possibly stratified water above the well screen. In many cases, however, the recharge rate may meet or exceed the purging rate. For these instances three to five times the volume of standing water must be purged prior to sampling. Several methods exist for removing the standing water within a well. Among these methods are various types of automated pumps, compressed air, hand pumps and bailers, each of which has several advantages and disadvantages which will be discussed below.

In some instances dependant upon the hydrogeologic setting, the recharge rate may be exceptionally slow (EPA, 1977), subsequently, sampling may not be possible until the next day when the well is recharged. Generally however, all attempts should be made to purge the wells dry or purge until the necessary three to five times the well volume is extracted. In other settings where the soils are relatively permeable purging and subsequent sampling may be possible in the same day.

1. Purging Methods

Depending upon time constraints and spatial variability of the monitoring wells, the decision whether to purge and sample a facility on the same day must be made by the field personnel performing the monitoring operation. Additional concerns regarding the depth of the well, water volumes, well access and inclement weather are all important in determining which type of device to use in purging the well. For instance, if fully automated, effortless purging is desired and time is not a major concern, the use of an automated pump may be in order. The major disadvantage of

these pumps, however, include slow pumping rates (typically a maximum of 0.5 gallons/minute) and the potential for cross contamination from well to well.

The hand pump is another type of purging device which is available invarious lengths and pumping rates (typically 2.75 gallons/minute). This device has the advantage of easy assembly, low cost and relatively high pumping rates. An obvious disadvantage, however, is the need for a thorough cleaning in the field before purging from one well to the next.

Another popular purging device is the teflon bailer. Teflon is considered to be the preferred material to use for ground water monitoring because of its relatively inert chemical character. Stainless steel is also an acceptable purging/sampling mechanism for similar reasons. Regardless of the composition, bailers are available in various lengths, the most popular being the 3' bailer which holds a volume of water equal to 1 liter or 0.26 gallons.

2. Sampling Methods

Thus far the focus of this discussion has primarily been upon purging techniques, subseqently, a short discussion which addresses sampling procedures is now in order. The use of automated pumps for sampling purposes requires considerable effort to avoid contamination. Many automated pumps are designed to remain on the ground surface while a specified length of flexible tubing is placed into the well. For sampling purposes if this technique is to be used, it is mandatory that the flexible tubing be composed of teflon and adequately cleaned prior to sampling from one well to another. The inevitable question arises, however, whether or not adequate cleaning is possible in the field for these types of automated pumps.

Because laboratory analyses evaluate water quality in terms of parts per million and parts per billion, it is not recommended to clean and prepare sampling devices in the field when a laboratory cleaning will undoubtedly produce a higher quality final product. Other types of automated pumps (called bladder pumps) are designed to fit down the borehole and are typically composed of teflon and stainless steel. One inherent difficulty associated with some bladder pumps in addition to possible sample contamination problems is the inability of many bladder pumps to adequately control and regulate the rate at which the flow of water leaves the flexible tubing. This is critical for samples to be analyzed for volatile organic analysis (VOA) whereas a rapid flow rate will cause aeration which subsequently volatilizes certain chemicals. For these reasons this office urges that the utmost consideration and thought be given to the feasibility of whether or not to utilize traditional automated pumps for sampling purposes.

Hand pumps are useful tools for purging wells in a relatively short period of time but, unfortunately, are highly unsuitable for sampling. The main reason being the likelihood of contamination and the unavailability of teflon or stainless steel hand-pumps in the commercial market. Additionally, no present technology exists for regulating the effluent discharge of water from a hand pump which, as mentioned before, presents a volatilization problem for certain samples.

The overall preferred method of acquiring ground-water samples via portable monitoring is by the use of telfon bailers. In a properly established and equipped laboratory setting, a standardized cleaning and preparation procedure may be followed. The obvious advantage of laboratorycleaning includes minimal generation of contaminants and consistency in preparatory procedures.

Dedicated Monitoring

Thus far the previous discussions have all focused upon techniques and procedures related to portable ground-water monitoring systems. At this time, a short overview of dedicated systems is in order. Dedicated well monitoring differs from portable monitoring primarily by the permanency of the set-up and the higher initial cost. Because portable systems require the use of much of the same equipment from well to well, great care must be exercised in avoiding cross contamination. Dedicated systems, however, require no between-well cleaning procedures. These systems offer permanently affixed down-well and well-head components which are capped after initial set-up.

Because ground water is not in contact with incompatible constituents that otherwise may enter the well from the surface, virtually no contamination is possible from an extrinsic source during times between sampling intervals. As with all sampling methods the competency and integrety of the individual extracting the sample is of the utmost importance. For instance, a great deal of manual dexterity must be exercised in regulating the flow of water leaving the flexible tubing from dedicated systems when collecting VOA samples in order to avoid unnecessary volatilization. In conclusion, dedicated systems have the potential for accurate and reliable ground-water monitoring and are therefore recommended for consideration.

In contrast to this, many individuals are under the false impression that bailers which are initially cleaned in a laboratory and permanently placed in monitoring wells are considered dedicated systems and subsequently are acceptable for ground-water monitoring purposes. Unfortunately, this is not true due to the possibility of extrinsic contamination during sampling intervals, such as decomposition of the bailer line, airborne dirt and dust, or other accidentally induced contaminants. Because the detection limits for the various parameters are measured in terms of parts per million and parts per billion, the utmost discretion is required in selecting sampling procedures which will accomodate these analyses.

1. Equipment Cleaning Procedures

If automatic pumps and flexible tubing are used, a minimum field cleaning procedure will entail using a phosphate-free soap/deionized water solution followed by a deionized water rinse. This method constitutes an absolute minimum field cleaning procedure and should only be used if sampling one G.W. monitoring well. These pumps are not recommended or authorized for sampling more than one well due to probable contamination problems.

Stainless steel bailers require the following minimum cleaning techniques prior to groundwater sample collection:

1. Phosphate-free soap and tap water wash
2. Tap-water rinse
3. Deionized or distilled water rinse
4. Isopropyl alcohol rinse
5. Deionized or distilled water rinse
6. Air dry
7. Wrap bailer to prevent contamination before use (specify the material used for wrapping the bailer, example: aluminum foil shiny side out).

Teflon bailers require the following minimum cleaning techniques prior to ground water sample collection:

1. Phosphate-free soap and tap water wash
2. Tap water rinse
3. 10% nitric or 10% hydrochloric acid rinse
4. Deoinized or distilled water rinse
5. Isopropyl alcohol rinse
6. Deionized or distilled water rinse
7. Air dry
8. Wrap to prevent contamination before use (specify material used for wrapping for wrapping the bailer, example: aluminum foil, shiny side out).

The bailer line which attaches to the teflon or stainless steel bailers should consist of either 1) teflon coated wire, 2) single-strand stainless-steel wire, 3) other monofilament line or 4) nylon rope. In order to avoid contamination, a new segment of one of the above approved types of line should be used at each well. Reusing old line will increase the probability of cross contamination (even if the line is cleaned) and therefore is not approved. Any variation to the above cleaning procedures should be submitted to this office for approval.

Condition

The above cleaning procedures were obtained from EPA Region IV. If changes occur in any procedure specified above, the facility will be notified and be requested to make the necessary ammendments to the sampling and analysis plan.

Sample Containers

Because water samples are analyzed for various parameters, several types of containers are required for a complete sampling scheme. Routine ground-water monitoring should include (in the following order as extracted from the well): 1) VOA samples (for TOX analysis), and 2) heavy metal (inorganic) analysis. If additional analyses are required, the samples should be collected in the order listed below.

For instance, samples which are analyzed for volatile organic analysis (VOA) and/or total organic halogens (TOX) should be collected first in 40 ml glass vials with teflon caps. Two full vials per sample are required.

9

N. C. Department of Human Resources
Division of Health Services

# SAMPLE ANALYSES REQUEST

State Laboratory of Public Health
P. O. Box 28047
306 N. Wilmington Street
Raleigh, 27611

Site Number _____ Field Sample Number _____

Name of Site _____ Site Location _____

Collected By _____ ID# _____ Date Collected _____ Time _____

Type of Sample:

| Environmental | Concentrate | Comments |
|---|---|---|
| ____ Groundwater (1) | ____ Solid (5) | _____ |
| ____ Surface Water (2) | ____ Liquid (6) | _____ |
| ____ Soil (3) | ____ Sludge (7) | _____ |
| ____ Other (4) | ____ Other (8) | _____ |

## INORGANIC CHEMISTRY

| Extractables | | Total | | | |
|---|---|---|---|---|---|
| Parameter | Results mg/1 | Parameter | Results mg/1 | Parameter | Results mg/1 |
| ____ Arsenic | _____ | ____ Arsenic | _____ | ____ Silver | _____ |
| ____ Barium | _____ | ____ Barium | _____ | ____ Sulfates | _____ |
| ____ Cadmium | _____ | ____ Cadmium | _____ | ____ Zinc | _____ |
| ____ Chromium | _____ | ____ Chloride | _____ | ____ Ph | _____ |
| ____ Lead | _____ | ____ Chromium | _____ | ____ Conductivity | _____ |
| ____ Mercury | _____ | ____ Copper | _____ | ____ TDS | _____ |
| ____ Selenium | _____ | ____ Fluoride | _____ | ____ TOC | _____ |
| ____ Silver | _____ | ____ Iron | _____ | ____ _____ | _____ |
| ____ _____ | _____ | ____ Lead | _____ | ____ _____ | _____ |
| ____ _____ | _____ | ____ Manganese | _____ | ____ _____ | _____ |
| ____ _____ | _____ | ____ Mercury | _____ | ____ _____ | _____ |
| ____ _____ | _____ | ____ Nitrate | _____ | ____ _____ | _____ |
| ____ _____ | _____ | ____ Selenium | _____ | ____ _____ | _____ |

## ORGANIC CHEMISTRY

| Parameter | Results mg/1 | Parameter | Results mg/1 | Parameter | Results mg/1 |
|---|---|---|---|---|---|
| ____ P&T:GC/MS | _____ | ____ EDB | _____ | ____ Methoxychlor | _____ |
| ____ Acid:B/N Ext. | _____ | ____ PCB's | _____ | ____ Toxaphene | _____ |
| ____ TOX | _____ | ____ Petroleum | _____ | ____ 2,4-D | _____ |
| ____ _____ | _____ | ____ Endrin | _____ | ____ 2,4,5-TP (silvex) | _____ |
| ____ _____ | _____ | ____ Lindane | _____ | ____ _____ | _____ |

## MICROBIOLOGY

| Parameter |
|---|
| ____ (MF) Coliform Colonies/100mls |
| ____ (MPN) Coliform Colonies/100mls |
| ____ _____ |
| ____ _____ |

## RADIOCHEMISTRY

| Parameter | Results PCi/1 |
|---|---|
| ____ Gross Alpha | _____ |
| ____ Gross Beta | _____ |
| ____ _____ | _____ |
| ____ _____ | _____ |

Date Received _____ Date Reported _____

Date Extracted _____ Date Analyzed _____

Reported By _____ Lab Number _____

DHS 3191 (Revised 7/85)
Solid and Hazardous Waste (Review 7/87)

Figure 3. Laboratory analysis request sheet.

10

Chain of Custody Record

Solid & Hazardous Waste Materials

Location of Sampling: _____Generator _____Transporter _____Treatment Facility

_____Storage Facility _____Disposal Facility _____Landfill

_____Other: _____

Company's Name _____ Telephone(_____)_____

Address _____

Collector's Name _____ Telephone(_____)_____
signature

Date Sampled _____ Time Sampled _____

Type of Process Generating Waste _____

Field Information

_____

_____

Field Sample No. _____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____

Chain of Possession:

1. _____ _____ _____
signature title inclusive dates

2. _____ _____ _____
signature title inclusive dates

3. _____ _____ _____
signature title inclusive dates

Results reported

_____ _____ _____
signature title date

Instuctions: Complete all applicable information including signature, and submit with analysis request forms.

Figure 4. Chain of custody record.

Samples which will be analyzed for inorganic constituents such as heavy metals should be collected following the VOA samples. These samples are collected in small, disposable, 1-quart/1-liter plastic cubes. Two full cubes per sample are required. Depending upon the source of the sample containers, particularly, containers which hold water to be analyzed for heavy metals, some containers may have a pre-measured amount of acid placed in the container to act as a preservative. In these instances do not rinse the sample container prior to use, if uncertain, consult the laboratory where the containers were purchased.

If organic contamination is suspected it may be necessary to undergo a complete organic analysis. In this event, samples which will be analyzed for organics such as an acid-base neutral analysis should be collected in one half gallon/2-liter glass jars with aluminum foil or teflon lined caps. Samples to be tested via acid-base neutral analysis require one full jar of water per sample.

Water samples to be analyzed for radiologic parameters should be collected following acid-base neutral collection. These samples must be collected in the large 1-gallon/4-liter plastic cubes.

Finally, samples which will be analyzed for bacteriological parameters should be collected last in 120ml plastic vials containing a pre-measured amount of sodium thyosulphate. One vial per sample is required to perform the analysis.

Transport and Storage of Samples

Upon completion of water sample collecting all samples will be stored and subsequently transported on ice or in a refrigerated state to the laboratory performing the analyses (APHA, 1985; EPA, 1977). The samples should be stored in such a manner as to inhibit breakage or accidental spills. Unless unusually extraordinary circumstances prevent otherwise, all samples should be delivered to the laboratory on the same day.

Administrative procedures

Samples are to be delivered to a State Certified Drinking Water Laboratory and need to be accompanied by two administrative forms. The first form is a laboratory analysis request sheet (Figure 3). This form stipulates which constituents are to be analyzed for a given sample. The other form is a chain of custody record sheet (Figure 4). This form documents who handled the sample from collection time to lab delivery. These forms (or equivalents) will be submitted to the solid waste hydrogeologist within 15 days of receipt of the analytical results.

Per 10 NCAC 10G section .0601 (a), routine ground-water monitoring shall be the responsibility of the permittee and may be State supervised at the discretion of the Division of Health Services. An exception to this being the initial sampling of newly constructed wells by personnel of the Division of Health Services. Additionally, the State may request "split" or replicate samples from the facility during any of the routine sampling intervals.

Routine ground-water monitoring which encompasses the parameters listed below shall be conducted twice during the first year of operation (for newly-permitted sites) and annually thereafter. Newly-permitted facilities are required to properly install all proposed ground-water monitoring wells and subsequently notify the State within 30 days upon completion, so that the Division of Health Services may schedule a date to initially sample the wells. As mentioned above, subsequent sampling is the responsibility of the facility. All pre-existing (permitted) facilities as of July 1, 1987 are responsible for annual ground-water monitoring activities, and shall forward a copy of the analytical laboratory results within 15 days upon receipt to the solid waste hydrogeologist P.O. Box 2091, Raleigh, North Carolina 27602-2091 c/o the Solid and Hazardous Waste Management Branch.

All facilities (newly-permitted and pre-existing) shall send written notice by July 1, 1987 designating a tentative, annual sampling date for their facility. The purpose of which is to inform State personnel as to a specific date that they may expect the annual water quality results and to accomodate scheduling purposes by State personnel.

The following total inorganic parameters will be included for routine, annual ground-water quality analysis: arsenic, barium, cadmium, chloride,chromium, copper, fluoride, iron, lead, manganese, mercury, nitrate, selenium, silver, sulphates and zinc. The following indicators should be included in all routine, annual ground-water analysis : TOX (total organic halogens), TOC (total organic carbon, TDS (total dissolved solids), BOD (biological oxygen demand), COD (chemical oxygen demand), conductivity and PH. In the event that a contaminant plume is indicated by routine analysis of the monitoring wells, further analysis may be required to adequately assess contaminant migration and extent. Such anaysis may include purge and trap analysis (utilizing the gas chromatograph and mass spectrometer) and acid base-neutral extraction. Finally, a broad level of consistency should be exercised in listing the various quanities of chemical constituents. For instance, units should be PPM (parts per million) or PPB (parts per billion) not both. It is suggested tht parts per million (PPM) be used whenever possible.

C. Surface-Water Monitoring

Sites which contain and/or border small rivers, streams or branches should include within the site plan application, a prospective surface water monitoring plan. This plan will be used to gauge the effect of the landfill upon surficial flow at a given point. A simple procedure for selecting surface-water monitoring sites is to locate a point on the stream where drainage leaves the site. This promulgates detection of contamination through, and possibly downstream, of the site via discharge of surface waters. The sampling points selected should be downstream from any new, old or proposed areas which may be disturbed, including borrow and rubble areas (Babb and Glaser, 1985). An upstream surface water sample should be obtained in order to determine the water quality upstream of the influence of the sanitary landfill.

The following procedure is recommended regarding sample collection of surface water samples. Prior to collecting the sample in the appropriate

container, specific collection points should be determined. Generally, automated or semi-automated samplers or other manual devices accessible from the banks of a stream should be used whenever possible. If logistic or naturally occurring conditions inhibit this method of sample collection, the amples may be obtained manually by wading up-current (and down-stream) of the sample station. The sample should be collected in an area representative of minimal turbulence and aeration (Babb and Glaser, 1985). Because sample containers may be dipped by hand into the stream, extreme caution must be employed in avoiding contamination into the mouth of the container. The following procedures extracted from the "approved RCRA Ground-Water Sampling and Analysis Plan" (Babb and Glaser, 1985) are recommended for extraction and subsequent collection of surface water samples.

1. Hold the bottle near the base with one hand, and with the other, remove the cap.

2. Rinse the sample container with the water to be sampled prior to filling the container. One exception to this is the coliform sample bottle. This bottle may have a pre-measured amount of sodium thyosulphate to neutralize any chlorine present in the water, therefore, this container should not be rinsed prior to sampling.

3. Push the sample container rapidly into the water (mouth down) and tilt-up towards the current to fill. A depth of about six inches is satisfactory. Great care should be taken to avoid breaching the surface while filling the container.

4. During times of little current movement move the container slowly through the water laterally.

5. During times of extreme drought when stream depths are to shallow to allow submersion of the sample container, a pool may be scooped-out of the channel bottom and allowed to clear prior to sampling.

6. Lift the container from the water, and leave one-half inch of air space, and place the uncontaminated cap back-on the container.

7. Place the samples in styrofoam shipping cartons (on ice) for courier transport to the laboratory.

8. A completed Division of Health Services Form 2887 or equivalent (Figure 3) must be submitted along with the samples to the appropriate certified laboratory performing the analysis.

For additional details and further information on how to properly collect, store and transport stream samples, see N.R.C.D. draft on physical and chemical monitoring (in preparation).

D. Fractured Rock Monitoring

Many portions of Western and Central North Carolina are dominated by fractured cystalline rock. These fractures may be expressed on the surface, but more typically, are characteristic of subsurface environments. Areas

14

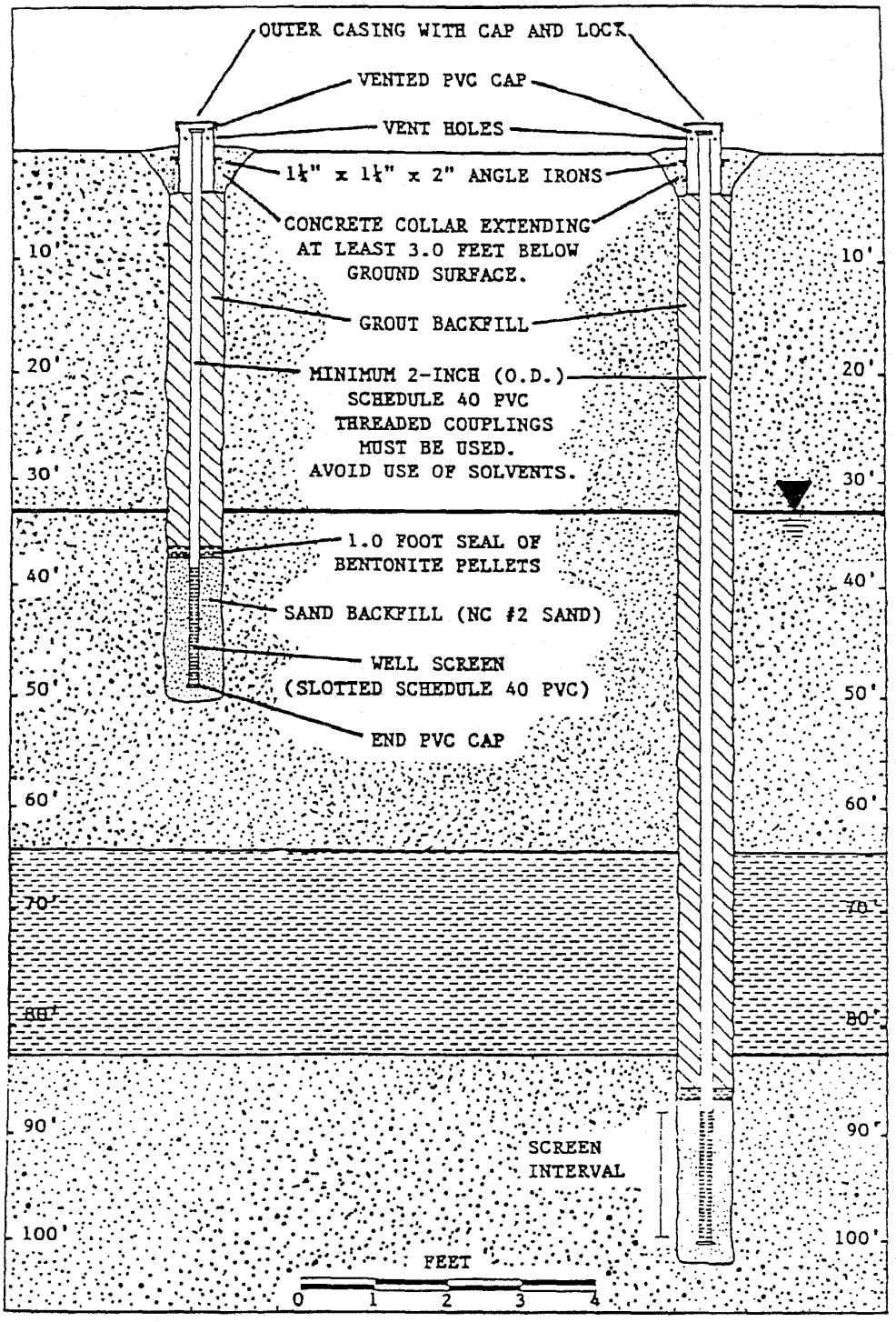



Figure 5. Typical ground-water monitoring well nest schematic.

such as these present inherent technical problems with landfill design and subsequently challenge the effectiveness and integrity of a ground-water monitoring system. The main reason being that fractured rock aquifers offe less predictability and certainty in estimating ground water flow patterns (EPA, 1977).

In order to overcome these difficulties the extent and inclination at depth of these fractures must be ascertained. The most common methods whic are available to determine these factors include remote sensing and geophysical surveys. Consultants and engineering firms, may however, specifically utilize and employ these techniques as they see fit in order t adequately address the question of inclination and depth of fracture patterns.

Upon completion of a fracture trace analysis the consulting engineering firm which is responsible for submitting the site plan application will include as part of the proposed ground-water monitoring plan, tentative dee ground-water monitoring well locations at points where fractures intersect and/or at localities characteristic of pronounced lineations which may border or disect the prospective site. As with all proposed well sites, th borehole depths, screen depths and screened intervals will be defined in th report and confirmed with the Division of Health Services prior to drilling. If two aquifers exist beneath a site, a well nest (Figure 5) may be required to adequately assess the migration of potentially contaminanted ground water in both hydrologic regimes..

In most instances, fracture monitoring requires drilling 100 to 200 fee below the surface. This presents a problem for conventional purging methods as described previously in this document. For these wells, a jet pump or equivalent pump which offers a rapid displacement of water will be required for purging. Sampling is performed as described earlier via teflon bailers. A dedicated monitoring system may be used in lui of bailers if depths are not considered a major problem. Consult your industrial representative before purchasing dedicated systems to evaluate the effectiveness of the dedicated device as applied to your specific well requirements.

## REFERENCES

American Public Health Association, 1985. Standard Method for the Examination of Water and Waste Water, 13th edition.

Babb, G., and Glaser, R., 1985. An Approved RCRA Groundwater Sampling and Analysis Plan. N.C. Solid & Hazardous Waste Management Branch Technical Report, 7p.

Department of Human Resources, Division of Health Services, 1985. Solid Waste Management Rules (10 NCAC 10G sections .0101-.0707), p. 1-31.

Department Natural Resources and Community Development, 1984. Criteria and Standards Applicable to Injection Wells (15 NCAC 2C sections .0200-.0214), p. 33-56.

Department of Natural Resources and Community Development, 1985. Well Construction Standards: Criterea and Standards Applicable to Water Supply and Certain Other Type Wells (15 NCAC 2C sections .0101-.0119). p.1-29.

Department of Natural Resources and Community Development,1985. Classifications and Water Quality Standards Applicable to the Ground Waters of North Carolina (15 NCAC 2K sections .0101-.0319), p. 1-18.

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Department of Natural Resources and Community Development, Division of Environmental Management. Water Quality Section (in preparation). Standard Operating Procedures Manual-Physical and Chemical Monitoring, 165p.

Environmental Protection Agency, 1977. Procedures Manual for Ground-Water Monitoring at Solid Waste Disposal Facilities, 269p.

GAI CONSULTANTS

# RESPONSES TO REVIEW COMMENTS
# LENOIR COUNTY LANDFILL
# PERMIT #54-03
# LAGRANGE, NORTH CAROLINA

**SUBMITTED TO**

**MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.**
**GARNER, NORTH CAROLINA**

**JANUARY 1996**

3812-H Tarheel Drive
Raleigh, NC 27609
919/878-4478
FAX 919/878-4032

January 3, 1996

Mr. Wayne Sullivan
Municipal Engineering Services Company, P.A.
Post Office Box 97
Garner, North Carolina 27529

Re: Responses to Review Comments
Lenoir County Landfill, Permit #54-03
LaGrange, North Carolina
Project No. 94202.02

Dear Mr. Sullivan:

Responses are made herein to the review comments of Mr. Lutfy of the Division of Solid Waste Management of the North Carolina Department of Environment, Health and Natural Resources made in a letter dated September 28, 1995 pertaining to the Transition Plan for the Lenoir County Landfill, Permit #54-03.

WATER QUALITY MONITORING PLAN (February 22, 1994)

Lutfy Comment: The text and plans need to be revised to reflect the upgraded monitoring system that is now being used at the Lenoir County Landfill. Likewise the Tables and Appendices should be revised to reflect current conditions.

Response: Revised text, tables and appendices reflecting the modified monitoring system for the Lenoir County landfill were submitted on October 4, 1994, in a report entitled "Water Quality Monitoring System Modifications and Water Sampling and Testing, Lenoir County Landfill, LaGrange, North Carolina, Permit No. 54-03."

Lutfy Comment: Table 3: Have the maintenance problems identified with the previously existing monitoring wells been corrected?

Response: Maintenance problems of the previously existing monitoring wells were corrected at the time modifications were made to the water quality system as described in the October 4, 1994 report.

Lutfy Comment: On the map illustrating the location of well # 5 there is a notation for an on-site water supply well. What is the exact location and design for this well? The location of this well should be indicated on the Local Area Study Map. Has the well ever been sampled for chemical analyses? If so, please supply copies of the sampling analytical data.

Response: The approximate location of the water supply well near Groundwater Monitoring Well 5 is on the enclosed drawing (Enclosure I). GAI and Lenoir County have been unable to locate the design or construction record for this water supply well. Samples of water from the water supply well were tested in March 1994 for total petroleum hydrocarbons. A copy of the results is in Enclosure II.

**Mr. Wayne Sullivan**
**January 3, 1996**
**Page 2**

SAMPLING AND ANALYSIS PLAN (SAP)

Lutfy Comment: The revised SAP, dated April 1995, appears generally okay. At the bottom of page five, specific conductivity should be reported along with other field sampling data.

Response: The Sampling and Analysis Plan dated November 1995 submitted herewith requires reporting specific conductivity.

Lutfy Comment: The landfill owner and operator is also required to report the direction and rate of ground-water flow for each monitoring well for each monitoring event.

Response: Direction and rate of groundwater flow for each monitoring well is provided as part of each sampling event report.

Lutfy Comment: The data for each sampling event must be compared with the N.C. Groundwater Standards and analyzed for statistically [sic]

Response: Appropriate comparisons and statistical analyses will be made as required.

Lutfy Comment: GAI needs to provide a separate copy of the revised SAP to each County to be included in their copy of the Transition Plan. For the Transition Plans to be maintained by the Solid Waste Section, either a sheet referencing the revised SAP on file should be placed in each County's Transition Plan or a separate copy of the revised SAP needs to be placed in each of the various Counties Transition Plans.

Response: Copies of the revised November 1995 SAP are submitted for inclusion in each County's Transition Plan.

BASELINE SAMPLING REPORT

Lutfy Comment: There was no evaluation of the ground-water quality data based upon comparison to the N.C. Groundwater Standards. Nor was there any statistical evaluation of the data.

Response: An evaluation of the groundwater quality data with comparison to the N.C. Groundwater Standards is in Table 1 (Enclosure III). Appropriate statistical analyses will be made as required.

APPENDIX II SAMPLING REPORT

Lutfy Comment: There was no evaluation of the ground-water quality data based upon comparison to the N.C. Groundwater Standards. Nor was there any statistical evaluation of the (Appendix I) data.

Response: An evaluation of the groundwater quality data with comparison to the N.C. Groundwater Standards is in Table 1 (Enclosure III). Appropriate statistical analyses will be made as required.

Lutfy Comment: No information was provided on the direction and rate of the ground-water flow for each of the monitoring wells.

**Mr. Wayne Sullivan**
**January 3, 1996**
**Page 3**

Response: Direction and rate of groundwater flow for each monitoring well for the Appendix II Sampling Report of August 9, 1995 by Environment 1, Inc., Greenville, North Carolina is in Table 2 (Enclosure IV). Support documentation for Table 2 are in Enclosure V.

Sincerely,
GAI Consultants - NC, Inc.

Thomas J. Rossbach, Ph.D., P.G.
Staff Geologist

Wendell W. Parker, Ph.D., P.E.
Vice President

WWP/kla

**ENCLOSURE I**

**WATER SUPPLY WELL LOCATION**

**ENCLOSURE II**

**CHEMICAL TEST DATA**
**WATER SUPPLY WELL**

SOUTHERN TESTING AND RESEARCH LABORATORIES, INC.
3709 AIRPORT DRIVE - WILSON, NC 27893
PHONE (919) 237-4175 FAX (919) 237-9341

FORM 65
TOTAL PETROLEUM HYDROCARBONS
METHOD: SW846 - 3510/8015
Catalog No.: EO-65

LAB SAMPLE NO.(s): 8092A1 of: 1 Date Reported: 92/04/15

Received From Date Received: 92/04/08

NAM : R.T. BRAFFORD
ORG : COUNTY OF LENOIR
ADD : P.O. BOX 757
CSZ : KINSTON, NC 28501

Account No.: 45017
Telephone : 527-2191
PO/Job No. :

Sample(s) of : WATER

Marked A: LENOIR #1 TPH 4-8-92 1050 B:

C: D:

| | Lab Sample No.=> A: 8092A1 | B: | C: | D: |
|---|---|---|---|---|
| TPH | | | | |
| Low-to-Medium Boiling (ppm) (gasoline, kerosene, jet fuel, etc.) | : <0.1 | : | : | : |
| Higher Boiling (ppm) (diesel, fuel oil, motor oil, etc.) | : <0.[illegible] | : | : | : |

Motor Oil Detection Limit = > : 25 ppm

COMMENTS:

Laboratory Contact For Above Report

Name : DONAL MORRISSEY, B.S.
Title: CHEMIST

Reviewed and Approved

Thomas A. Dean, Jr. Ph.D.
Manager, Enviromental Department

LAB USE ONLY

| | | | |
|---|---|---|---|
| Analyst(s): DM | No. Containers: 1 | Sample Submission: N | C-O-C: Y |
| Initial : | Pickup: Y | Time: Miles: | RUSH : N |

"Quality Service At A Fair Price"

41b/92

**ENCLOSURE II**

**TABLE 1**

**LENOIR COUNTY: MONITORING WELL #1**

| CONSTITUENT | NC GW STND (MG/L) | 9/9/94 SAMPLE #1 | 10/28/94 SAMPLE #2 | 1/6/95 SAMPLE #3 | 2/24/95 SAMPLE #4 | 7/17/95 SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
|---|---|---|---|---|---|---|---|---|---|
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (15) ZINC | 2.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| | **NC GW STND (UG/L)** | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #NUM! |

| LENOIR COUNTY: MONITORING WELL #2 | | | | | | NOT TESTED | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 9/9/94 | DATE | DATE | DATE | 7/17/95 | | | |
| CONSTITUENT | NC GW STND (MG/L) | SAMPLE #1 | SAMPLE #2 | SAMPLE #3 | SAMPLE #4 | SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (15) ZINC | 2.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| | NC GW STND (UG/L) | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #NUM! |

LENOIR COUNTY: MONITORING WELL #3

| CONSTITUENT | NC GW STND (MG/L) | 9/9/94 SAMPLE #1 | 10/28/94 SAMPLE #2 | 1/6/95 SAMPLE #3 | 2/24/95 SAMPLE #4 | 7/17/95 SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
|---|---|---|---|---|---|---|---|---|---|
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | | | 0.0020 | 0.0000 | 0.0020 | 0.0020 |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | | | 0.0220 | | 0.0200 | 0.0010 | 0.0210 | 0.0210 |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | | 0.0920 | 0.0100 | | 0.0110 | 0.0384 | 0.0377 | 0.0110 |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | 0.0520 | 0.0000 | 0.0520 | 0.0520 |
| (15) ZINC | 2.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| | NC GW STND (UG/L) | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | 25.0000 | 20.0000 | | | | 2.5000 | 22.5000 | 22.5000 |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #NUM! |

| LENOIR COUNTY: MONITORING WELL #4 | | 9/9/94 | 10/28/94 | 1/6/95 | 2/24/95 | 1/17/95 | | | |
|---|---|---|---|---|---|---|---|---|---|
| CONSTITUENT | NC GW STND (MG/L) | SAMPLE #1 | SAMPLE #2 | SAMPLE #3 | SAMPLE #4 | SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | | | 0.0020 | 0.0000 | 0.0020 | 0.0020 |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | 0.0100 | | | | 0.0420 | 0.0160 | 0.0260 | 0.0260 |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | 0.0540 | | | | 0.0190 | 0.0175 | 0.0365 | 0.0365 |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | 0.0930 | 0.0000 | 0.0930 | 0.0930 |
| (15) ZINC | 2.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| | NC GW STND (UG/L) | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #NUM! |

**LENOIR COUNTY: MONITORING WELL #5**

| | | DATE | 10/28/94 | 1/6/95 | 2/24/95 | 7/17/95 | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CONSTITUENT** | **NC GW STND (MG/L)** | SAMPLE #1 | SAMPLE #2 | SAMPLE #3 | SAMPLE #4 | SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | | 0.0130 | | | | 0.0000 | 0.0130 | 0.0130 |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (15) ZINC | 2.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| | **NC GW STND (UG/L)** | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | 10.0000 | | 18.0000 | 4.0000 | 14.0000 | 14.0000 |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | 17.0000 | | | 0.0000 | 17.0000 | 17.0000 |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | 15.0000 | 5.0000 | 36.0000 | 12.9185 | 18.6667 | 15.0000 |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | 6.0000 | 0.0000 | 6.0000 | 6.0000 |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | 27.0000 | 0.0000 | 27.0000 | 27.0000 |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #NUM! |

| LENOIR COUNTY: MONITORING WELL #8 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 9/9/94 | 10/28/94 | 1/6/95 | 2/24/95 | 7/17/95 | | | |
| CONSTITUENT | NC GW STND (MG/L) | SAMPLE #1 | SAMPLE #2 | SAMPLE #3 | SAMPLE #4 | SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | 0.0020 | | 0.0020 | 0.0000 | 0.0020 | 0.0020 |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | | | | 0.0120 | 0.0390 | 0.0135 | 0.0255 | 0.0255 |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | 0.0270 | | | | | 0.0000 | 0.0270 | 0.0270 |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | 0.0450 | 0.0000 | 0.0450 | 0.0450 |
| (15) ZINC | 2.10 | 0.1420 | | | | | 0.0000 | 0.1420 | 0.1420 |
| (16)MERCURY | 0.0011 | | | | | 0.0013 | 0.0000 | 0.0013 | 0.0013 |
| | NC GW STND (UG/L) | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | 10.0000 | | 6.0000 | 6.0000 | | 1.8856 | 7.3333 | 6.0000 |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | 15.0000 | | 10.0000 | 8.0000 | | 2.9439 | 11.0000 | 10.0000 |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | 14.0000 | 11.0000 | | | | 1.5000 | 12.5000 | 12.5000 |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | 107.0000 | 73.0000 | 73.0000 | 89.0000 | 41.0000 | 21.7771 | 76.6000 | 73.0000 |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | 47.0000 | 34.0000 | | 6.5000 | 40.5000 | 40.5000 |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | 44.0000 | 25.0000 | 20.0000 | 24.0000 | 32.0000 | 8.4380 | 29.0000 | 25.0000 |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | 34.0000 | 31.0000 | 35.0000 | 23.0000 | 12.0000 | 8.6023 | 27.0000 | 31.0000 |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | 7.0000 | 8.0000 | | 0.5000 | 7.5000 | 7.5000 |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | 44.0000 | 46.0000 | | | | 1.0000 | 45.0000 | 45.0000 |
| (62) XYLENES | 530 | | | | 5.0000 | | 0.0000 | 5.0000 | 5.0000 |

**LENOIR COUNTY: MONITORING WELL #9**

| CONSTITUENT | NC GW STND (MG/L) | 9/9/94 SAMPLE #1 | 10/28/94 SAMPLE #2 | 1/6/95 SAMPLE #3 | 2/24/95 SAMPLE #4 | 7/17/95 SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
|---|---|---|---|---|---|---|---|---|---|
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | 0.0130 | | | | | 0.0000 | 0.0130 | 0.0130 |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | 0.0030 | | | | 0.0040 | 0.0005 | 0.0035 | 0.0035 |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | 0.0210 | | | | 0.0330 | 0.0060 | 0.0270 | 0.0270 |
| (7) COBALT | NE | 0.0190 | | | | 0.0170 | 0.0010 | 0.0180 | 0.0180 |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | 0.0100 | | | | 0.0150 | 0.0025 | 0.0125 | 0.0125 |
| (10) NICKEL | 0.10 | | | | | 0.0510 | 0.0000 | 0.0510 | 0.0510 |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | 0.0960 | 0.0000 | 0.0960 | 0.0960 |
| (15) ZINC | 2.10 | 0.0600 | | | | 0.0690 | 0.0045 | 0.0645 | 0.0645 |
| | **NC GW STND (UG/L)** | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #NUM! |

LENOIR COUNTY: MONITORING WELL #10

| CONSTITUENT | NC GW STND (MG/L) | 9/9/94 SAMPLE #1 | 10/28/94 SAMPLE #2 | 1/6/95 SAMPLE #3 | 2/24/95 SAMPLE #4 | 7/17/95 SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
|---|---|---|---|---|---|---|---|---|---|
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | 0.0330 | | | | 0.0130 | 0.0100 | 0.0230 | 0.0230 |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (15) ZINC | 2.10 | 0.0400 | | | | | 0.0000 | 0.0400 | 0.0400 |
| (16)MERCURY | 0.0011 | | | | | 0.0006 | 0.0000 | 0.0006 | 0.0006 |
| | NC GW STND (UG/L) | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | 7.0000 | 6.0000 | 65.0000 | 27.5802 | 26.0000 | 7.0000 |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | 18.0000 | 16.0000 | 18.0000 | 12.0000 | 11.0000 | 2.9665 | 15.0000 | 16.0000 |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | 10.0000 | | 7.0000 | 5.0000 | | 2.0548 | 7.3333 | 7.0000 |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | 103.0000 | 77.0000 | 94.0000 | 90.0000 | 106.0000 | 10.2956 | 94.0000 | 94.0000 |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | 31.0000 | | 0.0000 | 31.0000 | 31.0000 |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | 13.0000 | | 12.0000 | 11.0000 | 27.0000 | 6.5336 | 15.7500 | 12.5000 |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | 6.0000 | | | 0.0000 | 6.0000 | 6.0000 |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | 110.0000 | 76.0000 | 83.0000 | 93.0000 | 48.0000 | 20.4841 | 82.0000 | 83.0000 |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | 14.0000 | | 7.0000 | 7.0000 | | 3.2998 | 9.3333 | 7.0000 |
| (54) TOLUENE | 1000 | | | | | 6.0000 | 0.0000 | 6.0000 | 6.0000 |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | 12.0000 | 0.0000 | 12.0000 | 12.0000 |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | 16.0000 | 11.0000 | 13.0000 | 12.0000 | 16.0000 | 2.0591 | 13.6000 | 13.0000 |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | 24.0000 | 28.0000 | | | 28.0000 | 1.8856 | 26.6667 | 28.0000 |
| (62) XYLENES | 530 | 13.0000 | | | 6.0000 | | 3.5000 | 9.5000 | 9.5000 |

| LENOIR COUNTY: MONITORING SURFACE #SW1 | | | | | | NOT TESTED | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 9/9/94 | 10/28/94 | 1/6/95 | 2/24/95 | 7/17/95 | | | |
| CONSTITUENT | NC GW STND (MG/L) | SAMPLE #1 | SAMPLE #2 | SAMPLE #3 | SAMPLE #4 | SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (4) BERYLLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (6) CHROMIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (9) LEAD | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (14) VANADIUM | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (15) ZINC | 2.10 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| | NC GW STND (UG/L) | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #NUM! |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #NUM! |

| LENOIR COUNTY: MONITORING SURFACE #SW2 | | | | | | NOT TESTED | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 9/9/94 | 10/28/94 | 1/6/95 | 2/24/95 | 7/17/95 | | | |
| CONSTITUENT | NC GW STND (MG/L) | SAMPLE #1 | SAMPLE #2 | SAMPLE #3 | SAMPLE #4 | SAMPLE #5 | STANDARD DEVIATION | MEAN | MEDIAN |
| (1) ANTIMONY | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (2) ARSENIC | 0.05 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (3) BARIUM | 2.0 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (4) BERYLLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (5) CADMIUM | 0.0050 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (6) CHROMIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (7) COBALT | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (8) COPPER | 1.0 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (9) LEAD | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (10) NICKEL | 0.10 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (11) SELENIUM | 0.050 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (12) SILVER | 0.0180 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (13) THALLIUM | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (14) VANADIUM | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (15) ZINC | 2.10 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| | NC GW STND (UG/L) | | | | | | | | |
| (16) ACETONE | 700 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (17) ACRYLONITRILE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (18) BENZENE | 1.0 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (19) BROMOCHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (20) BROMODICHLOROMETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (21) BROMOFORM (TRIBROMOMRTHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (22) CARBON DISULFIDE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (23) CARBON TETRACHLORIDE | 0.30 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (24) CHLOROBENZENE | 50 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (25) CHLOROETHANE (ETHYL CHLORIDE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (26) CHLOROFORM (TRICHLOROMETHANE) | 0.190 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (27) CHLORODIBROMOMETHANE (DIBROMOCHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (28) DBCP (1,2-DIBROMO-3-CHLOROPROPANE) | 0.0250 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (29) ETHYLENE DIBROMIDE (1,2-DIBROMOETHANE) | 0.0004 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (30) O-DICHLOROBENZENE (1,2-DICHLOROBENZENE) | 620 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (31) P-DICHLOROBENZENE (1,4-DICHLOROBENZENE) | 75 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (32) T-1,4-DICHLORO-2-BUTENE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (33) 1,1-DICHLOROETHANE (ETHYLIDENE CHLORIDE) | 700 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (34) ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE) | 0.380 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (35) VINYLIDENE CHLORIDE (1,1-DICHLOROETHENE) (ETHYLENE) | 7 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (36) CIS-1,2-DICHLOROETHENE (CIS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (37) T-1,2-DICHLOROETHENE (TRANS-1,2-DICHLOROETHYLENE) | 70 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (38) PROPYLENE DICHLORIDE (1,2-DICHLOROPROPANE) | 0.560 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (39) CIS-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (40) T-1,3-DICHLOROPROPENE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (41) ETHYLBENZENE | 29 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (42) METHYL BUTYL KETONE (2-HEXANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (43) METHYL BROMIDE (BROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (44) METHYL CHLORIDE (CHLOROMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (45) METHYLENE BROMIDE (DIBROMOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (46) METHYLENE CHLORIDE (DICHLOROMETHANE) | 5 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (47) MEK; 2-BUTANE (METHYL ETHYL KETONE) | 170 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (48) METHYL IODIDE (IODOMETHANE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (49) METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE) | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (50) STYRENE | 100 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (51) 1,1,1,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (52) 1,1,2,2-TETRACHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (53) TETRACHLOROETHYLENE (TETRACHLOROETHENE) (PERCHLOROETHYLENE) | 0.70 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (54) TOLUENE | 1000 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (55) 1,1,1-TRICHLOROETHANE (METHYLCHLOROFORM) | 200 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (56) 1,1,2 TRICHLOROETHANE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (57) TRICHLOROETHYLENE (TRICHLOROETHENE) | 2.80 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (58) CFC-11 (TRICHLOROFLUOROMETHANE) | 2100 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (59) 1,2,3-TRICHLOROPROPANE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (60) VINYL ACETATE | NE | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (61) VINYL CHLORIDE | 0.0150 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |
| (62) XYLENES | 530 | | | | | | #DIV/0! | #DIV/0! | #DIV/0! |

**ENCLOSURE IV**

**TABLE 2**

**TABLE 2**
**HYDROLOGIC PROPERTIES AT MONITORING WELL LOCATIONS**
**August 9, 1995 Appendix II Sampling**
**by Environment 1, Inc., Greenville, North Carolina**

| Monitoring Well | Permeability (cm/sec) | Total Porosity (%) | Effective Porosity (%) | Groundwater Flow Rate and Direction (ft/yr) |
|---|---|---|---|---|
| 1 | $4.3 \times 10^{-4}$ | 32.2 | 20 | 24 N 12°W |
| 3 | $1.3 \times 10^{-4}$ | 34.7 | 20 | 6 N 25°E |
| 4 | $5.4 \times 10^{-4}$ | 34.7 | 20 | 34 N 11°W |
| 5 | $5.3 \times 10^{-4}$ | 37.9 | 20 | 31 N 12°W |
| 8 | $2.2 \times 10^{-4}$ | 43.0 | 20 | 7 N 10°W |
| 9 | $3.8 \times 10^{-4}$ | 37.2 | 20 | 34 N 35°W |
| 10 | $6.9 \times 10^{-5}$ | 40.4 | 20 | 5 N 34°W |

Note: Rate and direction of groundwater flow determined using groundwater elevations measured by Environment 1 for each groundwater monitoring well for 7-17-95 sampling event.

**ENCLOSURE V**

**TABLE 2 SUPPORT DOCUMENTATION**

Client MESCO
Job No. 94202-02
Subject GW Pot Map - Lenoir

GAI CONSULTANTS-NC, INC.
Raleigh, NC

Final Page No. 1933
Prel. Page No. 193
Calc. MHA Date 1/2/96
Chkd. TL Date 1/2/96

| MW # | TOC Elevation | Static Water Level (ft) (7-17-95) | GW Elev. (Ft) (7-17-95) | GW Elev. (Ft) (2-24-95) | Δh (Ft) |
|---|---|---|---|---|---|
| 1 | 98.34 Ft | 14.48 Ft | 83.86 Ft | 79.59 | +4.2 |
| 3 | 63.87 " | 5.62 " | 58.25 " | 59.35 | -1.10 |
| 4 | 68.03 " | 5.26 " | 62.77 " | 63.92 | -1.15 |
| 5 | 92.17 " | 7.43 " | 84.74 " | 81.23 | +3.51 |
| 8 | 88.29 " | 18.05 " | 70.24 " | 70.09 | +0.15 |
| 9 | 62.40 " | 5.71 " | 56.69 " | 57.05 | -0.36 |
| 10 | 87.15 " | 18.64 " | 68.51 " | 66.51 | +2.0 |

MW5 - MW8 $\Delta h = 84.74 - 70.24 = 14.50$ $L = 1170$, $\frac{2}{14.5} \times 1170 = 16$,

MW8 - MW10 $\Delta h = 70.24 - 68.51 = 1.70$ $L = 370$ $\frac{2}{1.7} \times 370 = 435$

MW10 - MW9 $\Delta h = 68.51 - 56.69 = 11.82$ $L = 970$ $\frac{2}{11.82} \times 970 = 164$

MW1 - MW4 $\Delta h = 83.86 - 62.77 = 21.09$ $L = 1890$ $\frac{2}{21.09} \times 1890 = 180$

MW4 - MW3 $\Delta h = 62.77 - 58.25 = 4.50$ $L = 714$ $\frac{2}{4.50} \times 714 = 317$

MW3 - MW9 $\Delta h = 58.25 - 56.69 = 1.56$ $L = 950$ $\frac{2}{1.56} \times 950 = 1218$

Client MESCO
Job No. 94202.02
Subject GW Pot. Map Lenoir

**GAI CONSULTANTS-NC, INC.**
Raleigh, NC

Final Page No. 2 of 33
Prel. Page No. 2 of 3
Calc. MHA Date 1/2/96
Chkd. JR Date 1/8/96

| MW# | Perm. (cm/sec) (K) | Total Porosity (%) (n) | Effective Porosity (%) (ne) | Gradient (i) | Flow Rate (ft/yr) (V) | Direction |
|---|---|---|---|---|---|---|
| 1 | $4.3 \times 10^{-4}$ | 32.2 | 20 | 1.86 / 172 | 24 ✓ | N 12° W |
| 3 | $1.3 \times 10^{-4}$ | 34.7 | 20 | 0.25 / 30 | 6 ✓ | N 25° E |
| 4 | $5.4 \times 10^{-4}$ | 34.7 | 20 | 0.77 / 64 | 34 ✓ | N 11° W |
| 5 | $5.3 \times 10^{-4}$ | 37.9 | 20 | 0.74 / 66 | 31 | N 12° W |
| 8 | $2.2 \times 10^{-4}$ | 43.0 | 20 | 0.24 / 40 | 7 ✓ | N 10° W |
| 9 | $3.8 \times 10^{-4}$ | 37.2 | 20 | 0.69 / 40 | 34 ✓ | N 35° W |
| 10 | $6.9 \times 10^{-5}$ | 40.4 | 20 | 0.51 / 38 | 5 ✓ | N 34° W |

$\bar{V} = \frac{K i}{n_e} \times 1{,}034{,}646 \frac{ft/yr}{cm/sec}$

$\bar{V}$ = average velocity (flow rate) in ft/year
K = Permeability from slug test data (cm/sec)

Client MESCO
Job No. 94202.02
Subject GW Pot. Map-Lenoir

GAI CONSULTANTS-NC, INC.
Raleigh, NC

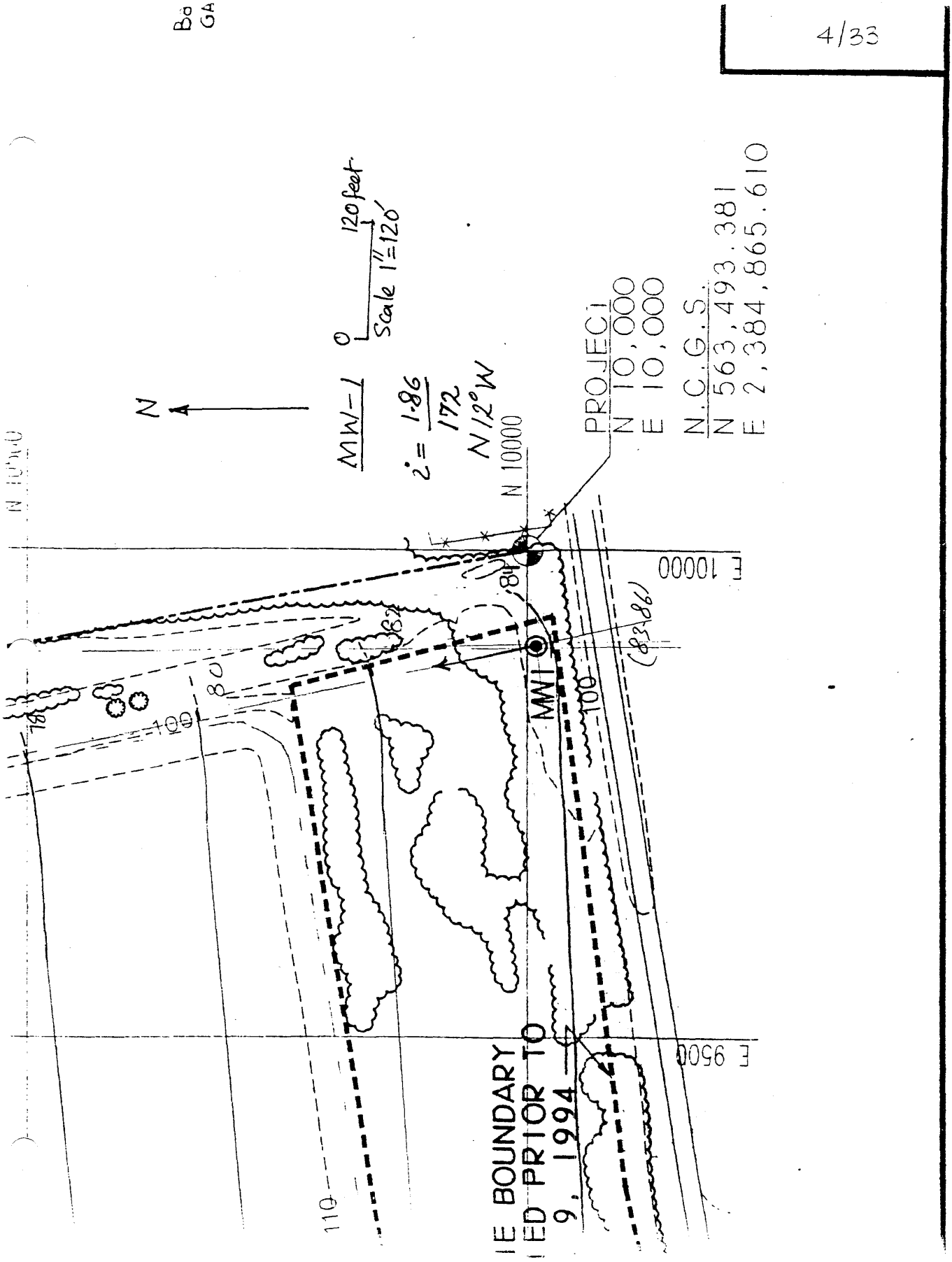
Final Page No. 3933
Prel. Page No. 3613
Calc. MHA Date 1/12/96
Chkd. TR Date 1/12/96

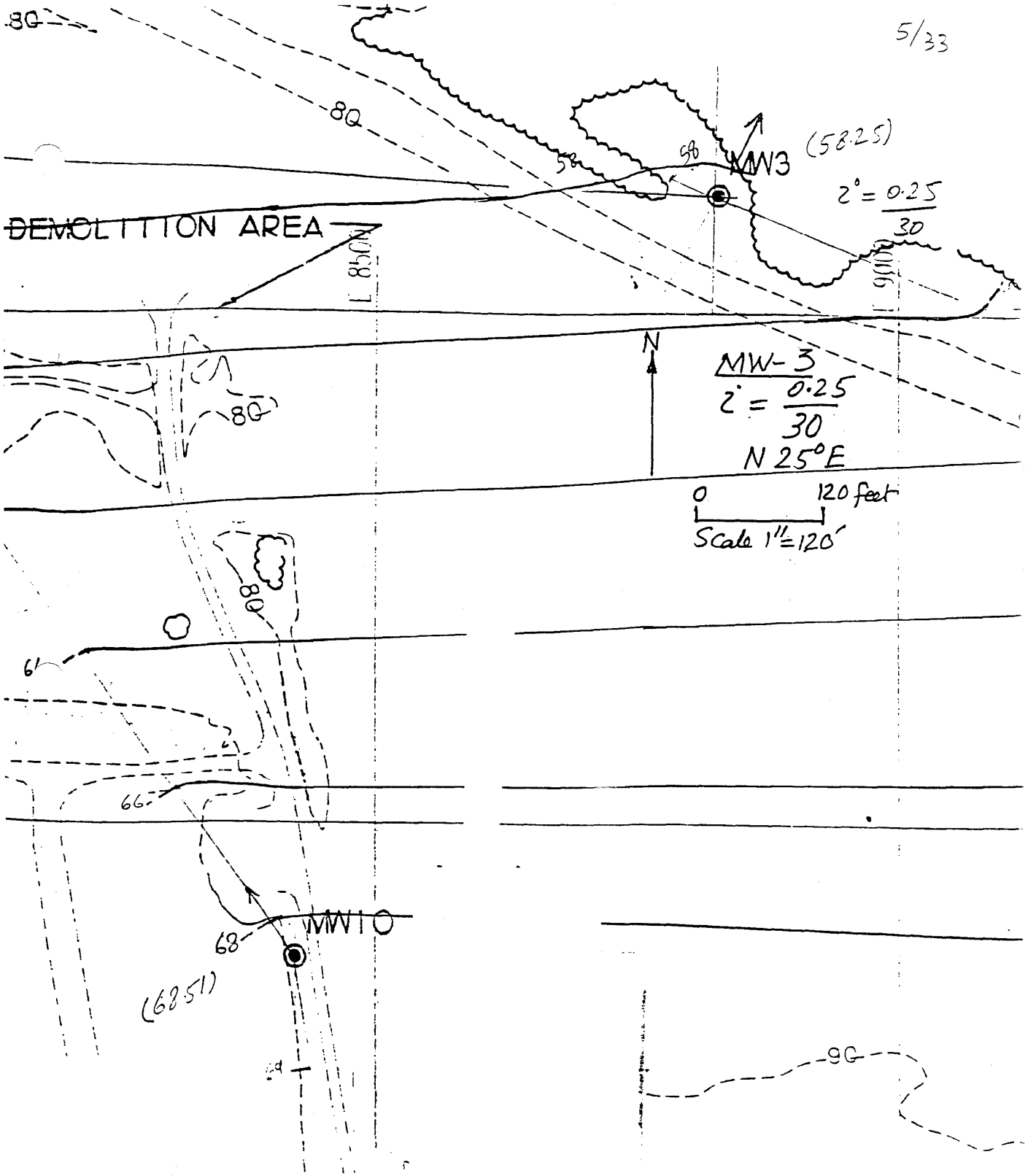
$i$ = Gradient (dimensionless).

Gradient and direction from potentiometric map developed from surveyed data from MESCO and groundwater levels measured by Environment-1 on 7-17-95

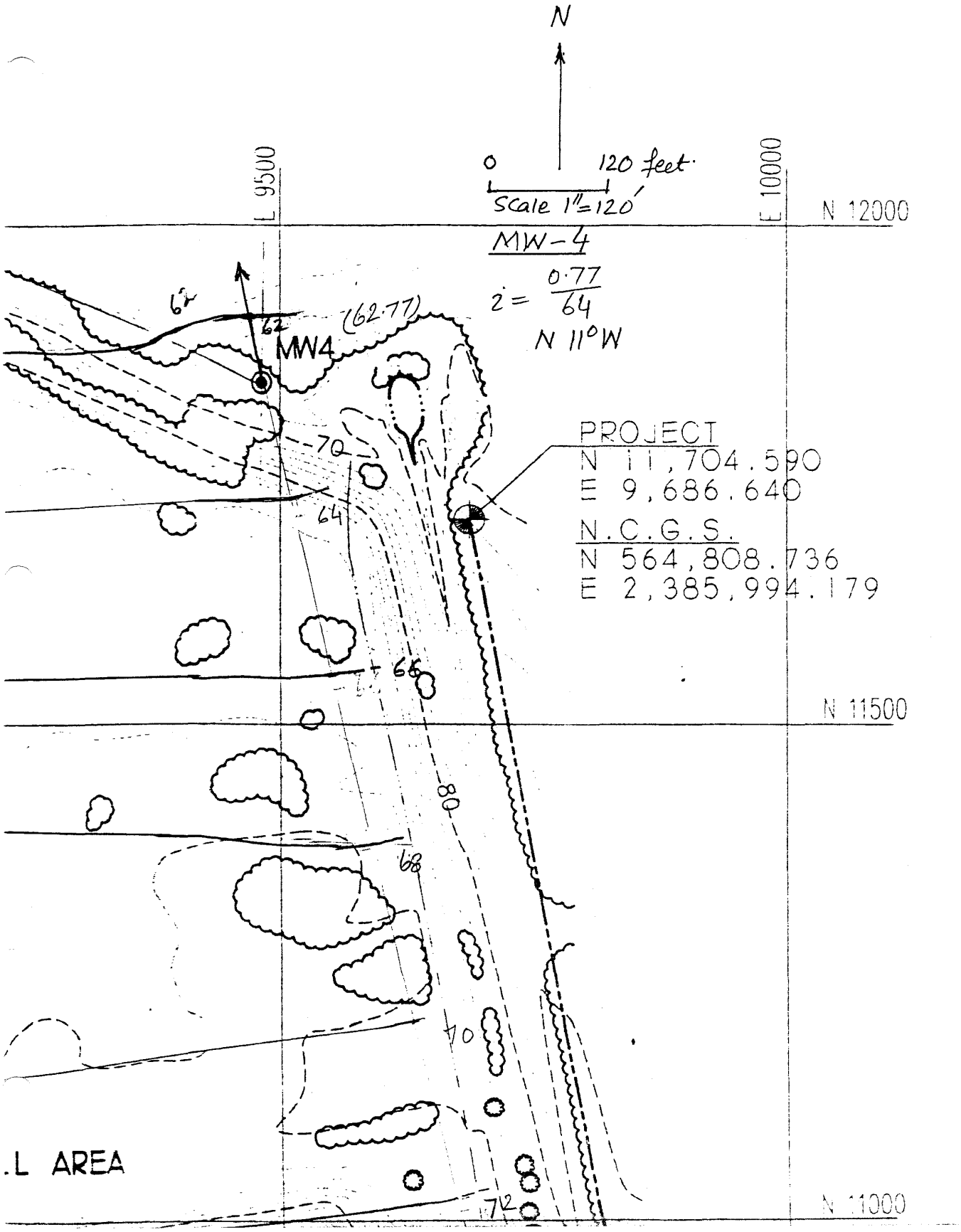
$n_e$ = Effective porosity

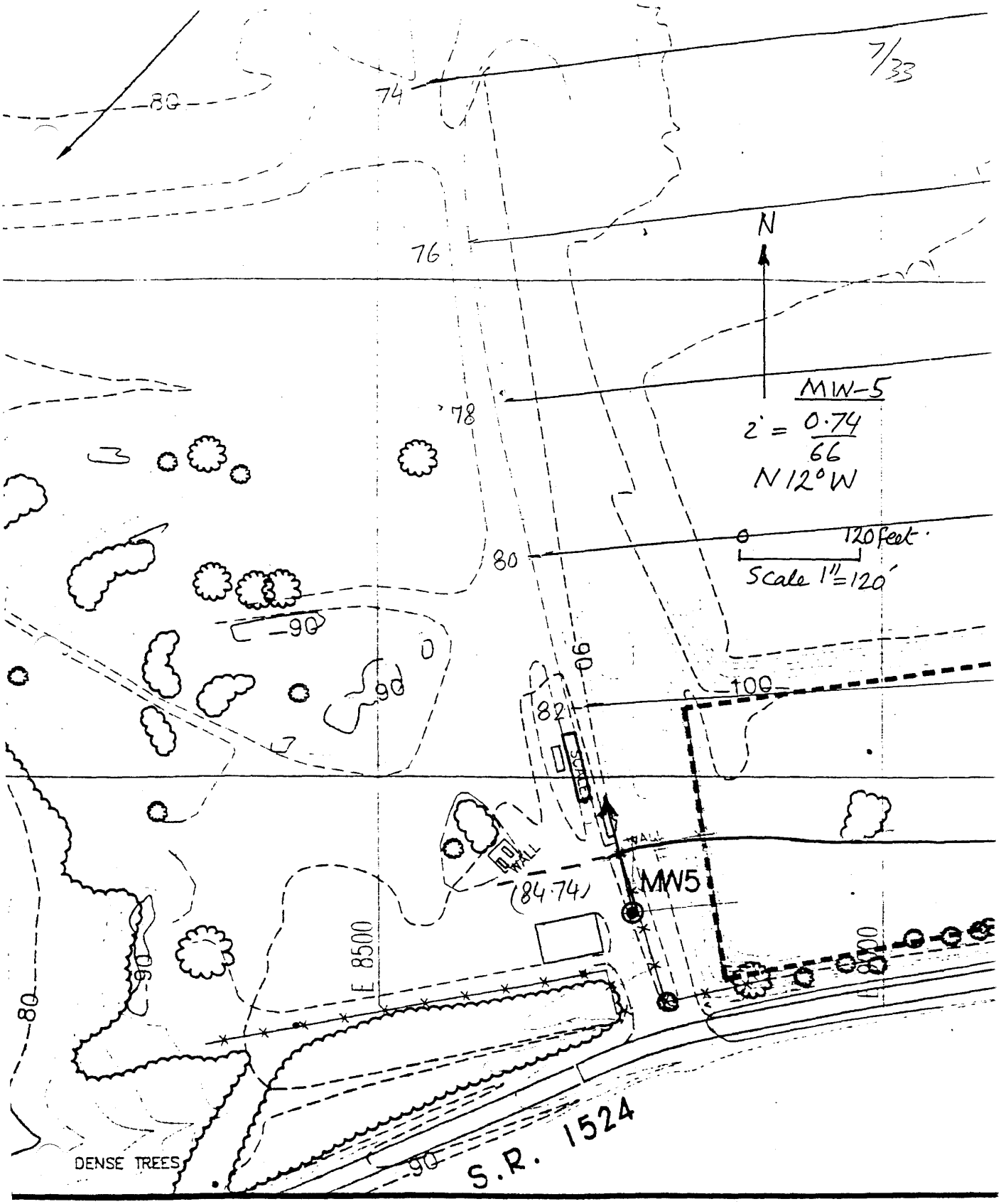
Effective porosity from typical values published by EPA based on lithology from well records and boring logs

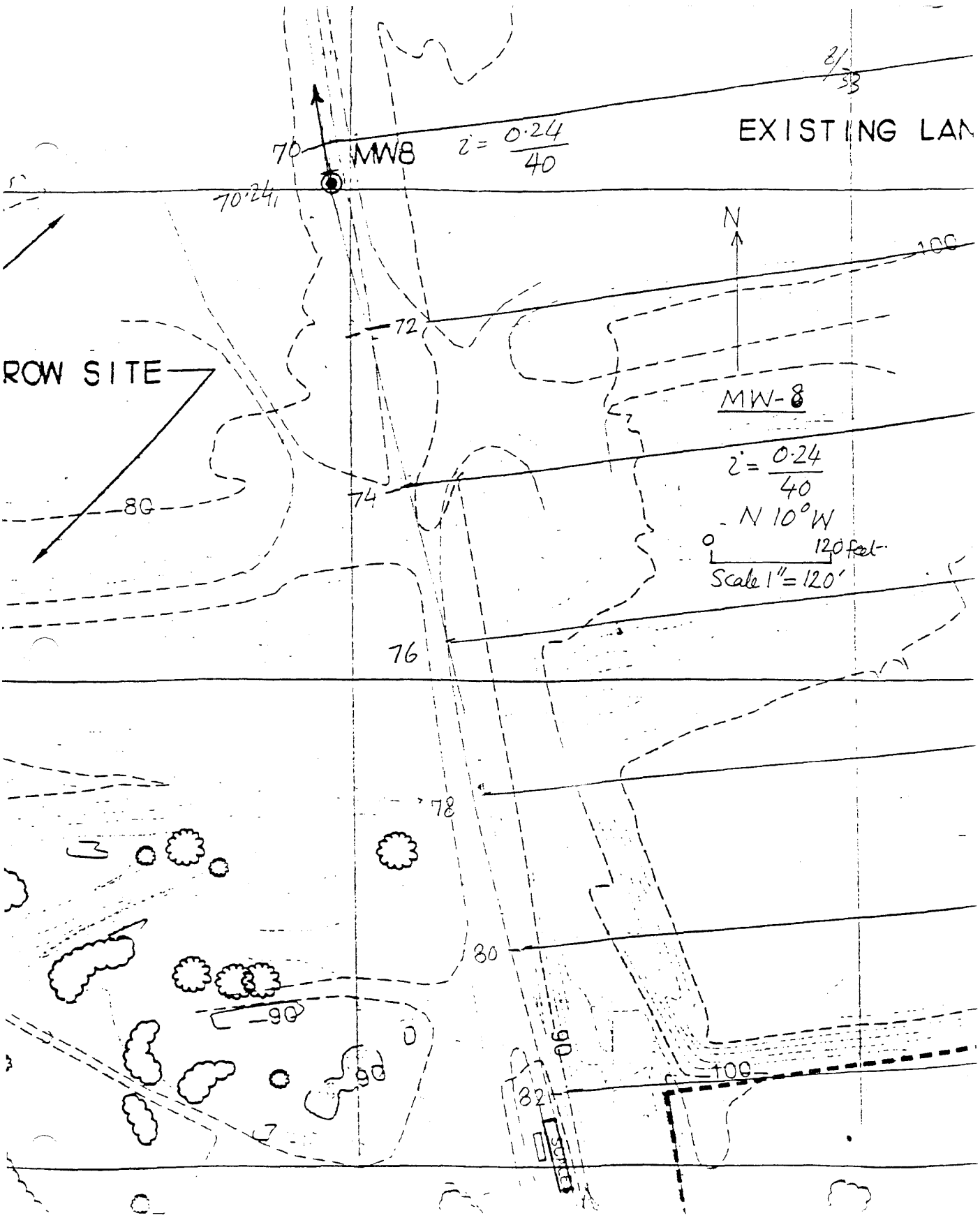

4/33
N
MW-1
i = 1.86 / 172
N 12° W
0
120 feet
Scale 1" = 120'
N 10000
PROJECT
N 10,000
E 10,000
N.C.G.S.
N 563,493.381
E 2,384,865.610
E 10000
E 9500
MW-1
(83.86)
84
82
80
100
110
IE BOUNDARY
IED PRIOR TO
9, 1994

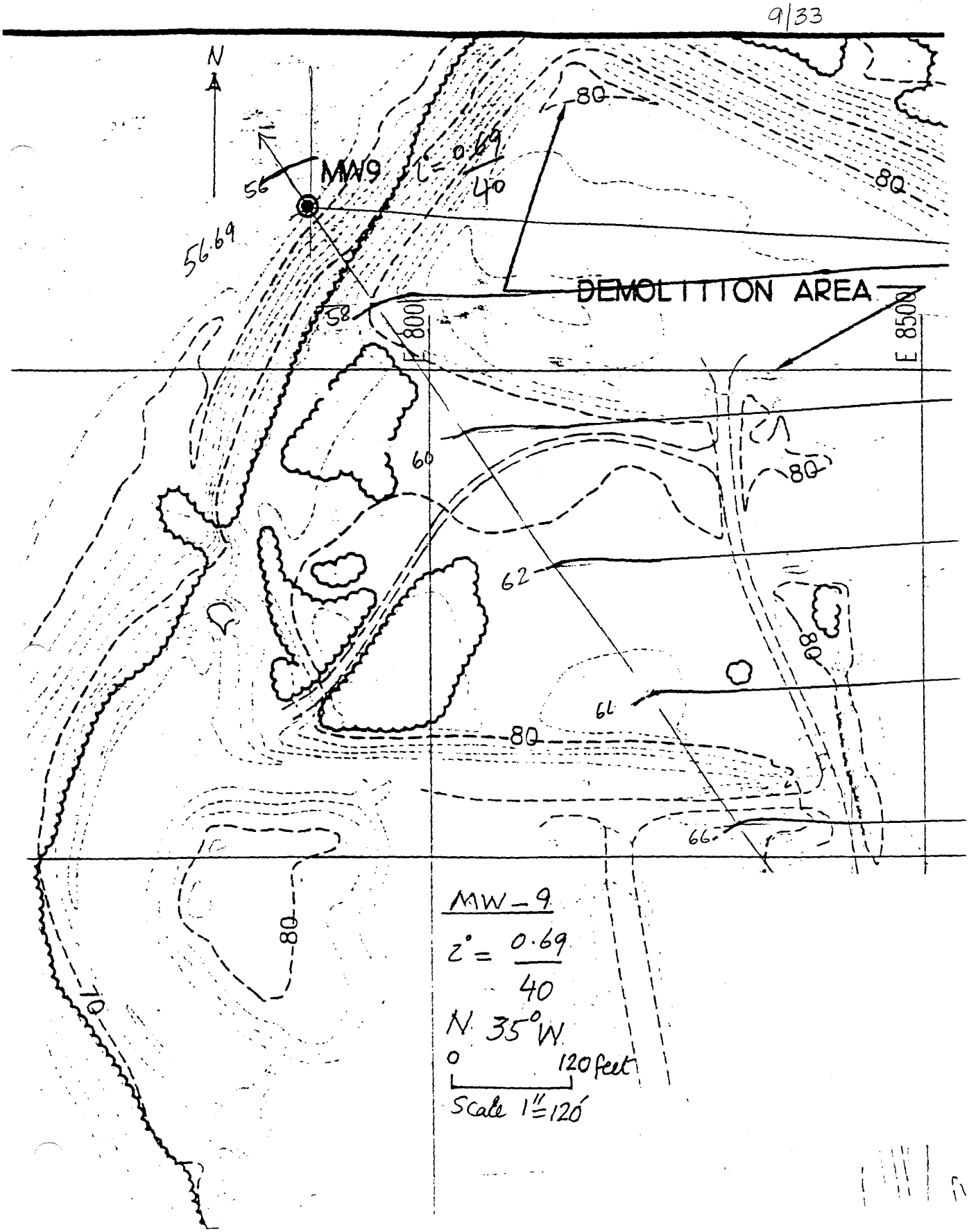

5/33
80
80
58
98
MW3
(58.25)
i° = 0.25/30
DEMOLITION AREA
L 8500N
9000
N
MW-3
i = 0.25/30
N 25°E
80
0
120 feet
Scale 1" = 120'
80
61
66
MW1
68
(68.51)
90

