DSWM
NEAC

GROUNDWATER QUALITY ASSESSMENT PLAN

DICKSON COUNTY LANDFILL
DICKSON COUNTY, TENNESSEE

NOVEMBER, 1994

Prepared By

GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting
745 South Church St., Suite 205
PO Box 2968 (37133-2968)
Murfreesboro, Tennessee 37130
(615) 895-8221 • (615) 895-0632 FAX

File Number 143-05

TABLE OF CONTENTS

List Of Figures

Page

List Of Tables

Page

List Of Appendices

Appendix A.	Appendix II. - Groundwater Monitoring List
Appendix B.	Sampling And Analysis Quality Assurance/Quality Control Plan

GROUNDWATER QUALITY ASSESSMENT PLAN

DICKSON COUNTY LANDFILL
DICKSON COUNTY, TENNESSEE

1. INTRODUCTION

Griggs & Maloney, Inc. has been retained by Dickson County to prepare a site investigation plan to assess the groundwater quality at the Dickson County Landfill, Dickson, Tennessee. The Tennessee Division of Solid Waste Management (DSWM) directed Dickson County to develop a groundwater quality assessment plan after sampling from a spring near the landfill indicated solid waste constituents from the landfill may have migrated into the groundwater. This document describes the objectives of the investigation, provides background information concerning the landfill, and gives a detailed description of the work plan for the groundwater quality assessment.

2. SCOPE-OF-WORK

This Groundwater Quality Assessment Plan is designed to serve as the primary guidance document for the groundwater quality assessment at the landfill. The overall objectives of the assessment are, as required in the Solid Waste Regulations: determination of whether solid waste constituents have entered the groundwater, and characterization of the concentrations and rate and extent of migration of waste constituents in the groundwater.

Multiple phases of investigation will be needed to complete the investigation. Because the need for an assessment monitoring program was initially indicated by sampling results from an off-site spring, the initial objective will be to determine whether the waste constituents detected in the spring came from the landfill. This will be accomplished by the installation of additional monitoring wells between the spring and the landfill. Additional hydrogeologic information will also be gathered by surveys to identity all springs, streams, and domestic and commercial water wells in the area. Other investigative work will be performed as necessary to meet the stated objectives of the investigation.

The Scope-of-Work for the assessment includes work to:

1) Install additional groundwater monitoring wells.
2) Develop and implement a groundwater sampling and analysis plan which will determine if solid waste constituents from the landfill have entered the groundwater.
3) Characterize the site's hydrogeology and determine the rate and extent of migration of waste constituents in the groundwater.
4) Identify all domestic and commercial water use within the area.
5) Prepare a comprehensive report of assessment findings and proposals for additional investigation or corrective action, if needed.

3. BACKGROUND INFORMATION

3.1. SITE LOCATION AND HISTORY

The Dickson County landfill is located on Eno Road approximately 1.5 miles southwest of Dickson, Tennessee. The entire landfill site, which includes areas previously used as a city dump and older landfilled areas, as well as the currently operating areas, includes approximately 85 to 95 acres. The current landfill operations are located on the western part of the site, and include a Class I balefill and a Class IV landfill. Figure 1 presents the location of the site on the U.S.G.S. 7.5 minute Dickson, Tennessee Quadrangle map.

The site was originally opened in the 1960's and operated as the city dump for the city of Dickson, until the site was sold to Dickson County in 1971. Part of the site was permitted as a sanitary landfill in 1980 and extension areas were permitted in 1988 and 1990. The latest set of engineering plans for the site were submitted in 1992 to meet the revised DSWM regulations. According to the plans, the Class I balefill operation will occupy approximately 14 acres and the Class IV landfill will occupy approximately 2.3 acres.

Four monitoring wells were installed to monitor the groundwater at the landfill. Two of the wells, all believed to be downgradient from portions of the landfill, have been regularly sampled to meet groundwater monitoring requirements. One of the wells, believed to be at an upgradient location, was dry from the time of installation, and has since been abandoned. As a background reference, Sullivan Spring, which is located about 0.3 miles north-northwest of the landfill, has been sampled to replace the dry well. Figure 2 shows the approximate locations of the monitoring wells and Sullivan Spring.

In March of 1994, the wells and spring were analyzed for the first time for the Appendix I parameters required by the revised DSWM regulations. The sampling results indicated levels of trichloroethylene (TCE) and cis-1,2-dichloroethylene were present in the sample obtained from Sullivan Spring. TCE was detected at 0.018 mg/L, which is above the maximum contaminant level (MCL) of 0.005 mg/L. In June, the two wells and Sullivan Spring were sampled again for the Appendix I parameters. In Sullivan Spring, TCE was detected at 0.083 mg/L, and 1,2-Dichloroethene was detected at 0.019 mg/L, which is above the MCL of 0.007 mg/L. Cis-1,2-Dichlorothene was also detected, but at levels below the MCL. In September, Sullivan Spring was resampled and again TCE and 1,2-Dichloroethene were detected above the MCL. Samples were also taken in Worley Furnace Branch, at locations upstream and downstream of the discharge point of Sullivan Spring. The contaminants were not detected in the upstream sample.

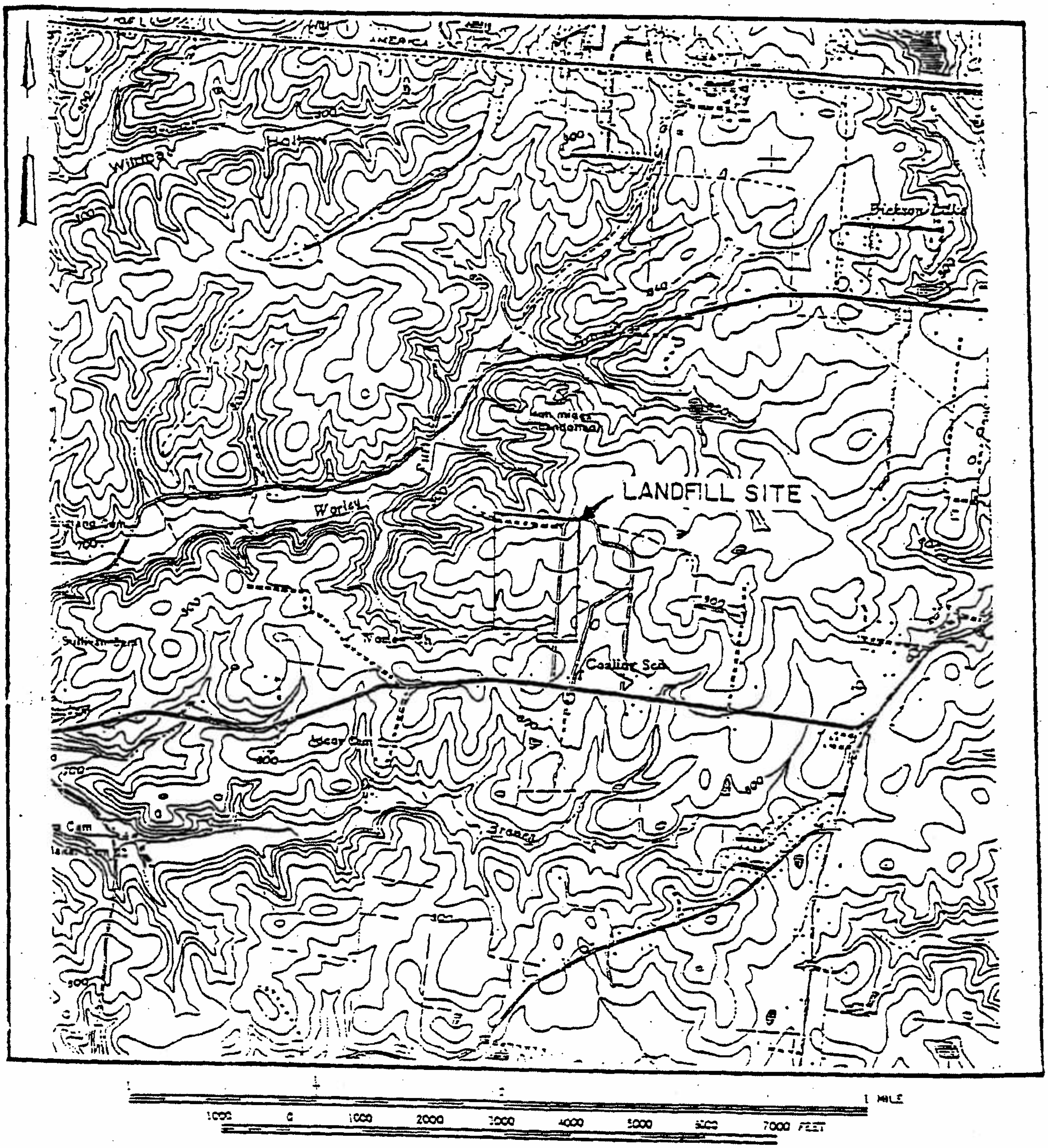


Figure 1
Site Location/Topographic Map

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting

P.O. Box 2968 • Murfreesboro, TN 37133-2968 • (615) 895-2771 • FAX (615) 895-0617

Project [illegible]

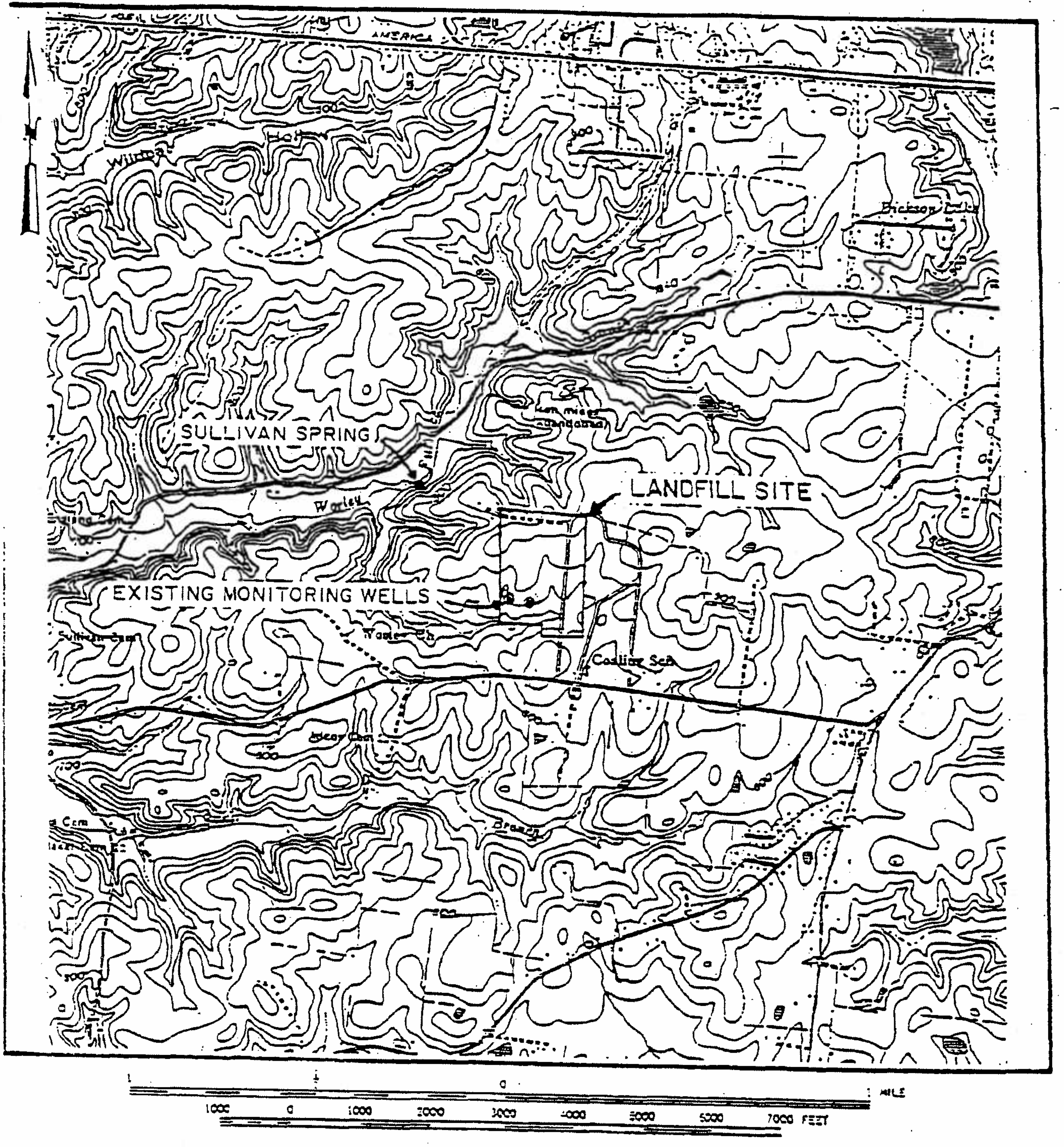


Figure 2
Site Location Map Showing Existing
Monitoring Wells & Spring

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

Project [illegible] November 1994

GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting

Sullivan Spring is used as a drinking water source by two families. At the time of the September sampling, the residences were notified by Mr. Jim Lunn, of Dickson County, that they should not use the water for drinking until further notice. The Division of Water Pollution Control was also notified of the findings at this time. In September, surface water sampling was conducted at various points on West Piney Creek. Sampling did not reveal detectable levels of any of the parameters. Residential wells on Furnace Hollow Road were also sampled during September. The laboratory results did not detect any of the parameters in question. (Gardner, 1994)

3.2. GEOLOGY

The Dickson County Landfill is located on the rolling plateau of the western Highland Rim, a section of the Interior Low Plateaus Physiographic province. The region is characterized by rolling terrain which has been cut by numerous streams. A mantle of unconsolidated regolith, of varying thickness, overlies Mississippian carbonate bedrock. (Bradley, 1984)

The landfill site is located on a rolling upland area which drains primarily toward Worley Furnace Branch and it's tributaries to the southwest, west, and northwest. Slopes are gentle to moderate within the landfill property boundaries, but are steep along the upland slopes. Relief over the landfill site is approximately 60 feet, with the highest elevations along the northern end of the landfill and the lowest elevations near the southwestern corner. Over 120 feet of relief exists between the highest areas of the landfill and Worley Furnace Branch.

