MULTI-SITE HYDROGEOLOGICAL INVESTIGATION
STRATEGIC PETROLEUM RESERVE SITES
LOUISIANA AND TEXAS

SUBCONTRACT SOIC-060150
TASK WR-94-157

Volume I of II

PREPARED FOR:

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EnecoTech Project #1201226001

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2.0 INTRODUCTION

EnecoTech was retained by DynMcDermott Petroleum Operations (DM) under subcontract SOIC-060150 to conduct hydrogeological verification studies for the United States Department of Energy (DOE), at three Louisiana (West Hackberry, Bayou Choctaw, and Weeks Island) and two Texas (Big Hill and Bryan Mound) Strategic Petroleum Reserve (SPR) Sites (Figure 2-1). DM issued the above purchase subcontract to EnecoTech on December 15, 1995. A preconstruction conference was held at the West Hackberry site on February 7, 1996. A Notice to Proceed specifying specific project activities was issued to EnecoTech at this conference.

The objectives of the hydrogeological verification studies were to:

(1) verify results of a Baseline Hydrogeological Screening Survey for crude and brine impact performed by Environmental Consulting & Technology, Inc. (ECT) during October, November, and December 1992, and January 1993;

(2) analyze verification well results relative to subsurface geology, hydrogeological parameters, and previous investigations;

(3) identify or confirm sources of impacts to the shallow ground water; and,

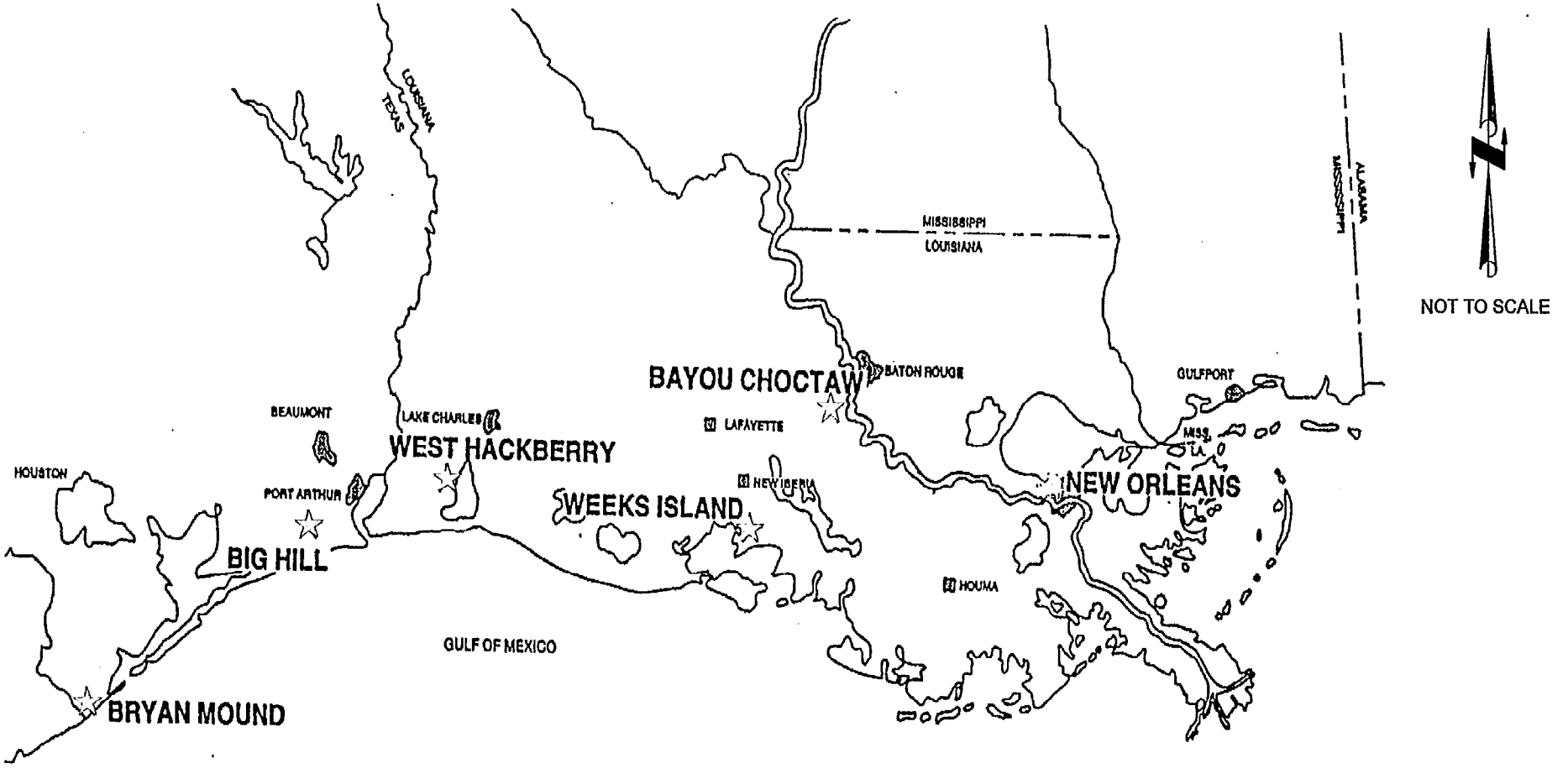
(4) develop site-specific recommendations for future investigations or study.

A total of twenty-eight (28) verification wells were installed to evaluate the suspected impacts by utilizing a combination of field and laboratory chemical analytical data. Additional field-approved investigation activities included the installation of one new monitoring well at Weeks Island and the installation of an alternate well in place of a plugged and abandoned well at West Hackberry. Site hydrogeology and stratigraphy were determined by logging the borings, conducting slug tests, and constructing potentiometric maps and cross-sections using data from newly-installed verification wells and pre-existing monitoring wells.

Project activities proceeded according to a phased approach consisting of specific tasks. The scope of work performed by EnecoTech during this hydrogeological verification investigation included:

- Preparing a Sampling and Analysis Plan (SAP), Waste Management Plan (WMP), and Health and Safety Plan (HASP) for each site prior to mobilization;

- Conducting a file review of previous studies performed at each site. This included non-intrusive assessments (soil gas screening and electromagnetic soil conductivity surveys), Geraghty & Miller (GM) Phase I and Phase II investigations, and other associated data;



EnecoTech
ENVIRONMENTAL CONSULTANTS

Project: SPR

SITE VICINITY MAP

Job No.: 1226-001	File No.: 122601S1.CDR	Drawn: WJF	Designed: KSP	Checked:	Approved:	Date: 9/6/96	Rev.:	Fig No.: 2-1

- Drilling and installing thirty 2-inch diameter onsite ground water monitoring (verification) wells;

- Collecting and describing soil samples from the verification well borings in accordance with the SAP;

- Selecting soil samples for laboratory chemical analysis. Sample selection was based on preliminary field screening results (organic analyzer measurements, olfactory, and visual methods);

- Properly developing the verification wells. Completion of well development activities was determined by the Subcontract Manager's Technical Representative (SMTR) or other DM designated personnel;

- Purging and sampling the verification wells prior to collecting ground water samples for laboratory analysis. Pre-sampling purging techniques and all ground water sampling-related actions are described in the approved SAPs;

- Managing all non-hazardous waste generated during the project. All waste management activities were conducted in accordance with Exhibit 6.6 of the purchase subcontract and the approved WMPs;

- Plugging and abandoning verification wells which did not exhibit elevated levels of brine and/or petroleum hydrocarbons and which are not expected to provide usable data during subsequent sampling events. Those wells exhibiting elevated concentrations of brine and/or petroleum hydrocarbons as indicated by laboratory analytical results or those wells which provide useful hydrologic or water quality data have been designated as "permanent" and will be used for long-term ground water monitoring. The final status of monitoring wells was determined by DM after reviewing and evaluating raw field and analytical data compiled by EnecoTech during this project; and, in coordination with DOE SPRPMO,

- Preparing a draft and final report presenting the field investigative methodologies utilized, the results of field screening and laboratory analysis, and the interpretations of these data and the recommendations derived from these interpretations.

EnecoTech contracted Layne Environmental Services to install and develop the monitoring wells. Southern Petroleum Laboratories (SPL) performed quantitative chemical analysis on the collected soil, ground water, and waste characterization samples in accordance with standard EPA methodologies.

2.1 Background/Previous Investigations

The establishment of the SPR was mandated by Congress in Title I, Part B of the Energy Policy and Conservation Act (P.L. 94-163), of December 22, 1975. The objective of the

SPR was to provide the United States with sufficient petroleum reserves in the event of an oil supply shortage or interruption.

The SPR consists of five active underground salt dome storage facilities (three in Louisiana and two in Texas), a marine terminal facility at St. James, Louisiana, and an administrative facility in New Orleans, Louisiana. Four of the five storage sites utilize solution-mined caverns for crude oil storage. The fifth site (Weeks Island) is an underground room-and-pillar salt mine, constructed by mechanical underground mining techniques.

A literature review indicated that shallow soils and ground water beneath the SPR storage sites have been affected by brine and petroleum hydrocarbons. Areas and activities representing potential sources are: salt dome mining operations, brine pond leakage, cuttings disposal, anhydrite disposal, disposal well operation, and/or brine disposal operations; and crude oil handling, transfer, and storage activities. Previous investigations have been conducted to identify and evaluate areas of brine and petroleum hydrocarbon impact in the shallow subsurface. Summarized below are brief descriptions of recent investigations preceding the present verification study.

In August 1989, Geraghty & Miller (GM) was retained by Boeing Petroleum Services (BPS - now DM), to commence a Phase I assessment of the Bryan Mound and West Hackberry SPR sites. Additionally, GM evaluated the distribution, magnitude, and sources of brine impact. The assessment consisted of file reviews and data compilation (identification of potential contaminant source areas, potentiometric maps of shallow aquifers, and maps of available water quality data. The Phase I report entitled "*Brine Contamination and Remediation Studies*" was submitted to BPS in December 1989.

Based upon the preliminary conclusions of the Phase I assessment, a work plan for Phase II activities was developed by GM and submitted to BPS in March 1990. The Phase II investigation at the West Hackberry and Bryan Mound sites consisted of a shallow site-wide geophysical survey, a soil boring installation and ground water monitoring, aquifer testing, and water quality sampling and analysis. Phase II field work commenced at West Hackberry on March 26, 1990 and at Bryan Mound on April 6, 1990. The results of these investigations and a Corrective Action Plan (CAP) for both sites were presented in a document entitled "*Contamination Assessment Report and Corrective Action Plan*" dated April 12, 1991

ECT was contracted to initiate a Baseline Hydrogeological Survey of all the SPR sites between October and December 1992. The scope of work also involved two phases: Phase I non-intrusive field work; and Phase II verification sampling and analysis. The assessment was completed in January 1993; the final report was submitted to BPS on January 19, 1993. Final recommendations were provided to BPS in a letter dated August 9, 1993. The Phase I assessment employed electromagnetic soil conductivity surveys and soil gas screening to evaluate potential shallow subsurface ground water impacts from either brine or crude oil. The number of survey stations and their locations were based on knowledge of site-specific hydrogeology, historic brine and/or crude oil releases, and results of previous geophysical surveys. The results of the electromagnetic

conductivity (EM) survey and volatile hydrocarbon concentrations in soil gas were plotted and contoured for each site.

Utilizing the screening techniques described above, areas at each of the sites were identified as requiring verification of suspected impacts. Due to the limitations of the Phase I non-intrusive survey (e.g., elevated EM readings may have been attributable to ground water chemistry, or interferences from electrical/magnetic fields) monitoring wells were installed during Phase II to evaluate and verify the subsurface impact by brine and/or crude oil. All field-derived data, quantitative analytical data, and interpretations from ECT's investigation are documented in this report as they pertain to the question of verifiable ground water impact.

Appendix A includes the site-specific Sampling and Analysis Plans and Waste Management Plans. Appendix B includes Water Well Registration forms for the verification wells. Appendix C includes well development documentation and ground water sampling forms. Appendix D includes borehole logs and well completion diagrams for the verification wells installed by EnecoTech and for the existing monitoring wells. Appendix E includes slug test plots. Appendix F includes distribution curves and laboratory reports. Appendix G includes all of the laboratory analytical data reports.

3.0 FIELD INVESTIGATIVE PROCEDURES

3.1 Soil Boring and Sampling Program

A total of twenty-eight (28) verification wells and one (1) monitoring well were installed at five SPR sites from March 18 through April 24, 1996. Each monitoring well was completed by a Louisiana- and Texas-licensed driller (Layne Environmental Services, Inc.) under EnecoTech's supervision. Drilling commenced concurrently at the Bryan Mound and Bayou Choctaw SPR sites. Upon completion of drilling activities at these sites, drilling activities were initiated at the Big Hill and West Hackberry SPR sites. The proposed monitoring wells on Weeks Island were installed last. Mobile Drill B-59 and 455 drilling rigs with 8-inch outside diameter (OD) hollow stem augers were used at the Texas and Louisiana sites, respectively.

All monitoring wells were drilled at locations determined from the baseline hydrogeological study results, as previously described in Section 2.1. Generally, the soil borings for the monitoring wells were advanced to intersect the shallow waterbearing zone. Additionally, paired wells were installed to evaluate potential vertical hydraulic communication between identified shallow and deeper aquifer zones at two selected locations (Bryan Mound, west of Cavern 110, and West Hackberry, west of Cavern 6). Three discrete soil samples were collected from each boring in the first ten feet, then at five-foot centers until total depth was reached. Samples were collected using a 1.75-inch diameter by 2-foot long split-spoon sampler. Each sample was extruded from the sampler, trimmed, visually classified, and separated into two Ziploc plastic bags. The soil samples were described by EnecoTech's designated professional logger in accordance with the Unified Soil Classification System.

One "split" of each soil sample was stored on ice in an insulated cooler. The remaining split was allowed to equilibrate to ambient temperature, and then was headspace screened with a photoionization detector (PID) to detect volatile organic compounds (VOCs). The results of the headspace analysis were used to identify potential zones of petroleum impact and for the selection of soil samples for laboratory chemical analysis. Each soil sample was screened by inserting the PID probe into the Ziploc bag and recording the maximum PID reading on the field boring log. All samples that produced headspace organic vapor concentrations above background - or ambient - levels, as measured in the field, were retained for laboratory chemical analysis. If no organic vapor concentrations above background levels were detected, and other field screening methods indicated no apparent impact present, the sample was placed in labelled 55-gallon containers for future disposal. The corresponding split samples stored on ice were also placed in labelled 55-gallon containers for future disposal.

Based on whether brine or petroleum hydrocarbon impact was to be verified and the results of preliminary field screening, samples were selected for laboratory chemical analysis of chlorides using United States Environmental Protection Agency (USEPA) Method 325.3, TDS using USEPA Method 160.1, and/or TPH using USEPA Method 418.1. In addition, at least one sample from the saturated zone interval to be screened during verification well completion was subjected to grain-size analysis.

3.2 Verification Monitoring Well Construction

The verification monitoring wells were constructed of 2-inch diameter, schedule 40 PVC blank riser pipe and 0.010-inch machine-slotted well screen. A silica sand filter (#20/40) was placed in the annular space between the casing and the borehole to a height of approximately 2 feet above the slotted interval. A 3-foot uniform bentonite pellet seal was placed above the sand pack to isolate the waterbearing zone being monitored. After emplacement of the bentonite pellets, the bentonite was hydrated using deionized water. The bentonite seal was given adequate time to hydrate prior to placement of a cement/bentonite slurry to the surface. The formula used for the cement/bentonite grout was in accordance with SPR Standard Specification 03300.

All verification monitoring wells were constructed with the PVC casing extending 3 feet above the ground surface and encased in a locking outer casing. A concrete pad with dimensions of 5 feet by 5 feet by 4 inches was constructed around each monitoring well at the Louisiana sites, and dimensions of 4 feet by 4 feet by 4 inches at the Texas sites. The concrete pads were constructed using 5,000 pounds per square inch (psi) concrete and were designed to facilitate water drainage away from the well. Protective steel posts will be placed around wells designated for long term monitoring. Monitoring well construction was in accordance with the Texas Natural Resources Conservation Commission (TNRCC) and the Louisiana Department of Transportation and Development (LDTOD) guidelines.

3.3 Well Development

The wells were developed by surging, i.e., inducing water flow into and out of the well screen for a period of time, followed by hand bailing to remove the loose sediment from the well casing and screen. The development process continued until the turbidity of the recovered water had visibly diminished and pH and specific conductance readings had stabilized. Development water was placed in labeled 55-gallon containers pending future disposal.

3.4 Ground Water Sampling

Ground water samples were collected from the verification monitoring wells at all five SPR sites between April 22 and May 9, 1996. Prior to ground water sample collection, the monitoring wells were purged with a decontaminated bailer to remove at least three well casing volumes. Field measurements of pH, conductivity, and temperature were conducted after each well volume was removed. Once these parameters had stabilized and the wells had recharged, ground water samples were collected using new, 3-feet long, 1.5-inch inside diameter (ID), disposable bailers. Each sample was transferred into laboratory-prepared, certified-clean glass sample containers, sealed with Teflon-lined lids, labeled, and placed on ice in an insulated cooler. Pre-sampling purging techniques and all ground water sampling-related actions are discussed in the site-specific SAPs.

All ground water samples were delivered to SPL in Scott, Louisiana, under properly executed chain-of-custody documentation. Ground water samples intended to evaluate crude oil impact were analyzed for TPH using USEPA Method 418.1. Ground water samples intended to evaluate brine impact were analyzed for chloride content by USEPA Method 325.3 and for TDS using USEPA Method 160.1.

Specific Change Notice SCN Number 11081-2 required that the sampling of the four WILT wells be included in project activities. The WILT currently consists of monitoring wells M5, M6, M7, and M8. Sampling procedures, specifically the purging and sampling protocol applied to the verification wells outlined above, were altered. The WILT wells were not purged; static ground water was sampled with 600 milliliter (ml) capacity Kemmerer Samplers. The pH, specific conductance, and temperature of each sample were measured in the field. The samples were then submitted for laboratory analysis of TPH using USEPA Method 418.1. Specific sampling procedures for the WILT array of wells were outlined in a correspondence from DM dated May 6, 1996.

3.5 Aquifer Slug Tests

After purging and sampling activities had been completed on the newly-installed verification wells, EnecoTech conducted aquifer slug tests. Before initiating the slug tests, the wells were allowed to equilibrate and ground water levels were gauged. In order to measure water displacement with time, an In-Situ pressure transducer was placed approximately one foot from the bottom of the subject well and calibrated with an In-Situ Hermit Environmental Data Logger Model SE1000C. Following calibration of the data logger and initiation of the recording sequence, a 4.5-foot long, 1.25-inch OD stainless steel slug was submerged into the well, thereby causing the water level to rise instantaneously. The resultant decrease in water level over time ("falling head") was recorded by the Hermit data logger. Once the water level had equilibrated, the slug was withdrawn from the well, and the subsequent rise in water level versus time ("rising head") was recorded by the Hermit data logger.

At the time the slug tests were conducted, the water levels in most of the verification monitoring wells were below the tops of the screens. Therefore, as discussed by Bouwer (1989), the falling head data were not used to determine aquifer characteristics. The rising head test data were input to GM's AQTESOLV™ program and the plots of drawdown versus time interpreted in accordance with Bouwer (1989). AQTESOLV™ determined hydraulic conductivity values for the unconfined or partially confined aquifers using the Bouwer and Rice Method (1976). The method of Cooper et al. (1967) was applied to wells penetrating an aquifer existing under confined conditions to determine transmissivity.

3.6 Ground Water Level Measurements

Static ground water levels were measured in all verification monitoring wells/boreholes immediately after drilling, just prior to development, and prior to purging and sampling activities. The ground water levels were measured using an electronic interface probe.

The ground water levels measured after drilling are included on the boring logs. Measurements taken prior to well development and purging and sampling activities are included on development and ground water sampling forms.

3.7 Verification Monitoring Well Survey

All verification monitoring wells were surveyed by John Jakubik and Associates, under contract to DM. The survey followed the State Plane Coordinate System and includes latitude and longitude information. The wells were surveyed for vertical control and for registration with the TNRCC and the LDTOD.

3.8 Waste Management Activities

All waste generated during the verification well study was handled in accordance with Exhibit 6.6 and the approved site-specific WMPs. Specifically, all soil cuttings, purged water, decontamination fluids, and concrete/rubble (from plugging and abandonment procedures) were stored in labeled 55-gallon containers. Based on landfill requirements, liquid waste was characterized by analyzing for partial Toxic Characteristic Leaching Procedure (TCLP) list constituents and for reactivity, corrosivity, and ignitability (RCI). Solid wastes were analyzed for benzene utilizing TCLP methodologies and for RCI.

After evaluation of the results of waste characterization analysis, DM has determined to dispose of the drummed cuttings, purged water, and decontamination fluids onsite. EnecoTech will arrange to have the empty drums transported to a recycling facility. The materials generated during plugging and abandonment of the verification monitoring wells will be disposed at the Browning-Ferris Industries (BFI) Gulf West Landfill in Anahuac Texas and the BFI Colonial Landfill in Sorrento, Louisiana. All forms related to tracking and disposal of the plugging and abandonment waste, and any documentation regarding the recycling of the used drums will be completed by EnecoTech and submitted to DM.

3.9 Long-Term Use of Verification Monitoring Wells

DM has designated 21 of the verification monitoring wells for inclusion in the long-term ground water quality monitoring programs to be implemented at each SPR site. Protective steel posts will be emplaced around the concrete pads at each of these wells. The remaining 7 verification monitoring wells will be plugged and abandoned in accordance with the Texas Natural Resources Conservation Commission (TNRCC) and the Louisiana Department of Transportation and Development/Department of Environmental Guidelines (LDTOD/DEQ) guidelines. As discussed in SCN 11081-1, the locking outer casing and concrete apron will be removed from every well to be plugged and abandoned and the top of the casing (stick-up) will be cut off below the ground surface. A cement/bentonite slurry prepared in accordance with TNRCC and LDOTD/DEQ specifications will be introduced into the well bore through a tremie.

The specific verification monitoring wells to be plugged and abandoned at each SPR site, and the site-specific long-term monitoring programs are discussed in Sections 5.9, 6.9, 7.9, 8.9, and 9.9.

4.0 LABORATORY QUALITY ASSURANCE AND QUALITY CONTROL

The laboratory reports include supportive Quality Assurance/Quality Control (QA/QC) data. Specifically, the QA/QC document package includes: method detection limits; date of analysis; analyst information; pertinent sample and client identification information; and QC data summaries. The QC data summaries indicate surrogate recoveries, matrix spike analysis and matrix spike duplicate analysis results, and method blank analysis results (as applicable).

8.0 BAYOU CHOCTAW SPR SITE

8.1 Site Location

The Bayou Choctaw SPR site is located in Iberville Parish, Louisiana, approximately 5 miles west of the Mississippi River and 13 miles southwest of Baton Rouge. The site consists of a main operations facility and a brine disposal area (located 2 miles south of the main site) occupying approximately 168 and 200 acres, respectively (Figure 8-1).

8.2 Site History/Description

Oil was first discovered at the Bayou Choctaw Salt Dome in 1931 by Standard Oil of Louisiana. Historic Tobin maps indicate over 50 producing wells were located within the boundaries of the site. Reportedly, the majority of these wells have been plugged and abandoned. Many of these wells were targeting the porous cap rock and sands pinching-out against uplifted fault boundaries of the salt dome.

The Bayou Choctaw site currently has six operating solution-mined SPR caverns acquired from Allied Petroleum in 1976. The caverns have a total the storage capacity of 72 million bbls of crude oil. Nine additional active caverns exist onsite that are operated by Union Texas Petroleum (UTP). Significant facilities at the site include: a brine pipeline used to transport brine to 12 disposal wells located approximately 2 miles south of the site; a 36-inch diameter crude oil pipeline that connects the site with the St. James Terminal to the southeast; a raw water intake structure at Cavern Lake; high pressure pumps; a brine storage pond; and an oil-brine separator. Additional structures at the site include a control center building and a spare parts warehouse. The Intracoastal Waterway is located approximately ¼-mile west of the site. Smaller canals and bayous on the site lead to the Intracoastal Waterway. A site map is included as Figure 8-2.

The DOE's 1994 Site Environmental Report reported no minor crude oil or brine spills occurred at the Bayou Choctaw site during 1994. However, minor brine releases have been reported from historical activity in the vicinity of the brine pond and the piping associated with the oil-brine separator.

8.3 Site Monitoring Wells

Prior to the verification well study four permanent monitoring wells, MW-1, MW-2, MW-3, and MW-4, had been drilled at the Bayou Choctaw site. These wells were drilled to approximately 30 feet bgs to monitor potential releases from the brine pond. Ground water analytical results from monthly sampling events between 1990 and 1995 indicate stable salinity levels in monitoring wells MW-1 and MW-2. These monitoring wells are located upgradient of the brine pond; salinity concentrations have been in the 15 ppt to 25 ppt range. Salinity concentrations at the downgradient monitoring well, MW-3, exhibit a decreasing trend during this period from 100 ppt in 1991 to near 40 ppt by the end of 1994, and continuing downwards toward 20 ppt through 1995/96. Monitoring

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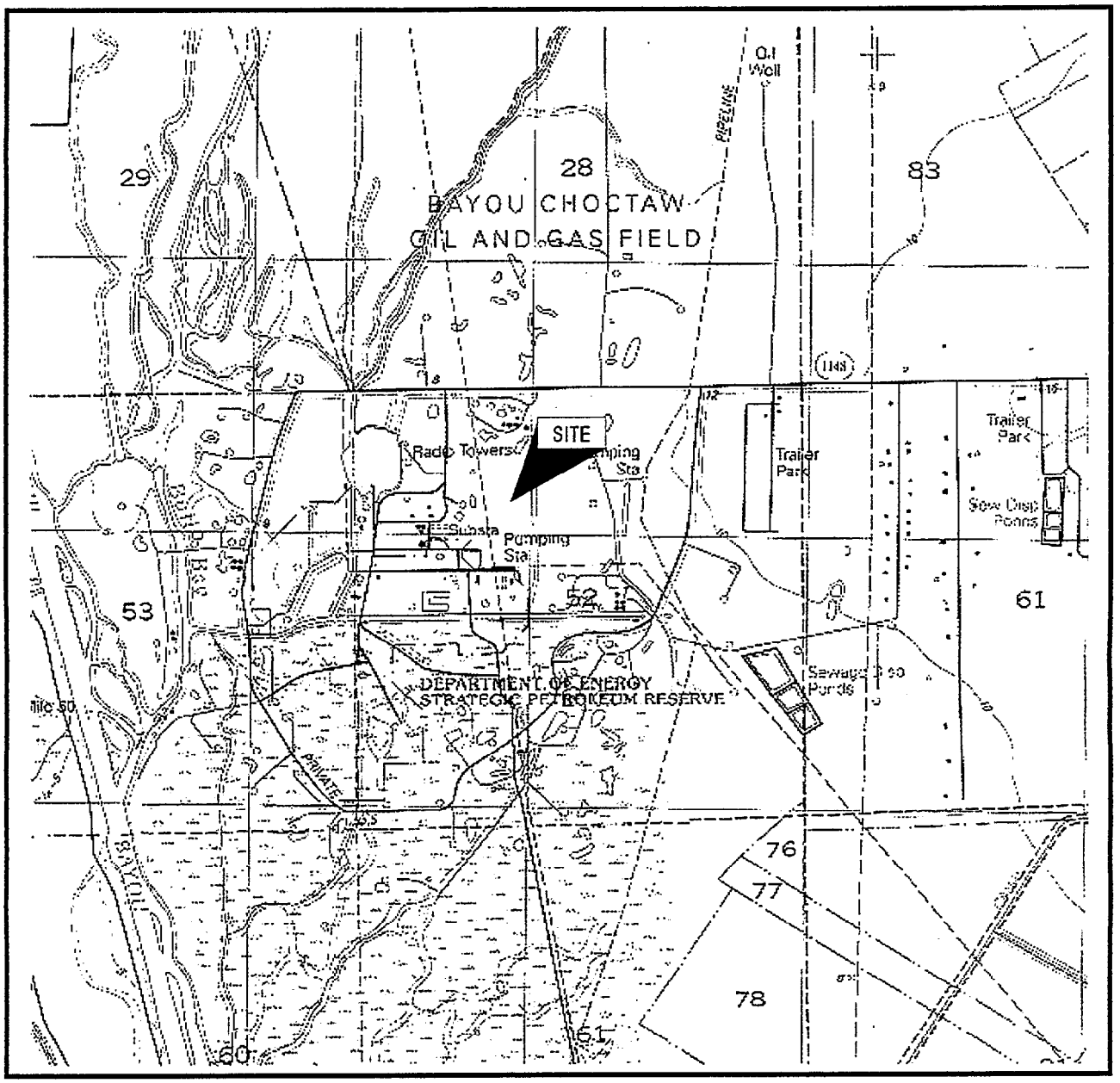

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ADDIS, LA.
SE/4 GROSSE TETE 15' QUADRANGLE
30091-C3-TF-024
1992
DMA 7744 IV SE-SERIES V886

QUADRANGLE LOCATION

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Project:	SPR - BAYOU CHOCTAW
	60825 HIGHWAY 1148. PLAQUMINE, LOUISIANA

SITE LOCATION MAP

Job No.:	1226-001	File No.	122601F2.CDR	Date:	7/29/96	REV.:	9/16/96
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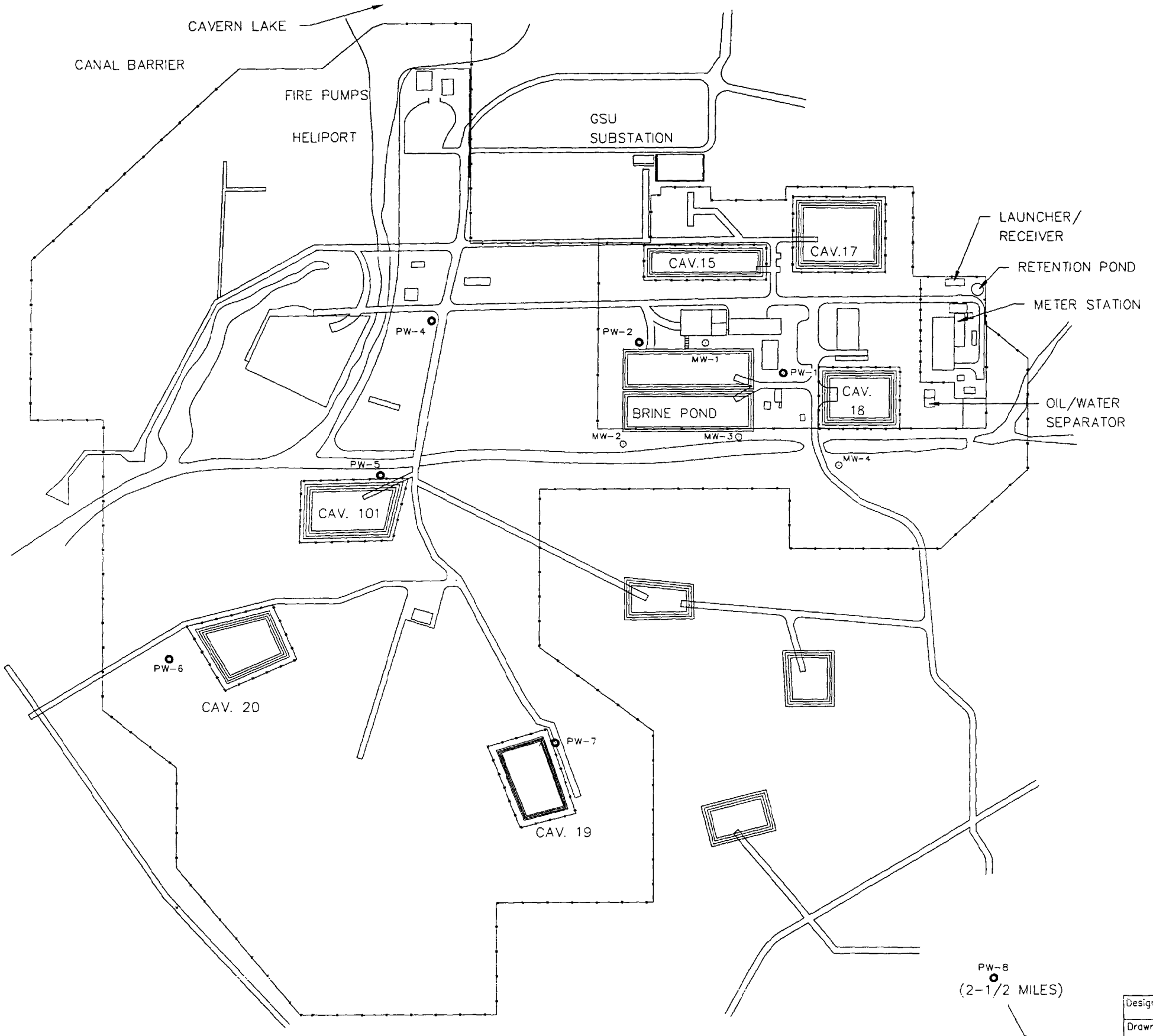

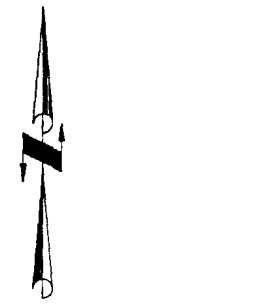

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SCALE IN FEET

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PW-8 ○ VERIFICATION MONITORING WELL

MW-1 ○ PRE-EXISTING MONITORING WELL

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Project: SPR – BAYOU CHOCTAW

60825 HIGHWAY 1148
PLAQUEMINE, LOUISIANA

Title: SITE MAP

		Date
Design:	JB	7/96
Drawn:	WJF	7/96
Checked:	KSP	9/96
Approved:		

File No. 1226-001 | Date: 7/26/96 | Figure No.: 8-2

ACAD File No.: BAYOUC | Rev.: 9/16/96 | Sheet 1 of 1

well MW-4 is located farther downgradient from the brine pond and has exhibited salinity concentrations in the range of 35 to 45 ppt. These salinity levels indicate saline ground water exists around the brine pond at the Bayou Choctaw site (SPR Site Environmental Report, 1994).

