Ground and Surface Water Sampling and Analysis Plan

Prepared for

Wayne County Subtitle D Landfill
Dudley, North Carolina

MESCO Project Number: G06096.6

This report is included as an Appendix E part of the Design Hydrogeologic Study completed for the Wayne County Subtitle D Landfill, Phase 3.

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

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1 INTRODUCTION

1.1 Objective

The objective of the Ground and Surface Water Sampling and Analysis Plan is to provide clear guidelines and procedures for field and laboratory personnel when obtaining and testing ground and surface water samples. This plan applies to all the Phase 1, Phase 2 and Phase 3 portions of the Wayne County Subtitle D Landfill. The sampling procedures outlined in this analysis plan are guidelines by which sampling will be performed. Deviation from the procedures may be warranted depending on facility conditions or unforeseen sampling variables. Alternative sampling procedures must conform to the N.C. Water Quality Monitoring Guidance Document for Solid Waste Facilities (Guidance Document).

Four (4) independent sampling events of monitoring wells MW-14, MW-15 and MW-16 will be taken within six (6) months of the date of issuance of the Permit to Operate for the Phase 3 disposal area, with at least one (1) sampling event occurring prior to receiving waste. The results of these sampling events will be used as baseline water quality information for the subsequent sampling events of Phase 3. Ground and surface water monitoring points will be sampled semi-annually thereafter for the Appendix I list of constituents. In addition to the Appendix I list of constituents; the leachate sample will also be tested for biochemical oxygen demand (BOD) chemical oxygen demand (COD), nitrate, nitrite, sulfate, total phosphorus, and pH.

1.2 Summary of Wells

This monitoring plan consists of sixteen (16) monitoring wells numbered sequentially MW-1 through MW-16, four (4) surface water monitoring points numbered SW-2, SW-3, SW-4 and SW-5, and one (1) leachate collection point numbered LE-1. The placement of these wells was decided based on the general direction of the groundwater flow within and surrounding the facility footprint, as well as the regulatory compliance boundaries defined in Rule 15A NCAC 13B.1631 (a)(2)(A). Three (3) monitoring wells MW-14, MW-15, MW-16, have recently been incorporated into the monitoring plan for the inclusion of Phase 3. MW-14 will be converted from piezometer P3-16, MW-15 will be converted from piezometer P3-18S, and MW-16 will be converted from piezometer P3-1. Phase 1 and 2 monitoring wells will continue to be employed for monitoring purposes. A list of all new monitoring points included in this plan is provided as Table E-1.

MW-1, the background well for the entire facility, is located in the northeastern section of the property approximately 150 feet from the boundary of the Phase 3 disposal area. The groundwater in this area exhibits southwesterly flow towards the waste area; therefore, MW-1 provides background water quality for all the downgradient wells of the landfill, helping to differentiate landfill leakage from potential contaminant migration originating upgradient of the facility.

MW-2 is located immediately downgradient of the sump in the eastern portion of Phase 1; it is designed to detect a liner breach in the sump area. Groundwater flows southwest towards the wetland.

MW-3 is located directly downstream of an old drainage feature, located south of Phase 1's southernmost border. This drainage feature was graded with fill material during the construction of Phase 1; however the area may still act as a conduit for groundwater under the condition that the fill hydraulic conductivity is higher than the native material.

MW-4, MW-5 and MW-10 are all within the vicinity of the leachate lagoon positioned to detect any failure. Drainage and groundwater flow in this area are controlled by nearby Edwards Branch and its unnamed tributary. These three wells were specifically placed to intercept downgradient flow of the rapidly moving groundwater in all directions before reaching neighboring streams. MW-4 is located 150 feet south of the western border to observe southwesterly flow from the lagoon. MW-5 is located 40 feet from the western corner and is positioned to intercept westerly flow. MW-10 is 70 feet from the southern border and monitors southerly flow towards the unnamed tributary.

MW-6 is hydraulically upgradient of the leachate lagoon but downgradient of Phase 1, and serves as a background well for the lagoon. The groundwater flow is westerly, and should detection occur in any downgradient monitoring points MW-6 will help determine the origin of the contamination.

MW-7 is located west of Phase 1 adjacent to two small drainage features that empty into Edwards Branch, monitoring westerly groundwater flow towards the creek.

MW-8, MW-9 and MW-12 are downgradient of the sump, designed to detect possible liner leaks in the sump area. MW-8 is downgradient of the sump near the northern corner of Phase 1 where groundwater flows west towards Edwards Branch. MW-9 is downgradient of the sump south of Phase 1 where groundwater flows west to southwest. MW-12 is located 120 feet west of the northwestern corner of Phase 2 immediately downgradient of the western sump where the groundwater flows west towards Edwards Branch.

MW-11 is located west of Phase 2, monitoring the groundwater that flows northwest through the middle of the Phase 2 area before reaching Edwards Branch.

MW-13 is east of the landfill 180 feet from the southern border of Phase2. This well monitors groundwater flowing through the easternmost portion of Phase 2, southwest, parallel to the unnamed tributary towards the marshy area east of the main access road.

MW-14 and MW-15 are located west of the Phase 3 area monitoring westerly groundwater flow before reaching the wetlands and Edwards Branch.

MW-16 is located east of the Phase 3 between MW-13 and MW-1. The groundwater flow is south westerly serving primarily as an additional background/review well.

Phase 3 will tie into the existing leachate lagoon established for Phase 1 and 2. Surface water tributaries off Edwards Branch will be monitored. SW-2 monitors the wetland area near MW-2, SW-3 monitors the southern tributary of Edwards Branch before it joins Edwards Branch, SW-4 will monitor Edwards Branch after the confluence with the small southern tributary, and SW-5 monitors Edwards Branch past the Phase 3 disposal area, as an upstream monitoring point. Locations of the sampling points are shown on Plate A.

1.3 Sampling Equipment

Groundwater samples will be obtained in the field using laboratory cleaned stainless steel bailers. Each bailer will be sanitized in a laboratory environment, prior to sampling, in accordance with the following procedures as prescribed in the Guidance Document:

1. Phosphate-free, soap tap water wash.
2. Tap water rinse.
3. De-ionized or distilled water rinse.
4. Isopropyl alcohol rinse.
5. De-ionized or distilled water rinse.
6. Air dry.
7. Aluminum foil wrap, shiny side out.

Alternative sampling equipment, such as disposable Teflon bailers may be warranted; all alternative equipment and procedures must conform to the Guidance Document. The standard equipment necessary to conduct sampling for each well consists of sample containers (including trip blanks and equipment blanks), one wide-mouth container, at least two 600-ft spools of 1/4-inch nylon rope, at least two boxes of nitrile gloves, one box of large plastic bags, temperature indicator, pH indicator, conductivity indicator, water level indicator, storage coolers, and ice. If the total depth of all wells to be sampled exceeds 1,200 feet, additional spools of rope will

be required to complete the sampling. If the number of wells to be sampled exceeds one third of the number of pairs of gloves in stock, additional boxes of gloves will be necessary. The bailers, wrapped in foil and plastic, will be transported between pieces of peaked foam rubber to prevent damage to the wrappings. All equipment subject to damage and contamination will be transported in sealed, plastic bags. The water level indicator will be cleaned in accordance with Steps 2 and 3 described above prior to placement in a clean plastic bag.

1.4 Sampling Containers

Ground and surface water monitoring will include organic (Volatile Organic Compounds) and inorganic (Metals) analysis. Samples will be collected for the various analyses in laboratory supplied containers.

1. Each sample container will be clearly labeled providing the following information: site name, county location, sample identification number, parameters to be analyzed, preservative added, date and time of sampling, and initials of the sampler.
2. Samples to be analyzed for organic content will be collected first in three 40-ml glass vials with Teflon caps. The sample vials will be completely filled to create zero head space in the vials.
3. Samples to be analyzed for inorganic contamination will be collected second in a quart/1-liter polyethylene container.

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

2 SAMPLING

Wells will be sampled from upgradient to downgradient, or when previous analytical data is available, from lowest to greatest contamination. This procedure is required to limit the potential of cross contamination between sampling points.

2.1 Set-Up

A clean sheet of plastic will be placed around the well to provide a clean surface for sampling equipment. The total well depth read from the well tag and the measured depth to water, determined using the water level indicator, will be used to compute the depth of water in the well. The total well depth will be measured and compared to the depth indicated on the well tag as a check for siltation or blockage at depth. The amount of standing water will be calculated by subtracting the depth to water from total well depth. Gallons of water in the well, as compared to well diameter, will be determined using the chart on Plate C. For example, if a two-inch well is 29 feet deep and has a measured depth to water of 10 feet, there are 19 feet of standing water or 3.3 gallons in the well.

Purging will be performed to remove stagnant water from the well, and to introduce fresh groundwater for sampling. Each well will be purged of three to five volumes of standing water (well volumes), or until dry if this cannot be achieved. Indicator parameters such as pH, temperature and specific conductance will be measured during purging as an indication that groundwater representative of the formation surrounding a given well is being sampled. Purging is considered complete when at least three well volumes have been purged and indicator parameters have stabilized such that three successive readings vary by no more than 10%. Purging may need to be continued beyond five well volumes if indicator parameters have not stabilized. All information will be recorded on a field data sheet or in a field logbook with copies submitted to the Division of Waste Management with the analytical results.

All meters used to monitor purge parameters will be calibrated immediately prior to purging and sampling, and those readings recorded in a field logbook. The meters should be recalibrated at the end of each sampling event and those readings recorded in the log also. Entries will always include pre- and post- calibration readings as well as the model and serial number of the equipment and the date, time, and person performing the calibration(s). Two standards, which bracket the average or suspected measurements for pH and specific conductance, will be used at the site. Additionally, if an equipment blank needs to be run, it should be done before any sampling is started.

2.2 Purging

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

At no time during purging will the bailer twine be allowed to touch the ground. In order to not allow the rope to touch the ground during purging, the rope will be collected when raising the bailer either by loops gathered in one hand or by alternating hand-to-hand as the bailer is pulled from the well. When purging deep wells (in excess of 40 feet), the ground and the well head may be covered with a clean plastic bag or sheet of plastic with a slit cut to allow the plastic to slide over the well head. This will be a separate sheet of plastic from the

one used for the sampling equipment. The plastic will be placed over the sampler's boots to allow the rope to fall onto the plastic without contamination. Alternatively, the twine may be lowered into an open bag placed in a 5-gallon bucket beside the well head.

If purging and sampling of a well are performed at separate times, the bailer will be left suspended in the well, above the water table, with the rope secured. The remaining rope will be doubled and grasped in a tight loop in one hand. Using the free hand, take the glove on the hand holding the rope and remove it by pulling away from the hand and over the rope into an inside-out position encasing the rope in the glove. The rope will be transferred to the opposite hand and the procedure will be repeated to cover any portion of the rope remaining uncovered. The glove-encased rope will be set on top of the well head until time to sample. Alternatively, the rope remaining after securing may be gathered in a tight loop and pushed into the 2-inch PVC well pipe and left. Even when sampling immediately follows purging, new gloves will be necessary.

2.3 Groundwater Sample Collection

The bailer will be lowered slowly into the well to avoid volatizing any dissolved-phase compounds that may be present in the groundwater. Once full, the bailer will be retrieved and containers filled by emptying the water through the hole at the bottom of the bailer. Glass 40-mL vials for VOC analyses will be filled in such a manner as to produce zero headspace in the vials. Polyethylene containers for metals analyses will be filled and sealed with the cap, leaving about ½-inch of airspace at the top. In addition to collecting the samples, water will be collected in the wide-mouth container for pH, temperature, and conductivity measurements. Upon completion of sampling, sample containers will be placed in labeled and sealed plastic bags, including equipment and trip blanks, and stored in ice-filled coolers to chill the samples to 4°C pending transport to a NCDENR-certified analytical laboratory. The contaminated nitrile gloves and rope will be discarded.

2.4 Surface Water Sample Collection

Surface water sampling will be taken with given consideration to minimize turbulence and aeration. Surface water sample containers will be handled with gloves on, keeping one hand near the base; containers will be dipped at location points with extreme caution in order to avoid contamination at the mouth of the container, pushing rapidly at an angle into the water, mouth up, and tilted towards the stream current to fill, so as not to lose any of the preservative into the surrounding water. If there is little current movement, the container will be moved slowly through the water laterally. During times of drought, if the water is not deep enough to allow filling of the container, a pool may be scooped out of the bottom of the stream to obtain a sample. The pool will be allowed to clear before sampling. All containers will be filled and treated in the same manner as the groundwater samples. The samples will be sealed in labeled, plastic bags, and stored in an ice-filled cooler to chill the samples to 4°C pending transport to a NCDENR-certified analytical laboratory. In addition to

collecting the samples, water will be collected in the wide-mouth container for pH, temperature, and conductivity measurements.

