

Hazardous Waste Section
File Room Document Transmittal Sheet

Your Name: Mary Siedlecki
EPA ID: N C D 0 8 8 5 6 0 0 3 2
Facility Name: Ashland Raleigh
Document Group: Groundwater (GW)
Document Type: Other (O)
Description: Samling and Analysis Plan
Date of Doc: 1/30/2013
Author of Doc: Anteagroup

File Room Use Only

Date Recieved by File Room:

Date Scanned:

Month	Day	Year

Scanner's Initials:

Sample and Analysis Plan

*Ashland Raleigh
1415 South Bloodworth Street
Raleigh, Wake County, North Carolina
USEPA ID No: NCD 088 560 032*

*Antea USA of North Carolina, Inc.
Project No. E020702565
January 30, 2013*

ASHLAND

Prepared for:
Ashland Inc.
5200 Blazer Parkway, DS-4
Dublin, Ohio 43017
+1 919 387 2345

Prepared by:
Antea USA of North Carolina, Inc.
8008 Corporate Center Drive, Suite 100
Charlotte, North Carolina 28226
+1 800 477 7411

January 30, 2013

Mr. Michael Dever
Remediation Project Manager
Ashland Inc.
5200 Blazer Parkway, DS-4
Dublin, Ohio 43017

Subject: **Sampling and Analysis Plan**
 Ashland Inc. – Raleigh, NC
 1415 South Bloodworth Street,
 Raleigh, Wake County, North Carolina
 USEPA ID No: NCD 088 560 032
 Antea USA of North Carolina, Inc. Project No. E020702565

Dear Mr. Dever:

Antea USA of North Carolina, Inc. (Antea USA of NC) is pleased to present the following Sampling and Analysis Plan to serve as documentation of the procedures that Antea USA of NC is currently utilizing for collection, analysis and evaluation of groundwater quality data at the above referenced facility. This Sampling and Analysis Plan also includes the following items recommended within the final Administrative Order for the facility dated May 17, 2011: data quality assurance and quality control measures, general inspection and maintenance schedule, and personnel training plan for site workers. If you have any questions, please contact me at (919) 655-4919.

Sincerely,

Antea USA of North Carolina, Inc.



Patrick Storz
Project Manager

cc: Mr. Donald Malone – Arcadis, Inc.; Raleigh, North Carolina
 Ms. Mary Siedlecki – NCDENR; Raleigh, North Carolina



Table of Contents

1.0	INTRODUCTION.....	1
2.0	SAMPLING PROCEDURES	1
2.1	Groundwater Elevation Measurements	1
2.2	Well Purging And Purging Adequacy	2
2.3	Sample Collection	3
2.4	Surface Water Collection	4
2.5	Decontamination Procedures	4
2.6	Quality Control For Groundwater Sampling	5
2.7	Sample Identification and Chain-of-Custody	5
2.7.1	Sample Identification	5
2.7.2	Sample Chain-of-Custody Procedures	5
3.0	SAMPLE ANALYSIS AND SCHEDULE.....	6
4.0	GENERAL INSPECTION AND MAINTENANCE SCHEDULE	7
4.1	RCRA Cap Inspection Program	7
4.2	Monitoring Well Inspection Program	7
5.0	PERSONNEL TRAINING PLAN FOR SITE WORKERS	8
6.0	REMARKS	8
7.0	REFERENCES.....	8

Figure

Figure 1 Site Layout

Appendices

- Appendix A Sampling Log Sheet
- Appendix B Well Construction Records
- Appendix C Chain-of-Custody Records

Sampling and Analysis Plan

Ashland Raleigh

1415 South Bloodworth Street

Raleigh, Wake County, North Carolina

USEPA ID No: NCD 088 560 032

Antea USA of North Carolina, Inc. Project No. E020702565

1.0 INTRODUCTION

Antea USA of North Carolina, Inc. (Antea USA of NC) is pleased to present this revised Sampling and Analysis Plan (SAP) for the Ashland Raleigh site located at 1415 South Bloodworth, Raleigh, North Carolina. A site location map is presented as **Figure 1**. The purpose of this amended SAP is to serve as a procedures manual that can be followed during each of the sample collection events to ensure that procedures are consistent and that sampling methods do not affect groundwater quality. The procedures outlined below are in accordance with the current United States Environmental Protection Agency (USEPA) Region 4 Science and Ecosystem Support Division (SESD) *Field Quality System and Technical Procedures*. This SAP also includes the following items recommended within the final Administrative Order (AO) for the facility dated May 17, 2011:

- Section 2.6 - Data Quality Assurance and Quality Control (QA/QC) measures (Paragraph VI of the AO),
- Section 4 - General Inspection and Maintenance Schedule (Paragraph IX.A. of the AO), and
- Section 5 - Personnel Training Plan for Site Workers (Paragraph IX.B. of the AO).

2.0 SAMPLING PROCEDURES

The sampling program consists of groundwater quality sampling, including collection of samples for laboratory analysis; field analysis of pH, specific conductance, temperature, dissolved oxygen (DO), and oxidation-reduction potential (ORP); and groundwater level measurements.

The Groundwater Sampling Record (**Appendix A**) will be used to record all measurements made during well gauging, purging and sampling. This form was designed to be used as a checklist and as documentation of all groundwater sampling activities for an individual well or a surface water sample. In addition to the Groundwater Sampling Record, Antea USA of NC will maintain a field logbook with additional information pertaining to the daily sampling activities (i.e., calibration times, personnel on-site, etc.).

2.1 Groundwater Elevation Measurements

Prior to the initiation of any gauging or sampling activity, all personnel will don clean, new, nitrile gloves. These nitrile gloves will be replaced as necessary during groundwater elevation measurements, well evacuation and sampling, and they will be changed between wells and/or sample locations.

If the monitoring well caps are equipped with air/water tight seals, the caps will be removed and the water level in the well allowed to equilibrate with ambient atmospheric conditions prior to obtaining water level measurements. Groundwater elevation measurements will be collected during each groundwater sampling event from all monitoring wells at the site. These same-day groundwater level measurements will be used to establish groundwater flow direction and gradients.

The depth to static water level in all wells will be measured before initiation of any well evacuation activities. To reduce the potential for cross-contamination between monitoring wells, measurements will be collected in order from least contaminated to most contaminated monitoring wells, as documented from the most recent analytical results. All groundwater level and well depth measurements will be made relative to an established reference point on the well casing and will be documented in the field logbook. If no mark is apparent, the person performing the measurements should take both the groundwater elevation and the total depth measurements from the north side of the top of casing and note this in the field logbook. Static water level measurements will be measured to the nearest 0.01 foot using an electric water level indicator. A total of three consecutive water level elevations will be measured to ensure accuracy. The electric water level indicator will be decontaminated between monitoring wells following the decontamination procedures outlined in Section 2.5 below.

Finally, the total depth of each well will be measured to the nearest 0.1 foot during each sampling event (not more frequent than annually) to verify the integrity of each monitoring well. The information will be recorded in the field logbook. Well construction records are included in **Appendix B**.

2.2 Well Purging And Purging Adequacy

Each well will be purged before sample collection to remove stagnant water from the well casing, thereby ensuring that the samples collected are representative of the water quality surrounding each well. In order to determine when a well has been adequately purged, field personnel will monitor the pH, specific conductance, temperature, dissolved oxygen, oxygen-reduction potential, and turbidity. Prior to initiating the purge, the amount of standing water in the water column should be determined.

Purging techniques will be performed in accordance with the USEPA SESD Operating Procedure (SESDPROC-301-R2) for groundwater sampling. The volume of water to be evacuated is normally calculated using the following equation:

$$\begin{aligned} V &= \pi r^2 h, \text{ where} \\ \pi &= 3.14159 \\ r &= \text{Radius of well casing} \\ h &= \text{Height of water column in well (Total well} \\ &\quad \text{(depth – depth to groundwater prior to} \\ &\quad \text{purging)} \\ V &= \text{Volume of water in well} \\ \text{Minimum Purge Volume} &= V \times 3 \end{aligned}$$

However, based on the slow recovery rates of the monitoring wells, low flow/low volume purging techniques (“micro-purge method”) will be used to adequately purge each of the monitoring wells. This method is utilized to minimize purge water volumes and minimize the drawdown in the monitoring well. Low flow/low volume dedicated pumps (QED MP-15 Power Pack and Controller) were installed in over half of the monitoring wells on-site. The remaining monitoring wells will be purged and sampled utilizing a stainless steel variable speed submersible pump. New polyethylene tubing is used for each of the monitoring wells and disposed after sample collection. The pump is decontaminated between each of the monitoring wells following the procedures outlined in section 2.5. The pump intake is placed within the screened interval at the zone of sampling, preferably the zone with the highest flow rate. Flow rates should not exceed the recharge rate of the aquifer. This is monitored by measuring the top of the water column with a properly cleaned water level indicator or similar device while pumping.

With respect to groundwater chemistry, an adequate purge is achieved when the pH, specific conductance, and dissolved oxygen of the groundwater have stabilized and the turbidity has either stabilized or is below 10 Nephelometric Turbidity Units (NTU). Stabilization occurs when, for at least three consecutive measurements, the pH remains constant within 0.1 Standard Unit (SU), specific conductance varies no more than 5 percent, and the dissolved oxygen remains constant within 0.2 milligrams per liter or 10% saturation.

Purge water will be containerized in closed-top 55-gallon drums, labeled and disposal will be arranged through an Ashland-approved waste disposal contractor.

2.3 Sample Collection

Prior to sampling, new plastic sheeting will be placed on the ground surface around the well casing to prevent contamination of the pumps, hoses, ropes, etc., in the event they accidentally come into contact with the ground surface or, for some reason, they need to be placed on the ground during the purging event. It is preferable that hoses used in purging that come into contact with the groundwater be kept on a spool and remain sealed both during transportation and during field use, to further minimize contamination by the transporting vehicle or the ground surface.

Sampling will begin with the least contaminated well(s) in order to minimize the potential for cross contamination. After a well has been purged and the parameters have stabilized, the sample will be collected. Samples will be collected directly from the tubing into the dedicated sample containers. As mentioned above, field parameters will be recorded on the sampling log during the purging process. Field measurements will be recorded with a commercially available meter(s) calibrated as recommended in the manufacturer's operating instructions. Instrument calibrations will be recorded daily. Visual characteristics of the sample, including turbidity will be recorded on the sampling log.

Samples will be collected in pre-preserved laboratory-supplied glassware. Samples will not be filtered unless a duplicate unfiltered sample is submitted for analysis along with the filtered sample. All samples will be collected with minimum agitation and volatilization of the constituents. Volatile organic compounds will be collected with zero headspace in the containers. Samples will be placed on ice immediately after collection.

Once documentation is complete for all samples, appropriate sections of the chain-of-custody (COC) will be completed and custody seal tape placed around the cooler. The COC form is included in **Appendix C**. Samples will be shipped to the analytical laboratory in a timely manner under the appropriate sample hold times.

2.4 Surface Water Collection

In addition to collecting groundwater samples from site monitoring wells, three surface water samples (SWS-1, SWS-2, and SWS-3) will be collected during each monitoring event. A sample may be collected directly into the sample container when the surface water source is accessible by wading or other means. The sampler will face upstream if there is a current and collect the sample without disturbing the bottom sediment. The sampler will collect the most downstream sample (SWS-3) first and will collect the most upstream sample (SWS-1) last to avoid potentially disturbed sediment from flowing downstream and impacting subsequent sample collection. . The sampler will be careful not to displace the preservative from a pre-preserved sample container, such as the 40-ml VOC vial.

2.5 Decontamination Procedures

In accordance with the EPA's Region 4 SESD *Field Equipment and Decontamination Procedures*, the following decontamination procedures will be followed:

Water Level or Tapes

- Wash with Liquinox and tap water.
- Rinse with tap water.
- Rinse with de-ionized water.

Decontamination of Stainless Steel Pump

- Washing with a Liquinox or similar detergent solutions using a brush to remove any particulate matter or surface film on the pump and wires.
- Rinse with tap water
- Rinse with de-ionized water
- Place equipment in a clean plastic bag

2.6 Quality Control For Groundwater Sampling

Quality control for groundwater sampling will consist of traceable documentation of sample collection activities, proper field preservation techniques, and verification of sample handling and effectiveness using appropriate laboratory trip blank samples. A laboratory-provided trip blank will be used during each quarterly sampling event. The trip blank will be handled like a sample and will be returned to the laboratory for analysis along with the collected samples.

Groundwater sample collection will be traceable through the sampling sheets maintained by field personnel. The sampling sheets will include information given on the sample label as well as the sampling equipment used. All groundwater samples will be labeled at the time of sampling. Samples will be cooled immediately after collection. Shipping containers will be prepared for transportation to the laboratory in accordance with the COC.

2.7 Sample Identification and Chain-of-Custody

2.7.1 Sample Identification

Prior to collecting each sample, sample containers will be labeled with the following information:

- Date and time of sample collection
- Sample project identification number
- Sample location number
- Name of person who collected sample
- Type of preservative
- Parameters to be analyzed

The sample location number on the label will correspond to the sample location numbers assigned on the field site map (**Figure 1**).

2.7.2 Sample Chain-of-Custody Procedures

An accurate record of sample collection, transport and analysis must be maintained and documented. Therefore, COC procedures will be instituted and followed throughout investigation. Field custody requirements dictate that as few people as possible handle the sample(s), and that the sampler is responsible for the care and custody of the samples until they are transferred or dispatched properly.

Samples shall be stored by those individuals or facilities designated on the COC form. The following methodologies will be used to ensure proper transfer documentation:

- Samples shall be accompanied by a COC record at all times.
- Samples shall be packed properly for shipment to minimize the potential for bottles to dislodge and/or break during shipment.
- Samples shall be transported directly to the analytical laboratory, or shipped via an overnight carrier to ensure holding times are not exceeded. If necessary, the airbill number will be recorded to facilitate tracking of the package.
- Methodology of shipment, courier name(s), and other pertinent information shall be recorded on the COC form.
- When samples are split with outside source or government agency, the split shall be noted.

An example COC form to be used by personnel responsible for ensuring the integrity of samples from the time of collection to the shipment to the laboratory is included in **Appendix C**. The contract laboratory shall be responsible for maintaining the COC of the sample(s) after they are received by the laboratory. The COC form shall be signed by each individual who has the samples in their possession. Preparation of the COC form shall be as follows:

- The COC record shall be initiated in the field by the person collecting the sample. Every sample that is entered on the COC form shall be assigned a unique identification number. Samples can be grouped for shipment using a single form.
- If the person collecting the sample does not transport the samples to the laboratory or delivers the sample containers for shipment, the person shall sign the first block for “Relinquished By ____”. “Received By ____” shall be completed by the next person assuming responsibility for the samples.
- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record form as “Relinquished By _____”.
- If the samples are shipped to the laboratory by commercial carrier, the COC form shall be sealed in a watertight container, placed in the shipping container, and the shipping container sealed before being given to the carrier.
- If the samples are directly transported to the laboratory, the COC shall be kept in the possession of the person delivering the samples.
- For samples shipped by commercial carrier, the airbill shall serve as an extension of the COC record between the final field custodian and receipt in the laboratory.

3.0 SAMPLE ANALYSIS AND SCHEDULE

Sample collection will occur on an annual basis from 2013 until 2017. Following completion of the 2017 sampling event, biennial sampling will be conducted from 2019 through 2027 and transition to a 5-year sampling frequency

thereafter, unless a trigger occurs for more frequent sampling to evaluate compliance with regulatory standards. Surface water and groundwater samples will be collected from the following locations during each sampling event:

- Groundwater monitoring wells MW-1, MW-3, MW-3D, MW-5, MW-7, MW-8R, MW8DR, MW-12D, MW-14OB, MW-14TZ, MW-16OB, MW-18BR, MW-22, MW-23, MW-23D, MW-23BR, MW-24, MW-25, and MW-26.
- Surface water sampling location SWS-1 (upgradient), SWS-2, and SWS-3.

Samples collected from groundwater monitoring wells and surface water locations during each monitoring event will be analyzed using SW-846 Method 8260B for volatile organics. All analytical work shall be performed by North Carolina certified laboratories. In addition, field parameter readings of temperature, dissolved oxygen, conductivity, oxidation-reduction potential, and pH will be collected during purging. Groundwater and surface water sampling results will be submitted to the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Waste Management, Hazardous Waste Section within 60 days of the sampling event.

4.0 GENERAL INSPECTION AND MAINTENANCE SCHEDULE

4.1 RCRA Cap Inspection Program

The frequency for the post-closure monitoring of the Resource Conservation and Recovery Act (RCRA) Cap is on an annual basis. The annual concrete cap inspection will include verification of the following items:

- Access restrictions to the site and/or RCRA CAP
- Condition of the concrete CAP
- The presence of standing water
- Verify materials are not being stored on the CAP
- Collection of site photos documenting current conditions

A RCRA post-closure inspection memo documenting the conditions and including photographs will be submitted to the NCDENR Hazardous Waste Section on an annual basis within 45 days of completing the inspection activities.

4.2 Monitoring Well Inspection Program

During each sampling event, each existing monitoring well will be inspected for damage or wear that may compromise the integrity of the well. The following will be replaced as needed based on the inspection results.

- Locks
- Tight fitting well seals (J-plugs)

- Flush mount manways
- Seals and o-rings for flush mount manways
- Stick up covers
- Bolts
- Washers
- Vaults
- Concrete pads
- Down-hole obstructions
- Any additional well construction defects that might interfere with sampling, well security, and/or the quality of the resultant data

Well identification markings will also be inspected and wells remarked if necessary. All well maintenance will be recorded in the field log book. Repairs that cannot immediately be completed will be reported to the project manager as soon as possible for appropriate action.

5.0 PERSONNEL TRAINING PLAN FOR SITE WORKERS

Personnel conducting inspection and/or monitoring activities will have received a minimum 40 hours of Hazardous Waste Operations and Emergency Response (HAZWOPER) training as outlined in 29 CFR 1910.120. Annual eight (8) hour refresher courses will be required and the current "Certificates of Completion" will be including in the site-specific Health and Safety Plan. In addition, personnel conducting groundwater and surface water sampling activities will be trained in current sampling practices as outlined in the EPA SESD *Field Quality System and Technical Procedures*.

6.0 REMARKS

The recommendations contained in this report represent Antea USA of NC professional opinions based upon the currently available information and are arrived at in accordance with currently accepted professional standards. This report is based upon a specific scope of work requested by the client. The contract between Antea USA of NC and its client outlines the scope of work, and only those tasks specifically authorized by that contract or outlined in this report were performed.