In November 1992, ECT drilled three shallow temporary monitoring wells, TW-1, TW-2, and TW-3, to the first observed ground water. Ground water was first encountered in these wells in soft clay intervals at depths ranging from 2 feet to 4 feet bgs. This ground water was believed by ECT to be a perched zone. Ground water samples were collected from these wells and analyzed for TDS, salinity, and TPH. Temporary well TW-1, installed approximately 150 feet east of the brine pond, exhibited TDS and salinity concentrations of 27,300 mg/l and 28.6 ppt, respectively. The TPH level was 9.8 mg/l. As reported, TDS and salinity concentrations were below analytical method detection limits in temporary well TW-2, drilled north of Cavern 101. The TPH concentration in the ground water sample from this well was 2.5 mg/l. Temporary well TW-3, installed approximately 3 miles south of the Cavern areas near Brine Disposal Well Pad No. 1, exhibited TDS and salinity concentrations of 3,880 mg/l and 2.66 ppt, respectively. Ground water from this well was not analyzed for TPH.

The present well verification study installed seven (7) additional monitoring wells at the Bayou Choctaw SPR site. Monitoring well locations were based on the ECT Baseline Hydrogeological Survey. Two verification monitoring wells, PW-1 and PW-6, were installed to evaluate brine and crude impact, and five monitoring wells, PW-2, PW-4, PW-5, PW-7, and PW-8, were installed to evaluate brine impact only. A list of verification wells for the Bayou Choctaw site and their proposed functions is included as Table 8-1.

8.4 Regional Geology and Hydrogeology

The Bayou Choctaw site topography is characterized as flat to gently sloping; elevations range from 5 feet to 10 feet above msl. The site is surrounded by an alluvial, fresh water backswamp environment. Surficial soils at Bayou Choctaw are classified as Sharkey clays by the U.S Department of Agriculture. These soils exhibit a poor water infiltration capacity which increases the flooding potential in the area. The Atchafalaya Clay (Holocene age) underlies the area from near ground surface to a depth of approximately 60 feet. This unit consists of soft grey clay with silt layers and abundant organic matter, and is characteristic of deposition during a sea-level rise. These Atchafalaya Clay is underlain by cyclic depositional sequences of Late Pleistocene age. These lithologic sequences range from clays and silts to coarse-grained sands and gravel that were deposited in environments ranging from fluvial-deltaic to restricted littoral lagoonal-barrier island systems. These shifting depositional environments resulted from fluctuations in sea-level, climatic change, and local source tectonics during the Late Pleistocene.

The Plaquemine Aquifer is the principal source of fresh water for the site and surrounding communities. The aquifer, which occurs at depths of 60 feet to 500 feet bgs, is comprised of the following: the Shallow Plaquemine Sand (60 feet to 170 feet bgs), the Prairie Clay aquitard (170 feet to 230 feet bgs), and the Gonzales Sand (230 feet to 600

TABLE 8-1

VERIFICATION WELLS

DynMcDermott Petroleum Operations Company
Bayou Choctaw SPR Site
Plaquemine, Louisiana

Verification Well	Location	Depth (ft)	Function
PW-1	East of Brine Pond	16	Verify crude oil impact, location is in center of soil gas anomaly and near observed crude oil in sump. Verify data on eastern extent of documented brine plume near brine pond.
PW-2	North of Brine Pond	23	Verify brine impact, location is at center of lobe of statistically predicted TDS anomaly. Will provide information of the northern extent of known brine impact.
PW-4	East of Cavern 102	20	Verify brine impact, location is at center of statistically predicated TDS anomaly.
PW-5	East of Cavern 101	23	Verify brine impact, location is at center of statistically predicted TDS anomaly.
PW-6	West of Cavern 20	17	Verify brine impact, predicted TDS concentrations increase markedly west of Cavern 20. Verify crude oil impact, soil gas anomaly west of Cavern 20.
PW-7	East of Cavern 19	17	Verify brine impact, location is at center of statistically predicted TDS anomaly.
PW-8	South of Brine Disposal Well Pad No. 1	18	EM results increased toward the center of each brine disposal well pad. This location is proposed to verify if these anomalies are indicative of brine impact.

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feet bgs). The fresh water and saline water interface exists at approximately 400 feet bgs, near the top of the cap rock structure of the Bayou Choctaw salt dome. An onsite water supply well located about 150 feet northeast of the brine pond is completed in the Shallow Plaquemine Sand at a depth of 100 feet to 120 feet bgs. Brine or salt impacts have not been documented or observed in this well.

8.5 Site Geology

Site geology was determined by reviewing the monitoring well soil boring logs developed at the Bayou Choctaw site to date. As part of this well verification study, seven (7) monitoring wells PW-1, PW-2, and PW-4 through PW-7 were installed. These wells were drilled to intersect and screen the first waterbearing zone capable of yielding appreciable amounts of water to a well.

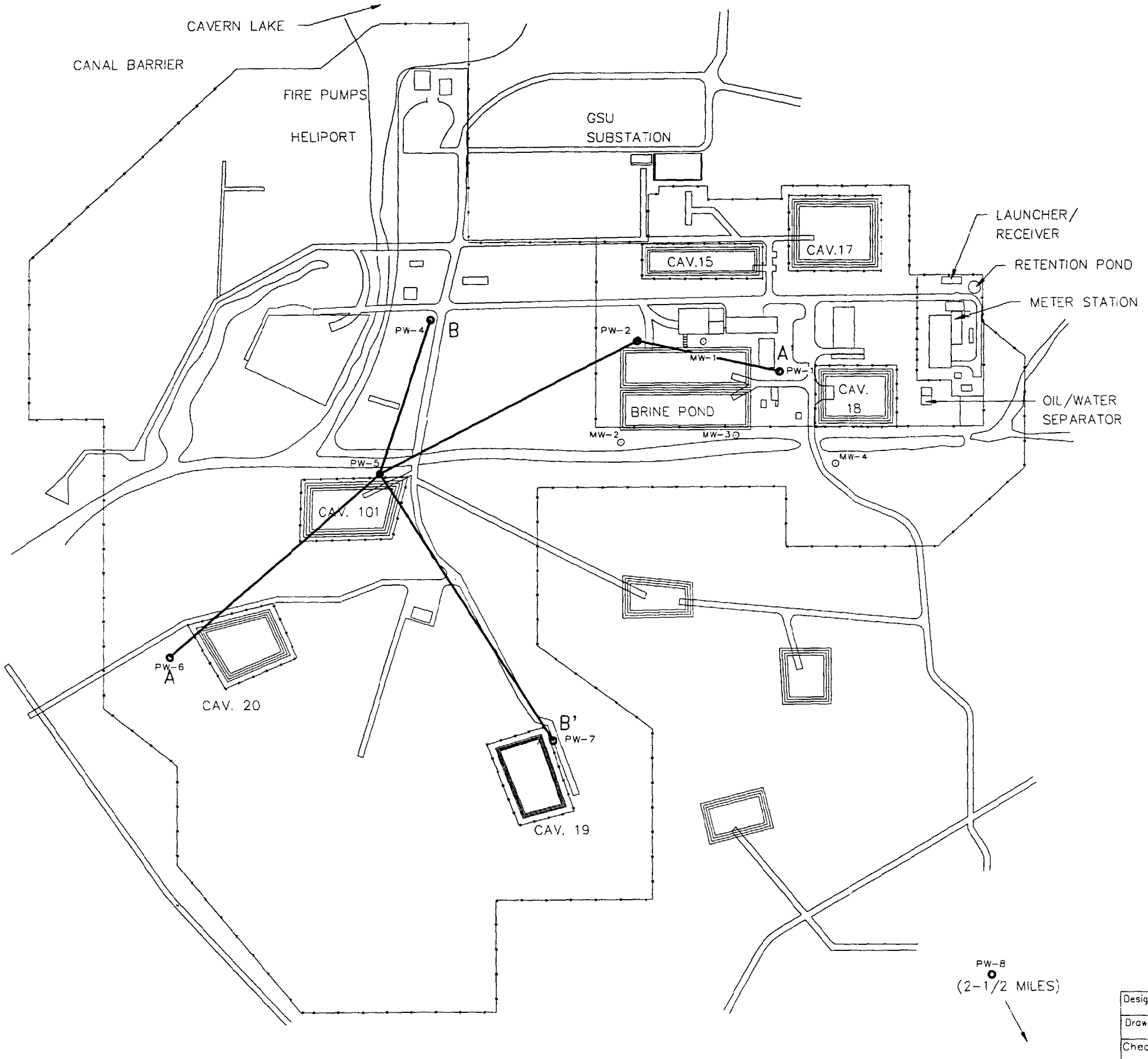
The verification monitoring well borings were drilled to total depths ranging from 17 feet bgs in monitoring wells PW-1, PW-6, and PW-7 to 23 feet bgs in monitoring wells PW-2 and PW-5. The subsurface lithology encountered during the drilling consisted of a brown and grey silty clay from extending from ground surface to depths ranging from 11 feet bgs in monitoring well PW-8 to 18 feet bgs in monitoring wells PW-2 and PW-5. Road base and fill material replaced this silty clay in monitoring well PW-7 to a depth of 8 feet. A sandy silt was observed underlying these deposits in monitoring well PW-4 from 13 feet bgs to total depth. A clayey silt was encountered in monitoring well PW-5 from 18 feet bgs to total depth. Additionally, a one foot thick fine- to medium-grained tan sand was observed in monitoring well PW-8 at 11 feet to 12 feet bgs. Underlying these lithologies to the termination depths were sandy clays and silty clays.

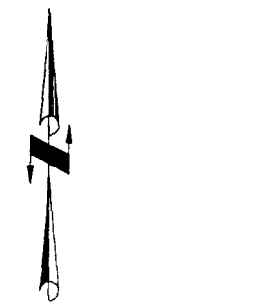
Boring logs of the three shallow temporary monitoring wells, TW-1, TW-2, and TW-3, indicated a stiff clay to a depth of 6 feet interlayered with soft clay and areas of fill consisting of clayey gravel.

8.6 Site Hydrogeology

Hydrogeologic cross-sections of the subsurface units drawn from the verification monitoring well boring logs are referenced in Figure 8-3 and are presented as Figures 8-4 and 8-5. Ground water was first encountered in the seven verification monitoring wells in a silty clay at depths ranging from 7 feet to 18 feet bgs. Subsequent ground water levels measured during development and prior to sampling activities have indicated water levels ranging between 4.39 feet and 9.33 feet bgs. This, in combination with the presence of near-surface moist sandy and silty clays, suggests this saturated zone is under confined to partially confined conditions.

A potentiometric map was developed from the ground water elevation data collected from the new verification and pre-existing monitoring wells by EnecoTech and DM personnel on April 22 and 23, 1996 (Figure 8-6). A summary of ground water elevations on this date is included as Table 8-2. The ground water flow direction on the west side of the site is to the southwest, toward the Intracoastal Waterway, and to the southeast on the east side of the site. The average hydraulic gradient derived from the potentiometric data was





LEGEND

PW-8 — VERIFICATION MONITORING WELL

MW-1 — PRE-EXISTING MONITORING WELL

CROSS-SECTION LINE

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		Date
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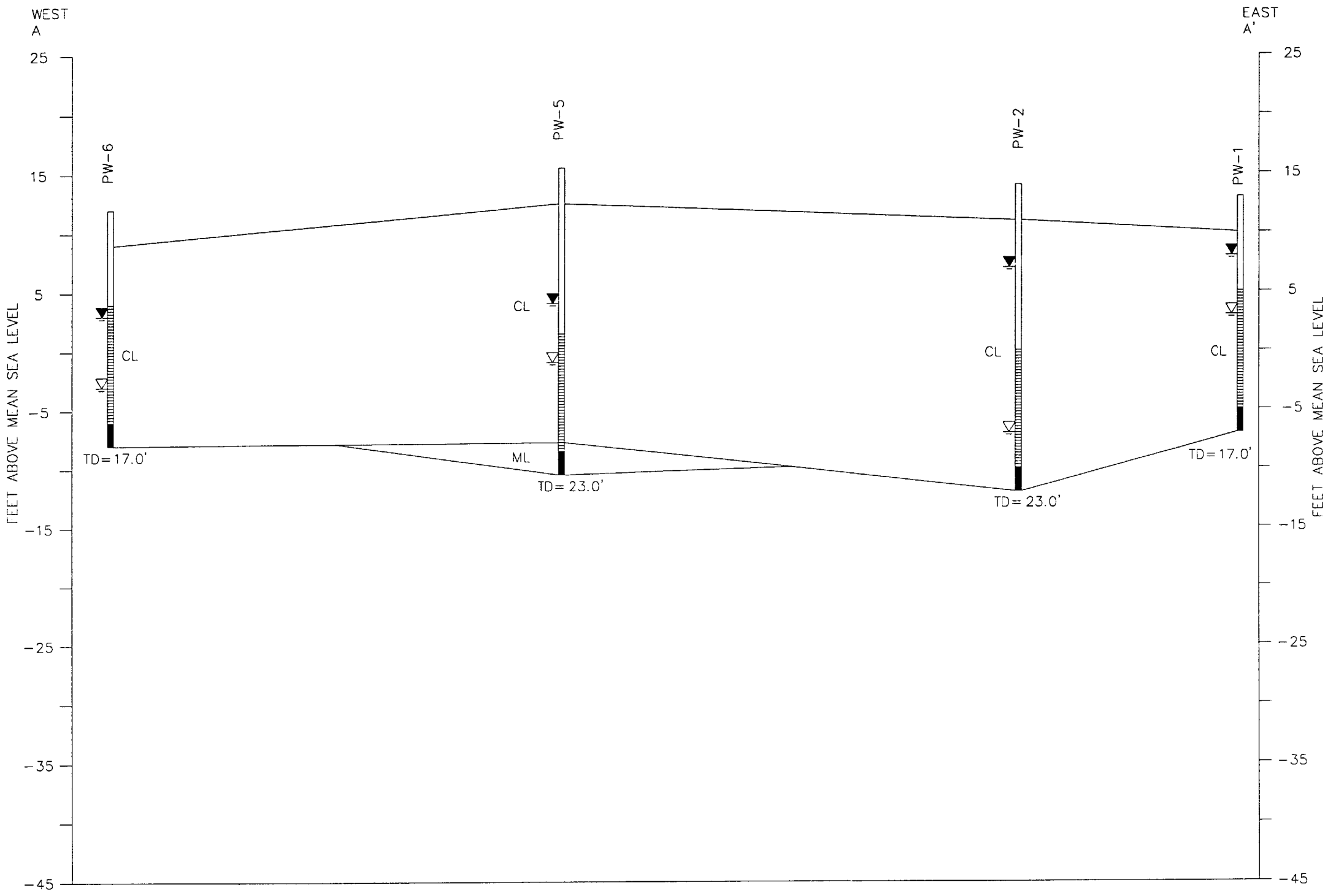
Title:

CROSS-SECTION LOCATION MAP

File No.: 1226-001 | Date: 7/26/96 | Figure No.: 8-3

ACAD File No.: BAYOUC | Rev.: 9/16/96 | Sheet 1 of 1



LITHOLOGIES:

SW	Well graded sands, gravelly sands, little or no fines.
SP	Poorly graded sands or gravelly sands, little or no fines.
SM	Silty sands, sand−silt mixtures.
SC	Clayey sands, sand−clay mixtures.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity.
MH	Inorganic silts, miscaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH	Inorganic clays of high plasticity, fat clays.
OH	Organic clays of medium to high plasticity, organic silts.
PI	Peat and other highly organic soils.

KEY:

BH= BOREHOLE

CASING
MW= MONITORING WELL
SCREEN

WATER ELEVATION 5/1, 5/2/96.

WATER ELEVATION WHILE DRILLING

LITHOLOGY CONTACT
DASHED WHERE
INFERRED

10.0
5.0
0
100
200
SCALE IN FEET

VERTICAL EXAGGERATION 30 x

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Project: SPR − BAYOU CHOCTAW

60825 HIGHWAY 1148
PLAQUEMINE, LOUISIANA

Title:

GEOLOGIC CROSS−SECTION
A − A'

		Date
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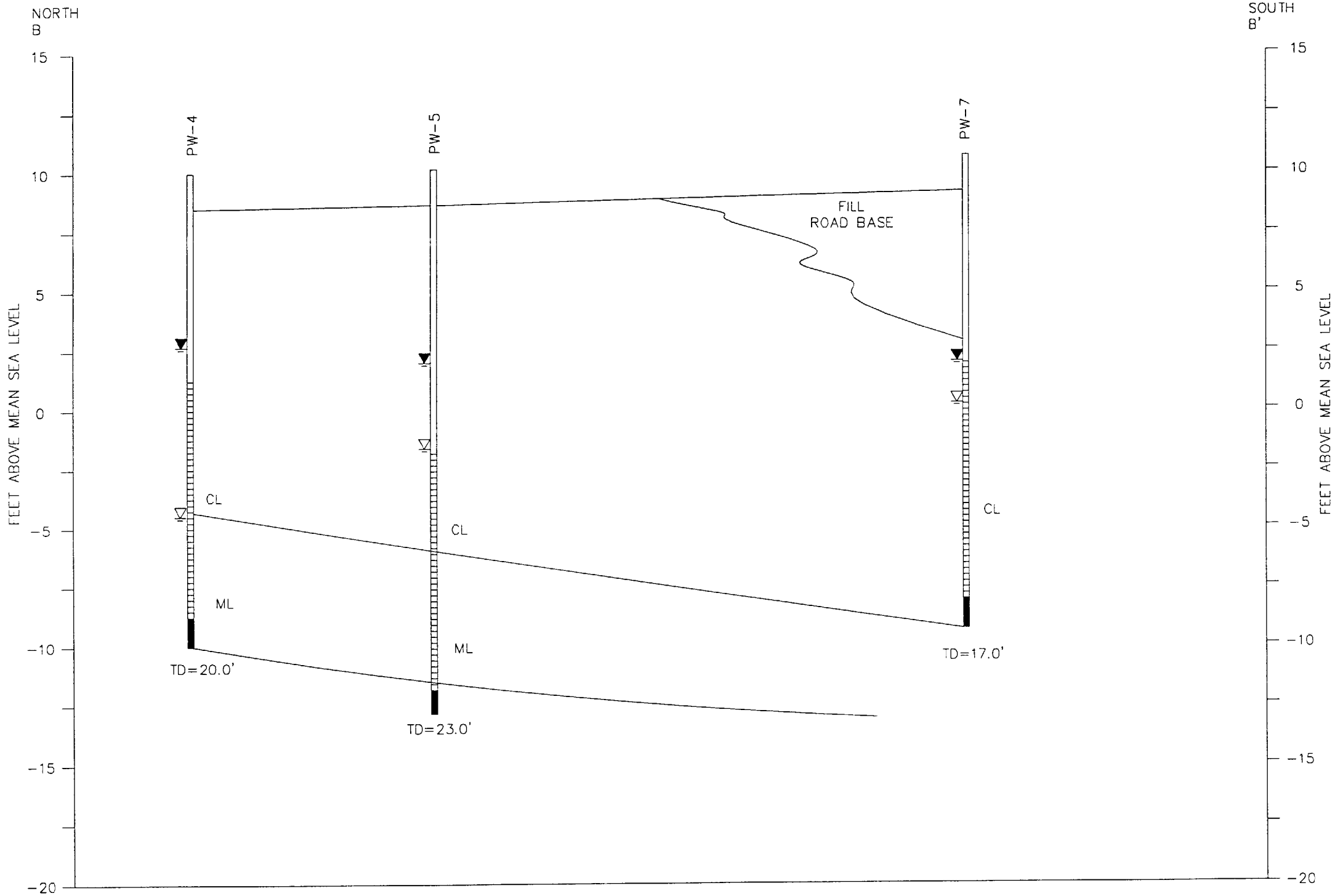
Checked:	KSP	9/96
Approved:		

File No.: 1226−001 | Date: 7/22/96 | Figure No.: 8−4

ACAD File No.: 122601D8 | Rev.: 9/16/96 | Sheet 1 of 1



LITHOLOGIES:

SW	Well graded sands, gravelly sands, little or no fines.
SP	Poorly graded sands or gravelly sands, little or no fines.
SM	Silty sands, sand-silt mixtures.
SC	Clayey sands, sand-clay mixtures.
ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
OL	Organic silts and organic silty clays of low plasticity.
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
CH	Inorganic clays of high plasticity, fat clays.
OH	Organic clays of medium to high plasticity, organic silts.
PT	Peat and other highly organic soils.

KEY:

BH= BOREHOLE

CASING
MW= MONITORING WELL
SCREEN

WATER ELEVATION 4/25/96

WATER ELEVATION WHILE DRILLING

LITHOLOGY CONTACT
DASHED WHERE
INFERRED

5.0
2.5
0
100
200
SCALE IN FEET

VERTICAL EXAGGERATION 40 x

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Title:

GEOLOGIC CROSS-SECTION
B - B'

		Date
Design:	JB	6/96
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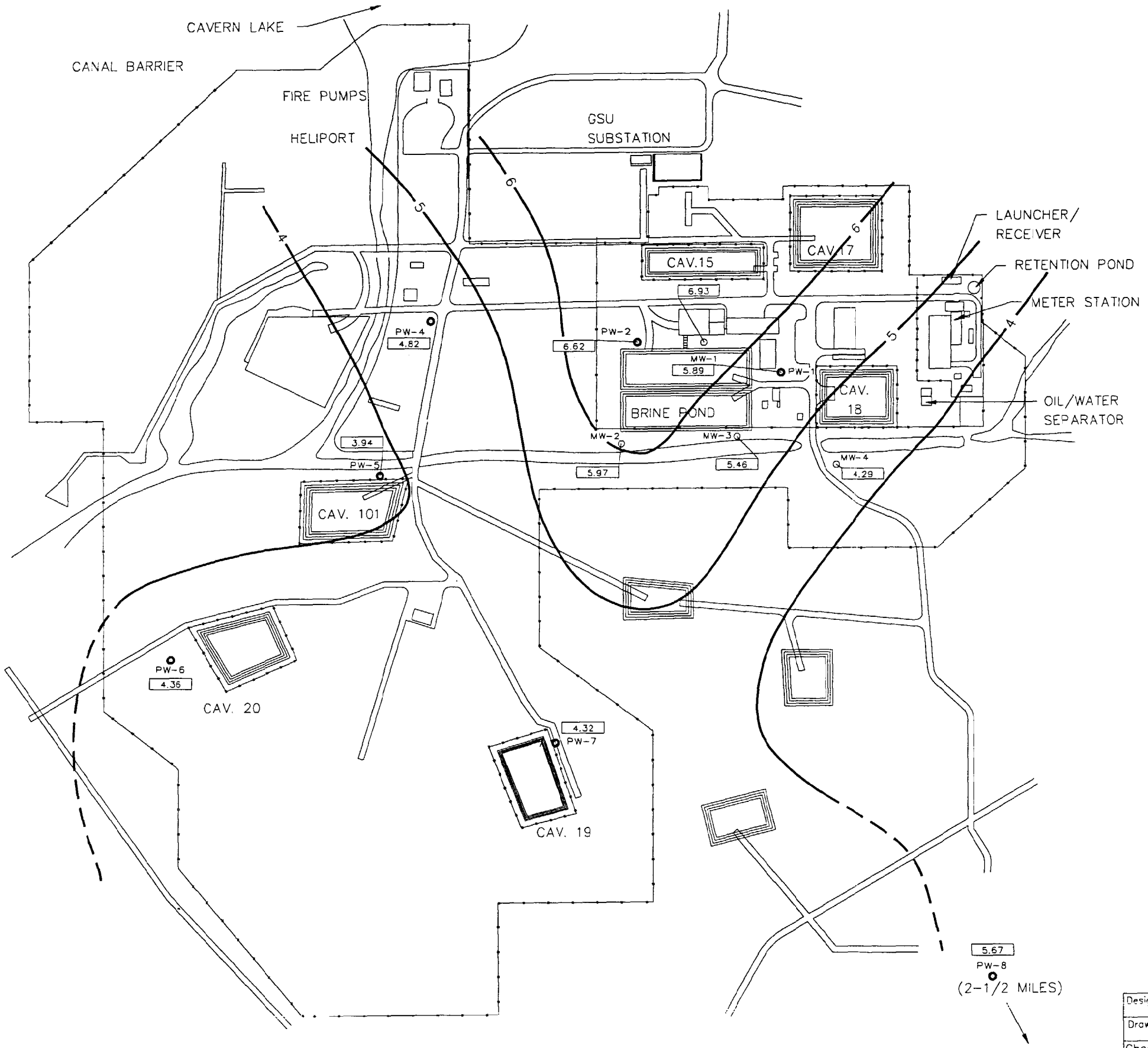
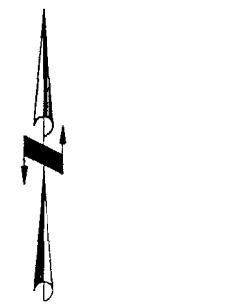
File No.: 1226-001 | Date: 7/19/96 | Figure No.: 8-5

ACAD File No.: 122601D1 | Rev.: 9/16/96 | Sheet 1 of 1





150 0 150 300 450

SCALE IN FEET

LEGEND

PW-8 — VERIFICATION MONITORING WELL

MW-1 — PRE-EXISTING MONITORING WELL

5.81 — MEASURED WATER ELEVATION (ft)

—20— WATER ELEVATION CONTOUR

NOTE:

CONTOUR INTERVAL: 1.0 (ft)

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Title: POTENTIOMETRIC MAP

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Approved:		

File No.: 1226-001 | Date: 7/26/96 | Figure No.: 8-6

ACAD File No.: BAYOUC | Rev.: 9/16/96 | Sheet 1 of 1

TABLE 8-2

GROUND WATER ELEVATIONS

DynMcDermott Petroleum Operations Company
Bayou Choctaw SPR Site
Plaquemine, Louisiana

Well #	Top of Casing	Depth to Water	Water Elevation
MW1	9.93	3	6.93
MW2	15.5	9.53	5.97
MW3	15.83	10.37	5.46
MW4	11.03	6.74	4.29
Canal	6.08	2.7	3.38
PW1	10.28	4.39	5.89
PW2	11.01	4.39	6.62
PW4	12.06	7.24	4.82
PW5	12.15	8.21	3.94
PW6	10.36	6	4.36
PW7	13.65	9.33	4.32
PW8	11.94	6.27	5.67

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determined to be 0.003 feet/foot. The gradient flattens out in the southern part of the site (south of the east-west canal).

Hydraulic conductivities calculated from slug test data from the seven verification monitoring wells at the site ranged from 1.90×10^{-5} cm/sec (PW-1) to 1.08×10^{-2} cm/sec (PW-7). The high hydraulic conductivity calculated for monitoring well PW-7 was attributed to the fill material near the top of the screened interval. Therefore, an average hydraulic conductivity of 1.47×10^{-4} cm/sec was calculated omitting this value. This hydraulic conductivity compares favorably to those published in standard texts for sandy and silty clay (i.e., 10^{-4} to 10^{-6} cm/sec).

A sieve analysis was performed on representative samples collected from each screened interval. Two samples were collected from monitoring well PW-1 based on lithologic differences observed in the field. Grain-size distribution curves were developed with cumulative percent finer by weight plotted on the arithmetic scale and the grain size plotted on the logarithmic scale. Sediment sorting was determined by the uniformity coefficient (C_U), defined as the ratio of grain size that is 60 percent finer by weight, D_{60}, to the grain size that is 10 percent finer by weight, D_{10}:

$$C_U = D_{60}/D_{10}$$

Uniformity coefficients of these samples ranged from 1.7 to 5.2 and therefore, were characterized as moderately well sorted to well sorted. Based on the grain-size distribution curves, these samples consist of fine sands and silts. A summary of verification well aquifer parameters at the Bayou Choctaw site is included as Table 8-3.

8.7 Laboratory Results

8.7.1 Analytical Results - Soil Boring Samples

Soil samples were collected at designated intervals for each verification well. Preliminary field screening did not indicate these samples had been affected by crude or brine impact. Therefore, soil boring samples were not submitted to the laboratory for chemical analysis.

8.7.2 Analytical Results - Ground Water Samples

Ground water samples were collected from all verification wells on April 22 and 23, 1996 and submitted to the laboratory for analysis. The soil gas survey results detected three areas that could indicate potential impact. Two of these areas were selected for the verification study. TPH were not detected in the ground water samples collected from monitoring wells PW-1, installed to verify an anomaly extending east of the brine pond southeast toward Cavern 18, and from PW-6 installed to verify an anomaly near Cavern 20. These results indicate that crude oil has apparently not significantly impacted the shallow ground water at the Bayou Choctaw site.

Total chloride concentrations in the ground water samples from the seven monitoring wells installed to verify brine impact ranged from 980 mg/l in monitoring well PW-6 to

TABLE 8-3

SUMMARY OF AQUIFER PARAMETERS

DynMcDermott Petroleum Operations Company
Bayou Choctaw SPR Site
Plaquemine, Louisiana

Monitoring Well	Initial Drawdown (cm)	Final Drawdown (cm)	Slug Test Duration (sec)	Estimated Hydraulic Conductivity (cm/sec)	Sieve Analysis Uniformity Coefficient (cm)
PW-1	48.31	16.55	2520	1.899×10^{-5}	1.45 @ 13.0' 3.66 @ 16.0'
PW-2	59.8	8.534	3360	6.486×10^{-5}	2.4 @ 20.0'
PW-4	41.97	5.97	2400	4.660×10^{-5}	4.6 @ 16.0'
PW-5	54.44	11.12	3120	2.025×10^{-5}	1.7 @ 13.0'
PW-6	54.62	1.83	840	7.007×10^{-4}	5.2 @ 16.0'
PW-7	70.47	0.09144	13.4	1.083×10^{-2}	1.6 @ 10.0'
PW-8	53.49	12.86	2520	2.780×10^{-5}	2.13 @ 15.0'

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41,200 mg/l in monitoring well PW-2. The highest chloride concentrations are centered just north of the brine pond extending southeast toward Cavern 18 and southwest toward Cavern 101 (Figure 8-7). TDS concentrations ranged from 2,170 mg/l in monitoring well PW-6 to 65,500 mg/l in monitoring well PW-2. As illustrated on the TDS isopleth map (Figure 8-8), the trend of elevated levels generally coincides with those of total chloride. Field electrical conductivity levels measured in all verification wells during purging ranged from 2,110 µmhos/cm in monitoring well PW-7 to over 20,000 µmhos/cm in monitoring wells PW-1, PW-2, PW-5, and PW-8. The distribution of field electrical conductivity values was consistent with the other brine indicator parameters (total chlorides and TDS) (Figure 8-9).

Monitoring well PW-8 was drilled south of Brine Disposal Well Pad No. 1, approximately 2.5 to 3 miles south of the main site, in an effort to verify elevated electromagnetic readings from previous investigations. Total chloride and TDS concentrations in ground water from this well were 16,800 mg/l and 28,100 mg/l, respectively.

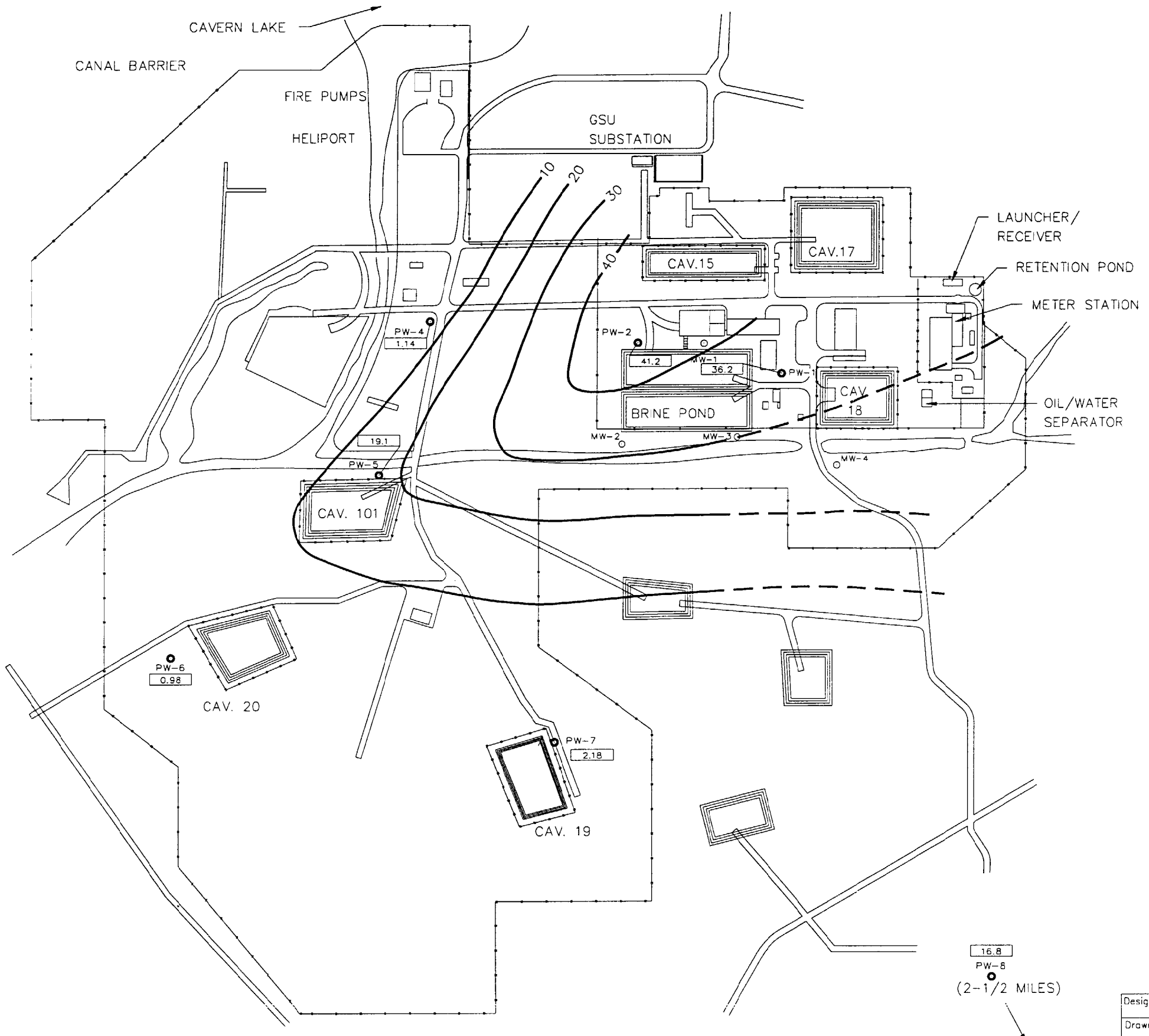
The Louisiana Department of Environmental Quality, Office of Water Resources, Ground Water Protection Division, (LDEQ) is in the process of determining aquifer usability criteria to support the development of a Risk-Based Corrective Action program to address the assessment and remediation of facilities that have impacted ground waters of the state. Aquifer usability will determined, in part, from ground water availability, and chloride and TDS content. At this time, specific standards for these parameters have not been promulgated; however, preliminary discussions have proposed that ground water with ambient chloride and TDS concentrations of greater than 250 ppm and 10,000 ppm, respectively, will be considered unfit for human or livestock consumption (LDEQ, 1996, personal communication).

Total chloride concentrations in all the verification monitoring wells installed exceeded the national secondary water quality criterion and the proposed LDEQ criterion for a domestic water supply and for agricultural irrigation. Additionally, total chloride concentrations from samples from monitoring wells PW-1, PW-2, PW-5, and PW-8 exceeded national water quality criterion for freshwater aquatic life. TDS concentrations in samples from all seven monitoring wells exceeded the national secondary water quality criterion for a domestic water supply, agricultural irrigation, and industrial uses. Laboratory analytical and field parameter results for ground water samples are summarized in Table 8-4.

8.8 Analytical Results - Interpretations and Conclusions

Based on the results of the previous investigations, and the sampling and field and laboratory chemical analysis and hydrogeologic characterization conducted during the Well Verification Study at Bayou Choctaw, the following interpretations/conclusions have been made.

- The site is underlain primarily by silty and sandy clay units to the total depth explored (17 feet to 23 feet bgs). Shallow ground water was first encountered at depths ranging from 7 feet to 18 feet bgs. Ground water



150 0 150 300 450

SCALE IN FEET

LEGEND

PW-8 — VERIFICATION MONITORING WELL

MW-1 — PRE-EXISTING MONITORING WELL

11.4 — MEASURED CHLORIDES (ppt)

—5,000— TOTAL CHLORIDES CONTOUR

NOTE:

CONTOUR INTERVAL: 10 (ppt)

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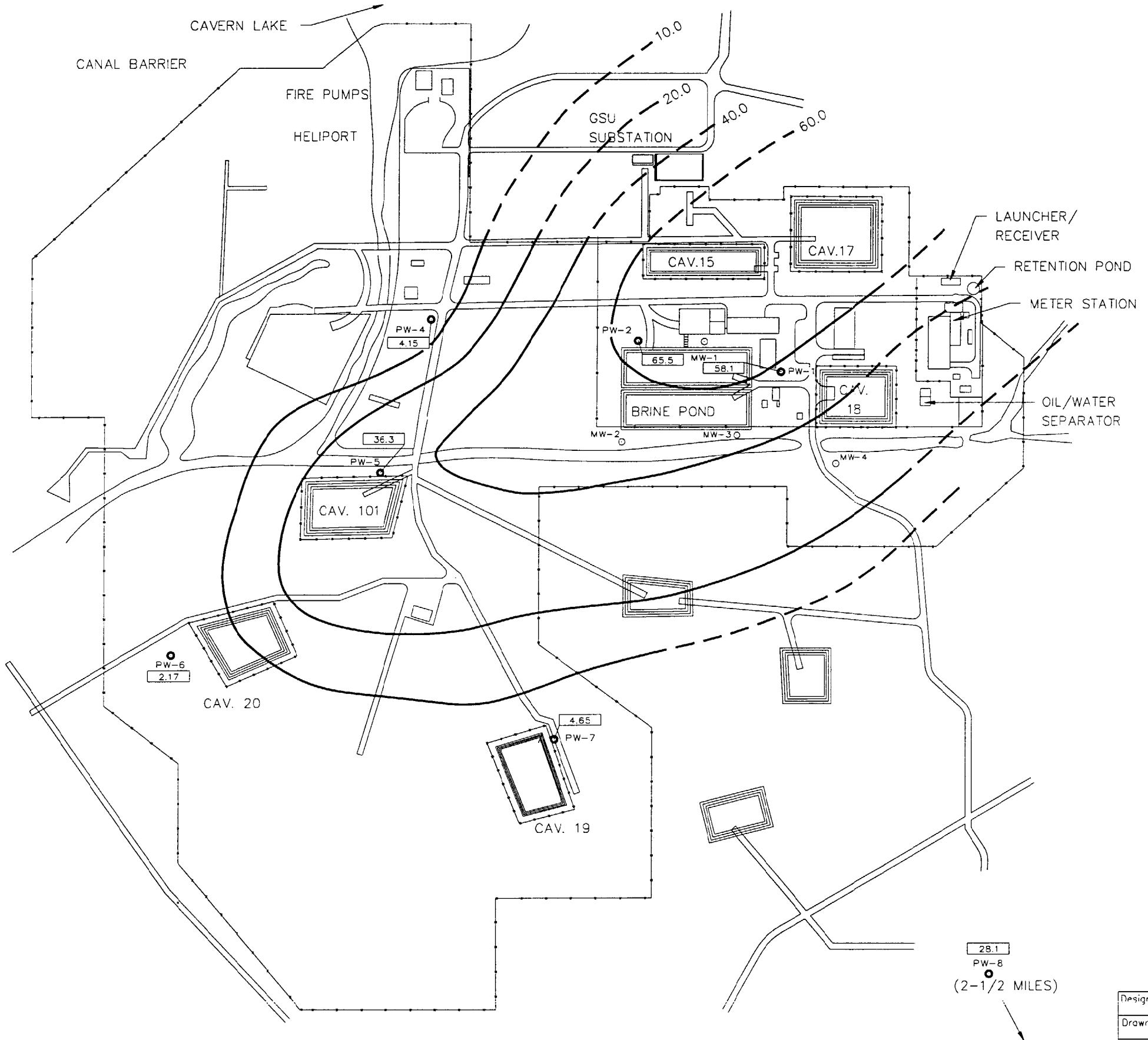
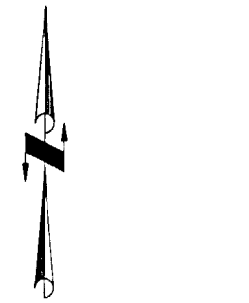
Title:

TOTAL CHLORIDE ISOPLETH MAP

File No.: 1226-001 | Date: 7/26/96 | Figure No.: 8-7

ACAD File No.: BAYOUC | Rev.: 9/16/96 | Sheet 1 of 1





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SCALE IN FEET

LEGEND

PW-8 ○	VERIFICATION MONITORING WELL
MW-1 ○	PRE-EXISTING MONITORING WELL
5.81	TOTAL DISSOLVED SOLIDS (ppt)
—20—	TOTAL DISSOLVED SOLIDS CONTOUR

NOTE:

CONCENTRATIONS IN PARTS PER THOUSAND (ppt)

CONTOUR INTERVAL: 20 (ppt)

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Title:

TOTAL DISSOLVED SOLIDS (TDS) ISOPLETH MAP

		Date
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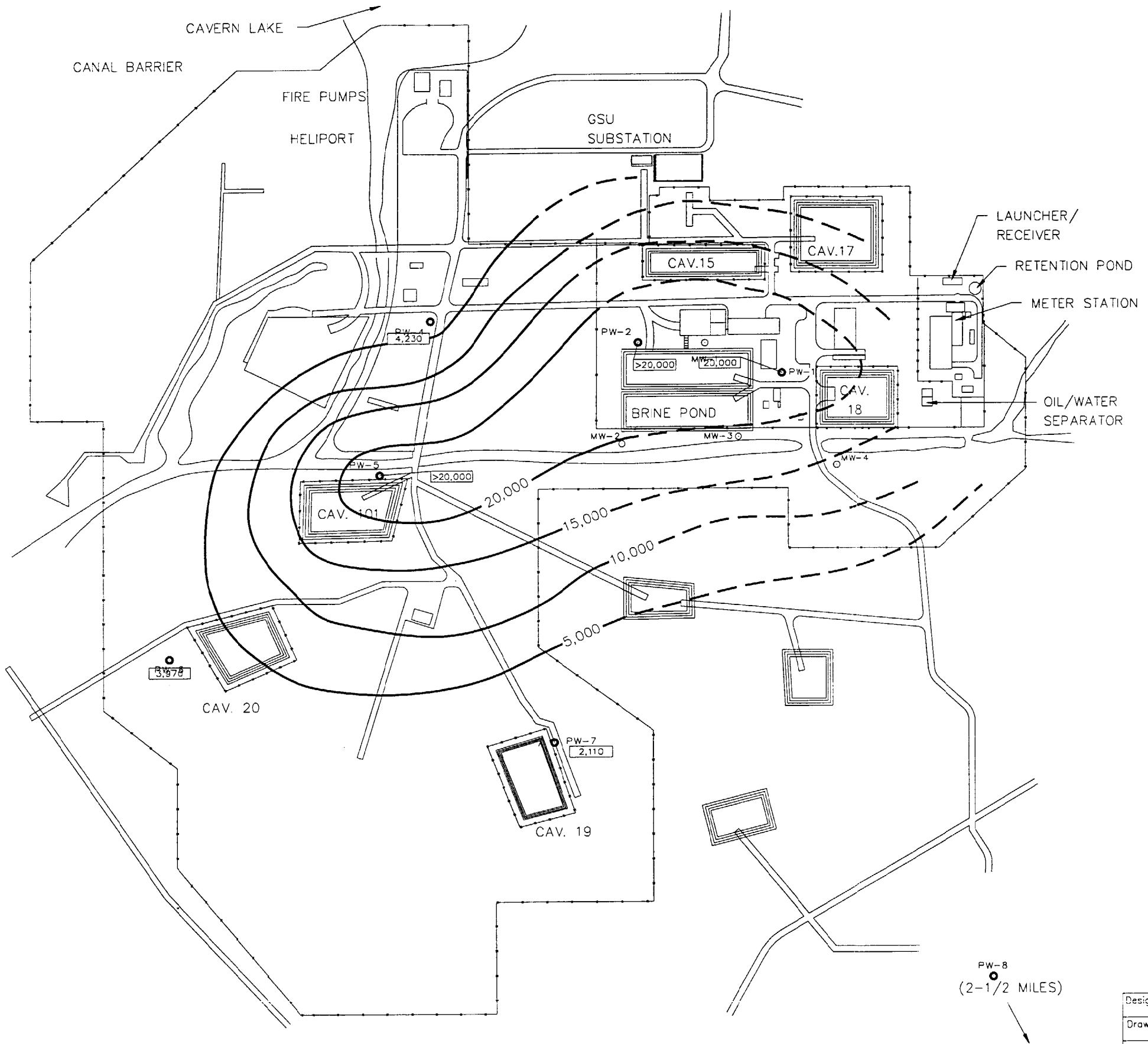
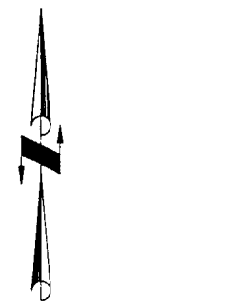
File No.: 1226-001 | Date: 7/26/96 | Figure No.: 8-8

ACAD File No.: BAYOUC | Rev.: 9/16/96 | Sheet 1 of 1





150 0 150 300 450

SCALE IN FEET

LEGEND

PW-8 ○ VERIFICATION MONITORING WELL

MW-1 ○ PRE-EXISTING MONITORING WELL

5.81 MEASURED CONDUCTIVITY (umhos/cm)

—5,000— CONDUCTIVITY CONTOUR

NOTE:

CONTOUR INTERVAL: 5,000 (µmhos/cm)

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Title:

ELECTRICAL CONDUCTIVITY ISOPLETH MAP

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Design:	JB	7/96
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File No.: 1226-001 | Date: 7/26/96 | Figure No.: 8-9

ACAD File No.: BAYOUC | Rev.: 9/16/96 | Sheet 1 of 1

TABLE 8-4

SUMMARY OF ANALYTICAL RESULTS FOR GROUND WATER SAMPLES

DynMcDermott Petroleum Operations Company
Bayou Choctaw SPR Site
Plaquemine, Louisiana

Analyte (mg/L)	PW-1	PW-2	PW-4	PW-5	PW-6	PW-7	PW-8
TPH[1]	ND[2]	--	--	--	ND	--	--
Chlorides[3]	36,200	41,200	1140	19,100	980	2180	16,800
Total Dissolved Solids[4]	58,100	65,500	4150	36,300	2170	4650	28,100
Physical Parameter							
pH	7.66	9.98	9.77	10.86	8.97	10.89	10.98
Electrical Conductivity (umhos/cm)	>20,000	>20,000	4230	>20,000	3970	2110	>20,000
Temperature (°F)	73.3	78.1	72.9	74.0	72.0	70.0	74.0

[1] TPH analyzed by USEPA Method 418.1
[2] ND = not detected
[3] Total chlorides analyzed by USEPA Method 325.3.
[4] Total dissolved solids analyzed by USEPA Method 160.1.

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levels in monitoring wells penetrating these units stabilized at depths ranging from 4.39 feet to 9.78 feet, suggesting the shallow saturated zone investigated is under confined to partially confined conditions.

- The potentiometric map of the site from data generated on April 22 and 23, 1996 indicates an average hydraulic gradient of 0.003 feet/foot. The gradient flattens out in the southern part of the site. The ground water flow direction on the west side of the site is to the southwest and to the southeast on the east side of the site.

- The average hydraulic conductivity of the waterbearing zone investigated was determined to be 1.47×10^{-4} cm/sec. This value compares favorably to those values published in standard texts for sandy and silty clays (i.e., 10^{-4} to 10^{-6}).

- Preliminary field screening did not indicate soil boring samples were affected by crude or brine impact. Therefore, soil boring samples were not submitted to the laboratory for chemical analysis.

- TPH were not detected in ground water collected from monitoring wells at the Bayou Choctaw site. Therefore, crude oil has apparently not impacted the shallow ground water at the Bayou Choctaw site.

- Total chloride concentrations in ground water samples from the seven verification monitoring wells ranged from 980 mg/l in monitoring well PW-6 to 41,200 mg/l in monitoring well PW-2. TDS concentrations ranged from 2,170 mg/l in monitoring well PW-6 to 65,500 mg/l in monitoring well PW-2. Field electrical conductivity levels ranged from 2,110 µmhos/cm in monitoring PW-7 to over 20,000 µmhos/cm.

- Isopleth maps of the three brine indicators (total chlorides, TDS, and field electrical conductivity) illustrate elevated brine levels are centered just north of the brine reservoir and extend southeast toward Cavern 18 and southwest toward Cavern 101. This brine distribution parallels the ground water flow direction at the site (ranging from southwest to southeast). Therefore, it appears that the primary source of brine impact is either the brine pond and associated piping or may be attributable to residual impacts from historical activity located just northwest of the current brine pond.

- Brine indicators (total chlorides, TDS, and field electrical conductivity) in the ground water sample from monitoring well PW-8 indicate the Brine Disposal Well Pad No.1 has been affected by salt water contamination associated with the routine well and pad operations or, possibly, historical anhydrite disposal.

8.9 Recommendations

Upon review of the results of analysis of the ground water samples collected during the present study, DM has determined that all of the verification wells will be incorporated into the permanent monitoring well network for the Bayou Choctaw SPR facility.

The present study and previous ground water quality monitoring events at the site have indicated apparent brine impact or TDS levels above 10 ppt in the shallow waterbearing zone in the vicinity of the brine pond and Brine Disposal Well No. 1. Therefore, continued monitoring of this saturated zone for brine indicators such as: total chlorides, TDS, and electrical conductivity is recommended. The monitoring wells recommended for inclusion in the monitoring program are as follows:

PW-1, PW-2, PW-4, PW-5, PW-6, PW-7, PW-8, MW-1, MW-2, MW-3, and MW-4.

These wells should be gauged and sampled on a routine basis in accordance with a written Sampling and Analysis Plan similar to that presented in Appendix A. Electrical conductivity levels, when taken, should be measured in the field during well purging. The ground water samples, when analyzed for total chlorides and TDS, should be subjected to EPA Method 325.3 and EPA Method 160.1 or a recognized equivalent method.

10.0 REFERENCES

Bouwer, H. and R.C. Rice 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells. Water Resources Research, 12(3). pp. 423-428.

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Cooper H.H., J.D. Bredehoeft, and S.S. Papadopulos. 1967. Response of a Finite Diameter Well to an Instantaneous Charge of Water. Water Resources Research 3(1). pp. 263-269.

Texas Water Commission. 1989. Groundwater Quality of Texas - An Overview of Natural and Man-Affected Conditions. TWC Report 89-01, 197 pp.

MULTI-SITE HYDROGEOLOGICAL INVESTIGATION
STRATEGIC PETROLEUM RESERVE SITES
LOUISIANA AND TEXAS

SUBCONTRACT SOIC-060150
TASK WR-94-157

Volume II of II

PREPARED FOR:

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September 1996

EnecoTech Project #1201226001

LIST OF APPENDICES

APPENDIX A

APPENDIX A

SAMPLING AND ANALYSIS PLANS
WASTE MANAGEMENT PLANS

DYNMCDERMOTT PETROLEUM OPERATIONS

Sampling and Analysis Plan

SITE: BAYOU CHOCTAW

PROPOSED MONITORING WELLS: Two monitoring wells to verify brine and crude impact; and five to verify brine impact. Total proposed footage = 245 feet.

PROPOSED NUMBER OF SAMPLES: Soil-Two samples analyzed for Total Petroleum Hydrocarbon (TPH) and seven samples analyzed for chlorides.

Ground Water-Two samples analyzed for TPH and seven samples analyzed for chlorides. Seven samples analyzed for Total Dissolved Solids (TDS).

1.0 Monitoring and Sampling

All field work will be conducted in accordance with procedures outlined in the EPA's Technical Enforcement Guideline Document EPA Publication dated September 1986. Data collected during ground water monitoring and sampling will be recorded in bound, paginated field logbooks. Pre-printed field data sheets will be used for recording and documenting sample collection, chain of custody, and equipment usage.

1.1 Soil Sampling - Soil samples will be collected during borehole drilling using either a split spoon sampler or a shelby tube. Sampling will be conducted according to the following procedures:

- Soil samples will be handled with decontaminated hand tools. Three samples will be collected in the first ten feet of depth, then one sample every five feet until the total depth is reached. Two samples will be taken from the anticipated screened zone.

- The soil samples collected will be logged by the professional logger in accordance with ASTM Method D-2487-85 (Soil Classification for Engineering Purposes).

- The samples will be separated into two clean, labeled plastic bags and sealed. One split sample will be stored on ice in an insulated cooler, while the remaining sample will be allowed to equilibrate, prior to headspace analysis.

- Vacant headspace will be sampled by opening the corner of the bag and inserting a probe extension connected to the photoionization detector (PID). The professional logger will further investigate soils visually for brine saturation and olfactory evidence of crude oil contamination.

- At least one soil sample from the screened zone of each monitoring well will be subjected to a standard grain-size analysis.

- Sample information will be measured and recorded immediately prior to sample collection. Sample labels will be completed to include: well number, time, date, sampling depth, parameter analyzed, and samplers name.

- Samples selected for chemical analysis will be transferred from the second chilled bag to 8-oz wide mouth jars. Samples will be placed on ice immediately after collection. Analytical parameters and methodologies are discussed in section 2.0.

- Decontamination will be conducted on split-spoon and other sampling equipment before and after each use. Decontamination includes washing with a phosphate-free detergent (alconox) and distilled water solution, rinsing first with distilled water and then with a distilled water/methanol solution.

1.2 Water Level Measurement

Monitoring well water level measurements will be taken prior to the initiation of ground water purging and sampling. The procedures that will be followed for collecting water level measurement data is summarized below:

- Record the well number, date, time, and initials of field personnel taking the measurements in a logbook.

- The length of the riser stick-up will be measured from the ground surface to a surveyed point at the top of the casing and recorded to the nearest tenth of a foot.

- The oil/water interface probe will be inserted at the survey point until it reaches the water. The depth to the water and total depth of the well will be measured from the surveyed point at the top of the casing.

- Between each monitoring well, the oil/water interface probe will be decontaminated by washing the cable and probe with a phosphate free detergent (alconox) and distilled water solution, rinsing first with distilled water and then with a distilled water/methanol solution.

1.3 Ground Water Sampling-Sampling will be conducted according to the following procedures:

- Prior to ground water sample collection, monitoring wells will be purged until at least three submerged volumes are removed or until well is evacuated to dryness, whichever comes first. Monitoring wells will be purged and sampled from the top of the water column. A bottom decanting disposable bailer will be slowly lowered into the water column to a depth equal to the length of the bailer used. Wells will be evacuated at a rate to prevent cascading of formation waters down the screened interval.

- During purging, field parameters measured will include ground water temperature, pH and specific conductance or salinity. These parameters will be recorded starting from the initial water discharged from the well and after each casing volume is removed. Samples will be collected once these parameters stabilize and wells recharge.

- Sample information will be recorded immediately prior to ground water sample collection. Sample labels will be completed to include: well number, time, date, parameter analyzed and samplers name.

- Samples for TPH analysis will be collected in one-liter glass bottles containing hydrochloric acid (HCL) as a preservative. Samples for chloride and Total Dissolved Solids (TDS) analyses will be collected in 100 ml glass bottles containing no preservatives. Samples will be placed on ice immediately after collection. Sample packaging and transport are discussed in section 1.5.

- Purge and decontamination water will be contained in 55-gallon DOT-approved drums and brought to an on-site staging area. Each drum will be properly sealed and labeled with an appropriate inventory number, date, job number, contractor name, well number and nature of contents.

1.4 Mitigation Guidelines -The following guidelines will be used to mitigate any potential problems that could adversely affect sample integrity:

- Dropped bottles or lids will be replaced with extras from the kit. Contact with edges or inside surfaces will be avoided.

- Gloves will be changed frequently when handling downhole instruments or other equipment prior to sampling. New gloves will be worn at the start of well purging and changed immediately prior to sample collection.

- Sampling will be avoided when precipitation or dusty conditions are present that could potentially contaminate the sample.

1.5 Sample Packaging and Transport-Sample fractions will be packaged into coolers with ice to maintain sample temperature of 4 °C. Chain-of-Custody forms will be placed in waterproof bags in their corresponding coolers. Coolers will be sealed in accordance with individual shipping requirements. Evidence tape will

be placed across each cooler to ensure that the contents were not violated during shipping. The last person to sign the chain-of-custody form for each cooler will sign and date the evidence tape. Sample fractions will be shipped to the laboratory on a timely basis to ensure sample holding times are not exceeded.

1.6 Chain-of-Custody Documentation-Chain-of-Custody forms accompany the samples at all times. They are an inventory of the samples and of those persons who have access to the samples. Subsequent sample transfers requires the relinquisher and the receiver to sign, date, and record the time of transfer on the chain-of-custody forms. Data on the chain-of-custody forms include: sample number, collection date and time, fraction collected, and analyses performed.

2.0 Analytical Parameters and Methodologies

Based upon the conditions encountered in the field and verification purposes, selected soil and ground water samples will be submitted to Southern Petroleum Laboratories in Lafayette, Louisiana for chemical analyses. These analyses will include TPH using EPA analytical method 418.1 and Chlorides using EPA analytical method 325.3. In addition, Total Dissolved Solids analysis using EPA analytical method 160.1 will be performed for ground water samples verifying brine impact. Analytical methodologies of chemical parameters used in this verification study are included as Attachment 3.

DYNMCDERMOTT PETROLEUM OPERATIONS

Waste Management Plan

I. Waste Management Policy

EnecoTech, Inc. (EnecoTech) has prepared this Waste Management Plan in accordance with DynMcdermott's Purchase Subcontract No. S01C-060150, Task WR-94-157, Exhibit 6.6, General Environmental Regulations for Construction, and Attachment 4, Waste Handling and Decontamination. All waste management activities will also comply with federal, state, and local regulations. EnecoTech will apply the more stringent requirement should a conflict between environmental requirements arise, unless the application would cause EnecoTech to violate federal, state or local laws. In that event, EnecoTech will address the issue with the Subcontract Manager's Technical Representitive (SMTR) approval prior to proceeding with the activity. The Waste Management Plan will be updated as work methodology changes, new chemical products are used and new waste is generated. EnecoTech will promptly comply with all regulatory up-dates and implement changes after receiving approval from the SMTR.

I, Jerry Beckman of EnecoTech certify that waste minimization will be implemented during the Well Verification Study, contract No. S01C-060150 through: source reduction (minimizing and eliminating chemical products used) and recycling and reusing materials where possible.

Jerry Beckman
Project Scientist

II. Work Process

A proposed total of twenty-nine monitoring wells will be installed at three Louisiana (~~Bryan~~ Bayou - KSP Choctaw, Weeks Island and West Hackberry and two Texas (Big Hill and Bryan Mound) oil storage sites. These monitoring wells will be used to verify the presence or absence of suspected petroleum hydrocarbons and/or brine contamination based on previous non-intrusive screening evaluations (electromagnetic soil and conductivity surveys). A combination of field and laboratory chemical analytical data will be utilized to evaluate the suspected impacts.

The monitoring wells will be drilled by a truck mounted hollow-stem auger drilling rig. The wells will be constructed of flushpoint, 2-inch diameter, Schedule 40 PVC blank riser pipe and 0.010-inch slotted well screen. A silica sand filter pack will be placed in the annular space between the casing and the borehole to a height of approximately 2 feet above the well screen. The elevation at the top of the sand filter pack will located and recorded for the log. A uniformed bentonite pellet seal (approximately 3 foot thick) will be constructed above the sand pack to prevent surface water from entering the screened interval of the well. The bentonite pellet seal will be given adaquate time to hydrate prior to placement of a cement/bentonite slurry to the surface. The sloped concrete apron will meet minimum requirements established by the Texas Natural Resources Conservation Commission (TNRCC) and be constructed per Standard Specification 03300. All monitoring wells will extend 3 feet above the ground surface. Initially, all wells will be completed with a locking outer casing and a sloping concrete apron in accordance with DynMcDermott, and the Louisiana Departmentl of Transportation and Development (LDOTD) or TNRCC guidelines.

During monitoring well construction no drilling fluids will be used. Natural formation materials or drilling fluid additives such as bentonite powder or gel will be utilized. Wastes generated will include excess soil cuttings, development and purge water. Handling, characterization and disposal of these wastes are discussed in sections VI., VII., and VIII. No aerosols will be used or any pollutants be released (such as volatile cleaning solvent) during construction activities.

III. Regulatory Analysis

This study is a self-imposed (by DOE) investigation of site soils and ground water. Based on previous CERCLA studies and land use, drilling wastes are anticipated to be nonhazardous. Wastes generated in Texas are regulated by the Texas Solid Waste and Disposal Act and administered by the Industrial and Hazardous Waste Division of the TNRCC. Wastes generated in Louisiana are regulated by Louisiana Department of Environmental Quality (LDEQ). Monitoring well construction and registration procedures are regulated by the TNRCC and the LDOTD.

IV. List of Chemical Products Used

A list of chemical products planned to be used during the work process is included as Attachment 1. Material Safety Data Sheets (MSDS's) for each proposed product have been supplied to the Subcontractor Manager's Material Representitive (SMTR) for review and approval.

V. Waste Minimization Activities

Layne Environmental Services (EnecoTech's subcontractor) will use hollow stem auger methods (as discussed in Section II.) to install monitoring wells during this multi site well verification study. This method reduces quantities of waste generated by eliminating the use of drilling fluids and various polymer additives. In addition, Layne will paint required bumper posts prior to delivery on-site. This will minimize or eliminate paint cans, old paint or other residue associated with this activity.

EnecoTech will ensure all containers accumulating waste are sealed closed to prevent stormwater contamination. Leaks or spills in waste management and work areas will be cleaned-up immediately (as discussed in Section IX).

EnecoTech's waste minimization objectives are to:

- Minimize quantities of waste generated, thereby reducing waste management and compliance costs; and
- Reduce inventories and releases of "hazardous chemicals reportable under Title III of the Superfund Amendments and Reauthorization Act.

VI. Waste Characterization

Waste streams anticipated during this well verification study include: drill-cuttings, development and purged water, and cement and PVC piping from plug and abandonment activities. Waste characterization will be based on chemical analytical results of samples collected from accumulated contained waste. Depending on landfill requirements, this testing may include partial Toxicity Characteristic Leaching Procedure (TCLP) analysis, Reactivity, Corrosivity, and Ignitability (RCI) determinations or Total Petroleum Hydrocarbon (TPH) analysis. A waste stream profile will be completed for each waste stream. Characteristic testing will be performed by Southern Petroleum Laboratories (SPL) in Lafeyette, Louisiana. All QA/QC data and the completed chain of custody will be included in the laboratory reports.

VII. Waste Accumulation Methodology

All wastes generated will be accumulated in DOT approved 55-gallon containers. These containerized wastes will be transported to a marked satellite staging area approved by the SMTR and in accordance with federal and state regulations. All containers will be identified with hazardous or nonhazardous labels to include: site name, well number, date and nature of contents. Wastes will be segregated if indicators of crude oil contamination are observed. The closed drums and surrounding sorbent pigs will be covered with a waterproof tarp. These measures will help minimize potential intermingling with stormwater runoff.

VIII. Waste Disposal Methodology

Nonhazardous waste generated at the two Texas sites are anticipated to be disposed of at BFI'S Gulf West Landfill in Anahuac, Texas. BFI'S Colonial Landfill in Sorrento, Louisiana will be used to dispose of nonhazardous waste generated at the three Louisiana sites. It is anticipated each containerized waste stream will be transported on flat bed trucks and in accordance with the Department of Transportation (DOT) regulations. All waste shipments will be accompanied by proper manifests. Hazardous waste generated will be disposed of by DynMcDermott. EnecoTech retains soil boring samples only if it is required by the client or under other special circumstances.

IX. Spill Reponse

The SMTR will be immediately notified in the event of spills or leaks in or around the work area. Such spills will be immediately contained and cleaned-up. Personel protective equipment used will accumulate in properly labelled 55-gallon containers and disposed of in accordance with federal, state and local regulations and DynMcDermott procedures. All spill incidents will be reported in writing and submitted to the SMTR by the end of the day. In the event of a large chemical product or waste spill DynMcDermott may implement its Hazardous Substance Spill/Release Contingency Plan. No clean-up actions of large spills will be initiated without DynMcDermott's approval.

X. Waste Water Discharges and Disposal

No waste water discharges will occur without the approval of the SMTR. The only waste waters anticipated are purged and decontamination water. Waste waters suspected to be contaminated through field analysis will be accumulated, characterized and disposed of as discussed in Sections VI, VII, and VIII above. Waste water found to be uncontaminated through field analysis will be disposed on site at an area designated by the SMTR.

XI. Workplace and Waste Area Inspections

Work area and waste management areas will be inspected weekly for releases and other environmental perturbations. These inspections will be recorded on a weekly waste inspection form. EnecoTech's Professional Logger will be providing these inspections. Inspection deficiencies observed will be documented and resolved by the end of the working day.

XII. Reports

Forms which will be completed during the waste management process include: 1) the Hazardous Waste Tracking Form, submitted at least quarterly to the SMTR; 2) the Weekly Waste Inspection Form, submitted weekly to the SMTR; and 3) a form used to tract costs for all waste management activities, submitted at the conclusion of the project. Copies of these forms are included as Attachment 2. Spill reports will also be generated as needed in accordance with Section IX of this plan.

APPENDIX B

APPENDIX B

WATER WELL REGISTRATION FORMS

[redacted] DEPARTMENT [redacted] TRANSPORTATION AND DEVELOPMENT
WATER RESOURCES SECTION
WATER WELL REGISTRATION SHORT FORM (DOTD-GW-1S)

PLEASE PRINT IN INK OR TYPE WHEN COMPLETING THIS FORM

1. USE OF WELL (Check Appropriate Box)
☐ DOMESTIC ☐ RIG SUPPLY ☒ MONITORING ☐ PIEZOMETER ☐ RECOVERY
☐ HEAT PUMP HOLE ☐ HEAT PUMP SUPPLY ☐ ABANDONED PILOT HOLE ☐ OTHER _____ (Please Specify)
2. WELL OWNER United States Dept of Energy PHONE (504) 734-4277
3. WELL OWNER'S ADDRESS SPR, 900 Commerce Rd East New Orleans, LA 70123
4. OWNER'S WELL NUMBER OR NAME (if any) PBW-1
5. DATE COMPLETED 3-19-96 DEPTH OF HOLE 18 FT. DEPTH OF WELL 15.7 FT.
6. STATIC WATER LEVEL 10 FT. BELOW GROUND SURFACE MEASURED ON 3-19-96 (Date)
7. CASING 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER LENGTH 5 FT.
8. SCREEN 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER SLOT SIZE .010 LENGTH 10 FT.
9. CEMENTED FROM 2 FT. TO GROUND SURFACE, USING ☐ PUMP DOWN METHOD OR ☒ GRAVITY METHOD
10. LOCATION OF WELL: PARISH Iberville WELL IS NEAR Plaquemine (Town or City)
APPROXIMATELY 3 MILES FROM West of Hwy 1 and Parish Road 1148 (Crossroads, Railroad, Any Landmark, etc.)
(Please draw sketch on back of Original)
11. REMARKS: Depth of well ~~doesn't~~ include 2' sump.
12. DRILLER'S LOG (Description and color of cuttings, such as shale, sand, etc. in feet)

FROM	TO	DESCRIPTION	FROM	TO	DESCRIPTION
0	3	brown and gray clay fill			
3	18	gray and brown silty clay			

13. FOR HEAT PUMP ONLY: AVG. DEPTH _____ FT. NUMBER OF HOLES _____
ABANDONMENT INFORMATION: DOES THE NEW WELL REPLACE AN EXISTING WELL? YES ☐ NO ☒
NAME OF PERSON WHO DRILLED THE WELL: Tom Atherton

(REV. 7/93) CONTRACTOR'S COPY

Layne Environmental Services
Name of Water Well Contractor
LICENSE NUMBER WWC-401
Authorized Signature 4-9-96 Date

MAIL ORIGINAL TO:
LOUISIANA DEPARTMENT OF
TRANSPORTATION AND DEVELOPMENT
ATTN.: CHIEF - WATER RESOURCES SECTION
P.O. BOX 94245
BATON ROUGE, LA 70804-9245
(504) 379-1434

FOR OFFICE USE ONLY
PARISH 047 WELL NO. -0071Z
IDENTIFICATION NUMBER
REVISED COORDINATES
Geologic Unit
SECTION TOWNSHIP RANGE
ELEV. QUAD. NO.
Use of Well M
INPUT BY: DATE:
INSPECTED BY: DATE:
REMARKS:

FOR MONITOR/PIEZO/RECOVERY WELLS ONLY
LATITUDE 301856 LONGITUDE 911826
SECTION 52 TOWNSHIP 19S RANGE 11E
ELEV. 10 QUAD. NO. 1640
SITE ADDRESS 60825-B Hwy 1148
Plaquemine, LA 70764

WATER WELL REGISTRATION SHORT FORM (DOTD-GW-TS)

PLEASE PRINT IN INK OR TYPE WHEN COMPLETING THIS FORM

1. USE OF WELL (Check Appropriate Box)
☐ DOMESTIC ☐ RIG SUPPLY ☒ MONITORING ☐ PIEZOMETER ☐ RECOVERY
☐ HEAT PUMP HOLE ☐ HEAT PUMP SUPPLY ☐ ABANDONED PILOT HOLE ☐ OTHER _____ (Please Specify)

2. WELL OWNER United States Dept of Energy PHONE (504) 734-4277

3. WELL OWNER'S ADDRESS SPR, 900 Commerce Rd East New Orleans, LA 70123

4. OWNER'S WELL NUMBER OR NAME (if any) PMW-2

5. DATE COMPLETED 3-19-96 DEPTH OF HOLE 23 FT. DEPTH OF WELL ~~21~~ 23 FT.

6. STATIC WATER LEVEL 14 FT. BELOW GROUND SURFACE MEASURED ON 3-19-96 (Date)

7. CASING 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER LENGTH 11 FT.

8. SCREEN 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER SLOT SIZE .010 LENGTH 10 FT.

9. CEMENTED FROM 5 FT. TO GROUND SURFACE, USING ☐ PUMP DOWN METHOD OR ☒ GRAVITY METHOD

10. LOCATION OF WELL: PARISH Iberville WELL IS NEAR Plaquemine (Town or City)
APPROXIMATELY 3 MILES FROM West of Hwy 1 and Parish Road 1148 (Crossroads, Railroad, Any Landmark, etc.)
(Please draw sketch on back of Original)

11. REMARKS: Depth of well ~~doesn't~~ include 2' sump.

12. DRILLER'S LOG (Description and color of cuttings, such as shale, sand, etc. in feet)

FROM	TO	DESCRIPTION	FROM	TO	DESCRIPTION
0	3	brown and gray clay			
3	23	grayish brown clay			

13. FOR HEAT PUMP ONLY: AVG. DEPTH _____ FT. NUMBER OF HOLES _____

14. ABANDONMENT INFORMATION: DOES THE NEW WELL REPLACE AN EXISTING WELL? YES ☐ NO ☒

15. NAME OF PERSON WHO DRILLED THE WELL: Tom Atherton

(REV. 7/93)

CONTRACTOR'S COPY

Layne Environmental Services
Name of Water Well Contractor

LICENSE NUMBER WWC-401

Authorized Signature

4-9-96
Date

MAIL ORIGINAL TO:
LOUISIANA DEPARTMENT OF
TRANSPORTATION AND DEVELOPMENT
ATTN.: CHIEF - WATER RESOURCES SECTION
P.O. BOX 94245
BATON ROUGE, LA 70804-9245
(504) 379-1434

FOR OFFICE USE ONLY
PARISH 047 WELL NO. -6727
IDENTIFICATION NUMBER
REVISED COORDINATES
Geologic Unit
Use of Well: M
SECTION TOWNSHIP RANGE
ELEV. QUAD. NO.
INPUT BY: _____ DATE: _____
INSPECTED BY: _____ DATE: _____
REMARKS: _____

FOR MONITOR/PIEZO/RECOVERY WELLS ONLY
LATITUDE 30 18 58 LONGITUDE 91 18 31
SECTION 52 TOWNSHIP 19S RANGE 11E
ELEV. 11 QUAD. NO. 164D
SITE ADDRESS: 60825-B Highway 1148
Plaquemine, LA 70764

[redacted] TER [redacted] DUR [redacted] SEC [redacted]

WATER WELL REGISTRATION SHORT FORM (DOTD-GW-1S)

PLEASE PRINT IN INK OR TYPE WHEN COMPLETING THIS FORM

1. USE OF WELL (Check Appropriate Box)

☐ DOMESTIC ☐ RIG SUPPLY ☒ MONITORING ☐ PIEZOMETER ☐ RECOVERY

☐ HEAT PUMP HOLE ☐ HEAT PUMP SUPPLY ☐ ABANDONED PILOT HOLE ☐ OTHER _____ (Please Specify)

2. WELL OWNER United States Dept of Energy PHONE (504) 734-4277

3. WELL OWNER'S ADDRESS SPR, 900 Commerce Rd East New Orleans, LA 70123

4. OWNER'S WELL NUMBER OR NAME (if any) PMW-4

5. DATE COMPLETED 3-18-96 DEPTH OF HOLE 20 FT. DEPTH OF WELL ~~18~~ 20 FT.

6. STATIC WATER LEVEL 13.5 FT. BELOW GROUND SURFACE MEASURED ON 3-18-96 (Date)

7. CASING 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER LENGTH 8 FT.

8. SCREEN 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER SLOT SIZE .010 LENGTH 10 FT.

9. CEMENTED FROM 2 FT. TO GROUND SURFACE, USING ☐ PUMP DOWN METHOD OR ☒ GRAVITY METHOD

10. LOCATION OF WELL: PARISH Iberville WELL IS NEAR, Plaquemine (Town or City)

APPROXIMATELY 3 MILES FROM West of Hwy 1 and Parish Road 1148 (Crossroads, Railroad, Any Landmark, etc.)

(Please draw sketch on back of Original)

11. REMARKS: Depth of well ~~doesn't~~ include 2' sump.

12. DRILLER'S LOG (Description and color of cuttings, such as shale, sand, etc. in feet)

FROM	TO	DESCRIPTION	FROM	TO	DESCRIPTION
0	3	brown and gray clay fill			
3	13	gray and brown silty clay			
13	20	gray clayey silt with sand			

13. FOR HEAT PUMP ONLY: AVG. DEPTH _____ FT. NUMBER OF HOLES _____

14. ABANDONMENT INFORMATION: DOES THE NEW WELL REPLACE AN EXISTING WELL? YES ☐ NO ☒

15. NAME OF PERSON WHO DRILLED THE WELL: Tom Atherton

(REV. 7/93)

CONTRACTOR'S COPY

Layne Environmental Services
Name of Water Well Contractor

LICENSE NUMBER WWC-401

[signature] 4-9-96
Authorized Signature Date

MAIL ORIGINAL TO:

LOUISIANA DEPARTMENT OF
TRANSPORTATION AND DEVELOPMENT
ATTN.: CHIEF - WATER RESOURCES SECTION
P.O. BOX 94245
BATON ROUGE, LA 70804-9245
(504) 379-1434

FOR OFFICE USE ONLY

PARISH 047 WELL NO. –6073Z

IDENTIFICATION NUMBER

REVISED COORDINATES

Geologic Unit

SECTION TOWNSHIP RANGE

ELEV. QUAD. NO.

Use of Well M

INPUT BY: _____ DATE: _____

INSPECTED BY: _____ DATE: _____

REMARKS: _____

FOR MONITOR/PIEZO/RECOVERY WELLS ONLY

LATITUDE 30 18 58 LONGITUDE 91 11 839

SECTION 52 TOWNSHIP 19S RANGE 11E

ELEV. 12 QUAD. NO. 164D

SITE ADDRESS: 60825-B Highway 1148
Plaquemine, LA 70764

WATER WELL REGISTRATION SHORT FORM (DOTD-GW-1S)

PLEASE PRINT IN INK OR TYPE WHEN COMPLETING THIS FORM

1. USE OF WELL (Check Appropriate Box)
☐ DOMESTIC ☐ RIG SUPPLY ☒ MONITORING ☐ PIEZOMETER ☐ RECOVERY
☐ HEAT PUMP HOLE ☐ HEAT PUMP SUPPLY ☐ ABANDONED PILOT HOLE ☐ OTHER _____ (Please Specify)

2. WELL OWNER United States Dept of Energy PHONE (504) 734-4277

3. WELL OWNER'S ADDRESS SPR, 900 Commerce Rd East New Orleans, LA 70123

4. OWNER'S WELL NUMBER OR NAME (if any) PW-5

5. DATE COMPLETED 3-20-96 DEPTH OF HOLE 23 FT. DEPTH OF WELL 19 FT.

6. STATIC WATER LEVEL 10 FT. BELOW GROUND SURFACE MEASURED ON 3-20-96 (Date)

7. CASING 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER LENGTH 7 FT.

8. SCREEN 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER SLOT SIZE .010 LENGTH 10 FT.

9. CEMENTED FROM 2 FT. TO GROUND SURFACE, USING ☐ PUMP DOWN METHOD OR ☒ GRAVITY METHOD

10. LOCATION OF WELL: PARISH Iberville WELL IS NEAR, Plaquemine (Town or City)
APPROXIMATELY 3 MILES FROM West of Hwy 1 and Parish Road 1148 (Crossroads, Railroad, Any Landmark, etc.)
(Please draw sketch on back of Original)

11. REMARKS: Depth of well ~~doesn't~~ include 2' sump

12. DRILLER'S LOG (Description and color of cuttings, such as shale, sand, etc. in feet)

FROM	TO	DESCRIPTION	FROM	TO	DESCRIPTION
0	3	brown and gray clay			
3	23	gray with brown silty clay			

13. FOR HEAT PUMP ONLY: AVG. DEPTH _____ FT. NUMBER OF HOLES _____

14. ABANDONMENT INFORMATION: DOES THE NEW WELL REPLACE AN EXISTING WELL? YES ☐ NO ☒

15. NAME OF PERSON WHO DRILLED THE WELL: Tom Atherton

(REV. 7/93) CONTRACTOR'S COPY

Layne Environmental Services
Name of Water Well Contractor

LICENSE NUMBER WWC-401

Authorized Signature 4-9-96 Date

MAIL ORIGINAL TO:
LOUISIANA DEPARTMENT OF
TRANSPORTATION AND DEVELOPMENT
ATTN.: CHIEF - WATER RESOURCES SECTION
P.O. BOX 94245
BATON ROUGE, LA 70804-9245
(504) 379-1434

FOR OFFICE USE ONLY
PARISH 047 WELL NO. -6074Z
IDENTIFICATION NUMBER
REVISED COORDINATES
Geologic Unit
Use of Well M
SECTION TOWNSHIP RANGE
ELEV. QUAD. NO.
INPUT BY: DATE:
INSPECTED BY: DATE:
REMARKS:

FOR MONITOR/PIEZO/RECOVERY WELLS ONLY
LATITUDE 301852 LONGITUDE 0911841
SECTION 52 TOWNSHIP 19S RANGE 11E
ELEV. 12 QUAD. NO. 164D
SITE ADDRESS 60825-B Highway 1148
Plaquemine, LA 70764

WATER WELL REGISTRATION SHORT FORM (DOTD-GW-TS)

PLEASE PRINT IN INK OR TYPE WHEN COMPLETING THIS FORM

1. USE OF WELL (Check Appropriate Box)
   ☐ DOMESTIC ☐ RIG SUPPLY ☒ MONITORING ☐ PIEZOMETER ☐ RECOVERY
   ☐ HEAT PUMP HOLE ☐ HEAT PUMP SUPPLY ☐ ABANDONED PILOT HOLE ☐ OTHER _____ (Please Specify)
2. WELL OWNER United States Dept of Energy PHONE (504) 734-4277
3. WELL OWNER'S ADDRESS SPR, 900 Commerce Rd East New Orleans, LA 70123
4. OWNER'S WELL NUMBER OR NAME (if any) PMW-6
5. DATE COMPLETED 3-20-96 DEPTH OF HOLE 17 FT. DEPTH OF WELL ~~15~~ 17 FT.
6. STATIC WATER LEVEL 12 FT. BELOW GROUND SURFACE MEASURED ON 3-20-96 (Date)
7. CASING 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER LENGTH 5 FT.
8. SCREEN 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER SLOT SIZE .010 LENGTH 10 FT.
9. CEMENTED FROM 2 FT. TO GROUND SURFACE, USING ☐ PUMP DOWN METHOD OR ☒ GRAVITY METHOD
10. LOCATION OF WELL: PARISH Iberville WELL IS NEAR, Plaquemine (Town or City)
    APPROXIMATELY 3 MILES FROM West of Hwy 1 and Parish Road 1148 (Crossroads, Railroad, Any Landmark, etc.)
    (Please draw sketch on back of Original)
11. REMARKS: Depth of well ~~doesn't~~ include 2' sump.
12. DRILLER'S LOG (Description and color of cuttings, such as shale, sand, etc. in feet)

FROM	TO	DESCRIPTION	FROM	TO	DESCRIPTION
0	3	gray clay fill			
3	17	gray and brown silty clay			

13. FOR HEAT PUMP ONLY: AVG. DEPTH _____ FT. NUMBER OF HOLES _____
14. ABANDONMENT INFORMATION: DOES THE NEW WELL REPLACE AN EXISTING WELL? YES ☐ NO ☒
15. NAME OF PERSON WHO DRILLED THE WELL: Tom Atherton

(REV. 7/93) CONTRACTOR'S COPY

Layne Environmental Services
Name of Water Well Contractor

LICENSE NUMBER WWC-401

Authorized Signature 4-9-96 Date

MAIL ORIGINAL TO:
LOUISIANA DEPARTMENT OF
TRANSPORTATION AND DEVELOPMENT
ATTN.: CHIEF - WATER RESOURCES SECTION
P.O. BOX 94245
BATON ROUGE, LA 70804-9245
(504) 379-1434

FOR OFFICE USE ONLY
PARISH C47 WELL NO. -6075Z
IDENTIFICATION NUMBER
REVISED COORDINATES
Geologic Unit
Use of Well M
SECTION TOWNSHIP RANGE
ELEV. QUAD. NO.
INPUT BY: _____ DATE: _____
INSPECTED BY: _____ DATE: _____
REMARKS: _____

FOR MONITOR/PIEZO/RECOVERY WELLS ONLY
LATITUDE 301846 LONGITUDE 911849
SECTION 52 TOWNSHIP 9S RANGE 11E
ELEV. 10 QUAD. NO. 164D
SITE ADDRESS: 60825-B Highway 1148
Plaquemine, LA 70764

[redacted] TER [redacted] OUR [redacted] SEC [redacted] N

WATER WELL REGISTRATION SHORT FORM (DOTD-GW-1S)

PLEASE PRINT IN INK OR TYPE WHEN COMPLETING THIS FORM

1. USE OF WELL (Check Appropriate Box)

☐ DOMESTIC ☐ RIG SUPPLY ☒ MONITORING ☐ PIEZOMETER ☐ RECOVERY

☐ HEAT PUMP HOLE ☐ HEAT PUMP SUPPLY ☐ ABANDONED PILOT HOLE ☐ OTHER _____ (Please Specify)

2. WELL OWNER United States Dept of Energy PHONE (504) 734-4277

3. WELL OWNER'S ADDRESS SPR, 900 Commerce Rd East New Orleans, LA 70123

4. OWNER'S WELL NUMBER OR NAME (if any) PMW-7

5. DATE COMPLETED 3-20-96 DEPTH OF HOLE 17 FT. DEPTH OF WELL 15 17 FT.

6. STATIC WATER LEVEL 7 FT. BELOW GROUND SURFACE MEASURED ON _____ (Date)

7. CASING 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER LENGTH 5 FT.

8. SCREEN 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER SLOT SIZE .010 LENGTH 10 FT.

9. CEMENTED FROM 2 FT. TO GROUND SURFACE, USING ☐ PUMP DOWN METHOD OR ☒ GRAVITY METHOD

10. LOCATION OF WELL: PARISH Iberville WELL IS NEAR, Plaquemine (Town or City)

APPROXIMATELY 3 MILES FROM West of Hwy 1 and Parish Road 1148 (Crossroads, Railroad, Any Landmark, etc.)

(Please draw sketch on back of Original)

11. REMARKS: Depth of well ~~doesn't include~~ 2' sump.

12. DRILLER'S LOG (Description and color of cuttings, such as shale, sand, etc. in feet)

FROM	TO	DESCRIPTION	FROM	TO	DESCRIPTION
0	7	gray clay fill			
7	17	gray with brown silty clay			

13. FOR HEAT PUMP ONLY: AVG. DEPTH _____ FT. NUMBER OF HOLES _____

14. ABANDONMENT INFORMATION: DOES THE NEW WELL REPLACE AN EXISTING WELL? YES ☐ NO ☒

15. NAME OF PERSON WHO DRILLED THE WELL: Tom Atherton

(REV. 7/93)

CONTRACTOR'S COPY

Layne Environmental Services
Name of Water Well Contractor

LICENSE NUMBER WWC-401

Authorized Signature

4-9-96
Date

MAIL ORIGINAL TO:

LOUISIANA DEPARTMENT OF
TRANSPORTATION AND DEVELOPMENT
ATTN.: CHIEF - WATER RESOURCES SECTION
P.O. BOX 94245
BATON ROUGE, LA 70804-9245
(504) 379-1434

FOR OFFICE USE ONLY

PARISH 047 WELL NO. -60762

IDENTIFICATION NUMBER

REVISED COORDINATES

Geologic Unit

SECTION TOWNSHIP RANGE

ELEV. QUAD. NO.

Use of Well: M

INPUT BY: _____ DATE: _____

INSPECTED BY: _____ DATE: _____

REMARKS: _____

FOR MONITOR/PIEZO/RECOVERY WELLS ONLY

LATITUDE 301842 LONGITUDE 911834

SECTION 52 TOWNSHIP 19S RANGE 11E

ELEV. 14 QUAD. NO. 164D

SITE ADDRESS: 60825-B Highway 1148
Plaquemine, LA 70764

[redacted] TER [redacted] DUR [redacted] SEC [redacted]

WATER WELL REGISTRATION SHORT FORM (DOTD-GW-1S)

PLEASE PRINT IN INK OR TYPE WHEN COMPLETING THIS FORM

1. USE OF WELL (Check Appropriate Box)

☐ DOMESTIC ☐ RIG SUPPLY ☒ MONITORING ☐ PIEZOMETER ☐ RECOVERY

☐ HEAT PUMP HOLE ☐ HEAT PUMP SUPPLY ☐ ABANDONED PILOT HOLE ☐ OTHER _____ (Please Specify)

2. WELL OWNER United States Dept of Energy PHONE (504) 734-4277

3. WELL OWNER'S ADDRESS SPR, 900 Commerce Rd East New Orleans, LA 70123

4. OWNER'S WELL NUMBER OR NAME (if any) PMW-8

5. DATE COMPLETED 3-21-96 DEPTH OF HOLE 18 FT. DEPTH OF WELL ~~18~~ 13 FT.

6. STATIC WATER LEVEL 10 FT. BELOW GROUND SURFACE MEASURED ON 3-21-96 (Date)

7. CASING 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER LENGTH 6 FT.

8. SCREEN 2 IN. ☐ METAL ☒ PLASTIC ☐ OTHER SLOT SIZE .010 LENGTH 10 FT.

9. CEMENTED FROM 2 FT. TO GROUND SURFACE, USING ☐ PUMP DOWN METHOD OR ☒ GRAVITY METHOD

10. LOCATION OF WELL: PARISH Iberville WELL IS NEAR, Plaquemine (Town or City)

APPROXIMATELY 3 MILES FROM West of Hwy 1 and Parish Road 1148 (Crossroads, Railroad, Any Landmark, etc.)

(Please draw sketch on back of Original)

11. REMARKS: Depth of well ~~doesn~~'t include 2' sump.

12. DRILLER'S LOG (Description and color of cuttings, such as shale, sand, etc. in feet)

FROM	TO	DESCRIPTION	FROM	TO	DESCRIPTION
0	12	gray clayey, silty, sand			
12	18	gray silty clay			

13. FOR HEAT PUMP ONLY: AVG. DEPTH _____ FT. NUMBER OF HOLES _____

14. ABANDONMENT INFORMATION: DOES THE NEW WELL REPLACE AN EXISTING WELL? YES ☐ NO ☒

15. NAME OF PERSON WHO DRILLED THE WELL: Tom Atherton

(REV. 7/93)

CONTRACTOR'S COPY

Layne Environmental Services
Name of Water Well Contractor

LICENSE NUMBER WWC-401

Authorized Signature

4-9-96
Date

MAIL ORIGINAL TO:

LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
ATTN.: CHIEF - WATER RESOURCES SECTION
P.O. BOX 94245
BATON ROUGE, LA 70804-9245
(504) 379-1434

FOR OFFICE USE ONLY

PARISH 047 WELL NO. -6077Z

IDENTIFICATION NUMBER

REVISED COORDINATES

Geologic Unit

SECTION TOWNSHIP RANGE

ELEV. QUAD. NO.

Use of Well: M - 7

INPUT BY: _____ DATE: _____

INSPECTED BY: _____ DATE: _____

REMARKS: _____

FOR MONITOR/PIEZO/RECOVERY WELLS ONLY

LATITUDE 30 17 12 LONGITUDE 91 17 45

SECTION 62 TOWNSHIP 19S RANGE 11E

ELEV. 12 QUAD. NO. 1640

SITE ADDRESS: 60825-B Highway 1148
Plaquemine, LA 70764

APPENDIX C

APPENDIX C

WELL DEVELOPMENT DOCUMENTATION
GROUND WATER SAMPLING FORMS

Well PW-1 Sheet ____ of ____

WELL DEVELOPMENT FIELD DATA

Well ID PW-1
Project SPR - Bayou Choctaw
Project No. 12-01226-001
Date(s) Developed 3-25-96
Personnel BMK
Initial ____
Rig Used ____
Operator ____
Pump/Bailer (Type) ____
(Capacity) ____
Water Source ____
Well ~~Depth~~ Level (Initial) 4.79 ft
(Final) ____ ft
Water ~~Level~~ Depth (Initial) 18.54 ft
(Final) ____ ft

Date Installed 3-19-96
Well Diameter 2"
Screen Intervals
15 ft to 5 ft
____ ft to ____ ft
____ ft to ____ ft
Annulus Diameter 8¼ in
Casing Height 3 ft (above GL)

Purge Volumes
Purge Water (Dev.) ____ gal ____ X 3
Total Minimum Purge Volume ____ gal
Total Volume Purged 34 gal
Volume Measured By ____
Additives ____
Surge Technique ____

Time	Volume of Water Removed	pH	Specific Conductance at 25°C (X1000)	Temperature	Turbidity	Other Physical Characteristics (Clarity, Odor, Particulates, Color)
1040	Initial	6.00	18.82	72.9		Grey very silty water
1100	11	5.94	19.70	72.9		" "
1113	Dry (22)	6.01	19.53	77.0		Grey silty water
1246	Initial	5.61	19.74	78.2		" "
1249	7	5.90	19.37	77.9		" "
1415	Initial	5.86	19.27	77.6		" "
1429	7	5.69	19.90	75.4		" "

Equipment Calibration ____

Comments PID - WH-0 BK-0 B2-0
16-30 Silica sand 17'-4" Bentonite 4'-1"
Grout 1'-0"

Checked By: ____ Date: ____

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Well Pw-2 Sheet ____ of ____

WELL DEVELOPMENT FIELD DATA

Well ID Pw-2
Project SPR - Bayou Choctaw
Project No. 12 01226 001
Date(s) Developed 3-26-96
Personnel ____
Initial ____
Rig Used ____
Operator ____
Pump/Bailer (Type) ____
(Capacity) ____
Water Source ____
Well Depth (Initial) 25.80 ft
(Final) ____ ft
Water Level (Initial) 4.83 ft
(Final) ____ ft

Date Installed 3/9-96
Well Diameter 2"
Screen Intervals
21 ft to 11 ft
____ ft to ____ ft
____ ft to ____ ft
Annulus Diameter 9¼ in
Casing Height 3 ft (above GL)

Purge Volumes
Purge Water (Dev.) ____ gal ____ X 3
Total Minimum purge volume ____ gal
Total Volume Purged 52 gal
Volume Measured By ____
Additives ____
Purge Technique ____

Time	Volume of Water Removed	pH	Specific Conductance at 25°C	Temperature	Turbidity	Other Physical Characteristics (Clarity, Odor, Particulates, Color)
400	Initial	6.31	ADL	60.4		clear/cloudy water
427	18	6.42	ADL	61.6		Brown silty water
1507	36	6.45	ADL	62.0		clear/cloudy water
1545	52	6.39	ADL	61.6		clear water

Equipment Calibration *ADL - ABOVE DETECTABLE LIMIT < 20,000 MICROMHOS

Comments PID WH-0 BK-0 BZ-0
16-30 Silica sand 23-9 Sand sand 9-8
Bentonite 8-5 Grout 5-0

Checked By: ____ Date: ____

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Well PW-4 Sheet ____ of ____

WELL DEVELOPMENT FIELD DATA

Well ID PW-4
Project SPR - Bayou Choctaw
Project No. 12 01226 001
Date(s) Developed 3-26-96
Personnel RDK
Initial ____
Rig Used ____
Operator ____
Pump/Bailer (Type) ____
(Capacity) ____
Water Source ____
Well Depth (Initial) 21.37 ft
(Final) ____ ft
Water Level (Initial) 8.32 ft
(Final) ____ ft

Date Installed 3-18-96
Well Diameter 2"
Screen Intervals
18 ft to 8 ft
____ ft to ____ ft
____ ft to ____ ft
Annulus Diameter 8¼ in
Casing Height 3 ft (above GL)

Purge Volumes
Purge Water (Dev.) ____ gal ____ X 5
Total Minimum purge volume ____ gal
Total Volume Purged 32 gal
Volume Measured By ____
Additives ____
Purge Technique ____

Time	Volume of Water Removed	pH	Specific Conductance @ 25°C (x1000)	Temperature	Turbidity	Other Physical Characteristics (Clarity, Odor, Particulates, Color)
1447	Initial	6.76	6.990	58.5		clear water
1510	10	7.00	5.400	61.6		grey very silty water
1540	20	6.86	5.950	61.3		" "
1620	32	6.84	6.680	62.7		" "

Equipment Calibration ____

Comments PID wtr-0 BK-0 BZ-0
16-30 Silica Sand 20-6 Sugarsand 6-5
Bentonite 5-2 Grout 2-0

Checked By: ____ Date: ____

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Well PW5 Sheet ____ of ____

WELL DEVELOPMENT FIELD DATA

Well ID PW5
Project SPR Bayou Choctaw
Project No. 12-01226-001
Date(s) Developed 3-26-96
Personnel BNK
Initial ____
Rig Used ____
Operator ____
Pump/Bailer (Type) ____
(Capacity) ____
Water Source ____
Well Depth (Initial) 19.69 ft
(Final) ____ ft
Water Level (Initial) 9.01 ft
(Final) ____ ft

Date Installed 3-20-96
Well Diameter 2"
Screen Intervals
____ ft to ____ ft
____ ft to ____ ft
____ ft to ____ ft
Annulus Diameter 8¼ in
Casing Height 3 ft (above GL)

Purge Volumes
Purge Water (Dev.) ____ gal ____ X 5
Total Minimum purge volume ____ gal
Total Volume Purged 31 gal
Volume Measured By ____
Additives ____
Purge Technique ____

Time	Volume of Water Removed	pH	Specific Conductance at 25°C	Temperature	Turbidity	Other Physical Characteristics (Clarity, Odor, Particulates, Color)
1612	Initial	6.27	ADL*	60.3		Brown Silty water
1630	Dry (10)	6.28	ADL*	64.9		Brown slightly silty water
715	Initial	6.00	ADL*	59.5		" "
735	Dry (8)	5.33	ADL*	64.3		" "
815	Initial	3.75	ADL*	70.0		" "
825	Dry (8)	3.98	ADL*	67.5		" "

Equipment Calibration *ADL - ABOVE DETECTABLE LIMIT < 20,000 MICROMHOS

Comments PID - WH - 0 BK - 0 BZ - 0
16-30 Silica Sand 19'-5" Bentonite 5'-2"
Grout 2'-0"

Checked By: ____ Date: ____

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Well PW-6 Sheet ____ of ____

WELL DEVELOPMENT FIELD DATA

Well ID PW-6
Project SPR-12-0226 001
Project No. SPR Bayou Choctaw
Date(s) Developed 3-25-96
Personnel RDK
Initial ____
Rig Used ____
Operator ____
Pump/Bailer (Type) ____
(Capacity) ____
Water Source ____
Well Depth (Initial) 1700 ft
(Final) ____ ft
Water Level (Initial) 630 ft
(Final) ____ ft

Date Installed 3-20-96/3-24-96
Well Diameter 2"
Screen Intervals
15 ft to 5 ft
____ ft to ____ ft
____ ft to ____ ft
Annulus Diameter 8¼ in
Casing Height 3 ft (above GL)

Purge Volumes
Purge Water (Dev.) ____ gal ____ X 5
Total Minimum purge Volume ____ gal
Total Volume Purged 31 gal
Volume Measured By ____
Additives ____
Surge Technique ____

Time	Volume of Water Removed	pH	Specific Conductance at 25°C	Temperature	Turbidity	Other Physical Characteristics (Clarity, Odor, Particulates, Color)
1515	Initial	7.31	ADL	72.8		greysilty water
1532	10	6.16	ADL	70.6		" "
1543	20	6.16	ADL	69.9		" "
1554	31	6.35	ADL	69.0		" "

Equipment Calibration ADL-ABOVE DETECTABLE LIMIT-20,000 MICROMHOS

Comments PTD- WH-0 BK-0 BZ-0
16-30 Silica sand 17'-4" Bentonite 4'-2"
Grout 2'-0"

Checked By: ____ Date: ____

EnecoTech ENVIRONMENTAL CONSULTANTS

Well PW-7 Sheet ____ of ____

WELL DEVELOPMENT FIELD DATA

Well ID PW-7
Project SAR Bayou Chaotaw
Project No. 120226 001
Date(s) Developed 3-26-96
Personnel PDK
Initial ____
Rig Used ____
Operator ____
Pump/Bailer (Type) ____
(Capacity) ____
Water Source ____
Well Depth (Initial) 17.40 ft
(Final) ____ ft
Water Level (Initial) 9.78 ft
(Final) ____ ft

Date Installed 3-20-96
Well Diameter 2"
Screen Intervals
15 ft to 5 ft
____ ft to ____ ft
____ ft to ____ ft
Annulus Diameter 8¼ in
Casing Height 3 ft (above GL)

Purge Volumes
Purge Water (Dev.) ____ gal ____ X 5
Total Minimum purge volume ____ gal
Total Volume Purged 19 gal
Volume Measured By ____
Additives ____
Surge Technique ____

Time	Volume of Water Removed	pH	Specific Conductance at 25°C	Temperature	Turbidity	Other Physical Characteristics (Clarity, Odor, Particulates, Color)
734	Initial	8.36	ADL	59.3		
742	6	7.25	ADL	58.6		
751	12	7.20	ADL	59.2		
800	19	7.15	ADL	58.6		

Equipment Calibration ADL - ABOVE DETECTABLE LIMIT <20,000 MICROMHOS

Comments PID WH-0 BK-0 BZ-0
16-30 Silica Sand 17'-4' Bentonite 4'-2'
Grout 2'-0"

Checked By: ____ Date: ____

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Well PW-8 Sheet ____ of ____

WELL DEVELOPMENT FIELD DATA

Well ID PW-8
Project SPR Bayou Choctaw
Project No. 12 01226 001
Date(s) Developed 3 26 96
Personnel MK
Initial ____
Rig Used ____
Operator ____
Pump/Bailer (Type) ____
(Capacity) ____
Water Source ____
Well Depth (Initial) 18.02 ft
(Final) ____ ft
Water Level (Initial) 6.78 ft
(Final) ____ ft

Date Installed 3-21-96
Well Diameter ____
Screen Intervals
16 ft to 6 ft
____ ft to ____ ft
____ ft to ____ ft
Annulus Diameter 8 1/4 in
Casing Height 3 ft (above GL)

Purge Volumes
Purge Water (Dev.) ____ gal ____ X 5
Total Minimum purge Volume ____ gal
Total Volume Purged 35 gal
Volume Measured By ____
Additives ____
Surge Technique ____

Time	Volume of Water Removed	pH	Specific Conductance at 25°C (x 1000)	Temperature	Turbidity	Other Physical Characteristics (Clarity, Odor, Particulates, Color)
917	Initial	6.48	7.470	58.0		Brown very silty water
934	Dry (11)	6.57	8000	60.4		Brown Silty water
1013	Initial	6.60	7470	60.4		Brown slightly silty water
1029	Dry (7)	6.68	7.140	60.3		" "
1046	Initial	6.60	7.350	60.8		" "
1057	Dry (6	6.61	7350	61		" "

Equipment Calibration ____

Comments PEP- WH-0 BK-0 BZ-0
16-30 Silica sand 18-4' Bentonite 4-2'
Grout 2-0'

Checked By: ____ Date: ____

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GROUND WATER SAMPLING FORM

Bayou Choctaw

GENERAL			
Well ID:	PW-1	**Project No.:**	
Date Purged:		**Date/Time Sampled:**	4-22-96
Field Personnel:	Lincoln Burgess		
Field Equipment:			
Sampling Method:	Bail	**Weather:**	Cloudy Raining
WELL INFORMATION			
Well Diameter (in.):	2"	**General Condition:**	Good
Was well locked upon arrival?	NO	**Was well locked upon completion?**	NO
WATER LEVEL AND PURGE VOLUME INFORMATION (Measurements in feet, tenths of feet and gallons.)			
All measurements taken from:	TOC		
Depth to LNAPL below MP:		**One purge volume (2" dia.) = 0.175 x (A-B)**	2.71
A. Depth to water below MP:	4.39	**One purge volume (4" dia.) = 0.6528 x (A-B)**	
B. Total well depth below MP:	19.92	**3 purge volumes =**	8.15
WELL PURGING AND SAMPLE COLLECTION			
Approximate withdrawal rate:	gpm	**Volume of water purged:**	8.5 gallons
pH meter:	6.8	**SC meter:**	10.99 x 100
pH calibrated at buffer	7.0	**SC calibrated @**	1000 **Date:** 4-22-96

SAMPLE REPLICATE MEASUREMENTS:

	A)	B)	C)	D)
pH std. units	8.88	9.32	7.66	
SC µmhos/cm @25°C	*ADL	*ADL	*ADL	
Temp. °C	75.7	71.9	73.3	

CHAIN-OF-CUSTODY FORMS:

COMMENTS: ADL = Above Detectable Limit < 20,000 Micromhos

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GROUND WATER SAMPLING FORM

GENERAL

Well ID: PW-2 (~~MW-2~~)

Project No.:

Date Purged:

Date/Time Sampled: 4-22-96

Field Personnel: LINCOLN BURGESS

Field Equipment:

Sampling Method: Bail

Weather: Cloudy chance of Rain

WELL INFORMATION

Well Diameter (in.): 2"

General Condition: Good

Was well locked upon arrival? NO

Was well locked upon completion? NO

WATER LEVEL AND PURGE VOLUME INFORMATION
(Measurements in feet, tenths of feet and gallons.)

All measurements taken from: TOC

Depth to LNAPL below MP:

One purge volume (2" dia.) = 0.175 x (A-B) 3.75

A. Depth to water below MP: 4.39

One purge volume (4" dia.) = 0.6528 x (A-B)

B. Total well depth below MP: 25.85

3 purge volumes = 11.26

WELL PURGING AND SAMPLE COLLECTION

Approximate withdrawal rate: gpm

Volume of water purged: 12 gallons

pH meter: 6.8

SC meter: 10.99 x1000

pH calibrated at buffer 7.0

SC calibrated @ 1000

Date: 4-22-96

SAMPLE REPLICATE MEASUREMENTS:

	A]	B]	C]	D]
pH std. units	9.94	10.68	9.98	
SC µmhos/cm @25°C	>ADL	>ADL	>ADL	
Temp. °C	76	74.3	78.1	

CHAIN-OF-CUSTODY FORMS:

COMMENTS: >ADL = ABOVE DETECTABLE LIMIT <20,000 MICROMHOS

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ENVIRONMENTAL CONSULTANTS

GROUND WATER SAMPLING FORM

GENERAL

Well ID: ~~MW-5~~ PW-4 Project No.:

Date Purged: ~~4-22-96~~ Date/Time Sampled: 4-22-96

Field Personnel: LINCOLN BURGESS

Field Equipment:

Sampling Method: Bail Weather: Cloudy Chance of Rain

WELL INFORMATION

Well Diameter (in.): 2" General Condition: Good

Was well locked upon arrival? NO Was well locked upon completion? NO

WATER LEVEL AND PURGE VOLUME INFORMATION
(Measurements in feet, tenths of feet and gallons.)

All measurements taken from: TOC

Depth to LNAPL below MP:

A. Depth to water below MP: 7.24

B. Total well depth below MP: 18.31

One purge volume (2" dia.) = 0.175 x (A-B) 1.93

One purge volume (4" dia.) = 0.6528 x (A-B)

3 purge volumes = 5.81

WELL PURGING AND SAMPLE COLLECTION

Approximate withdrawal rate: gpm Volume of water purged: 6.0 gallons

pH meter: 6.8 SC meter: 10.94 X100

pH calibrated at buffer 7.0 SC calibrated @ 1000 Date: 4-22-96

SAMPLE REPLICATE MEASUREMENTS:

	A)	B)	C)	D)
pH std. units	8.94	8.87	9.77	
SC µmhos/cm @25°C	6.17 X1000	4.55 X1000	4.23 X1000	
Temp. °C	76	73.6	72.9	

CHAIN-OF-CUSTODY FORMS:

COMMENTS:

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ENVIRONMENTAL CONSULTANTS

GROUND WATER SAMPLING FORM

GENERAL

Well ID: ~~PW-6~~ PW-5 Project No.:

Date Purged: Date/Time Sampled: 4-22-96

Field Personnel: Lincoln Borgess

Field Equipment:

Sampling Method: Bail Weather: Cloudy chance of Rain

WELL INFORMATION

Well Diameter (in.): 2" General Condition: Good

Was well locked upon arrival? NO Was well locked upon completion? NO

WATER LEVEL AND PURGE VOLUME INFORMATION
(Measurements in feet, tenths of feet and gallons.)

All measurements taken from: TOC

Depth to LNAPL below MP: One purge volume (2" dia.) = 0.175 x (A-B) 2.43

A. Depth to water below MP: 8.21 One purge volume (4" dia.) = 0.6528 x (A-B)

B. Total well depth below MP: 22.10 3 purge volumes = 7.29

WELL PURGING AND SAMPLE COLLECTION

Approximate withdrawal rate: gpm Volume of water purged: 7.5 gallons

pH meter: 6.8 SC meter: 10.94 x100

Date: 4-22-96

pH calibrated at buffer 7.0 SC calibrated @ 1000

SAMPLE REPLICATE MEASUREMENTS:

	A)	B)	C)	D)
pH std. units	9.12	10.84	10.86	
SC µmhos/cm @25°C	NADL	NADL	NADL	
Temp. °C	76	72.6	74	

CHAIN-OF-CUSTODY FORMS:

COMMENTS: NADL - ~~ABOVE~~ DETECTABLE LIMIT < 20,000 MICROMHOS

EnecoTech
ENVIRONMENTAL CONSULTANTS

GROUND WATER SAMPLING FORM

GENERAL

Well ID: ~~MW-5~~ PW-6 Project No.: 12-01226-001

Date Purged: 3-25-96 ~~4-22-96~~ Date/Time Sampled: 4-22-96

Field Personnel: LINCOLN BURGESS

Field Equipment: ORS

Sampling Method: Bail Weather: Cloudy chance of Rain

WELL INFORMATION

Well Diameter (in.): 2" General Condition: GOOD

Was well locked upon arrival? NO Was well locked upon completion? NO

WATER LEVEL AND PURGE VOLUME INFORMATION
(Measurements in feet, tenths of feet and gallons.)

All measurements taken from: TOC

Depth to LNAPL below MP: _____ One purge volume (2" dia.) = 0.175 x (A-B) 2.455

A. Depth to water below MP: 6.00 One purge volume (4" dia.) = 0.6528 x (A-B) _____

B. Total well depth below MP: 20.03 3 purge volumes = 7.365

WELL PURGING AND SAMPLE COLLECTION

Approximate withdrawal rate: _____ gpm Volume of water purged: 7.5 gallons

pH meter: 6.8 SC meter: 10.94 X100

pH calibrated at buffer 7.0 SC calibrated @ 1000 Date: 4-22-96

SAMPLE REPLICATE MEASUREMENTS:

	A)	B)	C)	D)
pH std. units	8.58	8.74	8.97	
SC µmhos/cm @25°C	5.23x1000	4.34x1000	3.97x1000	
Temp. °C	75°	73°	72°	

CHAIN-OF-CUSTODY FORMS: _____

COMMENTS: _____

EnecoTech
ENVIRONMENTAL CONSULTANTS

GROUND WATER SAMPLING FORM

GENERAL

Well ID: ~~[redacted]~~ PW-7 Project No.:

Date Purged: Date/Time Sampled: 4-22-96

Field Personnel: LINCOLN BURGESS

Field Equipment:

Sampling Method: Bail Weather: Cloudy chance of Rain

WELL INFORMATION

Well Diameter (in.): 2" General Condition: good

Was well locked upon arrival? NO Was well locked upon completion? NO

WATER LEVEL AND PURGE VOLUME INFORMATION
(Measurements in feet, tenths of feet and gallons.)

All measurements taken from: TOC

Depth to LNAPL below MP: One purge volume (2" dia.) = 0.175 x (A-B) 1.82

A. Depth to water below MP: 9.33 One purge volume (4" dia.) = 0.6528 x (A-B)

B. Total well depth below MP: 19.75 3 purge volumes = 5.47

WELL PURGING AND SAMPLE COLLECTION

Approximate withdrawal rate: gpm Volume of water purged: 6.0 gallons

pH meter: 7.08 SC meter: 10.94 x100

pH calibrated at buffer 7.0 SC calibrated @ 1000 Date: 4-22-96

SAMPLE REPLICATE MEASUREMENTS:

	A)	B)	C)	D)
pH std. units	9.38	10.73	10.89	
SC µmhos/cm @25°C	2.27x1000	2.10 x1000	2.10	
Temp. °C	73.1°F	70.1	70.0	

CHAIN-OF-CUSTODY FORMS:

COMMENTS:

APPENDIX D

APPENDIX D

BOREHOLE LOGS/WELL COMPLETION DIAGRAMS

EnecoTech
ENVIRONMENTAL CONSULTANTS

BOREHOLE LOG – PW-1

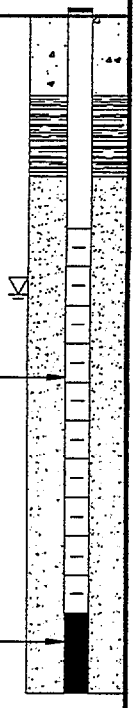
Page 1 of 1

Project Name: SPR – Bayou Choctaw
Project Number: 12-01226-001
Location: 60825 Hwy. 1148 Plaquemine, Louisana
T R SEC QTR QTR
Northing: _____ Easting: _____
Ground Surface Elev.: _____
Property Owner/Contact: _____

Date(s) Drilled: 03/19/96
Logged By: R. Knight
Contractor: Layne
Drill Rig/Method: Hollow Stem Auger
Sampling Method: Continuous
Borehole Diam.: 8-1/4" Drilling Fluid: None
Depth to Water: 7' Total Depth: 17'
Application: Testhole/Monitoring Well

Depth (ft)	Lithology	Samples	Color	Org. Vapor (ppm)	Penatration Resistance	Recovery %	USCS Code	Lithologic Description
			DK BROWN	0	0.50	100	CL	0.0–3.0' Clay silty – dark brown to gray, soft, moist, roots.
5			DK BROWN	0	0.50	100		3.0–8.0' Clay silty – dark brown to gray, moist, soft, root mass, iron deposits. Peat layer at 3.5'.
10			DK BROWN	0	0.75	100		8.0–13.0' Clay silty – dark brown to gray, medium moist.
				0	0.25			
15			GRAY	0	0.50	100		13.0–17.0' Clay sandy – very fine grained, gray, soft, wet.
20								
25								

Well Completion



122601P1.DWG

Comments:
GROUT BENTONITE SAND
STATIC WATER LEVEL

EnecoTech
ENVIRONMENTAL CONSULTANTS

BOREHOLE LOG – PW-2

Page 1 of 1

Project Name: SPR – Bayou Choctaw
Project Number: 12-01226-001
Location: 60825 Hwy. 1148 Plaquemine, Louisana
T R SEC QTR QTR
Northing: _____ Easting: _____
Ground Surface Elev.: _____
Property Owner/Contact: _____

Date(s) Drilled: 03/19/96
Logged By: R. Knight
Contractor: Layne
Drill Rig/Method: Hollow Stem Auger
Sampling Method: Continuous
Borehole Diam.: 8-1/4" Drilling Fluid: None
Depth to Water: 18' Total Depth: 23'
Application: Testhole/Monitoring Well

Depth (ft)	Color	Org. Vapor (ppm)	Penetration Resistance	Recovery %	USCS Code	Lithologic Description
						0.0–0.5' Road base and clay.
	BROWN	0	0.50	100	CL	0.5–3.0' Clay silty – brown to gray, medium moist, black organic material at 3'.
5	GRAY–BLK	5.0	0.25	5		3.0–8.0' Clay silty – sandy, very fine grained, gray–black, soft, moist, some roots.
10	GRAY	0	0.50	10		8.0–13.0' Clay silty – gray, medium moist, some roots.
15	GRAY	0	0.50	100		13.0–18.0' Clay silty – gray, medium moist, root mass.
20	BROWN	0	0.25	100		18.0–22.0' Clay sandy – very fine grained, brown, soft, wet.
	GRAY	0	0.50	100		22.0–23.0' Peat layer. 23.0' Clay silty – gray, medium moist.
25						

Well Completion

122601P2.DWG

Comments: GROUT BENTONITE SAND
STATIC WATER LEVEL

EnecoTech
ENVIRONMENTAL CONSULTANTS

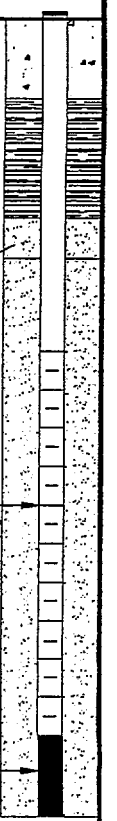
BOREHOLE LOG – PW-4

Project Name: SPR – Bayou Choctaw
Project Number: 12-01226-001
Location: 60825 Hwy. 1148 Plaquemine, Louisana
T R SEC QTR QTR
Northing: _____ Easting: _____
Ground Surface Elev.: _____
Property Owner/Contact: _____

Date(s) Drilled: 03/18/96
Logged By: R. Knight
Contractor: Layne
Drill Rig/Method: Hollow Stem Auger
Sampling Method: Continuous
Borehole Diam.: 8-1/4" Drilling Fluid: None
Depth to Water: 13' Total Depth: 20'
Application: Testhole/Monitoring Well