The uppermost geologic formations in the area of the landfill are, in descending order: the St. Louis Limestone, the Warsaw Limestone, and the Fort Payne Formation, all of which are Mississippian in age. The regional dip of the formations is to the northwest. (Bradley, 1984)

Regolith
variable
25-90 ft

The St. Louis Limestone caps the uplands over most of the area. At the landfill, for the most part, the unit has weathered to clay regolith. Borings at the landfill have identified the regolith as red, reddish-brown or orange, moderate to highly plastic, silty clay soils with varying amounts of chert fragments and blocks and nodules of chert. (ATEC, Geotechnical and Hydrogeologic Investigation, 1992) The borings have revealed that the unconsolidated soils are thick beneath the landfill site. The previous geotechnical borings and wells were drilled to depths ranging from 25 to 39 feet below the surface. Some of the auger borings were believed to have refused ~~on~~ dense chert beds and the ATEC report estimated limestone bedrock to be approximately 65 to 90 feet below the ground surface.

?

Bradley, 1984, estimated the regolith in the uplands of the Dickson area to generally range from 50 to more than 150 feet thick. Comparison of depths to bedrock for residential wells and test wells in the area near the landfill found the actual regolith thickness to be highly variable within short distances, which indicates that the bedrock surface is likely pinnacled. One test well drilled at the southeastern corner of the landfill was drilled to 331 feet before encountering bedrock. Where not weathered to regolith, the St. Louis Limestone is typically a yellowish-brown, fine-grained, cherty limestone. (Bradley, 1984)

The Warsaw Limestone underlies the St. Louis Limestone. Bradley, 1984, estimated the top of the Warsaw limestone to be near the 740 foot contour in the area of the landfill. This would place the top of the Warsaw at about 60 to 130 feet beneath the landfill site. The Warsaw Limestone is typically a thick-bedded, light-colored, medium- to coarse-grained, fossil fragmental limestone. Locally the upper part of the Warsaw may be weathered to clay regolith in some locations in the vicinity of the landfill. The unit is approximately 100 feet thick in the area. (Bradley, 1984)

The Fort Payne Formation is typically a calcareous, dolomitic, very cherty siltstone. It is estimated to have a maximum thickness of approximately 250 feet in the Dickson Area. (Bradley, 1984)

3.3. HYDROLOGY

3.3.1 SURFACE WATER

The landfill site drains primarily to the southwest, west, and northwest toward Worley Furnace Branch and it's tributaries. Worley Furnace Branch is located approximately 0.3 miles north-northwest of the landfill. The headwaters of a tributary of the stream begin at the southern end of the active landfill area. Portions of the southeastern part of the old city dump / landfill area drain to the south toward Baker Branch. Both Worley Furnace Branch and Baker Branch flow into West Piney River, which is located approximately 1.5 miles west of the landfill. All of the streams are within the Tennessee River Basin.

Numerous springs are located in the Dickson area. The spring believed to be the closest to the landfill is Sullivan Spring, which discharges into Worley Furnace Branch about 0.3 miles north-northwest of the landfill. The altitude of the spring is near the 720 foot elevation. The spring appears to issue from the limestone bedrock which outcrops along the valley wall of Worley Furnace Branch.

3.3.2 GROUNDWATER

According to Bradley, the groundwater system in the Dickson area is primarily recharged from precipitation in the uplands where the regolith is thick. Recharge enters the regolith, which stores the water and transmits it slowly downward to points where it can enter the bedrock system or flow along the bedrock-residuum contact. Although the regolith stores large quantities of water, due to the low permeability of the clay, the regolith will in most cases yield little water.

The primary aquifer in the Dickson area occurs in the solutionaly enlarged bedding plane openings in soluable limestone. The great majority of wells in the area are screened in the Warsaw limestone and, with one exception, all springs recharge from the Warsaw. (Bradley, 1984) The dense cherty Fort Payne Formation is generally an underlying confining layer, but does yield water in some wells.

A regional water level contour map taken from Bradley, 1984, is shown in Figure 3. The contour map shows water levels in the Dickson area based upon measurements in wells and springs in 1960. As the map shows, groundwater flow patterns are similar to surface flow patterns, as groundwater generally flows from the uplands toward the valleys. In the valleys, groundwater is discharged at springs or seeps. Based upon the map, on a regional scale groundwater in the area of the landfill is moving in a west-southwesterly direction.

Flow in Regolith??

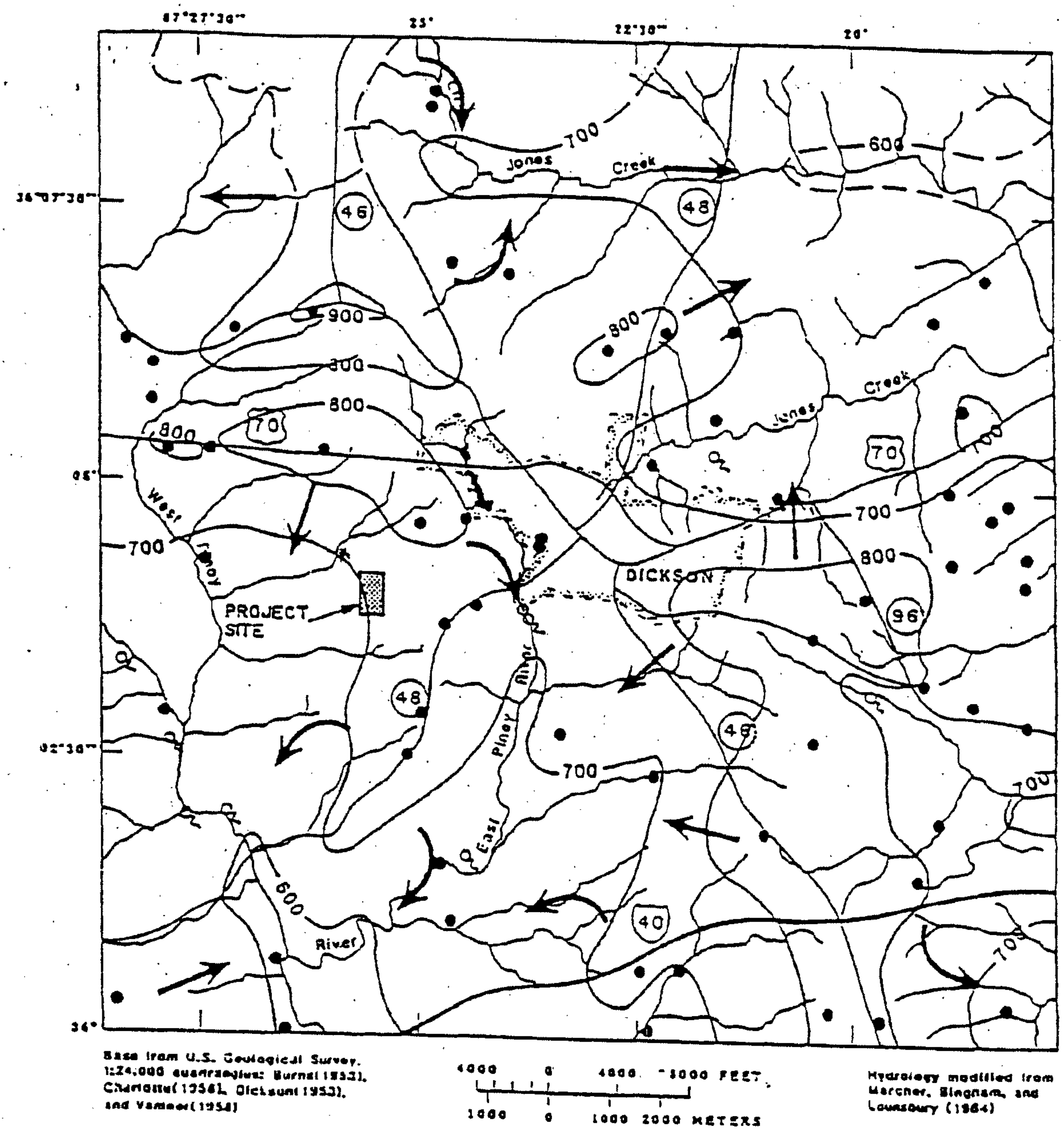
The existing monitoring wells at the landfill are screened immediately above the bedrock surface. (ATEC geotechnical report) The nature of flow within the regolith is uncertain. The wells show widely varying water levels and two of the four wells have been dry at times. The direction of groundwater flow cannot be determined based upon the information from the existing wells. Groundwater flow within the regolith may be discontinuous across the site, and controlled by the presence of pinnacles, regolith thickness and/or variable rates of recharge to solution openings in bedrock.

Good

✓ Based upon the thickness of regolith, the primary aquifer beneath the landfill should occur in solution enlarged openings in the Warsaw limestone. Of the 20 wells known to be located within a one-mile radius of the site, all but 4 of the wells are deeper than 125 feet, and most are believed to be drilled more than 50 feet into bedrock. (ATEC, geotechnical report) In drilling test wells into the Warsaw limestone in the Dickson area, Bradley found solution openings which ranged from less than 1 foot to more than 40 feet thick. In general the smaller openings were clean, water bearing zones, while the larger openings were partially or completely filled with clay. Solution openings which occurred below fine-grained "cap rock" near the top of bedrock were more likely to yield large amounts of water. The size and number of the solution openings decreased with depth. (Bradley, 1984)

Assuming "local recharge" & "regional" recharge
would need to
consider openings
leading and then up

Sullivan Spring appears to be recharged from the Warsaw limestone, which outcrops along the valley wall of Worley Furnace Branch. It is expected that the bedrock solution openings which recharge Sullivan Spring would most likely be at altitudes above or equal to the altitude at Sullivan Spring.



Base from U.S. Geological Survey, 1:24,000 quadrangles: Burns (1953), Charlotte (1956), Dickson (1953), and Vanleer (1954)

Hydrology modified from Marcher, Bingham, and Lounsbury (1964)

EXPLANATION

— 600 — — POTENTIOMETRIC CONTOUR — Shows altitude of water table, March 1960. Dashed where approximately located. Contour interval 100 feet. National Geodetic Vertical Datum of 1929

● Wells with water levels measured March, 1960

Springs

→ Direction of ground-water flow

NOTE: Map taken from Bradley.

Figure 3
Regional Water Level Contour Map

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

Project 143.05 November 1994

3.3.3 WATER USAGE

Figure 4 is a map adapted from the ATEC geotechnical investigation showing water well locations within a one-mile radius of the landfill. According to the ATEC report, the city of Dickson has 11 public wells east of the landfill site. According to Mr. Jim Lunn, with Dickson County, one additional city well is located next to the city water tank and the additional well is shown on the map. The city receives its water from Dickson City Lake, northeast of the site, and only two of the wells, 1398 and 1385, are actively used to ensure that the pumps are operational. Table 1 provides information concerning the water wells. (ATEC)

1389??