7.0 REFERENCES

EPA, Operating Procedure, Field Equipment Cleaning and Decontamination. Region 4 U.S. Environmental Protection Agency, Science and Ecosystem Support Division Athens, Georgia. December 2011.

Sampling and Analysis Plan
Ashland Raleigh
1415 South Bloodworth Street
Raleigh, Wake County, North Carolina
Antea USA of North Carolina, Inc. Project No. E020702565



EPA, Groundwater Sampling. Region 4 U.S. Environmental Protection Agency, Science and Ecosystem Support Division. Athens, Georgia. October 2011.

EPA, Operating Procedure, Surface Water Sampling. Region 4 U.S. Environmental Protection Agency, Science and Ecosystem Support Division. Athens, Georgia. November 2007.

URS, Sampling and Analysis Plan. URS Corporation. Atlanta, Georgia. May 4, 2004

This report was prepared by:
ANTEA USA OF NORTH CAROLINA, INC.

A handwritten signature in black ink, appearing to read "Kyle Sorensen".

Kyle Sorensen
Project Professional

1/30/13
Date

Reviewed by:

A handwritten signature in black ink, appearing to read "Patrick Storz".

Patrick Storz
Project Manager

1/30/13
Date

cc: Mr. Donald Malone – Arcadis, Inc.; Raleigh, North Carolina
Ms. Mary Siedlecki – NCDENR; Raleigh, North Carolina

*Sampling and Analysis Plan
Ashland Raleigh
1415 South Bloodworth Street
Raleigh, Wake County, North Carolina
Antea USA of North Carolina, Inc. Project No. E020702565*



Figure

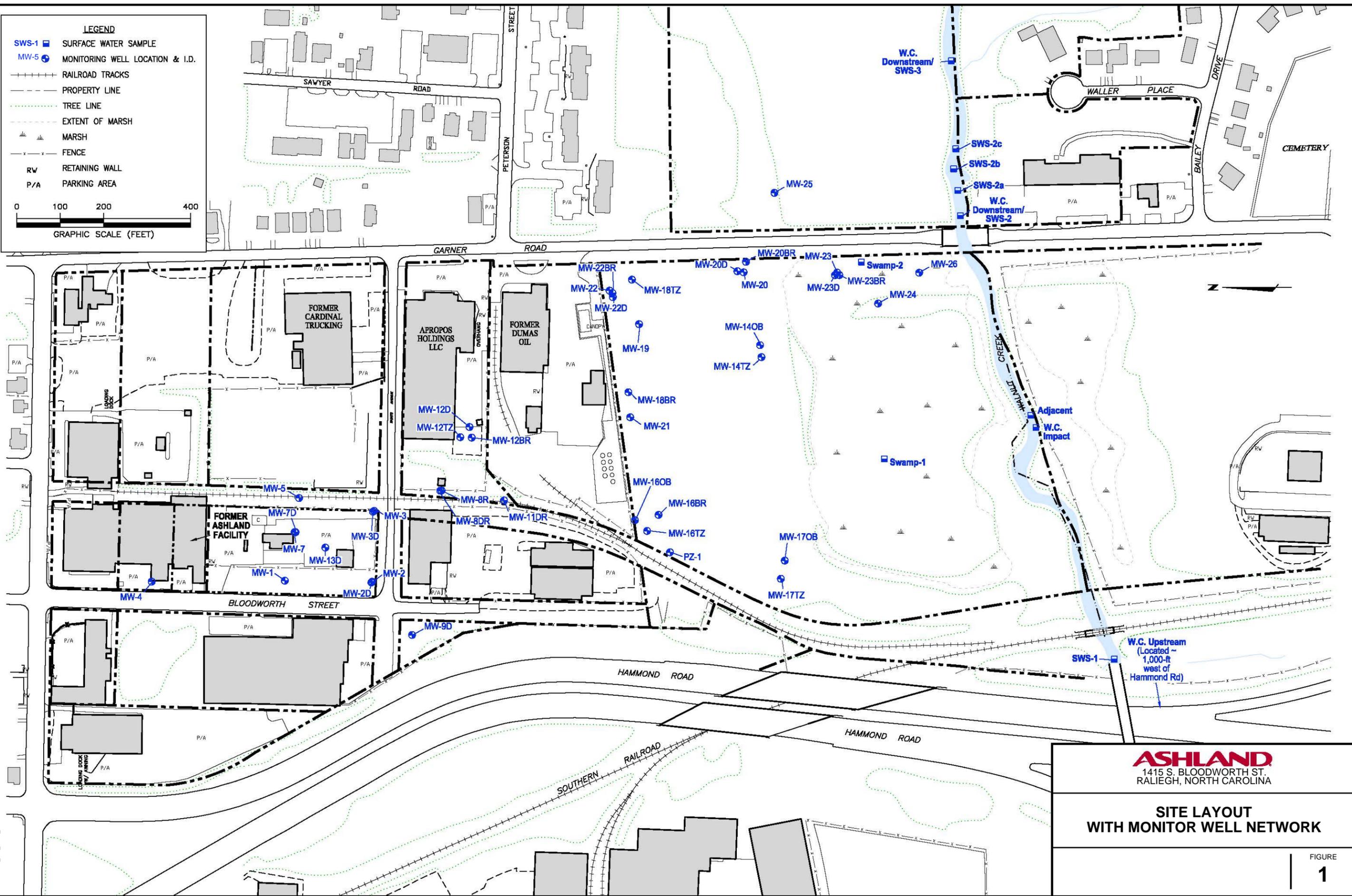
Figure 1 Site Layout

CITY: Augusta, GA DIV/GROUP: ENV DB: A. Saul LD: PIC: PM: D. Malone TM: R. Gerber
 1 LAYOUT: 4 SAVED: G:\ENV\CAD\Augusta-GA\ACT\CH0060000\NC261240\I\CH005000B01_1.dwg ACADVER: 13/02/2013 12:21 PM PAGES: 18, 19 (LMS TECH) PLOTSTYLETABLE: ... PLOTTED: ACS-IMP-MONO.CTB BY: 13/02/2013 12:22 PM
 XREFS:
 ashland_mc_base_xref
 ashland_mc_base_xref

LEGEND

- SWS-1 SURFACE WATER SAMPLE
- MW-5 MONITORING WELL LOCATION & I.D.
- +—+—+ RAILROAD TRACKS
- - - - - PROPERTY LINE
- TREE LINE
- - - - - EXTENT OF MARSH
- ~ ~ ~ ~ ~ MARSH
- x - x - x FENCE
- RW RETAINING WALL
- P/A PARKING AREA

0 100 200 400
 GRAPHIC SCALE (FEET)



ASHLAND
 1415 S. BLOODWORTH ST.
 RALIEGH, NORTH CAROLINA

**SITE LAYOUT
 WITH MONITOR WELL NETWORK**

FIGURE
1

*Sampling and Analysis Plan
Ashland Raleigh
1415 South Bloodworth Street
Raleigh, Wake County, North Carolina
Antea USA of North Carolina, Inc. Project No. E020702565*



Appendix A

Sampling Log Sheet

Sampled By <input type="checkbox"/> Facility Personnel <input type="checkbox"/> ES&T Other: _____	Facility Project No.	Site ID Date (m/d/y)
---	---------------------------------------	---------------------------------------

Site Description Monitoring Well Extraction Well Irrigation Well Spring Borehole Probe Other: _____

Air Temp: °C °F Weather: _____

Well Locked? yes no Damaged/Repairs Needed: _____

TOC MP Description: _____

TOC/MP Stickup: ft m above/below ground Well Inside Diameter (ID): 2-inch 4-inch Other: _____

Site Remarks (nearby wells pumping, tide, stream stage, etc.) _____

Water Level Data Measurement Units: ft m Well or Borehole Total Depth (TD) from MP or TOC: _____

<input type="checkbox"/> E-Tape, # _____ <input type="checkbox"/> Steel Tape <input type="checkbox"/> Other	Pre-Purge Initial	Pre-Purge Confirmation	Purging Start	During Purging	Purging End	After Sampling	Remarks
Time (hh:mm; 24-hr clock)							
Depth to Water							
Tape Correction							
Water Level (WL)							
Product Thickness							
Product Recovery <input type="checkbox"/> gallons <input type="checkbox"/> liters							

Measure water level from fixed measuring point (MP) or top of well casing (TOC). Record water depth to nearest 0.01 ft or 0.002 m, with minus (-) sign if level is above MP or TOC. If no mark on MP or TOC, measure water level from north side of casing. Measure static or pre-purging water level twice; record initial and confirmation measurements and measurement times (in 24-hour clock format). MP/TOC Stickup measurement is from ground surface to nearest 0.1 ft or 0.01 m. Depth to Water codes: N - not measured; D - dry; O - obstructed; P - pumping; F - flowing (artesian well); R - recently pumped; C - cascading. Water Level (WL) = Depth to Water - Tape Correction factor. Record free product presence at time of water level measurement; use "S" for free product thickness if sheen observed. If free product removed from well, record volume removed in gallons or liters, list product type in "Remarks" column.

Field WQ Data Purge Depth: Grab Bailor Pump Description: _____

Casing Volume: [_____ (TD) - _____ (WL)] • [_____ (Well ID)]² • [_____ (Conversion Factor)] = _____ gal liters
 Conversion Factor = 0.0408 for feet and gallons; 0.1544 for feet and liters; 0.5066 for meters and liters; Well ID in inches

Well Goes Dry While Purging

<input type="checkbox"/> Cum. Vol. Purged <input type="checkbox"/> Pumping Rate						(Final)	Meter Type	Remarks
Time (hh:mm; 24-hr clock)								
pH (Temperature Corrected? <input type="checkbox"/>)								
Temperature <input type="checkbox"/> °C <input type="checkbox"/> °F								
Dissolved Oxygen mg/L								
<input type="checkbox"/> SC or <input type="checkbox"/> EC μS/cm								
Turbidity <input type="checkbox"/> NTU								
Color/Tint								
Odor								

Record time purging starts and ends in "Purging Start" and "Purging End" columns in Water Level Data section. Cum. Vol. Purged: cumulative volume removed before sampling, in gallons or liters. Pumping Rate is gpm or Lpm, depending on box checked in casing volume calculation. Use "Final" column above for recording sample field measurements, total volume purged before sampling or average pumping rate during purging. Record equipment calibration methods, decontamination procedures, equipment failures, purge water disposal method, etc. In daily field notes. SC: Specific Conductance corrected for temperature (μS/cm at 25°C); EC: Electrical Conductivity not corrected for temperature (μS/cm). μS/cm = μmho/cm. 1 gallon (US) = 3.785 L = 0.833 Imperial gallon

Sample Data Sample Depth: Grab Bailor Pump Description: _____

Field Sample ID (unique ID on bottles)	Result Code	Date (m/d/y)	Time (hh:mm)	Bottles (total to lab)	Filtered (0.45 μm)	Lab ID	Case ID	SDG ID	Remarks
	P0								

Sample ID may be up to 15 characters. Sample Result Code, Date, and Time must be entered. Result Codes: P0, Primary Sample; D#, Duplicate Sample; S#, Split Sample (sent to second lab); BF#, Field Blank; BR#, Equipment Rinsete; BT#, Trip Blank; SF#, Field Spike (# = 1 to 9). Lab ID (up to 5 characters) is name of laboratory that will analyze the sample. Case ID (up to 5 characters) and SDG ID (sample delivery group, up to 15 characters) are required for blanks. Case ID may be the lab service request number or yy-mm. SDG may be lab's SDG, a cooler ID number, or mmdydy. Enter sample preservation and handling data on chain-of-custody form. Also record detailed information about duplicate, split, rinsate, spike, and/or blank sample collection/handling in daily field notes.

Sampler's Name (print) _____	Signature _____
-------------------------------------	------------------------

*Sampling and Analysis Plan
Ashland Raleigh
1415 South Bloodworth Street
Raleigh, Wake County, North Carolina
Antea USA of North Carolina, Inc. Project No. E020702565*

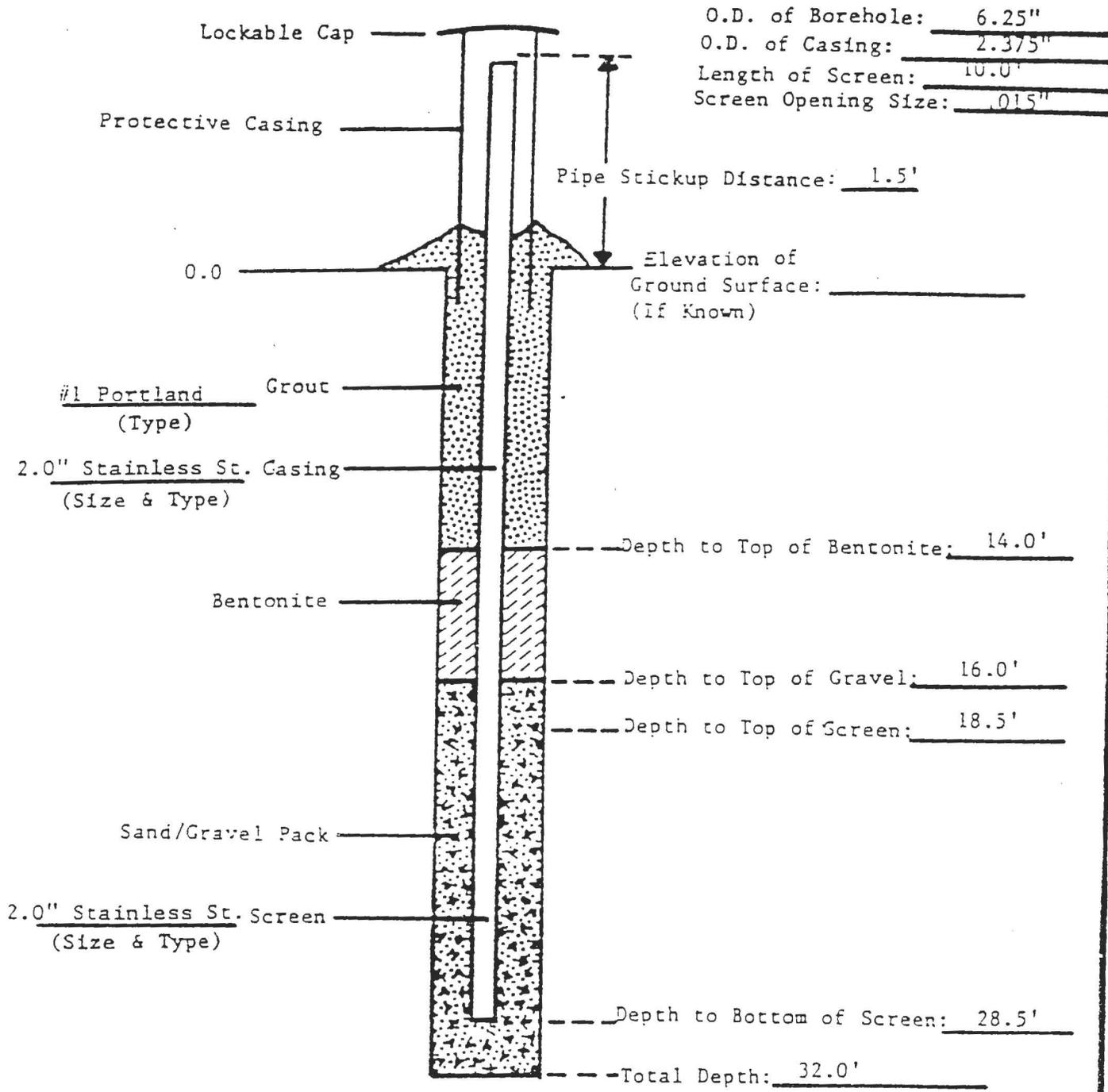


Appendix B

Well Construction Records

Well Number: MW-1 Drilling Method: Auger
 Date Started: 2-4-86 Drilling Fluids: None
 Date Finished: 2-4-86 Static Water Level: 24.25' Date: 2-6-86
 Geologist/Engineer: RSM/WPS/BR Observed by: _____
 Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

PROJECT:
 Ashland Chemical

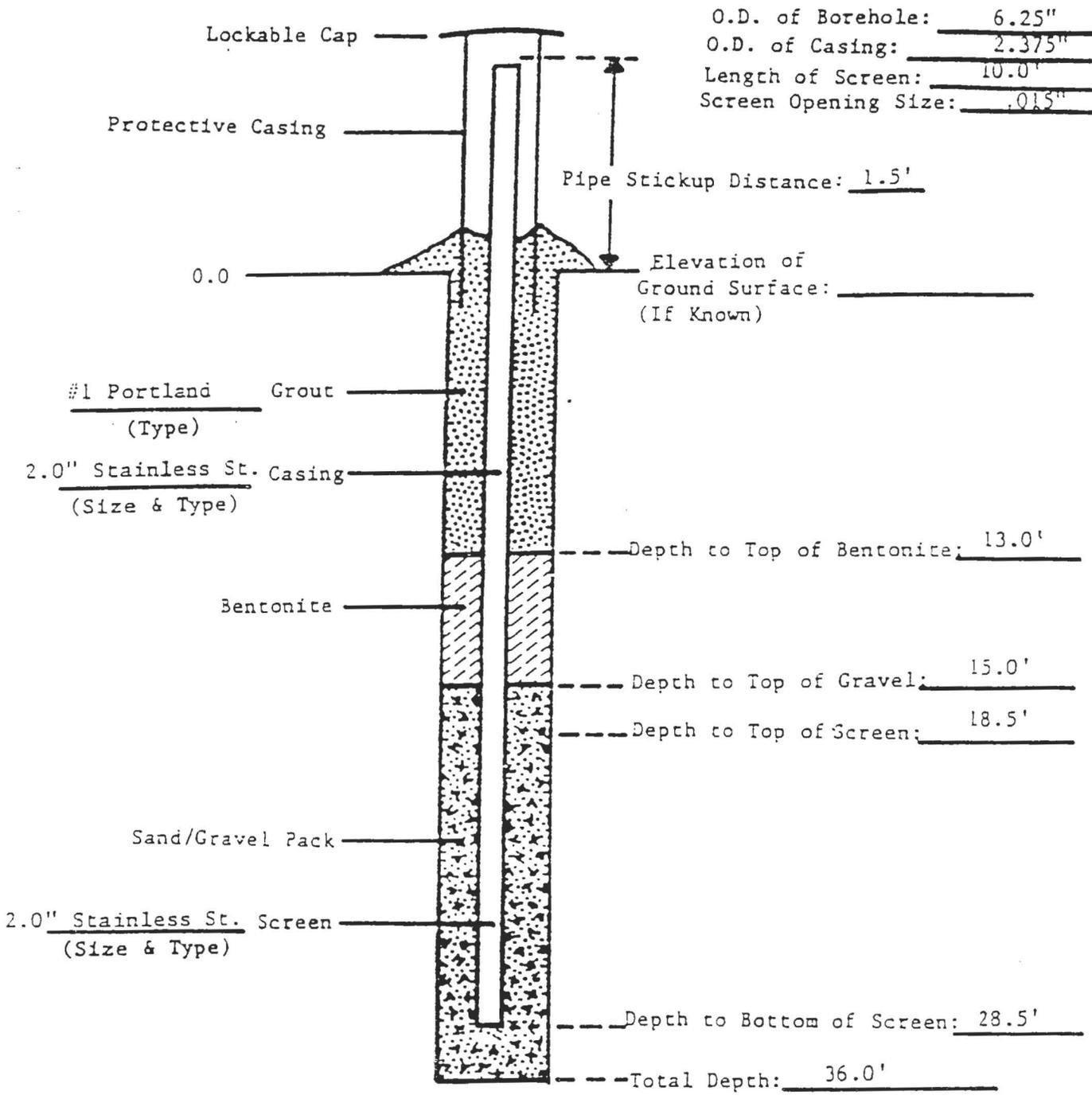
SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Well Number: MW-2
 Date Started: 2-5-86
 Date Finished: 2-5-86
 Geologist/Engineer: RSM

Drilling Method: Auger
 Drilling Fluids: N/A
 Static Water Level: 22.9' Date: 2-6-86
 Observed by: _____

Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

PROJECT:
 Ashland Chemical

SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Quad. No. _____ Serial No. _____
Lat. _____ Long. _____ Pc. _____
Minor Basin _____
Basin Code _____
Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD

MW-2D

DRILLING CONTRACTOR Soil & Material Drilling Co.
DRILLER REGISTRATION NUMBER 412

STATE WELL CONSTRUCTION PERMIT NUMBER: 91-0745-WM-0230

WELL LOCATION: (Show sketch of the location below)

Nearest Town: Raleigh

County: Wake

Tract, Community or Subdivision and Lot No.) _____

OWNER Ashland Chemical Company

ADDRESS South Bloodworth St.
(Street or Route No.)