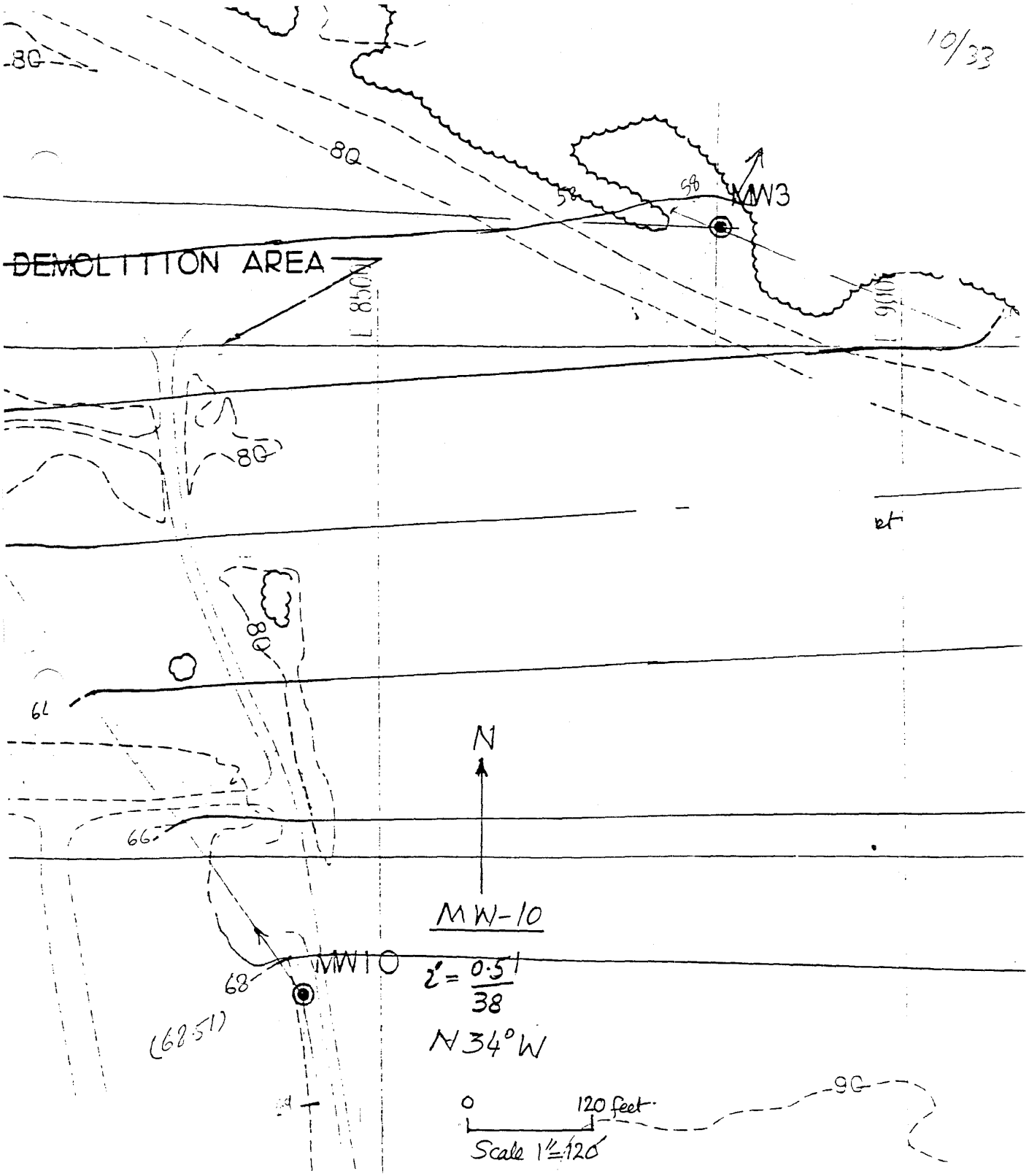
6/33


N
0
120 feet
Scale 1"=120'
L 9500
E 10000
N 12000
MW-4
i = 0.77/64
N 11°W
62
(62.77)
MW4
70
64
66
68
80
70
72
PROJECT
N 11,704.590
E 9,686.640
N.C.G.S.
N 564,808.736
E 2,385,994.179
N 11500
N 11000
.L AREA


7/33
80
74
76
78
80
82
90
90
90
90
90
100
N
MW-5
2' = 0.74/66
N 12° W
120 feet
Scale 1" = 120'
(84.74)
MW5
E 8500
E 8500
DENSE TREES
S.R. 1524


EXISTING LAN
MW8
i = 0.24/40
70
70.24
N
100
72
ROW SITE
MW-8
i = 0.24/40
N 10°W
74
80
0
120 feet
Scale 1" = 120'
76
78
80
90
90
90
100
82
SCALE


9/33
N
MW9
56
56.69
58
80
DEMOLITION AREA
E 8000
E 8500
60
62
64
66
70
MW-9
i° = 0.69 / 40
N 35° W
0
120 feet
Scale 1" = 120'


10/33
80
80
58
58
MW3
DEMOLITION AREA
L 850
L 900
80
80
61
66
N
MW-10
MW10
68
(68.51)
i' = 0.51 / 38
N 34° W
0
120 feet
Scale 1" = 120'
90

Client MESCO
Job No. 94202.02
Subject Porosity Calc. for MW's

GAI CONSULTANTS-NC, INC.
Raleigh, NC

Final Page No. 11 of 33
Prel. Page No. 1 of 1
Calc. MHA Date 1/3/96
Chkd. TR Date 1/3/96

| MW# | $G_s$ | $\gamma_d$ (PCF) | n (%) |
|---|---|---|---|
| 1. | 2.72 | 115 | 32.2 |
| 3. | 2.70 | 110 | 34.7 |
| 4. | 2.70 | 110 | 34.7 |
| 5 | 2.71 | 105 | 37.9 |
| 8 | 2.67 | 95 | 43.0 |
| 9 | 2.68 | 105 | 37.2 |
| 10 | 2.67 | 100 | 40.4 |

$$n = 1 - \frac{\gamma_d}{G_s \times \gamma_w}$$

n = Porosity in %
$G_s$ = Specific Gravity
$\gamma_d$ = Dry density of soil
$\gamma_w$ = Density of water

12/33

TABLE 3-1. DEFAULT VALUES FOR EFFECTIVE POROSITY (Ne) FOR USE IN TIME OF TRAVEL (TOT) ANALYSES

| Soil textural classes | Effective porosity of saturation[a] |
|---|---|
| Unified soil classification system | |
| GS, GP, GM, GC, SW, SP, SM, SC | 0.20 (20%) |
| ML, MH | 0.15 (15%) |
| CL, OL, CH, OH, PT | 0.01 (1%)[b] |
| USDA soil textural classes | |
| Clays, silty clays, sandy clays | 0.01 (1%)[b] |
| Silts, silt loams, silty clay loams | 0.10 (10%) |
| All others | 0.20 (20%) |
| Rock units (all) | |
| Porous media (nonfractured rocks such as sandstone and some carbonates) | 0.15 (15%) |
| Fractured rocks (most carbonates shales, granites, etc.) | 0.0001 (0.01%) |

Source: Barari, A., and L. S. Hedges. 1985. Movement of Water in Glacial Till. *Proceedings of the 17th International Congress of the International Association of Hydrogeologists*, pp. 129-134.

[a] These values are estimates and there may be differences between similar units. For example, recent studies indicate that weathered and unweathered glacial till may have markedly different effective porosities (Barari and Hedges, 1985; Bradbury et al., 1985).

[b] Assumes *de minimus* secondary porosity. If fractures or soil structure are present, effective porosity should be 0.001 (0.1%).

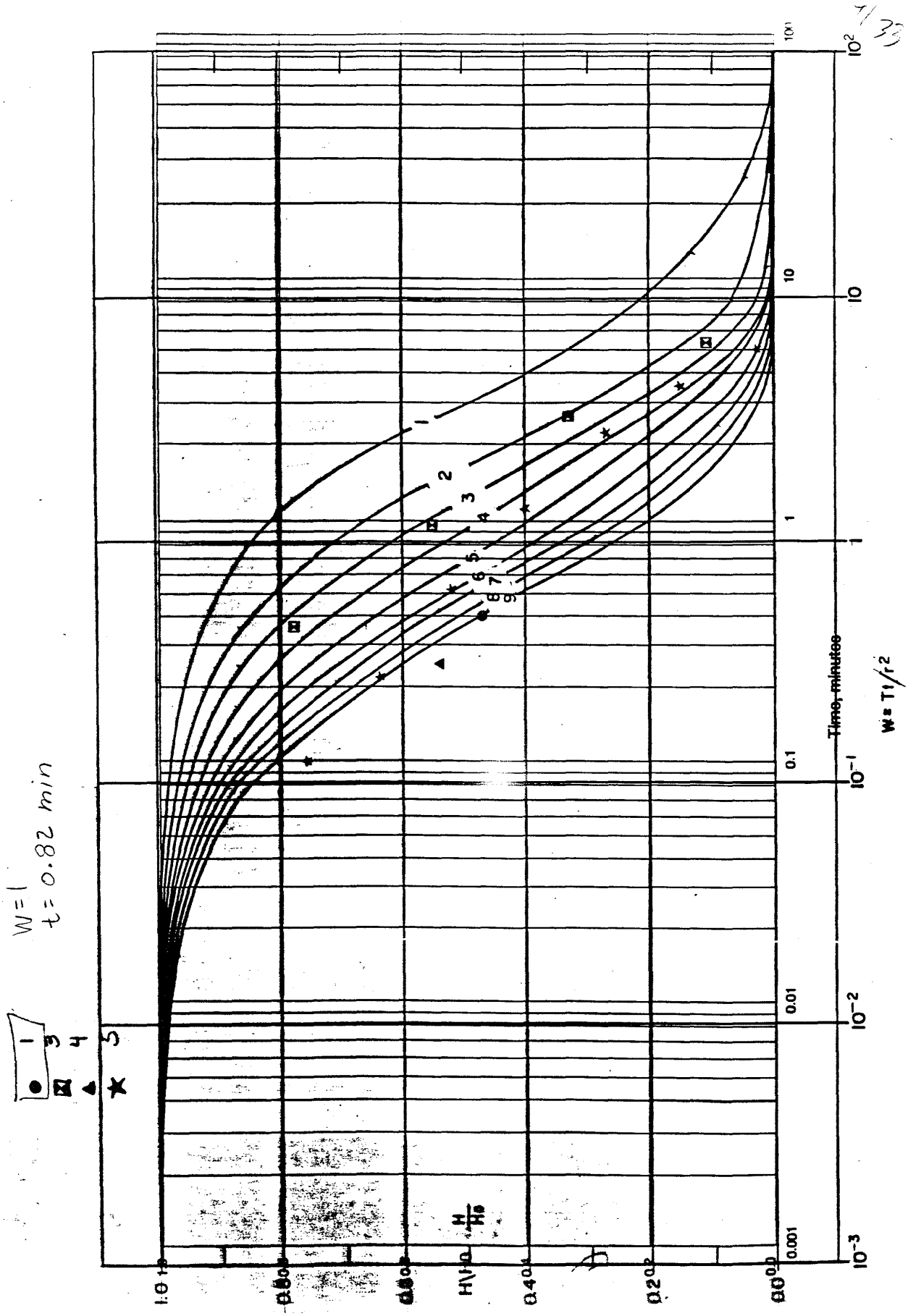
3-5

13/33

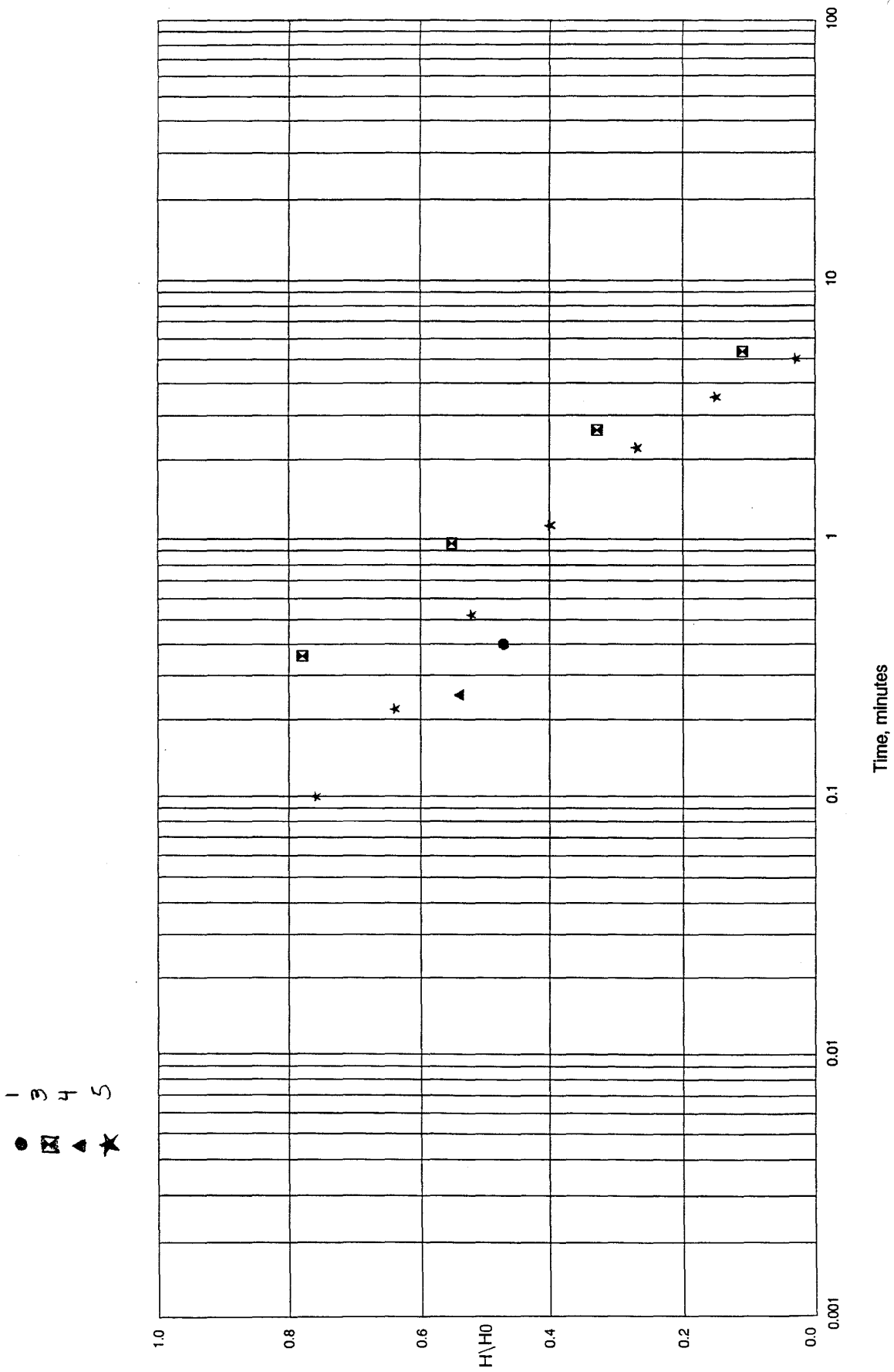
SLUG TEST MW1 LENOIR CO

| | | | |
|---|---|---|---|
| DEPTH TO GW | 16.83 | RADIUS, in. | 1 |
| HT OF STICKUP | 2.04 | WET SCREEN, ft | 10 |
| INITIAL GW READING | 0 | t, min | 0.82 |
| INITIAL TIME | 0.47 | k, cm/sec | 4.3E-04 |
| INITIAL GW BELOW TOC | 18.87 | | |
| HO | 18.87 | | |

| GW READING | DH | H | H/HO | HOUR | MIN | SEC | TIME |
|---|---|---|---|---|---|---|---|
| 10 | 10 | 8.87 | 0.47 | 0 | 0 | 52 | 0.40 |


W = 1
t = 0.82 min
Time, minutes
W = Tt/r²
H/H₀
1.0
0.8
0.6
0.4
0.2
0.0
0.001
0.01
0.1
1
10
10²
10⁻³
10⁻²
10⁻¹
1
2
3
4
5
6
7
8
9

15/33

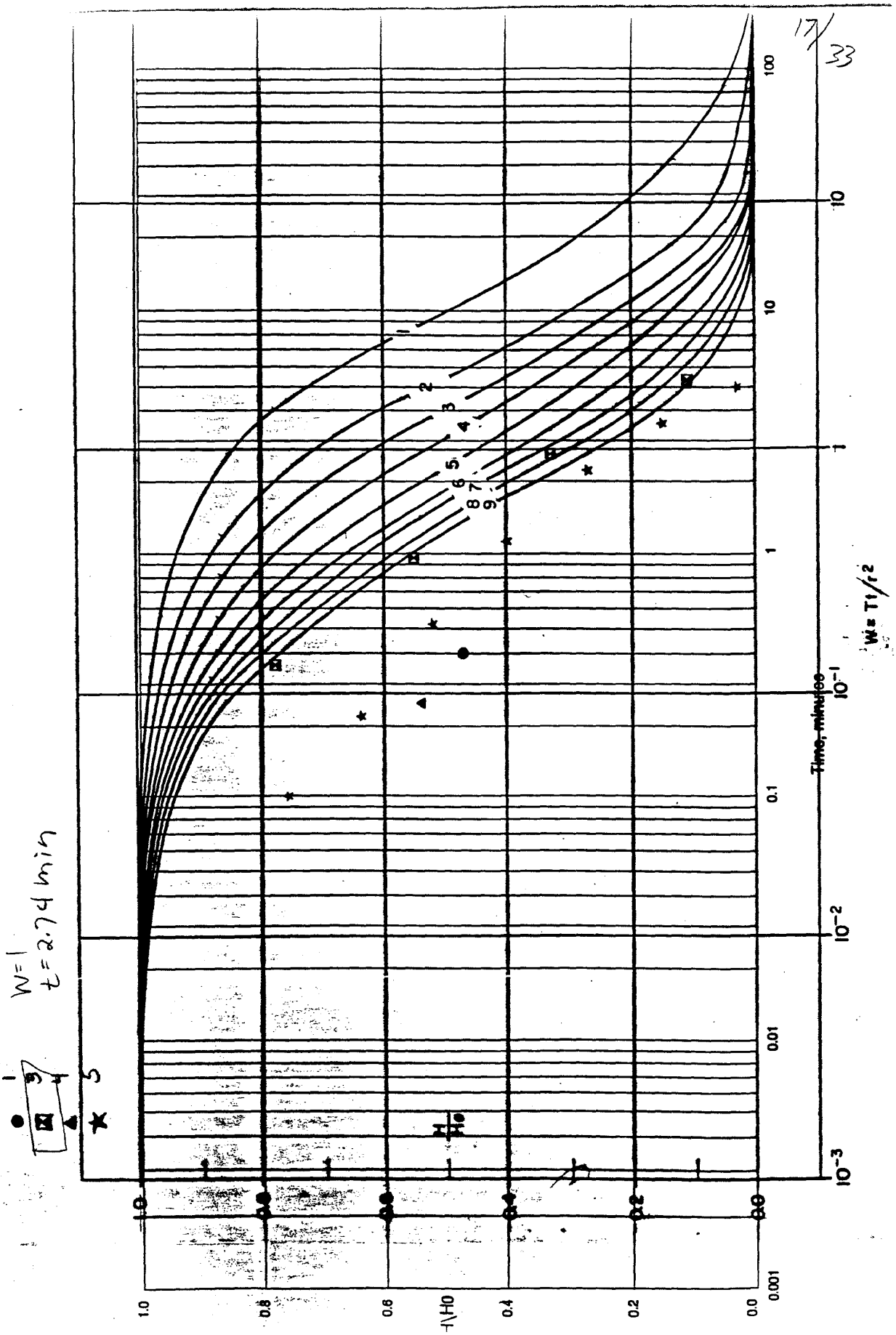


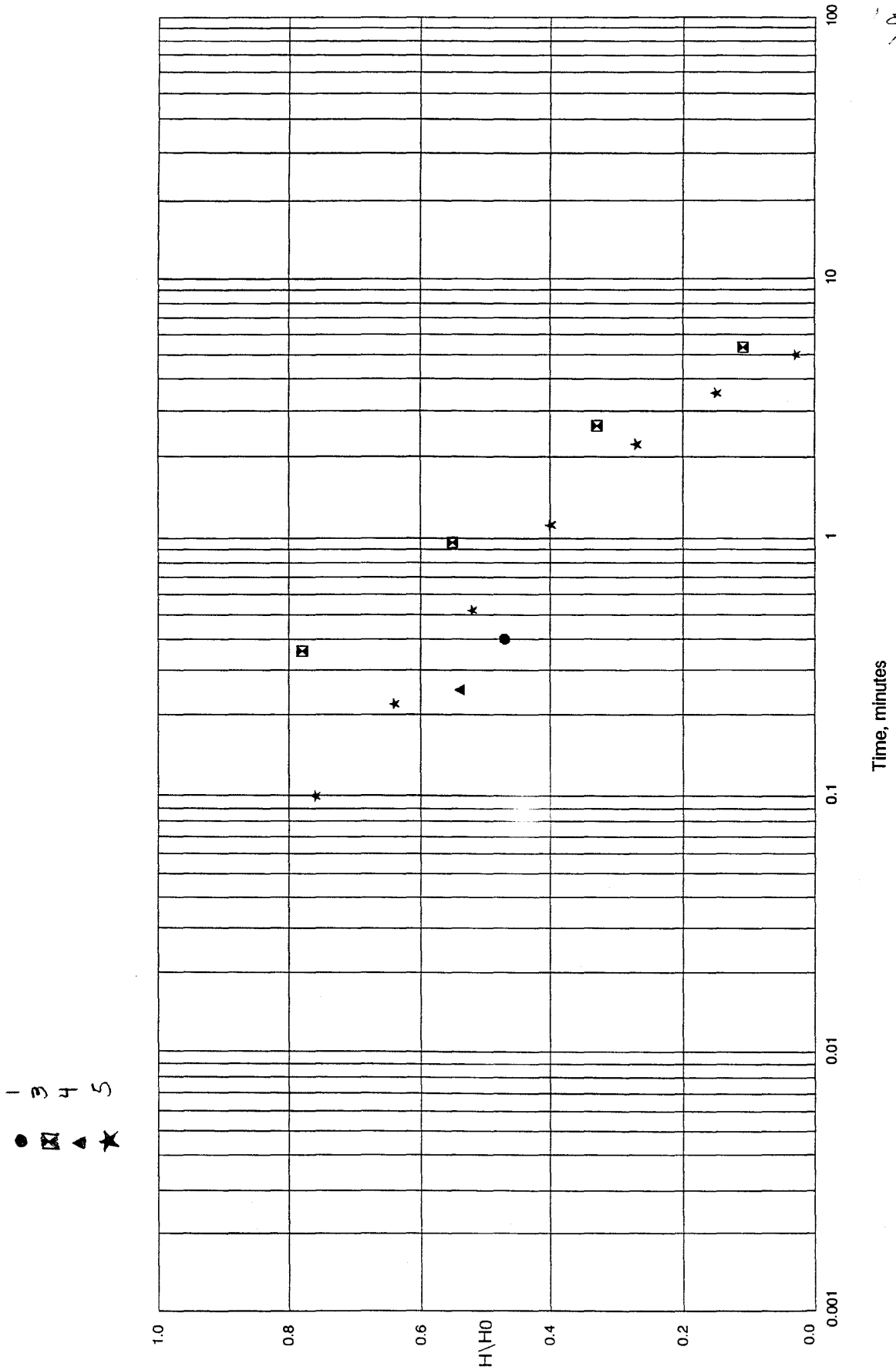
16/33

SLUG TEST MW3 LENOIR CO

| | | | |
|---|---|---|---|
| DEPTH TO GW | 4.78 | RADIUS, in. | 1 |
| HT OF STICKUP | 2.71 | WET SCREEN, ft | 10 |
| INITIAL GW READING | 3 | t, min | 2.74 |
| INITIAL TIME | 42.32 | k, cm/sec | 1.3E-04 |
| INITIAL GW BELOW TOC | 7.49 | | |
| H0 | 4.49 | | |

| GW READING | DH | H | H/H0 | HOUR | MIN | SEC | TIME |
|---|---|---|---|---|---|---|---|
| 4 | 1 | 3.49 | 0.78 | 0 | 42 | 41 | 0.36 |
| 5 | 2 | 2.49 | 0.55 | 0 | 43 | 17 | 0.96 |
| 6 | 3 | 1.49 | 0.33 | 0 | 44 | 57 | 2.63 |
| 7 | 4 | 0.49 | 0.11 | 0 | 47 | 39 | 5.33 |


17/33
W=1
t=2.74 min
1
2
3
4
5
6
7
8
9
1.0
0.8
0.6
0.4
0.2
0.0
H/H0
0.001
0.01
0.1
1
10
100
10^-3
10^-2
10^-1
Time, minutes
W = T1/r^2

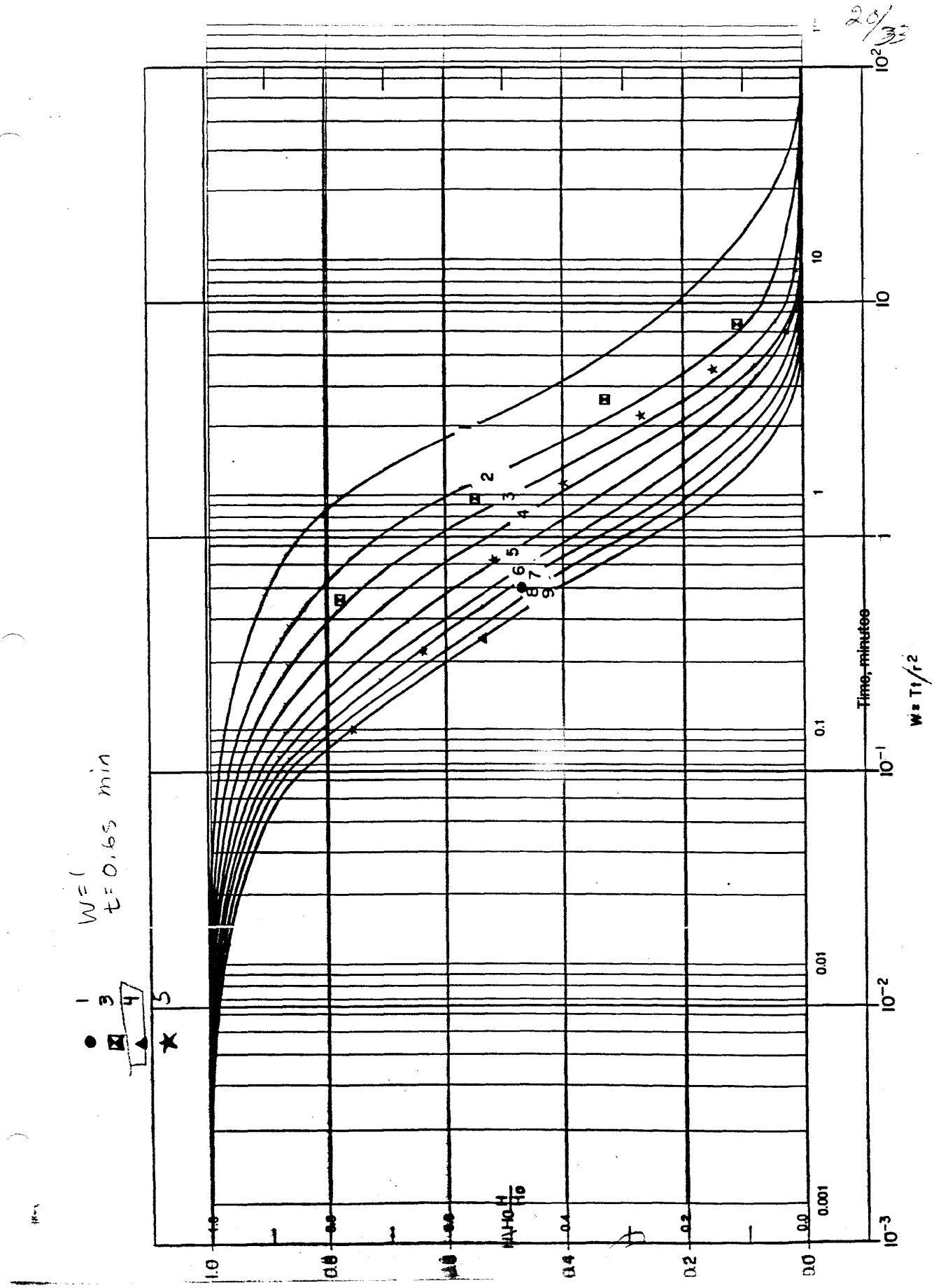

1.0
0.8
0.6
0.4
0.2
0.0
H\H0
0.001
0.01
0.1
1
10
100
Time, minutes
1
3
4
5

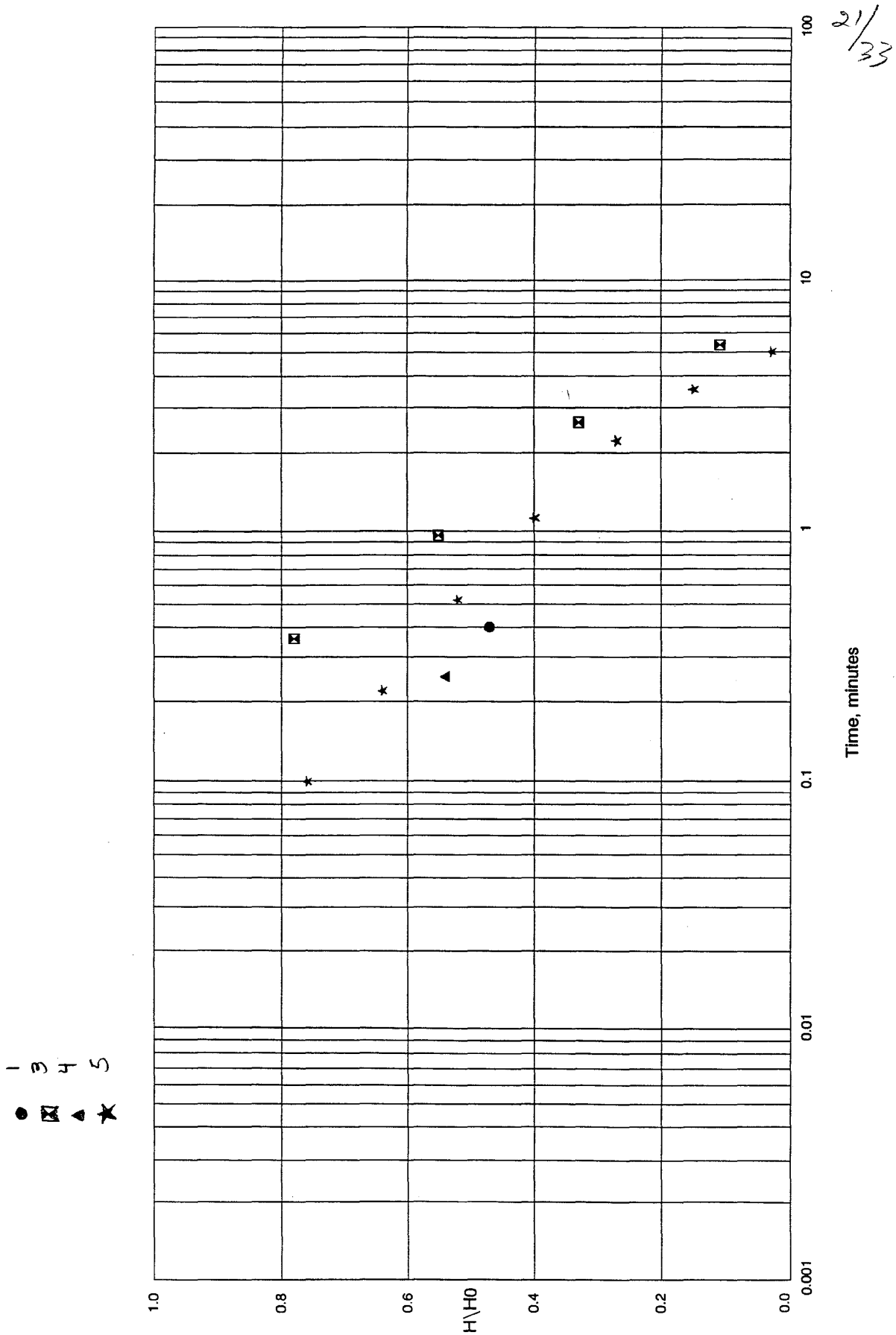
19/33

SLUG TEST MW4 LENOIR CO

| | | | |
|---|---|---|---|
| DEPTH TO GW | 6.17 | RADIUS, in. | 1 |
| HT OF STICKUP | 2.62 | WET SCREEN, ft | 10 |
| INITIAL GW READING | 0 | t, min | 0.65 |
| INITIAL TIME | 0.43 | k, cm/sec | 5.4E-04 |
| INITIAL GW BELOW TOC | 8.79 | | |
| H0 | 8.79 | | |

| GW READING | DH | H | H/H0 | HOUR | MIN | SEC | TIME |
|---|---|---|---|---|---|---|---|
| 4 | 4 | 4.79 | 0.54 | 0 | 0 | 41 | 0.25 |


20/33
W = 1
t = 0.65 min
1
2
3
4
5
6
7
8
9
1.0
0.8
0.6
0.4
0.2
0.0
$\frac{H_t - H_0}{H_0}$
0.001
0.01
0.1
1
10
$10^2$
$10^{-3}$
$10^{-2}$
$10^{-1}$
10
Time, minutes
$W = Tt/r^2$

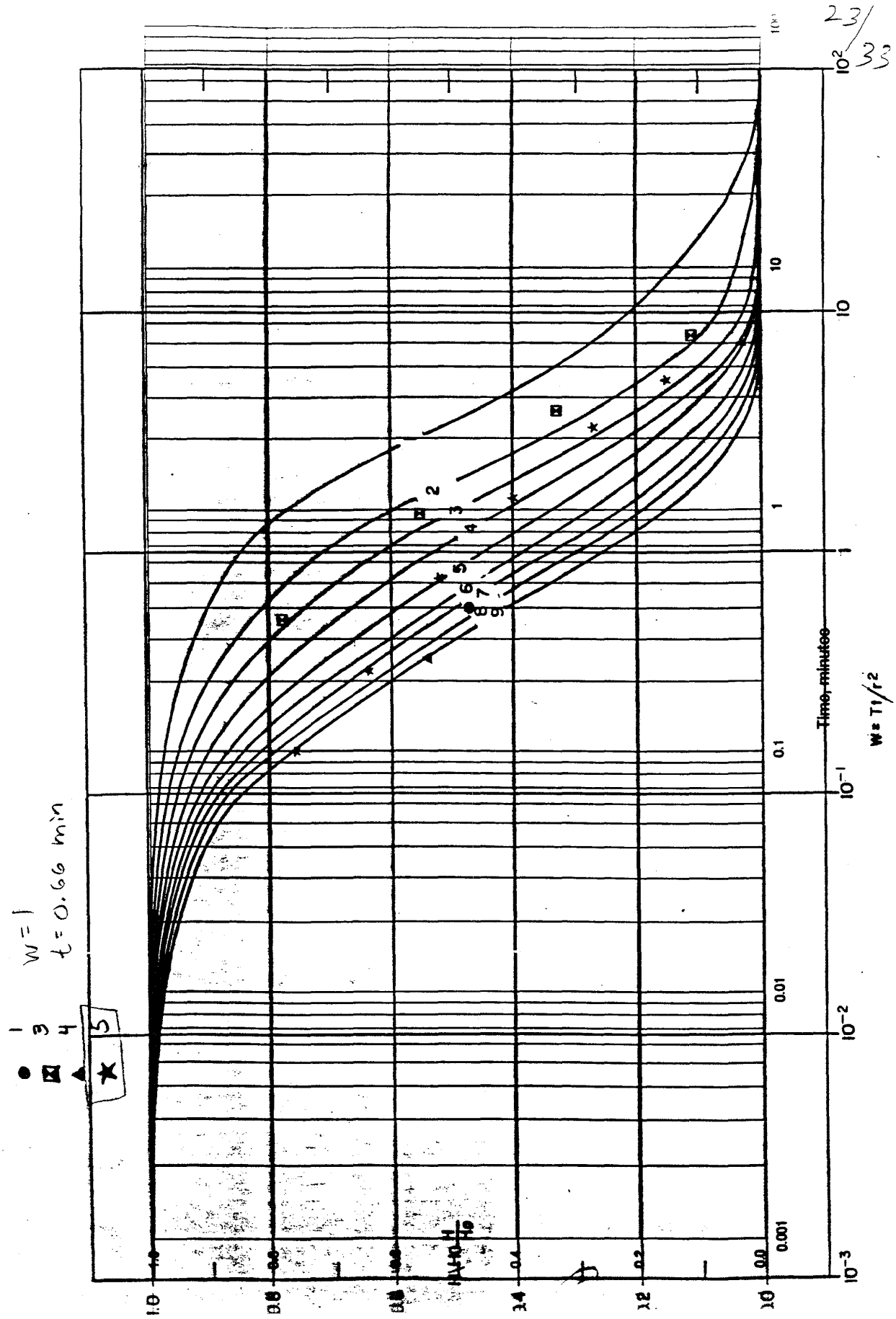

21/33
1.0
0.8
0.6
0.4
0.2
0.0
H\H0
0.001
0.01
0.1
1
10
100
Time, minutes
1
3
4
5

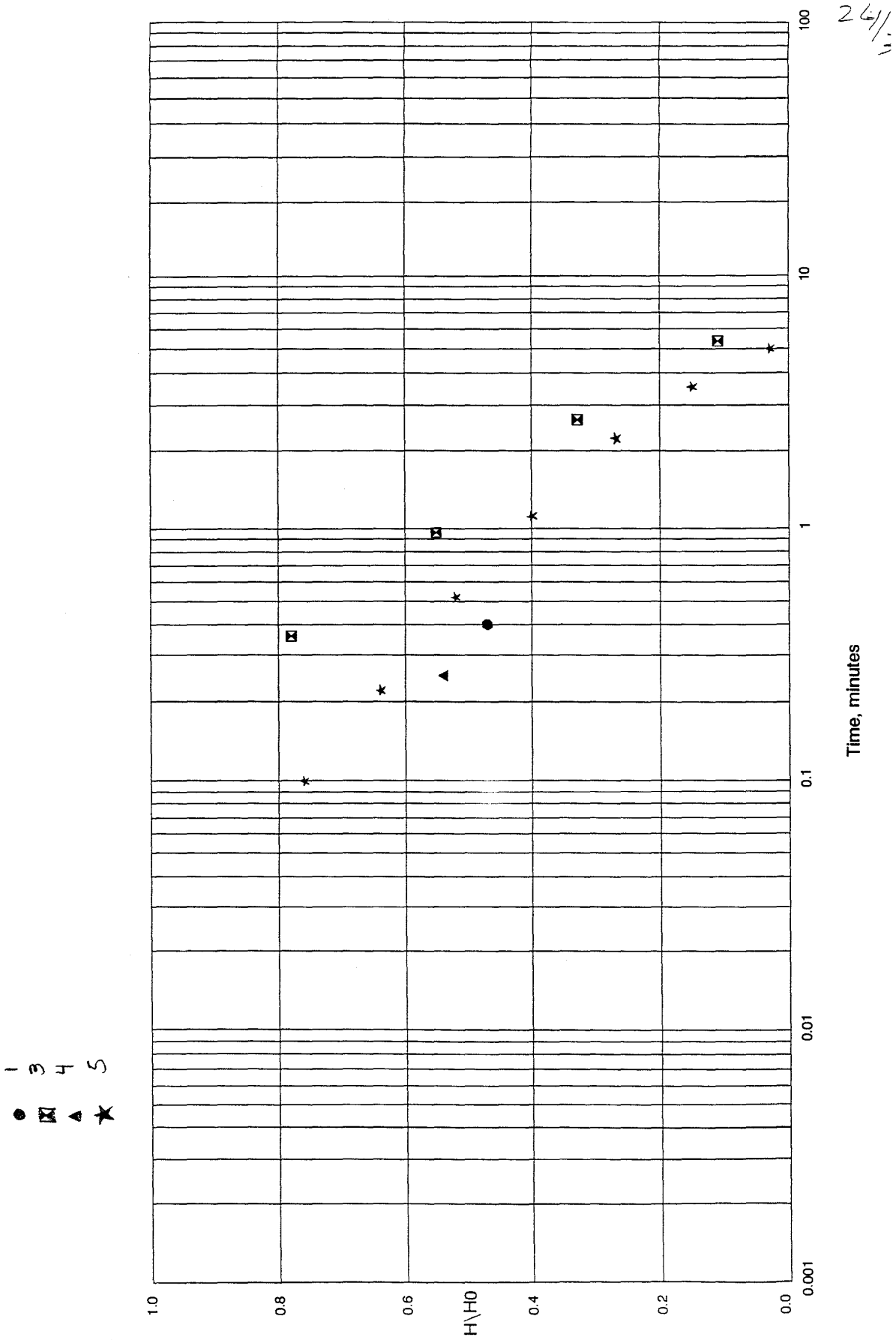
22/33

SLUG TEST MW5 LENOIR CO

| | | | |
|---|---|---|---|
| DEPTH TO GW | 11.27 | RADIUS, in. | 1 |
| HT OF STICKUP | 0 | WET SCREEN, ft | 10 |
| INITIAL GW READING | 3 | t, min | 0.66 |
| INITIAL TIME | 57.45 | k, cm/sec | 5.3E-04 |
| INITIAL GW BELOW TOC | 11.27 | | |
| HO | 8.27 | | |

| GW READING | DH | H | H/HO | HOUR | MIN | SEC | TIME |
|---|---|---|---|---|---|---|---|
| 5 | 2 | 6.27 | 0.76 | 0 | 57 | 33 | 0.10 |
| 6 | 3 | 5.27 | 0.64 | 0 | 57 | 40 | 0.22 |
| 7 | 4 | 4.27 | 0.52 | 0 | 57 | 58 | 0.52 |
| 8 | 5 | 3.27 | 0.40 | 0 | 58 | 34 | 1.12 |
| 9 | 6 | 2.27 | 0.27 | 0 | 59 | 41 | 2.23 |
| 10 | 7 | 1.27 | 0.15 | 0 | 60 | 58 | 3.52 |
| 11 | 8 | 0.27 | 03 | 0 | 62 | 27 | 5.00 |


23/33
W = 1
t = 0.66 min
1
3
4
5
2
6
7
8
9
Time, minutes
W = Tt/r²
1.0
0.8
0.6
0.4
0.2
0.0
0.001
0.01
0.1
1
10
10²
10⁻³
10⁻²
10⁻¹


24/
1.0
0.8
0.6
0.4
0.2
0.0
H\H0
0.001
0.01
0.1
1
10
100
Time, minutes
1
3
4
5

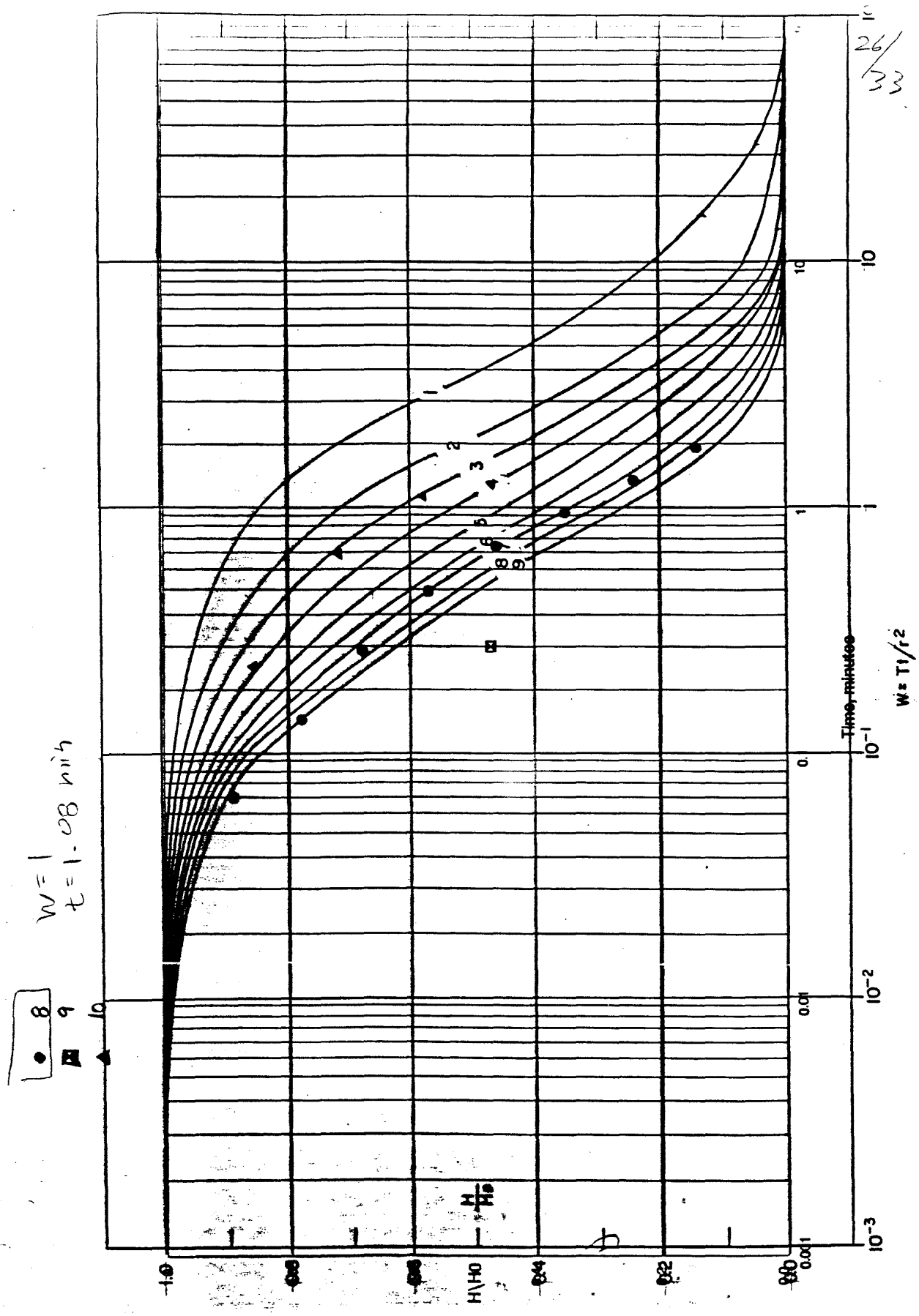
25/33

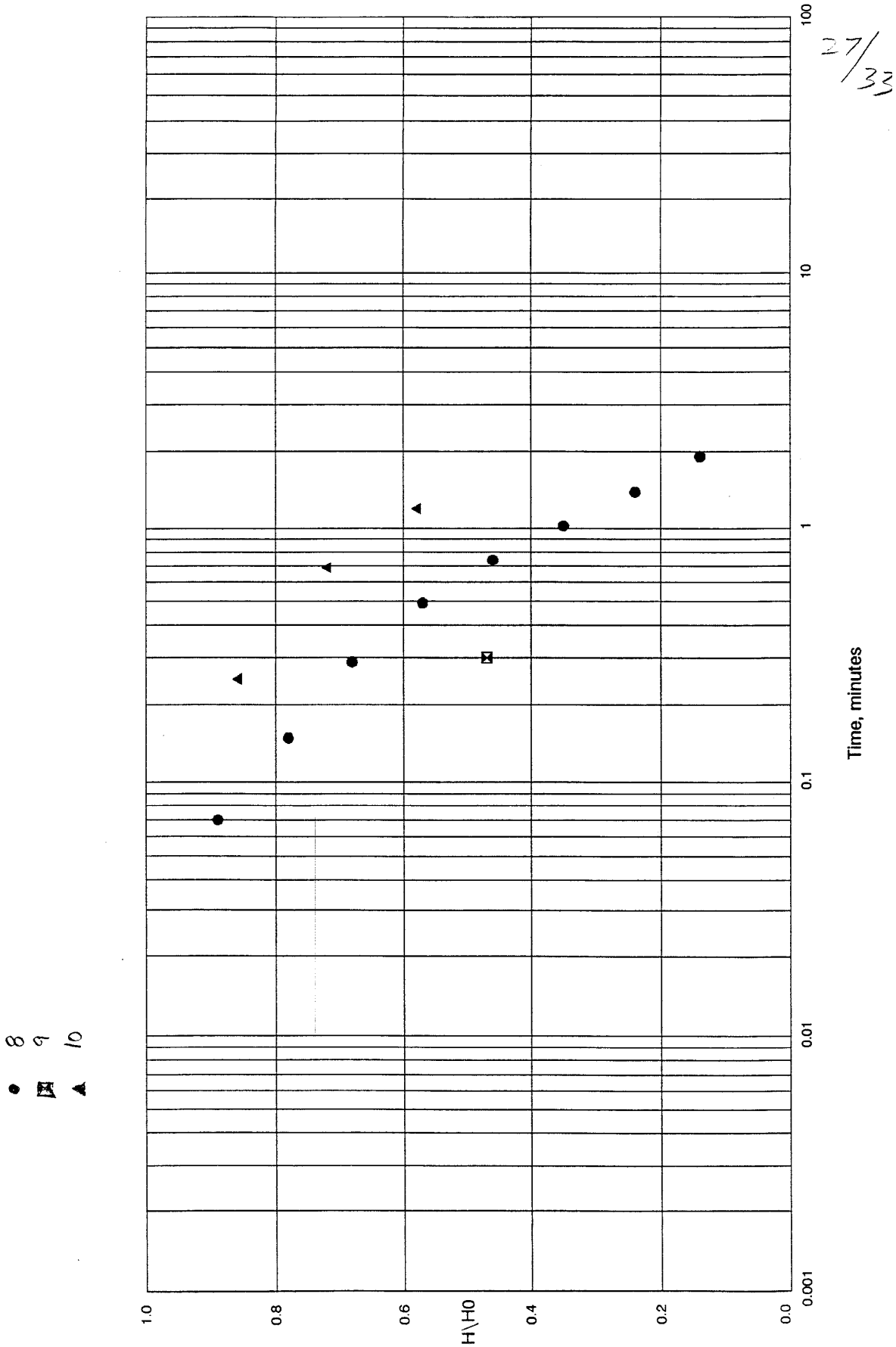
MW8

SLUG TEST ~~MW9~~ LENOIR CO

| | | | |
|---|---|---|---|
| DEPTH TO GW | 16.67 | RADIUS, in. | 1 |
| HT OF STICKUP | 2.58 | WET SCREEN, ft | 15 |
| INITIAL GW READING | 10 | t, min | 1.08 |
| INITIAL TIME | 16.48 | k, cm/sec | 2.2E-04 |
| INITIAL GW BELOW TOC | 19.25 | | |
| HO | 9.25 | | |

| GW READING | DH | H | H/HO | HOUR | MIN | SEC | TIME |
|---|---|---|---|---|---|---|---|
| 11 | 1 | 8.25 | 0.89 | 0 | 16 | 33 | 0.07 |
| 12 | 2 | 7.25 | 0.78 | 0 | 16 | 38 | 0.15 |
| 13 | 3 | 6.25 | 0.68 | 0 | 16 | 46 | 0.29 |
| 14 | 4 | 5.25 | 0.57 | 0 | 16 | 58 | 0.49 |
| 15 | 5 | 4.25 | 0.46 | 0 | 17 | 13 | 0.74 |
| 16 | 6 | 3.25 | 0.35 | 0 | 17 | 30 | 1.02 |
| 17 | 7 | 2.25 | 0.24 | 0 | 17 | 53 | 1.40 |
| 18 | 8 | 1.25 | 0.14 | 0 | 18 | 24 | 1.92 |


26/33
W = 1
t = 1.08 min
Time, minutes
W = Tt/r²
H/Ho
1.0
0.8
0.6
0.4
0.2
0.0
10
1
0.1
0.01
0.001
10⁻¹
10⁻²
10⁻³
1
2
3
4
5
6
7
8
9