4. INVESTIGATION PROCEDURES

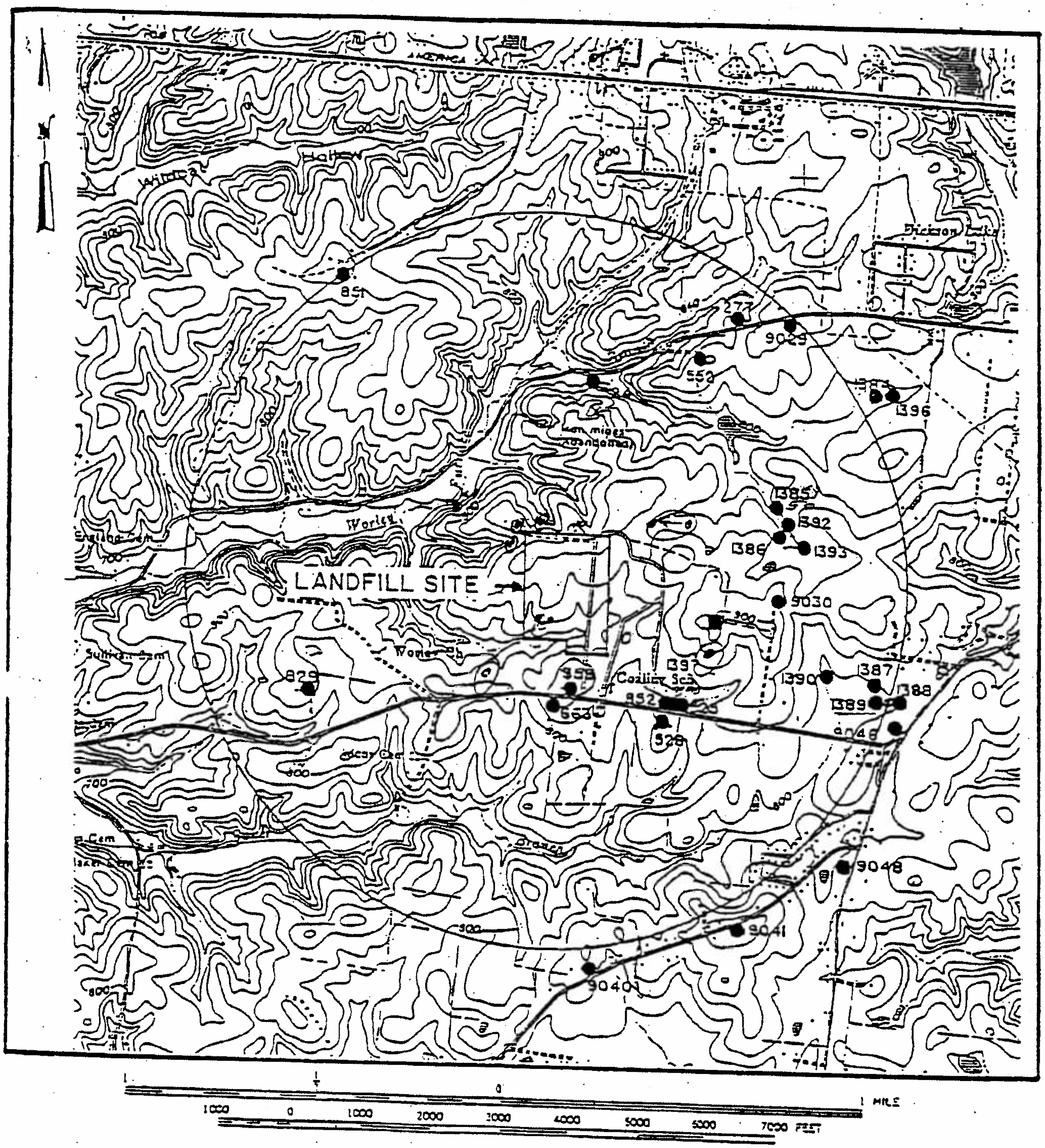
In order to meet the objectives which have been previously defined, the investigation will be performed in sequential phases. The initial phase will consist of the installation and sampling of monitoring wells, with the intended purpose of determining if, in fact, the contamination detected in Sullivan Spring came from the landfill. Based upon the results of the initial phase of work, subsequent phases will likely need to be performed to delineate the full extent of contamination at the site and to better define the hydrogeology of the landfill area.

4.1 MONITORING WELL LOCATIONS AND DEPTHS

In order to determine if the contamination detected in the spring came from the landfill, to begin the investigation a minimum of three additional monitoring wells will be installed. The wells will be located near the northwest corner of the landfill, between the landfill and Sullivan Spring. The proposed well locations are shown in Figure 5.

The depths at which the wells will be installed are dependent upon the depths at which groundwater is encountered and upon the results of preliminary sample screening which will be performed as the borings are advanced. If groundwater is encountered above the soil/ bedrock interface, groundwater samples will be obtained through use of either a HydroPunch sampler or from the installation of temporary wells. The samples will be analyzed for the list of parameters which have previously been detected in Sullivan Spring. ✓ If contamination is detected, permanent wells will be completed above the soil/bedrock interface. If contamination is not detected in the preliminary sampling, the soil aquifer will be cased off, and the boring will be advanced into bedrock. Any zone of groundwater encountered as the boring is advanced through bedrock, will be sampled to see if the indicator screening parameters are detected. If conditions warrant, multiple strings of casings will be used to seal off multiple aquifers.

field??
cl??



LEGEND

● - Well location and number adapted from ATEC Report.

■ - Addition Well location supplied by Mr. Jim Lunn of Dickson County.

Figure 4
Water Well Location Map

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

TABLE NO. 1
DICKSON COUNTY SANITARY LANDFILL
WATER WELL INFORMATION

WELL NO.	OWNER	DATE COMPLETED	TOTAL DEPTH	TOTAL YIELD	BOTTOM CASING	WATER BEARING ZONE	USE
277	C. Bradford	4/18/67	100	5	87	85	Home
358	J. Puckett	7/12/68	160	3	79	220	Home
521	J. Holt	3/25/64	129	4	128	125	Home
525	R. Holt	7/16/70	300	2	98	260	Home
528	A. Harris	8/31/70	360		71	120	Home
552	G. Donegan	2/24/70	105	50	100	100	Home
663	R. Buchanan	7/30/71	130	10	127	130	
828	E. Lovelace	4/28/73	200	2	47		Home
851	J. Horner	6/18/73	160	5			Home
852	H. Holt	6/25/73	340		160		Home
1384	City of Dickson	12/1/80	300	4	136	220	Municipal
1385	City of Dickson	10/20/80	160	400	106	143	Municipal
1386	City of Dickson	10/6/80	250	20	106	116	Municipal
1387	City of Dickson	10/4/80	300	8	103	252	Municipal
1388	City of Dickson	10/2/80	250	150	181	197	Municipal
1389	City of Dickson	8/4/80	300	150	144	180	Municipal
1390	City of Dickson	7/24/80	350	14	115	307	Municipal
1392	City of Dickson	7/14/81	280	165	127	145	Municipal
1393	City of Dickson		320	12	162	245	Municipal
1396	City of Dickson	7/7/80	280	110	127	130	Municipal
1397	City of Dickson	7/2/80	340	175	318	330	Municipal
9029	K. Walker		75		75		Home
9030	J. Robinson		212		107		Home
9040	D. Sanders		110		100		Home
9041	D. Sanders		133				Home
9046	D. Donegan		125				Home
9048	W. R Street		155		155		Home

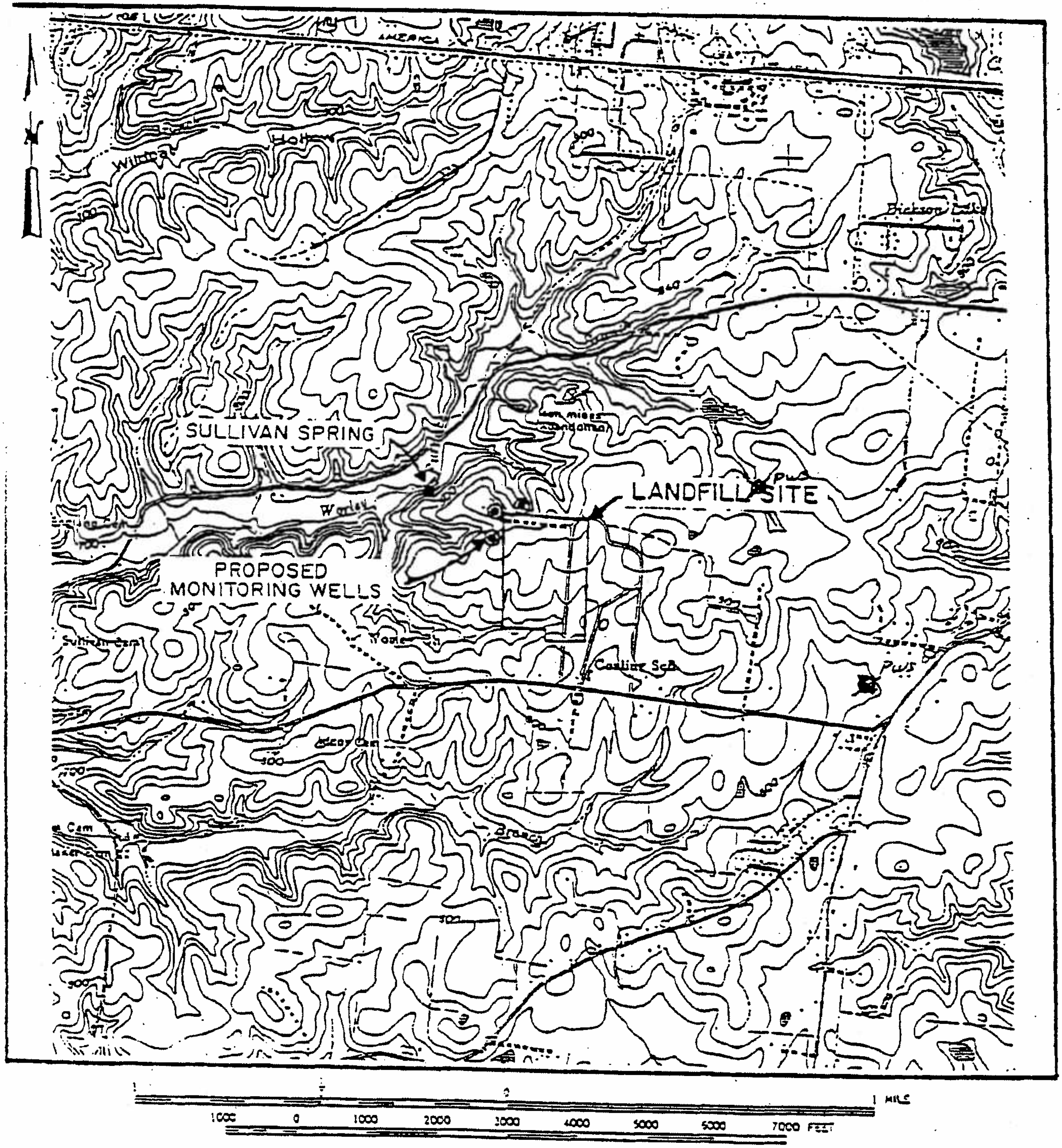


Figure 5
Proposed Monitoring Well Location Map

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting

At each location, the monitoring well will be installed in the zone of groundwater which indicates contamination, or if contamination is not indicated, in the zone of bedrock aquifer which indicates the highest yield. If contamination is detected at any of the wells, it is expected that additional wells will be necessary.

4.2 WELL DRILLING METHODS

From the ground surface, until refusal is encountered upon rock, drilling will be performed using hollow stem auger methods. Borings will be advanced using 4-1/4" ID hollow-stem augers. In order to characterize the soil conditions encountered, split spoon samples will be taken using a 2-foot long, 2-inch OD, 1.375 inch ID split spoon sampler. Split spoon samples will be taken at intervals of at least every ten (10) feet. All soil samples will be monitored with an HNu-101 Photoionization detector (PID), and if positive readings occur, selected samples may be sent to a laboratory for analysis.

Drilling into bedrock will be performed using air rotary drilling techniques. In order to seal off the soil aquifer, a minimum 14" diameter borehole will be advanced at least 2 feet into competent bedrock and a 10" diameter steel casing grouted into place. A 5 -5/8" bit will be used to advance the boring into bedrock. Should conditions require the isolation of multiple bedrock aquifers, a 10" diameter borehole will be advanced and a 6" steel casing set to isolate the aquifers.

Drum

All soil and rock cuttings from the drilling operation will be placed on plastic beside the borehole and if contamination is indicated will be disposed of in accordance with DSWM regulations.

✓✓ All soil and rock samples will be visually examined by an on-site geologist, classified, and the information entered on subsurface exploration borehole logs.

4.3. DECONTAMINATION PROCEDURES

Strict decontamination procedures will be followed throughout the investigation. The minimum requirements for decontamination of drilling equipment are as listed below.

All drilling equipment must be cleaned and decontaminated prior to and after each use on the site. A high pressure steam cleaner will be utilized to remove all foreign substances, dirt, oil and grease, rust, etc. from all trucks, augers, rods, drill stems, bits, casings, tremie pipe, and hoses used at the site. Decontamination will be performed on a decontamination pad, constructed so as to contain all wash waters, debris and residue from the augers and overspray occurring during the pressure washing operation. The pad will be constructed so as to enable the collection and transfer of waste into drums or other containers for storage and proper disposal.

To clean the drilling equipment the following procedure will be used:

1. Wash with hot water from a high pressure steam washer.
2. Rinse thoroughly with hot tap water or steam, if available.
3. All wash and rinse water used in the decontamination process will be collected for proper disposal according to current rules and regulations.
4. After each cleaning event, the equipment will be allowed to air dry, and then checked with the HNu PID for evidence of volatile organics, and visually for cleanliness.

4.4. WELL CONSTRUCTION METHODS

4.4.1 SINGLE CASED WELL INSTALLATION PROCEDURES

4-in

The casing and screen will be constructed of two (2) inch I.D., pre-cleaned, flush threaded, Schedule 40 PVC. The screen will be ten (10) feet in length and will have 0.01 inch factory milled slots. The well screen will be terminated with a threaded end cap and the casing will be terminated with a locking, watertight cap. Should preliminary sample screening results indicate high levels of contamination, four (4) inch diameter wells may be installed for potential use as recovery wells.

The annular space between the well screen and the borehole wall will be filled with a filter pack to a depth of approximately two (2) feet (minimum) above the top of the screened section. A weighted tape will be used to help prevent bridging and ensure the proper placement of the filter pack. The filter pack will consist of clean, washed, well sorted silica sand.

A filter pack seal of at least two (2) feet of bentonite pellets will be placed immediately above the sand. A weighted tape will be used to help prevent bridging and ensure the proper placement of the filter pack seal. If the bentonite seal is placed above the water table, two gallons of potable water will be used to hydrate the pellets. A minimum of 1 hour will be allowed for the pellets to hydrate.

