

January 27, 1998

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MEMORANDUM

To: Jim Barber

From: Matt Gamble

Re: Initial Sampling at Fort Bragg C & D Landfill  
Well Installation at Fort Bragg LCID Landfill

Jim,

The Solid Waste Section has review information submitted by Richard Rust, P.E., on January 20, 1997 regarding the above referenced matters. The well construction, well locations, and boring logs appear consistent with the approved plan for the C & D area. However, no analytical methods were specified on the Chain-of-Custody for the initial sampling event. Presumably they will refer to the approved plan and the results will establish baseline conditions.

The Water Quality Monitoring Plan, attached, for the LCID Landfill appears to meet Section requirements. Please note that the plan requires analysis for Appendix I and metals parameters. The Section will review the sampling report when received.

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REFERENCES:

Hydrologic and Geologic Study, Site Application for proposed Lamont Road Demolition Landfill, Ft. Bragg, NC, by Ray Daniels, PG, and Richard Rust, PE, PhD, dated 7 July 1996.

Solid Waste Management Rules 15A NCAC 13B, as amended through 1/1/97.

Well Construction Standards 15A NCAC 2C .0100, as amended through 12/1/92.

North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities, Solid Waste Section, Division of Solid Waste Management, DEHNR, Draft, March 1995.

Sampling and Analysis Requirements, Construction and Demolition Landfills, NC Solid Waste Section, January 1995.

Lamont Road LCID Landfill, Ft. Bragg, NC, Water Quality Monitoring (Report of Sampling and Analysis), March 1997, by BPA Environmental & Engineering, Inc., Greensboro, NC (910) 272-9713.

**MONITORING PLAN**

**PURPOSE**

This Groundwater and Surface Water Quality Monitoring Plan is to be included in the previously granted NC DEHNR Permit No. 26C, Land Clearing and Inert Debris (LCID) Landfill at Lamont Road, Ft. Bragg, NC. There is no previous Water Quality Monitoring Plan for this facility.

**HISTORICAL BACKGROUND**

The Lamont Road Land Clearing and Inert Debris (LCID) Landfill is located on the north side of Coolyconch Mountain, east of Lamont Road. The LCID Landfill site has been operated as a controlled repository for construction and demolition (C&D)

debris as well as for land clearing and inert debris since its permitting under NC DEHNR Permit No. 26C on 28 August 1987. Since February 1993 C&D debris has been diverted to the Longstreet Road Sanitary Landfill and only LCID has been accepted at the LCID Landfill site. Scales were installed in April 1993.

Ft. Bragg's and Pope AFB's continuing building program entails land clearing and demolition of old infrastructure. The LCID landfill is the designated disposal site for LCID from these sources.

The area adjacent and east of the LCID Landfill has been and continues to be excavated as a borrow site for sandy fill material. To the south east of the LCID Landfill, petroleum contaminated soils have been spread, dried, and stored for removal by contractor. To the east of the LCID Landfill, petroleum contaminated sludges have been stored in earthen impoundments for removal by contractor.

The Lamont Road Construction and Demolition (C&D) Landfill site is immediately south-southeast (SSE) of the LCID landfill. The C&D Landfill Construction and Operation Permit Application is currently under review by NC DEHNR. The C&D landfill is the intended site for disposal of C&D debris after closure of the Longstreet Road Sanitary Landfill scheduled to occur on 31 December 1997.

In conjunction with the closure of the Longstreet Road Sanitary Landfill and consequent off-post disposal of MSW, Ft. Bragg intends to permit, construct, and operate a waste transfer station SSE of the LCID Landfill and immediately west of the C&D Landfill site. The transfer station will be operated under a separate permit and therefore must be buffered from the C&D Landfill and the LCID landfill so that each may be monitored separately for groundwater contamination.

Three monitor wells are maintained and sampled in conjunction with the LCID landfill. MW-3 was installed by USGS during May 1992 to a depth of 120 feet and screened from 109.5 to 119.5 feet. It is located 70 meters east and slightly south of the truck scales adjacent to Lamont Road and serves as the upgradient well for the LCID Landfill. MW-2 is located inside the northern limit of fill of the LCID Landfill adjacent to the LCID Landfill's old sediment pond (now filled with LCID) and served as the downgradient well for the LCID Landfill. Midway between MW-3 and -2 is MW-1. Immediately adjacent to MW-1 is another well labeled "Dry Well". Sounding of MW-2 and -1 on 15 March 1996 revealed depths from top of casing to bottom of well of 46.75 and 46.96 feet respectively. Logs, well completion and Gamma records exist for MW-3 at USGS's Raleigh office. Records exist for sampling events of MW's -1, -2, and -3.

On 7 July 1996 a Geologic and Hydrogeologic Study (referenced above) for the C&D Landfill site was completed by Ray Daniels, PG and Richard Rust, PE, PhD and submitted to Jim Bateson, Hydrogeologist, Solid Waste Section, NC DEHNR. This study includes water table elevations, SPT blow count, and logs from 10 borings (B-1 through B-10 shown on Figure 1 of this Monitoring Plan) instrumented with piezometers, and undisturbed soil samples taken during borings representing the confined and unconfined units of the uppermost aquifer. Water table elevations were also taken from the three LCID MW's described above.

Groundwater Sampling of MW's -1, -2, and -3 on 24 March 1997 found the following: MW-2 had Arsenic, Barium, Chromium, and Lead exceeding 2L standards. MW-2 had Selenium and Chloroethane at less than 2L Standards. MW-3 (upgradient well) had lead at less than 2L Standards. Results of sampling from MW-2 may be suspect. MW-2 (adjacent to the old LCID sediment pond) is frequently flooded above the cement grout collar and sometimes flooded above top of casing. MW's -1, -2, and "Dry Well" are surrounded by LCID waste, and all three wells are of unknown construction. MW's -1, -2, and "Dry Well" are therefore to be decommissioned and replaced by two new wells proposed in this Monitoring Plan.

In October 1997 four additional piezometers (B-11 through B-14) were installed to the north and west of the LCID landfill. SPT blow count, and logs were taken every 5'. The logs are included in Appendix I of this Monitoring Plan. These piezometers, the existing monitor wells, and piezometers installed in 1996 were sounded. The results of this sounding and interpolation of these data points to depict the contours of the surficial aquifer are shown on Figure 1. The surficial aquifer system is flowing north.

Drilling was  
accomplished by  
Atlantic Boring Inc  
Air Park Rd  
Fuquay NC 27526  
Driller Registration #

The table below shows seasonal fluctuation over the past year arranged in approximate order from upgradient to downgradient. The last sounding, 10/30/97, occurred after an unusually prolonged dry spell.

Well/Piez	Elev., Top of Casing (TOC), in Ft. MSL	Elev, Water Table, 10/30/97, in Ft. MSL	Elev, Water Table, 3/24/97, in Ft. MSL	Elev, Water Table, 4/26/96, in Ft. MSL
MW-3, (Permanent Aquifer)	408.32	dry at 285.36	308.97	310.0
B-10	407.35	350.41		352.7
B-6	409.38	dry at 357.03		358.1
B-5	402.57	dry at 351.58		352.9
MW-1	373.41	347.52	348.75	349.4
MW-2	348.92	Top of casing submerged	312.95	314.6
B-12	381.13	338.90		
B-11	361.23	315.88		
B-13	361.24	307.71		
B-14	347.67	305.66		

#### CONCEPT

From the LCID landfill site, the nearest source for drinking water is the Ft. Bragg Water Plant located on Little River, 3.2 miles northeast and 4.6 miles downstream of the LCID Landfill. Surface drainage from the site flows north 0.8 miles to Cypress Creek. Cypress Creek then flows 2.5 miles northeast to intercept Little River 1.3 miles upstream of the water plant. Any Ft. Bragg facilities downgradient of the LCID Landfill which were obtaining drinking water from wells (e.g., Rod and Gun Club) are now supplied with water piped from the Ft. Bragg Water Plant.

The soils encountered during installation of B-11 through B-14 were identical to those encountered during the Geologic and Hydrogeologic Study for the C&D Landfill site. To summarize the above referenced Geologic and Hydrogeologic Study for the C&D

Landfill site: The site exhibited typical characteristics of the Mittendorf Formation. The site's uppermost aquifer is perched on discontinuous silty-clay and clay lenses ( $k = 10^{-7}$  cm/sec) less than 8 inches thick and of varying plan view dimensions. The lenses are located intermittently from the near-surface to the permanent aquiclude, the Cape Fear Formation (light grey to olive clayey-silt). Between the lenses are sands with permeabilities of up to  $10^{-2}$  cm/sec.

Although piezometers indicate the surficial aquifer flows from east to west at the C&D site and from south to north at the LCID Landfill, it is likely that groundwater percolates to the Cape Fear Aquiclude between the discontinuous lenses. Headwaters of intermittent streams are not recorded above 330' MSL in the drainage basin downstream of the site. 330' MSL is approximately 15' above the uppermost aquifer's groundwater elevation at the low (north) end of the LCID Landfill. The Cape Fear Formation is extensive, dips to the southeast, and exists at a depth below 300' MSL in the vicinity of the LCID Landfill. As indicated by USGS Quadsheet, Overhills, NC, 1957, photo-revised 1971, the highest perennial surface water elevation in the drainage basin downstream from the LCID Landfill is at 240' MSL, 0.8 miles north of the LCID Landfill where the basin draining the LCID Landfill intersects Cypress Creek.

The C&D Geologic and Hydrogeologic Study concludes: *The near surface ground water flow is from east to west with Coolyconch Mountain serving as the divide. The surrounding land use is controlled by the Department of Defense. There is no opportunity for a private landowner to install a potable water well between the C&D landfill site and surface water drainage features which might control or intercept near surface groundwater (Little Creek 1 mile northwest, Cypress Creek 1 mile north, Bones Creek 1 mile south) or between the C&D landfill site and monitor wells at the Longstreet Sanitary Landfill to the east (expected direction of flow of permanent water table perched on the Cape Fear aquiclude).*

The concept is therefore to monitor the near surface aquifers with two downgradient Type II MW's (MW's -8 and -9, yet to be installed). Upgradient samples are to be obtained from MW-4, which also serves as an upgradient well for the near surface aquifer at the C&D Landfill; and MW-3, which also serves as an upgradient well for the permanent aquifer at the C&D Landfill.

If Assessment Monitoring is triggered by VOC's in the downgradient wells, the petroleum contaminated soils storage area and the petroleum contaminated sludge storage area (south east and east, respectively, of the LCID Landfill) should be suspected as a likely source and isolated with additional wells from the LCID Landfill's groundwater monitoring system.

Fluctuation in water table elevation between the wet and dry seasons is estimated at 4 ft based on data from USGS groundwater monitor wells on Ft. Bragg fitted with continuous water level recording devices. Two of these wells are located approximately 9 miles west of the landfill and three are located 5 miles east of the landfill. Screen interval of 15' in Type II wells is considered adequate.

Based on the piezometer data, the historical seasonal water table fluctuation, and the fact that B-11 through B-14 were sounded following a prolonged drought; the anticipated MW depths and screen elevations are tabulated below. These depths may be modified as dictated by conditions encountered during drilling the wells.

Well No.	Depth	Screen Interval	Top of Screen (MSL)	Bottom of Screen (MSL)
MW-8	48'	15'	323'	308'
MW-9	53'	15'	320'	305'

#### WELL LOCATIONS

The existing LCID Landfill monitor well (MW-3), the proposed C&D Landfill monitor wells (MW's -4 and -5), which are upgradient of the LCID Landfill; and the proposed downgradient LCID Landfill monitor wells (MW's -8 and -9) are illustrated on the attached Figure 1.

