6/25/92 - 00674

FINAL

SITE CHARACTERIZATION REPORT

FOR THE
FITWING FUEL PITS
NAVAL AIR STATION OCEANA
VIRGINIA BEACH, VIRGINIA

CONTRACT TASK ORDER 0020

Prepared For:

NAVAL FACILITIES
ENGINEERING COMMAND
ATLANTIC DIVISION
NORFOLK, VIRGINIA

Under:

Contract N62470-89-D-4814

Prepared By:

ROY F. WESTON, INC.
Virginia Beach, Virginia

Under the Direction of:

BAKER ENVIRONMENTAL, INC.
Coraopolis, Pennsylvania

25 JUNE 1992

Enclosure 3

SITE CHARACTERIZATION REPORT CHECKLIST

Site: Fitwing Fuel Pits NAS Oceana PC# _____ Region Tidewater

The following checklist must be filled out by the Responsible Party (RP) and/or the RP's Consultant and included in the Site Characterization Report. **Indicate on the checklist the page and section number where each item is addressed in the attached report.** Also indicate on the checklist the section and page number where justification is given for items omitted from the attached report. The contents of the report should reflect and be commensurate with the nature of the release, degree of contamination and complexity of the site investigation.

A copy of the Initial Abatement Measures Report must be attached to or included in the Site Characterization Report.

Items marked with an * are required as part of the CAP Permit Application.

1. SITE ASSESSMENT

Page	/Section	
1	/1.1.1	Nature and quantity of release
35	/1.5.1	*Physical and chemical properties of released product
NA	/	Free Product Removal Report
NA	/	Tank information (capacity, location, contents)
18	/1.4.1	Geologic/hydrogeologic site information
18	/1.4.1	Site geology
18	/1.4.1	Subsurface conditions (fractures, solution cavities, lenses, depth to ground water)
7	/1.2.6	Pumping/injection wells
11	/1.3.3	Drillers/geologic logs and construction details for all wells and boreholes
4	/1.2.3.1	Aquifer characteristics
5	/1.2.3.1	Name
5	/1.2.3.1	Thickness
20	/1.4.2.1	Conductivity
24	/1.4.2.2	Transmissivity
20	/1.4.2	Hydraulic gradient
20	/1.4.2	Flow velocity/direction
18	/1.4.1	Hydrogeologic cross section
6	/1.2.3.2	Information as to water resources within 1000 ft of site (wells, springs, surface water)
7	/1.2.5	Information as to adjacent property owners and potentially affected ground and surface water users (names, addresses, telephone numbers)
1	/1.1.1	Information on historical releases at the site as well as historical releases from USTs located on adjacent property
7	/1.2.6	Construction information on potentially affected wells
7	/1.2.5	Current and projected groundwater/land use
37	/1.5.2	Description of vertical and lateral extent of contamination
37	/1.5.2	Free product phase
37	/1.5.2	Dissolved phase
37	/1.5.2	Residual phase
28	/1.4.3	Vapor phase

SCR Checklist
Page 2 of 4

37 /1.5.2 Plume migration direction and rate
18 /1.4 *Sampling/monitoring results

NOTE: All lab sheets and tables submitted in SCR must have sample media, analytical method used, detection limit method, unit of measure, sample depths, and sample locations. Sampling results from BTEX analysis must be reported individually and totaled.

Site maps/sketches (combine when appropriate and to scale when possible)

2 /1.1.1 *Locus map on 7 1/2 min. quad. or county highway map
10 /1.3.1 *Base map with property lines and physical features (buildings, roads, etc.)
38-42 /1.5.2 *Location of source(s) of contamination at site
10 /1.3.1 Sample locations (water, vapor, and/or soil)
NA / Excavation pits
18 /1.4.1 Surficial soils
8 /1.2.3.2 Surface waters
NA / Basements/conduits (and/or soil vapor surveys)
11 /1.3.3 Monitoring wells
8 /1.2.6 Domestic wells
8 /1.2.6 Public supply wells
NA / Springs
10 /1.3.1 Boring locations
10 /1.3.3 Observation well locations
22 /1.4.2 Ground water flow direction map
10 /1.2.5 Subsurface conduits (telephone, water, sewer, power, dispenser piping)
8 /1.2.6 *Potentially affected wells/streams/springs
6 /1.2.3.3 *Flood plain designation
38-42 /1.5.2 Isoconcentration or plume delineation map for each affected aquifer and/or soil zone for all phases present (cross-sectional and map view)
40-41 /1.5.2 Free product
40-41 /1.5.2 Dissolved
38-39 /1.5.2 Residual
29 /1.4.3 Vapor

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COMMENTS: _____

DEFICIENCIES: _____

SCR Checklist
Page 3 of 4

2. RISK ASSESSMENT

43 / 2.1 Description of demographics (population)
43 / 2.2 Impacted and potentially impacted receptors (human/wildlife/forestry, etc.)
44 / 2.3 Exposure pathways for receptors
- 44 / 2.3 Ingestion
- 44 / 2.3 Dermal contact
- 44 / 2.3 Inhalation
- NA / ____ Other

44 / 2.4 Exposure levels for receptors
- 44 / 2.4 Exposure level determination
  - 44 / 2.3 Tap water sample
  - 44 / 2.4 Direct well sample
  - 44 / 2.3 Surface water sample
  - NA / ____ OVA and location of measurement
  - 46 / 2.4 Extrapolation
  - NA / ____ Other

47 / 2.5 Evaluation of existing/potential risk to receptors (based on contaminant levels, exposure levels, frequency of exposure)
47 / 2.5 Evaluation of existing/potential risk to environment (based on contaminant levels, fate & transport, etc.)
NA / ____ Evaluation/provision of alternate water supply

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SCR Checklist
Page 4 of 4

3. REMEDIATION ASSESSMENT

48 / 3.2 Remediation feasibility
48 / 3.1 Projected remediation endpoints based on site, risk, and remediation assessments
- 48 / 3.1 Free product
- 48 / 3.1 Dissolved
- 48 / 3.1 Residual
- NA / ____ Vapor

49 / 3.3 Description & evaluation of applicable technologies
- 49 / 3.3 Design for each applicable technology
- 52 / 3.4 Timeframe for implementation and duration for each applicable technology to achieve projected remediation endpoints
- 52 / 3.4 Projected cost for each applicable technology to achieve projected remediation endpoints
- 52 / 3.4 Achievable endpoints for each applicable technology
  - 53 / 3.4.2 Free product
  - 53 / 3.4.2 Dissolved
  - 52 / 3.4.1 Residual
  - NA / ____ Vapor
- 52 / 3.4 Estimated timeframe for achieving endpoints for each applicable technology
  - 52 / 3.4 Free product
  - 52 / 3.4 Dissolved
  - 52 / 3.4 Residual
  - NA / ____ Vapor
- NA / ____ Immediate/future beneficial results for each applicable technology Only one applicable technology selected.

52 / 3.4 Recommendation of most appropriate technologies with costs

____ / ____ Site Characterization Report submitted within 45 days of release confirmation or extension granted

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COMMENTS: _____

DEFICIENCIES: _____

REVIEWED BY: _____ DATE: _____

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Roy F. Weston, Inc. (WESTON®), as partners with Baker Environmental, Inc. (Baker) on the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, was contracted by the Atlantic Division, Department of the Navy to further investigate the concerns related to leaking subsurface JP-5 fuel supply lines located at the Fitwing Fuel Pits, Naval Air Station Oceana (NAS Oceana), Virginia Beach, Virginia, between March 1992 and April 1992.

In accordance with the State of Virginia's Underground Storage Tank (UST) Regulations, Virginia State Water Control Board (VSWCB) Code VR 680-13-02, a Site Characterization Study was performed. The Site Characterization Study activities include background information review, performing 19 soil borings, 8 hydropunch locations, field screening of subsurface soils, soil sampling and analysis, installation of 9 groundwater monitor wells, groundwater sampling and analysis, performing an eight-hour aquifer test, and performing hydraulic conductivity tests within 2 monitoring wells. This investigation revealed the presence of adsorbed phase (soil), dissolved phase (groundwater), and free phase (floating) petroleum hydrocarbon contamination in the vicinity of the high-speed jet refueler pits, otherwise known as the Fitwing Fuel Pits.

The soil data indicate concentrations of total petroleum hydrocarbons (TPH) that exceed the State's "action level" of 100 mg/kg TPH, located primarily in the vicinity of Lanes One and Two and Lanes Five and Six of the refueling area. Dissolved groundwater contamination detected in the study area consisted of volatile organic compounds (VOCs). Free phase hydrocarbons were detected in RW-01 (>9.0 feet of product), 20-MW-01 (7.74 feet of product), 20-MW-02 (0.93 feet of product), and 20-EMW-7 (<0.10 feet of product). Contaminant concentration patterns indicate two distinct contaminant plumes suspected to have originated from leaks in the recently abandoned underground fuel supply pipeline. The analytical data do not indicate any influence from off-site sources or surface releases that may have occurred in the Fitwing area. Field observations indicate that groundwater is migrating to the south to southwest at a rate of approximately 2 to 39 ft/yr.

Of the VOCs detected in the groundwater at the site, five parameters, benzene, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene, had concentrations that exceeded the maximum contaminant level (MCL) established by the U.S. Environmental Protection Agency (USEPA) for drinking water. Several soil samples were also detected that exceeded the VSWCB "action level" for TPH concentrations in soils of 100 mg/kg. Despite these concerns, the risk evaluation investigation indicates that no human or environmental receptors are impacted by contamination at the site. From a qualitative perspective, the contaminants identified do not appear to represent or pose an immediate public health risk since there does not appear to be opportunities for exposure to contaminants.

Based on investigation results and regulatory requirements, remediation of the soils in the vicinity of the Fitwing Fuel Pits is recommended. Prior to any soil or groundwater remediation, free product is to be removed as the source for continued groundwater contamination. The installation of a well pumping and product recovery system is recommended after free product recovery. As part of the remediation process, pumped groundwater should be treated by air stripping and contaminated soil allowed to remain in-place and passively remediate.

1.0 SITE ASSESSMENT

This section of the Site Characterization Report consists of five subsections. Subsection 1.1 presents the objectives of the site assessment and background information pertaining to the site. Subsection 1.2 provides information about site structures, regional geologic and hydrologic conditions, climate, and local land and water uses. Subsections 1.3 and 1.4 discuss the investigative methods and field/analytical results. Subsection 1.5 presents the nature and extent of soil and groundwater contamination based upon the data collected.

1.1 OBJECTIVES OF THE SITE ASSESSMENT

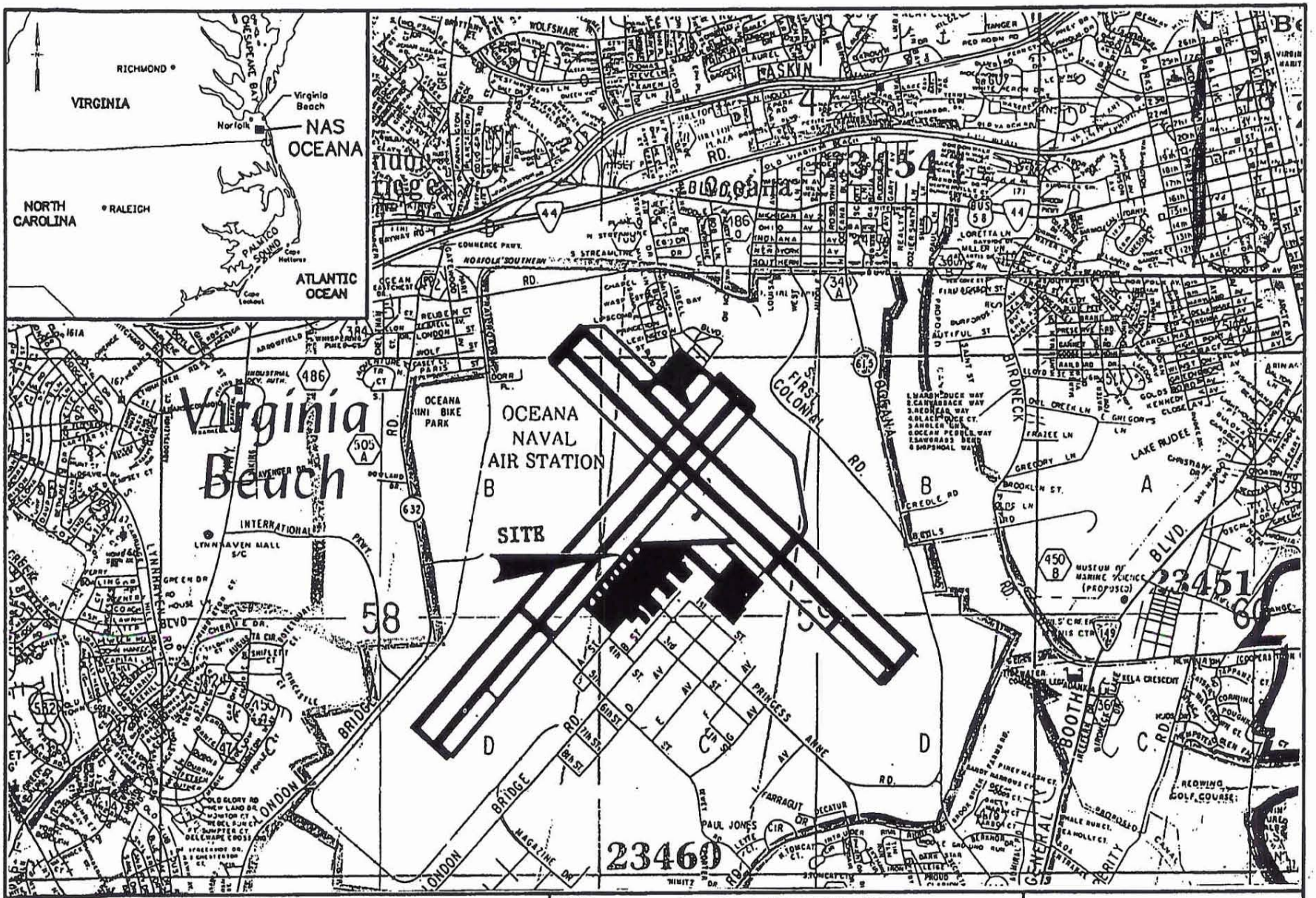
Roy F. Weston, Inc. (WESTON®), as partners with Baker Environmental, Inc. (Baker) on the Comprehensive Long-Term Environmental Action Navy (CLEAN) Program, was contracted by the Atlantic Division, Department of the Navy to further investigate the concerns related to leaking subsurface JP-5 fuel supply lines located at the Fitwing Fuel Pits, Naval Air Station Oceana (NAS Oceana), Virginia Beach, Virginia, between March 1992 and April 1992.

WESTON conducted the Site Characterization of the Fitwing Fuel Pits at NAS Oceana, Virginia Beach, Virginia, from 2 March 1992 through 9 April 1992. The location of the site is shown in Figure 1-1. The specific objective of the assessment was to investigate the geologic and hydrogeologic conditions at the site in order to define the extent and severity of potential subsurface fuel contamination or migration resulting from leaking fuel supply lines or surface spills in the area.

1.1.1 Site History

NAS Oceana was constructed in the 1940s to be used for routine naval missions and aircraft training operations. In the 1950s, a fuel storage facility area was constructed to supply fuel to high-speed refueling pits otherwise known as the Fitwing Fuel Pits. The area of this investigation, the Fitwing Fuel Pits, is located west of the control tower between the 5th Street storage tank farm and the day tank.

In July 1989, Froehling and Robertson (F&R) conducted a preliminary soil assessment at the Fitwing Fuel Pits to assess potential contamination from earlier reported leaks due to fuel line corrosion. The leaks were reported during earlier line inspections between fuel pits 2 and 3, and between fuel pits 5 and 6. During this study twenty-seven hand-augured borings were constructed along the Fitwing Fuel Pits to a depth of 6 feet below ground surface (bgs). Samples were collected from these borings and analyzed for total petroleum hydrocarbons (TPH), oil and grease, ignitability, and polynuclear aromatics (PNAs). The analytical data indicated elevated TPH values throughout the area with locally elevated PNAs. One sample collected near Refueling Pit 4 exhibited high levels



PROJECT TITLE: SITE CHARACTERIZATION REPORT FITWING FUEL PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT: DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA
DWG. TITLE: REGIONAL SITE LOCATION MAP	FIGURE NO. 1-1

WESTON

REG-SITE.dwg 6629-01-09

of oil and grease. A review of the TPH data indicated two anomalous areas along the fuel supply line. These areas occur between pits 1 and 2, and in the vicinity of pit 4.

In September 1990, O'Brien and Gere Engineers, Inc. installed four monitoring wells around the fuel pits to assess the site for potential groundwater contamination. Neither soil nor groundwater contamination was detected during this phase of investigation. However, subsequent construction during 1991 of a new underground fuel pipeline running parallel to the existing pipeline revealed fuel-saturated soils warranting additional investigation to assess the magnitude and extent of subsurface contamination. The fuel-saturated soil contamination was uncovered approximately 20 yards west of the existing underground fuel pipeline and in the vicinity of Fitwing Fuel Pits 1 through 3.

1.2 AREA CHARACTERISTICS

This section provides a general site description regarding the regional setting of the study area. Information about site structures, regional geologic and hydrologic conditions, climate, and local land and water uses have been included to characterize the study area.

1.2.1 Site Description

The Fitwing Fuel Pits are located west of the traffic control tower along the taxiway to Runway 5. The area includes six refueling pits separated by grassy medians that extend northeasterly approximately 2,400 feet. The traffic areas are constructed of fitted 15-foot by 15-foot concrete slabs approximately 11 inches thick. Newly constructed sections consist of poured concrete. The concrete seams are sealed with an asphalt-based packing to reduce surface water intrusion. In areas currently undergoing construction, signs of surface water or fuel leakage were observed along exposed seams.

1.2.2 Regional Geology

NAS Oceana is located in the Atlantic Coastal Plain Physiographic Province. The geology of this province is characterized by unconsolidated sediments of Cretaceous, Tertiary, and Quartenary ages that dip gently eastward from the Fall Zone and rest on a Pre-Cretaceous-aged bedrock (VSWCB, 1973). The Fall Zone is roughly coincident with Interstate 95, which runs north-south through Virginia. Consolidated bedrock includes crystalline igneous, metamorphic, and scattered Triassic age ("red beds") sedimentary rocks.

Unconsolidated sediments include interbedded sands, silts, and clays. The sands are typically fossiliferous and/or glauconitic, indicating a marine and estuarine origin. Surficial deposits of the region belong to the Columbia

Group, whose age is loosely defined as Post-Miocene. These sediments are predominately sands and gravels and supply groundwater to low-yield water table wells in parts of the region.

Underlying the Columbia Group are Miocene deposits of the Chesapeake Group. The Yorktown Formation is the uppermost unit of the group, consisting of fossiliferous sands, marls, and coquinas. Like the Columbia Group, this formation supplies groundwater to water table wells in the area. The Yorktown Formation is a shelly, fine-grained sand that grades into a series of interbedded silty sands with clay at its base. The Eastover Formation contains a characteristic bluish-gray to greenish-gray color. The St. Mary's Formation underlies the Eastover Formation in the northern part of Williamsburg and in the lower peninsula, but is not present in the study area. The Calvert Formation also underlies the Eastover Formation and is composed of dark green, glauconitic clay, interbedded with sandy clay and mud. It is approximately 200 feet thick in the Hampton area. The Calvert Formation is a substantial aquitard separating the upper Yorktown-Eastover aquifer from the middle Chickahominy-Piney Point Aquifer. Each of these aquifers consist of fine- to medium-grained sands and vary in thickness across the region.

Early Eocene deposits of the Marlboro and Nanjemay Formations underlie the late Eocene deposits. These formations act as an aquitard between the Middle and Lower Aquifer Systems. Included sediments are characterized as fine-grained sands, silts, and clays often referred to as "green sand" or "black sand" depending on the quantity of glauconite present.

The Yorktown Formation can be distinguished from the underlying Calvert Formation by abundant and markedly coarser-grained sand and gravel beds, and more abundant and thicker shell beds. The Yorktown is also lighter in color than the upper member of the Calvert.

Paleocene deposits include the Aquia Formation and the Potomac Group. These deposits are typically interbedded sands, silts, and clays and comprise the Lower aquifer of the region. This aquifer is not extensively developed.

1.2.3 Regional Hydrology

This section provides regional information on groundwater and surface water. Principle aquifers and surface water features in the study area are discussed below.

1.2.3.1 Groundwater

The hydrogeologic framework of the Norfolk area includes four principal aquifers, one unconfined and three confined. These aquifers and their geologic equivalents are as follows: 1) the water table aquifer (mostly the

Columbia Group); 2) the Yorktown Aquifer (upper part of the Yorktown Formation); 3) the Eocene-Upper Cretaceous Aquifer (lower part of the Calbert and the Mattapoin Formations); and 4) the Lower Cretaceous Aquifer (the Potomac Group). Confining beds between and within the aquifers retard, but do not prevent, vertical movement of groundwater. Overall, the water-bearing units comprise a leaky aquifer system with groundwater generally flowing easterly towards the Chesapeake Bay. The Lower Cretaceous Aquifer exhibits the most confinement (Siudyla et al., 1981).

The Columbia Aquifer consists of beds and lenses of sand and some gravel, shell beds, silt, sandy clay, and clay. The sand and shell beds and lenses (i.e., the major water-bearing strata) are heterogeneous and discontinuous because of the complex marine estuarine environments in which they were deposited. Sand units yield quantities adequate for domestic and small industrial demands. Individual well yields range from 5 to 50 gallons per minute (gpm) and specific capacities range from approximately 1 to 2 gpm/ft (Siudyla et al., 1981). Groundwater in coastal regions may be saline (Hamilton and Larson, 1988).

The Yorktown Aquifer underlies the Columbia Aquifer. Major water-bearing zones comprising the Yorktown Aquifer are found in the upper 50 to 100 feet of the Yorktown Formation. The water-bearing zones are composed of beds 5 to 20 feet thick of fine- to coarse-grained sand, gravel, and shells. The Yorktown Aquifer is separated from the overlying water table aquifer by beds of silt, clay, and sandy clay approximately 20 to 40 feet thick. Groundwater in coastal regions may be saline in the lower part of the aquifer (Hamilton and Larson, 1988).

Well yield and specific capacity data for the Yorktown Aquifer are limited. Reported well yields range from 12 to 304 gpm, with an average of approximately 87 gpm. Specific capacities range from 0.5 to 14.4 gpm/ft, with an average of 5 gpm/ft. Domestic well drillers in the area indicate that smaller diameter (1-1¼-inch to 2-inch) well yields range from 5 to 50 gpm (Siudyla et al., 1981).

The Eocene-Upper Cretaceous Aquifer occurs at approximately 500 feet bgs in the western section of the Norfolk area and at depths of approximately 1,000 feet in the eastern section. The aquifer consists of one or two fine- to medium-grained glauconitic sand beds, 10 to 30 feet thick, interbedded with silt and clay.

The Lower Cretaceous Aquifer is composed of interbedded gravel, sand, silt, and clay. It is separated from the Eocene-Upper Cretaceous Aquifer by clay and silt beds 50 feet or more in thickness. Beds of clay divide the aquifer into several permeable zones. The top of the aquifer ranges from 600 feet bgs in the northwest to approximately 1,100 feet in the eastern section. The bottom of the aquifer rests on basement rocks at a depth of 2,000 feet in the west to approximately 4,000 feet in the east. Well yields for this aquifer range from 200 to 1,000 gpm, and specific capacities range from 2.9 to 30.8 gpm/ft (Siudyla et al., 1981).

1.2.3.2 Surface Water

Stormwater in the refueling area is directed by way of surface contouring to grated storm drains that empty into open drainage ditches. Water also seeps through concrete seams into the underlying soils, as indicated by staining on exposed seams in a construction site located near the study area. The sandy nature of the surficial soils may also allow for ground seepage, recharging shallow groundwaters during periods of rain.

Surface water continues to travel downgradient to the nearest surface water body which is West Neck Creek located approximately 2 miles to the southwest. West Neck Creek eventually empties into London Bridge Creek which is a tributary of Eastern Branch Lynnhaven River. Manmade structures installed in the drainage pathways consist of oil booms and wicks. While these structures are designed to filter and control floating petroleum product, the structures do not remove dissolved petroleum compounds.

1.2.3.3 Floodplain

The President of the United States' Executive Order 11296 of 11 August 1966 and Operation Navy Instruction (OPNAVINST) 11010.22, set policies and procedures for the study and development of land in floodplains. The purpose of the studies is to prevent uneconomic uses and lessen the risk of losses from flooding on Federal installations and Federally financed or supported projects. Two floodplain studies were prepared by the Corps of Engineers, Norfolk District, U.S. Army, for the Cities of Virginia Beach and Chesapeake in July 1969 and December 1972, respectively. From the report data, two flood levels at NAS OCEANA have been established for planning purposes: the Intermediate Regional Tidal Flood (a tide having an average frequency of occurrence of about once in 100 years) and the Standard Project Tidal Flood (the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions considered reasonably characteristic of the geographical region involved, excluding extremely rare combinations).

The Master Plan addresses only those floodplain areas that have a direct impact on NAS OCEANA and its immediate vicinities. Urban development, although modifying the existing contours and drainage patterns in areas adjacent to this installation, has minimal effect on conditions existing on-station. While this site is subject to rainfall inundation, it is not located in either of the above-mentioned floodplains.

1.2.4 Climate

The climate of the Virginia Peninsula is moderate continental with mild winters and long, warm summers. The average monthly temperatures in the area range from 40°F in January to 78.4°F in July. Precipitation is well distributed throughout the year, with the heaviest rains occurring in July and August. The average annual precipitation is 45.22 inches.

1.2.5 Local Land Use

Land cover in the subject area is considered to be mixed urban. Local land uses are related to base operations and include commercial, residential, and industrial activities. The site is bordered on the north by a grassy median containing a fuel transfer tank (the day tank), on the west by a concrete taxiway, and along the south and east by concrete-covered aircraft parking areas. Further to the east are numerous hangar buildings and the control tower.

While the area is mixed urban, the immediate vicinity is open grass and concrete paving. The only subsurface conduit appears to be fuel supply lines. Sampling was performed near these lines to identify the possibility of conduit contamination.

1.2.6 Well Survey

As required by the Virginia State Water Control Board (VSWCB), pumping and injection wells within a 1-mile radius of the site were identified. This search was accomplished by contacting the VSWCB. As shown in Figure 1-2, 2 pumping wells and 2 destroyed wells were identified within approximately 1 mile of the site. Table 1-1 summarizes the information available about the wells and Appendix A presents a printout provided by the VSWCB detailing well information for these wells. Each of the 4 wells is owned by NAS Oceana. The 2 wells in use were reported to WESTON by NAS Oceana personnel to supply water for the washing of aircraft and are not used for drinking water purposes.

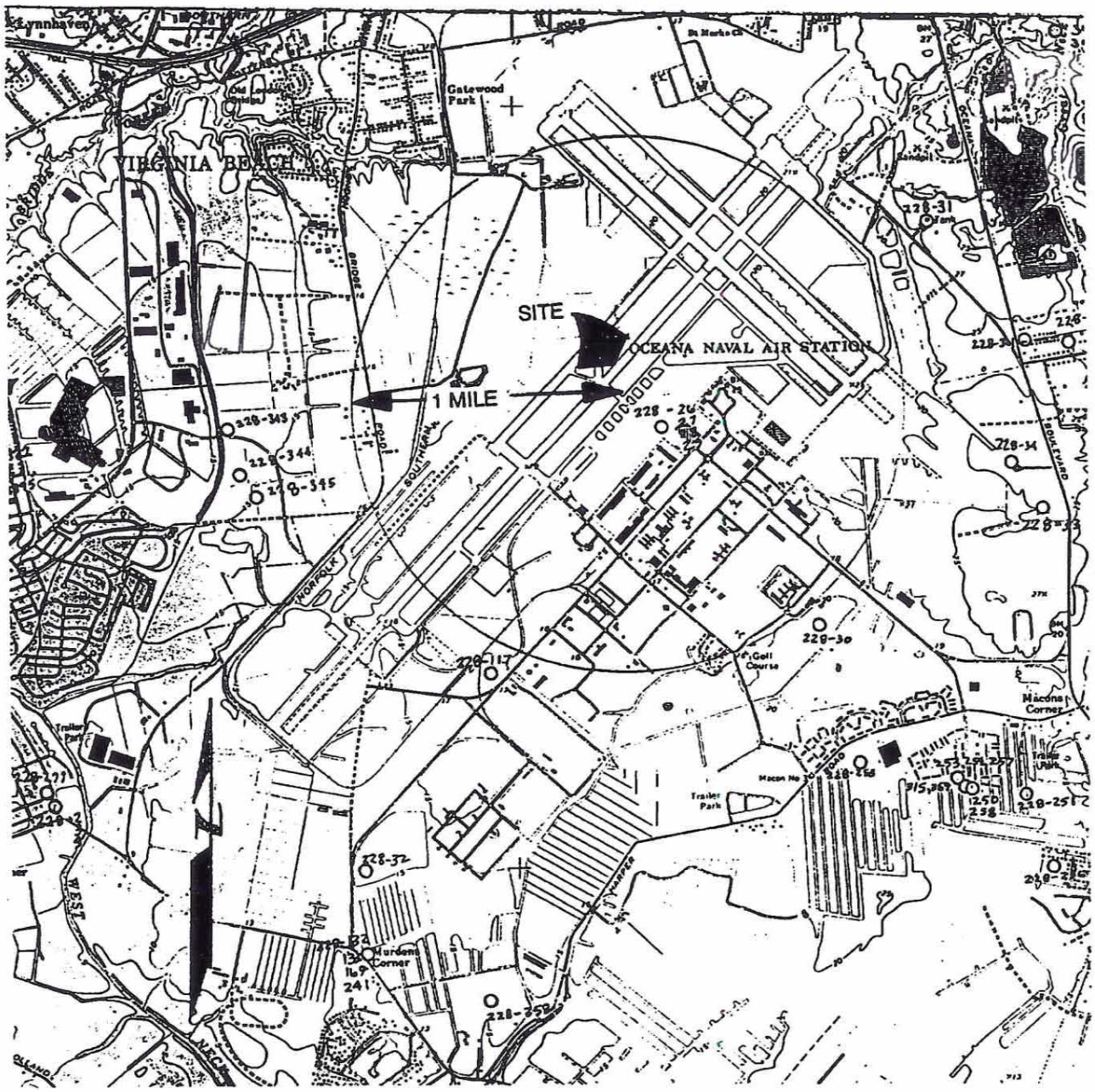
1.3 INVESTIGATIVE METHODS

Field activities were conducted from 2 March 1992 through 13 March 1992, and from 31 March 1992 through 10 April 1992. These activities included soil borings, monitoring well installation, aquifer testing, and soil and groundwater sampling. The following sections discuss the methodology employed for these activities.

1.3.1 Soil Boring Activities

Nineteen borings were advanced in the vicinity of the Fitwing Fuel Pits located at NAS Oceana as shown in Figure 1-3. The boreholes were advanced using 3¼-inch (inner diameter) hollow-stem augers. Each boring was advanced to a depth ranging between 10 to 19 feet bgs. Soil cuttings obtained during drilling activities were containerized in steel 55-gallon drums and stored on-site.

Split-spoon samples were collected at continuous 2-foot intervals. Specific sample intervals were determined by the site geologist based on geologic variability and monitored organic hydrocarbon concentrations. All soil



1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
THE RELATIONSHIP BETWEEN THE TWO DATUMS IS VARIABLE
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 2 FEET
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA 22903
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

PRINCESS ANNE, VA.

36076-G1-TF-024

1965
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DWG. TITLE: WELLS WITHIN 1 MILE OF THE SITE	FIGURE NO. 1-2	

TABLE 1-1

RECORDS OF WELLS WITHIN ONE MILE OF THE SITE

VSWCB WELL NO.	RECORDED OWNER	APPROXIMATE DISTANCE/DIRECTION SITE TO WELL	YEAR DRILLED	DEPTH (feet-bgs)	SCREEN INTERVAL (feet bgs)	WELL DIAMETER (inches)	COMMENTS
228-026	NAS Oceana	0.19 Mile Southeast	1942	30	---	1¼	Used for aircraft washing.[a]
228-027	NAS Oceana	0.19 Mile Southeast	1943	125	102-113'7"	8	Well destroyed.
228-028	NAS Oceana	0.19 Mile Southeast	1943	126.5	103-117	8	Well destroyed.
228-029	NAS Oceana	0.19 Mile Southeast	1944	143	105-131	8	Used for aircraft washing.[a]

a - Information supplied by NAS Oceana Environmental Department.

Note: 1) Well numbers are shown on Figure 1-2 and are those assigned by the Virginia State Water Control Board (VSWCB).

Source: VSWCB Tidewater Regional Office. Other file information is presented in Appendix A.

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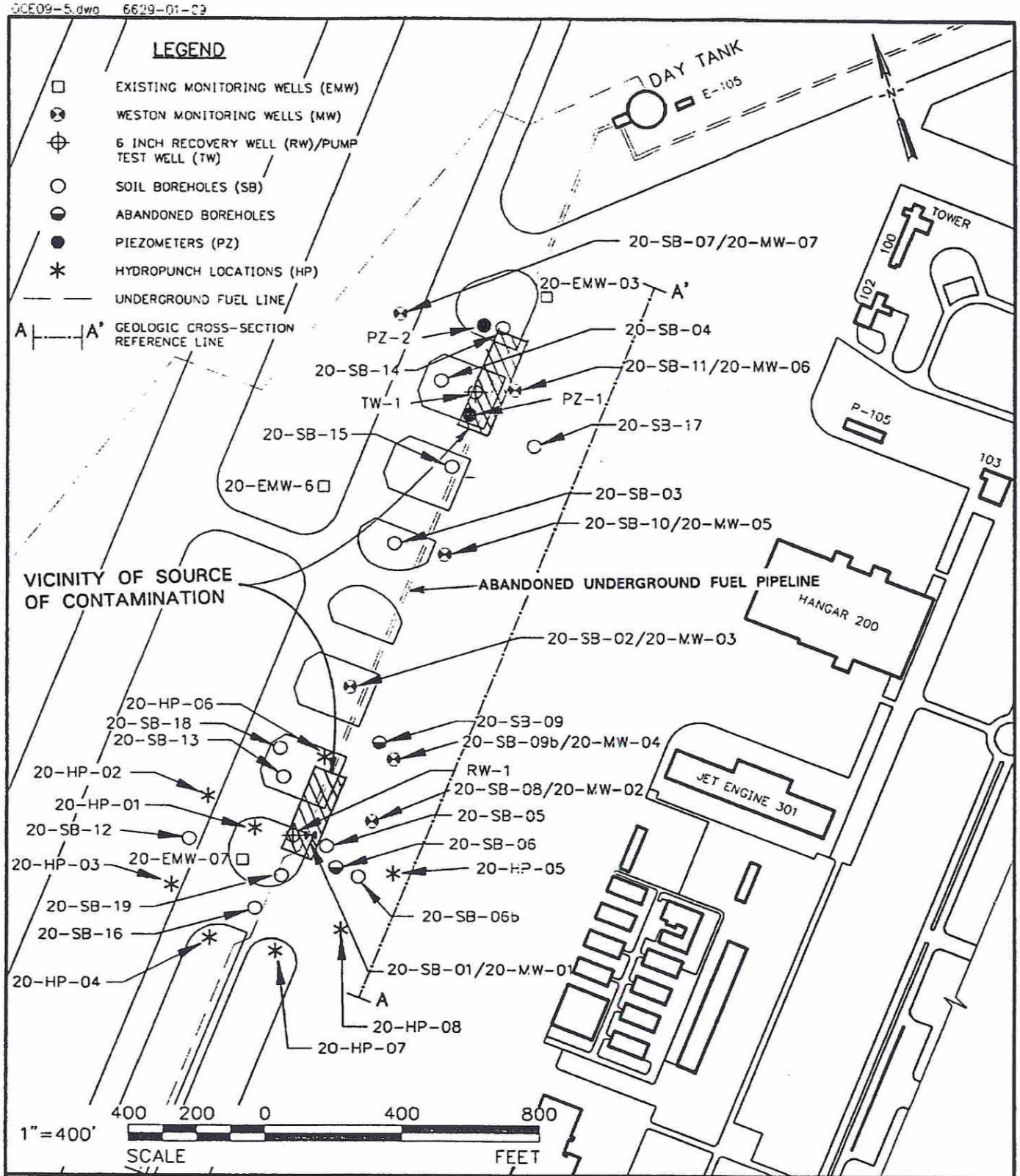


PROJECT TITLE: SITE CHARACTERIZATION REPORT FITWING FUEL PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA
DWG. TITLE MONITOR WELL AND SOIL BORING LOCATIONS	FIGURE NO. 1-3

samples were visually classified by the site geologist and recorded in a field log. The classification included characterization of soil type, color, moisture content, relative density (blow counts), and other pertinent information such as evidence of petroleum contamination. Standard penetration tests (SPT) were conducted following ASTM 1586 Guidelines. Copies of the test boring records are provided in Appendix B.

In addition to soil classification, each soil sample was screened with an HNU photoionization detector (PID) to check for the presence of total volatile organic vapor. The measurements were used to assist in determining the locations of soil samples and groundwater monitoring wells.

Drilling equipment, including hollow-stem augers, drill rods, and split-spoon samplers, was decontaminated to minimize the potential for cross-contamination between boring locations. The hollow-stem augers and drill rods were decontaminated using high-pressure steam. Split-spoon samplers and sampling scoops were decontaminated between samples by washing in Alconox solution (nonphosphate) and rinsing in isopropyl alcohol and distilled water. Decontamination fluids were contained within a temporary decontamination pad/area located at the Jet Engine Test Cell Area to prevent fluids from spilling onto the ground surface. These fluids were eventually transferred into 55-gallon steel drums and stored on-site. Upon completion of the site activities, the stored wastewaters were transported to an oil and grease separator pit where the drums were emptied into the facilities wastewater treatment system. The separator pit is located near the fuel storage tank farm.

1.3.2 Soil Sampling and Analysis

Two soil samples were collected from each boring and submitted for chemical analysis. Each of the selected soil samples were analyzed for TPH and benzene, toluene, ethyl benzene, and total xylenes (BTEX). Additionally, two duplicate soil samples were submitted for chemical analysis for each parameter listed above.

The samples were collected via 1½-inch diameter split-spoons as discussed in Subsection 1.3.1. Because of the saturated unconsolidated nature of the material below the water table, soil samples could not be retrieved from several of the borings below the water table. Samples selected for chemical analyses were obtained at depths near or above the water table or from intervals with elevated HNU readings. Standard sampling intervals that were selected for further chemical analysis were from 2 to 4 feet, and 6 to 8 feet bgs.

Each soil sample collected for chemical analyses was transferred into a laboratory-prepared bottle, properly labeled, and placed in an ice chest cooled to approximately 4°C. The samples were transported by automobile to Environmental Testing Services, Inc., in Norfolk, Virginia, for analysis. The samples were analyzed for TPH (EPA Method 8015 Modified) and BTEX (EPA Method 8020). Appropriate chain-of-custody documentation accompanied the samples to the laboratory.

1.3.3 Monitoring Well Installation

Shallow groundwater monitoring wells were constructed in 7 of the 19 soil borings. The locations of these wells are shown in Figure 1-3. Monitoring well locations were selected to assess relative contaminant concentrations and to establish outer limits for free product and dissolved phase contaminant plumes. In addition, the monitoring wells provided information on the groundwater flow patterns in the area. The depths of the monitoring wells ranged from 12.7 to 14.0 feet bgs. Table 1-2 provides a summary of well construction details.

Prior to well construction, boreholes were reamed using a 6½-inch (inner diameter) hollow-stem auger to the selected depth for screen placement. Due to the flowing nature of the soils, wells were constructed inside the auger, which was extracted gradually during construction of the annulus. The monitoring wells were constructed of 2-inch nominal diameter Schedule 80, flush-joint and threaded PVC casing, with a 10-foot long 0.010-inch slotted screen. A coarse-grain (No. 3 Filter Sand) sand pack extending above the top of the screen was placed in the annulus between the screen and the borehole wall. A bentonite pellet seal was constructed above the sand pack and hydrated with potable water. The remaining annular space was backfilled with a cement/bentonite mixture to ground surface. A flush-mounted manhole cover and PVC locking cap were fitted at the top of each well. Well construction diagrams for the monitoring wells are presented in Appendix C.

Following the construction activities, each monitoring well was developed until the groundwater was essentially sediment-free. The wells were developed by surging for approximately 10 minutes and pumping using a diaphram pump. Approximately 50 gallons (approximately 38 well volumes) of water was removed from each well. The water recovered from each well was containerized in 55-gallon steel drums and stored at a central staging area on-site. The water was later disposed of at the oil and grease separator pit located near the facility fuel tank farm. Monitoring well 20-MW-01 contained abundant free product and produced only 20 gallons of fluid during the pumping interval.

1.3.4. Hydropunch - Groundwater Testing

Eight hydropunch probes were advanced into the ground to depths from 8 to 9 feet bgs. The depth of placement was determined based on information obtained regarding the depth to groundwater from WESTON's initial borehole installations. The hydropunch locations are indicated in Figure 1-3.

The hydropunch probes were used to collect grab samples from the upper water column for field screening of dissolved phase petroleum compounds and for laboratory analysis of purgeable aromatic hydrocarbons. The information obtained from the field screening was used by the field geologist to aid in determining the locations of soil borings and monitoring wells.

TABLE 1-2

SUMMARY OF WELL CONSTRUCTION DETAILS

Well No.	Date Installed	Top of Casing Elevation (feet, above MSL)	Ground Surface Elevation (feet, above MSL)	Boring Depth (feet bgs)	Well Depth (feet bgs)	Screen Interval Depth (feet bgs)	Depth to Sandpack (feet bgs)	Depth to Bentonite (feet bgs)
20-MW-01	3 MARCH 92	20.38	20.30	13.0	12.7	12.7-2.7	1.6	0.8
20-MW-02	6 MARCH 92	19.10	19.34	13.3	13.3	13-3.0	2.0	1.0
20-MW-03	10 MARCH 92	19.89	19.95	13.5	13.4	13-3.0	2.0	1.0
20-MW-04	9 MARCH 92	19.53	19.83	14.0	13.8	13.2-3.2	2.0	1.0
20-MW-05	6 MARCH 92	20.25	20.48	13.5	13.3	13-3.0	2.0	1.0
20-MW-06	10 MARCH 92	20.32	20.58	14.0	13.9	13.5-3.5	2.5	1.5
20-MW-07	5 MARCH 92	19.23	19.25	13.7	13.7	13-3.0	2.0	1.0

MSL - Mean sea level.
bgs - Below ground surface.

An HNU®-Hanby field testing kit was used to screen groundwater samples from each hydropunch location. The test is sensitive to petroleum hydrocarbons and is able to approximate hydrocarbon concentrations to 0.5 ppm by matching the color of the test fluid to established color gradients. Results of the field testing are presented in Table 1-3.

Groundwater samples were also collected for analytical testing by the laboratory. The samples were analyzed for VOCs according to EPA Method 602. Analytical results for the groundwater samples collected by the hydropunch procedure are presented in Table 1-4.

1.3.5 Fluid Level Measurements and Well Elevation Survey

Fluid level measurements for each well were recorded in the site log during the field investigation and prior to groundwater sampling. The depth to water was measured using an oil/water interface probe capable of detecting product layers as thin as 0.01 foot. Depths were measured to the nearest 0.01-foot. The interface probe was decontaminated between readings by washing with an Alconox wash and rinsing with hexane, isopropyl alcohol, and distilled water.

Free product was detected in monitoring wells 20-MW-01, 20-MW-02, and in one previously existing well, 20-EMW-07, constructed by O'Brien and Gere Engineers, Inc. Monitoring well 20-MW-01 contained 7.74 feet of free product and monitoring well 20-MW-02 indicated 0.93 feet of free product thickness upon initial installation. Monitoring well 20-EMW-07 indicated less than 0.1-inch of product.

Each of the newly installed monitoring wells was surveyed by the firm of Miller-Stephenson, PC of Virginia Beach, Virginia. The top of casing and ground surface elevations were measured for each well location to the nearest 0.01-foot relative to mean sea level (MSL). The top of casing and ground surface elevations for each monitor well are given in Table 1-2.

1.3.6 Groundwater Sampling and Analyses

Groundwater samples were collected from 6 of the 7 monitor wells on 12 March and 13 March 1992, and from the hydropunch locations and the existing monitoring wells from 31 March 1992 through 4 April 1992. Monitoring well 20-MW-01 was not sampled due to the abundance of free phase hydrocarbons. The groundwater samples were analyzed for VOCs using EPA Method 602 and TPH using EPA Method 418.1. Additionally, one duplicate groundwater sample for QA/QC purposes was collected and analyzed for VOCs and TPH.

TABLE 1-3
SUMMARY OF FIELD SCREENING RESULTS FOR AROMATIC HYDROCARBONS
HYDROPUNCH TESTS

Sample No.	Depth of Hydropunch[a]	Depth to Water[a]	Color of Water	HNU[a]-Hanby Results (ppm)
20-HP-01	9	NR[b]	Clear Yellow	NA
20-HP-02	8	6.35[b]	Brown	<5
20-HP-03	8	NR	Gray	0.5
20-HP-04	8	6.05	Green Gray	>0.5
20-HP-05	8	5.5	Green Gray	0.5
20-HP-06	9	6.37[b]	Green Gray	20.0
20-HP-07	9	NR	Green Gray	Blank
20-HP-08	9	NR	Gray	Blank

a - Feet below ground surface.
b - Free product encountered.
NR - Not recorded.
PPM - Parts per million.

TABLE 1-4
SUMMARY OF CHEMICAL ANALYSES FOR GROUNDWATER SAMPLES COLLECTED BY HYDROPUNCH PROCEDURE

Parameter[a]	MCL[b] (µg/L)	Hydropunch Number/Field Sample Number (µg/L)							
		20-HP-02 20-HP-02	20-HP-03 20-HP-03	20-HP-04 20-HP-04	20-HP-05 20-HP-05	20-HP-06 20-HP-06	20-HP-07 20-HP-07	20-HP-08 20-HP-08	20-HP-08 20-HP-DUP
Benzene	710[c]	BDL	BDL	BDL	BDL	184	BDL	BDL	BDL
Toluene	200,000	BDL	BDL	BDL	BDL	246	BDL	BDL	BDL
Chlorobenzene	NA	BDL	BDL	BDL	BDL	247	BDL	BDL	BDL
Ethylbenzene	29,000	BDL	BDL	BDL	BDL	600	BDL	BDL	BDL
1,3 Dichlorobenzene	2,600	BDL	BDL	BDL	BDL	1,170	BDL	BDL	BDL
1,4 Dichlorobenzene	2,600	BDL	BDL	BDL	BDL	3,230	BDL	BDL	BDL
1,2 Dichlorobenzene	17,000	BDL	BDL	BDL	BDL	5,060	BDL	BDL	BDL
Total Xylenes	NA	3	BDL	3	3	290	BDL	BDL	BDL
Total VOC	NA	3	BDL	3	3	11,027	BDL	BDL	BDL

a - Analysis performed by EPA Method 602.
b - Maximum Contaminant Level in micrograms/liter (µg/L) as set by Emergency Regulations to Water Quality Standards VR680-21-01 for all other surface waters.
c - Federal Drinking Water Standard for benzene is 5µg/L.
NA - Not applicable. No regulatory level established.
BDL - Below Detection Limit

Notes:
1. 20-HP-01 was only field screened using the HNU®-Hanby Method. No sample was collected due to abundant free product.
2. Three trip blanks were analyzed with values of each parameter for each field blank below 1 µg/L. Trip blank analyses are included in the laboratory data presented in Appendix F.

Dedicated polyethylene bailers were used to purge and sample the monitoring wells. Purge water was containerized in 55-gallon steel drums and stored at a central staging area on-site. Water characteristics such as turbidity, color, odor, and the presence of free phase hydrocarbons were recorded in the site log.

Groundwater samples were collected from the wells using the dedicated polyethylene bailers. The samples were transferred into laboratory-prepared sample containers and placed in an ice chest cooled with ice to approximately 4°C. Groundwater samples were collected at the air/water interface by slowly pouring water from the bailer into the appropriate sample container to minimize volatilization. The samples collected from monitoring well 20-MW-02 were collected through the bottom of the bailer to avoid sampling the free phase hydrocarbon layer. The samples were transported by automobile to Environmental Testing Services, Inc. in Norfolk, Virginia, for analysis. Appropriate chain-of-custody documentation and a trip blank sample accompanied the samples to the laboratory.

1.3.7 Hydraulic Conductivity Tests

Hydraulic conductivity tests (also commonly referred to as slug tests) were conducted in 2 monitoring wells (20-MW-03 and 20-EMW-07) on 7 April 1992. The hydraulic conductivity test is performed by rapidly inserting or removing an object, i.e., a "slug", within a monitoring well. The slug displaces a volume of groundwater within the monitoring well. The resulting rise and/or fall of the groundwater level is measured with respect to time.

For the hydraulic conductivity tests performed at monitoring wells 20-MW-03 and 20-EMW-07, the slug used was a Teflon rod, 5 feet in length and 1¼ inches in width. Due to the rapid recovery rates anticipated for the site, the rise and/or fall of the groundwater levels was measured using an electric pressure transducer and recorded with an In Situ SE2000 Environmental Data Logger. The Teflon slug and pressure transducer were cleaned between wells using a nonphosphate soap solution and were rinsed with distilled water.

1.3.8 Aquifer Pump Tests

Aquifer pump tests consisting of a step-drawdown and a constant rate 8-hour pump test were performed at NAS Oceana in order to understand the maximum pumping rate at which the surficial aquifer in the vicinity of the Fitwing Fuel Pits will produce water and to understand the area of capture created while pumping. The tests also produced very important hydrogeologic parameters for the aquifer.

The processes and equipment used during the two aquifer tests (step-drawdown and constant rate) were the same with the only difference in the tests being the length of the tests. At the beginning of each test, a 4-inch submersible pump powered by an electrical generator was lowered into the well and set to a depth of 1-foot above the bottom of the well. Next, a pressure transducer was lowered into each well that was to be monitored

during the test. The transducers were used to detect pressure changes in the well as the test progressed and were connected to a data logger, which converted the pressure readings into water levels and matched the water level to a particular point of time, measured from the beginning of the test. Each data point was stored in the data logger memory for later retrieval by computer. The results of this test is presented in the results portion of this report (see Subsection 1.4.2.2).

1.4 INVESTIGATION RESULTS

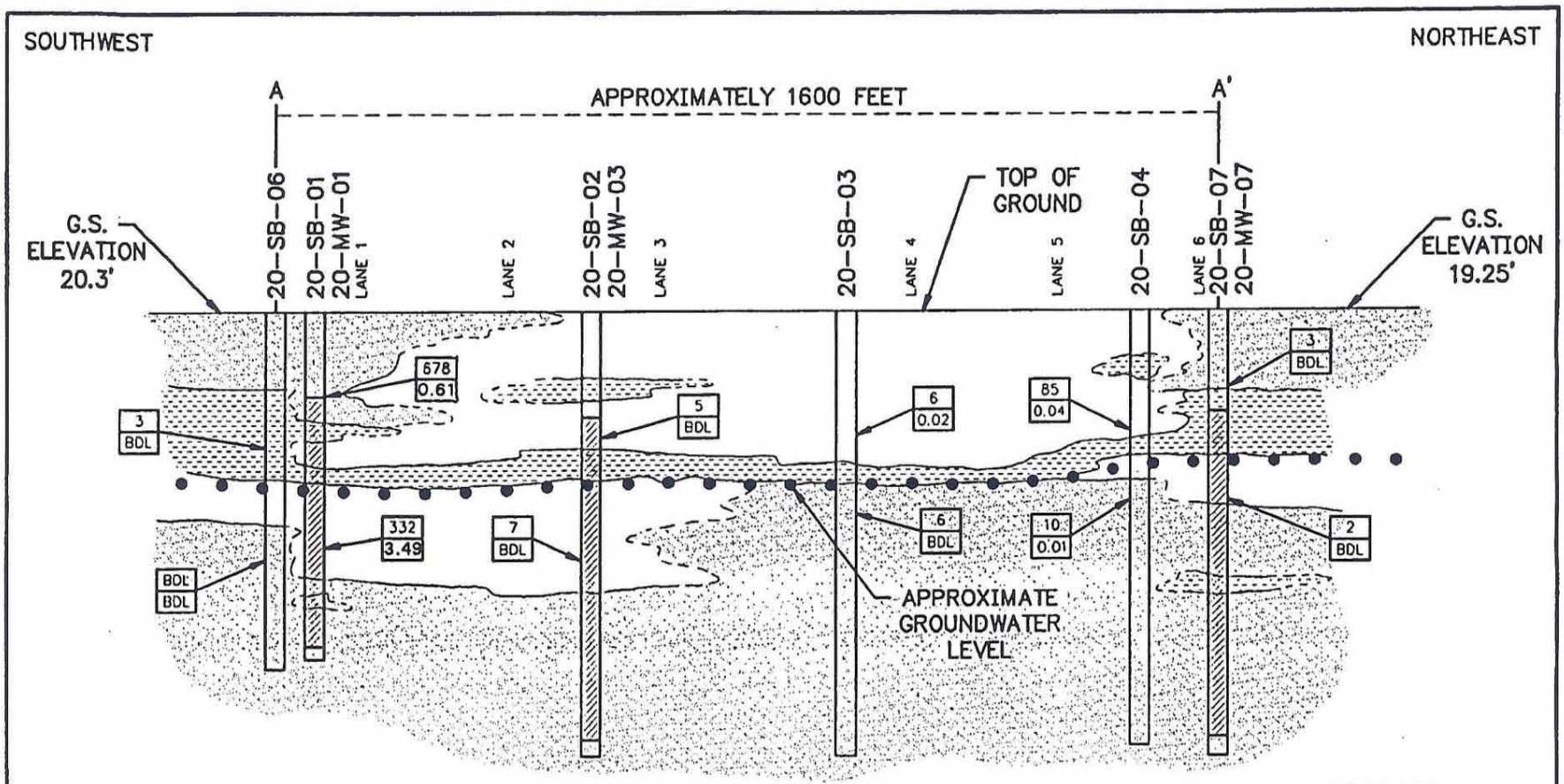
This section presents the results of the site characterization activities. Site subsurface conditions are discussed and are followed by a description of the nature and extent of petroleum hydrocarbon contamination as indicated by the available analytical data.

1.4.1 Site Soils and Geology

The surficial geologic unit in the study area is the Lynnhaven Member of the Upper Pleistocene Age Tabb Formation. This unit consists of clayey and silty sand grading downward into a coarse-grained gray sand. The thickness of the Lynnhaven Member ranges from 0 to 20 feet and forms the water table aquifer (Columbia Aquifer). The Lynnhaven Member Aquifer is underlain by relatively impermeable sediments, including silts, clays, and sandy clays ranging from 20 to 40 feet in thickness (Mixon et. al., 1989).

Soil samples were obtained from each of the 11 borings to characterize subsurface soil conditions. In general, the refueling area is underlain by 3 to 5 feet of sand, silty sand, and clay, and 0.5 to 3.0 feet of dark clay followed by medium- to coarse-grained greenish-gray sand. Copies of the boring logs describing the soils encountered are provided in Appendix B. A geologic cross-section is presented in Figure 1-4 that illustrates an increase in silty sand and clays to the south. This gradation resulted in slower production rates during monitor well development activities (approximately 7.5 gpm to the north and 1.8 gpm to the south).

A clay layer ranging from 0.5 to 3.0 feet in thickness was observed throughout the area. The basal contact of this clay is approximately 5 feet bgs. This contact approximates water table measurements for the area, suggesting that the aquifer is locally confined. The presence of elevated hydrocarbon levels in the underlying sands indicates the clay layer is inconsistent or, at best, a leaky aquitard. The concurrence of the base of the clay and the local water table may also suggest only a coincidental relationship. Perched water tables were encountered in some of the borings at intercepts with clay lenses. These features were localized with no lateral extent.



PROJECT TITLE: SITE CHARACTERIZATION REPORT FITWING FUEL PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT: DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA	WESTON
DWG. TITLE: SITE GEOLOGIC CROSS-SECTION	FIGURE NO.: 1-4	

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1.4.2 Site Hydrogeology

The hydrogeologic characteristics of the water table aquifer (Columbia) are influenced in part by various land development activities at NAS Oceana. As topographic relief across the site is slight, surface water not intercepted by storm drains or ditches would flow south to southewest, and would eventually discharge into the West Neck Creek. Based on available data, it is not clear what effect the overlying clay has on local groundwater recharge and movement. This layer may only slow vertical movement of groundwater and not act as a true confining layer. Considering the surface water factors discussed in Subsection 1.2.3.2, most of the groundwater recharge would migrate laterally towards natural and developed discharge areas through the surficial aquifer. Downward movement of groundwater into the lower aquifers is believed to be hindered by the presence of an aquitard layer consisting of relatively impermeable sediments.

Groundwater was encountered beneath the site between approximately 4 and 6 feet bgs. Table 1-5 summarizes fluid level measurements and elevations on 18 March 1992. Based on the 18 March 1992 groundwater elevation data, groundwater appears to be flowing southwest across the site (Figure 1-5). The groundwater gradient is estimated to be 4.2×10^{-4} ft/ft in a southwesterly direction.

1.4.2.1 Hydraulic Conductivity Tests

Each well where the hydraulic conductivity test was performed has a screened length of 10 feet: however, the entire length of the screen has the potential to not be completely located within the saturated portion of the aquifer due to the variation in the water table and the shallow nature of the wells. Therefore, to avoid any problems with air being entrapped around the well and creating false permeability values, rising head (slug removal) tests were performed. The test is carried out by placing the slug into the water in the well, allowing the water level to equilibrate to pretest levels, and then removing the slug. Water level measurements are recorded with time until the water level once again returns to equilibrium.

Based upon the hydraulic conductivity tests performed on 7 April 1992, the hydraulic conductivity for the site ranges from 2.14×10^{-3} to 4.92×10^{-3} ft/min. The results of the hydraulic conductivity test are summarized in Table 1-6.

Using the estimated gradient for the site and the hydraulic conductivity ranges determined for the site, the groundwater flow velocity can be estimated using the following equation:

$$V = Ki/n_e$$

Where: V = estimated groundwater flow velocity

K = hydraulic conductivity

i = groundwater gradient

n_e = average effective porosity, as a decimal fraction

TABLE 1-5

SUMMARY OF FLUID LEVEL MEASUREMENTS
FITWING REFUELING AREA

18 MARCH 1992

Well No.	Top of Casing Elevation (feet, above MSL)	Depth to Product (feet, below top of casing)	Depth to Groundwater (feet, below top of casing)	Product Thickness (feet)	Product Elevation (feet, above MSL)	Groundwater Elevation (feet, above MSL)
20-MW-01	20.38	5.18	12.06	6.88	15.20	13.96[a]
20-MW-02	19.10	5.32	5.55	0.23	13.78	13.74[a]
20-MW-03	19.89	ND	5.92	ND	ND	13.97
20-MW-04	19.53	ND	5.67	ND	ND	13.86
20-MW-05	20.25	ND	5.86	ND	ND	14.39
20-MW-06	20.32	ND	5.77	ND	ND	14.55
20-MW-07	19.23	ND	4.73	ND	ND	14.50
20-EMW-03	NS	ND	5.30	ND	ND	NS
20-EMW-04	NS	ND	5.39	ND	ND	NS
20-EMW-06	NS	ND	4.16	ND	ND	NS
20-EMW-07	NS	5.63	5.63	<0.01		NS

Notes: a - Calculated groundwater elevations based on specific gravity of JP-5 jet fuel of 0.82.
MSL - Mean sea level.
ND - Not detected.
NS - Not surveyed.