The remaining annular space, from the top of the filter pack seal to within two feet of the surface, will be filled with a bentonite/cement grout. The grout will consist of a mixture of Portland cement and 4-6% powered bentonite mixed to a density of 13.5 to 14.1 lbs/gallon. A tremie pipe will be used to place the annular grout.

The final two feet of the annular space will be filled with concrete and a locking above ground steel protective cover will be set into place. The concrete apron around each well will be sloped so that surface drainage will be diverted. Each monitoring well will be clearly marked as a monitoring well and numbered. Figure 6 presents a diagram of a single cased monitoring well proposed for use at the site.

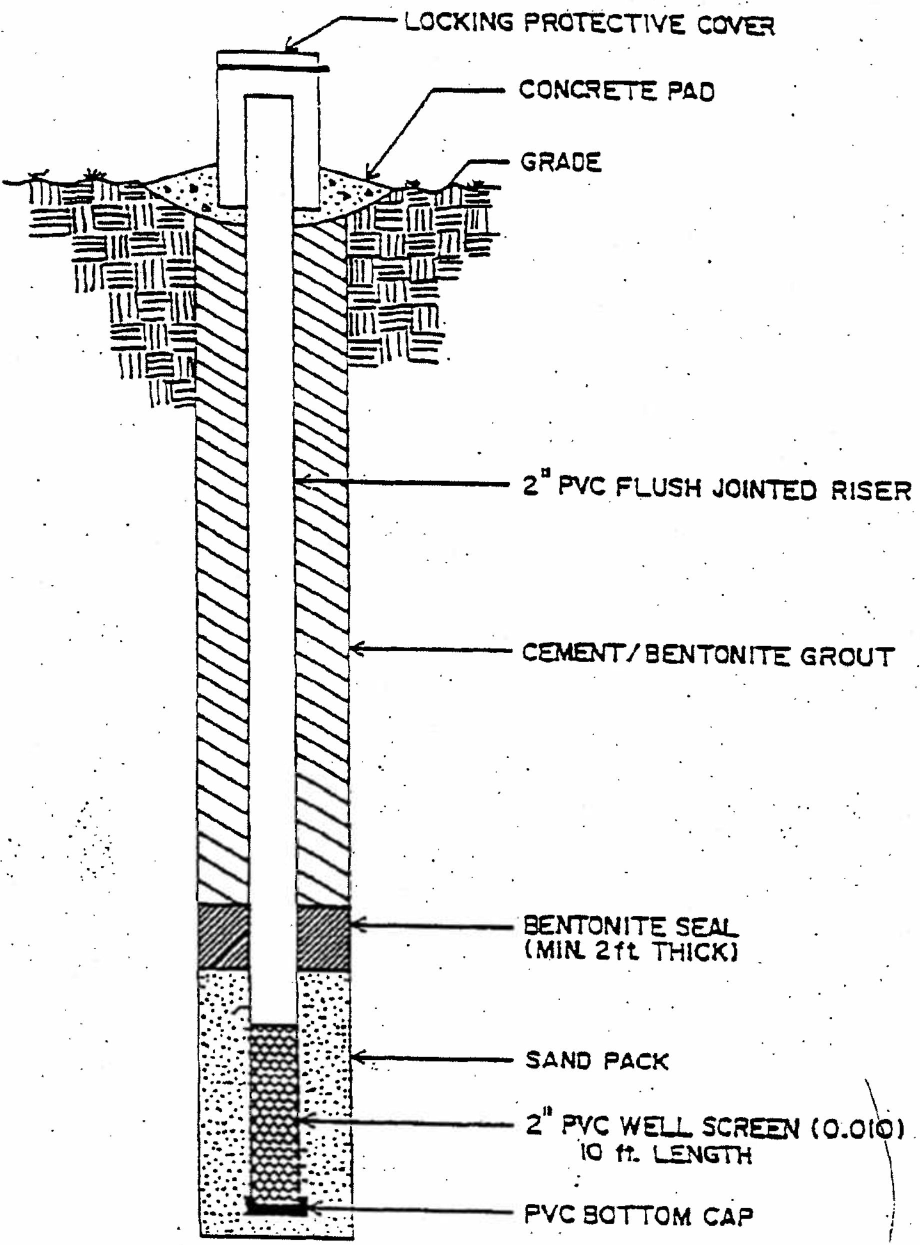


Figure 6
Single Cased Monitoring Well
Construction Diagram

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

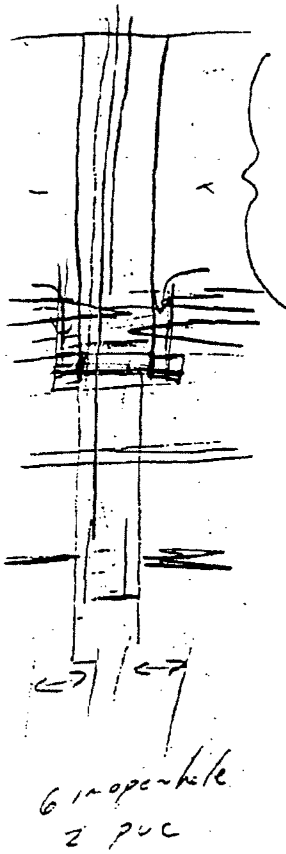
GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting

P.O. Box [illegible] • [illegible], TN [illegible] • (615) [illegible] • FAX (615) [illegible]

Project 143-05 November, 1994

4.4.2 DOUBLE CASED WELL INSTALLATION PROCEDURES

To prevent the vertical movement of contaminants within a borehole or to prevent the cross contamination of multiple aquifers, double cased monitoring wells will be installed when monitoring a separate, deeper aquifer for contamination.



In casing off the soil aquifer, a minimum fourteen (14) inch diameter borehole will be advanced at least two (2) feet into competent bedrock. A ten (10) inch diameter precleaned black steel outer casing will be used. Where multiple strings of outer casings are used, the outer borehole diameter will be a minimum of four (4) inches larger than the outside diameter of the casing. The annular space between the inner casing and the outer casing will also be a total of four (4) inches

The outer casing will be grouted into place using a bentonite/cement grout. The grout will consist of a mixture of Portland cement and 4-6% powered bentonite mixed to a density of 13.5 to 14.1 lbs/gallon. A tremie pipe will be used to place the annular grout. The grout will be allowed to set for a minimum of 24 hours before continuation of drilling activities.

The inner casing and screen will be constructed of two (2) inch I.D., pre-cleaned, flush threaded, Schedule 40 PVC. The screen will be ten (10) feet in length and will have 0.01 inch factory milled slots. The well screen will be terminated with a threaded end cap and the casing will be terminated with a locking, watertight cap.

The annular space between the well screen and borehole wall will be filled with a filter pack to a depth of approximately two (2) feet (minimum) above the top of the screened section. A weighted tape will be used to help prevent bridging and ensure the proper placement of the filter pack. The filter pack will consist of clean, washed, well sorted silica sand.

A filter pack seal of at least two (2) feet of bentonite pellets will be placed immediately above the sand. A weighted tape will be used to help prevent bridging and ensure the proper placement of the filter pack seal. If the bentonite seal is placed above the water table, two gallons of potable water will be used to hydrate the pellets. A minimum of 1 hour will be allowed for the pellets to hydrate.

The remaining annular space, from the top of the filter pack seal to within two feet of the surface, will be filled with a bentonite/cement grout. The grout will consist of a mixture of Portland cement and 4-6% powered bentonite mixed to a density of 13.5 to 14.1 lbs/gallon. A tremie pipe will be used to place the annular grout.

The final two feet of the annular space will be filled with concrete and a locking above ground steel protective cover will be set into place. The concrete apron around each well will be sloped so that surface drainage will be diverted. Each monitoring well will be clearly marked as a monitoring well and numbered. Figure 7 presents a diagram of a double cased monitoring well proposed for use at the site.

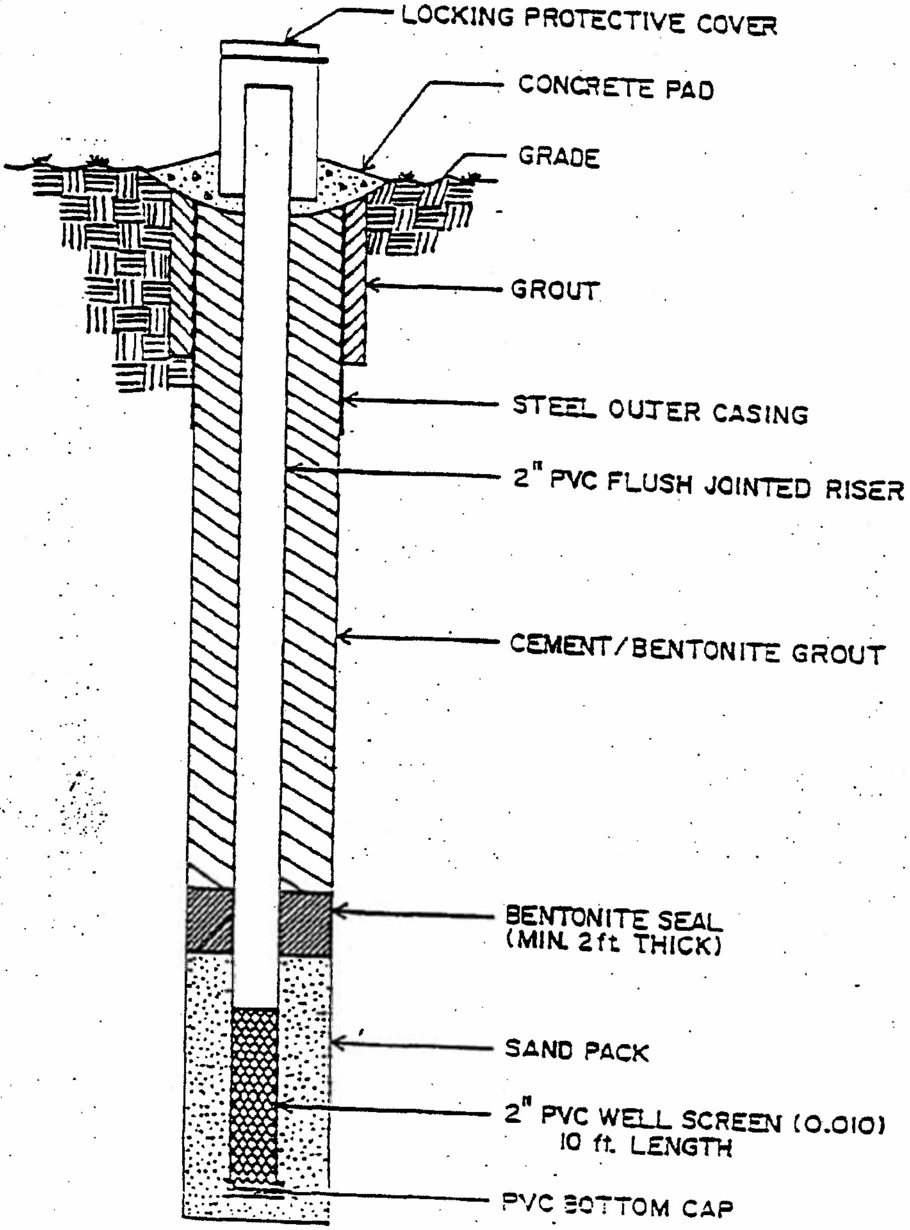


Figure 7
Double Cased Monitoring Well Construction Diagram

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting
P.O. Box 2968 • Murfreesboro, TN 37133-2968 • (615) 895-4221 • FAX (615) 895-0632

Project 143-05 November, 1994

Griggs & Maloney, Inc.

Monitoring Well Development Form

Project No.:		Project Name:			
Well ID No.:		Elevation (ft):		Well Diameter:	

Personnel:			
Installed Date:		Development Date:	
Development Method:			

Safety Procedures:	Respiratory:		Gloves:	
	Clothing:			

Total Well Depth (ft):		Depth to Water:	
Depth of Water Col., ft.:			

Vol. of Purge Water (gal): Factor x Water Col., ft. =	
3 x Calculated Purge Vol.:	

Well Recharge Rate:	Fast (<2hr)		Slow (>4 hr)	
	Med. (2-4hr)			

Free Product:	Yes	No	Quantity:	Detection Method:

WATER QUALITY INDICATORS

Sample Number	Time	Volume Purged Gal.	Temp. °C	Specific Cond. µMhos	pH	Clarity/ Sediment
Initial		0				
After 1 Well Volume						
After 2 Well Volume						
After 3 Well Volume						
After 4 Well Volume						
After 5 Well Volume						
After 6 Well Volume						

Figure 8
Monitoring Well Development Form

Groundwater Quality
Assessment Plan
Dickson County Landfill
Dickson County, Tennessee

4.7. GROUNDWATER SAMPLING

Groundwater sampling includes the measurement of free phase product, static water level measurements, calculation of standing water volume, evacuation of the well, collection of the sample, and decontamination of the sampling equipment. The ***"Sampling and Analysis Quality Assurance / Quality Control Plan"*** included in Appendix B presents the details of the sampling and analysis process and will be adhered to during the performance of all groundwater sampling and analysis.

After developing the newly installed monitoring wells, the wells will be allowed to stabilize for a period of at least seven (7) days. Groundwater static water level elevations will then be measured. All water level measurements will be referenced from an established and documented point on the top of the well casing. The measurements will be correlated with mean sea level datum and measured to the nearest 0.01 foot.

After the water level measurements are performed in all wells at the site, each well will be purged and groundwater samples collected for submittal to the laboratory for analysis. Monitoring well purging and sampling forms will be completed for each purging and sampling event for each well.

Samples will be collected for analysis in the order of volatilization as follows:

1. Volatile Organics
2. Extractable Organics
3. Pesticides and Herbicides
4. Dibenzofurans/dibenzo-p-dioxins
5. Mercury
6. Metals
7. Cyanide
8. Sulfide
9. pH and Conductivity

Initially during well drilling activities, preliminary groundwater sampling will be performed using either HydroPunch sampling methods, temporary well installations, or sampling from the open bedrock borehole. The preliminary sampling will be used to determine the proper depth to screen the wells. Representative samples will be obtained and submitted to a laboratory for rush (24 hour) analysis.

4.8 GROUNDWATER ANALYSIS

All groundwater samples will be submitted to a certified laboratory, approved by the State of Tennessee, to perform the analytical procedures required by this plan. Groundwater samples will be analyzed per the latest edition of *USEPA, SW-846, "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods."* Table 2 presents a detailed summary of the groundwater sample handling, preservation, and analysis requirements.

TABLE 2
GROUNDWATER SAMPLE HANDLING AND ANALYSIS SUMMARY
DICKSON COUNTY LANDFILL

846 [illegible] 8240
45 VOCs – 325

–846 8270 775

846 pest 8080 250
[illegible] 8150 100

1000

35

40

25

ANALYSIS REQUIRED	CONTAINER	PRESERVATIVE	HOLDING TIME	ANALYTICAL METHODS	REFERENCE
VOC	3 x 40ml VOA	(4)	14 days	8010/8020/ 8260	SW-846
Extractable Organics	3 x 1Liter Amber Glass	None	7 days to extraction , 30 days after	8270	SW-846
Pesticides and Herbicides	3 x 1Liter Amber Glass	(6)	7 days to extraction , 30 days after	8150/8080	SW-846
Dibenzo- furans/Di-benzo-p-dioxins	3 x 1Liter Amber Glass	(6)	7 days to extraction , 30 days after	8280	SW-846
Mercury	Plastic 200 ml	(6)	28 Days	7470	SW-846
Cyanide	Plastic 300 ml	(3)	14 Days	9010	SW-846
Sulfide	Glass 100 ml	(7)	7 Days	9030	SW-846
Total Metals	Plastic 3X 1 Liter	(6)	6 months	6010	SW-846

1 40 ml glass VOA vial with Teflon lined septa and hole cap.

2 Cool to 4 ° C

3 NaOH >12.0, Cool to 4 ° C.

4 Cool to 4° C., HCL pH <2.

5. Liter glass or plastic bottle.

6 Nitric acid to pH less than or equal to 2.0.

7 ZN Acetate (4 drops 2N./100mls.+NaOH >9.0)

4.9 SAMPLE LABELING AND HANDLING

All samples will be handled as prescribed by methodology set forth in the latest edition of *USEPA, SW-846, Test Methods For Evaluating Solid Waste, Physical/Chemical Methods.*

The sample label will contain the following information:

- Project location and project number
- Sample location, borehole or monitoring well number, or depth
- Method of collection
- Date and time of collection
- Samplers identifying name or initials
- Sample type
- Analysis requested
- Method of preservation

An example of a sample label is included in Appendix B. In addition to sample labels, sample seals may also be used to assure the integrity of the samples. A typical sample seal is also shown in Appendix B.

4.9.1 SAMPLE PACKAGING AND SHIPPING

Samples will be packaged to insure physical as well as chemical integrity. Samples will be delivered to the laboratory as soon as possible after sampling, preferably on the same day. If samples must be shipped by common carrier, use of next day service is required.

Prior to transport or shipping, the cooler will be packed with shock absorbent material to prevent breakage of the sample containers and prevent the coolant from shifting. Appropriate Chain-of-Custody documentation will be enclosed in the cooler with the samples. and the lid will be secured and sealed. The exterior of the cooler will be labeled with the name and address of the shipper and the address to be shipped to, and the total weight of the package. Warning labels will be affixed noting "THIS SIDE UP" and "FRAGILE" and any appropriate hazardous warning.

4.9.2. SAMPLE CHAIN-OF-CUSTODY

Because the samples collected from the investigation may be involved in legalistic proceedings at a later time, Chain-of-Custody documentation of all samples must be maintained. A Chain-of-Custody is required anytime the sample leaves the custody of the sampler. The possession of samples from the time of collection must be traceable.

A typical Chain-of-Custody form is included in Appendix B. The form must be filled out completely, legibly, and accurately and accompany the sample at all times for documentation of the sample handling. When common carriers or shippers are utilized to ship samples to the laboratory, the receipts and shipping manifest must be attached to the Chain-of-Custody to complete the chain. When samples are split between two or more parties, a separate Chain-of Custody shall be prepared and accompany each sample.

4.10 SAMPLING QUALITY ASSURANCE / QUALITY CONTROL

Trip blanks, equipment blanks, field blanks, split samples, and duplicate samples are examples of quality assurance/quality control (QA/QC) sampling requirements. QA/QC samples are handled, packaged, shipped, and analyzed in the same manner as the regular soil and groundwater samples. QA/QC samples are introduced into the total measurement system as a means of control and evaluation of the level of contamination and variability of results as contributed by potential artifacts and interferences arising at any point in the measurement process.

QA/QC samples are designed to measure:

1. The integrity of the sample container and sample equipment cleaning process;
2. The actual process of sample collection;
3. The purity of the sample preservatives and additive reagents and chemicals;
4. The influence of the site's environmental conditions on the samples;
5. Cross contamination of samples due to improperly cleaned sampling equipment; and
6. Indeterminate artifacts introduced during sample transport from containers, preservatives, cleaning agents, and sampling equipment.

Table 3 summarizes the number and frequency of the QA/QC sample collection.

4.10.3 DUPLICATE SAMPLES/SPLIT SAMPLES

Duplicate samples are utilized to monitor the ability of the sampling procedures to produce reproducible results and to provide the laboratory with sufficient sample to perform laboratory matrix spike and duplicate sample analysis. Duplicate samples are essentially identical samples. They are collected, preserved, handled, shipped, stored, and analyzed in the same manner as the regular samples.

One duplicate sample will be collected for each sample set of ten (10) samples collected for submittal to the laboratory.

Split samples are duplicate samples split between two or more parties for separate analysis by unrelated laboratories.

4.10.4 FIELD BLANKS

Field blanks are utilized to evaluate the sample container filling procedure, the effects of environmental contaminants at the site, purity of preservatives or additives.

Field blanks are prepared in the field, on-site, by filling appropriate sample containers with DI water and adding appropriate preservatives and additives as required. The field blank sample is then grouped, handled, stored, and transported with the true samples collected at the site.

Field blanks will be collected at the rate of one (1) sample for each twenty (20) samples collected.

4.11 SURVEY FOR STREAMS, SPRINGS, AND WELLS

In order to identify possible discharge points of groundwater from beneath the landfill, the investigation will include a survey to identify all streams and springs in the area. The survey will include the identification of all domestic and/or commercial water uses within at least a one-mile radius of the site. Further testing of samples from the offsite streams, springs, or wells may be recommended.

4.12 ADDITIONAL PHASES OF THE INVESTIGATION

Upon conclusion of the initial phase of monitoring well installations, sampling, and survey for springs, streams, and wells in the area, it is expected subsequent phases of investigation will likely need to be performed to delineate the full extent of contamination at the site, and to better characterize the area hydrogeology.

The subsequent phases of investigation may include such activities as additional well installations, slug and/or pump testing of wells, sampling of other springs, streams, or wells in the area, and injections of dye to characterize flow directions.

Since the exact nature of the need for subsequent investigation cannot be known until additional work is completed, the scope of work for each additional phase of investigation will be submitted as an Addendum to the Work Plan prior to performance of the work.

5.0 REPORT OF FINDINGS

Upon completion of the monitoring well installation and sampling, and receipt of all laboratory testing results, a report will be prepared which includes the following:

1) Documentation of all monitoring well drilling, installation, and sampling activities.
2) Laboratory analytical reports of the groundwater sampling results.
3) Characterization of the groundwater potentiometric surface elevations and flow directions.
4) Results of the well, spring, and stream survey.
5) Results of any additional hydrogeologic testing.
6) Recommendations for additional phases of investigation, if necessary.

6.0 SCHEDULE OF IMPLEMENTATION

The following schedule is presented as an example of the expected completion times for the scope-of-work to be performed.

DAYS FOR COMPLETION	ACTIVITIES OR TASKS TO COMPLETE
Day 0	Approval of Groundwater Quality Assessment Plan
Day 10	Notification of DSWM of schedule for well installation
Day 30	Begin monitoring well drilling and installations
Day 45	Completion of sampling event # 1- All Appendix II parameters
Day 60	Completion of sampling event # 2- Append. II detected + Appendix I
Day 75	Completion of sampling event # 3- Append. II detected + Appendix I
Day 90	Completion of sampling event # 4- Append. II detected + Appendix I
Day 120	Submittal of Report of Findings

7.0 REFERENCES

Bradley, Michael W., Ground Water in the Dickson Area of the Western Highland Rim of Tennessee. U.S.G.S. Water- Resources Investigations 82-4088 (Nashville, TN, 1984)

ATEC Associates, Inc., Geotechnical and Hydrogeologic Investigation Proposed Landfill Site for Dickson County, Tennessee. (May, 1992)

Gardener Engineering, "Dickson County Landfill/Balefill Groundwater Contamination Problem" (September, 1994)

APPENDIX A

APPENDIX II. - GROUNDWATER MONITORING LIST

Chlorobenzene	Benzene, chloro-
Chlorobenzilate	Benzeneacetic acid, 4-chloro-a-(4-chlorophenyl)-a-hydroxy, ethyl ester
p-Chloro-m-cresol; 4-Chloro-3-methylphenol	Phenol, 4-chloro-3-methyl-
Chloroethane; Ethyl chloride	Ethane, chloro-
Chloroform; Trichloromethane	Methane, trichloro-
2-Chloronaphthalene	Naphthalene, 2-chloro-
2-Chlorophenol	Phenol, 2-chloro-
4-Chlorophenyl phenyl ether	Benzene, 1-chloro-4-phenoxy-
Chloroprene	1,3-Butadiene, 2-chloro-
Chromium	Chromium
Chrysene	Chrysene
Cobalt	Cobalt
Copper	Copper
m-Cresol; 3-methylphenol	Phenol, 3-methyl-
o-Cresol; 2-methylphenol	Phenol, 2-methyl-
p-Cresol; 4-methylphenol	Phenol, 4-methyl-
Cyanide	Cyanide
2,4-D; 2-4-Dichlorophenoxyacetic acid	Acetic acid, (2,4-dichlorophenoxy)-
4,4'-DDD	Benzene, 1,1'-(2,2-dichloroethylidene) bis(4-chloro-
4,4'-DDE	Benzene, 1,1'-(dichloroethyenylidene) bis(4-chloro-
4,4'-DDT	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis(4-chloro-
Diallate	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester

Dibenz[a,h]anthracene	Dibenz[a,h]anthracene
Dibenzofuran	Dibenzofuran
Dibromochloromethane; Chlorodibromomethane	Methane, dibromochloro-
1,2-Dibromo-3-chloropropane; DBCP	Propane, 1,2-dibromo-3-chloro-
1,2-Dibromoethane; Ethylene dibromide; EDB	Ethane, 1,2-dibromo-
Di-n-butyl phthalate	1,2-Benzenedicarboxylic acid, dibutyl ester
o-Dichlorobenzene; 1,2-Dichlorobenzene	Benzene, 1,2-dichloro-
m-Dichlorobenzene; 1,3-Dichlorobenzene	Benzene, 1,3-dichloro-
p-Dichlorobenzene; 1,4-Dichlorobenzene	Benzene, 1,4-dichloro-
3,3'-Dichlorobenzidine	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-
trans-1,4-Dichloro-2-butene	2-Butene, 1,4-dichloro-, (E)-
Dichlorodifluoromethane; CFC 12;	Methane, dichlorodifluoro-
1,1-Dichloroethane; Ethyldidene chloride	Ethane, 1,1-dichloro-
1,2-Dichloroethane; Ethylene dichloride	Ethane, 1,1-dichloro-
1,1-Dichloroethylene; Vinylidene chloride; 1,1-Dichloroethene	Ethene, 1,1-dichloro-
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	Ethene, 1,2-dichloro-,(Z)-
trans-1,2-Dichloroethylene trans-1,2-Dichloroethene	Ethene, 1,2-dichloro-,(E)-
2,4-Dichlorophenol	Phenol, 2,4-dichloro-
2,6-Dichlorophenol	Phenol, 2,6-dichloro-

1,2-Dichloropropane; Propylene dichloride	Propane, 1,2-dichloro-
1,3-Dichloropropane; Trimethylene dichloride	Propane, 1,3-dichloro-
2,2-Dichloropropane; Isopropylidene chloride	Propane, 2,2-dichloro-
1,1-Dichloropropene	1-Propene, 1,1-dichloro-
cis-1,3-Dichloropropene	1-Propene, 1,3-dichloro-,(Z)-
trans-1,3-Dichloropropene	1-Propene, 1,3-dichloro-,(E)-
Dieldrin	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a, 7,7a-octahydro-, (1aa,2B,2aa,3B,6B, 6aa,7B,7aa)-
Diethyl phthalate	1,2-Benzenedicarboxylic acid, diethyl ester.
O,O-Diethyl O-2-pyrazinyl-phosphorothioate; Thionazin	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
Dimethoate	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
p-(Dimethylamino)azobenzene	Benzenamine, N,N-dimethyl-4-(phenylazo)-
7,12-Dimethylbenz[a]anthracene	Benz[a]anthracene, 7,12-dimethyl-
3,3'-Dimethylbenzidine	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
2,4-Dimethylphenol; m-xylenol	Phenol, 2,4-dimethyl-
Dimethyl phthalate	1,2-Benzenedicarboxylic acid, dimethyl ester
m-Dinitrobenzene	Benzene, 1,3-dinitro-
4,6-Dinitro-o-cresol; 4,6-Dinitro2-methylphenol	Phenol, 2-methyl-4,6-dinitro-
2,4-Dinitrophenol	Phenol, 2,4-dinitro-
2,4-Dinitrotoluene	Benzene, 1-methyl-2,4-dinitro-
2,6-Dinitrotoluene	Benzene, 2-methyl-1,3-dinitro-

Dinoseb; DNBP; 2-sec-Butyl-4,6-dinitrophenol	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
Di-n-octyl phthalate	1,2-Benzenedicarboxylic acid, dioctyl ester
Diphenylamine	Benzenamine, N-phenyl-
Disulfoton	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
Endosulfan I	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide,
Endosulfan II	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide, (3a,5aa,6B,9B,9aa)-
Endosulfan sulfate	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-,3-3-dioxide
Endrin	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aa,2B,2aB,3a,6a,6aB,7B,7aa)-
Endrin aldehyde	1,2,4-Methenocyclopenta[cd]pentalene-5-carboxaldehyde,2,2a,3,3,4,7-hexachlorodecahydro-, (1a,2B,2aB,4B,4aB,5B,6aB,6bB,7R*)-
Ethylbenzene	Benzene, ethyl-
Ethyl methacrylate	2-Propenoic acid, 2-methyl-, ethyl ester
Ethyl methanesulfonate	Methanesulfonic acid, ethyl ester
Famphur	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
Fluoranthene	Fluoranthene
Fluorene	9H-Fluorene
Heptachlor	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-

Heptachlor epoxide	2,5-Methano-2H-indeno(1,2-b]oxirene, 2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6,6a-hexahydro-, (1aa,1bB,2a,5a,5aB,6B,6aa)
Hexachlorobenzene	Benzene, hexachloro-
Hexachlorobutadiene	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
Hexachlorocyclopentadiene	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-
Hexachloroethane	Ethane, hexachloro-
Hexachloropropene	1-Propene, 1,1,2,3,3,3-hexachloro-
2-Hexanone; Methyl butyl ketone	2-Hexanone
Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene
Isobutyl alcohol	1-Propanol, 2-methyl-
Isodrin	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-,1,4,4a,5,8,8a-hexahydro-(1a,4a,4aB,5B,8B,8aB)-
Isophorone	2-Cyclohexen-1-one, 3,5,5-trimethyl-
Isosafrole	1,3-Benzodioxole, 5-(1-propenyl)-
Kepone	1,3,4-Metheno-2H-cyclobuta(cd]pentalen-2-one,1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-
Lead	Lead
Mercury	Mercury
Methacrylonitrile	2-Propenenitrile, 2-methyl-
Methapyrilene	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-
Methoxychlor	Benzene, 1,1'-(2,2,2,trichloroethylidene)bis(4-methoxy-
Methyl bromide; Bromomethane	Methane, bromo-
Methyl chloride; Chloromethane	Methane, chloro-

3-Methylcholanthrene	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
Methyl ethyl ketone; MEK; 2-Butanone	2-Butanone
Methyl iodide; iodomethane	Methane, iodo-
Methyl methacrylate	2-Propenoic acid, 2-methyl-, methyl ester
Methyl methanesulfonate	Methanesulfonic acid, methyl ester
2-Methylnaphthalene	Naphthalene, 2-methyl-
Methyl parathion; Parathion methyl	Phosophorothioic acid, O,O-dimethyl O-(4-nitrophenyl) ester
4-Methyl-2-pentanone; Methyl isobutyl ketone	2-Pentanone, 4-methyl-
Methylene bromide; Dibromomethane	Methane, dibromo-
Methylene chloride; Dichloromethane	Methane, dichloro-
Naphthalene	Naphthalene
1,4-Naphthoquinone	1,4-Naphthalenedione
1-Naphthylamine	1-Naphthalenamine
2-Naphthylamine	2-Naphthalenamine
Nickel	Nickel
o-Nitroaniline; 2-Nitroaniline	Benzenamine, 2-nitro-
m-Nitroaniline; 3-Nitroaniline	Benzenamine, 3-nitro-
p-Nitroaniline; 4-Nitroaniline	Benzenamine, 4-nitro-
Nitrobenzene	Benzene, nitro-
o-Nitrophenol; 2-Nitrophenol	Phenol, 2-nitro
p-Nitrophenol; 4-Nitrophenol	Phenol, 4-nitro-
N-Nitrosodi-n-butylamine	1-Butanamine, N-butyl-N-nitroso-

N-Nitrosodiethylamine	Ethanamine, N-ethyl-N-nitroso-
N-Nitrosodimethylamine	Methanamine, N-methyl-N-nitroso-
N-Nitrosodiphenylamine	Benzenamine, N-nitroso-N-phenyl-
N-Nitrosodipropylamine; Di-n-propylnitrosamine; N-Nitroso-N-dipropylamine	1-Propanamine, N-nitroso-N-propyl
N-Nitrosomethylethalamine	Ethanamine, N-methyl-N-nitroso-
N-Nitrosopiperidine	Piperidine, 1-nitroso-
N-Nitrosopyrrolidine	Pyrrolidine, 1-nitroso-
5-Nitro-o-toluidine	Benzenamine, 2-methyl-5-nitro-
Parathion	Phosphorothioic acid, O,O-diethyl-O-(4-nitrophenyl) ester
Pentachlorobenzene	Benzene, pentachloro-
Pentachloronitrobenzene	Benzene, pentachloronitro-
Pentachlorophenol	Phenol, pentachloro-
Phenacetin	Acetamide, N-(4-ethoxyphenyl)
Phenanthrene	Phenanthrene
Phenol	Phenol
p-Phenylenediamine	1,4-Benzenediamine
Phorate	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
Polychlorinated biphenyls; PCBs, Aroclors	1,1'-Biphenyl, chloro derivatives
Pronamide	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-
Propionitrile; Ethyl cyanide	Propanenitrile
Pyrene	Pyrene
Safrole	1,3-Benzodioxole, 5-(2-propenyl)-

Selenium	Selenium
Silver	Silver
Silvex; 2,4,5-TP	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-
Styrene	Benzene, ethenyl-
Sulfide	Sulfide
2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid	Acetic acid, (2,4,5-trichlorophenoxy)-
1,2,4,5-Tetrachlorobenzene	Benzene, 1,2,4,5-tetrachloro-
1,1,1,2-Tetrachloroethane	Ethane, 1,1,1,2-tetrachloro-
1,1,2,2-Tetrachloroethane	Ethane, 1,1,2,2-tetrachloro-
Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	Ethene, tetrachloro-
2,3,4,6-Tetrachlorophenol	Phenol, 2,3,4,6-tetrachloro-
Thallium	Thallium
Tin	Tin
Toluene	Benzene, methyl-
o-Toluidine	Benzenamine, 2-methyl-
Toxaphene	Toxaphene
1,2,4-Trichlorobenzene	Benzene, 1,2,4-trichloro-
1,1,1-Trichloroethane; Methylchloroform	Ethane, 1,1,1-trichloro-
1,1,2-Trichloroethane	Ethane, 1,1,2-trichloro-
Trichloroethylene; Trichloroethene	Ethene, trichloro-
Trichlorofluoromethane; CFC-11	Methane, trichlorofluoro-
2,4,5-Trichlorophenol	Phenol, 2,4,5-trichloro-
2,4,6-Trichlorophenol	Phenol, 2,4,6-trichloro-

1,2,3-Trichloropropane	Propane, 1,2,3-trichloro-
O,O,O-Triethyl phosphorothioate	Phosphorothioic acid, O,O,O-triethylester
sym-Trinitrobenzene	Benzene, 1,3,5-trinitro-
Vanadium	Vanadium
Vinyl acetate	Acetic acid, ethenyl ester
Vinyl chloride; Chloroethene	Ethene, chloro-
Xylene (total)	Benzene, dimethyl-
Zinc	Zinc

APPENDIX B

SAMPLING AND ANALYSIS QUALITY ASSURANCE/QUALITY CONTROL PLAN

QUALITY ASSURANCE / QUALITY CONTROL PLAN

SAMPLING AND ANALYSIS
OF
GROUNDWATER MONITORING WELLS

PREPARED FOR

DICKSON COUNTY

JUNE, 1994

Prepared by

GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting
745 South Church St., Suite 205
PO Box 2968 (37133-2968)
Murfreesboro, Tennessee 37130
(615) 895-8221 • (615) 895-0632 FAX

File Number 143-05

LIST OF APPENDICES

QUALITY ASSURANCE / QUALITY CONTROL PLAN
SAMPLING AND ANALYSIS
OF
GROUNDWATER MONITORING WELLS

1. INTRODUCTION

This document is prepared for the State of Tennessee Department of Environment and Conservation, Division of Solid/Hazardous Waste Management to establish Quality Control and Quality Assurance guidelines. These guidelines are to be followed throughout the groundwater assessment monitoring period at the Dickson County Class I Landfill.

This plan covers the complete process utilized for the collection of quality groundwater monitoring samples including the:

- measurement of groundwater levels
- detection / measurement of immiscible layers
- purging of wells
- sample collection, handling, and analysis
- quality control and quality assurance

2. GROUNDWATER LEVEL AND WELL DEPTH MEASUREMENT

2.1. STATIC WATER LEVEL

The depth to water level in the wells must be measured to calculate the casing water volume for purging and also for the purpose of determining the hydrological groundwater characteristics.

The static water level in the well is measured prior to the well evacuation. Initial static water levels are measured typically seven to ten days after installation and development of a new well and additional measurements are performed prior to each purging and sampling event. All water level measurements utilized to construct a piezometric surface map must be obtained within a consecutive twenty-four (24) hour period.

2.1. STATIC WATER LEVEL, Cont'd

The water level elevation will be determined to the nearest 0.01 feet as measured with a water level meter. The meter consist of a reel containing a length of weighted, marked fiberglass tape, which has a conducting probe attached to detect the air/water interface, and an alarm.

The water level measurement is performed three (3) times to insure accuracy and water level stability. Always measure the upgradient or background wells first to reduce the potential for cross contamination.

The following procedure will be followed for water level measurement in groundwater monitoring wells.

A) Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

B) Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

C) Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting over the well. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

D) Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

E) Sample the well headspace for volatile organics with an HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form.

F) Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged replace with a clean pair). Dispose of used gloves as per instructions in Section 11.0.

G) Determine if the water level tape and probe has been decontaminated. If not, wash with soap and water, and rinse with DI water. Dispose of wash and rinse water as per instructions in Section 11.0.

2.1. STATIC WATER LEVEL, Cont'd

H) Check the probe sensor and battery by immersing the probe in water. Note the level of the water on the electrode sensor when the alarm just begins to sound. If the probe operation is normal, proceed with item I. If the alarm does not sound when the electrode tip contacts the water's surface, determine what is causing the malfunction before proceeding or obtain another water level meter.

I) Lower the probe and tape into the well carefully and slowly. Do not allow the tape to contact the well casing to prevent damage to the tapes surface. Surface abrasions will cause difficulty with later cleaning and decontamination.

J) When the probe contacts the water surface and the alarm sounds, retrieve the probe until the alarm just ceases. Continue lowering and raising the probe until the point where the alarm just begins to sound is determined.

K) Hold the tape against the well elevation mark on the casing.

L) Note and record on the MWP&S form the distance from the well elevation mark to the groundwater's surface to the nearest 0.01 feet.

M) Repeat parts I-L two more times to verify the measurements. If the measurements are not constant, continue to measure at greater time intervals until the levels stabilize. The elevation of the well minus the distance to the water surface is equal to the elevation of the water.

N) To measure the total well depth, lower the weighted tape slowly to the bottom of the well.

O) Mark the tape and read at the well elevation reference mark to the nearest 0.01 feet.

P) Record the distance from the well elevation reference mark to the well bottom on the MWP&S log sheet.

Q) Remove the tape and probe from the well being careful not to allow the tape to rub on the well pipe or casing.

R) Replace the well cap and lock the well or continue with purging and sampling.

S) If free product or gross contamination are not encountered or suspected, wash the tape with soap and water and DI water rinse after each use. If free product or gross contamination are encountered or suspected, rinse the tape and probe with alcohol, rinse with water, wash with soap and water and DI water rinse and finally rinse with alcohol and then DI water. The tape and probe must be washed with soap and water and rinsed with alcohol and DI water prior to use in another well.

2.1. STATIC WATER LEVEL, Cont'd

S) All wash and rinse water and alcohol rinse must be collected and held for proper disposal according to the guidelines set forth in Section 11.0.

3. DETECTION AND SAMPLING OF IMMISCIBLE LAYERS

3.1. DETECTION OF IMMISCIBLE LAYERS

After opening the well, sample the well vapor space with an HNU-101 Photoionization Detector. If, after opening the well, the HNU indicates detectable levels of organics, a floating layer is indicated, and must be measured and sampled as set forth in the following section. If the HNU does not indicate detectable levels of volatile organics it will be assumed that no floating immiscible organic layer is present, and work will continue to purge and sample the wells.

3.2. SAMPLING OF IMMISCIBLE LAYERS

If immiscible layering is detected in any of the wells, samples of the immiscible layer must be collected prior to purging. For floating layers, samples will be collected with a disposable bailer, or a peristaltic pump if the layer is located within 25 feet of the surface. For bottom layers a double valve bailer will be utilized.

3.3. SAMPLING PROCEDURES FOR IMMISCIBLE LAYERS

The following procedure will be followed for sampling of immiscible layers in groundwater monitoring wells.

A) Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

B) Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

3.3. SAMPLING PROCEDURES FOR IMMISCIBLE LAYERS, Cont'd

C) Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting over the well. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

D) Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

E) Sample the well headspace for volatile organics with an HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form.

F) Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged replace with a clean pair). Dispose of used gloves as per instructions in Section 11.0.

G) Determine the static water level following procedures in Section 1.1.

H) Lower a previously cleaned bailer slowly into the well to the interval being sampled. If the layer is only a few inches thick, use an open top bailer and lower the bailer an

I) Raise the bailer to the surface carefully. Do not allow the bailer or bailer cord to contact the ground.

J) Remove the cap from the VOA vial, and tilt slightly.

K) Pour the sample slowly into the vial to avoid spillage and air entrainment, making sure to quantitatively transfer any sediment in the sample. Fill the vial to overflowing to provide for a zero airspace sample, and cap. Invert, tap the vial with a finger and check for air bubbles. If bubbles appear repeat the filling process.

L) Label, package, and store the sample according to instructions in Sections 8.0 and 9.0 for sample handling and documentation.

M) Replace the well cap and lock the well.

N) Rinse the water level tape and probe with alcohol, rinse with water, wash with soap and water and DI water rinse and finally rinse with alcohol and then DI water. The tape and probe must be washed with soap and water and rinsed with alcohol and DI water prior to use in another well.

O) Wash and rinse all equipment prior to leaving the site.

3.3. SAMPLING PROCEDURES FOR IMMISCIBLE LAYERS, CONT'D

P) All wash and rinse water and alcohol rinse must be collected and held for proper disposal according to the guidelines set forth in Section 11.0.

Q) Dispose of all contaminated materials, gloves, etc. according to the guidelines set forth in Section 11.0.

4. WELL PURGING

4.1. GROUNDWATER MONITORING WELLS PURGING

The water standing in the well prior to sampling may not be representative of the in-situ ground water quality. Therefore the standing water in the well and filter pack will be removed so that fresh water from the aquifer can replace the stagnant water.

If the well is in a high yield formation the well will be evacuated from above the sand pack to draw fresh water up through the well. The most efficient exchange of water in the well is effected by pumping from near the top of the water column. This causes the stagnant water in the casing above the filter screen to be evacuated first.

A minimum of three (3) well volumes of water will be evacuated from the well. The capacity for the well to recharge and the draw down of the water column should be noted for future reference.

Low yield wells will be evacuated to dryness and allowed to recharge slowly. Whenever full recovery of the water in the well exceeds two hours, samples will be collected as sufficient water becomes available. When the recharge rate is less than two (2) hours, monitor the water quality (pH, Conductivity, and Temperature) until the readings become stable, indicating the well has been sufficiently purged.

Peristaltic, submersible purge, and/or positive gas displacement Teflon bladder pumps, and/or disposable bailers will be utilized to evacuate the wells prior to sampling. Disposable polyethylene bailers may be used if free product will not be encountered in the well.

Peristaltic pumps may be utilized when the water lift is less than twenty-five (25) feet. At depths exceeding twenty-five (25) feet, submersible purge or positive displacement pumps or bailers will be used. Bailers may be utilized in all wells, although the limited capacity of the bailer makes their use laborious. When using bailers lower and raise slowly to prevent agitation of the water in the well.

4.1. GROUNDWATER MONITORING WELLS PURGING, Cont'd

Care will be taken to protect the bailer, pumps, suspension cords, tubing and cables from contacting the areas surrounding the well. A plastic sheet will be utilized to cover the ground and well opening area to protect the equipment.

When lowering the pumping equipment into the well, the pump and tubing will be supported to prevent it from dragging on the top of the well casing or binding when being lowered or raised.

The well may be considered to be evacuated when the water becomes clear and sufficient quantity has been evacuated (3x volume of water in the well). Purged water will be collected and screened to determine if it may be hazardous. If the possibility the purged water contains hazardous contaminant levels which exceed those levels which may endanger the health of personnel or the environment, the water will be drummed and held for proper disposal by post treatment on site or disposal by certified waste disposal handlers.

4.2. PURGING PROCEDURES FOR GROUNDWATER MONITORING WELLS

The following procedure will be followed for purging of groundwater from the monitoring wells:

A) Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

B) Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

C) Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting over the well. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

D) Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

E) Sample the well headspace for volatile organics with an HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form.

4.2. PURGING PROCEDURES FOR GROUNDWATER MONITORING WELLS, Cont'd

F) Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged, replace with a clean pair). Dispose of used gloves as per instructions in Section 11.0.

G) Determine the static water level following procedures in Section 1.1.

H) Determine the purging method to be followed.

I) Calculate the volume of water in the well from information gathered when measuring the well depth and static water level by one of the following methods:

Depth of well – Depth to water = Height of water column

1) BY FORMULA:

$r^2 \times h \times 7.481$ = gallons of water

where:
r = radius of the well pipe in feet
h = height of water column in the well
7.481 = gallons/cubic foot of water

2) BY WELL PIPE SIZE:

a) For 2" diameter wells:

Gallons = 0.1632 (gal/ft) X h (ft)

when h = height of water column in the well

b) For 4" diameter wells:

Gallons = 0.6528 (gal/ft) X h (ft)

when h = height of water column in the well

c) For 6" diameter wells:

Gallons = 1.4688 (gal/ft) X h (ft)

when h = height of water column in the well

Record the purge volume on the MWP&S form.

J) Sample the water in the well and test for pH, specific conductance, and temperature. Record results on the MWP&S form.

4.2. PURGING PROCEDURES FOR GROUNDWATER MONITORING WELLS, Cont'd

K) Purge the calculated volume of water from the well.

L) All purged water from the wells will be collected in tanks or drums for later analysis, treatment and disposal.

M) Repeat items J and K two additional times to purge a minimum of three (3) well volumes from the well when the recharge rate is sufficient.

N) Record all purge times, volumes, and water quality test results on the MWP&S form.

O) Rinse the purge pump or bailer (if not dedicated) with DI water and combine the rinse water with the purge water for disposal.

P) Wash and rinse all equipment prior to leaving the site.

Q) Wash the pumps and bailers with soap and water, rinse with DI water, rinse with alcohol, and finally with DI water prior to use in other wells. Combine the washings and rinse water with the purge water for disposal per the instructions in Section 11.0.

R) Samples will be collected as soon as possible after purging, allowing sufficient time for the well to recharge.

S) Replace the well cap and lock the well.

T) Dispose of all contaminated materials, gloves, etc. according to the guidelines set forth in Section 11.0.

5. SAMPLE COLLECTION

5.1. SAMPLE INTEGRITY

To ensure the sample collected is representative of the formation, it is important to minimize physically altering or chemically contaminating the sample during the collection process.

Care will be taken to protect the sampling equipment, tubing and cables from contacting the areas surrounding the well. A plastic sheet will be utilized to cover the ground and well opening area to protect the equipment.

5.2. SAMPLE COLLECTION - BAILER

A bailer is a long cylindrical tube constructed of materials which will not alter the quality of the sample being collected. Bailers used will not have glued joints. Bailers used at the site will be of the disposable, bottom-fill type, constructed of polyethylene.

The bailer will be lowered into the well by a line into the groundwater where it fills from the bottom. The bailer has a ball, which seals the bottom of the bailer to prevent the water from emptying when the bailer is lifted from the well.

5.3. SAMPLING PROCEDURES FOR BAILERS

The following procedure will be followed for sampling of groundwater in monitoring wells when using bailers.

A) Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

B). Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

C) Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting over the well. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

D) Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

E) Sample the well headspace for volatile organics with an HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form. Determine if immiscible layers are present (Section 2.0).

F) Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged replace with a clean pair). Dispose of used gloves as per instructions in Section 11.0.

G) Determine the static water level following procedures in Section 1.1.

5.3. SAMPLING PROCEDURES FOR BAILERS, Cont'd

H) Purge the well of the required three (3) well volumes of groundwater or to dryness.

I) Attach new line to a new disposable bailer or use a dedicated bailer for each well to be sampled.

J) Carefully and slowly lower the bailer to the groundwater surface.

K) Allow the bailer to fill slowly with a minimum of water surface agitation to prevent aeration.

L) Raise the filled bailer to the surface while protecting the line from becoming contaminated.

M) Remove the cap from the VOA vial, and tilt slightly.

N) Pour the sample slowly into the vial to avoid spillage and air entrainment, making sure to quantitatively transfer any sediment in the sample. Fill the vial to overflowing to provide for a zero airspace sample, and cap. Invert, tap the vial with a finger and check for air bubbles. If bubbles appear repeat the filling process.

O) Properly dispose of excess sample collected from the well by combining with the purge water or wash water.

P) Label, package, and store the sample according to instructions in Sections 8.0 and 9.0 for sample handling and documentation.

Q) Replace the well cap and lock the well.

R) Wash and rinse all equipment prior to leaving the site and rinse the exterior of all samples.

S) All wash and rinse water, alcohol rinse water, and excess sample must be collected and held for proper disposal according to the guidelines set forth in Section 11.0.

T) Dispose of all contaminated materials (bailers, line, plastic sheeting, gloves, etc.) according to the guidelines set forth in Section 11.0.

U) Samples will be labeled, packaged, stored, and shipped according to the guidelines set forth in Sections 8.0 and 9.0 of this plan.

V) Complete the required chain-of-custody and documentation for the sampling.

5.4. SAMPLE COLLECTION - BLADDER PUMP

A bladder pump is a long cylindrical tube with a flexible air operated bladder, constructed of materials which will not alter the quality of the sample being collected. Bladder pumps operate by alternately inflating and deflating the flexible bladder to alternately withdraw water from the well and pump the water to the surface.

5.5. SAMPLING PROCEDURES FOR BLADDER PUMPS

The following procedure will be followed for sampling of groundwater in monitoring wells when using bladder pumps.

A) Prepare a "Monitoring Well Purging and Sampling" (MWP&S) form (Appendix A) for each well to be measured, and enter all reference information for each well.

B) Locate the well identification on the casing and the well elevation reference mark and check against the site map for verification. If identification or elevation markings are not found on the well, verify the well identification and mark the well with the identification number and an elevation mark. Note the changes on the MWP&S form and inform the project manager. If a new elevation mark is placed on the well, a survey must be performed.

C) Place a plastic sheet on the ground surrounding the well by cutting a slit in a piece of plastic and inserting over the well. The plastic sheet should be of sufficient size to prevent contamination of equipment and supplies during the water level measurement process.

D) Unlock and open the protective well cover and the well cap. Note the well condition and any odors observed on the MWP&S form.

E) Sample the well headspace for volatile organics with an HNU-101 photoionization detector (previously calibrated) and record the HNU reading on the MWP&S form. Determine if immiscible layers are present (Section 2.0).

F) Put on a clean pair of unpowdered, disposable gloves. (When gloves become soiled or damaged, replace with a clean pair). Dispose of used gloves as per instructions in Section 11.0.

G) Determine the static water level following procedures in Section 1.1.

H) Purge the well of the required three (3) well volumes of groundwater or to dryness.

I) Attach the compressor lines to the gas control box.

5.5. SAMPLING PROCEDURES FOR BLADDER PUMPS, Cont'd

J) Connect the battery to the gas control box.

K) Attach the support line and compressed gas lines from the gas control box, to the previously decontaminated bladder pump.

L) Lower the pump and tubing into the well carefully to prevent the tubing from and support cable from becoming contaminated or rubbing on the well casing or protective cover which may damage or contaminate the pump or tubing.

M) When the pump has been lowered to the prescribed depth, secure the support line and turn on the power and compressed air.

N) Adjust the gas control box to the desired pump and fill cycle time to optimize the pumping rate.

O) Remove the cap from the VOA vial, and tilt slightly.

P) Allow the water being discharged from the pump to be slowly discharged into a precleaned 40-ml VOA vial. Fill the vial slowly to avoid entrainment of air, making sure to quantitatively transfer any sediment in the sample. Fill the vial to overflowing to provide for a zero airspace sample, and cap. Invert, tap the vial with a finger and check for air bubbles. If bubbles appear repeat the filling process.

Q) Properly dispose of excess sample collected from the well by combining with the purge water or wash water.

R) Label, package, and store the sample according to instructions in Sections 8.0 and 9.0 for sample handling and documentation.

S) Remove the pump and tubing from the well, being careful not to damage the well casing, pump, or tubing.

T) Collect all water from the pump and tubing, flush with potable water (inside and outside), collecting all water drained from the pump and tubing and rinse waters for proper disposal.

U) Replace the well cap and lock the well.

V) Wash and rinse all equipment prior to leaving the site and rinse the exterior of the sample container.

W) All wash and rinse water, alcohol rinse water, and excess sample must be collected and held for proper disposal according to the guidelines set forth in Section 11.0.

5.5. SAMPLING PROCEDURES FOR BLADDER PUMPS, Cont'd

J) Dispose of all contaminated materials (plastic sheeting, gloves, etc.) according to the guidelines set forth in Section 11.0.

K) Samples will be labeled, packaged, stored, and shipped according to the guidelines set forth in other sections of this plan.

L) Complete the required chain-of-custody and documentation for the sampling.

6. FIELD MEASUREMENT PROCEDURES

6.1. FIELD MEASUREMENT PROCEDURE - TEMPERATURE

The measurement of temperature during the purging and sampling of monitoring wells is required to monitor the purging process. Temperature will be measured by use of a glass thermometer which is stored in a plastic case.

Samples of water from the well are taken and prior to purging and at intervals during the purging process. The thermometer is inserted in the sample as soon as possible after withdrawing the water from the well, swirled to mix, and read when the thermometer fluid column has stabilized.

The temperature is recorded and the sample utilized for the measurement of pH and specific conductance. The thermometer is dried by wiping gently, and stored in its protective case.

6.2. FIELD MEASUREMENT PROCEDURE - PH

The pH of the groundwater sample is determined electrometrically with a combination glass pH electrode. The following procedure will be utilized for pH measurements:

A) Collect a fresh sample of the groundwater to be tested or use the sample used for the measurement of temperature.

B) Measure and note the temperature of a sample of pH=7 buffer solution.

C) Measure and note the temperature of a sample of either pH=4 or pH=10 buffer solutions (to bracket the pH of the groundwater). The temperature of the pH=7 and the other buffer used should be the same.

D) Turn on instrument power, select pH mode, remove the electrode protective cover and rinse with DI water.

6.2. FIELD MEASUREMENT PROCEDURE - PH, Cont'd

E) Check the calibration of the pH meter by immersing the electrode in a fresh sample of standard pH 7 buffer solution.

F) Slide back the battery compartment cover exposing the adjustment pots.

G) Adjust the CAL (calibrate) pot until the display reads 7.00.

H) Remove the electrode from the pH=7 buffer solution and rinse the electrode with DI water.

I) Check the slope of the pH meter by immersing the electrode in a fresh sample of standard pH=4 or pH=10 buffer solution.

J) Adjust the SLOPE pot until the display reads the value of the buffer being used.

K) Remove the electrode from the buffer solution and rinse the electrode with DI water.

L) Immerse the electrode into a sample of the groundwater which is at the same temperature as the buffering standard solutions.

M) Swirl or mix slowly until the reading stabilizes.

N) Read and record the value of the pH.

O) Dispose of the sample and wash water properly.

P) Turn off the power switch.

Q) Rinse the electrode thoroughly with DI water and replace the protective electrode cap.

R) The electrode should be rinsed with DI water after each test. Contain all rinse waters for proper disposal.

S) Calibrate the meter with buffers within 3.0 pH units of the test sample.

T) Place pH=7 buffer solution in the protective electrode cap.

U) Remove the battery when the meter will not be used for long periods of time to prevent the battery from leaking or corroding the meter.

6.3. FIELD MEASUREMENT PROCEDURE - SPECIFIC CONDUCTIVITY

The specific conductance of the groundwater sample is determined with a digital conductivity probe. The following procedure will be utilized for conductivity measurements:

A) Collect a fresh sample of the groundwater to be tested or use the sample used for the measurement of temperature.

B) Measure and note the temperature of a sample of conductivity standard which is near the conductance of the samples to be tested.

C) Check the conductivity probe tip for dried solids. If present rinse with DI water and allow the probe tip to air dry. Turn on instrument power and select the conductivity mode.

D) Slide back the battery compartment cover exposing the adjustment pots.

E) Check the zero of the meter by measuring the conductivity in air. Adjust the meter to zero by adjusting the zero pot. Note: the conductivity probe sensor must be thoroughly air dried prior to the zeroing.

F) Immerse the electrode in the conductivity standard and adjust the SPAN pot until the display reads the correct value for the standard.

G) Remove the electrode from the conductivity standard solution and rinse the electrode with DI water. Contain the rinse water for disposal.

H) Immerse the electrode into a sample of the groundwater which is at the same temperature as the conductivity standard solution.

I) Swirl or mix slowly until the reading stabilizes.

J) Read and record the value of the specific conductance of the sample.

K) Dispose of the sample and wash water properly.

L) Turn off the power switch.

M) Rinse the electrode thoroughly with DI water. Contain all rinse waters for proper disposal.

N) The electrode should be rinsed with DI water after each test.

O) Remove the battery when the meter will not be used for long periods of time to prevent the battery from leaking or corroding the meter.

6.4. SAMPLING QUALITY ASSURANCE / QUALITY CONTROL

Trip blanks, equipment blanks, field blanks, split samples, and duplicate samples are examples of Quality Assurance/ Quality Control (QA/QC) sampling requirements. QA/QC samples are handled, packaged, shipped, and analyzed in the same manner as the regular soil samples. QA/QC samples are introduced into the total measurement system as a means of control and evaluation of the level of contamination and variability of results as contributed by potential artifacts and interferences arising at any point in the measurement process.

QA/QC samples are designed to measure:

1) the integrity of the sample container and sample equipment cleaning process;

2) the actual process of sample collection;

3) the purity of the sample preservation and additive reagents and chemicals;

4) the influence of the site's environmental conditions on the samples (contamination);

5) cross contamination of samples due to improperly cleaned sampling equipment; and

6) indeterminant artifacts introduced during sample transport, from containers, preservatives, cleaning agents, and sampling equipment.

Table 1 summarizes the number and frequency of the QA/QC sample collection.

TABLE 1. QA/QC SAMPLE REQUIREMENTS
DICKSON COUNTY LANDFILL

QA/QC SAMPLE TYPE	SAMPLE GROUP	FREQUENCY
TRIP BLANKS	METALS/VOC	1 PER TRIP
EQUIPMENT BLANKS	"	1 PER 20
DUPLICATES	"	1 PER 10
FIELD BLANKS	"	1 PER 20
SPLIT SAMPLES	"	AS REQUESTED

6.4.1. FIELD BLANKS

Field blanks are utilized to evaluate the sample container filling procedure, the effects of environmental contaminants at the site, purity of preservatives or additives.

Field blanks are prepared in the field, on-site, by filling appropriate sample containers with DI water and adding appropriate preservatives and additives as required. The field blank sample is then grouped, handled, stored, and transported with the true samples collected at the site.

Field blanks will be collected at the rate of one (1) sample for each twenty (20) samples collected.

6.4.2. TRIP BLANKS

Trip Blanks are prepared in the laboratory with laboratory grade (distilled or deionized) water. The water is placed into the sample containers to verify their cleanliness before and during the sampling project and, in the case of volatile organics, will monitor the contamination of outside contamination on sample containers and collected samples during transportation and storage.

One trip blank per sample set is to be prepared for each parameter group sampled.

6.4.3. EQUIPMENT BLANKS

Equipment blanks, also known as rinseate blanks, are utilized to monitor the contamination or cross contamination of sampling equipment in the field from deficient field cleaning procedures. The equipment blank also addresses the field preservation procedures, environmental site interference, integrity of the source blank for field cleaning operations, and those concerns singularly addressed by the travel blank.

Samples of distilled or deionized water are taken using a blank water rinse of the particular item of sample equipment. The equipment blank is used for sampling equipment like bailers, pumps, pump tubing, spoons, trowels, hand augers, or corers. The equipment blank is prepared by collection of DI water which is being poured over the sampling equipment during the final rinse. Appropriate preservatives and additives which are required to be added to regular samples, will be added to the equipment blank in like manner.

One equipment blank sample per twenty (20) samples collected will be prepared.

6.4.4. DUPLICATE SAMPLES

Duplicate samples are utilized to monitor the reproducability of the sampling procedures and to provide the laboratory with sufficient sample to perform laboratory matrix spike and duplicate sample analysis. Duplicate samples are essentially identical samples. They are collected, preserved, handled, shipped, stored, and analyzed in the same manner as the regular samples.

One duplicate sample will be collected for each sample set of ten (10) samples collected for submittal to the laboratory.

Split samples are duplicate samples split between two or more parties for separate analysis by unrelated laboratories.

7. CLEANING AND DECONTAMINATION OF SAMPLING EQUIPMENT

7.1. SAMPLE CONTAINERS

Sample containers may be either purchased precleaned or may be cleaned by the laboratory or field team. The 40 ml VOA vials and containers to be used for samples for the pH, temperature, and specific conductivity measurements will precleaned or will be cleaned by the following procedure prior to use.

A. Vials, jars, caps, and lids will be washed with phosphate free detergent and hot water.

B. Rinse thoroughly with hot tap water.

C. Rinse with a solution of 10% nitric acid (CAUTION !!).

D. Rinse with tap water followed with DI water.

E. Rinse twice with isopropyl (or methyl) alcohol and allow to air dry for 24 hours.

F. Wrap with aluminum foil to prevent contamination during storage and transport to the site.

G. All alcohol and acid used for the decontamination process will be collected and disposed of properly whether generated in the laboratory or in the field.

7.2. SAMPLING EQUIPMENT

All sampling equipment used at the site will be disposable polyethylene bailers and will not require additional cleaning.

4) Dibenzofurans/ dibenzo-p-dioxins
5) Mercury
6) Total Metals
7) Cyanide
8) Sulfide
9) pH and Conductivity

11. DISPOSAL OF CONTAMINATED MATERIALS

All equipment, supplies, and waste which may contain or be contaminated with hazardous materials must be contained and handled for proper disposal. The following are examples of possible contaminated materials:

A) Water used for washing, rinsing, or decontaminating of sampling equipment or supplies.

B) Water purged from wells or excess samples.

C) Alcohols and acids from sample container decontamination.

D) Disposable and heavy work gloves.

E) Disposable bailers and bailer support lines.

F) Pump and suction tubing.

G) Plastic sheeting used for ground cover or work surfaces.

11.1. DISPOSAL OF CONTAMINATED WATERS

Water from the decontamination, purging and sampling activities must be collected in pails, drums or tanks for proper disposal. After completion of the sample analysis, if the samples contain contaminates at levels which may cause the wash waters to be deemed hazardous, the collected waters will be sampled and analyzed to determine the level of contamination and the proper disposal methodology following rules and regulations in force at the time of disposal.

11.2. DISPOSAL OF SOLVENTS AND ACIDS

Solvents used in the lab and the field for decontamination of sample equipment, supplies, and containers will be disposed of by:

Small quantities of solvents used to rinse cleaned containers and equipment and not believed to have significant levels of contamination will be disposed of by placing in a vented area and allowed to evaporate. Large quantities (> 1 liter) of waste solvents will be collected for disposal following rules and regulations in force at the time of disposal.

Solvents used to rinse contaminated equipment which are believed to have significant levels of contamination will be disposed of by placing in an approved shipping container; sampled and analyzed to determine if it is a hazardous waste; and if determined to be hazardous, disposed of by proper disposal methods following rules and regulations in force at the time of disposal.

Nitric acid utilized for rinsing sampling equipment, containers, and supplies in the laboratory will be collected and disposed of by neutralizing with sodium hydroxide and discharging into the publicly owned treatment works serving the laboratory. Nitric acid utilized in the field will be collected and returned to the laboratory for proper disposal.

11.3. DISPOSAL OF SOLID WASTE

All solid waste including plastic sheeting, bailers, bailer support line, pump and suction tubing, gloves, and trash will be collected and screened with the HNU PID for indications of volatile organics. If the HNU does not indicate volatile organics above the detectable level the waste will be dumped into the site's solid waste containers. If volatile organics are detected the waste will be sampled and analyzed to determine if it is a hazardous waste, and if determined to be hazardous, disposed of by proper disposal methods following rules and regulations in force at the time of disposal.

APPENDIX B

EXAMPLE - SAMPLE LABEL and SEAL

APPENDIX C

CHAIN - OF - CUSTODY

GRIGGS & MALONEY
INCORPORATED
Engineering & Environmental Consulting
745 South Church St., Suite 205
PO Box 2968 (37133-2968)
Murfreesboro, Tennessee 37130
(615) 895-8221 • (615) 895-0632 FAX

CHAIN OF CUSTODY / FIELD DATA SHEET

CLIENT: ____________________ PROJECT NO.: __________

STREET: ______________ CITY __________ STATE/ ZIP: __________

CONTACT: ______________ SITE: ____________________

FACILITY ID NO.: ______________ PAGE: ______ OF ______

Sample Description	Type G/C	Matrix/ Source	Collected			Preserved	Qty/ Size	Analysis Requested			
			Date	Time	By						

Remarks / Instructions: ______________________________

Shipped by:
Lab Vehicle ______
Client

Relinquished by:	Date	Time	Received by:	Date	Time	Relinquished to Lab:		
						By:	Date:	Time:
Relinquished by:	**Date**	**Time**	**Received by:**	**Date**	**Time**	**Accepted by Lab:**		
						By:	Date:	Time: