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REMEDIAL INVESTIGATION PLANS FOR WORK, SAMPLING AND ANALYSIS AND HEALTH AND SAFETY FOR BEULAH LANDFILL SITE NAS PENSACOLA FL
3/1/1992
ENGINEERING-SCIENCE

REMEDIAL INVESTIGATION PLANS FOR WORK, SAMPLING AND ANALYSIS, AND HEALTH AND SAFETY

BEULAH LANDFILL SITE

PREPARED FOR

BOARD OF COUNTY COMMISSIONERS
ESCAMBIA COUNTY
SOLID WASTE MANAGEMENT
CANTONMENT, FLORIDA

PREPARED BY

ENGINEERING-SCIENCE

Atlanta, Georgia

MARCH 1992
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REMEDIAL INVESTIGATION WORK PLAN
FOR
BEULAH LANDFILL SITE
PENSACOLA, FLORIDA

PREPARED BY
ENGINEERING-SCIENCE, INC.
ATLANTA, GEORGIA

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SECTION 1
INTRODUCTION

PURPOSE AND SCOPE

The purpose of this Remedial Investigation/Feasibility Study (RI/FS) Work Plan is to quantify the presence or absence, extent and magnitude of contamination at the Beulah Landfill site; determine if unacceptable risk exists to public health, welfare, and the environment; and to develop and evaluate potential remedial action alternatives. The RI/FS is undertaken to comply with federal and state environmental requirements.

The Beulah Landfill was placed on the National Priorities List (NPL), effective March 23, 1990. As a result, the U.S. Environmental Protection Agency (EPA) has determined that the site should be investigated and, if necessary, remediated under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1989 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA).

The scope of the RI/FS can be streamlined to focus on tasks and data required for evaluation of remedial alternatives that are most practical for landfill sites (USEPA, 1991). The RI will follow specific plans that include: a work plan for accumulation and analysis of data; a plan for sampling and chemical analyses; a plan for quality assurance/quality control (QA/QC); and a plan to protect health and safety of workers. Specific objectives of the field investigation phase include identification of suspected contaminants and their concentrations, definition of the extent of contamination, and characterization of migration pathways from the site to potential receptors. The data obtained during the RI will be analyzed to ensure suitability to complete both a baseline risk assessment and an FS. The FS will analyze remedial alternatives appropriate for landfills and will determine the preferred alternative for remediating any hazards to human health and the environment.

The RI and FS are interactive and will be conducted concurrently. The data collected in the RI will determine whether health or environmental risks occur, and whether remedial actions are required. The RI results will influence the development of remedial action alternatives in the FS. This Work Plan may be modified based on findings of the work-in-progress during the RI. The Respondents will meet with the EPA to discuss any modifications to this Work Plan prior to their implementation.

SECTION 2
SITE BACKGROUND AND EVALUATION OF EXISTING DATA

SITE DESCRIPTION

The Beulah Landfill is located on approximately 101.9 acres comprising the W½ NW¼, and a portion of the E½ NW¼ of Section 15, T.1 S., R. 31 W., Tallahassee Base Line, in southern Escambia County, Florida. The site is about 10 miles northwest of Pensacola, as shown in Figure 2.1. Access to the site is north on Jamesville Road from Mobile Highway (U.S. Highway 90) at a point about 5 miles southeast of its intersection with Nine Mile Road (U.S. Highway 90A, Figure 2.2). The property is divided into a north side and a south side by Coffee Creek (Figure 2.2). Coffee Creek drains to Elevenmile Creek which drains to Perdido Bay.

The site is relatively flat lying with steeper slopes next to the creeks. Site elevations range from about 65 feet NGVD to about 25 feet NGVD. The area surrounding the landfill is heavily wooded and relatively undeveloped. The Rosemont subdivision, a subdivision of single family homes, is located southwest of the landfill. The landfill is heavily vegetated with a thick understory of shrubs, and a rapidly developing canopy.

SITE HISTORY

The Beulah Landfill was operated from 1966 to June 1984. The northern half of the site is a closed landfill; during its operation, only solid wastes were accepted. Depths of the wastes range from 4 to 10 feet in the northwest section, increasing to 25 to 30 feet in the northeast section. The wastes are covered with 4 to 6 inches of native soil.

The southern half of the site was a borrow pit for sand prior to 1965. Solid wastes were initially deposited in the southwest corner of the borrow pit to depths of 15 to 20 feet. The disposal cells moved to the east as the landfill matured, and increased in depth to about 35 feet. Also, Coffee Creek was gradually moved north to its present position along the Gulf Power/Telephone Line easement (Figure 2.2).

In 1968, the first domestic septage and wastewater treatment sludges were deposited in a 10-acre excavated and bermed area at the southwest corner of the site. Initial deposition rates were about 5,000 gallons per day (gpd). The first sludge holding pond was filled in 1976 with construction and demolition debris, and solid waste, and then covered with a minimum of 12 inches of on-site soil. The easternmost 20-acre sludge pit was constructed in November 1977, in a diked area on the landfill.

Figure 2.1

SITE LOCATION MAP
BEULAH LANDFILL SITE

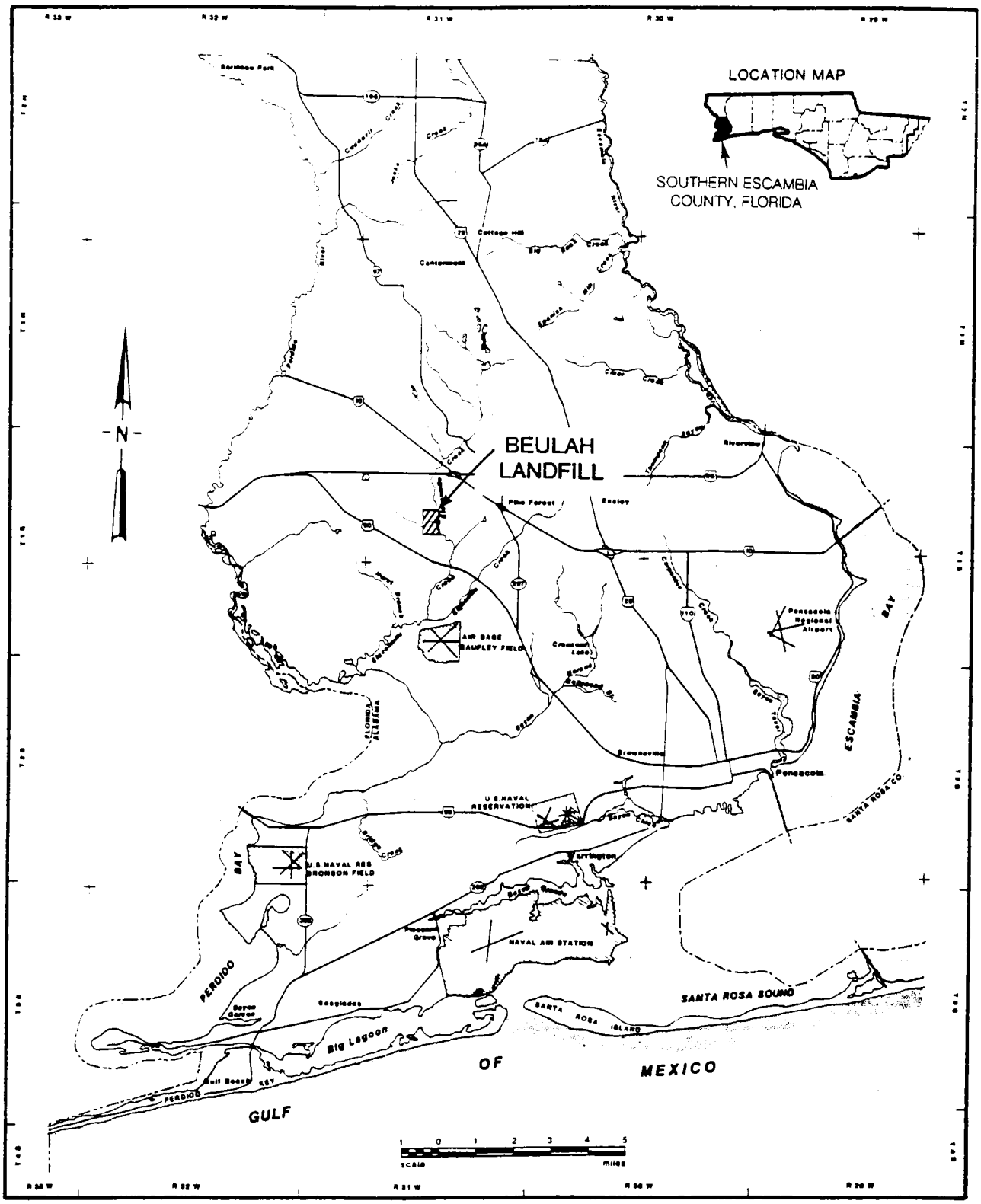
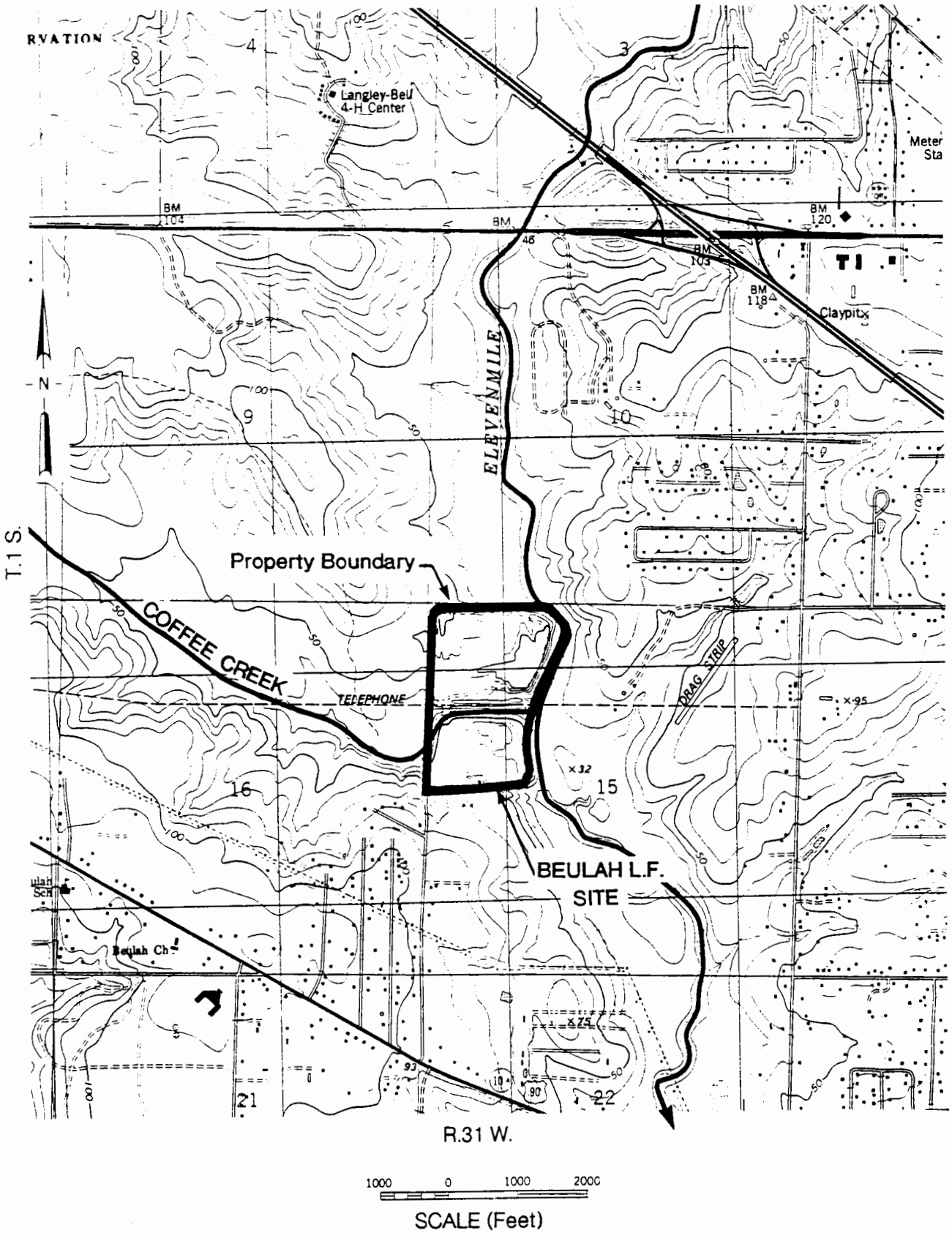


Figure 2.2

TOPOGRAPHIC MAP
BEULAH LANDFILL SITE



(SOURCE: USGS Cantonment, Fla. quadrangle, 1987 PR)

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Liquid wastes were deposited in the diked area on a previous fill of solid wastes. The solid wastes absorbed much of the liquid, creating a semi-solid, spongy surface which persists to the present. All sludge dumping ceased in June 1984. The final deposition rates were about 20,000 gpd. The former ponds are currently covered with grass and shrubs; no soil cover was placed on the sludges after disposal ceased.

In September 1980, as part of a regional survey of disposal sites, the EPA, Region IV, Surveillance and Analysis Division, Water Surveillance Branch, along with the contractor firm of Ecology and Environment, performed a 1-day field investigation of the site and issued a report. A follow-up investigation with additional sampling of groundwater, surface water, stream sediment and site soils, was conducted in August 1981 for the EPA by Ecology and Environment. The report of this investigation was released in January 1982. In March 1985, a groundwater monitoring plan for the Beulah Landfill was submitted by Escambia County to the Florida Department of Environmental Regulation (FDER). In June 1988, the Beulah Landfill Closure Plan was completed by the County and submitted to FDER. Appended to the closure plan were a hydrogeologic report of the landfill site, a report of bioassay tests on surface water from Coffee Creek (conducted by FDER), and groundwater monitoring data from testing of the site in 1988. In July 1989, the FDER issued a permit for closure of the landfill. Additional groundwater monitoring was completed after June 1988 to test groundwater beneath the site for parameters identified in the closure permit.

The Beulah Landfill was proposed for listing on the National Priorities List (NPL) for Uncontrolled Hazardous Waste Sites on June 24, 1988 (52 Fed. Register, p. 23988). The listing of the site became final effective March 23, 1990 (55 Fed. Register, p. 6154).

GEOLOGY

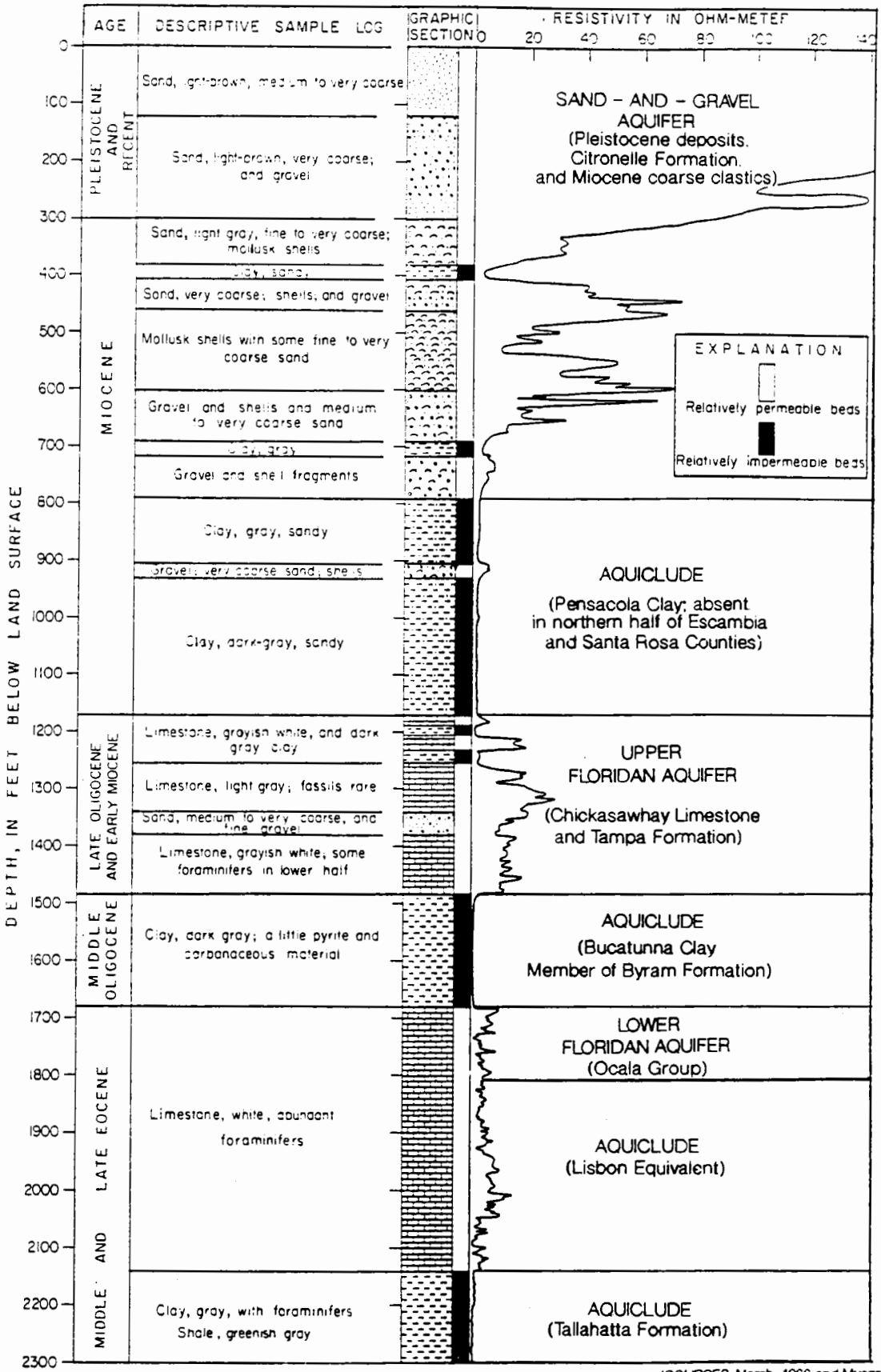
Regional Geology

The Pensacola area is situated in the Gulf of Mexico Coastal Plain, which consists of sands, silts, clays, and limestones of Mesozoic to Cenozoic age. The area lies on the north flank of the Gulf Coast Sedimentary Basin and the east flank of the Mississippi Embayment. This results in a regional southwestward dip and gulfward-thickening of most formations down to the basal Cretaceous deposits.

A generalized geologic column is shown in Figure 2.3. A geologic cross-section across Santa Rosa and Escambia Counties, parallel to the regional dip, is shown in Figure 2.4.

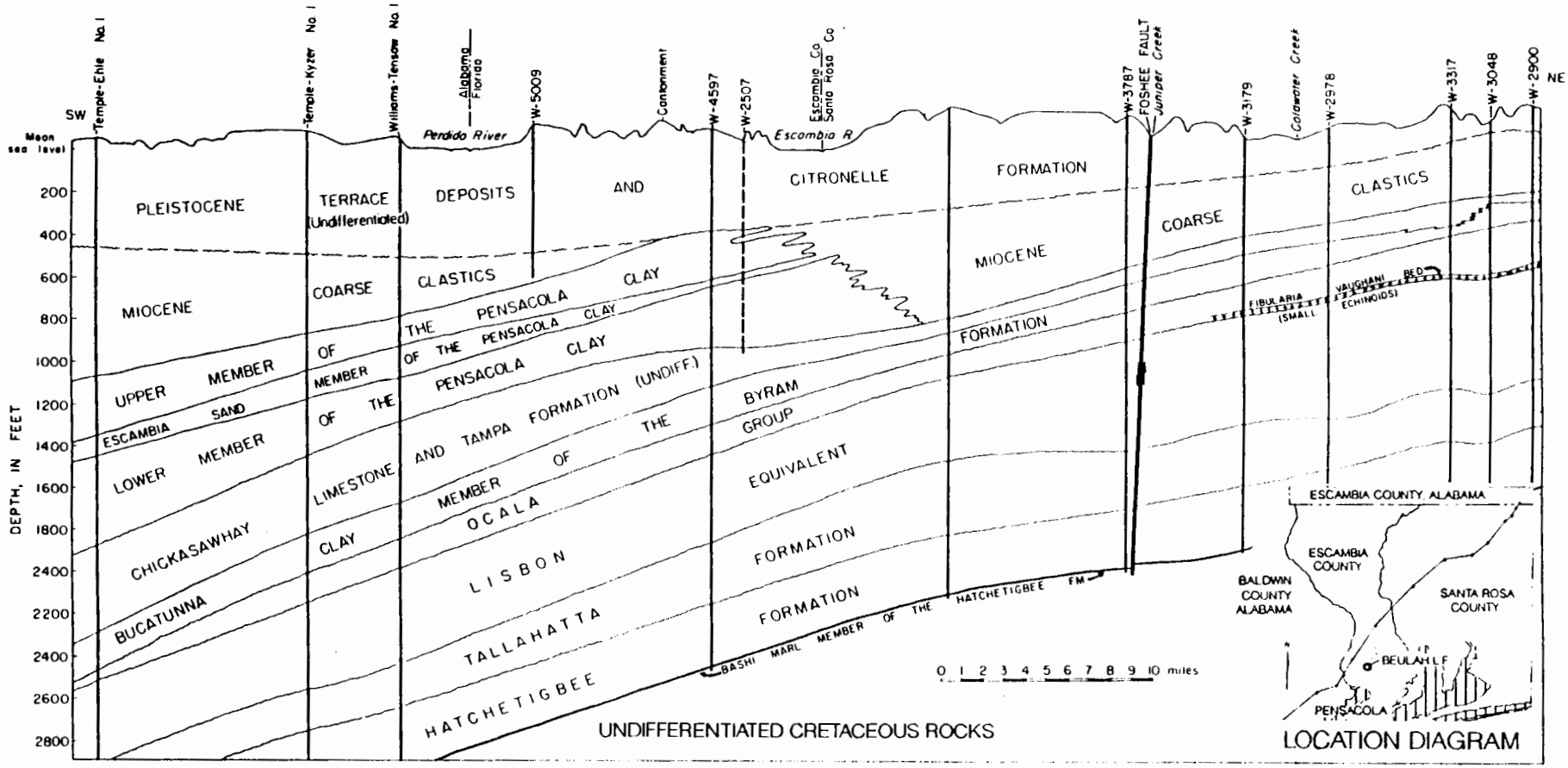
In south-central Escambia County, Pleistocene terrace deposits and the Citronelle Formation extend from land surface to 300 - 400 feet below the surface. These deposits, of fluvial and deltaic origin, are predominantly white to light brown, poorly sorted sands, with numerous lenses and layers of clay and gravel up to 60-feet thick. Occasional fragments and layers of lignite also occur. The Citronelle contains

GENERALIZED GEOLOGIC COLUMN
(As shown by representative log of oil test well near Pensacola)



(SOURCES: Marsh, 1966 and Musgrove et al., 1965)

GEOLOGIC CROSS-SECTION ACROSS ESCAMBIA AND SANTA ROSA COUNTIES
BEULAH LANDFILL SITE



(SOURCE: Marsh, 1966)

Figure 2.4

hardpan layers, up to 4-feet thick, consisting of iron-oxide and sand. These hardpans are generally of limited lateral extent. The iron oxides are limonite or geothite, which cement the sand.

Underlying the Citronelle Formation over most of the area is a unit of poorly sorted, fine to very coarse sand and gravels informally referred to as the Miocene coarse clastics. This unit is distinguished from the Citronelle by the abundance of shell fossils. The sediments are absent in an area between central Escambia County and southwestern Santa Rosa County, but thicken to as much as 500 feet to the north and south of this area (Figure 2.4).

Below the clastics is the Pensacola Clay, a sequence of clay, sandy clay, silty clay, and clayey sand. This formation is about 980-feet thick at Pensacola, but thins and interfingers with sand and gravel sediments a few miles north of Cantonment.

Underlying the Pensacola Clay is the Chickasawhay Limestone, a brown to light-gray hard dolomitic limestone, limestone and dolomite containing abundant shell fragments. The Chickasawhay may be overlain in the southern part of the county by the Tampa Limestone, a cream to light-gray sandy limestone containing shell fragments and foraminifers. The Chickasawhay ranges in thickness from 30 to 130 feet, and the Tampa attains a maximum thickness of 270 feet.

Beneath the Chickasawhay is the Bucatunna Clay Member of the Byram Formation. The Bucatunna consists of soft gray silty to sandy clay containing some fossils, and ranges in thickness from about 45 feet in northeast Santa Rosa County to 215 feet just north of Escambia Bay. The average thickness is 125 feet.

The Bucatunna Clay is underlain by the Ocala Limestone, which is a white to grayish-cream chalky limestone containing fossil fragments. Some lenses of gray shale, siltstone, and clay occur in the Ocala. The Ocala ranges in thickness from about 90 feet near Pensacola to 235 feet in northeastern Santa Rosa County, and averages 165 feet.

The Lisbon equivalent occurs beneath the Ocala Limestone. In the western Florida Panhandle, the Lisbon equivalent consists of dark gray to grayish-cream shaley limestone, often with some glauconite. The formation averages 495 feet in thickness, ranging from 345 feet in northern Escambia County to 600 feet in east-central Santa Rosa County.

Next in the sequence are gray shales and clays of the Tallahatta Formation and the Hatchetigbee Formation. The Tallahatta Formation thins from northwest Santa Rosa County to Pensacola, whereas the Hatchetigbee Formation thickens over the same distance. As a result, the combined thickness of the formations is relatively constant, ranging between 560 and 590 feet.

The Hatchetigbee Formation overlies undifferentiated calcareous shales of Cretaceous age.

Site Geology

The site geology is known from test borings made since 1984. A total of 10 borings have been completed on the property. Four borings were located around the perimeter of the north side, and six borings were located around the south side. All borings were subsequently converted to groundwater monitoring wells. The locations of the borings and the corresponding monitoring well designations are shown in Figure 2.5.

Boring SEC-1, drilled by the Northwest Florida Water Management District in 1984, reached a total depth of 400 feet. The dominant lithology was quartz sand of the Citronelle formation and Pleistocene terrace deposits. Clay-rich zones were observed at depths of 10 to 14 feet, and 100 to 120 feet below the surface. The log of this test boring is presented in Figure 2.6.

The remaining nine borings encountered tan-gray slightly silty to silty sands from the surface to a depth of 20 to 30 feet, underlain by red and yellow sand, and slightly silty sand. A geologic cross section through the site is shown in Figure 2.7. Clay layers were encountered in the borings for BMW-1, BMW-5, and BMW-7 at depths of 35 to 48 feet and 58 to 61 feet, 16 to 22 feet, and 9 to 10 feet, respectively. Thin layers of iron hardpan were encountered in the borings for BMW-5 and BMW-6 at 22 feet and 9.5 feet, respectively. Garbage and debris were reported in samples less than approximately 10 feet in depth in the borings for BMW-1, BMW-3, BMW-4, and BMW-5.

HYDROGEOLOGY

Regional Hydrogeology

The regional geologic formations are grouped into six hydrogeologic units (aquifers and confining units) based on lithology and permeability, as shown in Figure 2.3. The Sand-and-Gravel and the Upper Floridan aquifers contain the available fresh water in the northern half of Escambia County. In southern Escambia County, both the Upper and Lower Floridan contain salty (non-potable) water. The confining units (aquitards) shown on Figure 2.3 retard the vertical movement of water between aquifers.

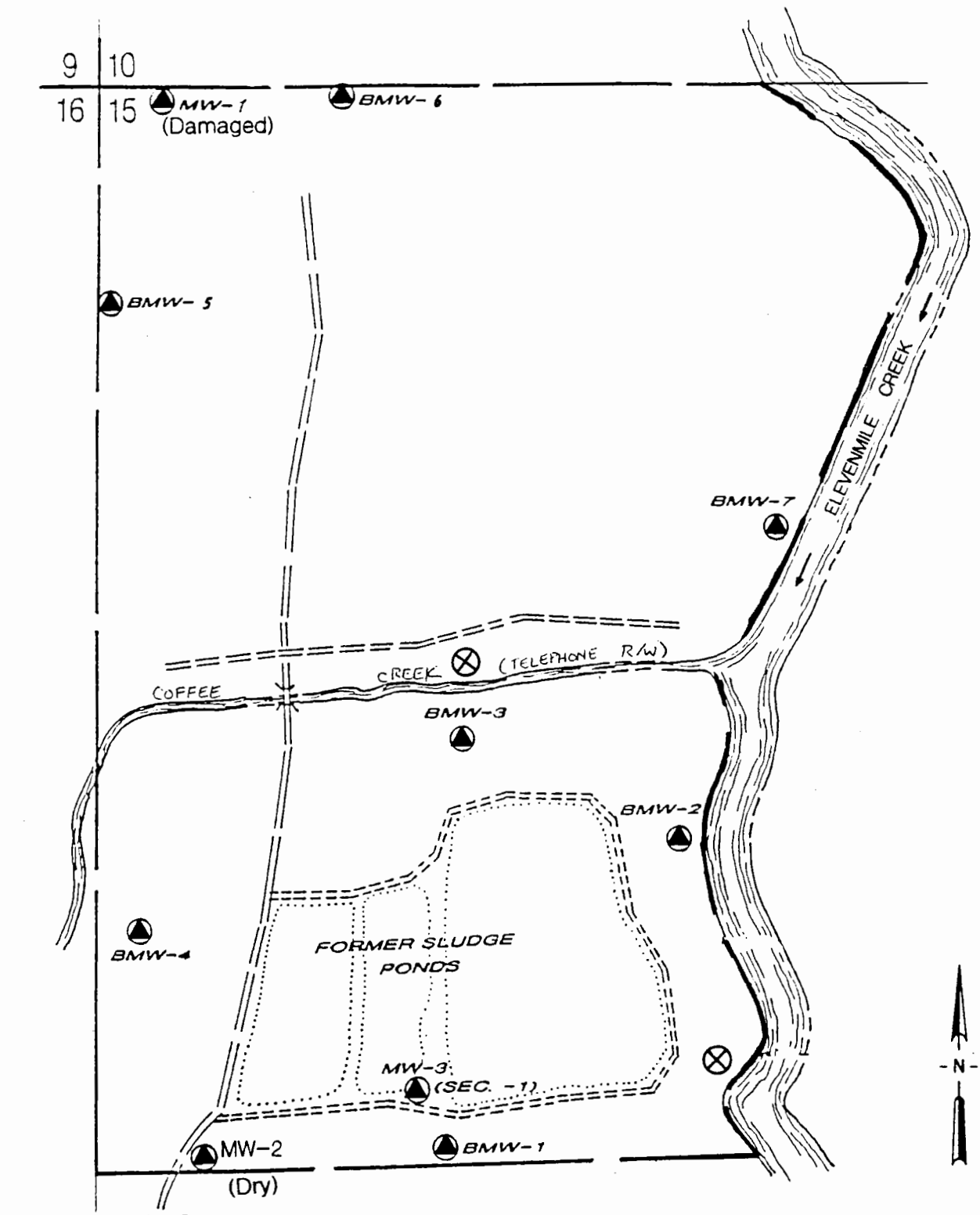
The Sand-and-Gravel Aquifer consists of the Pleistocene terrace deposits, the Citronelle Formation, and the Miocene coarse clastics. Zones of high average porosity and permeability form excellent reservoirs for groundwater. The majority of the water wells in Escambia County extract water from the Sand-and-Gravel Aquifer.

Water in the Sand-and-Gravel Aquifer is unconfined to semiconfined, and is recharged almost entirely from rainfall. Silt and clay layers in the lower parts of the aquifer may cause localized confined zones in which the water is under slight artesian pressure. Some perched lakes and water tables occur where the surficial

Figure 2.5

SITE MAP OF BEULAH LANDFILL

ESCAMBIA COUNTY, FLORIDA
SECTION 15,T.1 S., R.31 W.



LEGEND

- Monitoring Well
- Proposed New Well

0 400 Feet
SCALE

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FIGURE 2.6
DRILLING LOG FOR WELL SEC-1

Depth (feet)	Lithologic Description
0 - 10	Quartz sand, yellow to orange, fine to coarse, subangular, poorly sorted.
10 - 14	Clay, * white to purple, variegated, mottled plastic pure kaolinitic clay. Stiff, very low sand content. Limonite, thin streaks associated with clay.
14 - 20	Quartz sand, yellow, orange, fine to very coarse grain, predominantly coarse, subangular to subrounded, medium sphericity, with traces of: clay, mica, and organics.
20 - 40	Quartz sand, light brown and yellow, fine to gravel-size grains, predominantly gravel, subangular to angular, low sphericity, poorly sorted, with traces of mica, clay, and organics, yellow, soft clay.
40 - 60	Quartz sand, yellow to light brown, very fine grains, subangular, medium to high sphericity, well sorted, argillaceous, with mica flakes, soft, white, thinly bedded clay, and trace limonite.
60 - 80	Quartz sand, yellow and white, very fine, angular to subangular, well-sorted, argillaceous, mica flakes, greater percentage of soft, white clay.
80 - 100	As above, less clay with more gravel.
100 - 110	Clayey sand, greenish-dark brown, very fine, very soft, well sorted.
110 - 120	Clayey sand, fine, dark green to gray, as above.
120 - 130	Quartz sand, gray to black, very fine to medium grain, well sorted, argillaceous, black organic clay.
130 - 140	Quartz sand, as above yellow.
140 - 150	Quartz sand, light yellow to tan, very fine to fine grain, well sorted, slightly argillaceous with white, soft clay.
150 - 160	Quartz sand, light brown to yellow, medium to coarse grain, subrounded to subangular, moderately sorted, slightly argillaceous with traces of gray, soft clay.
160 - 180	Quartz sand, fine to medium grain, green to brown, well sorted with traces of silt and white, soft clay.
180 - 200	Quartz sand, fine to medium grain, greenish brown, well sorted, trace of clay and black organics.
200 - 220	Quartz sand, as above, more fine grains.
220 - 240	As above.
240 - 260	Quartz sand, as above, with some soft clay.
260 - 310	Quartz sand, fine to medium grain, clear, well sorted.
310 - 380	As above.
380 - 400	Quartz sand, very fine to fine grain, green, moderately sorted, green, moderately soft clay.

* Core sample taken.
Source: Wilkins and others, 1985, Appendix A.

CROSS-SECTION THROUGH BEULAH LANDFILL

BEULAH LANDFILL SITE

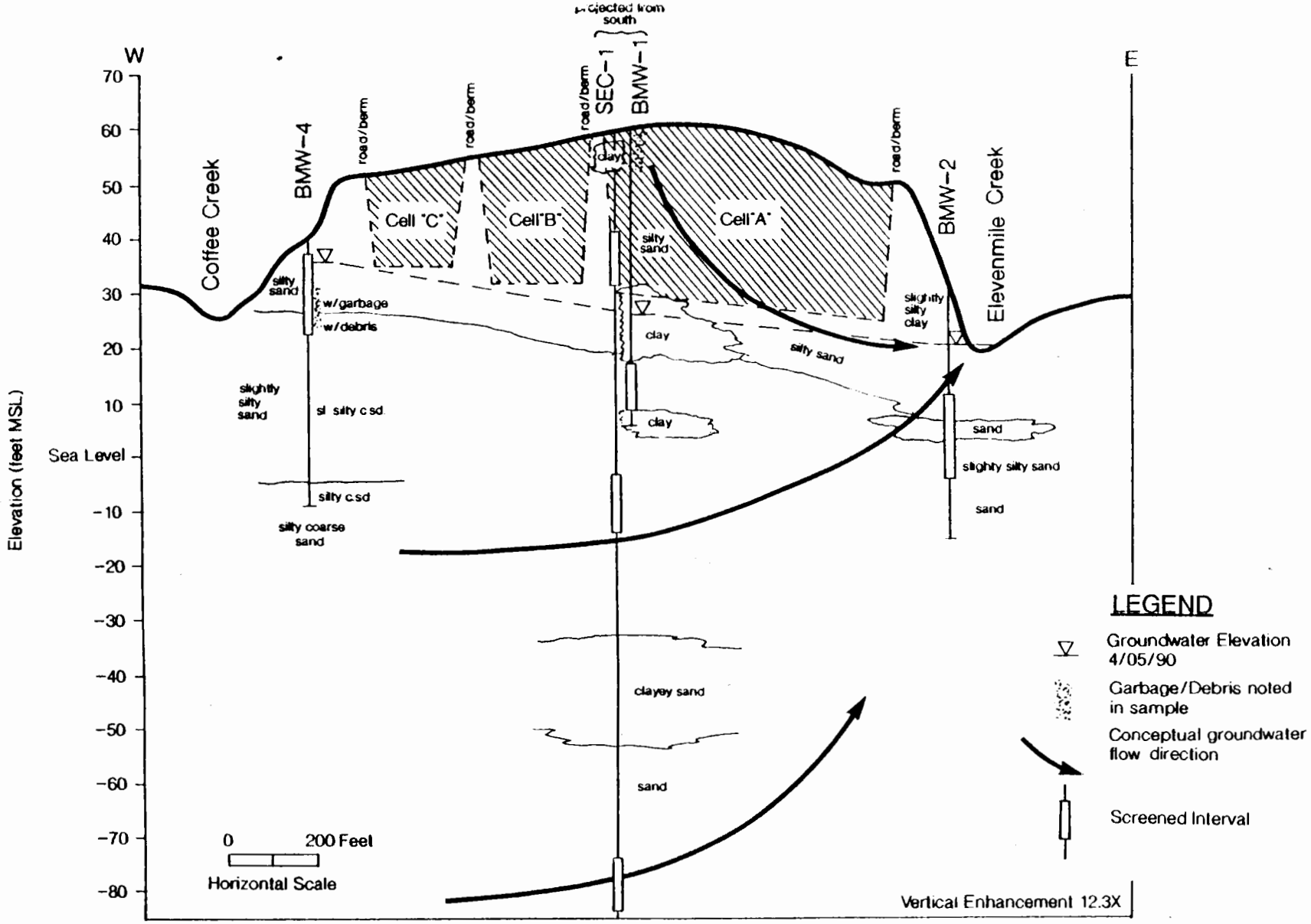


Figure 2.7

sands are underlain at shallow depths by clays or hardpans that restrict the downward movement of water to the regional water table.

The Sand-and-Gravel Aquifer consists principally of quartz grains. Thus, groundwater quality is generally excellent, being soft and relatively unmineralized (Barraclough and Marsh, 1962). Dissolved-solids content generally ranges from 15 to 40 parts per million (ppm), although in some locations, the water contains up to 300 ppm dissolved solids. Hardness ranges from 4 to 30 ppm calcium and magnesium carbonates. Water from deeper parts of the aquifer may contain as much as 150 ppm of these carbonates. The chloride content generally ranges between 2 and 30 ppm. The iron content is usually less than 0.25 ppm, but may be as high was 4.9 ppm. Water from the Sand-and-Gravel Aquifer in some areas contains hydrogen sulfide.

Underlying the Sand-and-Gravel Aquifer in the southern half of Escambia and Santa Rosa counties is the Pensacola Clay aquitard. This unit greatly restricts movement of water between the Sand-and-Gravel Aquifer and the underlying Floridan aquifer. Also, the clay is locally the confining unit for the Florida aquifer. In southern Escambia County, the Chickasawhay Limestone and Tampa Limestone comprise the Upper Floridan aquifer (Miller, 1986). Below the Beulah Landfill site, the top of the Upper Floridan occurs at approximately -1300 feet NGVD (Miller, 1986, plate 26). The Chickasawhay is recharged by rainfall that occurs to the north in Alabama, where the formation outcrops. Additional recharge comes from downward leakage from the overlying Sand-and-Gravel Aquifer in northern Escambia and Santa Rosa Counties. Groundwater flow in the Upper Floridan aquifer is to the south where the aquifer discharges into the Gulf of Mexico.

The Lower Floridan aquifer, consisting of the Ocala Limestone, is separated from the Upper Floridan by the Bucatunna clay, which acts as an aquitard. The Lower Floridan is recharged by rainfall where the formation outcrops in Alabama; discharge is to nearby streams and rivers (Bush and Johnston, 1988, p. C46-C47). Beneath Escambia County groundwater within the Lower Floridan is not potable. The Lower Floridan is confined below by the clays of the Lisbon equivalent.

Site Hydrogeology

Twelve monitoring wells have been installed in the Sand-and-Gravel Aquifer across the Beulah Landfill site to determine the local hydrogeologic conditions. The locations of the wells are shown in Figure 2.5. Well MW-3 (SEC-1) is a cluster of three wells installed to depths of 35, 80, and 150 feet by the Northwest Florida Water Management District in 1984. Wells MW-1 and MW-2 were installed in 1984 by Meister and Associates, Inc. Wells BMW-1 through BMW-7 were installed in 1988 by Larry M. Jacobs and Associates, Inc. Well construction details are summarized in Table 2.1. During a site visit in October 1991, Well MW-1 was determined to be unuseable due to vandalism. This well will be properly abandoned and replaced with a new background monitoring well (see Section 7).

TABLE 2.1
MONITORING WELL CONSTRUCTION DETAILS

Well I.D.	Date Completed	Ground Surface Elevation (ft MSL)	Top of Casing Elevation (ft MSL)	Boring Depth (ft BGS)	Well Depth (ft BGS)	Screened Interval (ft BGS)	Screen Elevation (ft MSL)
MW-1(1)	09/84	53.14	55.29		50	40-50	13.14 to 3.14
MW-2(2)	09/84	54.94	56.91		60	50-60	4.94 to -5.06
MW-3 (s)	08/84	66.64	68.31		35	25-35	41.64 to 31.64
MW-3 (i)	08/84	66.64	68.15		80	70-80	-3.36 to -13.36
MW-3 (d)	08/84	66.64	68.52	397	150	140-150	-73.36 to -83.36
BMW-1	03/31/88	66.54	69.61	61	58	49-58	17.54 to 8.54
BMW-2	03/17/88	30.77	34.24	46	35	20-35	10.77 to -4.23
BMW-3	03/21/88	33.31	36.37	46	22.5	7.5-22.5	25.81 to 10 81
BMW-4	03/21/88	40.47	43.78	50	18	3-18	37.47 to 22.47
BMW-5	04/30/88	47.15	50.47	36	36	21-36	26.15 to 11.15
BMW-6	03/24/88	38.65	41.80	51	27	12-27	26.65 to 11.65
BMW-7	03/16/88	31.40	34.90	36	29	14-29	17.40 to 2.40

MSL = above mean sea level
BGS = below ground surface
(1) = Well casing ruined by vandals; this well will be abandoned.
(2) = Well has been dry since 1986.
(s) = shallow well in cluster
(i) = intermediate well in cluster
(d) = deep well in cluster

Groundwater elevations measured between 1984 and 1990 are summarized in Table 2.2. A groundwater contour map, based on water levels measured on April 5, 1991, is shown in Figure 2.8. The contours show that groundwater flow beneath the site is towards Coffee Creek and Elevenmile Creek. The gradient is approximately 0.0063 towards Coffee Creek and 0.0067 towards Elevenmile Creek.

Note the water elevation measured in BMW-4 was not used in generating the groundwater contour map in Figure 2.8. The location of BMW-4 suggests it is in the former creek bed. Also, the high water level, compared to the levels in other monitoring wells, suggests that BMW-4 was screened in a shallow perched zone. This conclusion is supported by Figure 2.9, which compares the elevations at which water was first encountered in the well boring, the elevations of the screened interval, and the final groundwater elevations measured in the BMW wells. Note Figure 2.9 is <u>not</u> a hydrogeologic cross-section, although wells are depicted from west to east.

Water levels in MW-1 through MW-3 were not measured after the BMW-series wells were installed. Well MW-2 was dry less than 1 year after installation; the shallow well in the MW-3 cluster was dry in less than 2 months. Water levels are available in the intermediate and deep MW-3 wells until March 1985; after this date, only one measurement is reported without reference to which well was measured. Based on comparisons of level data, it is suspected that MW-3d was the well being measured after March 1985.

Water levels measured in all three MW-3 wells in September 1984 show a downward gradient of 0.229 between the shallow and intermediate screen intervals. An upward gradient of 0.098 was observed between the intermediate and deep screen intervals. These gradients indicate that the vertical groundwater flow is predominantly towards Elevenmile Creek, the main drainage in the area.

During installation of well cluster SEC-1, a core sample was collected from 16 to 18 feet, for the purpose of determining the vertical hydraulic conductivity of the material. The core consisted of 83 percent sand, 4 percent clay, and 13 percent silt. The hydraulic conductivity of this sediment, measured using a constant head permeameter, is 1.3×10^{-3} cm/sec or 3.7 ft/day.

DESCRIPTION AND RESULTS OF PAST SAMPLING AND ANALYSIS ACTIVITIES

Organic and inorganic data from past sampling and analysis activities are available for groundwater, surface water, stream sediments, and sludges at and near the Beulah Landfill site. In general, it is difficult to correlate the various data sets because of limited sampling of the various media (e.g., private wellwater, surface water) as well as lack of analyses for certain parameters throughout all sampling events. The absence of analyses of field blanks prevents assessment of the data quality. The general sampling locations are indicated in Figure 2.10.

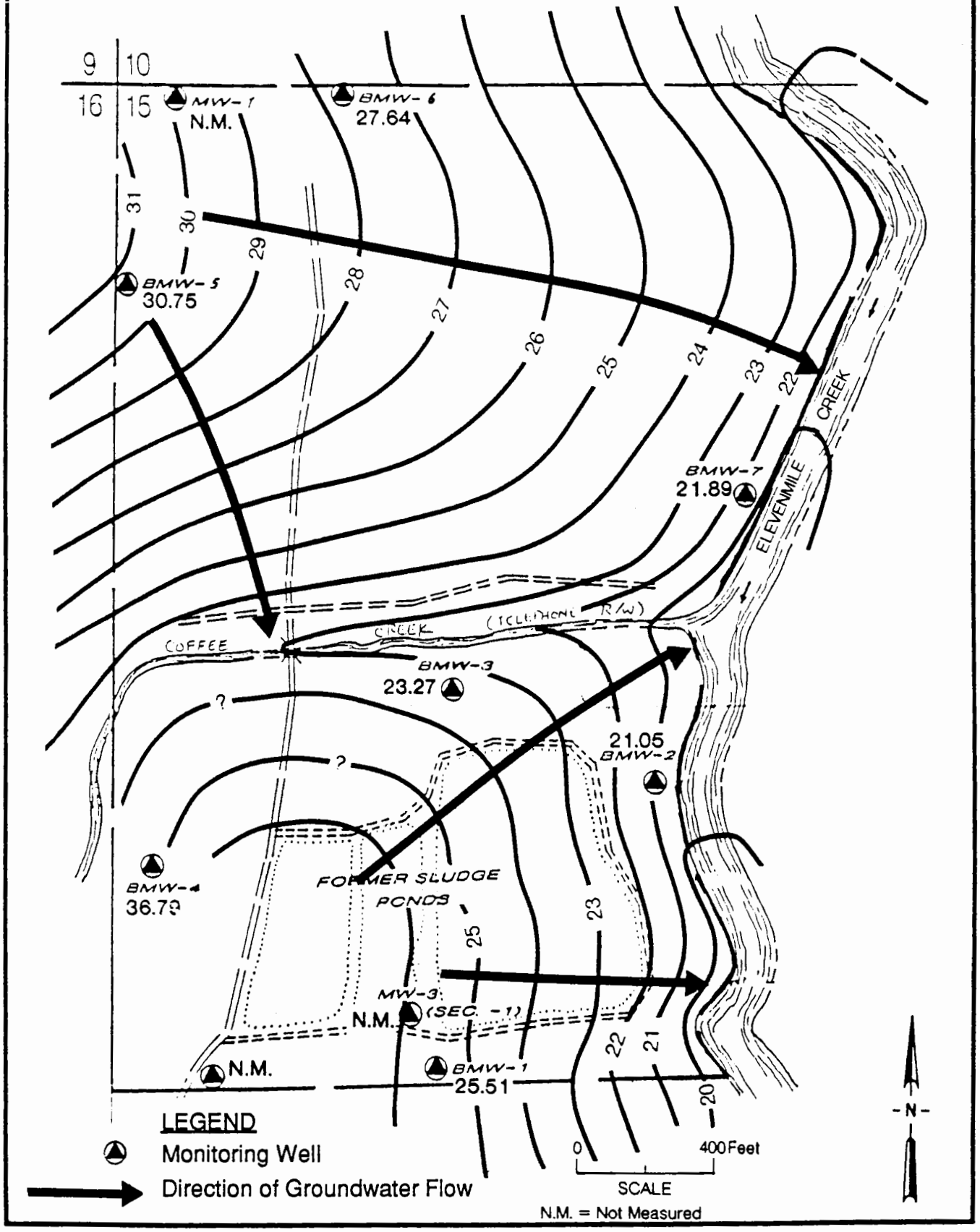
TABLE 2.2
GROUNDWATER ELEVATION SUMMARY

DATE	MW-1	MW-2	MW-3 (S)	MW-3 (I)	MW-3 (D)	BMW-1	BMW-2	BMW-3	BMW-4	BMW-5	BMW-6	BMW-7
09/05/84	27.89	27.19	34.46	24.81	31.89							
09/11/84	27.91	27.19	35.14	24.14	32.14							
10/23/84	27.22	26.94	dry	24.14	30.14							
11/05/84	26.96	26.29	dry	23.84	31.14							
02/14/85	28.29	25.86	dry	23.64	31.44							
03/18/85	27.14	26.61		25.47	30.31							
08/01/86	26.89	dry			30.23							
08/29/86	25.06	dry			28.47							
10/21/86	27.23	dry			29.89							
01/15/87	25.64	dry			28.89							
04/21/87	27.71	dry			33.64							
08/28/87	25.75	dry			31.97							
11/03/87	25.56	dry			29.22							
02/24/88	28.74	dry			32.04							
04/29/88						24.64	20.57	23.21	35.1	29.75	25.76	21.2
05/16/88						24.74	20.37	22.61	34.17	29.55	26.06	20
08/04/88						24.11	21.14		34.48	28.47	26.2	
07/18/89							19.27			29.65		21
01/09/89						24.58	20.64	23.07	32.08		26.8	21.6
04/06/89							20.77	23.31	34.47	28.85		21.66
07/27/89						23.04	17.57	20.21	33.17		24.36	18.14
10/11/89						21.54	16.99	19.37	30.67	25.83	23.03	18.04
01/24/90						25.05	20.9	22.81	36.42	30.36	27.36	21.72
04/05/90						25.51	21.05	23.27	36.79	30.75	27.64	21.89

Groundwater elevations measured in MW-3 between 8/01/86 and 2/24/88 assumed to represent the deep well.

Figure 2.8

GROUNDWATER CONTOUR MAP
BEULAH LANDFILL SITE
APRIL 5, 1990



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COMPARISON OF WATER LEVELS AND SCREENED INTERVALS IN BMW WELLS
BEULAH LANDFILL SITE

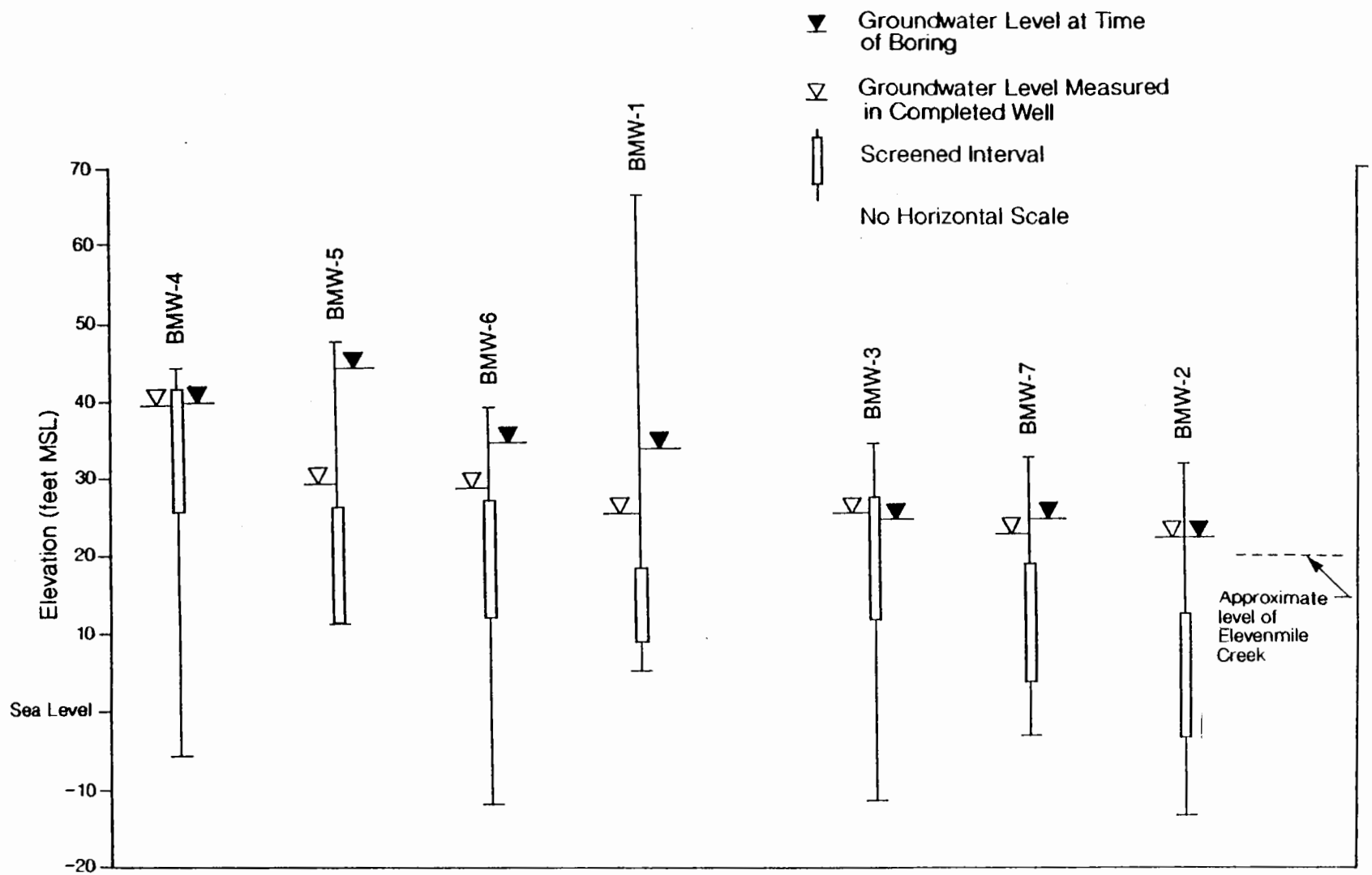
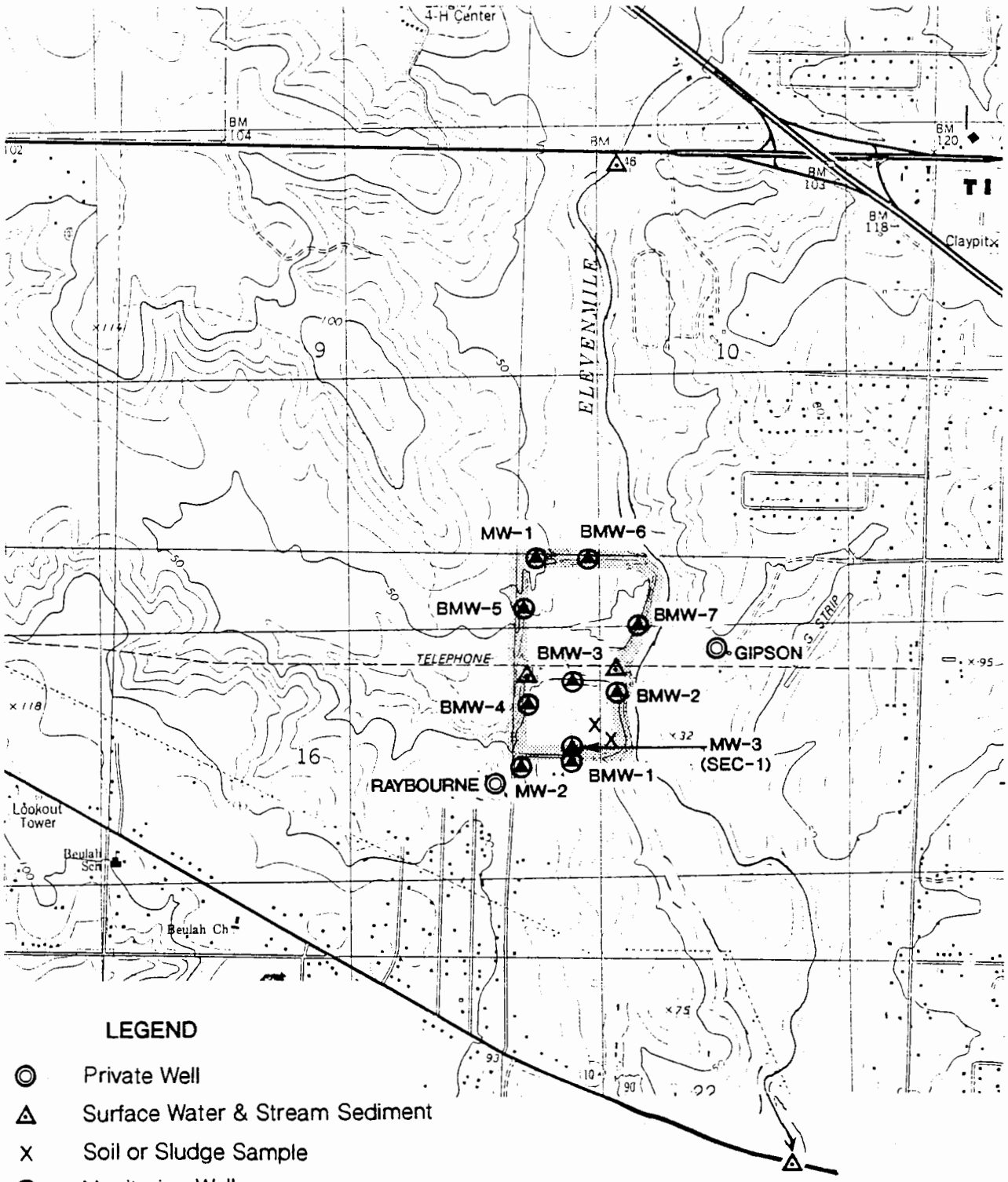


Figure 2.9

APPROXIMATE SAMPLING LOCATIONS
BEULAH LANDFILL SITE



(SOURCE: USGS Cantonment, Fla. quadrangle, 1987 PR)

Groundwater

Groundwater samples have been collected and analyzed from two monitoring well networks on site and from two private wells near the site. The private wells were sampled by the EPA in 1980 and 1981 as part of their initial investigations of the site. The first network of monitoring wells, MW-1 through MW-3, was sampled by Escambia County 11 times between September 1984 and February 1988. The second network, wells BMW-1 through BMW-7, was installed in 1988 as part of the Closure Plan for the Beulah Landfill. These wells were sampled 13 times between April 1988 and November 1991. Sampling of the second network continues on a quarterly basis.

Analytical results for the groundwater samples are summarized in Tables 2.3 and 2.4. The values in the tables represent the maximum value reported for each analyte in each well over all sampling rounds. The tables do not reflect the analytical results from any given sampling event. Volatile organic compounds were detected in samples from five of the 10 monitoring wells during three out of the four earliest sampling events. However, organic analyses were not performed on samples collected after June 1988. Thus, concentrations of organic compounds are not available for the eight most recent sampling events. Because of this lack of data, no estimates can be made regarding changes in concentration with time.

The ions that typically occur at elevated concentrations in leachate have been detected in the existing monitoring wells. Water from the Sand-and-Gravel Aquifer in Escambia and Santa Rosa Counties generally contains 15 to 40 mg/L total dissolved solids (TDS), 4 to 30 mg/L hardness as calcium and magnesium carbonates, and 2 to 30 mg/L chloride. The maximum TDS may reach 300 mg/L, and the maximum hardness may reach 150 mg/L carbonate (Barraclough and Marsh, 1962). For the monitoring well data, the sum of the inorganic anions and cations can be used as an approximation for TDS, and the hardness can be calculated from the calcium and magnesium concentrations. Thus, BMW-1, BMW-3, BMW-4, and BMW-7 possibly contain traces of leachate based on high TDS, hardness, and chloride values. The concentration of sodium in these four wells, and the water conductivities in BMW-3, BMW-4, and BMW-7 also appear to indicate traces of leachate. Comparison of TDS, hardness, and water conductivities from wells BMW-5 and MW-1 with literature values suggest these wells are indicative of background at the site.

TABLE 2.3
SUMMARY OF GROUNDWATER ANALYSES
SEPTEMBER 1984 TO APRIL 1990
(MAXIMUM ANALYTE LEVELS FOR EACH MONITORING WELL SHOWN)

Parameter	MW-1	MW-2	MW-3	BMW-1	BMW-2
Organics (EPA 624, 625, and 608) (μg/L)	ND (1)	bis(chloro-methyl) ether: 2	ND	ND	ND
Phenols	0.029	0.048	0.003	NA	NA
BOD	NA (2)	NA	NA	203	167
TOC	43	NA	43	9	3
pH (lowest)	4.9	6.24	3.6	4.4	4.8
Conductivity	120	140	320	276	38
Residue, filterable	NA	NA	NA	653	52
Hardness (3)	4.2	18	2.9	37	10
Bicarbonate	4.88	22	3.7	37.3	23.1
Chloride	13.3	19	8	74.6	39
Cyanide	<0.005	<0.005	<0.005	NA	NA
Fluoride	0.28	0.28	0.26	NA	NA
Nitrate, nitrite	1.2	3.7	1.3	0.44	0.11
Sulfate	5	<1	13.2	4	7
Antimony	1.78	1.72	<0.1	NA	NA
Arsenic	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	<0.1	<0.1	<0.1	0.1	<0.1
Beryllium	<0.001	<0.001	0.001	NA	NA
Cadmium	0.004	0.005	0.012	0.014	0.002
Calcium	0.32	2.3	0.11	6.93	2.65
Chromium	0.03	0.018	0.015	0.005	0.009
Copper	0.099	0.07	0.057	0.08	0.03
Iron	31	12.5	15.7	1.3	5.29
Lead	0.06	0.07	0.07	0.03	0.02
Magnesium	0.82	3	0.65	4.8	0.84
Manganese	0.275	0.07	0.15	0.59	0.39
Mercury	0.0019	0.0005	0.0016	0.0001	0.0001
Nickel	0.04	0.02	0.02	NA	NA
Potassium	NA	NA	NA	4.05	0.68
Selenium	<0.001	<0.001	<0.001	0.002	0.006
Silver	0.007	0.004	0.001	0.006	0.007
Sodium	3.7	9.9	2	44.83	12.54
Thallium	<1.0	<1.0	<0.1	NA	NA
Zinc	0.117	0.041	0.056	0.17	0.23

Units in mg/L except for pH (standard units), conductivity (umhos/cm), and organics (μg/L)
(1) ND = Not Detected
(2) NA = Not Analyzed
(3) Hardness = 2.5*(calcium concentration) + 4.1*(magnesium concentration)

TABLE 2.3--Continued
SUMMARY OF GROUNDWATER ANALYSES
SEPTEMBER 1984 TO APRIL 1990
(MAXIMUM ANALYTE LEVELS FOR EACH MONITORING WELL SHOWN)

Parameter	BMW-3	BMW-4	BMW-5	BMW-6	BMW-7
Organics (EPA 624, 625, and 608) (μg/L)	chlorobenzene 3	benzene 2 chlorobenz.3 dieldrin 0.04	chlorobenz. 3 TCE 11	ND(1)	benzene: 5 chlorobenz.: 5
Phenols	NA (2)	NA	NA	NA	NA
BOD	219	211	91	127	212
TOC	35	33	7	6	63
pH (lowest)	6.2	6.5	5.3	4.8	5.9
Conductivity	864	1961	171	51	1752
Residue, filterable	419	731	40	28	522
Hardness (3)	300	380	14	6.8	290
Bicarbonate	315.3	817.4	26.5	22.2	552
Chloride	342	828.8	7	14.8	89.8
Cyanide	NA	NA	NA	NA	NA
Fluoride	NA	NA	NA	NA	NA
Nitrate, nitrite	0.14	0.55	0.08	0.08	0.08
Sulfate	58	86	4	2	56
Antimony	NA	NA	NA	NA	NA
Arsenic	0.002	<0.001	<0.001	<0.001	0.015
Barium	0.22	0.32	<0.1	<0.1	0.11
Beryllium	NA	NA	NA	NA	NA
Cadmium	0.006	0.004	0.002	0.002	0.005
Calcium	103.41	114.83	2.32	1.67	76.1
Chromium	0.087	0.019	0.013	0.003	0.009
Copper	0.1	0.02	0.03	0.06	0.03
Iron	31	63.8	4.48	0.46	68.65
Lead	0.06	0.12	0.02	0.01	0.05
Magnesium	10.9	23.43	2	0.65	23.3
Manganese	13.9	28.4	0.47	0.72	47.1
Mercury	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	NA	NA	NA	NA	NA
Potassium	34.9	49.93	0.62	0.63	51.3
Selenium	0.001	0.001	<0.001	<0.001	0.001
Silver	0.058	0.083	0.025	0.006	0.03
Sodium	51.83	79.05	20.44	9.25	80.7
Thallium	NA	NA	NA	NA	NA
Zinc	0.1	0.17	0.07	0.07	0.06

Units in mg/L except for pH (standard units), conductivity (umhos/cm), and organics (μg/L)
(1) ND = Not Detected
(2) NA = Not Analyzed
(3) Formula for Hardness: H = 2.5*(calcium concentration) + 4.1*(magnesium concentration)

TABLE 2.4
SUMMARY OF PRIVATE WELL WATER ANALYSES
(SAMPLES ANALYZED 1980 AND 1981)

Analyte	J. C. Raybourn Well	A. L. Gipson Well
Priority Pollutant Organics [1]	ND[2]	ND
Nitrate/nitrite (mg/L)	2.40	0.85
Aluminum (μg/L)	ND	NA[3]
Barium (μg/L)	40	NA
Calcium (μg/L)	1,500	NA
Chromium (μg/L)	ND	NA
Magnesium (μg/L)	1,600	NA
Sodium (μg/L)	3,400	NA
Strontium (μg/L)	14	NA
Titanium (μg/L)	14	NA
Zinc (μg/L)	69	20

(1) Includes NRDC list volatiles, pesticides/PCBs, base/neutral compounds and acid compounds.
(2) ND = Not Detected
(3) NA = Not Analyzed

Numerous trace metals have been detected in groundwater samples from the Beulah Landfill. Of the metals analyzed, the following may cause concern for human health or environmental exposure:

Antimony	Lead
Arsenic	Mercury
Barium	Selenium
Cadmium	Silver
Chromium	Thallium
Copper	Zinc

The analytical results showed only antimony, cadmium, chromium, and lead have been detected above drinking water standards. Both antimony and lead exceed the standard in MW-1, a background well, suggesting these metals occur naturally at high levels. The reported levels of cadmium and chromium are only slightly above the standard, and should be confirmed by additional sampling.

The conclusions of the preceeding paragraphs are tentative and subject to confirmation. The existing data are incomplete, inconsistent, and have not been verified by rigorous analysis of quality assurance data. Charge balance calculations using concentrations of major anions and cations (bicarbonate, chloride, sulfate, calcium, iron, magnesium, potassium, and sodium) provide some measure of the analytical data quality. Of 63 analyses reviewed: anions exceeded cations in 21 analyses; cations exceeded anions in 33 analyses; and the anion-cation difference was less than 5 percent in only 9 analyses. Excess cations may be a result of the acid preservative added to unfiltered samples which dissolves metal ions bound to suspended clay particles and dissolves colloidal iron hydroxides. Excess anions may indicate analytical errors, interference between cations (causing apparently lower cation concentrations), or incomplete analysis of the cations.

Water samples from two private wells near the Beulah Landfill site were analyzed by the EPA in 1980 and 1981; the results are summarized in Table 2.4. The Gipson well was designated as being upgradient of the landfill (Figure 2.10). However, the presence of Elevenmile Creek between the well and the landfill site, and the vertical and horizontal gradients beneath the landfill, indicate the Gipson well is not representative of groundwater conditions upgradient of the landfill. Water levels were not measured in the Raybourne well, located about 300 feet southwest of the landfill. However, if the shallow groundwater contours mimic the surface topography, then it can be assumed that the Raybourne well is also upgradient from the landfill.

No organic compounds were detected in water samples from the Raybourne or Gipson wells. Inorganic analyses detected nitrate/nitrite, calcium, magnesium,

sodium, and zinc in the Raybourne well; results were not reported for other anions or for conductivity. Samples were not collected during subsequent sampling events; therefore, comparisons between the Raybourne and Gipson wells and the on-site monitoring well analyses cannot be made. In general, nitrate/nitrite concentrations in the monitoring wells averaged 0.27± 0.59 mg/L, and exceeded 1 mg/L in only 4 out of 66 analyses. Zinc concentrations in monitoring wells averaged 69 μg/L; this is the same concentration detected in the Raybourne well. Calcium, magnesium, and sodium concentrations in wells BMW-1, 3, 4, and 7 are above the Raybourne well, again suggesting these wells may contain traces of leachate.

Surface Water and Stream Sediment

Surface water and stream sediment samples were collected and analyzed by the EPA in 1980 and 1981, and the FDER in 1980. The results of the surface water analyses are summarized in Table 2.5. Samples were collected from Elevenmile Creek at a point 1.2 miles upstream of the northernmost landfill boundary and at a point 1.4 miles downstream of the southernmost landfill boundary. With the exception of zinc and nitrate/nitrite, the concentrations of all analytes in Elevenmile Creek decrease with distance downstream. Zinc increased from 27 μg/L to 78 μg/L. Nitrate/nitrite ranged from 0.63 to 0.65 ppm. Insufficient data exist to attribute these increases to leachate from the landfill. Water samples from Coffee Creek were collected at two separate locations. Concentrations of the inorganic parameters were well below those in Elevenmile Creek. No organic compounds were detected in any of the surface water samples, with the exception of a tentative identification of hydroxymethoxybenzaldehyde from the upstream Elevenmile Creek sample.

In December 1984, the FDER performed a toxicity bioassay on water from Coffee Creek to evaluate the potential toxicity of leachate which may enter the creek. Small populations of Daphnia pulex (water flea) and Notropis leedsi (banner-fin shiner) were exposed to five aliquots of the surface water, and the number of mortalities over a 72-hour period were tabulated. Compared with a control group, only random mortalities were noted during the D. pulex test, and no mortalities were observed during the N. leedsi test. Chemical analysis did not detect any organic or metal contaminants in the water samples. The FDER Biology section concluded that the creek water was not acutely toxic to the test organisms.

Stream sediment samples have been collected concurrently with and from the same locations as the surface water samples. The analytical results are summarized in Table 2.6. No organic compounds were detected in any of the stream sediment samples. The concentrations of metals in the sediment are most likely a result of the sediment's natural mineralogic composition.

TABLE 2.5
SUMMARY OF SURFACE WATER ANALYSES

Analyte	Elevenmile Creek Upstream (1)	Elevenmile Creek Downstream (2)	Coffee Creek (3)
Priority Pollutant Organics	hydroxymethoxy-benzaldehyde (tentative ID, not quantified)	ND (4)	ND
Aluminum (ug/L)	2,700	1,800	500
Barium (ug/L)	86	77	0
Calcium (ug/L)	34,000	30,000	2,600
Chromium (ug/L)	29	24	0
Magnesium (ug/L)	2,100	1,900	900
Sodium (ug/L)	180,000	157,000	4,200
Strontium (ug/L)	79	70	12
Titanium (ug/L)	37	25	24
Zinc (ug/L)	27	78	NA (5)
Chloride (ppm)	87	61	10
Phosphate (ppm)	0.25	0.2	0.04
Nitrate/nitrite (ppm)	0.63	0.65	0.41
Nitrogen-organic (mg/L)	2.34	1.67	0.51
NH3 N-Total (ppm)	0.77	0.56	0.41
pH (standard units)(lab)	8.32	7.94	7.01
conductivity (umho/cm)	562	361	38
BOD (mg/L)	15.9	9.9	1.2
turbidity	23	20	16
color (Pt-Co units)	220	220	75
Coli MPN	2,400	2,400	2,400
Fecal MPN	2,400	1,100	460

(1) Upstream sample taken at junction of Elevenmile Creek and Highway 90A
(2) Downstream sample taken at junction of Elevenmile Creek and Highway 90
(3) Metals/PP Organics sample taken west of bridge crossing Coffee Creek; other sample taken at junction of Elevenmile Creek and Coffee Creek
(4) ND = Not Detected
(5) NA = Not Analyzed
Sources of data: USEPA 1980,1981; FDER 1980

TABLE 2.6
SUMMARY OF STREAM SEDIMENT AND SOIL ANALYSES

Analyte	Elevenmile Creek Upstream (1)	Elevenmile Creek Downstream (2)	Coffee Creek (3)	Landfill Soil (4)
Priority Pollutant Organics (5)	ND (6)	ND	ND	ND
Aluminum (mg/kg)	1,975	600	10,600	4,900
Barium (mg/kg)	ND	ND	6	15
Calcium (mg/kg)	ND	ND	145	600
Chromium (mg/kg)	3	2	12	6
Copper (mg/kg)	ND	ND	3	1.0
Iron (mg/kg)	1,200	275	9750	1,750
Magnesium (mg/kg)	20	120	88	225
Manganese (mg/kg)	ND	ND	35	10
Strontium (mg/kg)	ND	ND	2	5
Titanium (mg/kg)	115	140	250	175
Vanadium (mg/kg)	4	1.0	18	6
Yttrium (mg/kg)	ND	ND	2	4
Zinc (mg/kg)	1.0	1.0	3	3

(1) Upstream sample taken at junction of Elevenmile Creek and Highway 90A.

(2) Downstream sample taken at junction of Elevenmile Creek and Highway 90.

(3) Sample taken west of bridge crossing Coffee Creek.

(4) Sample taken on landfill slope between Elevenmile Creek and disposal pits.

(5) Includes NRDC list volatiles, pesticides/PCBs, base/neutral compounds and acid compounds.

(6) ND = Not Detected.

Soil and Sludge

During the 1980 EPA investigation, a single soil sample and a single sludge sample were collected and analyzed. The actual sampling locations were poorly documented, being described simply as the far southeastern corner of the landfill. The results of the soil analyses are summarized in Table 2.6, and of the sludge analyses in Table 2.7. Although described by EPA as a "leachate saturated soil," no organic compounds were detected. The metals concentrations most likely reflect the mineralogic composition of the soils at the site. Without analysis of background soils, this soil analysis cannot be used to ascertain presence of metals above background concentrations. The sludge analysis identified several organic compounds and metals. The lack of an adequately documented sampling location limits the usefulness of the analysis, although it suggests zinc is a compound of concern.

In March 1985, Escambia County completed a monitoring plan for the Beulah Landfill. As part of the associated investigation, samples from the sludge ponds were collected and composited. The sludge sample analyzed was a composite of 10 samples from each of 15 locations over a 5 acre area; the actual sampling locations were not documented. Parameters analyzed included total nutrients, five heavy metals, percentage solids, and pH. Also tested was the reactivity, toxicity, ignitability, and corrosivity. The analytical results are summarized in Table 2.7. The analyses did not include testing for polynuclear aromatics, PCBs, phenols, or chlordane derivatives reportedly detected in the EPA sampling. Therefore, the presence and concentration of these compounds in the sludge remains unverified.

Landfill Gases

During the course of the investigations for a landfill monitoring plan, a "sniffer survey" was performed around the perimeter of the property. The purpose of this survey was to determine if methane gas was detected below the ground surface. The survey was conducted by pushing the probe tube of an Explosimeter/Combustible Gas Indicator into the ground at each test location. The depth sampled was between 6 and 8 inches. The instrument measured the concentrations of combustible gases or vapors as a percent of the lower explosive limit (LEL). The LEL is 5 percent by volume methane in air. The "sniffer survey" detected highest readings of about 40 percent LEL on the southwest section of the property, and 25 percent LEL along Coffee Creek. The values suggest methane concentrations at Beulah Landfill are not dangerous due to the loose sandy soils which vent freely to the atmosphere.

TABLE 2.7
SUMMARY OF SLUDGE ANALYSES

USEPA 1980	Escambia County 1985
Anthracene - 40 mg/kg	Cyanide - 1.62 mg/kg
Naphthalene - 40 mg/kg	Sulfide - 120 mg/kg
Fluoranthene - 40 mg/kg	Total nitrogen - 0.064 %
Pyrene - 40 mg/kg	Total phosphorus - 0.035 %
Pentachlorophenol - 20 mg/kg	Total potassium - 0.015 %
PCB-1260 - 0.560 mg/kg	Barium - 0.35 mg/kg
Hexadecanoic acid - 530 mg/kg	Cadmium - 4.4 mg/kg
Alpha-chlordane - 0.400 mg/kg	Copper - 287 mg/kg
Gamma-chlordane - 0.400 mg/kg	Lead - 158 mg/kg
Hydroxychlordene - 0.200 mg/kg	Mercury - 0.0008 mg/kg
	Nickel - 51 mg/kg
Copper - 1,050 mg/kg	Zinc - 650 mg/kg
Zinc - 1,530 mg/kg	Total solids - 37.1 %
	pH - 6.75 Standard Units
	E.P. Toxicity Test pesticides - ND
	Flashpoint - > 100 C

ND = Not Detected

SECTION 3
SITE DYNAMICS

INITIAL EVALUATION

An understanding of the dynamics between the site and its environs, including potential receptors both human and environmental, is essential to scoping the RI/FS. This section discusses a conceptual site model describing the dynamics of the Beulah Landfill.

Conceptual Site Model

Figure 3.1 summarizes a conceptual model for a landfill. Table 3.1 shows the preliminary evaluation of potential exposure pathways under current and future uses of the site. Organics and inorganics may be released from the landfill to the groundwater by leaching caused by compaction dewatering and/or by percolation. Leachate in groundwater may discharge to nearby surface waters. Landfill gases may migrate by dissolving in groundwater or may vent into the atmosphere.

Receptors at and/or near the site may include future site workers, trespassers, residents and area workers. Future site workers and trespassers may dermally contact the exposed wastes. Residents and area workers may contact groundwater through ingestion, inhalation, and/or dermal contact. Future site workers, trespassers, residents and/or area workers may contact landfill gases through inhalation. Environmental receptors include organisms that inhabit nearby creeks or who eat creek biota.

Preliminary Exposure Assessment

Exposure pathways to human and environmental receptors are identified in order to define the preliminary remediation goals. Exposure pathways describe how a chemical moves from its source to a receptor. Characterization of an exposure pathway includes identifying a source, release mechanism(s), and the transport and fate of the chemical.

Chemicals Previously Detected at the Site

The types of waste disposed at the landfill are briefly discussed in Section 2 of this report. The types of chemicals and the maximum concentrations detected in the

TABLE 3.1
PRELIMINARY HUMAN AND ENVIRONMENTAL EXPOSURE PATHWAYS

Source	Environmental Medium	Mechanism of Transport	Exposure Point	Route	Potential Receptors	Exposure Potential
Chemicals in sludge or wastes	Sludge/soil	Erosion	Onsite	Ingestion Dermal Absorption	Future Site Workers Trespassers Terrestrial Wildlife	High - exposed at surface Low - if capped
		Excavation	Onsite	Ingestion Dermal Absorption Inhalation	Future Site Workers	High - during excavation activities
	Groundwater	Leaching	Onsite	Ingestion Dermal Absorption Inhalation	Users of onsite groundwater	Low - minimal potential use because of Landfill
			Offsite	Ingestion Dermal Absorption Inhalation	Offsite groundwater users	Low - present Sand-and-Gravel aquifer use upgradient of Landfill
	Air	Landfill Gas	Onsite	Inhalation	Future Site Workers	Medium - potential migration in soil/groundwater; potential exposure during site investigation
		Landfill Gas	Offsite	Inhalation	Residents Area Workers	Low - potential migration in soil/groundwater; potential exposure during site investigation
	Surface Water/ Sediment	Leaching	Creeks	Ingestion Bioconcentration	Aquatic and terrestrial organisms	Depends on attenuation and dilution. Available data suggest low to medium exposure potential.
			Creeks	Ingestion of fish which bioconcentrate contaminants	Consumers of fish	Depends on degree and frequency of exposure and amount ingested. Available data suggest low to medium exposure potential.
			Creeks	Ingestion Dermal Absorption Inhalation	Recreational users of surface waters	Depends on degree of exposure and dilution. Available data suggest low to medium exposure potential.

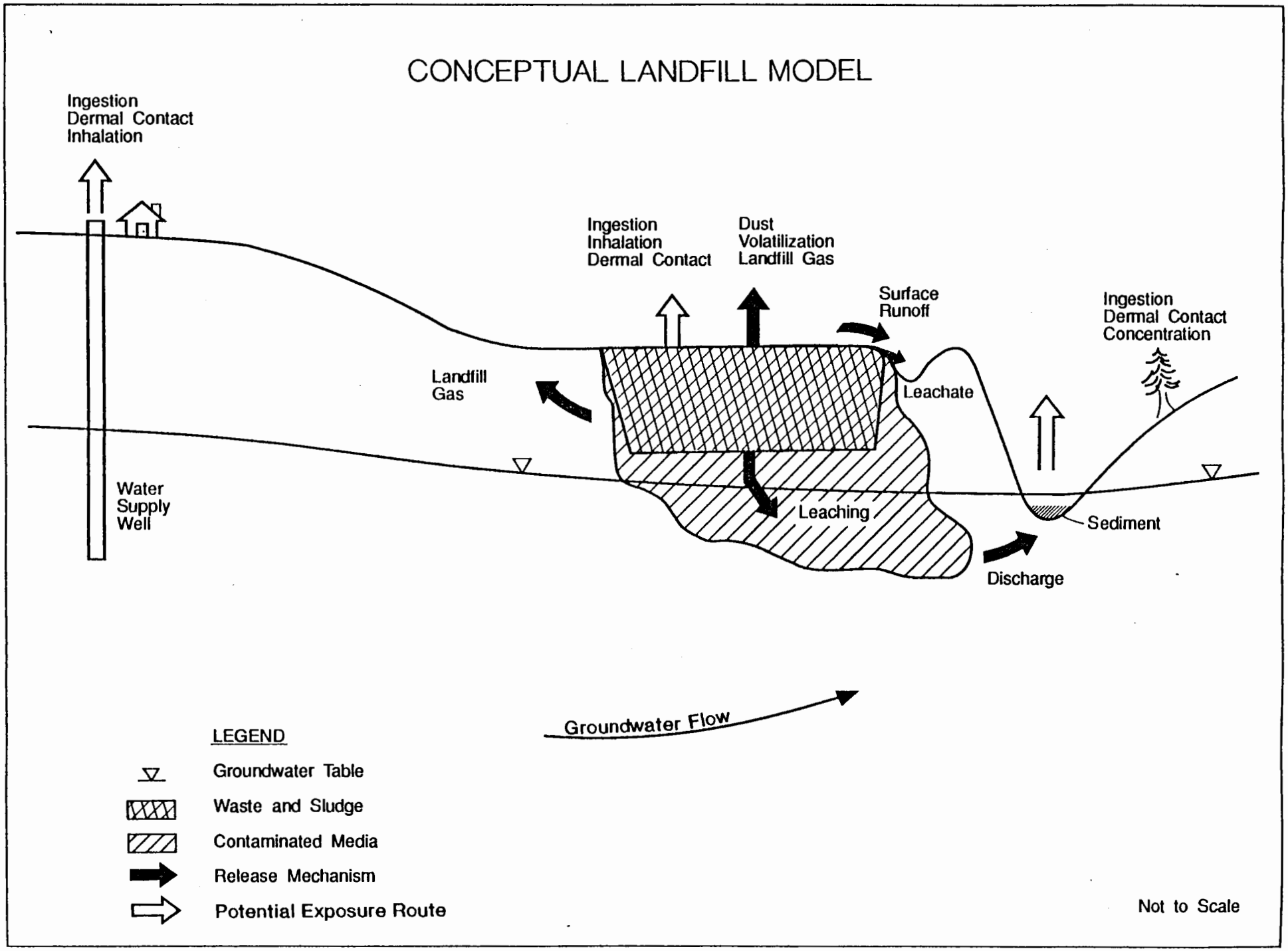

CONCEPTUAL LANDFILL MODEL
Ingestion
Dermal Contact
Inhalation
Ingestion
Inhalation
Dermal Contact
Dust
Volatilization
Landfill Gas
Surface
Runoff
Ingestion
Dermal Contact
Concentration
Landfill
Gas
Leachate
Water
Supply
Well
Leaching
Sediment
Discharge
Groundwater Flow
LEGEND
Groundwater Table
Waste and Sludge
Contaminated Media
Release Mechanism
Potential Exposure Route
Not to Scale

Figure 3.1

groundwater, surface water, stream sediment, and sludge are summarized in Tables 2.3 through 2.7. The testing to date has detected the following suspected contaminants:

benzene	pentachlorophenol
chlorobenzene	chlordane-derivatives
trichloroethylene	PCB-1260
anthracene	copper
naphthalene	lead
pyrene	zinc.

Contaminant Sources

The following wastes disposed at the Beulah Landfill site are the potential contaminant sources:

- Domestic septage and wastewater treatment sludges
- Chemicals distributed in the solid wastes
- Media that may have become contaminated by wastes (e.g. groundwater, surface water, and sediments of Coffee Creek and Elevenmile Creek).

Release Mechanisms

Mechanisms for contaminant release at the site include:

- Leaching of contaminants into the groundwater
- Leachate seeps discharging into adjacent soils and surface waters
- Erosion of cover material and perimeter berm, exposing landfill contents and allowing release by runoff
- Release of landfill gases.

Contaminant Transport

The primary transport mechanisms to be evaluated during the RI include groundwater flow, release from leachate seeps, and surface water runoff.

Leaching of contaminants from the landfill contents may be indicated by detection of chlorinated organic compounds at low levels and the concentrations of major cations and anions in a few wells. This release mechanism is of concern at the site because it has the potential to add contaminants to the environment and to affect receptors via both surface water and groundwater use. Releases may occur from low-rate infiltration from contaminated soils or from wastes in contact with groundwater. Wastes may also be exposed to surface runoff as a result of erosion; however, most of the surface runoff is retained by the ditch and secondary berm surrounding the northern and eastern sides of the landfill.

Contaminant Migration

Several migration pathways are possible, depending on the sorption characteristics of the specific chemicals and the soils. Dissolved chemicals in shallow groundwater will migrate downgradient, and may eventually reach potential receptors offsite. The upward vertical gradient observed in the well cluster SEC-1 suggests that deep migration of contaminants is hydraulically limited. Existing data are insufficient to determine whether a contaminant plume even exists at the Beulah Landfill Site and, if so, its lateral and vertical extent.

Based on an estimated hydraulic conductivity of 3.7 ft/day in the shallow silty sand, an average hydraulic gradient of 0.0065, and an assumed effective porosity of 30 percent, the local groundwater velocity is calculated to be about 29 ft/year. Based on these parameters and an estimated time of 23 years since sludges were first deposited on the site, potential contaminants are expected to be found within about 700 feet of the site. During the last 23 years, the contaminants may also have discharged to the creeks near the site, as these are the principal discharge areas for shallow groundwater.

If chemicals in leachate seeps are released to Coffee Creek and/or Elevenmile Creek, they could eventually reach Perdido Bay. Potential receptors include aquatic and terrestrial organisms in the streams, as well as human receptors who may consume fish from Elevenmile Creek or use the creek for recreational purposes. Once contaminants reach Perdido Bay, exposure risks are expected to approach zero due to dilution.

Contaminant Fate

Low levels of organic compounds have been detected in groundwater beneath the site. Under existing site conditions, these organics are expected to be transported with groundwater to leachate seeps, or to surface waters. During transport in groundwater, the contaminants are subject to adsorption, hydrolysis, and biological degradation under aerobic or anaerobic conditions. Chemicals entering surface waters may be adsorbed to sediments or absorbed by aquatic organisms. Exposure to aerobic conditions and sunlight may lead to volatilization, biological transformation, hydrolysis, or photolysis. Primary mechanisms affecting the migration and fate of the organic compounds are expected to be adsorption on sediment, volatilization and/or degradation, and absorption by aquatic organisms.

The fate of dissolved metals (i.e., copper, lead, and zinc) depends on such variables as pH, Eh, concentrations of organic materials and adsorbents, contact with iron and manganese oxides, and biological activity. The dominant fate of copper, lead, and zinc in aerobic waters is sorption by hydrous iron and manganese oxides, clay minerals, and organic material. Precipitation is an important control on mobility of these metals under reducing conditions. All three metals are bioaccumulated by aquatic organisms.

Exposure Pathways

Potential exposure pathways associated with the Beulah Landfill site are shown in Table 3.1. The pathways having the greatest exposure potential are:

- Release of contaminants from leachate seeps to surface waters and subsequent exposure to aquatic and terrestrial organisms in the creeks; and
- Erosion of soil materials covering the landfill contents.

Identification of these exposure pathways is used to develop the remedial action objectives and general remedial alternatives in the following section.

SECTION 4
PRELIMINARY IDENTIFICATION OF GENERAL REMEDIAL ACTION ALTERNATIVES

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Remedial actions conducted at CERCLA sites are required to attain a level or standard of control at least equivalent to Applicable or Relevant and Appropriate Requirements (ARARs) under Federal, State, and local laws. "Applicable Standards" are those cleanup or control standards and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a site having contamination. "Relevant and appropriate requirements" are those criteria or control standards and other substantive environmental protection requirements, criteria or limitations promulgated under Federal or State law that, while not "applicable", address problems or situations sufficiently similar to those encountered at the site so that their use is well suited to the particular site.

There are three primary categories of ARARs:

- Chemical-specific
- Location-specific, i.e. wetlands limitations or historic sites
- Action-specific, i.e. performance and design standards

These three types of ARARs are discussed in turn.

CHEMICAL-SPECIFIC ARARS

USEPA considers Federal drinking water Maximum Contaminant Levels (MCL), Maximum Contaminant Level Goals (MCLG), Federal Ambient Water Quality Criteria (AWQL), National Ambient Air Quality Standards (NAAQs) and State environmental standards to be potential chemical specific ARARs for surface water, groundwater, and air. Table 4.1 lists ARARs for suspected contaminants which have been identified at the Beulah Landfill site. Since many of these compounds do not have established regulatory limits, Table 4.1 also includes proposed criteria. FDER has issued groundwater guidance concentrations (Feb. 1989) which are to be used for screening groundwater to determine presence of contamination. The document specifically states; however, "The guidance

TABLE 4.1
POTENTIAL CHEMICAL-SPECIFIC ARARS

Chemical	Safe Drinking Water Act (1) Current MCL µg/L	Safe Drinking Water Act (1) Current MCLG µg/L	Safe Drinking Water Act (1) Proposed MCL µg/L	Safe Drinking Water Act (1) Proposed MCLG µg/L	Clean Water Act(1) For Consumption of Water and Organisms µg/L	Clean Water Act(1) For Consumption of Organisms Only µg/L	State of Florida: Groundwater Quality Standards for Class G-II Groundwater[2] µg/L	State of Florida: Surface Water Quality Standards(9) Recreation, Fish and Wildlife Class III Fresh Water µg/L	State of Florida: Drinking Water Standards(11) Primary mg/L	State of Florida: Drinking Water Standards(11) Secondary mg/L
Anthracene	–	–	–	–	0.0028(7)	0.0311(7)	–	–	–	–
Chlordane	2.0	–	2(4)	0(4)	0.00058(6)(7)	0.00059(6)(7)	–	<0.01	–	–
Fluoranthene	–	–	–	–	42	54	–	–	–	–
Naphthalene	–	–	–	–	–	–	–	–	–	–
PCB-1260	0.5	–	0.5(4)	0(4)	0.000044(6)(7)	0.000045(6)(7)	–	<0.001	–	–
Pentachlorophenol	1.0	–	1(5)	0.001(5)	1000(6)	29,000(6)	–	–	–	–
Benzene	5	0	1.2(6)(7)	0(6)(7)	1	–	–	–	0.001	–
Chlorobenzene	–	–	–	–	488	–	–	–	–	–
Trichloroethylene	5	0	–	–	2.7(7)	81(7)	3	–	0.003	–
Chromium (III)	100	–	100	100	33,000(6)	670,000(6)	50	50(10)	0.05	–
Copper	Treatment	1,300	–	–	1,300(6)	–	1,000	30	–	1
Lead	15	0	–	–	50	–	50	30	0.05	–
Zinc	–	–	–	–	–	–	5,000	30	–	5
Iron	300	–	–	–	–	–	–	1,000	–	0.3
Manganese	50	–	–	–	–	–	50	–	–	0.05

(1) Sources: "Fact Sheet: Drinking Water Regulations Under the Safe Water Act," Criteria and Standards Division, Office of Drinking Water, U.S. EPA, Washington, D.C., May 1990.
Phase II Fact Sheet: National Primary Drinking Water Regulations for 38 Inorganic and Synthetic Organic Chemicals,"" Office of Drinking Water, U.S. EPA, Washington, D.C., January 1991.
55 FR pages 30371 through 30425, Wednesday, July 25, 1990; Pg. 26548, Friday, June 7, 1991.
"ARARs Q's and A's: Compliance With Federal Water Criteria," Office of Solid Waste and Emergency Response, U.S. EPA, June 1990.
(2) Source: Section 17-550.310 Sec. 1-4, Florida Administrative Code
(3) Some of the ions that may be used for plume mapping (i.e., sodium, calcium, chloride, sulfate) do not have chemical-specific ARARs associated with them. These parameters are analyzed for use as conservative indicators in determining the extent of groundwater contamination.
(4) Proposed MCLs and MCLGs become effective July 1992
(5) Levels for pentachlorophenol are proposed. Final levels will be established by July 1991
(6) Criteria revised to reflect current agency guidelines or RfD as contained in the Integrated Risk Information System
(7) Criteria based on carcinogenity
(8) Secondary Maximum Contaminant Levels
(9) Florida Department of Environmental Regulations, Table of Surface Water Quality Standards (17-302.530), 1991.
(10) Chromium shall not exceed 0.50 mg/L hexavalent or 1 mg/L total chromium in effluent discharge and shall not exceed 0.05 mg/L total chromium after reasonable mixing in the receiving waters.
(11) Proposed Florida Department of Environmental Regulations, Primary and Secondary Drinking Water Standards Maximum Concentrations (17-550.320), 1991.

concentrations are not standards" and "without further justification cannot be used as Standards."

Florida has established three types of surface water quality standards; minimum standards for all surface waters, standards according to designated use, and special protection for waters designated as Outstanding Florida Waters. Minimum standards, found in Section 17-302.500, Florida Administrative Code (FAC), require that all surface waters of the state shall, at all places and at all times, be free from:

1. Domestic, industrial, agricultural, or other man-induced non-thermal components of discharges which, alone or in combination with other substances or in combination with other components of discharges (whether thermal or non-thermal):
   a. Settle to form putrescent deposits or otherwise create a nuisance; or
   b. Float as debris, scum, oil, or other matter in such amounts as to form nuisances; or
   c. Produce color, odor, taste, turbidity or other conditions in such degree as to create a nuisance; or
   d. Are acutely toxic; or
   e. Are present in concentrations which are carcinogenic, mutagenic, or teratogenic to human beings or to significant, locally occurring wildlife or aquatic species; or
   f. Pose a serious threat to the public health, safety or welfare.
2. Thermal components of discharges which, alone, or in combination with other discharges or components of discharges (whether thermal or non-thermal):
   a. Produce conditions so as to create a nuisance; or
   b. Do not comply with applicable provisions of Subsection 17-302.500 [2 (part b)], FAC

The use categories established by Florida for additional surface water quality standards (Section 17-302.400, FAC) are as follows:

- Class I - Potable Water Supplies
- Class II - Shellfish Propagation or Harvesting
- Class III - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife
- Class IV - Agricultural Water Supplies
- Class V - Navigation, Utility and Industrial Use

Florida has also established two types of groundwater quality criteria, minimum criteria and standards according to designated use. The minimum criteria (Section 17-302.500, FAC) require that all groundwater at all places, and at all times shall be free of contaminants resulting from man-made discharges in concentrations, which, alone or in combination with other contaminants:

1. Are harmful to plants, animals, or organisms in soils,
2. Are carcinogenic, mutagenic, teratogenic, or toxic to humans unless specific criteria have been established,
3. Are acutely toxic to indigenous species in surface waters affected by groundwater borne contaminants,
4. Pose a serious danger to public health, safety, or welfare,
5. Create or constitute a nuisance, or
6. Impair the reasonable and beneficial use of adjacent waters.

All groundwater in Florida is classified according to designated use as follows (Section 17-3.403, FAC):

Class G-I	Potable water use, groundwater in single-source aquifers which has a total dissolved solids content of less than 3,000 mg/L, and which has been classified G-I by the Environmental Regulation Commission.
Class G-II	Potable water use, groundwater in aquifers which has a total dissolved solids content of less than 10,000 mg/L, unless otherwise classified by the Commission.
Class G-III	Non-potable water use, groundwater in unconfined aquifers which has a total dissolved solids content of 10,000 mg/L or greater, or that has total dissolved solids of 3,000 to 10,000 mg/L and either has been reclassified by the Commission as having no reasonable potential as a future source of drinking water, or has been designated by the Department as an exempted aquifer pursuant to Rule 17-28.130(3), FAC
Class G-IV	Non-Potable water use, groundwater in confined aquifers which has a total dissolved solids content of 10,000 mg/L or greater

The additional criteria for Class G-I and G-II groundwater are the Primary and Secondary Drinking Water Standards [Rule 17-4.245(8), FAC]. These additional criteria are listed in Table 4.1 for suspected contaminants and are considered ARARs.

To date, neither the Federal government nor Florida has established ARARs for soil or sediments.

LOCATION-SPECIFIC ARARS

A site's location is a crucial element of its potential effect on human health and the environment. Location-specific ARARs are existing Federal, State and (sometimes) local regulations and policies that restrict the concentrations of hazardous substances or specific actions because of a site's location. Specific locations that receive extra protection include floodplains, wetlands, endangered species habitats, and historic places. Table 4.2 presents the location specific ARARs that may apply to activities at the Beulah Landfill.

ACTION-SPECIFIC ARARs

Action-specific ARARs are usually technology- or activity-based requirements, or limitiations on actions taken with respect to hazardous substances. These requirements typically define acceptable treatment, storage, and disposal procedures for hazardous substances during the implementation of the response action. The requirements generally set performance or design standards for specific activities related to managing hazardous wastes at solid waste sites. Selected action-specific ARARs for landfill sites are shown in Table 4.3.

PRELIMINARY REMEDIAL ACTION OBJECTIVES AND GOALS

Remedial action objectives for the Beulah Landfill are to provide adequate protection to human health and the environment from:

- Dermal contact or ingestion of hazardous constituents in sludges, wastes, or soils from the landfill
- Dermal contact, ingestion, or inhalation of hazardous constituents in groundwater beneath the landfill or in groundwater that has migrated offsite
- Dermal contact or ingestion of hazardous constituents in surface water and sediments in Coffee Creek and Elevenmile Creek

Preliminary remedial action goals are based on the remedial action objectives, existing data, preliminary ARARs, and the conceptual site model. The goals are as follows:

- Prevent ingestion of groundwater with contaminants in excess of non-zero MCLGs or MCLs (where MCLGs are set at zero)
- Prevent direct contact with landfill contents
- Minimize contamination of groundwater
- Prevent dermal contact and ingestion of contaminated soils and sludges

TABLE 4.2
POTENTIAL LOCATION-SPECIFIC ARARs

Location	Requirement	Governing Regulations	Regulating Agency
Within 100-year floodplain	Landfill, treatment, storage facility must be designed, constructed, operated and maintained to avoid washout.	RCRA; 40 CFR Section 264.18(b)	Florida DER and US EPA
Critical habitat on which endangered species or threatened species depend.	Action to conserve endangered species or threatened species, including consultation with the Department of the Interior (Endangered and threatened species are listed in Section 2.11.1)	Endangered Species Act of 1973, 16 USC 1531 et seq; 50 CFR Patt 200, 50 CFR Part 402	U.S. Fish & Wildlife Service, Florida Department of Environmental Regulation
Floodplain (100-year flood)	Provide leadership and take action to reduce the risk of flood loss, to minimize impacts of floods on human safety, and to restore and preserve natural and beneficial uses served by floodplains.	Executive Order 11988, Floodplain Management	Lead Environmental Agency
Wetlands, as defined in U.S. Army Corps of Engineers regulations	No dredging or filling of wetlands is permitted without a permit.	Clean Water Act, Section 404; 40 CFR Parts 230, 33 CFR Parts 320-330	U. S. Army Corps of Engineers
Wetlands, as defined in Executive Order 11990.	Provide leadership and take action to avoid adverse effects, minimize potential harm, and preserve and enhance wetlands.	Executive Order 11990, Protection of Wetlands, 40 CFR Part 6, Appendix A, Section 4(j)	Lead Environmental Review Agency
Wetlands, as defined in Florida Statutes, 403.817, and Regulations, 17-3	No dredging, filling or adverse effects allowed without a permit. (Jurisdiction is areally less comprehensive than that of U.S. Army Corps of Engineers[1])	Florida Statutes, Title 29, Chapter 403.91 et seq; Florida Regulations, 17-3	Florida Department of Environmental Regulation

[1]Florida Department of Environmental Regulations, Ms. Ann Redman, (904) 488-4805, 11/6/89.

TABLE 4.3
POTENTIAL ACTION-SPECIFIC ARARs

Location	Requirement	Governing Regulations	Regulating Agency
Capping	Cover must be designed and constructed to minimize infiltration, promote drainage but minimize erosion, accommodate settling, prevent run-on and exposure of wastes	RCRA, 40 CFR 264.310(a), 40 CFR 264.258(b)	USEPA, Florida DER
Excavation/Removal	Materials excavated may trigger land ban restrictions	RCRA, 40 CFR 268 (Subpart D)	USEPA
	Excavation must be controlled to meet odor and fugitive emissions requirements	CAA, Section 101 and 40 CFR 52	USEPA and Florida DER
Treatment	For groundwater, air-stripping as a treatment method must meet regulatory requirements for fugitive emissions and odor	CAA, Section 101 and 40 CFR 52	USEPA and Florida DER
	For soils, in-place or on-site treatment must satisfy performance standards to protect groundwater, surface water, and air quality; must limit surface or subsurface migration	RCRA, 40 CFR 264 (Subpart X)	USEPA and Florida DER

- Provide adequate protection to human health and the environment from direct contact or ingestion of surface waters or sediments that may be contaminated.
- Provide adequate protection to human health from explosive accumulations or inhalation of landfill gas

GENERAL REMEDIAL ACTION ALTERNATIVES

This section presents a summary of general remediation alternatives for soil and groundwater. Potential alternatives were selected based on technical feasibility, proven technology, long-term effectiveness, risk reduction, and probability of receiving regulatory acceptance. The selection was also influenced by recent EPA guidance for cleanup of landfills.

The EPA has published a guidance document entitled "Conducting Remedial Investigations/Feasibility Studies for CERCLA Landfill Sites (USEPA, 1991). On page ES-4, the document states:

> "Evaluation and selection of appropriate remedial action alternatives for CERCLA landfill sites is a function of a number of factors including:
>
> - Sources and pathways of potential risks to human health and the environment
> - Potential ARARs for the site (Significant ARARs might include RCRA and/or state closure requirements, and federal or state requirements pertaining to landfill gas emissions.)
> - Waste characteristics
> - Site characteristics (including surrounding area)
> - Regional surface water (including wetlands) and groundwater characteristics and potential uses..."

The document concludes (page ES-5) that:

> "Because these factors are similar for many CERCLA landfill sites, it is possible to focus the RI/FS and selection of remedy process. In general, the remedial actions implemented at most CERCLA landfill sites include:
>
> - Containment of landfill contents (i.e., landfill cap)
> - Remediation of hot spots
> - Control and treatment of contaminated groundwater and leachate
> - Control and treatment of landfill gas

Other areas that may require remediation include surface waters, sediments, and adjacent wetlands."

Although it has not been determined that any of these potential alternatives may be required at the Beulah Landfill, they are discussed in some detail below.

Excavation and Disposal in an Approved Landfill

This is a variant of the containment alternative where contaminant sources are excavated and placed in a secure landfill facility. This alternative is practical for source control where the extent of contamination in soil or sediments is well defined and an approved landfill is within a reasonable distance from the site. The major advantage of this type of remediation is that it requires no continuing maintenance. The major disadvantage is the continuing liability for the source materials. This alternative may not be practical if the contaminants of concern are dispersed in a large volume of soil.

Containment Using a Cap and Impermeable Barriers

This remedial technology is practical for source control if there is a significant amount of waste material in the unsaturated zone that will not contact groundwater. The percolation and recharge from precipitation is prevented by an impermeable cap. Impermeable vertical barriers may also be required depending on the subsurface lithology. For example, vertical barriers would be appropriate if some of the wastes are in the saturated zone and a confining bed underlies the area at a shallow depth. The cap would conform to USEPA guidance under RCRA guidelines, which recommends a three-layer system consisting of an upper vegetated soil layer, an underlain high permeability layer, and a low permeability layer, such as clay or clay plus a synthetic liner. The impermeable vertical barrier, if needed, would typically be a slurry wall using a soil bentonite clay mixture. Drawbacks to the capping approach include:

- Reduced effectiveness if contamination has already migrated beyond the waste site
- The low but significant probability of failure of the system as it ages
- Not a permanent remedy
- Requires on-going maintenance
- Requires re-evaluation every 5 years.

In-place Stabilization of Hot Spots

In-place stabilization addresses control of hot spots and includes treatment processes that decrease the surface area for leaching of chemicals to the groundwater or limit the solubility of toxic compounds. A monolithic block of treated soil is normally produced with the contaminants locked within the solidified

matrix. Possible stabilization methods include solidification using cement, cement and silicate, thermoplastics, polymers, or high temperature vitrification.

The advantages and disadvantages of this approach depend on the properties of the contaminants being stabilized and their interaction with the stabilizing medium. For example, soils contaminated with metals are best stabilized with cement that is highly alkaline, which decreases metal solubility chemically as well as mechanically. Waste materials with low water solubility and high mobility such as volatile organics are not readily stabilized.

Groundwater Withdrawal and Treatment

This is a widely used remedial technique where groundwater is already contaminated and contamination has migrated away from the contaminant source. This method is favored in situations where groundwater pumping can be used to create large drawdowns within the contaminant plume. Pumping wells or gravel filled trenches also are placed near the downgradient edge of the contaminant plume. The specific configuration is designed from knowledge of aquifer permeability, site-specific information on lithology, and the extent of contamination. Groundwater is pumped to a treatment facility and then discharged to a surface water drainage system, or to a waste treatment facility.

Potential groundwater treatments include carbon adsorption, air exchange, precipitation and filtration, air stripping of volatile organics, and biological processing. These treatments can be combined as needed. The type of treatment selected depends on the types of contaminants, their concentrations, and the remediation goal concentrations.

The principal advantage for this remedial technique is its well proven technology based on wide use over the past 20 years. The principal disadvantage is the high maintenance requirement.

Landfill Gas Control

Control of landfill gases may be needed if testing indicates active production of explosive or noxious gases. Constructing an active landfill gas collection and treatment system should be considered where (1) existing or planned homes or buildings may be adversely affected through either explosion or inhalation hazards, (2) final use of the site includes allowing public access, (3) the landfill produces excessive odors, or (4) it is necessary to comply with ARARs. Most landfills will require at least a passive gas collection system (that is, venting) to prevent buildup of pressure below the cap and to prevent damage to the vegetative cover.

Monitoring Only

Monitoring only is an appropriate alternative if the site contains waste materials with contaminant concentrations below the remedial response objectives and where the risk to human health and the environment is minimal and insufficient

to justify remedial action. The major disadvantages are the continuing possibility of future releases and the monitoring, operating, and maintenance requirements.

No Further Action

As required by the National Contingency Plan, the no-action alternative is included to assess baseline risks to human health and the environment. This alternative is applicable if no detectable contamination is found and where no change is detected in downgradient water quality compared to upgradient quality for groundwater and surface water. This alternative may also be applicable if there are no unacceptable risks to human health or the environment.

SECTION 5
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY OBJECTIVES

The objectives of the RI/FS are to:

- Complete a field program for collecting data to quantify the extent and magnitude of contamination in the groundwater, surface soils, and surface water/sediments.
- Determine if unacceptable risks exist to human health or the environment.
- Develop and evaluate remedial action alternatives if unacceptable risks are identified.

Table 5.1 shows the objectives of a RI field program for the Beulah Landfill site. The objectives of the RI/FS are expected to be met by the work described in this Plan, and the Sampling and Analysis Plan.

TABLE 5.1
REMEDIAL INVESTIGATION OBJECTIVES FOR THE BEULAH SITE

Activity	Objectives	Action
Hydrogeologic Investigation	Determine direction of groundwater flow and estimate gradients.	Replace upgradient well MW-1. Take water level measurements from existing wells, streams and impoundments.
	Determine rate of groundwater flow and evaluate the feasibility of groundwater extraction.	Perform hydraulic conductivity tests on existing wells; check water levels at a maximum of once a month during the RI.
Chemical Investigation		
Groundwater	Identify extent and type of groundwater contamination to perform an assessment of human health and environmental risks to determine if remedial action is necessary.	Collect and analyze groundwater samples.
	Determine source of groundwater contamination.	Collect and analyze groundwater samples and compare results to the landfill waste characteristics and background levels.
	Evaluate feasibility of groundwater treatment systems.	Obtain data on conventional water quality parameters.
Surface Water and Sediment	Determine viability of treatment technologies.	Collect field measurements on DO and temperature.
	Determine effect of groundwater on surface water.	Collect and compare up- and downgradient surface water and sediment samples to downgradient groundwater samples.
	Determine background concentrations in surface water and sediment.	Collect and analyze upstream water and sediment samples; include toxicity testing.
Waste Characterization	Investigate areal extent, and concentration of contaminants in the sludge ponds.	Collect and analyze samples from the surface.
Environmental Evaluation	Determine impact of landfill on nearby stream.	Collect and analyze surface water and sediment from nearby creek and stream.

SECTION 6
DATA QUALITY OBJECTIVES

Data collected during the RI will be used for site characterization, risk assessment, and remedial alternative evaluation; this corresponds to Level IV data quality as discussed below. The suspected contaminants for which the samples are to be analyzed, the analytical methods to be used, the method detection limits, and the accuracy and precision parameters are summarized in Section 3 of the Quality Assurance Project Plan (QAPP) for the RI.

Representativeness, completeness, and comparability of the data are qualitative parameters which are usually assessed after all the data have been reviewed. The term representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. The objective for representativeness will be achieved when samples are collected from proper locations. Sample locations identified in this plan were selected using available information and statistical methods to assure site coverage. A sufficient number of samples will be analyzed such that a minimum detectable relative difference of 20 percent above the sample mean is known at a type I error Level of 20 percent and a Type II error level of 20 percent. The term completeness means the amount of valid data obtained from measurement systems compared to the amount expected to be obtained under correct normal conditions. The completeness objective will be met when at least 90 percent of the data expected to be collected are shown to be valid. Data validity will be assessed using procedures described in the QAPP. The term comparability expresses the confidence with which one data set can be compared to another. The comparability objective will be achieved when at least 95 percent of the data are collected using standard methods, equipment, and procedures, as described herein and in the QAPP and SAP.

Six levels of data quality are defined in the RI/FS Guidance (EPA, 1991). These levels are described below.

- Level I - Field Screening. This level will be characterized primarily by the use of portable instruments that can provide real-time data for health and safety support. A photoionization detector (e.g. an HNU®) will be used to monitor VOC concentrations in air and in sludge/soil samples during drilling. An explosimeter will also be used during drilling to monitor the concentration of explosive gases.

- Level II - Field Analysis. This level is characterized by the use of portable analytical instruments that can be used onsite or in mobile laboratories stationed near the site. This level of data quality is not anticipated to be used during the RI.
- Level III - Non-CLP Analytical Services. Level III laboratory analyses are obtained by a commercial laboratory with or without Contract Laboratory Program (CLP) procedures. The laboratory may or may not participate in the CLP. The analytical procedures may be equivalent to those of the CLP, but without the validation or documentation procedures required of CLP analyses. The analyzed parameters are relevant to the design of the remedial action. Level III analyses will include inorganic anions, TOC, TDS, color and turbidity in groundwater and surface water.
- Level IV - CLP Routine Analytical Services. This level is characterized by rigorous QA/QC protocols, documentation, and validation. The analytical data may be qualitative or quantitative. The data will be used for risk assessment, engineering design, and cost-recovery documentation. This level is used for confirmatory sampling of sludges/soils, groundwater, and surface water. Analyses performed may include target contaminant list (TCL) organics and target analyte list (TAL) metals.
- Level V - Nonstandard Methods. These are analyses that may require method modification and/or development. Use of this level is not anticipated.
- Other. This category includes data obtained to aid in the engineering design of alternatives. Included are laboratory analysis of soil characteristics, and field determinations of pH, DO, and conductivity.

All water, sediment, and soil samples for this RI will be analyzed for full scan TCL-TAL compounds using Level IV services. These methods are described in detail in the SAP and QAPP.

SECTION 7
RI/FS TASKS

The field investigation is conducted to provide data that can be used to determine the type and extent of contamination at the site and to identify whether or not the site poses risks to human health and the environment. The RI/FS tasks described in this work plan have been developed to meet these objectives. This section of the work plan follows the standard format outlined in the Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988) as modified by EPA guidance (EPA, 1991) for RI/FS at landfill sites. Evaluation of the existing data was done before developing this Work Plan.

RI/FS Tasks

The following tasks have been identified for the RI/FS:

- Task 1 - Project Planning
- Task 2 - Community Relations Activities
- Task 3 - Field Investigations
  - Subtask 3A - Field Support
  - Subtask 3B - Installation of Background Well
  - Subtask 3C - Sampling Site Identification and Preparation
  - Subtask 3D - Waste Characterization Sampling
  - Subtask 3E - Groundwater Sampling
  - Subtask 3F - Surface Water and Sediment Sampling
  - Subtask 3G - Ambient Air Monitoring
  - Subtask 3H - Rapid Bioassessment
  - Subtask 3I - Hydraulic Testing
  - Subtask 3J - Disposal of RI Derived Waste
  - Subtask 3K - Identifying Potential Receptors
- Task 4 - Sample Analysis and Data Validation
- Task 5 - Data Evaluation
- Task 6 - Risk Assessment

- Task 7 - Remedial Investigation Report
- Task 8 - Development and Screening of Remedial Action Alternatives
- Task 9 - Evaluation of Remedial Action Alternatives
- Task 10 - Feasibility Study Report

Task 1 - Project Planning

Included in this task are the evaluation of existing data; development of the Work Plan; obtaining appropriate approvals for the work plan, budget, and schedule; preparation of the sampling and analysis plan (SAP), which consists of the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP); preparation of the site Health and Safety Plan (HSP); project management and agency coordination; obtaining permits and easements, if necessary; and meetings among the EPA, the FDER, and the contractor.

Development of the RI/FS Work Plan includes formulation of data quality objectives (DQO's), identification of the necessary RI/FS tasks, and preparation of budgets and schedules for implementing the proposed tasks. Results of the evaluation of existing data are presented in Section 2 of this Work Plan. Potential ARARs and remedial action alternatives are discussed in Section 4. This information was utilized to develop the RI scope.

A SAP has been prepared in conjunction with the Work Plan which includes an FSP, a QAPP, and an HSP for the proposed field activities. The FSP describes the sampling objectives, proposed sample locations, sample collection procedures, equipment necessary for sampling, and sample handling and analysis. The QAPP describes the project objectives and organization, functional activities, and quality assurance and quality control (QA/QC) protocols to be used to achieve the desired DQOs. Preparation of the HSP was based on historical information, OSHA regulations, and ES corporate health and safety policies.

Task 2 - Community Relations Activities

Community relations activities are developed and implemented by the EPA. Activities to be performed by the EPA include conducting community interviews and developing a community relations plan. The Respondents' community relations responsibilities, if any, will be specified in the community relations plan.

Task 3 - Field Investigations

All efforts to prepare and conduct onsite work are included in this task.

Subtask 3A - Field Support Activities

Field support includes those activities that are necessary before the field activities can be implemented. Several of the investigative activities that will be

conducted during the RI will require the services provided by subcontractors. Services expected to be subcontracted are:

- Construction of decontamination pad
- Provision for onsite office or records storage area
- Obtaining sample containers
- Laboratory analysis
- Disposal of RI-derived waste, if necessary.

Field testing equipment and health and safety equipment will also be secured and shipped to the site. An onsite support area will be set up.

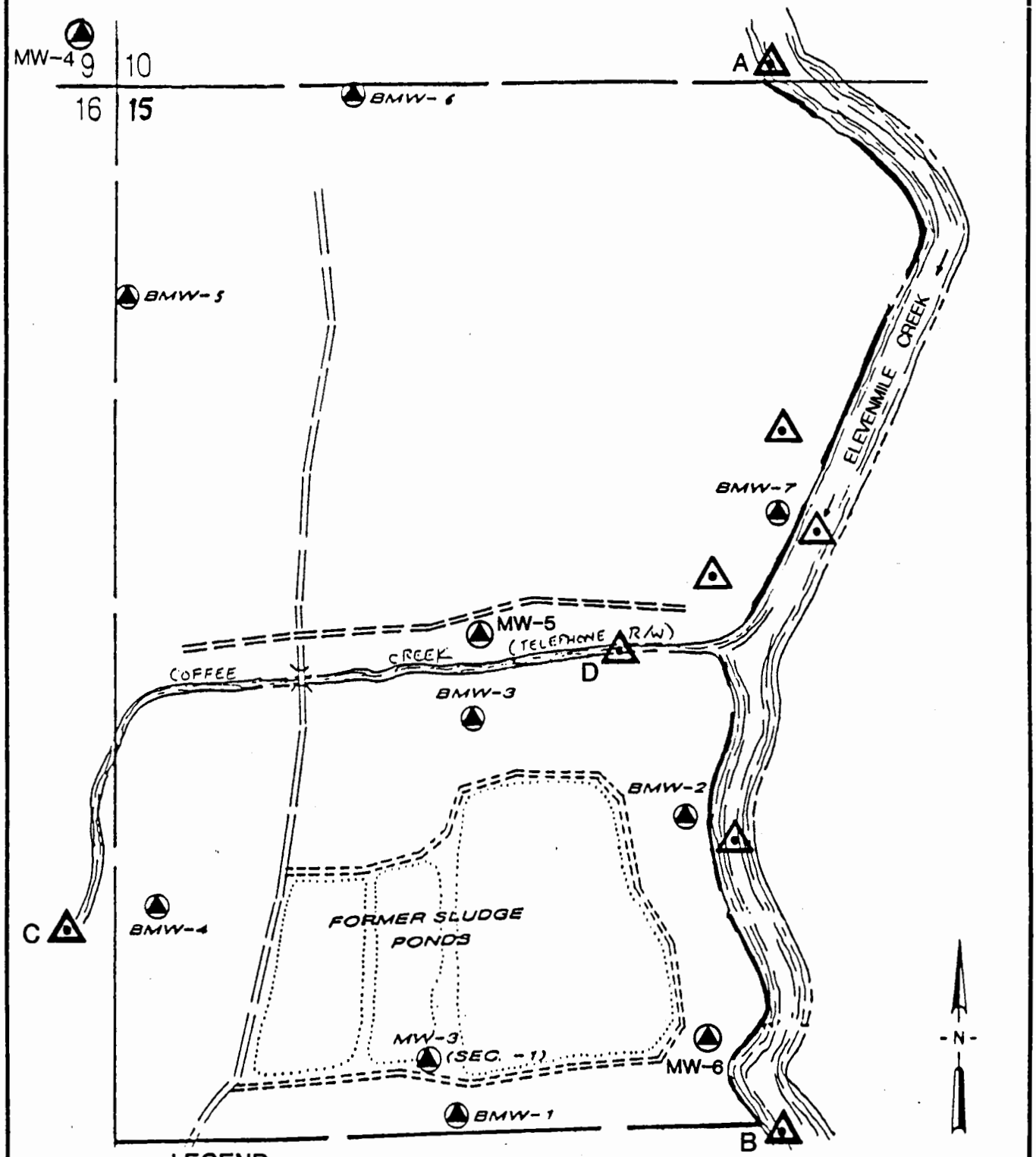
Subtask 3B - Installation of New Wells

As noted in Section 2, Well MW-1 has been vandalized and must be properly abandoned and replaced. The abandonment procedure will be to pull the well casing from the ground by overdrilling with 6 inch ID hollow-stem auger. The boring will then be sealed to land surface by pressure grouting with cement.

Three wells will be installed during the RI field investigation. Wells will be installed following procedures described in Appendix E of the Region V guidance (ECBSOPQAM, 1991). All downhole equipment and the drilling rig will be decontaminated according to EPA requirements. Wells MW-5 and MW-6 (Figure 7.1) will be installed to provide additional monitoring points for potential leachate seepage in groundwater. These wells will be drilled to depths of approximately 30 feet below land surface. Well MW-1 will be replaced by drilling a new background monitoring well (MW-4) at the location indicated on Figure 7.1. Well MW-4 will be drilled to approximately 50 feet in depth. All new wells will be screened with 10 feet of 0.010 slot 2-inch I.D. stainless-steel. Proposed well construction details are shown in Figure 7.2. Upon completion of grouting, the well will stand for 48 hours to allow grout to set up. During this period, the above-ground completion will be done. After the grout sets, each well will be developed with swabs or surge blocks and pumps for a minimum of 4 hours to remove particulates from the well screen. Development water will be containerized and disposed in the Pedido Landfill wastewater treatment system. As recommended by EPA procedures (ECBSOPQAM, 1991), the well construction materials will be analyzed for potential contamination. The bentonite, grout, and sand pack materials will be sampled; one sample each will be collected from a randomly-selected, unopened sack. The sand will be analyzed for TCL organics and TAL metals. Likewise, one sample of potable water used for rinse water will be analyzed as part of the QA/QC for decntamination of drilling tools.

Figure 7.1

APPROXIMATE GROUNDWATER AND SURFACE WATER SAMPLING LOCATIONS
BEULAH LANDFILL SITE



LEGEND

- Monitoring Well
- Surface Water Sampling Location
- A Bioassessment Station

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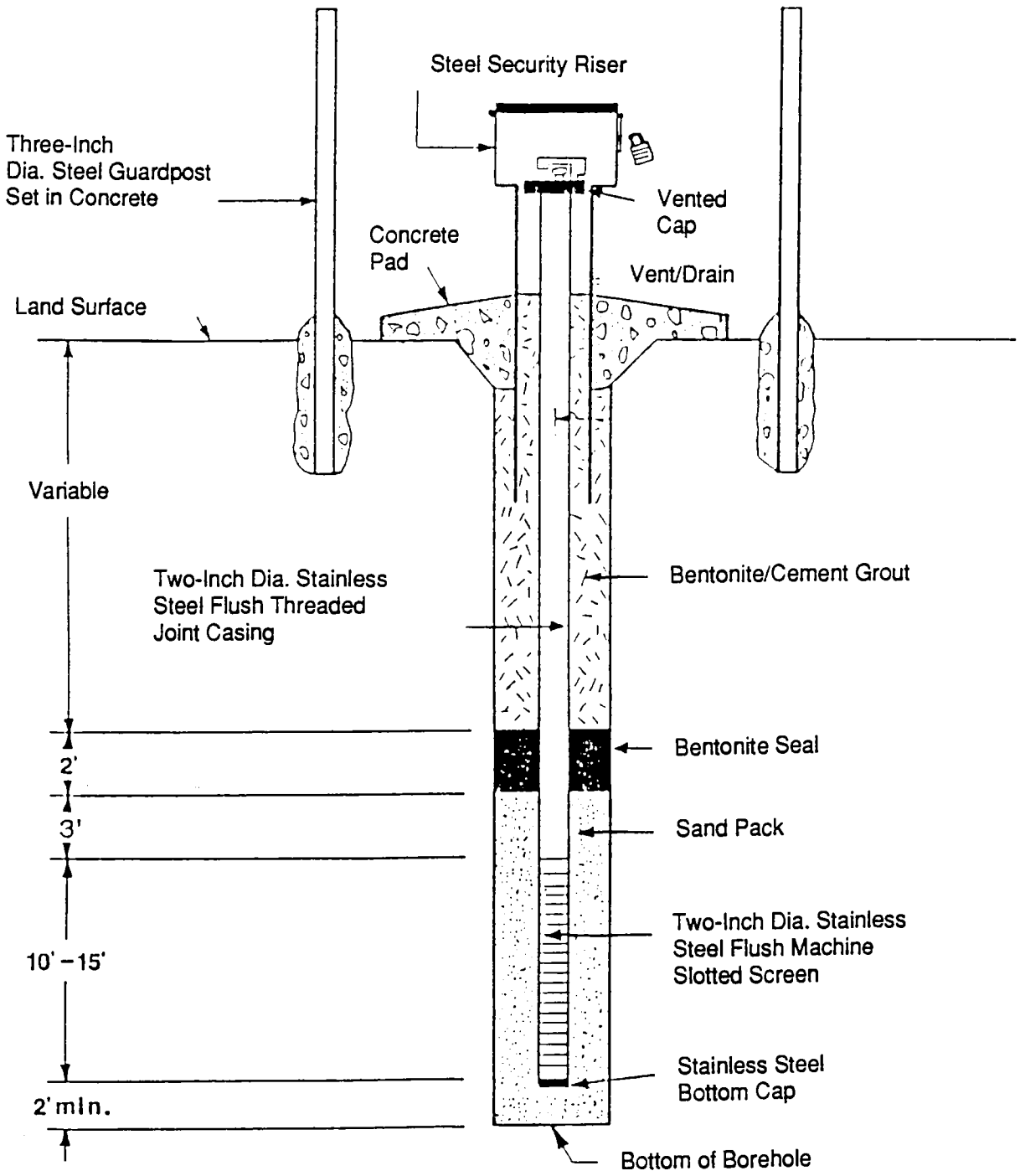
STANDARD MONITORING WELL CONSTRUCTION
BEULAH LANDFILL SITE



Subtask 3C - Sampling Site Identification and Preparation

Sampling locations at the three sludge disposal ponds were selected using a systematic random sampling technique. A 50 foot by 50 foot sampling grid was laid over an outline of the three ponds, as shown in Figure 7.3. Each cell is identified by a unique X-Y coordinate. Estimates of the variability of the sludge composition indicate that 24 sampling points are needed to characterize the chemicals in the sludge. The X-Y coordinates for each sampling point were then determined using a random number generator. An additional three locations were then selected to provide more coverage of the former ponds. The selected cell locations are also shown in Figure 7.3.

Transfer of the sample locations from the map to the actual ground location will be accomplished by the survey crew of the Escambia County Engineering Department. Grid locations will be tied to the existing site survey maps for future reference.

The surfaces of the former sludge ponds have stabilized to the point of supporting heavy vegetation and the passage of foot traffic. Vegetation will be cleared as necessary with hand-carried power tools and low ground pressure mobile equipment. At each sampling location, sufficient area will be cleared and prepared so that a clear and safe working area is available.

Subtask 3D - Waste Characterization Sampling

Sampling of the sludge ponds will be performed using hand augers. Auger buckets will be decontaminated immediately prior to each use per methods described in the SAP. Auger samples would be collected at 1-foot depths at each sampling location. Samples will be monitored for volatile organic compounds using a photoionization detector or an organic vapor analyzer. Samples will be prepared for shipment to the analytical laboratory using the methods and protocols discussed in the SAP. The sampling and analysis program for waste characterization is summarized in Table 7.1.

Subtask 3E - Groundwater Sampling

Groundwater sampling will be performed concurrently with the sampling for waste characterization. This sampling will be used for further site evaluation and to evaluate potential contaminant migration. Wells BMW-1 through BMW-7, MW-3i, MW-3d, MW-4, MW-5, and MW-6 will be sampled using the methods detailed in the SAP. The sampling and analysis program for groundwater is summarized in Table 7.1.

Groundwater elevations will be measured in each well prior to purging. The wells will then be purged prior to sampling. Purge water will be collected in labelled drums and stored at the well location. Final disposal of the purge water will be determined after the samples have been analyzed. Samples from each well will be analyzed for TCL organics, TAL inorganics, and water quality parameters as

Figure 7.3

PROPOSED SAMPLING GRID AND SAMPLING LOCATIONS
BEULAH LANDFILL SITE

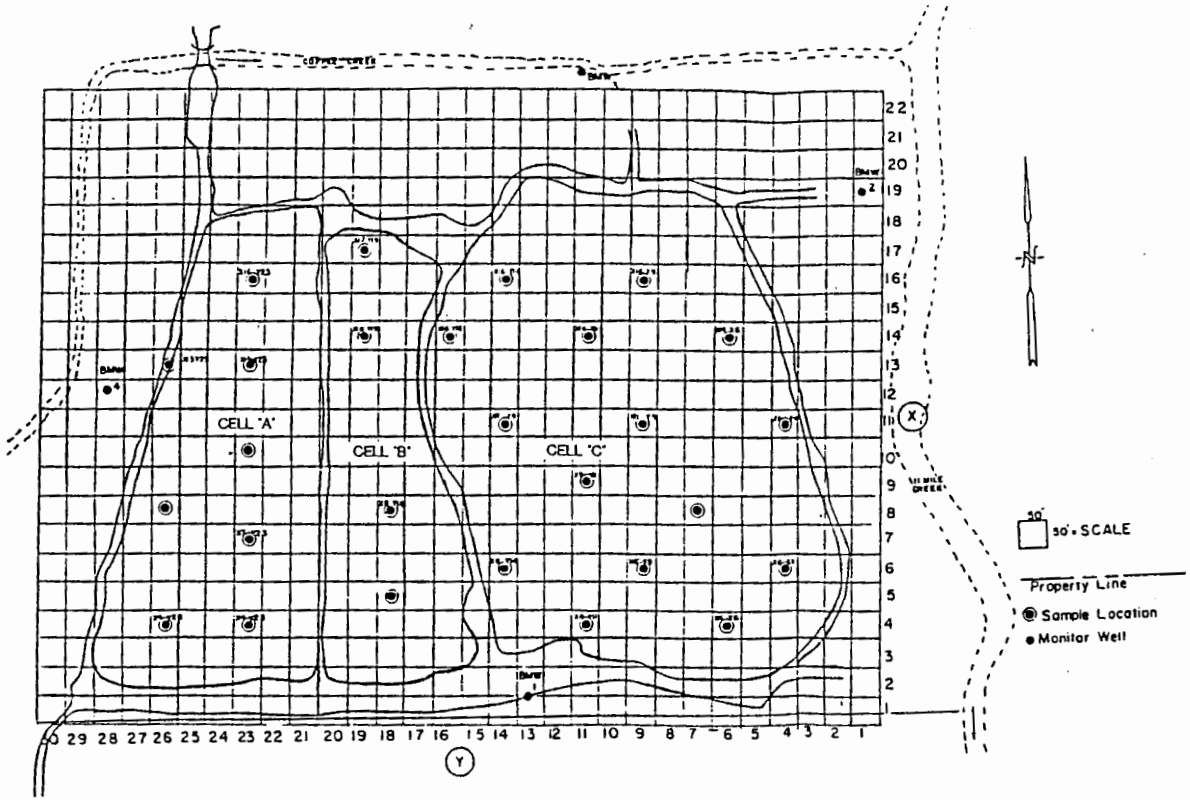


TABLE 7.1
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Analysis	Proposed Analytical Method	Maximum No. of Samples [1,2,3]
Soils and Sediment		
TCL BNA Extractables	CLP-SOW	35
TCL Volatile Organics	CLP-SOW	35
TCL Pesticides/PCBs	CLP-SOW	35
TAL Metals	CLP-SOW	35
Groundwater(5)		
TCL BNA Extractables	CLP-SOW	21
TCL Volatile Organics	CLP-SOW	27
TCL Pesticides/PCBs	CLP-SOW	21
TAL Metals	CLP-SOW	21
Other Inorganic Targets	Table 2	21
Surface Water		
TCL BNA Extractables	CLP-SOW	8
TCL Volatile Organics	CLP-SOW	8
TCL Pesticides/PCBs	CLP-SOW	8
TAL Metals	CLP-SOW	8
Other Inorganic Targets	Table 2	8
Ambient Air		
Respirable particulate matter	40 CFR 50, Apps. B, G, and J	5
TCL-TAL Scan	CLP-SOW	5
Volatile Organics	40 CFR 50, Apps. B, G, and J	5

TBD = to be determined; sample quantities will be approved by EPA RPM prior to conducting this work.

(1)Contract Laboratory Program, Statement of Work 1988 (including revisions 1989).

(2)Field and rinsate blanks are to be sampled at a rate of 1/day for both sludge/waste and groundwater/surface water.

(3)Only TCL volatile organics for sludge/waste will have trip blank samples at a rate of 1/day.

(4)Duplicate samples are to be taken at a rate of 1/20 samples.

(5)Sample quantities include water samples (trip blanks, rinsates, etc.) collected for QA/QC.

detailed in the SAP. Field parameters of pH, temperature, and specific conductance will be measured at the time of sample collection.

Subtask 3F - Surface Water and Sediment Sampling

Site contaminants may migrate by way of surface runoff, leachate seepage, and/or groundwater discharge into Coffee Creek and/or Elevenmile Creek. The existing surface water analytical data for Elevenmile Creek represent conditions some distance upstream and downstream from the site. However, the samples collected far downstream of the site may show no contamination due to dilution. To determine if contaminants are entering the surface water, samples of surface water and sediments will be collected from the locations indicated in Figure 7.1, and analyzed for TCL organics and TAL inorganics. One of the sampling locations will be chosen to determine background levels in Elevenmile Creek, and one location will be used to determine background levels in Coffee Creek. The remaining six locations will be located in drainage swales on the landfill and along the banks of the creeks, adjacent to the landfill to evaluate potential effects of overland runoff and leachate seepage into the surface waters. Sampling should occur during a period of relatively low stream flow to determine maximum groundwater impact on the creeks. A summary of the sampling and analysis program is presented in Table 7.1.

Subtask 3G - Ambient Air Monitoring

Ambient air monitoring will be performed to measure respirable particulates (PM_{10}), semivolatile organics and volatile organics per EPA methods (40 CFR Part 50 App. B). Respirable particulates (PM_{10}) potentially may have contaminants adsorbed on the surface, and thus present an inhalation risk.

The particulates will be determined by drawing a measured volume of air through pre-weighed filters. Particulate matter concentrations will be calculated gravimetrically. After the weight of the particulates has been measured, the particulates will be analyzed for TCL-TAL compounds by CLP-SOW methods. The semivolative and volatile organics will be analyzed by EPA methods (see SAP, Table 5).

Sampling locations and frequencies will be based on air transport modeling. The model used will be the Industrial Source Complex (ISC) model.

Subtask 3H - Rapid Bioassessment

Using methods described in EPA (1989c), a Rapid Bioassessment Protocol II will be performed in Coffee Creek and in Elevenmile Creek. This Level II assessment is a reconnaissance survey of stream habitat, involving general habitat assessment by a trained biologist, physico-chemical measurements instream, and biological collections with taxonomic identification to family level. The field investigation is performed by an experienced biologist knowledgeable in benthic ecology and taxonomy, assisted by a technician with biological background. Physical

measurements and assessments will be conducted at a minimum of four sites as indicated by letters A-D in Figure 7.1. Additional sites along Coffee Creek may be assessed as determined by the on-site biologist.

Subtask 3I - Hydraulic Testing

The purpose of hydraulic testing is to provide data;

1) on aquifer properties and potential response to pumping; and

2) on the groundwater pathway for use in the risk assessment.

If contaminants of concern are detected in the water samples from the wells sampled in Subtask 3D, then slug tests will be performed on all wells at the site. These tests will provide estimates of the aquifer's hydraulic conductivity at each well location. Tests will be conducted by inserting (or withdrawing) a solid cylinder of known volume into the well and recording the water-level response over time. The advantages of slug tests over pumping tests are the rapidity of the tests and the avoidance of generating large volumes of groundwater that may require special handling and disposal. The principal disadvantage of the slug tests is their inability to show the influence of the stream as a constant-head boundary, should the pump and treat alternative (see Section 4) need evaluation.

Subtask 3J - Disposal of RI Derived Waste

Wastes derived from the RI field tasks will include water produced from equipment decontamination and water produced from well development and purging, and from groundwater sampling. Disposable clothing and other trash will be stored separately from these wastes for final disposal.

All water generated during equipment decontamination and well sampling will be containerized for treatment at the Perdido Landfill. Equipment decontamination will be performed in an area designated for this purpose. The area will be surrounded by berms and lined with an HDPE liner so that the decontamination water can be collected.

Subtask 3K - Identifying Potential Receptors

A survey of local groundwater users will be made by contacting local utility companies and reviewing well records of the Northwest Florida Water Management District. Because residences near the Beulah Landfill are served by public water supplies, no sampling of private wells is contemplated. Residences within 2 miles of the site will be canvassed to determine presence of a well and uses of groundwater.

A telephone survey of state and federal agencies will be made to determine ecological concerns for the conditions immediately surrounding the site. Contact with the U.S. Fish and Wildlife Service, the Florida Game and Freshwater Fish Commission, and the Florida Natural Areas Inventory will be made to determine sensitive habitats or threatened species of plants and animals near the site.

Task 4 - Sample Analysis and Data Validation

This task includes operation of onsite analytical instruments (such as a portable GC) and laboratory instruments. All analytical data will be tabulated and organized for review by the contractor and by EPA. Reviews for data validation will include checks of replicate data and matrix spike/matrix spike duplicate data against data quality objectives for precision and accuracy. Chain-of-custody forms will be compared with the SAP and the laboratory reports to determine achievement of representatives and completeness goals. The analytical data will be reviewed as a whole for consistency, anomalous results, and further qualification, if necessary. A summary of data validation comments and limitations on the usefulness of the data will be prepared for inclusion in the RI report.

Task 5 - Data Evaluation

The data obtained from Task 3 will be integrated with site information obtained during Task 1 to complete the site characterization component of the RI report. Specific subtasks to be completed within the data evaluation task include:

- Preparation of hydrogeologic cross-sections and groundwater contour plots of each aquifer of interest.
- Computing vertical and horizontal hydraulic gradients in each aquifer of interest; using hydraulic gradient and hydraulic properties of aquifers to estimate flow rates and flow directions.
- Preparation of maps of extent of contamination in soils, groundwater, and stream sediments, as appropriate.
- Evaluation of contaminant transport characteristics by air, soil, surface water, and groundwater pathways to determine potentially complete pathways from source to receptors.

Task 6 - Risk Assessment

The baseline risk assessment will provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action. It will also form the basis for determining whether or not remedial action is necessary. The *Risk Assessment Guidance for Superfund Vol. 1* (USEPA, 1989) will be used by USEPA to evaluate potential human health impacts. Additional documents cited in Section 4 of this plan (USEPA, 1990; 1989a,b; 1991b) will also be used for the baseline risk assessment. the USEPA has responsibility for performing the baseline risk analysis for the RI at Beulah Landfill.

The risk assessment process for human health is divided into four components: contaminant identification, exposure assessment, toxicity assessment, and risk characterization. These are discussed in order.

Identification of Chemicals of Concern

The existing data will be reviewed to identify the chemicals of concern. These contaminants are selected based on their on-site concentration, their relative toxicity, frequency of detection, or because they are presently in or potentially may move into critical exposure pathways (e.g., drinking water).

Exposure Assessment

Using information provided in the EPA guidance manuals cited above, the actual and potential exposure points will be identified. For each exposure point, the release source, the transport media (e.g., groundwater, surface water, etc.) and the exposure route (oral, dermal, inhalation) will be delineated. The present and future risks at the site will be considered, and both current and maximum reasonable use scenarios will be developed.

Toxicity Assessment

Information in the Integrated Risk Information System (IRIS), similar data bases and literature sources will be used to provide a toxicity assessment of the chemicals of concern. This assessment shall include the types of adverse health or environmental effects associated with individual and multiple chemical exposures, the relationship between magnitude of exposures and adverse effects, and related uncertainties such as the weight of evidence for a chemical's potential carcinogenicity.

Risk Characterization

The current and potential risks to human health and the environment posed by the site will be characterized by integrating the concentrations of chemicals of concern and assumptions about future site events with the information developed during the exposure and toxicity assessments. Any uncertainties associated with contaminants, toxicities, and exposure assumptions will also be evaluated.

Risks to the environment from exposure to the chemicals of concern will also be addressed. The rapid bioassessment and environmental survey will assess any critical habitats, endangered species, or their habitats affected by chemicals of concern at the site. It will also provide the information necessary to adequately characterize the nature and extent of environmental risk or threat resulting from the site. The *Risk Assessment Guidance for Superfund - Environmental Evaluation Manual* (USEPA, 1989b) will be used to prepare the environmental evaluation.

Task 7 - Remedial Investigation Report

A report summarizing RI activities and findings will be prepared and submitted to the EPA for review and comment. Early chapters of the report summarizing the field investigation activities and the analytical data will be submitted to EPA as early as possible to aid in identification of ARARs which will be finalized during the

FS. The RI report will be prepared in accordance with the current RI/FS Guidance (USEPA, 1988a).

Task 8 - Development and Screening of Remedial Action Alternatives

The development and screening of Remedial Action Alternatives is performed to select an appropriate range of waste management options for evaluation. The range of options considered will include alternatives using treatment to reduce the toxicity, mobility, or volume of the waste, but varying in the types of treatment, the amount treated, and the management of long-term residuals or untreated wastes; alternatives involving containment and treatment; alternatives involving containment with little or no treatment; and a no-action alternative. Development and evaluation of the alternatives will be performed concurrently with the Site Characterization task.

The following functions will be performed during this task:

- Refine and document Remedial Action Objectives
- Develop General Response Actions
- Identify areas and volumes of contaminated media
- Identify screen and document remedial technologies
- Assemble and document alternatives
- Refine alternatives
- Conduct and document screening evaluations of each alternative.

Task 9 - Detailed Analysis of Remedial Action Alternatives

The final alternatives will be evaluated to provide the EPA with a framework with which to select a site remedy. Each individual alternative will be evaluated with respect to the following nine evaluation criteria:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance.

Following the individual analyses, a comparative analysis of the alternatives will be performed. The evaluation criteria will be used as a basis of comparison. The comparative analysis will lead to the development of a description of the strengths and weaknesses of the alternatives relative to one another.

Task 10 - Feasibility Study Report

Upon completion of the detailed analysis of alternatives, the contractor will prepare and submit a draft FS report to EPA for review and comment. The report will summarize the FS work and will include a synopsis of the RI findings. The FS report will be prepared according to the RI/FS guidance (USEPA, 1988). Information developed during the FS, such as identification of ARARs and detailed description of alternatives will be provided periodically to EPA, in order to obtain comments during the development process.

Treatability Studies

Treatability studies for the Beulah Landfill are not anticipated because the principal remedy for CERCLA municipal landfills is containment (USEPA, 1991). However, treatability studies may be needed to assist in the detailed analysis of other alternatives. Initially, a literature survey might be conducted to gather information on the performance, relative costs, applicability, removal efficiencies, operation and maintenance requirements, and implementability of candidate technologies. If practical candidate technologies have not been sufficiently demonstrated, or cannot be adequately evaluated for the site on the basis of available information, bench or pilot scale treatability studies would be conducted.

SECTION 8
PROJECT ORGANIZATION

PROJECT STAFFING AND RESPONSIBILITIES

Project Team

The Contractor team for this RI/FS project includes:

- PRP Oversite.
- Project Manager.
- Field Operations Manager.
- Subcontractor Services.

Figure 8.1 presents the overall project organization. Subcontractors will be utilized for site preparation, and surveying services. Site sampling work will be performed by the University of West Florida, Wetlands Research Laboratory. Laboratory services will be provided by Kiber Analytical Services, Atlanta, Georgia.

Responsibilities of Project Personnel

Project Manager

Mr. Craig L. Sprinkle, P.G. will serve as the overall project manager. He is responsible for directing the progress of the work and for providing technical review for all project deliverables.

Field Operations Manager

Mr. Peter Dohms, P.G. will be responsible for supervising all field activities. He is responsible for insuring that all the procedures and field QA requirements described in the project SAP are followed. He will also serve as the site health and safety officer and will insure that the procedures contained in the project H&S plan are followed.

PROJECT PROCEDURES

Communication

Figure 8.2 illustrates the lines of communication that will be followed for this project.

PROJECT ORGANIZATION
REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS)
BEULAH LANDFILL SITE

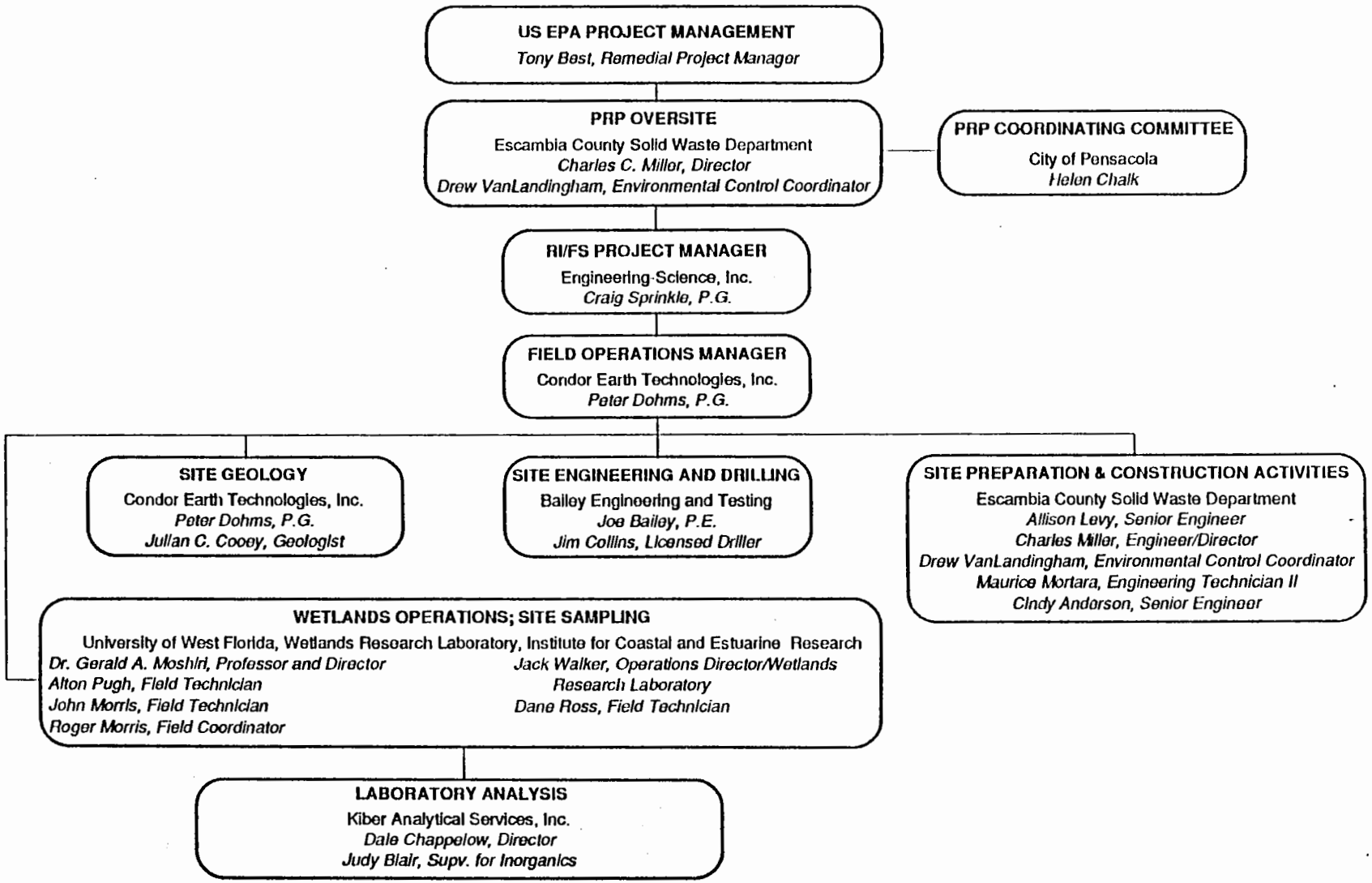


Figure 8.1

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PROJECT COMMUNICATION
BEULAH LANDFILL SITE

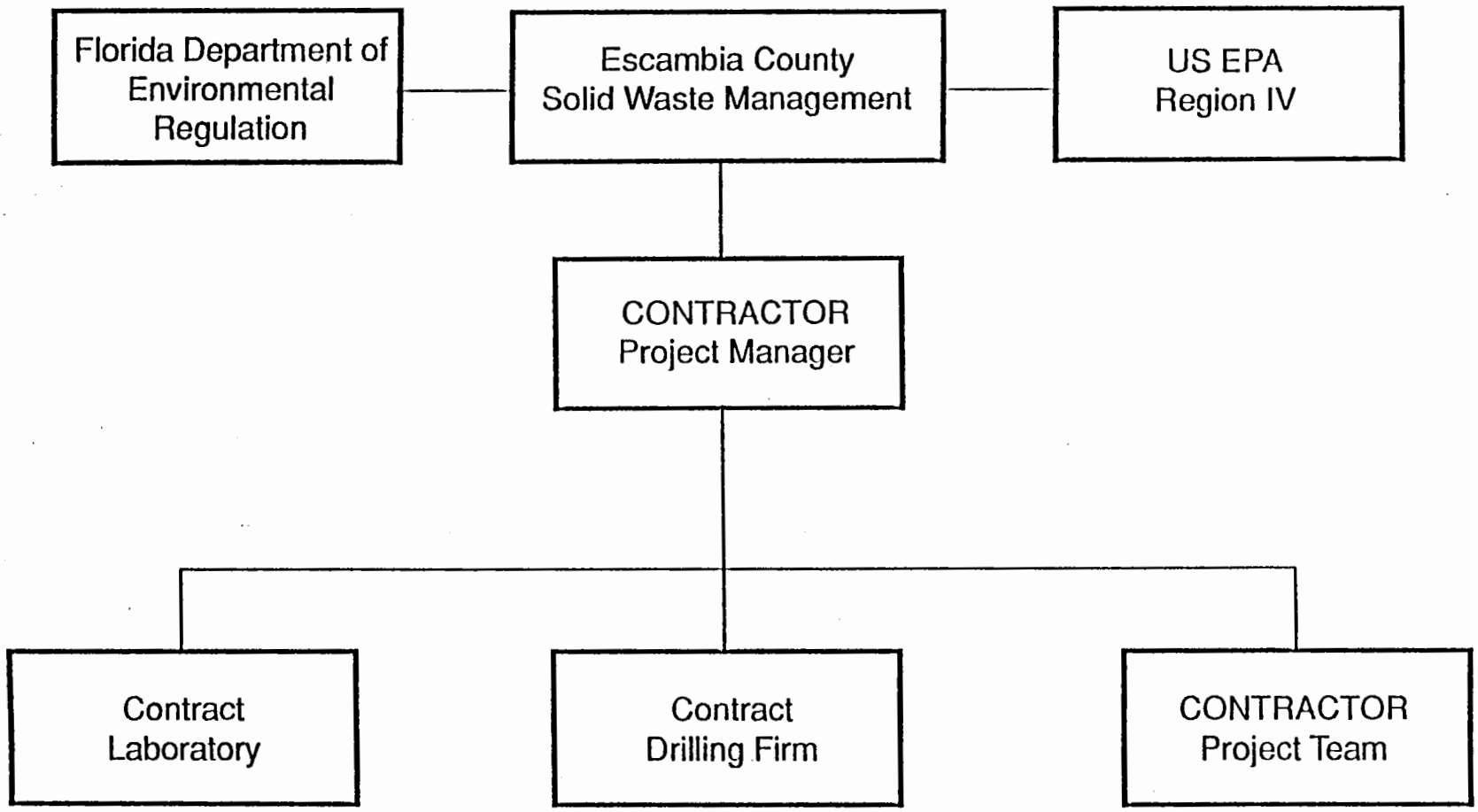

Figure 8.2

Maintenance of Records

This project will require the administration of a central project file. The data and records management protocols will provide adequate controls and retention of all materials related to the project. Record control will include receipt from external sources, transmittals, transfer to storage and indication of record status. Record retention will include receipt at storage areas, indexing, filing, storage, maintenance, and retrieval.

Record Control

All incoming materials related to the project including sketches, correspondence, authorizations, and logs shall be forwarded to the project manager or designated assistant. These documents will be placed in the project file as soon as is practical. If correspondence is needed for reference by project personnel, a copy will be made rather than retaining the original. All records shall be legible and easily identifiable.

Examples of the types of records that will be maintained in the project file are:

- Field documents;
- Correspondence;
- Photographs;
- Laboratory data;
- Reports; and
- Procurement agreements.

Outgoing project correspondence and reports must be reviewed and signed by the project manager prior to mailing. The office copy of all outgoing documents shall bear distribution information.

Record Status

To prevent the inadvertent use of obsolete or superseded project-related procedures, all personnel of the laboratory and/or project staffs will be responsible for reporting changes in protocol to the project manager and/or the laboratory manager. The project manager and/or laboratory manager will then inform the project and laboratory staffs and the project quality assurance officer of these changes.

Revisions to procedures shall be subject to the same level of review and approval as the original document. The revised document will be distributed to all holders of the original document and discussed with project personnel. Outdated procedures will be marked "void". The voided document may be destroyed at the request of the project manager. However, one copy of the voided document will be

maintained in the project file. The reasons for and the date the document was voided should be recorded.

Record Storage

All project-related information will be maintained by the Escambia County Solid Waste Department. Designated personnel will assure that incoming records are legible and are in suitable condition for storage. A records index will be initiated at the beginning of the overall project. Each document that is placed into the project file will be logged. The logging of the records will be the responsibility of the project manager and/or his designee.

Record storage will be performed in two stages:

- Storage during and immediately following the project; and
- Long-term storage of records directly related to the project.

Both phases will use storage facilities that provide a suitable environment to minimize deterioration or damage and that prevents loss. The facilities will, where possible, have controlled access and will provide protection from excess moisture and temperature extremes. Records will be secured in steel file cabinets labeled with the appropriate project identification.

The removal of records from all files during both stages will be controlled by the use of withdrawal cards.

At the completion of the project, the project manager or his appointed document custodian will be responsible for inventorying the project file. The records contained in the project file will be compared against the records listed on the file index sheets; discrepancies must be resolved prior to transferring the file to a permanent storage facility. All material from the project file, including drawings, project-related quality assurance documents, and software program documentation and verification records will be permanently stored. Duplicate records may be made and stored at a separate location.

All storage systems will provide for the prompt retrieval of information for reference or use outside the storage areas. Project records will be accessible for a period of three years after close of this project.

On-Site Control

A file, similar to the project central file, will be established and maintained by the field personnel under the direction of the field team leader. Upon completion of the field program, the on-site file will be transferred to, and integrated with, the office project files.

Task and Overall Budget/Schedule Monitoring

Timely, within-budget performance of this project will be accomplished with the use of a computerized system for reporting both project status and cost. The system

provides weekly statements of job expenditures by work task for the previous week and for the project to date. The project manager will prepare a monthly report which summarizes the funds expended, work completed, and an estimate of the effort required to complete the work.

Internal Quality Control

The Contractor shall develop both a program and a project quality assurance plan that will be followed on this project. These plans will describe the procedures that will be followed to insure that a high level of quality is maintained.

All reports will be reviewed internally prior to submission to the Respondents. The Contractor internal review will be performed by the project manager and contractor technical staff.

Reporting

Several reporting mechanisms will be utilized during the RI/FS at the site to insure that project objectives are met and the project is kept on schedule. The Contractor project manager will prepare monthly progress reports which address work performed during the period, problems encountered, work planned for the following month, and budget status.

Telecommunications between the Respondents and the project manager will provide for the informal exchange of field work progress, including completion of work, review of preliminary data, and identification of problems and potential solutions.

The EPA shall be notified in writing upon completion of all RI field activities. After receipt of analytical results, a preliminary Site Characterization Summary will be prepared and submitted to the EPA. The draft RI report will be prepared after completion of the Baseline Risk Assessment and submitted for regulatory review. A review meeting will be held, and comments received will be incorporated into a final RI report.

DELIVERABLES

Deliverables required by this project reflect USEPA requirements as outlined in the Administrative Order of Consent. These deliverables are summarized in Table 8.1.

Monthly progress reports will be submitted to the EPA for their review. These reports will include the following:

- Description of the actions which have been taken toward achieving compliance with the Consent Order during the previous month
- Results of sampling and tests and all other data obtained during the course of the work

TABLE 8.1
DELIVERABLES FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AT THE BEULAH LANDFILL SITE

Task No.	Task Title	Deliverable Components
1	Scoping	- RI/FS Work Plan - Field Sampling and Analysis Plan - Quality Assurance Project Plan - Site Health and Safety Plan
3	Field Investigations	- Preliminary Site Characterization Summary
6	Baseline Risk Assessment	- Technical Memorandum Listing Hazardous Substances and Indicator Chemicals - Technical Memorandum Describing Exposure Scenarios and Fate and Transport Models - Technical Memorandum Providing an Environmental Evaluation - Baseline Risk Assessment Chapter of the RI Report
7	RI Report	- Draft and Final RI Report
8	Development and Screening of Remedial Action Alternatives	- Technical Memorandum Documenting Revised Remedial Action Objectives - Technical Memorandum on Remedial Technologies, Alternatives, and Screening
10	FS Report	- Draft FS Report
11	Treatability Studies	- Technical Memorandum Identifying Candidate Technologies (if appropriate) - Treatability study Work Plan (or amendment to original Work Plan) - Treatability study SAP (or amendment to original SAP) - Treatability Study Evaluation Report

- All plans and procedures completed during the previous month
- Description of all actions, data, and plans scheduled for the next month
- Information regarding percentage of completion, unresolved delays encountered or anticipated that may affect the future schedule, and a description of efforts made to mitigate said delays.

Meetings and presentations to the EPA will be conducted at the conclusion of each major phase of the RI/FS.

PROJECT SCHEDULE

The RI/FS work schedule is summarized in Figure 8.3. The schedule is subject to change depending on results of the RI program, timing of regulatory reviews, and other factors that cannot be predicted.

BEULAH LANDFILL SITE

SCHEDULE OF ACTIVITIES

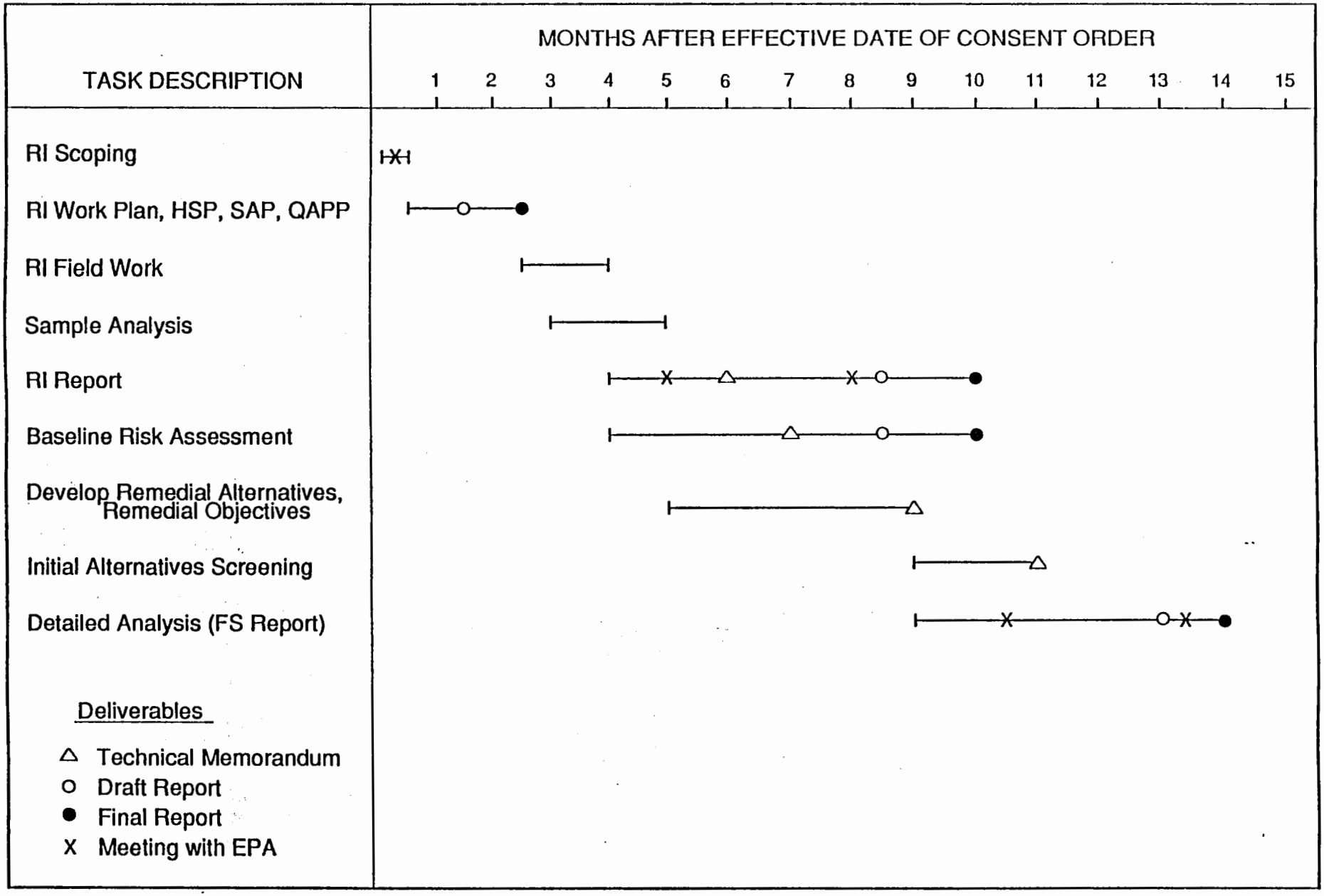

Figure 8.3

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SECTION 9
REFERENCES

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REMEDIAL INVESTIGATION
SAMPLING AND ANALYSIS PLAN
FOR
BEULAH LANDFILL SITE
PENSACOLA, FLORIDA

PREPARED BY:
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SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) provides guidance for field work by defining the sampling and data gathering methods to be used for the Remedial Investigation (RI) at the Beulah Landfill site. This SAP is intended to follow procedures contained in *Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual* (EPA Region IV, February 1, 1991). All tables and figures are located at the end of the numbered sections and preceding Appendix A.

The SAP will be used by personnel performing the field work. A copy of the SAP will be made available to each member of the field team. Revisions to this plan will receive approval from the U.S. Environmental Protection Agency (EPA) Region IV prior to use. Revisions shall be appropriately documented with a field change notice; an example is provided in Appendix A.

2.0 SITE BACKGROUND

The Beulah Sanitary Landfill construction and operation began in 1966 over a 101.9-acre site. Approximately 90 acres of the site was utilized for landfilling with the remaining 11 acres consisting of Coffee Creek and perimeter ditches. The site is located at the north end of Jamesville Road in Section 15, Township 1S, Range 31W at latitude 30 30′8"N and longitude 87 20′ 42"W (Figure 1).

Solid waste was first deposited in the southwest section at an average depth of 15 to 20 feet. As the disposal cells moved to the east, the depths increased to 30 to 35 feet. In 1968, the first domestic septage and wastewater treatment sludges were deposited in an excavated and bermed area (approximately 10 acres) at the southwest corner. In 1976, the sludge holding pond was filled with construction demolition debris and solid waste and covered with 12 inches or more of on-site material. In November 1977, an area of approximately 20 acres was constructed and diked to receive liquid sludges in the eastern portion of the property. This area was previously filled with solid waste that absorbed the liquid sludge to create a solid/spongy mixture. All sludge dumping was ceased in June 1984.

Records of the waste stream entering the Beulah Landfill facility were destroyed by the Superior Court of Escambia County and no composition studies have been done to date. Based on operator memory, the waste stream consisted of a combination of solid and liquid wastes from residential, commercial, construction,

and demolition as well as industrial sources including wastes from local military bases. The major waste depositors included the franchise collectors and haulers, private haulers, and the general public. Liquid waste haulers deposited septic wastes, wastewater treatment plant sludges, commercial and industrial sludges, and liquid waste in ponds onsite. All disposal activities were concluded in 1984.

3.0 SAMPLING OBJECTIVES

The objective of the field sampling program at Beulah Landfill is to acquire additional data needed to confirm the presence or absence of contamination at the site, characterize the principal pathways to potential receptors, and identify sources. Sampling efforts will include groundwater, surface water, soil and air sampling and habitat assessment. Soil sampling will be done to characterize the amounts and types of contaminants in the old sludge ponds. This information will be necessary to evaluate potential risks to human and environmental receptors. Groundwater and surface water sampling will be conducted to characterize water quality. The chemical analysis results from these samples will be used to confirm presence or absence of contaminants, to determine the horizontal and vertical extent of contamination, and to determine the risks posed by contaminants that may occur in these waters. Air sampling will be performed to characterize the air pathways for potential risks to on-site as well as off-site receptors. A Rapid Bioassessment Protocol II 9 (RBP II) assessment will be conducted to determine potential impairment of stream biota communities and to determine the need for more thorough bioassays. Table 1 provides a summary of field activities to be completed at the Beulah Landfill site.

4.0 SAMPLE LOCATION AND FREQUENCY

The sampling effort for site characterization is planned to address all potentially contaminated media and all potential exposure pathways. Should the initial characterization efforts indicate more information or testing is needed to complete the risk assessment, plans for the additional work will be provided to EPA for approval prior to commencing the work.

4.1 Water and Sediment Sampling

The purpose of sampling groundwater, surface water, and stream sediments is to determine the nature and extent of potential contamination of these media. Data obtained during sampling will also be used to evaluate fate and transport of potential contaminants in the groundwater and surface water pathways.

4.1.1 Groundwater Sampling

Twelve monitoring wells will be used to sample groundwater. This network consists of the seven BMW wells, wells MW-3i, MW-3d, and MW-4, MW-5, and MW-6 (Figure 2). The wells will be sampled to characterize groundwater quality beneath the site, and determine the presence or absence of groundwater

contamination. Analyses of groundwater samples will also provide data to be used in risk analysis.

4.1.2 Surface Water Sampling

Surface water and stream sediment sampling will be performed to evaluate the potential for contamination of the waters by leachate seepage, surface runoff or groundwater discharge. Eight sampling locations, shown in Figure 2, will be sampled. One location is upgradient of the landfill and will be used to determine background levels in Elevenmile Creek. One location will be chosen to determine background levels in Coffee Creek. Two locations will be sampled within the drainage swale along the eastern side of the landfill. These locations will be sampled when both water and sediments may be collected. The remaining four locations will be located along the banks of the creeks, adjacent to the landfill. Sampling should occur during a period of relatively low stream flow to determine the maximum groundwater impact on the creeks.

The RBP II work will be done at locations marked A through D on Figure 2. At a minimum, these four sites will be characterized and sampled for benthic invertebrates per EPA methods (USEPA, 1989c, see Reference Section of Work Plan). Additional sites along Coffee Creek may be investigated, at the discretion of the on-site biologist, to complete the Level II assessment.

4.1.3 Sampling Parameters

Characterization sampling of all groundwater and surface water monitoring points will be performed using methods approved by EPA (EPA, 1991c). Analysis of samples will consist of full scan Target Compound List pesticides and PCBs, volatile organic compounds (VOCs), and Base/Neutrals and Acid Extractables (BNAs) using CLP-SOW methods. Full scan TAL metals (total and dissolved) and selected common ions will also be analyzed. The list of parameters for the initial characterization and subsequent analysis is as follows:

- pH and temperature (field)
- specific conductance (field)
- dissolved oxygen (field)
- turbidity
- sodium
- total dissolved solids
- nitrate + nitrite-N
- sulfate
- chloride
- TOC
- GC/MS analysis for Pesticides and PCBs
- GC/MS analysis for volatile organics
- GC/MS analysis for semivolatile organics
- fluoride
- TAL metals

Table 2 presents a summary of the detection limits, accuracy, and precision objectives for the parameters, to be analyzed in water and sediment samples during the RI.

4.2 Waste Characterization Sampling

The main objective of waste characterization sampling is to determine the nature and extent of contamination associated with sludge disposal at the Beulah Landfill site. Hand augers will be used for shallow sampling on the sludge disposal pits.

Samples of soil/sludge will be collected from approximately 1-foot depths with a hand auger. Samples will be removed from the auger bucket with a clean stainless-steel spoon, placed in sample jars, and prepared for shipment to the analytical lab (e.g., capped, sealed, etc.). Samples will be maintained at 4°C during shipment. Once received at the lab, all sample handling and compositing will take place in a walk-in cold room to ensure no disruption of VOCs.

The empty sampling hole will be screened using an OVA or PID to detect organic vapors. The instrument readings will be recorded in the field notebook.

4.2.1 Sampling Site Locations

The soil sampling locations indicated in Figure 3 were selected to characterize the sludge/waste mixture. The sampling points were determined using a random number generator. The results of chemical analysis will be used to estimate the chemical variability of the sludge and to estimate the spatial variability. These estimates will be used to evaluate the statistical validity of the sampling approach and the need for further sampling.

4.2.2 Sampling Parameters

Table 5.2 of the Quality Assurance Project Plan (QAPP) contains all of the compounds for which soil/sediment samples, will be analyzed at the Beulah Landfill site. The soils will be analyzed for full scan TCL-TAL compounds. Table 2 presents a summary of the detection limits, accuracy, and precision objectives for the parameters to be analyzed in soil samples during the RI.

4.3 Air Sampling

The objective of air sampling is to quantify the airborne release of particulates and vapors. The air sampling methods that have been identified for this purpose include PM_{10} sample collection on quartz filters, PS-1 samplers for semivolatile organics, and TO-14 (Summa cannisters) for volatile organics.

Air transport modeling will be used to select up to four sampling locations. Also, sample duration and frequency will be determined from modeling. Following sample collection, filters will be shipped to the analytical laboratory for analysis by gravimetric and CLP-SOW methods. Preservation of filter samples is by cooling to 4°C.

4.3.1 Air Sampling Locations

Location of up to four sampling stations, and the duration and frequency of sampling at this site will be determined using an air transport model [Industrial Source Complex (ISC) Model]. During this effort, particulate emission rates will be assumed in source areas at the site and the transport will be modelled to potential receptor locations around the site. The receptor locations with the highest concentrations will be used to determine the location and operation frequency of air sampling stations. Once plans, schedules, and locations of air monitoring have been developed, these will be provided to EPA; sampling will not proceed without approval from the EPA RPM. An on-site meteorological station will be established to record weather conditions before, during, and after the air sampling.

4.3.2 Air Sampling Parameters

The parameters to be measured are respirable particulate matter (PM_{10}), semivolatile organics, and full TAL analysis of particulates. Volatile emissions will be measured using summa canisters; analysis will be by EPA methods (see Table 5).

There will be two samplers (Figure 4) located at each sampling location. One will collect a sample of particles of less than 10 μm aerodynamic diameter for gravimetric analysis of PM_{10}. The PM_{10} fraction will be analyzed for TAL metals by CLP-SOW methods. The second will collect samples of semivolatiles and volatiles in air.

4.4 Rapid Bioassessment Protocol II

The purpose of the RBP II is to evaluate stream habitats near the Beulah Landfill for potential impairment using techniques approved by EPA. The RBP II requires a skilled and experienced biologist and a trained technician to perform instream evaluations and benthic organism sampling. The procedures are provided in document EPA/444/4-89/001, entitled *Rapid Bioassessment Protocols for Use in Streams and Rivers--Benthic Macroinvertebrates and Fish*, (EPA, 1989). Appendix D of this SAP contains details extracted from the cited document for performing the RBP II. Results of the RBP II, along with available chemical data, will be used to determine the need for bioassays to determine potential toxicity to aquatic organisms. The need for and plans for further testing will be discussed with EPA prior to proceeding with the work.

5.0 SAMPLE DESIGNATION AND DOCUMENTATION

This section provides the requirements for recording and documenting the conditions of the field investigation and all pertinent data. Emphasis is placed on sample designation and documentation procedures to be followed during sample collection to ensure that samples may be easily tracked. Personnel involved in any aspect of the field investigation will be trained in these procedures prior to beginning work at the site.

In general, all documents will be completed in permanent black ink. Errors will be corrected by crossing out with a single line and then dating and initialing. The documents used during the field investigation will remain in a records storage area during the entire effort. Blank forms needed for the RI will be kept organized in the files for use by field personnel.

5.1 Logbooks

Three types of logbooks will be maintained throughout the field investigation. These are the site logbook, field logbooks, and field equipment logbooks (FEL). They are briefly described below.

5.1.1 Site Logbook

The site logbook is the master field document that is a bound book with hard cover and sequentially numbered pages. Its primary purpose is to contain, within one document, the actual field data or references to other field documents to describe every activity that has occurred each day. Any administrative occurrences, conditions, or activities that have affected the field work should also be recorded.

All entries into these logbooks will be signed and dated. The following is a partial list of the types of information to be recorded in the logbooks:

- Name and title of author, date and time of entry;
- Names and titles of field crew;
- Names and titles of all site visitors;
- Documentation of health and safety activities;
- Purpose of sampling activity;
- Type of sampled media (e.g., soil, sediment, groundwater, etc.);
- Sample collection method (e.g., split spoon, grab, composite, etc.);
- Number and volume of samples taken;
- Description of sampling points;
- Date and time of collection;
- Sample identification numbers;
- Sample distribution (e.g., laboratory);
- References for all maps and photographs of the sampling sites;
- Field observations;
- Any field measurements made such as pH, temperature, water level, HNu®, etc.;
- Decontamination procedures;

- Instrument calibrations;
- Records of telephone conversations; and
- Weather conditions.

5.1.2 Field Logbook

A separate logbook will be maintained by both the on-site geologist and personnel responsible for sampling and support activities. The requirements for these logbooks are the same as for the site logbooks. In general, these books will be the primary record of field testing and will contain the details of the tasks performed by the person maintaining the field logbook, including instrument readings, and results of field tests. Details of test borings for monitoring wells will be recorded on forms provided in Appendix A.

5.1.3 Field Equipment Logbook

The purpose of the FEL is to document the proper use, maintenance, and calibration of field testing equipment. All equipment will be inspected and approved by the field team leader before being used, and a calibration log sheet shall be maintained for each instrument used on-site and shall be kept in the FEL. The FEL should include:

- Name and identifying number of the instrument;
- Manufacturer;
- Date calibrated;
- Calibration points;
- Name of the person performing calibrations;;
- Lot number;
- Expiration date of calibration standards; and
- Results of the calibration.

5.2 Sample Label

All samples obtained at the site will be placed in an appropriate sample container for shipment to the laboratory. Each sample bottle will be identified with a separate identification label. The information on the label will include the following information:

- Project identification;
- Sample identification;
- Sampler's name or initials;
- Preservatives added;

- Date of collection;
- Time of collection; and
- Required analytical method numbers.

5.3 Sample Numbering System

A sample numbering system will be used to identify each sample taken during the field investigation. The numbering system will provide a tracking procedure to allow retrieval of information about a particular site and assure that each sample is uniquely numbered. A listing of sample numbers will be maintained by the field team leader. Each sample number will consist of four parts, as described below.

5.4 Project Identification

The designation "Beulah" will be used to identify the project.

5.5 Sample Source Identification

An alpha-numeric identification code unique to each sampling location will be used to identify sample sources. The following codes will be used:

Code	Sample Source Description
A-1	Air sampling location 1
SB-1	Soil boring location 1
BMW-1	Monitoring well identifier
SW-1	Surface water sampling location 1
SD-1	Stream sediment sampling location 1

The numeric character will vary according to the number of sampling location or well at the site.

5.6 Sample Event Numbering

A code will be used to identify the sampling event when it is anticipated that more than one sample will be obtained at a given location from the same sampling media. The following are examples of the codes to be used during the course of the follow-on activities at the Beulah Landfill site.

Code	Media Description
SS1, 0-0.5	Soil Sample, number and depth (in feet) at which the sample was acquired.
W1	Water sample and sampling event number. The sampling event number will be consecutively numbered for each sample obtained at that sample location.

5.7 Duplicate Sample Labeling

The label "ES" will be used to identify samples to be sent to the ES designated laboratory. Duplicate samples sent to the ES laboratory will be identified using a unique sample location identifier.

5.8 Examples of Sample Numbering

- **Beulah MW-4 W2 ES**

  Beulah Landfill, monitoring well MW-4, the second water sample obtained from this monitoring well, retained by ES for analysis.

- **Beulah SW-3 W1 ES**

  Beulah Landfill surface water station location no. 3, the first surface water sample obtained from this location, retained by Engineering-Science for laboratory analysis.

- **Beulah SB-2 SS2 0-1 ES**

  Beulah Landfill, soil boring location no. 2, the second soil sample obtained from this location, sample retrieved from surface to 1-foot interval, retained by ES for laboratory analysis.

6.0 SAMPLING EQUIPMENT AND PROCEDURES

Procedures employed in the collection of samples are of critical importance since the analytical results obtained and the subsequent decisions made based upon the data are vitally dependent upon the integrity of the samples. Procedures described here meet the EPA requirements for sampling (Section 4, ECBSOPQAM, 1991). Every effort must be made to assure that samples are representative of the particular media being sampled. Therefore, sample integrity must be properly maintained from the time of collection to analysis to minimize any potential for contamination. Tables 2 and 3 contain the requirements for containers, preservation, and maximum holding times for water and waste samples, respectively.

6.1 Groundwater Sampling

Sampling procedures for will follow EPA guidance (Section 4, ECBSOPQAM, 1991). The monitoring wells will be purged prior to collecting samples by removing three to five casing volumes of water from each well. The static water level in the well will be measured and recorded in the field logbook prior to purging. Purging will be accomplished by pumping or bailing. Purging will be continued until temperature, pH, and conductivity measurements have stabilized to within 10 percent of the previous measurement for three consecutive measurements. The well will be sampled immediately after purging if recharge is sufficient (greater than 80

percent water-level recovery). Wells with very slow recharge will be sampled within 24 hours of purging. A copy of the Well Purging Record is included in Appendix A.

Groundwater samples will be collected from each monitoring well using a decontaminated Teflon® bailer. For each well to be sampled, a new nylon or polypropylene cord will be used and then discarded. Sample containers will be filled directly from the bailer. When filling the sample containers for volatile organic analysis, care will be used to insure that no headspace or air bubbles are present in the container. A final aliquot of water will be collected and the pH, temperature, and conductivity will be measured and recorded in the field logbook. Table 3 presents a summary of the analytical methods as well as sample containers, preservatives, and holding times. The preservatives will be added to the sample containers prior to sampling. Groundwater sampling will be documented on a form identical to that shown in Appendix A.

Two samples will be collected from each well for metals analysis. One sample will be unfiltered, to be analyzed for total metals. The second sample will be field-filtered through an 0.45 μm pore filter for analysis of dissolved metals.

6.2 Surface Water and Stream Sediment Sampling

Surface water samples will be obtained in a manner consistent with the objectives for the sampling program. Sampling will occur when the streamflow is at base level so wading is practical. Grab samples of surface water for total metals will be collected from near the surface by filling the sample bottle directly from the creek. The sample container mouth will be positioned so that it faces upstream. Surface water samples for dissolved metals will be filtered using an 0.45 μm pore filter before filling the sample bottle. The bottle types and preservatives will be the same as those provided in Table 3 for groundwater. The samples will be prepared for shipment using the procedure described in Section 7.0.

Stream sediment samples will be collected from the stream bottom using a piston corer or clam shell dredge to obtain materials from the upper 6 inches of the stream bed. Samples will be collected from the west side of Elevenmile Creek to detect potential leachate effects from the landfill. Samples from Coffee Creek will be collected from the midpoint of the channel due to the proximity of landfills on both sides of the stream. Sediment samples will be placed in clean wide-mouth jars, sealed, placed on ice in coolers, and prepared for shipment following the procedure described in Section 7.0.

During surface water sampling a stream flow measurement will be made by the wading-rod method using a pygmy current meter or similar device. Depth and velocity readings will be taken at measured intervals across the stream. Stream flow will be calculated by summing the discharge calculated in each vertical section. Surface water sampling information is documented on the form shown in Appendix A.

6.3 Soil Sampling

This section describes the protocols that will be followed by field personnel during the sampling of soils/sludges. A qualified technician will be present for the collection of samples, monitoring of OVA/PID readings, recording of data, and preparation of chain-of-custody forms.

Soil samples will be collected for chemical analysis using a hand auger. The soils samples will be screened for possible contamination. The empty auger hole will be tested for the presence of organic vapors using an organic vapor detector or photoionization detector. The readings obtained using the meter and any observations of discoloration or odor will be recorded in the field notebook. The samples will be labeled and examined visually for lithologic description.

Soil samples will be collected from approximately 1-foot depths for chemical analysis. Soil samples to be analyzed for volatile organics will be collected in stainless-steel tube inserts and sealed as quickly as possible. The remaining samples will be obtained from a standard auger bucket, placed in a stainless-steel mixing bowl, and composited using a stainless-steel spoon or trowel. The sample containers will then be filled using a clean stainless-steel spoon. The sample containers will be sealed, labelled, and placed in coolers. The coolers will be iced to keep the samples cool. The samples will be shipped to the laboratory on the day of collection by courier. Requirements for sample containers, preservation procedures, and holding times are summarized in Table 4.

An appropriate marker will be placed at ground level at each sampling location for future reference.

6.4 Air Sampling

During air sampling, the air sampler draws a measured volume of air into a covered housing (through a size selective head, in the case of PM_{10}), and the entrained particulate matter is deposited into a pre-tared filter. Particulate matter concentrations are determined gravimetrically, then a portion of the filter is digested in nitric acid to extract the metals, which are then analyzed by ICP. The PM_{10} samplers operates at a flow rate of 1.13 $\pm$10 percent std m^3 / min.

The concentration of particulate matter in ambient air is determined by dividing the weight of deposited matter by the total volume of air sampled. This volume is, in turn, the product of the flow rate and the length of time sampled. Airflow variations and timing errors will be minimized by the use of a flow controller and an elapsed time meter. Details of the air sampling procedure are provided in Appendix B.

7.0 SAMPLE HANDLING AND ANALYSIS

Soil/Sediment samples for VOC analysis will be collected using an auger with stainless steel tube inserts. The inserts will be numbered with indelible marker

7.0 SAMPLE HANDLING AND ANALYSIS

Soil/Sediment samples for VOC analysis will be collected using an auger with stainless steel tube inserts. The inserts will be numbered with indelible marker prior to placing in the auger. After filling with a soil sample, the insert will be immediately sealed with Teflon® end caps. The end caps will be taped with Teflon® tape to ensure a tight seal during shipment.

All samples except soil and sediments to be analyzed for volatile organics will be placed in preserved, pre-cleaned (EPA Level III protocols) glass and plastic bottles for shipment to the laboratory. All bottles will have Teflon®-lined lids. The pre-cleaned bottles will be obtained from a suitable vendor. The sample bottle caps will be taped using polyethylene (Teflon® for VOA samples) tape to ensure they will remain sealed during shipment.

Individual sample bottles will be wrapped in bubble pack and placed in sealed plastic bags to prevent breakage during shipment. The bags will be placed with adsorbent material into insulated shipping coolers with plastic bags filled with crushed ice. A chain-of-custody record describing the contents of the cooler will be placed in a sealed plastic bag and taped to the upper lid of the cooler. The shipping coolers will be sealed to prevent leakage of melting ice and affixed with security labels taped over opposite ends of the lid. The coolers will be labeled in accordance with the DOT regulations for transport and shipped via courier to the laboratory.

7.1 Quality Control Samples

During each sampling effort, a number of quality control (QC) samples must be collected and submitted for laboratory analysis. The number and frequency of the QC sample collection are given in Table 5. A list of the types of QC samples that shall be collected along with a brief description of each sample type is outlined in the following sections. Also, ESD Branch of EPA Reigon IV will submit QA/QC samples to the laboratory for independent tests of quality.

7.1.1 Trip Blanks

Trip blanks are collected for chemical analysis of volatile organics. The analytical results serve as a baseline measurement of volatile organic contamination to which samples may be exposed during transport and laboratory storage.

Trip blanks originate in the laboratory. They are comprised of HPLC-grade water placed in sample containers by the laboratory, transported to the sample collection site, handled along with the samples, and returned to the laboratory along with samples of water and/or soil collected for volatile organic analysis. The trip blank containers are not to be opened in the field.

One trip blank is included in each shipping container containing samples for volatile organics analysis. It is stored in the laboratory with the samples and analyzed by the laboratory (for volatile organics only).

7.1.2 Rinsate Blanks

Rinsate blanks (equipment blanks) are collected for sampling equipment for sampling when devices other than the sample bottle itself are required. The analysis of these blanks serves to verify the cleanliness of the sampling equipment.

Rinsate blanks are comprised of HPLC-grade water that is transported to the sample collection site, poured into the sampling device following equipment decontamination procedures, transferred to the sample bottles, and shipped to the laboratory for analysis. The rinsate blanks are analyzed for the same parameters as the associated samples.

Rinsate blanks will be collected every day of sample collection, but initially only those from every other day will be analyzed. Those not initially analyzed will be stored at 4°C until their holding times expire. If analyses pertinent to the project are found in the rinsate, the remaining samples will be analyzed.

7.1.3 Field Blanks

Field blanks will be collected for each type of water used to decontaminate sampling equipment as required in Section 4 of ECBSOPQAM (1991). At a minimum, one sample from each event and each source of water shall be collected and analyzed. A separate field blank will be collected for each lot of HPLC water. Samples of well construction materials will also be collected as described in Section 7 of the Work Plan. One sample each of sand pack, bentonite, and grout mix will be analyzed for TCL organics and TAL metals.

7.1.4 Field Duplicates

Analysis of duplicates provides statistical information relating to sample variability and serves as a check on the precision of the sample collection method. Duplicate samples will be obtained from a location immediately following the collection of the original sample, with the exception of the samples for analysis of volatile organics. These samples will be obtained from as close as possible to the initial sample source.

Ten percent of all samples for each matrix will be collected in duplicate and submitted for laboratory analysis. Field duplicates will be labeled in such a manner so that persons performing laboratory analyses are not able to distinguish duplicates from other samples.

7.1.5 Matrix Spikes/Matrix Spike Duplicates

Each batch of samples will be analyzed with a set of matrix spikes and matrix spike duplicates (MS/MSD). The frequency of MS/MSD analysis will be not less than one per 20 samples. The MS/MSD samples will be fortified with the following compounds:

Fraction	Matrix Spiking Compound	Expected % Recovery Soils	Water
Volatiles	1,2-dichloroethene	59-172	61-145
	Trichloroethene	62-137	71-120
	Benzene	66-142	76-127
	Toluene	59-139	76-125
	Chlorobenzene	60-133	75-130
Semivolatiles	Phenol	26-90	12-110
	2-Chlorophenol	25-102	27-123
	1,4-Dichlorobenzene	28-104	36-97
	N-Nitrosodi-n-propylamine	41-126	41-116
	1,2,4-Trichlorobenzene	38-107	39-98
	4-Chloro-3-methylphenol	26-103	23-97
	Acenapthene	31-137	46-118
	4-Nitrophenol	11-114	10-80
	2,4-Dinitrotoluene	28-89	24-96
	Pentachlorophenol	17-109	9-103
	Pyrene	35-142	26-127
Pesticides	Lindane	46-127	59-123
	Heptachlor	35-130	40-131
	Aldrin	34-132	40-120
	Dieldrin	31-134	52-126
	Endrin	42-139	56-121
	4,4′-DDT	23-134	38-127

The percentage recovery of the matrix spiking compounds and relative percentage difference of duplicate analyses will be calculated to obtain measurements of accuracy and precision.

7.2 Sample Custody

Proper custody procedures are needed to ensure that samples have been obtained from the locations stated and that samples have reached the laboratory without alteration. All sample bottles shall be maintained in a locked storage area prior to use. Evidence of the sample traceability from collection to shipment, laboratory receipt, and laboratory custody must be documented. A sample is considered to be in a person's custody if the sample is:

- In a person's actual possession;
- In view after being in a person's possession;
- Locked so no one can tamper with it after having been in physical custody; or
- In a secured area, restricted to authorized personnel.

The field team leader is responsible for overseeing and supervising the implementation of custody procedures in the field. He is also designated as the field sample custodian and is responsible for ensuring sample custody until the samples have been transferred to a courier or directly to the laboratory.

Once the samples have been received by the laboratory, a designated person is responsible for maintaining a file of all the original documents (e.g., chain-of-custody forms, traffic reports, special analytical services request forms, etc.) pertinent to sample custody and sample analysis.

7.3 Chain-of-Custody Records

All samples will be accompanied by a chain-of-custody record; an example is shown in Appendix A. A chain-of-custody record will accompany the sample during shipment to the laboratory, and through the laboratory. When transferring samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. The laboratory maintains a file copy, and the completed original will be returned to the project manager as a part of the final analytical report. This record will be used to document sample custody transfer from the sampler to a laboratory or to an ES office.

Shipments will be sent by courier to the laboratory. Waybills will be retained as part of the permanent documentation and all sample shipments will be regulated by the U.S. Department of Transportation (DOT) as described in the Code of Federal Regulations (49 CFR 171 through 177).

8.0 DECONTAMINATION PROCEDURES

8.1 General

Decontamination procedures for sampling activities are discussed below. A summary of decontamination procedures is given in Table 6. Decontamination will consist of combinations of steam cleaning, laboratory-grade detergent (Liquinox®) wash, potable water rinse, pesticide-grade isopropanol rinse, and HPLC-grade water rinse as described herein. In general, as much decontamination as possible will be done onsite at a designated area. Note, no solvents, soap solutions, or rinse water may be re-used. Decontamination fluids will be containerized and transported to the County landfill for treatment.

Decontamination will be conducted in a manner that will guard against cross-contamination of equipment. Augers, bailers, and other large pieces of equipment will be placed on saw horses or tables to keep them from touching the ground. Smaller items will be placed on clean plastic sheeting or on surfaces covered with aluminum foil. Personnel will wear clean vinyl gloves during decontamination of equipment.

All decontamination procedures performed during the course of a field investigation must be documented in the field logbook and on a decontamination form. An example of an Equipment Decontamination Log is provided in Appendix A. Any deviations from the standard decontamination protocols must be noted in the field logbook.

8.2 Sampling Equipment

All tools used for sampling, including hand augers, sampling spoons, stainless-steel bowls, bailers, etc., will be decontaminated before each use. The decontamination procedure applicable for this equipment is dependent on the target compound to be analyzed for. These procedures are summarized in Table 6.

8.3 Water Level Indicator

The electrical water-level indicator, pressure transducer, or other measuring devices used in monitoring wells will be cleaned prior to use at each well. Cleaning will consist of wiping with a disposable, soap impregnated cloth followed by a tap water rinse and a deionized water rinse.

9.0 ADDITIONAL PROCEDURES

Activities to be completed during the RI not specifically related to sampling are described in this section.

9.1 Water Level Measurements

Water level measurements will be made using electronic water-level indicators. Water levels will be measured to ±0.01 foot prior to purging. Water levels will be measured periodically (monthly) in all wells as field work progresses.

9.2 Surveying

All soil sampling and monitoring well locations will be surveyed by a Florida-licensed surveyor. Surveying of well casings will have vertical and horizontal accuracies of 0.01 and 0.1 foot, respectively. Survey points will be tied to the United States Geological Survey (USGS) vertical datum and to the Florida State Coordinate System. All bench marks and all surveyed locations will be noted on appropriate site maps.

9.3 Aquifer Testing

Aquifer testing may be needed to address the practiality of using groundwater recovery as a remedial alternate. Slug testing will be used to aid in screening groundwater recovery as a technically feasible alternate. Results from slug tests will be compared with literature values to characterize the hydrologic properties of the aquifer.

The slug test method will be used to determine initial estimates of transmissivity for the aquifer at each site. The slug testing and analysis procedures will generally follow those outlined by Lohman (1972).

A pressure transducer and automatic recorder will be used to collect data during testing. The pressure sensor will be placed below the water level in the well and the water level allowed to stabilize. A metal slug will then be injected into the well and water levels recorded at closely spaced intervals over the time required for

the water levels to recover to their approximate original position. The test data will be analyzed using the program AQTESOLV® by Geraghty and Miller (1990). This computer program analyses and plots data using the method of Bouwer and Rice (1976) and Cooper, Bredehoeft and Papadopulos (1967).

9.4 Field Changes

In general, no deviations from planned activities may be made without prior written consent of the EPA RPM. Minor deviations such as schedule changes or total depths of monitoring wells may be made with verbal approval from the EPA RPM. All variances from procedural and planning/design documents and other project requirements will be documented on the Field Change Request Form. Field changes and deviations from project planning documents shall be reviewed and approved by the project manager or project quality assurance officer. All deviations from procedural and planning documents shall be recorded in the site logbook and documented by a technical record of project change. An example of this form is contained in Appendix A as Form A-1. Project reports shall detail all field changes and deviations from the project plans.

10.0 RI-DERIVED WASTE MANAGEMENT

Following completion of work at a site, the site will be restored as close as possible to its pre-investigation condition.

10.1 Decontamination fluids

The liquid waste generated onsite during decontamination procedures will be containerized and transported by the Respondents to the County landfill for treatment. The decontamination materials (gloves, foil, bottles, etc.) will be containerized separately from fluids for disposal by the County.

10.2 Well Development Fluids

All purge and development water will be containerized and transported by the Respondents to the Escambia County landfill for treatment.

10.3 Hazardous Waste Disposal

The Respondents will be responsible for all hazardous materials generated during this investigation. The Respondents will arrange for the transportation and disposal of all hazardous materials. The Respondents will be responsible for signing all manifests (to be prepared by the consultant) concerning the transportation and disposal of hazardous materials.

TABLE 1
SUMMARY OF FIELD ACTIVITIES

Field Activity	Purpose	Sampling Media	Analyses
Measure surface water flow and sample surface water and sediments at up to eight locations.	Confirm previous results and further characterize surface water quality.	Surface water and sediments	Full scan TCL-TAL with Level IV DQO.
Collect up to 27 surface soil samples.	Characterize potential contamination sources for direct exposure pathway.	Soil	Full scan TCL-TAL with Level IV DQO.
Sample up to 12 monitoring wells.	Confirm previous results and further characterize groundwater quality.	Groundwater	Full scan TCL-TAL with Level IV DQO.
Collect ambient air samples at up to four locations.	Characterize air quality.	Air	TCL-TAL scan plus volatile and semivolatile organics by EPA Methods T014-1 and PS-1
Perform RBP II.	Determine biota/habitat of streams	Bottom sediments/ benthic organisms	100-organism subsamples with taxonomic ID to family level.

TABLE 2
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppm)	Method	Reference
Total Organic Carbon	Water	ID	106,4.9	4	9060	1
Conductivity	Water	5,3.6	97,7.0	0.1	120.1	1
pH	Water	1.8,2.5	97,0.9	ID	9040	1
Temperature	Water	0,0	NA	NA	170.1	1
Oxygen,Dissolved	Water	4.8,2.3	102,35	0.1	360.1	1
Residue, Dissolved	Water	1.3,1.0	103,17	1.0	160.1	2
Turbidity	Water	4,1.2	85,8.1	0.1	180.1	2
Chloride (automated)	Water	0.47,0.21	101,3.5	0.5	9250	2
Fluoride	Water	5,3.6	110,3.6	0.01	340.2	2
Sulfate(Turbidimetric)	Water	2.6,2.1	102,5.6	1.0	9038	2
Nitrogen, Nitrate (automated-Cadmium)	Water	6,4.3	97,2.9	0.1	352.1	2
Nitrogen, Nitrite (automated)	Water	10,5.0	105,3.3	0.1	354.1	2
TAL Metals					**CLP-SOW**	
Aluminum	Water Soil	5.2, 4.7	92, 3.6	0.03 3.0		4
Antimony	Water Soil	12, 8.6	79, 17	0.043 4.3		4
Arsenic	Water Soil	16, 9.3 12,6.9	71, 9.6 10.1	0.003 0.6		4 4
Barium	Water Soil	14, 9.9 10,5.0	76, 0.5 100,6.7	0.003 0.3		4 4
Beryllium	Water Soil	1.3, 2.0	96, 0.1	0.001 0.1		4

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TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppm)	Method	Reference
Cadmium	Water	5.5, 3.0	98, 0.2	0.001		4
	Soil	9,2.2	101,8.1	0.7		4
Calcium	Water	11, 1.7	91, 2.6	0.013		4
	Soil			1.4		
Chromium	Water	4.8, 0.1	95, 3.1	0.008		4
	Soil	10,2.0	89, 8.4	0.8		4
Cobalt	Water	4.0, 3.9	92, 4.5	0.006		4
	Soil			0.6		
Copper	Water	4.1, 1.2	92, 0.3	0.009		4
	Soil	10,2.0	101,5.2	0.6		4
Cyanide	Water	6.9, 2.6	96, 2.5	0.005		4
	Soil			0.125		
Iron	Water	6.0, 0.4	88, 7.0	0.004		4
	Soil			0.4		
Lead	Water	20, 15	84, 15	0.001		4
	Soil	9,6.3	110,10.2	0.2		4
Magnesium	Water	6.0, 2.9	98, 1.1	0.078		4
	Soil			7.8		
Manganese	Water	3.1, 1.4	94, 0.2	0.001		4
	Soil			0.1		
Mercury	Water	10,7.1	102,3.3	0.00001		4
	Soil	20,16.0	89,6.0	0.001		4
Nickel	Water	5.7, 4.0	95,0.2	0.011		4
	Soil			1.1		
Potassium	Water	8.1, 0.9	86, 36	2.157		4
	Soil			216		

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppm)	Method	Reference
Selenium	Water	21, 10	78, 9.0	0.002		4
	Soil	9,3.8	110,8.2	0.4		4
Silver	Water	23, 9.3	44, 5.1	0.001		4
	Soil	20,1.1	127,0.6	1.0		4
Sodium	Water	20, 2.7	95, 40	0.067		4
	Soil			6.7		
Thallium	Water			0.001		
	Soil			0.2		
Vanadium	Water	5.9, 2.1	96, 2.0	0.010		
	Soil			1.0		
Zinc	Water	8.6, 1.2	93, 0.3	0.003		4
	Soil	12,3.0	103,5.8	0.3		4

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
Purgeables/Volatiles					**CLP-SOW**	
Acetone	Water			60		
	Sediment	25,10.0	135,9.9	60		3
Benzene	Water	30,17.4	95,2.0	0.6		3
	Sediment	30,17.4	95,2.0	0.6		3
Bromodichloromethane	Water	15,5.9	103,15.8	0.7		3
	Sediment	15,5.9	103,15.8	0.7		3
Bromoform	Water	15,3.4	118,23.5	0.6		3
	Sediment	15,3.4	118,23.5	0.6		3
Bromomethane	Water	27,13.0	100,10.0	1.1		3
	Sediment	27,13.0	100,10.0	1.1		3
2-Butanone(MEK)	Water			90		
	Sediment	30,14.0	131,20.0	90		3
Carbon disulfide	Water			0.7		
	Sediment	27,15.1	119,18.2	0.7		3
Carbon tetrachloride	Water	12,2.5	110,16.8	1		3
	Sediment	12,2.5	110,16.8	1		3
Chloroethane	Water	17,6.1	121,16.9	10		3
	Sediment	17,6.1	121,16.9	10		3
Chlorobenzene	Water	16,9.0	98,22.8	1		3
	Sediment	16,9.0	98,22.8	1		3
Chloroform	Water	16,2.2	93,3.3	1		3
	Sediment	16,2.2	93,3.3	1		3
Chloromethane	Water	27,21.4	113,18.1	10		3
	Sediment	27,21.4	113,18.1	10		3
Chlorodibromoethane	Water	17,1.8	101,3.0	0.4		3
	Sediment	17,1.8	101,3.0	0.4		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
1,1-Dichloroethane	Water	13,5.0	105,3.6	0.7		3
	Sediment	13,5.0	105,3.6	0.7		3
1,2-Dichloroethane	Water	17,3.2	102,4.5	0.5		3
	Sediment	17,3.2	102,4.5	0.5		3
1,2-Dichloroethene (total)	Water			0.7		
	Sediment	25,7.2	130,10.0	0.7		3
1,1-Dichloroethene	Water	17,10.6	112,6.1	0.9		3
	Sediment	17,10.6	112,6.1	0.9		3
1,2-Dichloropropane	Water	25,3.0	100,10.0	0.6		3
	Sediment	25,3.0	100,10.0	0.6		3
cis-1,3-Dichloropropene	Water	23,8.0	100,10.0	1		3
	Sediment	23,8.0	100,10.0	1		3
trans-1,3-Dichloropropene	Water	25,5.0	100,10.0	0.3		3
	Sediment	25,5.0	100,10.0	0.3		3
Ethylbenzene	Water	14,10.0	98,24.8	0.5		3
	Sediment	14,10.0	98,23.8	0.5		3
2-Hexanone	Water			10		
	Sediment	21,8.1	140,8.7	10		3
Methylene chloride	Water	15,10.7	87,18.8	4.5		3
	Sediment	15,10.7	87,18.8	4.5		3
4-Methyl-2-pentanone				10		
	Sediment	20,11.7	90,6.1	10		3
Styrene				0.7		
	Sediment	27,10.8	95,12.2	0.7		3
1,1,2,2-Tetrachloroethane	Water	16,6.9	93,17.6	0.9		3
	Sediment	16,6.9	93,17.6	0.9		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
Tetrachloroethene	Water	13,1.8	106,6.0	0.6		3
	Sediment	13,1.8	106,6.0	0.6		3
Toluene	Water	15,7.1	98,2.3	1		3
	Sediment	15,7.1	98,2.3	1		3
1,1,1-Trichloroethane	Water	12,1.5	106,7.3	3.4		3
	Sediment	12,1.5	106,7.3	3.4		3
1,1,2-Trichloroethane	Water	14,2.0	95,17.1	0.6		3
	Sediment	14,2.0	95,17.1	0.6		3
Trichloroethene	Water	13,3.6	104,22.7	1		3
	Sediment	13,3.6	104,22.7	1		3
Vinyl acetate	Water			0.7		
	Sediment	25,16.2	129,5.0	0.7		3
Vinyl chloride	Water	30,18.0	100,10.0	10		3
	Sediment	30,18.0	100,10.0	10		3
Xylenes	Water	12,9.0	115,11.0	1.1		3
	Sediment	12,9.0	115,11.0	1.1		3
Base, Neutral and Acid Extractables/Semivolatiles					**CLP-SOW**	
Acenaphthene	Water	12,1.7	110,9.2	2		3
	Sediment	12,1.7	110,9.2	70		3
Acenaphthylene	Water	10,4.1	100,4.0	2		3
	Sediment	10,4.1	100,4.0	74		3
Anthracene	Water	11,2.2	81,5.1	1.3		3
	Sediment	11,2.2	81,5.1	4.5		3
Benzo(a)anthracene	Water	12,2.3	98,3.2	1		3
	Sediment	12,2.3	98,3.2	35		3
Benzo(b)fluoranthene	Water	12,3.0	99,1.0	1.2		3
	Sediment	12,3.0	99,1.0	42		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
Benzo(k)fluoranthene	Water	16,5.4	104,3.4	0.8		3
	Sediment	16,5.4	104,3.4	28		3
Benzoic acid	Water			32		
	Sediment			1,130		
Benzo(ghi)perylene	Water	12,1.1	98,8.3	0.9		3
	Sediment	12,1.1	98,8.3	32		3
Benzo(a)pyrene	Water	15,6.4	98,8.3	1		3
	Sediment	15,6.4	98,8.3	35		3
Benzyl alcohol	Water	12,3.4	100,2.4	1.5		3
	Sediment	12,3.4	100,2.4	52		3
Bis(2-chloroethoxy)methane	Water	20,2.9	85,15.0	1.2		3
	Sediment	20,2.9	85,15.0	42		3
Bis(2-chloroethyl)ether	Water	23,13.7	80,11.3	1.4		3
	Sediment	23,13.7	80,11.3	49		3
Bis(2-chloroisopropyl)ether	Water	28,6.0	93,5.2	2.1		3
	Sediment	28,6.0	93,5.2	74		3
Bis(2-ethylhexyl)phthalate	Water	21,5.1	73,8.3	2		3
	Sediment	21,5.1	73,8.3	70		3
4-Bromophenyl phenyl ether	Water	20,7.6	96,3.6	1.6		3
	Sediment	20,7.6	96,3.6	56		3
Butyl benzyl phthalate	Water	12,4.6	81,5.0	2.1		3
	Sediment	12,4.6	81,5.0	74		3
p-Chloraniline	Water			1.2		
	Sediment	20,6.1	120,15.0	42		3
4-Chloro-3-methylphenol (p-chloro-m-cresol)	Water	15,4.6	93,6.5	2.7		3
	Sediment	15,4.6	93,6.5	95		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
2-Chloronaphthalene	Water	21,6.1	91,6.0	1.1		3
	Sediment	21,6.1	91,6.0	39		3
2-Chlorophenol	Water	25,4.7	86,3.0	1.0		3
	Sediment	25,4.7	86,3.0	35		3
4-Chlorophenyl phenyl ether	Water	17,9.0	104,7.0	2.7		3
	Sediment	17,9.0	104,7.0	95		3
Chrysene	Water	21,4.6	95,19.0	1.9		3
	Sediment	21,4.6	95,19.0	67		3
2-Methylphenol (o-cresol)	Water			1.3		
	Sediment	20,4.5	114,4.6	1.3		3
4-Methylphenol (p-cresol)	Water			1.5		
	Sediment	21,9.3	112,11.0	1.5		3
Dibenzo(a,h)anthracene	Water	15,10.1	112,12.2	0.9		3
	Sediment	15,10.1	112,12.2	32		3
Dibenzofuran	Water	16,1.1	98,10.0	2.5		3
	Sediment	16,1.1	98,10.0	88		3
Di-n-butyl phthalate	Water	11,8.3	99,15.9	1.2		3
	Sediment	11,8.3	99,15.9	42		3
1,2-Dichlorobenzene	Water	12,7.0	89,6.0	1		3
	Sediment	12,7.0	89,6.0	35		3
1,3-Dichlorobenzene	Water	15,9.4	100,1.8	1.3		3
	Sediment	15,9.4	100,1.8	45		3
1,4-Dichlorobenzene	Water	15,2.8	91,11.6	1.2		3
	Sediment	15,2.8	91,11.6	42		3
3,3'-Dichlorobenzidine	Water	15,5.3	99,1.6	3.3		3
	Sediment	15,5.3	99,1.6	115		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
2,4-Dichlorophenol	Water	13,6.6	107,2.7	2.1		3
	Sediment	13,6.6	107,2.7	74		3
Diethyl phthalate	Water	10,5.4	96,4.3	2		3
	Sediment	10,5.4	96,4.3	70		3
2,4-Dimethylphenol	Water	10,5.4	99,1.7	2.7		3
	Sediment	10,5.4	99,1.7	95		3
Dimethyl phthalate	Water	12,5.1	100,4.4	1.6		3
	Sediment	12,5.1	100,4.4	56		3
4,6-Dinitro-2-methylphenol	Water	12,5.1	96,3.8	48		3
	Sediment	12,5.1	96,3.8	1,670		3
2,4-Dinitrophenol	Water	17,4.1	106,5.5	76		3
	Sediment	17,4.1	106,5.5	2,650		3
2,4-Dinitrotoluene	Water	12,2.6	114,1.1	13		3
	Sediment	12,2.6	114,1.1	450		3
2,6-Dinitrotoluene	Water	10,1.9	99,1.2	8.8		3
	Sediment	10,1.9	99,1.2	310		3
Di-n-octyl phthalate	Water	15,6.1	97,2.7	3.2		3
	Sediment	15,6.1	97,2.7	110		3
Fluoranthene	Water	12,1.7	110,9.2	0.8		3
	Sediment	12,1.7	110,9.2	28		3
Fluorene	Water	11,1.0	109,6.0	2.5		3
	Sediment	11,1.0	109,6.0	88		3
Hexachlorobenzene	Water	20,7.6	105,10.1	2.7		3
	Sediment	20,7.6	105,10.1	95		3
Hexachlorobutadiene	Water	18,7.3	103,16.6	1.7		3
	Sediment	18,7.3	103,16.6	60		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
Hexachlorocyclopentadiene	Water			8.8		
	Sediment	16,1.6	100,3.8	330		3
Hexachloroethane	Water	15,3.9	98,6.1	3.1		3
	Sediment	15,3.9	98,6.1	110		3
Indeno(1,2,3-cd)pyrene	Water	15,2.8	88,9.8	1.3		3
	Sediment	15,2.8	88,9.8	45		3
Isophorone	Water	15,9.4	100,1.8	1.5		3
	Sediment	15,9.4	100,1.8	53		3
2-Methylnaphthalene	Water			1		
	Sediment	13,6.6	107,2.7	35		3
Naphthalene	Water	16,3.9	104,2.4	0.6		3
	Sediment	16,3.9	104,2.4	21		3
o-Nitroaniline	Water			2.2		
	Sediment	15,5.4	96,11.0	77		3
m-Nitroaniline	Water			8.5		
	Sediment	15,7.6	96,7.0	300		3
p-Nitroaniline	Water			4.2		
	Sediment	16,1.1	98,10.0	150		3
Nitrobenzene	Water	13,2.6	97,5.6	1.5		3
	Sediment	13,2.6	97,5.6	53		3
2-Nitrophenol	Water	12,1.9	97,2.3	2.8		3
	Sediment	12,1.9	97,2.3	98		3
4-Nitrophenol	Water	12,3.0	93,11.7	32		3
	Sediment	12,3.0	93,11.7	1,130		3
N-Nitroso-di-phenylamine	Water	12,3.6	90,6.1	0.8		3
	Sediment	12,3.6	90,6.1	28		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
N-Nitroso-di-n-propylamine	Water	12,3.6	90,6.1	2		3
	Sediment	12,3.6	90,6.1	70		3
Pentachlorophenol	Water	22,5.3	96,5.2	39		3
	Sediment	22,5.3	96,5.2	1,350		3
Phenanthrene	Water	17,1.7	95,10.0	0.8		3
	Sediment	17,1.7	95,10.0	28		3
Phenol	Water	21,5.6	92,5.7	1.4		3
	Sediment	21,5.6	92,5.7	49		3
Pyrene	Water	30,8.9	62,16.0	2.4		3
	Sediment	30,8.9	62,16.0	84		3
1,2,4-Trichlorobenzene	Water	12,6.1	97,10.6	1.9		3
	Sediment	12,6.1	97,10.6	67		3
2,4,5-Trichlorophenol	Water			7		
	Sediment	11,3.2	93,7.0	245		3
2,4,6-Trichlorophenol	Water	13,9.1	91,10.7	11		3
	Sediment	13,9.1	91,10.7	370		3
Aldrin	Water	16,4	81,4	0.02		3
	Sediment	16,4	81,4	0.8		3
alpha-BHC	Water	13,4	84,3	0.02		3
	Sediment	13,4	84,3	0.8		3
beta-BHC	Water	22,2	81,7	0.02		3
	Sediment	22,2	81,7	0.8		3
gamma-BHC	Water	18,9	81,7	0.02		3
	Sediment	18,9	81,7	0.7		3
delta-BHC	Water	12,6	82,5	0.02		3
	Sediment	12,6	82,5	0.8		3

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
alpha Chlordane	Water	13,13	82,4	0.12		3
	Sediment	13,13	82,4	4.2		3
gamma Chlordane	Water			0.23		
	Sediment			8.0		
4-4′-DDD	Water	20,18	84,30	0.02		3
	Sediment	20,18	84,30	0.7		3
4-4′-DDE	Water	13,6	85,14	0.02		3
	Sediment	13,6	85,14	0.6		3
4,4′-DDT	Water	17,39	93,13	0.02		3
	Sediment	17,39	93,13	0.7		3
Endosulfan I	Water	10,7	97,4	0.02		3
	Sediment	10,7	97,4	0.7		3
Endosulfan II	Water	41,65	93,34	0.03		3
	Sediment	41,65	93,34	1.1		3
Endosulfan sulfate	Water	13,33	89,37	0.02		3
	Sediment	13,33	89,37	0.8		3
Endrin	Water	20,25	89,4	0.04		3
	Sediment	20,25	89,4	1.4		3
Endrin ketone	Water			0.3		
	Sediment			0.9		
Heptachlor	Water	6,13	69,4	0.02		3
	Sediment	6,13	69,4	0.7		3
Heptachlor epoxide	Water	18,11	89,10	0.02		3
	Sediment	18,11	89,10	0.8		3
Methoxychlor	Water			22.4		
	Sediment			1.3		

TABLE 2--Continued
QUALITY ASSURANCE OBJECTIVES

Component	Matrix	Precision x RPD, Sd	Accuracy % Rec, sd	MDL (ppb)	Method	Reference
Toxaphene	Water	9,32	80,17.4	2.5		3
	Sediment	9,32	80,17.4	65		3
PCB-1016	Water	13,1.5	81,50	1.0		3
	Sediment	13,1.5	81,50	33.3		3
PCB-1221	Water	29,7.6	96,65	3.0		3
	Sediment	29,7.6	96,65	100		3
PCB-1232	Water	21,19.3	91,108	2.0		3
	Sediment	21,19.3	91,108	66.7		3
PCB-1242	Water	21,19.3	91,108	1.0		3
	Sediment	21,19.3	91,108	33.3		3
PCB-1248	Water	21,19.3	91,108	2.0		3
	Sediment	21,19.3	91,108	66.7		3
PCB-1254	Water	21,19.3	91,108	1.0		3
	Sediment	21,19.3	91,108	33.3		3
PCB-1260	Water	21,19.3	91,108	1.0		3
	Sediment	21,19.3	91,108	33.3		3

NA - Not Applicable
ID - Insufficient Data

References:
1. EPA 600/4-79-020, Revised March 1983
2. Standard Methods, 17th Edition, 1989
3. CLP-SOW for Organics, Feburary 1988, as revised through 1989
4. CLP-SOW for Inorganics July 1988, as revised through 1989.

MDL (Method Detection Limits): Detection limits are determined by using 40 CFR, Part 136, Appendix B. Some detection limits are based upon ideal conditions representing the best data achievable for clean sample. The Detection Limits are dependent and may vary upon sample matrix and dilution.

TABLE 3
REQUIREMENTS FOR SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND MAXIMUM HOLDING TIMES OF WATER SAMPLES

Parameter	Container	Sample Quantity*	Preservative	Maximum Holding Time
pH	P, G		None required	Analyze in field
Conductivity	P, G		Cool 4°C	Analyze in field
Temperature	P, G		None required	Analyze in field
Dissolved oxygen	P, G			Analyze in field
Nitrate + nitrite	G	100 mL	Cool 4°C, pH <2, H_2SO_4	28 days
Sulfate	P	50 mL	Cool 4°C	28 days
Chloride	P	50 mL	None required	28 days
Metals, except Hg	P	200 mL	pH <2, HNO_3	6 months
Mercury	P	100 mL	pH <2, HNO_3	28 days
Cyanide	P	500 mL	pH >12, NaOH	14 days
TOC	G	50 mL	Cool 4°C, pH <2, H_2SO_4	28 days
TDS	P	100 mL	Cool 4°C	7 days
Fluoride	P	300 mL	None required	28 days
Turbidity	P	100 mL	Cool 4°C	48 hours
GC/MS for volatile organics	G, Teflon® septum	2 VOA vials	Cool 4°C, HCl, Na thiosulfate(1)	14 days(2)
GC/MS for semivolatile organics	G, Teflon®-lined lid	2 L	Cool 4°C, ascorbic acid (1)	14 days(2)
GC/MS for pesticides and PCBs	G, Teflon®-lined lid	1 L		

TABLE 3--Continued
REQUIREMENTS FOR SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND MAXIMUM HOLDING TIMES OF WATER SAMPLES

---

(1) In the presence of residual chlorine.

(2) Holding time if preserved with HCl, 7 days if non-preserved.

* The following are analyzed from the same container:

  Nitrate + nitrite, TOC - 1-500mL, G

  Metals, Hg - 500mL, P

  Turbidity, TDS, Fluoride, Sulfate, Chloride - 1L, P

Total Sample Containers:

  1-L, P

  1-500mL, G

  2-L, G with Teflon®-lined lid

  2-500mL, P

  2-VOA vials

TABLE 4
REQUIREMENTS FOR SAMPLE CONTAINERS, PRESERVATION PROCEDURES, AND MAXIMUM HOLDING TIMES OF WASTE (CORE) AND STREAM SEDIMENT SAMPLES*

Parameter	Container	Sample Quantity	Preservative	Maximum Holding Time
Volatile organics	G, Teflon™ and silicone septum	4 oz. wide mouth	Cool 4°C	14 days
Semivolatile organics (all other organics)	G, Teflon™-lined septum	8 oz.wide mouth	Cool 4°C	10 days before extraction, 40 days after extraction
Total metals (except Hg)	G (at least 200-g sample)	8 oz. wide mouth	Cool 4°C	6 months
Mercury	G (at least 200-g sample)	(included with total metals)	Cool 4°C	28 days

*EPA, 1986, Test Methods for Evaluating Solid Waste (SW-846), 3rd edition.

TABLE 5
SUMMARY OF SAMPLING AND ANALYSIS PROGRAM

Analysis	Proposed Analytical Method[1]	Maximum No. of Samples[2,3,4]
Soils and Sediment		
TCL BNA Extractables	CLP-SOW	35
TCL Volatile Organics	CLP-SOW	35
TCL Pesticides/PCBs	CLP-SOW	35
TAL Metals	CLP-SOW	35
Groundwater[5]		
TCL BNA Extractables	CLP-SOW	21
TCL Volatile Organics	CLP-SOW	27
TCL Pesticides/PCBs	CLP-SOW	21
TAL Metals	CLP-SOW	21
Other Inorganic Targets	Table 2	21
Surface Water		
TCL BNA Extractables	CLP-SOW	8
TCL Volatile Organics	CLP-SOW	8
TCL Pesticides/PCBs	CLP-SOW	8
TAL Metals	CLP-SOW	8
Other Inorganic Targets	Table 2	8
Ambient Air		
Respirable particulate matter	40 CFR 50, Apps. B, G, and J	5
TCL-TAL scan	CLP-SOW	5
Volatile Organics	EPA TO14-1	5

[1]Contract Laboratory Program, Statement of Work 1988 (including revisions 1989).

[2]Field and rinsate blanks are to be sampled at a rate of 1/day for both sludge/waste and groundwater/surface water.

[3]Only TCL volatile organics for sludge/waste will have trip blank samples at a rate of 1/day.

[4]Duplicate samples are to be taken at a rate of 1/20 samples.

[5]Sample quantities include water samples (trip blanks, rinsates, etc.) collected for QA/QC.

TABLE 6
SUMMARY OF DECONTAMINATION PROCEDURES FOR SAMPLING EQUIPMENT[1]

Inorganic and Organic Sampling
Wash and scrub with Liquinox™ detergent (laboratory grade)
Rinse with municipal tap water.
Double rinse with isopropanol.
Rinse with HPLC-grade (organic free) water.
Air dry, wrap in aluminum foil.

[1] Solvents will be specified as pesticide grade or better. Paint will be removed from any part of the equipment that may contact the sample. Drilling rigs and downhole equipment must be steam cleaned and wire-brushed as necessary to remove dirt, rust, and organic materials prior to washing and rinsing.

NOTE: no solvents, soap solutions, or rinse water may be re-used. Decontamination fluids will be treated and disposed at the Escambia County Perdido Landfill.

SITE LOCATION MAP
BEULAH LANDFILL SITE

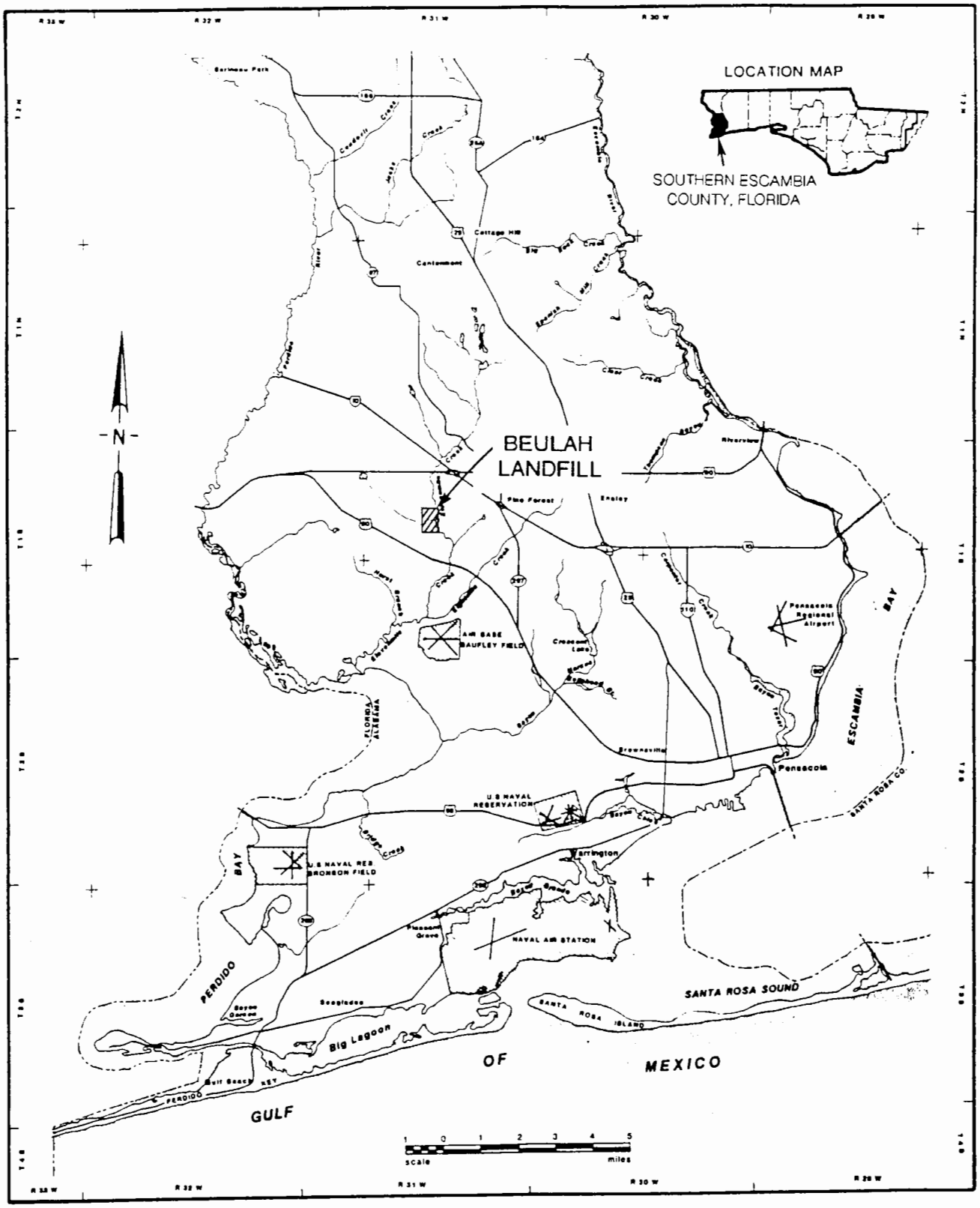
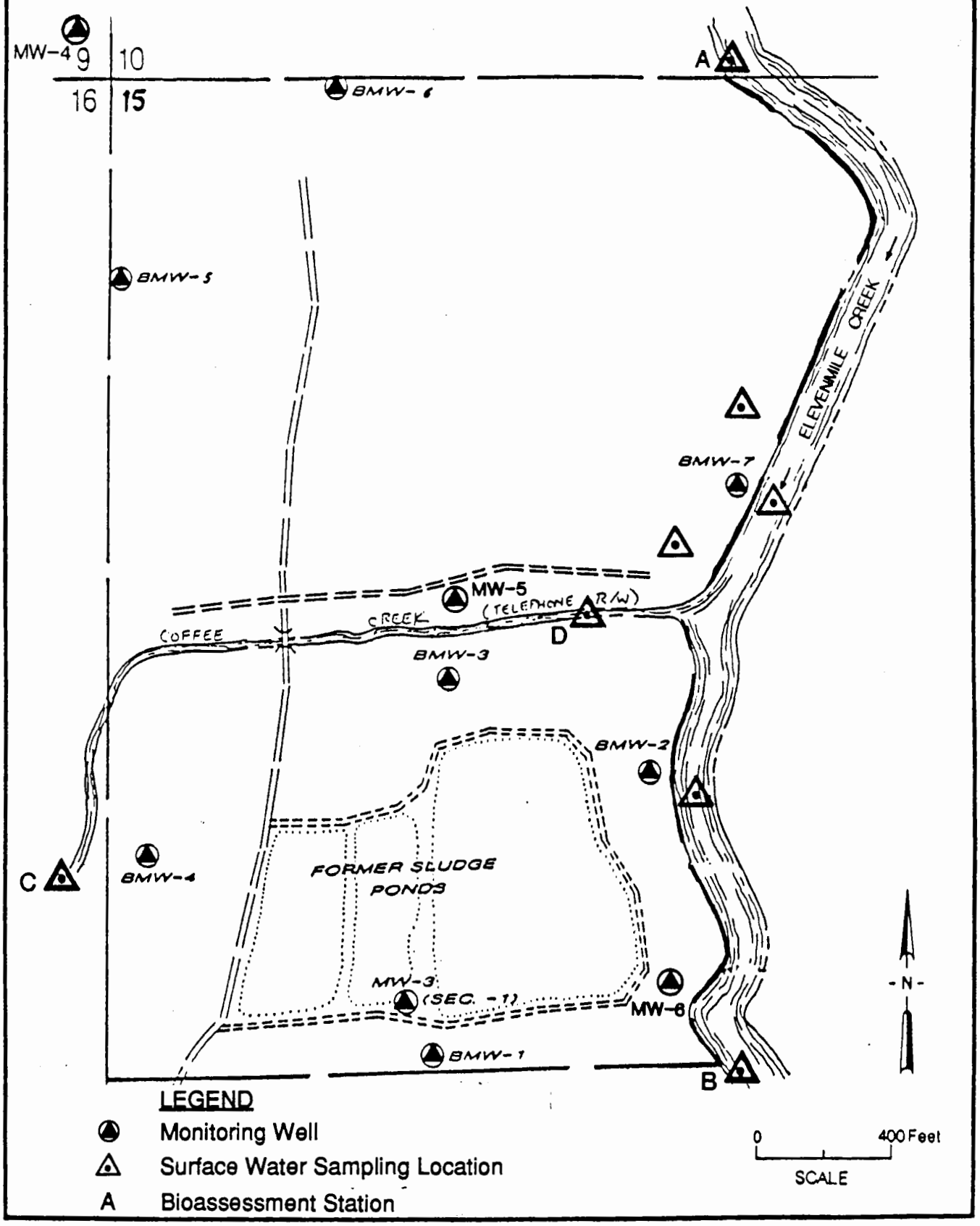


Figure 2

APPROXIMATE GROUNDWATER AND SURFACE WATER SAMPLING LOCATIONS
BEULAH LANDFILL SITE



BEULAH LANDFILL SITE
PROPOSED SAMPLING GRID AND SAMPLING LOCATIONS

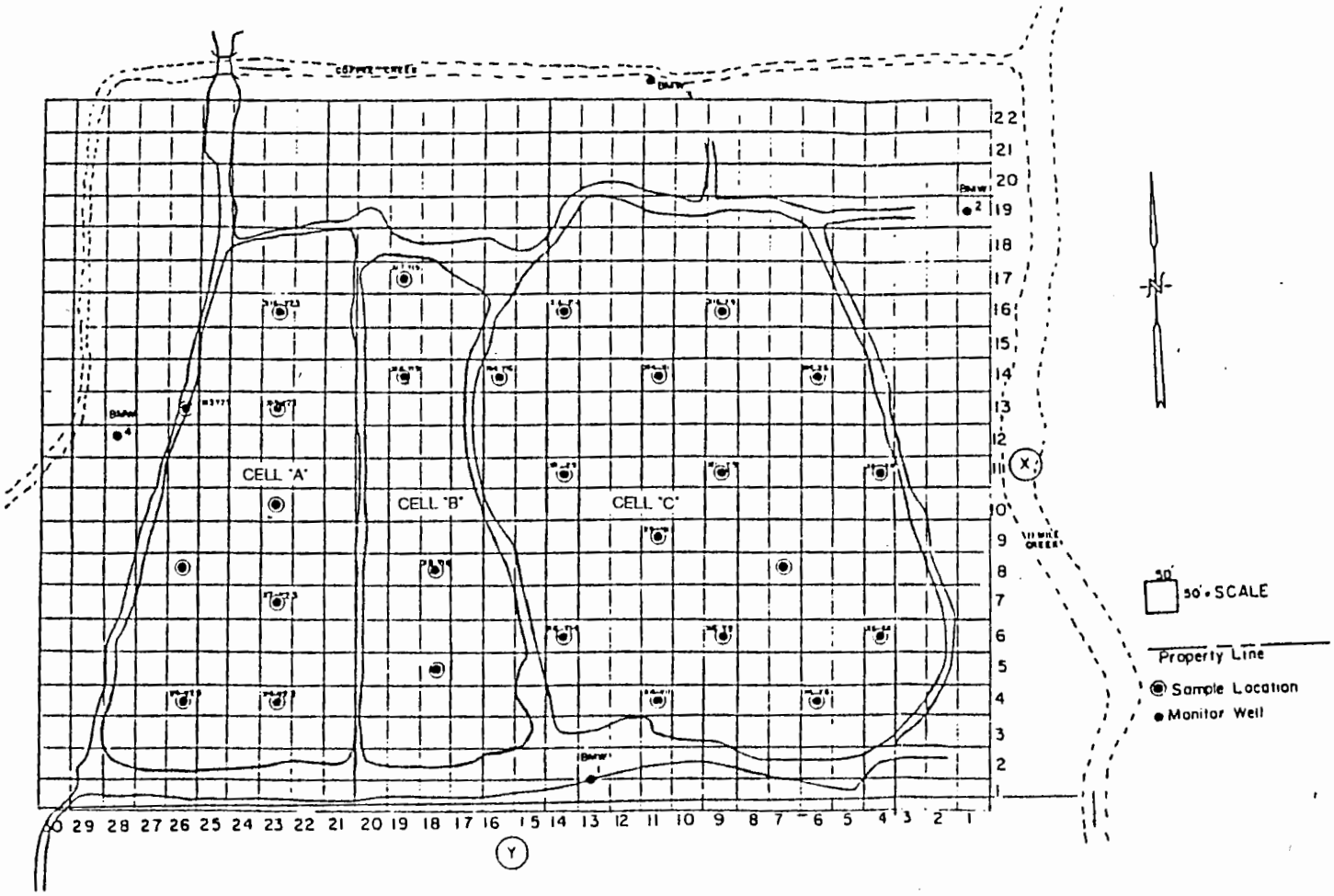
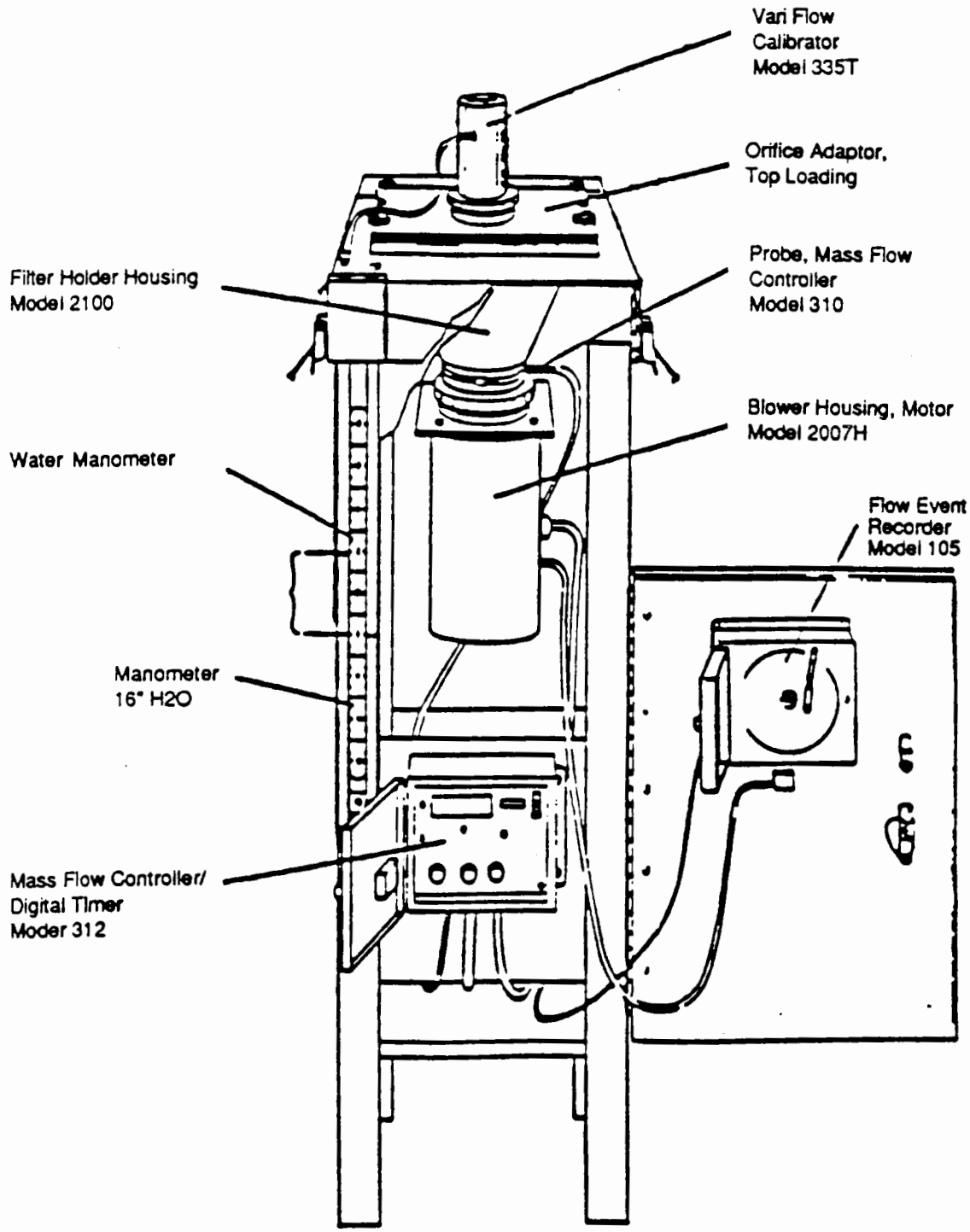


Figure 4

HI VOL SAMPLER ORIFICE ASSEMBLY CONNECTED



APPENDIX A
FIELD FORMS AND READINESS CHECKLISTS

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FIELD CHANGE REQUEST FORM

1. FIELD CHANGE NO._____
2. PAGE_____ OF_____

3. PROJECT_____
4. PROJECT NUMBER_____
5. APPLICABLE DOCUMENT_____

6. DESCRIPTION OF CHANGE:

_____
_____
_____
_____

7. REASON FOR CHANGE:

_____
_____
_____
_____

8. RECOMMENDED DISPOSITION:

_____
_____
_____
_____

9. PRESENT & COMPLETED WORK IMPACT:

_____
_____
_____
_____

10. REQUESTED BY:

_____ _____
Field/Project Manager Date

11. FINAL DISPOSITION:

_____
_____
_____
_____

12. APPROVAL:

_____ _____
EPA Remedial Project Manager Date

ENGINEERING-SCIENCE
GROUNDWATER SAMPLING FORM

Project: _____ Project No.: _____
Location: _____
Well Identification: _____
Date/Time: _____ Sample No. _____
Well Secure ? [Y or N] Comments: _____

Sampler(s): _____
Organic Vapor Detector FEL No. _____ , Reading _____
Weather: Wind_____, Precipitation_____, Air Temp._____
Water Level: FEL No. _____ Measurement _____
FEL No's : Conductivity _____ pH/Temp. _____ Redox._____

SAMPLE DATA:

Cond. (Umhos/cm)	pH	Temp. (C)	Redox (mv)	Observatio:

Sample Type and FEL No. _____
Sample Filtered for _____ Filter Size _____

Analyses	Bottles Number/Size	Bottle Media	Preservation Type HCL	NAOH	H2SO4	HNO3	Oth-

Duplicate ID: _____
Trip Blanks ID: _____
Field Blanks ID: _____
M-+rix Spikes ID: _____

R. iewed by : _____ Date/Time _____
Form Complete ? [Y or N] _____

6. SURFACE WATER/SEDIMENT SAMPLING FORM

1. Date/Time _____ Sample No. _____
2. Location _____
   _____
3. Sampler _____
4. Others Present _____
5. Organic Vapor Detector FEL No. _____, Reading _____
6. Weather: Wind _____, Precipitation _____, Air Temperature _____

7. FEL No.'s Cond. _____ pH _____ Temp. _____ Redox _____

8. Cond. µmhos/cm pH Temp. Redox mv
   Sample _____ _____ _____ _____

9. Dissolved Oxygen: (Circle One) Winkler or Meter
   (If Winkler, Show All Work)

   _____
   _____
   _____
   D.O. Meter FEL No. _____, D.O. = _____ ppm

10. Filtered Sample? _____ Membrane Filter Size _____
11. Flow _____ Method _____
12. Depth _____ Bottom Type _____
13. Riparian Vegetation _____
14. Other Observations (Algae, Blooms, Etc.): _____
    _____

15. [Y or N] Turbid _____
16. Floating Solids or Liquids? _____
17. Sample Type: Water _____, Sediment _____
    Depth of Sample: _____

    Comments: _____
    _____

18. Reviewed By _____ Date/Time _____
    Form Complete? [Y or N] _____
    Decon Complete? [Y or N] _____

ENGINEERING-SCIENCE - EQUIPMENT DECONTAMINATION LOG SHEET

Page _____ of _____

EQUIPMENT NUMBER(S) : _____

EQUIPMENT DESCRIPTION : _____

DATE	TIME	Detergent Wash	Tap Water Rinse	Solvent Rinse (Type)	Water Rinse (Type)	Air Dry	Type of Wrapping	Organic Vapor Check	Rinsate Sample ID	Operator Signature

ITEM	MANUFACTER	LOT NUMBERS	EXP. DATE	COMMENTS
etergent :				
lethanol :				
lexane :				
ater :				
rapping :				

ENGINEERIN -SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO.	PROJECT NAME/LOCATION	PRESERVATIVE REQUIRED / ANALYSES REQUIRED	SHIP TO:
SAMPLER(S): (Signature)			

DATE	TIME	SAMPLE DESCRIPTION	NUMBER OF CONTAINERS											MATRIX	REMARKS

Relinquished by: (Signature)	Date/Time	Recieved for Laboratory by: (Signature)	Date/Time	Remarks:
				Airbill #:

Distribution: Original Accompanies Shipment. Copies to Coordinator Field Files

ENGINEERING-SCIENCE
WELL PURGING RECORD

Project : _____ Project No. _____
ll I.D.: _____ Casing Type: _____
Location : _____ I.D. : _____
Purged by: _____ Total Depth: _____
Purging Method: _____ No. of Screened Intervals: _____
Supervised by: _____ Depth to Screen/Lgth(s): _____

Organic Vapor Detector FEL No.: _____, Reading: _____
Weather: Wind _____, Precipitation _____, Air Temp. _____
Water Level Measurement: FEL No. _____, Depth _____
Well Labeled [Y or N] _____, Elev, Ref. for Water Level _____
Well Secure ? [Y or N] _____ Odor: _____
Comments : _____

PURGING DATA

Depth to Product	Depth to Interface/Water	Thickness

al Depth _____ - Depth to Water _____ = Ht. _____
/Ft.(*) _____ x Ht. _____ = Well Volume _____
Required Purge Volume _____, Actual Purge _____
FEL No.'s : COND. _____ pH/Temp. _____ Redox _____

Date	Time;Gals	pH	Cond. (Umhos)	Temp. (c)	Redox (mv)	Turbid	Comments

ge Water Containerized _____ Post Purge Water Level _____
on Complete ? [Y or N] _____

Reviewed by : _____ Date/Time _____
Form Complete ? [Y or N] _____

(*) 2 inch I.D. Well= 0.16
4 inch I.D. Well= 0.65
6 inch I.D. Well= 1.47

ENGINEERING-SCIENCE - EQUIPMENT CALIBRATION LOG SHEET

Page _____ of _____

EQUIPMENT NUMBER : _____

EQUIPMENT DESCRIPTION : _____

DATE	TIME	Manufacturer of Standard	Liquid or Gas	Standard Concentration	Standard Lot No.	Exp. Date	Initial Reading	Corrected Reading	Operator Signature

ENGINEERING-SCIENCE - EQUIPMENT MAINTENANCE RECORD

Page _____

EQUIPMENT NAME : _____

EQUIPMENT NUMBER : _____

EQUIPMENT VENDOR : _____

EQUIPMENT SERIAL No. : _____

DATE	JOB No.	WORK TO BE DONE	Operator Signature	Dat Compl

ENGINEERING-SCIENCE
READINESS CHECKLIST FOR
MOBILIZATION EFFORT

Project Name _____ Project Manager _____

Project Location _____ Field Team Leader _____

Project Number _____ Client Contact _____

- ☐ Documents - Including appropriate number of copies for project team, Subcontractors.
  - Work Plan
  - QAPP
  - H&S Plan Community Relations Plan
  - Drilling Subcontract
  - Analytical Subcontract
  - Survey Subcontract
  - Proposal Part A, Part B
  - Previous Reports - SI/RI, Phase I, Regional hydrogeology Report, Soil Survey. etc.
  - Reference book (e.g., Johnston Well Screen)
  - Catalogs
- ☐ Forms - Including appropriate number of copies (activity specific).
  - Readiness Review
  - Blank log books
  - Decon
  - Well logs
  - Boring logs
  - Equipment Calibration
  - Soil/Sediment Sample
  - Water Sampling
  - Geophysics
  - Soil Gas

Aquifer testing

Well Development

Well Purging

Permits

State Well Completion Forms

Drilling Daily Summary

- Site - Specific Information

  Name, phone number for:

    On-site Point of Contact

    Client

    Project Personnel (Including Subcontractor)

  Phone numbers and direction to:

    Site

    Hotel

    Fed Ex

    Package Pickup - Airport

  Plan of Activities

  Preliminary schedules

  Project Personnel (Sampling teams, Auditors, Field Team Leaders, Geologist, technician and alternates)

- Equipment & Personnel - Make arrangements for necessary equipment and personnel arrive at the site at appropriate time. Equipment and Personnel required will be activity specific but can be estimated using other readiness review forms.

ENGINEERING-SCIENCE
READINESS CHECKLIST FOR
WELL PURGING AND/OR DEVELOPMENT

Project Name _____ Project Manager _____

Project Location _____ Field Team Leader _____

Project Number _____ Client Contact _____

- ☐ Personnel

  The number of personnel required is determined on a job by job basis. It is dependent on the length of the overall Job, number of subcontractor personnel on site, level of personal protection required and weather. Specific tasks that need to be considered are documentation, job oversite health and safety.

PRE-MOBILIZATION ACTIVITIES

- ☐ Order/obtain all necessary equipment (see below)
- ☐ Notify USEPA contacts of readiness

MATERIALS/EQUIPMENT REQUIRED

- ☐ Work Plan
- ☐ Health & Safety Plan (signed by personnel on site)
- ☐ Quality Assurance Plan
- ☐ Site Maps
- ☐ OSHA Job Safety & Health Protection Poster
- ☐ Well development/purging forms and clipboard
- ☐ Copy of Well Logs
- ☐ Log book(s)
- ☐ Vehicle passes
- ☐ ES magnetic signs
- ☐ Keys to wells, storage area, gates, etc.
- ☐ Keck pump
  - controller
  - supporter
  - power pack
- ☐ Benett Pump
  - air compressor
- ☐ McClulloch pump
  - gas can
  - 2-cycle oil
  - foot valve

reinforced PVC Hose with quick disconnects

garden hose

- ☐ 5-gallon buckets
- ☐ Emergency contacts, phone numbers and addresses
- ☐ 55-gallon drums
- ☐ calculator
- ☐ spray paint
- ☐ bailers
- ☐ 3/16" nylon rope
- ☐ Water level indicator
- ☐ Engineer's tape
- ☐ Gloves (PVC, nitrile, butyl, Silver Shield)
- ☐ steel toe boots
- ☐ safety glasses
- ☐ HNU & calibration gas or OVA, hydrogen and calibration gas
- ☐ draeger bellows and tubes
- ☐ pH meter and standards
- ☐ conductivity meter and standards
- ☐ turbidimeter and standards
- ☐ Applicable instruction manuals
- ☐ Decontamination solutions

Liquinox/Alconox

Methanol

Hexane

Isopropanol

HPLC grade water or ASTM type II

- ☐ Tools (screw drivers, hammer, bolt cutters, wrenches, pliers, ratchet set, machete, knife)
- ☐ stainless steel buckets
- ☐ stainless steel sprayers w/Teflon tubing and/or Teflon wash bottles
- ☐ Oil/Water interface probe
- ☐ plastic sheeting
- ☐ aluminum foil
- ☐ scrub brushes
- ☐ saw horses
- ☐ First-aid kit
- ☐ White paper towels - no inks or dyes
- ☐ Garbage bags
- ☐ Tyvek suits
- ☐ Camera and film
- ☐ Packing tape

ENGINEERING-SCIENCE READINESS CHECKLIST FOR GROUNDWATER SAMPLING

Project Name _____ Project Manager _____

Project Location _____ Field Team Leader _____

Project Number _____ Client Contact _____

PRE-MOBILIZATION ACTIVITIES

- ☐ Order/obtain all necessary equipment (see below)
- ☐ Notify USEPA contacts of readiness
- ☐ Personnel

  The number of personnel required is determined on a job by job basis. It is dependent on the length of the overall Job, number of subcontractor personnel on site, level of personal protection required and weather. Specific tasks that need to be considered are deconning, documentation, job oversite, health and safety, packaging, and sample transportation.

MATERIALS/EQUIPMENT REQUIRED

- ☐ Log book(s)
- ☐ Work plan
- ☐ Health & Safety Plan (signed by personnel on site)
- ☐ Quality Assurance Plan
- ☐ Site maps
- ☐ Well location maps
- ☐ Copy of well logs
- ☐ OSHA Job Safety & Health Protection Poster
- ☐ ES magnetic signs
- ☐ Laboratory Analytical Contract
- ☐ Vehicle passes
- ☐ Key to wells, storage areas, gates, etc.
- ☐ Well purging equipment (see Well Purging Readiness Checklist)
- ☐ Bailers
- ☐ 3/16" nylon rope
- ☐ Sample bottles
- ☐ Sampling forms and clipboard
- ☐ Emergency contacts, phone numbers, route to hospital posted
- ☐ Bottle labels
- ☐ Teflon tape
- ☐ White tape
- ☐ Packing tape

- ☐ Blue (40 ml glass) polynet
- ☐ Red (125 ml glass) polynet
- ☐ Green (1 liter glass) polynet
- ☐ Bubble pack
- ☐ Ziploc freezer bags (1-gallon)
- ☐ Ziploc freezer bags (1-quart)
- ☐ Vermiculite
- ☐ Sample shipping coolers
- ☐ Chain-of-custodies
- ☐ Carbon paper
- ☐ First aid kit
- ☐ Custody seals
- ☐ Address labels
- ☐ Fed-Ex forms, packets
- ☐ Steel toe boots
- ☐ Safety Glasses
- ☐ Gloves (PVC, nitrile, butyl, Silver Shield
- ☐ HNU & calibration gas or OVA, hydrogen and calibration gas
- ☐ Stainless steel buckets
- ☐ Stainless steel sprayers w/Teflon tubing and/or Teflon wash bottles
- ☐ Scrub brushes
- ☐ Plastic sheeting
- ☐ Aluminum foil
- ☐ Camera and film
- ☐ Card Table
- ☐ Decontamination Solutions
  - Liquinox/Alconox
  - Methanol
  - Hexane
  - Isopropanol
  - HPLC grade water or ASTM Type II
- ☐ White paper towels - no ink and dyes
- ☐ Calculator
- ☐ Garbage bags
- ☐ Saw horses
- ☐ Preservatives:
  - nitric acid
  - hydrochloric acid
  - sulfuric acid
  - sodium hydroxide
  - zinc acetate
  - ascorbic acid
- ☐ Pipettes & filler
- ☐ Teflon drop bottle
- ☐ Water level indicator
- ☐ Engineer's tape
- ☐ pH meter and standards
- ☐ Conductivity meter and standards
- ☐ Chlorine/alkalinity test kits
- ☐ Filtration equipment:
  - flask
  - hand pump
  - filter papers
  - stainless steel tweezers
  - peristaltic pump
  - tygon tubing
  - multi-chambered filter
- ☐ Respirator and cartridges
- ☐ Applicable instruction manuals
- ☐ Tyvek suits
- ☐ Indelible ink pen

- ☐ Tools (screw driver, hammer, bolt cutters, wrenches, pliers, rachet set, knife)
- ☐ Supply order forms

ENGINEERING-SCIENCE READINESS CHECKLIST FOR SURFACE WATER SAMPLING

Project Name _____ Project Manager _____

Project Location _____ Field Team Leader _____

Project Number _____ Client Contact _____

PRE-MOBILIZATION ACTIVITIES

- ☐ Order/obtain all necessary equipment (see below)
- ☐ Notify USEPA contacts of readiness
- ☐ Personnel

  The number of personnel required is determined on a job by job basis. It is dependent on the length of the overall Job, number of subcontractor personnel on site, level of personal protection required and weather. Specific tasks that need to be considered are deconning, documentation, job oversite, health and safety, packaging, and sample transportation.

MATERIALS/EQUIPMENT REQUIRED

- ☐ Log book(s)
- ☐ Work plan
- ☐ Health & Safety Plan (signed by personnel on site)
- ☐ Quality Assurance Plan
- ☐ Site maps
- ☐ OSHA Job Safety & Health Protection Poster
- ☐ Laboratory Analytical Contract
- ☐ ES magnitic signs
- ☐ Vehicle passes
- ☐ Keys for storage areas, gates, etc.
- ☐ Kemmerer sampler
- ☐ Waders
- ☐ Boat
- ☐ Snake leggings/hip waders
- ☐ First aid kit
- ☐ Gloves (PVC, nitrile, butyl, Silver Shield)
- ☐ Sampling forms and clipboard
- ☐ Emergency contacts, phone numbers and route to hospital posted
- ☐ Steel toe boots
- ☐ Safety glasses
- ☐ HNU & calibration gas or OVA, hydrogen and calibration gas

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ENGINEERING-SCIENCE READINESS CHECKLIST FOR MEASURING WATER LEVELS

Project Name _____ Project Manager _____

Project Location _____ Field Team Leader _____

Project Number _____ Client Contact _____

PRE-MOBILIZATION ACTIVITIES

- ☐ Obtain all necessary equipment (see below)
- ☐ Notify USEPA contacts of readiness
- ☐ Personnel required: 1 or 2 depending on the number of levels to be measured.

MATERIALS/EQUIPMENT REQUIRED

- ☐ Log book(s)
- ☐ Health & Safety Plan (signed by personnel on site)
- ☐ Work plan
- ☐ Site maps
- ☐ Quality Assurance Plan
- ☐ Well location maps
- ☐ Vehicle passes
- ☐ Keys to wells, storage areas, gates, etc.
- ☐ ES magnetic signs
- ☐ Water level indicator
- ☐ Oil/Water interface probe
- ☐ Engineer's tape
- ☐ Tools (screwdriver, hammer, bolt cutters, wrenchs, pliers ratchet set, machete, knife)
- ☐ Field forms and clipboard
- ☐ Emergency contacts, phone numbers, route to hospital posted
- ☐ OSHA Job Safety and Health Protection Poster
- ☐ Packing tape
- ☐ Steel toe boots
- ☐ Safety glasses
- ☐ PVC gloves
- ☐ White paper towels - no ink or dyes
- ☐ Teflon wash bottles
- ☐ Scrub brushes
- ☐ Plastic sheeting
- ☐ Stainless steel bucket
- ☐ First-aid kit

- ☐ Decontamination solution
  - Liquinox/Alconox
  - Methanol
  - Hexane
  - Isopropanol
  - HPLC grade water or ASTM Type II
- ☐ Camera and film
- ☐ Calculator

ENGINEERING-SCIENCE READINESS CHECKLIST FOR SOIL/SEDIMENT SAMPLING

Project Name _____ Project Manager _____

Project Location _____ Field Team Leader _____

Project Number _____ Client Contact _____

PRE-MOBILIZATION ACTIVITIES

- ☐ Order/obtain all necessary equipment (see below)
- ☐ Notify USEPA contacts of readiness
- ☐ Personnel

  The number of personnel required is determined on a job by job basis. It is dependent on the length of the overall Job, number of subcontractor personnel on site, level of personal protection required and weather. Specific tasks that need to be considered are deconning, documentation, job oversite, health and safety, packaging, and sample transportation.

MATERIALS/EQUIPMENT REQUIRED

- ☐ Log book(s)
- ☐ Work plan
- ☐ Health & Safety Plan (signed by personnel on site)
- ☐ Quality Assurance Plan
- ☐ Site maps
- ☐ Emergency contacts, phone number, route to hospital posted
- ☐ Laboratory Analytical Contract
- ☐ OSHA Job Safety & Health Protection Poster
- ☐ Vehicle passes
- ☐ Keys to wells, storage areas, gates, etc.
- ☐ Sample bottles
- ☐ Drilling contract
- ☐ ES magnetic signs
- ☐ Bottle labels
- ☐ Teflon tape
- ☐ White tape
- ☐ Packing tape
- ☐ Sampling forms and clipboard
- ☐ Metal detector
- ☐ Drilling logs
- ☐ Red (125 ml glass) polynet
- ☐ Green (1 liter glass) polynet
- ☐ Bubble pack

- ☐ Ziploc Freezer bags (1-gal.)
- ☐ Ziploc freezer bags (1-quart)
- ☐ Ice
- ☐ Vermiculite
- ☐ Sample shipping coolers
- ☐ Chain-of-custodies
- ☐ Carbon paper
- ☐ HNU and calibration gas or OVA, hydrogen and calibration gas
- ☐ Gloves (PVC, nitrile, butyl, Silver Shield)
- ☐ Aluminum foil
- ☐ Hand auger
  - handle
  - stainless steel bucket
  - extensions
  - pins
- ☐ Shovel
- ☐ Stainless steel bowls
- ☐ Stainless steel spoons/knives
- ☐ Stainless steel bucket
- ☐ Decontamination solution
  - Liquinox/Alconox
  - Methanol
  - Hexane
  - Isopropanol
  - HPLC grade water or ASTM Type II
- ☐ Scrub brushes
- ☐ Plastic sheeting
- ☐ Balance
- ☐ Steel toe boots
- ☐ Safety glasses
- ☐ Hard Hat
- ☐ Draeger bellow/tubes
- ☐ Mason jars/lithologic sample jar
- ☐ First-aid kit
- ☐ Stainless steel sprayers w/Teflon tubing and/or Teflon wash bottles
- ☐ Card table
- ☐ Stakes and/or survey marker
- ☐ Respirator and cartridges
- ☐ Explosimeter and calibration gas
- ☐ Calculator
- ☐ Garbage bags
- ☐ Tyvek suits
- ☐ Paper towels - no inks or dyes
- ☐ Camera and film
- ☐ Custody Seals
- ☐ Fed. Ex. forms and packets
- ☐ Address labels
- ☐ Supply order forms
- ☐ 55-gallon drum

Figure C-5

ENGINEERING - SCIENCE

SOIL BORING LOG AND WELL CONSTRUCTION RECORD

Client _____
Site _____
Boring I.D. _____
Geologist _____
Drilling Method _____
Sampling Method _____
Date Started _____
Date Completed _____
Drilling Subcontractor _____
Borehole Diameter (in) _____
Depth Drilled (ft) _____
Ground Elevation (ft) _____
Depth to Water (ft) _____
Date Measured _____

Page 1 of _____
Project I.D. _____
Well I.D. _____
Date Installed _____
Date Grouted _____
Casing Material _____
Screen Material _____
Casing Interval (ft) _____
Screened Interval (ft) _____
Sump Installed? _____
Well Depth (ft) _____
TOC Elevation (ft) _____
Water Level (ft) _____
Date Measured _____

DEPTH (feet)	SAMPLE	BLOWS/FOOT	% REC.	HNu/OVA (ppm)	LITHOLOGIC DESCRIPTION	SOIL CLASS	GRAPHIC LOG	WELL DIAGRAM
0								

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APPENDIX B
AIR SAMPLING STANDARD OPERATING PROCEDURES

B.1 AIR SAMPLING METHODS

B.1.1 Purpose

The purpose of this procedure is to define the requirements and methods for sampling ambient air upwind and downwind of the Beulah Landfill site to aid in estimating the risk to human health and the environment from any air-borne contaminants.

B.1.2 Scope

This procedure applies to monitoring ambient air quality for volatile organics, semi-volatile organics and metals. Brief descriptions of sampling equipment and methods are also in Section 7 of this Sampling and Analysis Plan.

B.1.3 Requirements

Twenty-four hour samples will be obtained to ensure representative samples are obtained. Available information on local meteorological conditions indicate winds at night shift from south to north; therefore two (2) twelve-hour samples (+/- two hours) will be collected on consecutive days with the same sampling media. Flow rates through sample pumps will be verified before and after this sampling period to ensure that the volume of the collected sample is correct.

The procedure for obtaining meteorological data in conjunction with field execution of the ambient air quality sampling procedure is listed below.

Air quality sampling will be performed only during a dry period that is preceded by at least 24 hours with less than 0.01 inches of precipitation.

Locations of the air quality sampling stations are shown in Figure B.1. The upwind station will be located as far from the actual landfill as allowed by the property boundaries. The three downwind stations will be located along the northern boundary. The center station will be located as near the center of the northern boundary as feasible, and will have colocated samplers. The northeast and northwest stations will be located approximately two-thirds of the distance from the center of the northern boundary to the eastern and western boundaries, respectively. The air quality samplers must be located at least 20 meters from obstructions such as trees, buildings, and large tanks. The colocated samplers must be at least 2 meters apart. Sources of extraneous contamination, such as portable generators and

vehicles, must be avoided when selecting the sampler locations. The sampler inlets will be located about 1.6 meters (approximately 5 feet) above land surface. Other criteria for locating samplers are listed in Table B.1.

B.1.4 Meteorological Station

A portable meteorological station (height = 2 to 3 meters) will be located near the center of the landfill (see Figure 1). Variables to be recorded are wind speed and direction, air temperature, relative humidity, and barometric pressure. These parameters will be stored on a data logger as 15 minute and hourly averages. At the end of the sampling period the data will be transferred to an IBM PC for analysis. The meteorological station will operate at least 24 hours prior to the start of air quality sampling and continue for at least 12 hours after sampling is completed.

Based on data from the Pensacola Naval Air Station, predominant winds during the daytime are from the south, while nightime winds are from the north. To obtain a composite 24 hour sample for air quality, the on-site sampling team must observe the change from nighttime wind direction to the daytime direction. After this shift occurs the air quality samplers may be started. Samplers will only be operated when the wind direction is from the southern quadrant (bearing N 135 to N 225 degrees) based on the 15 minute average direction. Should the wind direction shift outside this quadrant, the samplers must be turned off and the time logged. Air quality sampling may resume when the wind direction returns to the southern quadrant.

B.1.5 References

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. EPA-600/4-84-041. April, 1984.

Second Supplement to the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air. EPA-600/4-89/018. June, 1988.

Guidance on Applying the Data Quality Objectives Process for Ambient Air Monitoring at Superfund Sites (Stages I and II). EPA-450/4-89-015, August, 1989.

Guidance on Applying the Data Quality Objectives Process for Ambient Air Monitoring at Superfund Sites (Stage 3). EPA-450/4-90/005. March, 1990.

Air /Superfund National Technical Guidance Study Series. Volume IV - Procedures for Dispersion Modeling and Air Monitoring for Superfund Air Pathway Analysis, EPA-450/1-89-004. Interim Final, July, 1989.

Compendium Method TO-14: The Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA™ Passivated Canister Sampling and Gas Chromatographic Analysis. May, 1989.

Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air. EPA-600/4-83-027, June, 1983.

Operators Manual, GMW High Volume Air Samplers. General Metal Works, Inc. 1M-QP-1189.

Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High Volume Method). 40 CFR Chapter 1 (7-1-87 Edition), Part 50, Appendix B.

Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere. 40 CFR Chapter 1 (7-1-87 Edition), Part 50, Appendix J.

Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA-450/4-87-007. May, 1987.

Quality Assurance Handbook for Air Pollution Measurement Systems; Volume 1-Principles. EPA-600/9-76-005. January, 1976.

Quality Assurance for Air Pollution Measurement Systems; Volume 2 - Ambient Air Specific Methods. EPA-600/4-77-027a.

Methods for Assessing Exposure to Windblown Particulates. EPA-600/4-83-007. March, 1983.

Guideline on Air quality Models (Revised). EPA-450/2-78-027R. July, 1986.

B.1.6 Definitions

Collection Efficiency - The percentage of a specified substance retained by the sampling device.

Density - Mass per unit of volume.

PM10 - Suspended particles in the ambient air that have an aerodynamic diameter of 10 microns or less.

PUF - Polyurethane foam.

SUMMA™ - Trademark for a passivation process in which a pure chrome-nickel oxide is formed on the interior surface of sampling canisters.

VOC - Volatile Organic Compound.

SVOC - Semivolatile Organic Compound.

XAD-2 - Trademark for organic polymer adsorbent that adsorbs semi-volatile organics while not adsorbing any water, thus permitting the passage of a large air sample through this adsorbent.

B.1.7 Equipment

Three types of air samplers will be used with the sampling devices listed above. The sampler for each application is listed below:

Parameter	Air Sampler
Volatile Organics	SUMMA™ Canister sampler with flow controller.
Semi-Volatile Organics	PS-1 Sampler
Metals, Particulates	PM10 High Volume Sampler

Three types of sampling devices will be used to obtain samples for the determination of volatile organics, semi-volatile organics and metals. These types are listed below:

Parameter	Sampling Device
Volatile Organic Compounds (VOC)	SUMMA™ Canister
Semi-Volatile Organic Compounds (SVOC)	Filter followed by PUF/XAD-2/PUF Cartridge
Metals, particulates (PM10)	PM10 size select sampling head followed by glass fiber filter

Sampling procedures for the above methods are currently being tested by US EPA. The methods are modifications for TO 14 (VOCs), TO 13 (SVOCs) and TSP(PM10).

B.2 FILTER HANDLING AND SAMPLING PROCEDURES

B.2.1 Filter Handling Procedures

Loading filter in the cassettes will normally be done in the laboratory to minimize damage. If cassettes must be loaded at the site, the following precautions must be taken:

1. Loading of filter will be done only when ambient conditions permit;
2. Workers will wear vinyl gloves when handling filters to avoid contaminating the filters with body oils and moisture;
3. Filters will be kept in protective folders or boxes; and;
4. Unexposed filters will not be bent or folded.

The analytical laboratory (and/or filter manufacturer) will give each filter an identification (ID) number. When filters are placed into samplers, the sample ID is placed down. The "up" side is where particles impact.

Center the filter on the wire screen so that the gasket will form an airtight seal. Check the gasket to assure it is in good condition and has not deteriorated. Take care to ensure the filter cassette is not excessively tightened, as the filter may stick or the gasket may be permanently damaged.

B.2.2 Sampling Procedures - Mass Flow Controlled (MFC) High Volume or PM_{10} Sampler

Filter Installation Procedure - Upon arriving at the monitoring site, the operator will perform the following:

1. Perform single point flow check.
2. Following the manufacturer's instructions, loosen the nuts that secure the inlet to the base and gently tilt back the inlet to allow access to the filter support screen.
3. Examine the filter support screen. If the screen appears dirty, wipe it clean. Remove the cover of the filter cassettes and place the loaded cassette in position on the sampler support screen. Tighten the thumb nuts sufficiently to hold the filter cassette securely. Check that the gasket is in good condition and has not deteriorated.

   Caution: Tighten the thumb nuts evenly on alternate corners to properly align and seat the gasket. The nuts should be only hand-tightened because excessive compression can damage the sealing gasket.
4. Lower the sample inlet. Inspect the sample inlet to make sure that it is resting on the filter cassette and not on the PM_{10} sampler's frame. Secure the sample inlet to the sampler base.

5. Open the front door of the sampler and examine the flow recorder. Remove any moisture inside by wiping it with a clean cloth. Record the sampler S/N, filter ID number, site location, and sampling date on the back of a clean recorder chart and install the chart in the flow recorder.

   Note: Charts used for PM_{10} samplers normally have square-root-function scales; however, linear-function scales may be used.

   While installing the chart, do not bend the pen arm beyond its limits of travel. Raise the pen head by pushing on the very top of the pen arm (or by using the pen lift). Be sure that the chart tab is centered on the slotted drive to ensure full 360° rotation in 24 hours. Make sure that the chart edges are properly located beneath the retainers. Lower the pen arm and tap the recorder face lightly to make certain that the pen is free.

   Note: During periods of inclement weather, the chart tends to stick to the recorder face. Two charts can be installed simultaneously to enable the sample (top, annotated) chart to rotate freely.

6. Using a coin or slotted screwdriver, advance the chart and check to see that the pen rests on zero--the smallest circle diameter. If necessary, adjust the zero set screw while gently tapping on the side of the flow recorder. If a chart with a linear-function scale is used, some positive zero offset may be desirable to allow for normal variations in the zero readings. During this project all flow rate calculations will be based upon manometer readings. The Flow Chart will be used only to assure that there were no major flow rate disruptions during the sampling period.

7. Turn on the sampler and allow it to equilibrate to operating temperature (3 to 5 minutes).

8. While the sampler is equilibrating, record the following parameters on the MFC Sampler Field Data Sheet (Figure B.2):

   site location;

   sample date;

   filter ID number;

   sampler model and S/N; and

   operator's initials.

9. Inspect the manometer for crimps or cracks in its connecting tubing. Open the valves and blow gently through the tubing of the manometer while watching for the free flow of the fluid. Adjust the manometer's sliding scale so that its zero line is at the bottom of the meniscuses.

10. Measure the initial exit orifice sampler outlet plenum pressure (ΔP_{ex}) using an oil or water manometer, with a 0 to 255 mm (0 to 10 inches) range and a minimum scale division of 1 mm (0.1 inches). Record the initial ΔP_{ex} on the MFC Sampler Field Data Sheet.

11. Verify that the flow recorder (if used) is operational and that the pen is inking.

    Note: The flow recorder reading.

12. Turn the sampler off.

13. Check the time indicated by the time-set pointer on the flow recorder. If it is in error, rotate the chart clockwise by inserting a screwdriver or coin in the slotted drive in the center of the chart face until the correct time is indicated.

14. Reset the sampler timer for the next run day. Close the sampler door, taking care not to crimp the vacuum tubing or any power cords. The sampler is now ready to sample ambient air.

B.2.3 Filter Recovery Procedure

As soon as possible after sampling, the operator should return to the monitoring site to retrieve the exposed filter. Particle loss or filter damage will result if the filter is left in the sampler for extended periods.

1. Turn on the sampler and allow it to equilibrate to operating temperature (3 to 5 minutes).

2. Measure the final ΔP_{ex} and record it on the MFC Sampler Field Data Sheet.

3. Turn off the sampler.

4. Open the door of the sampler, remove the flow recorder chart, and examine the recorder trace. If the trace indicates extensive flow fluctuations, investigate and correct before the next sampling day.

5. Record the following parameters on the MFC Sampler Field Data Sheet:

   elapsed time reading, minutes (or hours);

   average recorder response, arbitrary units;

   average ambient temperature for the run day (T_{av}), K (K = C + 273); and

   average ambient barometric pressure for the run day (P_{av}), mm Hg or kPa.

   Note: The calculations presented in this subsection assume that the sampler has been calibrated in terms of actual temperature and barometric pressure. Average sampler flow rate for a sample period is determined

from the average exit orifice plenum pressure (ΔP_{ex}) and the average ambient temperature (T_{av}) and average ambient pressure (P_{av}) for the sample period. The readings of T_{av} and P_{av} are recorded on site or may be obtained from a nearby U.S. National Weather Service Forecast Office or weather station.

6. Calculate and record the average actual flow rate (as determined by the sampler's calibration relationship) on the MFC Field Data Sheet and on the back of the chart. Attach the chart to the data sheet.

$$Q_a = \{[\Delta P_{ex} (T_{av} + 30)/P_a]^{1/2} - b\} \{1/m\}$$

where:

Q_a = average sampler flow rate, actual m^3/min.

ΔP_{ex} = average exit orifice plenum pressure, mm Hg or kPa

T_{av} = average ambient temperature for the run day, K

P_{av} = average ambient pressure for the run day, mm Hg or kPa

b = intercept of the sampler calibration relationship

m = slope of the sampler calibration relationship.

7. Observe conditions around the monitoring site; note any activities that may affect filter particle loading (e.g., paving, mowing, fire) and record this information on the MFC Sampler Field Data Sheet.

8. Raise the sampler inlet and remove the filter cassette. Replace the cassette protective cover. To avoid particle loss, be careful to keep the cassette as level as possible.

9. The sampler may now be readied for the next run day.

10. Keeping the filter cassette level, carefully transport it, the data sheet, and the flow recorder chart to the laboratory sample custodian.

11. Chain-of-custody procedures specified elsewhere in this plan will be followed.

B.2.4 Post-Sampling Filter Handling Procedures

In a protected area (the monitoring trailer), the filter is removed from the cassette and returned to the glassine envelope/manila folder. The folder is replaced into the corresponding manila envelope and the sample label is affixed to the outside of the manila envelope. The sample tag is kept with the custody form.

B.3 FIELD VALIDATION CRITERIA

The following criteria have been established to assist the operator in initially determining whether a sample is valid. If a sample fails to meet these criteria, any factors observed that may result in a sample's invalidation are documented on the sample data sheet, and the data sheet and the filter are forwarded to the laboratory supervisor who will make the final decision regarding the sample's validity.

1. Timing:

   All samplers should operate for at least 23.5, but not more than 24.5 hours (1,410 to 1,470 minutes).

2. Flow Rates:

   After each sampling period, calculate the percentage difference between Q_a and the design flow rate (1.13 m^3/min) using the following formula:

$$\% \text{ Difference} = \frac{Q_a - Q_d}{Q_d} \times 100$$

where:

Q_d = design flow rate (1.13 m^3/min)

Record the value on the control chart for the field validation of the sampler's actual volumetric flow rate.

Q_a must be within flow-rate limits specified by the manufacturer. If these limits are exceeded, investigate potential error sources immediately. The following criteria should be used as the basis for determining a sample's validity:

- Decreases in flow rate during sampling (due to mechanical problems) of more than 10 percent from the initial set point result in sample invalidation. Recalibrate the sampler. A sample flow rate may also fluctuate due to heavy filter loading. If a high concentration is suspected, the operator should indicate this on the field data sheet. The laboratory supervisor will make the final decision regarding the sample's validity.
- Changes in flow-rate calibration of more than 10 percent, as determined by a field QC flow-rate check, will invalidate all samples collected back to the last calibration or valid flow check. Recalibrate the sampler.

B.4 CALIBRATION PROCEDURES

Particulate sampler calibration - PM_{10}, and TSP/Metals. Both the PM_{10} and TSP/Metals samplers will be equipped with Accu-vol flow controllers, and are

calibrated according to the same procedure, which is specified in 40 CFR 50, Appendix B.

A calibrated variable flow orifice (transfer standard) will be used to calibrate the mass flow control sampler prior to operation. The orifice transfer standard will have a NIST-traceable calibration relationship and be capable of accurately measuring flows between 1.02 and 1.24 cubic meters per minute (m^3/min). The orifice will be calibrated no less frequently than annually and be within ± 2 percent of the NIST-traceable primary standard. The orifice transfer standard will be calibrated by the manufacturer against a primary flow measurement device traceable to a NIST standard. Calibration requirements for the sampler and associated equipment is given on Table B.2.

B.5 QC REQUIREMENTS

The required QC sample frequency is summarized in Table B.3. In addition, 10 percent of all calculations will be checked, and all data will be subject to review and validation.

B.5.1 Quality Control Sample Frequency

These procedures are not amenable to preparation of blind or spiked samples. There is no accurate and convenient way to add a known quantity of dust to a filter. Nor is there any way to generate a standard atmosphere that contains a known concentration of dust and metals. Nor is there any means by which a filter can be divided for a split analysis of particle mass. Thus, blind, spiked, and split samples are not possible for either the TSP or PM_{10} procedures.

Field blanks are tared at the laboratory, shipped to the field, and subjected to the same handling that a sample filter endures. That is field blank filters are removed from their shipping envelopes, installed in a sampler, removed from the sampler, folded, and placed in a sample envelope. They then are returned to the laboratory for reweighing and analysis for metals.

Duplicate samples will be prepared by collocating two samplers at one site so they collect simultaneous samples. They must be close enough together to be considered collocated but not so close that they interfere one with the other. A separation of 3 meters will be used.

B.5.2 Field Quality Control Procedure

For MFC samplers, a field calibration check of the operational flow rate is performed before each 24 hour sampling event. The purpose of this check is to track the sampler's calibration stability. A control chart presenting the percentage difference between an MFC sampler's indicated and measured flow rates will be maintained. This chart provides a quick reference of instrument flow-rate drift problems and is useful for tracking the performance of the sampler. Either the sampler log book or a data sheet will be used to document flow-check information.

This information includes, but is not limited to, instrument and transfer standard model and serial numbers, ambient temperature and pressure conditions and collected flow-check data.

TABLE B.1

MINIMUM SAMPLING SITING CRITERIA

Height above ground, meters	Horizontal Distance from supporting structure, meters(1)	Other spacing Other criteria
2 to 3	<2	Distance from sampler to obstacle, such as trees or buildings, should be twice the height that the obstacle protrudes above the sampler. Must have unrestricted air flow around the sampler inlet. No furnace or incineration exhaust stacks should be nearby.(2). Spacing from roads varies with traffic (see 40 CFR 58, Appendix E). Sampler inlet is at least 2 meters but not greater than 4 meters from any collocated sampler. (See 40 CFR 58, Appendix A).

(1) When inlet is located on rooftop, this separation distance is in reference to walls, parapets, or penthouses located on the roof.

(2) This is to avoid undue influences from potential pollutant sources.

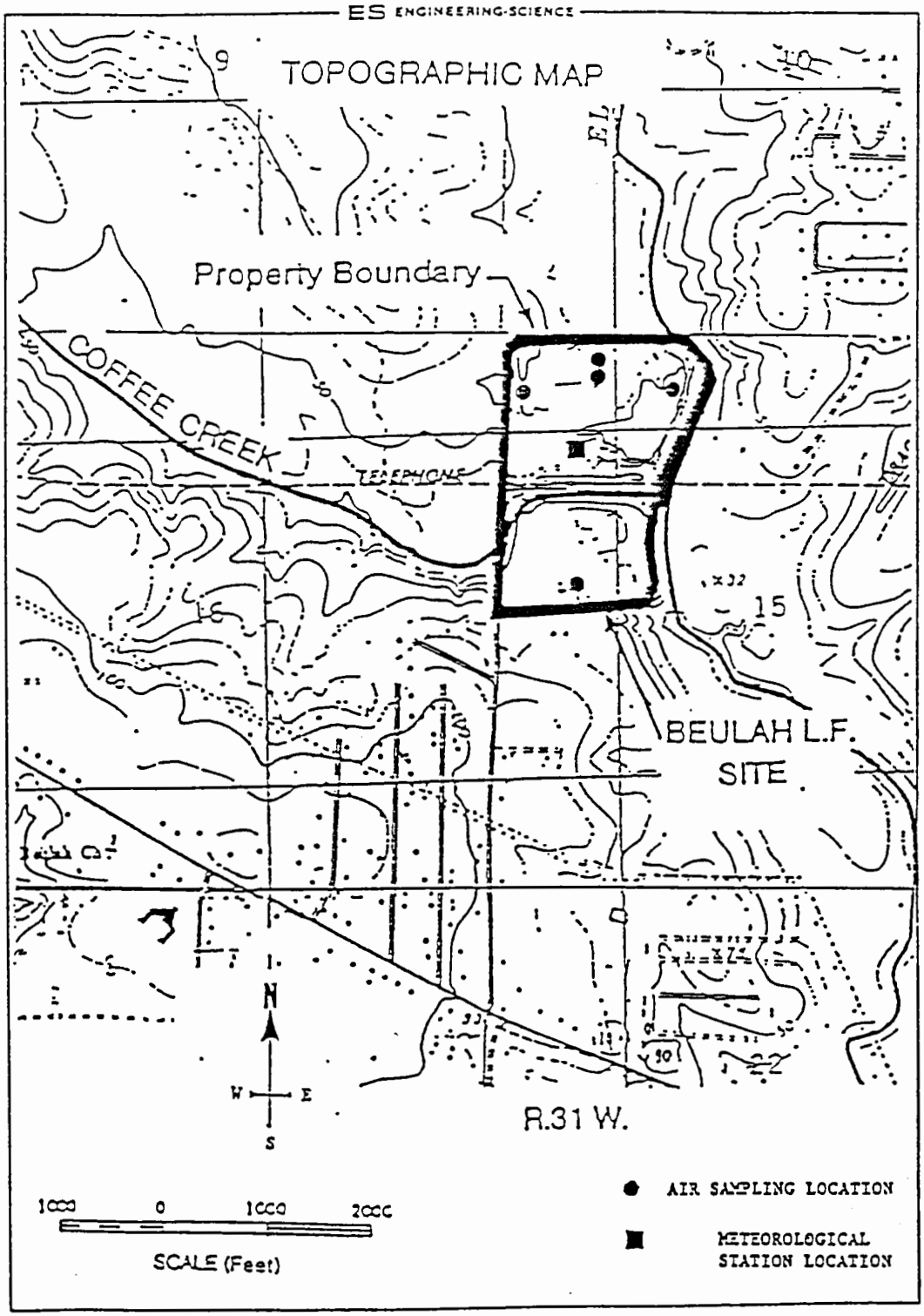
TABLE B.2
EQUIPMENT CALIBRATION REQUIREMENTS

Equipment	Acceptance Limits	Frequency and Method of Measurements	Action if Requirements Are Not Met
Sampler	Indicated flow rate = true flow rate ± 4%	Calibrate with certified transfer standard on receipt, after maintenance on sampler, and any time audits or flow checks deviate more than ± 7% from the indicated flow rate or ± 10% from the design flow rate.	Recalibrate
On/off times	± 30 min/24 hrs.	Check at purchase and routinely on sample-recovery days.	Adjust or repair.
Elapsed-time meter(1)	± 2 min/24 hrs.	Compare with a standard timepiece of known accuracy at receipt and at 6-mo. intervals.	Adjust or replace time indicator to attain acceptance limits.
Flow-rate transfer standard (orifice device)	Indicated flow rate (from previous calibration) = true flow rate ± 2%.	Check at receipt and at 1-yr. intervals against positive displacement standard volume meter; recalibrate or replace orifice unit if damage is evident.	Adopt new calibration curve.

TABLE B.3
AIR MONITORING QC SAMPLE FREQUENCY

Type of Sample	Required Frequency
PM_{10}	
Field Blank[1]	1/event[2]
Duplicate Sample[1]	1/event
Replicate Analysis[3]	1/event
TSP	
Field Blank[1]	1/event
Duplicate Sample[1]	1/event
Replicate Analysis[3]	1/event
Metals (Cu, Pb, Zn)	
Field Blank[1]	1/event
Duplicate Sample[1]	1/event
Reagent Blank[3]	1/analytical batch[4]
Spike/Spike Duplicate[3]	1/analytical batch
Replicate Analysis[3]	1/event

[1]Prepared in Field
[2]An event is defined as a 7-day sampling period beginning on a Sunday.
[3]Prepared at Laboratory
[4]An analytical batch is defined as a group of samples (no more than 20) that are extracted, digested, or otherwise prepared as a lot.



(1) METEOROLOGICAL STATION (4) SAMPLING LOCATIONS

(5) SAMPLERS PER EVENT

FIGURE B.1 BEULAH LANDFILL AIR SAMPLES

FIGURE B.2
MFC SAMPLER FIELD DATA

STATION NO. _____ SAMPLER ID _____

MOTOR SN _____ FLOW CONT. SN _____

RECORDER SN _____ TIMER SN _____

SSI SN _____

SAMPLER CALIBRATION, QA

M = _____ B = _____ R = _____

SAMPLING DATA

FILTER NO. _____ SAMPLE NO. _____

TIME-ON SETTING _____ (24 HR.) OFF SETTING _____

DATE-ON SETTING _____ OFF DATE _____

	SAMPLER MANOMETER		ELAPSED TIMER	
INITIAL ΔPEX	_____	IN H_2O	_____	(MIN/HR)
FINAL ΔPEX	_____	IN H_2O	_____	(MIN/HR)
AVERAGE ΔPEX	_____	IN H_2O	ELAPSED TIME _____	MIN

SAMPLE AVERAGE BAROMETER PRESSURE _____ mmHG(PAV)

SAMPLE AVERAGE TEMPERATURE _____ °K (TAV)

CALCULATIONS

$\overline{Q_A}$ _____ M^3/MIN

$\overline{Q_{STD}}$ _____ STD M^3/MIN

$\overline{Q_{STD}} = \overline{Q_A}\,(P_{AV}/P_{STD})(T_{STD}/T_{AV})$

$\overline{Q_A} = \{[\text{MEAN}\ \Delta P_{EX}\,(T_{AV} + 30)/P_{AV}]^{1/2} - B\}\ \{1/M\}$

$= \{[\text{MEAN}\ |(T_{AV} + 30)/P_{AV}]^{1/2} - B\}$

$\{1/M\}$ FOR FLOW RECORDERS

V_{STD} _____ STD M^3

$V_{STD} = (\overline{Q_{STD}})\ (\text{ELAPSED TIME})$

SET POINT CHECK, % D

$$\frac{Q_A - 1.13}{Q_A} \times 100\% = _____$$

OPERATOR _____

COMMENTS: _____

_____

_____

AT593/916J20

APPENDIX C
CALIBRATION AND SAMPLING PROCEDURES FOR VOLATILE ORGANIC COMPOUNDS IN AIR

1.0 PURPOSE

The purpose of this appendix is to describe the calibration and sampling procedures for volatile compounds in ambient air.

2.0 SCOPE

This appendix describes calibration and sampling procedure for volatile organic compounds (VOCs) in ambient air. The method is based on collection of whole air samples in pre-evacuated SUMMA™ passivated stainless steel canisters. The VOCs are subsequently analyzed in the laboratory. This method presents procedures for sampling into canisters which are initially below atmospheric pressure. This procedure will be used to collect air samples during the site characterization.

3.0 REQUIREMENTS

The subatmospheric to positive pressure sampling method uses an initially evacuated canister during sample collection. A sample of ambient air is drawn through a sampling train comprised of components that regulate the rate and duration of sampling into a pre-evacuated, SUMMA™ passivated, six liter stainless steel canister at a rate of approximately 7-10 cubic centimeters per minute (cm^3/min) for a 24-hour sampling period. This allows a total sample volume of greater than 10 liters to be collected. During the site characterization, sampling periods of less than 24 hours may be used. In these instances the sampling rate will be increased to obtain a comparable volume of sample.

At the end of the sampling period, the canister valve is closed, the pump is shut off, an identification tag is attached to the canister, and the canister is transported to the ITL for analysis. Laboratory analysis is performed by a gas chromatograph (GC) coupled to a mass spectrometer (MS) operating in the select ion monitoring (SIM) or flame ionization detector (FID) or a GC/flame photometric detector (FPD) mode for the target compounds. Two separate target compounds will be used during this project. Table C.1 presents the target compound list and target detection limits for the work at Beulah Landfill.

Volatile organic compounds will be collected in pre-evacuated stainless steel SUMMA™ passivated six liter canisters using a pump and flow control system to fill the canisters. Collection of ambient air samples in canisters provides: convenient integration of samples over a specific time period, (24 hours), remote sampling and central analysis, ease of storing and shipping samples, unattended sample collection, analysis of samples from multiple sites with one analytical system, and collection of sufficient sample volume to allow assessment of precision and/or analysis of samples by several analytical systems. However, care must be exercised in selecting, cleaning and handling sample canisters and sampling apparatus to avoid losses or contamination of the samples.

Interior surfaces of the canisters must be treated by the SUMMA™ passivation process in which a pure chrome-nickel oxide is formed on the interior surfaces. It has been demonstrated that samples of most of the compounds listed in Table C.1 and stored in pressurized SUMMA™ passivated canisters are stable up to 30 days.

The methods described in the SOP will be followed unless field conditions dictate changes. The Project Engineer can approve minor changes to the SOP while major changes in the SOP will require approval of the EPA RPM.

Changes in the SOP will be discussed and approved by the project team prior to implementation, and EPA will be notified of any changes.

4.0 REFERENCES

ASTM Method D1356 Definition of Terms Related to Atmospheric Sampling and Analysis.

ASTM Method D1605-60, Standard Recommended Practices for Sampling Ambient Air for analysis of gases and vapors.

Technical Assistance Document for Sampling and Analysis of Toxic Organic Compounds in Ambient Air. EPA-600/4-83-027, June, 1983.

Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Supplement. EPA-600/4-89

Compendium Method TO-14, The Determination of Volatile Organic Compounds (VOCs) in Ambient Air using SUMMA™ Passivated Canister Sampling and Gas Chromatographic Analysis, USEPA, May, 1988.

5.0 DEFINITIONS

Definitions used in this document are consistent with American Society for Testing and Materials (ASTM) Methods D1356, E260, and E355. All pertinent abbreviations and symbols are defined within this document at point of use.

Absolute canister pressure - Pg + Pa, where Pg = gauge pressure in the canister and Pa = barometric pressure.

Absolute pressure - Pressure measured with reference to absolute zero pressure (as opposed to atmospheric pressure), usually expressed as kilopascal (kPa) or millimeters of mercury (mm Hg) or pounds per square inch (psia).

Gauge pressure - Pressure measured above ambient atmospheric pressure (as opposed to absolute pressure). Zero gauge pressure is equal to ambient atmospheric (barometric) pressure.

Humid Zero Air - Zero air saturated with High Performance Liquid Chromatograph (HPLC) grade water vapor.

Subatmospheric to positive pressure sampling - Collection of an air sample in an evacuated canister at a (final) canister pressure above atmospheric pressure with the assistance of a sampling pump.

Zero Air - Air, nitrogen or argon which contains no VOCs, water or other contaminants.

6.0 INTERFERENCES AND LIMITATIONS

Sample contamination may occur if the sampling system and/or canisters are not properly cleaned before use. Additionally, all other sampling equipment (e.g., pump and flow controllers) should be thoroughly cleaned to ensure that the filling apparatus will not contaminate samples.

7.0 SAMPLE COLLECTION APPARATUS

The subatmospheric to positive pressure canister sampling system is commercially available and will be used for this test program.

A XON TECH Model 911 A or equivalent subatmospheric to positive pressure sampler will be used for volatiles during this test program.

8.0 SAMPLING SYSTEM AND SAMPLING PROCEDURES

8.1 System Description

The subatmospheric to positive pressure sampling system is illustrated in Figure C.1 and based on Xon Tech Model 911 A system to meter ambient air into the canister. In preparation for subatmospheric to positive pressure sample collection in a canister, the canister is evacuated in a laboratory to an initial absolute pressure of 0.05 mm Hg. When opened to the atmosphere to be sampled, the ambient air sample is pumped into the canister. This technique will be used to collect time integrated samples for a duration of 24 hours taken through a mechanical flow controller at a rate between 7-10 cm^3/min. During the study, sampling periods of less than 24 hours may be used. In these instances the sampling rate will be increased to collect a comparable sample volume.

The mechanical flow controller maintains a constant flow rate from full vacuum to 25 psig.

8.2 Calibration and Set-Up Procedures

A mechanical flow controller is set to maintain a constant flow rate of between 7-10 cm^3/min into the canister so the canister is filled to positive pressure over the desired sample period. The required flow rate can be calculated by:

$$F = (P \times V)/(T \times 60)$$

where:

F = flow rate, cubic centimeters per minute (cm^3)/min)

P = final canister pressure, atmospheres absolute.
P is approximately equal to 2.66 atmospheres

V = volume of the canister, cm^3

T = sampled period, hours

The mechanical flow controller is calibrated prior to sampling utilizing a primary standard (i.e., moving bubble meter).

There is a solenoid valve located between the mechanical flow controller and the canister. This normally closed solenoid is on a timer which delays sample flow to the canister for 30 seconds after the pump has started, this allows the inlet to be flushed before starting to collect the sample. This solenoid also closes if power is lost this prevents any flow to or out of the canister until this pump is manually restarted and the solenoid is reset.

The connecting lines between the sample inlet and the canister should be as short as possible to minimize their volume. The flow rate is provided by the pump into the canister should remain constant between 7-10 cm^3/min over the entire 24 hour sampling period. If a higher sampling rate is used because of a shortened sampling period, the flow into the canister should not deviate by more than 20% during the sampling period.

Prior to use, each canister and sampling system must be certified clean and pass a humid zero air certification. All tubing shall be checked carefully for leaks.

8.3 Sampling Procedure

Prior to collection of a sample, the calibration of mechanical flow controller is checked using a primary standard bubble flow meter. The calibrated flow is indicated on the Canister Sampling Field Data Sheet (Figure C.2). If the flow rate is not within specifications (7-10 cm^3/min), the flow is adjusted and rescheduled.

A collocated sampler (duplicate sample) will be used to determine sampling and analytical bias during the sampling program. One representative collocated sample will be used for every two monitoring events. The collocated duplicate sampler will be located at the northern portion of the site. The following proecduers are followed for sample collocation:

1. Attach the canister to the sampling system.
2. Record canister I.D. number, sampling system I.D. number, sampler location, and starting date on the canister sampling field data sheet (see Figure C.2).
3. Turn on pump and solenoid switches.
4. Open canister valve record start time and canister pressure on canister sampling field data sheet.
5. At the end of the sampling period, record canister pressure, time and date, then close the canister inlet valve.
6. Disconnect canister from canister sampling system. Cap canister with swaglock end cap.
7. A sample label is attached to the canister the label information includes the field master log number, site name, sample number, canister number sample type and remarks. (see Figure C.3).
8. The canister is than forwarded to the selected laboratory following chain of custody procedures defined in the Quality Assurance Project Plan.
9. After sample collection the mechanical flow controller may be checked, (if needed) using a electronic primary standard bubble flow meter to ensure that the flow rate had not changed over the test period.
10. The canister sampler system inlet and the outlets are sealed to maintain integrity of the sampler.

9.0 QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES

9.1 Field duplicates and blanks

One duplicate sample will be collected for determining sampling and analytical biases. One field blank will also be shipped to the laboratory. The blank canister will be pressurized to 25 psig with zero air at the field sample handling site.

9.2 Flow Calibration

Section 8.3 requires pre-sampling flow calibration measurements with a primary standard (e.g., moving bubble meter).

9.3 Canister Testing and Certification (Laboratory SOP)

All canisters must be pressure tested to 206 kPa ± 14 kPa (30 psig ± 2 psig) over a period of 24 hours.

All canisters must be certified clean (containing less than 0.2 ppbv of targeted VOCs) through humid zero air certification program.

All canister sampling systems to be certified initially clean (containing less than 0.2 ppbv of targeted VOCs) through a humid zero air certification program.

GAS SAMPLING TRAIN FOR VOLATILE ORGANIC COMPOUNDS

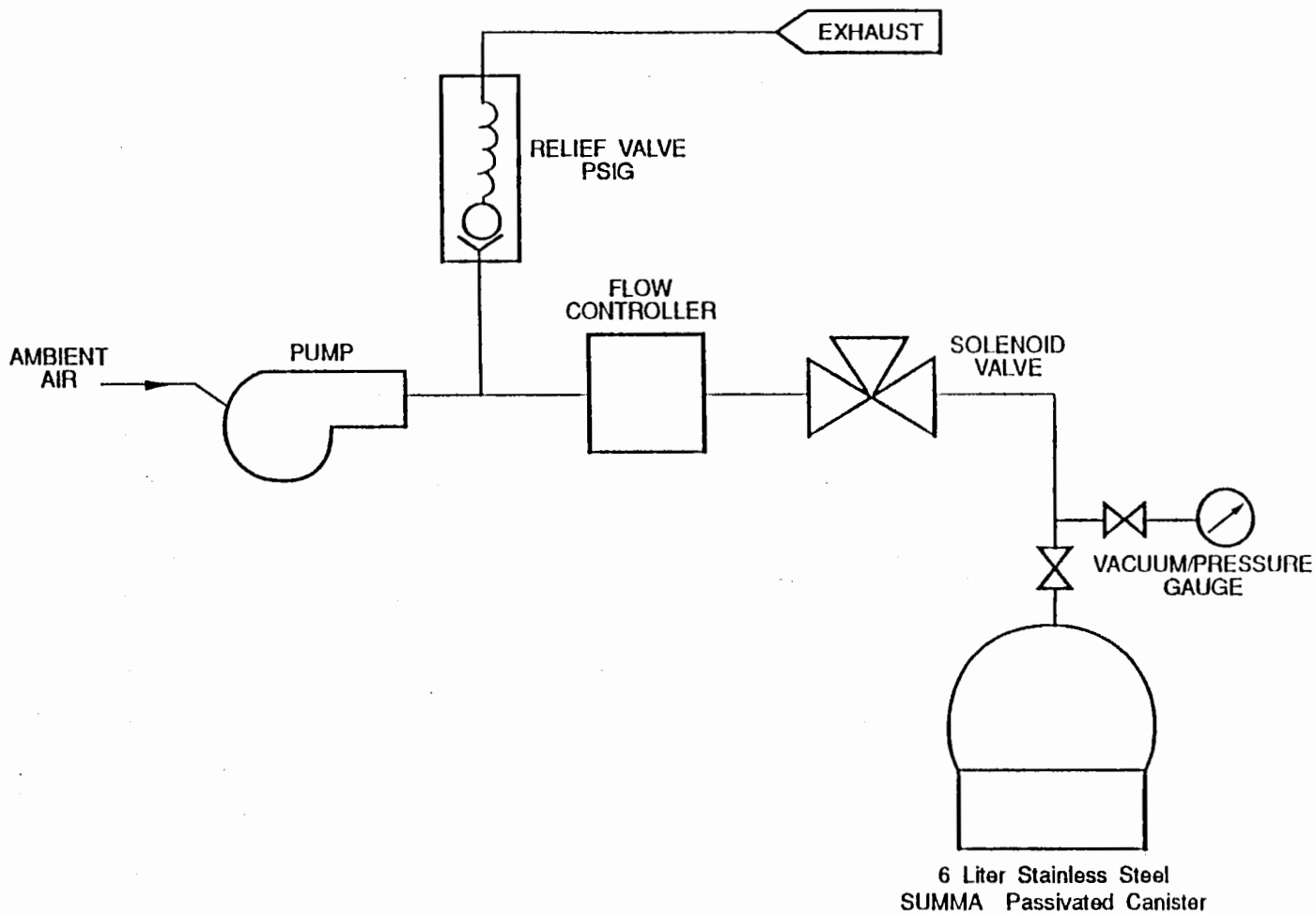


FIGURE C.1

FIGURE C.2
SUMMA CANISTER SAMPLE DATA SHEET

Project No: _____ Master Log No. _____
Project Location: _____ Canister Cleaned Date _____

Sample Code: _____ Canister Evacuated Date _____

Location Sampled: _____ Canister Pressure _____MM Hg After Evacuation

Operator: _____

Sampler I.D.# _____

Canister I.D.# _____

Sample Flow Rate: _____ cc/min Date _____

Test Start: Time _____ Date _____ Pressure _____-inches Mercury

Test End: Time _____ Date _____ Pressure _____+ psi

Date	Time	Reading	Comments

FIGURE C.3
EXAMPLE SAMPLE LABEL FOR CANISTERS

Master Log No. _____

Sample Code _____

Sample Type _____

Container No. _____ of _____

Sample Location _____

Sample Date _____ Contract No. _____

Remarks _____ Final Wt. _____ g

_____ Tare Wt. _____ g

_____ Sample Wt. _____ g

TABLE C.1

TARGET COMPOUND LIST FOR VOLATILE ORGANIC COMPOUNDS IN AMBIENT AIR

Target Compound	Target Detection Limit ppbv[1]
Vinyl chloride	2
Trichloroethylene	2
Chloroform	2
Benzene	2
Carbon tetrachloride	2
Tetrachloroethylene	5
1,1-Dichloroethene	5
Acrylonitrile	5
1,2-Dichloroethane	2
Chlorobenzene	2
1,1,1-Trichloroethane	5
1,1,2-Trichloroethane	5
1,1,2,2-Tetrachloroethane	2
Ethylbenzene	2
Methylene chloride	5
1,2,4-Trichlorobenzene	2
Styrene	5
1,1-Dichloroethane	2
Toluene	5
Xylenes, m- and p-	5
Xylene, o-	5
1,2-Dichloropropane	2
1,2-Dichlorobenzene	2
1,2-Dibromoethane	2
1,3-Butadiene	5
Acetone	5
Chloroethane	2
2-Butanone	5
Acrolein	5
Benzyl chloride	5
4-Methyl-2-pentanone	5
cis-1,3-Dichloropropene	2
trans-1,2-Dichloroethylene	2
1,4-Dichlorobenzene	5
Hexachlorobutadiene	5

TABLE C.1–Continued
TARGET COMPOUND LIST FOR VOLATILE ORGANIC COMPOUNDS IN AMBIENT AIR

Target Compound	Target Detection Limit ppbv[1]
Bromomethane	5
trans-1,3-Dichloropropene	2
Dichlorodifluoromethane	2
Chloromethane	2
cis-1,2-Dichloroethylene	2
Methanol	5
Bromodichloromethane	2
Acetonitrile	5
1,3-Dichlorobenzene	5
3-Chloro-1-propene	2
Dibromochloromethane	2
Methyl methacrylate	2
Vinyl acetate	5
1,1,2-Trichloro-1,2,2-trifluoroethane	2
Trichlorofluoromethane	2
Heptane	2
Octane	2
Chlorodifluoromethane	2
alpha-Methyl styrene	5
n-Pentane	2
Hexane	2

1 ppbv referenced to 25°C and 760 mm Hg.

APPENDIX D
RAPID BIOASSESSMENT PROTOCOL LEVEL II

1.0 PURPOSE

The purpose of this appendix is to describe the Rapid Bioassessment Protocol Level II (RBP II) for work on streams and creeks at the Beulah Landfill site.

2.0 SCOPE

This appendix provides a brief summary of the methods that have been described by US EPA in the manual *Rapid Bioassessment Protocol for Use in Streams and Rivers--Benthic Macroinvertebrates and Fish*, USEPA document EPA/444/4-89/001, May 1989. The methods are based on visual and enumerative skills of a trained biologist to assess surface water courses potentially affected by contaminants. The methods allow some quantitative measures of stream benthic diversity and provide useful data for more detailed bioassays, if required.

3.0 REQUIREMENTS

The RBP II requires a skilled biologist with experience assessing impacted streams. The biologist supported by a trained technician must be able to characterize benthic ecology following EPA methods and to subdivide benthic organisms into their correct taxa at the family level. The work involves description of substrata and instream cover, channel morphology, and riparian or bank structure at each location. Measurements of stream temperature, dissolved oxygen, pH, specific conductance are made following standard instrumental methods. Visual observations of oil sheen and turbidity are noted, along with odors, if present. Field notes should include the following general information about each site:

- Water body name
- Location of sampling station (road crossing, bridge names, etc.)
- Reach/milepoint
- Latitude/longitude
- County, State
- Aquatic Ecoregion
- Station identifier (alphanumeric)
- Names of investigating parties
- Date
- Agency Affiliated
- Name of person completing field logbook entries
- Reason for RBP II survey

The field book should contain notations regarding the physical characteristics of the stream including:

Predominant surrounding land use	Dams or channel restrictions present
Local watershed erosion	Channelization
Local sources of non-point pollution	Canopy cover
Estimated stream width	Sediment odors
Estimated stream depth	Sediment color/deposits
High-water mark	Sediment oils
Stream velocity	Inorganic substrata sizes (particle sizes from clay to boulder)
Organic substrates	

The field notes should also evaluate the habitat in terms of primary, secondary, and tertiary parameters affecting biota. Table D.1 shows the rating scheme for primary, secondary, and tertiary parameters. There are three parameters comprising each parameter group. The primary parameters apply to substrata and instream cover--the parameters are bottom substrata and available cover, embeddedness, and flow velocity. The secondary parameters apply to stream channel morphology--channel alteration, bottom scouring and deposition, and pool/riffle or run/bend ratio. The tertiary parameters apply to riparian and bank structure--bank stability, bank vegetation, and streamside cover. The total score is obtained by evaluating each of the nine parameters, totalling the number of points scored, and comparing to a control site or regional reference score. The ratio of the station score to the reference score (in percent) determines comparability of the stream to the reference. General guidelines are:

>90 percent	Comparable to reference
75-88 percent	Supporting to biota
60-73 percent	Partially supporting to biota
<58 percent	Non-supporting to biota

Notations should then be made estimating the relative abundance of the following biota:

periphyton	slimes
filamentous algae	macroinvertebrates
macrophytes	fish

The notations should use the following scale:

0 = absent/not observed
1 = rare
2 = common
3 = abundant
4 = dominant

Using appropriate grab sampling gear (surber sampler, dredge, or similar equipment), the team will collect 100-organism subsample of benthic community. The teams should list the families and numbers of individuals in each family. The team should collect samples from riffle areas to represents scraper and filtering collector feeding groups. It is also important to record the number of individuals collected in a supplemental CPOM sample

that represents the shredder feeding group. Finally, the team should record additional observations including the following:

- number of fish nesting sites;
- biota present;
- game fish observed;
- nearby physical features or structures (bridges, rip rap, culverts, outfalls, etc.);
- habitat alteration due to construction;
- color;
- odor; or
- sedimentation patterns and other factors that may impact the stream habitat.

4.0 REPORTS

The field notes for each station should be summarized in the following categories:

Taxa richness
FBI (modified)
Functional feeding groups:
  riffle community
  CPOM community
EPT/chironomidae
Percent contribution (dominant family)
EPT Index
Community Similarity Index

Methods for determining these parameters are provided in the EPA reference.

TABLE D.1
SCORING VAUES FOR HABITAT EVALUATIONS

	Condition			
Parameter	Excellent	Good	Fair	Poor
Primary	16-20	11-15	6-10	0-5
Secondary	12-15	8-11	4-7	0-3
Tertiary	9-10	6-8	3-5	0-2

HEALTH AND SAFETY PLAN
FOR
BEULAH LANDFILL
PENSACOLA, FLORIDA

PREPARED BY
ENGINEERING-SCIENCE, INC.
ATLANTA, GEORGIA

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ATLANTA, GEORGIA

REVIEWED AND APPROVED BY:

	Name	Date
Project Manager	Craig L Franklin	5 Feb 92
Office Health and Safety Representative	Edward Brunwald	2-5-92
Corporate Health and Safety Manager*	_____	_____

*If Levels A or B protection are required.

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BEULAH LANDFILL
HEALTH AND SAFETY PLAN

1.0 PURPOSE AND POLICY

The purpose of this plan is to identify the health and safety policies, practices and procedures to be followed during the Remedial Investigation/Feasibility Study (RI/FS) of the Beulah Landfill near Pensacola, Florida. In addition, this plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are conducted. The provisions of this plan are equally applicable to Engineering-Science (ES) personnel and subcontractor personnel.

2.0 SITE DESCRIPTION

The Beulah Landfill is located in Escambia County, Florida, approximately 8 miles northwest of Pensacola. The site is about 4,000 feet north of U.S. Highway 90. The site is comprised of that portion of the NW¼ of Section 15, T.1S., R. 31W. located to the west of Elevenmile Creek. Coffee Creek roughly divides the site into a north and a south component.

Beulah Landfill was operated as a landfill from 1966 until June 1984. The north side received primarily municipal trash. The south side received municipal trash, industrial wastes, domestic septage, domestic sludges, and wastewater treatment sludge. Based on the results of an analysis of a single sample of the sludge by the U.S. EPA, the landfill was listed on the National Priorities List, effective March 23, 1990.

3.0 SCOPE OF WORK

The purpose of this RI/FS is to investigate the extent of contamination and to mitigate the contamination source. The primary tasks to be performed during this investigation will include the following:

- Measure water levels in the existing wells;
- Sample and analyze groundwater, surface water, and sediment samples for water quality parameters and contaminants of concern;
- Sample and analyze samples of the sludge to characterize the wastes;

- Sample and analyze particulate matter in the air to characterize air quality;
- Collect data necessary to conduct a Baseline Risk Assessment and to assist in evaluation of Remedial Action Alternatives.

4.0 PROJECT TEAM ORGANIZATION

4.1 Responsibilities of Project Personnel

Responsibilities of on-site personnel are listed below:

- The Project Manager is responsible for the following:
  - Preparing and organizing the background review of the sites.
  - Coordinating the preparation and execution of the Work Plan, Health and Safety Plan, and Quality Assurance/Quality Control (QA/QC) Plan.
  - Preparing and organizing the field team.
- The Field Operations Manager has the authority to direct operations and site activities and his responsibilities include the following:
  - Managing field operations.
  - Executing the work plan and schedule.
  - Coordinating with the Project Health and Safety Officer in determining protection level.
  - Enforcing site control.
  - Documenting field activities and sample collection.
  - Serving as a liaison with site personnel.
- The responsibilities of the Project Health and Safety Officer include the following:
  - Periodically inspecting protective clothing and equipment.
  - Ensuring that protective clothing and equipment are properly stored and maintained.
  - Controlling entry and exit at the access control points.
  - Confirming each team member's suitability for work based on a physician's recommendation.
  - Monitoring the work parties for signs of stress, such as heat stress and fatigue.
  - Implementing the Health and Safety Plan.
  - Conducting periodic inspections to determine if the Health and Safety Plan is being followed.

- Enforcing the "buddy" system.
- Knowing emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department and police department.
- Notifying, when necessary, local public emergency officials.
- Coordinating emergency medical care.
- Setting up decontamination lines and the decontamination solutions appropriate for the type of chemical contamination on site.
- Controlling the decontamination of equipment, personnel, and samples from the contaminated areas.
- Assuring proper disposal of contaminated clothing and materials.
- Ensuring that required equipment is available.
- Advising medical personnel of potential exposures and consequences.
- Notifying emergency response personnel by telephone or radio in the event of an emergency.

• Project team members involved in this field investigation are responsible for the following:

- Taking precautions necessary to prevent injury to themselves and other employees.
- Complying with the Health and Safety Plan and reporting any deviations from this plan to the Field Team Leader.
- Maintaining visual contact between partners (buddy system).
- Performing only those tasks they believe they can do safely.
- Immediately reporting any accidents and/or unsafe conditions to the Field Team Leader.

5.0 EMPLOYEE TRAINING AND MEDICAL SURVEILLANCE REQUIREMENTS

5.1 Training

On-site personnel are required to receive 40-hours of initial health and safety training in hazardous waste operations (29 CFR Part 1910.120 [e]) prior to participating in this project.

The Project Health and Safety Officer is responsible for developing and conducting a site specific training program for on-site personnel. This training should encompass the following topics:

- Name of personnel responsible for site safety and health.
- Safety, health and other hazards at the site.
- Proper use of personal protective equipment.
- Work practices by which the employee can minimize risk from hazards.
- Safe use of engineering controls and equipment on the site.
- Acute effects of compounds at the site.
- Decontamination procedures.

Site training must be documented by use of attendance list. No personnel will be permitted to work on-site without first receiving training.

5.2 Medical Surveillance

The Occupational Safety and Health Administration (29 CFR Part 1910.120 [f]) requires all personnel engaged in operations involving hazardous material to be enrolled in a medical surveillance program. Exhibit C contains information concerning the content of this medical surveillance.

5.3 Medical Surveillance for Subcontractors

All subcontractor field personnel involved with this project must also be provided with medical surveillance examinations prior to commencing on-site activities. The content of the examination must be sufficiently detailed to determine an individual's fitness for duty, including his ability to work while wearing protective equipment (e.g., respirator, impermeable clothing, etc.). A letter (signed by a physician) attesting to each individual's fitness for duty must be provided to the Project Manager prior to work commencement.

6.0 RISK ASSESSMENT

6.1 Chemical Hazards

The compounds of greatest health concern at the Beulah Landfill Site are: anthracene, fluoranthene, pyrene, naphthylene, pentachlorophenol, PCB-1260, chlordane, benzene, chlorobenzene, and trichloroethylene. Tables 1 and 2 provide information of the physical and toxicological properties of these compounds. Benzene, chlorobenzene, and TCE have high vapor pressures (are volatile), but they are also soluble in water and therefore pose only a slight inhalation exposure problem when collecting water samples. However, air monitoring should periodically be conducted (particularly during sludge sampling) to determine if there is a need to upgrade the level of respiratory protection.

TABLE 1
PHYSICAL PROPERTIES OF COMPOUNDS SUSPECTED AT THE BEULAH LANDFILL
PENSACOLA, FLORIDA

Compound	Vapor Pressure	Vapor Density	Odor Threshold (ppm)	Flash Point (C°)	Water Solubility (mg/L)
Anthracene	1 mm Hg at 145°C	6.15	--	121	0.045-0.073
Fluoranthene	1×10^{-10} mm Hg at 20°C	--	--	--	0.26
Pyrene	2.5×10^{-6} mm Hg at 25°C	--	--	--	0.132
Naphthalene	0.087 mm Hg at 25°C	4.42	0.44	80	31.7 at 20°C
Pentachlorophenol	0.00011 mm Hg at 20°C	--	0.857 μg/L at 30°C	--	14 at 20°C
PCB-1260	4.05×10^{-5} mm Hg at 25°C	--	--	--	0.0027
Chlordane	2.2×10^{-5} mm Hg at 25°C	--	--	56	0.056
Benzene	100 mm Hg at 26°C	2.77	4.68	-11	1,000 at 25°C
Chlorobenzene	8.8 mm Hg at 20°C	3.88	0.050	29.4	500
Trichloroethylene	60 mm Hg at 20°C	4.54	10 μg/L	--	1,100 at 25°C
Copper (as sulfate)	--	--	--	--	14.3 g/100mL
Lead (as nitrate)	--	--	--	--	56.5 g/100 mL
Zinc (as chloride)	--	--	--	--	432 g/100 mL

-- = Not Available

NA = Not Applicable

TABLE 2
TOXICOLOGICAL PROPERTIES OF COMPOUNDS SUSPECTED AT THE BEULAH LANDFILL
PENSACOLA, GEORGIA

Compound	Threshold[1] Limit Value (ppm)	IDLH[2] (ppm)	Acute Toxic Effects	
PNAs (Naphthalene)	10 (50 $\mu g/m^3$)	500	Inhalation:	Headache, confusion, abdominal pain, profuse sweating.
			Dermal:	Dermatitis, eye irritation.
Pentachlorophenol	0.5 mg/m^3	150 mg/m^3	Inhalation:	Sweating, headache, dizziness, nausea, chest pain.
			Dermal:	Dermatitis, irritation of eyes, nose, throat.
Chlordane	0.5 mg/m^3	500 $\mu g/m^3$	Inhalation:	Blurred vision, confusion, abdominal pain, nausea, irritability, convulsions.
Benzene	10	2,000	Inhalation:	Irritates eyes and respiratory system, headache, nausea, abdominal pain.
			Dermal:	Dermatitis.
Chlorobenzene	75	2,400	Inhalation:	Drowsiness, incoordination.
			Dermal:	Irritates skin, eyes, nose.
Trichloroethylene	50	1,000	Inhalation:	Vertigo, visual disturbance.
			Dermal:	Dermatitis, eye irritation.
Copper (dust)	1 mg/m^3	NA[4]	Dermal:	Dermatitis, irritation of eyes and mucous membrane.

TABLE 2--Continued
TOXICOLOGICAL PROPERTIES OF COMPOUNDS SUSPECTED AT THE BEULAH LANDFILL PENSACOLA, GEORGIA

Compound	Threshold[1] Limit Value (ppm)	IDLH[2] (ppm)	Acute Toxic Effects
Lead (dust)	0.05 $\mu g/m^3$	NA	
Zinc (dust)	1 $\mu g/m^3$	2,090 $\mu g/m^3$	Inhalation: Chest pain. Dermal: Burns eyes and skin, irritates nose and throat.

(1) TLVs - Threshold Limit Values and Biological Exposure Indices for 1988-1989 prepared by the American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio
(2) IDLH - Immediately Dangerous to Life or Health. IDLH is defined as any atmosphere that poses an immediate hazard to life or produces immediate irreversible debilitating effects on health.
(3) The federal standard Permissible Exposure Limit) is cited.
(4) NA = Not available.

Trichloroethylene as a dermal toxin has been observed to cause dermatitis and narcosis when it is absorbed through the skin. The proper selection of protective clothing for Level C operations is important. Natural rubber or butyl rubber gloves and boots should not be used when handling this chemical. Trichloroethylene attacks rubber products making them ineffective for use as protective clothing. Neoprene gloves and boots are recommended as a substitute for butyl rubber garments.

6.2 Physical Hazards

Some of the compounds suspected at the landfill have flashpoints below 37.8°C and are therefore considered flammable. Also, methane may be generated within the landfill contents. No personnel shall be allowed to smoke within 50 feet of sampling or well-purging activities.

Another primary physical agent which can threaten personnel conducting this hazardous waste investigation is heat related illness. Exposure to high environmental temperatures produces stress on the body. As the body attempts to compensate, physiological strain results. This strain, usually in combination with others caused by work and fatigue may lead to manifestations of heat stress. The following sections delineate preventive measures and methods for heat stress monitoring.

6.3 Prevention of Heat Stress

Successful prevention of adverse effects of heat is dependent on the education of workers and supervisors: the implementation of procedures to alert individuals to the existence of dangerous heat stress levels, and the reduction or prevention of additional heat loads in "stressed" personnel. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness.

The signs and symptoms of heat stress are presented in Table 3. This information should be used by the Project Health and Safety Officer to retrain and remind personnel concerning the dangers and recognition of heat stress. Additional steps to prevent heat stress include the following:

- Adjust work schedules.
  - Modify work/rest schedules according to monitoring requirements
  - Mandate work slowdowns as needed.
  - Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.

- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must equal approximately the amount of water lost in sweat; i.e., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
  - Maintain water temperature at 50° F to 60° F (10° C to 16.6° C).
  - Provide small disposable cups that hold about four ounces (0.1 liter).
  - Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or diluted drinks) before beginning work.
  - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.

6.4 Heat Stress Monitoring

Either environmental or physiological monitoring can be used to predict and control workers' heat stress. For workers who are wearing permeable clothing, environmental monitoring and the suggested work/rest cycles outlined in the current American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values® should be applied.

The use of personal protective equipment will increase an individual's heat stress, and the physiological monitoring of personnel wearing semi-permeable or impermeable clothing should commence when the ambient temperature is 70°F or more. Table 4 presents a suggested frequency for such monitoring. Physiological monitoring includes measurements of workers' heart rate or temperature and is accomplished as follows:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.
  - If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
  - If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.
- Oral temperature. Use a clinical thermometer (three minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).

TABLE 3
SIGNS AND SYMPTOMS OF HEAT STRESS[1]

- HEAT RASH may result from continuous exposure to heat or humid air.
- HEAT CRAMPS are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - muscle spasms
  - pain in the hands, feet, and abdomen
- HEAT EXHAUSTION occurs from increased stress on various body organs including inadequate blood circulation due to cardio-vascular insufficiency or dehydration. Signs and symptoms include:
  - pale, cool, moist skin
  - heavy sweating
  - dizziness
  - nausea
  - fainting
- HEAT STROKE is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are:
  - red, hot, usually dry skin
  - lack of or reduced perspiration
  - nausea
  - dizziness and confusion
  - weak, rapid pulse
  - coma

[1] USEPA, 1984. Standard Operating Safety Guidelines.

TABLE 4
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATIZED WORKERS[a]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90 F (32.2 C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5 -90 F (30.8 - 32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5 -87.5 (28.1 - 30.8 C)	After each 90 minutes of work	After each 60 minutes of work
77.5 -82.5 F (25.3 - 28.1 C)	After each 120 minutes of work	After each 90 minutes of work
72.5 -77.5 F (22.5 25.3 C)	After each 150 minutes of work	After each 120 minutes of work

a - For work levels of 250 kilocalories/hour.

b - Calculate the adjusted air temperature (ta adj) by using this equation: ta adj F = ta F + (13 x percent sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows)

c - A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

- If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.
- If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third.
- Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

6.5 Field Hazards

6.5.1 Snakes

Coral snakes and pit vipers are the two families of venomous snakes in the US. Two species of coral snakes occur within the US: the Arizona coral snake and Eastern coral snake. Coral snakes are strikingly colored with broad alternating bands of red and black, separated by narrow yellow or white rings. Unlike pit vipers, the enlarged grooved fangs are in a fixed position in the rear of the mouth that cannot fold back. The coral snake possess a potent neurotoxin and bites can be fatal.

Seventeen of the 19 venomous snakes within the US belong to the pit viper family. They are represented by three genera: Agkistrodon; copperheads, cottonmouths; crotalus; and sistrurus; rattlesnakes. The majority of these snakes are stout-bodied, with heads wider than their neck, and patterned with blotches or crossbands. These snakes have retractable hollow fangs located near the front of the upper jaw. Their venom is a complex mixture of proteins that act on the blood.

Most venomous snakes in the US are shy and nocturnal so an encounter with field personnel would be rare. Field personnel should be vigilant of the habitat of these species (e.g., lowland marshes, irrigation ditches, and canals for cottonmouths) and avoid placing hands and feet where you cannot see. Snake leggings should be used when working in lowlying, wet areas.

6.5.2 Ticks

Ticks serve as reservoirs for a number of bacteria. Two of the most common ailments transmitted to man by the bite of a tick are rock mountain spotted fever and lyme disease.

The causative agent of rock mountain spotted fever is Rickettsia rickettsii. The disease is transmitted to man by the bite of an infected tick, and by contamination of skin with tick tissue juices or feces. The disease is widespread in the US. Rocky Mountain Spotted Fever is characterized by a sudden onset of fever, chills, and headaches. A rash on the extremities occurs 3 days after infection, and spreads rapidly covering most of the body. Hemorrhages and petechiae are common. Fatality is 20 percent in untreated cases; death is uncommon if promptly treated.

Prevention is accomplished by avoiding areas of tick infestation and early recognition and careful removal of the tick before attachment. Long sleeve shirts and pants should be worn in areas where ticks are suspected. The use of repellants is also helpful, although it is not permitted during sampling activities.

Lyme disease has become the most commonly reported disease transmitted by ticks in the US. From 1982 through 1988, 13, 904 cases of lyme disease have been reported nationally. Ninety percent of the reported cases occur in three US regions: the Atlantic Seaboard (particularly the northeastern states), the midwest (particularly Wisconsin and Minnesota), and the western states (particularly California and Oregon). The etiologic agent of lyme disease is a spirochete, Borrelia burgdorferi, which is transmitted to humans following a bite by an infected tick. In the northeast and midwest US, the black-legged deer tick, Ixodes dammini, is the primary vector.

Patients who receive antibiotic therapy early in the infection will develop few additional symptoms. If treatment is not introduced early, the patient may develop neurologic and/or cardiac irregularities. These abnormalities include: facial paralysis, nerve root inflammation, and heart block.

Within 2 years, 60 percent of the patients develop arthritis. Affected individuals frequently suffer from migratory chronic arthritis marked by a painful swelling of the joints. During these later stages of the disease, individual often complains of mood swings, depression, and memory loss.

The prevention of lyme disease is similar to the prevention of Rocky Mountain Spotted Fever (e.g., protective clothing, routinely check for ticks, and the use of tick repellent).

6.5.3 Chiggers, Harvest Mites, Red Mites "red bugs" (Trombiculidae)

The above common names refer to trombiculid in the larval stage. Eggs of trombiculid mites are laid on the ground on the lower stems and leaves of grass or bushes. Upon maturity, a larva emerges from the egg shell and usually crawls onto a small rodent, domestic mammal, or person who enters the infested area. The larval mite sinks its head into the skin and sucks tissue juice until engorged.

The larva produce a type of dermatitis in man. While some people are relatively immune, others develop a severe local reaction which is noted several hours after the mite has become attached. The initial reaction is an insufferable itching and inflammation. Soon after, a welt forms at the site, frequently accompanied by hemorrhage. The regions most commonly attacked are the legs and ankles.

Topical application of phenolated camphor or steroids will relieve the itching. Preventive measures for mites are the same as those for ticks.

6.5.4 Instability of Sludge Pond Surfaces

The inactive sludge disposal ponds have been stabilized to the point where their surfaces are capable of supporting a heavy vegetative cover, passage of foot traffic, and some entry by light duty mechanized equipment. However, there is concern that heavy duty mechanized equipment might not be able to safely enter onto the pond surfaces due to the potential for breakthrough.

During the completion of the field work described in this Health and Safety Plan, it is not anticipated that entry onto the inactive ponds by heavy mechanized equipment will be necessary. If it becomes necessary to place heavy equipment on any of the inactive pond surfaces, a geotechnical test program will be undertaken to ensure the pond surface will bear the load without failure. If pond surfaces are found to be weak, they will be reinforced prior to equipment entry using standardized methods.

7.0 AIR MONITORING

Initial site air monitoring will be conducted utilizing Level D protection. Site work zones will be established based upon these ambient air monitoring results and the type of activities that are to be performed.

Air monitoring is repeated whenever:

- A different type of operation is initiated (e.g., groundwater sampling as opposed to soil sampling).
- Weather conditions change.
- Work begins on a different portion of the site.

A photoionization detector and a combustible gas indicator will be the air monitoring devices used during this investigation. Information concerning the calibration and maintenance of the photoionization detector and combustible gas indicator can be found in Exhibit A.

8.0 PERSONAL PROTECTIVE EQUIPMENT

Based on an evaluation of potential hazards, the following personnel protective ensembles have been designated for each site activity.

Location	Job Function	Level of Protection				
Exclusion Zone	Sample Ground Water	A	B	C	D*	Other
	Collect Soil Samples	A	B	C*	D*	Other
Contamination Reduction Zone	Personnel Decontamination	A	B	C	D*	Other

* Anticipated protective ensemble.

Specific protective equipment for Levels C and D personal protection is as follows:

- Level C Protection
  - Full-face air purifying respirator
  - Organic vapor cartridges
  - Chemical resistant clothing (e.g., Saranex®)
  - Inner PVC or Silver Shield® gloves
  - Outer Neoprene gloves
  - Chemically resistant safety boots

  Optional:
  - Hard hat
  - Disposable boot covers
- Level D Protection
  - Coveralls
  - Safety boots
  - Neoprene gloves (if there is a potential for dermal exposure, otherwise leather gloves may be used)
  - Chemical safety goggles (must be worn for groundwater sampling and recovery well pumping if splash hazard is present)
- Optional:
  - Hard hat

All personal protective equipment used during the course of this field investigation must meet the following applicable OSHA Standards:

Type of Protection	Regulation	Source
Eye and face	29 CFR 1910.133	ANSI Z87.1-1968
Respiratory	29 CFR 1910.134	ANSI Z88.1-1980
Head	29 CFR 1910.135	ANSI Z89.1-1969
Foot	29 CFR 1910.136	ANSI Z41.1-1967

ANSI = American National Standards Institute

8.1 Site-Specific Action Levels

The following criteria should be used to determine the appropriate respiratory protection:

Volatile Organics (in the Breathing Zone)	Level of Protection
0 - 1 ppm	Level D
1 - 10 ppm	Level C

The following criteria should be used to determine appropriate action for explosive hazards at the site:

Explosive Vapors (% Lower Explosive Limit)	Action
10 - 20	Use non-sparking tools
above 20	Discontinue work and take remedial action

At least one portable fire extinguisher having a rating of not less than 12-BC units shall be on-site at all times.

8.2 Limitation of Level C Respiratory Protection

Level C respiratory protection consists of wearing a full-face air purifying respirator with organic vapor cartridges. Both the respirator and chemical cartridges must be approved by NIOSH and MSHA. Cartridges must be changed every hour.

Air purifying respirators cannot be used under the following conditions.

- Oxygen deficiency
- IDLH (Immediately Dangerous to Life or Health) concentration

- High relative humidity
- Contaminant levels exceed designated maximum use concentrations

Individuals who use air purifying respirators must wear a respirator which has been successfully fitted to their faces via an acceptable fit test. An improperly fitted respirator provides little respiratory protection. In the event that organic vapor levels exceed the upper limit for Level C protection, all field personnel are to stop work while the project health and safety officer consults with the office health and safety representative.

9.0 SITE WORK ZONES

To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, zones will be delineated at the site where different types of operations will occur. The flow of personnel between the zones should be controlled. The establishment of the work zones will help ensure that: personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency.

9.1 Exclusion Zone

The exclusion zone is an area where contamination does or could occur. An exclusion zone will be established for soil and groundwater sampling activities. Access into the exclusion zone will be controlled to ensure that personnel entering the areas are wearing the proper protection (e.g., hard hat, gloves, Saranex®, respirators). Unprotected onlookers should be located 50 feet upwind of this zone.

9.2 Contamination Reduction Zone

This will be established by the Project Health and Safety Officer as a buffer zone between the exclusion zone and the support zone. The contamination reduction zone will contain the personnel and equipment decontamination stations. The contamination reduction zone should always be located upwind of the exclusion zone in an area devoid of air contaminants.

9.3 Support Zone

The support zone will include the remaining areas of the job site. Break areas, operational direction and support facilities (to include supplies, equipment storage and maintenance areas) will be located in this area. No equipment or personnel will be permitted to enter the clean zone from the contamination reduction zone without passing through the personnel or equipment decontamination stations. Eating, smoking and drinking will be allowed in this area only.

10.0 PERSONNEL DECONTAMINATION

To prevent harmful materials from being transferred into clean areas or from exposing unprotected workers, all field personnel exiting an area of potential contamination will undergo decontamination. The extent of decontamination depends on a number of factors, the most important being the type and concentrations of the contaminant involved.

Soft-bristled scrub brushes and long handle brushes will be used to remove contaminants from personnel. Buckets of water or garden sprayers will be used for rinsing. Large plastic garbage bags will be used to store contaminated clothing (gloves, etc.) and equipment. Metal or plastic cans or drums will be used to store contaminated liquids. Washing and rinsing are done in combination with a sequential doffing of clothing starting at the first decon station with the most heavily contaminated article and progressing to the last station with the least contaminated article. Decontamination will not be required for Level D activities. An exclusion zone will be established for soil and groundwater sampling and for Level C activities to prevent personnel from entering these areas without proper safety equipment (e.g., hard hat, steel-toe boots, respirators, etc.).

Decontamination procedures will be divided into 10 stations. Level C decontamination will consist of the following:

10.1 Station 1: Segregated Equipment Drop

Deposit equipment used on the site (tools, sampling devices and containers, monitoring instruments, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross-contamination.

Necessary equipment includes:

1. Containers of various sizes
2. Plastic liners
3. Plastic drop cloths

10.2 Station 2: Suit/Safety Boot and Outer-Glove Wash

Thoroughly wash chemically resistant suit, safety boots and outer gloves. Scrub with long-handle, soft-bristle scrub brush and copious amounts of alconox/water solution. Repeat as many times as necessary.

Necessary equipment includes:

1. Container (30 gal)
2. Alconox/water solution
3. Long handle, soft-bristle scrub brushes

10.3 Station 3: Suit/Safety Boot and Outer-Glove Rinse

Rinse off alconox/water solution using copious amounts of water. Repeat as many times as necessary.

Necessary equipment includes:

1. Container (30 gal)
2. Spray unit
3. Water
4. Long handle, soft-bristle scrub brushes

10.4 Station 4: Canister or Mask Change

If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedures. Worker's canister is exchanged, new outer gloves and tyvec donned, and joints taped. Worker returns to duty. Otherwise the worker proceeds to Station 5.

Necessary equipment includes:

1. Canister (or mask)
2. Tape
3. Boot covers
4. Gloves

10.5 Station 5: Outer Glove Removal

Remove outer gloves and deposit in individually marked plastic bags.

Necessary equipment includes:

1. Container (30 gal)
2. Plastic liners
3. Bench or stool

10.6 Station 6: Tyvex or Saranex Suit Removal

With assistance of helper, remove tyvex or saranex suit. Deposit in container with plastic liner.

Necessary equipment includes:

1. Container (30 gal)
2. Stool
3. Plastic liner

10.7 Station 7: Inner-Glove Wash

Wash inner-gloves with decon solution or detergent/water solution that will not harm skin. Repeat as many times as necessary.

10.8 Station 8: Inner-Glove Rinse

Rinse inner-gloves with water. Repeat as many times as necessary.

Necessary Equipment includes:

1. Water
2. Basin
3. Small table

10.9 Station 9: Safety Boot Removal

Remove safety boots and deposit in individually marked plastic bags.

Necessary equipment includes:

1. Container
2. Plastic liners
3. Bench or stool

10.10 Station 10: Respirator Removal

Remove facepiece. Avoid touching face with gloves. Wash respirator in clean, sanitized solution (e.g., antiseptic mouthwash) and deposit facepiece in plastic bag. Store in clean area.

Necessary equipment includes:

1. Plastic bags

10.11 Station 11: Inner-Glove Removal

Remove inner-gloves and deposit in container with plastic liner.

Necessary equipment includes:

1. Container
2. Plastic liners

10.12 Station 12: Field Wash

Wash hands and face.

Necessary equipment includes:

1. Water
2. Soap

3. Tables

4. Wash basins or buckets

10.13 Station 13: Redress

Put on clean clothes.

Necessary equipment includes:

1. Table

2. Chairs

3. Clothes

10.14 Decontamination During Medical Emergencies

During some medical emergencies, it is possible that decontamination may aggravate or cause more serious health effects. If prompt life-saving first aid and medical treatment is required, decontamination procedures should be omitted. Whenever possible, personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

- Physical Injury

- Physical injuries can range from a sprained ankle to a compound fracture, from a minor cut to massive bleeding. Depending on the seriousness of the injury, treatment may be given at the site by trained personnel. For more serious injuries, additional assistance may be required at the site or the victim may have to be transported to a medical facility.

- Life saving care should be started immediately, without considering decontamination. The outside garments need not be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respirators and backpack assemblies must always be removed. Chemical-resistant clothing can be cut away. If the outer contaminated garments cannot be safely removed, the individual should be wrapped in plastic, rubber, or blankets to help prevent contaminating medical personnel and the inside of ambulances. Outside garments are then removed at the medical facility. No attempt should be made to wash or rinse the victim at the site. One exception would be if it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of life. For minor medical problems or injuries, the normal decontamination procedure should be followed.

- Heat Stress

- Heat related illness range from mild heat fatigue to life-threatening heat stroke. Heat stroke requires prompt treatment to prevent irreversible damage or death. Unless the victim is obviously contaminated,

decontamination should be omitted or minimized and treatment begun immediately. Protective clothing will probably have to be cut off. Less serious stages of heat stress also require prompt attention because they can progress to heat stroke.

- Chemical Exposure
- Exposure to chemicals can be divided into two categories:
  - Injuries from direct contact, such as acid burns or inhalation of toxic chemicals.
  - Potential injury caused by gross contamination of clothing or equipment.

For inhaled contaminants, treatment can only be performed by qualified physicians. If the contaminant is on the skin or in the eyes, first aid treatment generally includes flooding the affected area with water. For a few chemicals, water may cause more severe problems.

When protective clothing is grossly contaminated, contaminants may be transferred to treatment personnel or the wearer and cause injuries. Unless severe medical problems have occurred simultaneously with splashes, the protective clothing should be washed off as rapidly as possible and then carefully removed.

11.0 EQUIPMENT DECONTAMINATION

Sampling equipment will be decontaminated by methods specified in the Sampling and Analysis Plan.

11.1 Personnel Protection

Decontamination personnel are required to wear the following protective ensemble:

- Tyvek coveralls
- PVC or Silver Shield® gloves
- Chemically resistant boots
- Chemical safety goggles or glasses

Air monitoring shall be performed to ensure that the concentrations of isopropanol in the breathing zone does not exceed 400 ppm. The Project Health and Safety Officer is responsible for informing decontamination personnel (including subcontractors) of the hazards of isopropanol (pesticide grade). This communication program must, as a minimum, contain the following:

- Providing copies of material safety data sheets or isopropanol (pesticide grade) to personnel.
- Inform personnel of the labeling system utilized at the site.

- Inform personnel of precautionary measures that need to be taken when handling isopropanol.

All containers of isopropanol at the site must be labeled in accordance with the Hazard Communication Standard (29 CFR Part 1910.1200 [f]).

12.0 ACCIDENT PREVENTION

Field personnel shall receive health and safety training prior to the initiation of any site activities. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, regular safety and health meetings should be held. Discussion should include:

- Tasks to be performed.
- Time constraints (e.g., rest breaks, cartridge changes).
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- Emergency procedures.

The Project Health and Safety Officer will ensure that entry into any exclusion zone is controlled to make certain that personnel entering this zone don the appropriate protective equipment. Air monitoring will be performed to determine the proper protective ensemble to use prior to sampling activities. The Project Health and Safety Officer will post the emergency phone numbers (phone numbers for the hospital, ambulance, etc.) and train the field team in emergency procedures. Field personnel will be familiar with the proper sampling techniques.

13.0 CONTINGENCY PLAN

13.1 Emergency Procedures

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency notification information is contained in Section 14. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on site.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

13.2 Chemical Exposure

If a member of the field crew demonstrates symptoms of chemical exposure, the procedures outlined below should be followed.

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the Field Team Leader (via hand signals) of the chemical exposure. The Field Team Leader/Project Health and Safety Officer should contact the appropriate emergency response agency.
- Precautions should be taken to avoid exposure of other individuals to the chemicals.
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.
- All chemical exposure incidents must be reported in writing to the Office Health and Safety Representative. The Project Health and Safety Officer or Field Team Leader is responsible for completing the accident report (see Exhibit B).

13.3 Personal Injury

In case of personal injury at the site, the following procedures should be followed:

- Another team member (buddy) should signal the Field Team Leader (via two-way radio or hand signals) that an injury has occurred.
- A field team member trained in first aid can administer treatment to an injured worker.
- The victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.
- The Field Team Leader/Project Health and Safety Officer is responsible for making certain that an accident report form is completed. This form is to be submitted to the Office Health and Safety Representative. Follow-up action can then be taken to correct the situation that caused the accident.

13.4 Evacuation Procedures

- The Field Team Leader will initiate evacuation procedures by signaling (via hand signals or whistle) to leave the site.
- All personnel in the work area should evacuate the area and meet in the designated area.

- All personnel expected to be in or near the work area should be accounted for and the location of missing personnel determined immediately.
- Further instruction will be given by the Field Team Leader.

13.5 Procedures for a Major Fire, an Explosion, or Other On-Site Emergencies

- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep area surrounding the problem source clear after the incident occurs; and
- Complete accident report form and distribute to appropriate personnel.

14.0 EMERGENCY CONTACTS

In the event of any situation of unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations, contact should first be made with the site coordinator who will notify emergency personnel who will then contact the appropriate response teams. The emergency contact list must be posted at the site.

Phone: 911

For medical emergencies, fire, or any potentially life-threatening situation, the 911 emergency response number should be utilized.

(Phone at Nearest Residence):

24-Hour Hotline for Toxic

Exposure Treatment 1-800-272-3171

Medical Emergency

Name of Nearest Hospital:

West Florida Regional Medical Center

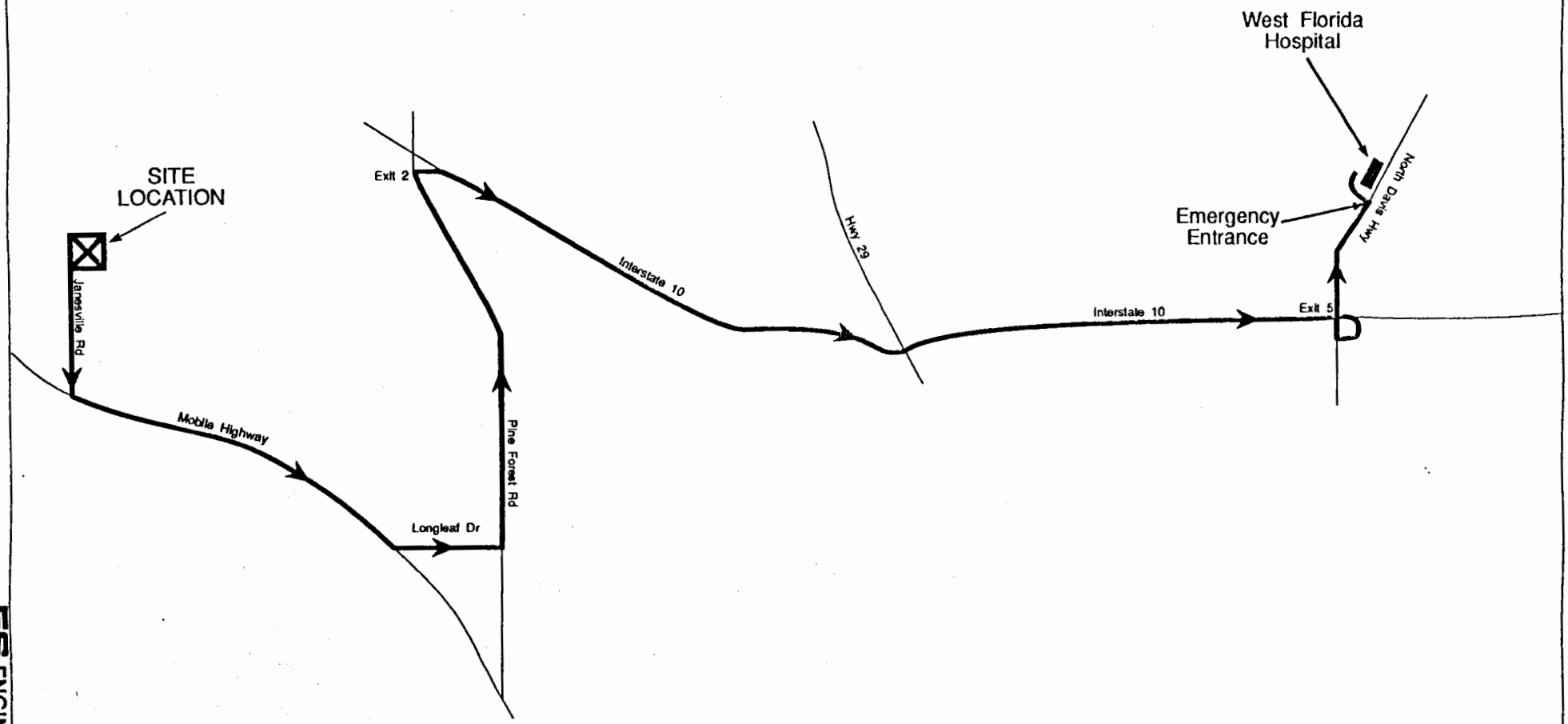
8383 North Davis Highway

Pensacola, Florida

(904) 478-4460, Ext. 4160

A map to the West Florida Regional Medical Center is on the next page.

BEULAH LANDFILL REMEDIAL INVESTIGATION
HEALTH AND SAFETY PLAN
HOSPITAL ROUTE MAP



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ES ENGINEERING-SCIENCE

EXHIBIT A

AIR MONITORING EQUIPMENT

CALIBRATION AND MAINTENANCE

EXHIBIT A

AIR MONITORING EQUIPMENT

CALIBRATION AND MAINTENANCE

INTRODUCTION

All monitoring instruments must be calibrated and maintained periodically. The limitations and possible sources of errors for the instrument must be understood by the operator. It is important that the operator ensures that the instrument responds properly to the substances it was designed to monitor. Below is the calibration and maintenance procedures for the HNU® photoionization detector and Biosensor®II combustible gas indicator.

HNU® Photoionization Detector

The photoionization detector must be calibrated each day prior to field use. A calibration gas will be taken into the field to perform this routine calibration check. The procedure for the calibration of a HNU® photoionization detector is listed below.

1. Attach the probe to the read out unit. Match the alignment key, then twist the connector clockwise until a distinct locking is felt.
2. Turn the FUNCTION switch to the battery check position. Check to ensure that the indicator reads within or beyond the green battery arc on the scale plate. If the indicator is below the green arc, or if the red LED comes on, the battery must be charged prior to using.
3. To zero instrument, turn the FUNCTION switch to the STANDBY position and rotate the ZERO POTENTIOMETER until the meter reads zero. Wait 15-20 seconds to ensure that the zero adjustment is stable. If not, then re-adjust.
4. Check to see that the SPAN POTENTIOMETER is set at the appropriate setting for the probe being used.

5. Set the FUNCTION switch to the desired ppm range.
6. Listen for the fan operation to verify fan function.
7. Check instrument with an organic point source such as a "magic marker" prior to field survey to verify instrument function.
8. Connect a sampling hose to the regulator outlet and the other end to the sampling probe of the HNU®.
9. Crack open the regulator valve (to calibration gas).
10. Take reading after 5-10 seconds.
11. If the reading deviates ± 15% from the concentration of the calibration gas, the instrument requires maintenance.
12. Results of calibration should be recorded in the logbook.

Recommended maintenance for the HNU® is listed below:

Function	Frequency
o Wipe down read-out unit.	After each use.
o Clean UV light source window.	Every month.
o Clean ionization chamber.	Every month.
o Recharge battery.	Daily or as use dictates.

Biosensor®II Combustible Gas Indicator

The combustible gas indicator must be calibrated each week. The procedure for calibrating the combustible gas indicator (Biosensor®II) is listed below:

1. Attach the 0.5 liter per minute fixed flow rate regulator to the calibration gas cylinder.
2. Attach a sample line from the regulator to the balloon inlet. Attach another sample line from the balloon outlet to the sample draw intake on the instrument.
3. Fill the balloon with calibration gas and allow the sample draw pump to draw it over the sensors. DO NOT OVERINFLATE BALLOON! Feed more gas into the balloon as needed to keep it partially inflated.

4. Wait for the readings to stabilize. Then, using a small jeweler's screwdriver, adjust the "gas span" pot to obtain a steady reading which corresponds to the calibration gas concentration that is printed on the label of the calibration gas cylinder. (Normally 50% L.E.L.)
5. Remove calibration lines.
6. Let the instrument run for one full minute to flush any excess calibration gas and check readings. The combustible sensor should now be reading 000% L.E.L., (± 001% L.E.L.), in fresh air. Repeat calibration procedures if necessary.
7. Combustible calibration complete.
8. Results of calibration must be recorded in the logbook.

The Biosensor®II uses a 2 volt lead gel cell battery. This battery should be charged daily or as use dictates. The battery cannot be overcharged.

EXHIBIT B

FORMS

ACCIDENT REPORT FORM

Project: _____

EMPLOYER

1. Name _____

2. Mail Address _____
(No. and Street) (City or Town) (State)

3. Location, if different from mail address _____

_____

INJURED OR ILL EMPLOYEE

4. Name _____ Social Security Number _____
(First) (Middle) (Last)

5. Home Address _____
(No. and Street) (City or Town) (State)

6. Age _____ 7. Sex: Male ____ Female ____ (Check one)

8. Occupation _____
(Specific job title, not the specific activity employee was performing at time of injury)

9. Department _____
(Enter name of department in which injured persons is employed, even though they may have been temporarily working in another department at the time of injury)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure _____
(No. and Street) (City or Town) (State)

11. Was place of accident or exposure on employer's premises? (Yes/No)

12. What was the employee doing when injured? _____
(Be specific - Was employee

_____

using tools or equipment or handling material?)

_____

ACCIDENT REPORT FORM
(Continued)

13. How did the accident occur? _____
(Describe fully the events which resulted

_____
in the injury or occupational illness. Tell what happened and how. Name

_____
objects and substances involved. Give details on all factors which led to

_____
accident. Use separate sheet for additional space.)

14. Time of accident: _____

15. WITNESS TO ACCIDENT

(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

16. Describe the injury or illness in detail and indicate the part of the body affected. _____

_____

17. Name the object or substance which directly injured the employee. (For example, object which struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation which irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.).

_____

_____

18. Date of injury or initial diagnosis of occupational illness _____
(Date)

19. Did the accident result in employee fatality? _____ (Yes or No)

OTHER

20. Name and address of physician _____

ACCIDENT REPORT FORM
(Continued)

21. If hospitalized, name and address of hospital _____

_____

Date of report _____ Prepared by _____

Official position _____

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

I have read and agree to abide by the contents of the Health and Safety Plan for the following project:

Beulah Landfill
Remedial Investigation
Pensacola, Florida

_____
Name (print)

_____
Signature

_____
Date

Return to Project Health and Safety Officer <u>before</u> starting work at the base.

SCBA

RESPIRATORY LOG

SITE: _____

LOCATION: _____

DATES OF INVESTIGATION: _____

User	Date of Use	SCBA#	Satisfactory Check-Out (Yes/No - Initials)	Date Cleaned

SCBA Performance Comments:

_____

Project Health and Safety Officer Date
or Field Team Leader

Return to Office Health and Safety Representative at the completion of field activities.

AIR PURIFYING

RESPIRATOR LOG

SITE: _____

LOCATION: _____

DATES OF INVESTIGATION: _____

User	Date of Use	Cleaned and Inspected Prior To Use (Initials)	Cartridges Changed Prior to Use (Yes, NO, N/A)	Total Hours on Cartridge

Project Health and Safety Officer or Field Team Leader: _____ Date: _____

Return to Office Health and Safety Representative at the completion of field activities.

EXHIBIT C

MEDICAL EXAMINATION

EXHIBIT C

MEDICAL EXAMINATION

EXAMINATION CONTENT

Each participant in the Engineering-Science medical program will receive a comprehensive base-line examination with periodic screening exams thereafter. These periodic exams may include an interim medical and occupational history review, a physical exam, laboratory blood and urine test, and a physician's evaluation. The periodic examinations will be supplemented by procedures and special tests as warranted by exposure to specific hazards.

MEDICAL HISTORY

Each participant will complete an occupational and medical history form before seeing a physician. When completed, the form will be turned over to the physician or the physician's designee.

The confidential occupational and medical history form is designed to elicit general and specific information concerning employee health. While this information is essential in determining health status, it also represents an opportunity for the employee to express concern regarding his occupational environment. Responses given will allow the medical staff to determine those test and procedures most appropriate to that work situation.

SAMPLE PRE-PLACEMENT PHYSICAL

Occupational and Medical History

Perform a complete medical history emphasizing these systems: nervous, skin, lung, blood-forming, cardiovascular, gastrointestinal, genitourinary, and reproductive.

Physical Examination

Physical examination include at least the following:

- Height, weight, temperature, pulse, respiration, and blood pressure.
- Head, nose, and throat.
- Eyes. Include vision tests that measure refraction, depth perception, and color vision. These tests should be administered by a qualified technician or physician. Vision quality is essential to safety, the accurate reading of instruments and labels, the avoidance of physical hazards, and for appropriate response to color-coded labels and signals.
- Ears. Include audiometric tests, performed at 500; 1,000; 2,000; 3,000; 4,000; and 6,000 hertz (Hz) pure tone in an approved booth (see requirements listed in 29 CFR Part 1910.95). Test should be administered by a qualified technician, and results read by a certified audiologist or a physician familiar with audiometric evaluation. The integrity of the eardrum should be established because perforated eardrums can provide a route of entry for chemicals into the body. The physician evaluating employees with perforated eardrums should consider the environmental conditions of the job and discuss the possible specific safety controls with the Office or Laboratory Health and Safety Representative before deciding whether such individuals can safely work.
- Chest (heart and lungs).
- Peripheral vascular system.
- Abdomen and rectum (including hernia exam).
- Spine and other components of the musculoskeletal system.
- Genitourinary system.
- Skin.
- Nervous system.

Test

- o Blood.
- o Urine.
- o A 14 by 17-inch posterior/anterior view chest x-ray, with lateral or oblique views. The x-ray should be taken by a certified radiology technician and interpreted by a board-certified or board-eligible radiologist. Check x-rays taken in the last 12-month period, as well as the oldest chest x-ray available, should be obtained and used for comparison. Chest x-rays should not be repeated more than once a year, unless otherwise determined by the examining physician.

Ability to Perform While Wearing Protective Equipment

To determine a worker's capacity to perform while wearing protective equipment, additional test may be necessary, for example:

- o Pulmonary function testing: Measurement should include forced expiratory volume in 1 second (FEV_1), forced vital capacity (FVC), and FEV_1-to-FVC ratio, with interpretation and comparison to normal predicted values corrected for age, height, race, and sex. A permanent record of flow curves should be placed in the worker's medical records. The tests should be conducted by a certified technician and the results interpreted by a physician.
- o Electrocardiogram (EKG). A standard, 12-lead resting EKG should be performed.

SAMPLE PERIODIC MEDICAL EXAMINATION

Interval Medical History

Interval medical history should be performed focusing on changes in health status, illnesses, and possible work-related symptoms. The examining physician should have information about the worker's interval exposure history, including exposure monitoring results (if performed).

Physical Examination

- Height, weight, temperature, pulse, respiration, and blood pressure.
- Head, nose, throat.
- Vision tests that measure refraction, depth perception, and color vision.
- Chest (heart and lungs).
- Peripheral vascular system.
- Abdomen and rectum (including hernia exam).
- Spine and other components of the musculoskeletal system.
- Genitourinary system.
- Skin.
- Nervous system.
- Blood test.
- Urine test.

Additional Tests

Additional medical testing may be performed, depending on available exposure information, medical history, and examination results. Testing should be specific for the possible medical effects of the worker's exposure. Multiple testing for a large range of potential exposures is not always useful; it may involve invasive procedures (e.g., tissue biopsy), be expensive, and may produce false-positive results.

Pulmonary Function

Pulmonary function test should be administered if the individual uses a respiratory, has been or may be exposed to irritating or toxic substances, or if the individual has breathing difficulties, especially when wearing a respirator.

Audiometric Tests

Annual retest are required for personnel subject to high noise exposures (an 8-hour, time-weighted average of 85 dBA or more), those required to wear hearing protection, or as otherwise indicated.

Electrocardiogram

An electrocardiogram (EKG) will be performed annually for those over 40 and every three years for all others. The EKG will be the standard 12-lead resting type.

Chest X-Rays

Chest x-rays will be performed when clinically indicated or every three years. The x-ray should be at least 14 by 17-inch P-A (posterior/anterior).

Blood and Urine Test

Blood and urine test frequently performed by occupational physicians include:

Blood Test

- Complete blood count with differential and platelet evaluation
- White cell count
- Red blood cell count
- Hemoglobin
- Hermatocrit
- Reticulocyte count
- Total protein
- Albumin
- Globulin
- Total bilirubin
- Alkaline phosphatase
- Gamma glutamyl transpeptidase (GGTP)
- Lactic dehydrogenase (LDH)
- Serum glutumigoxaloacetic transaminase (SGOT)
- Serum glutamic-pyruvic transaminase (SGPT)
- Blood urea nitrogen (BUN)
- Creatinine
- Uric Acid

Urinalysis

- Color
- Specific gravity
- pH
- Qualitative glucose
- Protein
- Bile
- Acetone
- Microscopic examination of cetrifuged sediments

ES
ENGINEERING-SCIENCE, INC.

57 EXECUTIVE PARK SOUTH, N.E., SUITE 590
ATLANTA, GEORGIA 30329

TEL: 404/325-0770
FAX: 404/325-8369

April 14, 1992

Mr. Tony Best, Remedial Project Manager
U.S. Environmental Protection Agency Region IV
345 Courtland St. NE
Atlanta, GA 30365

Re: Beulah Landfill RI/FS

Dear Tony:

The laboratory for the subject RI has discovered a minor error in our Sampling and Analysis Plan for the work. In Table 3 we neglected to specify the container for cyanide and the preservation methods to be used. The enclosed Table 3 corrects this oversight. Please replace these pages in your Beulah Work Plans. Again I apologize for the inconvenience to you and your staff.

Please call me if you have questions about the subject plans.

Sincerely,
ENGINEERING-SCIENCE, INC.

Craig L. Sprinkle, P.G.
Project Manager

cc: C. Miller
A.M. Stack
H. Chalk
M. Weishaar

AT593/916J20/LTR-2

ENGINEERING-SCIENCE, INC.
57 EXECUTIVE PARK SOUTH, N.E., SUITE 590
ATLANTA, GEORGIA 30329
TEL: 404/325-0770
FAX: 404/325-8369

April 10, 1992

RECEIVED
APR 16 1992
SOLID WASTE

Mr. Tony Best, Remedial Project Manager
U.S. Environmental Protection Agency
345 Courtland Street, NW
Atlanta, Georgia 30365

Re: RI/FS at Beulah Landfill Site

Dear Tony:

We recently sent you the final Plans for work at Beulah. We learned today we had left pages 37-40 out of the Sampling and Analysis Plan. These four pages are enclosed. We also realized the unchanged version of Section 7 of the Work Plan was copied. We have enclosed the correct version. We regret this inconvenience to you and your staff.

Please call me if you have questions regarding the Beulah Plans.

Sincerely,

ENGINEERING-SCIENCE, INC.

Craig L. Sprinkle

Craig L. Sprinkle, P.G.
Project Manager

CLS:bab
Enclosure

cc/enc: C. Miller
A.-M. Stack
H. Chalk
M. Weishaar

Done 4/20

AT593/915J40