Raleigh NC

City or Town State Zip Code

DATE DRILLED 2-14-86 USE OF WELL Monitor

TOTAL DEPTH 75.0' CUTTINGS COLLECTED Yes No

DOES WELL REPLACE EXISTING WELL? Yes No

STATIC WATER LEVEL _____ FT. above TOP OF CASING.

TOP OF CASING IS 1.8' FT. ABOVE LAND SURFACE.

YIELD (gpm): _____ METHOD OF TEST _____

WATER ZONES (depth): _____

DISINFECTION: Type _____ Amount _____

CASING

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>1.8'</u> To <u>63.5'</u> Ft.	<u>2.0"</u>	<u>154"</u>	<u>S.S.</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

REINFORCING

Depth	Material	Method
From <u>0.0</u> To <u>59.0'</u> Ft.	<u>#1 Portland</u>	<u>Tremie</u>
From _____ To _____ Ft.	_____	_____

SCREEN

Depth	Diameter	Slot Size	Material
From <u>63.5'</u> To <u>73.5'</u> Ft.	<u>2.0"</u> in.	<u>.015"</u> in.	<u>S.S.</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

GRAVEL PACK

Depth	Size	Material
From <u>61.0'</u> To <u>72.0'</u> Ft.	<u>Sand</u>	<u>Quartz Sand</u>
From _____ To _____ Ft.	_____	_____

REMARKS: Nested well, MW-2 sampled from 0.0-30.0, MW-2D sampled 30.0-75.0

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

SIGNATURE OF CONTRACTOR OR AGENT

DATE

Depth		DRILLING LOG Formation Description
From	To	
<u>30.0</u>	<u>75.0</u>	<u>Stiff Tan to White Micaceous SILT to Medium Dense Tan to White Micaceous Silty Medium to Coarse SAND</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

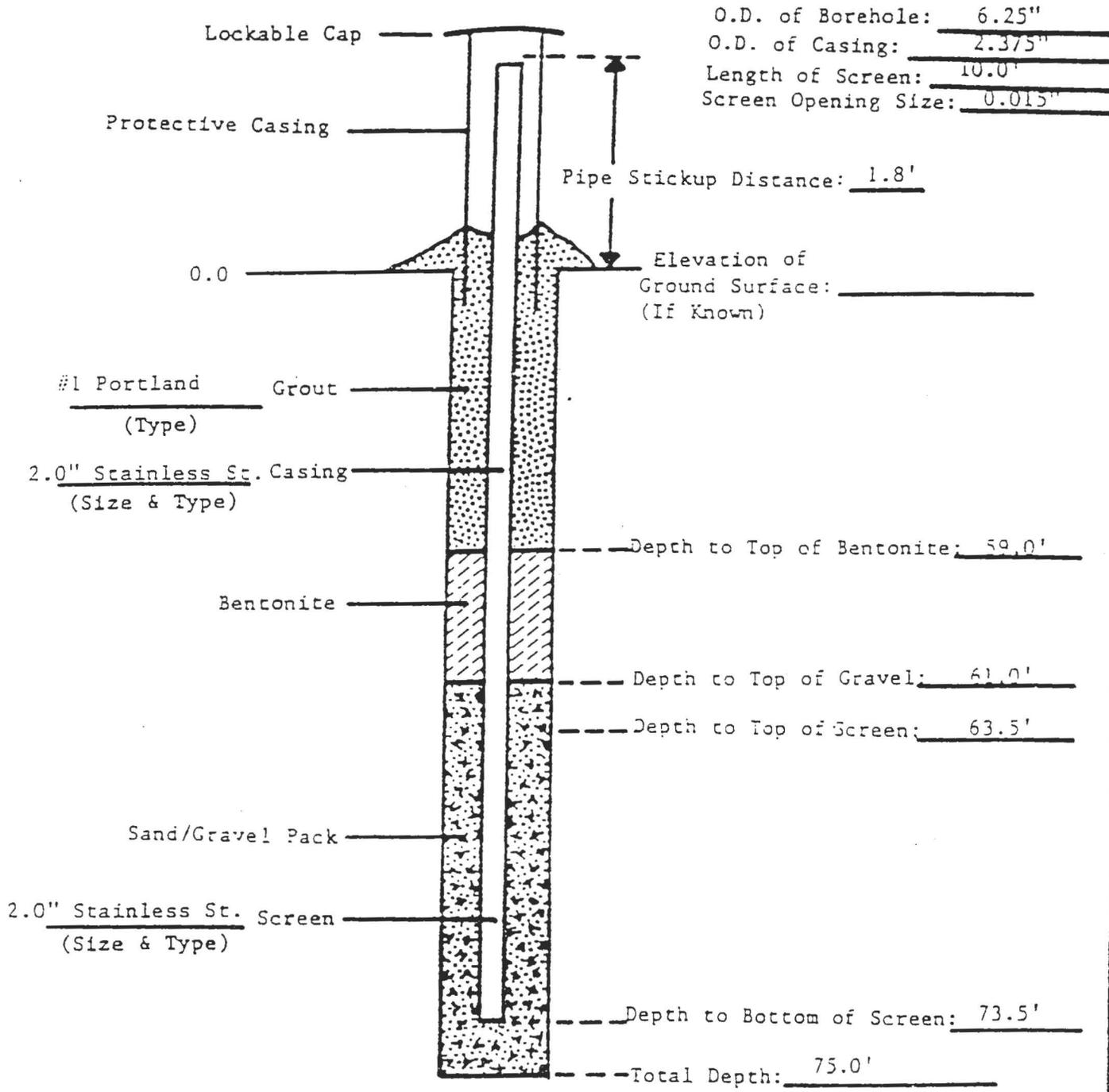
If additional space is needed use back of form.

LOCATION SKETCH

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

Well Number: _____ Drilling Method: Auger/Washbore
 Date Started: 2-14-86 Drilling Fluids: Super Gel X O Water
 Date Finished: 2-14-86 Static Water Level: 23.17 Date: 2-20-86
 Geologist/Engineer: Steve Czekalski Observed by: _____
 Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

PROJECT:
 Ashland Chemical

SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Quad. No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-3

DRILLING CONTRACTOR Soil & Material Drilling Co.
 DRILLER REGISTRATION NUMBER 412

STATE WELL CONSTRUCTION PERMIT NUMBER: 91-0745-WM-0230

WELL LOCATION (Show sketch of the location below)
 Nearest Town: Raleigh

County: Wake

OWNER Ashland Chemical Company
 ADDRESS South Bloodworth St.
Raleigh NC
 City or Town State Zip Code

Depth		DRILLING LOG
From	To	Formation Description
0.0	.66	Orange-Brown Clayey Medium Coarse SAND/Asphalt Rubble
.66	35.0	Medium Dense Tan to White an Orange Micaceous Silty Fine to Coarse SAND to Fine to Coarse Sandy SILT

DATE DRILLED 2-5-86 USE OF WELL Monitor
 TOTAL DEPTH 35.0 CUTTINGS COLLECTED Yes No
 DOES WELL REPLACE EXISTING WELL? Yes No
 STATIC WATER LEVEL 28.8 FT. above TOP OF CASING, below
 TOP OF CASING IS 1.5 FT. ABOVE LAND SURFACE.
 FLOW (gpm): _____ METHOD OF TEST _____
 WATER ZONES (depth): _____

CONTAMINATION: Type _____ Amount _____

CASING

From	To	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
1.5'	23.5'	Ft.	2.0"	.154"	S.S.
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

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)

GROUT

From	To	Depth	Material	Method
0.0	19.0	Ft.	#1 Portland	Pour
_____	_____	Ft.	_____	_____

SCREEN

From	To	Depth	Diameter	Slot Size	Material
23.5	33.5	Ft.	2.0"	.015 in.	S.S.
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

LEVEL PACK

From	To	Depth	Size	Material
21.0	33.5	Ft.	Sand	Quartz Sand
_____	_____	Ft.	_____	_____

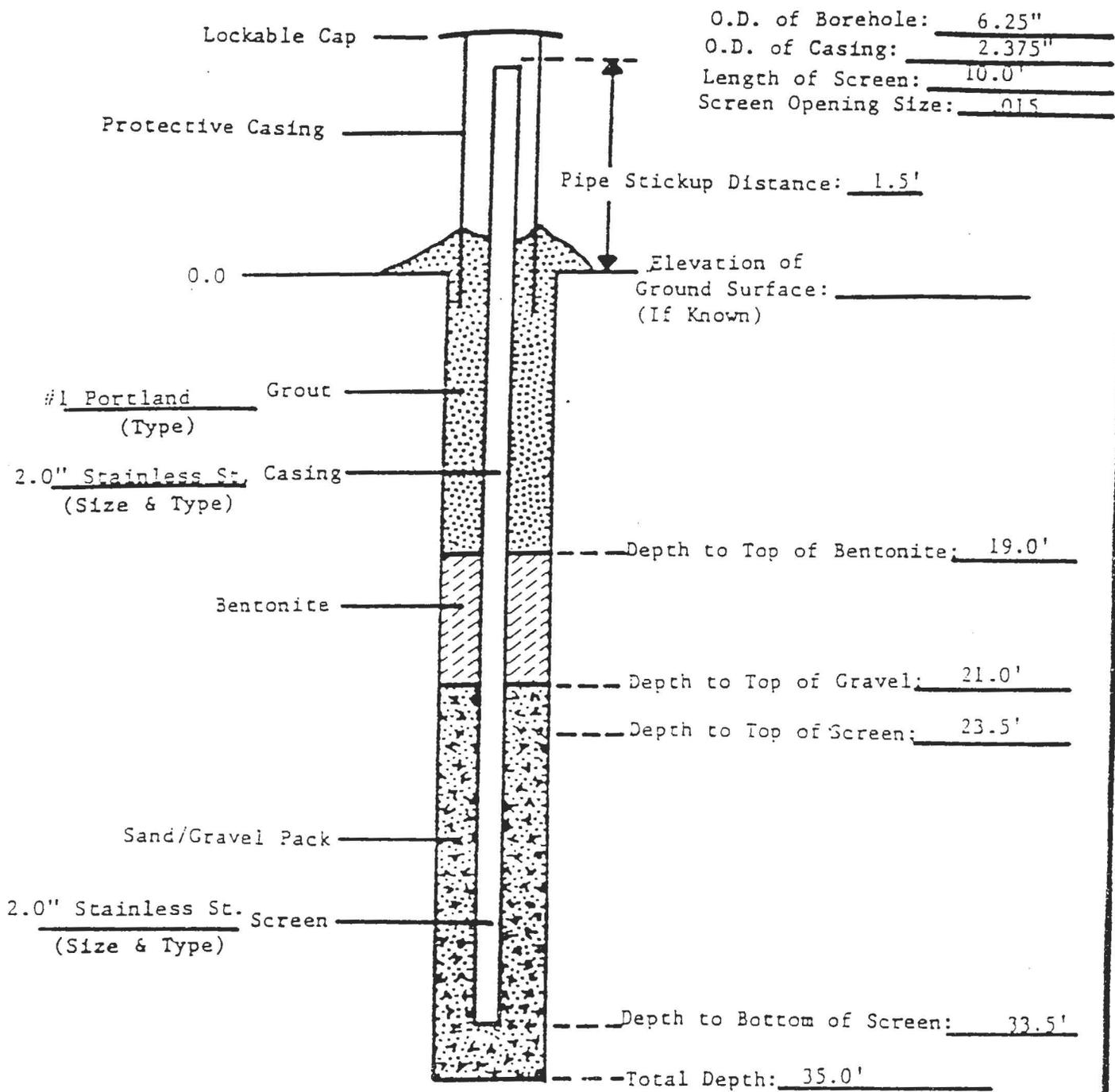
REMARKS: _____

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

SIGNATURE OF CONTRACTOR OR AGENT _____ DATE _____

Well Number: MW-3 Drilling Method: Auger
 Date Started: 2-5-86 Drilling Fluids: _____
 Date Finished: 2-5-86 Static Water Level: 28.8 Date: 2-20-86
 Geologist/Engineer: RSM/WPS Observed by: _____
 Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE



SOIL & MATERIAL ENGINEERS, INC. CARY, NORTH CAROLINA SCHEMATIC OF MONITOR WELL	PROJECT: Ashland Chemical	SCALE: Not To Scale JOB NO.: 055-85-163-A FIGURE NO.:
--	------------------------------	---

Quad. No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-3D

DRILLING CONTRACTOR Soil & Material Drilling Co.
 REGISTERED NUMBER 412

STATE WELL CONSTRUCTION PERMIT NUMBER: 91-0745-WM-0230

WELL LOCATION: (Show sketch of the location below)

Nearest Town: Raleigh

County: Wake

Plat, Block, Community or Subdivision and Lot No.:

OWNER: Ashland Chemical Company

ADDRESS: South Bloodworth St.

Raleigh NC
 City or Town State Zip Code

DATE DRILLED: 2-7-86 USE OF WELL: Monitor

TOTAL DEPTH: 76.0 CUTTINGS COLLECTED: Yes No

IS WELL REPLACE EXISTING WELL? Yes No

STATIC WATER LEVEL: 29.15 FT. above TOP OF CASING.

TOP OF CASING IS 1.5 FT. below LAND SURFACE.

YIELD (gpm): _____ METHOD OF TEST _____

WATER ZONES (depth): _____

CONTAMINATION: Type _____ Amount _____

CASING

From	To	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
1.5	61.0	Ft.	2.0"	.154	S.S.
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

GRIT

From	To	Depth	Material	Method
0.0	51.0	Ft.	#1 Portland	_____
_____	_____	Ft.	_____	_____

SCREEN

From	To	Depth	Diameter	Slot Size	Material
61.0	71.0	Ft.	2.0"	.015 in.	S.S.
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

GRAVEL PACK

From	To	Depth	Size	Material
53.0	71.0	Ft.	Sand	Quartz Sand
_____	_____	Ft.	_____	_____

REMARKS: Nearest well with MW-3 sampled 0.0-30.0, MW-3D 30.0-76.0

Depth		DRILLING LOG
From	To	Formation Description
29.5	37.0	Medium Dense Orange Brown Micaceous Slightly Clayey S
37.0	42.0	Fine-Coarse SAND Medium Dense Orange to White Slightly Clayey Fine Coarse SAND
42.0	65.0	Medium Dense to Very Dense Brown Micaceous Silty SAND to Sandy SILT
65.0	76.0	Soft Weathered Rock Granitic Gneiss

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)

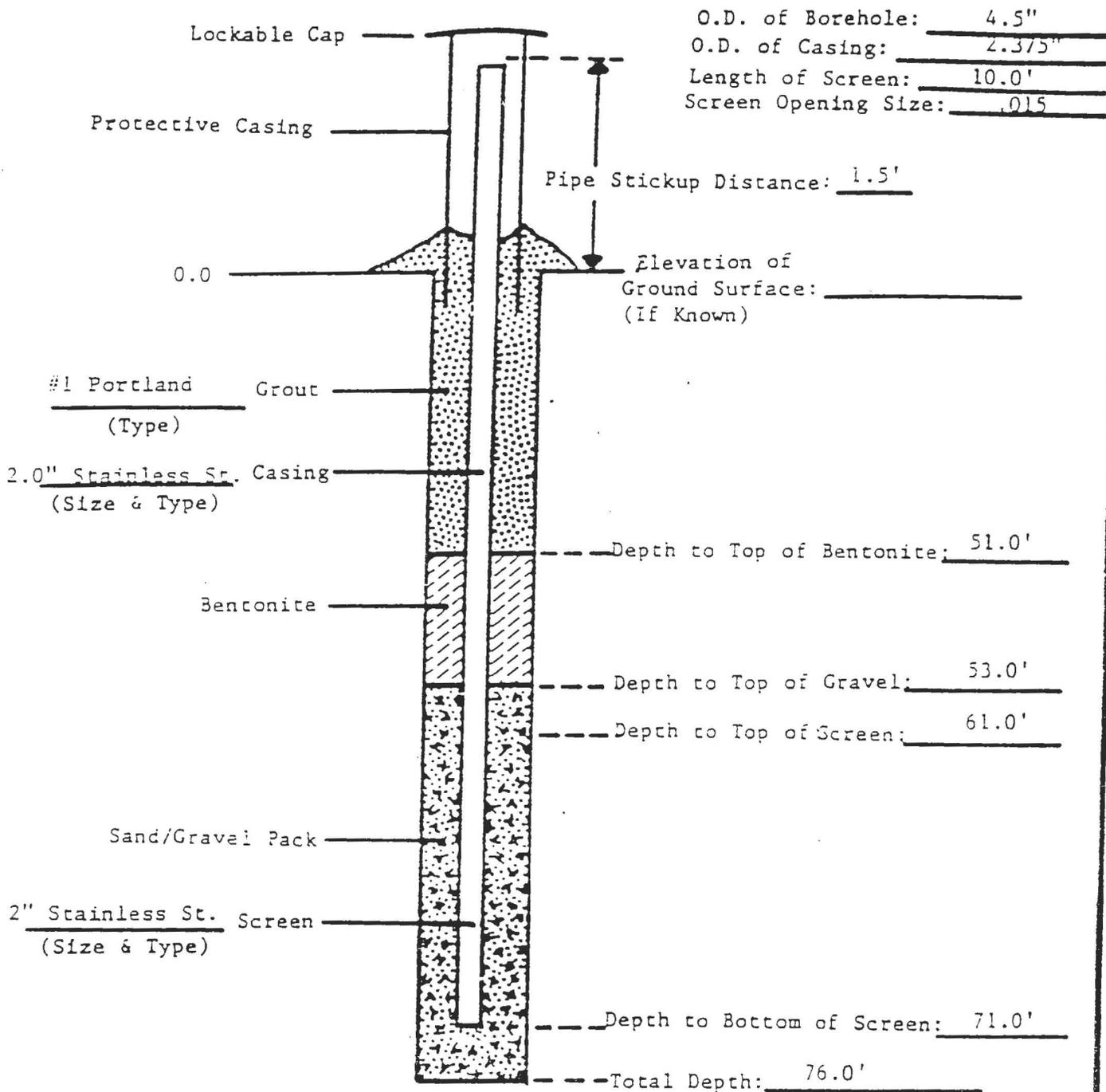
I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C, WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

SIGNATURE OF CONTRACTOR OR AGENT _____ DATE _____

Well Number: MW-3D Drilling Method: Mud Rotary
 Date Started: 2-7-86 Drilling Fluids: Super Gel X
 Date Finished: 2-11-86 Static Water Level: 29.15 Date: 2-20-86
 Geologist/Engineer: RSM Observed by: _____

Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

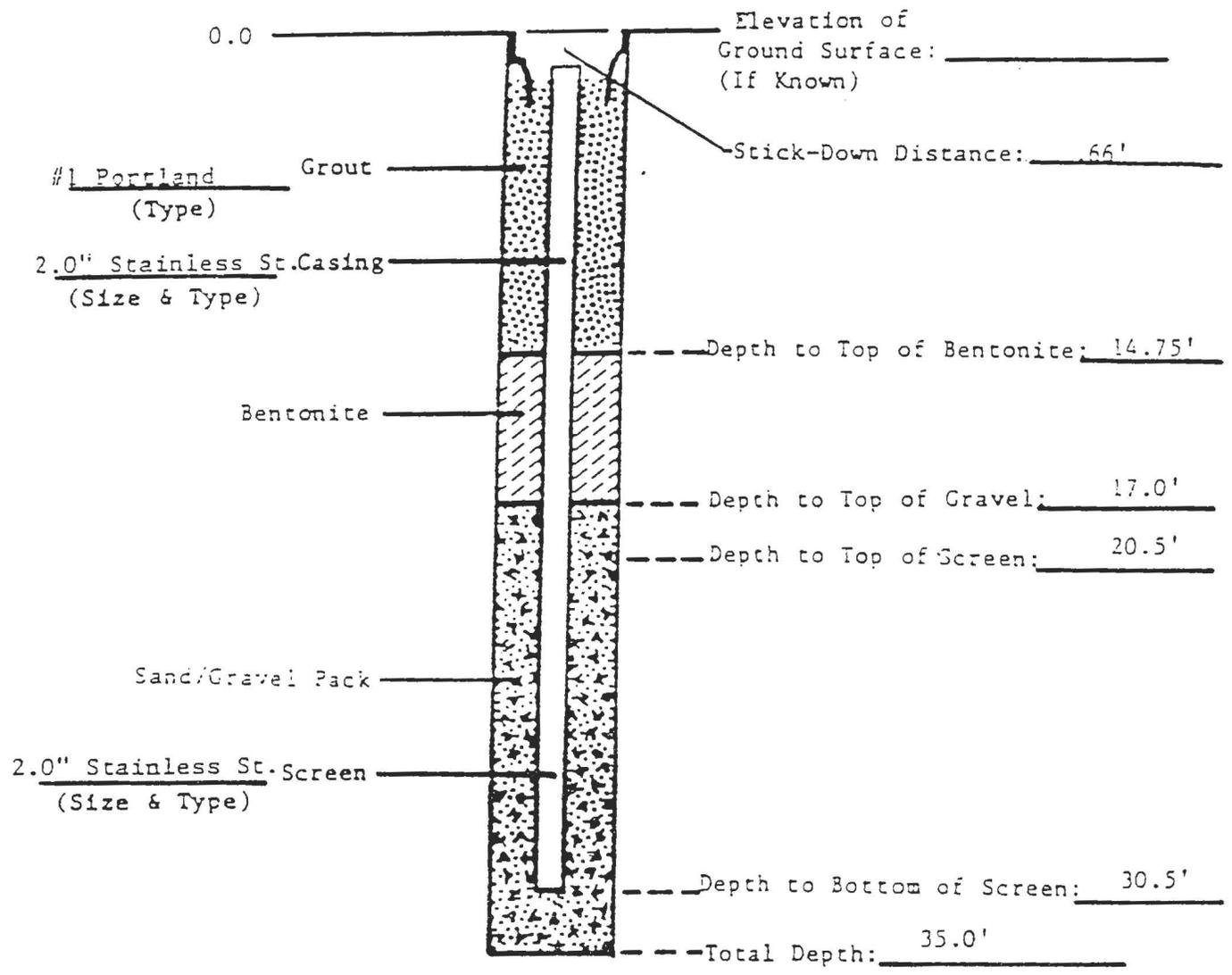
PROJECT:
 Ashland Chemical

SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Well Number: MW-4 Drilling Method: Auger
 Date Started: 2-12-86 Drilling Fluids: Water, Super Gel X
 Date Finished: 2-13-86 Static Water Level: 15' + 11 1/2" Date: 2-20-86
 Geologist/Engineer: WPS Observed by: _____
 Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE

O.D. of Borehole: 6.25"
 O.D. of Casing: 2.375"
 Length of Screen: 10.0'
 Screen Opening Size: .015"



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

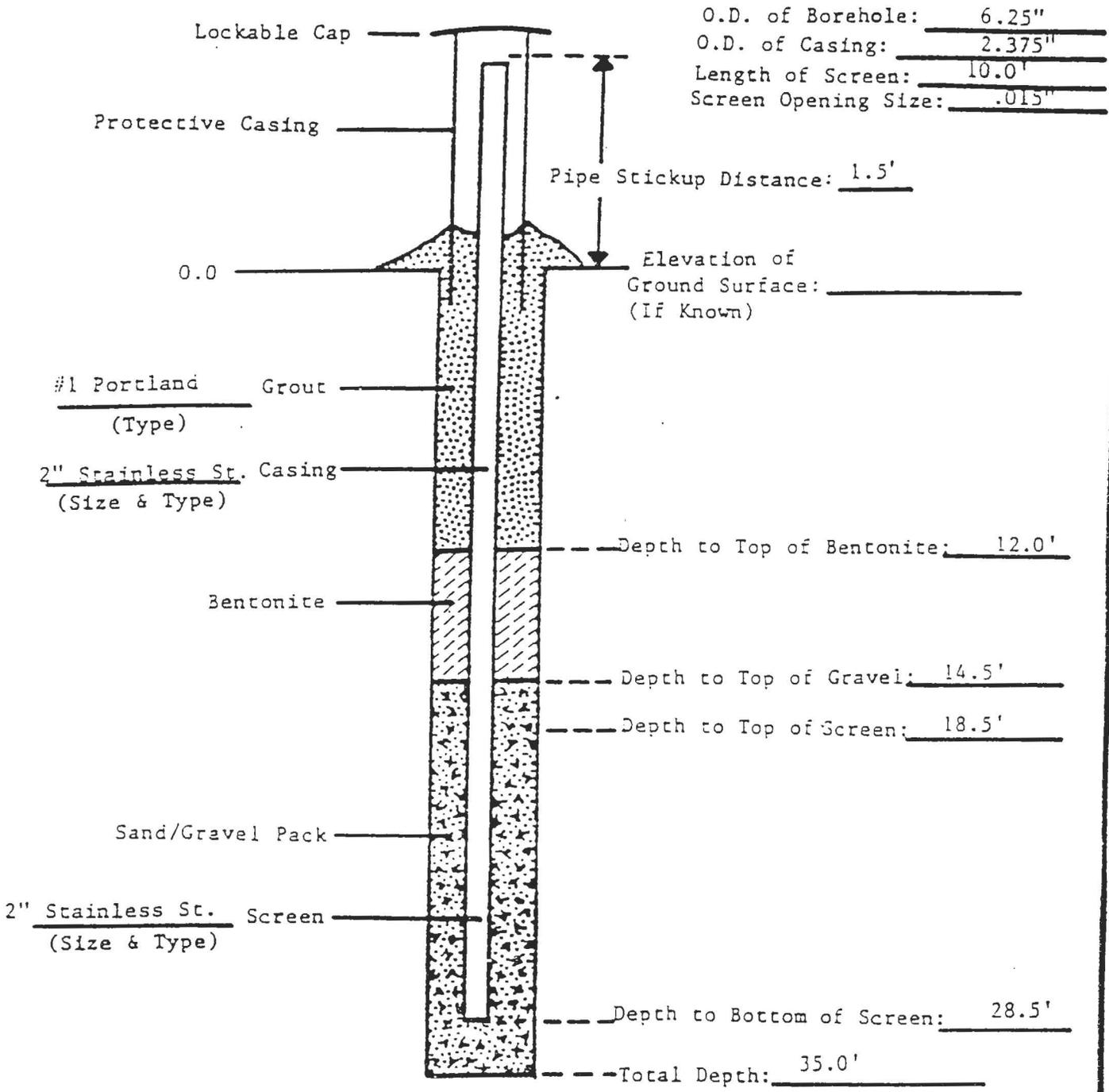
PROJECT:
 Ashland Chemical

SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Well Number: MW-5 Drilling Method: Auger
 Date Started: 2-7-86 Drilling Fluids: _____
 Date Finished: 2-7-86 Static Water Level: 21.75' Date: 2-20-86
 Geologist/Engineer: WPS Observed by: _____

Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

PROJECT:
 Ashland Chemical

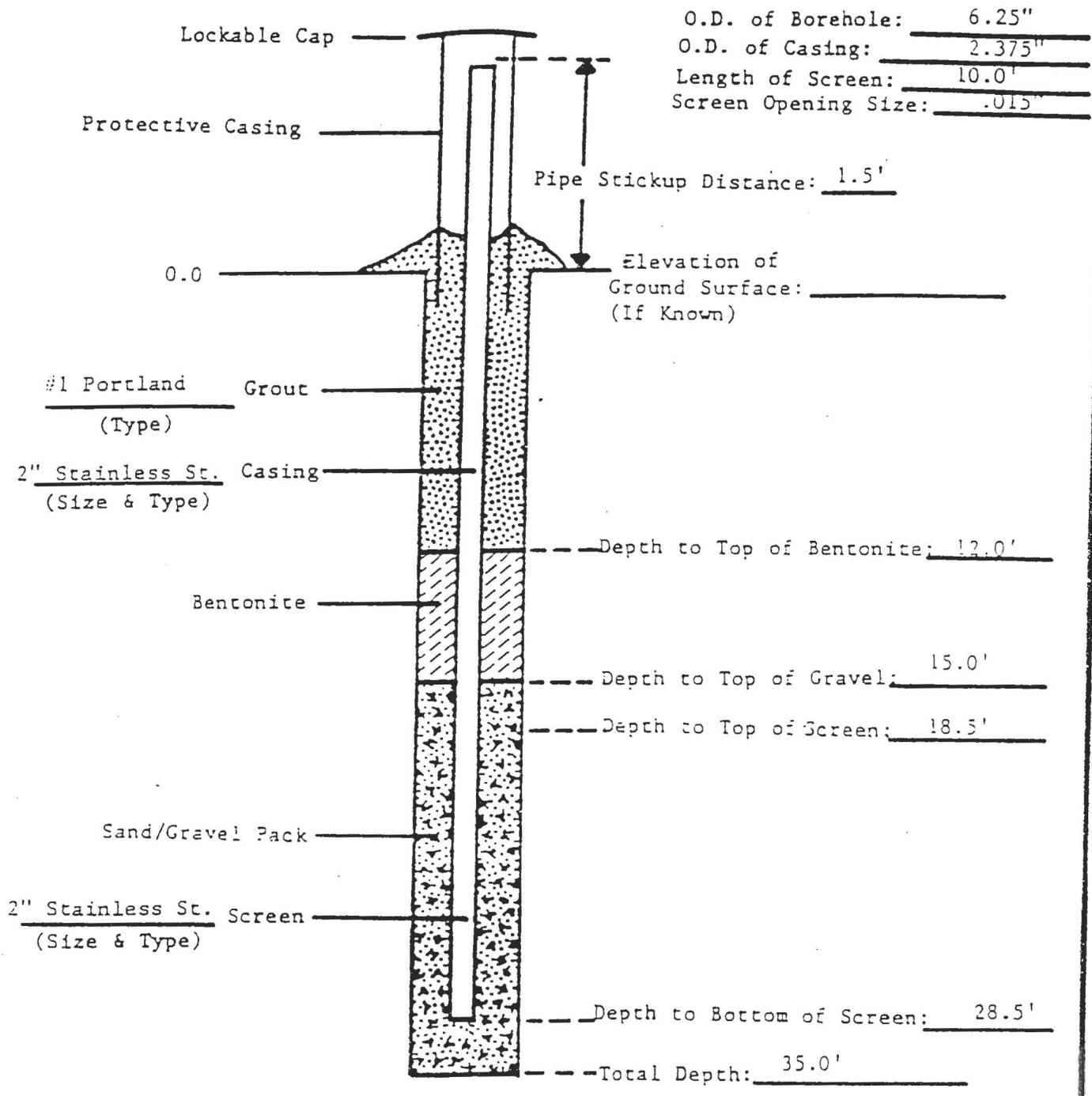
SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Well Number: MW-6
 Date Started: 2-6-86
 Date Finished: 2-6-86
 Geologist/Engineer: WPS/RSM

Drilling Method: Auger
 Drilling Fluids: _____
 Static Water Level: 21.4 Date: 2-20-86
 Observed by: _____

Remarks: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

PROJECT:
 Ashland Chemical

SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Quad. No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc. _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD MW-7

DRILLING CONTRACTOR Soil & Material Drilling Co.
 REGISTERED NUMBER 412

STATE WELL CONSTRUCTION PERMIT NUMBER: 91-0745-WM-023

WELL LOCATION: (Show sketch of the location below)

Nearest Town: Raleigh County: Wake

(City, Community, or Subdivision and Lot No.)

OWNER Ashland Chemical Company
South Bloodworth St.
 ADDRESS _____ (Street or Route No.)
Raleigh NC
 City or Town State Zip Code

DATE DRILLED 2-8-86 USE OF WELL Monitor

TOTAL DEPTH 35.0' CUTTINGS COLLECTED Yes No

IS WELL REPLACE EXISTING WELL? Yes No

STATIC WATER LEVEL: 21.4' FT above TOP OF CASING.
 TOP OF CASING IS .66 FT below LAND SURFACE.
Below

YIELD (gpm): _____ METHOD OF TEST _____

HYDRO ZONES (depth): _____

CRINATION: Type _____ Amount _____

CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>6.6</u> To <u>18.5</u> Ft.	<u>2.0"</u>	<u>.154</u>	<u>S.S.</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

POUR:

Depth	Material	Method
From <u>0.0</u> To <u>12.0</u> Ft.	<u>#1 Portland</u>	<u>Pour</u>
From _____ To _____ Ft.	_____	_____

SCREEN:

Depth	Diameter	Slot Size	Material
From <u>18.5</u> To <u>28.5</u> Ft.	<u>2.0"</u> in.	<u>.015</u> in.	<u>S.S.</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

VEL PACK:

Depth	Size	Material
From <u>15.0</u> To <u>28.5</u> Ft.	<u>Sand</u>	<u>Quartz Sand</u>
From _____ To _____ Ft.	_____	_____

REMARKS: _____

Depth		FORMATION DESCRIPTION
From	To	
<u>0.0</u>	<u>29.0</u>	<u>Orange to Brown Micaceous F Coarse Sandy SILT to Slight Clayey Sandy SILT</u>
<u>29.0</u>	<u>35.0</u>	<u>White to Pink Very Coarse S. to GRAVEL</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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 15 NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

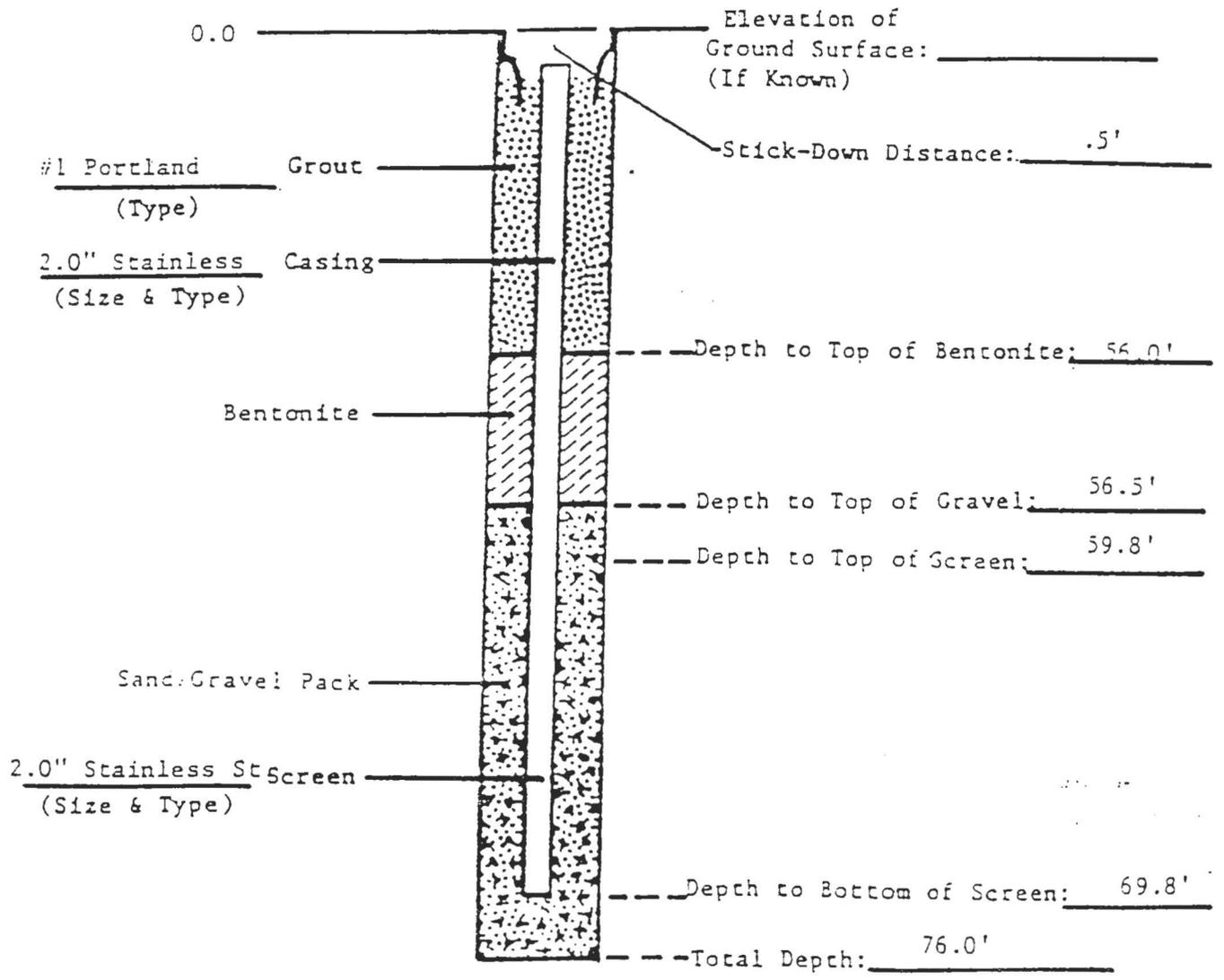
SIGNATURE OF CONTRACTOR OR AGENT _____ DATE _____

Well Number: MW-7D
 Date Started: 2-12-86
 Date Finished: 2-14-86
 Geologist/Engineer: RSM
 Remarks: _____

Drilling Method: Auger/Cashmore
 Drilling Fluids: Water
 Static Water Level: 24.07' Date: 2-20-86
 Observed by: _____

ALL DEPTHS REFERENCED FROM GROUND SURFACE

O.D. of Borehole: 6.25"
 O.D. of Casing: 4.375"
 Length of Screen: 10.0'
 Screen Opening Size: .015"



SOIL & MATERIAL ENGINEERS, INC.
 CARY, NORTH CAROLINA
 SCHEMATIC OF MONITOR WELL

PROJECT:
 Ashland Chemical

SCALE: Not To Scale
 JOB NO.: 055-85-163-A
 FIGURE NO.:

Quad. No. _____ Serial No. _____
 Lat. _____ Long. _____ Pc _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD 8s

DRILLING CONTRACTOR S&ME Drilling Co.
 DRILLER REGISTRATION NUMBER 412

STATE WELL CONSTRUCTION
 PERMIT NUMBER: 91-0745-WR-0249

WELL LOCATION: (Show sketch of the location below)

Nearest Town: Raleigh County: _____

City, Community, or Subdivision and Lot No.)
 OWNER Ashland Chemical Company
 ADDRESS 1415 S. Bloodworth St.
Raleigh, NC (Street or Route No.)

DATE DRILLED 10-15-87 City or Town State Zip Code
 USE OF WELL Monitor

TOTAL DEPTH 27 ft. CUTTINGS COLLECTED Yes No

DOES WELL REPLACE EXISTING WELL? Yes No

STATIC WATER LEVEL: _____ FT. above TOP OF CASING.
 below
 TOP OF CASING IS 0 FT. ABOVE LAND SURFACE.

YIELD (gpm): N/A METHOD OF TEST _____

WATER ZONES (depth): N/A

CONTAMINATION: Type N/A Amount N/A

CASING:

From	To	Depth	Diameter	Wail Thickness or Weight/Ft.	Material
0	17	Ft.	2"	0.308"	Sch 40 PVC
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

SP. JT:

From	To	Depth	Material	Method
0	13	Ft.	Portland	Pour
_____	_____	Ft.	_____	_____

SCREEN:

From	To	Depth	Diameter	Slot Size	Material
17	27	Ft.	2"	0.010 in.	Stainless Steel
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

GRAVEL PACK:

From	To	Depth	Size	Material
15	27	Ft.	Fine	Quartz Feldspar
_____	_____	Ft.	_____	_____

REMARKS: _____

Depth		FORMATION DESCRIPTION
From	To	
0.0	7.0	Reddish Brown Micaceous Sandy SILT (ML)
7.0	10.0	Reddish Brown to Yellowish White Micaceous Silty SAND With Gravel (SM)
10.0	27.0	Tan to Reddish Brown to Gray Coarse Sandy Clayey SILT with Gravel (GM)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

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)

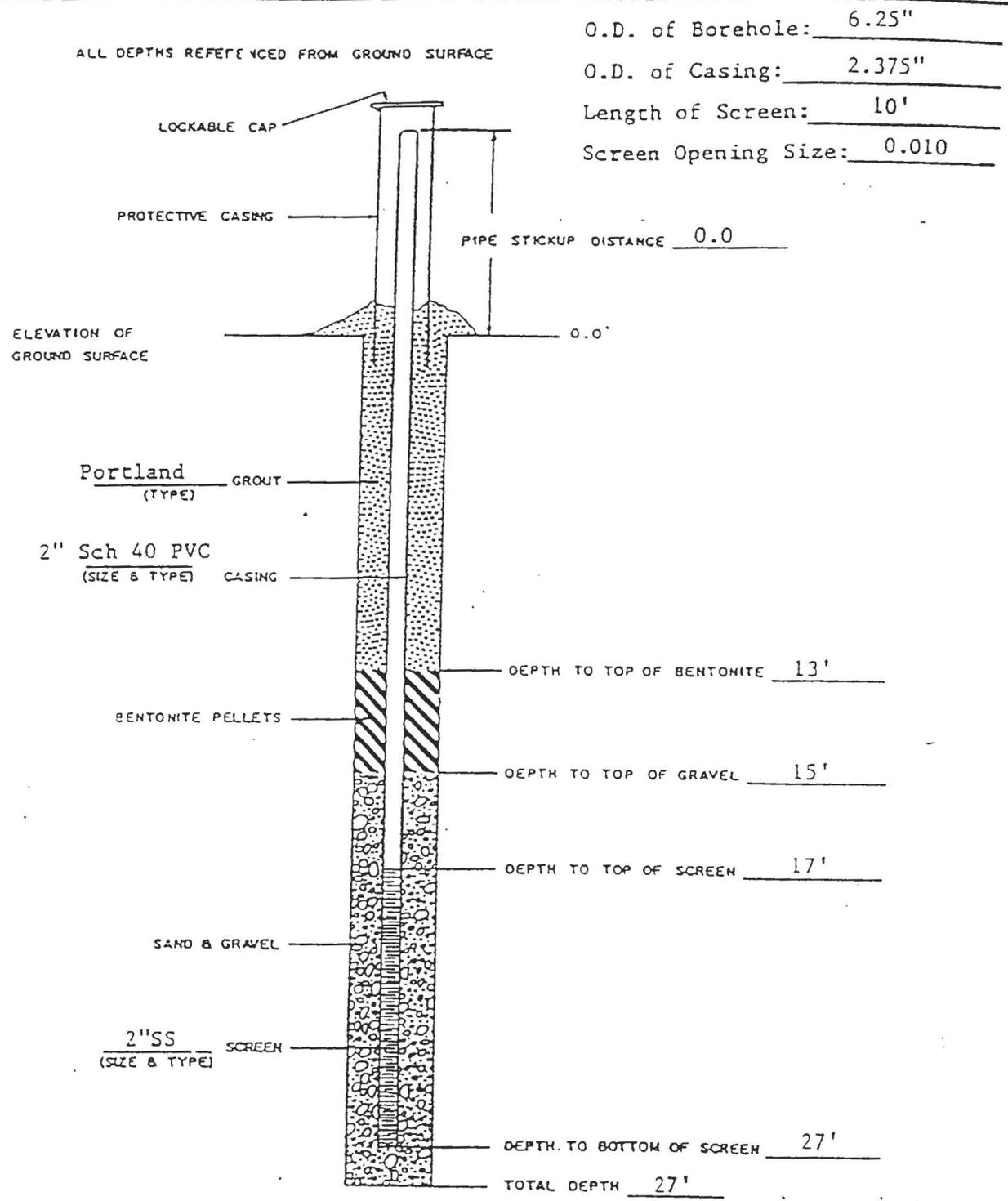
I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C. WELL CONSTRUCTION STANDARDS, AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

Thomas A. V. ...
 SIGNATURE OF CONTRACTOR OR AGENT

10/20/87

DATE

Date Started: 10/15/87 Drilling Fluids: Clean Water
 Date Finished: 10/15/87 Static Water Level: _____ Date: _____
 Geologist/Engineer: Tom Proctor Observed By: _____
 Remarks: _____



PROJECT Land Chemical Raleigh, NC	SOIL & MATERIAL ENGINEERS, INC. RALEIGH, NORTH CAROLINA	SCALE: N.T.S. JOB NO: 055-85-163A FIG. NO:
---	--	--

Quad. No. _____ Serial No. _____
 Lat. _____ Long. _____ P. _____
 Minor Basin _____
 Basin Code _____
 Header Ent. _____ GW-1 Ent. _____

WELL CONSTRUCTION RECORD 8d

DRILLING CONTRACTOR S&ME Drilling Co.
 DRILLER REGISTRATION NUMBER 412

STATE WELL CONSTRUCTION
 PERMIT NUMBER: 91-0745-WR-0249

WELL LOCATION: (Show sketch of the location below)

Nearest Town: Raleigh
 Road, Community, or Subdivision and Lot No.)
 OWNER Ashland Chemical
 ADDRESS 1415 S. Bloodworth St.
Raleigh (Street or Route No.)
 City or Town State Zip Code

County: _____

DATE DRILLED 10-19-87 USE OF WELL Monitor
 TOTAL DEPTH 59 ft. CUTTINGS COLLECTED Yes No
 DOES WELL REPLACE EXISTING WELL? Yes No
 STATIC WATER LEVEL: _____ FT. above TOP OF CASING,
 below
 TOP OF CASING IS 0 FT. ABOVE LAND SURFACE.
 FLOW (gpm): N/A METHOD OF TEST Monitor
 WATER ZONES (depth): N/A

Depth
 From 0.0 To 7.0

DRILLING LOG

Formation	Description
Reddish Brown	Micaceous
Sandy SILT (ML)	
Reddish Brown to Yellowish	
White Micaceous Silty SAND	with Gravel (SM)
Tan to Reddish Brown to	Gray Coarse Sandy Clayey
SILT with Gravel (GM)	
Dark Gray Green to White	
Very Micaceous Silty	
Medium Coarse SAND (SM)	
Dark Orange to Gray Green	
Very Micaceous Medium	
Sandy SILT (ML)	

7.0 10.0

10.0 31.0

31.0 37.0

37.0 59.0

If additional space is needed use back of form.

CHLORINATION: Type N/A Amount N/A

CASING:

From	To	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
0	9	Ft.	2"	0.308"	Sch 40 PVC
9	49	Ft.	2"		Stainless Steel
		Ft.			Steel

LOCATION SKETCH

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

CONCRETE:

From	To	Depth	Material	Method
0	45	Ft.	Portland	Pumped
		Ft.		

SCREEN:

From	To	Depth	Diameter	Slot Size	Material
49	59	Ft.	2 in.	0.010 in.	Stainless Steel
		Ft.			
		Ft.			

GRAVEL PACK:

From	To	Depth	Size	Material
47	59	Ft.	Fine	Quartz Feldspar
		Ft.		

REMARKS:

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

Thomas A. Fisher
 SIGNATURE OF CONTRACTOR OR AGENT

10/20/87
 DATE

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

MW-11D

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Graham & Currie

DRILLER REGISTRATION NUMBER: 537

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: Raleigh County: Wake

1501 South Bloodworth St.
 (Road, Community, or Subdivision and Lot No.)

2. OWNER Ashland Chemical Inc.

ADDRESS P.O. Box 2219
 (Street or Route No.)

Columbus OH 43216
 City or Town State Zip Code

3. DATE DRILLED 6/8/93 USE OF WELL Monitor

4. TOTAL DEPTH 55.02

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: 19.61 FT.
 (Use "+" if Above Top of Casing)

8. TOP OF CASING IS - .45 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): _____ METHOD OF TEST _____

10. WATER ZONES (depth): _____

11. CHLORINATION: Type _____ Amount _____

12. CASING:

From	Depth	To	Diameter	Wall Thickness or Weight/Ft.	Material
<u>.7</u>	<u>50.02</u>	<u>Ft.</u>	<u>2"</u>	<u>Sch 40</u>	<u>PVC</u>
From _____	To _____	Ft. _____	_____	_____	_____
From _____	To _____	Ft. _____	_____	_____	_____

13. GROUT:

From	Depth	To	Material	Method
<u>.9</u>	<u>45.5</u>	<u>Ft.</u>	<u>Portland</u>	<u>Pour</u>
<u>45.5</u>	<u>47.5</u>	<u>Ft.</u>	<u>Bentonite</u>	<u>Pour</u>

14. SCREEN:

From	Depth	To	Diameter	Slot Size	Material
<u>50.02</u>	<u>55.02</u>	<u>Ft.</u>	<u>2"</u>	<u>0.010 in.</u>	<u>PVC</u>
From _____	To _____	Ft. _____	_____	_____	_____
From _____	To _____	Ft. _____	_____	_____	_____

15. SAND/GRAVEL PACK:

From	Depth	To	Size	Material
<u>47.5</u>	<u>55.02</u>	<u>Ft.</u>	<u>Med.</u>	<u>Sand</u>
From _____	To _____	Ft. _____	_____	_____

16. REMARKS: Prepared screen in addition to sandpack.

DEPTH	DEPTH		DRILLING LOG
	From	To	
0	2		Topsoil, orange silt. Dry.
5	7		Orange silty fine sand. Dry.
10	12		Dark orange to fine micaceous sand. Dry.
15	17		Gray to tan silty sand. Dry.
20	22		Lt. gray to pink silty sand. Dry.
25	27		Brown to black micaceous sand. Dry.
30	32		Dark, silty micaceous sand. Wet.
35	37		Dark silty micaceous sand. Some white 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 attached.

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.

Rw Holland

SIGNATURE OF CONTRACTOR OR AGENT

7/9/93

DATE

RUST TEST BORING REPORT

BORING NO. NW-11D

PROJECT: Ashland Raleigh
 CLIENT: Ashland Chemical Inc.
 CONTRACTOR: Graham & Currie
 EQUIPMENT USED: CME 75

JOB NO: 83969.320
 PAGE NO: 1 of 3
 LOCATION: RAILROAD
 ELEVATION: _____
 DATE START: 6/8/93
 DATE FINISH: 6/8/93
 DRILLER: Morrison
 PREPARED BY: Holland

GROUND WATER		DEPTH TO:		CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	
					SS	
					SIZE ID	1 5/8"
					HAMMER WT	140lb
					HAMMER FALL	30"

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	OVA Reading (ppm)	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
		3	0	0-2	Topsoil. Orange sandy silt. Dry.
		3			
		4			
		4			
5.0		4	0	5-7	Orange silty fine sand. Dry.
		3			
		3			
		3			
10.0		4	0	10-12	Dark orange to brown silty fine micaceous sand. Dry.
		4			
		4			
		4			
15.0		1	0	15-17	Gray to tan silty fine sand. Dry.
		4			
		5			
		6			
20.0					

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0-4	VERY LOOSE	0-2	VERY SOFT	S SPLIT SPOON	MOSTLY 50-100%	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T TUBE	SOME 30-45%	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15-25%	UR - NOT READ
31-50	DENSE	9-15	STIFF	G GRAB SAMPLE	FEW 5-10%	
51+	VERY DENSE	16-30	VERY STIFF	X OTHER	TRACE <5%	
		31+	HARD	NR NO RECOVERY		

BORING NO. NW-11D



TEST BORING REPORT

BORING NO. MW-11

PAGE 2 of 3

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
20.0		7 11 12 12	0.1	20-22	Light gray to pink PWR. Wet.
25.0		6 11 16 25	1.6	25-27	Brown to black micaceous sand. Wet.
30.0		7 9 11 17	3.6	30-32	Dark silty micaceous sand. Wet.
35.0		9 18 25 20	2.2	35-37	35-36.5 Dark silty micaceous sand. Wet. 36.5 - 37 White PWR. Wet.
40.0		19 30 32 33	2.0		Silty weathered quartz gravel. Wet.
45.0					

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0 - 4	VERY LOOSE	0 - 2	VERY SOFT	S SPLIT SPOON	MOSTLY 50 - 100%	WD - WHILE DRILLING
5 - 10	LOOSE	3 - 4	SOFT	T TUBE	SOME 30 - 45%	NE - NOT ENCOUNTERED
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15 - 25%	UR - NOT READ
31 - 50	DENSE	9 - 15	STIFF	G GRAB SAMPLE	FEW 5 - 10%	
51 +	VERY DENSE	16 - 30	VERY STIFF	X OTHER	TRACE <5%	
		31 +	HARD	NR NO RECOVERY		BORING NO. MW-11D



TEST BORING REPORT

BORING NO. MW-1

PAGE 3 of 3

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
45.0		40	1.2	45.0	Hard crystalline PWR. Wet.
		60		46.5	
		>100			
50.0					
55.0					Auger refusal 55.02 feet. Terminated boring.

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0 - 4	VERY LOOSE	0 - 2	VERY SOFT	S SPLIT SPOON	MOSTLY 50 - 100%	WD - WHILE DRILLING
5 - 10	LOOSE	3 - 4	SOFT	T TUBE	SOME 30 - 45%	NE - NOT ENCOUNTERED
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15 - 25%	UR - NOT READ
31 - 50	DENSE	9 - 15	STIFF	G GRAB SAMPLE	FEW 5 - 10%	
51+	VERY DENSE	16 - 30	VERY STIFF	X OTHER	TRACE <5%	
		31+	HARD	NR NO RECOVERY		

BORING NO. MW-11D

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: Graham & Currie

DRILLER REGISTRATION NUMBER: 537

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: Raleigh County: Wake

1501 South Bloodworth Street

(Road, Community, or Subdivision and Lot No.)

2. OWNER Ashland Chemical Inc.

ADDRESS P.O. Box 2219

(Street or Route No.)

Columbus Ohio 43216

City or Town State Zip Code

3. DATE DRILLED 6/7/93 USE OF WELL Monitor

4. TOTAL DEPTH 34.58

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: 14.22 FT.

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS -15 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): _____ METHOD OF TEST _____

10. WATER ZONES (depth): _____

11. CHLORINATION: Type _____ Amount _____

12. CASING:

From	Depth	To	Diameter	Wall Thickness	Material
				or Weight/FT	
<u>.15</u>		<u>29.58</u>	<u>2"</u>	<u>Sch 40</u>	<u>PVC</u>
From _____	To _____	Ft. _____	_____	_____	_____
From _____	To _____	Ft. _____	_____	_____	_____

13. GROUT:

From	Depth	To	Material	Method
<u>.5</u>		<u>27.58</u>	<u>Portland</u>	<u>Pour</u>
<u>27.58</u>		<u>29.58</u>	<u>Bentonite</u>	<u>Pour</u>

14. SCREEN:

From	Depth	To	Diameter	Slot Size	Material
<u>29.58</u>		<u>34.58</u>	<u>2"</u>	<u>0.010 in.</u>	<u>PVC</u>
From _____	To _____	Ft. _____	_____	_____	_____
From _____	To _____	Ft. _____	_____	_____	_____

15. SAND/GRAVEL PACK:

From	Depth	To	Size	Material
<u>27.58</u>		<u>34.58</u>	<u>Medium</u>	<u>Sand</u>
From _____	To _____	Ft. _____	_____	_____

16. REMARKS: Prepacked screen in addition to sand pack.

DEPTH		DRILLING LOG
From	To	Formation Description
<u>0</u>	<u>2</u>	<u>Red silt. Few mic.</u>
<u>5</u>	<u>7</u>	<u>Tan to orange med. sand. Dry.</u>
<u>10</u>	<u>12</u>	<u>Brown micaceous si. sand. Moist.</u>
<u>15</u>	<u>17</u>	<u>Dk. brown to black ceous sand banded w wx rock. Wet.</u>
<u>20</u>	<u>22</u>	<u>Orange, Silt with d banding.</u>
<u>25</u>	<u>27</u>	<u>White to light gray Moist.</u>
<u>30</u>	<u>32</u>	<u>Hard white PWS. Over blows/6".</u>

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 attached.

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.

Ruthella

7/9/93

SIGNATURE OF CONTRACTOR OR AGENT

DATE

RUST

TEST BORING REPORT

BORING NO. MW-12D

PROJECT: Ashland Raleigh
 CLIENT: Ashland Chemical Inc.
 CONTRACTOR: Graham & Currie
 EQUIPMENT USED: CME 75

JOB NO: 83969.320
 PAGE NO: 1 of 2
 LOCATION: N&O
 ELEVATION:
 DATE START: 6/7/93
 DATE FINISH: 6/7/93
 DRILLER: Morrison
 PREPARED BY: Holland

GROUND WATER		DEPTH TO:		CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	SS
					SIZE ID	1 5/8"
					HAMMER WT	140 lb
					HAMMER FALL	30"

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	OVA Reading (ppm)	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
5.0		14	1.0	0-2	Red silt. Few mica. Dry.
		16			
		5			
		5			
10.0		2	0.2	5-7	Tan to orange medium-fine sand. Dry.
		2			
		1			
		3			
15.0		3	0.2	10-12	Brown micaceous silty sand. Moist.
		3			
		3			
		5			
20.0		3	4.0	15-17	Dark brown to black micaceous sand banded with white weathered rock. Wet.
		3			
		5			
		4			

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0-4	VERY LOOSE	0-2	VERY SOFT	S SPLIT SPOON	MOSTLY 50-100%	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T TUBE	SOME 30-45%	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15-25%	UR - NOT READ
31-50	DENSE	9-15	STIFF	G GRAB SAMPLE	FEW 5-10%	
51+	VERY DENSE	16-30	VERY STIFF	X OTHER	TRACE <5%	
		31+	HARD	NR NO RECOVERY		

BORING NO. MW-12D



TEST BORING REPORT

BORING NO. MW-12

PAGE 2 of 2

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
20.0		3	32	20-22	Orange silt mottled with black. From 21-22 ft. Micaceous sand with white weathered rock banding.
		5			
		6			
		11			
25.0			38	25-27	White to light gray PWR. Crystalline. Wet.
		17			
		54			
		54 44			
30.0		>100	57	30-30.5	Very hard PWR. Auger refusal 34.58 feet. Terminated boring.
35.0					
40.0					
45.0					

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0 - 4	VERY LOOSE	0 - 2	VERY SOFT	S SPLIT SPOON	MOSTLY 50 - 100%	WD - WHILE DRILLING
5 - 10	LOOSE	3 - 4	SOFT	T TUBE	SOME 30 - 45%	NE - NOT ENCOUNTERED
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15 - 25%	UR - NOT READ
31 - 50	DENSE	9 - 15	STIFF	G GRAB SAMPLE	FEW 5 - 10%	
51 +	VERY DENSE	16 - 30	VERY STIFF	X OTHER	TRACE <5%	
		31 +	HARD	NR NO RECOVERY		

BORING NO. MW-12D



Drilling Log

Monitoring Well MW-12TZ

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 246.02 ft. Total Hole Depth 60 ft. Diameter 10.5 in.
 Top of Casing 246.94 ft. Water Level Initial 20 ft. Static _____
 Screen: Dia 4 in. Length 15 ft. Type/Size PVC/0.010 in.
 Casing: Dia 4 in. Length 45 ft. Type PVC Riser
 Fill Material SAND Rig/Core B-51 Drill Rig
 Drill Co. Geologic Exploration Method Hollow Stem Auger
 Driller Todd Milsaps Log By K. Smith Date 10/17/97 Permit # WM 0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8							
10							
12						SM	Tan Fine Sands and Clays as mica
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38						PWR	
40							
42							
44							
46							
48							
50							



Drilling Log

Monitoring Well MW-12TZ

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
50							Fine Partially Weathered Granite, with large pieces of quartz and pink feldspar
52							
54							
56							
58							
60							
62							
64							
66							
68							
70							
72							
74							
76							
78							
80							
82							
84							
86							
88							
90							
92							
94							
96							
98							
100							
102							
104							
106							
108							
110							
112							
114							



Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 245.86 ft. Total Hole Depth 170 ft. Diameter 6 in.
 Top of Casing 248.4 ft. Water Level Initial 20 ft. Static _____
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 160 ft. Type PVC Riser
 Fill Material SAND Rig/Core Air Rig
 Drill Co. Geologic Exploration Method Air Rotary
 Driller Niall Pardue Log By K. Smith Date 10/09/97 Permit # WM 0500398
 Checked By D. McLay License No. 1175

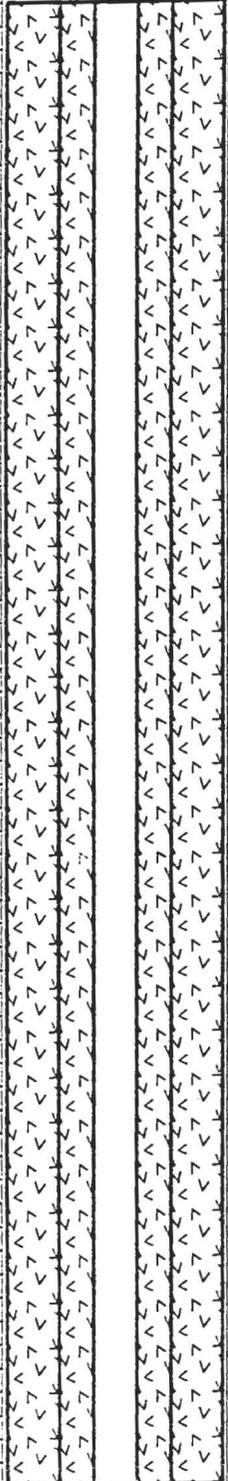
See Site Map
For Boring Location

COMMENTS:

See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8							
10							
12						FL	Fill Material
14							
16							
18							
20							
22							
24							
26							
28							
30							
32						SM	Tan Fine Sands and Silts
34							
36							
38							
40							
42						GP	Alluvium
44							
46							
48						PWR	
50							

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498

Depth (ft.)	Well Completion	FID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%		
50								
52								
54								
56								
58								
60								
62								
64							PWR	Fine Partially Weathered Granite, with large pieces of quartz and pink feldspar
66								
68								
70								
72								
74								
76								
78								
80								
82								
84								
86								
88								
90								
92								
94								
96					GR	Competent Granite Bedrock		
98								
100								
102								
104								
106								
108								
110								
112								
114						Small Fracture		



Drilling Log

Monitoring Well MW-12BR

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498

Depth (ft.)	Well Completion	FID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
114						Small Fracture
116						
118						
120						
122						Fracture, Water Sample Collected
124						
126						
128						
130						
132						
134						
136						
138						
140						
142					GR	
144						
146						
148						
150						
152						
154						
156						
158						
160						
162						
164						
166						
168						
170						
172						
174						
176						
178						

MW-13D

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: Graham & Currie STATE WELL CONSTRUCTION PERMIT NUMBER: _____
 DRILLER REGISTRATION NUMBER: 537

- WELL LOCATION: (Show sketch of the location below)
 Nearest Town: Raleigh County: Wake
1415 South Bloodworth St.
 (Road, Community, or Subdivision and Lot No.)
- OWNER Ashland Chemical Inc.
 ADDRESS P.O. Box 2219
 (Street or Route No.)
Columbus Ohio 43216
 City or Town State Zip Code
- DATE DRILLED 6/4/93 USE OF WELL Monitor
- TOTAL DEPTH 75.12
- CUTTINGS COLLECTED YES NO
- DOES WELL REPLACE EXISTING WELL? YES NO
- STATIC WATER LEVEL Below Top of Casing: 22.79 FT.
 (Use "+" if Above Top of Casing)
- TOP OF CASING IS - .13 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
- YIELD (gpm): _____ METHOD OF TEST _____
- WATER ZONES (depth): _____
- CHLORINATION: Type _____ Amount _____
- CASING:

DEPTH		DRILLING LOG
From	To	Formation Description
0	2	Gravel, red clay
5	7	Red silty sand.
10	12	White to lt. gray rock. Dry.
15	17	White to lt. gray rock w/dark micaceous banding. Dry.
20	22	Red silt w/dark micaceous banding. Moist.
25	27	Soft micaceous sand w/some silt. Wet.
30	32	White weathered rock w/micaceous banding. Wet.

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 attached.

- GROUT:

From	Depth	To	Diameter	Wall Thickness or Weight/Ft.	Material
<u>.13</u>	<u>70.12</u>	<u>Ft.</u>	<u>2"</u>	<u>Sch 40</u>	<u>PVC</u>
_____	_____	<u>Ft.</u>	_____	_____	_____
_____	_____	<u>Ft.</u>	_____	_____	_____
- SCREEN:

From	Depth	To	Diameter	Slot Size	Material
<u>.5</u>	<u>68.12</u>	<u>Ft.</u>	<u>Portland</u>	<u>Pour</u>	
<u>68.12</u>	<u>70.12</u>	<u>Ft.</u>	<u>Bentonite</u>	<u>Pour</u>	
_____	_____	<u>Ft.</u>	_____	_____	_____
_____	_____	<u>Ft.</u>	_____	_____	_____
- SAND/GRAVEL PACK:

From	Depth	To	Size	Material
<u>68.12</u>	<u>75.12</u>	<u>Ft.</u>	<u>Med.</u>	<u>Sand</u>
_____	_____	<u>Ft.</u>	_____	_____
- REMARKS: Prepacked screen in addition to sand pack.

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.

R. H. H. H.

7/9/93

SIGNATURE OF CONTRACTOR OR AGENT DATE



TEST BORING REPORT

BORING NO. MW-13D

PROJECT: Ashland Raleigh
 CLIENT: Ashland Chemical Inc.
 CONTRACTOR: Graham & Currie
 EQUIPMENT USED: CME 75

JOB NO: 83969.320
 PAGE NO: 1 of 4
 LOCATION: Ashland
 ELEVATION: _____
 DATE START: 6/4/93
 DATE FINISH: 6/5/93
 DRILLER: Morrison
 PREPARED BY: Holland

GROUND WATER		DEPTH TO:		CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	SS
					SIZE ID	1 5/8"
					HAMMER WT	140 lb
					HAMMER FALL	30"

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	OVA Reading (ppm)	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
		16	10	1-2	Gravel, red clay. Dry.
		26			
		19			
		12			
5.0		5	0.4	5-7	Red silty sand. Dry.
		6			
		6			
		5			
10.0		2	0.2	10-12	White to light gray weathered rock. Dry.
		3			
		5			
		4			
15.0		3	0.2	15-17	White to light gray weathered rock with dark micaceous banding. Dry.
		5			
		4			
		6			
20.0					

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0-4	VERY LOOSE	0-2	VERY SOFT	S SPLIT SPOON	MOSTLY 50-100%	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T TUBE	SOME 20-45%	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15-25%	UR - NOT READ
31-50	DENSE	9-15	STIFF	G GRAB SAMPLE	FEW 5-10%	
51+	VERY DENSE	16-30	VERY STIFF	X OTHER	TRACE <5%	
		31+	HARD	NR NO RECOVERY		

BORING NO. MW-13D



TEST BORING REPORT

BORING NO. MW-13D
PAGE 2 of 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
20.0		2	0.4	20-	Red silt with dark micaceous banding. Moist.
		2		22	
		3			
		4			
25.0		1	0.6	25-	Very soft micaceous sand with little silt. Wet.
		1		27	
		1			
		1			
30.0		2	7.0	30-	White weathered rock with micaceous banding. Wet.
		4		32	
		6			
		12			
35.0		5	4.6	35-	Tan medium-coarse sand with some weathered rock. Wet.
		4		37	
		6			
		9			
40.0		3	1.8	40-	Medium fine micaceous sand. Wet.
		8		42	
		9			
		15			
45.0					

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0-4	VERY LOOSE	0-2	VERY SOFT	S SPLIT SPOON	MOSTLY 50-100%	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T TUBE	SOME 30-45%	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15-25%	UR - NOT READ
31-50	DENSE	9-15	STIFF	G GRAB SAMPLE	FEW 5-10%	
51+	VERY DENSE	16-30	VERY STIFF	X OTHER	TRACE <5%	
		31+	HARD	NR NO RECOVERY		

BORING NO. MW-13D

RUST

TEST BORING REPORT

BORING NO. MW-13D

PAGE 3 of 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
20.0		4	3.8	45-47	Micaceous sand with some coarse sand and weathered rock. Wet.
45.0		7			
		12			
		15			
25.0		13	4.4	50-52	Fine quartz gravel to fine micaceous sand with few whi weathered rock. Wet.
50.0		12			
		8			
		22			
30.0		5	.6	55-57	White PWR.
55.0		100			
35.0					
60.0					
40.0					
65.0					
70.0					
45.0					

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE ID.	COMPONENT %	GROUND WATER ABBREV.
0 - 4	VERY LOOSE	0 - 2	VERY SOFT	S SPLIT SPOON	MOSTLY 50 - 100%	WD - WHILE DRILLING
5 - 10	LOOSE	3 - 4	SOFT	T TUBE	SOME 30 - 45%	NE - NOT ENCOUNTERED
11 - 30	MEDIUM DENSE	5 - 8	MEDIUM STIFF	U UNDISTURBED PISTON	LITTLE 15 - 25%	UR - NOT READ
11 - 50	DENSE	9 - 15	STIFF	G GRAB SAMPLE	FEW 5 - 10%	
1 -	VERY DENSE	16 - 30	VERY STIFF	X OTHER	TRACE < 5%	
		31 +	HARD	NR NO RECOVERY		

BORING NO. MW-13D



Drilling Log

Monitoring Well MW-140B

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 223.71 ft. Total Hole Depth 21 ft. Diameter 8.5 in.
 Top of Casing 225.71 ft. Water Level Initial 5 ft. Static _____
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 11 ft. Type PVC Riser
 Fill Material SAND Rig/Core ATV Earthprobe
 Drill Co. Geologic Exploration Method Solid Stem Auger
 Driller Bill Lambert Log By K. Smith Date 10/02/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description
							(Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8							
10						SM	Tan Sands and Silts
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION

DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH County: WAKE

SOUTH BLOODWORTH STREET
(Road, Community, or Subdivision and Lot No.)

2. OWNER ASHLAND CHEMICAL COMPANY
ADDRESS 1415 SOUTH BLOODWORTH STREET
(Street or Route No.)

RALEIGH NC 27610
City or Town State Zip Code

3. DATE DRILLED 10-16-97 USE OF WELL MONITOR

4. TOTAL DEPTH 35.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ FT

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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>33.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>25.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
From _____ To _____ Ft.	_____	_____

14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>33.0</u> To <u>35.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

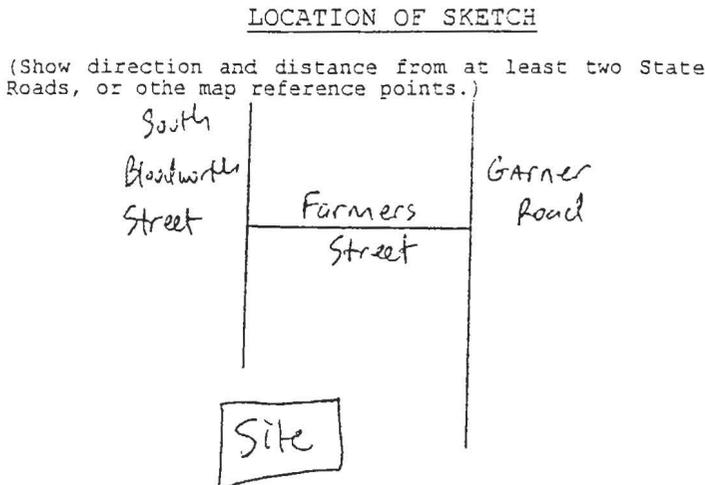
15. SAND/GRAVEL PACK:

Depth	Size	Material
From <u>30.0</u> To <u>35.0</u> Ft.	<u>8-20</u>	<u>FINE SILICA SAND</u>
From _____ To _____ Ft.	_____	_____

16. REMARKS: MW-14TZ BENTONITE SEAL FROM 25.0 TO 30.0 FEET

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.

Steve Zil 11-19-97
SIGNATURE OF CONTRACTOR OR AGENT DATE



Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 224.63 ft. Total Hole Depth 35 ft. Diameter 8.5 in.
 Top of Casing 226.8 ft. Water Level Initial 5 ft. Static _____
 Screen: Dia 2 in. Length 2 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 33 ft. Type PVC Riser
 Fill Material SAND Rig/Core B-51 Drill Rig
 Drill Co. Geologic Exploration Method Hollow Stem Auger
 Driller Todd Milsaps Log By K. Smith Date 10/15/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6						SM	Tan Fine Sands and Clays as mica
8							
10							
12							
14							
16							
18							
20							
22						GP	Alluvium, Coarse Sands and Gravel with some cobbles
24							
26							
28							
30							
32							
34						PWR	Fine Partially Weathered Granite, with large pieces of quartz and pink feldspar
36							
38							
40							
42							
44							
46							
48							
50							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION

DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH

County: WAKE

GARNER ROAD

DEPTH

DRILLING LOG

(Road, Community, or Subdivision and Lot No.)

From To

Formation Description

2. OWNER ASHLAND CHEMICAL COMPANY

0.0' 1.0'

GRAVEL/ASPHALT

ADDRESS 1415 SOUTH BLOODWORTH ST.

1.0' 12.0'

RED SILTY CLAY

(Street or Route No.)

12.0' 24.0'

TAN SILTY SAND

RALEIGH NC 27610

City or Town State Zip Code

3. DATE DRILLED 01-30-98 USE OF WELL MONITOR

4. TOTAL DEPTH 24.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ FT

(Use "*" if Above Top of Casing)

8. TOP OF CASING IS 0.0 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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

If additional space is needed use back of form

From	To	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
0.0	14.0	Ft.	2 INCH	SCH 40	PVC
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

LOCATION OF SKETCH

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

13. GROUT:

From	To	Depth	Material	Method
0.0	10.0	Ft.	PORTLAND BENTONITE	SLURRY
_____	_____	Ft.	_____	_____

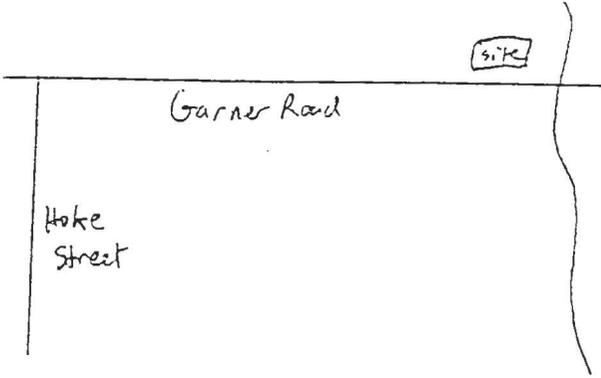
14. SCREEN:

From	To	Depth	Diameter	Slot Size	Material
14.0	24.0	Ft.	2.0 in.	.010 in.	PVC
_____	_____	Ft.	_____	_____	_____
_____	_____	Ft.	_____	_____	_____

15. SAND/GRAVEL PACK:

From	To	Depth	Size	Material
12.0	24.0	Ft.	8-20	FINE SILICA SAND
_____	_____	Ft.	_____	_____

16. REMARKS: MW-15-OB BENTONITE SEAL FROM 10.0 TO 12.0 FEET



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.

St. J. 2-17-98
SIGNATURE OF CONTRACTOR OR AGENT DATE



Drilling Log

Monitoring Well MW-150B

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 225.00 ft. Total Hole Depth 24 ft. Diameter 8.5 in.
 Top of Casing 224.70 ft. Water Level Initial 7 ft. Static _____
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 14 ft. Type PVC Riser
 Fill Material SAND Rig/Core B-51 Drill Rig
 Drill Co. Geologic Exploration Method Hollow Stem Auger
 Driller Todd Milsaps Log By J. Trotter Date 1/29/98 Permit # WMO500409
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description
							(Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2					GC	GC	Gravel (fill material)
4					CL	CL	Red clay (fill material)
6							
8							
10							
12							
14					GP	GP	Alluvium, coarse sand and gravel with some cobbles
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION
DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH

County: WAKE
DEPTH

DRILLING LOG

GARNER ROAD

From To Formation Description

(Road, Community, or Subdivision and Lot No.)

2. OWNER ASHLAND CHEMICAL COMPANY

0.0' 20.0' RED SANDY SILT

ADDRESS 1415 SOUTH BLOODWORTH ST.

20.0' 44.0' TAN ORANGE SANDY SILT

(Street or Route No.)

44.0' 45.0' TAN PARTIALLY WEATHERED ROCK

RALEIGH NC 27610

City or Town State Zip Code

DATE DRILLED 02-02-98 USE OF WELL MONITOR

TOTAL DEPTH 45.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ FT

(Use "+" if Above Top of Casing)

8. TOP OF CASING IS 0.0 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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

2. CASING:

If additional space is needed use back of form

LOCATION OF SKETCH

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

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>43.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>39.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
From _____ To _____ Ft.	_____	_____

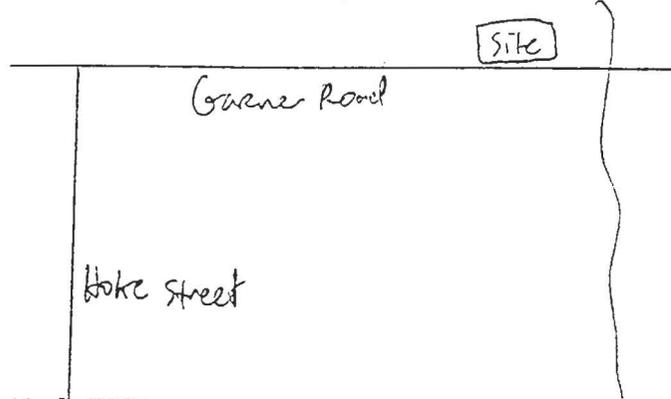
14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>43.0</u> To <u>45.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

Depth	Size	Material
From <u>41.0</u> To <u>45.0</u> Ft.	<u>8-20</u>	<u>FINE SILICA SAND</u>
From _____ To _____ Ft.	_____	_____

16. REMARKS: MW-14-08 BENTONITE SEAL FROM 39.0 TO 41.0 FEET



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.

Stu Zyl 2-17-98
SIGNATURE OF CONTRACTOR OR AGENT DATE



Drilling Log

Monitoring Well MW-15TZ

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 225 ft. Total Hole Depth 45 ft. Diameter 8.5 in.
 Top of Casing 224.7 ft. Water Level Initial 7 ft. Static _____
 Screen: Dia 2 in. Length 2 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 43 ft. Type PVC Riser
 Fill Material SAND Rig/Core B-5I Drill Rig
 Drill Co. Geologic Exploration Method Hollow Stem Auger
 Driller Todd Milsaps Log By J. Trotter Date 1/29/98 Permit # WM0500409
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2						CL	Red clay (fill material)
4							
6						GP	Tan alluvium, coarse sand and gravel with some cobbles
8							
10							
12							
14							
16							
18							
20							
22							
24							Grey/Tan alluvium, coarse sand and gravel with some cobbles
26							
28							
30						GP	
32							
34							
36							
38							
40							
42							
44							
46						PWA	Fine partially weathered granite, with large pieces of quartz and pink feldspar
48							
50							

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 235.94 ft. Total Hole Depth 21 ft. Diameter 8.5 in.
 Top of Casing 237.85 ft. Water Level Initial 15 ft. Static _____
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 11 ft. Type PVC Riser
 Fill Material SAND Rig/Core ATV Earthprobe
 Drill Co. Geologic Exploration Method Solid Stem Auger
 Driller Bill Lambert Log By K. Smith Date 10/03/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description
							(Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8							
10						SM	Maroon Sands and Silts with little Clay as mica
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION

DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH

County: WAKE

SOUTH BLOODWORTH STREET

Road, Community, or Subdivision and Lot No.)

2. OWNER ASHLAND CHEMICAL COMPANY

ADDRESS 1415 SOUTH BLOODWORTH STREET
(Street or Route No.)

RALEIGH NC 27610
City or Town State Zip Code

3. DATE DRILLED 11-07-97 USE OF WELL MONITOR

4. TOTAL DEPTH 47.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ 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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>45.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>41.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
From _____ To _____ Ft.	_____	_____

14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>45.0</u> To <u>47.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

Depth	Size	Material
From <u>43.0</u> To <u>47.0</u> Ft.	<u>8-20</u>	<u>FINE SILICA SAND</u>
From _____ To _____ Ft.	_____	_____

16. REMARKS: MW-16TZ BENTONITE SEAL FROM 41.0 TO 43.0 FEET

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 OF CONTRACTOR OR AGENT

DATE

At 2/

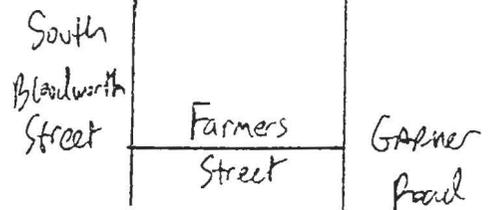
11-19-97

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

GW-1 REV. 9/91

RECEIVED
NOV 25 1997

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





Drilling Log

Monitoring Well MW-16TZ

Project Ashland Raleigh Owner Asland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 235.18 ft. Total Hole Depth 47 ft. Diameter 8 in.
 Top of Casing 237.44 ft. Water Level Initial 15 ft. Static _____
 Screen: Dia 2 in. Length 2 ft. Type/Size 0.010 in.
 Casing: Dia 2 in. Length 45 ft. Type PVC Riser
 Fill Material SAND Rig/Core 120 Diedrick
 Drill Co. Geologic Exploration Method _____
 Driller _____ Log By R. Leary Date 11/6/97 Permit # _____
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2						CL	Silty clays red (mostly) with first foot pea gravel, more sandy than silty clay
4						SM	Silty red sands, some clay grading to tan silts and sands
6						SM	Silty sands-mica
8						SM	
10						SM	
12						SM	
14						SM	
16						SM	
18						SM	
20						SM	
22						SM	
24						SM	
26						SM	
28						SM	
30						SM	
32						SM	
34						SM	
36						SM	
38						SM	
40						SM	
42						SM	
44						SM	
46						PWR	Granite, with quartz and mica Boring terminated
48							
50							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION
DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH

County: WAKE

SOUTH BLOODWORTH STREET
Road, Community, or Subdivision and Lot No.)

2. OWNER ASHLAND CHEMICAL COMPANY

ADDRESS 1415 SOUTH BLOODWORTH STREET
(Street or Route No.)

RALEIGH NC 27610
City or Town State Zip Code

3. DATE DRILLED 10-08-97 USE OF WELL MONITOR

4. TOTAL DEPTH 85.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ 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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

DEPTH		DRILLING LOG
From	To	Formation Description
0.0'	20.0'	RED SILTY CLAY (FILL)
20.0'	48.0'	BROWN SANDY CLAY
48.0'	55.0'	BROWN SANDY SILT
55.0'	65.0'	BROWN SAND WITH QUARTZ COBBLES
65.0'	68.0'	PINK GRANITE
68.0'	85.0'	GRAY GRANITE

If additional space is needed use back of form

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From 0.0 To 70.0 Ft.	2 INCH	SCH 40	PVC
From 0.0 To 68.0 Ft.	6 1/4 INCH	.188	GALVANIZED

13. GROUT:

Depth	Material	Method
From 0.0 To 65.0 Ft.	PORTLAND BENTONITE	SLURRY
From 0.0 To 68.0 Ft.	PORTLAND BENTONITE	SLURRY

14. SCREEN:

Depth	Diameter	Slot Size	Material
From 70.0 To 85.0 Ft.	2.0 in.	.010 in.	PVC

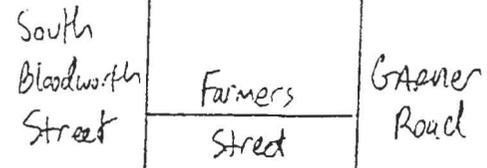
15. SAND/GRAVEL PACK:

Depth	Size	Material
From 69.0 To 85.0 Ft.	8-20	FINE SILICA SAND

16. REMARKS: MW-16BR BENTONITE SEAL FROM 65.0 TO 69.0 FEET

LOCATION OF 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.

Sto 3/L 11-19-97
SIGNATURE OF CONTRACTOR OR AGENT DATE



Drilling Log

Monitoring Well MW-16BR

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 241.07 ft. Total Hole Depth 122 ft. Diameter 10/5.95 in.
 Top of Casing 243.52 ft. Water Level Initial 30 ft. Static _____
 Screen: Dia 2 in. Length 15 ft. Type/Size PVC/0.010 in.
 Casing: Dia 6/2 in. Length 69/70 ft. Type PVC Riser
 Fill Material SAND Rig/Core Air Rig
 Drill Co. Geologic Exploration Method Air Rotary
 Driller Niall Pardue Log By K. Smith Date 10/6/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

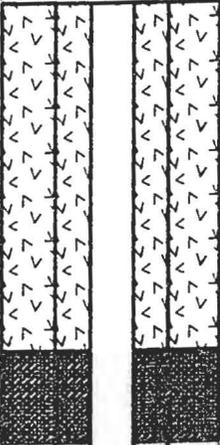
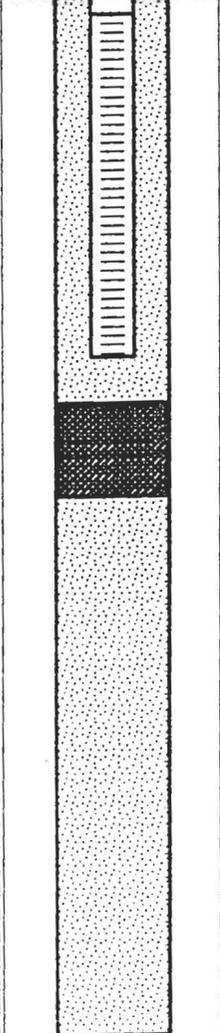
See Site Map
For Boring Location

COMMENTS:

See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							Fill Material
2							
4							
6						FL	
8							
10							
12							
14							Maroon sand and silty clays
16							
18							
20							
22							
24							
26							
28							
30						SM	
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498

Depth (ft.)	Well Completion	FID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%				
50					SM	Fine Partially Weathered Granite, with large pieces of quartz and pink feldspar				
52										
54										
56										
58										
60										
62										
64										
66										
68									GR	Fractured Zone Competent Granite Bedrock
70										
72										
74										
76										
78										
80										
82										
84										
86										
88										
90										
92										
94										
96										
98										
100										
102										
104										
106										
108										
110										
112										
114										



Drilling Log

Monitoring Well MW-16BR

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description
							(Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
114						GR	
116							
118							
120							
122							
124							
126							
128							
130							
132							
134							
136							
138							
140							
142							
144							
146							
148							
150							
152							
154							
156							
158							
160							
162							
164							
166							
168							
170							
172							
174							
176							
178							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION
DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH County: WAKE

SOUTH BLOODWORTH STREET
Road, Community, or Subdivision and Lot No.)

2. OWNER ASHLAND CHEMICAL COMPANY
ADDRESS 1415 SOUTH BLOODWORTH STREET
(Street or Route No.)

RALEIGH NC 27610
City or Town State Zip Code

3. DATE DRILLED 10-13-97 USE OF WELL MONITOR

4. TOTAL DEPTH 16.0 FEET
5. CUTTINGS COLLECTED YES NO
6. DOES WELL REPLACE EXISTING WELL? YES NO
7. STATIC WATER LEVEL Below Top of Casing: _____ 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 N/A
10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>6.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>2.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
From _____ To _____ Ft.	_____	_____

14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>6.0</u> To <u>16.0</u> Ft.	<u>2.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

Depth	Size	Material
From <u>4.0</u> To <u>16.0</u> Ft.	<u>8-20</u>	<u>FINE SILICA SAND</u>
From _____ To _____ Ft.	_____	_____

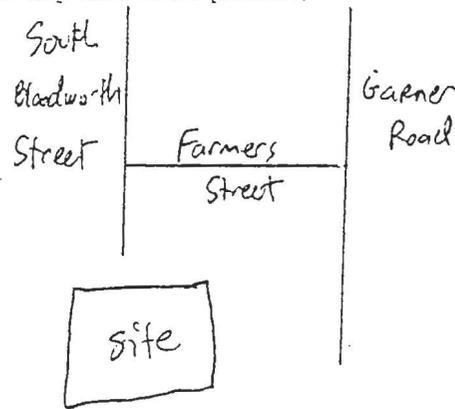
16. REMARKS: mw-1708
09-17 BENTONITE SEAL FROM 2.0 TO 4.0 FEET

DEPTH		DRILLING LOG
From	To	Formation Description
0.0'	16.0'	TAN SANDY SILT
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

If additional space is needed use back of form

LOCATION OF 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.

At 3/ 11-19-97
SIGNATURE OF CONTRACTOR OR AGENT DATE



Drilling Log

Monitoring Well MW-170B

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 221.91 ft. Total Hole Depth 16 ft. Diameter 8.5 in.
 Top of Casing 224.3 ft. Water Level Initial 5 ft. Static _____
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 6 ft. Type PVC Riser
 Fill Material SAND Rig/Core ATV Earthprobe
 Drill Co. Geologic Exploration Method Solid Stem Auger
 Driller Bill Lambert Log By K. Smith Date 10/03/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8						SM	Tan Sands and Silts
10							
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							



Drilling Log

Monitoring Well **MW-17TZ**

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 223.28 ft. Total Hole Depth 50 ft. Diameter 8.5 in.
 Top of Casing 225.65 ft. Water Level Initial 5 ft. Static _____
 Screen: Dia 2 in. Length 5 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 45 ft. Type PVC Riser
 Fill Material SAND Rig/Core B-51 Drill Rig
 Drill Co. Geologic Exploration Method Hollow Stem Auger
 Driller Todd Milsaps Log By K. Smith Date 10/14/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4						SM	Tan Sands and Silts
6							
8							
10							
12							
14							
16							
18							
20							
22							
24						GP	Alluvium, Coarse Sands and Gravel with some cobbles
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46						PWR	Fine Partially Weathered Granite, with large pieces of quartz and pink feldspar
48							
50							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION
DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH County: WAKE

SOUTH BLOODWORTH STREET
(Road, Community, or Subdivision and Lot No.)

2. OWNER ASHLAND CHEMICAL COMPANY

ADDRESS 1415 SOUTH BLOODWORTH STREET
(Street or Route No.)

RALEIGH NC 27610
City or Town State Zip Code

3. DATE DRILLED 10-16-97 USE OF WELL MONITOR

4. TOTAL DEPTH 35.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ 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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>33.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>25.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
From _____ To _____ Ft.	_____	_____

14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>33.0</u> To <u>35.0</u> Ft.	<u>2.0</u> in.	<u>.010</u> in.	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

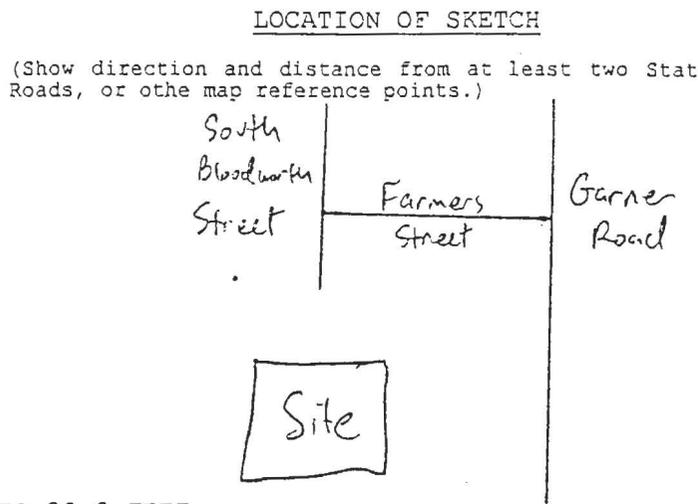
15. SAND/GRAVEL PACK:

Depth	Size	Material
From <u>30.0</u> To <u>35.0</u> Ft.	<u>8-20</u>	<u>FINE SILICA SAND</u>
From _____ To _____ Ft.	_____	_____

16. REMARKS: MW-18TZ BENTONITE SEAL FROM 25.0 TO 30.0 FEET

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.

Steve Z... 11-19-97
SIGNATURE OF CONTRACTOR OR AGENT DATE





Drilling Log

Monitoring Well **MW-18TZ**

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 228.65 ft. Total Hole Depth 35 ft. Diameter 8.5 in.
 Top of Casing 229.98 ft. Water Level Initial 10 ft. Static _____
 Screen: Dia 2 in. Length 2 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 33 ft. Type PVC Riser
 Fill Material SAND Rig/Core B-51 Drill Rig
 Drill Co. Geologic Exploration Method Hollow Stem Auger
 Driller Todd Milsaps Log By K. Smith Date 10/14/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description
							(Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8							
10							
12							
14							
16						SM	Tan Fine Sands and Silts
18							
20							
22							
24							
26							
28							
30							
32						PWR	Fine Partially Weathered Granite, with large pieces of quartz and pink feldspar
34							
36							
38							
40							
42							
44							
46							
48							
50							

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION
DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH County: WAKE

SOUTH BLOODWORTH STREET
Road, Community, or Subdivision and Lot No.)

2. OWNER ASHLAND CHEMICAL COMPANY

ADDRESS 1415 SOUTH BLOODWORTH STREET
(Street or Route No.)

RALEIGH NC 27610
City or Town State Zip Code

3. DATE DRILLED 10-12-97 USE OF WELL MONITOR

4. TOTAL DEPTH 85.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ 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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

DEPTH		DRILLING LOG
From	To	Formation Description
0.0'	10.0'	RED CLAY
10.0'	18.0'	RED BROWN SILTY CLAY
18.0'	45.0'	TAN SANDY CLAY
45.0'	65.0'	GRAY/PINK PARTIALLY WEATHERED ROCK
65.0'	85.0'	GRAY GRANITE

If additional space is needed use back of form

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>70.0</u> Ft.	<u>4 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From <u>0.0</u> To <u>69.0</u> Ft.	<u>6 1/4 INCH</u>	<u>.188</u>	<u>GALVANIZED</u>
From _____ To _____ Ft.	_____	_____	_____

Depth	Material	Method
From <u>0.0</u> To <u>64.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
From <u>0.0</u> To <u>69.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>

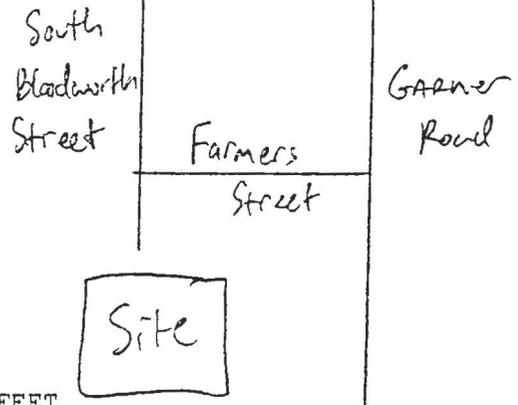
Depth	Diameter	Slot Size	Material
From <u>70.0</u> To <u>85.0</u> Ft.	<u>4.0 in.</u>	<u>.010 in.</u>	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

Depth	Size	Material
From <u>68.0</u> To <u>85.0</u> Ft.	<u>8-20</u>	<u>FINE SILICA SAND</u>

16. REMARKS: MW-18BR BENTONITE SEAL FROM 64.0 TO 68.0 FEET

LOCATION OF 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.

Steve J... 11-19-97
SIGNATURE OF CONTRACTOR OR AGENT DATE



Drilling Log

Monitoring Well MW-18BR

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 237.18 ft. Total Hole Depth 170 ft. Diameter 10/5.95 in.
 Top of Casing 239.4 ft. Water Level Initial 15 ft. Static _____
 Screen: Dia 2 in. Length 5 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 70 ft. Type PVC Riser
 Fill Material SAND Rig/Core Air Ria
 Drill Co. Geologic Exploration Method Air Rotary
 Driller Niall Pardue Log By K. Smith Date 10/13/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:

See key for description of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8						FL	Fill Material
10							
12							
14							
16						SM	Brown to Orange Sands and Silts
18							
20							
22						SP	Brown Sands and Gravels
24							
26							
28							
30							
32							
34							
36							
38						GP	Alluvium
40							
42							
44							
46							
48						PWR	
50							

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498

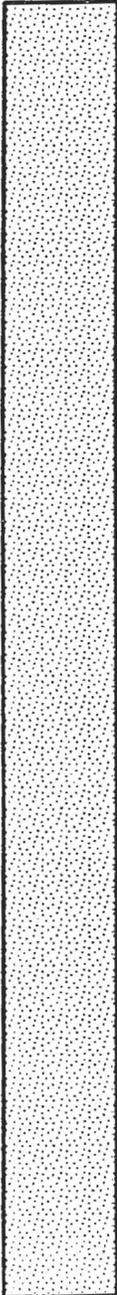
Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
50	[Patterned]				[Patterned]		
52							
54	[Patterned]				[Patterned]		
56							
58	[Patterned]				[Patterned]	PWR	Fine Partially Weathered Granite, with large pieces of quartz and pink feldspar
60							
62	[Patterned]				[Patterned]		
64							
66	[Patterned]				[Patterned]		
68							
70	[Patterned]				[Patterned]		Fractured Zone, Water approx 50 gal/min
72							
74	[Patterned]				[Patterned]		
76							
78	[Patterned]				[Patterned]		
80							
82	[Patterned]				[Patterned]		
84							
86	[Patterned]				[Patterned]		
88							
90	[Patterned]				[Patterned]	GR	
92							
94	[Patterned]				[Patterned]		
96							
98	[Patterned]				[Patterned]		
100							
102	[Patterned]				[Patterned]		
104							
106	[Patterned]				[Patterned]		
108							
110	[Patterned]				[Patterned]		
112							
114	[Patterned]				[Patterned]		



Drilling Log

Monitoring Well MW-18BR

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498

Depth (ft.)	Well Completion	FID (ppm)	Sample ID Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
114						Competent Granite Bedrock
116						
118						
120						
122						
124						
126						
128						
130						
132						
134						
136						
138						
140						
142						
144						
146						
148						
150						
152						
154						
156						
158						
160						
162						
164						
166						
168						
170						
172						
174						
176						
178						

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR: Geologic Exploration, Inc.

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

STATE WELL CONSTRUCTION

DRILLER REGISTRATION NUMBER: 1175 PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: RALEIGH

County: WAKE

SOUTH BLOODWORTH STREET
(Road, Community, or Subdivision and Lot No.)

DEPTH

DRILLING LOG

From To

Formation Description

0.0' 20.0'

TAN GRAY SANDY SILT

2. OWNER ASHLAND CHEMICAL COMPANY

ADDRESS 1415 SOUTH BLOODWORTH STREET
(Street or Route No.)

RALEIGH NC 27610

City or Town State Zip Code

3. DATE DRILLED 10-14-97 USE OF WELL MONITOR

4. TOTAL DEPTH 20.0 FEET

5. CUTTINGS COLLECTED YES NO

6. DOES WELL REPLACE EXISTING WELL? YES NO

7. STATIC WATER LEVEL Below Top of Casing: _____ FT

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 N/A

10. WATER ZONES (depth): N/A

11. CHLORINATION: Type N/A Amount N/A

12. CASING:

Depth	Diameter	Wall Thickness or Weight/Ft.	Material
From <u>0.0</u> To <u>10.0</u> Ft.	<u>2 INCH</u>	<u>SCH 40</u>	<u>PVC</u>
From _____ To _____ Ft.	_____	_____	_____
From _____ To _____ Ft.	_____	_____	_____

13. GROUT:

Depth	Material	Method
From <u>0.0</u> To <u>6.0</u> Ft.	<u>PORTLAND BENTONITE</u>	<u>SLURRY</u>
From _____ To _____ Ft.	_____	_____

14. SCREEN:

Depth	Diameter	Slot Size	Material
From <u>10.0</u> To <u>20.0</u> Ft.	<u>2.0</u> in.	<u>.010</u> in.	<u>PVC</u>
From _____ To _____ Ft.	_____ in.	_____ in.	_____
From _____ To _____ Ft.	_____ in.	_____ in.	_____

15. SAND/GRAVEL PACK:

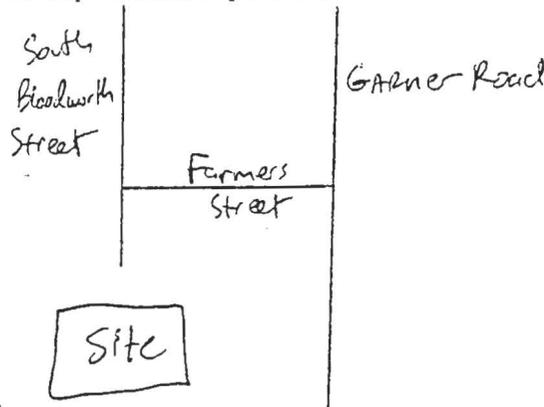
Depth	Size	Material
From <u>8.0</u> To <u>20.0</u> Ft.	<u>8-20</u>	<u>FINE SILICA SAND</u>
From _____ To _____ Ft.	_____	_____

16. REMARKS: mw-19 BENTONITE SEAL FROM 6.0 TO 8.0 FEET

If additional space is needed use back of form

LOCATION OF 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.

SIGNATURE OF CONTRACTOR OR AGENT

DATE

Steve Zyl

11-19-97



Drilling Log

Monitoring Well MW-19

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 230.79 ft. Total Hole Depth 17 ft. Diameter 8.5 in.
 Top of Casing 232.89 ft. Water Level Initial 15 ft. Static _____
 Screen: Dia 2 in. Length 10 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 7 ft. Type PVC Riser
 Fill Material SAND Rig/Core ATV Earthprobe
 Drill Co. Geologic Exploration Method Solid Stem Auger
 Driller Bill Lambert Log By K. Smith Date 10/03/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure)
							Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8						sm	Tan Sands with Silts and little Clays
10							
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							



Drilling Log

Monitoring Well MW-20

Project Ashland Raleigh Owner Ashland Chemical
 Location 1415 S. Bloodworth Street, Raleigh, NC Proj. No. 053240498
 Surface Elev. 221.74 ft. Total Hole Depth 20 ft. Diameter 8.5 in.
 Top of Casing 223.85 ft. Water Level Initial 5 ft. Static _____
 Screen: Dia 2 in. Length 15 ft. Type/Size PVC/0.010 in.
 Casing: Dia 2 in. Length 5 ft. Type PVC Riser
 Fill Material SAND Rig/Core ATV Earthprobe
 Drill Co. Geologic Exploration Method Solid Stem Auger
 Driller Bill Lambert Log By K. Smith Date 10/02/97 Permit # WM0500398
 Checked By D. McLay License No. 1175

See Site Map
For Boring Location

COMMENTS:
See key for descriptions of symbols

Depth (ft.)	Well Completion	FID (ppm)	Sample ID	Blow Count/ % Recovery	Graphic Log	USCS Class.	Description
							(Color, Texture, Structure) Trace < 10%, Little 10% to 20%, Some 20% to 35%, And 35% to 50%
-3							
2							
4							
6							
8							Tan Sands and Silts
10						SM	
12							
14							
16							
18							
20							
22							
24							
26							
28							
30							
32							
34							
36							
38							
40							
42							
44							
46							
48							
50							

Well Construction Details, Ashland Inc., Raleigh, North Carolina

Monitor Well	Date of Installation	TOC Elevation (ft msl)	Total Depth (ft bls)	Screened Interval (ft bls)	Northing* (ft)	Easting* (ft)	Casing Diameter & Material	Notes
MW-1	02/1986	260.56	28.5	18.5 - 28.5	732406.33	2108582.89	2-inch sst	
MW-2	02/1986	256.98	28.5	18.5 - 28.5	732205.30	2108580.66	2-inch sst	
MW-2D	02/1986	257.50	73.5	63.5 - 73.5	732207.57	2108578.99	2-inch sst	
MW-3	02/1986	260.44	33.5	23.5 - 33.5	732201.16	2108743.20	2-inch sst	
MW-3D	02/1986	260.92	71.0	61.0 - 71.0	732203.62	2108741.28	2-inch sst	
MW-4	02/1986	256.25	30.5	20.5 - 30.5	732712.91	2108580.76	2-inch sst	
MW-5	02/1986	257.41	28.5	18.5 - 28.5	732373.63	2108772.31	2-inch sst	
MW-6	02/1986	260.37	28.5	18.5 - 28.5	732578.97	2108776.24	2-inch sst	
MW-7	02/1986	259.95	28.5	18.5 - 28.5	732384.00	2108694.44	2-inch sst	
MW-7D	02/1986	260.09	69.8	59.8 - 69.8	732381.69	2108694.23	2-inch sst	
MW-8	10/1987	251.55	27.0	17.0 - 27.0	732045.98	2108779.93	2-inch PVC	Abandoned in 2008
MW-8R	08/2008	252.92	27.0	17.0 - 27.0	732045.98	2108779.93	2-inch PVC	
MW-8D	10/1987	251.38	59.3	49.3 - 59.3	732046.13	2108777.04	2-inch sst	Abandoned in 2008
MW-8DR	08/2008	252.89	54.0	44.0 - 54.0	732046.13	2108777.04	2-inch PVC	
MW-9D	06/1993	251.65	62.5	57.5 - 62.5	732113.58	2108458.19	2-inch PVC	
MW-11D	06/1993	249.38	55.0	50.0 - 55.0	731907.09	2108761.57	2-inch PVC	Abandoned in 2008
MW-11DR	08/2008	250.33	37.0	27.0 - 37.0	731907.09	2108761.57	2-inch PVC	
MW-12TZ	10/1997	246.94	59.0	44.0 - 59.0	732002.84	2108912.44	4-inch PVC	
MW-12D	06/1993	244.45	34.6	29.6 - 34.6	731981.45	2108935.54	2-inch PVC	
MW-12BR	10/1997	248.40	170.0	160.0 - 170.0	731976.41	2108911.40	2-inch PVC	
MW-13D	06/1993	260.22	75.1	70.1 - 75.1	732313.13	2108658.89	2-inch PVC	
MW-14OB	10/1997	225.71	21.0	11.0 - 21.0	731312.97	2109123.79	2-inch PVC	
MW-14TZ	10/1997	226.80	35.0	33.0 - 35.0	731309.90	2109096.27	2-inch PVC	
MW-15OB	01/1998	225.38	24.0	14.0 - 24.0	NA	NA	2-inch PVC	
MW-15TZ	02/1998	225.43	45.0	43.0 - 45.0	NA	NA	2-inch PVC	
MW-16OB	10/1997	237.85	21.0	11.0 - 21.0	731600.91	2108722.01	2-inch PVC	
MW-16TZ	11/1997	237.44	47.0	45.0 - 47.0	731572.94	2108697.31	2-inch PVC	
MW-16BR	10/1997	243.52	85.0	70.0 - 85.0	731546.63	2108734.29	2-inch PVC	
MW-17OB	10/1997	224.30	16.0	6.0 - 16.0	731256.12	2108629.50	2-inch PVC	
MW-17TZ	10/1997	225.65	50.0	45.0 - 50.0	731265.12	2108587.76	2-inch PVC	
MW-18TZ	10/1997	229.98	35.0	33.0 - 35.0	731607.86	2109273.97	2-inch PVC	
MW-18BR	10/1997	239.40	85.0	75.0 - 85.0	731616.03	2109015.69	4-inch PVC	
MW-19	10/1997	232.89	17.0	7.0 - 17.0	731591.52	2109171.82	2-inch PVC	
MW-20	10/1997	223.85	20.0	5.0 - 20.0	731350.97	2109290.89	2-inch PVC	
MW-20D	05/2006	222.38	45.0	35.0 - 45.0	731364.62	2109294.11	2-inch PVC	Well Log NA
MW-20BR	05/2006	222.08	83.0	73.0 - 83.0	731344.93	2109315.55	2-inch PVC	Well Log NA
MW-21	05/2006	238.75	25.0	15.0 - 25.0	731611.20	2108958.87	2-inch PVC	Well Log NA
MW-22	05/2006	232.47	25.0	15.0 - 25.0	731651.26	2109234.59	2-inch PVC	Well Log NA
MW-22D	05/2006	232.57	43.0	33.0 - 43.0	731658.75	2109249.61	2-inch PVC	Well Log NA
MW-22BR	05/2006	232.65	108.0	98.0 - 108.0	731652.26	2109243.97	2-inch PVC	Well Log NA

* Northing and Easting based on North American Datum (NAD) 83.

ft Feet

ft msl Feet above mean sea level.

ft bls Feet below land surface.

NA Not available.

sst Stainless Steel

PVC Poly-Vinyl Chloride

*Sampling and Analysis Plan
Ashland Raleigh
1415 South Bloodworth Street
Raleigh, Wake County, North Carolina
Antea USA of North Carolina, Inc. Project No. E020702565*



Appendix C

Chain-of-Custody Record