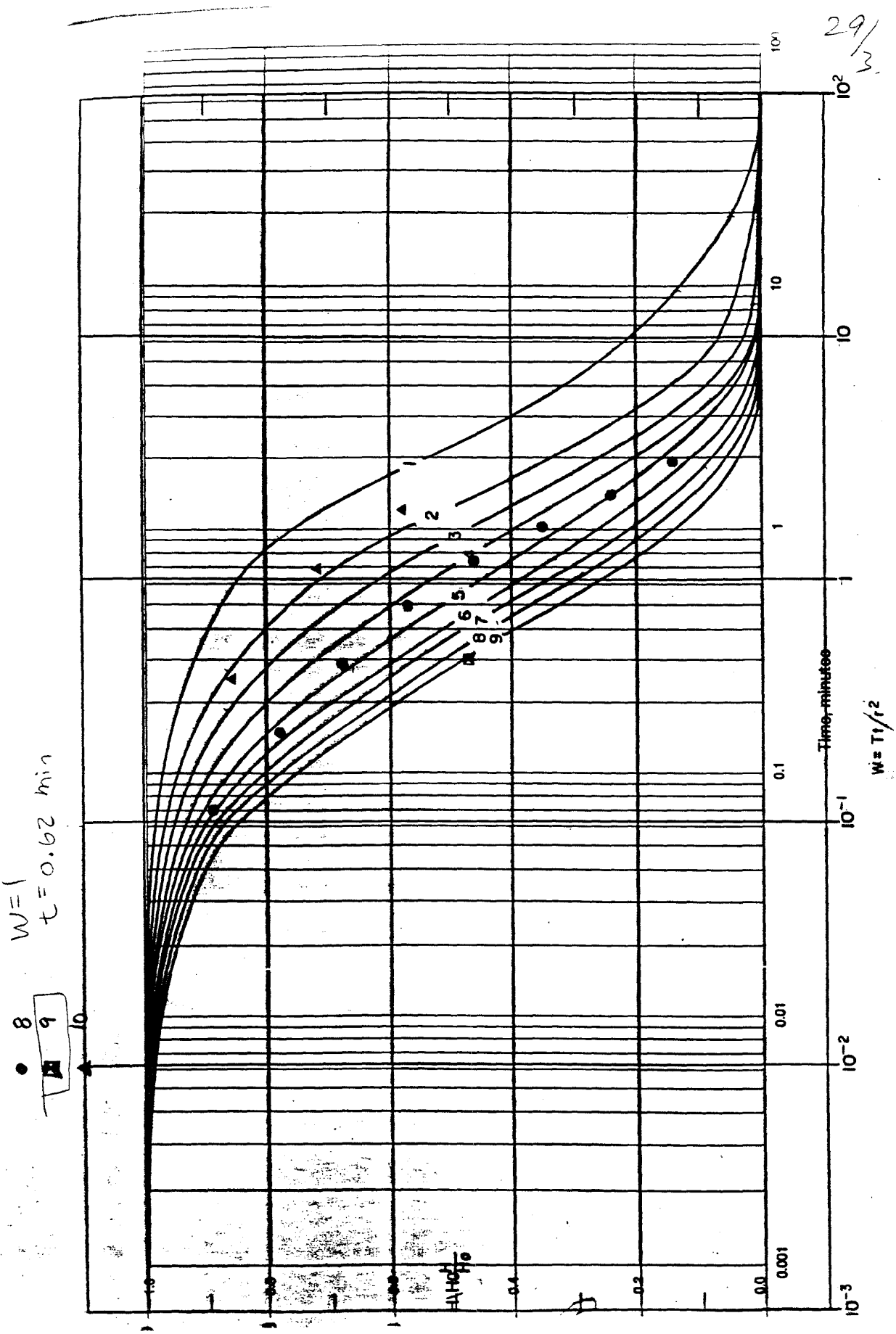

8
9
10
1.0
0.8
0.6
0.4
0.2
0.0
H\H0
0.001
0.01
0.1
1
10
100
Time, minutes
27/33

28/33

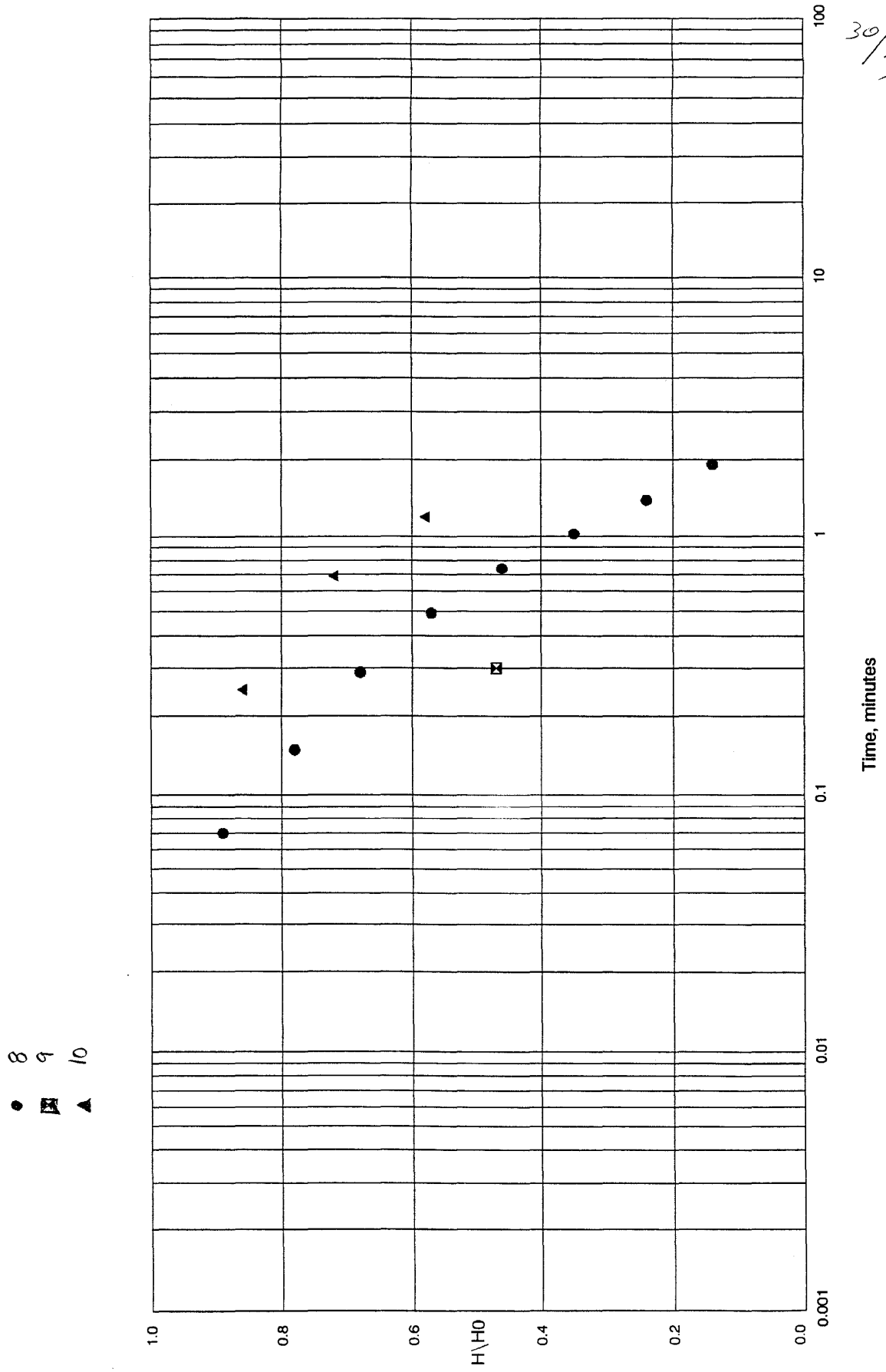
SLUG TEST MW9 LENOIR CO

| | | | |
|---|---|---|---|
| DEPTH TO GW | 4.96 | RADIUS, in. | 1 |
| HT OF STICKUP | 2.6 | WET SCREEN, ft | 15 |
| INITIAL GW READING | 0 | t, min | 0.62 |
| INITIAL TIME | 0.27 | k, cm/sec | 3.8E-04 |
| INITIAL GW BELOW TOC | 7.56 | | |
| HO | 7.56 | | |

| GW READING | DH | H | H/HO | HOUR | MIN | SEC | TIME |
|---|---|---|---|---|---|---|---|
| 4 | 4 | 3.56 | 0.47 | 0 | 0 | 34 | 0.30 |


29/3
W=1
τ=0.62 min
Time, minutes
W= Tt/r²
1
2
3
5
6
7
8
9
10
1
0.1
0.01
0.001
10²
10
1
10⁻¹
10⁻²
10⁻³
0.4
0.2
0.0

30/33

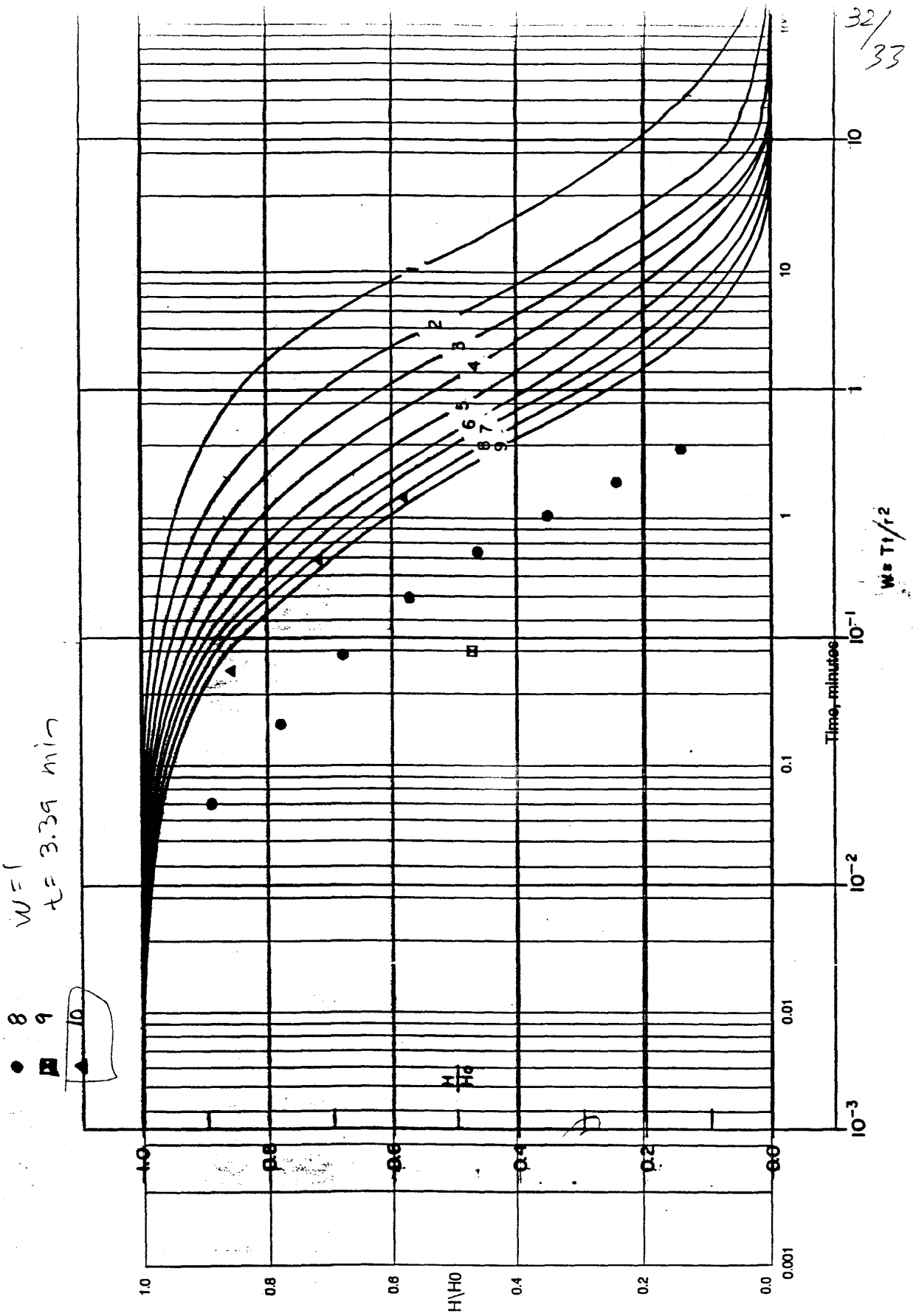


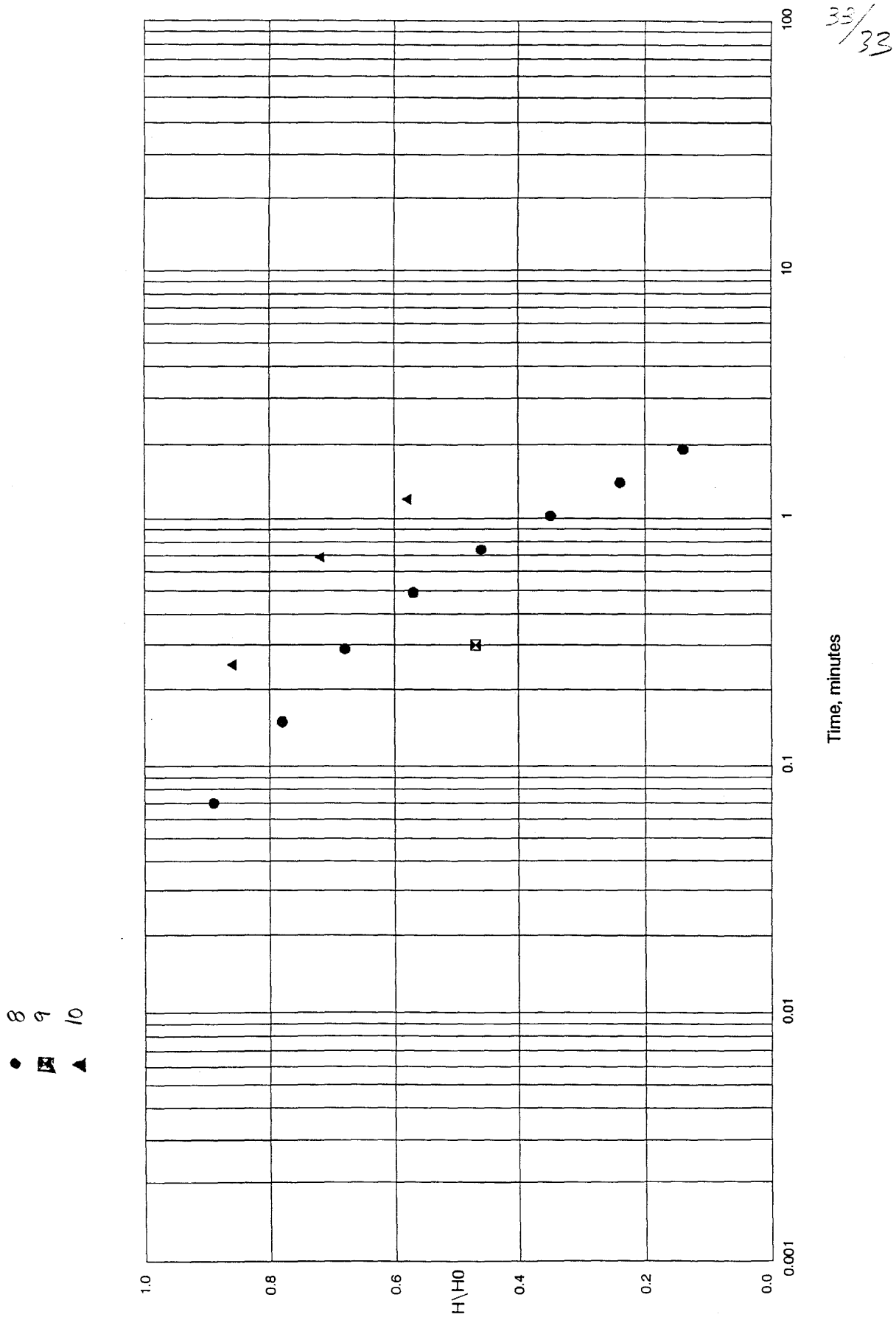
31/33

SLUG TEST MW10 LENOIR CO

| | | | |
|---|---|---|---|
| DEPTH TO GW | 19.27 | RADIUS, in. | 1 |
| HT OF STICKUP | 2.88 | WET SCREEN, ft | 15 |
| INITIAL GW READING | 15 | t, min | 3.39 |
| INITIAL TIME | 32.13 | k, cm/sec | 6.9E-05 |
| INITIAL GW BELOW TOC | 22.15 | | |
| HO | 7.15 | | |

| GW READING | DH | H | H/HO | HOUR | MIN | SEC | TIME |
|---|---|---|---|---|---|---|---|
| 16 | 1 | 6.15 | 0.86 | 0 | 32 | 23 | 0.25 |
| 17 | 2 | 5.15 | 0.72 | 0 | 32 | 49 | 0.69 |
| 18 | 3 | 4.15 | 0.58 | 0 | 33 | 20 | 1.20 |


32/33
W=1
t=3.39 min
8
9
10
1
2
3
4
5
6
7
8
9
10
1
0.1
0.01
0.001
1.0
0.8
0.6
0.4
0.2
0.0
H/Ho
Time, minutes
W= Tt/r²


8
9
10
1.0
0.8
0.6
0.4
0.2
0.0
H\H0
0.001
0.01
0.1
1
10
100
Time, minutes
33/33

North Carolina
Department of Environment and Natural Resources

Division of Waste Management

Michael F. Easley, Governor
William G. Ross Jr., Secretary
Dexter R. Matthews, Director

February 21, 2002

Mr. John Sugg
Lenoir County Solid Waste Director
Courthouse, Box 3289
Kinston, North Carolina 28501

Re: Adjustments to Water Quality Monitoring Requirements - Lenoir County Closed Landfill (Permit # 54-03)

Dear Mr. Sugg:

Municipal Engineering Services Company, P.A. (MESCO) on behalf of Lenoir County has requested a variance in the groundwater monitoring program at the above referenced landfill. Specifically, a request was made to: (1) substitute wells MW-11 and MW-12 for MW-8 and MW-10 respectively as part of the compliance monitoring network; and (2) change the monitoring status for the entire landfill from assessment monitoring back to detection monitoring.

**Monitoring Well Substitution**

The Solid Waste Section approves the substitution of wells MW-11 and MW-12 for wells MW-8 and MW-10. Monitoring wells MW-8 and MW-10 will not have to be sampled semiannually. However both wells must be maintained in the event conditions change and sampling must be resumed.

**Change in Monitoring Status**

Previously, approval was given to remove monitoring wells MW-1, MW-3, MW-6, and MW-9 from Appendix II sampling requirements. Currently wells MW-4, MW-8, MW-10, MW-11, and MW-12 remain in assessment monitoring. Based on the monitoring data that has been submitted and allowed by 15A NCAC 13B.1634 (e) the Solid Waste Section approves the return of MW-4, MW-11, and MW-12 to detection monitoring for the Appendix I list of parameters.

Although approval was given to allow detection monitoring for MW-3, the August 11, 2001 sampling results will require it to be returned to assessment monitoring because of the detection of 1,1-dichloroethane. Despite the fact that the concentration is less than the groundwater standard, it is statistically greater than the background concentration and must again be sampled for the Appendix II list of parameters. For the entire landfill to be able to return to detection monitoring as requested, it must meet the conditions of Rule 15A NCAC 13B .1634 (e), and

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according to the monitoring data, this has not happened at the Lenoir County Landfill. Consequently, the landfill continues to be in assessment monitoring.

**Summary**

In summary, the Solid Waste Section approves the following changes in the water quality monitoring program at the Lenoir County Landfill:

1. Monitoring wells MW-8 and MW-10 will be removed from sampling requirements;

2. Monitoring wells MW-1, MW-4, MW-6, MW-9, MW-11, and MW-12 will return to a detection monitoring program and be sampled for the Appendix I list of parameters;

3. Monitoring well MW-3 will return to assessment monitoring and be sampled for the Appendix II list of parameters when appropriate.

Approval for these changes is based compliance with Rule .1634 (e). Failure to comply with this rule may result in the return of affected wells to assessment monitoring requirements.

Thank you for your cooperation with this matter. If you have any questions, please call me at (919) 733-0692, extension 257.

Sincerely,

Larry Rose

Larry Rose
Environmental Compliance
Solid Waste Section

cc: James Coffey- Chief, Solid Waste Section
Mark Fry - Eastern District Supervisor
John Crowder - Waste Management Specialist
Cheryl Marks - Hydrogeologist