2.5 Leachate Sampling

The Phase 3 leachate will be pumped along the waste boundary to connect with the Phase 1 and 2 leachate. All three will be sampled together at the current leachate sampling sites. Leachate will be obtained from the end of the inflow pipe in the leachate lagoon, LE-1. No new leachate collection locations will be added. Leachate pump station sampling points, LE-2, LS4, LS5 and LS6, will function as supplementary leachate sampling locations and will not be sampled with semi-annual sampling. When collecting leachate samples, sample containers will be handled with extreme caution in order to avoid contamination at the mouth of the container. Containers will be filled by being held directly under the spigot. All containers will be filled in the same manner and treated the same as the groundwater samples. The samples will be sealed in labeled, plastic bags, and stored in an ice-filled cooler to chill the samples to 4°C pending transport to a NCDENR-certified analytical laboratory.

2.6 Chain-of-custody

Chain-of-custody forms will be used to document the handling of all samples collected and listing all individuals who have taken possession of a given set of samples, including field personnel, laboratory couriers, and laboratory personnel. Trip blanks, equipment blanks, and sample containers will all travel and be stored together. Trip blanks will remain in the condition they are received from the laboratory and will not be opened or tampered with during the sampling. A chain-of-custody record will be completed for each day's samples, indicating the date and time, sample location, sample matrix (soil, water, etc.), and laboratory analyses to be conducted. In addition, a field sampling data sheet will be completed indicating the depth to water, pH, temperature, and specific conductivity of the sample measured in the field at each well sampled.

3 ANALYSIS

When the water samples reach the laboratory, they will be transferred to a sample custodian who will sign the chain-of-custody documentation as receipt of the samples. Internal control of the water samples in the laboratory will be in accordance with QA/QC procedures for the laboratory. Copies of QA/QC manuals for approved laboratories are on file at the Division of Solid Waste.

Groundwater, surface water and leachate will be analyzed for the Appendix I list of chemical constituents; QA/QC procedures utilized during the testing will be in conformance with the laboratory QA/QC manual. Leachate samples will also be analyzed for biological oxygen demand (BOD), chemical oxygen demand (COD), phosphate, nitrate, sulfate, and pH. In addition, practical quantitation limits (PQLs) for each of the constituents will be determined in accordance with the equipment that is used in the laboratory testing.

4 CONCLUSION

This report, included as part of the Design Hydrogeologic Report for the proposed Wayne County Subtitle D Landfill Phase 3, completes the requirements as described in rule 15A NCAC 13B.1623 (b)(3). The ground and surface water monitoring plan is designed to be effective in the early detection of any possible release of hazardous constituents or the leachate surface impoundment to the uppermost aquifer.

Respectfully submitted,
MUNICIPAL ENGINEERING SERVICES COMPANY, P.A.

Madeline German, PG
Geologist

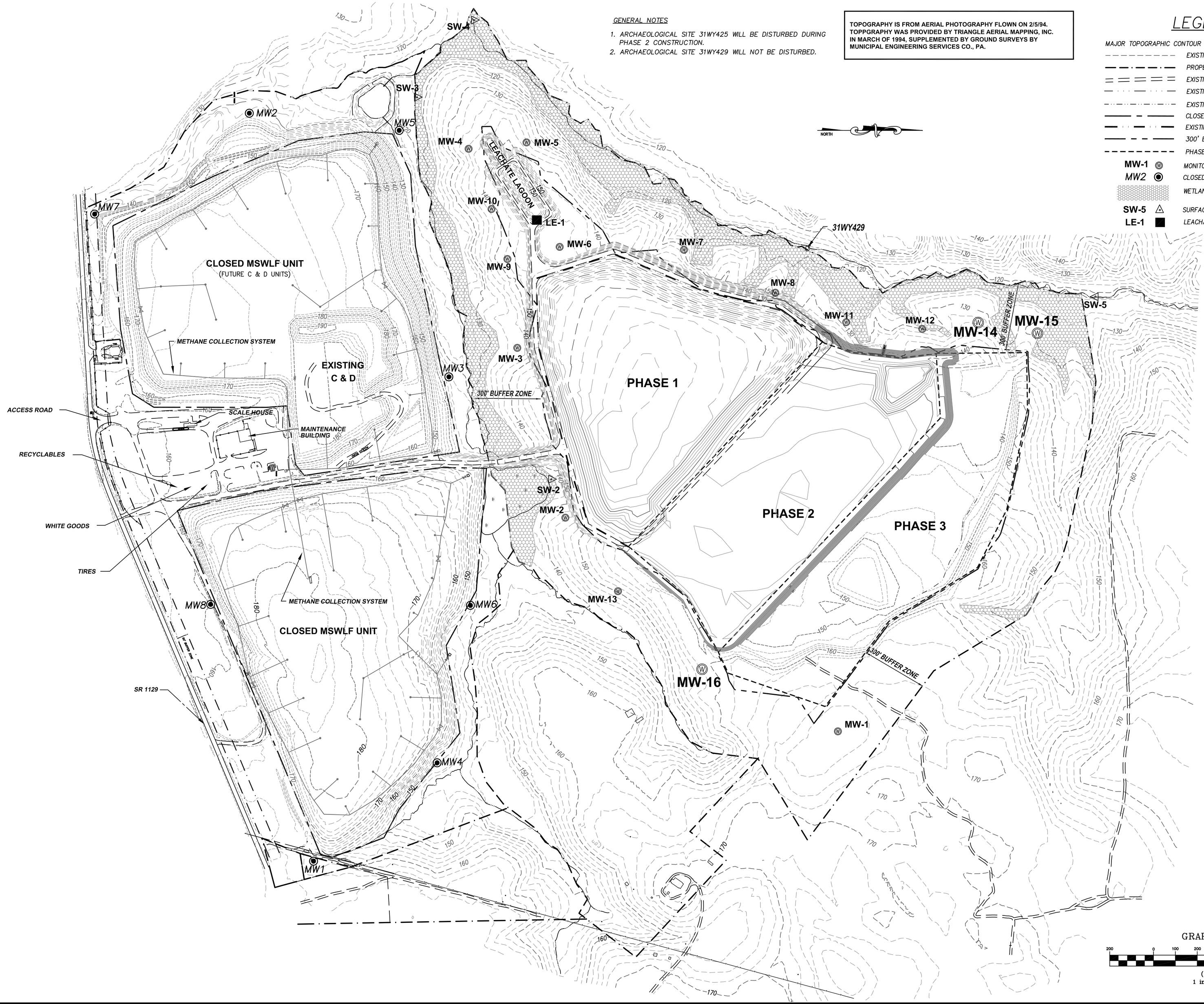
Table E-1: Summary of Ground and Surface Water Monitoring Points

Sampling Point	Type	Gradient	Total Depth (ft)	Designation
MW-14	Monitoring Well	Down	21	Phase 3 Monitoring Well
MW-15	Monitoring Well	Down	16	Phase 3 Monitoring Well
MW-16	Monitoring Well	Up	20	Background/Review Well

GENERAL NOTES

1. ARCHAEOLOGICAL SITE 31WY425 WILL BE DISTURBED DURING PHASE 2 CONSTRUCTION.
2. ARCHAEOLOGICAL SITE 31WY429 WILL NOT BE DISTURBED.

TOPOGRAPHY IS FROM AERIAL PHOTOGRAPHY FLOWN ON 2/5/94. TOPPGRAPHY WAS PROVIDED BY TRIANGLE AERIAL MAPPING, INC. IN MARCH OF 1994, SUPPLEMENTED BY GROUND SURVEYS BY MUNICIPAL ENGINEERING SERVICES CO., PA.



LEGEND

MAJOR TOPOGRAPHIC CONTOUR INTERVAL: 10 FEET

- EXISTING CONTOURS
- PROPERTY LINE
- EXISTING UNPAVED ROAD
- EXISTING CREEK, STREAM, ETC.
- EXISTING DIVERSION DITCHES
- CLOSED MSWLF SANITARY UNIT
- EXISTING MSWLF SANITARY UNIT
- 300' BUFFER ZONE
- PHASE LIMITS
- MW-1 MONITORING WELLS
- MW2 CLOSED MONITORING WELLS
- WETLANDS
- SW-5 SURFACE WATER
- LE-1 LEACHATE SAMPLING LOCATION

NOTE: PROPOSED MONITORING WELLS WILL BE CONVERTED FROM EXISTING PIEZOMETERS

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch = 200 ft.

Municipal Engineering Services Company, P.A.
P.O. BOX 97 GARNER, N.C. 27529 (919) 772-5393
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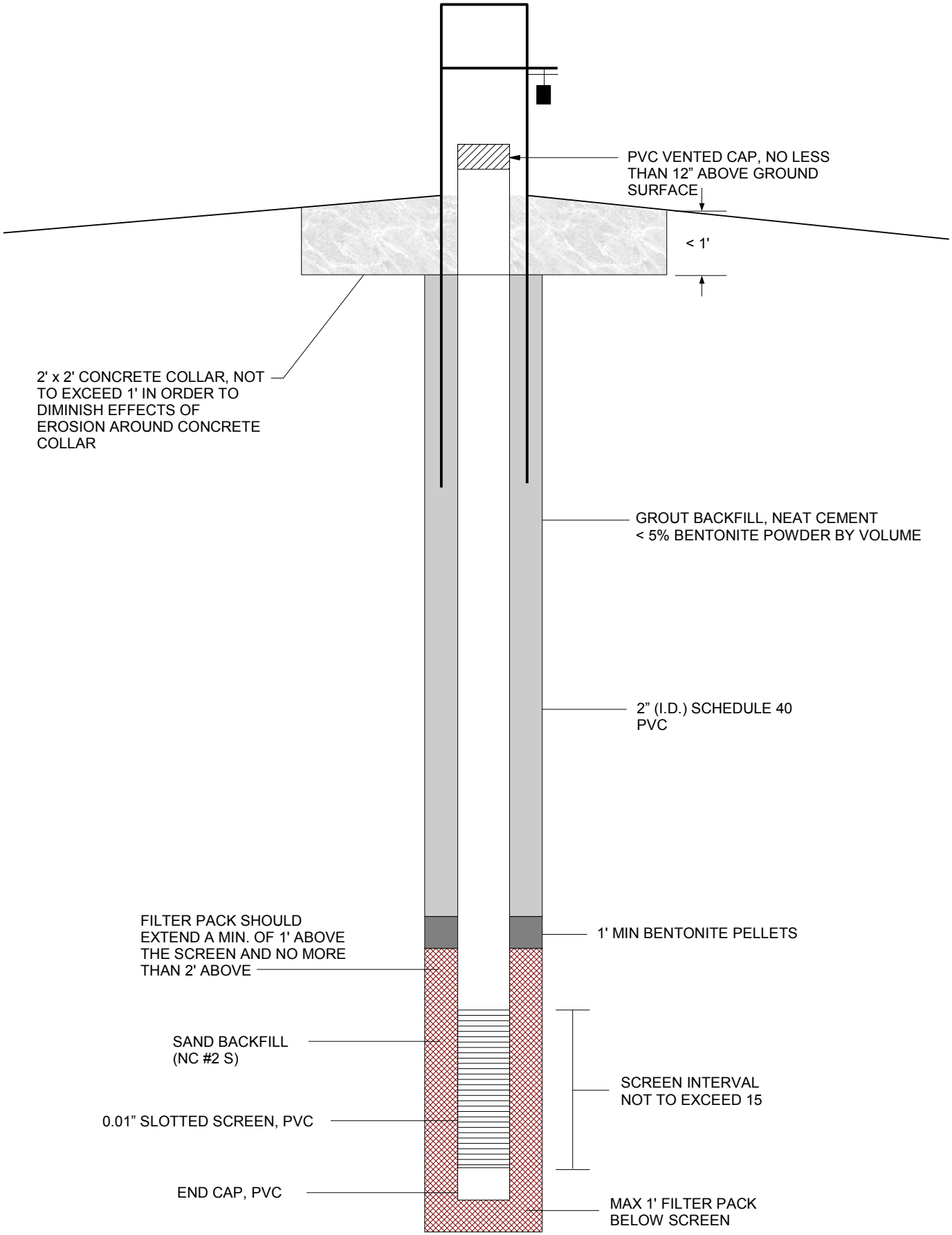
LICENSE NUMBER: C-0281

MUNICIPAL SOLID WASTE LANDFILL FACILITY
WAYNE COUNTY
NORTH CAROLINA

DATE	BY	REV.	DESCRIPTION
04/25/2011	MG	1	ADDED LEACHATE COLLECTION POINT, LE-1

PROPOSED MONITORING WELL LOCATIONS

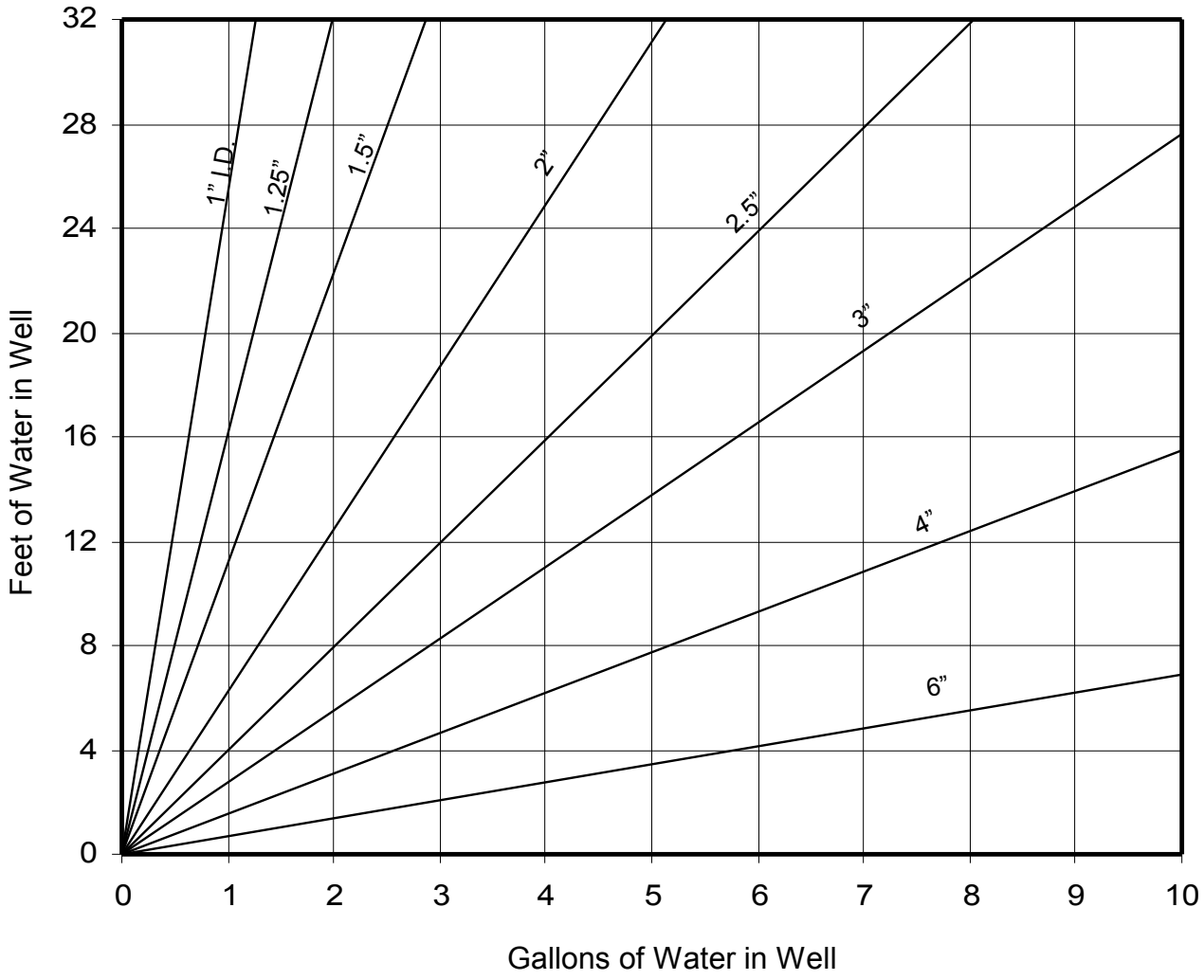
SCALE:	1" = 200'
DATE:	7/15/2008
DRWN. BY:	M. GERMAN
CHKD. BY:	S. PATRICK
PROJECT NUMBER	G06096.6
DRAWING NO.	PLATE A
SHEET NO.	1 OF 1



NOTE: SHALLOW WELLS REQUIRE A MINIMUM OF 5' COMBINED THICKNESS OF GROUT AND BENTONITE.

TYPICAL MONITORING WELL

PLATE B



GRAPHICAL PLOT OF STANDING VOLUMES OF WATER

PLATE C