#### WELL INSTALLATION

Wells will be installed as per 15A NCAC 2C .0108 by a well driller registered as per 15A NCAC 2C .0103. Approval of this plan by NC DEHNR, Solid Waste Section, will serve as authorization to install wells as per 15A NCAC 2C .0105. If requested by NC DEHNR, DEM, samples of cuttings will be furnished as per 15A NCAC 2C .0114 (a). Wells will be developed as per 15A NCAC 2C .0108. Records will be filed as per 15A NCAC 2C .0114 (b).

The borings for monitor well installation will be accomplished by air rotary method. Cohesionless sands and silts are expected, which may cave in. Steel casing will be advanced as necessary to prevent cave-in and removed with installation of washed sand backfill and the bentonite seal described below. Wells will be logged by field classification and SPT of soils every 5'. Refusal to the soil-drilling equipment or very slow

advancement may necessitate use of other drilling methods to advance the borehole (dense or difficult subsurface materials are not anticipated). Rotary-wash drilling, rock coring using potable water and air-percussion drilling could be used for penetrating very dense/difficult soils or rock.

All downhole drilling equipment will be decontaminated by steam cleaning prior to drilling at each location to minimize the possibility of cross-contamination between wells.

Type II monitor wells will be constructed in boreholes at locations MW-8 and MW-9. The wells will consist of 2-inch diameter, Schedule 40 PVC pipe with flush-threaded joints. The bottom section of the PVC pipe will consist of manufactured well screen with 0.010-inch wide openings.

The screened intervals for these MW's are to start 1 foot above estimated seasonal high groundwater elevation and to extend downward for a depth of 15 feet.

The 2 inch PVC pipe casing is to protrude at least 1 foot above the surface topography.

Washed sand backfill will be placed around the outside of the screen and pipe to at least one foot above the top of the well screen (but not more than 2 feet) and one foot below the bottom of the screen. The sand backfill is used to stabilize the formation and to help yield a less turbid groundwater sample. A bentonite seal (minimum 1-ft thick) will be installed on top of the sand backfill to seal the monitor well at the desired level. The remainder of the borehole will be grouted to the ground surface, using the tremie method, with a Portland cement/bentonite mixture.

A locking steel protective cover will then be placed over the well. The protective cover will be anchored with a concrete collar sloped at the surface to shed surface-water, thus reducing the potential for surface-water run-in. A metal data plate will be set in the concrete collar or rivetted to the steel protective cover. The data plate will contain information related to the drilling contractor (name and registrations number), date completed, total and screened depths, and a warning that the well is not for water supply and that the groundwater may contain hazardous materials. Each monitor well will be protected from damage by vehicles by placing 3 vehicle protection posts (bollards) around the locking protective cover. Bollards will be 4 inch ID steel pipe, placed 3' into the ground, backfilled around the base to the ground surface, filled to the top of pipe with concrete grout, and painted white.

Following installation, the new wells will be developed by evacuating water from them by bailing or pumping. The purpose of

development is to allow water from the formation to more freely enter the borehole. The techniques also tend to remove fines within the sand filter pack to enhance the possibility of sampling ground water relatively free of suspended solids.

Survey control for the new wells and the existing well will be established by a North Carolina Registered Land Surveyor. Horizontal control will be to the nearest 0.1-foot and vertical control to the nearest 0.01-foot to top of casing.

#### BASELINE SAMPLING REPORT

A "One Sampling Event" Baseline Sampling Report will be written as follows:

- a. Records of well completion will be prepared as per 15A NCAC 13B .0601.
- b. Boring log per well and typical well schematic will be included as a part of the well completion record, above.
- c. Hydraulic conductivity by in-situ slug test will be conducted once per well after well installation and development.
- d. Porosity and effective porosity will be determined once per well by laboratory testing of an undisturbed soil sample removed during well boring (where possible) from the depth to be screened.
- e. Direction and rate of groundwater flow will be calculated using hydraulic gradients from water table elevations recorded during the sampling event with Darcy equation using k value determined by laboratory permeability testing of soil samples obtained during well boring (where possible) and from results of slug testing. Direction and rate of groundwater flow will be calculated for the single sampling event.
- f. Water quality analytical data for the Baseline Sampling will be for Appendix I volatile parameters and 8 metals (As, Ba, Cd, Cr, Pb, Se, Ag, and Hg).
- g. Field testing for pH, temp, and specific conductivity is included in the water sampling event.

## SURFACE WATER MONITORING

Since the LCID Landfill is located on the west side of the crest of Coolyconch Mountain, there is no upgradient surface water available for monitoring. As indicated by USGS Quad sheet, Overhills, NC, 1957, photo-revised 1971, perennial surface water elevation in the drainage basin serving the site is at 240' MSL, 0.8 miles north of the LCID Landfill where the drainage basin intersects Cypress Creek. Considering the distance to perennial water, sampling at the intersection of Cypress Creek not advised due to the attenuation which would occur over such a long distance and due to the presence of a large secure training complex straddling the basin between the LCID Landfill and Cypress Creek which discharges stormwater into the same basin. Sampling in the drainage basin above Cypress Creek is not practical as the surface flow is intermittent.

## SAMPLING

Sampling of will be conducted semi-annually as per NC DEHNR, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities", March 1995. To eliminate duplication, the sampling LCID Landfill wells will be conducted with the sampling of C&D Landfill wells, as upgradient LCID Landfill wells are shared with the C&D Landfill monitoring system.

Probes and water level indicator cables will be decontaminated before and between usages. A new pair of disposable gloves will be used at each well to prevent contamination during sampling and cross contamination between wells. The wells will be purged and sampled using clean disposable Teflon bailers and new polypropylene rope for each well.

Groundwater elevations will be recorded to the nearest 0.01 foot prior to purging and prior to taking a sample after recharge.

Purging will consist of removal of at least three times the volume of water within the wells or evacuating to dryness, whichever occurs first. Field Parameters (Temperature, pH, and specific conductivity) will be recorded during purging. Purging will continue beyond removal of five well volumes if the pH and specific conductivity have not stabilized. The well will be allowed to recharge after purging and prior to sampling but not longer than 24 hours after purging.

Field parameters will be recorded again during sampling.

Use of field blanks and trip blanks will be part of each sampling event. The groundwater monitor well installation and sampling described herein is generally consistent with the 15A NCAC 2C .0108; NC DEHNR, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities", March 1995; and NC DEHNR, "Sampling and Analysis Requirements, Construction and Demolition Landfills, NC Solid Waste Section", January 1995.

#### CHEMICAL ANALYSIS

Monitor wells MW-8 and -9 will be sampled on a semi-annual basis as per NC DEHNR, "North Carolina Water Quality Monitoring Guidance Document for Solid Waste Facilities", March 1995, and the water will be tested for parameters specified by NC DEHNR for Construction and Demolition Landfills. As of the date of this Plan, the parameters and constituents are specified in "Sampling and Analysis Requirements, Construction and Demolition Landfills, NC Solid Waste Section", dated January 1995. However, since parameters and constituents are subject to change, sampling and laboratory personnel are to check with NC DEHNR, Solid Waste Management Division, (919) 733-0692 Ext 257 or 258, prior to each sampling to verify the then current parameters and constituents.

Analyses of surface-water samples and subsequent analyses of ground water will include one sample from each monitoring point and well. Water samples will be collected in laboratory-cleaned and laboratory-furnished containers, preserved as appropriate for the planned test method, and shipped for overnight delivery to the laboratory. Chain-of-custody protocol will be followed.

Copies of laboratory analysis reports will be furnished to NC DEHNR, Solid Waste Division, Groundwater Section, as soon as practicable.

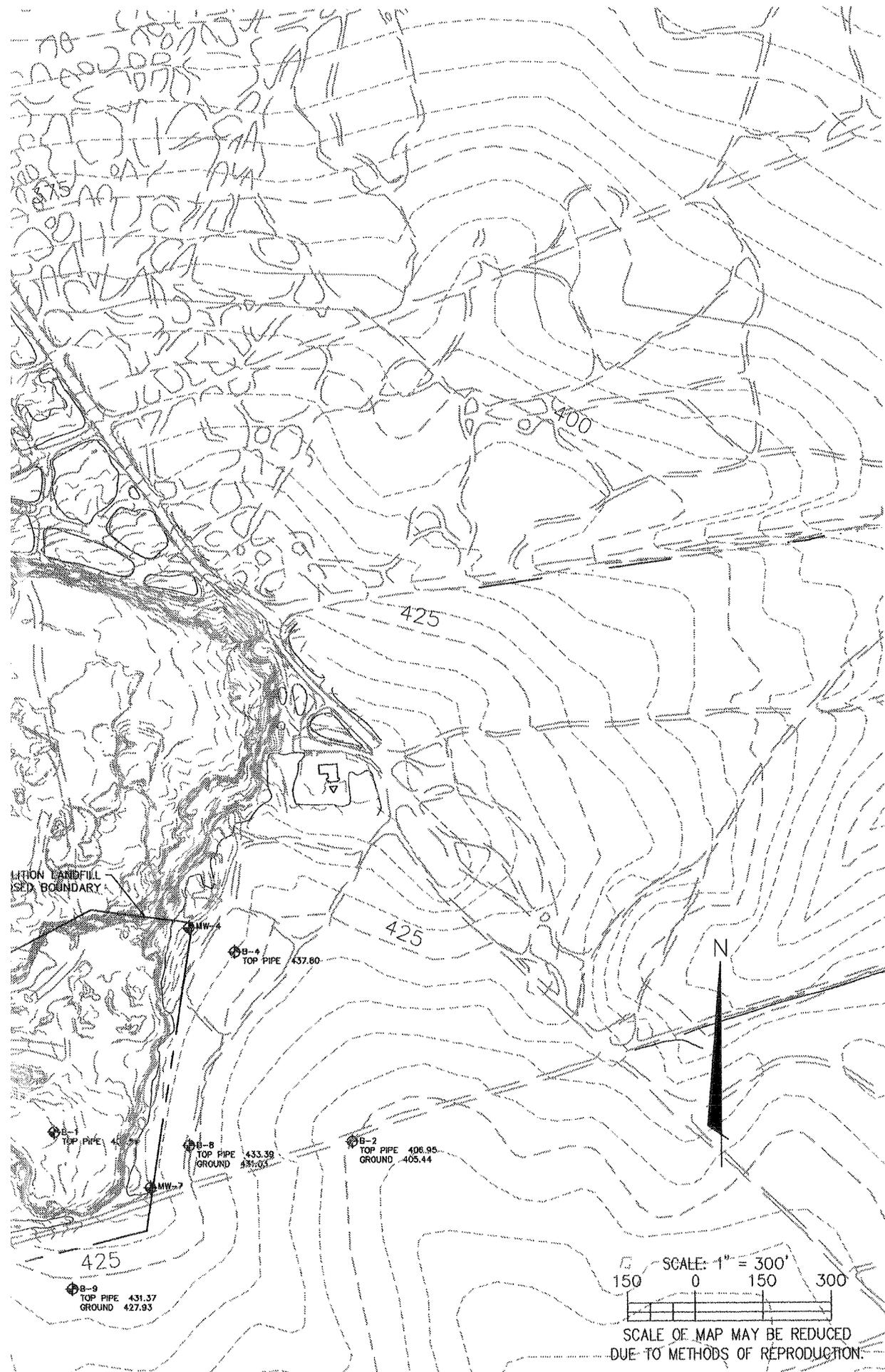


FIGURE #1  
 LCID WATER QUALITY  
 MONITORING PLAN