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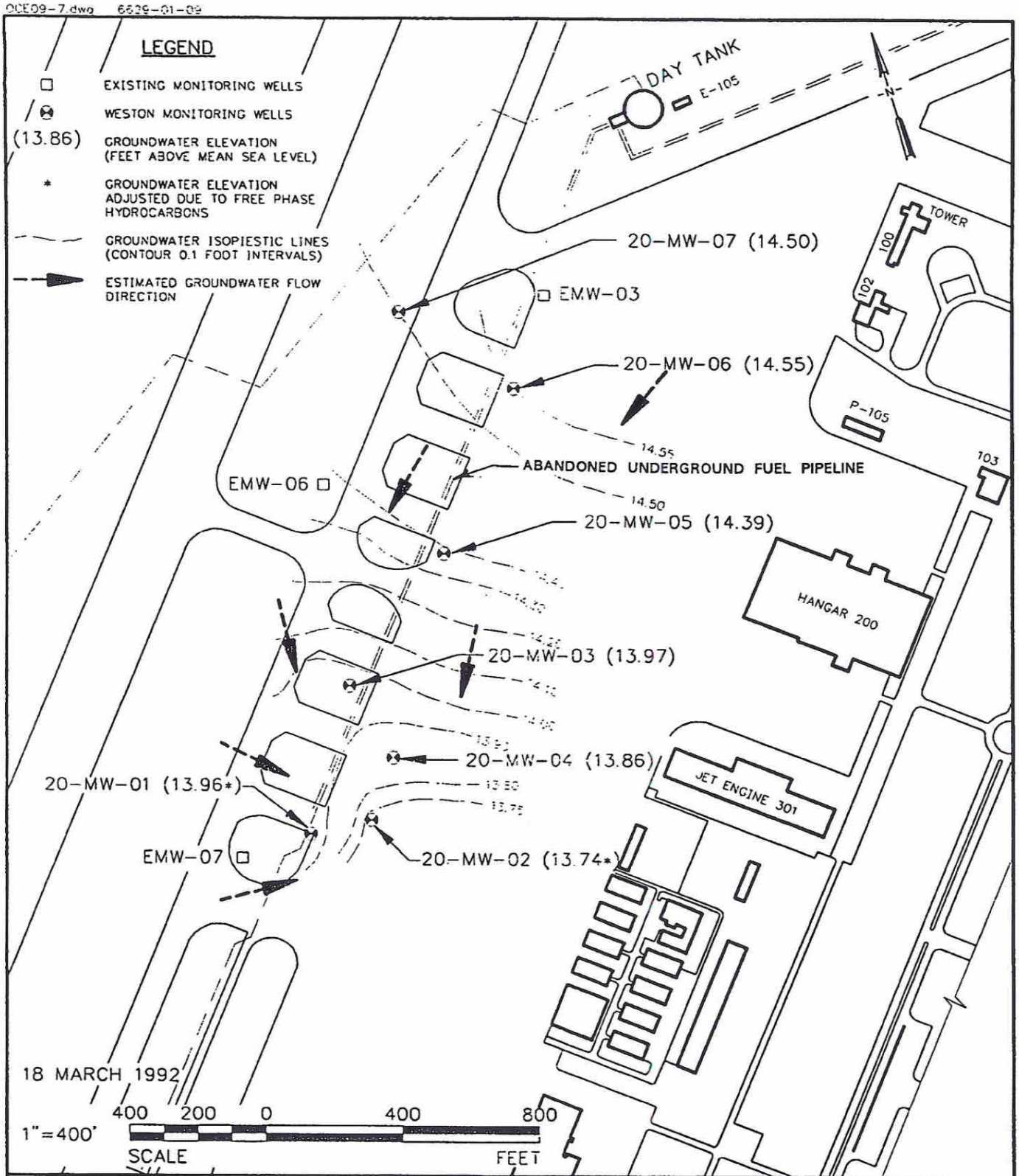


PROJECT TITLE: SITE CHARACTERIZATION REPORT FITWING FUEL PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA
DWG. TITLE GROUNDWATER CONTOUR MAP	FIGURE NO. 1-5

TABLE 1-6

SUMMARY OF HYDRAULIC CONDUCTIVITY TESTS

Well No.	Hydraulic Conductivity Removal Test	
	ft/min	cm/sec
20-MW-03	2.14×10^{-3}	1.09×10^{-3}
20-EMW-07	4.92×10^{-2}	2.50×10^{-2}

Notes:

1. The methods and equations used to interpret and reduce the slug test data are based on information published in two papers: "A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells", Herman Bouwer and R. C. Rice, Water Resources Research, June 1976, Volume 12, Number 3; and "The Bouwer and Rice Slug Test - An Update", Herman Bouwer, Groundwater, May-June 1989, Volume 27, Number 3.

2. Hydraulic conductivity tests conducted on 7 April 1992 using an In Situ Environmental Data Logger (Model SE2000) and pressure transducers.

Using the range of values calculated for K of 2.14×10^{-3} to 4.92×10^{-2} ft/min calculated from the hydraulic conductivity test, a groundwater gradient of 4.2×10^{-4} ft/ft, and an estimated effective porosity of 0.28 (Fetter), the range of groundwater flow velocities are calculated as 3.21×10^{-6} to 7.38×10^{-5} ft/min or 2 to 39 feet/year.

1.4.2.2 Aquifer Tests

Aquifer tests (pump tests) consisted of a step-drawdown and an 8-hour constant rate aquifer test. Wells that were used for the step-drawdown and pump tests were located in the Fitwing Fuel Area. The pumping well was TW-01 and the observation wells were PZ-01, PZ-02, and 20-MW-06 (Figure 1-3).

The step-drawdown test was the first aquifer test performed and consisted of a four-step process where the first three steps were pumping phases and the last step was the recovery stage. The initial step was 30 minutes of pumping time, whereas the second and third step were run for approximately 60 minutes. The recovery interval was designed to last approximately 12 hours, but it was discontinued after only 38 minutes because of artificial recharge from the discharge line.

The second aquifer test (the constant rate aquifer test) consisted of two steps - the initial 8-hour pumping phase followed by a 14-hour, 39-minute recovery phase.

After all data had been collected, the information was downloaded into a computer from the field data logger. The computer program, AQTESOLV, was used for determination of aquifer properties (i.e., transmissivity and storativity).

Transmissivity and storativity were determined from data achieved during the pump and step-drawdown tests. Transmissivity, in this case, refers to the product of the average hydraulic conductivity and the thickness of the aquifer. Thus, it is the rate of flow under a hydraulic gradient equal to unity through a cross-section of unit width over the whole thickness of the aquifer (Kruseman and De Ridder, 1983). The dimensions for transmissivity are length^2/time. The storativity or storage coefficient is defined as the volume of water released or stored per unit surface area of the aquifer per unit change in the component of head normal to that surface (Kruseman and De Ridder, 1983). It is dimensionless. The values achieved for transmissivity and storativity are given in Table 1-7.

TABLE 1-7

AQUIFER PROPERTIES AT NAS OCEANA

WELL NO.	TRANSMISSIVITY T (ft^2/min)	STORATIVITY S	PUMP RATE (gpm)	RADIUS FROM PUMPING WELL (ft)	MAXIMUM DRAWDOWN OBSERVED (ft)	ESTIMATED AQUIFER THICKNESS (ft)	TEST DESCRIPTION
PZ-01	0.3418	5.105×10^{-4}	4.00	88	0.286	50	SDT-S0
PZ-02	0.3264	1.109×10^{-4}	4.00	188	0.047	50	SDT-S0
20-MW-06	0.5044	5.434×10^{-4}	4.00	50	0.272	50	SDT-S0
PZ-01	0.9151	9.041×10^{-6}	6.20	88	0.476	50	SDT-S1
PZ-02	2.291	3.156×10^{-4}	6.20	188	0.110	50	SDT-S1
20-MW-06	1.371	8.543×10^{-6}	6.20	50	0.460	50	SDT-S1
PZ-01	1.528	3.784×10^{-6}	8.75	88	0.524	50	SDT-S2
PZ-02	3.773	3.788×10^{-5}	8.75	188	0.157	50	SDT-S2
20-MW-06	1.925	3.16×10^{-7}	8.75	50	0.620	50	SDT-S2
TW-01	0.079	1.755	10.50	0	0.317	50	RT
PZ-02	3.56	6.822×10^{-3}	10.50	188	0.283	50	RT
20-MW-06	5.545	2.689×10^{-9}	10.50	50	0.479	50	RT
PZ-01	1.991	2.564×10^{-3}	10.50	88	0.317	50	PT
PZ-02	1.378	1.576×10^{-3}	10.50	188	0.299	50	PT
20-MW-06	2.028	2.915×10^{-4}	10.50	50	0.516	50	PT

SDT-S0 indicates Step-Drawdown Test (Step 0)
SDT-S1 indicates Step-Drawdown Test (Step 1)
SDT-S2 indicates Step-Drawdown Test (Step 2)
RT indicates Recovery Test
PT indicates Pump Test
gpm - gallons per minute

The Theis method was applied to all data achieved during the test to derive the transmissivity and storativity. Other methods were also utilized (i.e., Cooper and Jacob); however, the values were similar, thus the Theis method was favored. The transmissivity was determined from the data by the equation below:

$$T = \frac{Q}{4 \pi s} W(u)$$

where, Q = the discharge rate in feet cubed per day

s = the drawdown in feet measured in a piezometer or well at a distance r in feet from the pumping well

W(u) = Theis well function

The storativity (s) was determined by the following:

$$S = 4 T (t/r^2)u$$

where, T = transmissivity in feet squred per minute

t = the time in minutes since pumping started

r = the linear distance from the piezometer or well to the pumping well

and,

$$u = \frac{r^2 S}{4Tt}$$

The initial phase of the step-drawdown test (Step 0) produced very similar transmissivity and storativity values, however, as the pumping steps progressed and the pumping rates were increased, the values became widely variable (Table 1-7). For example, the transmissivity values obtained during Step 1 of the test varied as much as 2.245 ft^2/min. According to Table 1-7, the most aberrant transmissivity values produced during the step-drawdown test were from the piezometer PZ-02 readings and may be a result from differences in hydraulic gradient or aquifer materials.

Storativity values derived from the data of the step-drawdown test are relatively consistent in the initial step (Step 0), however, they begin to vary by a factor of 2 during Steps 1 and 2. Once again, the values achieved from the data of piezometer PZ-02 are higher, especially in Step 1.

The values achieved for storativity and transmissivity from the pump test and recovery test are also variable, and have even greater differences than those of the step-drawdown test. For example, the lowest value determined for the transmissivity from the recovery test is 0.079 ft^2/min, whereas the highest is 5.545 ft^2/min. The difference

(5.466 ft^2/min) in this case is fairly significant. Storativity values from the recovery test are also significantly different and must be compared with the average values for storativity from the step-drawdown test in order to seem relative. Storativity values form the pump test are relatively the same as in the initial step of the step-drawdown test, but are larger by a factor of 3 than these in Steps 1 and 2 (Table 1-7).

The recovery test data from PZ-01 could not be calculated by any method available because of the fact that the water level continues to drawdown for 90 minutes after the pump is shut off, and does not return to zero even as the other observation wells do (see Appendix E, Test 6, Step 2).

Because the transmissivity is the product of the hydraulic conductivity and the aquifer thickness, the transmissivity values determined from the step-drawdown and pump test should be similar to transmissivity values calculated from the average slug test hydraulic conductivity values multiplied by the aquifer thickness from Table 1-7. The average hydraulic conductivity value form the slug tests for the Fitwing Fuel Area is 2.57×10^{-2} ft/minute. When multiplied by the aquifer thickness (50 feet), the transmissivity equals 1.29 ft^2/minute. The average value for transmissivity from all of the pump test, recover test, and step-drawdown test data is 1.84 ft^2/minute. These two number are relatively close and are considered to be in agreement.

One of the more important reasons for carrying out the pump test is to determine what the area of capture would be for a well that is of the same dimensions as that of the pumping well (6-inch inside diameter with a 10-inch total diameter). Based on data collected during the pump test (Appendix E), the pumping well with a discharge rate of 10.5 gallons per minute effected the observation well, PZ-02, which is 188 feet away from the center of the pumping well, in 21 minutes. The pumping was able to draw down the water level in PZ-02 approximately 4 inches.

In addition to determining area of capture, the pump test also provided WESTON knowledge of another important hydrogeolic aspect - the maximum discharge rate at which the aquifer will produce water. The step-drawdown test was originally designed to determine this, but after the last step was completed, it was decided that the discharge rate may be increased higher than 8.75 gallons per minute (the discharge rate for Step 2). The pump test subsequently utilized a discharge rate of 10.5 gallons per minute. This rate drew the water level in the pumping well (TW-01) down 5.7 feet. The static water level in the well was approximately 12 feet. The pump was originally set at 20 feet below the surface, had 8 feet of head remaining between the pump and the water level. Obviously, the maximum discharge rate was not obtained during this test; however, for a 22-foot well (TW-01), the maximum rate would not be much over 10.5 gallons per minute.

Conclusions regarding the findings of the aquifer tests are as follows:

- Transmissivities calculated from the pumping tests can be checked against the transmissivities derived from the recovery test. According to Kruseman and De Ridder (1983), the recovery method has the advantage that the rate of recharge is constant and equal to the mean rate of discharge during pumping. Moreover, drawdown variations that may result for oscillations in the discharge rate do not occur during recovery making the recorded data an accurate representation of the aquifer transmissivity. Based on this fact, the average transmissivity from the recovery tests is 3.06 ft^2/minute. The average transmissivity for the pumping test is 1.53 ft^2/minute. These values are within relative agreement.

- The average storativity value from all recorded data is 9.14×10^{-4}. This value is in agreement with the majority of storativity values for each observation well involved in the step-drawdown and constant rate tests.

- The greatest distance for the zone of capture was determined to be 188 feet from the center of the pumping well, however, this is not the maximum extent of the capture zone for the discharge rate of 10.5 gallons per minute. It appears that the capture zone may have been larger than 188 feet based on the fact that PZ-02 was drawn down relatively quickly and that the water level dropped approximately 4 inches. Thus, the point where drawdown and zero drawdown occurs at the aforementioned discharge rate, is beyond 188 feet from the center of TW-01.

- The discharge rate of 10.5 gallons per minute utilized during the pumping test does not appear to be the maximum sustainable rate. Based on a 22-foot deep well, the 10.5 gallons per minute discharge rate allowed 8 feet of head to remain in the well. A higher discharge rate could be used to lower the head approximately 5 feet more in a 22-foot deep well.

1.4.3 Field Screening of Soils

Split-spoon samples collected during the soil borings were screened with a PID to check for the presence of volatile organic vapor. Results of the field screening are shown in Table 1-8. Volatile organic vapor concentrations ranged from 0 to 400 units in the samples screened. Samples monitored from borings 20-SB-01, 20-SB-05, 20-SB-08, 20-SB-11, 20-SB-13, and 20-SB-15 exhibited readings greater than 100 units. PID readings were typically highest in samples collected, or immediately below the water table. However, one elevated PID readings was encountered at a depth near the water table (20-SB-11, see Table 1-8).

TABLE 1-8

SUMMARY OF PID FIELD SCREENING OF SOILS

Boring No. / Well No.	Sample Depth (feet)/PID Readings (units)									
	0.0-2.0	2.0-4.0	4.0-6.0	6.0-8.0	8.0-10.0	10.0-12.0	12.0-14.0	14.0-16.0	16.0-18.0	18.0-20.0
20-SB-01	0	50	50		115			126	---	
20-SB-02	ND	ND	ND		ND			ND	ND	—
20-SB-03	ND	ND	ND	ND	ND			ND	---	
20-SB-04	0.5	2	35	5	ND			ND	---	
20-SB-05	8	20	70	100	70			5	---	
20-SB-06[a]	5	8	70	---						
20-SB-06b	ND	ND	ND	ND	20			5	---	
20-SB-07	ND	ND	ND	ND	ND			ND	---	
20-SB-08	ND	ND	80	140	90			70	---	
20-SB-09[a]	ND	3	---							
20-SB-09b	ND	ND	ND	ND	ND	---				
20-SB-10	ND	0.5	0.5	ND	ND			ND	---	
20-SB-11	10	60	100	8	10	---				
20-SB-12	ND	ND	ND	ND	ND	ND	---			
20-SB-13	ND	52	105	155		30	---			
20-SB-14	ND	ND	ND	ND		ND	---			
20-SB-15	ND		200	400		250	---			
20-SB-16	4	12	ND	ND		ND	---			
20-SB-17	ND	ND	ND	ND		ND	---			
20-SB-18	ND	5	15	50		5	---			
20-SB-19	ND	ND	ND	ND		ND	---			

a - Soil boring had to be offset due to obstruction.
SB - WESTON soil boring.
--- Borehole terminated previously.
ND - Not detected.
Blank Cell - No PID reading recorded.

1.4.4 Soil Sampling

Subsurface soil samples were collected from the 19 boring locations. The samples were analyzed for TPH and BTEX and the laboratory results are summarized in Table 1-9. Laboratory analyses are provided in Appendix F, and chain-of-custody records are provided in Appendix G.

Of the 41 soil samples analyzed (two from each boring and three duplicates), 26 samples contained TPH at or above the laboratory detection limit of 1.0 mg/kg. TPH concentrations ranged from 1 mg/kg to 703 mg/kg in soil boring 20-SB-13 (6 to 8 feet bgs). Soil borings that exhibited TPH concentrations greater than 100 mg/kg include 20-SB-01, 20-SB-05, 20-SB-08, 20-SB-13, 20-SB-15, and 20-SB-18. These concentrations exceed the corrective action level of 100 mg/kg established by the State of Virginia for TPH in soils. Of the remainder of the soil samples analyzed, none exceeded a TPH concentration of 85 mg/kg. The analytical data indicate that the TPH detected from these soil samples appears to be representative of the kerosene group of fuels, which is similar to JP-5 jet fuel (see the laboratory reports in Appendix F).

Analytical results for BTEX in soils indicate elevated concentrations of one or more of the BTEX parameters in soil borings 20-SB-01, 20-SB-03, 20-SB-04, 20-SB-05, 20-SB-08, 20-SB-13, 20-SB-15, 20-SB-18 and 20-SB-19 with low concentrations of total xylene in 20-SB-19 and low levels of toluene in 20-SB-10, 20-SB-11 and 20-SB-17. The analytical results are summarized in Table 1-9.

1.4.5 Groundwater Sampling

Groundwater samples were collected on 12 and 13 February 1992 from 6 of the 7 newly installed monitoring wells, and from 31 March through 9 April 1992, from 8 hydropunch locations and the 5 existing monitoring wells. The samples were analyzed for VOCs (EPA Method 602) and TPH (EPA Method 418.1). Results of the laboratory analyses are presented in Table 1-10. In addition, field parameters, including pH, temperature, and specific conductance, were measured at the time of sampling. These field parameter measurements are reported in Table 1-11.

VOCs were detected in 2 of the existing monitoring wells (20-EMW-04 and 20-EMW-07) and in hydropunch locations 20-HP-02, 20-HP-04, 20-HP-05, and 20-HP-06. 20-HP-01 was not sampled, but contained petroleum product. The total VOC concentrations (i.e., sum of detected VOCs) ranged from 3 μg/L (parts per billion-ppb) in hydropunch locations 20-HP-02, 20-HP-04, and 20-HP-05, to 11,027 μg/L in hydropunch location 20-HP-06. The highest VOC levels (20-HP-06) were detected in the vicinity of Fitwing Fuel Pit No. 2. In addition to the concentrations detected in 20-HP-02, 20-HP-04, 20-HP-05, and 20-HP-06, monitor wells 20-EMW-04 and 20-EMW-07 had total VOC concentrations of 15 μg/L and 39 μg/L, respectively.

TABLE 1-9
SUMMARY OF TPH AND BTEX ANALYSIS FOR SOIL SAMPLES
FITWING REFUELING AREA

Soil Boring Number	Field Sample Number	Sample[a] Interval	PARAMETER					
			TPH[b]	Benzene[c]	Toluene[c]	Ethyl Benzene[c]	Total Xylenes[c]	Total BTEX[c]
20-SB-01	20-SB-01-01	2.0-4.0	679	BDL	40	350	540	930
20-SB-01	20-SB-01-02	8.0-10.0	332	70	200	930	2100	3300
20-SB-02	20-SB-02-01	4.0-6.0	5	BDL	BDL	BDL	BDL	BDL
20-SB-02	20-SB-02-02	8.0-10.0	7	BDL	BDL	BDL	BDL	BDL
20-SB-03	20-SB-03-01	4.0-6.0	6	BDL	BDL	BDL	20	20
20-SB-03	20-SB-03-DUP[d]	4.0-6.0	5	BDL	BDL	BDL	BDL	BDL
20-SB-03	20-SB-03-02	6.0-8.0	6	BDL	BDL	BDL	BDL	BDL
20-SB-04	20-SB-04-01	4.0-6.0	85	BDL	BDL	40	BDL	40
20-SB-04	20-SB-04-02	6.0-8.0	10	BDL	BDL	10	BDL	10
20-SB-05	20-SB-05-01	4.0-6.0	173	BDL	BDL	BDL	80	80
20-SB-05	20-SB-05-DUP[d]	4.0-6.0	115	BDL	BDL	BDL	220	220
20-SB-05	20-SB-05-02	6.0-8.0	291	BDL	130	710	1530	2370
20-SB-06b	20-SB-06b-01	4.0-6.0	3	BDL	BDL	BDL	BDL	BDL
20-SB-06b	20-SB-06b-03	8.0-10.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-07	20-SB-07-01	2.0-4.0	3	BDL	BDL	BDL	BDL	BDL
20-SB-07	20-SB-07-02	4.0-6.0	2	BDL	BDL	BDL	BDL	BDL
20-SB-08	20-SB-08-01	4.0-6.0	454	BDL	114	141	359	610
20-SB-08	20-SB-08-02	6.0-8.0	178	BDL	251	1050	2060	3490
20-SB-09b	20-SB-09b-01	4.0-6.0	1	BDL	BDL	BDL	BDL	BDL
20-SB-09b	20-SB-09b-02	6.0-8.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-10	20-SB-10-01	4.0-6.0	BDL	BDL	BDL	10	BDL	10
20-SB-10	20-SB-10-02	6.0-8.0	BDL	BDL	10	10	BDL	20
20-SB-11	20-SB-11-01	4.0-6.0	BDL	10	BDL	BDL	BDL	10
20-SB-11	20-SB-11-02	8.0-10.0	BDL	BDL	10	BDL	BDL	10

a - Feet below ground surface.
b - TPH reported in mg/kg.
c - BTEX reported in µg/kg.
d - *Duplicate sample.*
BDL - Below detection limit set by the laboratory (0.01 mg/kg) for BTEX and 1 mg/kg for TPH.

Note: 1) The TPH detected and reported appears representative to kerosene.

TABLE 1-9
SUMMARY OF TPH AND BTEX ANALYSIS FOR SOIL SAMPLES
FITWING REFUELING AREA
(Continued)

Soil Boring Number	Field Sample Number	Sample[a] Interval	PARAMETER					
			TPH[b]	Benzene[c]	Toluene[c]	Ethyl Benzene[c]	Total Xylenes[c]	Total BTEX[c]
20-SB-12	20-SB-12-01	4.0-6.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-12	20-SB-12-02	8.0-10.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-13	20-SB-13-01	4.0-6.0	572	20	10	120	270	420
20-SB-13	20-SB-13-02	6.0-8.0	703	BDL	20	BDL	100	120
20-SB-14	20-SB-14-01	2.0-4.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-14	20-SB-14-02	6.0-8.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-15	20-SB-15-01	4.0-6.0	149	BDL	20	70	100	190
20-SB-15	20-SB-15-02	6.0-8.0	69	BDL	BDL	BDL	70	70
20-SB-16	20-SB-16-01	2.0-4.0	8	BDL	BDL	BDL	BDL	BDL
20-SB-16	20-SB-16-02	6.0-8.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-17	20-SB-17-01	2.0-4.0	BDL	BDL	10	BDL	BDL	10
20-SB-17	20-SB-17-02	6.0-8.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-18	20-SB-18-01	4.0-6.0	220	BDL	BDL	90	190	280
20-SB-18	20-SB-18-02	6.0-8.0	32	BDL	20	BDL	190	210
20-SB-19	20-SB-19-01	2.0-4.0	BDL	BDL	BDL	BDL	30	30
20-SB-19	20-SB-19-02	6.0-8.0	BDL	BDL	BDL	BDL	BDL	BDL
20-SB-19	20-SB-DUP[d]	6.0-8.0	1	BDL	BDL	BDL	BDL	BDL

a - Feet below ground surface.
b - TPH reported in mg/kg.
c - BTEX reported in µg/kg.
d - Duplicate sample.
BDL - Below detection limit set by the laboratory (0.01 mg/kg) for BTEX and 1 mg/kg for TPH.

Note: 1) The TPH detected and reported appears representative to kerosene.

TABLE 1-10
SUMMARY OF TPH AND VOC ANALYSES
FOR GROUNDWATER SAMPLES

Sample Location	Sample No.	Parameter[a]									
		TPH mg/L	Benzene	Toluene	Xylene (Total)	Ethyl-Benzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichlorobenzene	Chlorobenzene	Total VOC
20-MW-02[b]	20-GW-02	938	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-MW-03	20-GW-03	3	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-MW-04	20-GW-04	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-MW-05	20-GW-05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-MW-05	20-GW-DUP-01	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-MW-06	20-GW-06	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-MW-07	20-GW-07	2	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-HP-02[c]	20-HP-02	BDL	BDL	BDL	3	BDL	BDL	BDL	BDL	BDL	3
20-HP-03	20-HP-03	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-HP-04	20-HP-04	BDL	BDL	BDL	3	BDL	BDL	BDL	BDL	BDL	3
20-HP-05	20-HP-05	BDL	BDL	BDL	3	BDL	BDL	BDL	BDL	BDL	3
20-HP-06	20-HP-06	230	184	246	290	600	1,170	3,230	5,060	247	11,027
20-HP-07	20-HP-07	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-HP-08	20-HP-08	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-HP-08	20-HP-DUP	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-EMW-3	20-EMW-03	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-EMW-4	20-EMW-04	BDL	15	BDL	BDL	BDL	BDL	BDL	BDL	BDL	15
20-EMW-6	20-EMW-06	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
20-EMW-7	20-EMW-07	BDL	16	BDL	23	BDL	BDL	BDL	BDL	BDL	39
20-EMW-7	20-EMW-DUP	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

a - TPH reported in mg/L. VOCs reported in µg/L.
b - Monitor well 20-MW-01 was not sampled due to the abundance of free phase hydrocarbons.
c - 20-HP-01 was only field screened using the HNU®-Hanby method. No sample was collected due to abundant free phase hydrocarbons.
BDL - Below detection limit set by the laboratory 1 mg/L for TPH and 1 µg/L for BTEX.

TABLE 1-11

SUMMARY OF GROUNDWATER FIELD PARAMETERS
FITWING REFUELING AREA
12 AND 13 MARCH 1992

Well No.	Field Parameter		
	pH[a]	Specific Conductance[b] (cm/μmhos)	Temperature (C°)
20-MW-01[c]	---	---	---
20-MW-02	5.55	300	15.5
20-MW-03	4.90	208	13.8
20-MW-04	5.58	264	15.0
20-MW-05	5.05	196	14.5
20-MW-06	4.95	241	15.0
20-MW-07	4.90	164	13.5
20-EMW-03	7.1	235	15.5
20-EMW-04	NR	235	15.2
20-EMW-06	NR	195	13.8
20-EMW-07	NR	205	14.5

a - pH values measured in the field using an American Scientific pH meter.
b - Specific conductivity measured in the field using a YSI conductivity meter.
c - Due to an abundance of free phase hydrocarbons, this well was not sampled.
NR - Not recorded.

As indicated in Table 1-5, free product was detected in 3 of the monitor wells. In addition, 3 hydropunch locations, 20-HP-01, 20-HP-02, and 20-HP-06, contained free product.

1.5 NATURE AND EXTENT OF CONTAMINATION

Investigation results indicate the presence of adsorbed phase (soil), dissolved phase (groundwater), and free phase (floating) contamination. Discussions of the nature and extent of this contamination follow.

1.5.1 Nature of Contamination

Historical information, field interpretations, and analytical results confirm that subsurface soils in the vicinity of the abandoned underground pipeline near the Fitwing Fuel Pits are contaminated with petroleum-related compounds related to kerosene or jet fuels. Most of the chemical compounds in petroleum type fuels are either aliphatic or aromatics compounds. Aliphatic compounds are organic compounds with either straight or branched carbon chains. An example of aliphatic compounds found in gasoline are hexane, pentane, and octane. Aromatic compounds are organic compounds with a carbon ring structure.

Kerosene belongs to the group of petroleum products called middle distillates. This group includes diesel fuel, jet fuel, and lighter fuel oils. Products in this group tend to be denser, less volatile, less mobile, and less water soluble than gasoline. In addition, this group usually contains a lower percentage of the aromatic hydrocarbons, such as benzene, toluene, ethylbenzene, chlorobenzenes, and total xylenes, than gasoline. The physical/chemical characteristics of JP-4 and related compounds (JP-5/JP-X) are shown in Table 1-12.

Petroleum hydrocarbons can be present in the subsurface as liquid-phase hydrocarbons (LPH), dissolved-phase hydrocarbons (DPH), and vapor-phase hydrocarbons (VPH). The migration process of gasoline in the subsurface is unique for each phase. Released LPH tend to move downward through the unsaturated zone in response to gravity. The vertical migration is generally limited to the vicinity of the release until the hydrocarbon comes in contact with groundwater. Since petroleum hydrocarbon is less dense than water and relatively insoluble in water, LPH that reach the water table may form a distinct layer (free product) that can float on and travel under the influence of the natural groundwater flow regime.

The DPH migrate in the subsurface by advection and hydrodynamic dispersion. Advection is the transportation of chemical constituents by groundwater flow. Hydrodynamic dispersion is a process by which the chemical constituents are mechanically mixed by the motion of the groundwater. Dispersion is responsible for diluting the concentrations of the dissolved hydrocarbon plume as the distance from the source is increased.

TABLE 1-12

PHYSICAL/CHEMICAL CHARACTERISTICS OF
JP-4 AND RELATED COMPOUNDS

CHEMICAL COMPOSITION:	Approximate Composition: Alkanes 61.0% Cycloalkanes 29.0% Alkylbenzenes 8.0% Indans/tetralins 1.1% Naphthalenes 0.0% <1%
PHYSICOCHEMICAL DATA:	Physical State: Liquid (at 20°C) Color: Colorless to light brown Odor: Fuel-oil; threshold: 1 ppm Density: 0.75 g/mL (at 20°) Freeze/Melt Point: -72.00° Boiling Point: 60.00 to 270.00°C Flash Point: -23.00 to -1.00°C; closed cup: -29°C Flammable Limits: 1.30 to 8.00% by volume Autoignition Temp: 240.0 to 242.0°C Vapor Pressure: 9.10E+01 mm Hg (at 20°C) Satd. conc. in Air: 6.6000E+05 mg/m^3 (at 20°C) Solubility in Water: 300 mg/L (at 20°C) Viscosity: 0.829 cp (at 21°C) Surface Tension: 2.5000E+01 dyne/cm (estim) (at 20°C) Log (Octanol-Water Partions Coeff.): 3.00 to 7.00 (range for typical components) Soil Adsorp. Coeff.: 2.40E+02 to 5.00E+06 (range for typical components) Henry's Law Const.: 1.00E-04 to 1.00E+01 atm m^3/mol (range for typical components) Bioconc. Factor: 5.00E+01 to 5.00E+05 (range for typical components)

The VPH are a result of the volatilization of the constituents in the LPH. Vapor migration is controlled by many parameters such as soil permeability, temperature, and moisture. In general, however, VPH tend to follow more conductive pathways such as in the vadose zone.

Groundwater samples collected from monitoring wells and from hydropunch locations indicate the presence of VOCs. VOCs detected included: benzene, toluene, ethylbenzene, total xylenes (BTEX) and chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene. BTEX constituents are associated with kerosene or jet fuels. However, the source of the chlorinated benzenes is unknown.

1.5.2 Extent of Contamination

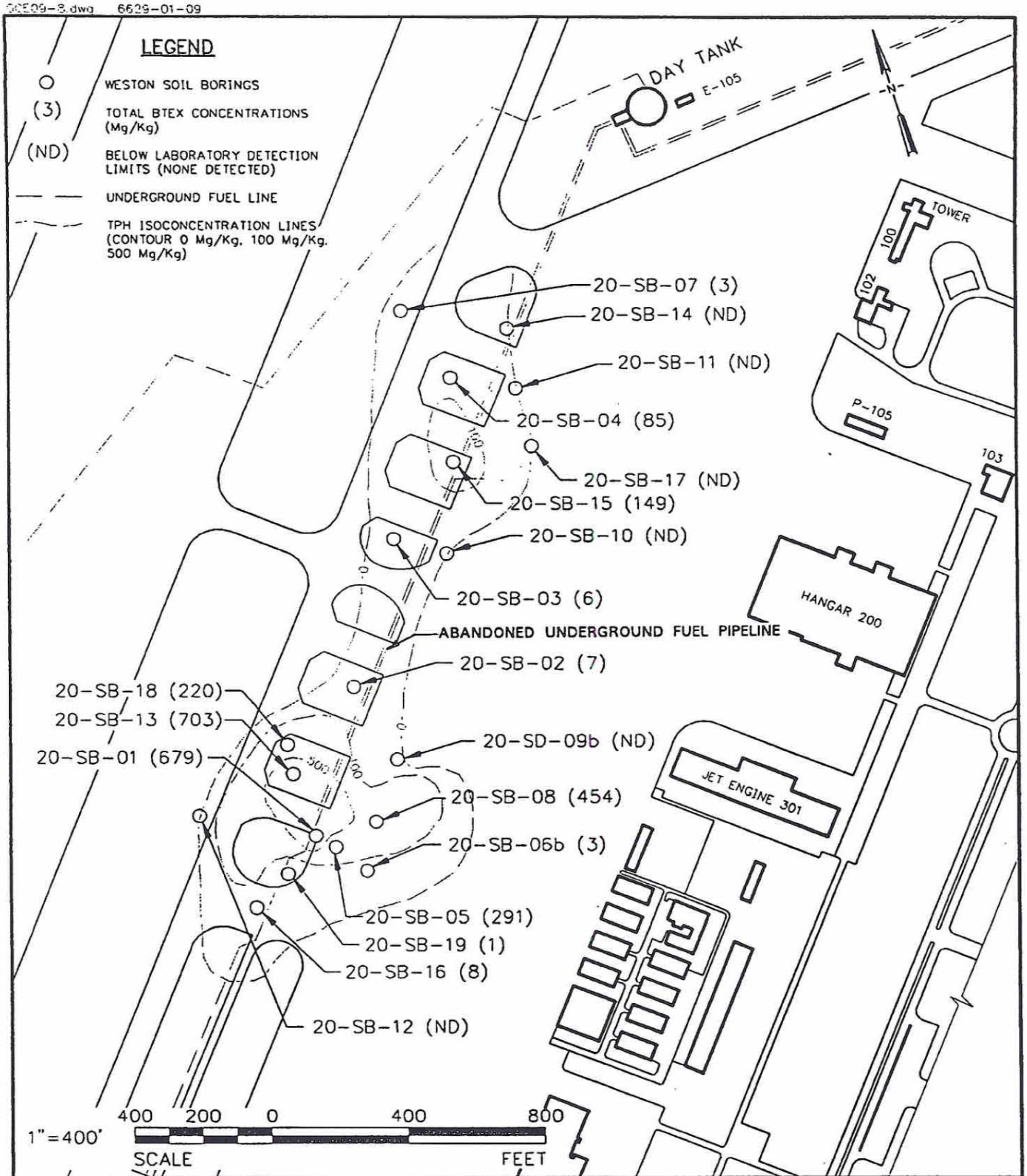
Concentrations of TPH contamination in soils in the vicinity of the Fitwing Fuel Pits are depicted in Figure 1-6. The distribution pattern of TPH concentrations in soil indicates that the highest area of soil contamination is located in the vicinity of Refueling Lanes 1 and 2. This is supported by PID screening and analytical results from soil borings 20-SB-01, 20-SB-05, 20-SB-08, 20-SB-13, and 20-SB-18, which are located in the vicinity of Refueling Lanes 1 and 2.

Contours plottted for TPH and BTEX concentrations in soils (Figures 1-6 and 1-7, respectively) indicate the presence of two contamination plumes related to the Fitwing Fuel Pits. One plume is located in the vicinity of Fueling Pits 1 and 2. The second plume is near Fueling Pits 5 and 6.

Free petroleum product was detected in three monitoring wells (20-MW-01, 20-MW-05, 20-EMW-07), three hydropunch locations (20-HP-01, 20-HP-02, 20-HP-06), one soil boring (20-SB-05), and in a recovery well (RW-01). These test points are in the vicinity of Fueling Pits 1 and 2, as indicated in Figure 1-3. The highest levels of free petroleum product were recorded in RW-01 (>9 feet of product) and 20-MW-01 (7.74 feet of product). The product is clear in appearance, possibly suggesting that the release is relatively recent.

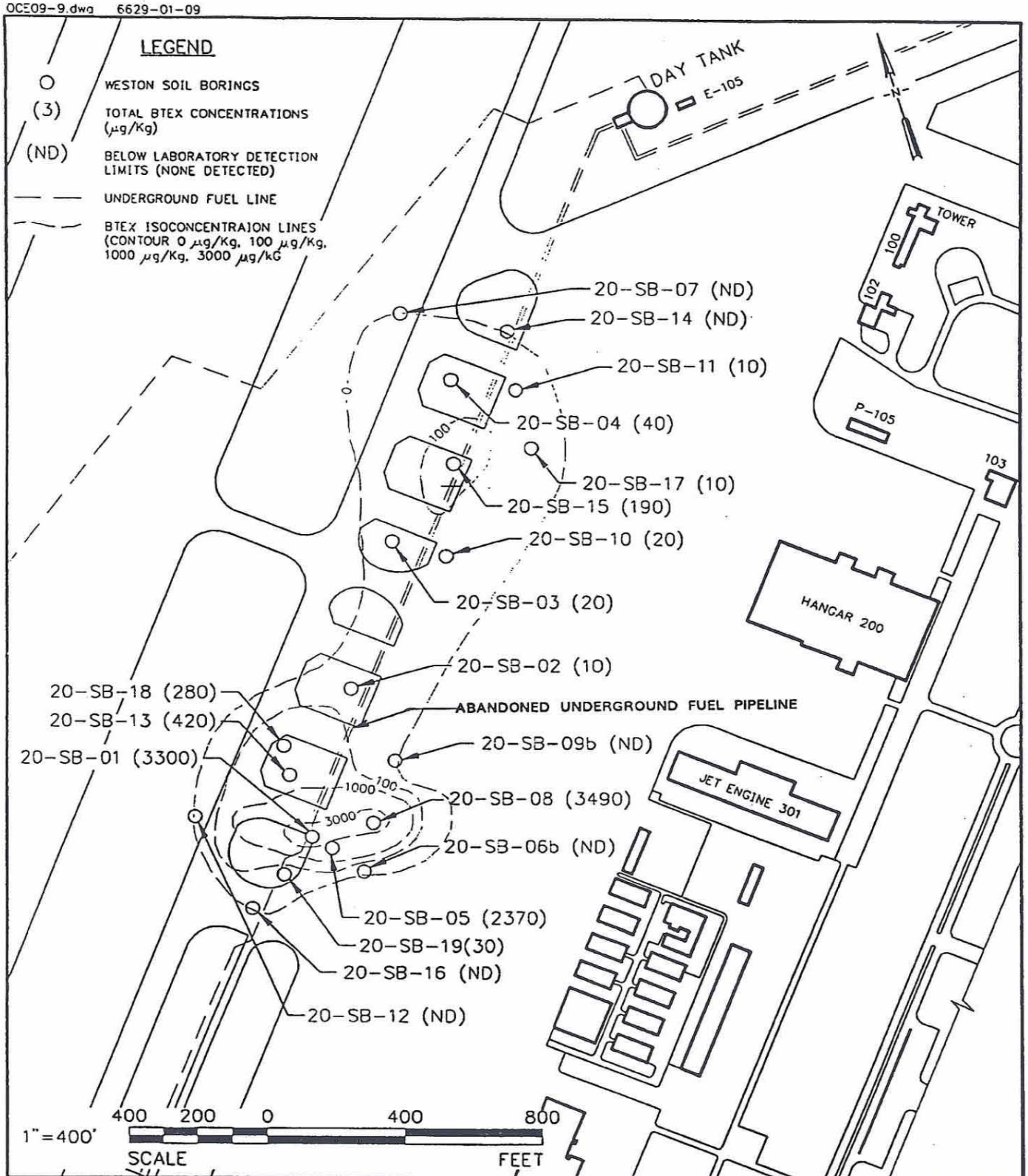
Groundwater chemical constituents in the vicinity of the Fitwing Fuel Pits are depicted in Figures 1-8 and 1-9 for TPH and VOCs, respectively. The contaminant distribution patterns appear to be occurring as two contaminant plumes located in the vicinity of Refueling Pits 1 and 2, and 5 and 6. The highest levels of TPH and VOCs were detected in a hydropunch location 20-HP-06, which had a TPH value of 230 mg/L and a total VOC concentration of 11,027 μg/L. Comparison of the hydrocarbon concentrations in soil with that in groundwater confirm the presence of two distinct contaminant plumes from two points along the fuel supply line.

Based on available data, the estimated direction of plume migration is towards the south-southeast. Jet fuel hydrocarbons are expected to be relatively mobile in most soil and groundwater systems. Data collected during slug and aquifer testing indicates that the range of groundwater flow velocities are from 2 to 39 ft/yr. Because



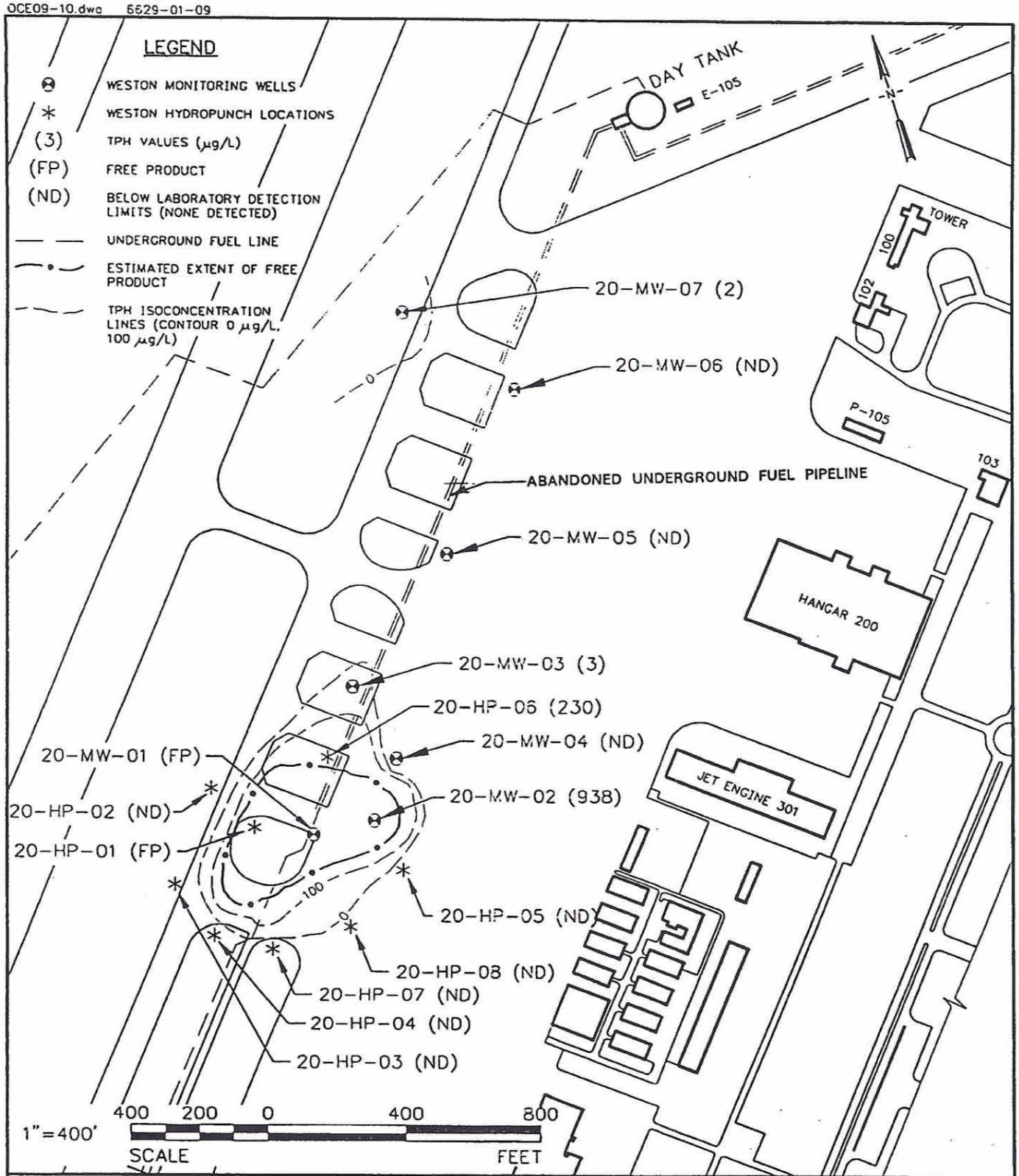
PROJECT TITLE: SITE CHARACTERIZATION REPORT FITWING FUEL PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA
DWG. TITLE TPH IN SOILS ISOCONTOUR MAP	FIGURE NO. 1-6

OCE09-9.dwg 6629-01-09



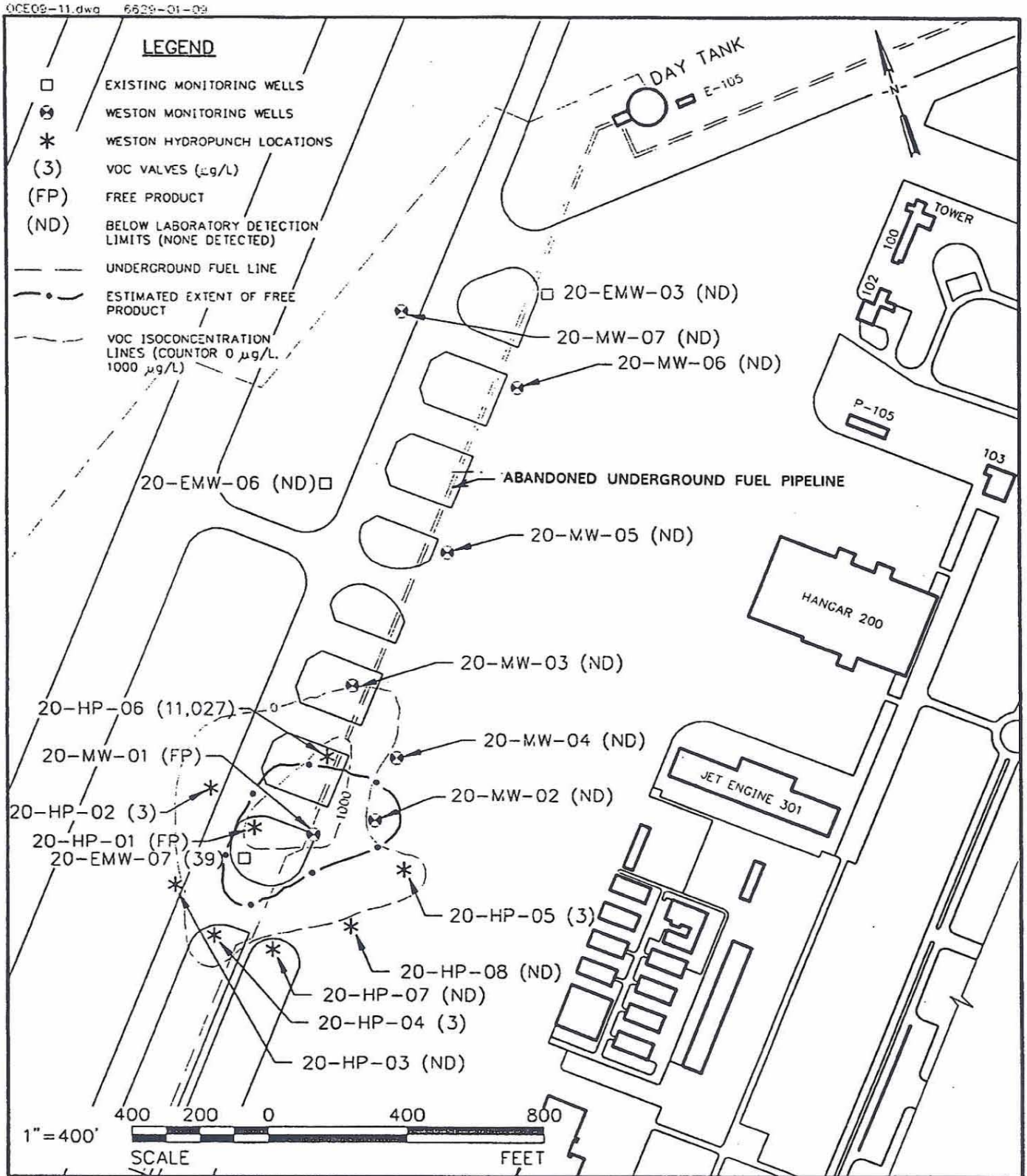
PROJECT TITLE: SITE CHARACTERIZATION REPORT HIGH SPEED JET REFUELER PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA	WESTON
DWG. TITLE BTEX IN SOILS ISOCONTOUR MAP	FIGURE NO. 1-7	

OCE09-10.dwg 6629-01-09



PROJECT TITLE: SITE CHARACTERIZATION REPORT HIGH SPEED JET REFUELER PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA
DWG. TITLE TPH IN GROUNDWATER ISOCONTOUR MAP	FIGURE NO. 1-8

OCE09-11.dwg 6629-01-09



PROJECT TITLE: SITE CHARACTERIZATION REPORT FITWING FUEL PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA
DWG. TITLE VOC IN GROUNDWATER ISOCONTOUR MAP	FIGURE NO. 1-9

hydrocarbons are retarded in their rate of movement through soils, it is expected that plume migration rates will be at a somewhat lower rate than the values calculated for groundwater.

1.5.3 Conclusions

The following conclusions are based on the results of the Site Characterization Study:

- Soil contamination (>100 mg/kg TPH) was encountered in the vicinity of Refueling Pits 1 and 2, with a smaller anomaly occurring between Refueling Pits 5 and 6. The source of the soil contamination is likely due to releases resulting from the failure of the underground fuel supply lines which was abandoned in 1991.

- Abundant petroleum product was encountered in the vicinity of Refueling Pits 1 and 2. Maximum free product thicknesses measured during this investigation were greater than 9 feet in the recovery well (RW-01) and 7.74 feet of product in 20-MW-01. The product appears not to be weathered, suggesting that the free product present is the result of recent releases.

- Groundwater sampling revealed one groundwater sample from 20-HP-06 that contained 11,027 $\mu g/L$ total VOCs. Specific parameters that exceed current MCLs include benzene, 1,2 dichlorobenzene, 1,4 dichlorobenzene, and 1,3 dichlorobenzene. It is unclear as to the source of the chlorinated benzene compounds.

- Other off-site sources for contamination, such as the fuel storage area to the south or the day tank to the north, do not appear to have impacted the area of investigation. There are low levels of TPH in soils at 20-MW-07 that may have originated from an underground fuel line to the north. However, insufficient data are available to verify this assumption.

- Groundwater in the investigation site generally flows to the south to southwest. However, a plot of groundwater contours (Figure 1-7) indicates significant local influences, resulting in a shift in flow direction to the northeast near refueling pits 1 and 2.

2.0 RISK ASSESSMENT

The objective of the Risk Assessment portion of the Site Characterization Report is to: 1) identify the actual and/or potential receptors (human or environmental) to any contamination attributable to the site; 2) identify the actual and/or potential pathways of exposure; 3) quantify the exposure levels; and 4) evaluate the actual and/or potential human and/or environmental risk.

The Risk Assessment section consists of five subsections. The first subsection identifies the demographics and land and water uses in the area. The second subsection identifies any actual or potential human or environmental receptors that might be affected by contamination at the site. The third subsection identifies the actual or potential exposure pathways. The fourth subsection quantifies the exposure levels, and the fifth subsection evaluates the potential risk.

2.1 SITE DEMOGRAPHICS

NAS Oceana is located in a mixed urban area that includes commercial, residential, and industrial activities. The Fitwing Fuel Pits are bounded on the north and west by taxiway and Runway 5R, and on the south and east by a hangar and other aircraft-support buildings. The Fitwing Fuel Pits are grassed areas located between concrete taxiways. The areas includes six refueling pits separated by the grassy medians that extend northeasterly approximately 2,400 feet. To the north and west of the site, grassed areas lie between the concrete taxiway and runway.

There are 2 pumping wells that were identified within a 1-mile radius of the Fitwing Fuel Pits. One of the groundwater wells is screened from 105 to 131 feet bgs, which is below the level of contamination. The second well has a total depth of 30 feet. Both wells were reported to WESTON by NAS Oceana personnel to supply water for the washing of aircraft and are not used for drinking water purposes. The City of Virginia Beach and NAS Oceana obtain their drinking water from a municipal water supply, which is primarily obtained from the City of Norfolk, Virginia (approximately 10 miles west of NAS Oceana).

2.2 IDENTIFICATION OF RECEPTORS

There are limited actual or potential human or non-human receptors to contamination at this site. For the most part, the soil contamination detected in the area occurs below the ground surface. The surrounding surface area is either paved or grassed; therefore, there is little potential for dispersion due to fugitive dust except during intrusive activities such as construction or landscaping. Even though groundwater monitor wells installed in the area indicate free product and levels of VOCs above the State of Virginia and federal MCLs, present and future use of the groundwater for uses other than aircraft washing is considered unlikely. Since drinking water is

supplied to NAS Oceana by municipal pipeline from off-site sources, no human receptors of contaminated drinking water are expected.

The distance downgradient to the nearest surface water body is approximately 2 miles to the southwest to West Neck Creek, which eventually empties into London Bridge Creek. The potential for impact to human receptors appears to be low since manmade structures have been installed by NAS Oceana to filter and catch any petroleum that may enter the surface water. Manmade structures installed in the drainage pathways consist of oil booms and wicks. While these structures are designed to filter and control floating petroleum product, the structures do not remove dissolved petroleum compounds. These dissolved compounds could potentially affect aquatic organisms that may come into contact with them. In addition, birds that feed on these aquatic organisms could be affected.

2.3 IDENTIFICATION OF EXPOSURE PATHWAYS

The possible exposure pathways of concern for human exposure may include: ingestion, inhalation (of volatile organics from groundwater and surface water, and particulates), and dermal contact of contaminated groundwater and surface waters. Contaminated surface waters and sediments would be the likely environmental exposure pathways to aquatic organisms.

Soil contamination was detected at depth in soil; however, as stated previously, human exposure to soils at this depth is not likely unless construction or remediation conditions exist. No surficial soil samples were collected, but since the surrounding area is either grassed or paved no potential for dispersion due to fugitive emissions from soil are expected.

There are no known drinking water sources within a 1-mile radius of the NAS Oceana; therefore, no exposure pathways for humans are considered to exist (EPA, 1988). Hence, no tap water samples were collected. Other private wells may be located within a 1-mile radius of the site, but the existence of such wells is not known at this time. Groundwater transportation of leached TPH or BTEX constituents into a surface water receiver is an exposure pathway. This pathway is highly restricted by the distance to the nearest stream and the manmade structures installed in the pathway of groundwater flow. Surface water samples were not collected.

2.4 QUANTIFICATION OF EXPOSURE LEVELS

National Primary Drinking Water Regulations (NPDWRs), Maximum Contaminant Levels (MCLs) currently exist for TPH, benzene, ethylbenzene, toluene, and total xylenes. The Commonwealth of Virginia has set standards for TPH in soil and groundwater.

Federal and Commonwealth of Virginia Ambient Water Quality Criteria (AWQC) have been established for the protection of human and aquatic life. These criteria are non-enforceable guidelines, which are used to establish standard such as MCLs. The estimated surface water concentrations were compared to the Federal and Commonwealth criteria on Table 2-1. The following discussion summarizes water contamination at this site.

The analytical data for soils and groundwater are presented in Appendix F. The soils data show that concentrations of TPH were detected in the vicinity of Refueling Pits 1 and 2, and between Refueling Pits 5 and 6. Of the 26 detected TPH levels, the concentrations ranged from 1.0 mg/kg to 703 mg/kg. TPH concentrations were not detected in 15 out of the 38 samples analyzed.

BTEX was detected in 21 of the 38 soil samples analyzed. Total BTEX concentrations ranged from 10 μg/kg to 3,490 μg/kg. The maximum concentrations detected for specific parameters include benzene (70 μg/kg), toluene (251 μg/kg), ethyl benzene (1,050 μg/kg), and total xylenes (2,060 μg/kg).

Nine compounds were detected at least once in the groundwater analysis. Some of these compounds were either components of, or additives to, JP-5 fuel. No compounds that were detected at a frequency greater than 50%, were encountered that exceeded state or federal MCLs. These include benzene, 1,2 dichlorobenzene, 1,3 dichlorobenzene, 1,4 dicholorobenzene, and chlorobenzene. Benzene was detected at a frequency of 18% and the chlorinated benzene other compounds were deteced at a frequency of 6%. Total xylenes were detected at a frequency of 29%. Table 2-1 summarizes the occurrence frequency for VOCs analyzed in groundwater.

- Benzene was detected in 3 out of the 17 groundwater samples collected. The range of concentration of these detected levels was 15 μg/L to 184 μg/L. All of the detected levels were above the federal Drinking Water Standard MCL of 5 μg/L but is below the VSWCB's MCL of 710 μg/L for benzene.

- Toluene was detected in 1 out of the 17 groundwater samples collected. The concentration was 246 μg/L, which does not exceed the VSWCB groundwater or federal Drinking Water Standard MCLs (20,000 μg/L and 1,000 μg/L, respectively).

TABLE 2-1

FREQUENCY SUMMARY FOR VOLATILES IN GROUNDWATER

Parameter	State Standards (µg/L)	Federal MCLs (µg/L)	Minimum Detected Concentration (µg/L)	Maximum Detected Concentration (µg/L)	Frequency of Detected Values (%)	Number of Detects Greater Than Standards	
						State	Federal
Benzene	710	5	15	184	18	0	3
Chlorobenzene	N/A	100	247	247	6	0	1
1,2-Dichlorobenzene	17,000	600	5,060	5,060	6	0	1
1,3-Dichlorobenzene	2,600	600	1,170	1,170	6	0	1
1,4-Dichlorobenzene	2,600	75	3,230	3,230	6	1	1
Ethylbenzene	29,000	700	600	600	6	0	0
Toluene	200,000	1,000	246	246	6	0	0
Xylenes, total	N/A	10,000	3	290	29	0	0

NA - Not applicable, no standards have been set.

Note: 1) Federal MCLs are based on the Drinking Water Standard and State MCLs are based on the Surface Water Standards with General, Statewide Application.

- Chlorobenzene was tentatively identified in 1 out of the 17 groundwater samples at a concentration of 347 μg/L. This concentration exceeds the federal Drinking Water Standard MCL of 100 μg/L.

- 1,2-dichlorobenzene was detected in 1 out of the 17 groundwater samples collected. The concentration was 5,060 μg/L. The detected level exceeds the federal Drinking Water Standard MCL of 600 μg/L but is below the VSWCB's MCL of 17,000 μg/L.

- 1,3-dichlorobenzene was detected in 1 of the 17 groundwater samples collected. The concentration was 1,170 μg/L, which exceeds the federal Drinking Water Standard MCL of 600 μg/L but is below the VSWCB's MCL of 2,600 μg/L.

- 1,4-dichlorobenzene was detected in 1 out of the 17 groundwater samples collected. The concentration was 3,320 μg/L. This exceeds the VSWCB groundwater MCL (2,600 μg/L) and the federal Drinking Water Standard MCL (75 μg/L).

- Total xylenes were identified in 5 out of the 17 groundwater samples collected. The concentration detected ranged from 3 μg/L to 290 μg/L. These concentrations did not exceed the federal Drinking Water Standard MCL of 10,000 μg/L.

- Ethylbenzene was detected in 1 of the 17 groundwater samples collected. The concentration was 600 μg/L. This does not exceed current VSWCB and federal MCLs.

2.5 RISK SUMMARY

As stated in Subsection 2.2, limited, if any, human or non-human receptors are anticipated to be impacted by contamination at this site. Therefore, a quantitative risk evaluation was not performed. From a qualitative perspective, the contaminants identified do not represent or pose a public health risk as there are limited opportunities for exposure to contaminants. It should be restated, however, that groundwater concentrations of benzene, 1,2 dichlorobenzene, 1,3 dichlorobenzene, 1,4-dichlorobenzene, and chlorobenzene was detected and slightly exceeded their respective federal Drinking Water Standard MCLs at 1 sample location. At 1 sample point, 1,4-dichlorobenzene was detected and exceeded its respective AWQC standards. However, since the primary uses for the para-isomer (1,4) of this compound are for other chemical compounds and chemical synthesis (IRP Toxicology Guide, 1989), it is unclear whether 1,4-dichlorobenzene contamination can be attributed to the petroluem fuel release.

3.0 REMEDIATION ASSESSMENT

The Remediation Assessment portion of the Site Characterization Report is presented in four sections. The first section discusses the objectives of the Remediation Assessment. In the second section, a discussion of the necessity for both soil and groundwater remediation in the vicinity of the Fitwing Fuel Pits. Section 3 describes a variety of technologies for soil and groundwater restoration, while Section 4 provides recommendations for the type of technology best suited for soil restoration at the site.

3.1 OBJECTIVES

The objectives of this Remediation Assessment is to define the remediation endpoints, and select an applicable remediation technology capable of achieving the remediation endpoints.

In evaluating the desirable endpoint for remediation, federal and state regulations were considered. The parameters that were selected as achievable endpoint controls were VSWCB's TPH action level for soil and practical achievable level for free phased product thickness. VSWCB's action level for TPH in soil is 100 mg/kg and the practical and achievable level for free phased product is 0.01-foot or less. While the VSWCB action level for TPH in soil is not considered clean up goals, it is a desirable target to aim for.

A groundwater endpoint has not been recommended because dissolved contaminants are not viewed as a problem for the following reasons:

- Only 1 of 20 groundwater samples taken had a laboratory analysis that revealed moderate VOC contamination.
- No drinking water wells were identified within 1 mile of the site.
- Only 1 of the 8 VOC contaminants analyzed for exceeded AWQC standards.
- The nearest surface water body is 2 miles downgradient.
- The migration rate of the groundwater is 39 ft per yr.
- Limited groundwater treatment (air stripping) may be provided to the withdrawn groundwater as part of the LPH treatment.

Discussion of the remediation feasibility, technologies and recommendation is presented below.

3.2 POTENTIAL/FEASIBILITY OF REMEDIATION

Soil and groundwater in the vicinity of the Fitwing Fuel Pits have been impacted by petroleum hydrocarbons. This has been confirmed by analytical results of soil and groundwater samples collected on-site during this investigation (Subsection 1.4). "Action levels" for soil and MCL for groundwater contamination will be utilized to determine the need for remediation. The action level for TPH in soil is 100 ppm, as defined by VSWCB. To date, the State of Virginia has not developed cleanup levels for VOCs in groundwater. Federal Drinking Water Standard MCLs for benzene (5 μg/L), 1,4-dichlorobenzene (75 μg/L), 1,2-dichlorobenzene (600 μg/L), 1,3-dichlorobenzene (600 μg/L), and chlorobenzene (100 μg/L) were exceeded in one or more hydropunch locations and monitoring well locations. The AWQC's standard for 1,4-dichlorobenzene (2,600 μg/L) in groundwater was exceeded.

Soil contamination (adsorbed, TPH) exceeding the 100 mg/kg action level appears to be restricted in the vicinity of Fuel Pits 1 and 2, and Fuel Pits 5 and 6 (Figure 1-6). Groundwater contamination (dissolved, VOC), which exceeds some MCLs, extends from monitoring well 20-MW-01 east to monitoring well 20-MW-02 (Figure 1-9). The hydrocarbon-contaminated soil and free phased product appear to be acting as the sources for groundwater contamination.

Although present and future exposure to identified soil and groundwater contaminants is unlikely, compliance with VSWCB and AWQC standards necessitates the need for eliminating the source of contamination and for the restoration of groundwater quality. Remedial activities should focus on the elimination of the free product as the primary source of groundwater contamination.

3.3 POTENTIAL REMEDIATION TECHNOLOGIES

Potential technologies for soil remediation and groundwater treatment during LPH recovery are discussed in the following sections. Information regarding the various technologies was obtained from documents developed by EPA (see Appendix H, References).

3.3.1 Soil

The objective for remediation of contaminated soils is to reduce or eliminate excessively contaminated soil to comply with VSWCB regulations. An "action level" concentration of 100 ppm TPH for soils contaminated by petroleum hydrocarbons serves as the suggested cleanup objective. In order to comply with this regulation, four soil remediation technologies have been considered. This section of the report provides a brief introduction to the technologies considered for the treatment of contaminated soil.

3.3.1.1 Bioremediation

Bioremediation is a process that relies on naturally occurring or genetically altered microorganisms to break down or transform contaminants to less hazardous compounds. The use of this technology requires a moderate level of petroleum contamination and the addition of nutrients and oxygen to enhance the degradation process. Bioremediation is often used in conjunction with groundwater remediation efforts. Typically, groundwater is extracted from the subsurface via an infiltration gallery or injection system located above or upgradient of the contaminated area. Bioremediation also may be used in conjunction with excavation (Subsection 3.3.1.4) in a technique called landfarming. However, this method typically requires relatively large tracts of land. The use of in situ bioremediation for the remediation of petroleum-contaminated soils in the vicinity of the fuel pits appears to be a fairly limited option given the high concentration of petroleum compounds, the moderate hydraulic conductivity of the soils, the generally homogeneous site stratigraphy, and the slightly alkaline soil pH. The cost for this type of technology varies widely depending on site geology, hydrogeology, and the extent of contamination.

3.3.1.2 In Situ Leaching

In situ leaching is a process that involves extracting contaminants from soil by "washing" or "flushing" using water, or more typically, a water-surfactant mixture. The process involves injecting or spraying a solution onto the area of contamination. The solution then percolates downward through the soil, and adsorbed hydrocarbons are extracted from the soil. The mixture leaches through the soil under the influence of gravity until the mixture reaches the groundwater table. The leached solution is then collected and pumped to the surface for removal or on-site treatment and reinjection. The use of this technology for soil remediation at the site is also an option given the nature of the contamination and the permeability of the site soils (greater than 1×10^{-4} cm/s). The cost to perform this type of remediation can range from $150 to $200 per yd^3 of soil.

3.3.1.3 Vacuum Extraction

Vacuum extraction is a method that vents soil by volatilizing the contaminants in the soil from a liquid phase to a vapor phase with the removal of the vapor phase contaminants from the soil pore spaces. The process involves the application of a vacuum through a network of wells. The vapors are drawn through the soil pore spaces to the wells, where they are captured and brought to the surface. Once the contaminant-saturated vapors are brought to the surface, additional treatment may be required. This technology may be enhanced by the injection of volatile-free air into the zone of contamination. The use of this technology for soil remediation at the site also appears to be an option given the moderate hydraulic conductivity of the soils, the homogeneous site stratigraphy, and the apparently limited area of contamination. The cost for implementing the vacuum extraction technique is moderate to high.

3.3.1.4 Excavation

Soil excavation is a method that can lead to several different disposal and treatment methods, principally low-temperature thermal reduction and off-site landfilling. Low-temperature thermal reduction (LTTR) is a process where contaminated soils are excavated from an area and placed into an apparatus where the contaminants are driven from the soil through enhanced volatilization by the application of heat. Once treated, the soils may be used as backfill material. Landfilling is another option where contaminated soils are excavated and then transported offsite to a disposal facility.

3.3.2 Groundwater

Restoration of a contaminated aquifer generally involves one of five options: 1) source removal; 2) containment of the plume; 3) removal of the plume after measures have been taken to halt the source of contamination; 4) diversion of groundwater to prevent clean groundwater from flowing through a source of contamination or to prevent contaminated groundwater from contacting drinking water supplies; and 5) prevention of a product or substance from contacting the groundwater by lowering the water table beneath the source of contamination. Free product and dissolved phase petroleum in the groundwater are present. Evaluation of treatment technologies should include plans for the removal of the plume after measures have been taken to halt the source of contamination in the vicinity of the Fitwing Fuel Pits. Several groundwater restoration technologies are discussed in the following sections.

3.3.2.1 Air Stripping

In the air stripping process, a contaminated water stream is mixed with a clean air stream. The intimate contact causes the air to remove the dissolved organic substances from the water. Several types of air strippers are available, including packed tower air strippers, trickle tray air strippers, and diffusion air strippers. Packed tower strippers are filled with a packing material designed to provide a large surface area for the purpose of enhancing water to air transport of organics. Trickle tray air strippers are similar to packed air strippers with the exception that the contaminated water is applied over a stack of trays that contain a high surface area medium. A diffusion air stripper makes use of vigorous aeration techniques to volatilize contaminated water to air bubbles that are released into the atmosphere. Reductions in volatile petroleum compounds within the groundwater, achieved with packed tower air stripping, have been reported to be as high as 95 to 99%. The implementation of this technology for groundwater remediation in the vicinity of the refueling pits is an alternative. Treatment of air stripper emissions, typically through the use of granular-activated carbon (GAC), may be required. The cost for air stripping is relatively low.

3.3.2.2 Carbon Adsorption

The process of adsorption onto GAC involves contacting a wastestream with the carbon, usually by allowing it to follow through a series of packed-bed reactors. The effectiveness of carbon as a treatment process is due to its ability to function as an adsorbent for molecules dissolved in water. This technique is effective in the removal of organic compounds and many inorganic compounds. This ability is due mainly to the large internal surface area of the carbon molecule. The carbon used to treat contaminated water can be packed into 55-gallon drums (larger containers may be necessary). Once the carbon-packed reactors have been utilized, the spent carbon requires disposal or regeneration under strict regulatory regulations. The cost for carbon adsorption is generally moderate, and depends primarily upon the required frequency of carbon regeneration.

3.3.2.3 Bioremediation

The process of bioremediation was discussed in Subsection 3.3.1.1 for the remediation of soil contamination. This technology can also be applied to remediation of groundwater. Bioremediation methods differ from air stripping and carbon absorption techniques since the contaminated groundwater remains below ground during remediation and the contaminants are not separated from the groundwater, but are transformed to less toxic compounds. The low concentration of volatile petroleum compounds found at the site limits the use of bioremediation.

3.4 RECOMMENDED TECHNOLOGIES

Although the Risk Assessment provided in Section 2.0 suggests that the site does not pose an immediate health risk, the extent of contamination present indicates that remediation activities are necessary. One technology for soil is most likely applicable for remediation of the Fitwing Fuel Pit area. The option is briefly discussed in the following subsection. The incurred costs for this option will be relatively low and may require some time to complete. The time required is unknown at this point but would be limited to achieving endpoint objectives.

Because the vadose zone is relatively thin (8-foot maximum), the suggested remedial option for this site would include a two-phase remedial approach. The first phase would involve removal of free product from the site. The second-phase would be to identify and ensure that any additional source of free product has been sealed or removed to stop further contamination. This effort should include pressure tightness testing on all piping in the area to be conducted in accordance with standard industry practice.

3.4.1 Soil

Based on site history and on the results of soil sampling, it appears that soil contamination (>100 mg/kg TPH) resulted due to releases from the recently abandoned fuel supply lines in the Fitwing Fuel Pit area. The extent of contamination appears to be limited to an area of approximately 4 acres around Fueling Pits 1 and 2, and approximately one acre near Fueling Pit 5. The technologies introduced in Subsection 3.3 were briefly evaluated for their application to the contaminated area and with respect to technical merit, implementation ability, economic feasibility, and immediate beneficial results.

While adsorbed phase soil contamination may represent a potential ongoing source of dissolved phase groundwater contamination, the 6.88 feet of free phased product is considered the primary source of the existing contamination. The TPH concentrations in soil are relatively low and over a wide area and are expected to passively remediate under natural conditions. In-place passive remediation relies upon natural processes to destroy the compounds of interest. Natural processes include biodegradation, photolysis, leaching and adsorption.

The 1988 federal UST technical standards (40 CFR 280) include passive remediation as a corrective action option. In-place passive remediation is an alternative at this site because:

- There are no actual or potential human or environmental receptors anticipated at the site.
- The distance to the nearest downgradient surface water body is approximately 2 miles.
- The released petroleum product is biodegradable.

3.4.2 Groundwater

Remediation for groundwater is not being proposed; however, treatment may be necessary as part of LPH reduction. The extent of groundwater contamination appears limited to the area under the parking lot and northwest of the refueling pits. The technologies introduced in Subsection 3.3 were evaluated for technical merit, implementation ability, economic feasibility, and immediate beneficial results in relation to the extent and concentration of the contamination plumes. The advantage to the selected technology of air stripping is that it should be able to reduce all detected VOCs to a level acceptable to the federal Drinking Water Standards. Reducing VOCs to a level acceptable to the federal Drinking Water Standards is important because a byproduct of LPH removal is groundwater which will be essential to meet discharge permit requirements. An air stripper may not be required if VSWCB will allow the groundwater withdraw to be directly discharged under an NPDES permit.

Groundwater treatment is directed toward the one specific task which is removing LPH as a contaminant source of groundwater at this site. Free phased product removal will be accomplished by placing an interim recovery system at MW-01. Product should be properly disposed of. Product recovery shall continue until a thickness of 0.01-inch or less is achieved.

The recommended approach for remediation at this site is to install a well pumping and product recovery system. Use of recovery wells would be preferred over trenching due to limited disruption of aircraft traffic. A dual pumping system which depresses the water table, allowing recovery of free product as well as developing a groundwater capture zone is recommended. Figure 3-1 presents a schematic of a dual pumping system. Groundwater monitoring of VOCs at MW-01 should continue on a quarterly basis while LPH is being removed and for 1 year thereafter.

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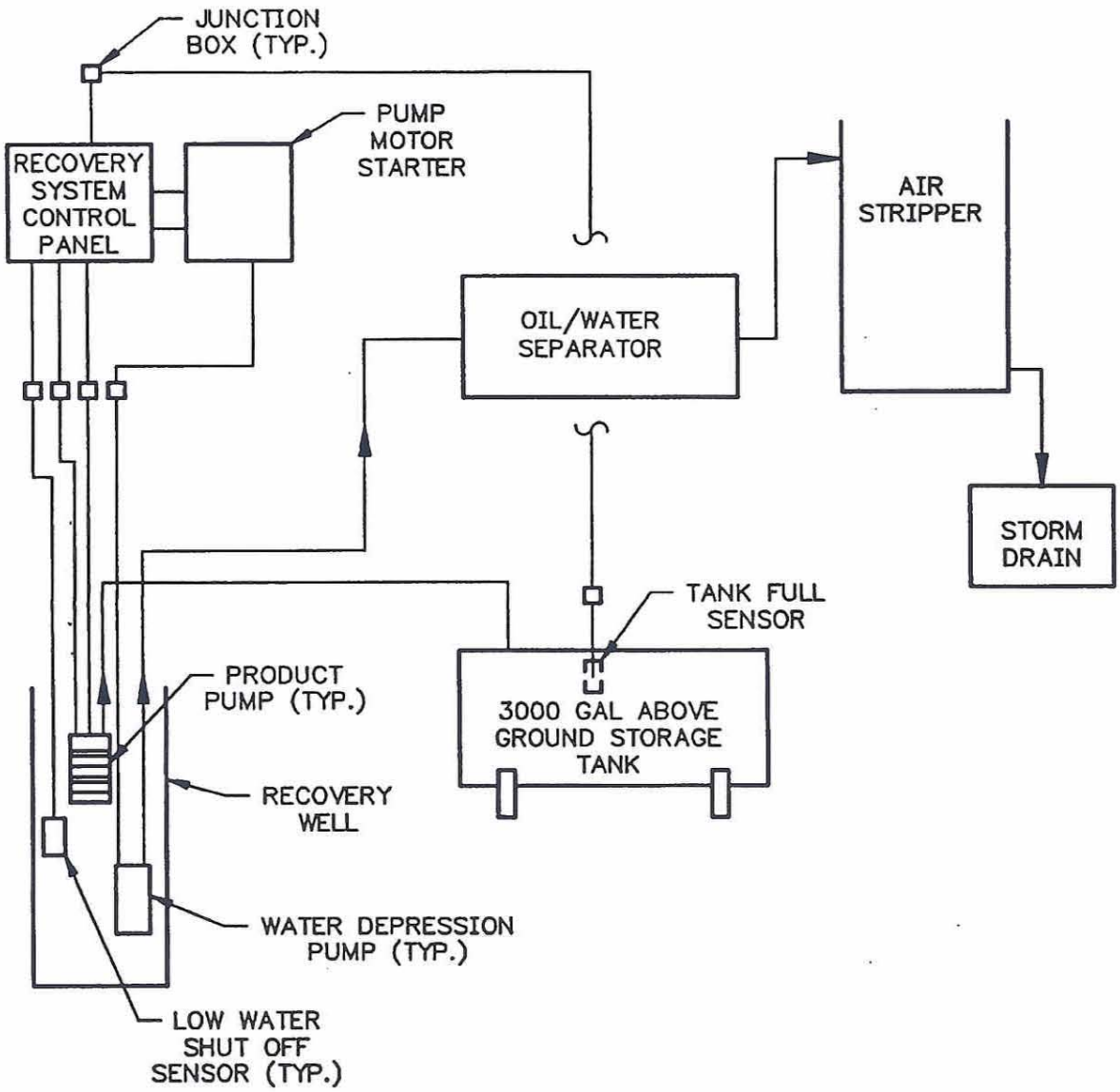


PROJECT TITLE: SITE CHARACTERIZATION REPORT FITWING FUEL PITS NAVAL AIR STATION OCEANA VIRGINIA BEACH, VIRGINIA	CLIENT DEPARTMENT OF THE NAVY ATLANTIC DIVISION NAVAL FACILITIES ENGINEERING COMMAND NORFOLK, VIRGINIA	WESTON
DWG. TITLE DUAL PUMPING SYSTEM SCHEMATIC	FIGURE NO. 3-1	

APPENDIX A

VIRGINIA STATE WATER CONTROL BOARD FILE INFORMATION ON WELLS IN VICINITY OF THE SITE

VIRGINIA STATE WATER CONTROL BOARD

FILE INFORMATION ON WELLS IN VICINITY OF THE SITE

SWCB Well No. 228-26
NAS Oceana Well No. W-70

Installed 1942, 5 gpm production rate, 1¼" opening, total depth of 30 feet, used for water supply and waste disposal.

SWCB Well No. 228-27
On NAS Oceana Adjacent SWCB Well No. 228-26

Installed 1943, 108 gpm production rate, 8" ID, total depth of 125 feet, screened from 102 feet to 113'7", well destroyed.

SWCB Well. No. 228-28
On NAS Oceana Adjacent SWCB Well No. 228-26

Installed 1943, 72 gpm production rate, 8" ID, total depth of 126.5 feet, screened from 103 feet to 117 feet, well destroyed.

SWCB Well No. 228-29
Adjacent NAS Oceana Well No. W-70

Installed 1944, 30 gpm production rate, 8" ID, total depth of 143 feet, screened from 105 feet to 131 feet, use not reported.

SWCB Well No. 228-30
NAS Oceana Well No. 492

Installed 1959, 100 gpm production rate, total depth of 108 feet, used to supply golf course sprinklers.

SWCB Well No. 228-31
NAS Oceana Well No. 1422

Installed 1959, 20 gpm production rate, total depth of 135 feet, used for water supply and waste disposal.

SWCB Well No. 228-32
NAS Oceana Well No. W199

Installed 1961, 5 gpm production rate, total depth of 35 feet, used for water supply and waste disposal.

SWCB Well No. 228-33
NAS Oceana Well No. W197

Installed 1964, 5 gpm production rate, total depth of 35 feet, used for water supply and waste disposal.

SWCB Well No. 228-34
NAS Oceana Well No. R36D

Installed 1966, 5 gpm production rate, 1¼" opening, total depth of 99 feet, used for water supply and waste disposal.

SWCB Well. No. 228-117
NAS Oceana Well Geothermal No. 23

Installed 1978, 4½" opening, total depth of 1,033 feet, hole is grouted with cement from 2 feet to 1,033 feet, used for geothermal applications.

SWCB Well No. 228-132

No information on file.

SWCB Well No. 228-133

No information on file.

SWCB Well No. 228-169

Owned by SWCB, installed 1979 as an observation well, 4" opening, total depth of 24 feet, screened from 19 feet to 24 feet, abandoned and casing pulled.

SWCB Well No. 228-234

Owned by HRSD Atlantic STP, installed 1981, 1¼" opening, total depth of 50 feet, screened from 45 feet to 50 feet, used for monitoring at the sludge farm.

SWCB Well No. 228-250

No information on file.

SWCB Well No. 228-251

Owned by the City of Virginia Beach, installed 1981, 24 gpm production rate, 3" opening, total depth of 153 feet, screened from 60 feet to 70 feet, used for observation well.

SWCB Well No. 228-253

No information on file.

SWCB Well No. 228-254

Owned by the City of Virginia Beach, installed 1981, 60 gpm production rate, 3" opening, total depth of 94 feet, screened from 65 feet to 75 feet, used for an observation well.

SWCB Well No. 228-255

Owned by the City of Virginia Beach, installed 1981, 40 gpm production rate, 3" opening, total depth of 204 feet, screened 70 feet to 80 feet, used for an observation well.

SWCB Well No. 228-257

No information on file.

SWCB Well No. 228-258

Owned by the City of Virginia Beach, installed 1981, 50 gpm production rate, 6" opening, total depth of 150 feet, screened from 110 feet to 140 feet, used for a test well.

SWCB Well No. 228-299

Owned by Dreda McCreary, installed 1981, 1¼" opening, total depth of 21 feet, used to supply a private swimming pool.

SWCB Well No. 228-315

No information on file.

SWCB Well No. 228-343

Owned by the City of Virginia Beach, installed 1980, 10 gpm production rate, 6" opening, total depth of 204 feet, screened from 165 feet to 175 feet, used for an observation well.

SWCB Well No. 228-344

Owned by the City of Virginia Beach, installed 1980, 8 gpm production rate, 3" opening, total depth of 202 feet, screened from 52 feet to 62 feet, used for an observation well.

SWCB Well No. 228-345

Owned by the City of Virginia Beach, installed 1981, 12 gpm production rate, 3" opening, total depth of 210 feet, screened from 67 feet to 77 feet, used for an observation well.

SWCB Well No. 228-358

Owned by the City of Virginia Beach, installed 1981, 1 gpm production rate, 3" opening, total depth of 210 feet, screened from 180 feet to 190 feet, used for an observation well.

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWN NAME	LAT LONG	COND DATE	YIELD	H2S ANAL	TDEPTH	SCRN1 FROM	SCR1 TO	SCR2 TO	SCR3 TO	SCR4 TO	TOPO MAP
228-00009	LAKEVILLE ESTATES #3	36 49 00.0 076 12 22.0	1970	160.0	YES	148.0	100	120	.	.	.	34-C
228-00010	PEMBROKE MANOR #1	36 50 40.2 076 07 55.5	1063	.	NO	125.0	59	64	93	122	.	34-C
228-00011	PEMBROKE MANOR #2	36 50 45.0 076 07 55.0	0963	50.0	NO	125.0	57	62	85	115	.	34-C
228-00012	PEMBROKE MANOR #3	36 50 49.2 076 07 56.4	863	50.0	NO	125.0	52	57	87	120	.	34-C
228-00013	PEMBROKE MANOR #4	36 50 54.7 076 07 59.3	763	50.0	NO	125.0	58	68	115	.	.	34-C
228-00014	PEMBROKE MANOR #5	36 50 52.3 076 08 05.6	863	50.0	NO	125.0	52	57	96	119	.	34-C
228-00015	PEMBROKE MANOR #6	36 50 50.5 076 08 11.8	1263	50.0	NO	125.0	74	79	93	120	.	34-C
228-00016	PEMBROKE MANOR #7	36 50 44.6 076 08 14.4	1063	50.0	NO	31.0	55	60	74	117	.	34-C
228-00017	PEMBROKE MANOR #8	36 50 44.7 076 08 20.6	164	50.0	NO	125.0	52	57	68	120	.	34-C
228-00018	PEMBROKE MANOR #9	36 50 43.8 076 08 24.9	1163	50.0	NO	126.0	55	60	86	120	.	34-C
228-00019	BRADFORD ACRES	36 54 05.1 076 07 59.6	0059	75.0	YES	94.0	84	94	.	.	.	34-B
228-00020	CREEDS AIRPORT #1	36 36 27.2 076 00 27.9	343	70.0		77.0	43	69	.	.	.	2-D
228-00021	CREEDS AIRPORT #2	36 36 27.2 076 00 27.9	243	70.0		79.0	43	63	68	.	.	2-D
228-00022	COAST GUARD RADIO STA	36 43 37.3 076 00 39.6	658	50.0	YES	132.0	46	56	80	.	.	2-A
228-00023	PUNGO NAS #1	36 43 37.3 076 00 39.6	1242	70.0		73.0	47	64	.	.	.	2-A
228-00024	PUNGO NAS #2	36 43 37.3 076 00 39.6	143	40.0		69.0	45	62	.	.	.	2-A
228-00025	PUNGO NAS #3	36 43 37.3 076 00 39.6	944	45.0		73.0	48	58	62	.	.	2-A
228-00026	OCEANA NAS WELL 70	36 48 59.0 076 02 00.1	42	5.0		30.0	.	.	.	.	.	34-D
228-00027	OCEANA NAS #1	36 48 59.0 076 02 00.1	343	100.0		125.0	102	114	.	.	.	34-D
228-00028	OCEANA NAS #5	36 48 59.0 076 02 00.1	0643	72.0		126.5	103	117	.	.	.	34-D
228-00029	OCEANA NAS #6	36 48 59.0 076 02 00.1	1144	30.0		143.0	105	119	131	.	.	34-D
228-00030	OCEANA NAS WELL 492	36 48 20.0 076 01 17.0	0559	.		108.0	.	.	.	.	.	34-D
228-00031	OCEANA NAS WELL 1422	36 49 35.6 076 00 51.2	0059	20.0		135.0	.	.	.	.	.	34-D
228-00032	OCEANA NAS WELL 199	36 47 33.3 076 03 06.8	0061	5.0		35.0	.	.	.	.	.	34-D
228-00033	DEPT NAVY NORTHWEST	36 48 36.0 076 00 22.0	0064	5.0	YES	35.0	.	.	.	.	.	34-D
228-00034	OCEANA NAS WELL R36D	36 48 49.1 076 00 28.1	0066	5.0	YES	99.0	.	.	.	.	.	34-D
228-00035	KEMPSVILLE SCHOOL	36 49 35.1 076 09 40.3	0753	100.0		110.0	60	70	.	.	.	34-C
228-00036	SEABOARD DIST SCHOOL	36 45 06.5 076 02 00.2	555	45.0		100.0	68	78	.	.	.	34-D
228-00037	LINKHORN PARK SCHOOL	36 51 00.0 076 00 33.0	755	.		127.0	41	51	.	.	.	34-D
228-00039	CHESAPEAKE BAY BR-TUN	36 58 04.0 076 06 46.8	1063	25.0		1500.0	.	.	.	.	.	34-A
228-00040	SOUTHERN MATERIALS CO	36 50 22.8 076 08 12.6	1267	100.0	YES	120.0	50	70	.	.	.	34-C
228-00042	HEIGGS FARM RENTAL HOUSE	36 41 39.5 075 58 40.6	0077	.	NO	65.0	60	65	.	.	.	001-B
228-00043	JB ROBINSON BOYS HOME	36 50 51.5 076 11 34.8	653	30.0	NO	225.0	.	.	.	.	.	34-C
228-00044	RUDDE CAMP GROUNDS	36 48 23.5 075 59 45.9	0570	147.0	YES	130.0	62	82	112	.	.	33-C
228-00045	VA BEACH CAMPGROUND	36 48 03.6 075 59 40.4	0372	151.0	YES	145.0	72	92	126	.	.	33-C
228-00046	SENECA CAMPGROUNDS #1	36 33 24.8 076 00 27.0	772	80.0	NO	170.0	58	88	.	.	.	2-D
228-00047	SENECA CAMPGROUNDS #2	36 33 24.8 076 00 27.0	872	80.5	YES	102.0	69	94	.	.	.	2-D
228-00048	GERTLAND, INC.	36 47 42.0 076 10 17.0	0972	32.5	NO	106.0	50	60	80	.	.	34-C
228-00049	GERTLAND, INC.	36 47 53.0 076 10 04.0	1072	.		100.0	.	.	.	.	.	34-C
228-00050	GERTLAND, INC.	36 47 53.0 076 10 04.0	1172	45.0	NO	550.0	74	94	.	.	.	34-C
228-00051	STRATFORD CHASE	36 48 43.0 076 10 53.0	1072	40.0	NO	155.0	52	72	.	.	.	34-C
228-00052	STRATFORD CHASE	36 48 32.0 076 10 34.0	1072	62.0	YES	123.0	70	95	.	.	.	34-C
228-00053	CREEDS VOLUNTEER FIRE	36 36 17.2 076 01 33.2		.	YES	86.0	.	.	.	.	.	2-D
228-00055	BLACKWATER STORE	36 36 23.3 076 05 10.2		.	YES	60.0	.	.	.	.	.	2-D
228-00056	CREEDS ELEMENTARY	36 38 13.4 076 02 14.9	0956	62.0	YES	110.0	57	62	.	.	.	2-A
228-00057	INDIAN COVE CAMPGD #1	36 43 30.0 075 58 14.0		21.0	YES	86.0	.	.	.	.	.	1-B

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWN NAME	LAT LONG	CNTY DATE	YIELD	H2O ANAL	TDEPTH	SCR1 FROM	SCR1 TO	SCR2 TO	SCR3 TO	SCR4 TO	TOPO MAP
228-00058	INDIAN COVE CAMPGD #2	36 43 34.0 076 58 13.0		21.0	YES	66	.	.	.	.	.	1-B
228-00059	NEPRATEX INDUSTRIES	36 53 30.4 076 11 15.2	1974	.	YES	1142	993	1028	1084	1120	.	34-B
228-00060	MIKE MEIGGS-MONITORING WELL	36 41 49.5 076 58 24.3	0379	.	YES	30	25	30	.	.	.	1-B
228-00061	RICHARD FOSTER	36 51 35.5 076 02 59.0		24.0		140	134	140	.	.	.	34-D
228-00062	JAMES E MORRIS #1	36 52 22.0 076 06 12.0	0875	.	YES	90	.	.	.	.	.	34-D
228-00063	JAMES E MORRIS #2	36 52 22.0 076 06 12.0		.	YES	25	.	.	.	.	.	34-D
228-00064	FLORENCE LAYNE	36 54 25.5 076 06 54.9		.	YES	25	.	.	.	.	.	34-A
228-00065	COUNCILMAN	36 51 40.4 076 04 32.4		.	YES	20	.	.	.	.	.	34-D
228-00066	W F HARRIS	36 53 15.4 076 05 23.5	0013	.	YES	135	.	.	.	.	.	34-A
228-00067	J S HUMF	36 53 56.0 076 05 08.0	0073	.	YES	25	.	.	.	.	.	34-A
228-00069	LARRY LAWSON	36 51 23.0 076 03 15.4		.	YES	25	.	.	.	.	.	34-D
228-00070	LARRY LAWSON	36 51 23.0 076 03 15.4		.	YES	170	160	170	.	.	.	34-D
228-00071	WM. MCKEFFERY	36 51 39.9 076 03 18.5	0676	18.0	YES	144	136	144	.	.	.	34-D
228-00072	HERMAN HAASNOOT	36 52 50.2 076 03 24.9	0676	9.0		90	82	88	.	.	.	34-A
228-00073	VA BEACH PARKS & REC	36 47 12.0 075 59 36.0		.	YES	218	208	218	.	.	.	33-C
228-00074	VA BEACH PARKS & REC	36 47 12.0 075 59 36.0		.	YES	100	.	.	.	.	.	33-C
228-00075	VA BEACH PARKS & REC	36 46 35.3 076 05 46.0		.	YES	101	.	.	.	.	.	34-D
228-00076	VA BEACH PARKS & REC	36 47 24.5 076 07 59.7	0058	40.0	YES	105	84	94	.	.	.	34-C
228-00077	VA BEACH PARKS & REC	36 47 22.2 076 06 07.1	0945	.	YES	150	80	85	.	.	.	34-D
228-00078	OBSERVATION WELL #127	36 45 29.0 076 03 15.0	0961	40.0		106	50	55	.	.	.	034-D
228-00079	VA BCH SCH BRD (# 128)	36 44 55.4 076 03 27.8	0956	60.0		120	55	65	.	.	.	2-A
228-00080	OBSERVATION WELL #125	36 51 58.0 076 03 04.0	0363	30.0		105	52	57	.	.	.	034-D
228-00081	JB DYE ELEM SCH #3	36 53 53.0 076 03 46.2	0161	50.0	NO	40	35	40	.	.	.	034-A
228-00082	JOHN B. DYE ELEM #1	36 53 53.0 076 03 46.2	0356	32.0		70	38	48	.	.	.	034-A
228-00083	JOHN B. DYE ELEM #2	36 53 53.0 076 03 46.2	0161	22.0		105	31	36	.	.	.	034-A
228-00084	FARMERS MARKET	36 50 12.3 076 05 21.6	1157	.	NO	55	50	55	.	.	.	34-D
228-00085	FLEET SERVICE SCHOOL	36 52 14.0 075 59 01.4	0743	60.0	NO	150	20	25	.	.	.	33-C
228-00086	ELMER TARREL	36 52 06.6 076 00 12.4	1155	50.0	YES	120	50	55	.	.	.	34-D
228-00087	J W WOOD	36 52 57.0 076 00 03.0	0361	32.0		33	22	27	.	.	.	34-A
228-00089	BAYVILLE FARMS	36 54 06.1 076 06 45.6	0050	.	YES	38	33	38	.	.	.	034A
228-00090	C.C. CARPENTER	36 52 49.0 076 00 32.0	0752	150.0		150	60	65	90	.	.	34-A
228-00091	PINE TREE INN	36 50 40.0 076 04 30.6	0753	20.0		120	94	104	.	.	.	34-D
228-00092	BERNARD B SPIGEL	36 51 47.7 076 04 03.2	1044	25.0		137	120	135	.	.	.	34-D
228-00094	PR. ANNE COUNTRY CLUB	36 51 54.8 075 58 43.5	0860	75.0	YES	90	72	77	.	.	.	33-C
228-00095	PR. ANNE COUNTRY CLUB	36 51 55.3 075 59 08.1	0360	50.0	YES	110	72	77	.	.	.	33-C
228-00096	JOHN ARAGONA	36 50 17.0 076 06 28.0	0560	100.0		100	30	40	75	99	.	34-D
228-00097	BRADFORD ACRES	36 54 06.0 076 08 08.0	0958	50.0	NO	85	.	.	.	.	.	34-B
228-00099	AVALON HILLS, INC.	36 48 52.0 076 11 32.0	1063	14.0		125	55	60	.	.	.	34-C
228-00100	JOHN ARAGONA TW #9	36 50 17.0 076 06 28.0	0560	150.0		104	65	75	.	.	.	34-D
228-00101	CTY OF NORFOLK-STUMPY	36 46 27.1 076 09 39.9	0654	40.0	YES	125	110	120	.	.	.	34-C
228-00103	STUMPY LAKE	36 46 36.9 076 09 33.4	0853	210.0	YES	200	110	125	.	.	.	34-C
228-00104	THOROUGHGOOD ELEM SCH OBS #124	36 53 27.0 076 08 05.0	0658	32.0	NO	45	25	30	.	.	.	34-B
228-00105	KEMPSVILLE MEADOWS ES	36 49 04.0 076 08 34.0	0758	75.0	NO	95	74	79	.	.	.	34-C
228-00106	OBSERVATION WELL #126	36 49 06.0 076 04 39.0	0162	60.0		84	55	60	.	.	.	34-D
228-00106	OBSERVATION WELL #126	36 49 06.0 076 04 39.0	0162	.		.	.	.	.	.	.	34-D
228-00107	CITY OF VA BEACH	36 45 08.3 076 03 25.0	0374	80.0	NO	103	68	84	.	.	.	34-D

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWNER NAME	LAT LONG	COMPDATE	YIELD	H2OANAL	TDEPTH	SCRFROM	SCR1TO	SCR2TO	SCR3TO	SCR4TO	TOPOMAP
228-00108	OBSERVATION WELL #129	36 48 50.0 076 12 07.0	1056	55.0		120	68	73	.	.	.	34-C
228-00108	OBSERVATION WELL #129	36 48 50.0 076 12 07.0	1056	.		.	.	.	.	.	.	34-C
228-00109	BETTIE F. WMS ELEM SCH	36 51 51.8 076 09 52.0	0661	50.0	NO	85	65	70	.	.	.	034-C
228-00110	OBSERVATION WELL #130	36 49 20.0 076 09 36.0	0661	35.0		85	73	78	.	.	.	034-C
228-00111	KELLAM HARDWARE	36 44 56.0 076 03 07.0		.		400	60	65	.	.	.	2-A
228-00112	KINGS GRANT WATER CO #1	36 51 32.0 076 05 01.0	1063	6.1	NO	126	64	69	.	.	.	34-D
228-00113	KINGS GRANT WATER CO #2	36 51 32.0 076 05 01.0	1063	24.0	NO	126	64	69	.	.	.	34-D
228-00114	KINGS GRANT WATER CO #3	36 51 32.0 076 05 01.0	1063	18.0	NO	126	66	71	.	.	.	34-D
228-00115	KINGS GRANT WATER CO #4	36 51 32.0 076 05 01.0	1063	45.0	NO	125	.	.	.	.	.	34-D
228-00116	CITY OF VA BCH GEOTHERMAL 22	36 36 24.2 076 00 25.5	1078	.	NO	1038	.	.	.	.	.	002-D
228-00117	DEPT OF THE NAVY GEOTHERM 23	36 48 08.0 076 02 38.0	1073	.		1033	.	.	.	.	.	034-D
228-00119	OBSERVATION WELL #82	36 47 24.4 076 12 05.7	0976	.	YES	232	70	75	102	.	.	34-C
228-00120	OBSERVATION WELL #83	36 47 11.0 076 06 00.0	1176	.	YES	400	118	128	.	.	.	34-D
228-00120	OBSERVATION WELL #83	36 47 11.0 076 06 00.0	1176	.	YES	.	.	.	.	.	.	34-D
228-00121	T.D. BERLUND	36 50 23.0 076 08 48.0	0777	.	YES	20	17	20	.	.	.	34-C
228-00122	PAUL L NEWTON	36 48 47.0 076 04 36.0	73	.	YES	27	24	27	.	.	.	034D
228-00123	H B ROCK JR	36 49 50.4 076 06 00.2		.	YES	22	.	.	.	.	.	034D
228-00124	GENE SIUDYLA	36 50 15.9 076 08 40.5		.	YES	34	.	.	.	.	.	034C
228-00125	HRSD ATLANTIC PLANT	36 46 13.1 075 58 24.1	0976	.		122	.	.	.	.	.	33-C
228-00126	DT BARHAM	36 50 07.1 076 07 20.8		.	YES	21	.	.	.	.	.	34-D
228-00127	MALBON PIG FARM	36 46 29.4 075 58 19.9	0677	.	YES	60	50	60	.	.	.	33-C
228-00128	MALBON PIG FARM #1	36 46 32.8 075 58 20.4	0277	.	YES	30	20	30	.	.	.	33-C
228-00129	MALBON PIG FARM #2	36 46 32.8 075 58 20.4	0277	30.0		30	20	30	.	.	.	33-C
228-00130	MALBON PIG FARM #3	36 46 32.8 075 58 20.4	0677	.		30	20	30	.	.	.	33-C
228-00131	MALBON PIG FARM #4	36 46 32.8 075 58 20.4	0677	.		30	.	.	.	.	.	33-C
228-00132	OBSERVATION WELL #92A	36 47 13.0 076 03 07.0	1277	.	YES	400	97	102	.	.	.	034-D
228-00132	OBSERVATION WELL #92A	36 47 13.0 076 03 07.0	1277	.	YES	.	.	.	.	.	.	034-D
228-00133	OBSERVATION WELL #92B	36 47 15.0 076 03 08.0	1277	.	YES	70	53	58	.	.	.	034-D
228-00133	OBSERVATION WELL #92B	36 47 15.0 076 03 08.0	1277	.	YES	.	.	.	.	.	.	034-D
228-00134	MEIGGS FARM S. MONITORING #5	36 41 47.6 075 58 26.8	0379	.	YES	30	25	30	.	.	.	001-B
228-00135	OBSERVATION WELL #93	36 45 04.0 076 03 13.0	1277	.	YES	400	60	65	.	.	.	34-D
228-00135	OBSERVATION WELL #93	36 45 04.0 076 03 13.0	1277	.	YES	.	.	.	.	.	.	34-D
228-00136	GILL BLACKWATER STORE	36 38 13.0 076 05 43.0		.	YES	60	50	60	.	.	.	002-A
228-00137	MR TILFORD WILLIAMS	36 33 24.0 076 00 19.0		.	YES	26	20	26	.	.	.	002-D
228-00138	CREEDS VOLUNTEER FIRE	36 36 17.0 076 01 34.0		.	YES	30	.	.	.	.	.	002-D
228-00139	BLACKWATER FIRE DEPT	36 35 07.0 076 05 02.0		.	YES	60	50	60	.	.	.	002-D
228-00140	NORTH BAY SHORES CAMP	36 42 47.0 075 58 43.0		.	YES	65	60	65	.	.	.	001-B
228-00141	NORTH BAY SHORES CAMP	36 42 47.0 075 58 43.0		.	YES	65	60	65	.	.	.	001-B
228-00142	N BAY SHORES CAMPGROUND #3	36 42 47.0 075 58 43.0		.	YES	65	60	65	.	.	.	001-B
228-00144	MIKE MEIGGS	36 41 50.1 075 58 28.0	0578	40.0	YES	60	50	60	.	.	.	1-B
228-00145	MIKE MEIGGS	36 41 50.1 075 58 28.0	0578	40.0		60	50	60	.	.	.	1-B
228-00146	PLEASANT RIDGE T V	36 41 40.3 076 01 37.4		.	YES	80	75	80	.	.	.	002-A
228-00147	R. EATON	36 41 54.0 076 03 28.0		.	YES	25	20	25	.	.	.	002-A
228-00148	E. GARNER	36 35 19.8 076 01 06.9		.	YES	102	92	102	.	.	.	002-D
228-00149	MR. GLENNON	36 52 38.9 075 59 11.6	1178	40.0	YES	28	20	28	.	.	.	034-A
228-00150	YMCA BEACH CLUB	36 54 41.6 076 06 44.5	0363	65.0		81	75	81	.	.	.	034-A

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWN NAME	LAT LONG	COMP DATE	YIELD	H2O ANAL	TDEPTH	SCR1 FROM	SCR1 TO	SCR2 TO	SCR3 TO	SCR4 TO	TOPO MAP
228-00151	IKE MEIGGS FARM	36 41 46.5 075 58 42.8	1178	.	NO	65	60	65	.	.	.	001-B
228-00152	VA BCH MT TRASHMORE II #5	36 47 09.5 076 12 02.5	0072	.	NO	25	.	.	.	.	.	034-C
228-00153	VA BCH MT TRASHMORE II #6	36 47 16.8 076 12 18.2	0072	.	YES	25	.	.	.	.	.	034-C
228-00154	VA BCH - MT TRASHMORE II #7	36 47 03.2 076 12 30.3	0072	.	NO	25	.	.	.	.	.	034-C
228-00155	V BCH DEPT REFUSE MT TRASHII#8	36 46 57.0 076 12 17.6	0072	.	YES	25	.	.	.	.	.	034-C
228-00156	V BCH MT TRASHMOREII #9	36 46 38.1 076 12 13.2	0072	.	NO	25	.	.	.	.	.	034-C
228-00157	VA BCH MT TRASHMOREII #10	36 46 48.8 076 12 06.8	0072	.	NO	25	.	.	.	.	.	034-C
228-00158	VA BCH MT TRASHMOREII #11	36 47 23.4 076 12 02.0	0072	.	YES	25	.	.	.	.	.	034-C
228-00159	VA BCH PEMBROKE #3	36 50 52.2 076 07 59.4	0379	.		200	150	160	.	.	.	34-C
228-00160	CITY OF VA. BEACH - PEMBROKE	36 50 52.2 076 07 59.4	0379	.	NO	125	57	62	87	120	.	34-C
228-00161	CITY OF VA. BEACH - PEMBROKE	36 50 52.5 076 07 59.4	0379	.	NO	31	25	30	.	.	.	34-C
228-00162	OBSERVATION WELL #155	36 54 25.0 076 10 50.0	0379	200	YES	1600	1207	1229	1264	1306	1367	034-B
228-00163	OBSERVATION WELL #154	36 53 25.0 076 11 40.0	0579	200	YES	1339	1000	1010	1068	1124	.	034-B
228-00164	DANIEL ALDER	36 48 38.9 076 09 48.1	0679	.	YES	82	60	74	.	.	.	034-C
228-00165	VA BEACH-PUNGO HIGHWAY SHOP	36 41 28.0 076 00 37.0		.	YES	70	.	.	.	.	.	2-A
228-00166	VA BCH PUNGO HIGHWAY SHOP	36 41 27.0 076 00 37.0		.	YES	67	61	66	.	.	.	2-A
228-00167	OBSERVATION WELL #98A	36 41 26.0 076 00 35.0	0679	.	YES	24	20	24	.	.	.	2-A
228-00168	OBSERVATION WELL #98D	36 41 26.0 076 00 35.0	0679	.	YES	200	89	98	.	.	.	2-A
228-00169	OCEANA D (OBS WELL #92D)	36 47 14.0 076 03 04.0	0379	.	YES	24	19	24	.	.	.	34-D
228-00170	OBSERVATION WELL 97A	36 33 54.0 076 06 10.0	0779	.	YES	76	66	76	.	.	.	2-D
228-00171	OBSERVATION WELL 97B	36 33 54.0 076 06 10.0	0779	.	YES	24	20	24	.	.	.	2-D
228-00172	LAGOMAR OBS. #1	36 45 33.7 075 58 31.6		.	YES	25	20	25	.	.	.	033-C
228-00173	LAGOMAR OBS #2	36 45 33.7 075 58 31.6	1978	.	YES	25	20	25	.	.	.	33-C
228-00174	LAGOMAR OBS #3	36 45 33.7 075 58 31.6	0078	.	YES	25	20	25	.	.	.	033-C
228-00175	LAGOMAR OBS #4	36 45 33.7 075 58 31.6	0078	.	YES	25	20	25	.	.	.	033-C
228-00176	LAGOMAR OBS #5	36 45 33.7 075 58 31.6	1978	.	NO	25	20	25	.	.	.	33-C
228-00177	LAGOMAR OBS #6	36 45 33.7 075 58 31.6	0078	.	NO	25	20	25	.	.	.	033-C
228-00178	LAGOMAR OBS #7	36 45 33.7 075 58 31.6	0078	.	YES	25	20	25	.	.	.	033-C
228-00179	LAGOMAR OBS #8	36 45 33.7 075 58 31.6	0078	.	YES	25	.	.	.	.	.	33-C
228-00180	LAGOMAR OBS #9	36 45 33.7 075 58 31.6	0078	.	YES	25	.	.	.	.	.	033-C
228-00181	LAGOMAR OBS #10	36 45 33.7 075 58 31.6	0079	.	YES	47	37	47	.	.	.	33-C
228-00182	CHRISTIAN BROADCASTING NETWORK	36 48 10.0 076 11 42.0	0679	5	YES	155	60	68	.	.	.	34-C
228-00183	CONRAD REID	36 53 16.5 076 07 29.1		.	YES	138	130	138	.	.	.	34-A
228-00184	SWCB-TCC-83-B	36 46 55.1 076 05 49.7	0479	.	NO	130	120	130	.	.	.	34-D
228-00185	SWCB-TCC WELL C	36 46 55.1 076 05 49.1	0479	63	YES	130	120	130	.	.	.	34-D
228-00186	CISTOLA	36 53 28.0 076 05 57.6	0871	.		126	.	.	.	.	.	34-A
228-00187	CAROLINE WESTERHOF	36 52 56.2 076 05 51.2	0179	10	YES	44	30	44	.	.	.	34-A
228-00188	LEROY WOOD	36 46 36.5 076 10 53.4		.	NO	90	.	.	.	.	.	34-C
228-00189	WM. HAYDEN	36 51 36.3 076 03 27.1	0380	9	YES	132	124	132	.	.	.	034-D
228-00190	SWCB 78-5B (93)	36 44 56.9 076 02 59.0	0679	52	YES	120	60	65	.	.	.	002-A
228-00191	SWCB 78-5C (93)	36 44 57.0 076 02 59.1	0679	.	NO	120	60	65	.	.	.	002-A
228-00192	JOHN VOGEL - HUNT CLUB KENNELS	36 46 23.7 076 01 14.7	0679	30	YES	200	193	200	.	.	.	34-D
228-00193	BILLY CALLAHAN	36 51 33.2 076 07 33.5	1977	.	YES	18	.	.	.	.	.	34-C
228-00194	BARBARA MYER	37 05 14.0 076 07 46.5	1080	.	YES	87	.	.	.	.	.	34-C
228-00195	DEAN CUSTIS	36 49 46.4 076 04 36.7	0381	3	YES	13	10	13	.	.	.	34-D
228-00196	DON SWANLUND	36 48 13.3 076 05 04.8	0381	.	YES	147	.	.	.	.	.	34-D

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWN NAME	LAT LONG	COMP DATE	YIELD	H2O ANAL	TDEPTH	SCR1 FROM	SCR1 TO	SCR2 TO	SCR3 TO	SCR4 TO	TOPO MAP
228-00197	RICK LARABEE	36 52 05.2 076 03 00.5	0880	.	YES	150	125	130	.	.	.	34-D
228-00198	PRINCESS ANN INN	36 51 12.0 075 58 39.0	0281	20	YES	32	22	32	.	.	.	33-C
228-00199	SIR AFTON INN	36 50 43.0 075 58 54.0	0381	.	YES	39	.	.	.	.	.	33-C
228-00200	PAT WADE	36 48 03.9 076 15 25.7	0678	.	YES	18	16	17	.	.	.	34-C
228-00201	JOHN HOLLAND	36 54 22.0 076 02 45.0	0481	.	YES	85	.	.	.	.	.	34-A
228-00202	JACK HOLLAND	36 54 12.8 076 02 58.8	0481	.	YES	65	60	65	.	.	.	34-A
228-00203	JULIAN FRAZIER	36 54 27.2 076 04 38.1		.	YES	12	.	.	.	.	.	34-A
228-00204	HARRY WEILER	36 51 13.2 076 01 47.1	1971	.	YES	20	.	.	.	.	.	34-D
228-00204	HARRY WEILER	36 51 13.2 076 01 47.1	1971	.	YES	.	.	.	.	.	.	34-D
228-00205	KEITH THOMPSON	36 51 31.4 076 09 21.9		.	YES	16	.	.	.	.	.	34-C
228-00206	OBSERVATION WELL #100B	36 46 13.0 075 58 32.0	0281	.	YES	54	49	54	.	.	.	33-C
228-00206	OBSERVATION WELL #100B	36 46 13.0 075 58 32.0	0281	.	YES	54	49	54	.	.	.	33-C
228-00207	OBSERVATION WELL #100C	36 46 13.5 075 58 32.0	0281	.	YES	35	30	35	.	.	.	33-C
228-00207	OBSERVATION WELL #100C	36 46 13.5 075 58 32.0	0281	.	YES	35	30	35	.	.	.	33-C
228-00208	E. J. JONES	36 50 45.7 075 58 49.5	1950	.	YES	20	.	.	.	.	.	33-C
228-00209	OCEAN RANCH MOTEL	36 51 37.0 075 58 42.9	0381	.	YES	35	25	35	.	.	.	33-C
228-00210	SOUTHERN ICE	36 50 45.8 075 58 55.7	0281	.	YES	65	55	65	.	.	.	33-C
228-00211	MAI KAI RESORT APTS	36 52 58.8 075 59 14.6	0381	.	YES	27	.	.	.	.	.	34-A
228-00212	JIM ALAN DIAZ	36 52 07.1 076 08 35.2	0581	.	YES	17	.	.	.	.	.	34-C
228-00213	CAROLINE WESTERHOFF	36 52 56.4 076 05 51.2	0581	.	YES	46	41	46	.	.	.	34-A
228-00214	DEBBIE THOMPSON	36 47 56.0 076 09 33.5	0581	.	YES	45	.	.	.	.	.	34-C
228-00215	WILLIAM J. RICHARD	36 51 31.5 076 09 24.4	1971	.	YES	22	20	22	.	.	.	34-C
228-00216	FORREST ANDERSON	36 52 46.5 075 59 30.5	0381	27	YES	88	83	88	.	.	.	33-C
228-00217	B AND F TIRE AND RECAPPING	36 51 09.9 076 10 24.1	0581	.	NO	70	67	70	.	.	.	34-C
228-00218	VICKI DAVIS	36 47 54.5 076 09 55.7	0681	.	YES	16	11	16	.	.	.	34-C
228-00219	DR. CLARK RUSS	36 54 24.2 076 02 37.5	0378	.	YES	95	90	95	.	.	.	34-A
228-00220	OBSERVATION WELL #156	36 48 34.0 076 13 09.0		.	YES	65	55	65	.	.	.	34-C
228-00220	OBSERVATION WELL #156	36 48 34.0 076 13 09.0		.	YES	.	.	.	.	.	.	34-C
228-00221	PROVIDENCE MOBILE HOME PARK	36 48 34.1 076 13 08.8	1977	.	YES	65	60	65	.	.	.	34-C
228-00222	J. MARTIN CONROY	36 52 36.0 075 59 04.0	0681	.	YES	45	35	45	.	.	.	34-A
228-00223	A. MORGAN RUCKER	36 52 35.9 075 59 10.5	0781	.	YES	55	45	55	.	.	.	34-A
228-00224	ANABEL MATHEWS	36 47 57.1 076 09 35.9	0880	.	YES	35	.	.	.	.	.	34-C
228-00225	PETE SMITH	36 49 50.1 075 58 39.1	0601	.	YES	18	15	18	.	.	.	33-C
228-00226	RICHARD BIHR	36 54 20.6 076 02 56.1	0477	.	YES	25	20	25	.	.	.	34-A
228-00227	RICHARD BIHR	36 54 20.6 076 02 56.1	0781	.	YES	77	67	77	.	.	.	34-A
228-00228	MCLESKEY REALTY CO.,INC.	36 49 45.7 075 58 18.3	0281	.	YES	25	18	25	.	.	.	33-C
228-00229	BOB COULT	36 54 11.9 076 03 50.6	0777	30	YES	110	105	110	.	.	.	34-A
228-00230	HRSD ATLANTIC STP 1A	36 46 04.2 075 58 22.0	0181	.	NO	50	45	50	.	.	.	33-C
228-00231	HRSD ATLANTIC STP 1B	36 46 04.2 075 58 22.0	0181	.	NO	38	33	38	.	.	.	33-C
228-00232	HRSD ATLANTIC STP 2A	36 45 50.4 075 58 24.9	0181	.	NO	50	45	50	.	.	.	33-C
228-00233	HRSD ATLANTIC STP 2B	36 45 50.4 075 58 24.9	0181	.	NO	35	30	35	.	.	.	33-C
228-00234	HRSD ATLANTIC STP 3A	36 45 44.7 075 58 36.1	0181	.	NO	50	45	50	.	.	.	33-C
228-00235	HRSD ATLANTIC STP 3B	36 45 44.7 075 58 36.1	0181	.	NO	35	30	35	.	.	.	33-C
228-00236	HRSD ATLANTIC STP 4A	36 45 52.0 075 58 54.3	0181	.	NO	53	48	53	.	.	.	33-C
228-00237	HRSD ATLANTIC STP 4B	36 45 52.0 075 58 54.3	0181	.	NO	43	38	43	.	.	.	33-C
228-00238	HRSD ATLANTIC STP 5	36 46 08.2 075 59 11.0	0181	.	NO	47	42	47	.	.	.	33-C

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
NWCRUSGS

WELL NO	OWN NAME	LAT LONG	COMPDATE	YIELD	H2OANAL	TDEPTH	SCRNFROM	SCR1TO	SCR2TO	SCR3TO	SCR4TO	TOPOMAP
228-00239	HRSD ATLANTIC STP 6A	36 46 14.7 075 58 48.7	0101	.	NO	50	45	50	.	.	.	33-C
228-00240	HRSD ATLANTIC STP 6B	36 46 14.7 075 58 48.7	0101	.	NO	36	31	36	.	.	.	33-C
228-00241	SWCB	36 47 15.2 076 03 04.7	1277	.	NO	102	97	102	.	.	.	34D
228-00242	VA BCH REDWING OBS 01	36 47 28.9 075 59 29.9	1280	25	NO	220	170	180	.	.	.	33C
228-00243	OBSERVATION WELL 173B	36 47 22.0 075 59 10.0	1260	2	YES	182	80	90	.	.	.	33C
228-00244	VA BCH REDWING OBS 03	36 47 23.8 075 59 36.6	1280	21	NO	182	68	78	.	.	.	33C
228-00245	VA BCH REDWING OBS 04	36 47 28.2 075 59 14.2	1260	24	NO	112	70	80	.	.	.	33C
228-00246	VA BCH REDWING OBS 05	36 47 21.0 075 59 16.0	0181	21	NO	102	62	72	.	.	.	33-C
228-00247	VA BCH REDWING OBS 06	36 47 20.5 075 59 19.2	0181	20	NO	102	63	73	.	.	.	33C
228-00248	VA BCH REDWING OBS 07	36 47 21.2 075 59 16.6	0181	5	NO	35	25	35	.	.	.	33-C
228-00249	VA BCH REDWING PARK TP 1	36 47 21.0 075 59 16.3	0181	50	YES	102	59	89	.	.	.	33C
228-00250	OBSERVATION WELL 172A	36 47 45.0 076 00 43.0	0181	8	YES	225	155	165	.	.	.	34D
228-00251	VA BCH OCEANA II OBS 02	36 47 44.2 076 00 30.4	0181	24	NO	153	60	70	.	.	.	34D
228-00252	VA BCH OCEANA II OBS 03	36 47 22.3 076 00 06.4	0181	5	NO	224	125	135	.	.	.	34-D
228-00253	OBSERVATION WELL 172D	36 47 45.0 076 00 43.0	0181	20	YES	154	60	70	.	.	.	34-D
228-00254	VA BCH OCEANA II OBS 05	36 47 46.7 076 00 45.7	0181	60	NO	94	65	75	.	.	.	34D
228-00255	VA BCH OCEANA II OBS 06	36 47 52.9 076 01 11.1	0181	40	NO	200	70	80	.	.	.	34D
228-00256	VA BCH OCEANA II OBS 07	36 47 29.0 076 00 23.0	0181	30	NO	102	70	80	.	.	.	34D
228-00257	OBSERVATION WELL 172C	36 47 45.0 076 00 43.0	0181	20	YES	35	20	30	.	.	.	34D
228-00258	VA BCH OCEANA II TP 1	36 47 45.8 076 00 43.0	0281	50	YES	150	110	140	.	.	.	34-D
228-00259	VA BCH OBS WO-01	36 44 09.5 076 00 28.3	0281	1	NO	204	100	110	.	.	.	2A
228-00260	VA BCH OBS WO-02	36 44 32.0 076 00 43.0	0381	5	NO	111	50	55	.	.	.	2A
228-00261	VA BCH OBS WO-03	36 44 01.1 076 00 38.1	0281	1	NO	142	117	127	.	.	.	2A
228-00262	VA BCH OBS WO-04	36 43 52.3 076 00 43.0	0281	33	NO	120	52	62	.	.	.	2A
228-00263	VA BCH OBS WO-05	36 43 52.4 076 00 53.9	0281	50	YES	132	52	62	.	.	.	2A
228-00264	VA BCH OBS WO-06	36 43 53.1 076 00 54.3	0381	1	NO	70	50	60	.	.	.	2A
228-00265	VA BCH OBS WO-07	36 43 54.4 076 00 54.6	0381	26	NO	70	50	60	.	.	.	2A
228-00266	VA BCH OBS WO-08	36 43 52.4 076 00 54.0	0381	67	NO	40	20	25	.	.	.	2A
228-00267	VA BCH WO-TP1	36 43 52.3 076 00 53.8	0381	50	NO	77	50	60	.	.	.	2A
228-00268	VA BCH OBS PNG-01	36 43 24.4 076 01 16.4	0281	40	NO	204	120	130	.	.	.	2A
228-00269	VA BCH OBS PNG-02	36 41 25.4 076 01 33.7	0281	1	NO	210	120	130	.	.	.	2A
228-00270	VA BCH OBS PNG-03	36 40 59.0 076 01 27.0	0281	.	NO	202	55	65	.	.	.	2A
228-00271	VA BCH OBS PNG-05	36 43 33.0 076 01 06.0	0281	.	NO	72	52	62	.	.	.	2A
228-00272	VA BCH OBS MA-01	36 45 08.1 076 01 18.6	0281	21		132	51	61	.	.	.	34-D
228-00273	VA BCH OBS MA-02	36 44 54.6 076 01 31.9	0281	4	NO	200	75	85	.	.	.	2-A
228-00274	VA BCH OBS MA-03	36 44 58.9 076 01 25.8	0281	5	NO	110	95	105	.	.	.	2-A
228-00275	VA BCH OBS MA-04	36 44 51.4 076 01 33.6	0281	2	NO	180	75	85	.	.	.	2-A
228-00276	VA BCH OBS MA-05	36 45 01.3 076 01 12.4	0281	1	NO	162	75	85	.	.	.	34-D
228-00277	VA BCH OBS MA-06	36 45 13.4 076 01 39.4	0381	.	NO	99	62	72	.	.	.	34-D
228-00278	VA BCH OBS VBS-01	36 44 40.7 076 01 03.8	0181	2	NO	205	110	120	.	.	.	2-A
228-00279	VA BCH OBS VBS-02	36 44 42.9 076 01 07.4	0181	13	NO	170	155	165	.	.	.	2-A
228-00280	VA BCH OBS VBS-03	36 44 42.8 076 01 07.3	0181	15	NO	70	55	60	.	.	.	2-A
228-00281	VA BCH OBS VBS-04	36 44 38.9 076 01 21.5	0181	30	NO	202	165	175	.	.	.	2-A
228-00282	VA BCH OBS CM-01	36 45 21.8 076 01 31.9	0281	10	NO	205	135	145	.	.	.	34-D
228-00283	VA BCH OBS CM-02	36 45 15.3 076 01 20.5	0381	18	NO	154	55	63	.	.	.	34-D
228-00284	VA BCH OBS CM-03	36 45 21.1 076 01 16.2	0281	20	NO	150	77	87	.	.	.	34-D

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWN NAME	LAT LONG	COMPDATE	YIELD	H2OANAL	TDEPTH	SCR1FROM	SCR1TO	SCR2TO	SCR3TO	SCR4TO	TOPO MAP
228-00285	VA BCH OBS CM-04	36 45 14.5 076 01 19.6	0381	2	NO	90	76	86	.	.	.	34-D
228-00286	VA BCH OBS CM-05	36 45 15.7 076 01 21.4	0381	4	NO	90	75	85	.	.	.	34-D
228-00287	VA BCH OBS CM-06	36 45 17.2 076 01 24.1	0381	10	NO	90	75	85	.	.	.	34-D
228-00288	VA BCH OBS CM-07	36 45 15.4 076 01 20.8	0381	.	NO	30	20	25	.	.	.	34-D
228-00289	VA BCH OBS CM-TP1	36 41 59.4 082 50 51.2	0381	50	NO	100	74	89	.	.	.	34-D
228-00290	VA BCH OBS LC-01	36 45 34.7 076 00 10.4	0281	3	NO	202	100	110	.	.	.	34-D
228-00291	VA BCH OBS LC-02	36 45 28.4 076 00 11.7	0281	18	NO	202	125	135	.	.	.	34-D
228-00292	VA BCH OBS LC-04	36 45 22.5 076 00 19.6	0281	1	NO	152	95	110	.	.	.	34-D
228-00293	VA BCH OBS LC-05	36 45 12.2 076 00 25.5	0281	2	NO	152	103	113	.	.	.	34-D
228-00294	VA BCH OBS LC-06	36 44 59.4 075 59 53.6	0281	30	NO	204	50	60	.	.	.	1-B
228-00295	VA BCH OBS LC-07	36 44 53.0 075 59 57.0	0281	1	NO	139	115	125	.	.	.	1-B
228-00296	VA BCH OBS LC-08	36 45 25.0 076 00 43.6	0281	4	NO	150	105	115	.	.	.	34-D
228-00297	VA BCH OBS LC-09	36 45 21.9 076 00 18.1	0281	.	NO	142	122	132	.	.	.	34-D
228-00298	VA BCH OBS LC-10	36 45 21.9 076 00 17.2	0281	.	NO	62	52	57	.	.	.	34-D
228-00299	DREDA MCCREARY	36 47 45.8 076 04 22.6	0081	.	YES	21	.	.	.	.	.	34-D
228-00300	SERVITEX INC	36 53 15.9 076 10 41.2	0782	75	YES	75	65	75	.	.	.	34-B
228-00301	MELINDA VANLONE	36 49 13.0 076 00 27.0	1973	.	YES	60	.	.	.	.	.	34-D
228-00302	MALBON BROTHERS FARM NO. 1	36 46 05.0 075 59 28.0	1979	.	NO	40	35	40	.	.	.	33-C
228-00303	MALBON BROTHERS FARM NO.2	36 46 22.0 075 59 47.0	1979	.	NO	25	15	25	.	.	.	33-C
228-00304	MALBON BROTHERS FARM NO.3	36 46 08.0 075 59 47.0		.	YES	60	.	.	.	.	.	33-C
228-00305	BACK BAY REFUGE MAINTENANCE	36 39 43.0 075 54 40.0	1970	.	YES	15	10	15	.	.	.	1-B
228-00306	BACK BAY REFUGE VISITOR'S CTR.	36 40 22.0 075 54 57.0	1970	.	YES	20	15	20	.	.	.	1-B
228-00307	FALSE CAPE PARK BARBOUR'S HILL	36 37 13.0 075 54 18.0		.	YES	10	5	10	.	.	.	1-C
228-00308	FALSE CAPE PARK ENVIRON. CTR.	36 34 39.0 075 53 22.0		.	YES	6	.	.	.	.	.	1-C
228-00309	FALSE CAPE PARK FALSE CAPE LG.	36 35 40.0 075 53 18.0		.	YES	10	.	.	.	.	.	1-C
228-00310	MILDRED BUCKLEY	36 50 04.0 076 11 17.0	0682	.	YES	21	.	.	.	.	.	34-C
228-00311	LIEUTENANT ALDRIDGE	36 47 38.0 076 10 58.0	0583	.	YES	92	.	.	.	.	.	34-C
228-00312	FALSE CAPE STATE PARK #1	36 34 47.0 075 53 11.0	0993	45	YES	60	24	34	.	.	.	1-C
228-00313	FALSE CAPE STATE PARK #2	36 34 47.0 075 53 07.0	1083	30	YES	27	15	25	.	.	.	1-C
228-00314	OBSERVATION WELL #173A	36 47 22.0 075 59 18.0	0181	.	YES	312	281	291	.	.	.	33-C
228-00315	OBSERVATION WELL #172B	36 47 45.0 076 00 43.0	0181	2	YES	304	270	280	.	.	.	34-D
228-00316	OBSERVATION WELL #174A	36 49 20.0 076 09 32.0	0181	.	YES	202	160	170	.	.	.	34-C
228-00317	OBSERVATION WELL #174B	36 49 20.0 076 09 32.0	0181	.	YES	80	65	75	.	.	.	34-C
228-00318	OBSERVATION WELL #175	36 48 37.0 076 09 20.0	0281	.	YES	152	90	100	.	.	.	34-C
228-00319	T.J. BROCKENBROUGH	36 52 28.0 076 00 50.0	0484	8	YES	55	50	55	.	.	.	34-D
228-00320	HOBERT STANTON	36 53 50.0 076 06 08.0	0384	24	NO	109	104	109	.	.	.	34-A
228-00321	L. MCANDREWS	36 45 33.0 076 07 13.0	0484	8	YES	73	68	73	.	.	.	34-D
228-00323	BILL DAVENPORT	36 51 45.0 076 03 50.0	0684	18	NO	56	51	56	.	.	.	34-D
228-00324	HARRY PITT	36 54 16.0 076 03 16.0	0984	15	YES	105	100	105	.	.	.	34-A
228-00325	K. KASSIR	36 54 18.0 076 03 13.0	0784	30	NO	106	101	106	.	.	.	34-A
228-00326	E. ACKISS	36 44 23.0 076 01 20.0	0185	45	NO	190	185	190	.	.	.	2-A
228-00327	DEVONA GILBERT	36 36 13.0 076 05 17.0	0584	.	YES	38	28	38	.	.	.	2-D
228-00328	BANTON & CONNER	36 49 10.0 076 00 17.0		30	NO	32	25	32	.	.	.	34-D
228-00329	MEIGGS NEW LAGOON (NORTH)	36 41 48.0 075 58 32.0	0785	.	YES	23	18	23	.	.	.	1-B
228-00330	MEIGGS NEW LAGOON (WEST)	36 41 42.0 075 58 34.0	0785	.	YES	23	18	23	.	.	.	1-B
228-00331	MEIGGS NEW LAGOON (EAST)	36 41 45.0 075 58 30.0	0785	.	YES	17	12	17	.	.	.	1-B

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWN NAME	LAT LONG	COMPDATE	YIELD	H2OANAL	TDEPTH	SCR1FROM	SCR1TO	SCR2TO	SCR3TO	SCR4TO	TOPO MAP
228-00332	MEIGGS NEW LAGOON (SOUTH)	36 41 43.0 075 58 33.0	0785	.	YES	23	18	23	.	.	.	1-B
228-00333	BROAD BAY GOLF COURSE #1	36 53 45.0 076 02 47.0	0984	50.0	YES	150	78	84	134	.	.	34-A
228-00334	BROAD BAY GOLF COURSE #2	36 53 46.0 076 02 43.0	1084	11.0	YES	150	94	114	.	.	.	34-A
228-00335	BROAD BAY GOLF COURSE #3	36 53 43.0 076 02 42.0	1084	15.0	YES	150	104	124	.	.	.	34-A
228-00336	BROAD BAY GOLF COURSE #4	36 53 42.0 076 02 50.0	1084	30.0	YES	150	124	144	.	.	.	34-A
228-00337	BROAD BAY GOLF COURSE #5	36 53 45.0 076 02 52.0	1184	.	YES	150	30	90	140	.	.	34-A
228-00338	BROAD BAY GOLF COURSE #6	36 53 44.0 076 02 57.0	1084	.	YES	150	30	120	.	.	.	34-A
228-00339	MEIGGS NL NORTH BERM WELL	36 41 49.0 075 58 33.0	0930	3.0	YES	8	3	8	.	.	.	1-B
228-00340	MEIGGS NL WEST BERM WELL	36 41 47.0 075 58 34.0	0930	1.5	YES	8	3	8	.	.	.	1-B
228-00341	MEIGGS NL EAST BERM WELL	36 41 47.0 075 58 32.0	0930	3.0	YES	8	3	8	.	.	.	1-B
228-00342	MEIGGS NL SOUTH BERM WELL	36 41 45.0 075 58 33.0	0930	4.0	YES	8	3	8	.	.	.	1-B
228-00343	VA BCH OCEANA INDUST. PARK 1	36 48 51.0 076 03 39.0	1280	10.0	NO	204	165	175	.	.	.	34-D
228-00344	VA BCH OCEANA INDUST PARK 2	36 48 46.0 076 03 35.0	1280	8.0	NO	202	52	62	.	.	.	34-D
228-00345	VA BCH OCEANA INDUST PARK 3	36 48 42.0 076 03 32.0	0181	12.0	NO	210	67	77	.	.	.	34-D
228-00346	VA BCH PRINCESS ANNE MC 1	36 45 04.0 076 03 46.0	0181	4.0	NO	169	79	99	.	.	.	34-D
228-00347	VA BCH PRINCESS ANNE MC 2	36 45 02.0 076 03 34.0	0181	4.0	NO	224	60	70	.	.	.	34-D
228-00348	VA BCH NIMMO CHURCH 1	36 46 09.0 076 01 00.0	0281	2.0	NO	210	110	120	.	.	.	34-D
228-00349	VA BCH NIMMO CHURCH 2	36 45 42.0 076 01 21.0	0281	.	NO	202	65	75	.	.	.	34-D
228-00350	VA BCH NIMMO CHURCH 3	36 46 33.0 076 00 17.0	0281	6.0	NO	204	105	115	.	.	.	34-D
228-00351	VA BCH NIMMO CHURCH 4	36 46 07.0 076 00 51.0	0281	.	NO	202	110	120	.	.	.	34-D
228-00352	VA BCH OCEANA III-01	36 49 02.0 076 00 07.0	0281	.	NO	202	145	155	.	.	.	34-D
228-00353	VA BCH OCEANA III-02	36 48 59.0 076 00 03.0	0281	.	NO	202	88	98	.	.	.	34-D
228-00354	VA BCH PRINCESS ANNE SCH 01	36 44 50.0 076 02 09.0	1280	20.0	NO	225	165	175	.	.	.	2-A
228-00356	VA BCH BW GOLF COURSE 01A	36 49 16.0 076 05 16.0	0181	13.0	NO	135	120	130	.	.	.	34-D
228-00357	VA BCH BC GOLF COURSE 02	36 49 09.0 076 05 11.0	0181	7.8	NO	202	60	70	.	.	.	34-D
228-00358	VA BCH OCEANA I 01	36 47 04.0 076 02 37.0	0181	1.0	NO	210	180	190	.	.	.	34-D
228-00359	VA BCH LAGOMAR 02	36 45 13.0 075 58 33.0	0381	60.0	NO	102	50	60	.	.	.	33-C
228-00360	VA BCH LAGOMAR 01	36 45 01.0 075 58 46.0	0381	30.0	NO	102	82	92	.	.	.	33-C
228-00361	VA BCH WK-01	36 43 22.0 075 59 53.0	0281	5.0	NO	200	85	95	.	.	.	1-B
228-00362	VA BCH TEC-01	36 44 32.0 076 04 24.0	0281	.	NO	202	60	70	.	.	.	2-A
228-00363	VA BCH JD-01	36 43 54.0 076 01 55.0	0381	30.0	NO	102	75	85	.	.	.	2-A
228-00364	VA BCH RW PARK M2	36 47 22.0 075 59 10.0	0281	.	NO	252	190	200	.	.	.	33-C
228-00365	VA BCH RW PARK M3	36 47 22.0 075 59 10.0	0281	.	NO	175	160	170	.	.	.	33-C
228-00366	VA BCH WO-M1	36 43 52.0 076 00 53.0	0381	.	NO	250	213	214	176	.	.	2-A
228-00367	VA BCH WO-M2	36 43 53.0 076 00 52.0	0381	.	NO	140	132	133	118	.	.	2-A
228-00368	VA BCH C. MUNDEN	36 45 15.0 070 01 20.0	0381	.	NO	250	146	147	185	210	238	34-D
228-00369	VA BCH OCEANA II M2	36 47 45.0 076 00 45.0	0181	12.0	NO	205	130	140	.	.	.	34-D
228-00370	VA BCH MC-01	36 45 09.0 076 00 43.0	0281	.	NO	130	115	125	.	.	.	34-D
228-00371	VA BCH BS-01	36 53 22.0 076 11 40.0	0181	.	NO	150	75	85	.	.	.	34-B
228-00372	VA BCH BS-02A	36 53 07.0 076 11 23.0	0181	.	NO	70	55	65	.	.	.	34-B
228-00373	J. GREEN	36 50 57.0 076 08 47.0	0486	.	YES	18	15	18	.	.	.	34-C
228-00374	MEIGGS FARM	36 41 49.0 075 58 24.0	0886	.	YES	9	3	9	.	.	.	1-B
228-00375	MEIGGS FARM	36 41 47.0 075 58 26.0	0886	.	YES	7	2	7	.	.	.	1-B
228-00376	CAVALIER GOLF - #2	36 51 50.0 076 00 10.0		12.0	NO	55	.	.	.	.	.	34-D
228-00377	CAVALIER GOLF #4	36 51 34.0 076 00 05.0		25.0	NO	55	.	.	.	.	.	34-D
228-00378	CAVALIER GOLF #7	36 51 28.0 075 59 38.0		25.0	NO	69	.	.	.	.	.	33-C

VIRGINIA WATER CONTROL BOARD GROUNDWATER DATA
CITIES AND COUNTIES OF TIDEWATER REGION
WWCRUSGS

WELL NO	OWN NAME	LAT LONG	COMPDATE	YIELD	H2OANAL	TDEPTH	SCR1FROM	SCR1TO	SCR2TO	SCR3TO	SCR4TO	TOPO MAP
228-00379	CAVALIER GOLF #10	36 51 24.0 076 59 47.0		25.00	NO	58	.	.	.	.	.	33-C
228-00380	CAVALIER GOLF #12	36 51 20.0 076 59 55.0		25.00	NO	71	.	.	.	.	.	33-C
228-00381	CAVALIER GOLF #16	36 51 51.0 077 00 18.0		25.00	NO	43	.	.	.	.	.	34-D
228-00382	CAVALIER GOLF #17/18	36 52 02.0 076 00 25.0		25.00	NO	47	.	.	.	.	.	34-D
228-00383	CAVALIER GOLF & YACHTCLUB	36 51 20.0 076 59 46.0	0886	.	NO	103	52	68	92	.	.	33-C
228-00384	HELL'S POINT GOLF CLUBHOUSE	36 44 30.0 076 58 44.0	0782	.	NO	100	.	.	.	.	.	1-B
228-00385	HELLS POINT GOLF MAINTENANCE	36 44 07.0 076 58 16.0	0782	.	NO	60	40	60	.	.	.	1B
228-00386	HELL'S POINT GOLF IRRIGATION	36 44 20.0 076 58 44.0	0782	.	NO	40	20	40	.	.	.	1-B
228-00387	HELLS POINT GOLF - IRRIGATION	36 44 21.0 076 58 43.0	0782	.	NO	60	40	60	.	.	.	1-B
228-00388	HELL'S POINT GOLF IRRIGATION	36 44 21.0 076 58 44.0	0782	.	NO	80	60	80	.	.	.	1-B
230-00001	QUARTERPATH SWIMMING POOL	37 15 57.0 076 40 55.0	0581	50.00		452	432	452	.	.	.	96-C
230-00002	MRS. HUGH HAYNES	37 16 52.8 076 41 20.0	0581	75.00		405	385	405	.	.	.	96-C
230-00004	WALSINGHAM ACADEMY #1	37 15 23.0 076 43 37.0	0350	48.00	YES	437	380	411	430	.	.	96-C
230-00005	COLLEGE OF W & M	37 16 17.0 076 42 54.0		.		500	.	.	.	.	.	96-C
230-00006	COL. WMSBURG GOODWIN A	37 16 17.0 076 42 24.0	0440	74.00	YES	439	409	420	432	.	.	96-C
230-00007	COL. WMSBURG LODGE B	37 16 04.0 076 42 03.0	0452	236.00		481	431	478	.	.	.	96-C
230-00008	COL. WMSBURG INN C	37 16 02.0 076 41 55.0	0553	275.00	YES	485	397	412	436	471	.	96-C
230-00009	COL. WMSBURG CAPITOL D	37 16 17.0 076 41 33.0	0055	300.00	YES	484	.	.	.	.	.	96-C
230-00010	COL. WMSBURG. INFO. CTRE	37 16 47.0 076 41 51.0	0356	472.00	YES	453	396	411	446	.	.	96-C
230-00011	COL. WMSBURG LAUNDRY F	37 16 25.0 076 41 46.0	1961	4.11	YES	450	350	370	445	.	.	96-C
230-00012	COL. WMSBURG LODGE G	37 16 03.0 076 42 02.0	1962	700.00	YES	471	330	390	410	440	466	96-C
230-00013	COLONIAL WMSBURG PALACE-WELL H	37 16 22.0 076 42 05.0	0365	560.00	YES	501	399	412	428	444	471	96-C
230-00014	COL. WMSBURG. CASCADE I	37 16 56.0 076 41 50.0	0267	512.00	YES	500	369	381	412	450	.	96-C
230-00016	COLONIAL WILLIAMSBURG	37 16 02.0 076 41 55.0	1175	395.00		476	400	415	438	473	.	96-C
230-00018	COLLEGE OF WILLIAM AND MARY	37 16 15.0 076 42 34.0	0024	300.00		442	.	.	.	.	.	96-C
230-00019	PRINCESS ANNE MOTEL - ROWLAND	37 17 04.0 076 43 16.0	0481	50.00		423	.	.	.	.	.	96-C
230-00020	JOHN ROLFE MOTEL - TOM HUNT	37 16 58.0 076 43 23.0	0581	50.00		400	390	400	.	.	.	96-C
230-00021	YORKSHIRE INN - TOM PAPARIS	37 15 53.0 076 40 54.0	0481	50.00		456	446	456	.	.	.	96-C
233-00001	CITY OF FRANKLIN #1	36 40 51.0 076 55 34.0	1930	40.00		354	.	.	.	.	.	5-B
233-00002	CITY OF FRANKLIN #2	36 40 53.0 076 55 22.0	0531	.		333	.	.	.	.	.	5-B
233-00003	CITY OF FRANKLIN #3	36 40 52.0 076 55 23.0	1044	1700.00	YES	604	56	66	111	296	317	5-B
233-00004	CITY OF FRANKLIN #4	36 40 15.0 076 56 18.0	0357	2000.00		604	238	242	347	394	582	5-B
233-00005	FRANKLIN TOWN WELL	36 40 53.0 076 55 17.0	0667	1100.00	NO	750	355	360	390	420	460	5-B
233-00006	VA. STATE POLICE	36 41 00.0 076 57 56.0	0368	15.00		372	344	354	.	.	.	5-B
233-00007	K. J. LYONS	36 40 44.0 076 55 26.0		.		275	.	.	.	.	.	5-B
233-00008	S. W. RAWLS, JR	36 40 54.0 076 57 42.0		.		400	.	.	.	.	.	5-B
233-00009	FRED STEWART	36 40 50.0 076 56 56.0		.		110	.	.	.	.	.	5-B
233-00010	CONTINENTAL C-168	36 40 00.0 076 56 10.0	0066	.		220	.	.	.	.	.	5-B
233-00011	OBSERVATION WELL #145B	36 40 33.0 076 56 26.0	0680	.		730	714	734	.	.	.	5-B
233-00012	OBSERVATION WELL #145C	36 40 33.0 076 56 26.0	0680	.		360	350	350	.	.	.	5-B
233-00013	OBSERVATION WELL #145D	36 40 33.0 076 56 26.0		.		140	130	140	.	.	.	5-B
234-00001	SOUTHERN BLOCK & PIPE	36 43 26.6 076 16 00.2	862	.	YES	125	87	92	.	.	.	3-A
234-00002	SOUTHERN BLOCK & PIPE	36 47 17.5 076 17 37.9	366	226.00	NO	138	92	112	.	.	.	35-D
234-00003	W R GRACE & CO	36 47 25.9 076 17 40.1		60.00		140	105	115	.	.	.	35-D
234-00004	VEPCO	36 46 16.5 076 18 21.5	1258	100.00		89	75	85	.	.	.	35-D
234-00005	VEPCO	36 46 17.1 076 18 27.0	1258	.		102	67	72	97	.	.	35-D

APPENDIX B

BOREHOLE LOGS

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT0-20

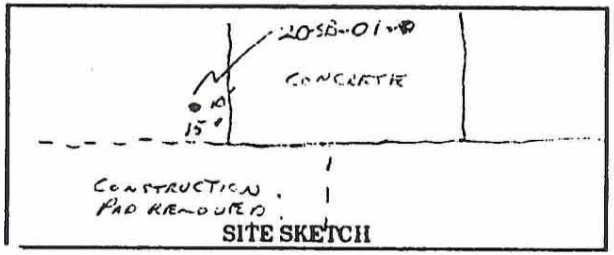
FACILITY ID OCEANA (NAS)

LOCATION ID BB001

DATE ESTABLISHED MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION _____



SITE SKETCH

BOREHOLE DIAMETER (IN) 3 1/2

TOTAL DEPTH (FT) 19'

WATER ENCOUNTERED (FT) 2.8

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ____

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
10:25		0	2	CS	SAND	75	3333	75%: 0-.5 BR Gy CLAYEY SAND, .5-1.4 COARSE SAND (C5/1) HNU-0
10:30	205B01-01	2	4	CS	SAND	90	3333	90% CS (C5/1) 2-2.8 ; 2.8-3.4 GRAY WET COARSE SAND WELL SORTED, 3.4-3.8 DK BR SILTY CLAY @ ROOT DEBRIS
10:35		4	6	CL	CLAY	100	3344	100% 4.0-4.4 Gy BR SILTY C.S. FINING DOWN. 4.4-5.2 DK Gy CLAY (10YR 3/1) -SILTY CLAY 5.2-6 DK GY Gy (10YR 6/1) CLAY
10:55	205B01-02	8	10	S	SAND	100	11-6-33	8.0-8.4 TAN SILTY SAND WET 8.4-8.8 DK Gy CLAY ; 8.8-10 LT Gy-GR COARSE SAND WET, HIGHEST HNU (110) IN 8.8-10, SAND (W) LT GR
11:05		14	16	CS	SAND	100	3-6-13-18	STRAKING (CALCENITIC ?) 14-14.3 WET MED SAND, GR Gy HIGH HNU 12.5-14.3 - 16.0 COARSE SAND V. MOIST GRAY @ LOCALIZED GR Gy. @ BR INCLUSIONS (?) HNU RANGED-BJ TO 16.0 Grays 10YR 10/1
11:10	—	—	—	—	—	—	—	PROBLEMS WITH FLOWING SAND AT 17. SAMPLING 17-19!
		17	19	CS	SAND		11-16242	ALL FLOW IN SANDS, GR Gy COARSE SAND (10YR 6/1)
								GW ~ 2.8 (PERCHED) ~ 5.0 (ACTUAL.) END HOLE.

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-2 0

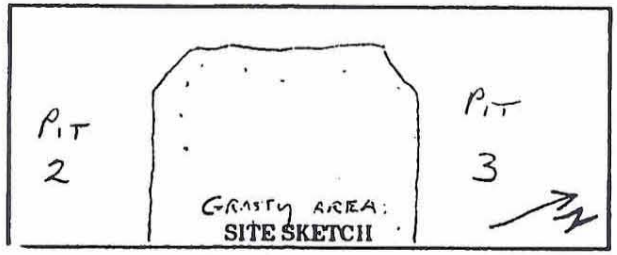
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-02

DATE ESTABLISHED 04 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION BETWEEN PIT 2+3 UPGRADIENT OF PIPE LINE.



SITE SKETCH

BOREHOLE DIAMETER (IN) 3½

TOTAL DEPTH (FT) 19

WATER ENCOUNTERED (FT) 4.8

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ----

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
09:25		0	2	SA	FILL	50	8.6.7.7	GY BR [10YR 4/1-3/1] SILTY CLAY WITH CONCRETE DEBRIS
09:27		2	4		CLAY	50	7.7.6.6	TAN GY [10YR 6/2] MOIST CLAY TO SILTY CLAY
09:30	SB02-01	4	6		CLAY SAND	75	3.2.2.2	4-4.8 GY BR [10YR 4/1] MOIST CLAY 4.8-8.6 GR GY CLAYEY SAND
09:40	SB-02-02	8	10		SAND	50	6.1.2.1	8-8.5 GY BR CLAY SAND 8.5-9 WET GY SILTY SAND TO COARSE SAND
09:46		14	16		SAND	60	7.9.12.12	GY [10YR 6/1] WET COARSE SAND.
09:50		17	19		SAND	?	9.12.28.28	GY TO GR GY COARSE SAND
								-END-

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-20

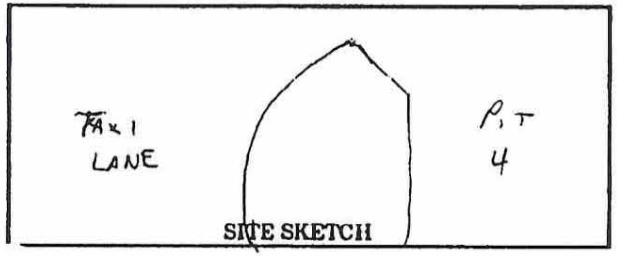
FACILITY ID OCEANA (NAS)

LOCATION ID 20 SB-03

DATE ESTABLISHED 04 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION BETWEEN TAXI LANE AND PIT 4 UPGRADIENT OF FUEL LINE



SITE SKETCH

BOREHOLE DIAMETER (IN) 3 1/2

TOTAL DEPTH (FT) 16

WATER ENCOUNTERED (FT) 4.8

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ----

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
11:25		0	2		SILT	80%	4.3.4.5	BR GY CLAYEY SILT TO SILTY SAND.
11:30		2	4		SILT	40	5.8.8.6	GY BR - LITE BR CLAYEY SILT
11:32	SB-03-01 SB-03-DUP	4	6		SILT SAND	80	5.4.6.2	4-4.7 GY CLAY SILT 4.8 MOIST CLAY - 5.1 5.1-5.8 WET SILTY SAND
11:35	SB-03-02	6	8		SAND	75	5.4.3.5	6-7.2 TAN [10YR 7/4] SAND WET 7.2-7.5 GRAY [10YR 6/1] COARSE SAND
11:45		8	10		SAND	80	4.2.6.7	GY WET COARSE SAND WITH BK PEBBLES (ANORTHITE?) [10YR 4/1]
11:48		14	16		SAND	80	11.13.13.15	SAME AS 8-10
								END.

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-20

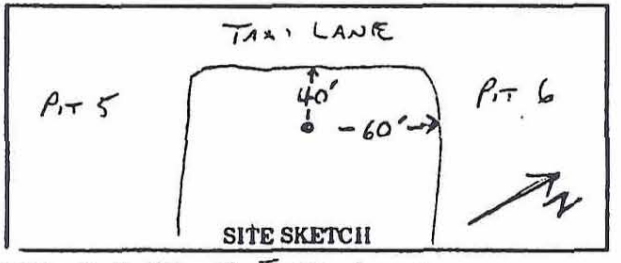
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-04

DATE ESTABLISHED 04 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY R E W

LOCATION DESCRIPTION BETWEEN PIT 5 AND PIT 6 UPGRADIENT OF FUEL LINE.



SITE SKETCH

BOREHOLE DIAMETER (IN) 3 1/2

TOTAL DEPTH (FT) 23

WATER ENCOUNTERED (FT) 4.8

TOP OF BEDROCK (FT) ———

DRILLING/EXCAVATING METHOD A

DRILLING/EXCAVATING COMPANY ————

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
13:45		0	2		CLAY	80	4-4-7-6	GY BR CLAY 10YR 3/1
13:50		2	4		CLAY	50	5-4-4-3	GY BR SILTY CLAY MOIST AT 2.5 DAMP.
13:52	SB-04-01	4	6		CLAY SAND	75	2-2-2-5	4-4.5 TAN GY CLAY 4.5-5.5 GR GY SILTY SAND [5Y 6/1] WET
13:55	SB-04-02	6	8		SAND	60	88-7-8	GR GY COARSE SAND [5Y 6/1]
14:00		8	10		SAND	80	4-6-7-9	GR GY [5Y 6/1] COARSE SAND
14:15		14	16		SAND	60	9-13-13-15	SAME AS 8-10
		16	18		SAND			AUGERING TO 23' HIT CHANGE IN AUGER
		18	20		SAND			RESISTANCE.
		20	22		SAND			
14:20		22	23	?	SAND/CLAY?			
							END	

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-20

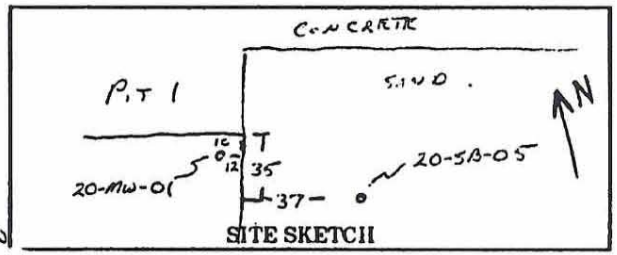
FACILITY ID OCEANA (NAS)

LOCATION ID 20SB-05

DATE ESTABLISHED 04 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION IN CONSTRUCTION SITE S. OF 20MW-01 DOWNGRADIENT



BOREHOLE DIAMETER (IN) 3 1/2

TOTAL DEPTH (FT) 16 (25)

WATER ENCOUNTERED (FT) 4.8

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ----

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
15:45		0	2		SAND	40	4-4-5-6	TAN SAND AND GRAVEL. GRAVEL <10%
15:48		2	4		CLAY	40	2-3-2-3	DARK GY CLAY
15:50	SB-05-01 SB-05-DUP	4	6 (4.8 ▽)		CLAY SAND	50	3-2-3-7	4-4.8 GY BR CLAY TO GR GY CLAY 4.8-5.0 GY WET SILTY SAND
15:55	SB-05-02	6	8		SAND	90	13-16-13-7	GR GY [5Y 7/1] COARSE SAND HEAVY ODOR SAT.? IN FUEL
16:05		8	10		SAND	100	3-2-2-1	8-9.1 BR-GY CLAY [10YR 3/1] 9.1-10 GR GY COARSE SAND ODOR.
16:10		14	16		SAND	80	10-11-16-12	GR GY [10YR 6/1] COARSE SAND SLIGHT FUEL ODOR
16:30		16	25	?	SAND?	—	—	BORED TO 25' WITH NO CHANGE IN AUGER SPEED.
								BELIEVED TO BE ALL SAND. FLOWING SAND
								PREVENTS SAMPLING.
								END. PLUGGED HOLE WITH BENTONITE HOLE
								PLUG. AUGERS FULL OF SAND PREVENTING GROUT.

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

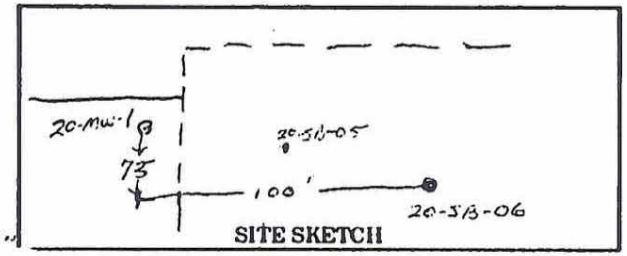
FACILITY ID OCEANA (NAS)

LOCATION ID 20AG06

DATE ESTABLISHED 05 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION IN CONSTRUCTION AREA SOUTH OF CTO20MW-01



SITE SKETCH

BOREHOLE DIAMETER (IN) 3 1/4

TOTAL DEPTH (FT) 6

WATER ENCOUNTERED (FT) 5.8

TOP OF BEDROCK (FT) ———

DRILLING/EXCAVATING METHOD AU

DRILLING/EXCAVATING COMPANY ————

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
0910		0	2		SAND	90	6-5-9-7	TAN COARSE SAND WITH GRAVEL MOIST.
0915		2	4		CLAY	75	3-3-3-4	2-2.3 WET COARSE SAND 10YR 7/1 2.3-3.3 GRADES TO CLAY WITH ROOTS.
0918	20SB-06-01	4	6		CLAY	75	2-3-4-7	4-4.6 CLAY 10YR 5/1 CLAY 4.6-5.5 SILTY CLAY GRADING TO SILTY SAND
								5.3-5.5 WAT. HNU SIGNIFICANT HNU READINGS
								SO PULLED OUT AND OFFSET
								MAX HNU = 70 UNITS.

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-20

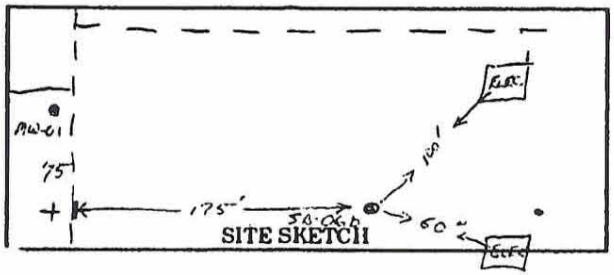
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-066

DATE ESTABLISHED 05 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY R E W

LOCATION DESCRIPTION IN CONSTRUCTION AREA SOUTH OF CT020 MW-01



BOREHOLE DIAMETER (IN) 3 1/4

TOTAL DEPTH (FT) 16

WATER ENCOUNTERED (FT) 5.1

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ----

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
09:31		0	2		SAND	75	3-3-6-7	0-1.5 COARSE SAND WITH GRAVEL AT SURFACE TAN 10YR 7/1
09:34		2	4		CLAY	50	7-3-4-5	2-2.2 COARSE SAND WET 2.2-3.1 GRAY BROWN CLAY
09:36	20SB-066-01	4	6 (5.1 ▽)		SAND	75	3-3-4-6	4-5.1 BROWN GRAY CLAY 5.1-5.6 SILTY SAND COARSE TO COARSE SAND. MOIST AT 5.4-5.6
		—	—		—	—	—	
09:45	20-SB066-02	6	8		SAND	80	8-10-8-6	6-6.3 Gy BR CLAY 6.3-7.7 Gy TO GR Gy COARSE SAND WET
09:51	20-SB-066-03	8	10		SAND	75	5-7-2-2	GR Gy WET COARSE SAND 5YR 5/1
09:56		14	16		SAND	90	11-12-12-10	GRAY 2.5Y 5/1 COARSE SAND
								END.

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-20

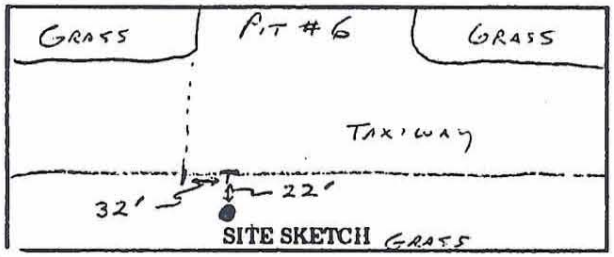
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-07

DATE ESTABLISHED 05 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY R E W

LOCATION DESCRIPTION North of Taxi-way across from Fuel Pit #6.



SITE SKETCH GRASS

BOREHOLE DIAMETER (IN) 3 1/4

TOTAL DEPTH (FT) 16

WATER ENCOUNTERED (FT) 4.6

TOP OF BEDROCK (FT) _____

DRILLING/EXCAVATING METHOD _ _

DRILLING/EXCAVATING COMPANY _ _ _ _

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
11:33		0	2		SAND	90	4.5.7.5	0-.5 TOPSOIL .5-2 TAN SAND
11:35	20SB-07-01	2	4		CLAY	100	3.3.2.3	2-2.2 TAN COARSE SAND 2.2-4 GY BR 10YR 4/1 CLAY WITH ROOTS
11:40	20SB-07-02	4	6 (4.6)		SAND	75	2.3.4.6	4-4.6 GRAY BR. CLAY CHANGING TO SILTY SAND 4.6-5.5 GREY SILTY SAND (WET)
11:45		6	8		SAND	100	7.7.10.12	TAN GRAY 10YR 7/2 COARSE SAND WET
11:54		8	10		SAND	100	6.8.8.8	8-8.8 BR CLAY 10YR 4/1 8.8-9.3 TAN COARSE SAND 9.3-10 GY COARSE SAND
12:01		14	16		SAND	100	10.12.13.15	14-14.5 TAN COARSE SAND 14.5-16 GY 10YR 6/1 COARSE SAND.
								END

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

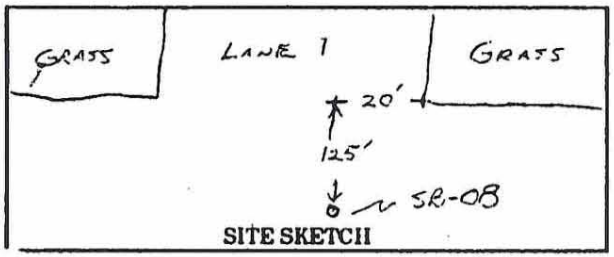
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-08

DATE ESTABLISHED 06 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION SE OF LANE 1 125'



SITE SKETCH

BOREHOLE DIAMETER (IN) 3 1/2

TOTAL DEPTH (FT) 16

WATER ENCOUNTERED (FT) 4.5

TOP OF BEDROCK (FT) ——

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ----

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
0905		0	2		CONCRETE SAND	100	2-6	0-.9 CONCRETE .9-2 TAN COARSE SAND.
09:08		2	4		SAND	50	7-4-3-3	2-2.5 TAN SILTY SAND 2.5-3.2 MOIST COARSE SAND
09:10	20-SB-08-01	4	6		SAND	100 ~~80~~	3-2-2-3	4-4.4 TAN COARSE SAND 4.4-5.2 GY BR SILTY SAND 5.2-6 GY BK CLAYEY SAND WATER AT ~4.5'
09:18	20-SB-08-02	6	8		SAND	90	7-9-11-7	6-6.7 BR SILTY SAND 6.7-7.8 GR GY COARSE SAND STRONG JP5 ODOR
09:25		8	10		SAND	80	3-2-1-1	8-9.1 BR [10YR 4/1] SILTY SAND 9.1-9.7 YL TO GR GY COARSE SAND ~ODOR
09:28		14	16		SAND	100		GY [10YR 6/1] COARSE SAND WITH ~2% BL QUARTZ GRAVEL (0.1")
								END FLOWING SAND.

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

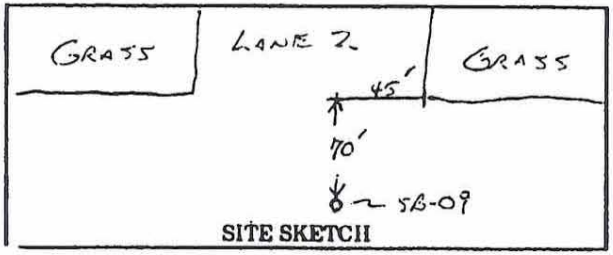
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-09

DATE ESTABLISHED 06 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY R E W

LOCATION DESCRIPTION SE OF LANE 2



SITE SKETCH

BOREHOLE DIAMETER (IN) 3 1/4

TOTAL DEPTH (FT) 4

WATER ENCOUNTERED (FT) —

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ____

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
13:40		0	2		CONCRETE SAND	75	7-14	0-0.9 CONCRETE 0.9-1.5' BR GY SILTY ~~GRAY~~ SAND
13:45		2	4		SAND	50	19-11-11-5	BR GR WET SILTY SAND.
								FILLED UP HIT UNIDENTIFIED STRUCTURE AT
								APPROXIMATELY 2.0 BGS. WILL OFFSET

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-20

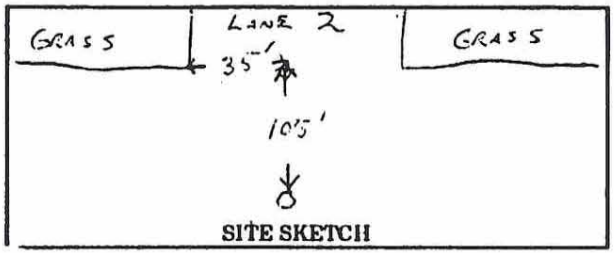
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-096

DATE ESTABLISHED 09 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION SE. OF LANE 2



SITE SKETCH

BOREHOLE DIAMETER (IN) 6 1/2

TOTAL DEPTH (FT) 10

WATER ENCOUNTERED (FT) 6.6

TOP OF BEDROCK (FT) ———

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ————

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
08:52		0	2		SAND	75	9.12	0-0.7 CONCRETE 0.7-1.4 TAN COARSE SAND
08:55		2	4		SAND	75	15.12.9.5	2-3.5 DAMP TAN COARSE SAND
08:58	20-SB-096-01	4	6		SAND CLAY	100	3.3.2.4	4-4.8 MOIST TAN COARSE SAND 4.8-6.0 Gy BK [10YR 4/1] CLAY
09:04	20-SB-096-02	6	8		CLAY/ SAND	75	6.8.9.6	6-6.4 Gy BK [10YR 5/1] CLAY 6.4-7.5 Gy COARSE SAND WET.
09:10		8	10		SAND	100	3.4.3.3	8-8.2. Gy SAND 8.2-8.6 CLAYEY SAND (GRAY) 8.6-10 Gy [10YR 5/1] COARSE SAND
								END

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: ET 0-20

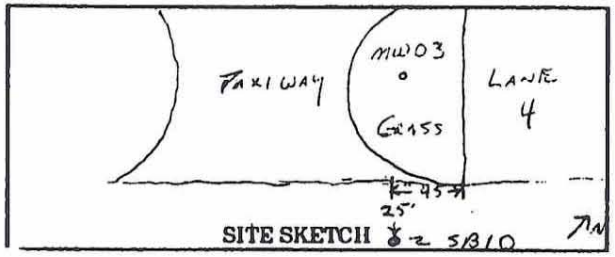
FACILITY ID OCEANA (NAS)

LOCATION ID 20-SB-10

DATE ESTABLISHED 06 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY R E W

LOCATION DESCRIPTION _____



BOREHOLE DIAMETER (IN) 3 1/4

TOTAL DEPTH (FT) 16

WATER ENCOUNTERED (FT) 4.8

TOP OF BEDROCK (FT) _____

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY _ _ _ _

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
14:10		0	2	TOPSOIL	CONCRETE SAND	100	7.13	0-0.9 CONCRETE 0.9-2 SAND
14:12		2	4		SAND	75	17.16.17.12	COARSE GY BR SAND WET.
14:15	20-SB-10-01	4	6	4.8 ▽	SAND	90	2.2.2.3	4-4.6 COARSE WET SAND. 4.6-5.8 GY-GY BR CLAY [10YR 5/1]
14:26	20-SB-10-02	6	8		SAND	100	4.6.10.10	6.0-6.8 GY BR CLAY 6.8-8.0 SILTY SAND GRADING TO GR GY COARSE SAND
								WET
14:32		8	10		SAND	75	3.3.1.1	GR GY COARSE SAND TO GY COARSE SAND
14:38		14	16		SAND	75	1.2.7.8	GY [10YR 5/1] COARSE SAND
								END : FLOWING SAND

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

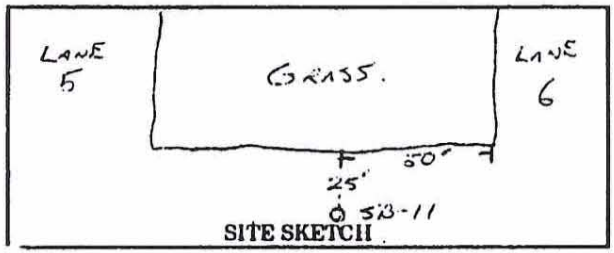
FACILITY ID OCEANA (NAS)

LOCATION ID CTO20-SB-11

DATE ESTABLISHED 10 MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION BETWEEN LANES 5 AND 6



SITE SKETCH

BOREHOLE DIAMETER (IN) 6 1/2

TOTAL DEPTH (FT) 10

WATER ENCOUNTERED (FT) 5.7

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD AG

DRILLING/EXCAVATING COMPANY ----

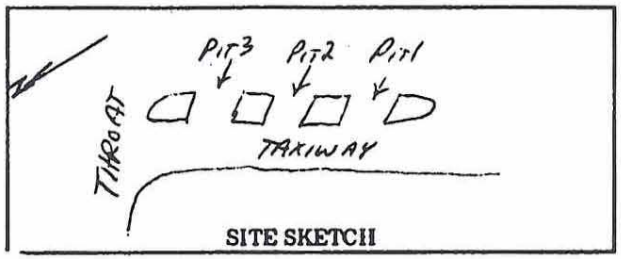
TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
0920		0	2		SAND	100	7.13	0-0.9 CONCRETE 0.9-2.0 TAN COARSE SAND.
0922		2	4		SAND	75	9.14.9.11	2-3.2 GyBr COARSE SAND 3.2-3.6 Gy Blk CLAY [10yR 3/1]
09:28	20SB11-01	4	6 (5.7 ▽)		CLAY	100	4.1.2.3	4-5.1 GR Gy CLAY (MOIST) 5.1-5.7 MOIST Gy Br. CLAY TO SILTY CLAY [10yR 4/1]
09:35		6	8		CLAY	100	3.3.7.12	6-6.8 Gy CLAY - SILTY CLAY MOIST 6.8-7.2 SILT TO SILTY SAND GR Gy 7.2-8.0
—		—	—			—	—	COARSE GR. Gy SAND WET.
09:45		8	10		SAND	75	7.10.108	8-8.7 GR Gy [10yR 6/1] COARSE SAND 8.7-9.5 TAN [10yR 8/6] COARSE SAND.
								END.

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050
PROJECT ID - PHASE: CTO-20
FACILITY ID OCEANA (NAS)
LOCATION ID 20SB12
DATE ESTABLISHED April ~~MAR~~ 1992 (DD-MMM-YY)
ESTABLISHING COMPANY REW
LOCATION DESCRIPTION _____



SITE SKETCH

BOREHOLE DIAMETER (IN) 5 1/4"
TOTAL DEPTH (FT) ~~16~~ 16'
WATER ENCOUNTERED (FT) 5.9' bgs
TOP OF BEDROCK (FT) —
DRILLING/EXCAVATING METHOD Auger
DRILLING/EXCAVATING COMPANY McCallum

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	~~SOIL~~ ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
1025	—	0	2	~~NO~~ Loam	Sand	—	—	Med. Sand, Yellow, under 6" Topsoil Loam
1026		2	4	NO	clay	90%	2,4,3,3	clay, grey light cohesive moist
1030	20SB12-01	4	6	NO	clay	80%	2,3,3,7	4-5' clay y green/grey 5GY 6/1 w/ Grey clay
								5-6' Sandy clay to clayey sand at 5.9' Wet at 5.9'
1035	—	6	8	NO	Sand	80%	9,9,4,3	Fine to Med sand Lt. grey, Wet, grades to mottled
								grey w red silty & slightly clayey sand @ 8'
1044	20SB12-02	8	10	NO	Sand	—	7,6,10,17	8-8.5 Silty clay very plastic, cohesive, Not Light
								8.5-10' F. to coarse Qtz sand w/ minor heavy (dark)
								minerals overall lt. grey 10YR 6/1
1052	—	14	16	NO	Sand	—	12,15,24,33	Coarse Sand with pebbles as above grey with occ. pockets
								of light grey clay. Sand fines downward to fine sand
								w some mineral constituents. Qtz with sparse heavy
								minerals

WESTON

BOREHOLE LOG

6629-01-09

PROJECT ID - PHASE: C70-2D

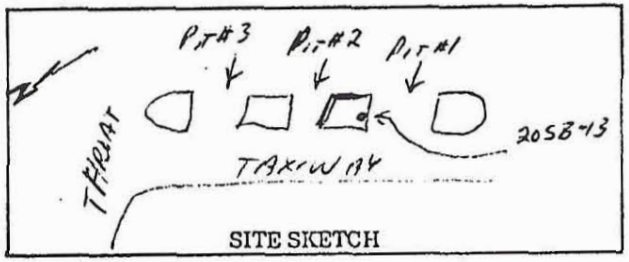
FACILITY ID OCEANA NAS

LOCATION ID C ZO 2053-13

DATE ESTABLISHED 01-04-92 (DD-MMM-YY)

ESTABLISHING COMPANY WESTON

LOCATION DESCRIPTION 205B-13



SITE SKETCH

BOREHOLE DIAMETER (IN) 5 3/4"

TOTAL DEPTH (FT) 12'

WATER ENCOUNTERED (FT) 7'

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD Auger-Acker

DRILLING/EXCAVATING COMPANY McCallom

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	~~SOIL ROCK TYPE~~ HNU	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
1125	—	0	2	—	CLAY	—	—	Loam Black Sl. clayey from cuttings
1135	—	2	4	52	CLAY	—	3,4,4,4	clay loam to 2.5', Black; 2.5-4' clay dark grey tight Increased pet. odor w/ depth.
1142	205B13-01	4	5	80	CLAY	—	2,3,4,5	Dark grey/sl black clay strong pet. odor. Mottled
		5	6	105	CLAY			Green & Reddish yellow below 5' 5GY 5/1 Gley
1155	205B13-02	6	8	155	CLAY/SAND	—	5,7,7,4	clay, mottled green/brown to 7'; 7-8' silty fine sand
								wet runny strong pet. odor Grey brown 5Y 5/6 and
								Grey 5Y 5/1 sand.
1205		8	10					Not collected
1205	2	10	12	30	CLAY/SAND	—	6,7,10,14	10-10.5 OK. Grey clay, Mod. Pet. odor Plastic
								cohesive Wet tight (wont roll); 10.5-12.0' Sand
								med. to coarse grey with pebbles, wet sl. pet odor
								(5 on HNU) 10YR 6/1

Revised 01-MAY-91

BOREHOLE LOG

PROJECT ID - PHASE: C70 - 20

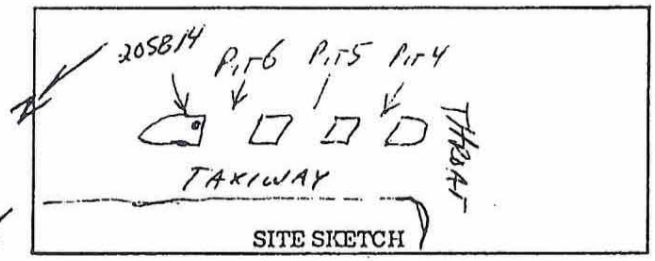
FACILITY ID OCEANA (NAS)

LOCATION ID 20SB-14

DATE ESTABLISHED 01-04-92 (DD-MMM-YY)

ESTABLISHING COMPANY WESTON

LOCATION DESCRIPTION North of Pit #6



SITE SKETCH

BOREHOLE DIAMETER (IN) 5 3/4"

TOTAL DEPTH (FT) 12'

WATER ENCOUNTERED (FT) 5'

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD Auger/Acker

DRILLING/EXCAVATING COMPANY McCallum.

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	~~SOIL ROCK TYPE~~ HAU	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
1415	—	0	2	ND	LOAM		—	Loam Black w/ Red mottling from Auger cuttings
1425	20SB14-01	2	4	ND	CLAY	NR	3,4,4,4	clay loam 2-2.2' Black 2.2-3.6' Sandy clay grades
								to sand red/yellow w/ clay pockets 7.5YR 5/6
								3.6-4.0' Blk clay, cohesive, sl. plastic sl. org/sewage odor.
1429	—	4	6	ND	CLAY	NR	3,2,2,3	4-5' clay dk. grey tight moist, below 5' silty & plasticity
								& cohesiveness wet 5.8-6' tight mottled Gray & yellow
								clay
1445	20SB14-02	6	8	ND	CLAY	NR	2,3,5,6	CLAY w silt 6-6.5'; 6.5-6.8 Tight clay mottled
								Greenish Grey; No pet odor 5G 6/1
1452		8	10					Not Collected
1452	2 —	10	12	ND	SAND	NR	NR	10-10.2' clay 5Y 4/1 grey; 10.2-10.3' silty sandy clay
								10.3-11.0 F. to med. Qtz sand w/ mica & minor dark minerals
								Lt. grey wet; ~~Lots~~ little 11-12' same but dk. grey 5Y 5/1.

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09

PROJECT ID - PHASE: CTO-20

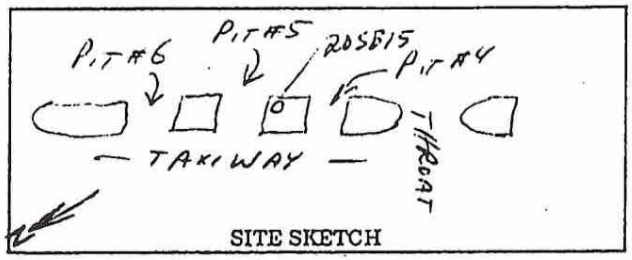
FACILITY ID OCEANA (NAS)

LOCATION ID SI-20SB-15

DATE ESTABLISHED 01-04-92 (DD-MMM-YY)

ESTABLISHING COMPANY WESTON

LOCATION DESCRIPTION 20SB-15



SITE SKETCH

BOREHOLE DIAMETER (IN) 5 3/4"

TOTAL DEPTH (FT) 12'

WATER ENCOUNTERED (FT) 8.25'

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD Auger

DRILLING/EXCAVATING COMPANY McCallum

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	~~SOIL ROCK TYPE~~ HNU	GEOL MAT TYPE	RECOV ~~(FT)~~ %	BLOW COUNT	DESCRIPTION
1525	—	0	2	—				Not sampled
1530	—	2	4	0	CLAY/SAND	90	2,1,2	clay loam dark gray 2-2.5'
								2.5-3.7' fine to med. silty sand Brown w/small clay
								pockets 3.7-4.0' Blck. clay ~~tight moist~~ w some fine sand
1535	20SB15-01	4	6	200	CLAY	80	1,1,3,2	BLACK clay tight moist, mod. petodor decrease with depth
								Pocket of med. sand at 4.5' (1").
1550	20SB15-02	6	8	400	silty clay	80	1,4,3,3	silty clay 5.8-7.2' DK. Brn. + yellow grades to clay
								greenish gley 5G-5/1 Mod. Pet. odor; 7.2-8.0 clay ~~brn~~ gray
1602	—	8	10	—	—			Not sampled
1602	—	10	12	250	clay/sand	80	1,4,6,7,9	10-10.5 - clay plastic sticky, wet, mottled greenish
								gray; 10.5-10.8 fine sand; 10.8-12.0 fine sand
								Yellow/olive 5Y 5/4

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: ET 0-20

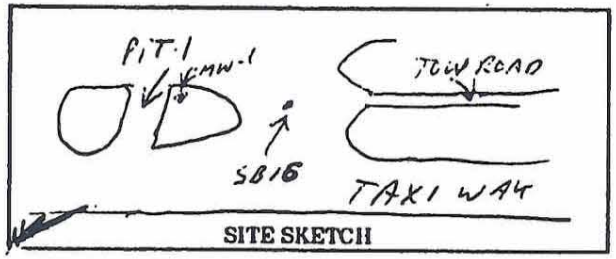
FACILITY ID OCEANA (NAS)

LOCATION ID ~~ET 0-20~~ 20SB16

DATE ESTABLISHED 2 April ~~MAR~~ 1992 (DD-MMM-YY)

ESTABLISHING COMPANY B E W

LOCATION DESCRIPTION ~~20SB16~~



SITE SKETCH

BOREHOLE DIAMETER (IN) 5"

TOTAL DEPTH (FT) 12'

WATER ENCOUNTERED (FT) ~5.5'

TOP OF BEDROCK (FT) ———

DRILLING/EXCAVATING METHOD Auger

DRILLING/EXCAVATING COMPANY McCallum

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
1020		0	2		~~SAND~~ Fill		~~2,3,4,11~~	0-1' Concrete core
								1-2' Sand & Gravel Fill with minor clay slight petroleum odor 45 ppm PID
1028	20SB16-01	2-4	4'	clayey sand	Sand	85%	7,9,13,11	clayey sand Brown 10YR 4/4 clays slight petroleum odor
								12 ppm - HNU 10YR 5/6 Yellow Brown
1032		4-6	6'	sand	Sand	100%	6,3,3	Fine Sand w/some clay HNU=NO(0ppm) to 5'
					clay			5-5.5 sandy clay greyish brown 5.5-6 fine Brown sand packets 2.5Y 4/4 w/ fine clay
1035	20SB16-02	6-8'	8'	clay	Sand	100%	5,10,15,20	6-6.8 fine brown sand with little clay
					clay			6.8-7.5 clay Greenish Grey light moist cohesive 5GY 7/1
					Sand		~~3,2,4~~	7.5-8.0 fine sand with clay clay decreases with depth 5GY 6/1 Greenish Grey
1040		10	12	clayey sand	Sand	100%	3,2,3,1	Fine silty sand with very little clay 10-11 Greenish Grey
								5Y 3/1 11-12 Dark Grey sticky silty clayey sand dark
								Grey No petroleum odor

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

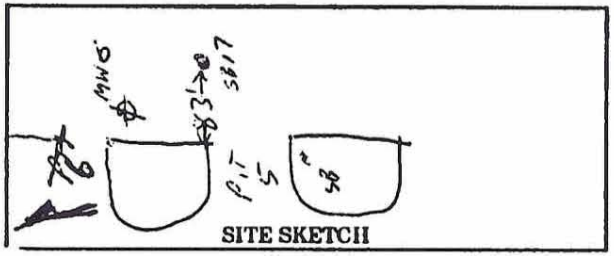
FACILITY ID OCEANA (NAS)

LOCATION ID Fuel pits eastside

DATE ESTABLISHED 2 April ~~MAR~~ 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION 20SB17



BOREHOLE DIAMETER (IN) 5 1/4

TOTAL DEPTH (FT) 12'

WATER ENCOUNTERED (FT) _____

TOP OF BEDROCK (FT) _____

DRILLING/EXCAVATING METHOD _ _

DRILLING/EXCAVATING COMPANY _ _ _ _

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
		0	1			—	—	Concrete Cone 11" actually
		1	2			—	—	Sand & Gravel fill Yellowish yellow
1127	SB17-01	2	4	clay sand		100%	1,4,7,10,4	2-3 Sandy with clay pockets fill material Grey with roots & dark grey No petroleum odor 3-4' coarse QTZ sand with pebbles & clay obs
1130		4	6	clay		90%	4,4,4,4	4-4.7 fine silty sand Yellow brown
								4.7-6.0 clay tight hard Grey damp with roots & organics
1134	20SB1702	6	8	clay sand		100%	4,5,9,9	5 6.0-6.8 clay tight hard Grey damp
								6.8-7.4 clay tight greenish Grey mottled 5G-4/1 7.4-8.0 silty clayey sand greenish grey
1137		10	12					8.0-10.5 clay dark grey with roots wet tight noncohesive (contains little sand (loamy texture))
								10.5-11.2 Red yellow 10YR 5/8 Sand very fine wet
								11.2-12.0 fine to Medium sand DK Grey 5Y 4/1
								All Sample screen with PID ND (0 ppm)

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CT 0-20

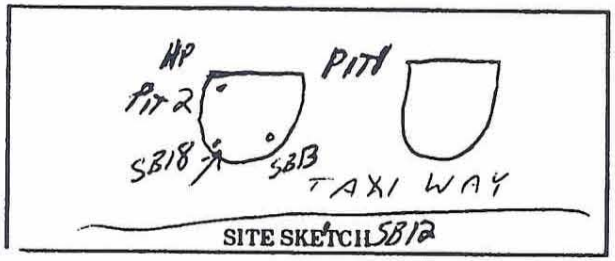
FACILITY ID OCEANA (NAS)

LOCATION ID 20SB18/CT020

DATE ESTABLISHED MAR 1992 (DD-MMM-YY)

ESTABLISHING COMPANY REW

LOCATION DESCRIPTION Pit 2 Southend



SITE SKETCH SB12

BOREHOLE DIAMETER (IN) 5"

TOTAL DEPTH (FT) 12'

WATER ENCOUNTERED (FT) 5.81

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD — —

DRILLING/EXCAVATING COMPANY McCallum

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
1342		0	2	Loam		—	—	Augers cuttings: Loam black with grass roots in upper
1344	~~20SB18-01~~ 20SB18-01	2	4	clay		60%	3,3,3,4	clay light brn to 3.5' below 3.5' more silty clay with slight petroleum odor ~5 ppm HNU
1346	20SB18-03	4	6	clay		80%	4,4,3,3	light greenish gray 5GY 7/1 clay 4-5.8' moist when dry stiff 5.8-6.0 clayey sand med-petedor ~15 ppm
1348	20SB18-02	6	8	sand		70%	6,8,7,4	6-8' silty fine sand 5GY 6/1 Greenish Grey wet slight pet. odor (50 ppm)
1355	—	10	12	sand		80%	3,5,7,4	10-12 Sand with silt+clay coarse sand upward to all fine to med. sand @ 12' Spp.
								Water at ~ 5.8' bgs
								Fill hole to 6.5 with Volclay 1/4" Cap Tablets

Revised 01-MAY-91

WESTON

BOREHOLE LOG

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

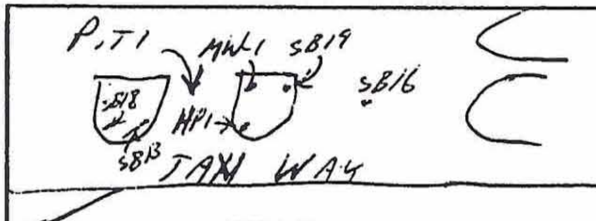
FACILITY ID OCEANA (NAS)

LOCATION ID 20SB19

DATE ESTABLISHED 2 April ~~MAR~~ 1992 (DD-MMM-YY)

ESTABLISHING COMPANY BEW

LOCATION DESCRIPTION Pit / Southend



SITE SKETCH

BOREHOLE DIAMETER (IN) 5 1/2"

TOTAL DEPTH (FT) 12'

WATER ENCOUNTERED (FT) 3'+

TOP OF BEDROCK (FT) —

DRILLING/EXCAVATING METHOD 3 1/4" I.D. Auger

DRILLING/EXCAVATING COMPANY McCallum

TIME (HHMM)	SAMPLE ID	BEGIN DEPTH (FT)	END DEPTH (FT)	SOIL ROCK TYPE	GEOL MAT TYPE	RECOV (FT)	BLOW COUNT	DESCRIPTION
1530		0	2					Top 6" Grey Loam with pebbles rocks & fill. 0.5-2.0 clay loam 7.5YR 4/3 with Grass roots
1535	20SB1901	2	4	Sand		90	2,3,3,3	Brown/Red pebbly med wet sand 2-3.5 Red at 3.2-3.5'
								Fine silty sand brown 7.5YR 6/8, 3.5-3.8' clay w Roots B Type soil horizon
1538	—	4	6	clay		100	2,3,4,3	clay tight cohesive stiff Dark Grey & Black
								4-6' ↑
1544	20SB1902	6	8	Clay / Sand		80	4,7,13,12	6-6.5 same as above 6.5-7.2 fine sandy clay greenish grey
								7.2-8.0 fine sand Greenish Grey 5G 5/1
1550	—	10	12	silty sand		60	2,2,1,2	8.0-9.0 Green Grey/ sand with 2" lense Olive 5Y 5/6
								green sand; 9-10 Grey silty Fine Qtz sand 5Y 4/1
								HNU ND in all samples

APPENDIX C

WELL CONSTRUCTION DIAGRAMS

14:20

WESTON℠

WELL COMPLETION INFORMATION

(SINGLE CASED, SCREENED)

6629-01-09 -0050

PROJECT ID - PHASE: CTO-20

FACILITY ID OCEANA (NAS)

WELL LOCATION ID 20-MW-01

SCREENED LENGTH (FT) 10' 2.5-12.5

INNER CASING LENGTH (FT) 2' 0-2.5'

INNER CASING MATERIAL 80 (PVC)

SCREEN SLOT SIZE (IN) 0.01

REMARKS LAST AUGER YIELDED FREE PRODUCT

WELL COMPLETION METHOD SS

INSTALLATION DATE * 03 MAR 1992

INSTALLING COMPANY MCCALLUM (___)

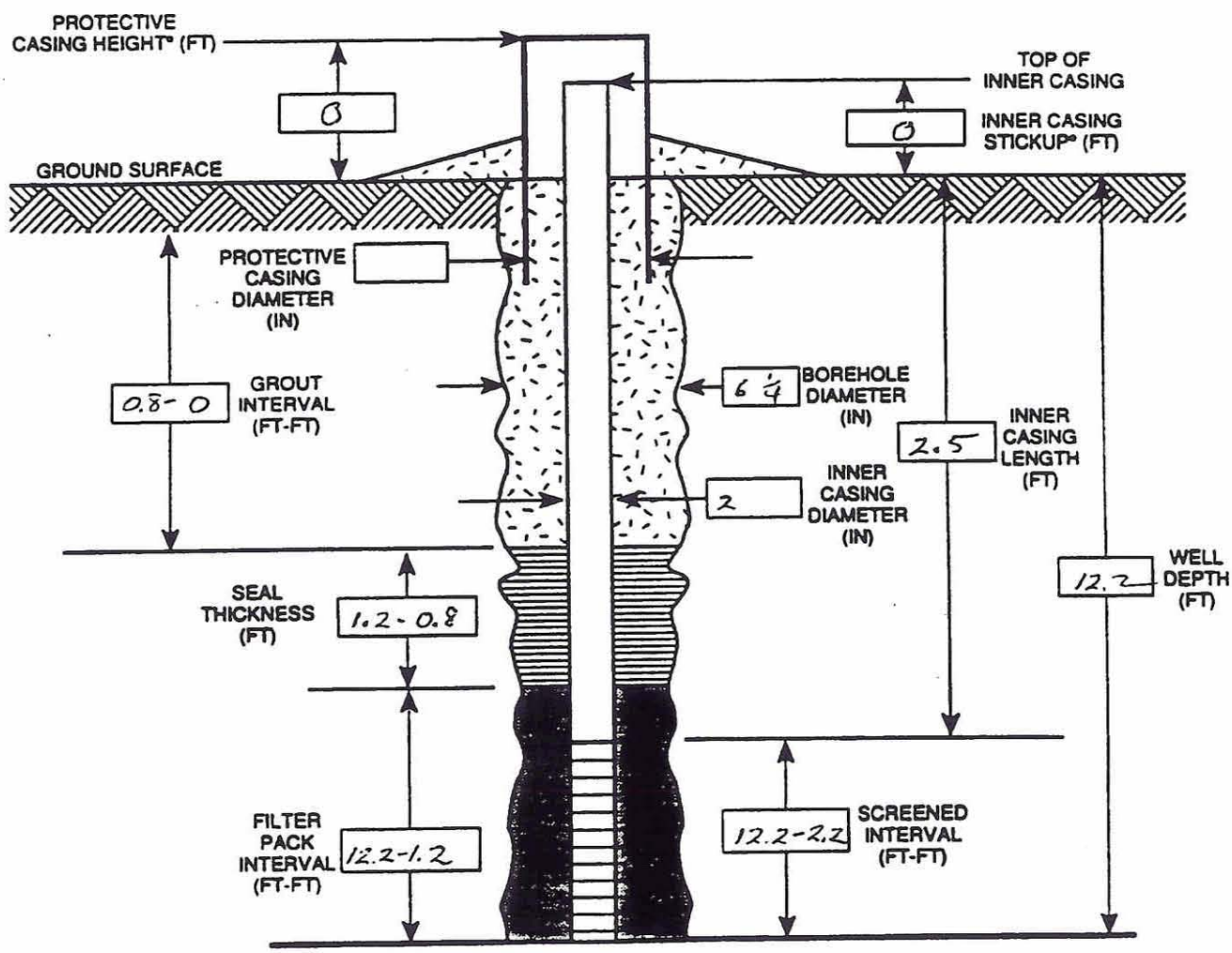
PURGE PUMP TYPE _____ (___)

SAMPLE PUMP TYPE _____ (___)

PURGE PUMP DEPTH (FT) _____

SAMPLE PUMP DEPTH (FT) _____

WELL YIELD BEGINNING (GPM) _____



G34-240a

Revised 12-19-89

*DATE: DD-MMM-YY

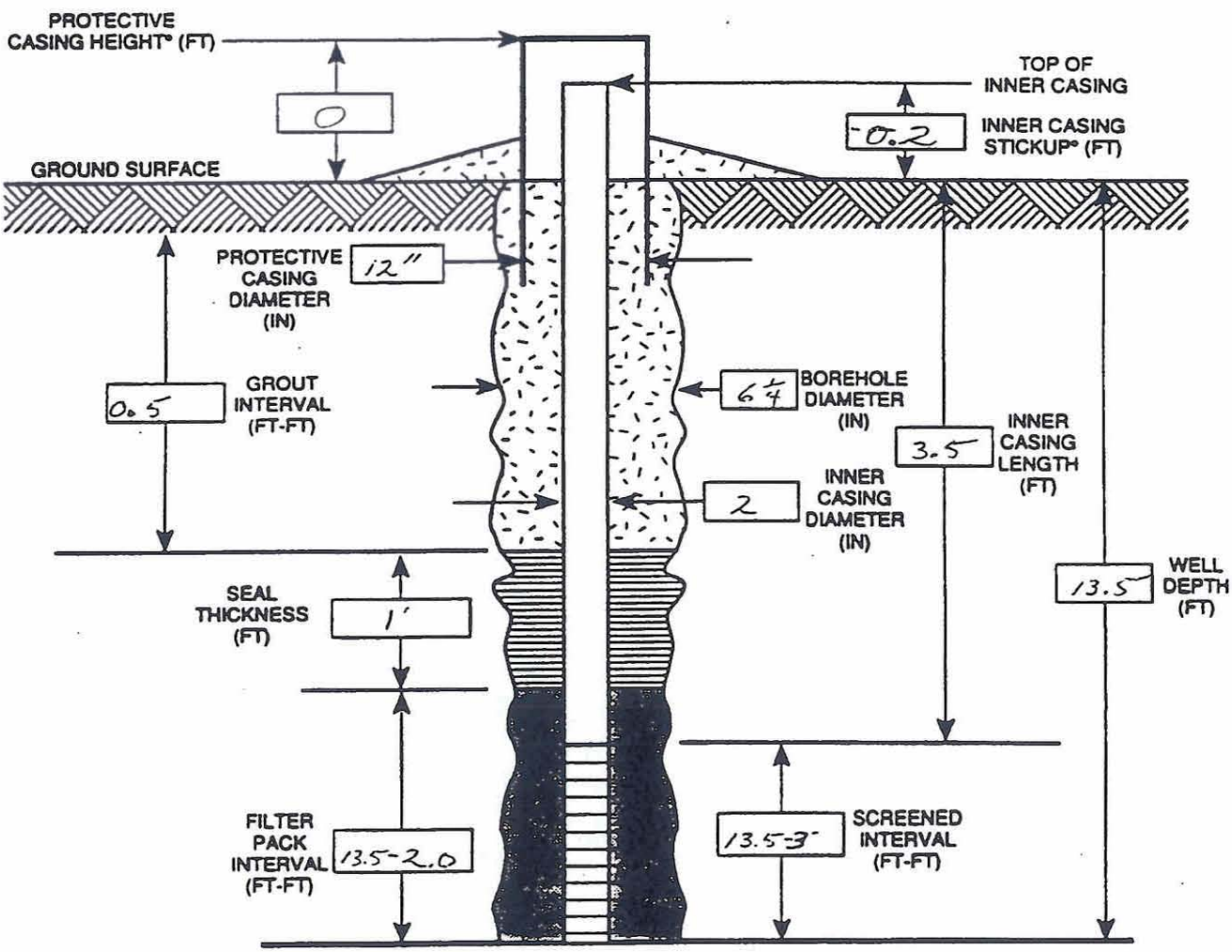
*ESTIMATED

WELL COMPLETION INFORMATION
(SINGLE CASED, SCREENED)

6629-01-09-0050

PROJECT ID - PHASE: CTO-20
FACILITY ID OCEANA (NAS)
WELL LOCATION ID 20MW-02
SCREENED LENGTH (FT) 13.5-~~12.0~~ 13.0
INNER CASING LENGTH (FT) 3.5
INNER CASING MATERIAL ~~8"~~ 2" (PVC)
SCREEN SLOT SIZE (IN) 0.01
REMARKS LOCATED AT 20-SB-08
SB-08 HAD STRONG JP-5 ODOR HNU MAX. 140

WELL COMPLETION METHOD S S
INSTALLATION DATE * 06 MAR 1992
INSTALLING COMPANY _____ (___)
PURGE PUMP TYPE _____ (___)
SAMPLE PUMP TYPE _____ (___)
PURGE PUMP DEPTH (FT) _____
SAMPLE PUMP DEPTH (FT) _____
WELL YIELD BEGINNING (GPM) _____



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*DATE: DD-MMM-YY
*ESTIMATED

Revised 12-19-89

WELL COMPLETION INFORMATION

(SINGLE CASED, SCREENED)

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

FACILITY ID OCEANA (NAS)

WELL LOCATION ID 20-MW-03

SCREENED LENGTH (FT) 10

INNER CASING LENGTH (FT) 3.5

INNER CASING MATERIAL SCH 80 (PVC) 2"

SCREEN SLOT SIZE (IN) 0.01

REMARKS LOCATED ON CTO20-SB-02

WELL COMPLETION METHOD SS

INSTALLATION DATE * 10 MAR 1992

INSTALLING COMPANY McCALLAN (___)

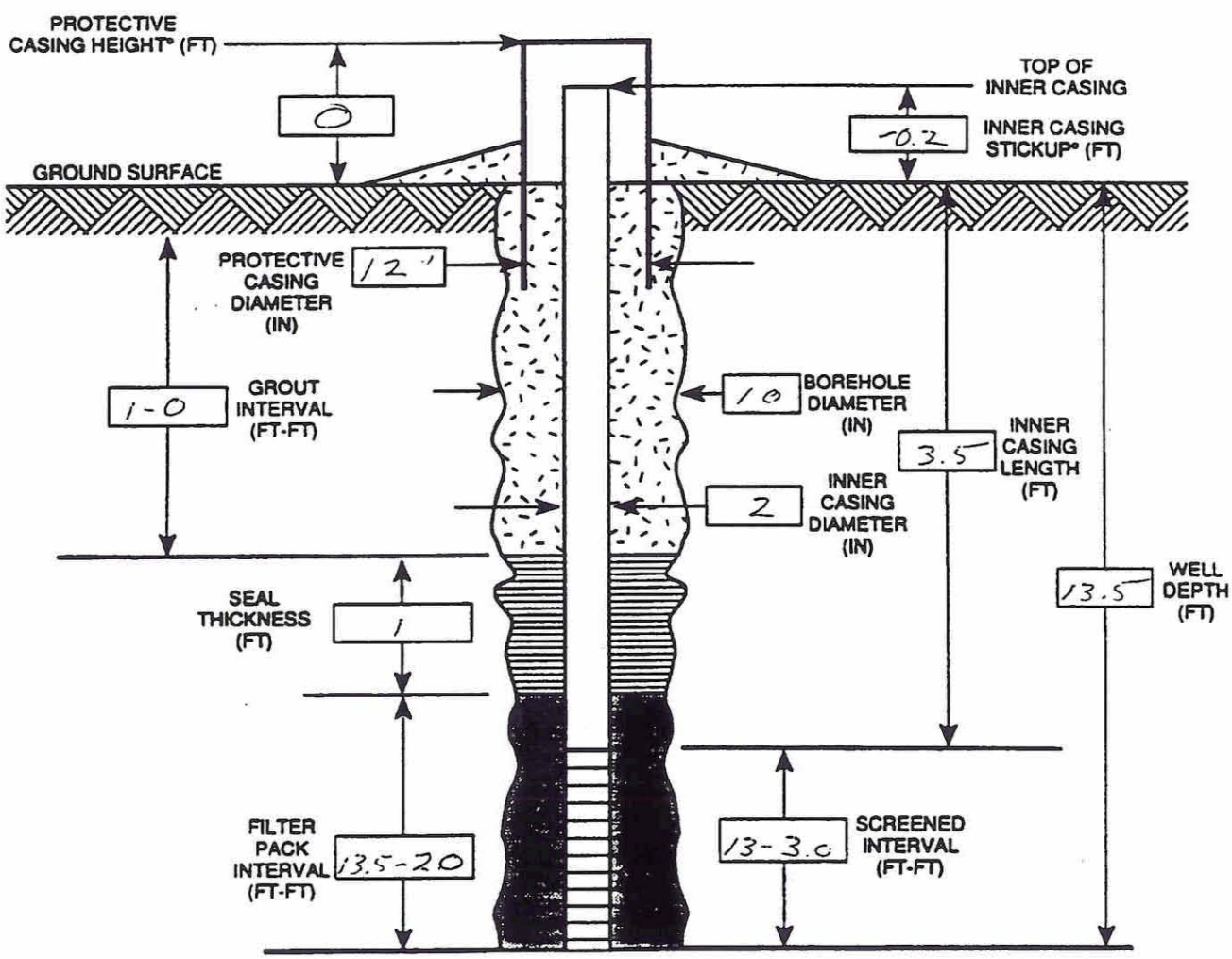
PURGE PUMP TYPE _____ (___)

SAMPLE PUMP TYPE _____ (___)

PURGE PUMP DEPTH (FT) _____

SAMPLE PUMP DEPTH (FT) _____

WELL YIELD BEGINNING (GPM) _____



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*DATE: DD-MMM-YY

*ESTIMATED

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WELL COMPLETION INFORMATION

(SINGLE CASED, SCREENED)

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

FACILITY ID OCEANA (NAS)

WELL LOCATION ID 20-MW-04

SCREENED LENGTH (FT) 10

INNER CASING LENGTH (FT) 4

INNER CASING MATERIAL SCH 80 (PVC) 2"

SCREEN SLOT SIZE (IN) 0.01

REMARKS LOCATED ON CTO20-SB-096

WELL COMPLETION METHOD S S

INSTALLATION DATE * 09 MAR 1992

INSTALLING COMPANY McCLEAN (___)

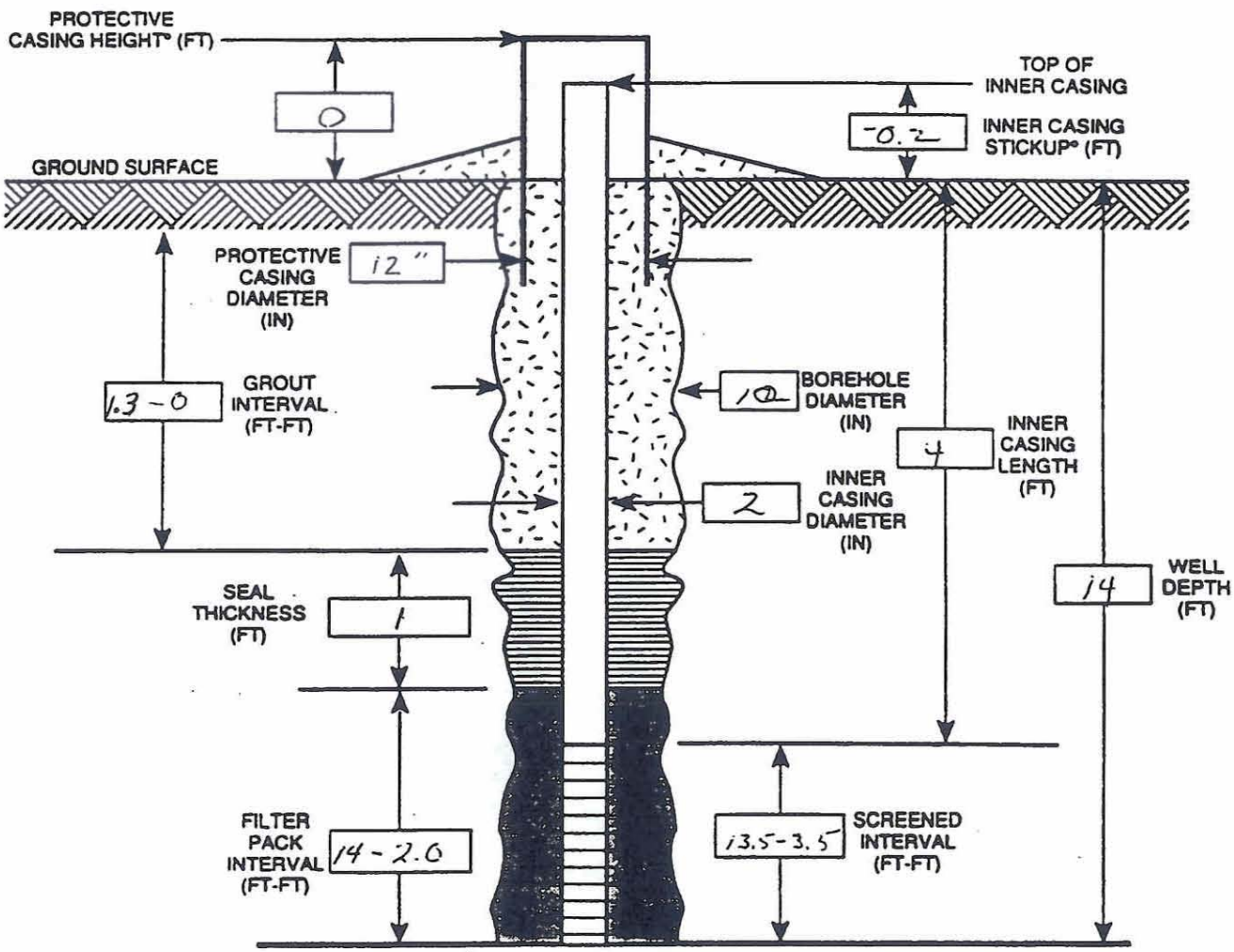
PURGE PUMP TYPE _____ (___)

SAMPLE PUMP TYPE _____ (___)

PURGE PUMP DEPTH (FT) _____

SAMPLE PUMP DEPTH (FT) _____

WELL YIELD BEGINNING (GPM) _____



G34-240a

*DATE: DD-MMM-YY

*ESTIMATED

Revised 12-19-89

WELL COMPLETION INFORMATION

(SINGLE CASED, SCREENED)

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

FACILITY ID OCEANA (NAS)

WELL LOCATION ID 20MW05

SCREENED LENGTH (FT) 10

INNER CASING LENGTH (FT) 3.5

INNER CASING MATERIAL SCH 80 (PVC)

SCREEN SLOT SIZE (IN) 0.01

REMARKS CONSTRUCTED IN SB-10

WELL COMPLETION METHOD S S

INSTALLATION DATE * 06 MAR 1992

INSTALLING COMPANY _____ (___)

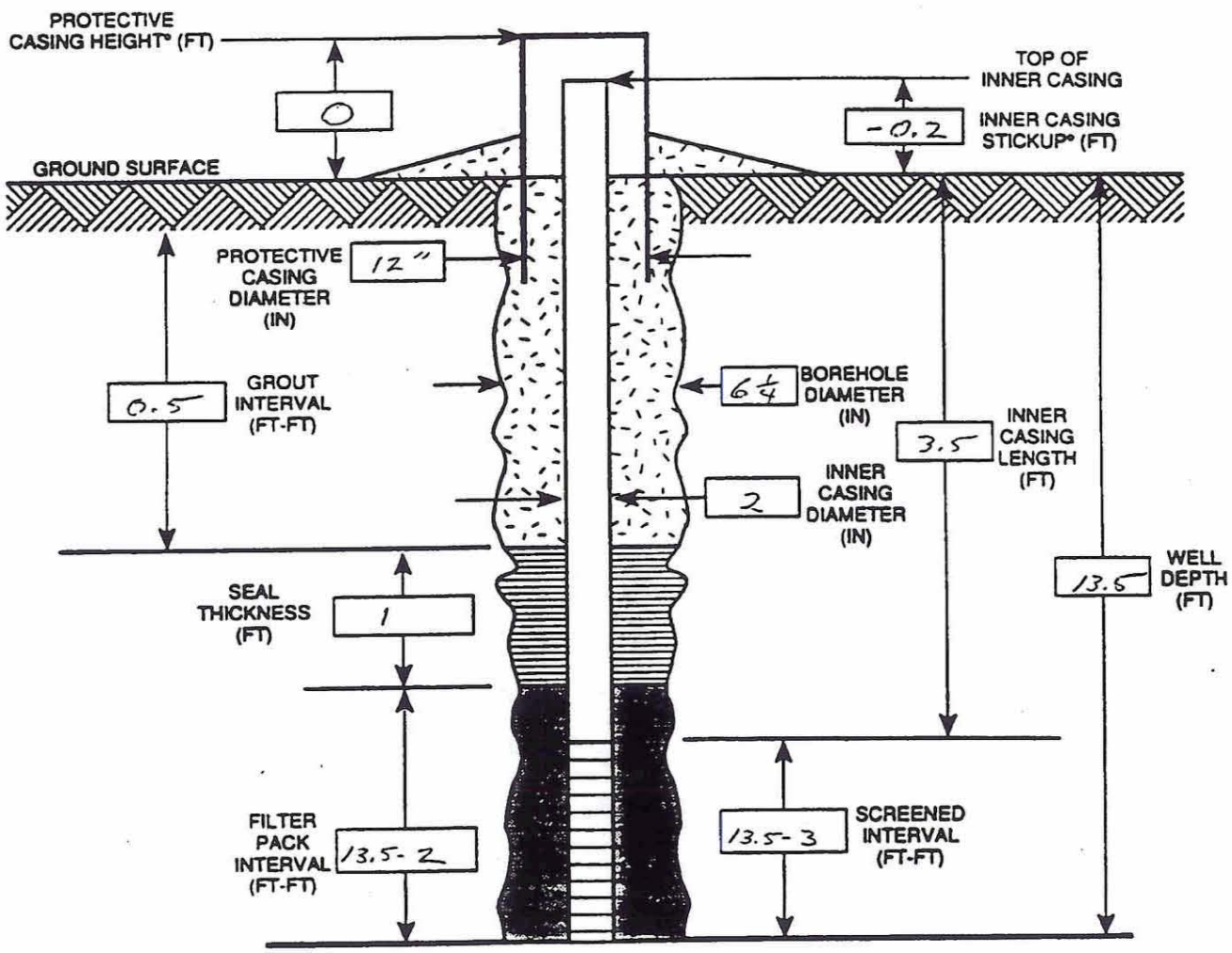
PURGE PUMP TYPE _____ (___)

SAMPLE PUMP TYPE _____ (___)

PURGE PUMP DEPTH (FT) _____

SAMPLE PUMP DEPTH (FT) _____

WELL YIELD BEGINNING (GPM) _____



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°ESTIMATED

WELL COMPLETION INFORMATION

(SINGLE CASED, SCREENED)

6629-01-09-0050

PROJECT ID - PHASE: CTO-20

FACILITY ID OCEANA (NAS)

WELL LOCATION ID 20MW-06

SCREENED LENGTH (FT) 10

INNER CASING LENGTH (FT) 4

INNER CASING MATERIAL SCH 80 (PVC) 2"

SCREEN SLOT SIZE (IN) 0.01

REMARKS LOCATION ON 20-513-11

WELL COMPLETION METHOD S S

INSTALLATION DATE * 10 MAR 1992

INSTALLING COMPANY McCALLAN (___)

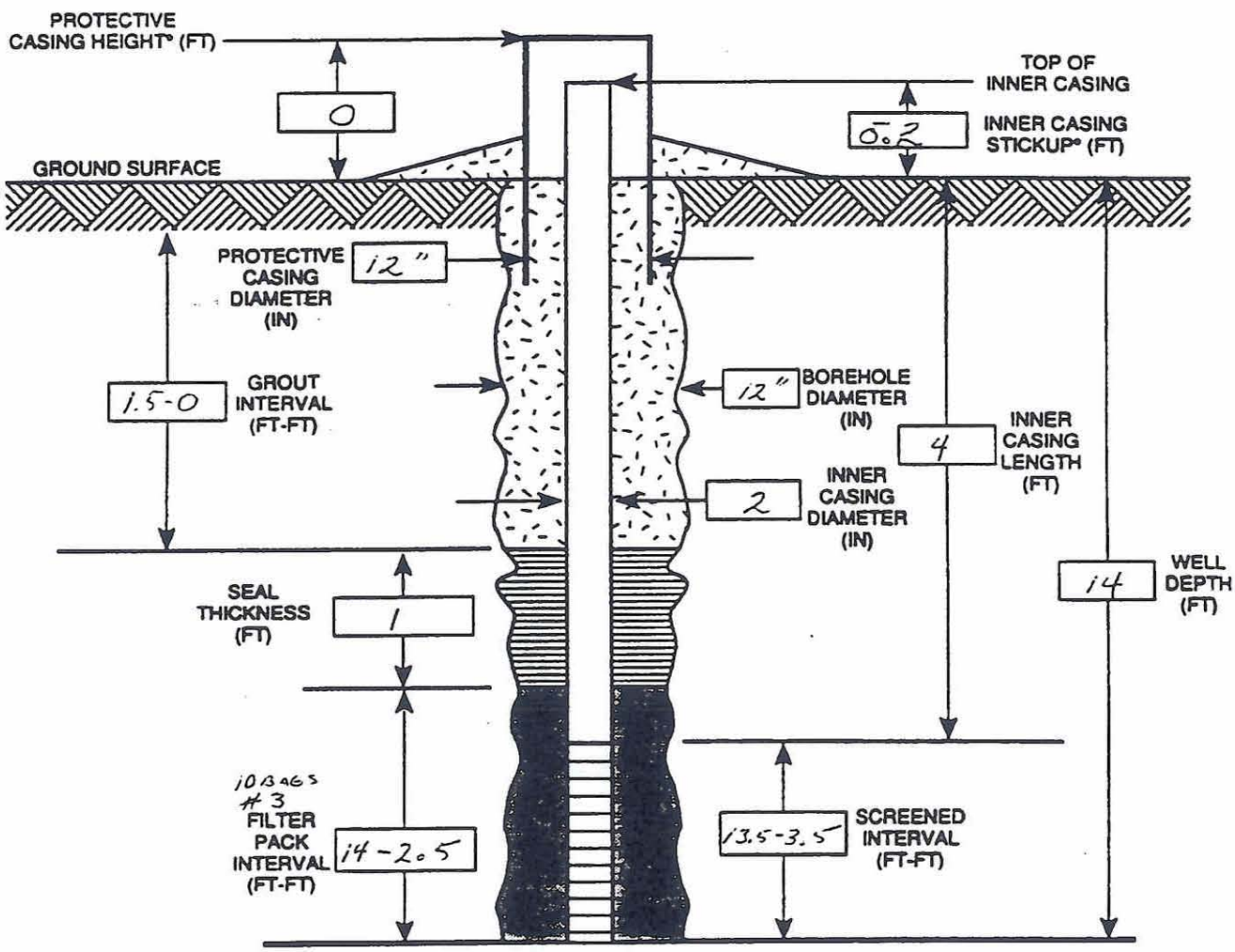
PURGE PUMP TYPE _____ (___)

SAMPLE PUMP TYPE _____ (___)

PURGE PUMP DEPTH (FT) _____

SAMPLE PUMP DEPTH (FT) _____

WELL YIELD BEGINNING (GPM) _____



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*DATE: DD-MMM-YY

*ESTIMATED

Revised 12-19-89

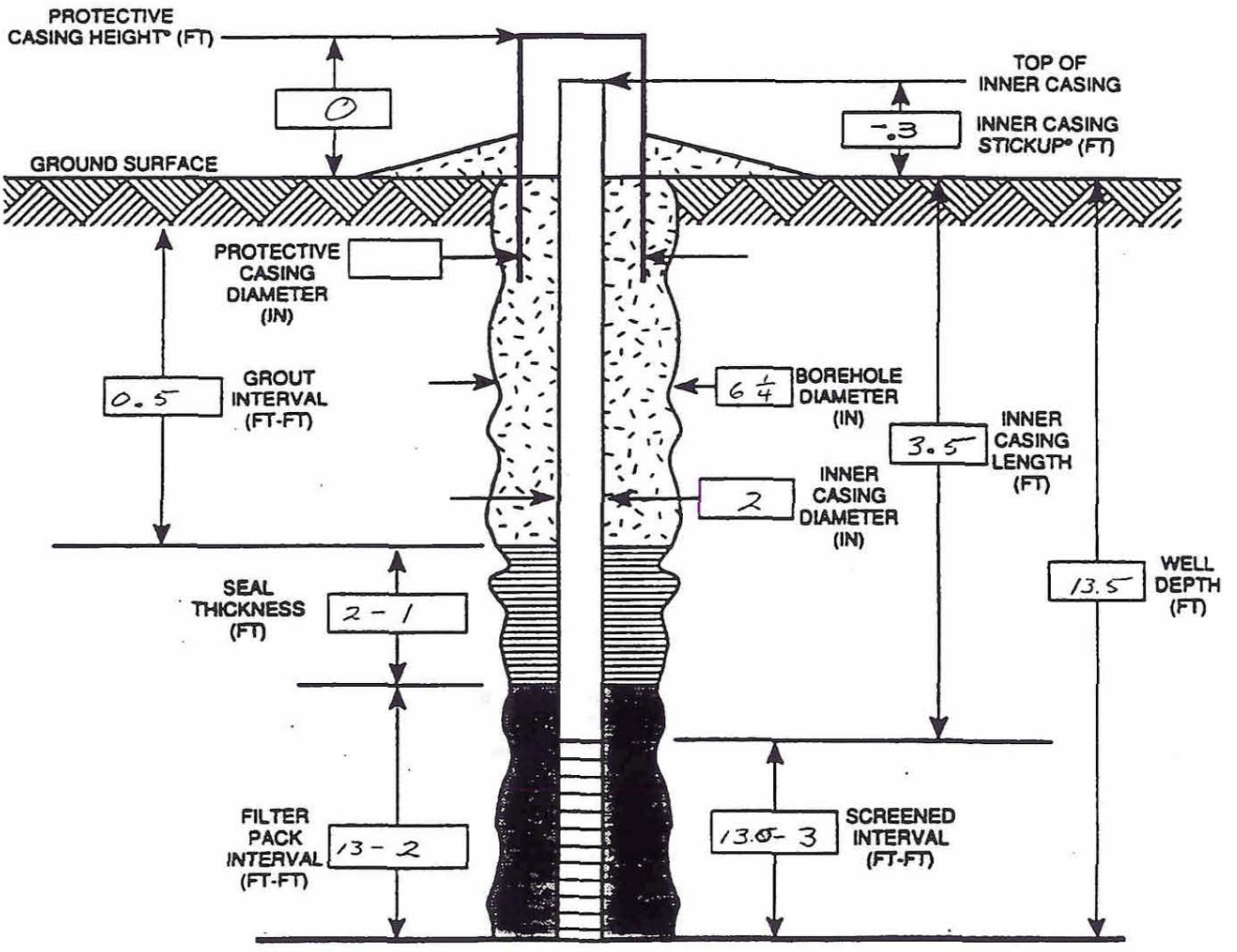
WELL COMPLETION INFORMATION

(SINGLE CASED, SCREENED)

6629-01-09 -0050

PROJECT ID - PHASE: CTO-20
FACILITY ID OCEANA (NAS)
WELL LOCATION ID 20 MW-07
SCREENED LENGTH (FT) 10
INNER CASING LENGTH (FT) 13.5
INNER CASING MATERIAL 2" (PVC) SCH 80
SCREEN SLOT SIZE (IN) 0.01
REMARKS WELL ESTABLISHED ON BOREHOLE 20-SB-07

WELL COMPLETION METHOD SS
INSTALLATION DATE * 05 MAR 1992
INSTALLING COMPANY _____ (___)
PURGE PUMP TYPE _____ (___)
SAMPLE PUMP TYPE _____ (___)
PURGE PUMP DEPTH (FT) _____
SAMPLE PUMP DEPTH (FT) _____
WELL YIELD BEGINNING (GPM) _____



G34-240a

*DATE: DD-MMM-YY
*ESTIMATED

Revised 12-19-89

GEOLIS Well Development Form

COMPANY: McCallum
CLIENT: Baker
PROJECT: 6629-01-09
SITE: Fixwing Fuel Pits

WELL NO.: 20-MW-02
DATE: 13 March 92
LOGGER: Tim Frink
SIGNATURE:

ONE WELL VOLUME: _____ gallons WELL TD: _____ ft TOC

Well Volume (gallons/foot): 2-inch = 0.16 4-inch = 0.65 6-inch = 1.47 8-inch = 2.61

TIME	ACTIVITY CODE	DEPTH TO WATER (ft)	PURGE RATE (gpm)	PURGE VOLUME (gal)	FIELD MEASUREMENTS				TURBIDITY	COMMENTS
					MTP	MSC	MPH			
1411	DBB	5.84		0					None	
1415				2.5	14.0	282	5.4		Low	
1420				5.0	15.0	273	5.7		L	
1424				7.5	14.8	339	5.65		L	
1428				10.0	15.0	305	5.55		L	
1431				12.5	15.5	298	5.55		L	
1438	DBE			15.0	15.5	300	5.55		L	
	FINAL									

DEVELOPMENT ACTIVITY CODES

DBB - Begin Bailing
DBE - End Bailing
DOB - Begin Overpumping
DOE - End Overpumping
DRB - Begin Rawhiding
DRE - End Rawhiding
DCB - Begin Recirculation
DCE - End Recirculation
DHB - Begin Hydraulic Jetting
DHE - End Hydraulic Jetting
DAB - Begin Air Surging
DAE - End Air Surging
DSB - Begin Surge Blocking
DSE - End Surge Blocking
DXB - Begin Other
DXE - End Other
Specify other method: _____
FMT - Field Measurements (select from codes at right)

FIELD MEASUREMENT CODES

MTP - Temperature
MSC - Specific Conductance
MPD - Photoionizer (e.g., HNu)
MFL - Flame Ionizer (e.g., OVA)
MDO - Dissolved Oxygen
MPH - pH
MEH - Eh
MMC - Imhoff Cone
MO1 - Other: _____
MO2 - Other: _____

TURBIDITY

Enter Turbidity Meter Reading (Final should be < 5 NTU)
OR
Enter Qualitative Observations
H - High: Opaque/Muddy/Silty
M - Medium: Translucent/Cloudy
L - Low: Transperant/Some Silt
N - None: Clear/No Visible Silt

G061291T

GEOLIS Well Development Form

COMPANY: McCallum
CLIENT: Baker
PROJECT: 6629-01-09
SITE: Fluning Fuel Pits

WELL NO.: 20-MW-03
DATE: 12 March 92
LOGGER: Tim Frinak
SIGNATURE:

ONE WELL VOLUME: _____ gallons WELL TD: _____ ft TOC

Well Volume (gallons/foot): 2-inch = 0.16 4-inch = 0.65 6-inch = 1.47 8-inch = 2.61

TIME	ACTIVITY CODE	DEPTH TO WATER (ft)	PURGE RATE (gpm)	PURGE VOLUME (gal)	FIELD MEASUREMENTS				TURBIDITY	COMMENTS
					MTP	MSC	MPH			
1532	DBB	5.3		0	13	192	4.95		Clear	
1535				2.5	13.8	198	4.9		Low	
1542				5.0	13.8	208	4.9		L	
1546				7.5	13.8	208	4.9		L	
1547	DBE			10.0	13.8	208	4.9		L	
	FINAL									

DEVELOPMENT ACTIVITY CODES

DBB - Begin Bailing
DOB - Begin Overpumping
DRB - Begin Rawhiding
DCB - Begin Recirculation
DHB - Begin Hydraulic Jetting
DAB - Begin Air Surging
DSB - Begin Surge Blocking
DXB - Begin Other
Specify other method: _____
DBE - End Bailing
DOE - End Overpumping
DRE - End Rawhiding
DCE - End Recirculation
DHE - End Hydraulic Jetting
DAE - End Air Surging
DSE - End Surge Blocking
DXE - End Other
FMT - Field Measurements (select from codes at right)

FIELD MEASUREMENT CODES

MTP - Temperature
MSC - Specific Conductance
MPD - Photoionizer (e.g., HNu)
MFD - Flame Ionizer (e.g., OVA)
MDO - Dissolved Oxygen
MPH - pH
MEH - Eh
MMC - Imhoff Cone
MO1 - Other: _____
MO2 - Other: _____

TURBIDITY

Enter Turbidity Meter Reading (Final should be < 5 NTU)
OR
Enter Qualitative Observations
H - High: Opaque/Muddy/Silty
M - Medium: Translucent/Cloudy
L - Low: Transparent/Some Silt
N - None: Clear/No Visible Silt

G061291T

GEOLIS Well Development Form

COMPANY: McCallum
CLIENT: Baker
PROJECT: G629-01-09
SITE: Fitwing Fuel Pits

WELL NO.: 20-MW-04
DATE: 13 March 92
LOGGER: Tim Frinak
SIGNATURE:

ONE WELL VOLUME: _____ gallons WELL TD: _____ ft TOC

Well Volume (gallons/foot): 2-inch = 0.16, 4-inch = 0.65, 6-inch = 1.47, 8-inch = 2.61

TIME	ACTIVITY CODE	DEPTH TO WATER (ft)	PURGE RATE (gpm)	PURGE VOLUME (gal)	FIELD MEASUREMENTS				TURBIDITY	COMMENTS
					MTP	MSC	MPH			
1344	DBB	5.33		0	13.9	290	5.4		None	
1348				2.5	14.8	228	5.45		Low	
1351				5.0	15.0	272	5.55		L	
1355				7.5	15.0	268	5.58		L	
1359	DBE			10.0	15.0	264	5.58		L	
	FINAL									

DEVELOPMENT ACTIVITY CODES

DBB - Begin Bailing
DOB - Begin Overpumping
DRB - Begin Rawhiding
DCB - Begin Recirculation
DHB - Begin Hydraulic Jetting
DAB - Begin Air Surging
DSB - Begin Surge Blocking
DXB - Begin Other
Specify other method: _____
DBE - End Bailing
DOE - End Overpumping
DRE - End Rawhiding
DCE - End Recirculation
DHE - End Hydraulic Jetting
DAE - End Air Surging
DSE - End Surge Blocking
DXE - End Other
FMT - Field Measurements (select from codes at right)

FIELD MEASUREMENT CODES

MTP - Temperature
MSC - Specific Conductance
MPD - Photoionizer (e.g., HNu)
MFD - Flame Ionizer (e.g., OVA)
MDO - Dissolved Oxygen
MPH - pH
MEH - Eh
MMC - Imhoff Cone
MO1 - Other: _____
MO2 - Other: _____

TURBIDITY

Enter Turbidity Meter Reading (Final should be < 5 NTU)
OR
Enter Qualitative Observations
H - High: Opaque/Muddy/Silty
M - Medium: Translucent/Cloudy
L - Low: Transparent/Some Silt
N - None: Clear/No Visible Silt

G061291T

GEOLIS Well Development Form

COMPANY: Mc Callum
CLIENT: Baker
PROJECT: G629-01-09
SITE: Fitwing Fuel Pits

WELL NO.: 20-MW-05
DATE: 13 March 92
LOGGER: Tim Frinak
SIGNATURE:

ONE WELL VOLUME: _____ gallons WELL TD: _____ ft TOC

Well Volume (gallons/foot): 2-inch = 0.16 4-inch = 0.65 6-inch = 1.47 8-inch = 2.61

TIME	ACTIVITY CODE	DEPTH TO WATER (ft)	PURGE RATE (gpm)	PURGE VOLUME (gal)	FIELD MEASUREMENTS				TURBIDITY	COMMENTS
					MTP	MSC	MPH			
1315	DBB	5.45		0	13	185	5.5		Clear	
1319				2.5	14	109	5.25		Moderate	
1322				5.0	17	195	5.1		M	
1326				7.5	14.5	195	5.05		M	
1330	DBE			10.0	17.5	196	5.05		M	
	FINAL									

DEVELOPMENT ACTIVITY CODES		FIELD MEASUREMENT CODES	TURBIDITY
DBB - Begin Bailing	DBE - End Bailing	MTP - Temperature	Enter Turbidity Meter Reading (Final should be < 5 NTU)
DOB - Begin Overpumping	DOE - End Overpumping	MSC - Specific Conductance	OR
DRB - Begin Rawhiding	DRE - End Rawhiding	MPD - Photoionizer (e.g., HNu)	Enter Qualitative Observations
DCB - Begin Recirculation	DCE - End Recirculation	MFD - Flame Ionizer (e.g., OVA)	H - High: Opaque/Muddy/Silty
DHB - Begin Hydraulic Jetting	DHE - End Hydraulic Jetting	MDO - Dissolved Oxygen	M - Medium: Translucent/Cloudy
DAB - Begin Air Surging	DAE - End Air Surging	MPH - pH	L - Low: Transparent/Some Silt
DSB - Begin Surge Blocking	DSE - End Surge Blocking	MEH - Eh	N - None: Clear/No Visible Silt
DXB - Begin Other:	DXE - End Other	MMC - Millioff Cond.	
Specify other method:		MO1 - Other:	
FMT - Field Measurements (select from codes at right)		MO2 - Other:	

GEOLIS Well Development Form

COMPANY: McCallum
CLIENT: Baker
PROJECT: 6629-01-09
SITE: Fitwing Fuel Pits

WELL NO.: 20-MW-06
DATE: 12 March 92
LOGGER: Jim Frinak
SIGNATURE:

ONE WELL VOLUME: _____ gallons WELL TD: _____ ft TOC

Well Volume (gallons/foot): 2-inch = 0.16 4-inch = 0.65 6-inch = 1.47 8-inch = 2.61

TIME	ACTIVITY CODE	DEPTH TO WATER (ft)	PURGE RATE (gpm)	PURGE VOLUME (gal)	FIELD MEASUREMENTS				TURBIDITY	COMMENTS
					MTP	MSC	MPH			
1450	DBB	5.3		0	14	210	4.95		Clear	
1456				2.5	14.8	221	4.95		Low	
1501				5.0	15.0	225	4.95		L	
1507				7.5	15.0	240	4.95		L	
1512				10.0	15.0	241	4.95		L	
1518	DBE			12.5	15.0	241	4.95		L	
	FINAL									

DEVELOPMENT ACTIVITY CODES		FIELD MEASUREMENT CODES	TURBIDITY
DBB - Begin Bailing	DBE - End Bailing	MTP - Temperature	Enter Turbidity Meter Reading (Final should be < 5 NTU)
DOB - Begin Overpumping	DOE - End Overpumping	MSC - Specific Conductance	OR
DRB - Begin Rawhiding	DRE - End Rawhiding	MPD - Photoionizer (e.g., HNu)	Enter Qualitative Observations
DCB - Begin Recirculation	DCE - End Recirculation	MFD - Flame Ionizer (e.g., OVA)	H - High: Opaque/Muddy/Silty
DHB - Begin Hydraulic Jetting	DHE - End Hydraulic Jetting	MDO - Dissolved Oxygen	M - Medium: Translucent/Cloudy
DAB - Begin Air Surging	DAE - End Air Surging	MPH - pH	L - Low: Transparent/Some Silt
DSB - Begin Surge Blocking	DSE - End Surge Blocking	MEH - Eh	N - None: Clear/No Visible Silt
DXB - Begin Other	DXE - End Other	MMC - Imhoff Cone	
Specify other method:		MO1 - Other:	
FMT - Field Measurements (select from codes at right)		MO2 - Other:	

GEOLIS Well Development Form

COMPANY: McCallum
CLIENT: Baker
PROJECT: 6629-01-09
SITE: Fitwing Fuel Pits

WELL NO.: 20-MW-07
DATE: 12 March 92
LOGGER: Tim Frinak
SIGNATURE:

ONE WELL VOLUME: _____ gallons WELL TD: _____ ft TOC

Well Volume (gallons/foot): 2-inch = 0.16, 4-inch = 0.65, 6-inch = 1.47, 8-inch = 2.61

TIME	ACTIVITY CODE	DEPTH TO WATER (ft)	PURGE RATE (gpm)	PURGE VOLUME (gal)	FIELD MEASUREMENTS				TURBIDITY	COMMENTS
					MTP	MSC	MPH			
1410	DBB	4.28	~~5~~	0	14	179	5.5		Clear	
1415			~~25~~	2.5	14	174	5.25		Low	
1418				5.0	13.5	163	4.9		L	
1424				7.5	13.5	164	4.9		L	
1432	DBE			10	13.5	168	4.9		L	
	FINAL									

DEVELOPMENT ACTIVITY CODES

DBB - Begin Bailing
DOB - Begin Overpumping
DRB - Begin Rawhiding
DCB - Begin Recirculation
DHB - Begin Hydraulic Jetting
DAB - Begin Air Surging
DSB - Begin Surge Blocking
DXB - Begin Other
DBE - End Bailing
DOE - End Overpumping
DRE - End Rawhiding
DCE - End Recirculation
DHE - End Hydraulic Jetting
DAE - End Air Surging
DSE - End Surge Blocking
DXE - End Other
Specify other method:
FM1 - Field Measurements (select from codes at right)

FIELD MEASUREMENT CODES

MTP - Temperature
MSC - Specific Conductance
MPD - Photoionizer (e.g., HNu)
MFD - Flame Ionizer (e.g., OVA)
MDO - Dissolved Oxygen
MPH - pH
MEH - Eh
MMC - Imhoff Cone
MO1 - Other:
MO2 - Other:

TURBIDITY

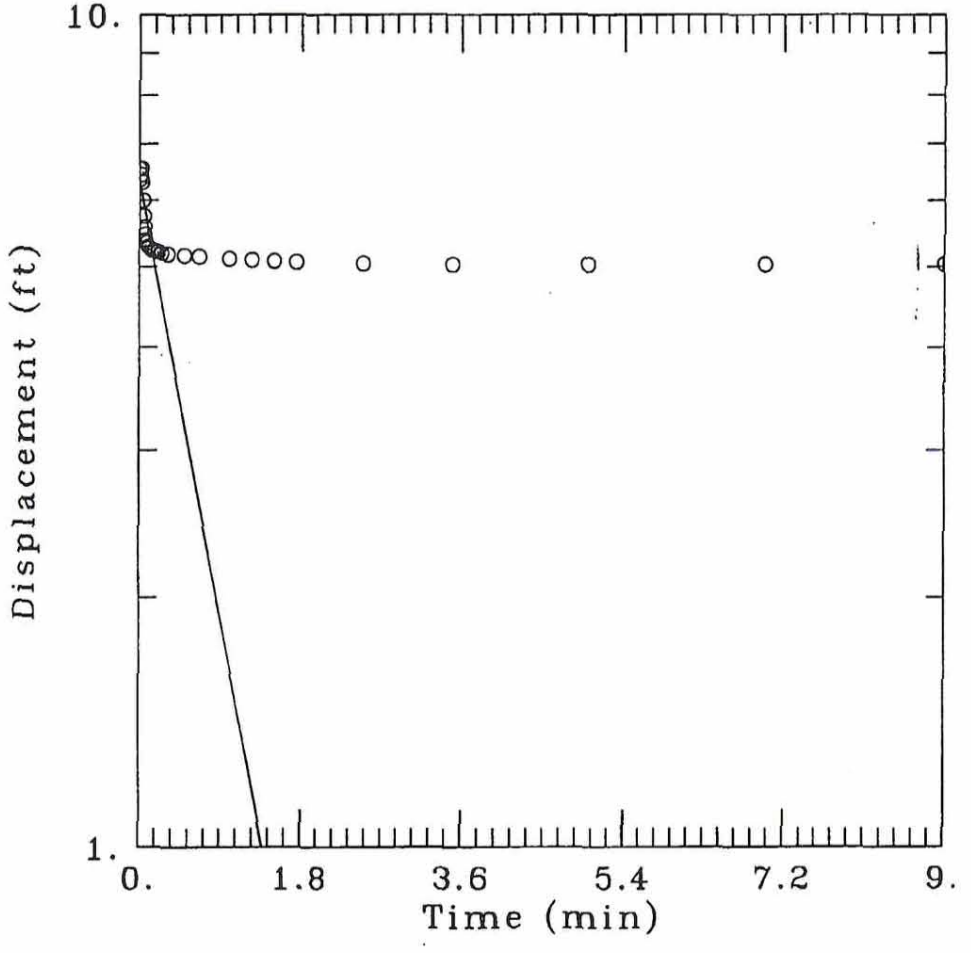
Enter Turbidity Meter Reading (Final should be < 5 NTU)
OR
Enter Qualitative Observations
H - High: Opaque/Muddy/Silty
M - Medium: Translucent/Cloudy
L - Low: Transparent/Some Silt
N - None: Clear/No Visible Silt

G061291T

APPENDIX D

HYDRAULIC CONDUCTIVITY DAT.

MW-3 SLUG TEST NAS-OCEANA



DATA SET:
NASSTMW3.DAT
04/29/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.002149 ft/min
y0 = 6.292 ft

TEST DATA:
H0 = 6.544 ft
rc = 0.167 ft
rw = 0.833 ft
L = 10. ft
b = 50. ft
H = 5. ft

SE2000
Environmental Logger
04/10 18:27

Unit# 03 Test 3

Setups:	INPUT 1	INPUT 2
Type	Level (F)	Level (F)
Mode	TOC	TOC
I.D.	MW-3	E-4
Reference	0.000	0.000
SG	1.000	1.000
Linearity	0.000	0.000
Scale factor	50.009	20.098
Offset	-0.050	-0.210
Delay mSEC	50.000	50.000

Step 0 04/07 14:54:29

Elapsed Time	INPUT 1	INPUT 2
0.0000	1.418	-0.012
0.0083	1.355	-0.012
0.0166	1.434	-0.012
0.0250	1.544	-0.006
0.0333	1.308	-0.012
0.0416	0.993	-0.012
0.0500	0.740	-0.006
0.0583	0.567	-0.012
0.0666	0.457	-0.012
0.0750	0.378	-0.012
0.0833	0.331	-0.012
0.1000	0.283	-0.012
0.1166	0.267	-0.012
0.1333	0.236	-0.012
0.1500	0.220	-0.012
0.1666	0.220	-0.012
0.1833	0.220	-0.012
0.2000	0.204	-0.012
0.2166	0.204	-0.012
0.2333	0.204	-0.012
0.2500	0.189	-0.012
0.2666	0.189	-0.012
0.2833	0.189	-0.012
0.3000	0.189	-0.012
0.3166	0.173	-0.012
0.3333	0.173	-0.012
0.4166	0.157	-0.012
0.5000	0.157	-0.012
0.5833	0.141	-0.012
0.6666	0.141	-0.012
0.7500	0.126	-0.012
0.8333	0.110	-0.012
0.9166	0.110	-0.012
1.0000	0.110	-0.012
1.0833	0.094	-0.012
1.1666	0.094	-0.012

1.2500	0.094	-0.012
1.3333	0.094	-0.012
1.4166	0.078	-0.019
1.5000	0.078	-0.019
1.5833	0.078	-0.019
1.6666	0.078	-0.019
1.7500	0.063	-0.019
1.8333	0.063	-0.012
1.9166	0.063	-0.012
2.0000	0.063	-0.012
2.5000	0.047	-0.012
3.0000	0.047	-0.012
3.5000	0.031	-0.025
4.0000	0.015	-0.019
4.5000	0.031	-0.019
5.0000	0.031	-0.019
5.5000	0.031	-0.012
6.0000	0.031	-0.012
6.5000	0.031	-0.012
7.0000	0.031	-0.012
7.5000	0.031	-0.012
8.0000	0.031	0.000
8.5000	0.031	0.000
9.0000	0.031	0.006
9.5000	0.047	0.012
10.0000	0.047	0.012
11.0000	0.047	0.006
12.0000	0.047	0.012
13.0000	0.047	0.019
14.0000	0.047	0.031
15.0000	0.047	0.038
16.0000	0.047	0.031
17.0000	0.063	0.025
18.0000	0.031	0.012
19.0000	0.015	0.012

END

SE2000
Environmental Logger
04/10 18:29

Unit# 03 Test 3

Setups:	INPUT 1	INPUT 2
Type	Level (F)	Level (F)
Mode	TOC	TOC
I.D.	MW-7	E-4
Reference	0.000	0.000
SG	1.000	1.000
Linearity	0.000	0.000
Scale factor	50.009	20.098
Offset	-0.050	-0.210
Delay mSEC	50.000	50.000

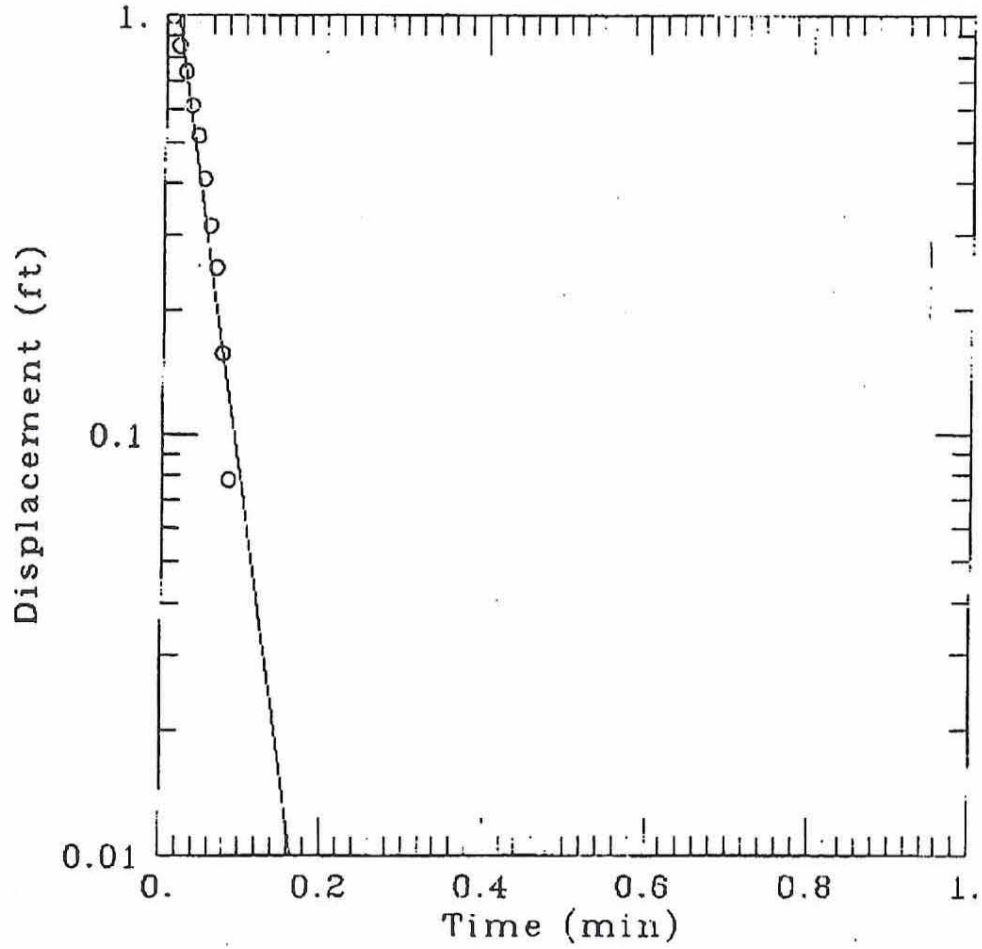
Step 1 04/07 15:49:35

Elapsed Time	INPUT 1	INPUT 2
0.0000	1.087	12.232
0.0083	0.993	12.232
0.0166	0.851	12.232
0.0250	0.740	12.232
0.0333	0.614	12.232
0.0416	0.520	12.232
0.0500	0.409	12.232
0.0583	0.315	12.232
0.0666	0.252	12.232
0.0750	0.157	12.232
0.0833	0.078	12.232
0.1000	-0.063	12.232
0.1166	-0.173	12.232
0.1333	-0.299	12.232
0.1500	-0.409	12.232
0.1666	-0.504	12.232
0.1833	-0.598	12.232
0.2000	-0.662	12.232
0.2166	-0.740	12.232
0.2333	-0.803	12.232
0.2500	-0.866	12.232
0.2666	-0.929	12.232
0.2833	-0.977	12.232
0.3000	-1.024	12.232
0.3166	-1.056	12.232
0.3333	-1.087	12.232
0.4166	-1.197	12.232
0.5000	-1.229	12.232
0.5833	-1.245	12.232
0.6666	-1.261	12.232
0.7500	-1.261	12.232
0.8333	-1.261	12.232
0.9166	-1.276	12.232
1.0000	-1.276	12.232
1.0833	-1.292	12.232
1.1666	-1.292	12.232

1.2500	-1.292	12.232
1.3333	-1.292	12.232
1.4166	-1.292	12.232
1.5000	-1.292	12.232
1.5833	-1.292	12.232
1.6666	-1.308	12.232
1.7500	-1.292	12.232
1.8333	-1.308	12.232
1.9166	-1.292	12.232
2.0000	-1.308	12.232
2.5000	-1.308	12.232
3.0000	-1.308	12.232
3.5000	-1.324	12.232
4.0000	-1.324	12.232
4.5000	-1.324	12.232
5.0000	-1.324	12.232
5.5000	-1.324	12.232
6.0000	-1.324	12.232
6.5000	-1.324	12.232
7.0000	-1.339	12.232
7.5000	-1.324	12.232
8.0000	-1.324	12.232
8.5000	-1.308	12.232
9.0000	-1.308	12.232
9.5000	-1.308	12.232
10.0000	-1.308	12.232
11.0000	-1.308	12.232
12.0000	-1.308	12.232
13.0000	-1.308	12.232
14.0000	-1.308	12.232
15.0000	-1.324	12.232
16.0000	-1.308	12.232
17.0000	-1.292	12.232

END

MW-07 SLUG TEST NAS-OCEANA



DATA SET:
MW7ST.DAT
05/01/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Bouwer-Rice

ESTIMATED PARAMETERS:
K = 0.04927 ft/min
y0 = 1.594 ft

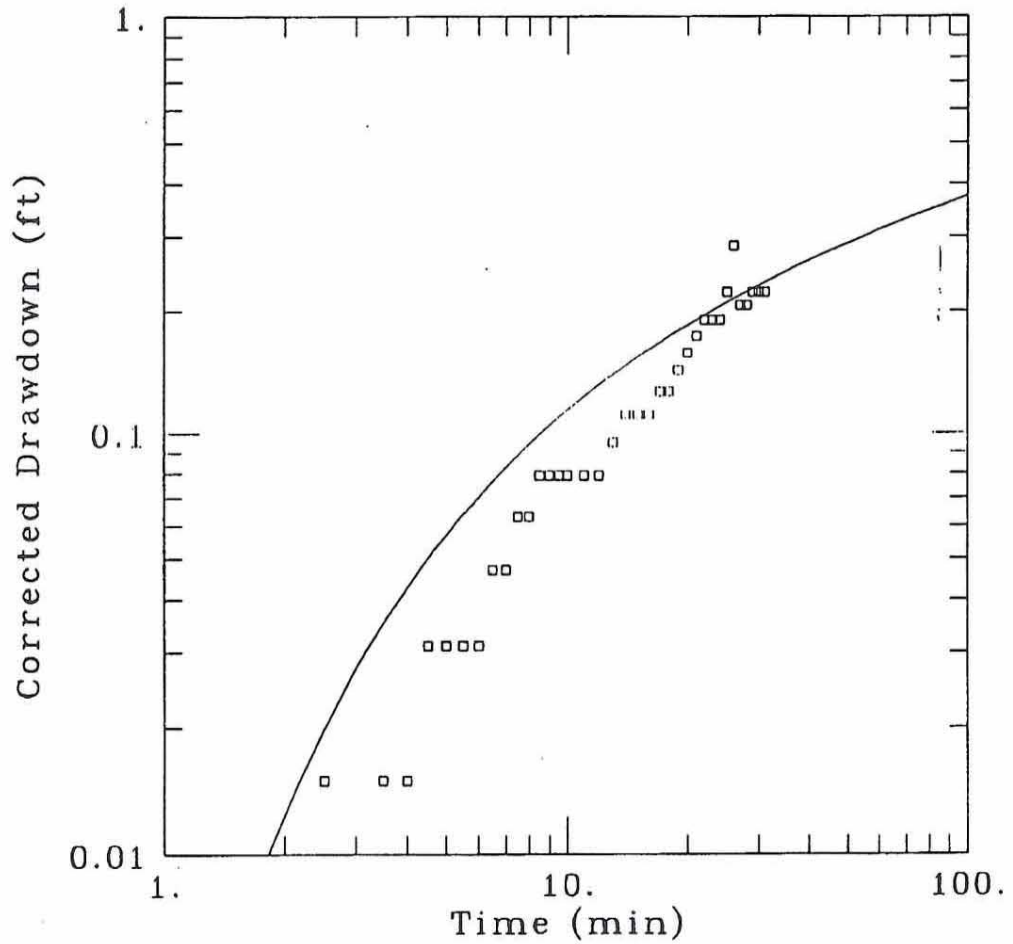
TEST DATA:
H0 = 1.087 ft
rc = 0.1667 ft
rw = 0.8333 ft
L = 10. ft
b = 50. ft
H = 5. ft

APPENDIX E

STEP-DRAWDOWN TEST, RECOVERY AND PUMP TEST PLOTS

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-1 (STEP 0) STEP DRAWDOWN TEST



DATA SET:
B: \DATA\PZ1SOT7.AQT
05/04/92

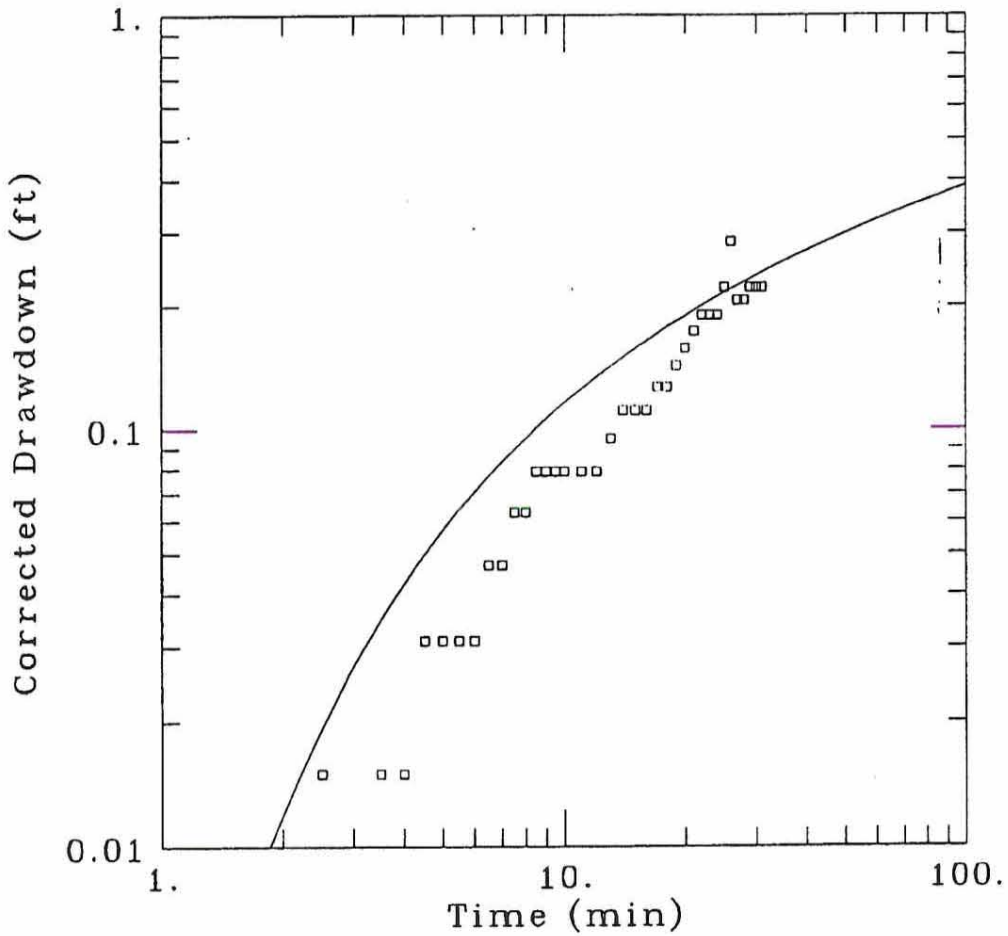
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
PZ-1

ESTIMATED PARAMETERS:
T = 0.3418 ft^2/min
S = 0.0005105

TEST DATA:
Q = 0.5348 ft^3/min
r = 88. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-2 (STEP 0) STEP DRAWDOWN TEST



DATA SET:
B:\DATA\PZ2SOT7.AQT
05/04/92

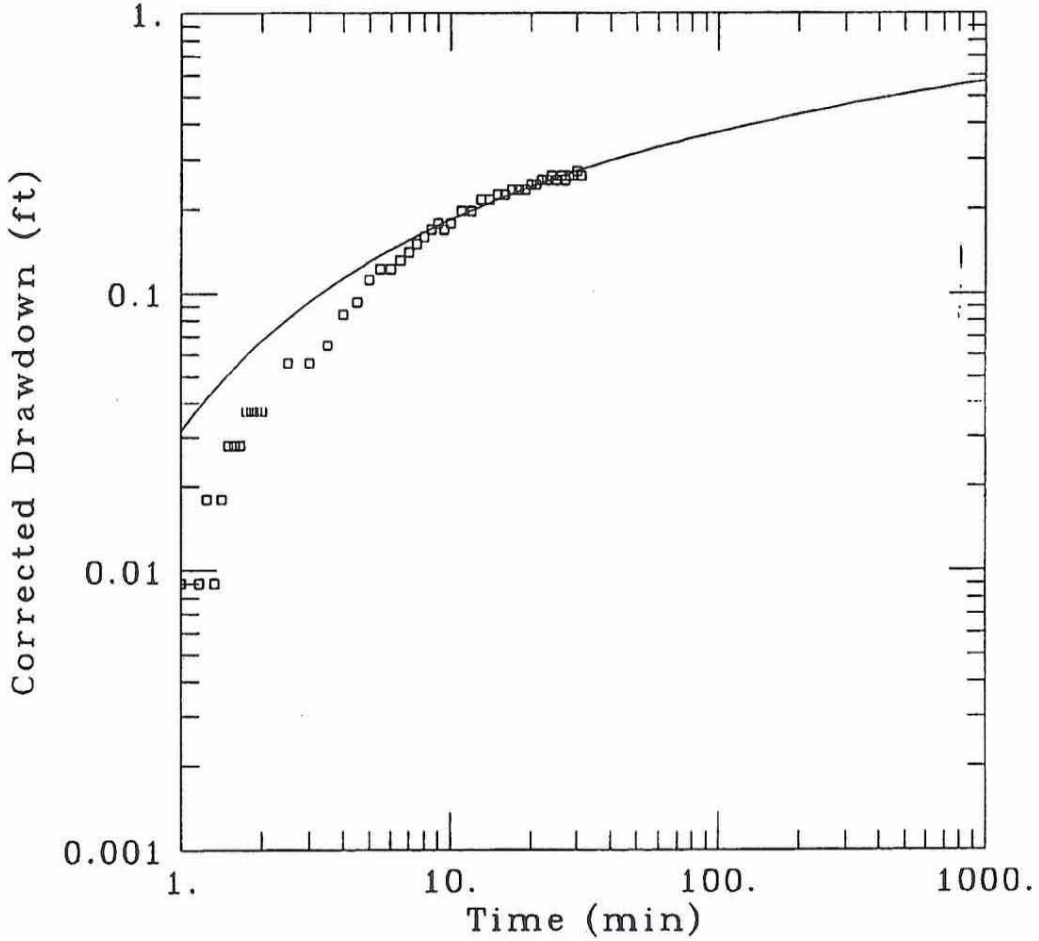
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
PZ-2

ESTIMATED PARAMETERS:
T = 0.3264 ft^2/min
S = 0.0001109

TEST DATA:
Q = 0.5348 ft^3/min
r = 188. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

MW-06 (STEP 0) STEP DRAWDOWN TEST



DATA SET:
B:\DATA\MW6SOT7.AQT
05/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
04/09/92

TEST WELL:
TW-1

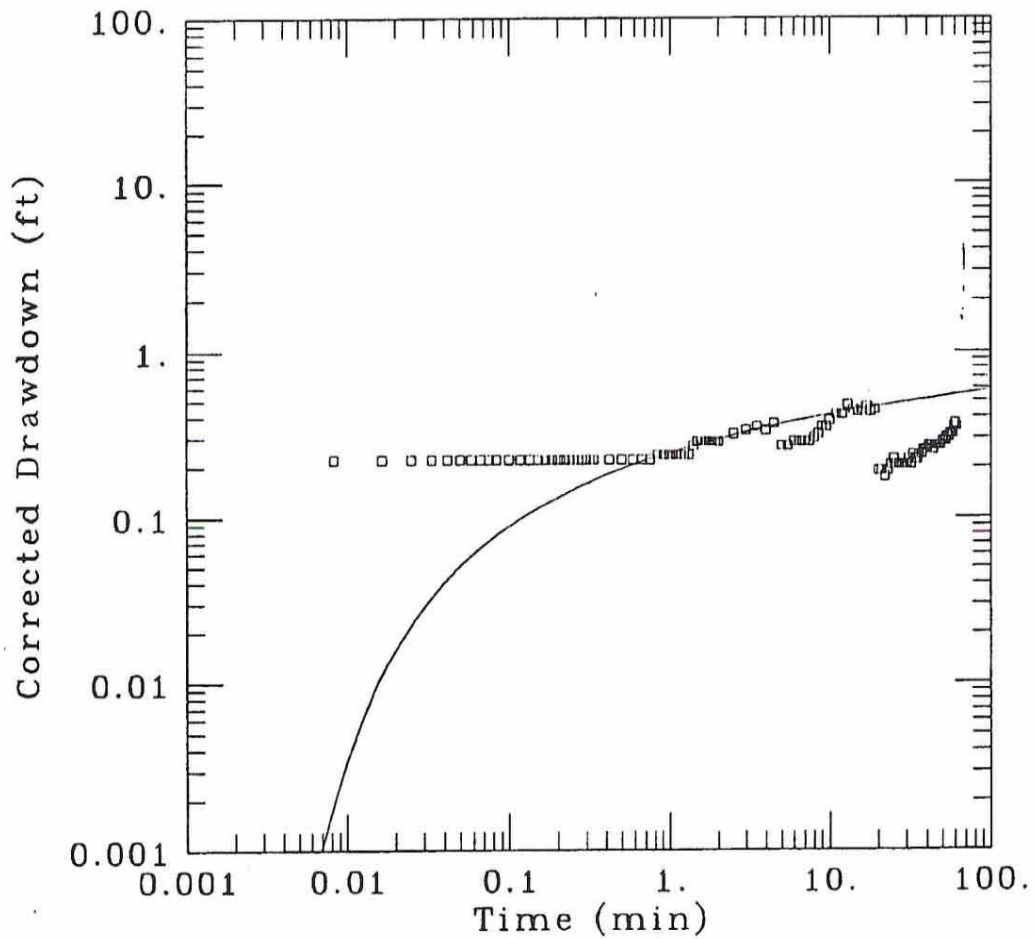
OBS. WELL:
MW-06

ESTIMATED PARAMETERS:
T = 0.5044 ft^2/min
S = 0.0005434

TEST DATA:
Q = 0.5348 ft^3/min
r = 50. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-1 (STEP 1) STEP DRAWDOWN TEST



DATA SET:
B:\DATA\PZ1S1T7.AQT
05/04/92

AQUIFER TYPE:
Unconfined

SOLUTION METHOD:
Theis

TEST DATE:
04/09/92

TEST WELL:
TW-1

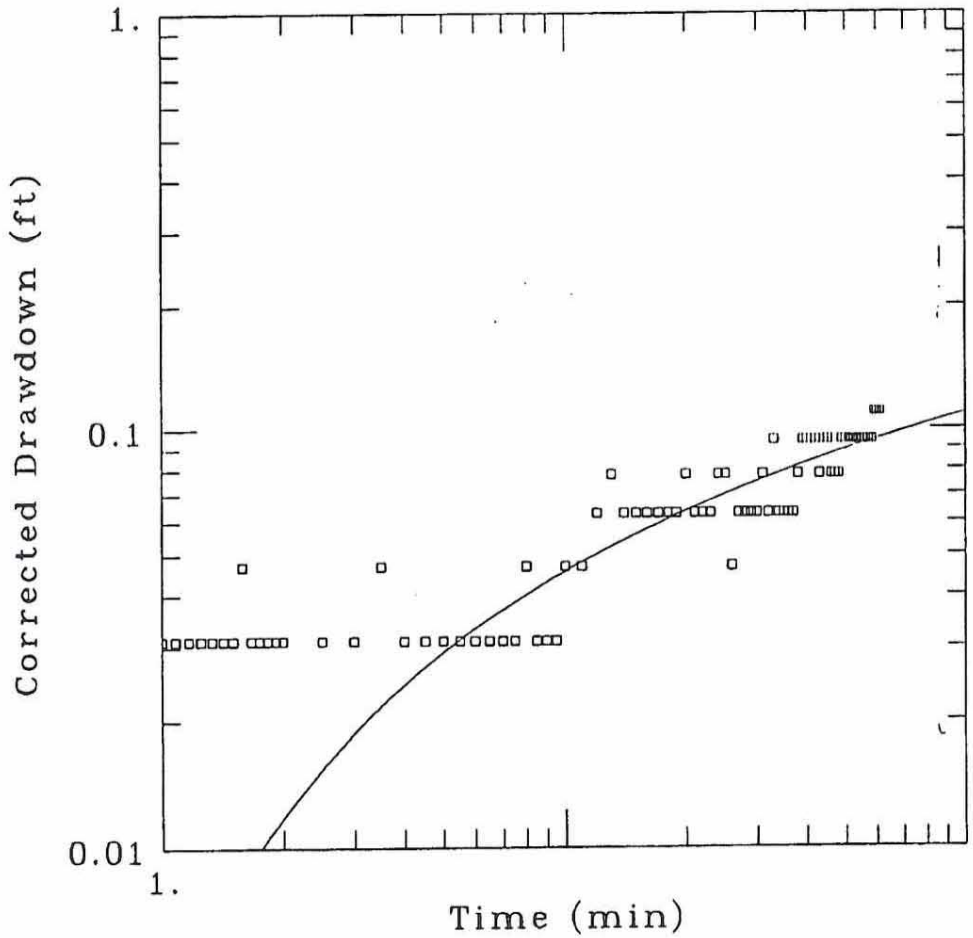
OBS. WELL:
PZ-1

ESTIMATED PARAMETERS:
T = 0.9151 ft^2/min
S = 9.0409E-06

TEST DATA:
Q = 0.8289 ft^3/min
r = 88. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-2 (STEP 1) STEP DRAWDOWN TEST



DATA SET:
B:\DATA\PZ2S1T7.DAT
05/01/92

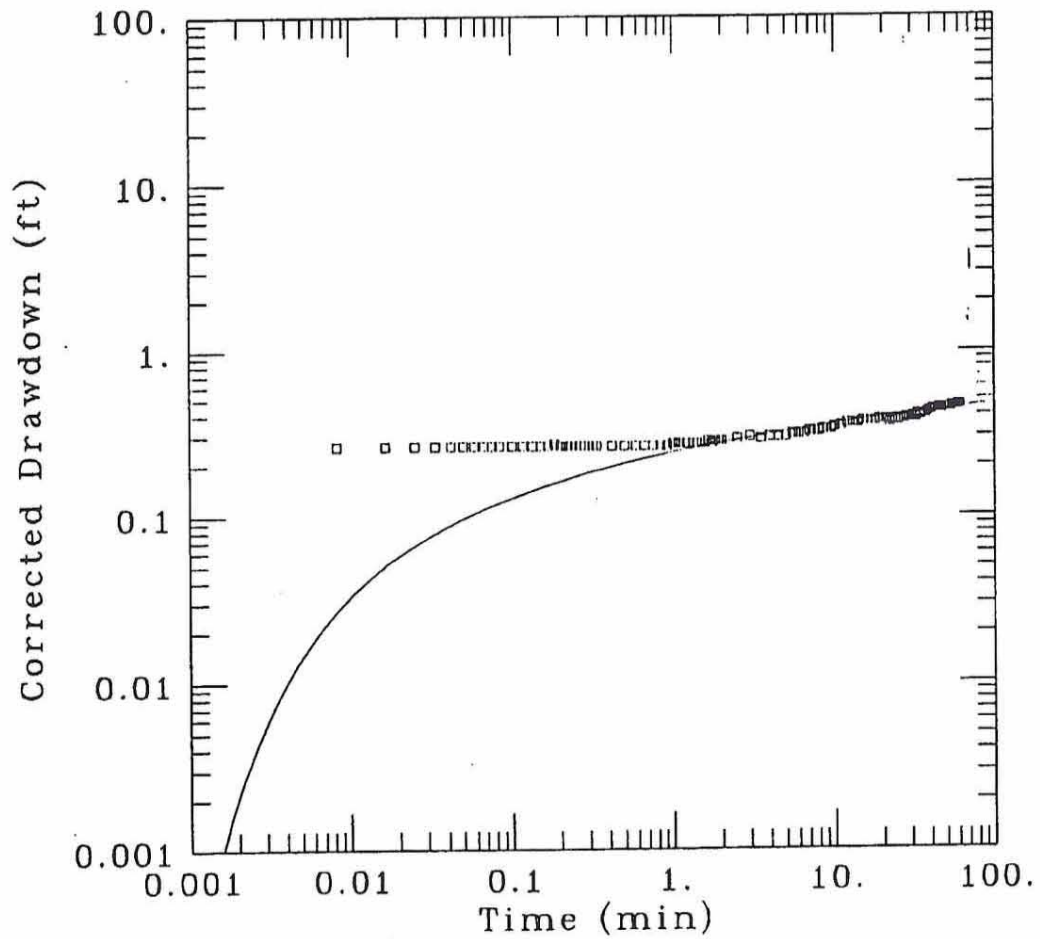
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
PZ-2

ESTIMATED PARAMETERS:
T = 2.291 ft^2/min
S = 0.0003156

TEST DATA:
Q = 0.8289 ft^3/min
r = 188. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

MW-6 (STEP 1) STEP DRAWDOWN TEST



DATA SET:
B: \DATA\MW6S1T7.AQT
05/04/92

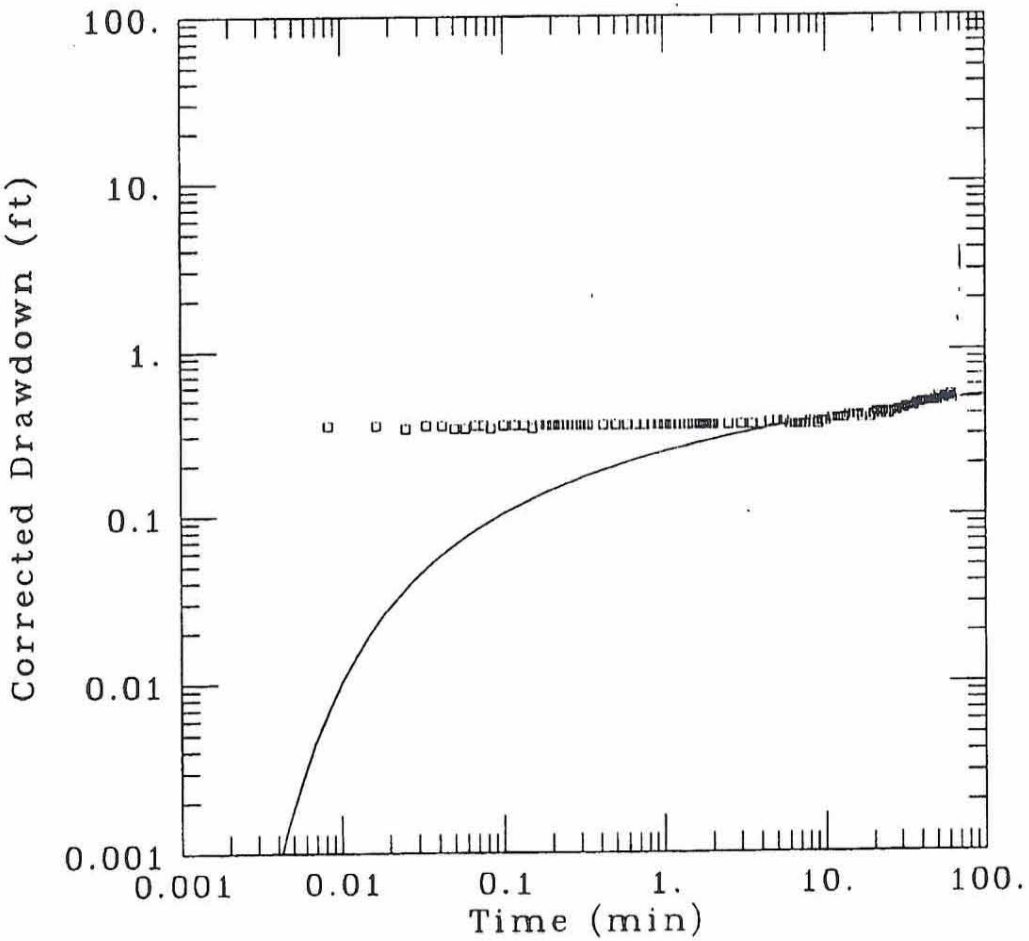
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
MW-6

ESTIMATED PARAMETERS:
T = 1.371 ft^2/min
S = 8.5433E-06

TEST DATA:
Q = 0.8289 ft^3/min
r = 50. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA,

PZ-1 (STEP 2) STEP DRAWDOWN TEST



DATA SET:
B:\DATA\PZ1S2T7.AQT
05/04/92

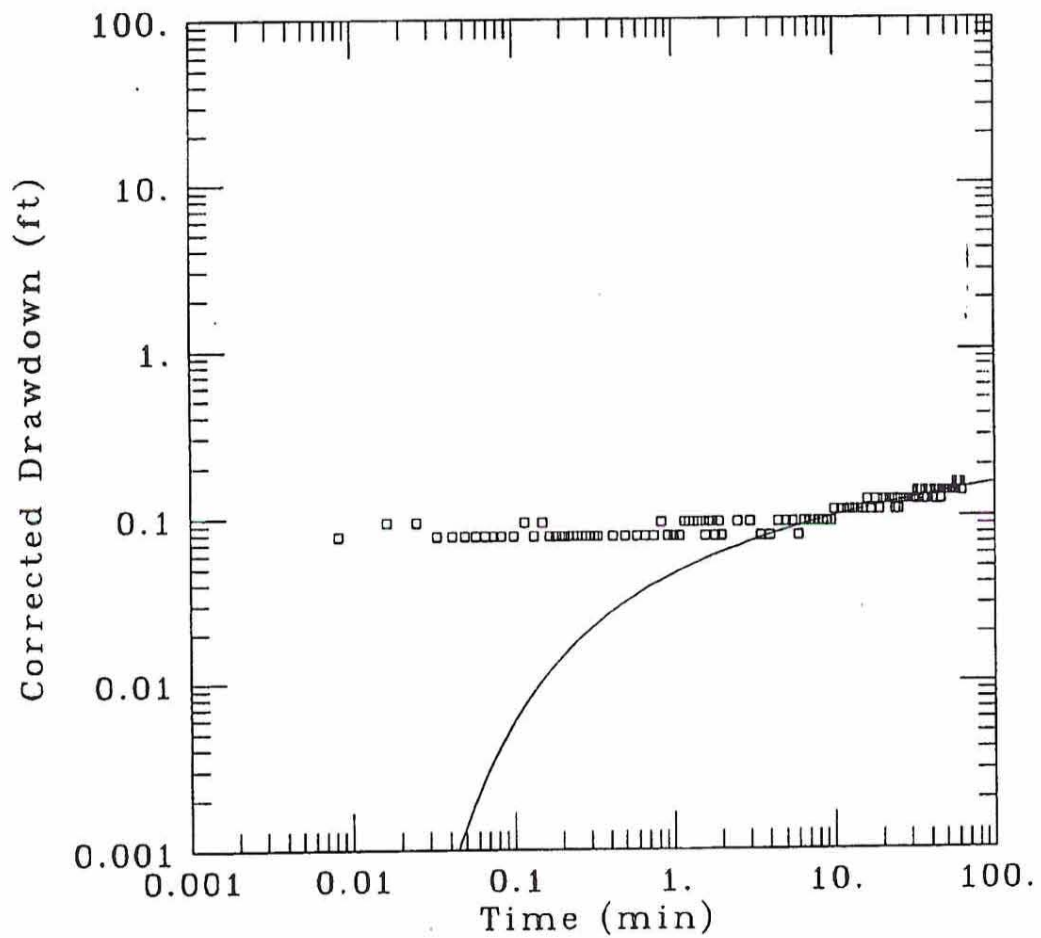
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
MW-6

ESTIMATED PARAMETERS:
T = 1.528 ft^2/min
S = 8.7837E-06

TEST DATA:
Q = 1.169 ft^3/min
r = 88. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-2 (STEP 2) STEP DRAWDOWN TEST



DATA SET:
B:\DATA\PZ2S2T7.AQT
05/04/92

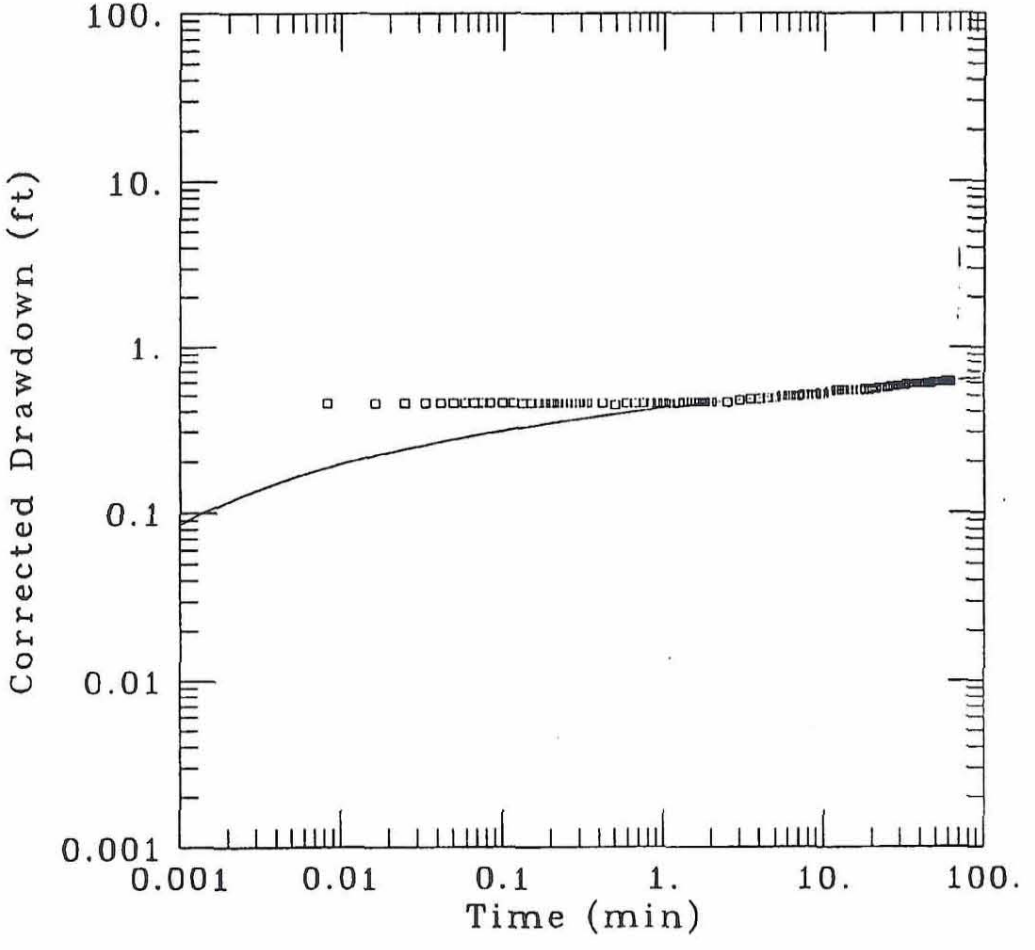
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
PZ-2

ESTIMATED PARAMETERS:
T = 3.773 ft^2/min
S = 3.7875E-05

TEST DATA:
Q = 1.169 ft^3/min
r = 188. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

MW-6 (STEP 2) STEP DRAWDOWN TEST



DATA SET:
B: \DATA\MW6S2T7.AQT
05/04/92

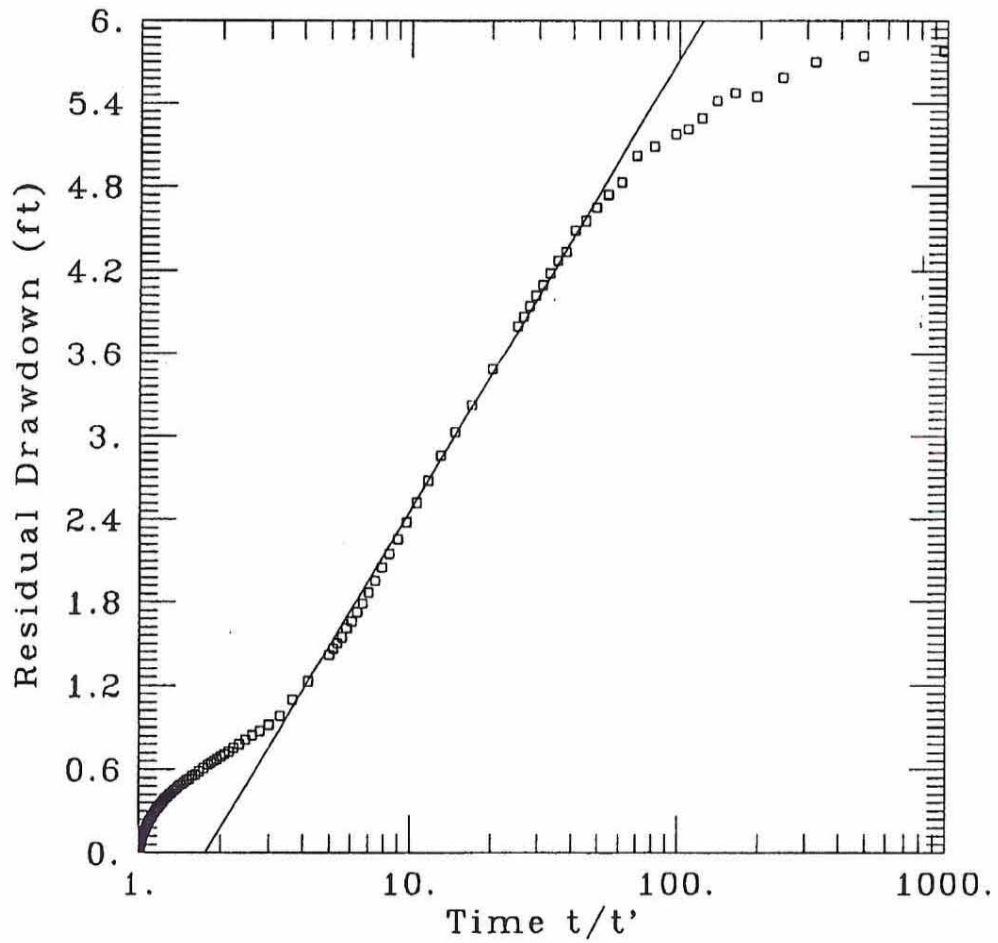
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
MW-6

ESTIMATED PARAMETERS:
T = 1.925 ft^2/min
S = 3.1595E-07

TEST DATA:
Q = 1.169 ft^3/min
r = 50. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

TW-1 RECOVERY DATA-PUMP TEST



DATA SET:
B: \DATA\TW1RD.AQT
05/01/92

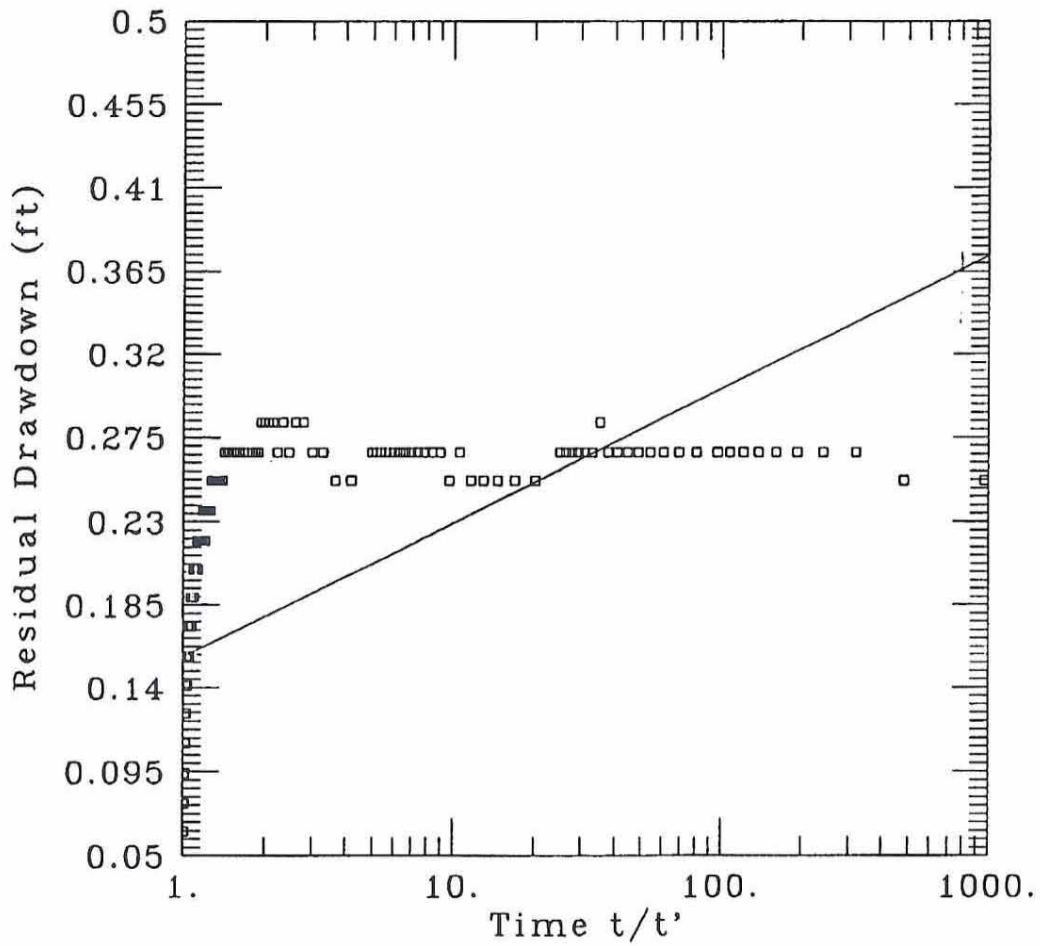
AQUIFER TYPE:
Confined
SOLUTION METHOD:
Theis Recovery
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
TW-1

ESTIMATED PARAMETERS:
T = 0.079 ft^2/min
S' = 1.755

TEST DATA:
Q = 1.404 ft^3/min
t pumping = 8. min

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-2 RECOVERY DATA-PUMP TEST



DATA SET:
B:\DATA\PZ2RD.AQT
05/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Theis Recovery

TEST DATE:
04/09/92

TEST WELL:
TW-1

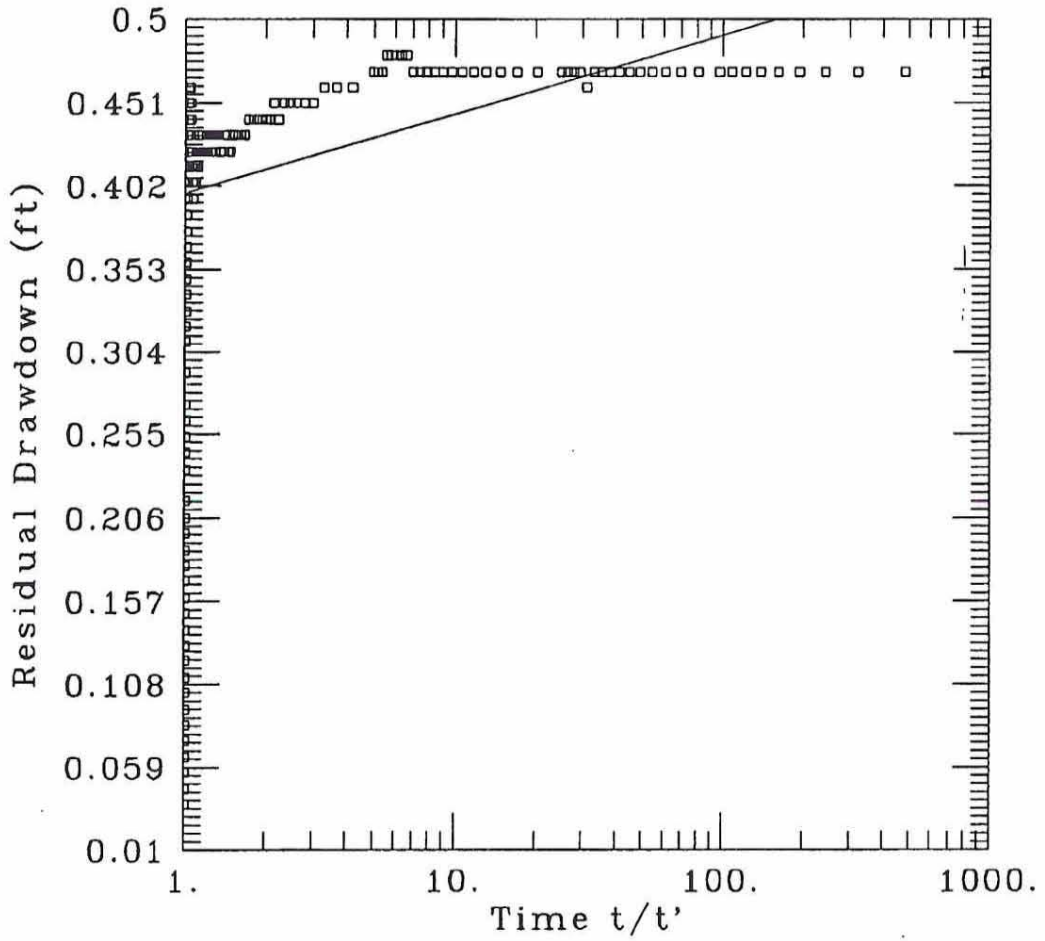
OBS. WELL:
PZ-2

ESTIMATED PARAMETERS:
T = 3.56 ft^2/min
S' = 0.006822

TEST DATA:
Q = 1.404 ft^3/min
t pumping = 8. min

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

MW-06 RECOVERY DATA-PUMP TEST



DATA SET:
B:\DATA\MW6RD.AQT
05/04/92

AQUIFER TYPE:
Confined

SOLUTION METHOD:
Theis Recovery

TEST DATE:
04/09/92

TEST WELL:
TW-1

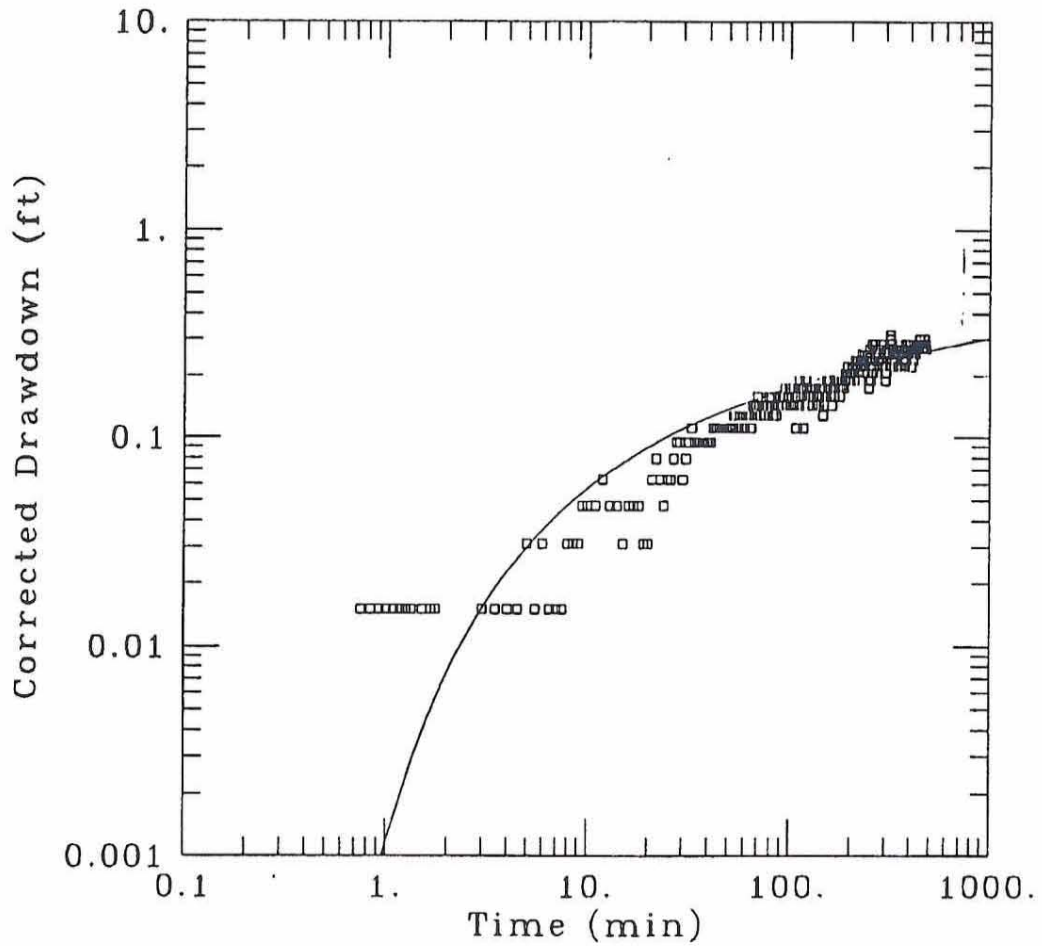
OBS. WELL:
MW-06

ESTIMATED PARAMETERS:
T = 5.545 ft^2/min
S' = 2.6887E-09

TEST DATA:
Q = 1.404 ft^3/min
t pumping = 8. min

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-1 PUMP TEST NAS-OCEANA



DATA SET:
B:\DATA\PZ1PT.AQT
05/04/92

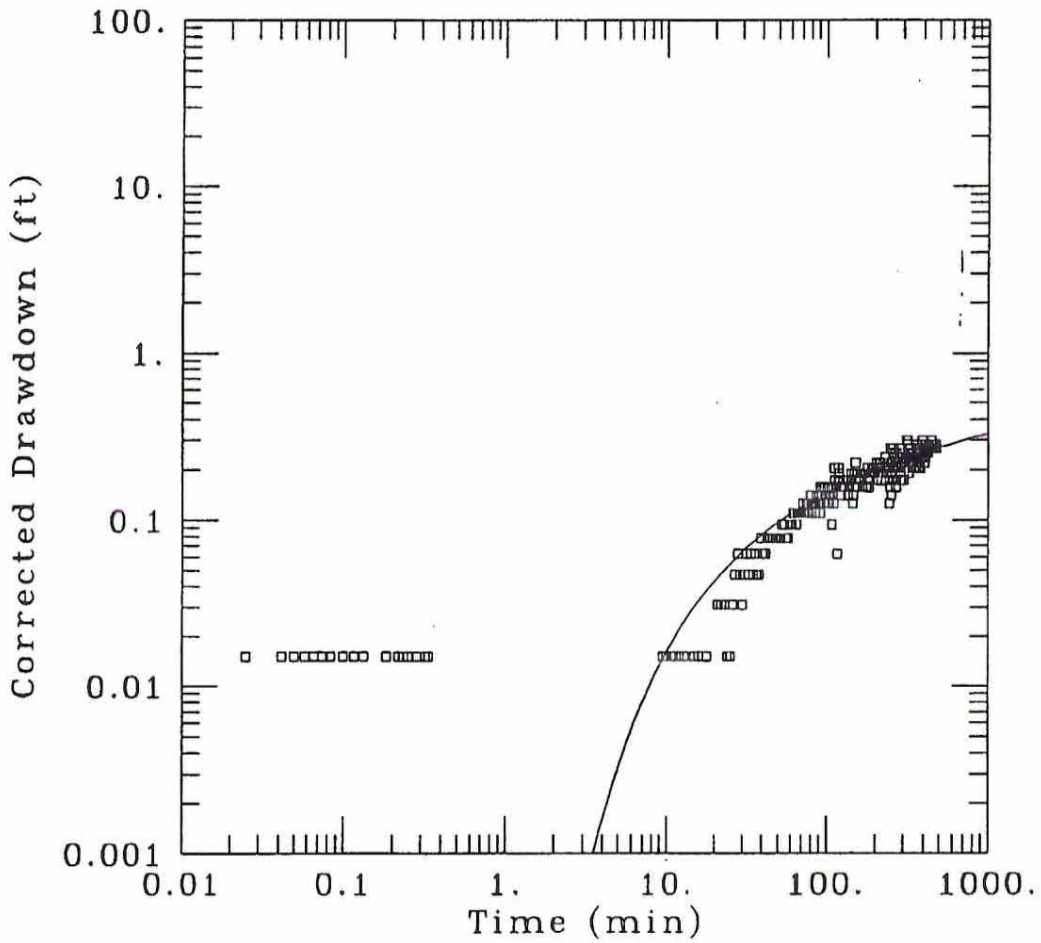
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
PZ-1

ESTIMATED PARAMETERS:
T = 1.991 ft^2/min
S = 0.002564

TEST DATA:
Q = 1.404 ft^3/min
r = 88. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

PZ-2 PUMP TEST NAS-OCEANA



DATA SET:
B: \DATA\PZ2PT.AQT
05/01/92

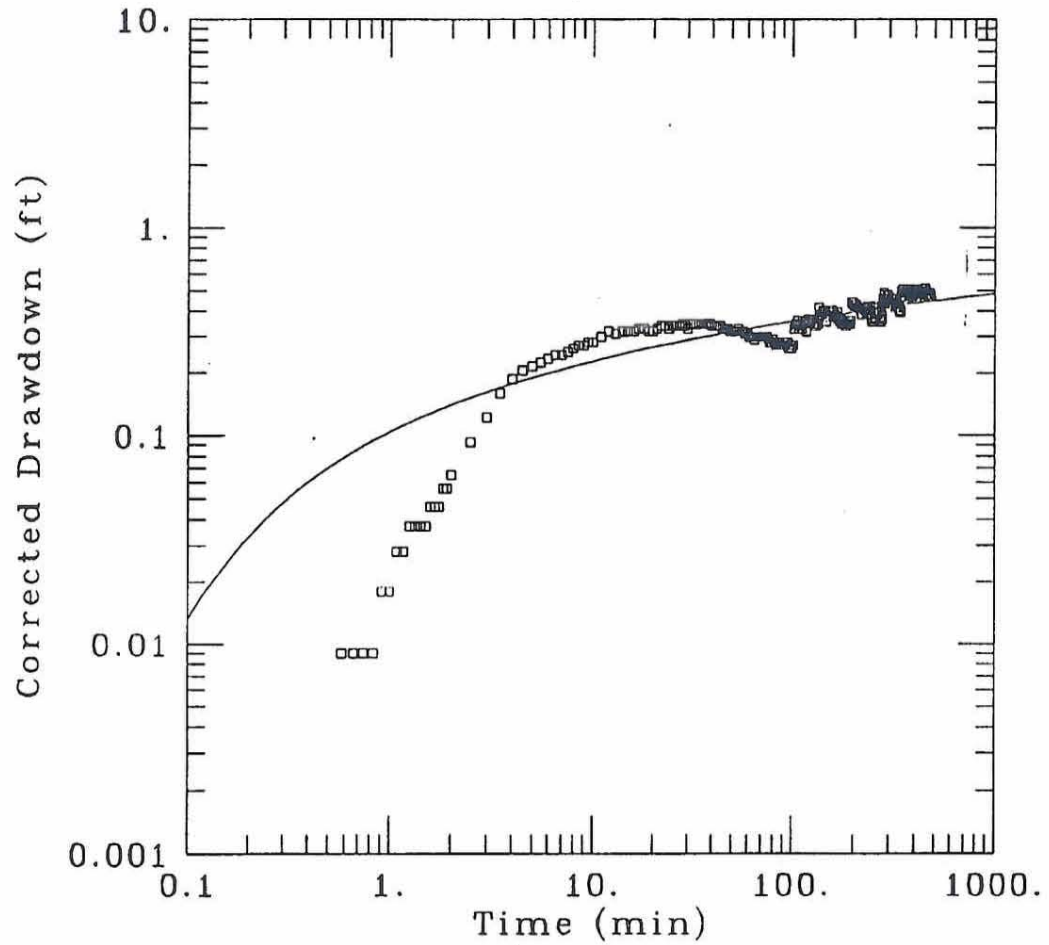
AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
PZ-2

ESTIMATED PARAMETERS:
T = 1.378 ft^2/min
S = 0.001576

TEST DATA:
Q = 1.404 ft^3/min
r = 188. ft
b = 50. ft

ROY F. WESTON, INC.	Client: NAS-OCEANA
Project No.: 6629-01-09	Location: VIRGINIA BEACH, VA.

MW-6 PUMP TEST NAS-OCEANA



DATA SET:
B: \DATA\MW6PT.AQT
05/01/92

AQUIFER TYPE:
Unconfined
SOLUTION METHOD:
Theis
TEST DATE:
04/09/92
TEST WELL:
TW-1
OBS. WELL:
MW-6

ESTIMATED PARAMETERS:
T = 2.028 ft^2/min
S = 0.0002915

TEST DATA:
Q = 1.404 ft^3/min
r = 50. ft
b = 50. ft

APPENDIX E

STEP-DRAWDOWN TEST, RECOVERY AND PUMP TEST PLOTS

RAW HERMIT DATA FROM THE STEP-DRAWDOWN, RECOVERY, AND PUMP TESTS

Step-Drawdown Data =	Test 7, Step 0
	Test 7, Step 1
	Test 7, Step 3
Pump Test Data =	Test 6, Step 0
Recovery Test Data =	Test 6, Step 1

SE2000
Environmental Logger
04/09 07:49

Unit# 03 Test 7

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	TW-01	PZ-1	PZ-2	MW-6
Reference	0.000	0.000	0.000	0.000
SG	1.000	1.000	1.000	1.000
Linearity	0.000	0.000	0.000	0.000
Scale factor	20.098	50.443	50.009	29.822
Offset	-0.210	0.010	-0.050	0.084
Delay mSEC	50.000	50.000	50.000	50.000

Step 0 04/08 16:28:52

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	-0.006	-0.015	0.000	-0.009
0.0083	1.140	-0.015	0.000	-0.009
0.0166	-0.354	-0.015	0.000	-0.009
0.0250	0.107	-0.015	0.000	-0.009
0.0333	0.088	-0.015	0.000	-0.009
0.0416	0.183	-0.015	0.000	-0.009
0.0500	0.139	-0.015	0.000	-0.009
0.0583	0.183	-0.015	0.000	-0.009
0.0666	0.202	-0.015	0.000	-0.009
0.0750	0.240	-0.015	0.000	-0.009
0.0833	0.253	-0.015	0.000	-0.009
0.1000	0.304	-0.015	0.000	-0.009
0.1166	0.316	-0.015	0.000	-0.009
0.1333	0.342	-0.015	0.000	-0.009
0.1500	0.405	-0.015	0.000	-0.009
0.1666	0.424	-0.015	0.000	-0.009
0.1833	0.430	-0.015	0.000	-0.009
0.2000	0.449	-0.015	0.000	-0.009
0.2166	0.475	-0.015	0.000	-0.009
0.2333	0.513	-0.015	0.000	-0.009
0.2500	0.494	-0.015	0.000	-0.009
0.2666	0.525	-0.015	0.000	-0.009
0.2833	0.582	-0.015	0.000	-0.009
0.3000	0.576	-0.015	0.000	-0.009
0.3166	0.544	-0.015	0.000	-0.009
0.3333	0.576	-0.015	0.000	-0.009
0.4166	0.753	-0.015	0.000	-0.009
0.5000	0.855	0.000	0.000	-0.009
0.5833	0.905	0.000	0.000	-0.009
0.6666	0.994	-0.015	0.000	-0.009
0.7500	1.095	-0.015	0.000	0.000
0.8333	1.178	-0.015	0.000	0.000
0.9166	1.285	-0.015	0.000	0.000
1.0000	1.399	-0.015	0.000	0.009
1.0833	1.457	-0.015	0.015	0.000
1.1666	1.514	0.000	0.015	0.009

1.2500	1.558	0.000	0.000	0.018
1.3333	1.615	0.000	0.015	0.009
1.4166	1.647	0.000	0.000	0.018
1.5000	1.697	0.000	0.000	0.028
1.5833	1.710	0.000	0.015	0.028
1.6666	1.742	0.000	0.000	0.028
1.7500	1.767	0.000	0.000	0.037
1.8333	1.824	0.000	0.015	0.037
1.9166	1.843	0.000	0.015	0.037
2.0000	1.862	0.000	0.015	0.037
2.5000	1.951	0.015	0.015	0.056
3.0000	2.033	0.000	0.000	0.056
3.5000	2.090	0.015	0.000	0.065
4.0000	2.147	0.015	0.000	0.084
4.5000	2.160	0.031	0.000	0.093
5.0000	2.191	0.031	0.015	0.112
5.5000	2.172	0.031	0.015	0.122
6.0000	2.267	0.031	0.000	0.122
6.5000	2.318	0.047	0.015	0.131
7.0000	2.350	0.047	0.015	0.140
7.5000	2.362	0.063	0.000	0.150
8.0000	2.286	0.063	0.015	0.159
8.5000	2.286	0.079	0.000	0.169
9.0000	2.312	0.079	0.015	0.178
9.5000	2.274	0.079	0.000	0.169
10.0000	2.261	0.079	0.015	0.178
11.0000	2.318	0.079	0.015	0.197
12.0000	2.204	0.079	0.015	0.197
13.0000	2.248	0.095	0.031	0.216
14.0000	2.299	0.111	0.047	0.216
15.0000	2.261	0.111	0.031	0.225
16.0000	2.280	0.111	0.031	0.225
17.0000	2.274	0.127	0.031	0.234
18.0000	2.286	0.127	0.031	0.234
19.0000	2.236	0.143	0.031	0.234
20.0000	2.248	0.158	0.031	0.244
21.0000	2.242	0.174	0.031	0.244
22.0000	2.293	0.190	0.047	0.253
23.0000	2.248	0.190	0.031	0.253
24.0000	2.274	0.190	0.047	0.263
25.0000	2.293	0.222	0.047	0.253
26.0000	2.274	0.286	0.047	0.263
27.0000	2.223	0.206	0.047	0.253
28.0000	2.267	0.206	0.031	0.263
29.0000	2.286	0.222	0.047	0.263
30.0000	2.299	0.222	0.047	0.272
31.0000	2.274	0.222	0.047	0.263

END

SE2000
Environmental Logger
04/09 07:42

Unit# 03 Test 7

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	TW-01	PZ-1	PZ-2	MW-6
Reference	0.000	0.000	0.000	0.000
SG	1.000	1.000	1.000	1.000
Linearity	0.000	0.000	0.000	0.000
Scale factor	20.098	50.443	50.009	29.822
Offset	-0.210	0.010	-0.050	0.084
Delay mSEC	50.000	50.000	50.000	50.000

Step 1 04/08 17:00:38

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	2.293	0.206	0.031	0.263
0.0083	2.293	0.222	0.031	0.263
0.0166	2.267	0.222	0.031	0.263
0.0250	2.318	0.222	0.031	0.263
0.0333	2.337	0.222	0.031	0.263
0.0416	2.305	0.222	0.031	0.263
0.0500	2.343	0.222	0.031	0.263
0.0583	2.286	0.222	0.031	0.263
0.0666	2.350	0.222	0.031	0.263
0.0750	2.324	0.222	0.031	0.263
0.0833	2.369	0.222	0.031	0.263
0.1000	2.362	0.222	0.031	0.263
0.1166	2.369	0.222	0.031	0.263
0.1333	2.350	0.222	0.031	0.263
0.1500	2.369	0.222	0.031	0.263
0.1666	2.356	0.222	0.031	0.263
0.1833	2.375	0.222	0.031	0.272
0.2000	2.407	0.222	0.031	0.263
0.2166	2.407	0.222	0.031	0.263
0.2333	2.407	0.222	0.031	0.263
0.2500	2.432	0.222	0.031	0.263
0.2666	2.413	0.222	0.031	0.263
0.2833	2.394	0.222	0.031	0.263
0.3000	2.407	0.222	0.031	0.263
0.3166	2.445	0.222	0.031	0.263
0.3333	2.470	0.222	0.031	0.263
0.4166	2.470	0.222	0.031	0.263
0.5000	2.495	0.222	0.031	0.263
0.5833	2.489	0.222	0.031	0.263
0.6666	2.540	0.222	0.031	0.263
0.7500	2.495	0.222	0.031	0.263
0.8333	2.527	0.238	0.031	0.263
0.9166	2.527	0.238	0.031	0.263
1.0000	2.533	0.238	0.031	0.272
1.0833	2.540	0.238	0.031	0.272
1.1666	2.533	0.238	0.031	0.272

1.2500	2.609	0.238	0.031	0.272
1.3333	2.559	0.238	0.031	0.272
1.4166	2.641	0.270	0.031	0.272
1.5000	2.755	0.286	0.031	0.272
1.5833	2.799	0.286	0.047	0.272
1.6666	2.901	0.286	0.031	0.281
1.7500	2.939	0.286	0.031	0.272
1.8333	2.933	0.286	0.031	0.281
1.9166	2.945	0.286	0.031	0.281
2.0000	2.939	0.286	0.031	0.281
2.5000	2.901	0.317	0.031	0.291
3.0000	2.914	0.333	0.031	0.300
3.5000	2.863	0.349	0.047	0.291
4.0000	2.869	0.333	0.031	0.300
4.5000	2.793	0.365	0.031	0.300
5.0000	2.819	0.270	0.031	0.300
5.5000	2.812	0.270	0.031	0.310
6.0000	2.806	0.286	0.031	0.310
6.5000	2.780	0.286	0.031	0.310
7.0000	2.780	0.286	0.031	0.319
7.5000	2.812	0.286	0.031	0.319
8.0000	2.825	0.302	0.047	0.319
8.5000	2.914	0.317	0.031	0.328
9.0000	2.907	0.349	0.031	0.328
9.5000	2.863	0.349	0.031	0.328
10.0000	2.857	0.381	0.047	0.338
11.0000	2.844	0.413	0.047	0.347
12.0000	2.907	0.413	0.063	0.357
13.0000	2.895	0.476	0.078	0.357
14.0000	2.888	0.445	0.063	0.357
15.0000	2.895	0.429	0.063	0.366
16.0000	2.850	0.445	0.063	0.366
17.0000	2.844	0.461	0.063	0.366
18.0000	2.844	0.429	0.063	0.366
19.0000	2.907	0.445	0.063	0.375
20.0000	2.907	0.190	0.078	0.375
21.0000	2.838	0.190	0.063	0.375
22.0000	2.819	0.174	0.063	0.357
23.0000	2.844	0.190	0.063	0.366
24.0000	2.888	0.206	0.078	0.375
25.0000	2.869	0.222	0.078	0.366
26.0000	2.793	0.206	0.047	0.375
27.0000	2.838	0.206	0.063	0.375
28.0000	2.869	0.206	0.063	0.385
29.0000	2.863	0.206	0.063	0.385
30.0000	2.888	0.206	0.063	0.385
31.0000	3.085	0.222	0.078	0.394
32.0000	3.116	0.206	0.063	0.385
33.0000	3.123	0.238	0.094	0.404
34.0000	3.059	0.222	0.063	0.394
35.0000	3.066	0.222	0.063	0.404
36.0000	3.097	0.238	0.063	0.404
37.0000	3.148	0.238	0.063	0.404
38.0000	3.167	0.254	0.078	0.413
39.0000	3.097	0.254	0.094	0.422
40.0000	3.097	0.254	0.094	0.422
41.0000	3.154	0.270	0.094	0.432
42.0000	3.142	0.270	0.094	0.432
43.0000	3.135	0.270	0.078	0.432
44.0000	3.167	0.254	0.094	0.432

45.0000	3.110	0.270	0.094	0.441
46.0000	3.142	0.270	0.078	0.432
47.0000	3.129	0.270	0.078	0.432
48.0000	3.154	0.270	0.078	0.441
49.0000	3.154	0.270	0.094	0.441
50.0000	3.123	0.286	0.094	0.441
51.0000	3.110	0.286	0.094	0.441
52.0000	3.154	0.286	0.094	0.441
53.0000	3.148	0.302	0.094	0.441
54.0000	3.097	0.302	0.094	0.451
55.0000	3.123	0.302	0.094	0.451
56.0000	3.116	0.317	0.094	0.451
57.0000	3.135	0.317	0.094	0.451
58.0000	3.085	0.317	0.094	0.451
59.0000	3.161	0.349	0.110	0.460
60.0000	3.148	0.365	0.110	0.460
61.0000	3.104	0.349	0.110	0.460

END

SE2000
Environmental Logger
04/09 07:32

Unit# 03 Test 7

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	TW-01	PZ-1	PZ-2	MW-6
Reference	0.000	0.000	0.000	0.000
SG	1.000	1.000	1.000	1.000
Linearity	0.000	0.000	0.000	0.000
Scale factor	20.098	50.443	50.009	29.822
Offset	-0.210	0.010	-0.050	0.084
Delay mSEC	50.000	50.000	50.000	50.000

Step 2 04/08 18:02:37

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	3.116	0.349	0.078	0.451
0.0083	3.167	0.349	0.078	0.451
0.0166	3.116	0.349	0.094	0.451
0.0250	3.161	0.333	0.094	0.451
0.0333	3.116	0.349	0.078	0.451
0.0416	3.180	0.349	0.078	0.451
0.0500	3.161	0.333	0.078	0.451
0.0583	3.161	0.333	0.078	0.451
0.0666	3.154	0.349	0.078	0.451
0.0750	3.154	0.349	0.078	0.451
0.0833	3.192	0.333	0.078	0.451
0.1000	3.218	0.349	0.078	0.451
0.1166	3.230	0.349	0.094	0.451
0.1333	3.268	0.349	0.078	0.451
0.1500	3.237	0.333	0.094	0.451
0.1666	3.224	0.349	0.078	0.451
0.1833	3.186	0.349	0.078	0.451
0.2000	3.211	0.349	0.078	0.451
0.2166	3.199	0.349	0.078	0.451
0.2333	3.186	0.349	0.078	0.451
0.2500	3.230	0.349	0.078	0.451
0.2666	3.243	0.349	0.078	0.451
0.2833	3.268	0.349	0.078	0.451
0.3000	3.275	0.349	0.078	0.451
0.3166	3.287	0.349	0.078	0.451
0.3333	3.287	0.349	0.078	0.451
0.4166	3.224	0.349	0.078	0.451
0.5000	3.313	0.349	0.078	0.441
0.5833	3.325	0.349	0.078	0.451
0.6666	3.287	0.349	0.078	0.451
0.7500	3.389	0.349	0.078	0.451
0.8333	3.458	0.349	0.094	0.451
0.9166	3.452	0.349	0.078	0.451
1.0000	3.503	0.349	0.078	0.451
1.0833	3.566	0.349	0.078	0.451
1.1666	3.547	0.349	0.094	0.451

1.2500	3.566	0.349	0.094	0.451
1.3333	3.642	0.349	0.094	0.460
1.4166	3.610	0.349	0.094	0.460
1.5000	3.629	0.349	0.094	0.460
1.5833	3.680	0.349	0.078	0.460
1.6666	3.629	0.349	0.094	0.460
1.7500	3.686	0.349	0.094	0.460
1.8333	3.705	0.349	0.078	0.460
1.9166	3.629	0.349	0.094	0.460
2.0000	3.724	0.349	0.078	0.460
2.5000	3.712	0.349	0.094	0.460
3.0000	3.762	0.349	0.094	0.469
3.5000	3.762	0.349	0.078	0.479
4.0000	3.775	0.349	0.078	0.479
4.5000	3.743	0.365	0.094	0.488
5.0000	3.737	0.365	0.094	0.488
5.5000	3.762	0.365	0.094	0.498
6.0000	3.775	0.349	0.078	0.498
6.5000	3.788	0.349	0.094	0.498
7.0000	3.794	0.349	0.094	0.498
7.5000	3.788	0.349	0.094	0.507
8.0000	3.794	0.365	0.094	0.507
8.5000	3.762	0.365	0.094	0.507
9.0000	3.718	0.349	0.094	0.507
9.5000	3.775	0.365	0.094	0.516
10.0000	4.219	0.365	0.110	0.516
11.0000	3.978	0.381	0.110	0.535
12.0000	3.813	0.381	0.110	0.545
13.0000	3.788	0.381	0.110	0.545
14.0000	3.750	0.397	0.110	0.545
15.0000	3.794	0.397	0.110	0.545
16.0000	3.813	0.397	0.126	0.545
17.0000	3.813	0.381	0.110	0.545
18.0000	3.838	0.397	0.126	0.554
19.0000	3.788	0.381	0.110	0.545
20.0000	3.788	0.397	0.126	0.554
21.0000	3.832	0.413	0.126	0.554
22.0000	3.857	0.413	0.126	0.563
23.0000	3.794	0.413	0.126	0.563
24.0000	3.851	0.397	0.110	0.563
25.0000	3.914	0.397	0.110	0.563
26.0000	3.933	0.413	0.126	0.573
27.0000	3.921	0.413	0.126	0.573
28.0000	3.927	0.413	0.126	0.573
29.0000	3.940	0.429	0.126	0.582
30.0000	3.927	0.429	0.126	0.582
31.0000	3.895	0.429	0.126	0.582
32.0000	3.883	0.445	0.126	0.582
33.0000	3.940	0.445	0.141	0.592
34.0000	3.895	0.445	0.141	0.592
35.0000	3.940	0.445	0.141	0.592
36.0000	3.914	0.445	0.126	0.592
37.0000	3.914	0.461	0.126	0.592
38.0000	3.952	0.461	0.126	0.592
39.0000	3.895	0.461	0.141	0.592
40.0000	3.965	0.476	0.141	0.592
41.0000	3.895	0.476	0.126	0.592
42.0000	3.978	0.476	0.141	0.592
43.0000	3.927	0.476	0.141	0.601
44.0000	3.946	0.476	0.141	0.601

45.0000	3.971	0.476	0.141	0.601
46.0000	3.952	0.476	0.126	0.592
47.0000	3.959	0.476	0.141	0.601
48.0000	3.940	0.476	0.141	0.610
49.0000	3.933	0.492	0.141	0.610
50.0000	3.965	0.476	0.141	0.610
51.0000	3.940	0.508	0.141	0.610
52.0000	3.914	0.492	0.141	0.610
53.0000	3.959	0.492	0.141	0.610
54.0000	3.908	0.492	0.141	0.610
55.0000	3.933	0.492	0.141	0.610
56.0000	3.952	0.508	0.141	0.610
57.0000	3.933	0.508	0.141	0.610
58.0000	3.908	0.508	0.157	0.620
59.0000	3.933	0.508	0.157	0.620
60.0000	3.914	0.508	0.157	0.620
61.0000	3.978	0.524	0.157	0.620
62.0000	3.914	0.492	0.141	0.610

END

SE2000
Environmental Logger
04/09 07:24

Unit# 03 Test 7

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	TW-01	PZ-1	PZ-2	MW-6
Reference	0.000	0.000	0.000	0.000
SG	1.000	1.000	1.000	1.000
Linearity	0.000	0.000	0.000	0.000
Scale factor	20.098	50.443	50.009	29.822
Offset	-0.210	0.010	-0.050	0.084
Delay mSEC	50.000	50.000	50.000	50.000

Step 3 04/08 19:04:51

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	3.927	0.492	0.141	0.610
0.0083	3.889	0.508	0.126	0.601
0.0166	3.895	0.508	0.126	0.610
0.0250	3.851	0.508	0.126	0.610
0.0333	3.857	0.492	0.126	0.610
0.0416	3.781	0.508	0.126	0.610
0.0500	3.731	0.492	0.126	0.610
0.0583	3.686	0.508	0.126	0.610
0.0666	3.642	0.508	0.126	0.610
0.0750	3.591	0.492	0.126	0.610
0.0833	3.553	0.508	0.126	0.610
0.1000	3.471	0.508	0.126	0.610
0.1166	3.389	0.508	0.126	0.610
0.1333	3.313	0.508	0.126	0.610
0.1500	3.249	0.508	0.126	0.610
0.1666	3.186	0.492	0.126	0.610
0.1833	3.123	0.508	0.126	0.610
0.2000	3.066	0.492	0.126	0.610
0.2166	3.009	0.508	0.126	0.610
0.2333	2.958	0.508	0.126	0.610
0.2500	2.914	0.508	0.126	0.610
0.2666	2.863	0.508	0.126	0.610
0.2833	2.819	0.492	0.141	0.610
0.3000	2.774	0.508	0.126	0.610
0.3166	2.723	0.508	0.126	0.610
0.3333	2.679	0.508	0.126	0.610
0.4166	2.464	0.508	0.126	0.601
0.5000	2.286	0.508	0.126	0.601
0.5833	2.128	0.508	0.126	0.601
0.6666	1.982	0.492	0.126	0.592
0.7500	1.849	0.508	0.141	0.592
0.8333	1.723	0.508	0.141	0.582
0.9166	1.615	0.508	0.126	0.582
1.0000	1.514	0.508	0.141	0.582
1.0833	1.431	0.508	0.141	0.573
1.1666	1.355	0.492	0.141	0.573

1.2500	1.292	0.492	0.126	0.573
1.3333	1.235	0.492	0.141	0.563
1.4166	1.178	0.508	0.141	0.554
1.5000	1.121	0.492	0.126	0.554
1.5833	1.064	0.492	0.126	0.554
1.6666	1.019	0.492	0.126	0.545
1.7500	0.975	0.492	0.126	0.545
1.8333	0.943	0.508	0.126	0.535
1.9166	0.918	0.508	0.126	0.535
2.0000	0.893	0.492	0.126	0.535
2.5000	0.785	0.492	0.126	0.507
3.0000	0.703	0.508	0.141	0.488
3.5000	0.627	0.508	0.141	0.469
4.0000	0.576	0.508	0.141	0.451
4.5000	0.525	0.492	0.141	0.441
5.0000	0.494	0.492	0.157	0.422
5.5000	0.462	0.492	0.157	0.404
6.0000	0.437	0.492	0.157	0.394
6.5000	0.418	0.476	0.157	0.375
7.0000	0.399	0.492	0.141	0.357
7.5000	0.380	0.476	0.157	0.357
8.0000	0.367	0.476	0.157	0.338
8.5000	0.354	0.476	0.141	0.328
9.0000	0.342	0.476	0.141	0.319
9.5000	0.335	0.461	0.141	0.310
10.0000	0.323	0.461	0.141	0.310
11.0000	0.310	0.461	0.141	0.291
12.0000	0.297	0.476	0.141	0.272
13.0000	0.285	0.476	0.141	0.263
14.0000	0.272	0.476	0.141	0.253
15.0000	0.266	0.476	0.157	0.244
16.0000	0.253	0.476	0.141	0.234
17.0000	0.247	0.461	0.141	0.225
18.0000	0.234	0.476	0.141	0.216
19.0000	0.228	0.476	0.141	0.206
20.0000	0.221	0.476	0.141	0.197
21.0000	0.215	0.476	0.141	0.197
22.0000	0.209	0.461	0.141	0.187
23.0000	0.202	0.429	0.126	0.178
24.0000	0.196	0.445	0.126	0.178
25.0000	0.190	0.445	0.141	0.169
26.0000	0.183	0.461	0.126	0.169
27.0000	0.183	0.445	0.141	0.159
28.0000	0.177	0.461	0.126	0.159
29.0000	0.171	0.445	0.126	0.150
30.0000	0.171	0.461	0.126	0.150
31.0000	0.164	0.476	0.126	0.140
32.0000	0.164	0.476	0.126	0.140
33.0000	0.164	0.476	0.126	0.140
34.0000	0.152	0.461	0.110	0.131
35.0000	0.152	0.461	0.126	0.131
36.0000	0.152	0.476	0.126	0.131
37.0000	0.152	0.461	0.110	0.112
38.0000	0.145	0.461	0.110	0.112

END

SE2000
Environmental Logger
04/10 16:53

Unit# 03 Test 6

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	TW-01	PZ-1	PZ-2	MW-6
Reference	0.000	0.000	0.000	0.000
SG	1.000	1.000	1.000	1.000
Linearity	0.000	0.000	0.000	0.000
Scale factor	20.098	50.443	50.009	29.822
Offset	-0.210	0.010	-0.050	0.084
Delay mSEC	50.000	50.000	50.000	50.000

Step 0 04/09 10:01:40

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	0.943	-0.015	-0.015	-0.009
0.0083	1.013	0.000	0.000	-0.009
0.0166	1.076	0.000	0.000	-0.009
0.0250	1.165	0.000	0.015	-0.009
0.0333	1.228	0.000	0.000	-0.009
0.0416	1.285	0.000	0.015	-0.009
0.0500	1.361	0.000	0.015	-0.009
0.0583	1.450	0.000	0.015	-0.009
0.0666	1.495	0.000	0.015	-0.009
0.0750	1.552	0.000	0.015	-0.009
0.0833	1.615	0.000	0.015	-0.009
0.1000	1.697	0.000	0.015	-0.009
0.1166	1.773	0.000	0.015	-0.009
0.1333	1.786	0.000	0.015	-0.009
0.1500	1.811	0.000	0.000	-0.009
0.1666	1.799	0.000	0.000	-0.009
0.1833	1.856	0.000	0.015	-0.009
0.2000	1.843	0.000	0.000	-0.009
0.2166	1.849	0.000	0.015	-0.009
0.2333	1.868	0.000	0.015	-0.009
0.2500	1.875	0.000	0.015	-0.009
0.2666	1.932	0.000	0.000	-0.009
0.2833	1.932	0.000	0.015	-0.009
0.3000	1.957	0.000	0.000	-0.009
0.3166	1.970	0.000	0.015	0.000
0.3333	1.995	0.000	0.015	-0.009
0.4166	2.084	0.000	0.000	0.000
0.5000	2.172	0.000	0.000	0.000
0.5833	2.274	0.000	0.000	0.009
0.6666	2.312	0.000	-0.015	0.009
0.7500	2.426	0.015	0.000	0.009
0.8333	2.565	0.015	0.000	0.009
0.9166	2.685	0.015	-0.015	0.018
1.0000	2.793	0.015	-0.015	0.018
1.0833	2.983	0.015	0.000	0.028
1.1666	3.173	0.015	0.000	0.028

1.2500	3.351	0.015	0.000	0.037
1.3333	3.496	0.015	0.000	0.037
1.4166	3.623	0.000	0.000	0.037
1.5000	3.731	0.015	0.000	0.037
1.5833	3.794	0.000	0.000	0.046
1.6666	3.864	0.015	0.000	0.046
1.7500	3.952	0.015	0.000	0.046
1.8333	4.028	0.000	0.000	0.056
1.9166	4.073	0.000	0.000	0.056
2.0000	4.111	0.000	0.000	0.065
2.5000	4.333	0.000	-0.015	0.093
3.0000	4.402	0.015	-0.015	0.122
3.5000	4.504	0.015	-0.015	0.159
4.0000	4.548	0.015	-0.015	0.187
4.5000	4.618	0.015	-0.015	0.206
5.0000	4.706	0.031	-0.015	0.216
5.5000	4.833	0.015	-0.015	0.225
6.0000	4.896	0.031	-0.015	0.234
6.5000	4.960	0.015	-0.015	0.244
7.0000	5.042	0.015	-0.015	0.244
7.5000	5.099	0.015	-0.015	0.253
8.0000	5.143	0.031	0.000	0.263
8.5000	5.213	0.031	0.000	0.272
9.0000	5.264	0.031	0.000	0.272
9.5000	5.270	0.047	0.015	0.281
10.0000	5.314	0.047	0.015	0.281
11.0000	5.390	0.047	0.015	0.300
12.0000	5.384	0.063	0.015	0.319
13.0000	5.409	0.047	0.015	0.310
14.0000	5.422	0.047	0.000	0.319
15.0000	5.447	0.031	0.015	0.319
16.0000	5.492	0.047	0.015	0.319
17.0000	5.517	0.047	-0.015	0.328
18.0000	5.511	0.047	0.015	0.328
19.0000	5.549	0.031	0.000	0.319
20.0000	5.574	0.031	0.000	0.319
21.0000	5.599	0.063	0.031	0.328
22.0000	5.657	0.079	0.031	0.338
23.0000	5.657	0.063	0.031	0.338
24.0000	5.618	0.047	0.015	0.328
25.0000	5.663	0.063	0.015	0.338
26.0000	5.638	0.063	0.031	0.338
27.0000	5.676	0.079	0.047	0.338
28.0000	5.682	0.095	0.063	0.347
29.0000	5.707	0.095	0.047	0.338
30.0000	5.707	0.063	0.031	0.328
31.0000	5.695	0.079	0.047	0.347
32.0000	5.745	0.095	0.063	0.347
33.0000	5.758	0.111	0.047	0.347
34.0000	5.758	0.095	0.063	0.347
35.0000	5.752	0.095	0.047	0.347
36.0000	5.701	0.095	0.063	0.347
37.0000	5.777	0.095	0.047	0.347
38.0000	5.796	0.095	0.047	0.347
39.0000	5.790	0.095	0.078	0.347
40.0000	5.802	0.095	0.063	0.338
41.0000	5.828	0.095	0.063	0.338
42.0000	5.834	0.111	0.063	0.338
43.0000	5.847	0.111	0.078	0.338
44.0000	5.834	0.111	0.078	0.338

45.0000	5.872	0.111	0.078	0.328
46.0000	5.853	0.111	0.078	0.328
47.0000	5.885	0.111	0.078	0.328
48.0000	5.828	0.111	0.078	0.328
49.0000	5.688	0.111	0.078	0.319
50.0000	5.714	0.111	0.078	0.319
51.0000	5.707	0.111	0.078	0.319
52.0000	5.688	0.111	0.078	0.319
53.0000	5.733	0.127	0.094	0.319
54.0000	5.739	0.127	0.094	0.328
55.0000	5.726	0.111	0.094	0.319
56.0000	5.733	0.111	0.078	0.319
57.0000	5.739	0.127	0.078	0.319
58.0000	5.752	0.111	0.078	0.310
59.0000	5.720	0.127	0.094	0.310
60.0000	5.739	0.111	0.094	0.310
61.0000	5.695	0.127	0.094	0.300
62.0000	5.733	0.127	0.110	0.300
63.0000	5.764	0.127	0.110	0.300
64.0000	5.752	0.127	0.094	0.300
65.0000	5.726	0.111	0.094	0.291
66.0000	5.733	0.143	0.110	0.300
67.0000	5.752	0.143	0.110	0.300
68.0000	5.739	0.143	0.110	0.300
69.0000	5.739	0.143	0.110	0.300
70.0000	5.764	0.158	0.110	0.300
71.0000	5.752	0.143	0.126	0.300
72.0000	5.739	0.127	0.110	0.300
73.0000	5.752	0.143	0.110	0.300
74.0000	5.771	0.143	0.110	0.300
75.0000	5.739	0.127	0.126	0.300
76.0000	5.733	0.127	0.110	0.291
77.0000	5.745	0.143	0.126	0.281
78.0000	5.777	0.143	0.110	0.281
79.0000	5.752	0.158	0.141	0.291
80.0000	5.726	0.143	0.141	0.291
81.0000	5.777	0.158	0.126	0.281
82.0000	5.739	0.143	0.126	0.281
83.0000	5.764	0.127	0.126	0.272
84.0000	5.726	0.143	0.126	0.281
85.0000	5.758	0.127	0.110	0.272
86.0000	5.783	0.127	0.126	0.272
87.0000	5.796	0.143	0.141	0.272
88.0000	5.802	0.143	0.126	0.272
89.0000	5.815	0.158	0.141	0.272
90.0000	5.790	0.158	0.126	0.281
91.0000	5.790	0.143	0.110	0.272
92.0000	5.802	0.158	0.157	0.281
93.0000	5.809	0.158	0.141	0.281
94.0000	5.815	0.158	0.141	0.281
95.0000	5.815	0.174	0.157	0.281
96.0000	5.815	0.143	0.126	0.263
97.0000	5.790	0.143	0.126	0.263
98.0000	5.796	0.158	0.157	0.272
99.0000	5.796	0.158	0.141	0.263
100.000	5.815	0.174	0.141	0.272
101.000	5.802	0.174	0.157	0.272
102.000	5.796	0.143	0.126	0.328
103.000	5.821	0.158	0.141	0.338
104.000	5.790	0.143	0.126	0.347

105.000	5.733	0.143	0.141	0.347
106.000	5.701	0.158	0.157	0.357
107.000	5.695	0.158	0.141	0.347
108.000	5.657	0.111	0.094	0.328
109.000	5.669	0.143	0.141	0.338
110.000	5.682	0.158	0.141	0.338
111.000	5.669	0.143	0.126	0.328
112.000	5.688	0.190	0.204	0.357
113.000	5.714	0.174	0.173	0.347
114.000	5.701	0.174	0.157	0.347
115.000	5.682	0.174	0.157	0.357
116.000	5.688	0.174	0.157	0.347
117.000	5.657	0.111	0.063	0.319
118.000	5.676	0.174	0.173	0.347
119.000	5.682	0.190	0.204	0.366
120.000	5.714	0.190	0.189	0.366
121.000	5.758	0.190	0.173	0.366
122.000	5.777	0.174	0.157	0.366
123.000	5.745	0.158	0.141	0.357
124.000	5.764	0.158	0.157	0.366
125.000	5.771	0.174	0.157	0.366
126.000	5.771	0.174	0.173	0.366
127.000	5.790	0.158	0.157	0.347
128.000	5.796	0.174	0.157	0.357
129.000	5.771	0.143	0.157	0.338
130.000	5.764	0.158	0.157	0.338
131.000	5.783	0.158	0.157	0.347
132.000	5.764	0.174	0.173	0.347
133.000	5.802	0.174	0.173	0.347
134.000	5.777	0.174	0.173	0.347
135.000	5.809	0.174	0.173	0.413
136.000	5.809	0.143	0.141	0.385
137.000	5.802	0.143	0.173	0.385
138.000	5.821	0.158	0.173	0.385
139.000	5.809	0.143	0.157	0.385
140.000	5.840	0.158	0.157	0.394
141.000	5.771	0.174	0.173	0.404
142.000	5.777	0.174	0.173	0.394
143.000	5.777	0.174	0.189	0.404
144.000	5.764	0.174	0.173	0.394
145.000	5.783	0.158	0.173	0.375
146.000	5.745	0.127	0.126	0.357
147.000	5.764	0.143	0.141	0.375
148.000	5.771	0.158	0.173	0.375
149.000	5.783	0.158	0.189	0.385
150.000	5.771	0.174	0.189	0.394
151.000	5.809	0.158	0.157	0.375
152.000	5.783	0.190	0.220	0.394
153.000	5.771	0.190	0.173	0.404
154.000	5.777	0.158	0.157	0.385
155.000	5.777	0.174	0.189	0.385
156.000	5.796	0.190	0.189	0.404
157.000	5.783	0.190	0.189	0.394
158.000	5.790	0.190	0.173	0.394
159.000	5.777	0.158	0.173	0.375
160.000	5.777	0.174	0.189	0.385
161.000	5.752	0.158	0.173	0.385
162.000	5.771	0.143	0.173	0.375
163.000	5.764	0.174	0.189	0.375
164.000	5.771	0.174	0.189	0.375

165.000	5.783	0.190	0.189	0.394
166.000	5.783	0.174	0.189	0.375
167.000	5.796	0.158	0.157	0.366
168.000	5.790	0.174	0.173	0.366
169.000	5.802	0.174	0.189	0.366
170.000	5.821	0.190	0.189	0.357
171.000	5.815	0.190	0.189	0.357
172.000	5.790	0.190	0.189	0.357
173.000	5.821	0.190	0.189	0.366
174.000	5.802	0.174	0.173	0.347
175.000	5.802	0.190	0.189	0.357
176.000	5.809	0.190	0.189	0.357
177.000	5.821	0.158	0.157	0.347
178.000	5.796	0.174	0.157	0.347
179.000	5.796	0.174	0.173	0.347
180.000	5.790	0.190	0.204	0.357
181.000	5.834	0.190	0.204	0.347
182.000	5.815	0.174	0.157	0.338
183.000	5.847	0.190	0.189	0.338
184.000	5.821	0.174	0.173	0.347
185.000	5.840	0.174	0.173	0.347
186.000	5.872	0.174	0.189	0.347
187.000	5.847	0.190	0.189	0.347
188.000	5.840	0.190	0.189	0.347
189.000	5.821	0.206	0.189	0.357
190.000	5.834	0.190	0.189	0.347
191.000	5.859	0.206	0.204	0.347
192.000	5.828	0.206	0.204	0.347
193.000	5.859	0.222	0.204	0.357
194.000	5.885	0.206	0.189	0.357
195.000	5.859	0.190	0.204	0.441
196.000	5.834	0.190	0.189	0.432
197.000	5.853	0.190	0.189	0.441
198.000	5.834	0.206	0.204	0.441
199.000	5.847	0.206	0.189	0.441
200.000	5.859	0.206	0.189	0.432
201.000	5.847	0.190	0.189	0.422
202.000	5.878	0.206	0.204	0.422
203.000	5.866	0.206	0.204	0.422
204.000	5.878	0.222	0.220	0.432
205.000	5.891	0.206	0.204	0.422
206.000	5.878	0.222	0.173	0.432
207.000	5.866	0.206	0.189	0.422
208.000	5.866	0.206	0.189	0.422
209.000	5.866	0.190	0.189	0.413
210.000	5.834	0.206	0.204	0.413
211.000	5.872	0.222	0.220	0.413
212.000	5.885	0.238	0.220	0.413
213.000	5.859	0.238	0.204	0.422
214.000	5.872	0.238	0.189	0.422
215.000	5.885	0.222	0.204	0.404
216.000	5.853	0.222	0.204	0.413
217.000	5.866	0.238	0.220	0.422
218.000	5.853	0.222	0.173	0.404
219.000	5.866	0.206	0.189	0.385
220.000	5.866	0.206	0.189	0.385
221.000	5.866	0.206	0.189	0.404
222.000	5.891	0.222	0.204	0.413
223.000	5.872	0.238	0.204	0.422
224.000	5.866	0.238	0.220	0.422

225.000	5.859	0.238	0.220	0.413
226.000	5.872	0.222	0.189	0.404
227.000	5.872	0.222	0.189	0.404
228.000	5.897	0.238	0.204	0.404
229.000	5.872	0.254	0.236	0.422
230.000	5.885	0.238	0.204	0.404
231.000	5.872	0.222	0.204	0.404
232.000	5.859	0.206	0.204	0.385
233.000	5.872	0.238	0.204	0.394
234.000	5.847	0.254	0.204	0.404
235.000	5.866	0.222	0.204	0.385
236.000	5.859	0.206	0.189	0.385
237.000	5.891	0.222	0.189	0.394
238.000	5.891	0.222	0.189	0.394
239.000	5.872	0.238	0.220	0.385
240.000	5.878	0.238	0.220	0.385
241.000	5.897	0.238	0.204	0.385
242.000	5.872	0.254	0.220	0.394
243.000	5.885	0.254	0.204	0.394
244.000	5.910	0.254	0.204	0.394
245.000	5.904	0.238	0.204	0.394
246.000	5.859	0.190	0.173	0.366
247.000	5.834	0.174	0.126	0.357
248.000	5.872	0.190	0.157	0.357
249.000	5.878	0.254	0.267	0.404
250.000	5.885	0.270	0.267	0.422
251.000	5.878	0.254	0.220	0.404
252.000	5.866	0.190	0.141	0.366
253.000	5.885	0.222	0.189	0.375
254.000	5.872	0.222	0.189	0.385
255.000	5.872	0.206	0.173	0.375
256.000	5.878	0.206	0.189	0.375
257.000	5.885	0.286	0.267	0.413
258.000	5.891	0.286	0.252	0.422
259.000	5.885	0.238	0.173	0.385
260.000	5.866	0.206	0.173	0.385
261.000	5.847	0.222	0.204	0.385
262.000	5.859	0.222	0.204	0.385
263.000	5.859	0.238	0.204	0.385
264.000	5.891	0.254	0.236	0.404
265.000	5.897	0.286	0.252	0.422
266.000	5.904	0.270	0.252	0.413
267.000	5.891	0.238	0.220	0.404
268.000	5.872	0.238	0.220	0.394
269.000	5.885	0.254	0.220	0.394
270.000	5.872	0.206	0.173	0.366
271.000	5.866	0.206	0.157	0.357
272.000	5.859	0.222	0.204	0.366
273.000	5.872	0.222	0.204	0.357
274.000	5.872	0.270	0.252	0.385
275.000	5.878	0.238	0.220	0.375
276.000	5.885	0.254	0.236	0.375
277.000	5.897	0.238	0.189	0.366
278.000	5.891	0.238	0.204	0.460
279.000	5.891	0.238	0.204	0.451
280.000	5.891	0.238	0.204	0.451
281.000	5.897	0.238	0.220	0.460
282.000	5.885	0.270	0.252	0.488
283.000	5.910	0.270	0.252	0.479
284.000	5.923	0.286	0.267	0.479

285.000	5.910	0.286	0.252	0.479
286.000	5.866	0.238	0.220	0.460
287.000	5.872	0.222	0.189	0.441
288.000	5.390	0.238	0.220	0.460
289.000	5.777	0.238	0.204	0.460
290.000	5.859	0.222	0.189	0.460
291.000	5.796	0.222	0.173	0.451
292.000	5.796	0.222	0.173	0.441
293.000	5.885	0.238	0.220	0.460
294.000	5.809	0.254	0.220	0.460
295.000	5.866	0.286	0.267	0.479
296.000	5.796	0.254	0.236	0.469
297.000	5.771	0.254	0.220	0.460
298.000	5.752	0.254	0.236	0.460
299.000	5.796	0.222	0.173	0.441
300.000	5.790	0.222	0.173	0.432
301.000	5.796	0.190	0.173	0.422
302.000	5.828	0.206	0.204	0.432
303.000	5.815	0.222	0.189	0.432
304.000	5.790	0.238	0.204	0.441
305.000	5.790	0.238	0.204	0.441
306.000	5.790	0.254	0.220	0.451
307.000	5.669	0.270	0.236	0.460
308.000	5.688	0.270	0.236	0.451
309.000	5.752	0.254	0.220	0.441
310.000	5.828	0.254	0.220	0.441
311.000	5.872	0.254	0.236	0.432
312.000	5.980	0.270	0.236	0.432
313.000	6.018	0.270	0.236	0.441
314.000	6.005	0.270	0.236	0.432
315.000	6.011	0.254	0.236	0.432
316.000	6.030	0.270	0.236	0.441
317.000	6.049	0.302	0.299	0.460
318.000	6.049	0.317	0.299	0.469
319.000	6.075	0.317	0.283	0.469
320.000	6.062	0.317	0.267	0.460
321.000	6.024	0.238	0.204	0.413
322.000	6.018	0.286	0.267	0.451
323.000	5.942	0.286	0.252	0.460
324.000	5.992	0.254	0.189	0.432
325.000	6.062	0.238	0.204	0.422
326.000	6.043	0.270	0.267	0.441
327.000	6.094	0.270	0.252	0.441
328.000	6.100	0.270	0.236	0.441
329.000	6.037	0.254	0.220	0.422
330.000	6.043	0.254	0.236	0.422
331.000	6.005	0.270	0.252	0.413
332.000	5.986	0.238	0.220	0.413
333.000	5.980	0.254	0.220	0.422
334.000	5.954	0.254	0.220	0.413
335.000	5.973	0.238	0.220	0.404
336.000	5.954	0.254	0.236	0.413
337.000	5.935	0.270	0.236	0.422
338.000	5.967	0.254	0.220	0.404
339.000	6.106	0.254	0.252	0.404
340.000	6.182	0.270	0.252	0.394
341.000	6.182	0.254	0.220	0.404
342.000	6.163	0.270	0.236	0.404
343.000	6.151	0.254	0.236	0.394
344.000	6.138	0.238	0.220	0.479

345.000	6.157	0.238	0.252	0.498
346.000	6.151	0.222	0.204	0.479
347.000	6.144	0.254	0.236	0.488
348.000	6.189	0.270	0.267	0.498
349.000	6.176	0.270	0.252	0.498
350.000	6.201	0.254	0.236	0.507
351.000	6.208	0.270	0.236	0.507
352.000	6.157	0.254	0.236	0.488
353.000	6.157	0.222	0.220	0.479
354.000	6.144	0.222	0.204	0.469
355.000	6.163	0.270	0.252	0.488
356.000	6.170	0.254	0.236	0.488
357.000	6.106	0.254	0.252	0.488
358.000	6.075	0.254	0.236	0.488
359.000	6.068	0.222	0.204	0.460
360.000	6.094	0.222	0.204	0.460
361.000	6.043	0.222	0.204	0.460
362.000	6.081	0.254	0.252	0.479
363.000	6.075	0.254	0.236	0.488
364.000	6.087	0.254	0.236	0.488
365.000	6.075	0.238	0.220	0.488
366.000	6.081	0.238	0.220	0.488
367.000	6.119	0.238	0.220	0.498
368.000	6.087	0.238	0.236	0.488
369.000	6.100	0.270	0.283	0.498
370.000	6.106	0.254	0.267	0.507
371.000	6.119	0.238	0.204	0.488
372.000	6.125	0.238	0.236	0.488
373.000	6.043	0.238	0.236	0.488
374.000	6.018	0.222	0.204	0.469
375.000	6.043	0.238	0.220	0.479
376.000	6.068	0.222	0.220	0.479
377.000	6.049	0.270	0.267	0.488
378.000	6.075	0.286	0.283	0.498
379.000	6.056	0.270	0.267	0.498
380.000	6.068	0.238	0.204	0.469
381.000	6.056	0.254	0.252	0.488
382.000	6.087	0.270	0.267	0.488
383.000	6.100	0.254	0.236	0.479
384.000	6.068	0.238	0.236	0.469
385.000	6.068	0.254	0.236	0.469
386.000	6.049	0.254	0.252	0.479
387.000	6.106	0.286	0.283	0.498
388.000	6.100	0.254	0.252	0.479
389.000	6.081	0.254	0.236	0.479
390.000	6.081	0.254	0.236	0.469
391.000	6.056	0.254	0.236	0.479
392.000	6.100	0.254	0.236	0.479
393.000	6.087	0.254	0.236	0.479
394.000	6.081	0.254	0.252	0.488
395.000	6.125	0.286	0.299	0.507
396.000	6.087	0.286	0.283	0.498
397.000	6.100	0.286	0.283	0.498
398.000	6.113	0.270	0.236	0.479
399.000	6.087	0.270	0.252	0.488
400.000	6.030	0.286	0.267	0.498
401.000	6.024	0.270	0.252	0.488
402.000	6.011	0.254	0.252	0.479
403.000	6.062	0.270	0.252	0.479
404.000	6.043	0.270	0.267	0.479

405.000	5.973	0.254	0.236	0.479
406.000	5.992	0.222	0.220	0.460
407.000	6.011	0.254	0.252	0.479
408.000	6.024	0.270	0.283	0.488
409.000	5.992	0.270	0.252	0.488
410.000	6.030	0.270	0.252	0.488
411.000	5.986	0.254	0.236	0.479
412.000	5.973	0.254	0.236	0.488
413.000	5.980	0.238	0.252	0.479
414.000	6.037	0.254	0.252	0.488
415.000	5.973	0.254	0.252	0.488
416.000	5.904	0.254	0.252	0.488
417.000	5.910	0.270	0.252	0.498
418.000	5.878	0.270	0.267	0.498
419.000	5.916	0.270	0.252	0.498
420.000	5.961	0.270	0.252	0.498
421.000	5.973	0.270	0.267	0.498
422.000	5.948	0.254	0.252	0.498
423.000	5.948	0.270	0.252	0.498
424.000	5.948	0.270	0.252	0.498
425.000	5.923	0.270	0.267	0.498
426.000	5.923	0.254	0.252	0.488
427.000	5.942	0.270	0.267	0.498
428.000	5.986	0.270	0.252	0.498
429.000	5.973	0.270	0.267	0.498
430.000	6.018	0.270	0.283	0.507
431.000	6.081	0.286	0.283	0.507
432.000	6.075	0.286	0.283	0.507
433.000	6.081	0.270	0.267	0.507
434.000	6.075	0.286	0.267	0.498
435.000	6.068	0.286	0.267	0.507
436.000	6.087	0.286	0.267	0.498
437.000	6.075	0.286	0.267	0.498
438.000	6.056	0.286	0.267	0.498
439.000	6.094	0.286	0.267	0.498
440.000	6.062	0.270	0.267	0.498
441.000	6.081	0.270	0.267	0.498
442.000	6.062	0.286	0.267	0.498
443.000	6.081	0.270	0.267	0.498
444.000	6.068	0.286	0.283	0.498
445.000	6.081	0.286	0.283	0.507
446.000	6.094	0.286	0.283	0.507
447.000	6.068	0.286	0.283	0.498
448.000	6.056	0.302	0.299	0.507
449.000	6.068	0.302	0.299	0.516
450.000	6.049	0.302	0.283	0.507
451.000	6.043	0.286	0.283	0.507
452.000	6.043	0.286	0.267	0.488
453.000	6.056	0.286	0.267	0.498
454.000	6.030	0.286	0.283	0.498
455.000	6.075	0.286	0.283	0.498
456.000	6.037	0.286	0.267	0.488
457.000	6.075	0.286	0.267	0.488
458.000	6.068	0.270	0.283	0.479
459.000	6.043	0.286	0.283	0.479
460.000	6.056	0.286	0.267	0.479
461.000	6.068	0.270	0.267	0.479
462.000	6.037	0.286	0.283	0.488
463.000	6.049	0.286	0.283	0.479
464.000	6.030	0.286	0.283	0.488

465.000	6.043	0.286	0.267	0.479
466.000	6.037	0.286	0.267	0.479
467.000	6.049	0.270	0.267	0.479
468.000	6.037	0.270	0.267	0.469
469.000	6.030	0.286	0.283	0.479
470.000	6.037	0.286	0.283	0.488
471.000	5.999	0.302	0.283	0.488
472.000	5.954	0.302	0.283	0.488
473.000	5.980	0.302	0.283	0.488
474.000	5.973	0.286	0.267	0.488
475.000	5.967	0.286	0.283	0.488
476.000	5.986	0.286	0.283	0.479
477.000	5.929	0.270	0.267	0.479
478.000	5.986	0.286	0.267	0.479
479.000	5.967	0.286	0.267	0.479
480.000	5.967	0.270	0.267	0.469

END

SE2000
Environmental Logger
04/10 17:25

Unit# 03 Test 6

Setups:	INPUT 1	INPUT 2	INPUT 3	INPUT 4
Type	Level (F)	Level (F)	Level (F)	Level (F)
Mode	TOC	TOC	TOC	TOC
I.D.	TW-01	PZ-1	PZ-2	MW-6
Reference	0.000	0.000	0.000	0.000
SG	1.000	1.000	1.000	1.000
Linearity	0.000	0.000	0.000	0.000
Scale factor	20.098	50.443	50.009	29.822
Offset	-0.210	0.010	-0.050	0.084
Delay mSEC	50.000	50.000	50.000	50.000

Step 1 04/09 18:01:54

Elapsed Time	INPUT 1	INPUT 2	INPUT 3	INPUT 4
0.0000	5.714	0.270	0.252	0.469
0.0083	5.777	0.270	0.252	0.469
0.0166	5.745	0.270	0.252	0.469
0.0250	5.701	0.270	0.267	0.469
0.0333	5.587	0.270	0.267	0.469
0.0416	5.447	0.270	0.267	0.469
0.0500	5.473	0.270	0.267	0.469
0.0583	5.416	0.270	0.267	0.469
0.0666	5.289	0.254	0.267	0.469
0.0750	5.213	0.270	0.267	0.469
0.0833	5.175	0.270	0.267	0.469
0.1000	5.086	0.270	0.267	0.469
0.1166	5.017	0.270	0.267	0.469
0.1333	4.827	0.270	0.267	0.469
0.1500	4.738	0.270	0.267	0.469
0.1666	4.649	0.270	0.267	0.469
0.1833	4.554	0.270	0.267	0.469
0.2000	4.485	0.270	0.267	0.469
0.2166	4.333	0.270	0.267	0.469
0.2333	4.269	0.270	0.283	0.469
0.2500	4.180	0.270	0.267	0.469
0.2666	4.098	0.270	0.267	0.460
0.2833	4.022	0.270	0.267	0.469
0.3000	3.946	0.270	0.267	0.469
0.3166	3.870	0.270	0.267	0.469
0.3333	3.800	0.270	0.267	0.469
0.4166	3.484	0.270	0.252	0.469
0.5000	3.224	0.270	0.252	0.469
0.5833	3.028	0.270	0.252	0.469
0.6666	2.857	0.270	0.252	0.469
0.7500	2.679	0.270	0.252	0.469
0.8333	2.521	0.270	0.267	0.469
0.9166	2.381	0.270	0.252	0.469
1.0000	2.255	0.270	0.267	0.469
1.0833	2.147	0.270	0.267	0.469
1.1666	2.052	0.286	0.267	0.469

1.2500	1.951	0.286	0.267	0.469
1.3333	1.868	0.286	0.267	0.469
1.4166	1.786	0.270	0.267	0.479
1.5000	1.723	0.270	0.267	0.479
1.5833	1.659	0.270	0.267	0.479
1.6666	1.609	0.286	0.267	0.479
1.7500	1.545	0.270	0.267	0.479
1.8333	1.501	0.270	0.267	0.469
1.9166	1.463	0.270	0.267	0.469
2.0000	1.419	0.270	0.267	0.469
2.5000	1.228	0.270	0.252	0.460
3.0000	1.095	0.270	0.252	0.460
3.5000	0.981	0.270	0.267	0.460
4.0000	0.918	0.270	0.267	0.451
4.5000	0.874	0.270	0.283	0.451
5.0000	0.842	0.270	0.283	0.451
5.5000	0.810	0.270	0.267	0.451
6.0000	0.779	0.270	0.283	0.451
6.5000	0.753	0.286	0.267	0.441
7.0000	0.728	0.286	0.283	0.451
7.5000	0.709	0.286	0.283	0.441
8.0000	0.690	0.286	0.283	0.441
8.5000	0.671	0.286	0.283	0.441
9.0000	0.658	0.286	0.267	0.441
9.5000	0.646	0.286	0.267	0.441
10.0000	0.633	0.286	0.267	0.441
11.0000	0.608	0.286	0.267	0.441
12.0000	0.582	0.286	0.267	0.432
13.0000	0.563	0.286	0.267	0.432
14.0000	0.551	0.286	0.267	0.432
15.0000	0.532	0.302	0.267	0.432
16.0000	0.519	0.302	0.267	0.432
17.0000	0.506	0.286	0.267	0.422
18.0000	0.494	0.286	0.267	0.422
19.0000	0.487	0.286	0.267	0.432
20.0000	0.475	0.286	0.252	0.422
21.0000	0.462	0.286	0.252	0.422
22.0000	0.456	0.286	0.252	0.422
23.0000	0.449	0.302	0.252	0.422
24.0000	0.443	0.302	0.252	0.432
25.0000	0.430	0.302	0.252	0.432
26.0000	0.424	0.286	0.252	0.432
27.0000	0.418	0.286	0.252	0.432
28.0000	0.405	0.302	0.252	0.432
29.0000	0.405	0.302	0.252	0.432
30.0000	0.399	0.286	0.252	0.432
31.0000	0.392	0.302	0.236	0.432
32.0000	0.392	0.302	0.236	0.432
33.0000	0.380	0.302	0.236	0.422
34.0000	0.373	0.302	0.236	0.432
35.0000	0.373	0.302	0.236	0.432
36.0000	0.361	0.302	0.236	0.432
37.0000	0.361	0.302	0.236	0.422
38.0000	0.354	0.302	0.236	0.422
39.0000	0.348	0.302	0.236	0.422
40.0000	0.348	0.302	0.220	0.422
41.0000	0.342	0.302	0.236	0.422
42.0000	0.335	0.302	0.236	0.422
43.0000	0.335	0.302	0.220	0.422
44.0000	0.329	0.302	0.236	0.422

45.0000	0.323	0.302	0.236	0.422
46.0000	0.323	0.302	0.220	0.422
47.0000	0.316	0.302	0.220	0.422
48.0000	0.316	0.302	0.220	0.422
49.0000	0.310	0.302	0.220	0.422
50.0000	0.310	0.302	0.220	0.422
51.0000	0.304	0.302	0.220	0.432
52.0000	0.304	0.302	0.220	0.432
53.0000	0.297	0.302	0.220	0.422
54.0000	0.291	0.302	0.220	0.422
55.0000	0.291	0.302	0.220	0.422
56.0000	0.291	0.302	0.220	0.422
57.0000	0.285	0.302	0.220	0.422
58.0000	0.285	0.302	0.220	0.422
59.0000	0.285	0.317	0.204	0.422
60.0000	0.272	0.302	0.220	0.422
61.0000	0.272	0.317	0.220	0.422
62.0000	0.272	0.302	0.220	0.422
63.0000	0.272	0.302	0.204	0.422
64.0000	0.272	0.302	0.220	0.422
65.0000	0.266	0.302	0.220	0.422
66.0000	0.266	0.317	0.204	0.422
67.0000	0.259	0.317	0.204	0.432
68.0000	0.259	0.317	0.204	0.432
69.0000	0.259	0.317	0.204	0.422
70.0000	0.253	0.317	0.204	0.422
71.0000	0.253	0.317	0.204	0.413
72.0000	0.253	0.317	0.204	0.413
73.0000	0.247	0.317	0.204	0.413
74.0000	0.247	0.317	0.204	0.413
75.0000	0.247	0.302	0.204	0.413
76.0000	0.240	0.302	0.204	0.422
77.0000	0.240	0.317	0.204	0.413
78.0000	0.240	0.317	0.204	0.422
79.0000	0.234	0.317	0.204	0.413
80.0000	0.234	0.302	0.204	0.413
81.0000	0.228	0.317	0.204	0.413
82.0000	0.228	0.317	0.189	0.413
83.0000	0.234	0.317	0.204	0.413
84.0000	0.228	0.302	0.189	0.404
85.0000	0.228	0.317	0.204	0.404
86.0000	0.228	0.302	0.189	0.404
87.0000	0.221	0.317	0.189	0.404
88.0000	0.221	0.317	0.189	0.404
89.0000	0.221	0.317	0.189	0.404
90.0000	0.221	0.317	0.189	0.404
91.0000	0.215	0.302	0.189	0.404
92.0000	0.215	0.302	0.189	0.404
93.0000	0.215	0.317	0.189	0.404
94.0000	0.215	0.317	0.189	0.413
95.0000	0.215	0.302	0.189	0.413
96.0000	0.215	0.302	0.189	0.413
97.0000	0.209	0.302	0.189	0.404
98.0000	0.202	0.286	0.189	0.404
99.0000	0.202	0.286	0.173	0.404
100.000	0.209	0.302	0.189	0.413
101.000	0.202	0.286	0.189	0.404
102.000	0.196	0.270	0.173	0.404
103.000	0.196	0.286	0.189	0.404
104.000	0.196	0.286	0.189	0.404

105.000	0.202	0.286	0.189	0.413
106.000	0.190	0.270	0.173	0.404
107.000	0.190	0.270	0.173	0.394
108.000	0.190	0.286	0.173	0.413
109.000	0.190	0.286	0.173	0.413
110.000	0.190	0.270	0.173	0.404
111.000	0.190	0.286	0.189	0.413
112.000	0.190	0.286	0.189	0.413
113.000	0.183	0.270	0.173	0.404
114.000	0.183	0.286	0.173	0.404
115.000	0.183	0.270	0.173	0.404
116.000	0.177	0.286	0.173	0.413
117.000	0.183	0.286	0.189	0.413
118.000	0.177	0.286	0.173	0.413
119.000	0.177	0.286	0.173	0.413
120.000	0.177	0.286	0.173	0.413
121.000	0.177	0.286	0.173	0.413
122.000	0.177	0.286	0.173	0.413
123.000	0.183	0.286	0.173	0.413
124.000	0.177	0.286	0.173	0.413
125.000	0.177	0.286	0.173	0.413
126.000	0.177	0.286	0.173	0.413
127.000	0.171	0.286	0.173	0.413
128.000	0.171	0.286	0.173	0.413
129.000	0.177	0.286	0.173	0.413
130.000	0.171	0.286	0.173	0.413
131.000	0.171	0.286	0.173	0.404
132.000	0.171	0.286	0.173	0.413
133.000	0.171	0.286	0.173	0.413
134.000	0.171	0.286	0.173	0.413
135.000	0.164	0.286	0.173	0.413
136.000	0.171	0.286	0.157	0.413
137.000	0.164	0.286	0.157	0.413
138.000	0.164	0.302	0.157	0.413
139.000	0.164	0.286	0.173	0.413
140.000	0.158	0.286	0.157	0.413
141.000	0.164	0.286	0.157	0.413
142.000	0.164	0.286	0.173	0.413
143.000	0.164	0.302	0.173	0.422
144.000	0.158	0.302	0.157	0.413
145.000	0.158	0.286	0.173	0.422
146.000	0.158	0.286	0.157	0.413
147.000	0.158	0.286	0.157	0.413
148.000	0.158	0.286	0.157	0.422
149.000	0.158	0.286	0.157	0.422
150.000	0.158	0.302	0.157	0.422
151.000	0.158	0.286	0.157	0.432
152.000	0.158	0.302	0.157	0.441
153.000	0.158	0.302	0.173	0.441
154.000	0.158	0.302	0.157	0.451
155.000	0.158	0.302	0.157	0.441
156.000	0.152	0.286	0.157	0.441
157.000	0.152	0.302	0.157	0.441
158.000	0.158	0.302	0.157	0.451
159.000	0.158	0.302	0.157	0.451
160.000	0.152	0.302	0.157	0.451
161.000	0.152	0.302	0.157	0.451
162.000	0.152	0.286	0.157	0.451
163.000	0.152	0.286	0.157	0.451
164.000	0.152	0.302	0.157	0.451

165.000	0.152	0.302	0.157	0.441
166.000	0.152	0.286	0.157	0.441
167.000	0.145	0.302	0.157	0.441
168.000	0.145	0.302	0.157	0.451
169.000	0.152	0.286	0.157	0.451
170.000	0.145	0.302	0.157	0.451
171.000	0.152	0.302	0.157	0.451
172.000	0.152	0.302	0.157	0.451
173.000	0.145	0.302	0.157	0.451
174.000	0.145	0.302	0.157	0.460
175.000	0.145	0.302	0.157	0.460
176.000	0.139	0.286	0.157	0.451
177.000	0.145	0.302	0.157	0.451
178.000	0.145	0.302	0.157	0.451
179.000	0.145	0.302	0.157	0.451
180.000	0.145	0.302	0.157	0.441
181.000	0.139	0.302	0.157	0.451
182.000	0.145	0.302	0.157	0.441
183.000	0.145	0.302	0.157	0.441
184.000	0.139	0.302	0.157	0.432
185.000	0.139	0.302	0.157	0.432
186.000	0.139	0.302	0.157	0.432
187.000	0.139	0.302	0.157	0.432
188.000	0.139	0.302	0.141	0.432
189.000	0.139	0.302	0.157	0.432
190.000	0.139	0.302	0.157	0.432
191.000	0.139	0.302	0.141	0.432
192.000	0.139	0.302	0.157	0.432
193.000	0.139	0.302	0.141	0.432
194.000	0.139	0.302	0.157	0.432
195.000	0.133	0.302	0.157	0.432
196.000	0.139	0.302	0.173	0.441
197.000	0.139	0.302	0.157	0.432
198.000	0.133	0.302	0.141	0.432
199.000	0.133	0.302	0.157	0.441
200.000	0.133	0.302	0.141	0.441
201.000	0.133	0.302	0.141	0.441
202.000	0.133	0.302	0.157	0.441
203.000	0.133	0.302	0.157	0.441
204.000	0.133	0.302	0.141	0.441
205.000	0.133	0.302	0.141	0.441
206.000	0.133	0.302	0.157	0.451
207.000	0.133	0.302	0.141	0.441
208.000	0.133	0.302	0.141	0.441
209.000	0.133	0.302	0.141	0.441
210.000	0.126	0.302	0.141	0.441
211.000	0.126	0.302	0.141	0.441
212.000	0.126	0.302	0.141	0.441
213.000	0.126	0.302	0.141	0.441
214.000	0.126	0.302	0.141	0.441
215.000	0.133	0.302	0.141	0.441
216.000	0.126	0.302	0.141	0.441
217.000	0.126	0.286	0.141	0.441
218.000	0.126	0.286	0.141	0.441
219.000	0.126	0.302	0.141	0.441
220.000	0.120	0.286	0.141	0.441
221.000	0.126	0.286	0.141	0.441
222.000	0.126	0.286	0.141	0.441
223.000	0.126	0.302	0.141	0.441
224.000	0.126	0.302	0.141	0.451

225.000	0.126	0.302	0.141	0.451
226.000	0.126	0.302	0.141	0.451
227.000	0.120	0.286	0.141	0.451
228.000	0.120	0.302	0.141	0.441
229.000	0.120	0.302	0.141	0.441
230.000	0.120	0.302	0.141	0.441
231.000	0.120	0.302	0.141	0.441
232.000	0.126	0.302	0.141	0.441
233.000	0.126	0.302	0.141	0.451
234.000	0.120	0.286	0.141	0.451
235.000	0.120	0.286	0.141	0.460
236.000	0.114	0.286	0.141	0.460
237.000	0.120	0.302	0.157	0.460
238.000	0.114	0.302	0.141	0.451
239.000	0.120	0.286	0.126	0.451
240.000	0.114	0.286	0.141	0.451
241.000	0.114	0.302	0.141	0.451
242.000	0.120	0.286	0.141	0.441
243.000	0.120	0.286	0.141	0.451
244.000	0.114	0.302	0.141	0.441
245.000	0.120	0.302	0.141	0.441
246.000	0.120	0.302	0.157	0.441
247.000	0.114	0.286	0.141	0.441
248.000	0.114	0.286	0.126	0.441
249.000	0.114	0.286	0.126	0.441
250.000	0.120	0.302	0.141	0.451
251.000	0.107	0.286	0.126	0.441
252.000	0.107	0.286	0.126	0.441
253.000	0.107	0.286	0.141	0.451
254.000	0.114	0.286	0.157	0.460
255.000	0.114	0.302	0.126	0.460
256.000	0.107	0.286	0.126	0.451
257.000	0.107	0.286	0.141	0.451
258.000	0.107	0.286	0.126	0.451
259.000	0.107	0.286	0.126	0.451
260.000	0.107	0.302	0.157	0.451
261.000	0.107	0.286	0.126	0.441
262.000	0.101	0.286	0.126	0.441
263.000	0.107	0.286	0.126	0.441
264.000	0.101	0.286	0.126	0.432
265.000	0.101	0.286	0.126	0.432
266.000	0.101	0.286	0.126	0.432
267.000	0.101	0.286	0.126	0.422
268.000	0.107	0.286	0.141	0.432
269.000	0.101	0.286	0.141	0.432
270.000	0.101	0.286	0.141	0.432
271.000	0.095	0.286	0.126	0.422
272.000	0.095	0.286	0.126	0.422
273.000	0.101	0.286	0.126	0.422
274.000	0.101	0.286	0.126	0.422
275.000	0.101	0.286	0.141	0.422
276.000	0.101	0.286	0.141	0.422
277.000	0.101	0.286	0.126	0.422
278.000	0.095	0.286	0.126	0.413
279.000	0.095	0.286	0.126	0.413
280.000	0.095	0.286	0.126	0.413
281.000	0.095	0.286	0.126	0.413
282.000	0.095	0.286	0.126	0.422
283.000	0.095	0.286	0.126	0.422
284.000	0.101	0.286	0.126	0.432

285.000	0.095	0.286	0.126	0.432
286.000	0.095	0.286	0.126	0.422
287.000	0.095	0.286	0.126	0.422
288.000	0.095	0.286	0.126	0.422
289.000	0.095	0.286	0.126	0.422
290.000	0.095	0.286	0.126	0.432
291.000	0.088	0.286	0.126	0.422
292.000	0.088	0.286	0.126	0.413
293.000	0.095	0.286	0.126	0.413
294.000	0.088	0.286	0.110	0.413
295.000	0.088	0.270	0.126	0.413
296.000	0.095	0.270	0.126	0.413
297.000	0.088	0.286	0.126	0.413
298.000	0.088	0.286	0.126	0.413
299.000	0.088	0.286	0.126	0.413
300.000	0.088	0.286	0.126	0.413
301.000	0.088	0.286	0.126	0.413
302.000	0.088	0.286	0.126	0.413
303.000	0.088	0.270	0.126	0.413
304.000	0.088	0.270	0.126	0.413
305.000	0.095	0.270	0.126	0.413
306.000	0.088	0.286	0.126	0.413
307.000	0.088	0.286	0.110	0.404
308.000	0.088	0.270	0.126	0.404
309.000	0.088	0.270	0.126	0.404
310.000	0.088	0.270	0.110	0.413
311.000	0.088	0.286	0.110	0.413
312.000	0.088	0.286	0.110	0.422
313.000	0.088	0.270	0.110	0.432
314.000	0.082	0.270	0.126	0.422
315.000	0.088	0.286	0.126	0.422
316.000	0.082	0.270	0.126	0.422
317.000	0.082	0.270	0.110	0.422
318.000	0.082	0.270	0.110	0.413
319.000	0.095	0.286	0.126	0.422
320.000	0.088	0.286	0.126	0.413
321.000	0.082	0.270	0.110	0.413
322.000	0.082	0.270	0.110	0.413
323.000	0.082	0.270	0.110	0.413
324.000	0.082	0.270	0.126	0.413
325.000	0.082	0.270	0.110	0.413
326.000	0.082	0.270	0.110	0.413
327.000	0.082	0.270	0.110	0.413
328.000	0.082	0.270	0.110	0.413
329.000	0.082	0.270	0.110	0.413
330.000	0.082	0.270	0.110	0.422
331.000	0.095	0.302	0.126	0.432
332.000	0.088	0.286	0.110	0.413
333.000	0.082	0.270	0.110	0.404
334.000	0.076	0.270	0.110	0.413
335.000	0.101	0.302	0.110	0.422
336.000	0.082	0.270	0.110	0.413
337.000	0.076	0.270	0.110	0.404
338.000	0.076	0.270	0.110	0.413
339.000	0.082	0.270	0.110	0.413
340.000	0.076	0.270	0.110	0.422
341.000	0.076	0.270	0.110	0.422
342.000	0.082	0.270	0.110	0.422
343.000	0.082	0.270	0.126	0.422
344.000	0.082	0.270	0.110	0.432

345.000	0.082	0.270	0.110	0.422
346.000	0.082	0.286	0.110	0.422
347.000	0.082	0.270	0.110	0.422
348.000	0.082	0.270	0.110	0.422
349.000	0.082	0.270	0.110	0.413
350.000	0.076	0.286	0.110	0.413
351.000	0.082	0.270	0.110	0.404
352.000	0.076	0.270	0.110	0.404
353.000	0.082	0.270	0.110	0.404
354.000	0.076	0.270	0.110	0.413
355.000	0.076	0.286	0.110	0.413
356.000	0.082	0.270	0.110	0.413
357.000	0.082	0.286	0.110	0.413
358.000	0.076	0.270	0.110	0.404
359.000	0.076	0.270	0.110	0.404
360.000	0.076	0.270	0.110	0.404
361.000	0.076	0.270	0.110	0.404
362.000	0.076	0.270	0.110	0.413
363.000	0.069	0.270	0.110	0.413
364.000	0.069	0.270	0.110	0.413
365.000	0.076	0.270	0.110	0.413
366.000	0.069	0.270	0.110	0.413
367.000	0.069	0.270	0.110	0.413
368.000	0.069	0.270	0.110	0.413
369.000	0.069	0.286	0.110	0.422
370.000	0.069	0.270	0.110	0.422
371.000	0.069	0.286	0.110	0.422
372.000	0.069	0.270	0.094	0.413
373.000	0.076	0.286	0.110	0.404
374.000	0.076	0.270	0.110	0.404
375.000	0.076	0.270	0.110	0.404
376.000	0.076	0.286	0.110	0.394
377.000	0.076	0.286	0.110	0.394
378.000	0.069	0.270	0.110	0.394
379.000	0.076	0.270	0.110	0.394
380.000	0.069	0.270	0.094	0.394
381.000	0.069	0.270	0.110	0.394
382.000	0.069	0.270	0.110	0.394
383.000	0.069	0.270	0.094	0.394
384.000	0.069	0.270	0.094	0.394
385.000	0.069	0.270	0.110	0.394
386.000	0.076	0.286	0.110	0.413
387.000	0.069	0.286	0.110	0.404
388.000	0.069	0.270	0.110	0.404
389.000	0.069	0.270	0.094	0.404
390.000	0.069	0.270	0.110	0.404
391.000	0.069	0.286	0.110	0.394
392.000	0.063	0.270	0.094	0.394
393.000	0.069	0.270	0.110	0.394
394.000	0.069	0.286	0.110	0.394
395.000	0.069	0.270	0.110	0.394
396.000	0.069	0.270	0.110	0.404
397.000	0.069	0.270	0.110	0.404
398.000	0.069	0.270	0.094	0.404
399.000	0.069	0.270	0.094	0.404
400.000	0.069	0.286	0.110	0.394
401.000	0.063	0.270	0.110	0.394
402.000	0.063	0.270	0.094	0.394
403.000	0.069	0.270	0.110	0.394
404.000	0.063	0.270	0.094	0.385

405.000	0.069	0.270	0.094	0.394
406.000	0.063	0.270	0.094	0.394
407.000	0.063	0.270	0.094	0.394
408.000	0.069	0.270	0.110	0.394
409.000	0.063	0.270	0.094	0.394
410.000	0.063	0.270	0.094	0.394
411.000	0.063	0.286	0.110	0.394
412.000	0.063	0.270	0.094	0.385
413.000	0.069	0.270	0.094	0.394
414.000	0.069	0.270	0.094	0.394
415.000	0.069	0.270	0.094	0.404
416.000	0.063	0.270	0.094	0.404
417.000	0.069	0.270	0.094	0.404
418.000	0.069	0.270	0.094	0.404
419.000	0.069	0.270	0.094	0.413
420.000	0.063	0.270	0.110	0.404
421.000	0.063	0.270	0.094	0.404
422.000	0.069	0.270	0.094	0.404
423.000	0.063	0.270	0.094	0.394
424.000	0.063	0.270	0.094	0.394
425.000	0.063	0.270	0.094	0.394
426.000	0.063	0.270	0.094	0.385
427.000	0.063	0.270	0.094	0.385
428.000	0.063	0.270	0.094	0.385
429.000	0.063	0.270	0.094	0.385
430.000	0.057	0.270	0.094	0.394
431.000	0.063	0.270	0.094	0.394
432.000	0.063	0.270	0.094	0.394
433.000	0.063	0.270	0.094	0.385
434.000	0.063	0.270	0.094	0.385
435.000	0.063	0.270	0.094	0.385
436.000	0.063	0.270	0.094	0.385
437.000	0.063	0.270	0.094	0.375
438.000	0.057	0.270	0.094	0.375
439.000	0.063	0.270	0.094	0.385
440.000	0.063	0.270	0.094	0.385
441.000	0.057	0.270	0.094	0.375
442.000	0.057	0.270	0.094	0.375
443.000	0.057	0.270	0.094	0.375
444.000	0.057	0.270	0.094	0.375
445.000	0.063	0.270	0.094	0.385
446.000	0.057	0.270	0.094	0.385
447.000	0.057	0.270	0.094	0.385
448.000	0.057	0.270	0.094	0.385
449.000	0.057	0.270	0.094	0.385
450.000	0.057	0.270	0.094	0.375
451.000	0.057	0.270	0.094	0.375
452.000	0.057	0.270	0.094	0.375
453.000	0.057	0.270	0.094	0.375
454.000	0.057	0.270	0.094	0.375
455.000	0.057	0.270	0.094	0.375
456.000	0.057	0.270	0.094	0.366
457.000	0.057	0.270	0.094	0.366
458.000	0.057	0.270	0.094	0.366
459.000	0.057	0.270	0.094	0.366
460.000	0.057	0.270	0.094	0.366
461.000	0.057	0.270	0.094	0.366
462.000	0.057	0.270	0.094	0.357
463.000	0.050	0.270	0.094	0.366
464.000	0.057	0.270	0.094	0.366

465.000	0.050	0.270	0.094	0.366
466.000	0.050	0.270	0.094	0.366
467.000	0.057	0.270	0.094	0.375
468.000	0.050	0.270	0.094	0.385
469.000	0.050	0.270	0.094	0.385
470.000	0.057	0.270	0.094	0.385
471.000	0.050	0.270	0.078	0.385
472.000	0.050	0.270	0.094	0.385
473.000	0.057	0.270	0.094	0.375
474.000	0.050	0.270	0.094	0.375
475.000	0.050	0.270	0.078	0.366
476.000	0.057	0.270	0.094	0.366
477.000	0.050	0.254	0.094	0.366
478.000	0.050	0.270	0.094	0.366
479.000	0.050	0.254	0.078	0.357
480.000	0.050	0.254	0.078	0.357
481.000	0.050	0.270	0.094	0.366
482.000	0.050	0.270	0.078	0.366
483.000	0.050	0.270	0.094	0.366
484.000	0.050	0.270	0.094	0.366
485.000	0.050	0.270	0.078	0.366
486.000	0.050	0.270	0.094	0.366
487.000	0.050	0.270	0.094	0.357
488.000	0.050	0.254	0.078	0.357
489.000	0.050	0.254	0.094	0.366
490.000	0.050	0.254	0.094	0.366
491.000	0.050	0.254	0.078	0.366
492.000	0.050	0.254	0.094	0.366
493.000	0.044	0.270	0.078	0.366
494.000	0.050	0.254	0.094	0.366
495.000	0.050	0.270	0.094	0.366
496.000	0.044	0.270	0.094	0.366
497.000	0.044	0.254	0.078	0.366
498.000	0.050	0.254	0.094	0.375
499.000	0.050	0.254	0.078	0.366
500.000	0.044	0.270	0.094	0.375
501.000	0.044	0.270	0.094	0.357
502.000	0.044	0.254	0.094	0.357
503.000	0.044	0.254	0.094	0.357
504.000	0.044	0.254	0.078	0.357
505.000	0.044	0.254	0.078	0.357
506.000	0.044	0.254	0.078	0.357
507.000	0.044	0.254	0.078	0.357
508.000	0.050	0.254	0.078	0.357
509.000	0.044	0.254	0.078	0.347
510.000	0.044	0.254	0.094	0.347
511.000	0.044	0.254	0.078	0.347
512.000	0.044	0.254	0.078	0.347
513.000	0.044	0.254	0.078	0.347
514.000	0.044	0.254	0.078	0.347
515.000	0.044	0.254	0.078	0.347
516.000	0.038	0.254	0.078	0.347
517.000	0.044	0.254	0.078	0.347
518.000	0.044	0.254	0.094	0.347
519.000	0.044	0.254	0.078	0.347
520.000	0.038	0.254	0.078	0.347
521.000	0.044	0.270	0.078	0.347
522.000	0.044	0.270	0.078	0.347
523.000	0.038	0.254	0.078	0.338
524.000	0.038	0.254	0.078	0.347

525.000	0.044	0.254	0.078	0.347
526.000	0.044	0.254	0.078	0.357
527.000	0.044	0.254	0.078	0.366
528.000	0.038	0.254	0.078	0.357
529.000	0.044	0.254	0.078	0.366
530.000	0.044	0.254	0.078	0.366
531.000	0.044	0.254	0.078	0.357
532.000	0.044	0.254	0.078	0.357
533.000	0.044	0.254	0.078	0.347
534.000	0.044	0.254	0.078	0.357
535.000	0.044	0.270	0.078	0.357
536.000	0.044	0.254	0.078	0.357
537.000	0.038	0.254	0.078	0.357
538.000	0.038	0.254	0.078	0.347
539.000	0.044	0.254	0.078	0.347
540.000	0.044	0.254	0.078	0.347
541.000	0.038	0.254	0.078	0.338
542.000	0.044	0.254	0.078	0.338
543.000	0.038	0.254	0.078	0.338
544.000	0.038	0.254	0.078	0.347
545.000	0.044	0.254	0.078	0.347
546.000	0.038	0.254	0.078	0.347
547.000	0.038	0.254	0.078	0.347
548.000	0.038	0.254	0.078	0.338
549.000	0.038	0.254	0.078	0.347
550.000	0.038	0.254	0.078	0.338
551.000	0.038	0.254	0.078	0.347
552.000	0.038	0.254	0.078	0.347
553.000	0.038	0.254	0.078	0.347
554.000	0.038	0.254	0.078	0.338
555.000	0.038	0.254	0.078	0.338
556.000	0.038	0.254	0.078	0.338
557.000	0.031	0.254	0.078	0.338
558.000	0.038	0.254	0.078	0.328
559.000	0.038	0.254	0.078	0.328
560.000	0.038	0.254	0.078	0.328
561.000	0.038	0.254	0.078	0.328
562.000	0.038	0.254	0.078	0.328
563.000	0.038	0.254	0.078	0.328
564.000	0.031	0.254	0.078	0.328
565.000	0.031	0.254	0.078	0.328
566.000	0.038	0.254	0.078	0.328
567.000	0.031	0.254	0.078	0.328
568.000	0.038	0.254	0.078	0.328
569.000	0.038	0.254	0.078	0.328
570.000	0.031	0.254	0.078	0.328
571.000	0.031	0.254	0.078	0.328
572.000	0.038	0.254	0.078	0.338
573.000	0.038	0.254	0.078	0.338
574.000	0.038	0.254	0.078	0.338
575.000	0.038	0.254	0.078	0.338
576.000	0.038	0.254	0.078	0.338
577.000	0.044	0.270	0.078	0.347
578.000	0.038	0.254	0.078	0.347
579.000	0.038	0.254	0.078	0.347
580.000	0.038	0.254	0.078	0.347
581.000	0.038	0.254	0.078	0.347
582.000	0.038	0.254	0.078	0.338
583.000	0.038	0.254	0.078	0.347
584.000	0.038	0.254	0.078	0.338

585.000	0.038	0.254	0.078	0.338
586.000	0.038	0.254	0.078	0.328
587.000	0.038	0.254	0.078	0.328
588.000	0.038	0.254	0.078	0.328
589.000	0.038	0.254	0.063	0.319
590.000	0.031	0.254	0.078	0.319
591.000	0.038	0.270	0.078	0.319
592.000	0.038	0.254	0.078	0.328
593.000	0.038	0.254	0.063	0.319
594.000	0.038	0.270	0.078	0.319
595.000	0.038	0.254	0.078	0.319
596.000	0.038	0.254	0.078	0.328
597.000	0.031	0.254	0.063	0.328
598.000	0.038	0.254	0.078	0.328
599.000	0.038	0.254	0.078	0.338
600.000	0.038	0.254	0.078	0.338
601.000	0.038	0.254	0.063	0.338
602.000	0.031	0.254	0.078	0.338
603.000	0.038	0.254	0.078	0.338
604.000	0.038	0.254	0.078	0.347
605.000	0.038	0.254	0.078	0.347
606.000	0.031	0.254	0.078	0.347
607.000	0.038	0.254	0.078	0.357
608.000	0.038	0.254	0.078	0.357
609.000	0.031	0.254	0.063	0.347
610.000	0.038	0.254	0.078	0.347
611.000	0.031	0.254	0.078	0.338
612.000	0.038	0.254	0.063	0.338
613.000	0.031	0.270	0.078	0.338
614.000	0.031	0.254	0.063	0.328
615.000	0.038	0.270	0.078	0.328
616.000	0.031	0.254	0.063	0.328
617.000	0.031	0.254	0.063	0.328
618.000	0.038	0.254	0.078	0.328
619.000	0.031	0.254	0.078	0.328
620.000	0.031	0.254	0.063	0.319
621.000	0.031	0.254	0.063	0.328
622.000	0.038	0.254	0.078	0.328
623.000	0.031	0.254	0.078	0.328
624.000	0.038	0.254	0.063	0.319
625.000	0.031	0.254	0.063	0.328
626.000	0.031	0.254	0.063	0.328
627.000	0.038	0.254	0.078	0.319
628.000	0.031	0.254	0.078	0.319
629.000	0.031	0.254	0.078	0.328
630.000	0.031	0.254	0.078	0.328
631.000	0.031	0.254	0.078	0.338
632.000	0.038	0.254	0.078	0.338
633.000	0.038	0.254	0.078	0.338
634.000	0.038	0.254	0.063	0.338
635.000	0.031	0.254	0.063	0.338
636.000	0.038	0.270	0.078	0.338
637.000	0.038	0.270	0.078	0.328
638.000	0.038	0.254	0.078	0.328
639.000	0.031	0.254	0.063	0.319
640.000	0.031	0.254	0.063	0.319
641.000	0.038	0.254	0.063	0.319
642.000	0.031	0.254	0.078	0.319
643.000	0.031	0.254	0.063	0.319
644.000	0.031	0.254	0.078	0.310

645.000	0.031	0.254	0.063	0.310
646.000	0.031	0.254	0.078	0.319
647.000	0.031	0.270	0.078	0.319
648.000	0.031	0.254	0.078	0.319
649.000	0.025	0.254	0.063	0.328
650.000	0.031	0.254	0.063	0.328
651.000	0.031	0.254	0.078	0.338
652.000	0.025	0.254	0.063	0.328
653.000	0.031	0.254	0.063	0.328
654.000	0.031	0.254	0.063	0.328
655.000	0.031	0.270	0.063	0.319
656.000	0.031	0.254	0.063	0.319
657.000	0.031	0.254	0.063	0.319
658.000	0.031	0.254	0.078	0.310
659.000	0.031	0.254	0.063	0.319
660.000	0.025	0.254	0.063	0.310
661.000	0.025	0.254	0.063	0.310
662.000	0.031	0.254	0.063	0.319
663.000	0.031	0.254	0.063	0.319
664.000	0.031	0.254	0.063	0.328
665.000	0.031	0.254	0.063	0.328
666.000	0.031	0.254	0.063	0.328
667.000	0.031	0.254	0.078	0.328
668.000	0.031	0.254	0.063	0.328
669.000	0.031	0.254	0.063	0.328
670.000	0.031	0.254	0.063	0.338
671.000	0.038	0.254	0.078	0.338
672.000	0.031	0.254	0.063	0.338
673.000	0.031	0.254	0.063	0.328
674.000	0.031	0.254	0.063	0.328
675.000	0.031	0.254	0.078	0.319
676.000	0.031	0.254	0.063	0.319
677.000	0.031	0.254	0.078	0.328
678.000	0.031	0.254	0.063	0.319
679.000	0.031	0.254	0.078	0.319
680.000	0.025	0.254	0.063	0.319
681.000	0.031	0.254	0.063	0.319
682.000	0.031	0.254	0.078	0.319
683.000	0.031	0.254	0.063	0.319
684.000	0.031	0.254	0.078	0.319
685.000	0.031	0.270	0.063	0.319
686.000	0.031	0.254	0.063	0.310
687.000	0.031	0.254	0.063	0.319
688.000	0.031	0.254	0.063	0.310
689.000	0.031	0.254	0.063	0.310
690.000	0.031	0.254	0.063	0.310
691.000	0.031	0.254	0.078	0.310
692.000	0.031	0.254	0.078	0.310
693.000	0.031	0.254	0.063	0.310
694.000	0.031	0.254	0.063	0.328
695.000	0.031	0.254	0.063	0.328
696.000	0.031	0.254	0.063	0.328
697.000	0.031	0.254	0.078	0.328
698.000	0.031	0.254	0.078	0.328
699.000	0.031	0.254	0.063	0.319
700.000	0.031	0.254	0.063	0.319
701.000	0.031	0.270	0.063	0.319
702.000	0.031	0.254	0.078	0.319
703.000	0.038	0.270	0.078	0.319
704.000	0.031	0.270	0.063	0.319

705.000	0.031	0.270	0.063	0.319
706.000	0.031	0.254	0.063	0.319
707.000	0.031	0.270	0.063	0.319
708.000	0.031	0.254	0.063	0.310
709.000	0.031	0.270	0.063	0.319
710.000	0.031	0.254	0.063	0.328
711.000	0.038	0.270	0.063	0.338
712.000	0.031	0.270	0.063	0.328
713.000	0.031	0.270	0.063	0.328
714.000	0.031	0.254	0.063	0.328
715.000	0.031	0.254	0.063	0.319
716.000	0.031	0.270	0.063	0.319
717.000	0.031	0.254	0.063	0.319
718.000	0.031	0.254	0.063	0.319
719.000	0.038	0.270	0.063	0.319
720.000	0.031	0.254	0.063	0.319
721.000	0.031	0.270	0.078	0.319
722.000	0.038	0.270	0.078	0.319
723.000	0.038	0.254	0.063	0.319
724.000	0.031	0.270	0.063	0.319
725.000	0.031	0.270	0.078	0.319
726.000	0.031	0.254	0.063	0.319
727.000	0.031	0.270	0.063	0.319
728.000	0.031	0.270	0.078	0.319
729.000	0.038	0.254	0.063	0.319
730.000	0.038	0.270	0.078	0.328
731.000	0.038	0.270	0.063	0.338
732.000	0.031	0.270	0.063	0.338
733.000	0.031	0.270	0.063	0.338
734.000	0.038	0.270	0.063	0.338
735.000	0.031	0.254	0.078	0.338
736.000	0.031	0.270	0.078	0.338
737.000	0.038	0.254	0.063	0.338
738.000	0.038	0.270	0.078	0.338
739.000	0.038	0.270	0.063	0.338
740.000	0.038	0.270	0.063	0.338
741.000	0.038	0.270	0.078	0.338
742.000	0.038	0.270	0.063	0.319
743.000	0.038	0.270	0.078	0.310
744.000	0.038	0.254	0.078	0.291
745.000	0.038	0.270	0.078	0.272
746.000	0.038	0.270	0.063	0.263
747.000	0.038	0.254	0.063	0.253
748.000	0.038	0.270	0.078	0.244
749.000	0.038	0.270	0.063	0.234
750.000	0.038	0.270	0.078	0.216
751.000	0.038	0.270	0.063	0.206
752.000	0.038	0.270	0.063	0.197
753.000	0.038	0.270	0.078	0.197
754.000	0.038	0.270	0.078	0.197
755.000	0.038	0.270	0.078	0.187
756.000	0.038	0.270	0.063	0.178
757.000	0.038	0.270	0.078	0.178
758.000	0.038	0.270	0.078	0.169
759.000	0.038	0.270	0.078	0.159
760.000	0.038	0.270	0.078	0.159
761.000	0.031	0.270	0.078	0.150
762.000	0.038	0.270	0.078	0.150
763.000	0.038	0.270	0.078	0.140
764.000	0.038	0.270	0.078	0.140

765.000	0.038	0.270	0.078	0.140
766.000	0.038	0.270	0.078	0.140
767.000	0.038	0.270	0.078	0.131
768.000	0.038	0.270	0.078	0.131
769.000	0.038	0.270	0.078	0.122
770.000	0.038	0.270	0.078	0.122
771.000	0.044	0.270	0.078	0.122
772.000	0.044	0.270	0.078	0.112
773.000	0.044	0.270	0.078	0.112
774.000	0.044	0.270	0.078	0.103
775.000	0.044	0.270	0.063	0.093
776.000	0.038	0.270	0.078	0.093
777.000	0.044	0.270	0.078	0.093
778.000	0.044	0.270	0.078	0.093
779.000	0.044	0.270	0.078	0.084
780.000	0.044	0.270	0.078	0.084
781.000	0.044	0.270	0.078	0.084
782.000	0.044	0.270	0.078	0.084
783.000	0.044	0.270	0.078	0.075
784.000	0.038	0.270	0.078	0.075
785.000	0.038	0.270	0.078	0.075
786.000	0.044	0.270	0.063	0.075
787.000	0.044	0.270	0.078	0.075
788.000	0.044	0.270	0.078	0.075
789.000	0.044	0.270	0.078	0.075
790.000	0.044	0.270	0.063	0.075
791.000	0.044	0.270	0.078	0.084
792.000	0.044	0.270	0.078	0.075
793.000	0.044	0.270	0.078	0.075
794.000	0.044	0.270	0.078	0.084
795.000	0.044	0.286	0.078	0.084
796.000	0.044	0.270	0.078	0.084
797.000	0.044	0.270	0.078	0.075
798.000	0.044	0.270	0.078	0.075
799.000	0.044	0.270	0.078	0.075
800.000	0.050	0.286	0.078	0.065
801.000	0.044	0.286	0.078	0.075
802.000	0.044	0.270	0.078	0.065
803.000	0.044	0.286	0.078	0.065
804.000	0.050	0.270	0.078	0.065
805.000	0.044	0.270	0.078	0.065
806.000	0.044	0.270	0.078	0.065
807.000	0.044	0.286	0.078	0.065
808.000	0.044	0.286	0.078	0.056
809.000	0.044	0.286	0.078	0.056
810.000	0.044	0.286	0.078	0.056
811.000	0.044	0.286	0.078	0.056
812.000	0.050	0.270	0.078	0.056
813.000	0.044	0.286	0.078	0.056
814.000	0.044	0.286	0.078	0.056
815.000	0.044	0.286	0.078	0.065
816.000	0.044	0.286	0.078	0.065
817.000	0.044	0.286	0.078	0.075
818.000	0.050	0.286	0.078	0.065
819.000	0.050	0.286	0.078	0.065
820.000	0.050	0.286	0.078	0.065
821.000	0.044	0.286	0.078	0.056
822.000	0.044	0.286	0.078	0.056
823.000	0.050	0.286	0.094	0.065
824.000	0.044	0.286	0.078	0.065

825.000	0.044	0.286	0.078	0.065
826.000	0.050	0.286	0.078	0.065
827.000	0.044	0.286	0.078	0.056
828.000	0.050	0.286	0.078	0.056
829.000	0.044	0.286	0.078	0.056
830.000	0.044	0.286	0.078	0.056
831.000	0.050	0.286	0.078	0.046
832.000	0.050	0.286	0.078	0.056
833.000	0.050	0.286	0.078	0.046
834.000	0.050	0.286	0.078	0.046
835.000	0.050	0.286	0.078	0.046
836.000	0.050	0.286	0.078	0.037
837.000	0.044	0.286	0.078	0.046
838.000	0.050	0.286	0.078	0.046
839.000	0.044	0.286	0.078	0.037
840.000	0.050	0.286	0.063	0.046
841.000	0.044	0.286	0.078	0.046
842.000	0.050	0.286	0.078	0.046
843.000	0.050	0.286	0.078	0.046
844.000	0.050	0.286	0.078	0.046
845.000	0.050	0.286	0.078	0.046
846.000	0.050	0.286	0.078	0.056
847.000	0.050	0.286	0.078	0.056
848.000	0.050	0.286	0.078	0.065
849.000	0.050	0.286	0.078	0.065
850.000	0.050	0.286	0.078	0.056
851.000	0.050	0.286	0.078	0.065
852.000	0.050	0.286	0.078	0.056
853.000	0.044	0.286	0.078	0.056
854.000	0.050	0.286	0.078	0.056
855.000	0.050	0.286	0.078	0.056
856.000	0.050	0.286	0.078	0.065
857.000	0.050	0.286	0.078	0.056
858.000	0.050	0.286	0.094	0.056
859.000	0.050	0.286	0.078	0.056
860.000	0.057	0.286	0.078	0.056
861.000	0.050	0.286	0.078	0.056
862.000	0.050	0.286	0.078	0.056
863.000	0.050	0.286	0.078	0.056
864.000	0.050	0.286	0.094	0.046
865.000	0.050	0.286	0.078	0.046
866.000	0.050	0.286	0.078	0.056
867.000	0.050	0.286	0.078	0.046
868.000	0.050	0.286	0.078	0.046
869.000	0.050	0.286	0.078	0.046
870.000	0.050	0.286	0.078	0.056
871.000	0.050	0.286	0.094	0.056
872.000	0.050	0.302	0.078	0.056
873.000	0.050	0.302	0.094	0.056
874.000	0.050	0.302	0.094	0.056
875.000	0.050	0.302	0.094	0.056
876.000	0.050	0.286	0.078	0.056
877.000	0.050	0.286	0.094	0.056
878.000	0.050	0.286	0.078	0.046
879.000	0.044	0.286	0.078	0.046

END

APPENDIX F

LABORATORY ANALYSES

APR 2 2 1992

ENVIRONMENTAL TESTING SERVICES, INC.

P.O. Box 12715 • 888 Norfolk Square • Norfolk, Virginia 23502 • (804) 461-ETSI (3874) • Fax (804) 461-0379

Roy F. Weston, Inc.
Attn: Mr. Marvin Farmer
287 Independence Blvd.
Pembroke II Suite 113
Virginia Beach, Virginia 23462

Preliminary results for Job #6629-01-09.
Sample delivery dates: March 6, March 12, March 13, April 2, April 3 and April 10, 1992.

I. **Total Petroleum Hydrocarbons**: SW-846 Method 8015, modified.

Matrix: Soil

Sample ID	TPH in mg/kg	DF	Type
20SB-01-01	679	2	Kero
20SB-01-02	332	2	Kero
20SB-02-01	5	2	Kero
20SB-02-02	7	2	Kero
20SB-03-01	6	2	Kero
20SB-03-02	6	2	Kero
20SB-03-Dup.	5	2	Kero
20SB-04-01	85	2	Kero
20SB-04-02	10	2	Kero
20SB-05-01	173	2	Kero
20SB-05-02	291	2	Kero
20SB-05-Dup.	115	2	Kero
20SB-06b-01	3	2	Kero
20SB-06b-03	<1	2	ND
20SB-07-01	3	2	ND
20SB-07-02	2	2	ND
20SB-08-01	454	2	Kero
20SB-08-02	178	2	Kero
20SB-09b-01	1	2	ND
20SB-09-02	<1	2	ND

(Continued...)

Anne S. Burnett
Quality Control Officer

I. **Total Petroleum Hydrocarbons:** SW-846 Method 8015, modified. (...Continued)

Matrix: Soil

Sample ID	TPH in mg/kg	DF	Type
20SB-10-01	<1	2	Kero
20SB-10-02	<1	2	Kero
20SB-11-01	<1	2	Kero
20SB-11-02	<1	2	Kero
20SB-12-01	<1	2	ND
20SB-12-02	<1	2	ND
20SB-13-01	572	2	Kero
20SB-13-02	703	2	Kero
20SB-14-01	<1	2	ND
20SB-14-02	<1	2	ND
20SB-15-01	149	2	Kero
20SB-15-02	69	2	ND
20SB-16-01	8	2	ND
20SB-16-02	<1	2	ND
20SB-17-01	<1	2	ND
20SB-17-02	<1	2	ND
20SB-18-01	220	2	Kero
20SB-18-02	32	2	Kero
20SB-19-01	<1	2	ND
20SB-19-02	<1	2	ND
20SB-Dup.	1	2	ND

ND = Not determined

Anne S. Burnett
Quality Control Officer

II. **BTEX Analysis**: EPA Method 8020.

(Results presented in mg/kg)
Matrix: Soil

Sample ID	Benzene	Toluene	Ethyl Benzene	Total Xylenes	DF
20SB-01-01	<0.01	0.04	0.35	0.54	2
20SB-01-02	0.07	0.20	0.93	2.10	2
20SB 02-01	<0.01	<0.01	<0.01	0.01	1
20SB-02-02	<0.01	<0.01	<0.01	<0.01	1
20SB-03-01	<0.01	<0.01	<0.01	0.02	1
20SB 03-02	<0.01	<0.01	<0.01	<0.01	1
20SB-03-Dup.	<0.01	<0.01	<0.01	<0.01	1
20SB-04-01	<0.01	<0.01	0.04	<0.01	5
20SB 04-02	<0.01	<0.01	0.01	<0.01	1
20SB-05-01	<0.01	<0.01	<0.01	0.08	5
20SB-05-02	<0.01	0.13	0.71	1.53	5
20SB 05-Dup.	<0.01	<0.01	<0.01	0.22	5
20SB-06b-01	<0.01	<0.01	<0.01	<0.01	1
20SB-06b-03	<0.01	<0.01	<0.01	<0.01	1
20SB-07-01	<0.01	<0.01	<0.01	<0.01	1
20SB-07-02	<0.01	<0.01	<0.01	<0.01	1
20SB-08-01	<0.01	0.11	0.14	0.36	10
20SB-08-02	0.13	0.25	1.05	2.06	10
20SB-09b-01	<0.01	<0.01	<0.01	<0.01	1
20SB-09-02	<0.01	<0.01	<0.01	<0.01	1
20SB-10-01	<0.01	<0.01	0.01	<0.01	1
20SB-10-02	<0.01	0.01	0.01	<0.01	1
20SB-11-01	0.01	<0.01	<0.01	<0.01	1
20SB-11-02	<0.01	0.01	<0.01	<0.01	1
20SB-12-01	<0.01	<0.01	<0.01	<0.01	1
20SB-12-02	<0.01	<0.01	<0.01	<0.01	1
20SB 13-01	0.02	0.01	0.12	0.27	1
20SB-13-02	<0.01	0.02	<0.01	0.10	2
20SB-14-01	<0.01	<0.01	<0.01	<0.01	1
20SB 14-02	<0.01	<0.01	<0.01	<0.01	1
20SB-15-01	<0.01	0.02	0.07	0.10	2
20SB-15-02	<0.01	<0.01	<0.01	0.07	2
20SB 16-01	<0.01	<0.01	<0.01	<0.01	1
20SB-16-02	<0.01	<0.01	<0.01	<0.01	1
20SB-17-01	<0.01	0.01	<0.01	<0.01	1
20SB 17-02	<0.01	<0.01	<0.01	<0.01	1
20SB-18-01	<0.01	<0.01	0.09	0.19	5
20SB-18-02	<0.01	0.02	<0.01	0.19	1
20SB 19-01	<0.01	<0.01	<0.01	0.03	1
20SB-19-02	<0.01	<0.01	<0.01	<0.01	1
20SB-Dup.	<0.01	<0.01	<0.01	<0.01	1

Anne S. Burnett
Quality Control Officer

III. **Total Petroleum Hydrocarbons**: Infra-red spectrophotometry, EPA Method 418.1.

Matrix: Liquid

Sample ID	TPH in mg/l	DF
20GW-01-Dup.	<1	1
20GW-02	938	200
20GW-03	3	1
20GW-04	<1	1
20GW-05	<1	1
20GW-06	<1	1
20GW-07	2	1
20HP-02	<1	1
20HP-03	<1	1
20HP-04	<1	1
20HP-05	<1	1
20HP-06	230	50
20HP-07	<1	1
20HP-08	<1	1
20HP-Dup.	<1	1
20EMW-03	<1	1
20EMW-04	<1	1
20EMW-06	<1	1
20EMW-07	<1	1
20EMW-Dup.	<1	1

Anne S. Burnett
Quality Control Officer

IV. **Aromatic Volatiles**: EPA Method 602, Purge & Trap.

(Results presented in mg/l)
Matrix: Liquid

Sample ID	Benzene	Toluene	Chloro Benzene	Ethyl Benzene	Total Xylenes	1,3 *Dichl	1,4 *Dichl	1,2 *Dichl
20GW-01-Dup.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20GW-02	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20GW-03	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20GW-04	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20GW-05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20GW-06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20GW-07	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trip Blank	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20HP-02	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
20HP-03	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20HP-04	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
20HP-05	<0.001	<0.001	<0.001	<0.001	0.003	<0.001	<0.001	<0.001
20HP-06	0.184	0.246	0.247	0.600	0.290	1.170	3.230	5.060
20HP-07	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20HP-08	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20HP-Dup.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20EMW-03	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20EMW-04	0.015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20EMW-06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
20EMW-07	0.016	<0.001	<0.001	<0.001	0.023	<0.001	<0.001	<0.001
20EMW-Dup.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Trip Blank	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Anne S. Burnett
Quality Control Officer

APPENDIX G

CHAIN-OF-CUSTODY RECORDS

CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
P.O. Box 12715 • 888 Norfolk Square • Norfolk, VA 23502
(804) 461-3874 • Fax (804) 461-0379

CLIENT INFORMATION	
Company	Roy F. Weston, Inc
Contact	Marvin Farmer / Jeff Grant
Address	Pembroke Two Va. Beach, VA.
Phone & FAX	473-9729 473-9744
Purchase Order No.	NA
Job No.	6629-01-09
Quote Number	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Field Readings/ Comments	Lab No.
~~Duplicate~~ JHG	VHA							
20EMW-3	CTO-20	4-8-92/1105	JHG	Water	Ice/H_2SO_4	602+ xylenes/ TPH 418.1	2-40ml vials/ Jar	
20EMW-4	CTO-20	4-9-92/1455	JHG	Water	Ice/H_2SO_4	602+ xylenes/ TPH 418.1	2-40ml vales/ Jar	
20EMW-6	CTO-20	4-9-92/1428	JHG	Water	Ice/H_2SO_4	602+ xylenes/ TPH 418.1	2-40ml vials/ Jar	
20EMW-7	CTO-20	4-9-92/1155	JHG	Water	Ice/H_2SO_4	602+ xylenes/ TPH 418.1	2-40ml vales/ Jar	
20EMW-Duplicate	CTO-20	4-9-92/ — JHA	JHG	Water	Ice/H_2SO_4	602+ xylenes/ TPH 418.1	2-40ml vales/ Jar	

Special Instructions: Rush 7 day turnaround (Please report Trip blank for this sheet "2")

Possible Sample Hazards: _____ Sample Disposal: Return to Client _____ or Disposal by Lab ✓

Express Service: (yes) / no Date Due: _____

Sample Pick-up Charge: yes / no Mileage Charge yes / no (# _____)

Relinquished By:	Signature		Company	Weston	Date/Time 4-10-92 / 9:50
Received By:	Signature	Donald W Cuth	Company	ETS	Date/Time 4-10-92 / 7:50
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time

CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
P.O. Box 12715 • 888 Norfolk Square • Norfolk, VA 23502
(804) 461-3874 • Fax (804) 461-0379

CLIENT INFORMATION	
Company	Weston
Contact	Jeff Hunt / Maridee Farmer
Address	Pembroke Two No. Beach
Phone & FAX	473-9729 / 473-9794
Purchase Order No.	Job No. 6629-01-09
Quote Number	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Field Readings/ Comments	Lab No.
205B16-01	CTO 20 2-4'	4/2/92 1028	JHL	SOIL	Ice	TPH 8015 / BTEX 8020		
205B16-02	6-8'	4/2/92 1035	JHL	SOIL		TPH 8015 / BTEX 8020		
205B17-01	2-4	4/2/92 1127	JHL	SOIL		TPH 8015 / BTEX 8020		
205B17-02	6-8	4/2/92 1134	JHL	SOIL		TPH 8015 / BTEX 8020		
205B18-01	4-6	4/2/92 1346	JHL	SOIL		TPH 8015 / BTEX 8020		
205B18-02	6-8'	4/2/92 1348	JHL	SOIL		TPH 8015 / BTEX 8020		
205B19-01	2-4	4/2/92 1535	JHL	SOIL		TPH 8015 / BTEX 8020		
205B-Duplicate	—	4/2/92 —	JHL	SOIL		TPH 8015 / BTEX 8020		
205B-19-02	6-8	4/2/92 1544	JHL	SOIL		TPH 8015 / BTEX 8020		

Special Instructions: Petroleum Compounds RUSH 7 Day Turnaround

Possible Sample Hazards: _____ Sample Disposal: Return to Client _____ or Disposal by Lab ✓

Express Service: yes / no Date Due: 4/10/92

Sample Pick-up Charge: yes / no Mileage Charge yes / no (# _____)

Relinquished By:	Signature	Jeffrey A. Hunt	Company	Weston	Date/Time 4/3/92 1900
Received By:	Signature	Diane L. Burnett	Company	ETS, Inc.	Date/Time 4/3/92 1930
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time

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CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
P.O. Box 12715 • 888 Norfolk Square • Norfolk, VA 23502
(804) 461-3874 • Fax (804) 461-0379

CLIENT INFORMATION	
Company	WESTON
Contact	J. Hart / M. Farmer
Address	Pembroke Two Va. Beach
Phone & FAX	473 9729 / 473 9744
Purchase Order No.	Job No. 0629-01-09
Quote Number	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Field Readings/ Comments	Lab No.
20HP08	CTO 20	4/2/92	JHH	Water	H_2SO_4	TPH 418.1 IR	1 Liter	
20HPDup	CTO 20	4/2/92	JHH	Water	H_2SO_4	TPH 418.1 IR	1 Liter	
20HP08	CTO 20	4/2/92	JHH	Water	Ice	602 +xylenes	2-40ml VOAs	
20HPDup	CTO 20	4/2/92	JHH	Water	Ice	602 +xylenes	2-40ml Vials	

Special Instructions: 7 Day Turnaround

Possible Sample Hazards: _____ Sample Disposal: Return to Client _____ *or* Disposal by Lab _____

Express Service: yes / no Date Due: 4/10/92

Sample Pick-up Charge: yes / no Mileage Charge yes / no (# _____)

Relinquished By:	Signature		Company	WESTON	Date/Time 4/3/92 1900
Received By:	Signature		Company	ETS, Inc	Date/Time 4/3/92 1930
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time

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CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
P.O. Box 12715 • 888 Norfolk Square • Norfolk, VA 23502
(804) 461-3874 • Fax (804) 461-0379

CLIENT INFORMATION	
Company	Roy F. Weston
Contact	Jeff Ebert / Marvin Farmer
Address	Pembroke Two Va. Beach
Phone & FAX	473-9729 / 473 9744
Purchase Order No.	Job No. 6629-01-09
Quote Number	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Field Readings/ Comments	Lab No.
~~20HP01~~	~~MW 20~~	~~3/31/92 0910~~	~~JHG~~	~~Water~~	~~Ice~~	~~TPH 418.1~~	Free Product	NO ANALYSIS
20HP02		3/31/92 1000	JHG	Water	H2SO4/Ice	TPH 418.1	1" Sediment	
20HP03		3/31/92 1045	JHG	Water	H2SO4/Ice	TPH 418.1	1/4" ↓	
20HP04		3/31/92 1155	JHG	Water	H2SO4/Ice	TPH 418.1	1/2" ↓	
20HP05		3/31/92 1240	JHG	Water	H2SO4/Ice	TPH 418.1	1" Sediment	
20HP06		3/31/92 1515	JHG	Water	H2SO4/Ice	TPH 418.1	1/4" Sediment	
20HP07	↓	3/31/92 1625	JHG	Water	H2SO4/Ice	TPH 418.1	1/4" Sediment	

Special Instructions: All samples to be analyzed by 418.1 TR method JHG 4/1/92

Possible Sample Hazards: Petroleum Compounds **Sample Disposal:** Return to Client _____ *or* Disposal by Lab ✓

Express Service: (yes) / no **Date Due:** 4/1/92

Sample Pick-up Charge: yes / (no) **Mileage Charge** yes / (no) (# _____)

Do Not ANALYZE 20HP01! JHG
It's Free Product

Relinquished By:	Signature	Jeffrey A. Ebert	Company	Roy F. Weston	Date/Time 4/2/92 0745
Received By:	Signature	Anne L Burnett	Company	ETS, Inc.	Date/Time 4/2/92 0810
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time

ETS Form 003/Rev. 1-92

CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
816 Norview Avenue
P.O. Box 595 - Norfolk, Virginia 23501
(804) 853-1715 - FAX (804) 853-1047

Company	Roy F Weston Inc.
Contact	Jeff Ghent Mgr Wing Farmer
Address	
Phone & FAX	473 9729 / 473 9744
Sampling Program	Clean / RAKER
Sample Team Members	Jeff Ghent
Job Number	6629-01-09
Purchase Order No.	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Lab Comments
20SB12-01	CTO 20	4/1/92 1030	JHG	SOIL	Ice only	TPH 8015/BTEX 8020	
20SB12-02		4/1/92 1044	JHG	SOIL		TPH 8015 / BTEX 8020	
20SB13-01		4/1/92 1142	JHG	SOIL		TPH 8015 / BTEX 8020	
20SB13-02		4/1/92 1155	JHG	SOIL		TPH 8015 / BTEX 8020	
20SB14-01		4/1/92 1425	JHG	SOIL		TPH 8015 / BTEX 8020	
20SB14-02		4/1/92 1445	JHG	SOIL		TPH 8015 / BTEX 8020	
20SB15-01		4/1/92 1535	JHG	SOIL		TPH 8015 / BTEX 8020	
20SB15-02	↓	4/1/92 1550	JHG	SOIL	↓	TPH 8015 / BTEX 8020	

Special Instructions: _____

Possible Sample Hazards: Petroleum Compounds

Turnaround Time Required: (Rush must be approved by appropriate Manager and is subject to surcharge.)*

Normal ____ * Rush ✓

Sample Disposal: Return to Client ____ *or* Disposal by Lab ✓

Relinquished By:	Signature	Company		Date/Time 4/1/1992 1705
Received By:	Signature Anne A Bennett	Company	ESI Inc	Date/Time 4/2/92 0810
Relinquished By:	Signature	Company		Date/Time
Received By:	Signature	Company		Date/Time
Relinquished By:	Signature	Company		Date/Time
Received By:	Signature	Company		Date/Time

CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
P.O. Box 12715 • 888 Norfolk Square • Norfolk, VA 23502
(804) 461-3874 • Fax (804) 461-0379

CLIENT INFORMATION	
Company	Roy F Weston Inc
Contact	Scott Hart Amanda Farmer
Address	Pembroke Five Independence Blvd. Va Beach
Phone & FAX	473 9729
Purchase Order No.	X
Job No.	1609-01-02
Quote Number	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Field Readings/ Comments	Lab No.
TRIPBLANK	CTO 20	3/31/92		Water		VOA 602/BTEX		
20HP01	CTO 20	3/31/92	JHG	Water	Ice	602 + naph (BTEX)	No Sample	
20HP02	CTO 20	3/31/92 1000	JHG	Water	Ice	602 (BTEX)		
20HP03	CTO 20	3/31/92 1045	JHG	Water	Ice	602 (BTEX)		
20HP04	CTO 20	3/31/92 1155	JHG	Water	Ice	602 (BTEX)		
20HP05	CTO 20	3/31/92 1240	JHG	Water	Ice	602 (BTEX)		
20HP06	CTO 20	3/31/92 1515	JHG	Water	Ice	602 (BTEX)		
20HP07	CTO 20	3/31/92 1625	JHG	Water	Ice	602 (BTEX)		

Special Instructions: _____

Possible Sample Hazards: Petroleum Compounds Sample Disposal: Return to Client _____ or Disposal by Lab ✓

Express Service: (yes) / no Date Due: 4/2/92

Sample Pick-up Charge: yes / no Mileage Charge yes / no (# _____)

Relinquished By:	Signature	Scott H. Hart	Company	Roy F Weston Inc	Date/Time 4/2/92 0745
Received By:	Signature	Anne A. Burnett	Company	ETS, Inc	Date/Time 4/2/92 0806
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time
Relinquished By:	Signature		Company		Date/Time
Received By:	Signature		Company		Date/Time

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CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
P.O. Box 12715 • 888 Norfolk Square • Norfolk, VA 23502
(804) 461-3874 • Fax (804) 461-0379

CLIENT INFORMATION	
Company	R F WESTON / FARMER
Contact	M. FARMER
Address	W. P. 9611
Phone & FAX	
Purchase Order No.	Job No. 6299-01-09
Quote Number	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Field Readings/ Comments	Lab No.
20GW-07-01	CTO 20	12 MARCH 92 18:05	TF	WATER	H_2SO_4/—	TPH 418.1/VOA 602		
20GW-06-01	CTO 20	12 MARCH 92 18:15	TF	WATER	H_2SO_4/—	TPH 418.1/VOA 602		
20GW-03-01	CTO 20	12 MARCH 92 18:15	TF	WATER	H_2SO_4/—	TPH 418.1/VOA 602		
20GW-05-01	CTO 20	13 MARCH 92 14:55	TF	WATER	H_2SO_4/—	TPH 418.1/VOA 602		
20GW-04-01	CTO 20	13 MARCH 92 15:05	TF	WATER	H_2SO_4/—	TPH 418.1/VOA 602		
20GW-02-01	CTO 20	13 MARCH 92 15:15	TF	WATER	H_2SO_4/—	TPH 418.1/VOA 602	FREE PRODUCT	
20GW-DUP-01	CTO 20	13 MARCH 92 —	TF	WATER	H_2SO_4	TPH 418.1/VOA 602		

Special Instructions: EACH SAMPLE ANALYZE FOR TPH (METHOD 418.1) AND VOA (602)

Possible Sample Hazards: JP-5 Sample Disposal: Return to Client ____ or Disposal by Lab X

Express Service: yes (no) Date Due: SEE M. FARMER TRIP BLANK WAS NOT PROVIDED BY LAB.

Sample Pick-up Charge: yes / (no) Mileage Charge yes / (no) (# ____)

Relinquished By:	Signature [signature]	Company R.F. WESTON	Date/Time 13 MARCH 92 16:15
Received By:	Signature [signature]	Company WESTON	Date/Time 13 MARCH 92 16:15
Relinquished By:	Signature [signature]	Company WESTON	Date/Time 13 MARCH 92 17:35
Received By:	Signature [signature]	Company Weston	Date/Time 13 MARCH 92 17:35
Relinquished By:	Signature [signature]	Company Weston	Date/Time 3/13/92 1800
Received By:	Signature [signature]	Company E.T.S.	Date/Time 3/13/92 1800

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CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
P.O. Box 12715 • 888 Norfolk Square • Norfolk, VA 23502
(804) 461-3874 • Fax (804) 461-0379

CLIENT INFORMATION	
Company	R. F WESTON
Contact	MARVIN FARMER
Address	VA BEACH
Phone & FAX	(804) 473-9729 / (804) 473-9744
Purchase Order No.	Job No. 6629-01-09
Quote Number	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Field Readings/ Comments	Lab No.
CTO20-SB-08-01	CTO20	06 MARCH 09:10	TF	SOIL	ICE	TPH 8015 / BTEX 8020		
CTO20-SB-08-02	CTO20	06 MARCH 09:18	TF	SOIL	ICE	TPH 8015 / BTEX 8020		
CTO20-SB-09B-01	CTO20	09 MARCH 08:56	TF	SOIL	ICE	TPH 8015 / BTEX 8020		
CTO20-SB-09B-02	CTO20	09 MARCH 09:04	TF	SOIL	ICE	TPH 8015 / BTEX 8020		
CTO20-SB-10-01	CTO20	06 MARCH 14:15	TF	SOIL	ICE	TPH 8015 / BTEX 8020		
CTO20-SB-10-02	CTO20	06 MARCH 14:26	TF	SOIL	ICE	TPH 8015 / BTEX 8020		
CTO20-SB-11-01	CTO20	10 MARCH 09:28	TF	SOIL	ICE	TPH 8015 / BTEX 8020		
CTO20-SB-11-02	CTO20	10 MARCH 09:45	TF	SOIL	ICE	TPH 8015 / BTEX 8020		

Special Instructions: TPH: 8015 BTEX 8020

Possible Sample Hazards: — Sample Disposal: Return to Client _____ or Disposal by Lab X

Express Service: yes (no) Date Due: _____

Sample Pick-up Charge: yes / (no) Mileage Charge yes / (no) (# _____)

Relinquished By:	Signature	Company	Date/Time
Received By:	Signature Cathy Bursey	Company Weston	Date/Time 11 MAR 92 / 0700
Relinquished By:	Signature Cathy Bursey	Company Weston	Date/Time 11 MAR 92 / 0800
Received By:	Signature William H. Kent	Company Weston	Date/Time 11 March 92 / 0800
Relinquished By:	Signature William H. Kent	Company WESTON	Date/Time 3-12-92 / 0800
Received By:	Signature Rosemary Fitzpatrick	Company ETS	Date/Time 3-12-92 / 0800

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CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
816 Norview Avenue
P.O. Box 595 - Norfolk, Virginia 23501
(804) 853-1715 - FAX (804) 853-1047

Company	Roy F. WESTON
Contact	M. FARMER
Address	
Phone & FAX	473-9729 / 473-9744
Sampling Program	CTO20
Sample Team Members	FRANK T.
Job Number	6629-01-09
Purchase Order No.	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Comments
20-SB-05-01 CTOTE	CTO20-05	4 MARCH 15:50	TF	Soil	ICE	TPH 8015 / BTEX 8020	
20-SB-05-02	CTO20-05	4 MARCH 15:55	TF	Soil	↓	↓ ↓	
20-SB-05-DUP	CTO20-05	4 MARCH —	TF	Soil	↓	↓ ↓	
20-SB-06b-01	CTO20-06b	5 MARCH 09:36	TF	Soil	↓		
20-SB-06b-02	CTO20-06b	5 MARCH 09:51	TF	Soil	↓		
20-SB-07-01	CTO20-07	5 MARCH 11:35	TF	Soil	↓		
20-SB-07-02	CTO20-07	5 MARCH 11:40	TF	Soil	↓	↓ ↓	

Special Instructions: TPH 8015 BTEX 8020

Possible Sample Hazards: _____

Turnaround Time Required: (Rush must be approved by appropriate Manager and is subject to surcharge.)*
Normal X * Rush ____

Sample Disposal: Return to Client ____ or Disposal by Lab X CHECK WITH M. FARMER

Relinquished By:	Signature	Company	Roy F. Weston	Date/Time 5 MARCH 1400
Received By:	Signature	Company	WESTON	Date/Time 5 March 1410
Relinquished By:	Signature	Company	Weston	Date/Time 5 March
Received By:	Signature	Company	ETS	Date/Time 3-5-92 1330
Relinquished By:	Signature	Company		Date/Time
Received By:	Signature	Company		Date/Time

CHAIN-OF-CUSTODY RECORD

ENVIRONMENTAL TESTING SERVICES, INC.
816 Norview Avenue
P.O. Box 595 - Norfolk, Virginia 23501
(804) 853-1715 - FAX (804) 853-1047

Company	Roy F. Weston
Contact	M. Farmer
Address	
Phone & FAX	473-9729 / 473-9744
Sampling Program	CTO-20
Sample Team Members	Frinak, T
Job Number	6629-01-09
Purchase Order No.	

Sample ID	Sample Location	Date/Time Collected	Collectors Initials	Matrix	Preservative	Analysis	Comments
20-SB-01-01	CTO20-01	3 March 10:35	TF	Soil	ICE	TPH 8015 / BTEX 8020	
20-SB-01-02	CTO20-01	3 March 10:55	TF	Soil	—	TPH 8015 / BTEX 8020	
20-SB-02-01	CTO 20-02	4 March 09:30	TF	Soil	—		
20-SB-02-02	CTO 20-02	4 March 09:40	TF	Soil	—		
20-SB-03-01	CTO 20-03	4 March 11:30	TF	Soil	—	TF	
20 SB-03-02	CTO 20-03	4 March 11:35	TF	Soil	—		
20 SB-03-DUP	CTO 20-03	4 March 11:35	TF	Soil	—		
20SB-04-01	CTO 20-04	4 March 13:50	TF	Soil	—		
20SB-04-02	CTO 20-04	4 March 13:55	TF	Soil	↓	TPH 8015 / BTEX 8020	

Special Instructions: TPH - 8015 BTEX 8020

Possible Sample Hazards: —

Turnaround Time Required: (Rush must be approved by appropriate Manager and is subject to surcharge.)*
Normal X * Rush ____

Sample Disposal: Return to Client ____ or Disposal by Lab X CHECK WITH MARVIN FARMER

Relinquished By:	Signature	Company R. F. WESTON	Date/Time 3 March 12:04
Received By:	Signature	Company R. F. WESTON	Date/Time 05 March 1410
Relinquished By:	Signature	Company R. F. Weston	Date/Time 05 March
Received By:	Signature	Company ETS	Date/Time 3-6-92 1330
Relinquished By:	Signature	Company	Date/Time
Received By:	Signature	Company	Date/Time

APPENDIX H

REFERENCES

REFERENCES

American Society of Testing and Materials, 198 4. Standard Method for Penetration Test and Split-Barrel Sampling of Soils. Annual Book of Standards, V.04.08, Philadelphia, PA, pp. 221-225.

Bouwer, H. and R. C. Rice. Junw, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells. Water Resources Research, Vol. 12, No. 3.

Fetter, C. W., Jr. 1980. Applied Hydrogeology. Charles E. Merrill Publishing Company, Columbus, OH, p.64, p.75, and p.116.

Hamilton, Pixie A. and Jerry D. Larson. 1988. Hydrogeology and Analysis of the Groundwater Flow System in the Coastal Plain of Southeastern Virginia. U.S. Geological Survey. Water Resources Investigations Report 87-4240.

Hazardous Substance Data Bank (HSDB). 1991. Database Search, June 19, 1991.

Installation Restoration Program Toxicology Guide. 1989. Biomedical and Environmental Information Analysis. Health and Safety Division, Oak Ridge National Laboratory, Oak Ridge, TN. DOE Interagency Agreement No. 1891-A076-A1.

Mixon, R. B., Berquist, C. R., Jr., Newell, W. L., and F.G. Johnson. 1989. Geologic Map and Generalized Cross Sections of the Coastal Plain and Adjacent Parts of the Piedmont, Virginia. Virginia Division of Mineral Resources, Miscellaneous Investigations Series, Map I-2033.

Oaks, R.Q., Jr. and N.K. Coch. 1973. Post-Miocene Stratigraphy and Morphology, Southeastern Virginia. Virginia Division of Mineral Resources, Bulletin 82.

Siudyla, E.A., May, A.E. and D.W. Hawthorne. 1981. Groundwater Resources of the Four Cities Area, Virginia. Virginia State Water Control Board, Bureau of Water Control Management Planning, Bulletin 331.

Teifke, R.H. 1973. Stratigraphic Units of the Lower Cretaceous Through Miocene Series, in Geologic Studies, Coastal Plain of Virginia. Virginia Division of Mineral Resources, Bulletin 83, Parts 1 and 2.

U.S. Environmental Protection Agency, 1987. Underground Storage Tank Corrective Action Technologies. Hazardous Waste Engineering Research Laboratory, Cincinnati, OH. EPA/625/6-87-015.

U.S. Environmental Protection Agency. 1990. Assessing UST Corrective Action Technologies: Early Screening of Clean-Up Technologies of the Saturated Zone. Risk Reduction Engineering Laboratory, Cincinnati, OH. EPA/600/2-90/027.

U.S. Environmental Protection Agency. April 1991. "Drinking Water Regulations and Health Advisories." Office of Water, U.S. Environmental Protection Agency, Washington, D.C.

Commonwealth Of Virginia State Water Control Board Regulations. July 1, 1988. "Groundwater Standards." VR680-21-04, ppg. 29-33.

Commonwealth Of Virginia State Water Control Board Regulations. 1992. "Surface Water Standards with General, Statewide Application." VR680-21-01, ppg 10-15.