Depth (ft)	Color	Org. Vapor (ppm)	Penatration Resistance	Recovery %	USCS Code	Lithologic Description
0	DK BROWN	0	0.5	100	CL	0.0–3.0' Clay – silty, dark brown–gray, mottled, iron deposits, calcium nodules, moist, some roots. Peat layer at 3'.
5	DK GRAY	0	0.5	100		3.0–8.0' Clay silt – dark gray, brown mottling, some roots.
10	LT BROWN	0	0.5	100		8.0–13.0' Clay silt – light brown to gray, mottled, some roots.
15	BLUE–GRY	0	0.5	100	ML	13.0–20.0' Silt sand – very fine grained, blue–gray, wet at 13', some roots, iron deposits.
20						
25						

Well Completion



122601P4.DWG

Comments: GROUT BENTONITE SAND
STATIC WATER LEVEL

EnecoTech
ENVIRONMENTAL CONSULTANTS

BOREHOLE LOG – PW-5

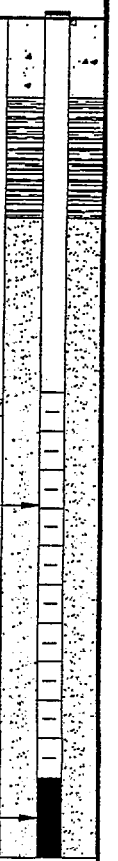
Page 1 of 1

Project Name: SPR – Bayou Choctaw
Project Number: 12-01226-001
Location: 60825 Hwy. 1148 Plaquemine, Louisana
T R SEC QTR QTR
Northing: _____ Easting: _____
Ground Surface Elev.: _____
Property Owner/Contact: _____

Date(s) Drilled: 03/20/96
Logged By: R. Knight
Contractor: Layne
Drill Rig/Method: Hollow Stem Auger
Sampling Method: Continuous
Borehole Diam.: 8-1/4" Drilling Fluid: None
Depth to Water: 10' Total Depth: 23'
Application: Testhole/Monitoring Well

Depth (ft)	Lithology	Samples	Color	Org. Vapor (ppm)	Penatration Resistance	Recovery %	USCS Code	Lithologic Description
			BROWN	0	1.00	100	CL	0.0–3.0' Clay silty – brown to gray, medium, root mass, moist, iron deposits. Peat layer at 3'.
5			BROWN	0	0.50	100		3.0–8.0' Clay silty – brown to gray, medium, mottled, moist, some iron deposits.
10			GRAY	0	1.00	100		8.0–13.0' Clay silty – gray, brown mottling, medium, moist, root mass, iron deposits.
15			GRAY	0	1.00	100		13.0–18.0' Clay sily – gray, medium, moist.
20			GRAY-OLV	0	0.50	100	ML	18.0–23.0' Silt clayey – gray-olive, medium wet, root mass.
25								

Well Completion



122601P5.DWG

Comments: GROUT BENTONITE SAND
▽ SIATIC WATER LEVEL

EnecoTech
ENVIRONMENTAL CONSULTANTS

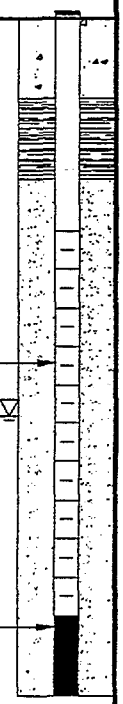
BOREHOLE LOG – PW-6

Project Name: SPR – Bayou Choctaw
Project Number: 12-01226-001
Location: 60825 Hwy. 1148 Plaquemine, Louisana
T R SEC QTR QTR
Northing: _____ Easting: _____
Ground Surface Elev.: _____
Property Owner/Contact: _____

Date(s) Drilled: 03/20/96–03/21/96
Logged By: R. Knight
Contractor: Layne
Drill Rig/Method: Hollow Stem Auger
Sampling Method: Continuous
Borehole Diam.: 8-1/4" Drilling Fluid: None
Depth to Water: 10' Total Depth: 17'
Application: Testhole/Monitoring Well

Depth (ft)	Lithology	Samples	Color	Org. Vapor (ppm)	Penetration Resistance	Recovery %	USCS Code	Lithologic Description
				0	0.25	100	CL	0.0–7.0' Clay – silty, brown–gray, soft, mottled, root mass, moist.
			BROWN	0	0.50	100		
5								
10			GRAY	0	0.50	100		7.0–12.0' Clay – silty, gray, medium, moist to wet root mass.
15			BROWN	0	0.50	100		12.0–17.0' Clay – sandy, very fine grained, medium, wet root mass.
20								
25								

Well Completion



122601P6.DWG

Comments: GROUT BENTONITE SAND
STATIC WATER LEVEL

EnecoTech
ENVIRONMENTAL CONSULTANTS

BOREHOLE LOG – PW-7

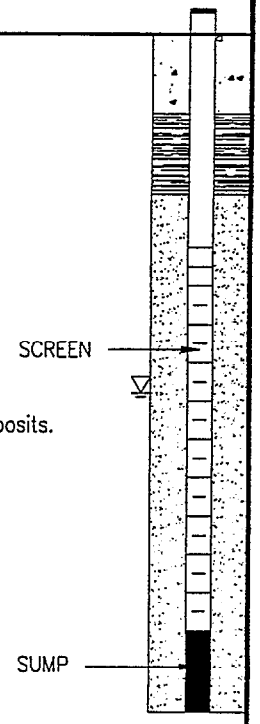
Page 1 of 1

Project Name: SPR – Bayou Choctaw
Project Number: 12-01226-001
Location: 60825 Hwy. 1148 Plaquemine, Louisana
T R SEC QTR QTR
Northing: _____ Easting: _____
Ground Surface Elev.: _____
Property Owner/Contact: _____

Date(s) Drilled: 03/20/96
Logged By: R. Knight
Contractor: Layne
Drill Rig/Method: Hollow Stem Auger
Sampling Method: Continuous
Borehole Diam.: 8-1/4" Drilling Fluid: None
Depth to Water: 9' Total Depth: 17'
Application: Testhole/Monitoring Well

Depth (ft)	Lithology	Samples	Color	Org. Vapor (ppm)	Penatration Resistance	Recovery %	USCS Code	Lithologic Description
			BROWN	0	0.25	20		0.0–8.0' Road base – brown/white.
				0	0.75	30		
10			DK BROWN	0	0.25	30	CL	8.0–17.0' Clay – silty, dark brown–gray, soft, iron deposits.
				0	0.25	40		
15				0	0.25	10		

Well Completion



122601P7.DWG

Comments: GROUT BENTONITE SAND
STATIC WATER LEVEL

EnecoTech
ENVIRONMENTAL CONSULTANTS

BOREHOLE LOG – PW-8

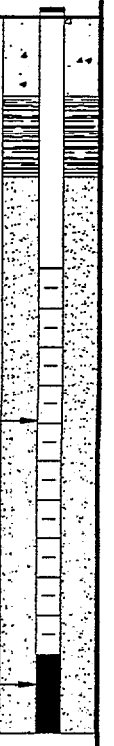
Page 1 of 1

Project Name: SPR – Bayou Choctaw
Project Number: 12-01226-001
Location: 60825 Hwy. 1148 Plaquemine, Louisana
T R SEC QTR QTR
Northing: _____ Easting: _____
Ground Surface Elev.: _____
Property Owner/Contact: _____

Date(s) Drilled: 03/21/96
Logged By: R. Knight
Contractor: Layne
Drill Rig/Method: Hollow Stem Auger
Sampling Method: Continuous
Borehole Diam.: 8-1/4" Drilling Fluid: None
Depth to Water: 12' Total Depth: 18'
Application: Testhole/Monitoring Well

Depth (ft)	Lithology	Samples	Color	Org. Vapor (ppm)	Penatration Resistance	Recovery %	USCS Code	Lithologic Description
						100		0.0–2.0' Fill material, clay – silty, sandy, fine to medium grained gravels.
			GRAY	0	0.50		CL	2.0–3.0' Clay – silty, gray, medium, moist, root mass.
5			BLACK	0	0.50	100		3.0–7.0' Clay – silty, black, medium, moist, odor observed,
			GRAY	0	0.50	100		7.0–11.0' Clay silty – gray, medium moist, root mass.
10			TAN	0	0.0	100	SP	11.0–12.0' Sand – medium to fine grained, oolitic, silica, wet.
15			GRAY	0	1.00	100	CL	12.0–18.0' Clay silty – moist, root mass, gray, brown mottling, medium, iron deposits.
20								
25								

Well Completion



12260.1P8.DWG

Comments: GROUT BENTONITE SAND
STATIC WATER LEVEL

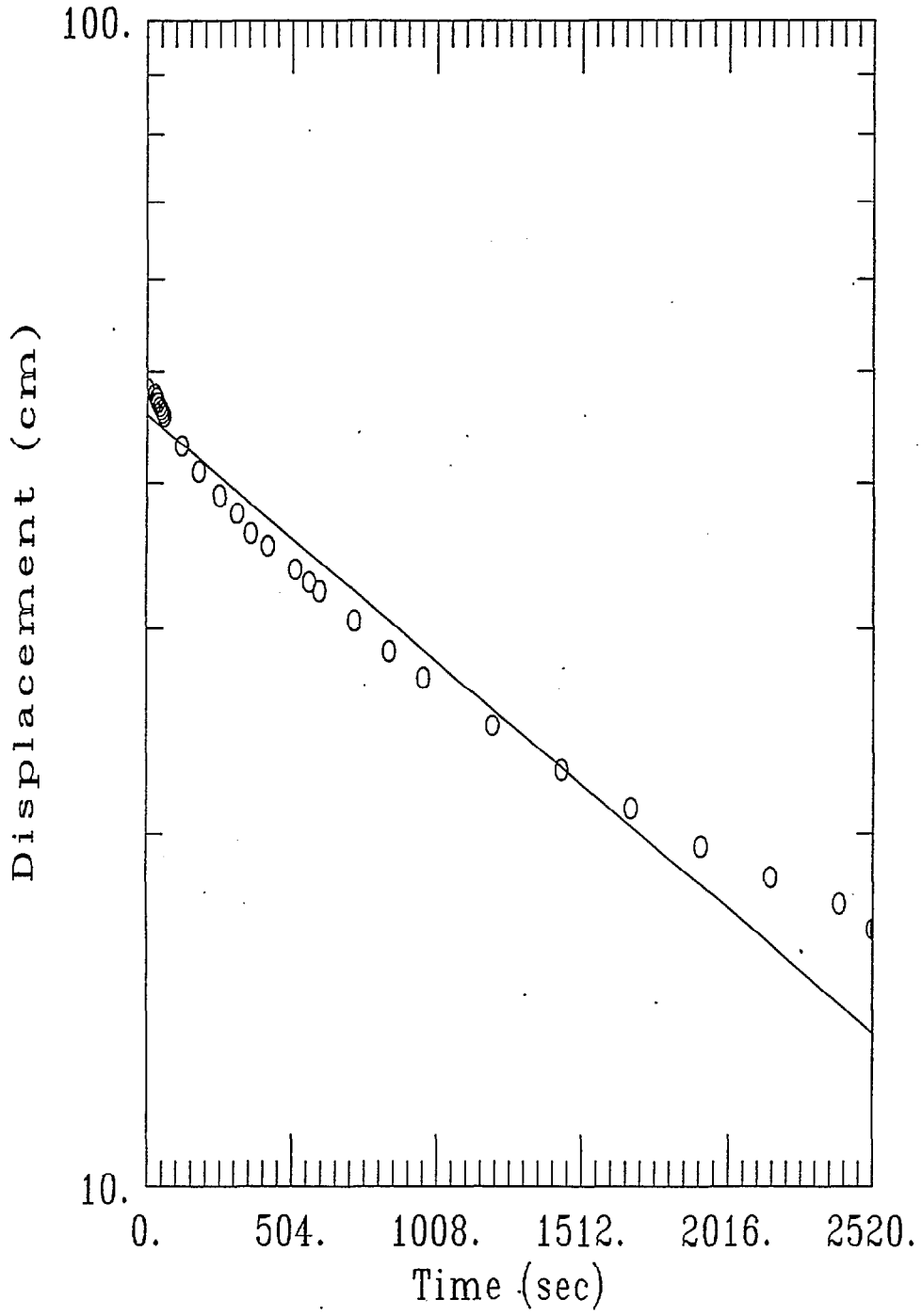
APPENDIX E

SLUG TEST PLOTS

EnecoTech Inc.
ENVIRONMENTAL CONSULTANTS

PROJECT:	SPR- BAYOU CHOCTAW
JOB No.: 12-01226-001	FILE No.: 112601P1.CDR
ADDRESS:	60825 HIGHWAY 1148 PLAQUEMINE LOUISIANA

BAYOU CHOCTAW PW-1



Key:
K= cm/sec
Yø = cm

Aquifer Type:

UNCONFINED

Solution Method:

BOUWER AND RICE

Estimated Parameters:

K = 1.899×10^{-5}

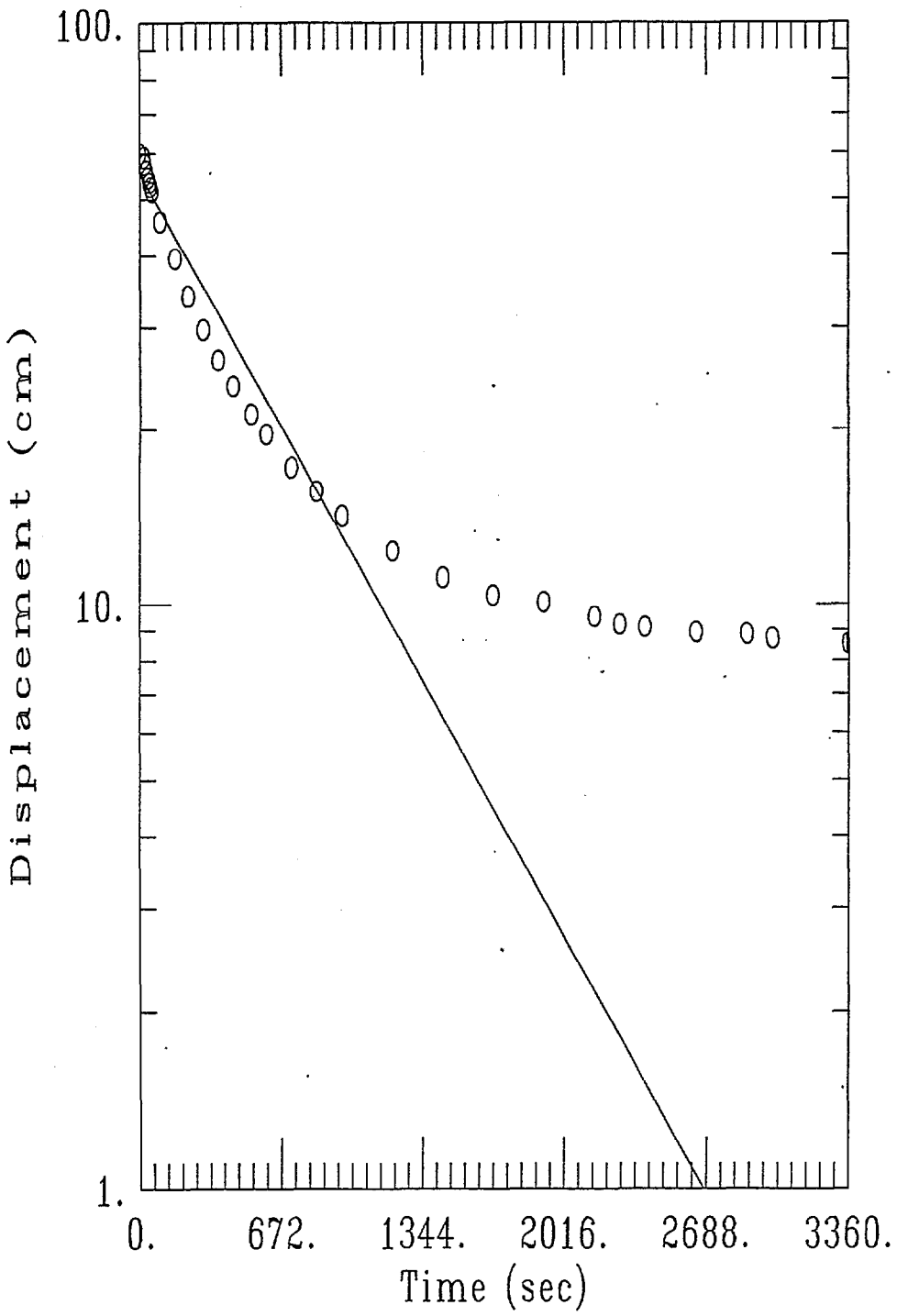
Yø =45.81

Slug Test Data:

EnecoTech Inc.
ENVIRONMENTAL CONSULTANTS

PROJECT: SPR- BAYOU CHOCTAW		
JOB No.: 12-01226-001	FILE No.: 112601P2.CDR	ADDRESS: 60825 HIGHWAY 1148 PLAQUEMINE LOUISIANA

BAYOU CHOCTAW PW-2



Key:
K= cm/sec
Yø = cm

Aquifer Type:

UNCONFINED

Solution Method:

BOUWER AND RICE

Estimated Parameters:

K = 6.487×10^{-5}

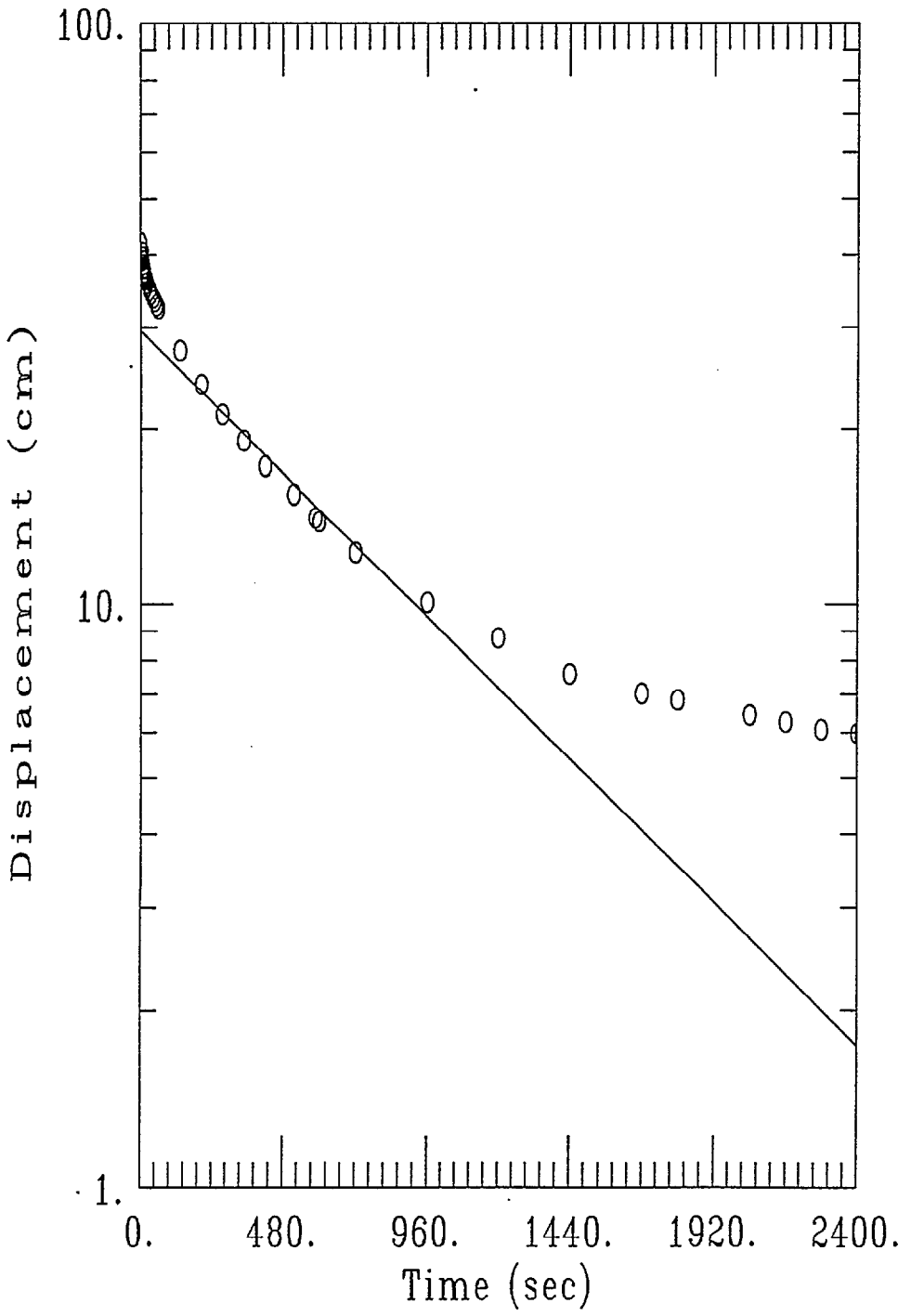
Yø = 55.42

Slug Test Data:

EnecoTech Inc.
ENVIRONMENTAL CONSULTANTS

		PROJECT: SPR- BAYOU CHOCTAW
JOB No.: 12-01226-001	FILE No.: 112601P4.CDR	ADDRESS: 60825 HIGHWAY 1148 PLAQUEMINE LOUISIANA

BAYOU CHOCTAW PW-4



Key:
K= cm/sec
Yø = cm

Aquifer Type:

UNCONFINED

Solution Method:

BOUWER AND RICE

Estimated Parameters:

K = 4.66×10^{-5}

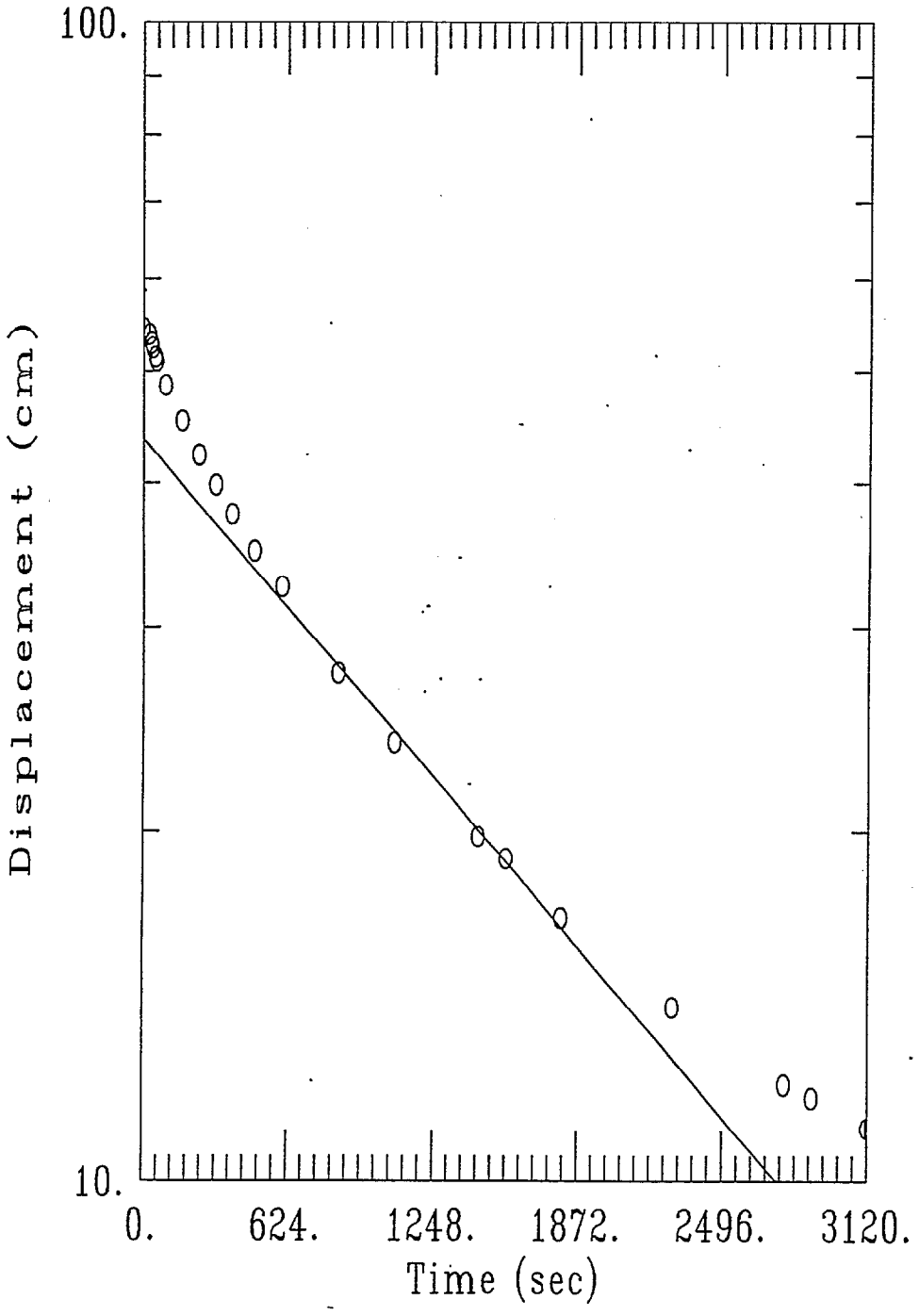
Yø = 29.59

Slug Test Data:

EnecoTech Inc.
ENVIRONMENTAL CONSULTANTS

	PROJECT: SPR- BAYOU CHOCTAW	
JOB No.: 12-01226-001	FILE No.: 112601P5.CDR	ADDRESS: 60825 HIGHWAY 1148 PLAQUEMINE LOUISIANA

BAYOU CHOCTAW PW-5



Key:
K= cm/sec
Yø = cm

Aquifer Type:

UNCONFINED

Solution Method:

BOUWER AND RICE

Estimated Parameters:

K = 2.025×10^{-5}

Yø = 43.64

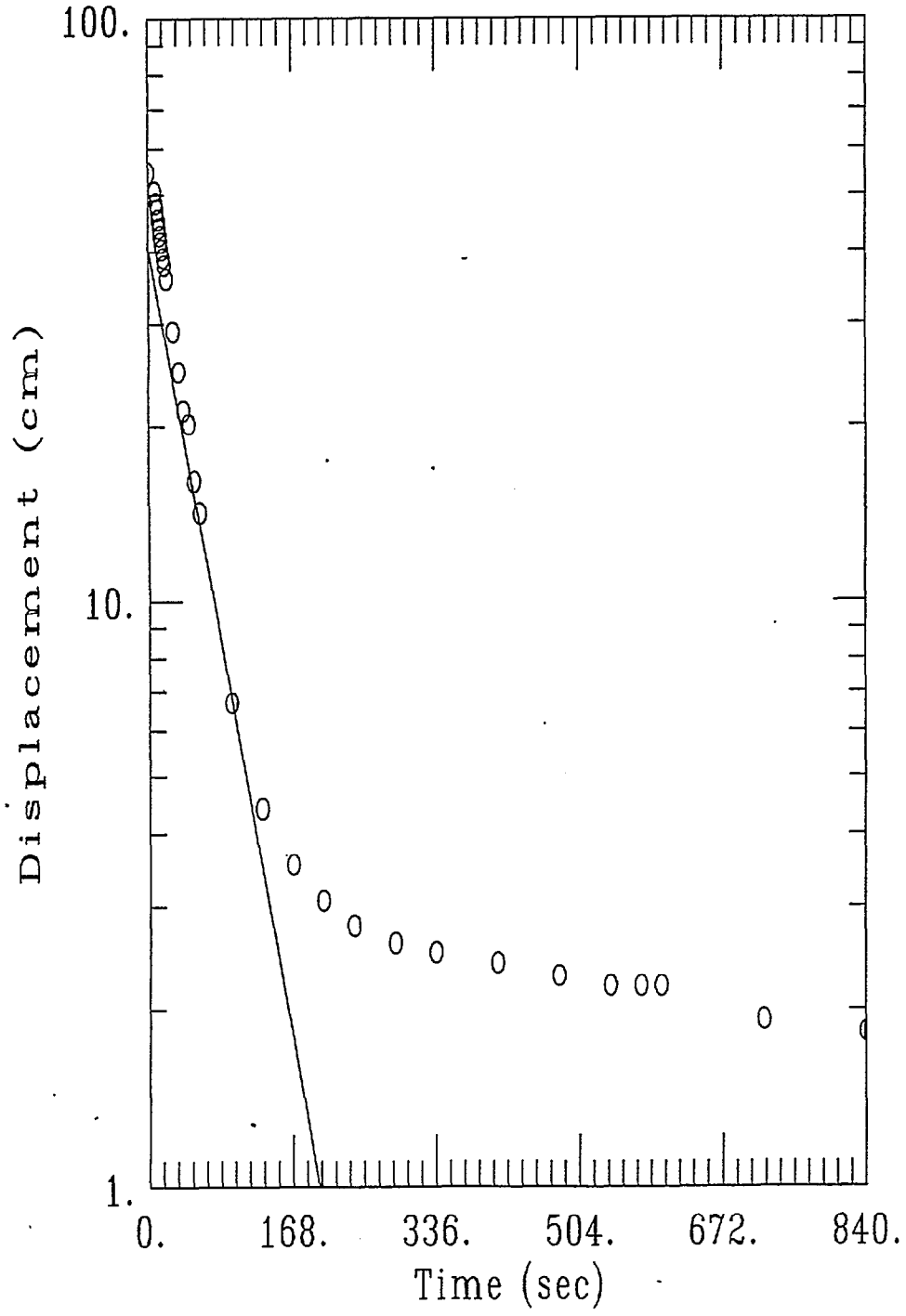
Slug Test Data:

EnecoTech Inc.
ENVIRONMENTAL CONSULTANTS

		PROJECT: SPR- BAYOU CHOCTAW
JOB No.: 12-01226-001	FILE No.: 112601P6.CDR	ADDRESS: 60825 HIGHWAY 1148 PLAQUEMINE LOUISIANA

BAYOU CHOCTAW PW-6

Key:
K= cm/sec
Yø = cm



Aquifer Type:

UNCONFINED

Solution Method:

BOUWER AND RICE

Estimated Parameters:

K = 7.007 x 10 $^{-4}$

Yø = 40.47

Slug Test Data:

EnecoTech Inc.
ENVIRONMENTAL CONSULTANTS

JOB No.:	FILE No.:	PROJECT:	ADDRESS:
12-01226-001	112601P7.CDR	SPR-BAYOU CHOCTAW	60825 HIGHWAY 1148 PLAQUEMINE LOUISIANA

BAYOU CHOCTAW PW-7

Key:
K= cm/sec
Yø = cm

Aquifer Type:

UNCONFINED

Solution Method:

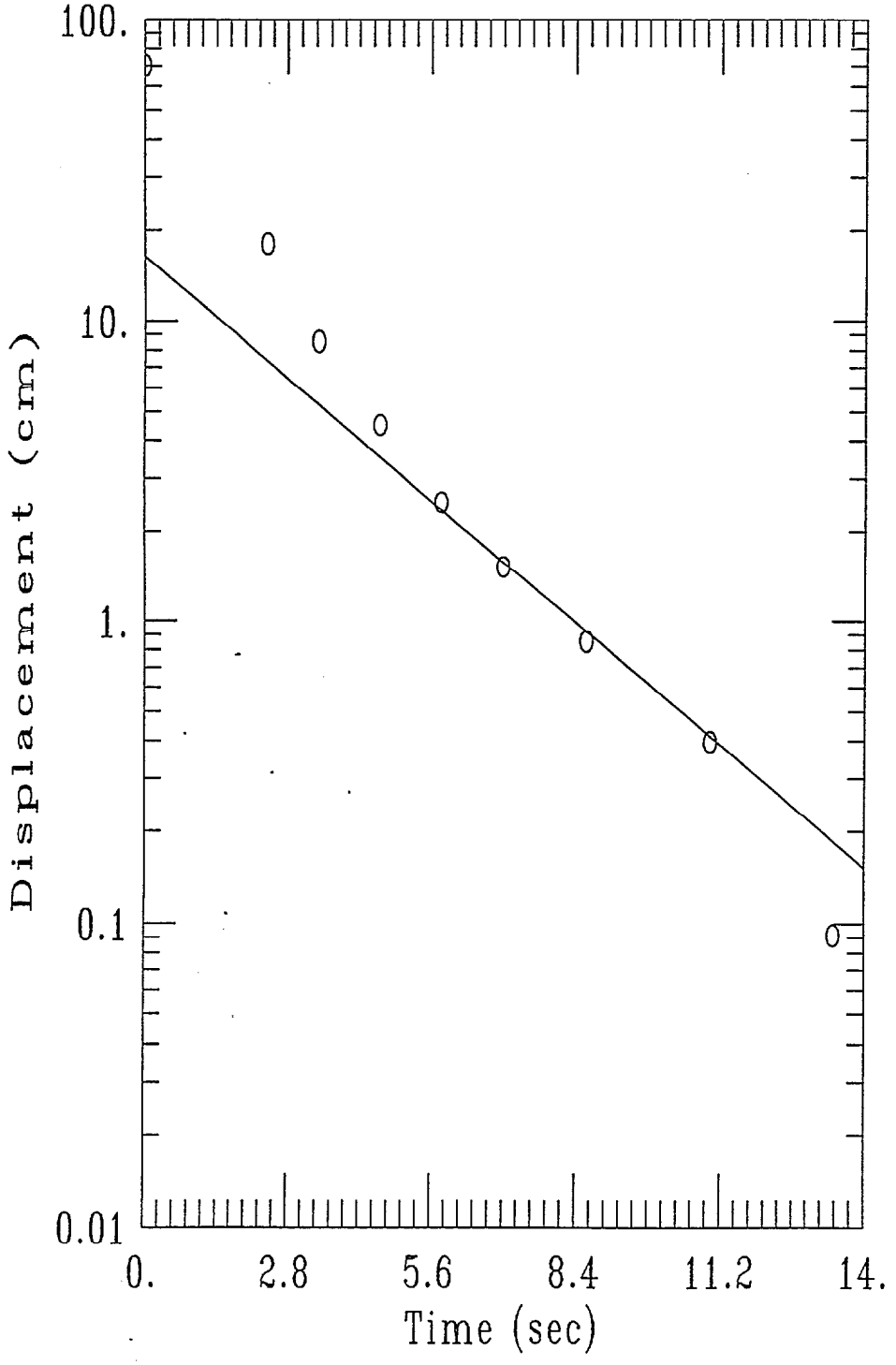
BOUWER AND RICE

Estimated Parameters:

K = 1.083 x 10^{-2}

Yø = 16.43

Slug Test Data:

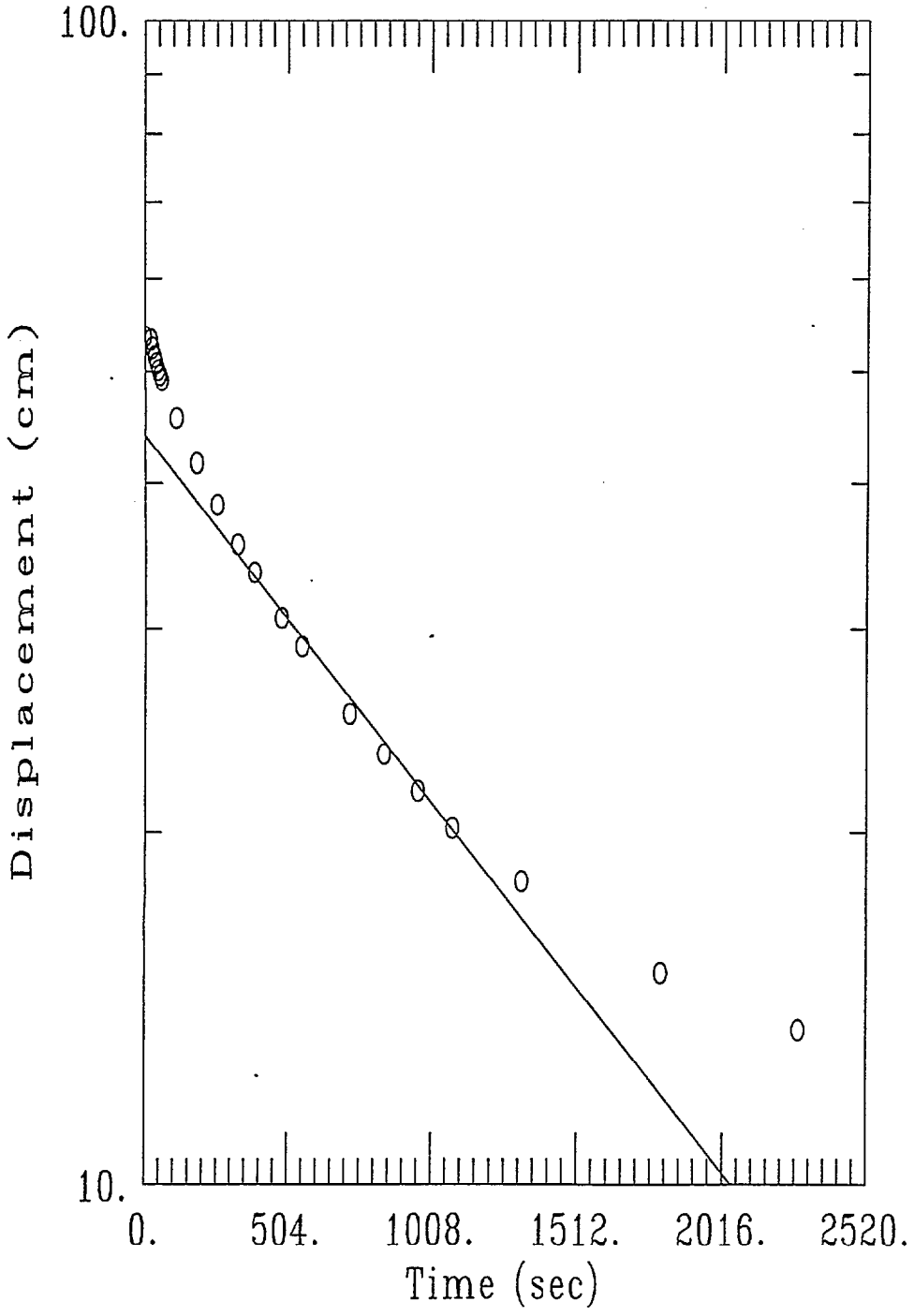


EnecoTech Inc.
ENVIRONMENTAL CONSULTANTS

PROJECT:	SPR- BAYOU CHOCTAW
JOB No.: 12-01226-001	FILE No.: 112601P8.CDR
ADDRESS:	60825 HIGHWAY 1148 PLAQUEMINE LOUISIANA

BAYOU CHOCTAW PW-8

Key:
K= cm/sec
Yø = cm



Aquifer Type:

UNCONFINED

Solution Method:

BOUWER AND RICE

Estimated Parameters:

K = 2.78 x 10 $^{-5}$

Yø = 43.91

Slug Test Data:

APPENDIX F

DISTRIBUTION CURVES AND LABORATORY REPORTS

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-01

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-1-13' TAG #1399

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/19/96 08:35:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS MICROMETER	% BY WEIGHT	UNITS
300	83.19	Weight %
250	6.15	Weight %
180	1.57	Weight %
150	1.64	Weight %
125	1.68	Weight %
106	0.88	Weight %
75	3.59	Weight %
38	1.30	Weight %
PAN	0.00	Weight %

ANALYZED BY: LB
DATE/TIME: 04/10/96 11:00:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco Jr
Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-02

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-1-16' TAG #1400

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/19/96 08:50:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS MICROMETER	% BY WEIGHT	UNITS
300	23.23	Weight %
250	1.27	Weight %
180	3.24	Weight %
150	3.64	Weight %
125	3.34	Weight %
106	3.39	Weight %
75	17.60	Weight %
38	27.00	Weight %
PAN	17.29	Weight %

ANALYZED BY: LB
DATE/TIME: 04/10/96 11:40:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

DB Coco

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-03

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-2-20' TAG #1402

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/19/96 13:25:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS MICROMETER	% BY WEIGHT	UNITS
300	16.62	Weight %
250	2.00	Weight %
180	3.75	Weight %
150	7.59	Weight %
125	9.32	Weight %
106	10.01	Weight %
75	29.97	Weight %
38	13.59	Weight %
PAN	7.15	Weight %

ANALYZED BY: LB
DATE/TIME: 04/10/96 13:30:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-04

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-4-16' TAG #1397

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/18/96 15:55:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS MICROMETER	% BY WEIGHT	UNITS
300	36.52	Weight %
250	1.96	Weight %
180	7.81	Weight %
150	7.39	Weight %
125	10.95	Weight %
106	2.35	Weight %
75	15.99	Weight %
38	13.01	Weight %
PAN	4.20	Weight %

ANALYZED BY: LB
DATE/TIME: 04/10/96 15:00:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Cocco

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-05

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-5-13' TAG #1404

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/20/96 08:00:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS MICROMETER	% BY WEIGHT	UNITS
300	67.46	Weight %
250	6.46	Weight %
180	11.65	Weight %
150	9.49	Weight %
125	2.32	Weight %
106	0.30	Weight %
75	1.25	Weight %
38	1.07	Weight %
PAN	0.00	Weight %

ANALYZED BY: LB
DATE/TIME: 04/10/96 16:00:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco /-
Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-06

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-6-16' TAG #1408

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/20/96 06:50:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS MICROMETER	% BY WEIGHT	UNITS
300	34.61	Weight %
250	1.46	Weight %
180	2.84	Weight %
150	4.70	Weight %
125	3.49	Weight %
106	3.88	Weight %
75	20.65	Weight %
38	18.04	Weight %
PAN	10.33	Weight %

ANALYZED BY: LB
DATE/TIME: 04/10/96 17:00:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-07

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-7-10' TAG #1406

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/20/96 12:50:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS MICROMETER	% BY WEIGHT	UNITS
300	70.87	Weight %
250	15.28	Weight %
180	7.08	Weight %
150	6.77	Weight %
125	0.40	Weight %
106	0.64	Weight %
75	0.77	Weight %
38	0.18	Weight %
PAN	0.00	Weight %

ANALYZED BY: LB
DATE/TIME: 04/11/96 08:00:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9603C55-08

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #1035-1037
04/15/96

PROJECT: SPR BAYOU CHOCTAW, LA
SITE:
SAMPLED BY: ENECOTECH
SAMPLE ID: BC-MW-8-15' TAG #1410

PROJECT NO: 1201226001
MATRIX: SOIL
DATE SAMPLED: 03/21/96 10:55:00
DATE RECEIVED: 03/29/96

SIEVE ANALYSIS

MICROMETER	% BY WEIGHT	UNITS
300	56.51	Weight %
250	14.28	Weight %
180	11.29	Weight %
150	9.41	Weight %
125	3.14	Weight %
106	0.99	Weight %
75	2.39	Weight %
38	1.05	Weight %
PAN	0.94	Weight %

ANALYZED BY: LB
DATE/TIME: 04/11/96 09:00:00
NOTES: ND - Not Detected
NA - Not Analyzed

COMMENTS:

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco /—
Bo Blankfield, Laboratory Director

EnecoTech
ENVIRONMENTAL CONSULTANTS

9603C55

CHAIN OF CUSTODY RECORD

9700 Richmond Ave. • Suite 108 • Houston, TX 77042

COC MI # 1035

PROJ. NO.	PROJECT NAME
12-01226	SPR Bayou Choctaw LA.

SAMPLERS: (Signature) Roger Nagle

Ship To: SPL
20 Ambassador Caffery Pkwy

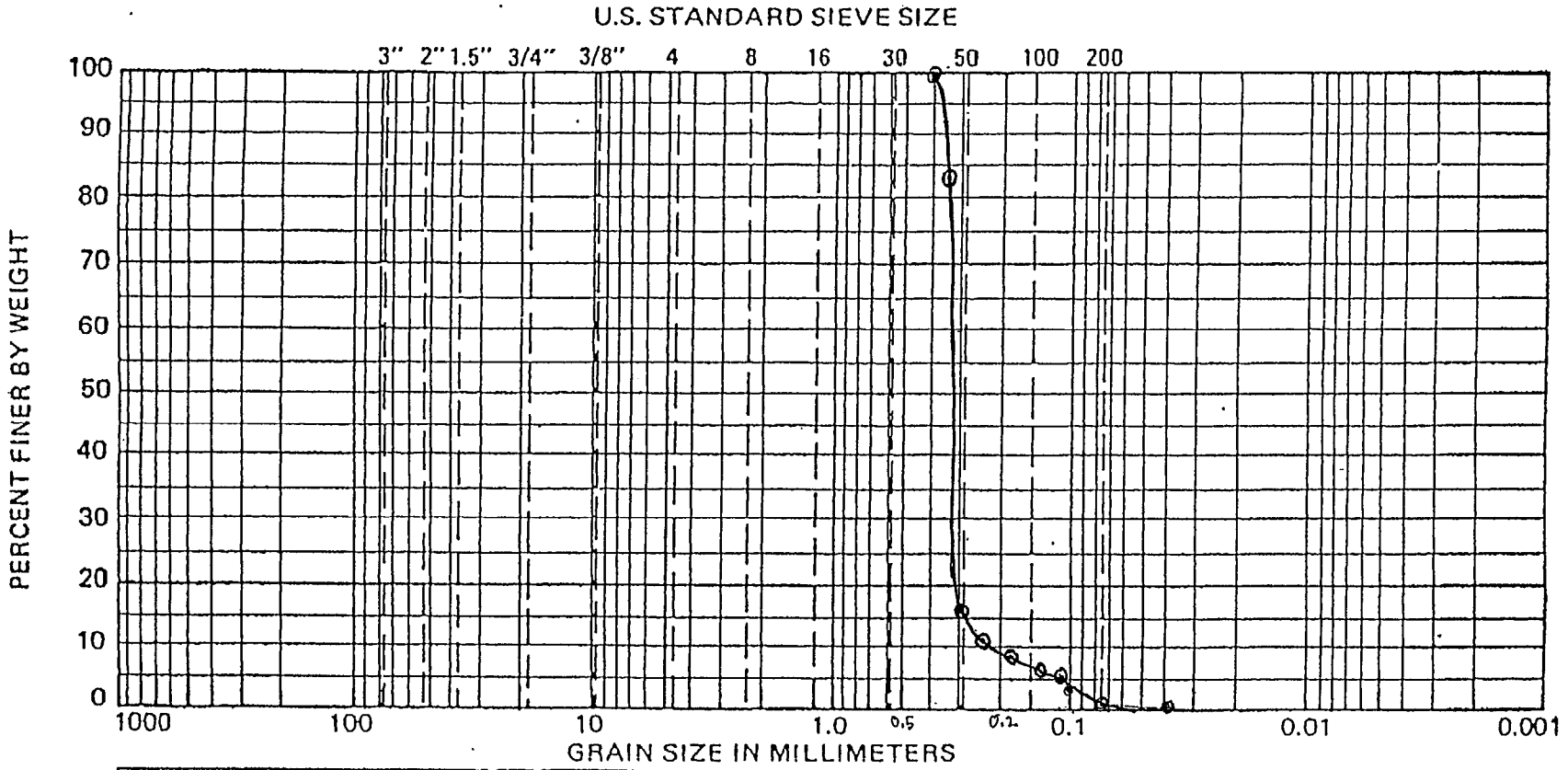
EnecoTech contact: Terry Beckman

STAT. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Serve	Remarks/Bottle No.
	31496	0935		X	BC-mw-1-13'	1	X	Tag# 1399
	31496	0950		X	BC-mw-1-16'	1	X	1400
	31496	1325		X	BC-mw-2-20'	1	X	1402
	31896	1555		X	BC-mw-4-16	1	X	1397
	32096	0800		X	BC-mw-5-13'	1	X	1404
	32096	0950		X	BC-mw-6-16'	1	X	1408
	32096	1250		X	BC-mw-7-16'	1	X	1406
	32196	1055		X	BC-mw-8-15'	1	X	1410

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	32996 1245				
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	
			3/29/96 1245	Reference Quote # 091295DC.01	

Distribution. Original Accompanies Shipment: First Copy to Coordinator Field Files: Second Copy to Representative of Inspected Facility

Split Samples: ☐ Accepted ☐ Declined _____ Signature



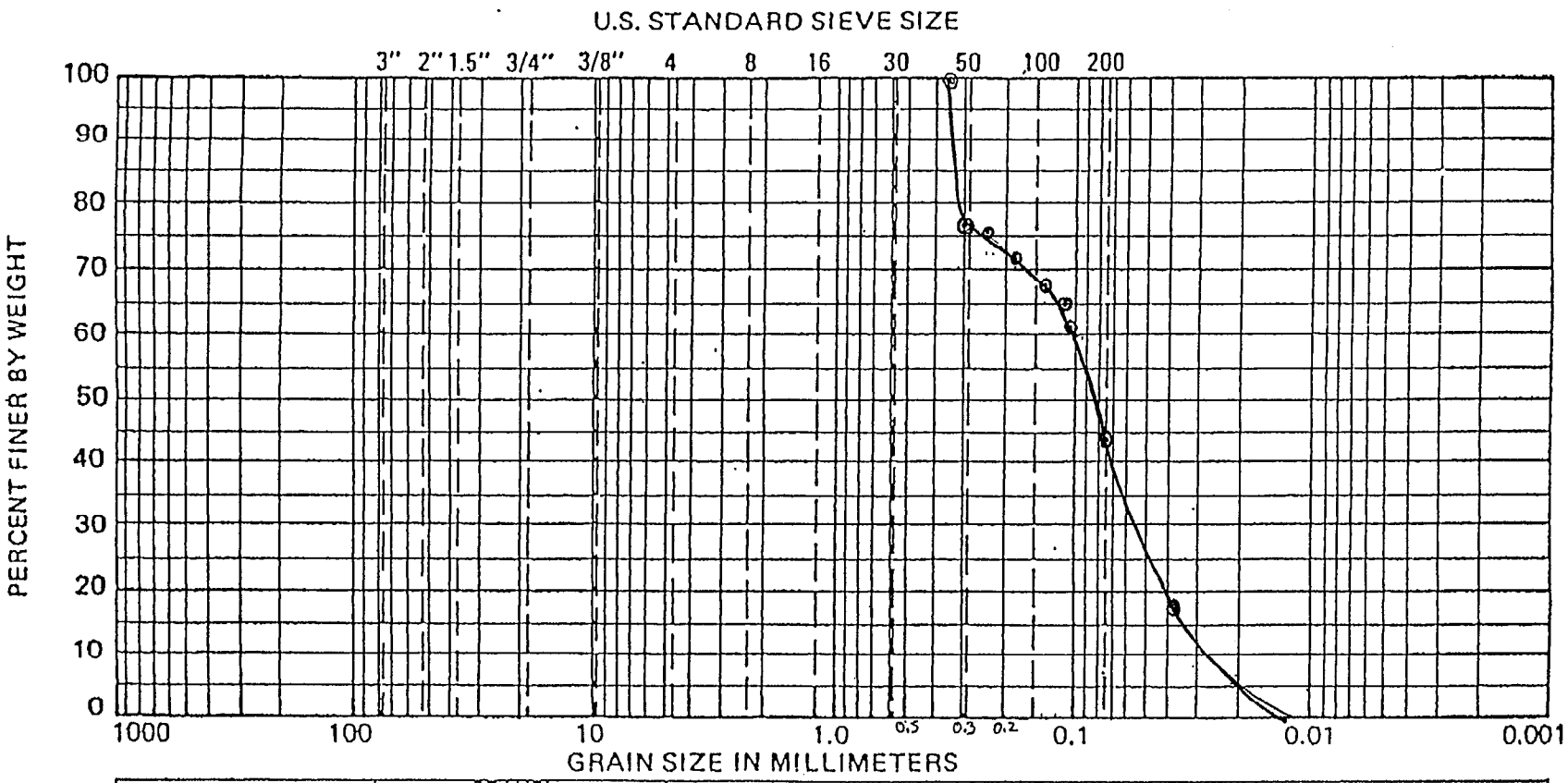
	DEPTH		CLASSIFICATION	NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-1 @ 13'

File No:	ACAD No.:	Drawn:	Designed:	Checked:	Approved:	Date:	Rev.:	



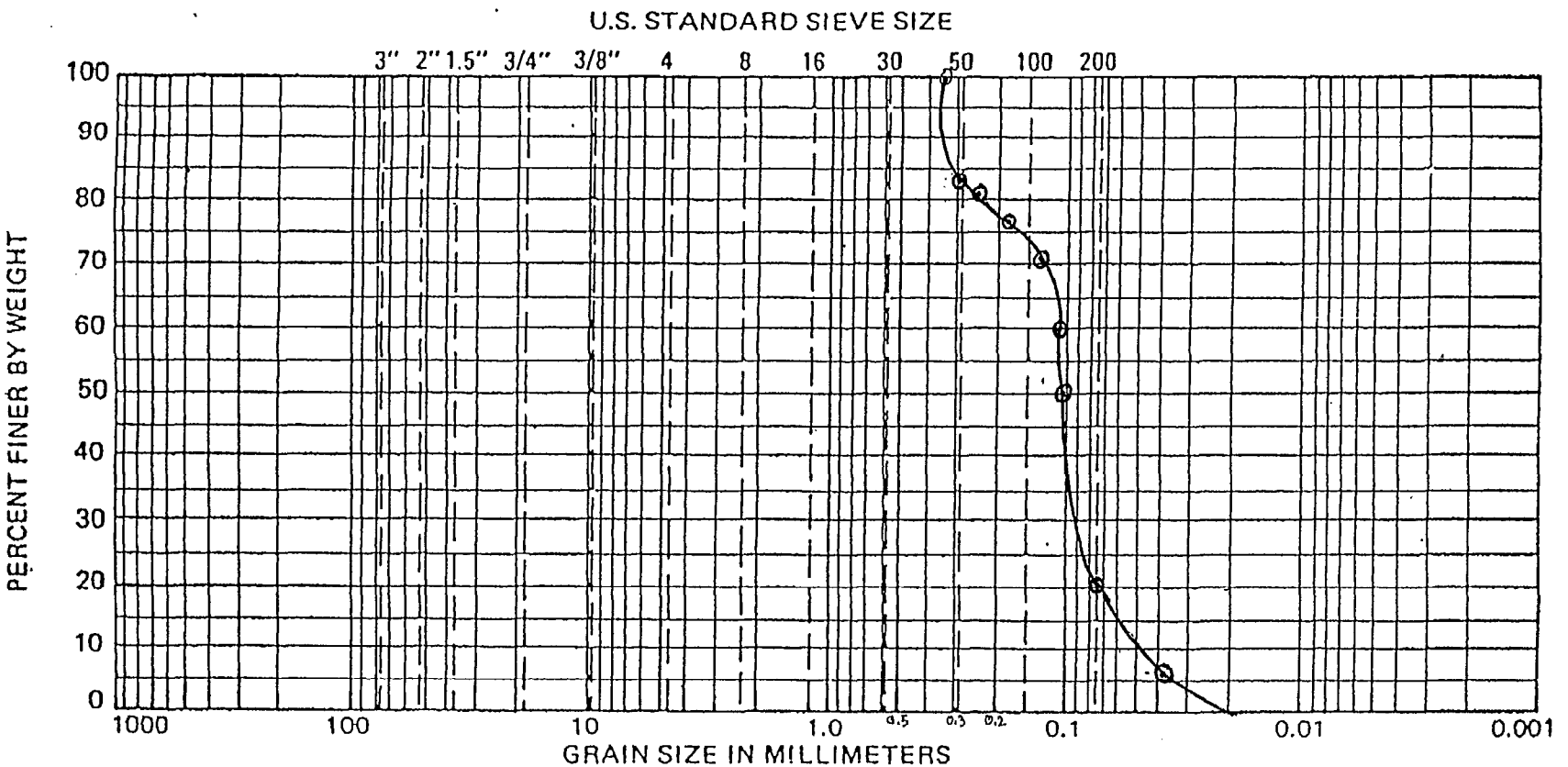
	DEPTH	CLASSIFICATION	NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-1 @ 16.0'

File No.:	ACAD No.:	Drawn:	Designed:	Checked:	Approved:	Date:	Rev.:	



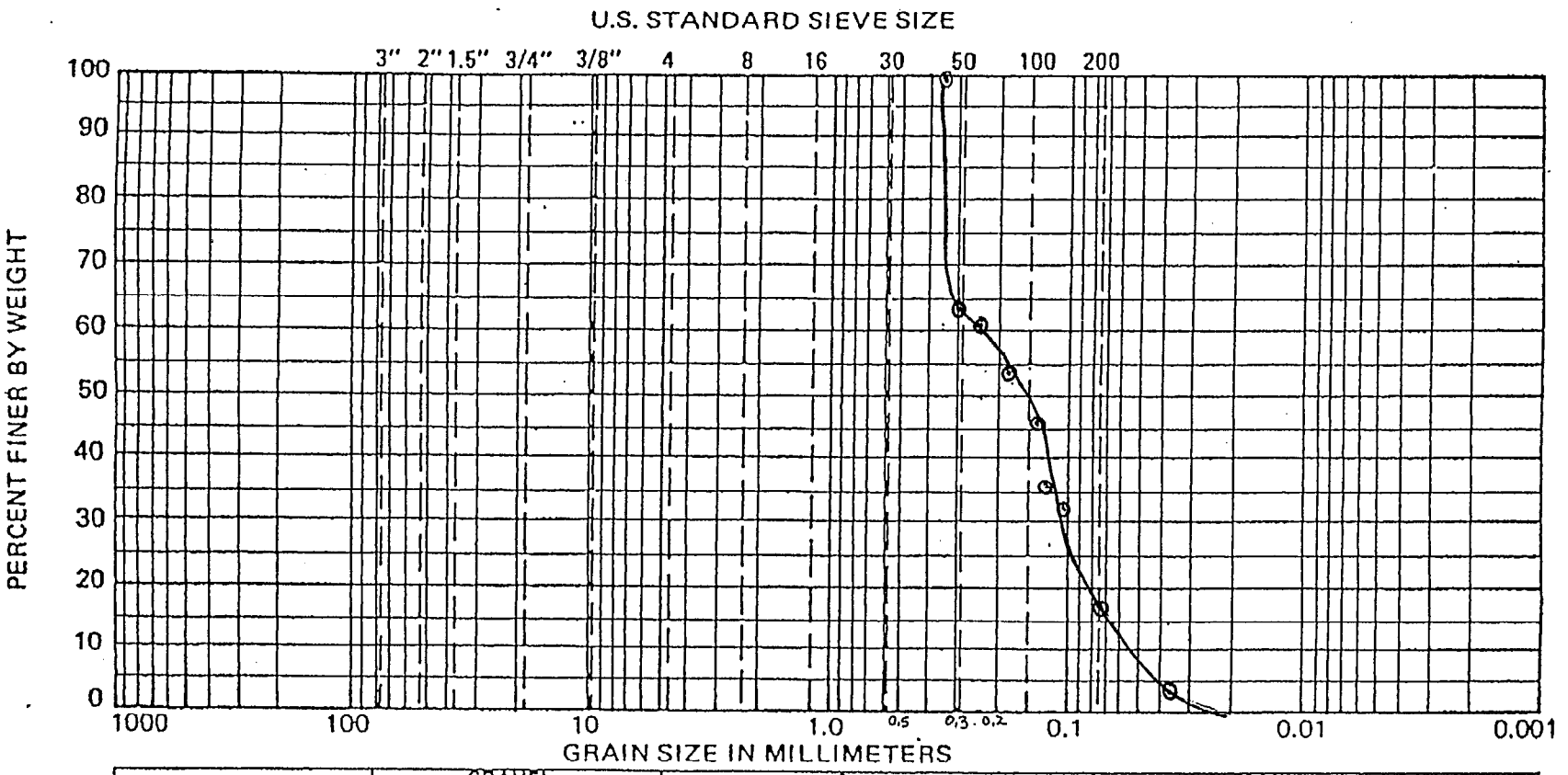
	DEPTH	CLASSIFICATION		NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-2 @ 20.0'

File No.:	ACAD No.:	Drawn:	Designed:	Checked:	Approved:	Date:	Rev.:	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

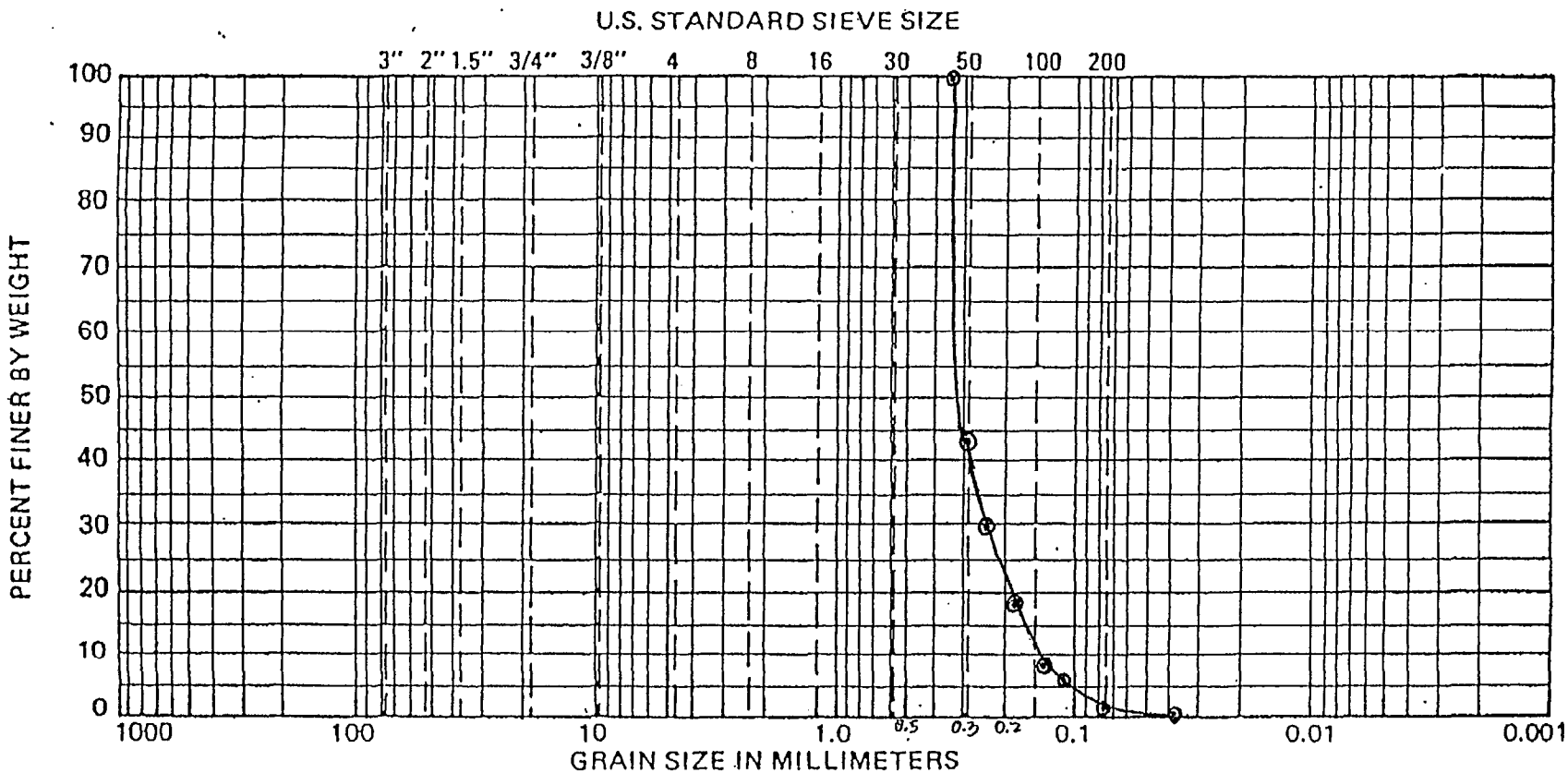
	DEPTH	CLASSIFICATION		NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-4 @ 16.0'

File No.:	ACAD No.:	Drawn:	Designed:	Checked:	Approved:	Date:	Rev.:	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

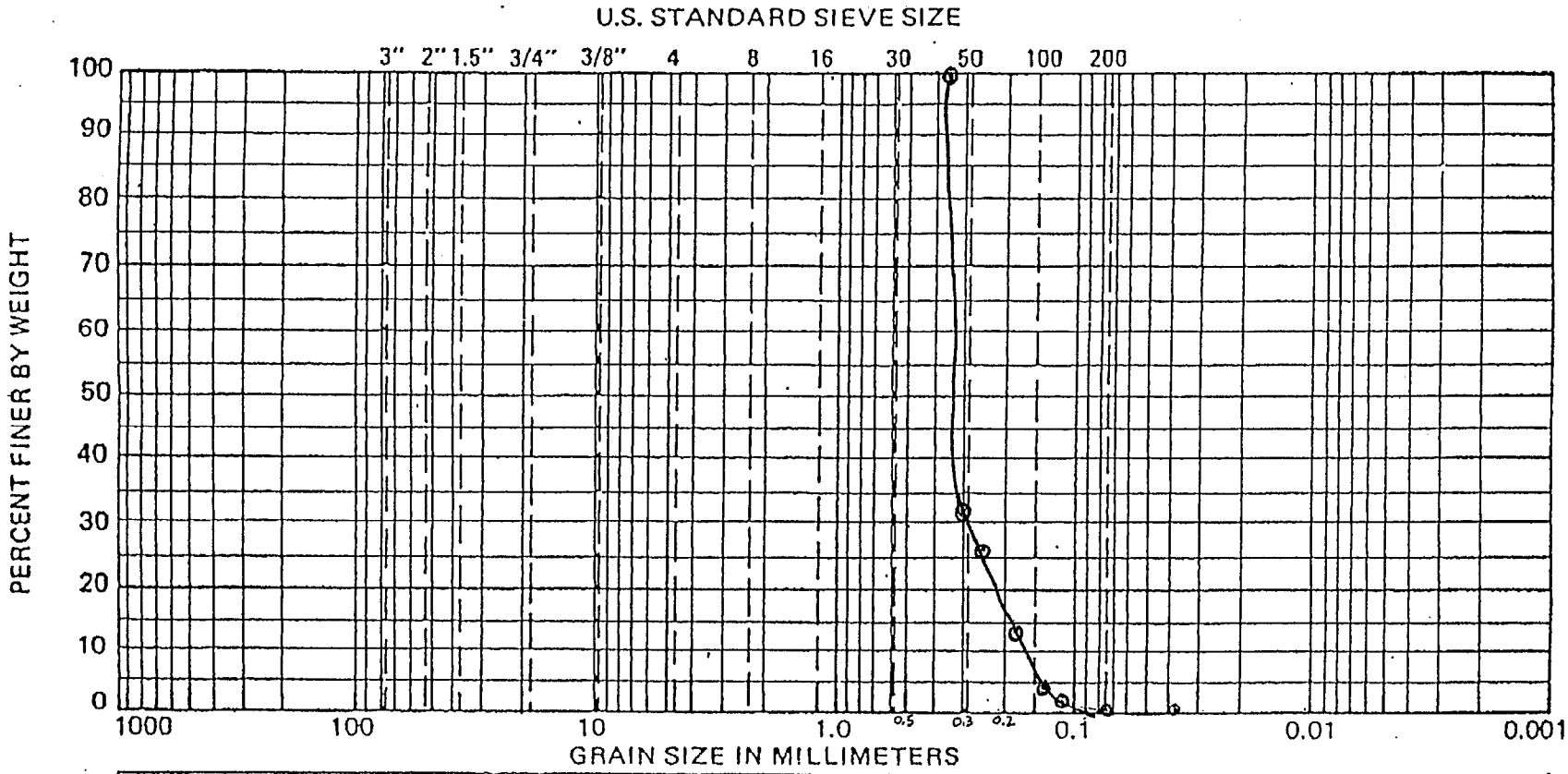
	DEPTH	CLASSIFICATION	NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-8 @ 15.0'

File No:	ACAD No.:	Drawn:	Designed:	Checked:	Approved.	Date:	Rev.:	



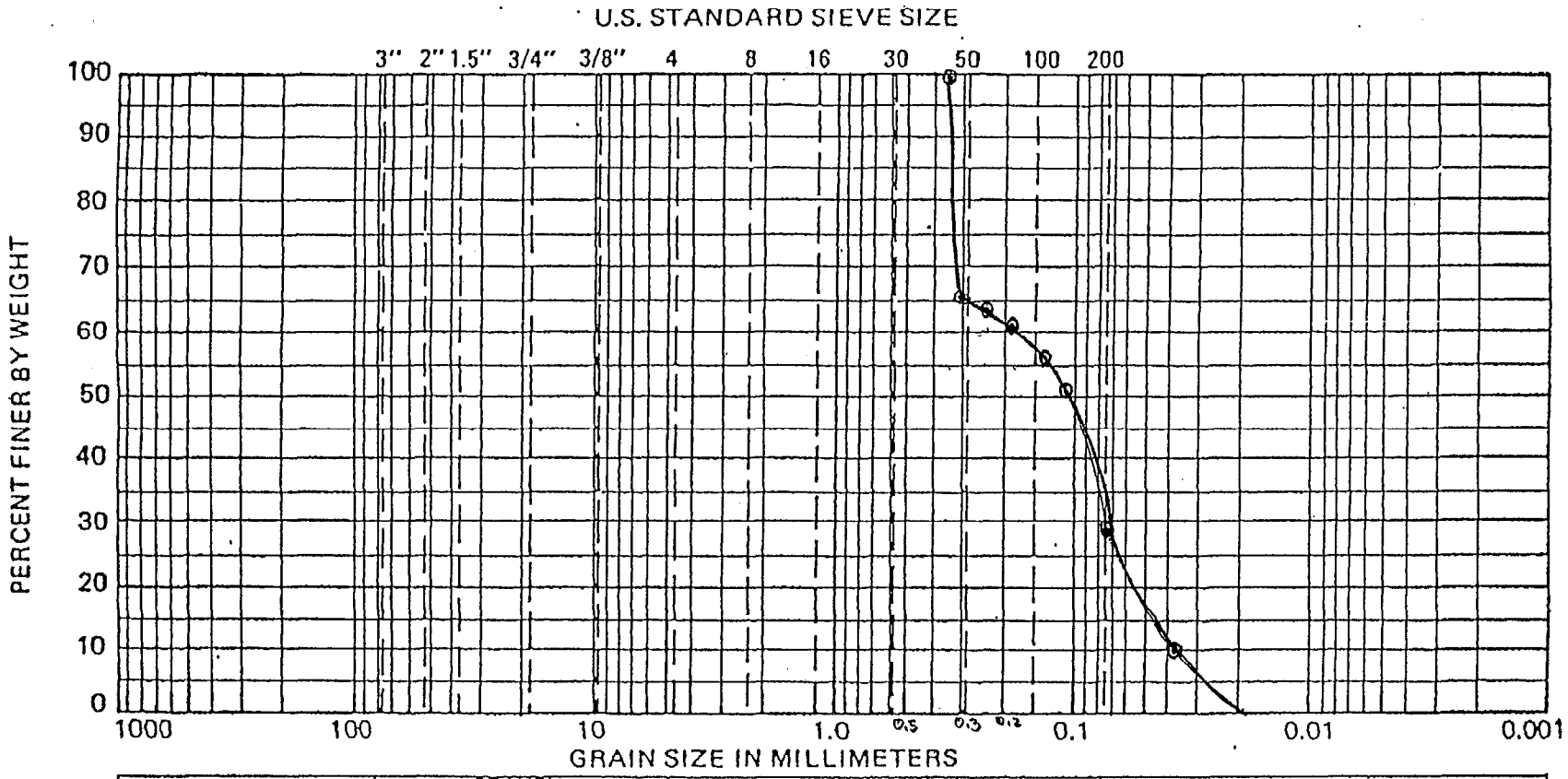
	DEPTH		CLASSIFICATION	NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-5 @ 13.0'

File No:	ACAD No.:	Drawn:	Designed:	Checked:	Approved.	Date:	Rev.:	



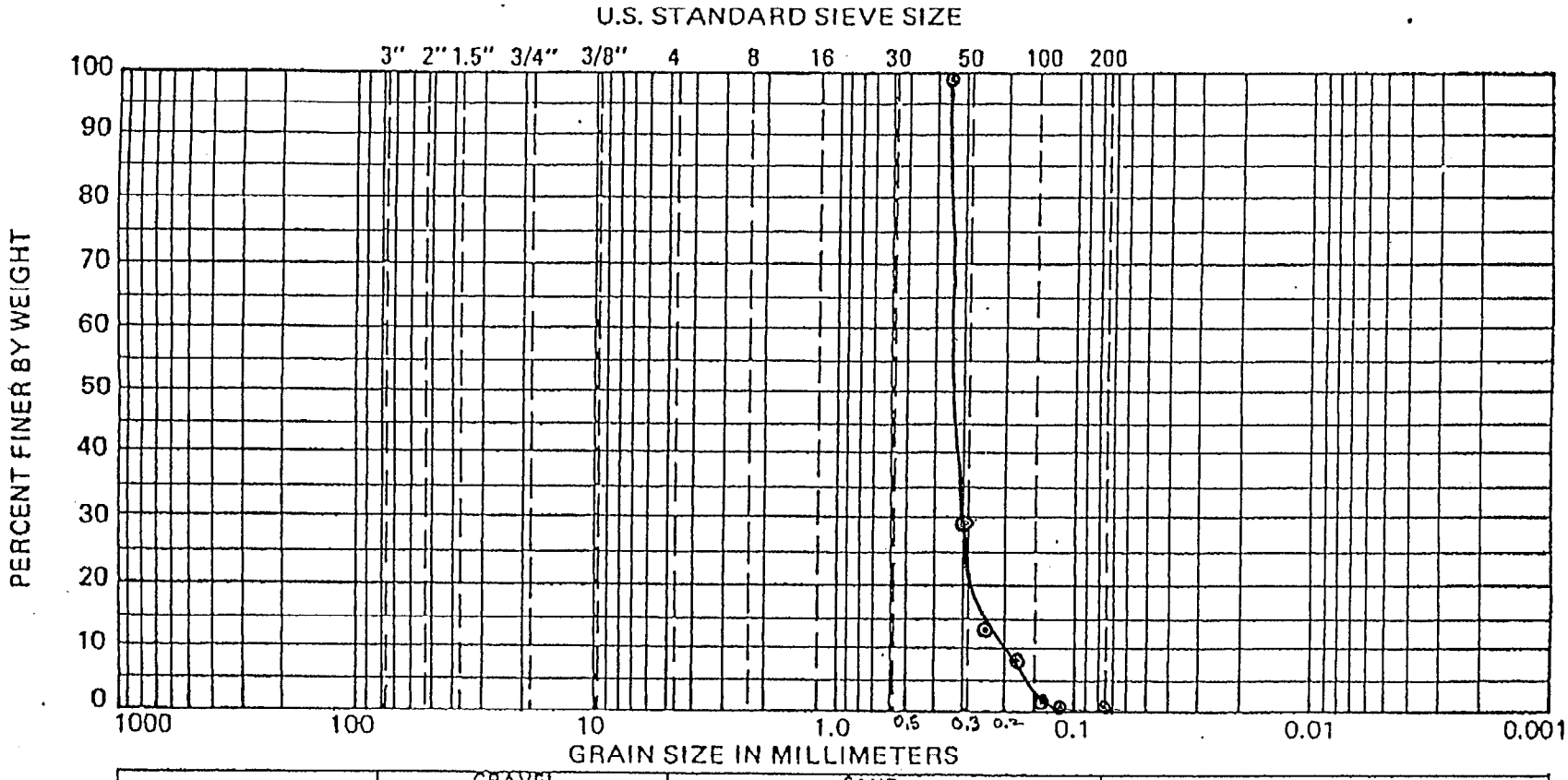
	DEPTH		CLASSIFICATION	NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-6 @ 16.0'

File No.:	ACAD No.:	Drown:	Designed:	Checked:	Approved:	Date:	Rev.:	



	DEPTH		CLASSIFICATION	NAT. W C	LL	PL	PI	

EnecoTech®
ENVIRONMENTAL CONSULTANTS

Project:

BAYOU CHOCTAW PW-7 @ 10.0'

File No.:	ACAD No.:	Drawn:	Designed:	Checked:	Approved:	Date:	Rev.:	

APPENDIX G

LABORATORY ANALYTICAL DATA REPORTS

ORIGINAL

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9604D86-01

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #6745
DATE: 05/02/96

PROJECT: SPR - BAYOU CHOCTAW
SITE: BAYOU CHOCTAW, LA
SAMPLED BY: ENECOTECH
SAMPLE ID: PW-7

PROJECT NO:
MATRIX: WATER
DATE SAMPLED: 04/22/96 11:30:00
DATE RECEIVED: 04/27/96

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
Chloride, Total Method 325.3 * Analyzed by: LB Date: 04/29/96 15:00:00	2180	1	mg/L
Total Dissolved Solids Method 160.1 * Analyzed by: LB Date: 04/29/96 14:00:00	4650	10	mg/L

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

DB Coco

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9604D86-02

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #6745
DATE: 05/02/96

PROJECT: SPR - BAYOU CHOCTAW
SITE: BAYOU CHOCTAW, LA
SAMPLED BY: ENECOTECH
SAMPLE ID: PW-6

PROJECT NO:
MATRIX: WATER
DATE SAMPLED: 04/22/96 10:34:00
DATE RECEIVED: 04/27/96

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
Chloride, Total Method 325.3 * Analyzed by: LB Date: 04/29/96 15:00:00	980	1	mg/L
Total Dissolved Solids Method 160.1 * Analyzed by: LB Date: 04/29/96 14:00:00	2170	10	mg/L
Total Recoverable Petroleum Hydrocarbons Method 418.1 * Analyzed by: JD Date: 05/01/96 11:00:00	ND	1	mg/L

ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco /-
Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9604D86-03

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #6745
DATE: 05/02/96

PROJECT: SPR - BAYOU CHOCTAW
SITE: BAYOU CHOCTAW, LA
SAMPLED BY: ENECOTECH
SAMPLE ID: PW-1

PROJECT NO:
MATRIX: WATER
DATE SAMPLED: 04/22/96 14:45:00
DATE RECEIVED: 04/27/96

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
Chloride, Total Method 325.3 * Analyzed by: LB Date: 04/29/96 15:00:00	36200	1	mg/L
Total Dissolved Solids Method 160.1 * Analyzed by: LB Date: 04/29/96 14:00:00	58100	10	mg/L
Total Recoverable Petroleum Hydrocarbons Method 418.1 * Analyzed by: JD Date: 05/01/96 11:00:00	ND	1	mg/L

ND - Not detected.

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco /

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9604D86-04

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #6745
DATE: 05/02/96

PROJECT: SPR - BAYOU CHOCTAW
SITE: BAYOU CHOCTAW, LA
SAMPLED BY: ENECOTECH
SAMPLE ID: PW-2

PROJECT NO:
MATRIX: WATER
DATE SAMPLED: 04/22/96 13:14:00
DATE RECEIVED: 04/27/96

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
Chloride, Total Method 325.3 * Analyzed by: LB Date: 04/29/96 15:00:00	41200	1	mg/L
Total Dissolved Solids Method 160.1 * Analyzed by: LB Date: 04/29/96 14:00:00	65500	10	mg/L

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco /
Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9604D86-05

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #6745
DATE: 05/02/96

PROJECT: SPR - BAYOU CHOCTAW
SITE: BAYOU CHOCTAW, LA
SAMPLED BY: ENECOTECH
SAMPLE ID: PW-8

PROJECT NO:
MATRIX: WATER
DATE SAMPLED: 04/22/96 14:05:00
DATE RECEIVED: 04/27/96

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
Chloride, Total Method 325.3 * Analyzed by: LB Date: 04/29/96 15:00:00	16800	1	mg/L
Total Dissolved Solids Method 160.1 * Analyzed by: LB Date: 04/29/96 14:00:00	28100	10	mg/L

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Cosco

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9604D86-06

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #6745
DATE: 05/02/96

PROJECT: SPR - BAYOU CHOCTAW
SITE: BAYOU CHOCTAW, LA
SAMPLED BY: ENECOTECH
SAMPLE ID: PW-4

PROJECT NO:
MATRIX: WATER
DATE SAMPLED: 04/22/96 12:40:00
DATE RECEIVED: 04/27/96

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
Chloride, Total Method 325.3 * Analyzed by: LB Date: 04/29/96 15:00:00	1140	1	mg/L
Total Dissolved Solids Method 160.1 * Analyzed by: LB Date: 04/29/96 14:00:00	4150	10	mg/L

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

BB Coco /-
Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

Certificate of Analysis No. L1-9604D86-07

ENECOTECH ENV. CONSULTANTS
2825 WILCREST, SUITE 308
HOUSTON, TX 77042
ATTN: JERRY BECKMAN

P.O.#
COC #6745
DATE: 05/02/96

PROJECT: SPR - BAYOU CHOCTAW
SITE: BAYOU CHOCTAW, LA
SAMPLED BY: ENECOTECH
SAMPLE ID: PW-5

PROJECT NO:
MATRIX: WATER
DATE SAMPLED: 04/22/96 12:09:00
DATE RECEIVED: 04/27/96

ANALYTICAL DATA

PARAMETER	RESULTS	DETECTION LIMIT	UNITS
Chloride, Total Method 325.3 * Analyzed by: LB Date: 04/29/96 15:00:00	19100	1	mg/L
Total Dissolved Solids Method 160.1 * Analyzed by: LB Date: 04/29/96 14:00:00	36300	10	mg/L

Notes: *Ref: Methods for Chemical Analysis of Water and Wastes, 1983, EPA
**Ref: Standard Methods for Examination of Water & Wastewater, 18th ed.
***Ref: Test Methods for Evaluating Solid Waste, EPA SW846, 3rd Ed.

QUALITY ASSURANCE: This analysis was performed in accordance with EPA guidelines for analysis and quality control. Results reported on a Wet Weight Basis unless otherwise noted.

Bo Blankfield, Laboratory Director

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

** SPL QUALITY CONTROL REPORT **

Matrix: Water

Reported on: 04/30/96
Analyzed on: 04/29/96
Analyst: LB

This sample was randomly selected for use in the SPL quality control program. Samples chosen are fortified with a known concentration in duplicate. The results are as follows:

Chloride, Total
Method 325.3 *

SPL Sample ID Number	Blank Value mg/L	Amt Added mg/L	Matrix Spike Recovery %	Matrix Spike Duplicate Recovery %	Relative Percent Difference %	QC Limits Recovery	RPD Max.
9604D86-02A	ND	150	NC	NC	NC	80 - 120	20

32539604291500 -9604I73

Samples in batch:

9604D86-01A 9604D86-02A 9604D86-03A 9604D86-04A
9604D86-05A 9604D86-06A 9604D86-07A 9604E15-04A

COMMENTS:
NC = NOT CALCULATED
SAMPLE CONCENTRATION IS GREATER THAN 4 TIMES THE SPIKE ADDED.

SPL, Incorporated

Karen Grizzaffi

Karen Grizzaffi, QC Officer

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

** SPL QUALITY CONTROL REPORT **

Matrix: Water

Reported on: 04/30/96
Analyzed on: 04/29/96
Analyst: LB

This sample was randomly selected for use in the SPL quality control program. Samples chosen are fortified with a known concentration in duplicate. The results are as follows:

Chloride, Total
Method 325.3 *

SPL Sample ID Number	Blank Value mg/L	LCS Concentration mg/L	Measured Concentration mg/L	% Recovery	QC Limits Recovery
LCS	ND	150	155	103	80 - 120

32539604291500 -9604I74

Samples in batch:

9604D86-01A 9604D86-02A 9604D86-03A 9604D86-04A
9604D86-05A 9604D86-06A 9604D86-07A 9604E15-04A

COMMENTS:

SPL, Incorporated

Karen Grizzaffi

Karen Grizzaffi, QC Officer

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

** SPL QUALITY CONTROL REPORT **

Matrix: Water

Reported on: 04/30/96
Analyzed on: 04/29/96
Analyst: LB

This sample was randomly selected for use in the SPL quality control program. The results are as follows:

Total Dissolved Solids
Method 160.1 *

-- DUPLICATE ANALYSIS --

SPL Sample ID	Original Sample Concentration mg/L	Duplicate Sample mg/L	RPD	RPD Max.
9604D70-02D	2910	2720	6.7	20

16019604291400 -9604I66

Samples in batch:

9604D70-02D	9604D84-02A	9604D84-03B	9604D86-01A
9604D86-02A	9604D86-03A	9604D86-04A	9604D86-05A
9604D86-06A	9604D86-07A		

COMMENTS:

SPL, Incorporated

Karen Grizzaffi

Karen Grizzaffi, QC Officer

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

** SPL QUALITY CONTROL REPORT **

Matrix: Water

Reported on: 04/30/96
Analyzed on: 04/29/96
Analyst: LB

This sample was randomly selected for use in the SPL quality control program. Samples chosen are fortified with a known concentration in duplicate. The results are as follows:

Total Dissolved Solids
Method 160.1 *

SPL Sample ID Number	Blank Value mg/L	LCS Concentration mg/L	Measured Concentration mg/L	% Recovery	QC Limits Recovery
LCS	ND	500	486	97.2	80 - 120

16019604291400 -9604I67

Samples in batch:

9604D70-02D	9604D84-02A	9604D84-03B	9604D86-01A
9604D86-02A	9604D86-03A	9604D86-04A	9604D86-05A
9604D86-06A	9604D86-07A		

COMMENTS:

SPL, Incorporated

Karen Grizzaffi

Karen Grizzaffi, QC Officer

LAFAYETTE AREA LAB
500 AMBASSADOR CAFFERY PKWY.
SCOTT, LOUISIANA
ZIP 70583-8544
PHONE: (318) 237-4775

** SPL QUALITY CONTROL REPORT **

Matrix: Water

Reported on: 05/02/96
Analyzed on: 05/01/96
Analyst: JD

This sample was randomly selected for use in the SPL quality control program. Samples chosen are fortified with a known concentration in duplicate. The results are as follows:

Total Recoverable Petroleum Hydrocarbons
Method 418.1 *

SPL Sample ID Number	Blank Value mg/L	Amt Added mg/L	Matrix Spike Recovery %	Matrix Spike Duplicate Recovery %	Relative Percent Difference %	QC Limits Recovery	RPD Max.
BLANK_SPIKE	ND	10.0	100	100	0	70 - 130	20

IRW1960501110000-9605083

Samples in batch:

9604D86-02B 9604D86-03B

COMMENTS:

SPL, Incorporated

Karen Grizzaffi, QC Officer

6745

SPL LAB ID: 9604D86

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Analysis Request and Chain of Custody Record

SPL Laboratories, Inc.
500 Ambassador Caffery Pkwy.
Scott, Louisiana 70583
(318) 237-4775 / (800) 304-5227 / Fax (318) 237-8005

Sample submitted by: LINC BURGESS

Project Name: SPR - BAYOU CHOCTAW

Company	Address	Contact	Project Location and State	Project No.
ENECO TECH	2826 Wilcrest Suite 308 Houston, TX 77042	Jerry Beckman Phone 713-975-9650	Bayou CHOCTAW - LA	

Sample No. / Identification	Date and Time	Grab	Comp	Sample Container (Size/Type)	Sample Type (Water, Soil, Oil, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED TEST	ANALYSIS REQUESTED METHOD	REMARKS
MW-7	4-22-96 11:30	✓			Water		Clorides & Total Disolved Solids	325.3 & 160.1	
MW-6	4-22-96 10:34	✓			Water		Clorides & Total Disolved Solids	325.3 & 160.1	
MW-1	4-22-96 14:45	✓			Water		Clorides & Total Disolved solids	325.3 & 160.1	
MW-2	4-22-96 13:14	✓			Water		Clorides & Total Disolved solids	325.3 & 160.1	
MW-8	4-22-96 14:05	✓			Water		Clorides & TDS	325.3 & 160.1	
MW-4	4-22-96 12:40	✓			Water		Clorides & TDS	325.3 & 160.1	
MW-5	4-22-96 12:09	✓			Water		Clorides & TDS	325.3 & 160.1	
MW-1	4-22-96 14:45	✓		liter	Water	HCl	TPH	418.1	
MW-6	4-22-96 10:34	✓		liter	Water	HCl	TPH	418.1	

5/3 Cl's TDS per FAX

Samplers: (Signature)	Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact
Lynn C Burgess		Lynn C Burgess	Date: 4-26-96 Time: 11:00			
		Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact
		Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact
				Received by: (Signature)	Date: 4/27/96 Time: 0330	Data Results to:
				Invoice to:		

SAMPLER REMARKS:

7349

SPL LAB ID: 9605508

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SPL Laboratories, Inc.
500 Ambassador Caffery Pkwy.
Scott, Louisiana 70583
(318) 237-4775 / (800) 304-5227 / Fax (318) 237-8005

Analysis Request and Chain of Custody Record

Project Name: WEEKS ISLAND SPR

Sample submitted by: LINCOLN BURGESS

Company	Address	Contact	Project Location and State	Project No.
ENECOTECH	2825 Wilcrest Suite 330 Houston, TX 77042	Jerry Beckman Phone 713-975-9650	WEEKS ISLAND, LA	

Sample No. / Identification	Date and Time	Grab	Comp	Sample Container (Size/Type)	Sample Type (Water, Soil, Oil, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED TEST	ANALYSIS REQUESTED METHOD	REMARKS
PW-1	5/8/96 13:37	✓		liter	water	HCl	TPH	418.1	PERM 5/17 DSC
PW-3	5/8/96 14:58	✓		liter	water	HCl	TPH	418.1	
W-7	5/9/96 10:49	✓		liter	water	HCl	TPH	418.1	
W-8	5/9/96 11:25	✓		liter	water	HCl	TPH	418.1	
W-6	5/9/96 12:35	✓		liter	water	HCl	TPH	418.1	
W-5	5/9/96 12:10	✓		liter	water	HCl	TPH	418.1	

Samplers: (Signature)	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact
Lincoln C. Burgess	Lincoln C. Burgess	5-9-96 3:11			
Affiliation	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact
	Relinquished by: (Signature)	Date: Time:	Received by: (Signature)	Date: Time:	Intact
			Received by: (Signature)	Date: 5/9/96 Time: 1500	Data Results to:
			Involced to:		

SAMPLER REMARKS: