Feasibility Study
Cornet Bay Marina

Washington State Department of Ecology
Consent Decree # 93-2-00018-3

Prepared for

Washington State Department of Ecology

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June 2008
Project No. 61994.01

TABLE OF CONTENTS

Page

TABLE OF CONTENTS cont.

Page

TABLE OF CONTENTS cont.

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
AS	Air sparging
bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylene
btoc	Below top of casing
CAP	Cleanup Action Plan
cm/s	Centimeters per second
cPAH	Carcinogenic polycyclic aromatic hydrocarbon
cy	Cubic yards
DRO	Diesel range organics
EA	EA Engineering, Science, and Technology, Inc.
Ecology	Washington State Department of Ecology
EDB	1,2-Dibromoethane
EDC	1,2-Dichloroethane
EFR	Enhanced fluid recovery
EPA	United States Environmental Protection Agency
ERH	Electrical resistance heating
FS	Feasibility Study
ft	Feet
GRO	Gasoline range organics
ICC	Island County Code
in	Inch
ISTD	*In-situ* thermal desorption
IWS	In Well Stripping
LRO	Lube oil-range organics
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg	Milligram per kilogram
MTBE	Methyl-tertiary-butyl ether
MTCA	Model Toxics Control Act

LIST OF ACRONYMS cont.

O&M	Operation and Maintenance
OSS	Onsite Sewer System
PAH	Polyaromatic hydrocarbons
PQL	Practical quantitation limit
PVC	Polyvinyl chloride
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SVE	Soil vapor extraction
TCLP	Toxicity Characteristic Leaching Procedure
TEE	Terrestrial Ecological Evaluation
TPH-D	Total petroleum hydrocarbon – diesel range organics
TPH-G	Total petroleum hydrocarbon – gasoline range organics
µg/L	Microgram per liter
UST	Underground storage tank
VOC	Volatile organic compounds
WAC	Washington Administrative Code

1. INTRODUCTION

This report presents the results of a Feasibility Study (FS) for the Cornet Bay Marina located on Whidbey Island, Washington (Figure 1). The site has been investigated by the Washington State Department of Ecology (Ecology) and will be remediated under a Consent Decree between Ecology and the current property owner (Ecology 1993). The FS has been prepared in accordance with the Ecology guidelines on feasibility study preparation, as required by the Model Toxics Control Act (MTCA).

1.1 PURPOSE

The purpose of a FS is to present and evaluate alternatives for contaminated site cleanup. The FS is used by Ecology to solicit public and agency comments to select a cleanup action for the site under Washington Administrative Code (WAC) 173-340-360 through 173-340-390. This site is a petroleum contaminated site and the alternatives evaluated are technologies known to be applicable for petroleum site remediation.

1.2 REPORT ORGANIZATION

This FS uses data collected during prior site investigations conducted by the property owner and Ecology as well as data collected for the FS to develop and evaluate cleanup action alternatives. After the FS is complete, Ecology will issue a cleanup action plan (CAP) presenting the selected cleanup action(s) that will be used to address site contamination. This FS is organized as follows:

Section 1	Introduction
Section 2	Background
Section 3	Remedial Investigation
Section 4	Feasibility Study Activities
Section 5	Nature and Extent of Contamination
Section 6	Development of Cleanup Standards
Section 7	Technology Screening
Section 8	Description of Remedial Alternatives
Section 9	Model Toxics Control Act (MTCA) Minimum Requirements
Section 10	Disproportionate Cost Analysis
Section 11	References.

2. BACKGROUND

This section presents a site overview, brief site history information, current site uses and environmental conditions. The objective of this section is to summarize the historical work conducted at the site and to present information necessary to support the conclusions of this FS.

2.1 SITE DESCRIPTION AND HISTORY

The Cornet Bay Marina is located on Whidbey Island, on the south side of Deception Pass, bounded on the west by Cornet Bay and on the east by Cornet Bay Road (Figure 2). Deception Pass State Park is north of, and adjacent to the site. The site is relatively flat, with the exception of the elevated septic tank drain field at the northeast corner of the site. A wooden bulkhead (shown in the photo) along the bay separates the land from the water.

View of Cornet Bay Marina Site Looking North Toward Store

The site, constructed in 1962, is an operating marina serving the general public with a diesel and unleaded gasoline fueling system. The fuel system consists of a 2-compartment 12,000-gallon tank (9,000-gallon gasoline and 3,000-gallon diesel) enclosed in an underground reinforced concrete vault. Two galvanized steel lines, encased in one large diameter polyvinyl chloride (PVC) pipe, run underground from the tank to the bulkhead and out to the fueling dock. Other structures on site include a convenience store, storage shed, two above-ground waste oil tanks, and a boat harbor.

2.1.1 Geology And Hydrogeology

Shallow soils at the site consist primarily of fill material, including dredged sediments from the adjacent bay. Based on soil types observed during soil boring and test pit excavation, shallow soils (less than 10 feet below ground surface [ft bgs]) are heterogenous and are not correlated well across the site. Soils consist of sand and silt, with varying amounts of gravel and clay. Based on drilling performed by Ecology in 1995, soils below about 10 ft bgs (to a total investigated depth of 25 ft bgs) consist primarily of clay. A cross section of the site, prepared by Ecology, is presented in Figure 3.

During a test pit investigation conducted in June 2006, undisturbed samples of both clayey-silt and silty-gravelly-sand were collected from about 4 ft bgs for laboratory analysis of physical parameters. The hydraulic conductivities of both materials were low; 1.74E-07 centimeters per second (cm/s) for a vertical sample from the clayey-silt and 8.97E-06 cm/s and 3.13E-07 cm/s for vertical and horizontal samples, respectively, of the gravelly-silty-sand.

Groundwater occurs at the site at depths ranging from about 4 to 7 ft bgs. Groundwater is tidally influenced; however, the primary groundwater flow direction is assumed to be generally to the

west, toward Cornet Bay. Tidal influence was measured during the June 2006 field investigation. Based on the results of the investigation, there was an approximately 2.5 ft change in water levels at monitoring well MW-2, approximately 0.5 ft in MW-1, and approximately 0.2 ft in MW-3. Monitoring well locations are presented in Figure 4. The differences in reactions in the various wells are most likely attributed to the proximity to the bulkhead and the relatively impermeable soil.

2.2 PRELIMINARY INVESTIGATIONS

From the mid-1960s until February 1989, four underground storage tanks (USTs) were used at the site: 10,000-gallon regular gasoline, 6,000-gallon regular gasoline, 3,000-gallon diesel, and 2,000-gallon gasoline or "pre-mix" for 2-stroke engines. In January 1989, petroleum was observed seeping into the bay along the bulkhead. The seeps were contained by absorbent booms. No other remediation was done at that time.

In April 1989, the original USTs at the site were emptied and a limited investigation was conducted by Roxbury Construction (Nelson 1990). The investigation indicated that petroleum contamination had occurred due to broken fuel lines. During the study, only soil was investigated; no groundwater assessment was done. The four USTs were removed in March 1990 by Technical Services, Inc under contract to Welch Enterprises. Soil from the tank excavation was placed back in the ground. A summary of the tank removal activities is provided in a report by Welch (1990).

In late 1990, the current 2-compartment tank was installed within a portion of the former UST excavation. Petroleum-contaminated soil and free product were observed in the excavation. An unknown volume of contaminated water from the excavation was pumped into a drainage ditch along Cornet Bay Road (Ecology 1990). Approximately 10,000 gallons of petroleum-contaminated groundwater was reportedly pumped out of the excavation and disposed offsite (Nelson 1990). In addition, an unknown volume of petroleum-contaminated soil was removed from the excavation and disposed offsite. Test pit excavations were performed in four widely-spaced locations at the site and soil and groundwater samples were collected for analysis. Elevated concentrations of gasoline-range organics (GRO), diesel-range organics (DRO), and benzene, toluene, ethylbenzene and xylene (BTEX) constituents were detected at the locations sampled. An "emulsion layer of fuel" was reported on the water surface in at least 2 of the test pits (Welch 1990).

3. REMEDIAL INVESTIGATION

A Consent Decree for the site was established in 1993 between the Ecology and the Cornet Bay Marina site owner/operator to assess the extent and degree of gasoline and diesel contamination at the site in accordance with the requirements of the MTCA (Ecology 1993). The scope of work outlined in the Consent Decree included the completion of a Remedial Investigation (RI) directed by Ecology. On numerous occasions since the Consent Decree was signed, Ecology has investigated the soil, groundwater and sediment at the site to assess the impact of the petroleum release. Each of these investigations is described briefly in the sections that follow. Figure 4 shows the sampling locations for these activities. The analytical results for soil and groundwater are presented in Figures 5 and 6, respectively.

3.1 1995 INVESTIGATION

In November 1995, ten soil borings (B1 through B10) were drilled and sampled by Ecology. Soil samples were collected where field screening techniques indicated the presence of petroleum (Ecology 1996a). Groundwater samples were collected from several boreholes. Concentrations of GRO, DRO, and BTEX constituents were detected at concentrations exceeding the cleanup criteria at most of the locations sampled. The two locations with the highest concentrations of GRO and DRO in the soil were boring B8 and B3, see Figure 5.

Boring B8 was located just north of the store building and had a maximum GRO concentration of 2,600 milligrams per kilogram (mg/kg) and a maximum DRO concentration of 7,400 mg/kg. Boring B3 was located just south of the store building and had a GRO concentration of 4,900 mg/kg and a DRO concentration of 4,030 mg/kg. A surface water sample acquired near the bulkhead showed no contamination.

3.2 1996 MONITORING WELL INSTALLATION

Three monitoring wells were installed by Ecology in downgradient locations at the site in 1996:

- MW-1 (screened from 10 to 25 ft bgs),
- MW-2 (screened from 5 to 25 ft bgs), and
- MW-3 (screened from 5 to 20 ft bgs) (Ecology 1996b).

Monitoring well construction data is provided in Table 1. The wells were sampled by Ecology in 1996, 2003, and 2005. No contamination has been detected in MW-1, which is screened deeper than the other two wells, at depths below the water table. Concentrations of DRO, GRO, and benzene were well above MTCA Method A cleanup levels in samples collected from wells MW-2 and MW-3 for each sampling event (Ecology 1996b, Ecology 2003, Ecology 2005). Table 2 presents the results of each groundwater sampling event since 1996.

At MW-2, the highest concentrations of GRO and DRO were detected in 2003. The concentration for GRO was 21,300 micrograms per Liter (µg/L). The concentration for DRO was 127,000 µg/L.

At MW-3, the highest concentrations of GRO and DRO were detected in 1996. The concentration for GRO was 24,000 µg/L. The concentration for DRO was 98,000 µg/L.

3.3 2003 INVESTIGATION

Ten direct push borings (DP1 through DP10) were advanced and sampled at the site in June 2003 (Ecology 2003). This work was done to determine if natural attenuation had reduced contaminant levels and also to investigate the southern area of the site. Samples collected from the borings indicated the presence of elevated concentrations (above MTCA Method A cleanup levels) of DRO, GRO, and BTEX in soil and groundwater throughout the site. Areas of elevated concentrations corresponded to areas of elevated GRO and DRO detected during the investigation conducted in 1995. The two locations with the highest concentrations of GRO and DRO in the soil were boring DP-1 and DP-9, see Figure 5.

Boring DP-1 was located approximately 30 ft north of the store building and had a GRO concentration of 2,730 mg/kg and a DRO concentration of 7,050 mg/kg. Boring DP-9 was located approximately 60 ft south of the store building and had a GRO concentration of 1,910 mg/kg and a DRO concentration of 5,170 mg/kg.

The highest concentrations of GRO alone were found in the soil at boring locations DP-5 and DP-10, see Figure 5. Boring DP-5 was located approximately 140 ft south of the store building and had a GRO concentration of 5,150 mg/kg. Boring DP-10 was located approximately 50 ft east of the store building and had a GRO concentration of 5,310 mg/kg.

In addition, during this investigation a sheen was observed on the bay water extending about 3 ft out from the north edge of the bulkhead. The results of this work indicated natural attenuation was not reducing contaminant levels and also that the southern area of the property was contaminated.

3.4 2005 INVESTIGATION

Between April and June 2005, EA Engineering, Science, and Technology, Inc. (EA) conducted a limited investigation to better define the nature and extent of contamination at the site. Eight direct push borings (GP-1 through GP-8) and three hand auger borings (HA-1 through HA-3) were advanced and sampled at the site. The results of this investigation are reported in the Investigation Report (EA 2005) and a letter to Ecology regarding the summary of results for the June 2005 Field Investigation (EA 2006a). Based on the results of EA's limited investigations, the extent of the contamination appears to be generally confined to the marina property, see Figures 5 and 6. GRO and DRO concentrations were below cleanup levels around the perimeter of the property, with the exception of hand auger borings HA-1 and HA-2, the DRO detected at these locations appears to be more consistent with lube oil-range organics (LRO) and it is likely that this contamination is not attributable to operations at the marina.

3.5 2005 SEDIMENT SCREENING SURVEY

Ecology conducted a Screening Survey for Petroleum Contaminants (Ecology 2005) at the Cornet Bay Marina in 2005. The study included collection of groundwater, surface water, and sediment samples to determine if petroleum contaminants were migrating into intertidal areas of Cornet Bay and evaluate the significance of existing contaminant levels. Sampling locations are shown in Figure 4.

Samples of groundwater indicated contamination exceeding screening levels for benzene and GRO in MW-2 and MW-3. Additionally, the concentration of DRO exceeded screening levels in MW-3. Samples of surface water from the two streams adjacent to the site showed no contamination.

The study found that sediment samples along the bulkhead showed no evidence of BTEX, gasoline or diesel, with the exception of one location at the southern end of the bulkhead that contained low levels of BTEX and diesel (Ecology 2005). Concentrations of polyaromatic hydrocarbons (PAHs) exceeded screening levels at 4 of the 6 sampled sediment locations, suggesting that sediment contamination is due to creosote from the timber bulkhead.

Tissue samples from shellfish were not collected during this event as planned because the number of clams found was insufficient for sampling purposes,

The sediment data are presented in the Sediment Screening Report, which is included with other reports that document the Remedial Investigation actions.

4. FEASIBILITY STUDY ACTIVITIES

The scope of work outlined in the Consent Decree for the site also included the completion of this FS. In support of the FS and future remediation activities, EA conducted the following activities:

- A groundwater level study
- Additional groundwater monitoring
- A test pit investigation
- Surface water sampling
- An assessment of the existing bulkhead
- An assessment of the existing building
- An assessment of the existing on-site sewage system.

4.1 GROUNDWATER LEVEL STUDY

On 26 May 2006, EA visited the Cornet Bay Marina to deploy Level Troll® 500 water level loggers to determine if the groundwater at the site is influenced by tidal variations. The level loggers were installed in the three onsite monitoring wells and on a piling on the marina dock (see photo). The level loggers record temperature, depth, and pressure at set time intervals as specified by the user.

Monitoring wells MW-1, MW-2, and MW-3 were first opened and checked for product. No measurable product was noted in any of the three monitoring wells. Water level and total depth measurements were obtained and recorded before installing the level loggers. Water levels measured in the wells are presented in Table 1. Level loggers were deployed at a depth of 15 ft. below the top of the well casing (ft btoc). Level logger cables were suspended from the bottom of the well plug. The level logger placed in the 2-inch (in.) PVC casing tied to the marina dock piling was suspended using a safety ring.

PVC Pipe on Dock Piling for Level Troll® Protection

The level loggers were programmed to begin collecting data on 26 May 2006, in 15-minute intervals, for a period of 7 days. The level loggers were checked prior to leaving the site to assure the data was being recorded.

EA returned to the site to retrieve the level loggers on 1 June 2006. Data from the level loggers was downloaded to the Rugged Reader® Palm device to transfer the data into an Excel® spreadsheet.

The measured water levels were adjusted and graphed, as shown in Figure 7, using the information provided by Ecology in Appendix A. Over the week long monitoring period, the tide varied approximately 14 ft. Over the same time period, the water level variance was negligible (less than 2 in.) in MW-3, up to 6 in. in MW-1, and more than 2.6 ft in MW-2.

4.2 GROUNDWATER MONITORING ACTIVITIES

On 1 June 2006, EA sampled wells MW-1, MW-2, and MW-3 using a peristaltic pump and low-flow sampling procedures. In accordance with the Sampling and Analysis Plan (SAP) Revision 3 (EA 2006b), groundwater samples were collected for laboratory analysis of GRO; DRO; LRO; and BTEX. In addition, groundwater samples were also analyzed for FS parameters including alkalinity, salinity, hardness, iron, manganese, chemical oxygen demand, total organic carbon, biological oxygen demand, anions, chloride, sulfate, and nitrate.

The monitoring wells were opened and checked for the presence of free product using a free product indicator. No measurable product was noted in the three monitoring wells. Water level and total depth measurements were obtained and recorded before installing dedicated polyethylene tubing in the wells. The tubing intake was placed approximately 2 to 3 ft below the groundwater level. The tubing intake in MW-1 was lowered during purging, due to drawdown experienced during purging.

The peristaltic pump was used to purge groundwater at a rate of 300-500 milliliters per minute. Groundwater quality parameters were measured every three minutes during purging until parameters stabilized. Purge forms are provided in Appendix B. Groundwater samples were then collected. A duplicate sample was collected from MW-3 (CB-MW3D). Table 1 summarizes monitoring well construction information, water level measurements, and water quality parameters obtained after the readings stabilized.

Groundwater purged during development and monitoring well sampling was contained in a 30-gallon drum and stored within the enclosure around the UST vault.

Laboratory results for the petroleum constituents in the monitoring well groundwater samples are attached and are summarized in Table 2 along with results from prior sampling events. Contaminant concentrations in MW-1 and MW-2 appear to remain fairly consistent with May 2005 results, while MW-3 indicates a slight increase for most of the petroleum constituents analyzed for. The analytical results for groundwater FS parameters are presented in Table 3. Complete laboratory reports are presented in Appendix C.

4.3 TEST PIT EXCAVATION AND SOIL SAMPLING RESULTS

On 1 June 2006, five test pits (TP1 through TP5) were excavated onsite for soil sample collection, to identify soil types, and to observe the possible presence of product at the water table. The test pits were dug using an excavator operated by Clear Creek Contractors with EA oversight. The test pits were excavated to a maximum depth of 6 ft bgs. Test pit locations are indicated on Figure 8. Test pit logs are provided in Appendix D.

Shallow soil types encountered across the site area were not consistent and varied from sand and gravel to silt and clay. In TP1, located between the existing fuel vault and the septic tank drainfield, sand and gravel were encountered to the total depth of 5 ft bgs. In TP2, located just north of the store building, sand and gravel were encountered to a depth of about 4 ft bgs, and were underlain by silt and clay to 6 ft bgs. In TP3, located near the southeastern corner of the property, materials encountered with depth were gravel, silt, sand, and clay, to a total depth of 6 ft bgs. Test pit TP4, located south of the store building, penetrated silt and clay from about 0.5 ft bgs to the total depth of 4 ft bgs. In test pit TP5, located near the southeast corner of the store building, soils consisted of silt, grading to sand, and grading back to silt at the total depth of 6 ft bgs. Groundwater was encountered at depths ranging from about 4 to 6 ft bgs in the test pits. Strong hydrocarbon odors, sheens, and/or elevated photoionization detector readings were encountered in soil from all test pits except TP4. Details are provided in the test pit logs (Appendix D).

Soil samples were collected from each test pit for analysis of GRO, BTEX, and DRO. Three of the soil samples were also submitted for analysis of FS parameters (total organic carbon, chemical oxygen demand, total nitrogen, potassium, and phosphorus) and two of them were submitted for analysis of toxicity characteristic leaching procedures (TCLP) benzene. The analytical results for petroleum constituents indicate elevated concentrations of GRO in every test pit except TP4. Analytical results for test pit soil samples are summarized in Tables 4 and 5 and complete laboratory reports are presented in Appendix C. Additionally, a sediment sample was collected from the southern end of the site during this sampling event; the result is included in Table 4.

Three Shelby tube samples were collected for physical analyses, including density, porosity, grain size, and hydraulic conductivity. One vertical Shelby tube sample was collected from dense, clayey-silt in test pit TP2. One vertical and one horizontal Shelby tube sample were collected from gravelly-silty-sand in test pit TP3. The laboratory reports for these samples are located in Appendix E.

4.4 SURFACE WATER SAMPLING

On 7 September 2006, two samples were collected from Cornet Bay to determine if the groundwater contamination at the site was impacting the surface water adjacent to the site. During the site visit, a sheen was noted on the water's surface and appeared to be emanating from the bulkhead. A sample of this surface sheen water was collected and sent to a laboratory for analysis of GRO and DRO. In addition, a sample was collected off the dock, farther out from the bulkhead to indicate potential background levels of GRO and DRO from daily marina activities. The approximate location of these samples is shown in Figure 8.

The analytical results for the samples indicated elevated levels of GRO and DRO in the surface sheen water near the bulkhead. The dock sample showed no contamination. These results suggest that the sheen was of petroleum fuel composition and that the site has an ongoing release into Cornet Bay through the bulkhead due to the upland contamination at the site. Analytical results for the surface water sheen sample were 85.4 µg/L for GRO and 368 µg/L for DRO. The complete laboratory report is presented in Appendix C.

4.5 BULKHEAD ASSESSMENT

On 7 September 2006, Reid Middleton, Inc. conducted a field investigation to determine the condition of the timber bulkhead at the site and provide an opinion of probable design and construction costs for a replacement bulkhead (if required).

The assessment indicated that various components of the bulkhead were rotting at several locations. The complete bulkhead was rated in fair condition however, because the deteriorated areas did not overlap there were no compounding effects on the bulkhead integrity. The life expectancy ranges from 7 to 12 years for the various components of the bulkhead. The assessment also provided recommendations and limitations so as not to endanger the existing bulkhead while working around it with various pieces of equipment performing the tasks that would be associated with the remediation of the site. If replacement of the bulkhead is necessary, the budgetary cost estimate for this task is approximately $1,070,000 in 2006 dollars. The complete Cornet Bay Marina Bulkhead Assessment is provided in Appendix F.

4.6 BUILDING ASSESSMENT

On 1 June 2006, Hassler Builders, Inc. conducted a site visit to determine the feasibility of temporarily moving the store building to facilitate remediation. Based on Hassler Builders' observations, the building move is feasible, and would include lifting and securing the building for a move of approximately 100 ft, then returning the building to a newly poured foundation. The budgetary cost estimate for this task is approximately $50,000 in 2006 dollars. The cost estimate is included in Appendix G.

4.7 ONSITE SEWAGE SYSTEM ASSESSMENT

According to the as-built documentation provided by Island County Public Health (Appendix H), the onsite sewage system (OSS) includes two septic tanks, a pump chamber, and a modified sand filter/mound combination drainfield. Although there has been no subsurface investigation within the drainfield area, it is suspected that contamination would have spread to this area since there are high concentrations of GRO and DRO immediately adjacent to the mound. During a cleanup action at the site, this potential contamination would have to be addressed. Therefore, it was necessary to consider whether the drainfield component of the existing onsite sewage system could be replaced if it had to be removed as part of the selected remedial alternative for the site.

Washington State Department of Health OSS regulations specify a horizontal separation distance of 100 ft between the edge of a drainfield and surface water. However, the regulation also provides that a local health officer may allow expansion of an existing OSS adjacent to a marine shoreline that does not meet minimum horizontal separation between the drainfield and the ordinary high water mark as long as other requirements specified in the regulation are met, including a horizontal separation of 50 ft or greater.

Telephone conversations with the Island County Public Health officials were not able to ascertain a definite answer as to whether this particular drainfield could be replaced but indicated that it is a possibility once site conditions are evaluated following the cleanup action.

5. NATURE AND EXTENT OF CONTAMINATION

The results of the RI/FS activities conducted at the site are used in this section to define the nature and extent of contamination in soil, groundwater, and sediment at the site.

5.1 LOCATION AND EXTENT OF FREE PRODUCT

Free product was visible in 3 of the 5 test pits excavated during investigations conducted in June 2006, although product thickness could not be determined. During groundwater monitoring, sheen was seen in both MW-2 and MW-3. MW-1 is screened well below the water table, and it is not possible to measure free product at this location.

Sheens have been seen intermittently in the vicinity of the bulkhead during past years. Sheen was observed on the bay water at the north edge of the bulkhead near MW-2 when it was sampled in 2003. During the Sediment Screening Survey conducted by Ecology in 2005, a visible sheen could be seen on the water coming from the bulkhead as the tidal waters dropped. After the tidal waters receded, there were no visible seeps along the bulkhead so it could not be determined at that time if the source of the sheen was groundwater. During the FS investigation conducted in June 2006, sheen was observed seeping from the bulkhead at the south end of the store. The sheens are suspected to originate from free product remaining at the site.

The exact extent and depth of free product throughout the site is not known, though it is expected to be most prominent in the area between the fuel vault and MW-2. The approximate extent of free product indicated in all the data is presented as accurately as possible in Figure 9.

5.2 SOIL QUALITY

Figure 10 depicts graphically the results of the soil sampling events conducted since 1995. In general, soil contamination has been observed between 3 and 7 ft bgs, over the majority of the site. No significant contamination has been seen in the southwest portion of the site. Figure 9 presents the estimated nature and extent of soil contamination.

Soil contamination is found predominantly within the smear zone. The smear zone is defined as the range of depths within which the groundwater will fluctuate under normal seasonal and tidal conditions. In this zone, free product will move and “smear” the soil in response to changes in the water level elevation. The smear zone soil may be saturated or unsaturated with groundwater at any given time.

5.3 GROUNDWATER QUALITY

Groundwater samples have been periodically collected and analyzed from the three wells onsite since they were installed in 1996. Groundwater samples have contained measurable quantities of BTEX and petroleum hydrocarbons. A summary of the historical results of groundwater sampling are presented in Table 2. Additional groundwater samples were collected during soil boring events, the results of which are presented in Figure 6.

Groundwater samples from the two wells screened across the water table (MW-2 and MW-3) have consistently shown GRO and DRO contamination, which is consistent with floating products such as gasoline and diesel. MW-1 was screened at a greater depth, at least 5 ft below the water table. Groundwater samples collected from MW-1 have not shown contamination by GRO or DRO, which supports a conclusion that groundwater contamination remains within a few feet of the water table.

5.4 SEDIMENT QUALITY

Ecology conducted an investigation of the sediment in Cornet Bay in 2005. The study found that sediment samples along the bulkhead showed no evidence of BTEX, gasoline or diesel, with the exception of one location at the southern end of the bulkhead that contained low levels of BTEX and diesel (Ecology 2005). Concentrations of PAHs exceeded screening levels at 4 of the 6 sampled sediment locations, suggesting that sediment contamination is due to creosote.

Additionally, during the FS investigation conducted in June 2006, a sample of sediment was collected from the sediment settling pond at the southern end of the site. This sample was analyzed for DRO, GRO and BTEX. Results were below detection limits for the analyzed constituents.

Sediment sampling locations are shown in Figure 4.

The full extent of PAH contamination in sediments is not known, and further sampling of PAHs and possibly dioxins would be required for complete characterization. Cleanup of the upland area of the marina site is a priority and will proceed as stipulated in the Consent Decree. Cleanup of sediment contamination from the bulkhead will be addressed at a later time, and evaluation of an approach to sediment cleanup is not included in this FS.

6. DEVELOPMENT OF CLEANUP STANDARDS

Under MTCA, cleanup standards are to be established on a site by site basis, requiring the establishment of the following elements:

- Cleanup levels
- Points of compliance
- Other applicable regulatory requirements.

These elements are discussed in the following sections.

6.1 MODEL TOXICS CONTROL ACT CLEANUP LEVELS

The intention for cleanup at this site is to achieve a permanent cleanup action in which "cleanup standards are met without further actions being required at the site" as defined in WAC 173-340-200. The site was probably contaminated to some degree throughout its long operating history (since the 1960s) and then primarily by an extensive susbsurface release of petroleum fuel products (gasoline and diesel) in 1989. Given the circumstances of this site, appropriate testing for petroleum contamination includes (from MTCA Table 830-1) total petroleum hydrocarbon – gasoline range organics (TPH-G), total petroleum hydrocarbon – diesel range organics (TPH-D), benzene, toluene, ethylbenzene, xylenes, 1,2-dibromeoethane (EDB), 1,2-dichloroethane (EDC), methyl-tertiary-butyl ether (MTBE), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), and lead.

6.1.1 Establishment of Groundwater Cleanup Levels

The Cornet Bay Marina Site is adjacent to surface waters of Puget Sound. Groundwater discharges directly to surface water beneath and around the bulkhead. Groundwater cleanup levels must be protective of marine surface water for both human health and aquatic life. Groundwater at the site is not used for drinking water, nor would it likely be in the future because of its location next to nonpotable surface water. The marina gets its drinking water piped from a drinking water well 100-150 ft. east of the eastern most extent of groundwater contamination at the site. This well also serves seven houses in the vicinity with drinking water and is reportedly about 60 ft. deep. The well is directly upgradient from the site and there appears to be no likely pathway for contamination at the site to reach this well. Nevertheless, because this well is in close proximity to the site, cleanup levels for protection of groundwater as drinking water should also be considered.

The discussion of groundwater cleanup levels is divided into a discussion of groundwater cleanup levels for protection of human health by protection of groundwater as drinking water and by protection of marine surface water. A secondary discussion addresses protection of aquatic life by protection of marine surface water.

6.1.1.1 Protection of Human Health

Groundwater cleanup levels for protection of groundwater as drinking water

MTCA provides three methods for developing cleanup levels for potable groundwater (WAC 173-340-720): Method A, Method B (standard and modified), and Method C (standard and modified). Cleanup levels developed under these methods must be at least as stringent as contaminant concentrations established under applicable state and federal laws (applicable and/or relevant and appropriate requirements [ARARs]), and also must be protective of surface water beneficial uses.

Method A may be used to establish cleanup levels at sites that have few hazardous substances and that either (1) numerical standards are available in MTCA or applicable ARARs, or (2) a "routine" cleanup action (as defined WAC 173-340-200) is applicable to the site. This site meets the required criteria for use of Method A. The site has been contaminated only with petroleum substances of which TPH-G, TPH-D, and benzene appear to be of remaining concern. Numerical groundwater cleanup levels for all of the required analytes from MTCA Table 830-1 (Ecology 2007) are stipulated in MTCA Table 720-1.

Method B is applicable to all sites. Standard Method B uses default formulas, assumptions, and procedures in WAC 173-340-720. Under modified Method B, modifications can be made to the default assumptions to derive site-specific cleanup levels. There is little rational to modify the standard assumptions, and the use of Method C is not applicable at this site. For sites contaminated with petroleum mixtures, Method B requires fractionation analysis of samples for petroleum composition, and these data are then used to compute site-specific groundwater cleanup levels for the TPH fractions. An inherent assumption is that the composition of samples represents the petroleum composition of groundwater contamination throughout the site. However, hydrocarbon identification analyses of groundwater samples at this site indicated the nature of petroleum contamination is variable well to well. Considering these data and also the large extent of contamination at the site (nearly and acre) suggests that the petroleum composition of individual samples would not necessarily represent petroleum contamination in groundwater throughout the site.

Groundwater cleanup levels for protection of marine surface water

Surface water cleanup levels for protection of human health must consider direct contact and ingestion of surface water, and consumption of aquatic life. There is no routine human contact with surface water at the site. Swimming next to the bulkhead is precluded by marina infrastructure and tidal flat conditions. Furthermore surface water sampling indicates non-detect background conditions just away from the bulkhead.

MTCA (WAC 173-340-730) provides three methods for developing cleanup levels for surface water: Method A, Method B (standard and modified), and Method C (standard and modified).

Method A may be used to develop surface water cleanup levels at routine sites with few hazardous substances. There is no "look up" Method A cleanup levels for surface water provided in MTCA. Under Method A, the surface water cleanup level for a particular substance must be designated in stipulated the ARARs and the most stringent level used. If there is no cleanup level established under ARARs for a particular substance, then the Method A cleanup level is based on the natural background concentration or the practical quantitation limit (PQL), for the substance which ever is higher. PQLs would be utilized at the site because the background level contaminant of concern surface water is non-detect. Contaminant levels protective of human health for surface water are found in ARARs for four of the required analytes (benzene, ethylbenzene, EDC, cPAHs). PQL values would have to be used for the other seven required analytes. Given modern laboratory analytical techniques, PQLs derived from analyses for some of these substances at the site could be so stringent as to be unattainable if applied as cleanup levels for groundwater.

Under standard Method B, the surface water cleanup level for a particular substance must be at least as stringent as the most stringent concentration either established in the ARARs or computed under the standard Method B equations and default assumptions provided in WAC 173-340-730. The area offshore from the site is pristine and is routinely used for boating and fishing. There is little rationale to modify the default assumptions in the standard Method B equations, and Method C is not applicable to this site. Method B requires fractionation analysis of samples for petroleum composition when using the equations to compute surface water cleanup levels for petroleum mixtures. In lieu of this however, Method A cleanup levels protective of groundwater as drinking water for petroleum mixtures in MTCA Table 720-1 are allowed as Method B surface water cleanup levels protective of human health [WAC 173-340-730(3) (b)(iii)(C)].

Under standard Method B, cleanup levels for protection of human heath - surface water can be established for seven of the required analytes. Singular bio-concentration factors are not available for three of the required analytes (MTBE, EDB, and xylenes). Research was done into available information on bioconcentration factors for these substances (TOXNET, etc.). Results are not consistent, but the information suggest that standard Method B cleanup levels for surface water would be significantly greater than Method A or standard Method B cleanup levels for potable groundwater for MTBE, EDB, and xylenes. There are no reference dose or cancer potency factor values available for lead, and Method B cleanup levels cannot be derived.

Groundwater Cleanup Level Summary Table.

Groundwater cleanup levels (µg/L) for potable groundwater and protection of human health for marine surface water derived under Method A, Standard Method B or ARARs as described above are presented in the following table:

	Method A (Drinking Water)	Method B (Drinking Water)	Method B (Surface Water)
Total petroleum hydrocarbon – gasoline range organics	800	NA	800
Total petroleum hydrocarbon – diesel range organics	500	NA	500
Benzene	5	0.8	23
Toluene	1,000	640	15,000 (ARAR)
Ethylbenzene	700	800	2,100 (ARAR)
Xylenes	1,000	1,600	> Method A/B, drinking water
1,2-dichloroethane	5	0.48	37 (ARAR)
1,2-dibromoethane	0.01/PQL	0.00051/PQL	> Method A/B, drinking water
Methyl-tertiary-butyl ether	20	24	> Method A/B, drinking water
Benzo(a)pyrene *	0.0002 (ARAR)	0.0002 (ARAR)	0.018 (ARAR)
Lead	15	NA	NA

Notes:
ARAR = Applicable or Relevant and Appropriate Requirement
NA = Not applicable
PQL = Practical Quantitation Limit
> = greater than
*Reference chemical for cPAHs

Cleanup levels protective of human health – marine surface water as allowed under Standard Method B/ARARs are higher than cleanup levels protective of potable groundwater established under Methods A or Standard B. If Standard Method B cleanup levels protective of surface water were to be used as the cleanup levels for groundwater at the site, the groundwater must be classified as nonpotable. Groundwater at this site can be considered nonpotable under WAC 173-340-720(2)(d) because the site is adjacent to marine surface water that is not suitable as a domestic water supply. Conditions that allow this are: (1) the groundwater is not currently used as drinking water, (2) it is unlikely that contamination in the groundwater will be transported to areas where groundwater is or could be a source of drinking water, (3) groundwater at the site is hydraulically connected to the surface water. It is likely these conditions are met at this site.

Final cleanup levels for groundwater at the site will be established in the Cleanup Action Plan.

6.1.1.2 Protection of Aquatic Life

With the exception of lead, there are no established marine surface water cleanup levels in MTCA or ARARs for the required analytes that are protective of marine aquatic life (acute and chronic exposures). Whole effluent toxicity testing (WAC 173-205) may be required to ensure

protection of aquatic life if contaminant levels in groundwater at the point of discharge to surface water are above PQLs at the site for the required analytes.

6.1.2 Establishment of Soil Cleanup Levels

There is a store on the marina property and part of the property is fuel-storage infrastructure and a raised drainfield. The bulk of the property is graveled driveways and parking, with some grassy area. There are no trees or shrubs on the site. Adjacent land within 500 ft. of the site contains a boat repair facility, six houses with large yards, a picnic area and some undeveloped forested land.

Soil Cleanup Levels at the Site Must Be Protective of Both Human Health and Terrestrial Life.

6.1.2.1 Soil Cleanup Levels for Protection of Human Health

The site is heavily visited by the public during boating season. The site does not qualify as an industrial property and soil cleanup levels for unrestricted land use are applicable. Visitors to the site could be temporarily exposed to dust, and the operator and employees of the marina have longer-term exposure. (There is minimal contaminated surface soil at this site however. The soil contamination is primarily in the subsurface "smear zone" about 3-7 ft deep).

MTCA provides two methods for developing soil cleanup levels for unrestricted land use (WAC 173-340-740): Method A and Method B (standard and modified).

Method A soil cleanup levels apply to sites that have few hazardous substances, and where either numerical cleanup levels are available in MTCA and/or ARARs, or the cleanup of the site can be considered "routine". The site meets these criteria. The site is contaminated with petroleum substances, and numerical soil cleanup levels for the required analytes from MTCA Table 830-1 are stipulated in MTCA Table 740-1.

Method B is applicable to all sites. Standard Method B uses default formulas, assumptions, and procedures in WAC 173-340-740. Under modified Method B, modifications can be made to the default assumptions to derive site-specific cleanup levels, but there is little rational to modify the assumptions at this site. Other exposure pathways must be evaluated when using Method B such as direct contact, leaching to groundwater, and vapors. For sites contaminated with petroleum mixtures, Method B requires fractionation analysis of samples for petroleum composition, and these data are then used to compute site-specific soil cleanup levels for TPH fractions. It is assumed that the composition of samples represents the petroleum composition of soil contamination throughout the site. Given the heterogeneity of the soil and the large extent of contamination at this site (nearly and acre) the petroleum composition of individual samples probably would not necessarily represent TPH contamination in soil throughout the site.

Soil cleanup levels (mg/kg) protective of human health derived under Method A and Standard Method B are presented below:

	Method A	Method B
Total petroleum hydrocarbon – gasoline range organics	30	NA
Total petroleum hydrocarbon – diesel range organics	2,000	NA
Benzene	0.03	18
Toluene	7	6,400
Ethylbenzene	6	8,000
Xylenes	9	16,000
1,2-dichloroethane	NA	11
1,2-dibromoethane	0.005	0.012
Methyl-tertiary-butyl ether	0.1	560
Benzo(a)pyrene	0.1	0.14
Lead	250	NA

Notes:
NA = Not applicable
*Method B values are cleanup levels protective of soil ingestion only.

6.1.2.2 Protection of Terrestrial Life

Soil cleanup levels must have no significant adverse effects on the protection and propagations of terrestrial ecological receptors (plants and animals) that could live on or be attracted to the site. MTCA provides a tiered Terrestrial Ecological Evaluation (TEE) process for evaluating threats to terrestrial ecological receptors (WAC 173-340-7490 through 173-340-7494).

The first tier provides exclusion criteria to determine if a site even requires a TEE. Exclusion criteria potentially applicable to this site are either (1) contaminant levels in all soil throughout the site to a depth of 15 ft must not exceed non-detect/background level concentrations, or (2) there are barriers to the pathways for exposure of terrestrial life to soil at the site. A TEE could be excluded for this site only if the intended cleanup actions (stipulated in the CAP) would eliminate all exposure pathways for plants and animals to any soil that is not pristine.

The second tier provides four criteria to determine if a site could qualify for a "simplified" TEE. These criteria consider the use and nature of lands adjacent to the site in relation to plants and wildlife. This site does not qualify for a simplified TEE because it is located adjacent to shore lands and also a picnic area that is part of Deception Pass State Park.

The remaining alternative is to conduct a site-specific TEE for the site. The initial step in this process is a "problem formulation" step (WAC 173-340-7493(2)) where site-specific issues regarding protection of terrestrial life are identified. These include (1) chemicals of ecological concern, (2) exposure pathways, (3) terrestrial ecological receptors of concern, and (4) toxicological effects. The problem formulation is discussed in the following sections.

Chemicals of Concern

The land use of the site is commercial. Food products are sold at the store along with boating and fishing supplies. Both gasoline and diesel fuels are sold to boaters, and there are fuel storage tanks and distribution piping at the site. For commercial land uses, protection of wildlife only is required (plants and soil biota are excluded [WAC 173-340-7493(2)(i)]). A partial list of chemical substances with "indicator" concentrations in soil protective of terrestrial life is provided in the regulation (Model Table 749-3). The site was contaminated by petroleum fuel products during past years. Extensive soil data at the site acquired during characterization indicate that TPH-G and TPH-D concentrations are predominant in the soil (with benzene). Indicator values for TPH-D and TPH-G protective of wildlife (5,000 mg/kg and 6,000 mg/kg respectively) are provided in Model Table 749-3. These values are higher than the Method A soil cleanup levels for protection of human health. An indicator value for benzo(a)pyrene of 12 mg/kg protective of wildlife is higher than the Method A soil cleanup level protective of human health. An indicator value for lead (118 mg/kg) is provided, which is less than the Method A lead cleanup level in soil (250 mg/kg) for human health. Model Table 749-3 does not provide indicator values protective of wildlife for other required analytes (BTEX, EDB, EDC, MTBE).

Exposure Pathways

Currently, areas of the site not occupied by structures (store, fuel tanks, and drain field) are graveled parking areas and driveways, and a patch of grass and weeds (approximately 7,500 square ft in size). Because of the gravel cover and heavy vehicular traffic, the driveways and parking areas provide no opportunity for wildlife to feed and reside, or have significant contact with the soil. The grassy area ostensibly could provide limited habitat for wildlife to feed and reside, and have contact with the soil. After cleanup actions are completed, it is anticipated current use of the site would continue and structures would remain. Barriers to contact with the soil could be included in site restoration (paving and/or gravel would cover the property, and the grassy area could be eliminated).

Terrestrial Life Receptors

Because the land use is commercial, only wildlife receptors are considered. Sea birds, land birds, and small mammals could frequent the site. Birds could temporarily be attracted to discarded human food material and natural food could be available in the grassy area. Small mammals could be attracted to the same food sources and possibly reside at the site - inside or associated with structures or burrowing in the grassy area. Currently the site provides little attraction even for birds and small mammals. After cleanup the site could provide almost no attraction even for birds and small mammals.

Toxicological Effects

For contact with soil, the most serious circumstance would be contact by wildlife with soil above residual saturation. For birds, this could be directly detrimental to egg development. (There is no surface soil above residual saturation at the site). A determination of the complete spectrum

of toxicological effects of petroleum mixtures and other contaminants for site-specific wildlife would be untimely and complex.

At this point however, it appears unnecessary to proceed further in the site-specific TEE process and continue an evaluation of toxicological effects on site-specific wildlife for the following reasons:

(1) The petroleum contamination is aged. The cleanup level concentrations in soil protective of human health for gasoline and diesel range organics are significantly lower than the indicator concentrations in soil protective of wildlife for gasoline and diesel range organics (MTCA Table 749-3). In general, concentrations in soil for the carcinogenic substances (benzene, EDB, EDB, MTBE, cPAH) protective of human health are lower than concentrations protective of wildlife.

(2) Currently the site offers little attraction to wildlife in terms of habitat for food and residence, and cleanup actions would make the site even less attractive to wildlife. Cleanup actions could result in soil at non-detect concentrations remaining at the site (such as excavation and replacement with clean fill). Furthermore, site restoration after cleanup actions could include paving and/or gravel cover over the site and elimination of the grassy area, which provides barriers to wildlife for soil contact.

Cleanup actions will be specified in the Cleanup Action Plan along with further establishment of cleanup levels for soil.

6.2 POINTS OF COMPLIANCE

The points of compliance defines the point or points on a site where the cleanup levels must be attained. The term includes both standard and conditional points of compliance (Ecology 2001). Points of compliance are established at this site for soil and groundwater in accordance with the requirements and procedures set forth in MTCA regulations.

6.2.1 Soil

The point of compliance for soil cleanup levels is defined as throughout the site. This means that the point of compliance extends throughout the soil profile and potentially below the water table and across the site to the limits of contamination near the property boundary. The standard point of compliance for soil is 15 ft bgs. Data from the site however indicates the depth extent of soil contamination is not more than 10 ft.

6.2.2 Groundwater

The standard point of compliance for groundwater is throughout the site, from the uppermost level of the saturated zone, taking into consideration the seasonal groundwater fluctuations, and extending vertically to the lowest-most depth that could potentially be affected by the site. Horizontally, the point of compliance is the limits of contamination near the property boundary.

The standard point of compliance for surface water is defined as the location where contamination in groundwater is released to the surface water. This point of compliance will be as measured in monitoring wells adjacent to and screened below the bulkhead.

6.3 OTHER POTENTIALLY APPLICABLE REQUIREMENTS

MTCA requires that all cleanup actions comply with applicable state and federal laws [WAC 173-340-360(2)]. MTCA defines applicable state and federal laws to include "legally applicable requirements" and "relevant and appropriate requirements" (ARARs). ARARs for the implementation of the remedial action at Cornet Bay Marina are presented in the following table.

ARARs For Cornet Bay Marina Remedial Action

Requirement	ARAR?	Rationale
FEDERAL		
Clean Water Act National Pollution Discharge Elimination System 40 CFR Part 122 The National Pollution Discharge Elimination System establishes permitting requirements, technology-based limitations and standards, control of toxic pollutants, and monitoring of effluents to assure discharge permit conditions and limits are not exceeded. Section 304 Ambient Water Quality Standards	YES YES	Applicable if groundwater will be extracted from ground and discharged. Standards for protection of Human Health and Aquatic life (acute and chronic) in marine surface waters.
Safe Drinking Water Act (National Primary and Secondary Drinking Water Regulations) (42 U.S.C. 300f, 40 CFR Part 141, 40 CFR Part 143) The Safe Drinking Water Act provides a national framework to ensure the quality and safety of drinking water. The primary standards establish Maximum Contaminant Level (MCLs) and Maximum Contaminant Level Goals (MCLGs) for chemical constituents in drinking water. Secondary standards pertain primarily to the aesthetic qualities of drinking water. MCLs are enforceable standards set as close to the MCLGs as feasible, considering available treatment technology.	YES	The removal action is being conducted to reduce chemical concentrations in soil and groundwater, with a goal of meeting cleanup levels throughout the site.
Clean Air Act, as Amended (42 U.S.C. 7401) The Clean Air Act is a comprehensive law which is designed to regulate any activities that affect air quality, and provides the national framework for controlling air pollution. The National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50) set standards for ambient pollutants which are regulated within a region. The National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61) establishes numerical standards for hazardous air pollutants.	YES	The Clean Air Act is will be required if any remediation alternatives produce air emissions.
Endangered Species Act Prohibits jeopardizing federal threatened or endangered species, or adversely modifying habitats essential to their survival.	NO	Threatened or endangered species are not known to inhabit the area around Cornet Bay Marina. Site activities will not jeopardize threatened or endangered species.

ARARs For Cornet Bay Marina Remedial Action

Requirement	ARAR?	Rationale
National Historic Preservation Act, Archeological Resources Protection (16 U.S.C. 470 et seq.) The National Historic Preservation Act requires that historically significant properties be protected. Establishes requirements for the preservation of historic sites, buildings, or objects of significance. Undesirable impacts to such areas must be mitigated.	NO	No historically significant structures are found at the site. All site activities will occur in a previously disturbed area. Historically significant properties will not be disturbed.
Coastal Zone Management Act	YES	The Costal Zone Management Act is required if any remedial alternatives are going to permanently affect land use.
Resource Conservation and Recovery Act Provides the governing regulations for owners and operators of hazardous waste treatment, storage, and disposal facilities; and for the generators and transporters of hazardous waste. In the State of Washington, the Resource Conservation and Recovery Act implemented by the Dangerous Waste Regulations (WAC Chapter 173-303).	YES	All waste generated during the removal action will be characterized and handled per Resource Conservation and Recovery Act regulations, as implemented by WAC 173-303.
Occupational Safety and Health Act (29 CFR 1910) Establishes the worker health and safety requirements for operations at hazardous waste sites.	YES	Site activities will be conducted under appropriate Occupational Safety and Health Act standards.
National Toxics Rule (40 CFR Part 131) Water Quality Standards: Establishment of numeric criteria for protections of water quality from priority toxic pollutants.	YES	Numeric criteria for priority toxic pollutants are provided for protection o f Human Health and Aquatic life (acute and chronic) in marine waters.
Rules for Transport of Hazardous Waste (49 CFR 107, 171) The U.S. Department of Transportation establishes requirements for packaging, handling, and manifesting hazardous waste.	YES	Any hazardous waste generated during site activities will be characterized as needed to determine packaging, handling, and transport requirements.
STATE		
Dangerous Waste Regulations (WAC 173-303) The State of Washington Dangerous Waste Regulations implements the federal hazardous waste regulations pursuant to the Resource Conservation and Recovery Act. These regulations establish requirements for the generation, treatment, and disposal of dangerous waste. These requirements might be applicable as chemical-specific ARARs, depending on the chosen remedial action. WAC 173-303 may be applicable if dangerous wastes are generated by the chosen remedial alternative.	YES	WAC 173-303 will be followed for all offsite generation, treatment, and disposal of hazardous waste (if generated during the removal action).
Minimum Standards for Construction and Maintenance of Wells, Regulation and Licensing of Well Contractors and Operators (RCW 18.104, WAC 173-160, 162) Establishes standards for the design, construction, and maintenance of water wells in the State of Washington.	YES	Wells installed to implement the removal action will be constructed under these regulations.

ARARs For Cornet Bay Marina Remedial Action

Requirement	ARAR?	Rationale
Air Pollution Control Regulations (WAC 173-400), Control of New Sources of Air Toxics (WAC 173-600), and Ambient Air Quality Standards for Particulate Matter (WAC 173-470) The Washington clean air regulations were enacted to comply with the federal Clean Air Act, as amended. The intent of this act is to ensure the protection of public health and the air resources of the state. The regulation is applicable to remedial activities and establishes technical and procedural standards for the control of air contaminant sources. Limits have been established for visibility, particulate, fugitive odor, and hazardous air emissions.	YES	All substantive requirements of the State air pollution control regulations will be followed during implementation of the remedial action.
Washington Industrial Safety and Health Act, Chapter 296-62 WAC Regulations guiding worker safety during the implementation of sampling efforts and/or remedial actions.	YES	Site activities will be conducted under appropriate Washington Industrial Safety and Health Act standards.
Water Pollution Control Act, Chapter 90.48 RCW This act prohibits the discharge of pollutants into water.	YES	Applicable if effluents are to be discharged from the treatment facility during implementation of the remedial action.
Water Quality Standards for Surface Waters of the State of Washington, Chapter 173-201A WAC The State of Washington has adopted the Federal Water Quality Criteria for Toxic Substances. These criteria are applied to all surface waters, regardless of the designated use of the water body.	YES	Applicable if effluents are to be discharged from the treatment facility during implementation of the remedial action. Standards are provided for protection of aquatic life (acute and chronic) in marine waters.
Underground Injection Control (WAC 173-218) Limits injection into aquifers to protect groundwater for beneficial uses.	YES	Potentially applicable if substances are injected (re-injected) into groundwater during implementation of the remedial action.
Water Quality Standards for Groundwater of the State of Washington (WAC 173-200). Public Water Supplies (WAC 246-290). Provides MCLs for chemical constituents in drinking water. The State of Washington has adopted these standards to ensure groundwater is protected. Effluent Testing for Toxicity (WAC 173-205)	YES	Must be considered for establishing cleanup levels in groundwater. Testing may be required to ensure contaminant levels in groundwater discharging to surface water are protective of aquatic life.
Maximum Environmental Noise Levels (WAC 173-60) These rules are adopted pursuant to chapter 70.107 RCW, the Noise Control Act of 1974, in order to establish maximum noise levels permissible in identified environments, and thereby to provide use standards relating to the reception of noise within such environments.	YES	Relevant depending on remedial action selected
Shoreline Management Act (WAC 173-26) The provisions of this chapter implement the requirements of chapter 90.58 RCW, the Shoreline Management Act of 1971. RCW 90.58.200 authorizes the adoption of rules by the department as necessary and appropriate to carry out the provisions of the act. RCW 90.58.080 directs local governments to develop and administer local shoreline master programs for regulation of uses on shorelines of the state.	YES	Will need to work with local government on applicability of this regulation to the selected remedial action.
On-site Sewage Systems (WAC 246-272 and 246-272A) Rules and regulations concerning on-site sewage systems.	YES	Potentially applicable if the drainfield of for the OSS is removed as part of the remedial action.

LOCAL		
Requirement	ARAR?	Rationale
On-site Sewage Systems (ICC 8.07C and 8.07D) Rules and regulations concerning on-site sewage systems.	YES	Potentially applicable if the drainfield of for the OSS is removed as part of the remedial action.
Land Development Standards (ICC 11) Land development standards, storm water and surface water regulations, and clearing and grading requirements	YES	Compliance with substantive conditions of local permits required depending on the selected remedial action.
Buildings and Construction (ICC 14) Building permits and building codes	YES	Compliance with substantive conditions of local permits required depending on the selected remedial action.
Shoreline Use Regulations (ICC 17.05) The provisions of this chapter implement the requirements of chapter 90.58 RCW, the Shoreline Management Act of 1971. RCW 90.58.200 authorizes the adoption of rules by the department as necessary and appropriate to carry out the provisions of the act. RCW 90.58.080 directs local governments to develop and administer local shoreline master programs for regulation of uses on shorelines of the state.	YES	Will need to work with local government on applicability of this regulation to the selected remedial action.
NOTE: ARAR = Applicable or Relevant and Appropriate Requirement. ICC = Island County Code. MCL = Maximum Contaminant Level. MCLG = Maximum Contaminant Level Goal.		

7. TECHNOLOGY SCREENING

This section describes and screens remedial technologies that are commercially available and applicable to remediation of petroleum hydrocarbons. The screening process is very general, and designed to narrow the field to create a set of remedial alternatives that can be further evaluated against Ecology criteria. Screening has been conducted with the overriding concern of Ecology that the sites be remediated as quickly as reasonably possible. This analysis evaluates only mature technologies that have reached the stage of general commercial application.

7.1 IMPACT OF FREE PRODUCT ON REMEDIATION

The presence of free product at a site impacts the effectiveness, cost, and risk associated with treatment systems. The free product also acts as a source for continued soil and groundwater contamination. Because of this, it is common to first attempt to remove as much of the free product from the site as possible prior to remediating either the soil or groundwater.

Left in place, free product can overwhelm the capacity of the treatment system. *In-situ* biological and chemical systems are designed for a known volume of contaminants and a specific groundwater flow rate. If contaminants are continually being released from free product at the site, they will exceed the design capacity of a remedial action selected for the site, allowing contaminants to migrate offsite without treatment.

Ex-situ treatment systems are generally less impacted by free product, particularly in small volumes such as at the Cornet Bay Site. However, free product can cause a release of contaminants if water is not properly handled (in the case of excavation); create problems with mechanical systems (breakdown seals, buildup on parts); clog or cause biological fouling on filtration systems (particulate filters, ion exchange systems, reverse osmosis systems); or may pass untreated through the treatment system.

7.2 TECHNOLOGY SCREENING

Remediation at this site needs to address four types of media:

- Unsaturated soil – sometimes referred to as the vadose zone, or soil above the water table
- Smear zone – a variable zone impacted by fluctuations in the water table elevation
- Saturated Soil – soil below the water table
- Groundwater.

In previous investigations of the site, limited contamination has been observed in the unsaturated soil, so the focus of this FS will be to address the contaminants in the smear zone, saturated soil, and groundwater. Addressing these areas also address the potential for migration of contamination from the site into Cornet Bay.

Commercially available technologies applicable to the remediation of petroleum contaminated soil (saturated and unsaturated), the smear zone, and groundwater are listed in the following table, and described in more detail in Sections 7.2.1 to 7.2.12.

Technology List

Section	Technology	Impacted Media
7.2.1	Air Sparging	Saturated Soil/Groundwater
7.2.2	Bioventing	Unsaturated Soil
7.2.3	Containment	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater
7.2.4	Dual/Multi Phase Extraction	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater
7.2.5	*In-Situ* Thermal Desorption	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater
7.2.6	Excavation and Disposal	Unsaturated Soil/Smear Zone
7.2.7	*Ex-Situ* Bioremediation	Unsaturated Soil/Smear Zone
7.2.8	*In-Situ* Bioremediation	Saturated Soil/Groundwater
7.2.9	*In-Situ* Chemical Oxidation	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater
7.2.10	Volatilization/Vapor Collection	Unsaturated Soil
7.2.11	Pump and Treat	Saturated Soil/Groundwater
7.2.12	In well stripping	Saturated Soil/Groundwater

7.2.1 Air Sparging

Air sparging (AS) is an *in-situ* remedial technology that reduces concentrations of volatile constituents in petroleum products that are adsorbed to soils and dissolved in groundwater [United States Environmental Protection Agency (EPA) 2004]. This technology, which is also known as "*in-situ* air stripping" and "*in-situ* volatilization," involves the injection of contaminant-free air into the subsurface saturated zone, enabling a phase transfer of hydrocarbons from a dissolved state to a vapor phase. The air is then vented through the unsaturated zone. Air sparging is most often used together with soil vapor extraction (SVE), but it can also be used with other remedial technologies. When air sparging is combined with SVE, the SVE system creates a negative pressure in the unsaturated zone through a series of extraction wells to control the vapor plume migration.

When used appropriately, air sparging has been found to be effective in reducing concentrations of volatile organic compounds (VOCs) found in petroleum products at UST sites. Air sparging is generally more applicable to the lighter gasoline constituents (*i.e.*, BTEX), because they readily transfer from the dissolved to the gaseous phase. Air sparging is less applicable to diesel fuel and kerosene.

Ozone can be mixed with the air in an air sparging system to create a reaction between the ozone and the petroleum contaminants, providing chemical treatment of the petroleum contaminants in addition to physically removing contaminants.

Free product reduces the effectiveness of AS systems by acting as an ongoing source of contaminants. Contaminant levels may drop during system operations but will increase once the system is shutdown for any appreciable time. Free product may also interfere with the distribution of air through the smear zone in the vadose zone, creating preferential pathways and dead zones.

Air sparging works best in permeable, homogenous soil. In tighter, heterogeneous soil, preferential pathways are creating leaving pockets of soil untreated.

7.2.2 Bioventing

Bioventing is an *in-situ* remediation technology that uses native microorganisms to biodegrade organic constituents adsorbed to soils in the unsaturated zone. Soils in the capillary fringe and the saturated zone are not affected. In bioventing, the activity of the indigenous bacteria is enhanced by inducing air flow into the unsaturated zone (using extraction or injection wells) and, if necessary, by adding nutrients. Bioventing systems promote biodegradation of constituents and minimize volatilization (generally by using lower air flow rates than for SVE). Bioventing has proven to be very effective in remediating releases of petroleum products including gasoline, jet fuels, kerosene, and diesel fuel. Bioventing is most often used at sites with mid-weight petroleum products (*i.e.*, diesel fuel and jet fuel), because lighter products (*i.e.*, gasoline) tend to volatilize readily and can be removed more rapidly using SVE. Heavier products (*i.e.*, lubricating oils) generally take longer to biodegrade than the lighter products.

Bioventing is not appropriate for sites with groundwater tables located less than 3 ft below the land surface. Special considerations must be taken for sites with a groundwater table located less than 10 ft below the land surface because groundwater upwelling can occur within bioventing wells under vacuum pressures, potentially occluding screens and reducing or eliminating vacuum-induced soil vapor flow. This potential problem is not encountered if injection wells are used instead of extraction wells to induce air flow (EPA 2006).

Free product reduces the effectiveness of bioventing systems by acting as an ongoing source of contaminants. Vapor levels may drop during system operations but will increase once the system is shutdown for any appreciable time. Because free product is not readily broken down into a vapor phase, bioventing systems are relatively ineffective in treating free product in a liquid phase.

Similar to air sparging, bioventing is most effective in permeable, homogenous soil. In tighter, heterogeneous soil, preferential pathways are created leaving pockets of soil untreated.

7.2.3 Containment

Containment addresses contamination by attempting to contain it onsite. Slurry or sheet pile walls and surface capping are commonly used techniques to encapsulate contamination. This action acts to prevent contamination from migrating offsite. Unless it is combined with another treatment technology is does nothing to destroy or eliminate the source of soil or groundwater contamination.

7.2.4 Dual/Multi-Phased Extraction

Dual or multi-phase extraction, as the name implies, simultaneously removes liquid phase (free product, contaminated groundwater) and gas phase (soil vapor) contaminants. There are a number of systems of this kind available in the marketplace. Enhanced Fluid Recovery (EFR) is one example of a form of a multi-phased extraction system aimed at removing free product and contaminants from the smear zone. A monitoring well where free product has been observed is connected to a vacuum truck and a vacuum is applied. Free product, contaminated groundwater, and soil vapors are drawn from the well into the truck. The water/product is hauled offsite for disposal at a permitted facility. EFR can be a relatively inexpensive treatment method. There are no upfront costs unless additional wells are needed. A typical EFR event lasts for one day and multiple wells can be treated at one time. EFR events typically need to be repeated at widely spaced time intervals in order to sufficiently reduce contaminant concentrations. While primarily used for removing gasoline contamination, EFR has recently been used on DRO with some success. For DRO sites, a surfactant can be injected into the well a couple of days before treatment, to loosen the DRO and allow for its removal. However, this may also mobilize DRO and allow it to migrate further (FRTR 2006).

This site presents complications for dual/multi-phase extraction because this site is not paved. Without paving and a very shallow water table it is not be possible to maintain a vacuum, and thus removal will not be possible. Additionally, the soils are not very permeable, which limits the ability of the extraction system to address all areas of concern.

7.2.5 In-situ Thermal Desorption

In-situ thermal desorption (ISTD) uses heating and steam stripping for subsurface remediation. The technology has been demonstrated as an effective method for the removal of volatile and semivolatile contaminants from both the vadose and saturated zones regardless of soil permeability or heterogeneity.

ISTD technology utilizes electrical power to heat the soil in the subsurface treatment region. A common approach is electrical resistivity heating (ERH). Electrodes are installed in the subsurface treatment area using standard drilling or pile driving techniques. Sets of conventional utility transformers are used to direct three-phase electricity from a municipal power line through the electrodes. The electrodes are in electrical contact and cause heating of the subsurface. Other approaches utilize thermal wells to directly heat the subsurface, or radio frequency energy. Soil heating systems require the installation of a soil vapor extraction and treatment system.

By increasing subsurface temperatures to the boiling point of water, ISTD speeds the removal of contaminants by two primary mechanisms: increased volatilization and steam stripping. As subsurface temperatures begin to climb, contaminant vapor pressure, and the corresponding rate of contaminant extraction, increases by a factor of about 30. Through preferential heating, ISTD creates steam in silt and clay stringers and lenses. The physical action of steam escaping these tight soil lenses drives contaminants out of those portions of the soil matrix that tend to lock in contamination via low permeability or capillary forces. The released steam then acts as a carrier

gas, sweeping contaminants to vapor or multi-phase extraction wells constructed in the vadose zone.

7.2.6 Excavation and Disposal

Excavation is used to remove contaminated soil from a source area. This approach can be effective and relatively inexpensive if the contaminants are located at a shallow depth, above the water table, and there are no major obstructions on the site. Although excavation is possible below the water table, it can be substantially more expensive because it is necessary to either dewater the site (if possible) or to provide water management for the saturated soils. The excavation depth is typically limited by available equipment. Standard backhoes can reach an average depth of 15 ft bgs; deeper excavations require either larger, more expensive equipment or creating benches below the ground surface, to increase the reach of the equipment.

Roads, utilities, structures, and other obstructions at the site can limit the location and depth of excavations, particularly in unstable soils. Shoring, protecting, or relocating the obstruction may be necessary. Excavation around obstructions is possible but may result in a substantial amount of contaminants remaining on the site.

Excavated soil can either be transported offsite for treatment or disposal, or treated onsite. Offsite treatment and/or disposal can be expensive depending on the location of the site relative to treatment or disposal facilities, the volume of soil involved, and the availability of different treatment or disposal options in the area. In addition, generally the same volume of soil hauled offsite for disposal or treatment must be hauled back to the site as backfill for the excavation.

Onsite treatment of the soil is an option. However, the applicability of this option is limited by space availability at the site (for treatment stockpiles), the volume of material to be treated, the contaminant concentrations (which impact treatment time), and the ability to safely leave an open excavation at the site. With onsite treatment, the volume of backfill can be reduced or eliminated.

Free product can be excavated along with the contaminated soil. Care must be taken to contain the runoff from excavation stockpiles. The selected treatment facility for the runoff water must be capable of handling petroleum byproducts in its treatment train.

7.2.7 Ex-Situ Bioremediation

Ex-situ bioremediation is the process of removing contaminated soil and treating it elsewhere. *Ex-situ* bioremediation is usually done with one of three methods, landfarming, biopiles, or in a bioreactor.

In landfarming, soil is excavated and taken to an area where it is spread out in thin layers. The layers are tilled and aerated to stimulate biological activity and breakdown of contaminants. Additional amendments may be added to the soil to stimulate biological activity. This method requires large open areas where soil can be spread out and may not be a viable option in cases where there is limited space and large volumes of soil.

> *"Biopiles are used to reduce concentrations of petroleum constituents in excavated soils through the use of biodegradation. This technology involves heaping contaminated soils into piles and stimulating aerobic microbial activity within the soils through the aeration and/or addition of minerals, nutrients, and moisture. The enhanced microbial activity results in degradation of adsorbed petroleum-product constituents through microbial respiration. Biopiles are similar to land farms in that they are both above-ground, engineered systems that use oxygen, generally from air, to stimulate the growth and reproduction of aerobic bacteria which, in turn, degrade the petroleum constituents adsorbed to soil. While land farms are aerated by tilling or plowing, biopiles are aerated most often by forcing air to move by injection or extraction through slotted or perforated piping placed throughout the pile"* (EPA 2004).

Ex-situ bioreactor processes involve placing the contaminated soil in a reactor. Once inside the reactor amendments are added and the temperature and moisture is controlled to achieve maximum biological degradation of contamination.

7.2.8 In-Situ Bioremediation

In-situ bioremediation is a treatment process that uses naturally occurring microorganisms to break down petroleum hydrocarbons into less toxic or nontoxic substances (EPA 1996).

Numerous bioremediation technologies are commercially available to enhance microbial growth and population size by creating optimal environmental conditions. *In-situ* bioremediation systems treat the contaminated soil or groundwater in the location in which it was found. Generally, treatment involves injecting or mixing (through wells, excavation, or direct push technologies) solutions containing oxygen, nutrients and/or microbes into the saturated soil that will enhance and accelerate the natural bioremediation process.

One limitation of this technology is that differences in heterogeneity in soil types and density may cause injected products to follow along preferential flow paths, and it may be difficult to inject product into low permeable soils. Consequently, the product may not contact all areas of contamination leaving some areas of the site untreated. Additionally, this technology will not treat areas of soil above residual saturation where free product is present.

7.2.9 In-Situ Chemical Oxidation

In-situ chemical oxidation technologies can be used for *in-situ* destruction and decomposition of petroleum contaminants. A variety of chemical oxidants and application techniques are commercially available that can be used at sites contaminated with petroleum compounds. With sufficient contact time, chemical oxidants are capable of converting the petroleum hydrocarbon mass to carbon dioxide and water and ultimately irreversibly reduce concentrations of petroleum hydrocarbons in soil and groundwater. In contrast to other remedial technologies, contaminant reduction can be seen relatively quickly (e.g., weeks or months) (EPA 2004).

While many of the chemical oxidants have been used in wastewater treatment for decades, only recently have they been used to treat hydrocarbon contaminated groundwater and soil *in-situ*. Chemical oxidation technologies are predominantly used to address contaminants in the source area saturated zone and capillary fringe, however recent developments in soil mixing technology in combination with fast reaction time of chemical oxidants are allowing for treatment of the unsaturated and smear zone because the soil can be mixed thoroughly maximizing contact of contaminated soil and chemical oxidant.

One limitation of this technology is the depth below the surface that can be treated with soil mixing. In addition, clays and silts may not be as easy to mix thoroughly as these soils tend to stick together more than sands and gravels. Consequently, the product may not contact all areas of contamination leaving some areas of the site untreated.

Several chemical oxidants have been used to remediate petroleum contaminated UST sites. The most commonly used (and most effective) are Hydrogen Peroxide/Fenton's Reagent and Ozone. Sodium or Potassium Permanganate have been used, but experience with these compounds is more limited, although some recent bench-scale and field studies are showing promise.

The performance of chemical oxidation systems are negatively impacted by the presence of free product. While the chemical reaction is capable of treating the contaminants, the concentration of contaminants will overwhelm the treatment capacity. While it may be possible to provide a sufficient dose of the chemical oxidant to breakdown the contaminants in the free product, it is difficult to control the contact time between the free product and the oxidant, reducing the effectiveness of the treatment process.

7.2.10 Volatilization/Vapor Collection

Soil vapor extraction (SVE), also known as soil venting or vacuum extraction, is an *in-situ* remedial technology that reduces the concentration of volatile constituents in petroleum products adsorbed to soils in the vadose zone. In this technology, a vacuum is applied to the soil matrix to create a negative pressure gradient that causes movement of vapors toward extraction wells. Volatile constituents are removed from the subsurface through the extraction wells. The extracted vapors are then treated and discharged to the atmosphere or reinjected to the subsurface (where permissible).

This technology has proven effective in reducing concentrations of VOCs and certain semi-volatile organic compounds found in petroleum products at UST sites. SVE is generally more successful when applied to the lighter (more volatile) petroleum products such as gasoline, and in homogeneous, permeable soils. Diesel fuel, heating oils, and kerosene, which are less volatile than gasoline, are not readily treated by SVE but may be suitable for removal by bioventing. SVE is most effective in homogenous, permeable soil. As in AS and bioventing, air flow in heterogeneous, tight soil create low air flow and preferential pathways that allows pockets of the site remain untreated.

Free product reduces the effectiveness of SVE systems by acting as an ongoing source of contaminants. Vapor levels may drop during system operations but will increase once the

system is shutdown for any appreciable time. Because free product is not readily broken down into a vapor phase, SVE systems are relatively ineffective in treating free product in a liquid phase.

7.2.11 Pump and Treat

Pump and treat systems have been used for years for groundwater remediation systems but their use has fallen into disfavor in recent years. The primary concern with this technology is that, without source removal, pump and treat has no foreseeable duration because achieving cleanup levels becomes increasingly difficult as contaminant concentrations are reduced. In general, a pump and treat system consists of a series of extraction wells screened in the contaminated groundwater. Pumps in the wells extract the contaminated groundwater and pump it to a central location for treatment. The treated groundwater can then be discharged to a sewer system, reinfiltrated into the groundwater, or discharged to surface water (requiring and a National Pollutant Discharge Elimination System permit).

The practicality of these systems is limited by the ability to extract contaminants from the groundwater and by the ability to dispose of the treated water. Extraction of contaminants from the groundwater is limited by the formation and it may not be possible to reduce contaminant concentrations below the groundwater cleanup levels. Remediation time frame can last for decades. Discharge to a storm sewer is generally not permitted; discharge to a sanitary sewer can be expensive or unavailable.

7.2.12 In Well Stripping

In well stripping is an *in-situ* treatment process where air-lift pumping is used to move groundwater through a vertical circulation well. A pressurized air delivery line is placed in the well to deliver a stream of air bubbles into the well. The rising column of bubbles acts as an air-lift pump pushing the combined stream of air/water up the well casing while drawing contaminated water in through the lower well screen. As the air bubbles and water move up the well casing, VOCs transfer from a dissolved phase to a vapor phase in the air bubbles. A vacuum is applied at the wellhead and the vapors are drawn off for treatment. Water is recirculated back into the aquifer at a different vertical elevation (generally higher) from the intake screen. The system is similar to *ex-situ* air stripping where; in this case, the air-stripping tower is the well itself. Because of the circulation patterns established around the treatment well, contaminated groundwater may be captured and stripped several times as it passes through the treatment zone.

The performance of this technology is negatively impacted by heterogeneous and impermeable soils because optimal subsurface circulation patterns will not be created within the groundwater. In addition, free product at the site would potentially clog screens, damage equipment seals and mechanical systems, and impact off-gas treatment systems.

7.3 TECHNOLOGY SCREENING SUMMARY

The following table presents the screening of technologies described earlier.

Technology Screening

Technology	Applicability	Screening Summary
Air Sparging	Saturated Soil/Groundwater	Soil at the site is too heterogeneous and impermeable to address all contaminated areas, will not be evaluated further.
Bioventing	Unsaturated Soil	Soil at the site is too heterogeneous and impermeable to address all contaminated areas, will not be evaluated further.
Containment	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater	May be applicable, will be carried through evaluation of alternatives. May be limited by staging and work space requirements.
Dual/Multi Phase Extraction	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater	Will not be feasible without adding a surface cap at the site and will not effectively address groundwater contamination, will not be evaluated further.
In-situ Thermal Desorption	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater	May be applicable, will be carried through evaluation of alternatives.
Excavation & Disposal	Unsaturated Soil/Smear Zone	May be applicable, will be carried through evaluation of alternatives.
Ex-Situ Bioremediation	Unsaturated Soil/Smear Zone	May be applicable, will be carried through evaluation of alternatives. May be limited by staging and work space requirements.
In-Situ Bioremediation	Saturated Soil/Groundwater	May be applicable, will be carried through evaluation of alternatives. Direct push injection of product may be problematic given heterogeneous and impermeable soils. May require multiple applications in areas of high contaminant concentrations.
In-Situ Chemical Oxidation	Unsaturated Soil/Smear Zone/ Saturated Soil/Groundwater	May be applicable, will be carried through evaluation of alternatives. Soil mixing of chemical oxidant may be advantageous given heterogeneous and impermeable soils.
Soil Vapor Extraction	Unsaturated Soil	Soil at the site is too heterogeneous and impermeable to address all contaminated areas, will not be evaluated further.
In well stripping	Saturated Soil/Groundwater	Soil at the site is too heterogeneous and impermeable and optimal subsurface circulation patterns will not be created within the groundwater to consider this technology further.
Pump and Treat	Saturated Soil/Groundwater	Pump and treat is a long term treatment requiring additional treatment once the groundwater has been extracted. This option will not be considered further.

Based on the technology screening, the following technologies passed the initial screening process and will be developed into remedial alternatives in the following section.

- Containment
- *In-situ* Thermal Desorption
- Excavation & Disposal
- *Ex-situ* Bioremediation
- *In-situ* Bioremediation
- *In-situ* Chemical Oxidation.

8. DESCRIPTION OF REMEDIAL ALTERNATIVES

In this section the remedial technologies that passed the technology screening described in the previous section are combined into remedial alternatives to specifically address the soil and groundwater contamination at the site. The remedial alternatives presented here represent six alternatives capable of providing a reasonable and potentially permanent solution to site contamination, as preferred by MTCA guidance.

The technologies that could address the three main concerns at the site: free product, unsaturated soil, and saturated soil/groundwater were identified through the technology screening in the previous section of this FS. They include:

- Containment
- *In-situ* Thermal Desorption
- Excavation & Disposal
- *Ex-situ* Bioremediation
- *In-situ* Bioremediation
- *In-situ* Chemical Oxidation.

There is a possibility that the area of the site could be returned to natural conditions following remediation instead of continuing operation as a marina. The end use of the site had not been determined at the writing of this FS, and that possibility is considered in the evaluation of remedial alternatives. In that case, only the excavation and *ex-situ* bioremediation alternatives should be considered because restoring the site to natural conditions requires excavation and disposal of soil in order to return the site to a natural sloping grade. The other alternatives can be eliminated because they are designed to address contamination in place. It would be inefficient and cost prohibitive to remediate the soil *in-situ* when it will have to be excavated and disposed of as part of the natural site restoration scenario anyway.

The six remedial alternatives described in the following sections are combinations of the technologies discussed above. These alternatives are designed to address remediation of contaminated site media. The excavation and *ex-situ* bioremediation alternatives have been subdivided into two options based on the possible outcomes for site restoration. Approximate restoration times described in the remedial alternatives do not include the time necessary to install a new bulkhead when required. A seventh alternative, No Action, is included in accordance with EPA guidance on the preparation of feasibility studies.

8.1 ALTERNATIVE 1: CONTAINMENT

This alternative addresses the contamination at the site by attempting to contain it onsite. Containment could only be achieved by having an impermeable bulkhead and constructing a sheet pile or slurry wall around the rest of the site as shown in Figure 11. Following these activities, pavement will be placed over the site to act as a cap to prevent infiltration of storm

water. Under this option it will be necessary to replace the existing timber bulkhead with an impermeable steel bulkhead.

For this alternative it is important to consider the fact that it will be very difficult to achieve complete containment and there is no guarantee that contamination will not escape under the bulkhead or slurry wall containment. Additionally, the contamination will remain in the soil and groundwater at the site indefinitely.

This alternative does not include removal of the existing UST at the site and construction of the sheet pile or slurry wall will be complicated by spatial constraints and the location of the existing OSS and drainfield on the site.

8.2 ALTERNATIVE 2: *IN-SITU* THERMAL DESORPTION

This alternative involves the use of ISTD. Utilizing ERH methodology, a grid will be established across the contaminated areas of the site (Figure 12) using up to 160 electrodes with co-located multi-phase extraction wells. Vapor off-gas will be treated using an oxidizer. The electrodes and piping will be buried to allow complete site access during the treatment period which could range from six months to one year. This option is expected to remove gasoline contamination to the required cleanup levels, as well as approximately most of the diesel contamination. This alternative may leave areas with diesel exceeding cleanup levels; however, the diesel is not mobile and will attenuate over time. This alternative includes the removal and replacement of the existing UST at the site.

8.3 ALTERNATIVE 3: EXCAVATION THROUGH SMEAR ZONE

This alternative involves excavation of contaminated soil through the smear zone across the majority of the site. Excavation would be performed using a track-mounted excavator to remove soil from the area shown in Figure 12 to a depth or approximately 9 ft. Approximately 11,200 cubic yards (cy) of petroleum-contaminated soil will be containerized and transported to a disposal facility. Based on the TCLP results from soil sampling in June of 2006, the soil could be disposed in a Subtitle D landfill.

The site will be backfilled with clean soil, compacted, and resurfaced following excavation. While backfilling, soil placed within the smear zone will be mixed with an oxygen source, such as ORC® or EHC® to allow enhanced bioremediation of the groundwater. The oxygen source will support bioremediation of petroleum products remaining in the smear zone after excavation.

The duration of this cleanup action will vary based on the number of excavators dedicated to the task and the number of containers (for soil transport) available when the work is conducted. Estimates range from 3 to 6 months.

There are two options for consideration under this alternative which affect associated construction activities and cost of this cleanup action. The first option includes restoring the site to preconstruction conditions following excavation and the second option includes restoring the

site to a natural state following excavation. These options are explained in the following sections.

Alternative 3A: Excavation and Restoration to Preconstruction Conditions

Under this option, the store building will be temporarily moved so that the soil can be removed from below the structure, the timber bulkhead will be replaced, the onsite sewage system will be removed, and the existing UST will be removed.

Following backfilling and compaction of the excavation area a new foundation will be set for the store, which will be returned to its original condition. A new onsite sewage system and UST will be installed. The cost of replacing the bulkhead has been included with this alternative based on the bulkhead assessment performed in September 2006.

Alternative 3B: Excavation and Restoration to Natural Conditions

Under this option, the store building will be demolished so that the soil can be removed from below the structure, the timber bulkhead will ultimately be demolished, the onsite sewage system will be removed, and the existing UST will be removed along with the other below ground utilities at the site. Following backfilling and compaction of the excavation area, a natural slope and shoreline will be constructed to match the adjacent shorelines.

8.4 ALTERNATIVE 4: *EX-SITU* BIOREMEDIATION

This alternative involves excavation of contaminated soil through the smear zone across the majority of the site. Excavation would be performed using a track-mounted excavator to remove soil from the areas shown in Figure 13 to a depth of approximately 9 ft. It is anticipated that the store building will be demolished and that soil will be removed and treated in four phases due to limited onsite treatment space. Approximately 11,200 cy of petroleum-contaminated soil will be treated on site using *ex-situ* bioremediation or “biopiles”.

The biopiles will be approximately 10 ft tall and approximately 20 ft wide. The length of the biopiles will vary depending on the quantity of soil removed during the phase of operation. Soil from phase III and IV of the excavation will be combined for treatment. The biopiles will be constructed in "lifts", with aeration and moisturizing piping placed every few feet within the pile. Soils with lower permeability, such as the clays found at this site, are more difficult aerate. To allow better air flow through the biopiles, the soil will be mixed with a compost type material. A shed will be constructed to house the blowers.

The site will be backfilled using the treated soil, compacted, and resurfaced. While backfilling, soil placed within the smear zone will be mixed with an oxygen source, such as ORC® or EHC® to allow enhanced bioremediation of the groundwater. The oxygen source will support bioremediation of petroleum products remaining in the smear zone after excavation.

This cleanup action is expected to take approximately 3 to 5 years to complete. The timeframe may vary depending on the soil treatment time and other methodologies used to speed up the

treatment process. If the adjacent park area to the east of the site could be used during the cleanup action, the timeframe may be reduced further. During the remedial activities the site will be fully fenced and not accessible to the public during this time.

There are two options for consideration under this alternative which affect associated construction activities and cost of this cleanup action. The first option includes restoring the site to preconstruction conditions following treatment and the second option includes restoring the site to a natural state following treatment. These options are explained in the following sections.

Alternative 4A: *Ex-situ* Bioremediation and Restoration to Preconstruction Conditions

Under this option, the store building will be demolished so that the soil can be removed from below the structure and to increase the limited onsite treatment space. The onsite sewage system will be removed, the existing UST will be removed, and the timber bulkhead will be replaced.

Following backfilling and compaction of the excavation area a new foundation will be set and the store restored. A new onsite sewage system and UST will be installed. The cost of replacing the bulkhead has been included with this alternative based on the bulkhead assessment performed in September 2006.

Alternative 4B: *Ex-situ* Bioremediation and Restoration to Natural Conditions

Under this option, the store building will be demolished so that the soil can be removed from below the structure, the timber bulkhead will ultimately be demolished, the onsite sewage system will be removed, and the existing UST will be removed along with the other below ground utilities at the site. Following backfilling and compaction of the excavation area, a natural slope and shoreline will be constructed to match the adjacent shorelines. Excess soil will be transported offsite to an appropriate disposal facility prior to *ex-situ* treatment.

8.5 ALTERNATIVE 5: PARTIAL EXCAVATION AND *IN-SITU* BIOLOGICAL DEGRADATION

Alternative 5 is a combination of excavation and *in-situ* biological degradation. For this option the store building will be temporarily moved and excavation will be implemented to remove areas suspected of having free product, since biological degradation is not effective remediating free product. The area suspected of containing free product will be excavated to the water table (4 to 6 ft bgs), as shown in Figure 14. An estimated 1,500 cy of soil will be removed along with the existing UST. Excavated soil will be containerized and transported to an offsite disposal facility. The UST will be replaced during backfilling.

A source of oxygen and nutrients will then be introduced into the ground using direct push injection from depths approximately 3 to 13 ft bgs. The product will encourage and support aerobic biodegradation of the petroleum contaminants. Due to the high levels of petroleum contamination at the site it is expected the two injection events will be required to address site contamination. The second phase of injections will occur six to twelve months after the first injection. This cleanup action would take two or three years to complete.

8.6 ALTERNATIVE 6: PARTIAL EXCAVATION AND *IN-SITU* CHEMICAL OXIDATION

Alternative 5 is a combination of excavation and *in-situ* chemical oxidation. For this option the store building will be temporarily moved and excavation will be implemented to remove areas suspected of having free product, since chemical oxidation is not effective addressing free product. The area suspected of containing free product will be excavated to the water table (4 to 6 ft bgs), as shown in Figure 14. An estimated 1,500 cy of soil will be removed along with the existing UST. Excavated soil will be containerized and transported to an offsite disposal facility. The UST will be replaced during backfilling.

A chemical oxidizer will then be introduced into the ground using soil mixing equipment to treat contaminated soil and groundwater from approximately 3 to 13 ft bgs. The product will chemically degrade the petroleum contaminants. It is anticipated that the existing timber bulkhead will have to be replaced as part of this option in order to treat the soil adjacent to the bulkhead. This cleanup action would take approximately 6 – 8 months to complete.

8.7 ALTERNATIVE 7: NO ACTION

The No Action Alternative is included as a baseline alternative for comparison to the active remedial alternatives. In this case, the no action alternative will require institutional control be placed on the property to prevent contact with the contamination during excavation activities, and prevention of access to the groundwater. Institutional controls are legal or administrative measures designed to limit or control activities that could result in inadvertent exposure to contamination before, during, and after a cleanup action, particularly if contaminant residues are likely to remain above cleanup levels for an extended period of time.

The No Action alternative does not satisfy MTCA threshold requirements for meeting cleanup standards. No Action would not significantly affect the built environment. No roads, buildings or utilities would be physically damaged or disrupted. The long-term presence of contamination could deter future investment in the built environment and the community. The natural environment would continue to be significantly and adversely impacted by the contamination present.

9. MTCA MINIMUM REQUIREMENTS

This section evaluates each of the remedial alternatives with respect to the requirements for cleanup actions specified in WAC 173-340-360. Cleanup actions selected under MTCA must first meet a specific set of minimum requirements [WAC 173-340-360(2)] before being compared to other remedial alternatives in a disproportionate cost analysis (presented in Section 10).

The minimum requirements include "threshold" and "other" requirements.

9.1 THRESHOLD REQUIREMENTS

MTCA provides the framework for evaluating and selecting cleanup actions. Within this framework are threshold requirements that must be met by all cleanup actions. The threshold requirements for cleanup actions, as defined in WAC 173-340-360(2)(a) are:

- Protect human health and the environment
- Comply with cleanup standards
- Comply with applicable state and federal law
- Provide for compliance monitoring.

How each of the alternatives meet the threshold requirement is presented below.

9.1.1 Protect Human Health and the Environment and Comply with Cleanup Standards

Section 6 presented the cleanup standards that protect human health and the environment. In general, with the exception of the No Action Alternative, each of the remedial alternatives can meet most or all of the cleanup standards.

9.1.2 Comply with State and Federal Laws

There are numerous laws and associated regulations that influence how any particular remedial action is implemented, as detailed in Section 6. Most of the alternatives can be implemented at the site and comply with state and federal laws. Exceptions may include issues related to the replacement of the timber bulkhead and on-site sewage system, including the mounded drainfield, if those items are removed during the course of the selected remedial alternative.

9.1.3 Provide for Compliance Monitoring

Compliance monitoring plans that address monitoring of the effectiveness of the remedial action will be developed in conjunction with the Cleanup Action Plan (requirements specified in WAC 173-340-410). All of the remedial alternatives being considered include comprehensive compliance monitoring plans.

9.2 OTHER MTCA REQUIREMENTS FOR CLEANUP ACTIONS

The "other" MTCA requirements for cleanup actions are:

- To use permanent solutions to the maximum extent practicable
- To provide for a reasonable restoration time frame
- To consider public concerns raised on the draft cleanup action plan during the public comment period [WAC 173-340-360(2)].

9.2.1 Use Permanent Solutions to the Maximum Extent Practicable

MTCA specifies that when selecting a cleanup action preference shall be given to actions that are "permanent to the maximum extent practicable." To determine whether a cleanup action uses permanent solutions to the maximum extent possible, a disproportionate cost analysis shall be used [WAC 173-340-360 (3)(b)]. A disproportionate cost analysis is not required if a permanent cleanup action (WAC 173-240-200) which achieves cleanup standards without further action at the site is known. Given the circumstances at this site a permanent cleanup action is not definitely known or can be assured at this time, and a disproportionate cost analysis is appropriate. The disproportionate cost analysis is presented in Section 10.

9.2.2 Provide for a Reasonable Restoration Time Frame

All of the remedial alternatives considered can be completed within a reasonable time frame (generally less than 3 years) with the exception of alternative 4 (3 to 5 years).

9.2.3 Public Concerns

Public concerns will be addressed by Ecology during the selection of the remedial action. A Public Notice and Participation periods is required (WAC 173-340-600) prior to implementation of the action.

10. DISPROPORTIONATE COST ANALYSIS

The procedure for determining whether a cleanup action uses permanent solutions to the maximum extant practicable is provided in WAC 173-340-360(3). This section presents a "disproportionate cost analysis" to compare the relative costs and benefits of all the alternatives. Costs are disproportionate to benefits if the incremental cost of an alternative exceeds the incremental benefit achieved with the additional cost. The analysis may be quantitative or qualitative. The analysis begins by ranking alternatives from the most permanent to the least permanent. Once alternatives are ranked, they are evaluated based on seven criteria in WAC 173-340-360(f). The seven criteria are:

1) Protectiveness
2) Permanence
3) Cost
4) Effectiveness over the long term
5) Management of short-term risks
6) Technical and administrative implementability
7) Consideration of public concerns.

For each of the seven criteria, the alternatives will be given a score from 1 to 5, with 5 being the highest score possible. These scores will be summed, creating the value for the "benefit" of the alternative. The scoring system is described in the following sections.

10.1 PROTECTIVENESS

Protectiveness of human health and the environment includes the degree to which existing risks are reduced, time required to reduce risk at the site and attain cleanup standards, onsite and offsite risks resulting from implementing the alternative, and improvement of the overall environmental quality. All of the remedial alternatives are designed to aggressively address possible human health risk associated with exposure to contaminated media. Scores are assigned to each of the alternatives as follows. For this comparison, the excavation alternative will be most disruptive to on and off site alternatives, and will be used to compare implementation risks.

Alternative	Score	Discussion
1: Containment	2	There is no guarantee that complete containment is achievable. Installation is complicated and will be disruptive to the site operations and neighborhood. Contamination will be contained but remain in the environment indefinitely.
2: *In-situ* Thermal Desorption	4	Reduces risk, though installation is complicated and will be disruptive to the marina. On and offsite risks of implementing this alternative are lower compared to excavation.
3: Excavation	3	Removes risk from soil and the smear zone, though does not immediately address groundwater contamination issues. Excavation will be very disruptive to marina operations and neighborhood, and will add a significant amount of truck traffic to local roads.

Alternative	Score	Discussion
4: *Ex-situ* Bioremediation	2	Reduces risk but will require a lengthy time frame for complete remediation and will be very disruptive to marina operations and the surrounding neighborhood. On and offsite risks of implementing this alternative are greater than excavation because this option involves leaving open excavations for extended periods of time.
5: *In-Situ* Bioremediation	3	Reduces risk but will require a lengthy time frame for complete remediation. On and offsite risks of implementing this alternative are low compared to excavation.
6: *In-Situ* Chemical Oxidation	3	Reduces risk, though soil mixing will be very disruptive to marina operations and the surrounding neighborhood. On and off site risks are similar to excavation.
7: No Action	1	Provides no additional protectiveness

10.2 PERMANENCE

The remedial alternatives were scored based on the degree to which the alternative permanently reduces the toxicity, mobility or volume of hazardous substances, including the adequacy of the alternative in destroying the hazardous substances, the reduction or elimination of hazardous substance releases and sources of releases, the degree of irreversibility of waste treatment process, and the characteristics and quantity of treatment residuals generated. The score assigned to each is based on relative permanence presented earlier. None of the alternatives are guaranteed to achieve cleanup standards therefore none are scored as a 5.

Alternative	Score	Discussion
1: Containment	2	Prevents migration of hazardous substances, requires long-term monitoring and possible operation and maintenance (O&M).
2: *In-Situ* Thermal Desorption	4	Reduces or eliminates hazardous substances, will not require long-term monitoring, O&M, or institutional controls.
3: Excavation	4	Reduces or eliminates hazardous substances, will not require long-term monitoring, O&M, or institutional controls.
4: Ex-situ Bioremediation	3	Reduces or eliminates hazardous substances, will require O&M.
5: *In-Situ* Bioremediation	3	Reduces or eliminates hazardous substances, may require additional applications and long-term monitoring to complete remediation.
6: *In-Situ* Chemical Oxidation	4	Reduces or eliminates hazardous substances, will not require long-term monitoring, O&M, or institutional controls.
7: No Action	1	Does not reduce or eliminate hazardous substances. Requires institutional controls and long-term monitoring

10.3 COST

Costs for each remedial alternative were developed as part of the FS process. Cost estimates were prepared for each alternative using "A Guide to Developing and Documenting Cost Estimates during the Feasibility Study" (EPA 2000), and include a 25% contingency factor. The cost estimates were calculated using the most common products and application methods available for a remedial alternative. There are numerous competing companies and alternative application methods that may be used in the remedial design that could be more cost effective, though the cost estimates provided allow a relative comparison of alternatives to each other.

The detailed cost estimates are presented in Appendix I in 2007 dollars. The cost summary and score for each of the alternatives is provided in the following table. Scoring is based on cost rank. Least expensive alternative scores a 5, with the most expensive alternative scoring 1.

Estimated Costs for Marina Restoration Option

	Alternative 1	Alternative 2	Alternative 3A	Alternative 4A	Alternative 5	Alternative 6	Alternative 7
	Containment	*In-Situ* Thermal Desorption	Excavation (precon conditions)	*Ex-Situ* Bio (precon conditions)	*In-Situ* Bio	*In-Situ* Oxidation	No Action
Capital Costs	$ 2,670,000	$ 4,117,000	$ 4,802,000	$ 4,034,000	$ 6,476,000	$ 4,135,000	$ 25,000
O&M Costs	$ 106,000	$ 21,000	$ 21,000	$ 441,000	$ 46,000	$ 46,000	$ -
Periodic Costs	$ -	$ -	$ -	$ -	$ 1,007,000	$ -	$ -
Total Costs	$ 2,776,000	$ 4,138,000	$ 4,823,000	$ 4,475,000	$ 7,529,000	$ 4,181,000	$ 25,000
Score	4	3	2	2	1	3	5

Since cost is the only criteria where the site restoration options for alternatives 3 (excavation) and 4 (*ex-situ* bioremediation) will score differently, these alternatives have been scored in the following table for comparison.

Estimated Costs of Natural Restoration Option

	Alternative 3B	Alternative 4B
	Excavation (natural conditions)	*Ex-Situ* Bio (natural conditions)
Capital Costs	$ 2,762,000	$ 2,688,000
O&M Costs	$ 26,000	$ 446,000
Periodic Costs	$ -	$ -
Total Costs	$ 2,788,000	$ 3,134,000
Score	3	3

10.4 EFFECTIVENESS OVER THE LONG-TERM

Long-term effectiveness includes "the degree of certainty that the alternative will be successful, the reliability of the alternative during the period of time hazardous substances are expected to remain on-site at concentrations above cleanup levels, the magnitude of residual risk with the alternative in place, and the effectiveness of controls required to manage treatment residues or remaining wastes." MTCA suggests the use of the use of the following hierarchy of cleanup action components in descending order of long-term effectiveness:

1) Reuse or recycling will be assigned a score of 5

2) Destruction or detoxification will be assigned a score of 4

3) Immobilization or solidification will be assigned a score of 3

4) On- or off-site disposal will be assigned a score of 2

5) On-site isolation or containment and institutional controls will be assigned a score of 1.

Alternative	Score	Discussion
1: Containment	1	Petroleum hydrocarbons remain in contained place.
2: *In-Situ* Thermal Desorption	4	Petroleum hydrocarbons are destroyed in this process.
3: Excavation	2	Petroleum hydrocarbons are transported off-site for disposal. Contamination may remain in groundwater.
4: *Ex-situ* Bioremediation	4	Petroleum hydrocarbons are destroyed in this process. Contamination may remain in groundwater.
5: *In-Situ* Bioremediation	4	Petroleum hydrocarbons are destroyed in this process.
6: *In-Situ* Chemical Oxidation	4	Petroleum hydrocarbons are destroyed in this process.
7: No Action	1	Petroleum hydrocarbons remain in place.

10.5 MANAGEMENT OF SHORT-TERM RISKS

The risk to human health and the environment associated with the alternative during construction and implementation, and the effectiveness of measures that will be taken to manage such risks. Impacts from remedial action implementation include vehicle traffic, temporary relocation of a building, temporary closure of facilities, odor, open excavations, and noise, dust and safety concerns associated with extensive heavy equipment activity. The greatest short-term risk to human health is related to safety and general construction activity.

Alternative	Score	Discussion
1: Containment	3	Constructing slurry or sheet pile walls and a new bulkhead will disrupt marina operations for approximately 3 to 4 months. Construction equipment will be noisy and unsightly for the surrounding neighborhood.
2: *In-Situ* Thermal Desorption	3	Installing electrode and recovery wells and associated piping and electrical lines will disrupt marina operations for approximately 3 to 4 months. Overall, this will have slightly more short term impact than Alternative 5, but less short term impact than Alternative 3. Operating the system may be noisy during operations if 3-phase power cannot be obtained and generator is used to power system.
3: Excavation	2	Excavating the entire site will disrupt marina operations and neighborhood traffic for 4 to 6 months. Construction equipment will be noisy and unsightly for the surrounding neighborhood.
4: Ex-situ Bioremediation	1	Excavating and treating the soil onsite will disrupt marina operations for 3 to 5 years. This is the most disruptive alternative in the short term. The excavation and treatment process will be noisy for the duration of the project due to construction equipment and blowers used for treatment of biopiles.
5: *In-Situ* Bioremediation	4	Limited excavation will disrupt traffic and marina operations for approximately 2 weeks. The remaining treatments will be installed using a geoprobe, which can be noisy, but will otherwise not cause a great impact to site activities.
6: *In-Situ* Chemical Oxidation	3	Limited excavation will disrupt traffic and marina operations for approximately 2 weeks while soil mixing activities will disrupt marina operations for an additional month. If a new bulkhead is required marina operations could be affected for another month. Soil mixing and construction equipment will be noisy and unsightly for the surrounding neighborhood.
7: No Action	5	This alternative will cause no short term disruptions.

10.6 TECHNICAL AND ADMINISTRATIVE IMPLEMENTABILITY

Ability to be implemented includes consideration of whether the alternative is technically possible, availability of necessary offsite facilities, services and materials, administrative and regulatory requirements, scheduling, size, complexity, monitoring requirements, access for construction operations and monitoring, and integration with existing facility operations and other. Remedial actions conducted under a Consent Decree are exempt from the procedural requirements of the local government permits [WAC 173-340-710 (9)(b)].

Alternative	Score	Discussion
1: Containment	2	Permitting or other administrative requirements will be necessary for construction. The permitting process for a new bulkhead is expected to take 1 to 2 years. Complete containment will be very difficult to achieve and installation will be complicated by the OSS and associated drainfield.
2: *In-Situ* Thermal Desorption	4	Permitting or other administrative requirements may be necessary for construction. 3-phase power is required for the operation of the system; Puget Sound Energy may have to run new electrical services to the site to support the system.

Alternative	Score	Discussion
3: Excavation	3	Grading permit from the local government will be required for excavation. May require permits from Island County to work in the waterway. May not be able to replace onsite sewage system. If bulkhead is replaced, the permitting process for a new bulkhead is expected to take 1 to 2 years.
4: Ex-situ Bioremediation	2	Grading permit from the local government will be required for excavation. May require permits from Island County to work in the waterway. May not be able to replace onsite sewage system. If bulkhead is replaced, the permitting process for a new bulkhead is expected to take 1 to 2 years. The length of time required for treatment means maintaining open excavations during treatment.
5: *In-Situ* Bioremediation	1	Soil conditions at the site are not suitable for this alternative and the amount of product required is unrealistic for injection application into the formation.
6: *In-Situ* Chemical Oxidation	2	Grading permit from local government will be required for excavation. May require permits from Island County to work in the waterway. If a new bulkhead is required, the permitting process is expected to take 1 to 2 years. Soil conditions at the site are not suitable for this alternative but soil mixing application will help overcome soil conditions.
7: No Action	5	Easily implemented

10.7 CONSIDERATION OF PUBLIC CONCERNS

Public concerns will be addressed during the public review period. Scoring of this criterion will be deferred until after public comment. Below is a summary of scores for each alternative to be used for the disproportionate cost analysis.

Summary of Scores

Screening Criteria	Alternative						
	Containment	*In-situ* Thermal Desorption	Excavation	*Ex-situ* Bioremediation	*In-Situ* Bioremediation	*In-Situ* Chemical Oxidation	No Action
Protectiveness	2	4	3	2	3	3	1
Permanence	2	4	4	3	3	4	1
Effectiveness over the long term	1	4	2	4	4	4	1
Management of short-term risks	3	3	2	1	4	3	5
Technical and administrative implementability	2	4	3	2	1	2	5
TOTAL	10	19	14	12	15	16	13

10.8 DISPROPORTIONATE COST ANALYSIS

The goal of this disproportionate cost analysis is to determine whether the incremental cost of an alternative is disproportionate to the incremental benefit relative to the lower cost alternative [WAC 173-340-360(e)(i)]. A systematic approach was developed to quantify the relative benefit of the alternatives. The total benefit of each alternative was calculated as the sum of ratings for six of the seven MTCA evaluation criteria (cost is not included as a benefit) as presented in the previous table. The budgetary cost estimated was then divided by the total "benefit" provide by the alternative to obtain a cost/unit of benefit.

10.8.1 Marina Restoration Option

The following table presents the cost/unit benefit for the remedial alternatives based on the assumption that the site will continue to operate as a marina following the cleanup action and will need to be restored to preconstruction conditions.

	Containment	*In-situ* Thermal Desorption	Excavation	*Ex-situ* Bioremediation	*In-Situ* Bioremediation	*In-Situ* Chemical Oxidation
"Benefit" Score	10	19	14	12	15	16
Cost	$2,776,000	$4,138,000	$4,823,000	$4,475,000	$7,529,000	$4,181,000
Cost/Unit "Benefit"	$277,600	$217,789	$344,500	$372,917	$501,933	$261,313

Based on this analysis, the ISTD alternative provides the most benefit per unit of cost. It also has the highest benefit score overall. Therefore, ISTD could be considered as the preferred remedial alternative for this scenario. Some of the benefits associated with this alternative include:

- Contamination will be addressed throughout the saturated and unsaturated zones.
- There is a high degree of certainty in the outcome of this action.
- There will be permanent reduction of contamination in a relatively short time frame.
- The majority of contaminants are destroyed in this process.
- There are few unknowns associated with implementation of this action.
- The timber bulkhead doesn't have to be replaced or the store moved.
- There will be limited disruption to the marina and surrounding community.

Some of the concerns associated with alternative include:

- The system will require periodic operation and maintenance over its lifetime.

- Currently there is no 3-phase power at the site; 3-phase power will need to be obtained if system cannot be installed to work with existing infrastructure. This cost has been included in the cost estimate.

- A pilot test is advisable prior to full implementation of this alternative, for selection of ISTD to apply.

10.8.2 Natural Restoration Option

The following table presents the cost/unit benefit for the remedial alternatives based on the assumption that the site will no longer continue to operate as a marina following the cleanup action and can be restored to natural conditions.

	Excavation	*Ex-situ* Bioremediation
"Benefit" Score	14	12
Cost	$2,788,000	$3,134,000
Cost/Unit "Benefit"	$199,143	$261,167

Based on this analysis, the excavation provides the most benefit per unit of cost. It also has the highest benefit score overall. Therefore excavation should be considered as the preferred remedial alternative for this scenario. Some of the benefits associated with this alternative include:

- A shorter construction period which reduces risk sooner.
- Little to no operation and maintenance required.
- Better technical and administrative implementability.

Some of the concerns associated with this alternative include:

- Contaminants are not destroyed in the process; soil is transported offsite for disposal.

- It will be very disruptive to the surrounding neighborhood.

- Services provided by the marina (fuel, supplies, and moorage) to boaters and the surrounding community will be eliminated.

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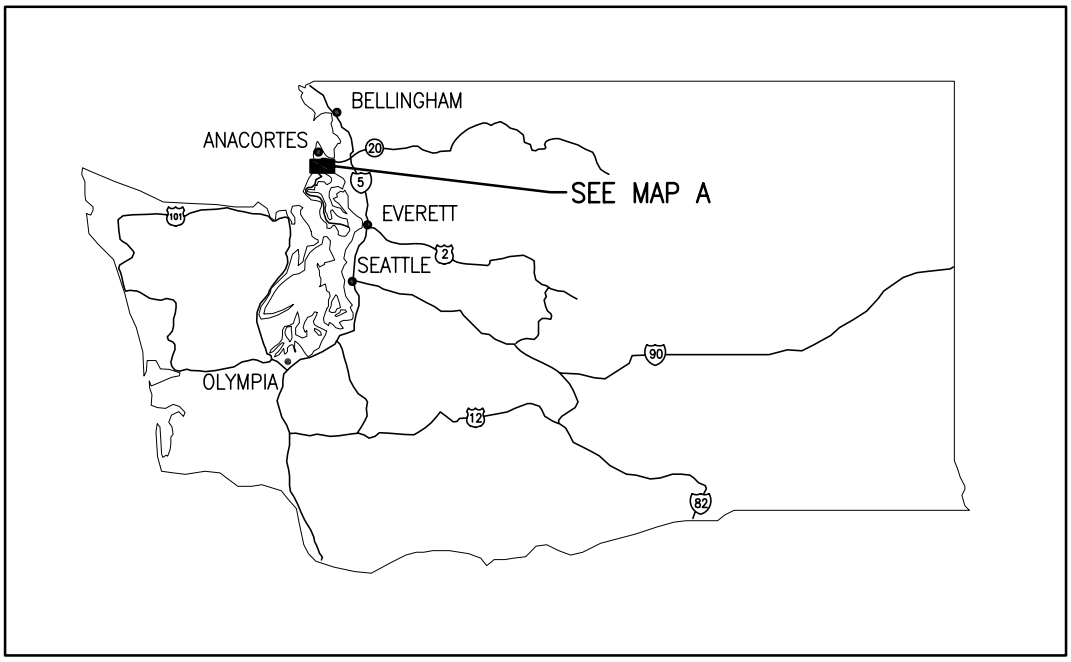
FIGURES



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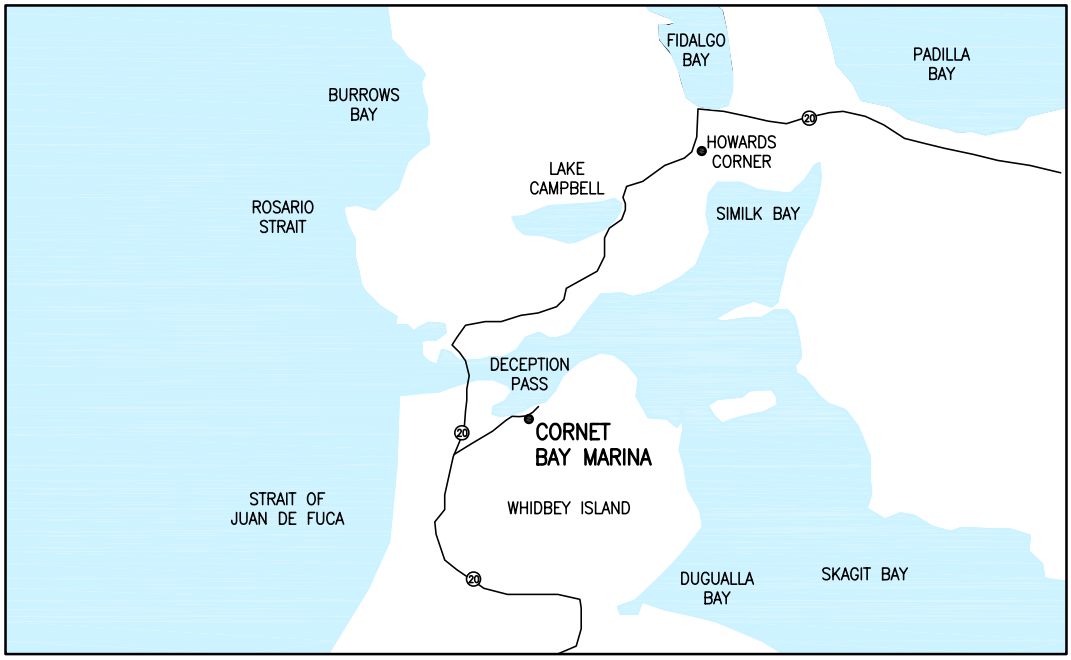


MAP A

Figure 1. Cornet Bay Marina, Site Location Map.

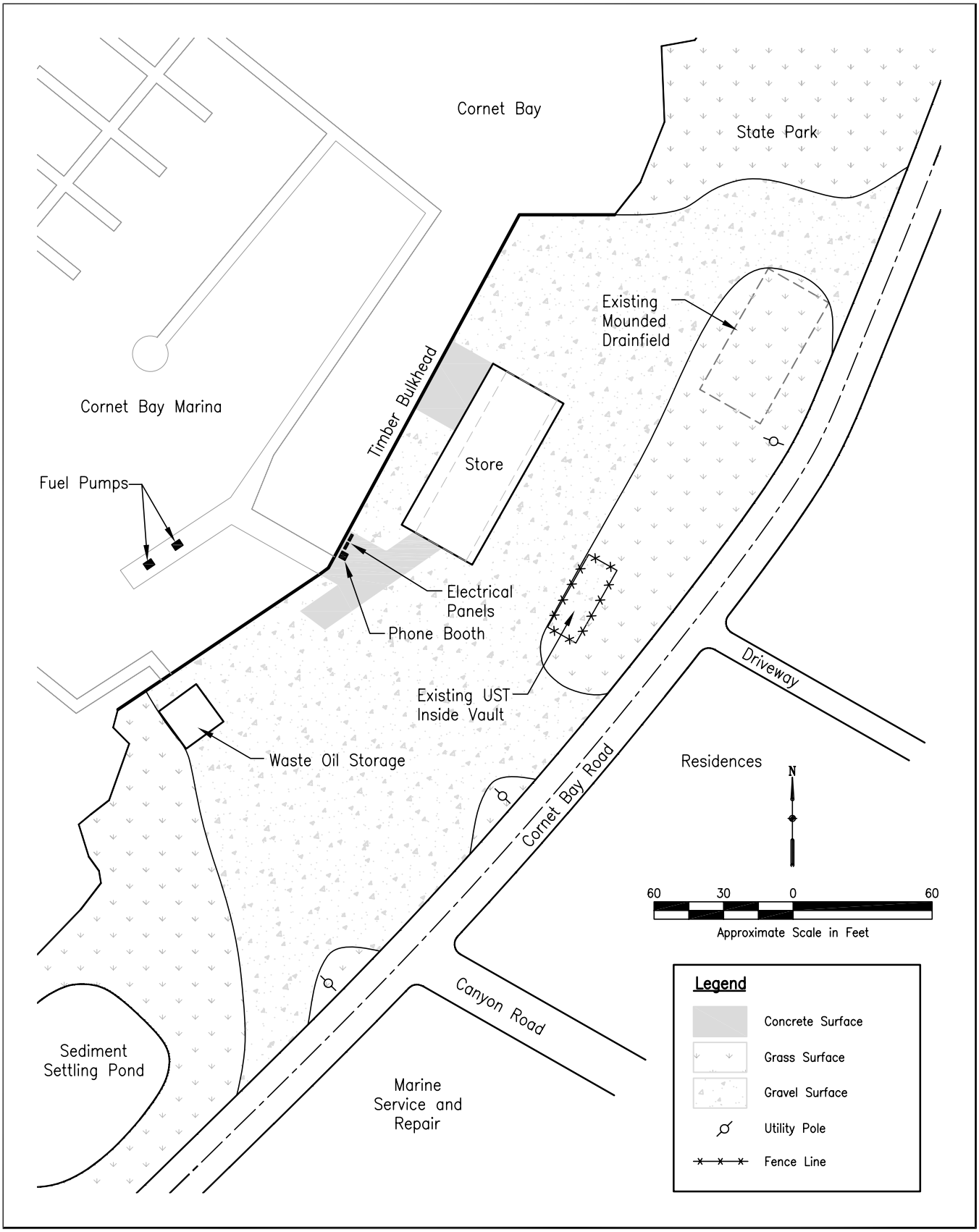
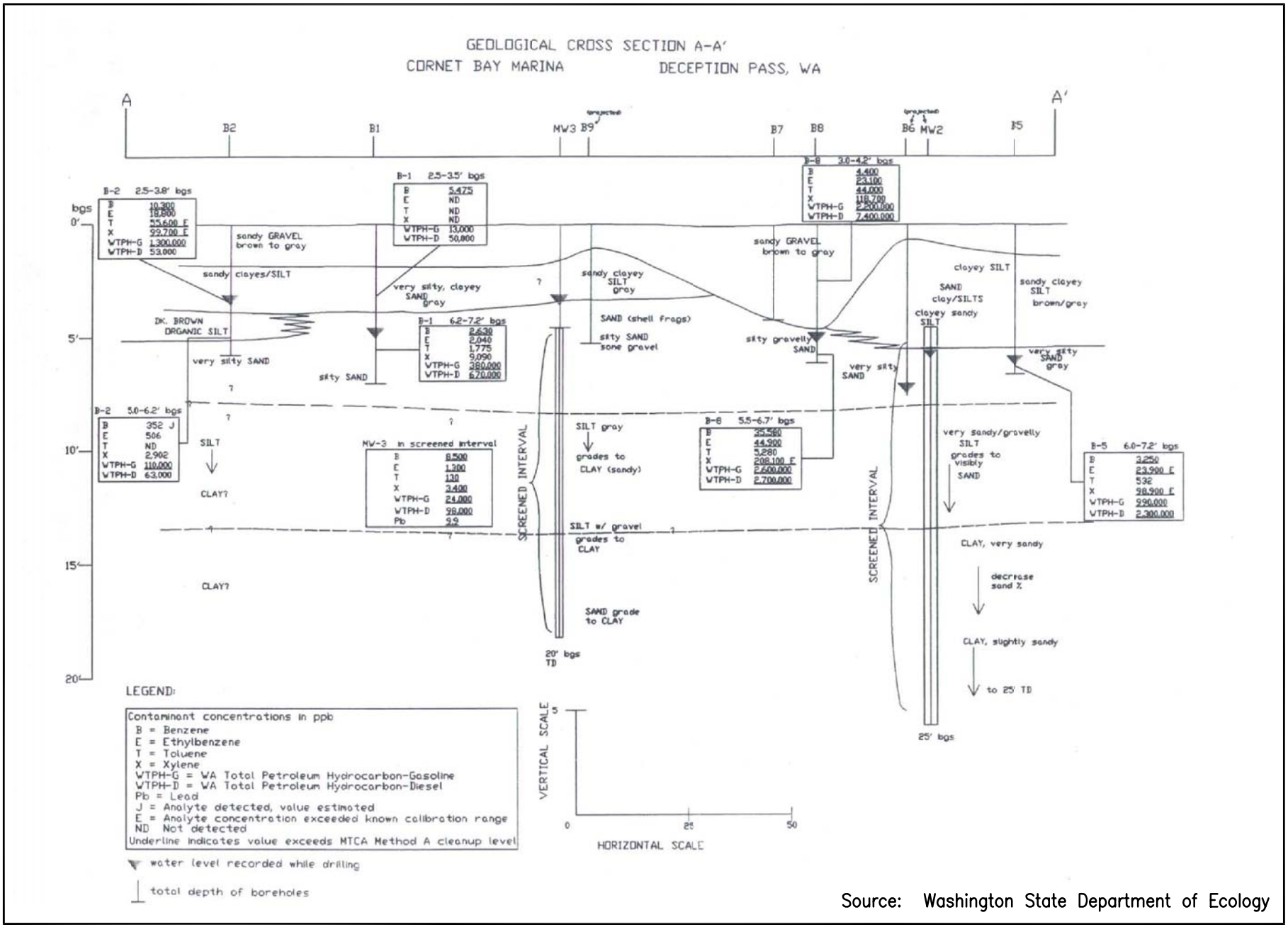


Figure 2. Cornet Bay Marina, Site Map.



Source: Washington State Department of Ecology

Figure 3. Geological Cross Section

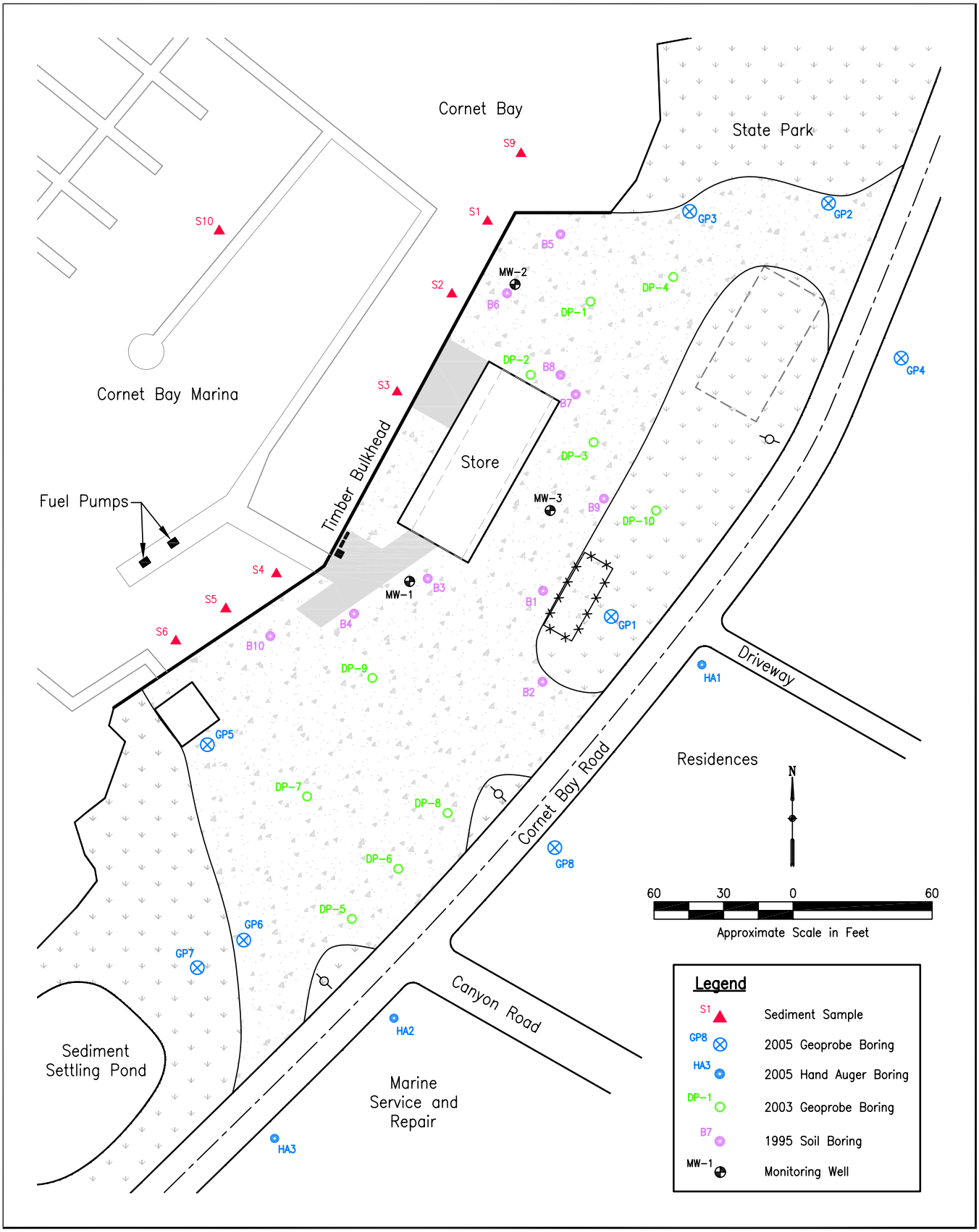


Figure 4. Cornet Bay Marina, Remedial Investigation Sample Locations.

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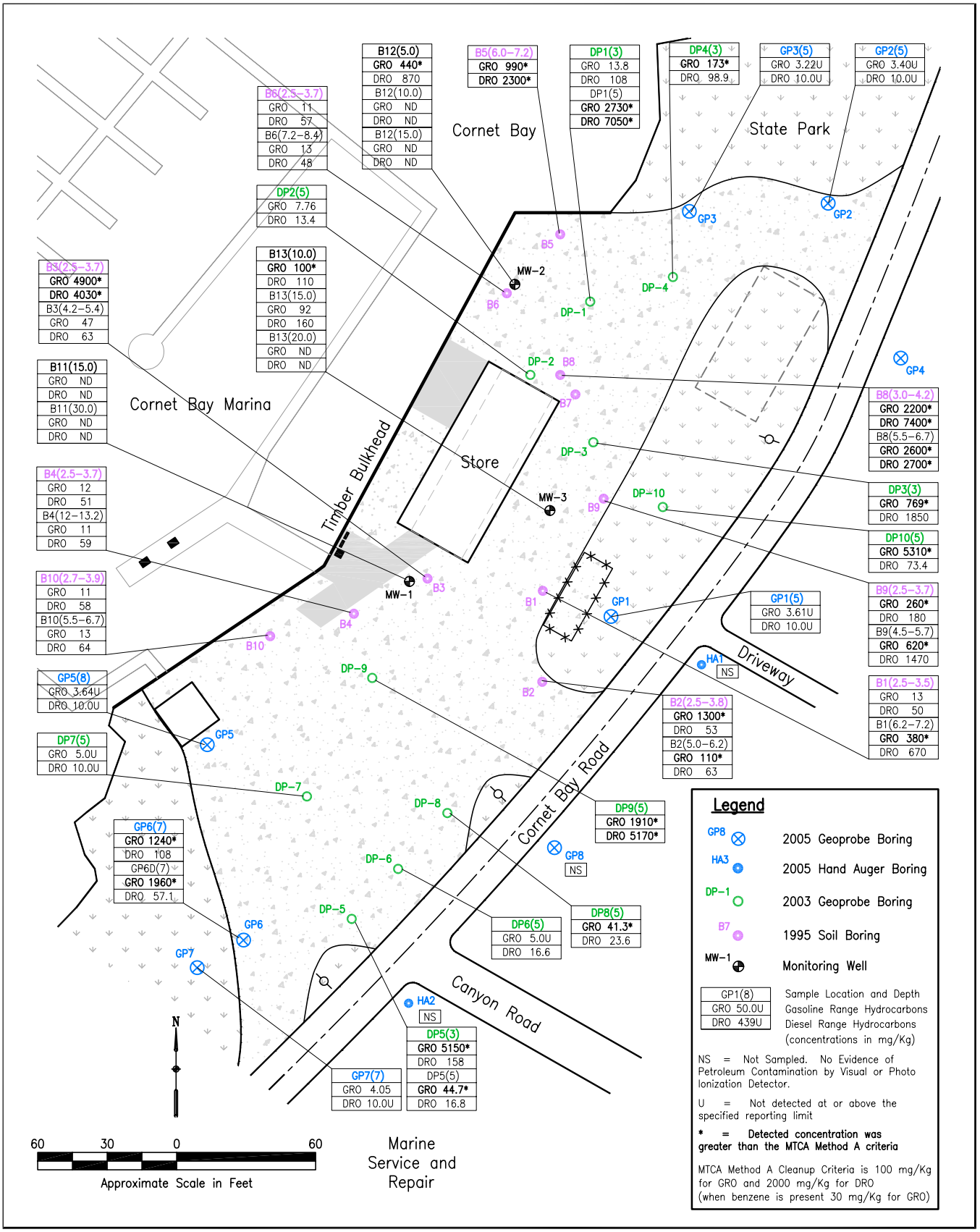

Figure 5. Cornet Bay Marina, Remedial Investigation Soil Analytical Results.

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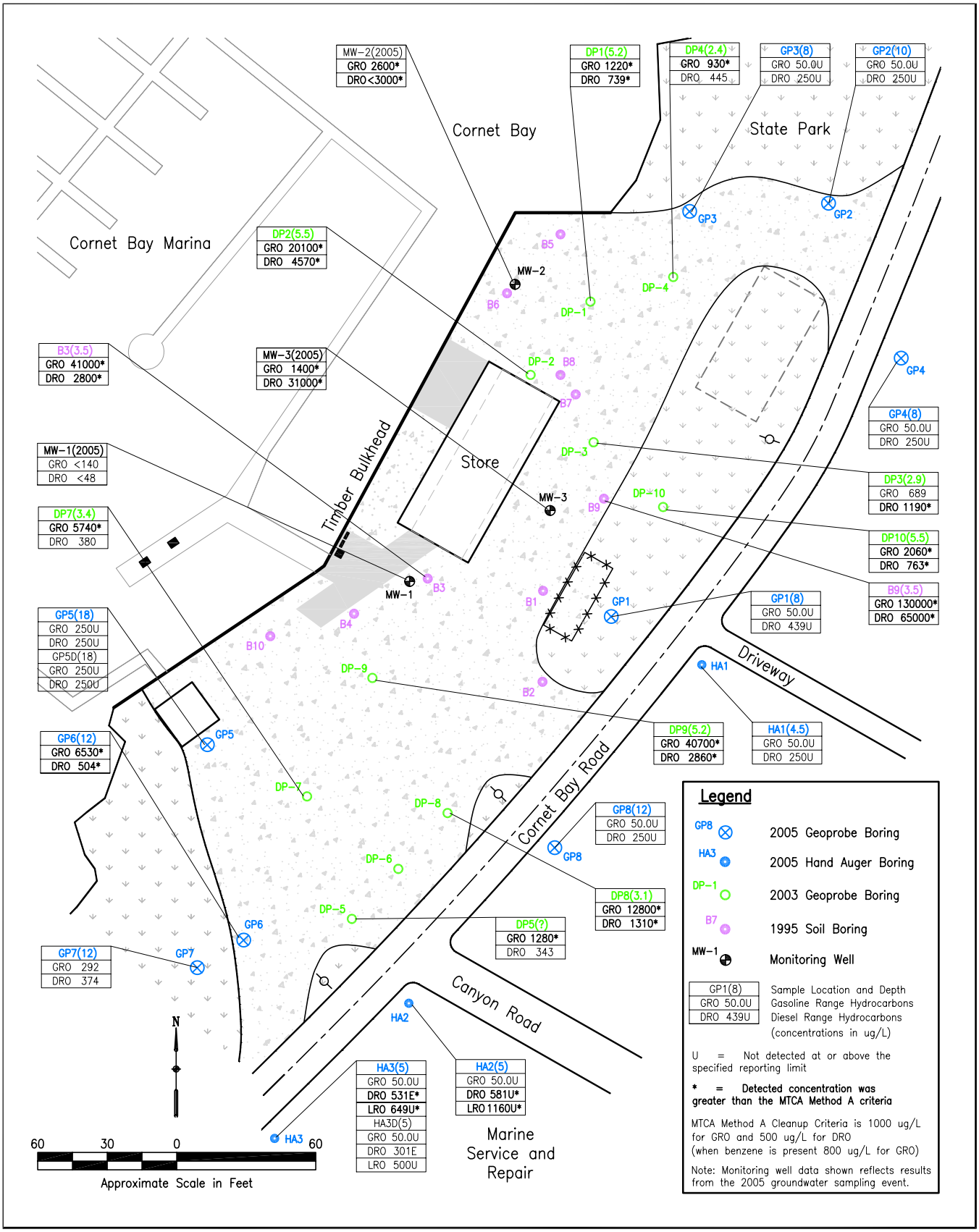

Figure 6. Cornet Bay Marina, Remedial Investigation Groundwater Analytical Results.

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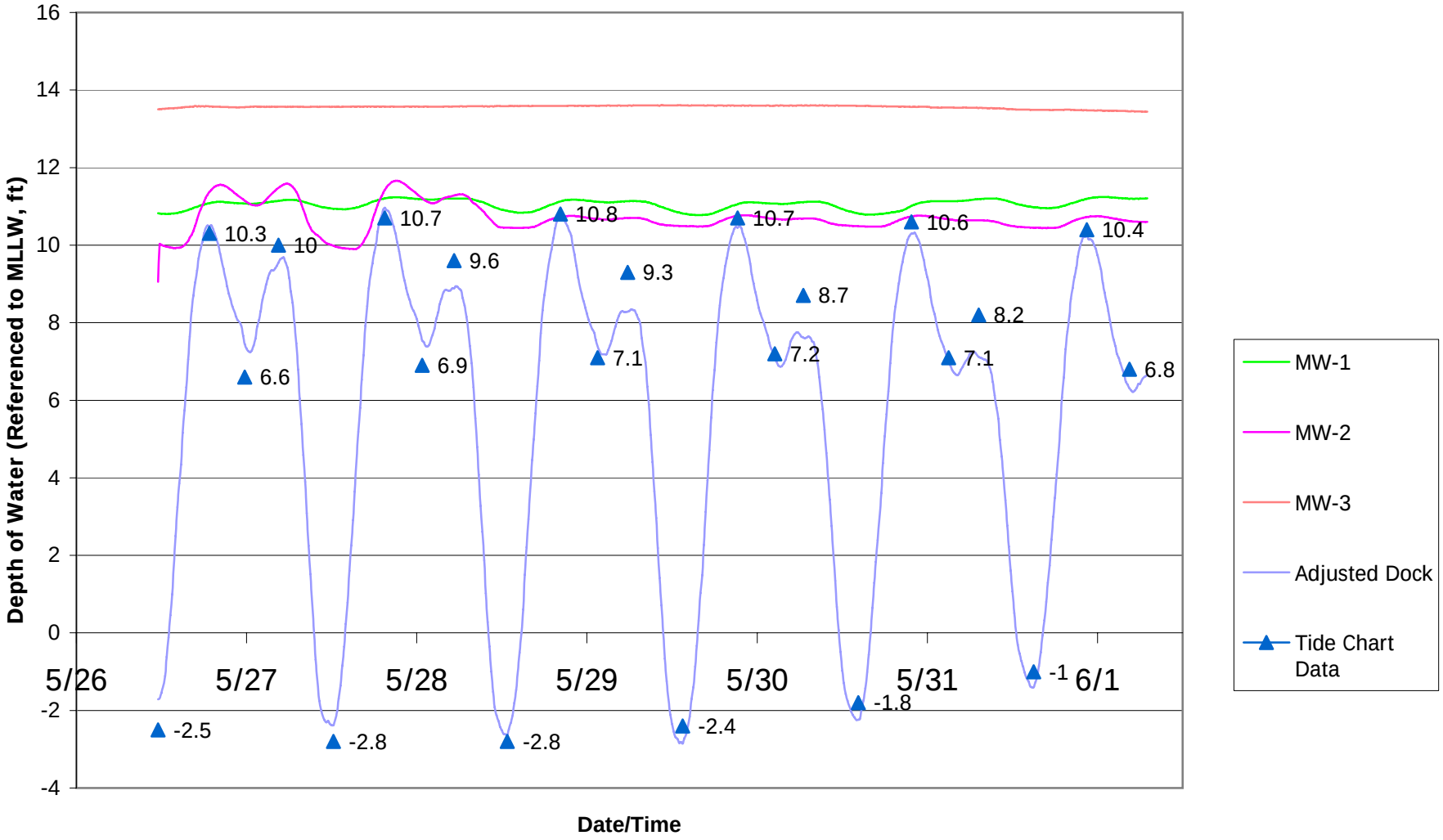
Figure 7. Cornet Bay Marina, Water Level Measurements (26 May to 1 June 2006)



Note: Water level on dock adjusted based on local tide tables.

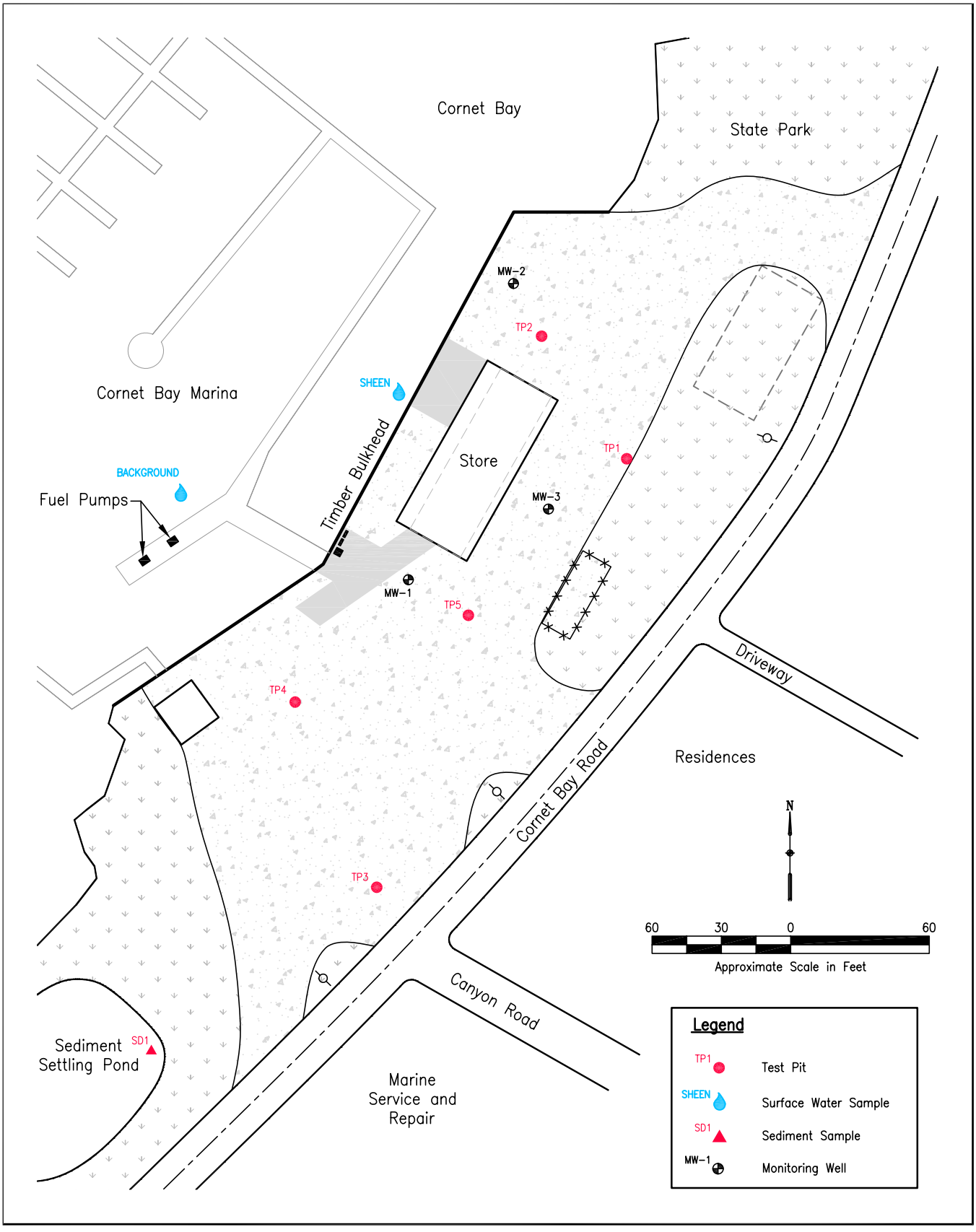


Figure 8. Cornet Bay Marina, Feasibility Study Sample Locations.

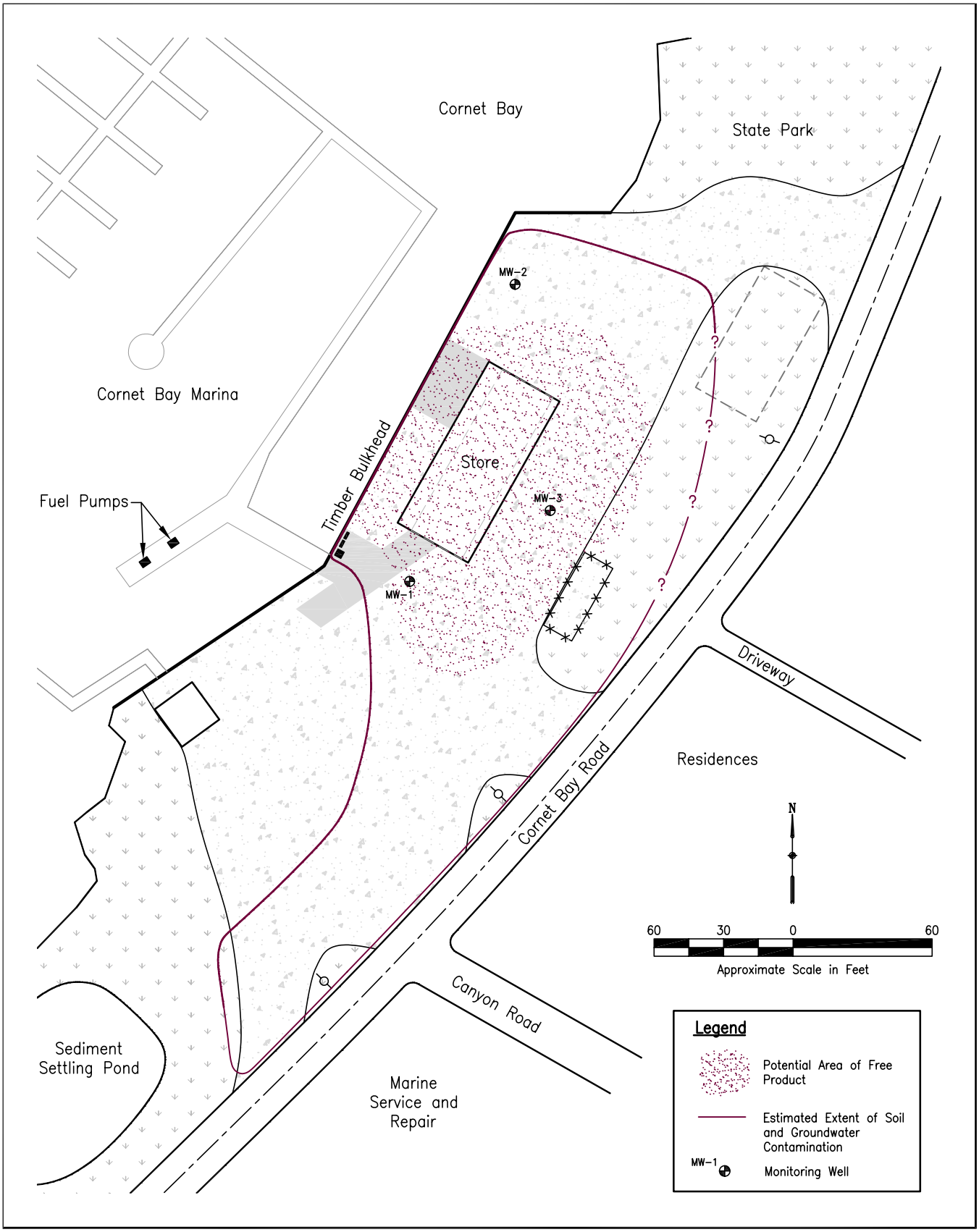


Figure 9. Estimated Nature and Extent Contamination.

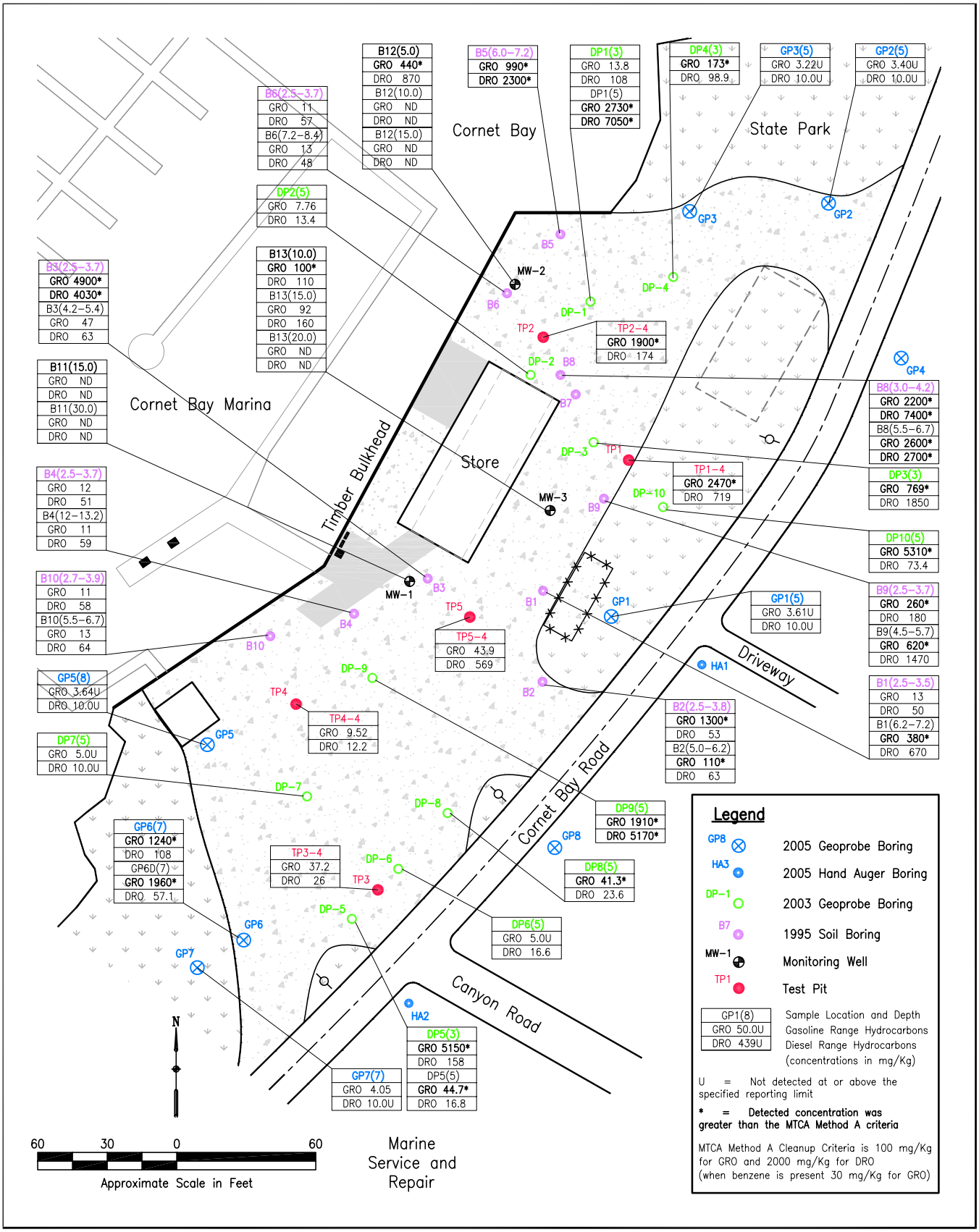


Figure 10. Cornet Bay Marina, Comprehensive Soil Analytical Results.

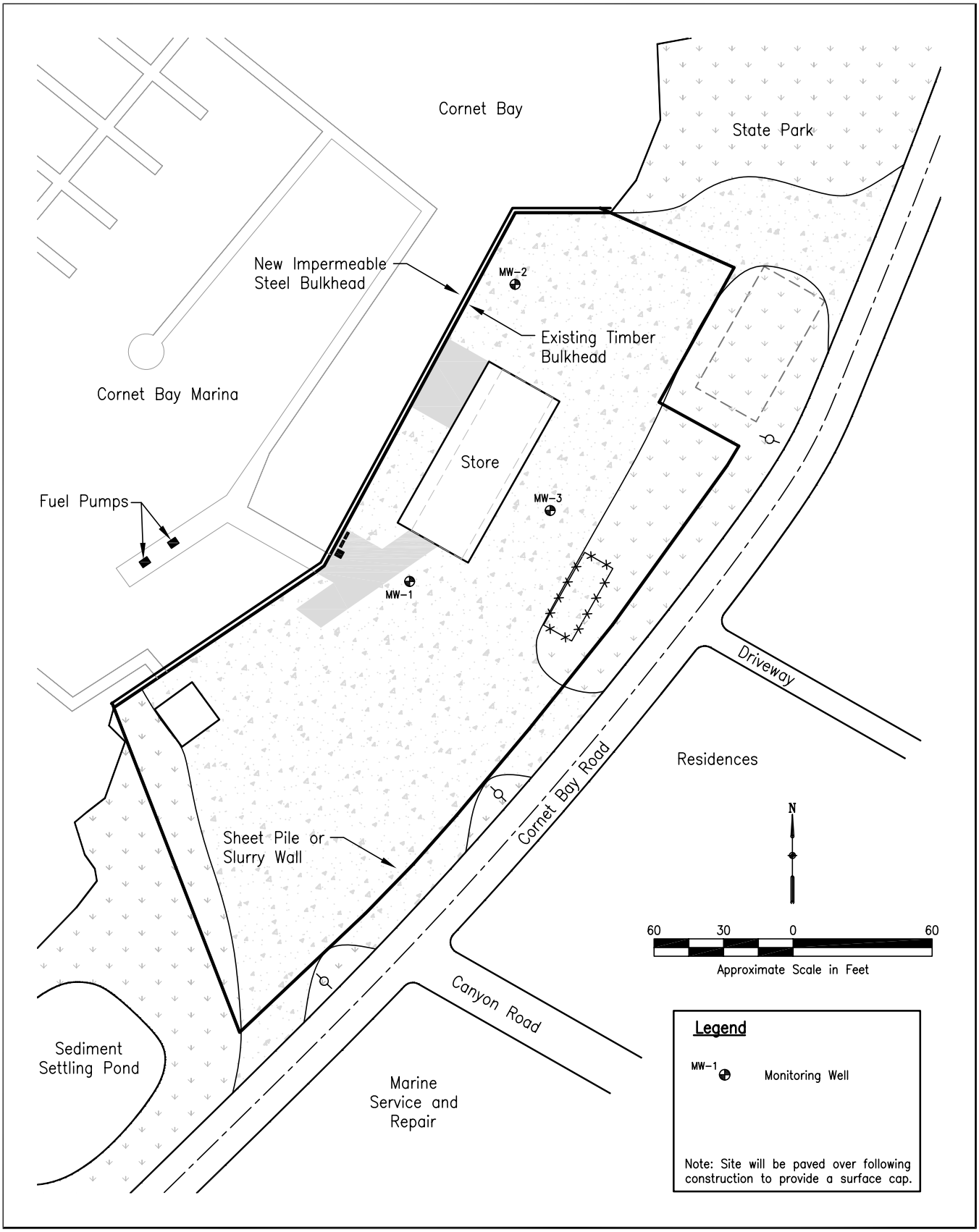


Figure 11. Alternative for Containment.

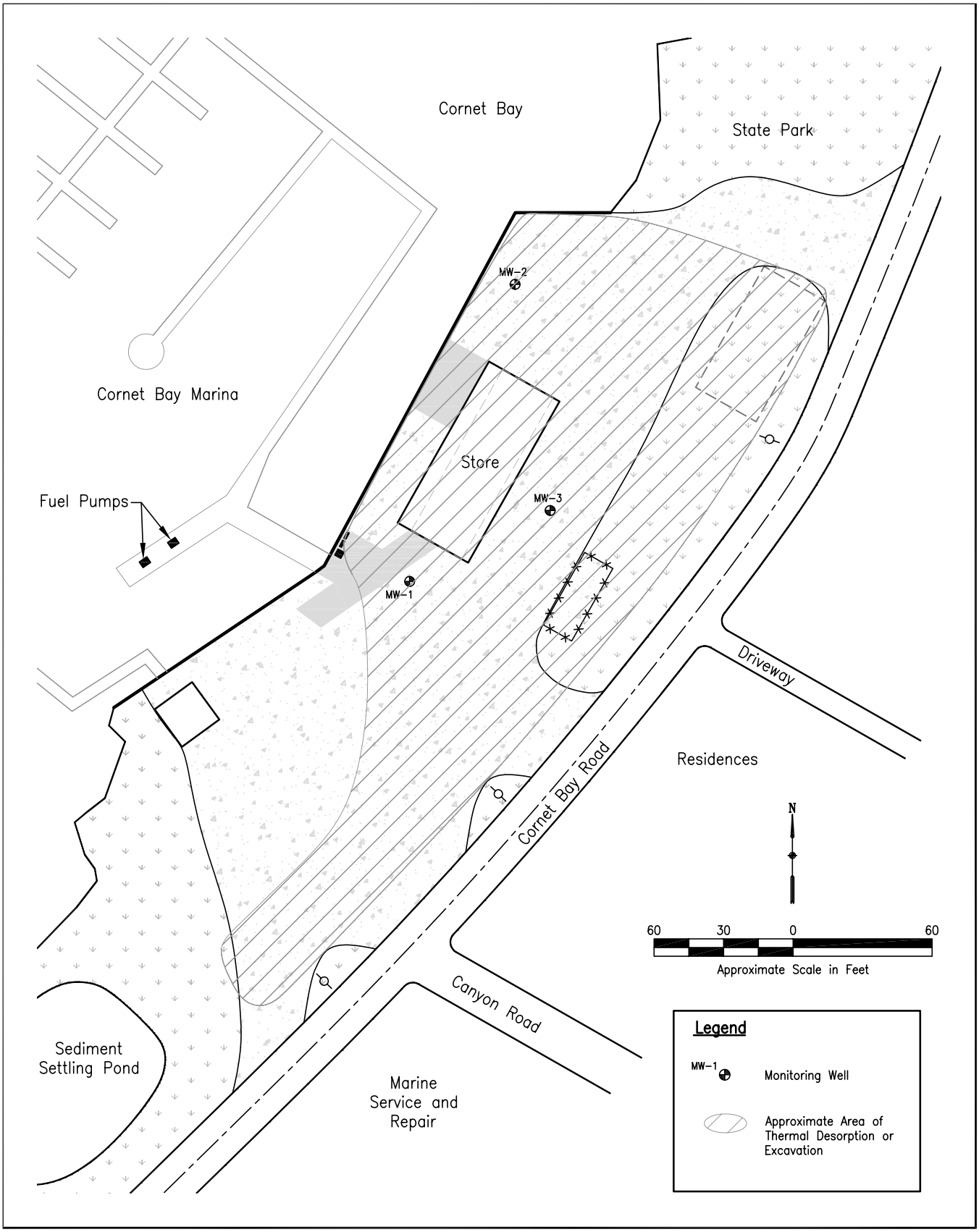


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Figure 12. Alternative for In-Situ Thermal Desorption or Soil Excavation.

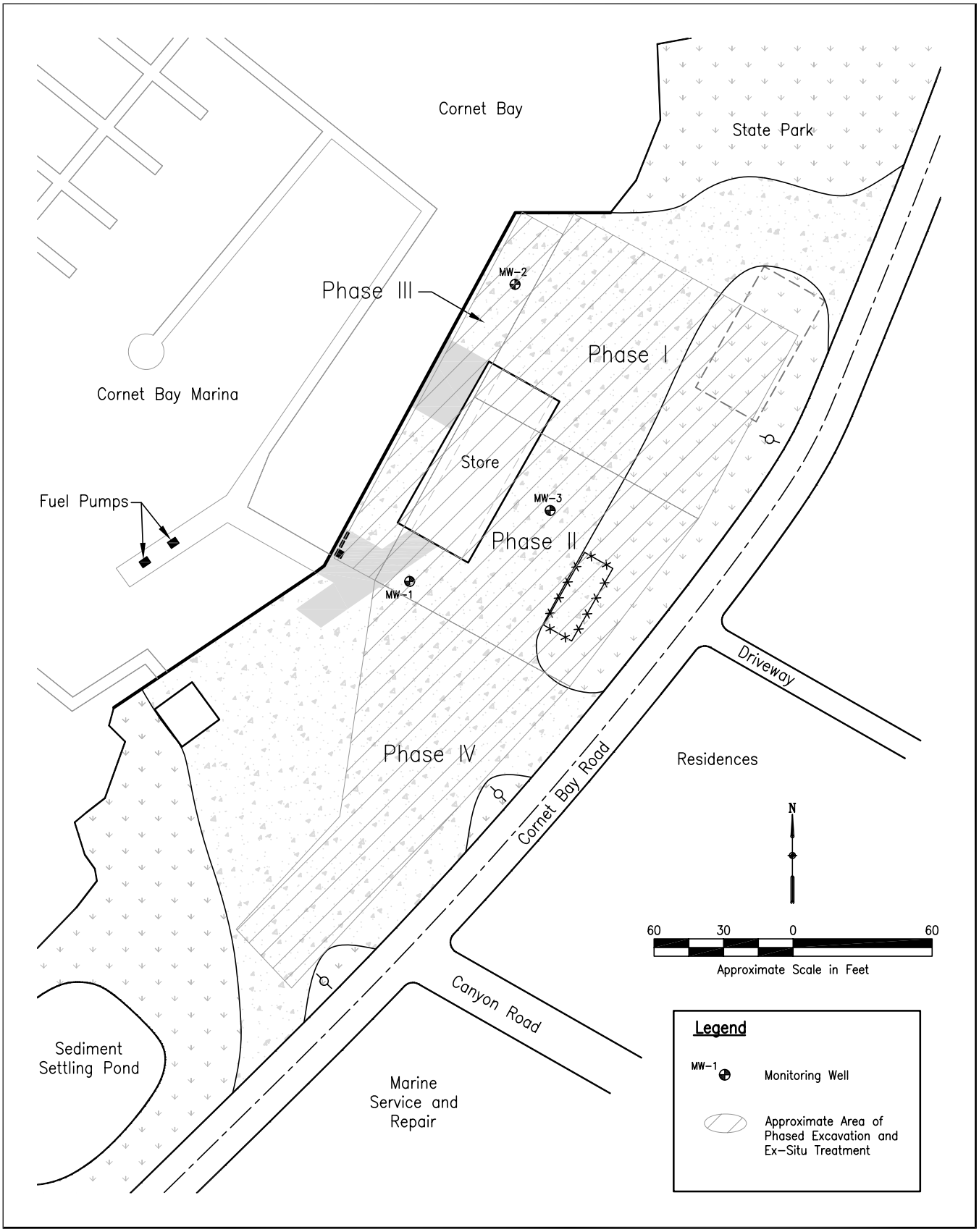


Figure 13. Alternative for Ex-Situ Bioremediation.

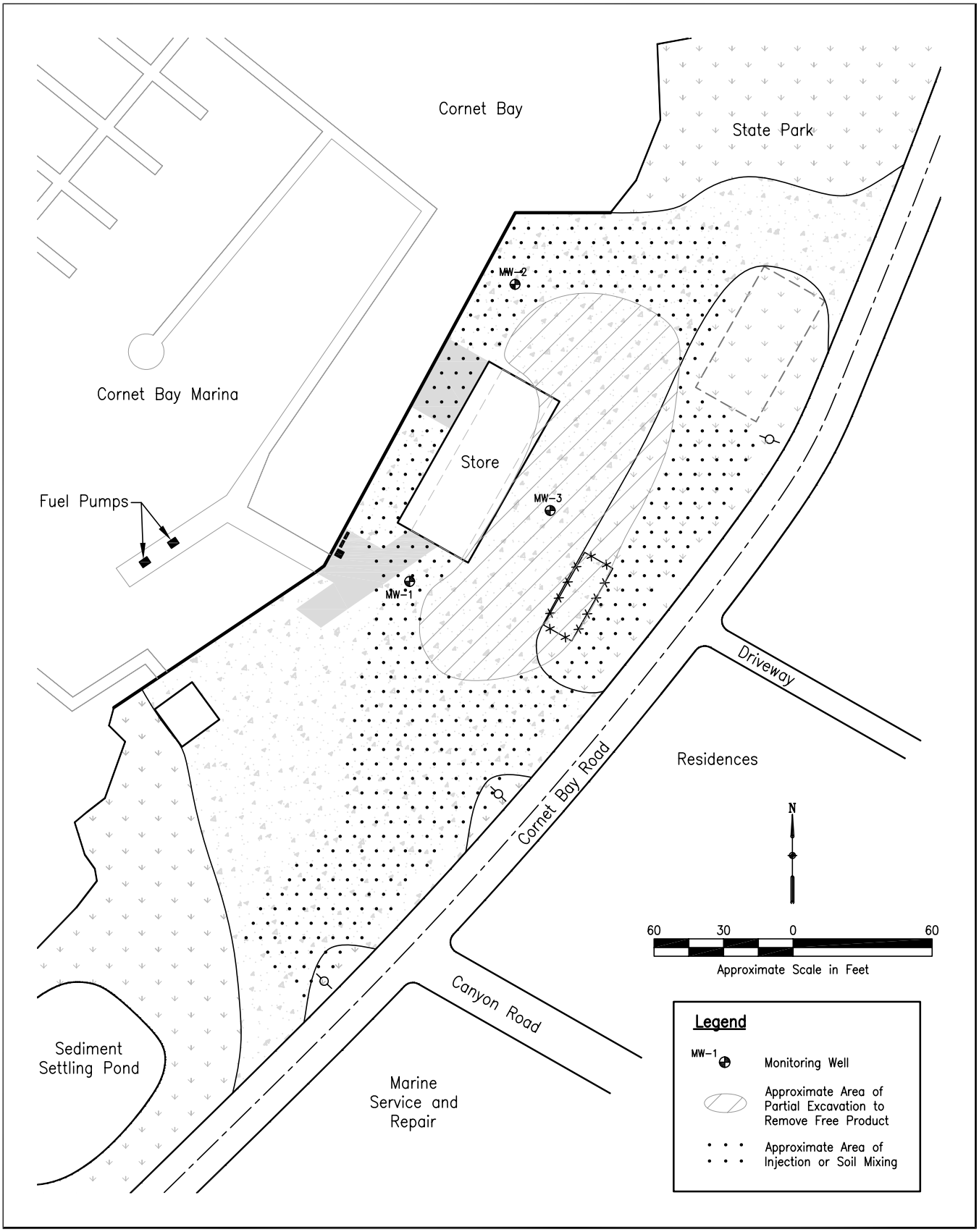


Figure 14. Alternative for In-Situ Bioremediation or Chemical Oxidation.

TABLES

TABLE 1. MONITORING WELL CONSTRUCTION AND FIELD MEASUREMENT DATA.

Well ID	Well Type	Total Depth (ft bgs)	Top of Screen Depth (ft btoc)	Bottom of Screen Depth (ft btoc)	Screen Length (ft)	Water Level Measured on 26 May 2006 (ft btoc)	Water Level Measured on 1 June 2006 (ft btoc)
MW-1	M	31	10	25	15	6.68	6.43
MW-2	M	25	5	25	20	6.74	6.73
MW-3	M	20	5	20	15	3.68	3.12

		Water Quality Parameters					
Well	Date Measured	pH	Conductivity (mS/cm)	Turbidity (NTUs)	Dissolved Oxygen (mg/L)	Temperature (^{o}C)	Oxidation-Reduction Potential (mV)
MW-1	6/1/2006	7.67	9.223	1.7	0.26	13.23	-165.4
MW-2	6/1/2006	6.80	1.689	2.52	0.64	12.6	-168.1
MW-3	6/1/2006	6.88	2.918	10.6	0.85	14.0	-144.0

NOTES:

^{o}C = degrees Celsius.
ft bgs = feet below ground surface
ft btoc = feet below top of casing.
mg/L - milligrams per liter
mS/cm = milliSiemans per centimeter.
mV = milliVolts
NA = not available
NTUs = Nephelometric turbidity units

TABLE 2. MONTIORING WELL GROUNDWATER ANALYTICAL DATA FOR PETROLEUM CONSTITUENTS.

Well	Sample Date	Benzene	Toluene	Ethylbenzene	Xylenes	MTBE	GRO	DRO	LRO	Lead
MW-1	10/?/96	ND	ND	ND	ND	--	ND	--	--	2.4
	6/2/2003	<0.5	<0.5	<0.5	<1.0	<1.0	<50	294	<500	--
	5/27/2005	<1.0	<1.0	<1.0	<3.0	--	<140	<48	--	--
	6/1/2006	<0.5	<0.5	<0.5	<1.0	--	<50	529 D-09	<500	--
MW-2	10/?/96	16,400	23	170	98	--	1,900	--	--	2.2
	6/2/2003	9,000	<50	354	<100	<100	21,300	127,000	<10,000	--
	5/27/2005	7,300 J	<10	84	<30	--	2,600	<3,000	--	--
	6/1/2006	7,150	16.6	86.9	29.6	--	20,300	<5050	<10,100	--
MW-3	10/?/96	8,500	130	1,300	3,400	--	24,000	98,000	--	9.9
	6/2/2003	185	4.63	86.7	29.4	3.91	1,170	17,200	<500	--
	5/27/2005	260	<10	91	<30	--	1,400	31,000 E	--	--
	6/1/2006	643	15.3	324	34.8	--	3,900	<5,150	<10,300	--
Duplicate	6/1/2006	643	16	324	34.7	--	3,880	2,020 D-06	<500	--
MTCA A Cleanup Levels		5	1,000	700	1,000	20	800/1000	500	500	15

NOTES:

All results are in ug/L (micrograms per liter = parts per billion).

-- = not sampled/not analyzed

NA = not available

E = result is considered estimated due to large relative percent difference between sample and duplicate (31,000 vs. 7,600 ug/L).

J = analyte was positively identified. The associated numerical result is an estimate.

Groundwater samples on 6/1/06 were collected by EA Engineering.

D-09 = Results in diesel organics range are primarily due to overlap from a heavy oil range product.

D-06 = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

The trip blank (CB-MW-TB) associated with these samples was below the laboratory detection limit for all constituents.

MTCA Method A cleanup level for gasoline is 800 ug/L instead of 1000 ug/L when benzene is present.

Shaded cells indicate the results exceed the cleanup criteria.

DRO = Diesel range organics.

GRO = Gasoline range organics.

LRO = Lub-oil range organics

MTBE = methyl tertiary butyl ether

TABLE 3. MONITORING WELL GROUNDWATER ANALYTICAL DATA FOR FEASIBILTY STUDY PARAMETERS.

Well	Bicarbonate Alkalinity	BOD	COD	Hardness	Salinity (g/kg)	TOC	Alkalinity				Chloride	Nitrate-Nitrogen	Sulfate	Iron	Manganese
							Carbonate Alkalinity	Hydroxide Alkalinity	Bicarbonate Alkalinity	Total Alkalinity					
MW-1	1,160	12.9	50 U, D-14	701	4.7	26.8	5 U	5 U	1,160	1,160	2,900	4 U	12.8	0.2 U	0.605
MW-2	705	40.4	119	373	0.7	48	5 U	5 U	705	705	115	0.4 U, I-02, D-14	7.83	16	2.95
MW-3	734	19.4	156 D-14	459	1.2	42	5 U	5 U	734	734	399	1 U, I-02, D-14	19.4	5.6	3.46

NOTES:

All results are in mg/L (milligrams per liter = parts per million) unless otherwise noted.

Groundwater samples on 6/1/06 were collected by EA Engineering.

D-14 = Diluted due to matrix effect.

I-02 = This sample was analyzed outside of the recommended holding time.

J = analyte was positively identified. The associated numerical result is an estimate.

U = Result was below the laboratory reporting limit for this compound.

BOD = Biological Oxygen Demand.

COD = Chemical Oxygen Demand.

TOC = Total Organic Carbon.

TABLE 4. TEST PIT SOIL ANALYTICAL DATA FOR PETROLEUM CONSTITUENTS.

Sample ID	Date Sampled	GRO (mg/kg)	DRO (mg/kg)	LRO (mg/kg)	TCLP Benzene (mg/L)
CB-TP1-SS-2	6/1/2006	4.03	12.0 D-09	27.0 U	--
CB-TP1-SS-4	6/1/2006	**2,470**	719	76.8 U	0.08 U
CB-TP2-SS-2	6/1/2006	21.50	11.7 Q-41	29.3 U	--
CB-TP2-SS-4	6/1/2006	**1,900**	174	32.2 U	--
CB-TP2-SS-6	6/1/2006	**218**	208	30.7	--
CB-TP3-SS-1.5	6/1/2006	**396**	277	28.6 D-10	--
CB-TP3-SS-4	6/1/2006	**37.20**	26	42.6	--
CB-TP3-SS-6	6/1/2006	**61.50**	15.2	27.7 U	--
CB-TP4-SS-2	6/1/2006	4.50 U	12.3 Q-41	30.7 U	--
CB-TP4-SS-4	6/1/2006	9.52 G-02	12.2 Q-41	30.6 U	--
CB-TP5-SS-4	6/1/2006	**43.90**	569	63.6 U	0.183
CB-TP5-SS-4D	6/1/2006	**33.30**	85.6	32.1 U	--
CB-SD1-0.5	6/1/2006	4.95 U	13.2 Q-41	33.1 U	--
MTCA Method A Cleanup Criteria		30/100	2,000	2,000	

NOTES:

NA = not available

D = Duplicate sample.

DRO = Diesel range organics.

GRO = Gasoline range organics.

LRO = Lub-oil range organics.

mg/kg = milligrams per kilogram.

mg/L = milligrams per liter.

MTCA Method A cleanup level for gasoline is 30 mg/kg instead of 100 mg/kg when benzene is present.

U = Not detected at or above the specified reporting limit.

D-06 = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

D-09 = Results in the diesel organic range are primarily due to overlap from a heavy oil range product.

D-10 = The heavy oil range organics present are due to hydrocarbons eluting primarily in the diesel range

G-02 = The chromatogram for this sample does not resemble a typical gasoline pattern.

Q-41 = The analyte had a high bias in the associated calibration verification standard.

TABLE 5. TEST PIT SOIL ANALYTICAL DATA FOR FEASIBILITY STUDY PARAMETERS.

Sample ID	Date Sampled	COD (mg/kg)	Nitrate/Nitrite-Nitrogen (mg/kg)	Total Keldahl Nitrogen (mg/kg)	Total Nitrogen (mg/kg)	TOC (mg/kg)	Phosphorus (mg/kg)	Potassium (mg/kg)
CB-TP2-SS-4	6/1/2006	121,000 B-14	0.127 U	200	255	3,640	695	3,790
CB-TP3-SS-4	6/1/2006	119,000 B-14	0.116 U	254	295	6,350	464	1,400
CB-TP5-SS-4	6/1/2006	119,000 B-14	0.207	197	252	5,530	670	3,060

NOTES:

mg/kg = Micrograms per liter.

U = Not detected at or above the specified reporting limit.

NA = not available

COD = Chemical oxygen demand

TOC = Total organic carbon

APPENDIX A

Elevations Calculation Pad

Department of Ecology

BY bb DATE 7/31/96 SHEET 1 OF 1

CHKD. BY _____ DATE _____ PROGRAM / SECTION _____ COUNTY _____

PROJECT Cornet Bay Marina

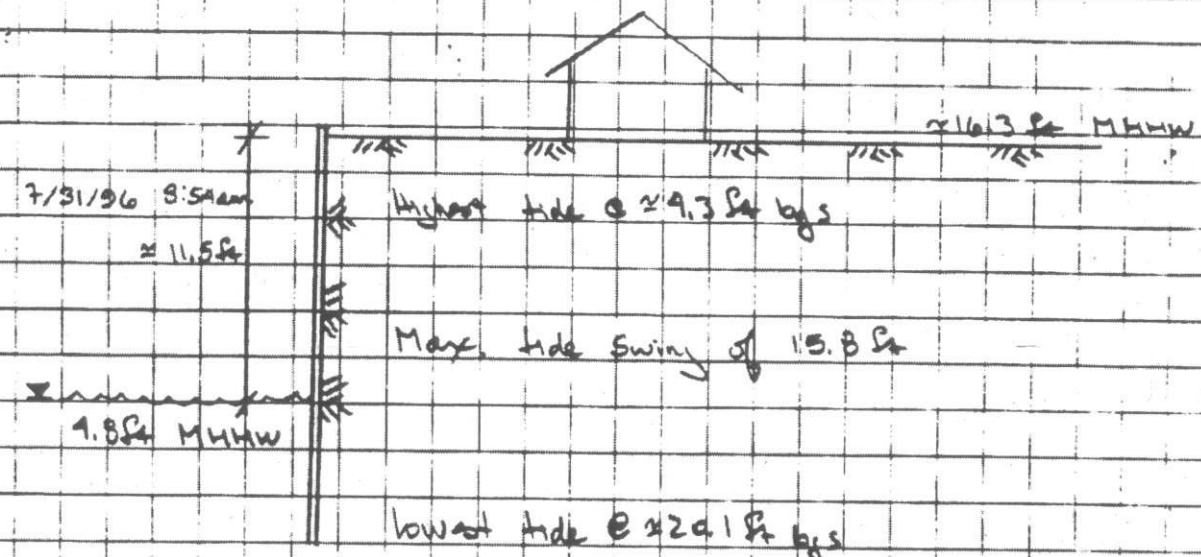
SUBJECT Elevations

CALCULATION PAD

- Call. [illegible] (360) 675-5911
- Measure distance from ground surface @ bulkhead to water. 11.5 ft @ 8:54 am on 7/31/96
- Check tides on computer @ 8:55 am on 7/31/96 = 4.9 ft (MHHW)
- Search tides (10 years) from 1/1/90 to 12/31/99 for highest high and lowest low

on 1/2/91 @ 6:59 am highest tide of 12.0 ft MHHW

on 5/25/90 @ 12:33 pm lowest tide of -3.8 ft MLLW



APPENDIX B

Purge Forms

Ground Water Purge and Sampling Form

Well Identification	MW-1
Well Diameter (inches)	2"
Well Monument Locked and Good Condition?	yes
Inside Well Head and Outside Well Casing (D=dry), (WAC=Water above Casing), WBC=Water Below Casing)	WBC
Well Casing Plug Locked and Good Condition?	yes
Depth to Ground water (ft btoc)	6.43'
Well Total Depth (ft btoc) 25.03 +.28	25.31

Site Location: Corset Bay Date: 6/1/06

Project Number: 61994.01 Personnel: MBB

Purge Method: X Low Flow ___Conventional ___None

Purge Equipment: X Peristaltic Pump ___Redi-flo Pump ___Other

Sampling Equipment: X Peristaltic Pump ___Redi-flo Pump ___Bailer

Weather Conditions: Overcast, drizzle ~ 53°F

Well Volume Calculation: 2"=.16, 4"=.64, 6"=1.44 gallons

Time	1208	1211	1214	1217	1220	1223	1226	1229	1232	1236
Depth to Ground water (ft btoc)	6.43	~~8.20~~ 8.13	8.20	* —	9.04	9.32	9.65	—	10.09	
Total Groundwater Purged(gallons, liters, other)	—	—	—	1	—	—	—	2	—	2.2
Purge Rate (gpm, ft³/min, ml/min, other)	400	→	→	→	→	→	→	→	→	→
pH Rental YSI 556	7.60	7.60	7.62	7.69	7.69	7.67	7.67	7.67	7.67	7.67
Conductivity (mS/cm)	9.103	9.120	9.142	9.171	9.208	9.195	9.205	9.204	9.218	9.223
Turbidity (NTU) Industrial Scientific	6.24	4.52	1.60	4.25	1.98	1.75	1.20	1.20	—	1.7
Disssolved Oxygen (mg/L)	2.57	1.10	0.81	5.35	4.70	2.30	0.64	0.37	0.26	0.26
Temperature (°C)	13.61	13.57	13.53	13.56	13.28	13.12	13.18	13.26	13.24	13.23
ORP/eH (mV)	-63.8	-85.8	-104.9	-130.8	-132.2	-139.9	-148.6	-156.3	-163.3	-165.4
Color of Purged Water (gray, brown, red, clear)	clear w/ ss	→	→	→	→	→	→	→	→	→

Sample Identification: CB-MW1

Time Sampled: 1240

Purge water disposed To: Drum onsite

Analysis

X NWTPH-G/BTEX by 8021b

X NWTPH-Dx + FS Parameters

___ Total Lead

___ MTBE/EDC by 8260

___ EDB by 8011

Comments: Tubing pulled ~15' off bottom of well.

* lowered tubing 2', was pulling air.

Ground Water Purge and Sampling Form

Well Identification	MW-2
Well Diameter (inches)	2"
Well Monument Locked and Good Condition?	yes
Inside Well Head and Outside Well Casing (D=dry), (WAC=Water above Casing), WBC=Water Below Casing)	WBC
Well Casing Plug Locked and Good Condition?	yes
Depth to Ground water (ft btoc) 1402	6.73
Well Total Depth (ft btoc) 24.54+.28	=24.82'

Site Location: Cornet Bay Date: 6/1/06
Project Number: 61994.01 Personnel: MBB
Purge Method: X Low Flow ___Conventional ___None
Purge Equipment: X Peristaltic Pump ___Redi-flo Pump ___Other
Sampling Equipment: X Peristaltic Pump ___Redi-flo Pump ___Bailer
Weather Conditions: Overcast, Drizzle ~55°F
Well Volume Calculation: 2"=.16, 4"=.64, 6"=1.44 gallons

Time	1408	1411	1414	1417	1420	1423				
Depth to Ground water (ft btoc)	—	7.88	8.04 OK	=	8.35	8.44				
Total Groundwater Purged(gallons, liters, other)	—	—	—	1	1.2	1.3				
Purge Rate (gpm, ft³/min, ml/min, other)	~350 →									
pH	6.93	6.82	6.80	6.80	6.79	6.80				
Conductivity (mS/cm)	1.805	1.693	1.699	1.684	1.674	1.689				
Turbidity (NTU)	9.5	9.8	6.1	4.1	2.82	2.52				
Disssolved Oxygen (mg/L)	3.20	1.15	0.93	0.80	0.72	0.64				
Temperature (°C)	12.96	12.80	12.63	12.62	12.60	12.57				
ORP/eH (mV)	-165.8	-167.9	-169.3	-169.0	-166.4	-168.1				
Color of Purged Water (gray, brown, red, clear)	clear w/ ss →									

Sample Identification: CB-MW2
Time Sampled: 1430
Purge water disposed To: Drum Onsite

Analysis
X NWTPH-G/BTEX by 8021b ___ MTBE/EDC by 8260
X NWTPH-Dx + other Parameters ___ EDB by 8011
___ Total Lead

Comments: Tubing pulled 5' off bottom of well.
- smell of hydrocarbons

Ground Water Purge and Sampling Form

Well Identification	MW-3
Well Diameter (inches)	2"
Well Monument Locked and Good Condition?	yes
Inside Well Head and Outside Well Casing (D=dry), (WAC=Water above Casing), WBC=Water Below Casing)	WAC
Well Casing Plug Locked and Good Condition?	yes
Depth to Ground water (ft btoc)	~~3.12~~ 3.13
Well Total Depth (ft btoc) 18.47 + .28	18.75

Site Location: Coriet Bay. Date: 6/1/06

Project Number: 61994.01 Personnel: MBB

Purge Method: X Low Flow ___Conventional ___None

Purge Equipment: X Peristaltic Pump ___Redi-flo Pump ___Other

Sampling Equipment: X Peristaltic Pump ___Redi-flo Pump ___Bailer

Weather Conditions: Overcast, Breezy - ~52°F

Well Volume Calculation: 2"=.16, 4"=.64, 6"=1.44 gallons

Time	1044	1047	1050	1053	1056	1059.	1102			
Depth to Ground water (ft btoc) 1040 3.12'	4.47	—	—	4.72	—	4.73	4.74			
Total Groundwater Purged(gallons, liters, other)	—	—	—	1	—	—	~2			
Purge Rate (gpm, ft³/min, ml/min, other)	350	←					→			
pH	6.94	6.93	6.91	6.90	6.88	6.88	6.88			
Conductivity (mS/cm)	4.274	4.113	3.658	3.580	3.302	3.096	2.918			
Turbidity (NTU)	27	21	16.2	11.5	7.2	9.2	10.6			
Disssolved Oxygen (mg/L)	3.65	2.47	1.43	1.26	0.93	0.81	0.85			
Temperature (°C)	14.19	14.18	14.04	14.01	14.03	14.00	14.03			
ORP/eH (mV)	-102.5	-113.8	- 125.2	-126.9	-136	-141.5	-144			
Color of Purged Water (gray, brown, red, clear)	clear	→								

Sample Identification: CB-MW3/CB-MW3D

Time Sampled: 1105 1110

Purge water disposed To: Drum Onsite

Analysis

X NWTPH-G/BTEX by 8021b

X NWTPH-Dx

___ Total Lead

___ MTBE/EDC by 8260

___ EDB by 8011

___

Comments: Tubing intakes pulled up to ~6' btoc, - water smells of light diesel fuel - screen on water. tethers for FS.

\12040.77\2004\Fall03sampling\purgesampleform.xls

APPENDIX C

Laboratory Analytical Results

11720 North Creek Pkwy N Suite 400, Bothell, WA 98011-8244 425-420-9200 FAX 420-9210 ☒
11922 E 1st Ave, Spokane, WA 99206-5302 509-924-9200 FAX 924-9290 ☐
9405 SW Nimbus Ave, Beaverton, OR 97008-7145 503-906-9200 FAX 906-9210 ☐
20332 Empire Ave, Ste F1, Bend, OR 97701-5712 541-383-9310 FAX 382-7588 ☐
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210 ☐

CHAIN OF CUSTODY REPORT

Work Order #: BPF0087

NCA CLIENT: WA Dept of Ecology

REPORT TO: EA Engineering - Jil Frain
ADDRESS: 12011 NE 1st street, suite 100
Bellevue, WA 98005
PHONE: 425-451-7400 FAX: ~ 7800

INVOICE TO: WA Dept of Ecology / NWRO
Attn: Roger Nye
3190 160th Ave SE.
Bellevue, WA 98008

P.O. NUMBER: Field Order#: PF313180

PROJECT NAME: Cornet Bay Marina
PROJECT NUMBER: 6199401 4000
SAMPLED BY: CB

TURNAROUND REQUEST
in Business Days *
Organic & Inorganic Analyses: ☒ STD | 7 | 5 | 4 | 3 | 2 | 1 | <1
Petroleum Hydrocarbon Analyses: ☒ STD | 4 | 3 | 2 | 1 | <1
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	PRESERVATIVE	NWTPH-G	NWTPH-Dx	TCLP BENZENE	COD EPA 410.4	TOC SW 9060	Total N 353.2/351.2	Phosp Potassic EPA 6010	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	CB-TP3-SS-1.5	6/1/06 1305		X	X						S	2		-01
2	CB-TP3-SS-4	1315		X	X		X	X	X	X		4		-02
3	CB-TP3-SS-6	1330		X	X							2		-03
4	CB-TP4-SS-2	1405		X	X							2		-04
5	CB-TP4-SS-4	1415		X	X							2		-05
6	CB-TP5-SS-4	1630		X	X	X	X	X	X	X		5		-06
7	CB-SD1-0.5	1530		X	X							2		-07
8	CB-TP-TB	0820		X								1		-08
9	CB-TP5-SS-4D	1630		X	X						S	2		-04
10	TEMP BLANK										—	1		

RELEASED BY: Mark Blinstrub DATE: 6/2/06
PRINT NAME: Mark Blinstrub FIRM: EA Eng. TIME: 1210

RECEIVED BY: Cathy Cambell DATE: 6/2/06
PRINT NAME: Cathy Cambell FIRM: NCA TIME: 12:10

RELEASED BY: DATE:
PRINT NAME: FIRM: TIME:

RECEIVED BY: DATE:
PRINT NAME: FIRM: TIME:

ADDITIONAL REMARKS:

TEMP:

COC REV 09/04

11720 North Creek Pkwy N Suite 400, Bothell, WA 98011-8244 425-420-9200 FAX 420-9210 [X]
11922 E 1st Ave, Spokane, WA 99206-5302 509-924-9200 FAX 924-9290 [ ]
9405 SW Nimbus Ave, Beaverton, OR 97008-7145 503-906-9200 FAX 906-9210 [ ]
20332 Empire Ave, Ste F1, Bend, OR 97701-5712 541-383-9310 FAX 382-7588 [ ]
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210 [ ]

CHAIN OF CUSTODY REPORT

Work Order #: MPF0087

NCA CLIENT: WA Dept of Ecology
REPORT TO: EA Engineering – Jill Train
ADDRESS: 12011 NE 1st Street, Suite 100, Bellevue, WA 98005
PHONE: 425-451-7400 FAX: ~ 7800

INVOICE TO: WA Dept of Ecology / NWRO
Attn: Roger Nye
3190 160th Ave SE
Bellevue, WA 98008
P.O. NUMBER: Field Order #: PF 313180

PROJECT NAME: Cornet Bay Marina
PROJECT NUMBER: 61994.01 4000
SAMPLED BY: CB

TURNAROUND REQUEST in Business Days *
Organic & Inorganic Analyses: [X] STD. [7] [5] [4] [3] [2] [1] [<1]
Petroleum Hydrocarbon Analyses: [5] STD. [4] [3] [2] [1] [<1]
[OTHER] Specify:
* Turnaround Requests less than standard may incur Rush Charges.

	CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	PRESERVATIVE	REQUESTED ANALYSES: NWTPH-Dx	NWTPH-Gx	TCLP Benzene	COD EPA 410.4	TOC SW 9060	Total N 353.2/351.2	Phosp Potassium EPA 6010								MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1	CB-TP1-SS-2	6/1/06 0920		X	X													S	2		-10
2	CB-TP1-SS-4	0930		X	X	X													3		-11
3	CB-TP2-SS-2	1045		X	X														2		-12
4	CB-TP2-SS-4	1100		X	X		X	X	X	X									4		-13
5	CB-TP2-SS-6	1130		X	X														2		-14
6																					
7																					
8																					
9																					
10																					

RELEASED BY: Mark Blinstrub
PRINT NAME: Mark Blinstrub FIRM: EA Eng. DATE: 6/2/06 TIME: 1210

RECEIVED BY: Cathy Crandell
PRINT NAME: Cathy Crandell FIRM: TRS DATE: 6/2/06 TIME: 12:10

RELEASED BY:
PRINT NAME: FIRM: DATE: TIME:

RECEIVED BY:
PRINT NAME: FIRM: DATE: TIME:

ADDITIONAL REMARKS:

COC REV 09/04

TEMP:

TestAmerica
ANALYTICAL TESTING CORPORATION

11720 North Creek Pkwy N Suite 400, Bothell, WA 98011-8244 425-420-9200 FAX 420-9210 X
11922 E. First Ave, Spokane, WA 99206-5302 509-924-9200 FAX 924-9290
9405 SW Nimbus Ave, Beaverton, OR 97008-7145 503-906-9200 FAX 906-9210
2000 W International Airport Rd Ste A10, Anchorage, AK 99502-1119 907-563-9200 FAX 563-9210

CHAIN OF CUSTODY REPORT

Work Order #: BPF0087

CLIENT: WA Dept of Ecology

INVOICE TO: WA Dept of Ecology / NWRO
Attn: Roger Nye
3190 160th Ave SE
Bellevue, WA 98008

REPORT TO: EA Engineering, Jil Frain
ADDRESS: 12011 NE 8th Street, Suite 100
Bellevue, WA
PHONE: 425-451-7460 FAX: — 7808

P.O. NUMBER: Field Order #: (PF313180)

PROJECT NAME: Comet Bay Marina
PROJECT NUMBER: 61994.01 4000
SAMPLED BY: MBB

TURNAROUND REQUEST
In Business Days *
Organic & Inorganic Analyses: X STD. | 7 | 5 | 4 | 3 | 2 | 1 | <1
Petroleum Hydrocarbon Analyses: X STD. | 4 | 3 | 2 | 1 | <1
OTHER Specify:
* Turnaround Requests less than standard may incur Rush Charges.

PRESERVATIVES: 5 HCL | 2 HCL | None | HNO3 | HNO3 | H2SO4 | Sulfuric, ice

CLIENT SAMPLE IDENTIFICATION	SAMPLING DATE/TIME	NWTPH-BTEX	NWTPH-Dx	NWTPH-G	NWTPH-Dx	Alkalinity SM2320B	Salinity SM2520	Hardness SM2340B	Fe, Mn	COD 410.4, TOC 9060	BOD 405.1	Anions Chloride, Sulfate	MATRIX (W, S, O)	# OF CONT.	LOCATION / COMMENTS	NCA WO ID
1 CB-MW1	6/1/06 1240	X	X			X	X	X	X	X	X	X	W	8		-15
2 CB-MW2	1430	X	X			X	X	X	X	X	X	X		8		-16
3 CB-MW3	1105	X	X			X	X	X	X	X	X	X		8		-17
4 CB-MW3D	1110	X	X											5		-18
5 CB-MW-TB	—	X												2		-19
6																
7																
8																
9																
10																

RELEASED BY: Mark Blinstrub
PRINT NAME: Mark Blinstrub FIRM: EA Eng. DATE: 6/2/06 TIME: 1210

RECEIVED BY: Cathy Crumble
PRINT NAME: Cathy Crumble FIRM: TA-S DATE: 6/2/06 TIME: 12:10

RELEASED BY: PRINT NAME: FIRM: DATE: TIME:

RECEIVED BY: PRINT NAME: FIRM: DATE: TIME:

ADDITIONAL REMARKS:

TEMP:

COC REV 09/2004

TestAmerica
ANALYTICAL TESTING CORPORATION

SEATTLE, WA 11720 NORTH CREEK PKWY N, SUITE 400
BOTHELL, WA 98011-8244
PH: (425) 420.9200 FAX: (425) 420.9210

June 21, 2006

Jill Frain
EA Engineering, Science and Technology
12011 NE 1st Street, Suite 100
Bellevue, WA/USA 98005

RE: Cornet Bay Marina

Enclosed are the results of analyses for samples received by the laboratory on 06/02/06 12:10. The following list is a summary of the Work Orders contained in this report, generated on 06/21/06 18:27.

If you have any questions concerning this report, please feel free to contact me.

Work Order	Project	ProjectNumber
BPF0087	Cornet Bay Marina	61994.01 4000

Kortland Orr, PM

CASE NARRATIVE for BPF0087

Client:	EA Engineering, Sciences, and Technology
Project Manager:	Jil Frain
Project Name:	Coronet Bay Marina
Project Number:	61994.01 4000

1.0 DESCRIPTION OF CASE

Thirteen soil samples, 4 water samples, and 2 trip blanks were submitted for analysis of some or all of the following: Gasoline Hydrocarbons and BTEX by NWTPH-Gx and EPA 8021B, Semivolatile Petroleum Products by NWTPH-Dx w/o Acid/Silica Gel Clean-up, Total and Dissolved Metals by EPA 6000/7000 Series Methods, TCLP Volatile Organic Compounds by EPA Method 1311/8260B, Conventional Chemistry Parameters by APHA/EPA Methods, and Anions by EPA Method 300.0.

2.0 COMMENTS ON SAMPLE RECEIPT

Samples were received June 2, 2006. The recorded temperature of the samples at time of receipt was 4.3 °C.

3.0 PREPARATION AND ANALYSIS

Gasoline Range Hydrocarbons and BTEX by NWTPH-Gx and EPA 8021B

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Semivolatile Petroleum Products by NWTPH-Dx w/o Acid/Silica Gel Clean-up

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Total Metals by EPA 6000/7000 Series Methods

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Dissolved Metals by EPA 6000/7000 Series Methods

No anomalies were associated with the sample preparation and analysis. All criteria for acceptable QC measurements were met.

TCLP Volatile Organic Compounds by EPA Method 8260B

No anomalies were associated with the sample preparation and analysis. All criteria for acceptable QC measurements were met.

Conventional Chemistry Parameters by APHA/EPA Methods

- The Nitrate analysis was performed past the recommended holding time of 2 days due to miscommunication in the laboratory.
- The Nitrate analysis was performed diluted due to high levels of Chloride in the samples.

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Anions by EPA Method 300.0.

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Kortland Orr
Project Manager
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Conventional Chemistry Parameters by APHA/EPA Methods

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- The Nitrate analysis was performed diluted due to high levels of Chloride in the samples.

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

Anions by EPA Method 300.0.

No additional anomalies, discrepancies, or issues were associated with sample preparation, analysis and quality control other than those already qualified in the data and described in the Notes and Definitions page at the end of the report.

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TestAmerica Analytical Testing Corporation

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SEATTLE, WA 11720 NORTH CREEK PKWY N, SUITE 400
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PH: (425) 420.9200 FAX: (425) 420.9210

EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
CB-TP3-SS-1.5	BPF0087-01	Soil	06/01/06 13:05	06/02/06 12:10
CB-TP3-SS-4	BPF0087-02	Soil	06/01/06 13:15	06/02/06 12:10
CB-TP3-SS-6	BPF0087-03	Soil	06/01/06 13:30	06/02/06 12:10
CB-TP4-SS-2	BPF0087-04	Soil	06/01/06 14:05	06/02/06 12:10
CB-TP4-SS-4	BPF0087-05	Soil	06/01/06 14:15	06/02/06 12:10
CB-TP5-SS-4	BPF0087-06	Soil	06/01/06 16:30	06/02/06 12:10
CB-SD1-0.5	BPF0087-07	Soil	06/01/06 15:30	06/02/06 12:10
CB-TP-TB	BPF0087-08	Soil	06/01/06 08:20	06/02/06 12:10
CB-TP5-SS-4D	BPF0087-09	Soil	06/01/06 16:30	06/02/06 12:10
CB-TP1-SS-2	BPF0087-10	Soil	06/01/06 09:20	06/02/06 12:10
CB-TP1-SS-4	BPF0087-11	Soil	06/01/06 09:30	06/02/06 12:10
CB-TP2-SS-2	BPF0087-12	Soil	06/01/06 10:45	06/02/06 12:10
CB-TP2-SS-4	BPF0087-13	Soil	06/01/06 11:00	06/02/06 12:10
CB-TP2-SS-6	BPF0087-14	Soil	06/01/06 11:30	06/02/06 12:10
CB-MW1	BPF0087-15	Water	06/01/06 12:40	06/02/06 12:10
CB-MW2	BPF0087-16	Water	06/01/06 14:30	06/02/06 12:10
CB-MW3	BPF0087-17	Water	06/01/06 11:05	06/02/06 12:10
CB-MW3 D	BPF0087-18	Water	06/01/06 11:10	06/02/06 12:10
CB-MW-TB	BPF0087-19	Water	06/01/06 12:00	06/02/06 12:10

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Volatile Petroleum Products by NWTPH-Gx

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-01 (CB-TP3-SS-1.5)		**Soil**				**Sampled: 06/01/06 13:05**				
Gasoline Range Hydrocarbons	NWTPH-Gx	**396**	-----	36.9	mg/kg dry	10x	6F06041	06/06/06 10:52	06/06/06 22:53	
Surrogate(s): 4-BFB (FID)		*106%*			*50 - 150 %*	*1x*			"	
BPF0087-02 (CB-TP3-SS-4)		**Soil**				**Sampled: 06/01/06 13:15**				
Gasoline Range Hydrocarbons	NWTPH-Gx	**37.2**	-----	4.06	mg/kg dry	1x	6F05025	06/05/06 09:44	06/05/06 19:38	
Surrogate(s): 4-BFB (FID)		*108%*			*50 - 150 %*	"			"	
BPF0087-03 (CB-TP3-SS-6)		**Soil**				**Sampled: 06/01/06 13:30**				
Gasoline Range Hydrocarbons	NWTPH-Gx	**61.5**	-----	3.93	mg/kg dry	1x	6F05025	06/05/06 09:44	06/05/06 20:08	
Surrogate(s): 4-BFB (FID)		*119%*			*50 - 150 %*	"			"	
BPF0087-04 (CB-TP4-SS-2)		**Soil**				**Sampled: 06/01/06 14:05**				
Gasoline Range Hydrocarbons	NWTPH-Gx	ND	-----	4.50	mg/kg dry	1x	6F05025	06/05/06 09:44	06/05/06 20:38	
Surrogate(s): 4-BFB (FID)		*106%*			*50 - 150 %*	"			"	
BPF0087-05 (CB-TP4-SS-4)		**Soil**				**Sampled: 06/01/06 14:15**				G-02
Gasoline Range Hydrocarbons	NWTPH-Gx	**9.52**	-----	4.64	mg/kg dry	1x	6F05025	06/05/06 09:44	06/05/06 21:07	
Surrogate(s): 4-BFB (FID)		*103%*			*50 - 150 %*	"			"	
BPF0087-06 (CB-TP5-SS-4)		**Soil**				**Sampled: 06/01/06 16:30**				
Gasoline Range Hydrocarbons	NWTPH-Gx	**43.9**	-----	5.70	mg/kg dry	1x	6F05025	06/05/06 09:44	06/05/06 21:37	
Surrogate(s): 4-BFB (FID)		*107%*			*50 - 150 %*	"			"	
BPF0087-07 (CB-SD1-0.5)		**Soil**				**Sampled: 06/01/06 15:30**				
Gasoline Range Hydrocarbons	NWTPH-Gx	ND	-----	4.95	mg/kg dry	1x	6F05025	06/05/06 09:44	06/05/06 22:07	
Surrogate(s): 4-BFB (FID)		*102%*			*50 - 150 %*	"			"	
BPF0087-08 (CB-TP-TB)		**Soil**				**Sampled: 06/01/06 08:20**				
Gasoline Range Hydrocarbons	NWTPH-Gx	ND	-----	5.00	mg/kg wet	1x	6F05025	06/05/06 09:44	06/05/06 22:36	
Surrogate(s): 4-BFB (FID)		*106%*			*50 - 150 %*	"			"	

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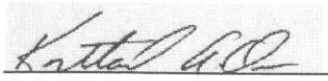

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Volatile Petroleum Products by NWTPH-Gx

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-09 (CB-TP5-SS-4D)		**Soil**			**Sampled: 06/01/06 16:30**					
Gasoline Range Hydrocarbons	NWTPH-Gx	**33.3**	-----	4.73	mg/kg dry	1x	6F05025	06/05/06 09:44	06/06/06 01:35	
Surrogate(s): 4-BFB (FID)		*109%*			*50 - 150 %*	"			"	
BPF0087-10 (CB-TP1-SS-2)		**Soil**			**Sampled: 06/01/06 09:20**					
Gasoline Range Hydrocarbons	NWTPH-Gx	**4.03**	-----	4.00	mg/kg dry	1x	6F06041	06/06/06 10:52	06/06/06 22:22	
Surrogate(s): 4-BFB (FID)		*93.8%*			*50 - 150 %*	"			"	
BPF0087-11 (CB-TP1-SS-4)		**Soil**			**Sampled: 06/01/06 09:30**					
Gasoline Range Hydrocarbons	NWTPH-Gx	**2470**	-----	77.1	mg/kg dry	20x	6F05025	06/05/06 09:44	06/06/06 00:35	
Surrogate(s): 4-BFB (FID)		*126%*			*50 - 150 %*	*1x*			"	
BPF0087-12 (CB-TP2-SS-2)		**Soil**			**Sampled: 06/01/06 10:45**					
Gasoline Range Hydrocarbons	NWTPH-Gx	**21.5**	-----	4.26	mg/kg dry	1x	6F05025	06/05/06 09:44	06/06/06 02:34	
Surrogate(s): 4-BFB (FID)		*108%*			*50 - 150 %*	"			"	
BPF0087-13 (CB-TP2-SS-4)		**Soil**			**Sampled: 06/01/06 11:00**					
Gasoline Range Hydrocarbons	NWTPH-Gx	**1900**	-----	46.2	mg/kg dry	10x	6F05025	06/05/06 09:44	06/05/06 17:07	
Surrogate(s): 4-BFB (FID)		*151%*			*50 - 150 %*	*1x*			"	*SR-4*
BPF0087-14 (CB-TP2-SS-6)		**Soil**			**Sampled: 06/01/06 11:30**					
Gasoline Range Hydrocarbons	NWTPH-Gx	**218**	-----	4.43	mg/kg dry	1x	6F05025	06/05/06 09:44	06/06/06 03:03	
Surrogate(s): 4-BFB (FID)		*152%*			*50 - 150 %*	"			"	*SR-4*

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Gasoline Hydrocarbons (Benzene to Naphthalene) and BTEX by NWTPH-G and EPA 8021B

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-15 (CB-MW1)		**Water**			**Sampled: 06/01/06 12:40**					
Gasoline Range Hydrocarbons	NWTPH-Gx/802 1B	ND	-----	50.0	ug/l	1x	6F04009	06/05/06 00:00	06/06/06 10:02	
Benzene	"	ND	-----	0.500	"	"	"	"	"	
Toluene	"	ND	-----	0.500	"	"	"	"	"	
Ethylbenzene	"	ND	-----	0.500	"	"	"	"	"	
Xylenes (total)	"	ND	-----	1.00	"	"	"	"	"	
Surrogate(s): 4-BFB (FID)		*89.7%*			*58 - 144 %*	"			"	
4-BFB (PID)		*101%*			*68 - 140 %*	"			"	
BPF0087-16 (CB-MW2)		**Water**			**Sampled: 06/01/06 14:30**					
Gasoline Range Hydrocarbons	NWTPH-Gx/802 1B	**20300**	-----	500	ug/l	10x	6F04009	06/05/06 00:00	06/05/06 13:57	
Toluene	"	**16.6**	-----	5.00	"	"	"	"	"	
Ethylbenzene	"	**86.9**	-----	5.00	"	"	"	"	"	
Xylenes (total)	"	**29.6**	-----	10.0	"	"	"	"	"	
Surrogate(s): 4-BFB (FID)		*96.7%*			*58 - 144 %*	*1x*			"	
4-BFB (PID)		*99.2%*			*68 - 140 %*	"			"	
BPF0087-16RE1 (CB-MW2)		**Water**			**Sampled: 06/01/06 14:30**					
Gasoline Range Hydrocarbons	NWTPH-Gx/802 1B	**20300**	-----	5000	ug/l	100x	6F04009	06/05/06 00:00	06/06/06 11:04	
Benzene	"	**7150**	-----	50.0	"	"	"	"	"	
Toluene	"	ND	-----	50.0	"	"	"	"	"	
Ethylbenzene	"	**88.6**	-----	50.0	"	"	"	"	"	
Xylenes (total)	"	ND	-----	100	"	"	"	"	"	
Surrogate(s): 4-BFB (FID)		*90.5%*			*58 - 144 %*	*1x*			"	
4-BFB (PID)		*98.0%*			*68 - 140 %*	"			"	
BPF0087-17 (CB-MW3)		**Water**			**Sampled: 06/01/06 11:05**					
Gasoline Range Hydrocarbons	NWTPH-Gx/802 1B	**3900**	-----	500	ug/l	10x	6F04009	06/05/06 00:00	06/05/06 14:28	
Benzene	"	**643**	-----	5.00	"	"	"	"	"	
Toluene	"	**15.3**	-----	5.00	"	"	"	"	"	
Ethylbenzene	"	**324**	-----	5.00	"	"	"	"	"	
Xylenes (total)	"	**34.8**	-----	10.0	"	"	"	"	"	
Surrogate(s): 4-BFB (FID)		*90.7%*			*58 - 144 %*	*1x*			"	
4-BFB (PID)		*99.3%*			*68 - 140 %*	"			"	

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12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Gasoline Hydrocarbons (Benzene to Naphthalene) and BTEX by NWTPH-G and EPA 8021B

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-18 (CB-MW3 D)		**Water**			**Sampled: 06/01/06 11:10**					
Gasoline Range Hydrocarbons	NWTPH-Gx/802 1B	**3880**	-----	500	ug/l	10x	6F04009	06/05/06 00:00	06/05/06 16:19	
Benzene	"	**643**	-----	5.00	"	"	"	"	"	
Toluene	"	**16.0**	-----	5.00	"	"	"	"	"	
Ethylbenzene	"	**324**	-----	5.00	"	"	"	"	"	
Xylenes (total)	"	**34.7**	-----	10.0	"	"	"	"	"	
Surrogate(s): 4-BFB (FID)			*90.2%*		*58 - 144 %*	*1x*			"	
4-BFB (PID)			*96.8%*		*68 - 140 %*	"			"	
BPF0087-19 (CB-MW-TB)		**Water**			**Sampled: 06/01/06 12:00**					
Gasoline Range Hydrocarbons	NWTPH-Gx/802 1B	ND	-----	50.0	ug/l	1x	6F04009	06/05/06 00:00	06/05/06 21:19	
Benzene	"	ND	-----	0.500	"	"	"	"	"	
Toluene	"	ND	-----	0.500	"	"	"	"	"	
Ethylbenzene	"	ND	-----	0.500	"	"	"	"	"	
Xylenes (total)	"	ND	-----	1.00	"	"	"	"	"	
Surrogate(s): 4-BFB (FID)			*89.7%*		*58 - 144 %*	"			"	
4-BFB (PID)			*100%*		*68 - 140 %*	"			"	

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-01RE1 (CB-TP3-SS-1.5)		**Soil**			**Sampled: 06/01/06 13:05**					
Diesel Range Hydrocarbons	NWTPH-Dx	**277**	-----	10.8	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 14:25	
Lube Oil Range Hydrocarbons	"	**28.6**	-----	27.0	"	"	"	"	"	D-10
Surrogate(s): 2-FBP		*146%*			*50 - 150 %*	"			"	
Octacosane		*107%*			*50 - 150 %*	"			"	
BPF0087-02RE1 (CB-TP3-SS-4)		**Soil**			**Sampled: 06/01/06 13:15**					
Diesel Range Hydrocarbons	NWTPH-Dx	**25.5**	-----	11.8	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 14:55	
Lube Oil Range Hydrocarbons	"	**42.6**	-----	29.5	"	"	"	"	"	
Surrogate(s): 2-FBP		*110%*			*50 - 150 %*	"			"	
Octacosane		*108%*			*50 - 150 %*	"			"	
BPF0087-03RE1 (CB-TP3-SS-6)		**Soil**			**Sampled: 06/01/06 13:30**					
Diesel Range Hydrocarbons	NWTPH-Dx	**15.2**	-----	11.1	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 15:24	
Lube Oil Range Hydrocarbons	"	ND	-----	27.7	"	"	"	"	"	
Surrogate(s): 2-FBP		*104%*			*50 - 150 %*	"			"	
Octacosane		*102%*			*50 - 150 %*	"			"	
BPF0087-04 (CB-TP4-SS-2)		**Soil**			**Sampled: 06/01/06 14:05**					
Diesel Range Hydrocarbons	NWTPH-Dx	ND	-----	12.3	mg/kg dry	1x	6F05035	06/05/06 11:44	06/09/06 03:50	Q-41
Lube Oil Range Hydrocarbons	"	ND	-----	30.7	"	"	"	"	"	
Surrogate(s): 2-FBP		*110%*			*50 - 150 %*	"			"	
Octacosane		*112%*			*50 - 150 %*	"			"	
BPF0087-05 (CB-TP4-SS-4)		**Soil**			**Sampled: 06/01/06 14:15**					
Diesel Range Hydrocarbons	NWTPH-Dx	ND	-----	12.2	mg/kg dry	1x	6F05035	06/05/06 11:44	06/09/06 04:04	Q-41
Lube Oil Range Hydrocarbons	"	ND	-----	30.6	"	"	"	"	"	
Surrogate(s): 2-FBP		*116%*			*50 - 150 %*	"			—"	
Octacosane		*117%*			*50 - 150 %*	"			"	
BPF0087-06RE1 (CB-TP5-SS-4)		**Soil**			**Sampled: 06/01/06 16:30**					
Diesel Range Hydrocarbons	NWTPH-Dx	**569**	-----	25.5	mg/kg dry	2x	6F05035	06/05/06 11:44	06/12/06 15:54	
Lube Oil Range Hydrocarbons	"	ND	-----	63.6	"	"	"	"	"	
Surrogate(s): 2-FBP		*118%*			*50 - 150 %*	"			"	
Octacosane		*96.2%*			*50 - 150 %*	"			"	

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-07 (CB-SD1-0.5)		**Soil**			**Sampled: 06/01/06 15:30**					
Diesel Range Hydrocarbons	NWTPH-Dx	ND	-----	13.2	mg/kg dry	1x	6F05035	06/05/06 11:44	06/09/06 04:49	Q-41
Lube Oil Range Hydrocarbons	"	ND	-----	33.1	"	"	"	"	"	
Surrogate(s): 2-FBP			*100%*		*50 - 150 %*	"			"	
Octacosane			*105%*		*50 - 150 %*	"			"	
BPF0087-09RE1 (CB-TP5-SS-4D)		**Soil**			**Sampled: 06/01/06 16:30**					
Diesel Range Hydrocarbons	NWTPH-Dx	**85.6**	-----	12.8	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 16:23	
Lube Oil Range Hydrocarbons	"	ND	-----	32.1	"	"	"	"	"	
Surrogate(s): 2-FBP			*110%*		*50 - 150 %*	"			"	
Octacosane			*101%*		*50 - 150 %*	"			"	
BPF0087-10RE1 (CB-TP1-SS-2)		**Soil**			**Sampled: 06/01/06 09:20**					
Diesel Range Hydrocarbons	NWTPH-Dx	**12.0**	-----	10.8	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 16:53	D-09
Lube Oil Range Hydrocarbons	"	ND	-----	27.0	"	"	"	"	"	
Surrogate(s): 2-FBP			*105%*		*50 - 150 %*	"			"	
Octacosane			*103%*		*50 - 150 %*	"			"	
BPF0087-11RE1 (CB-TP1-SS-4)		**Soil**			**Sampled: 06/01/06 09:30**					
Diesel Range Hydrocarbons	NWTPH-Dx	**719**	-----	30.7	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 17:22	
Lube Oil Range Hydrocarbons	"	ND	-----	76.8	"	"	"	"	"	
Surrogate(s): 2-FBP			*118%*		*50 - 150 %*	"			"	
Octacosane			*102%*		*50 - 150 %*	"			"	
BPF0087-12 (CB-TP2-SS-2)		**Soil**			**Sampled: 06/01/06 10:45**					
Diesel Range Hydrocarbons	NWTPH-Dx	ND	-----	11.7	mg/kg dry	1x	6F05035	06/05/06 11:44	06/09/06 07:35	Q-41
Lube Oil Range Hydrocarbons	"	ND	-----	29.3	"	"	"	"	"	
Surrogate(s): 2-FBP			*98.5%*		*50 - 150 %*	"			—"	
Octacosane			*99.3%*		*50 - 150 %*	"			"	
BPF0087-13RE1 (CB-TP2-SS-4)		**Soil**			**Sampled: 06/01/06 11:00**					
Diesel Range Hydrocarbons	NWTPH-Dx	**174**	-----	12.9	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 17:52	
Lube Oil Range Hydrocarbons	"	ND	-----	32.2	"	"	"	"	"	
Surrogate(s): 2-FBP			*116%*		*50 - 150 %*	"			"	
Octacosane			*102%*		*50 - 150 %*	"			"	

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BOTHELL, WA 98011-8244
PH: (425) 420.9200 FAX: (425) 420.9210

EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up)

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Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-14RE1 (CB-TP2-SS-6)		**Soil**			**Sampled: 06/01/06 11:30**					
Diesel Range Hydrocarbons	NWTPH-Dx	**208**	-----	12.3	mg/kg dry	1x	6F05035	06/05/06 11:44	06/12/06 18:22	
Lube Oil Range Hydrocarbons	"	ND	-----	30.7	"	"	"	"	"	
Surrogate(s): 2-FBP		*116%*			*50 - 150 %*	"			"	
Octacosane		*98.0%*			*50 - 150 %*	"			"	
BPF0087-15 (CB-MW1)		**Water**			**Sampled: 06/01/06 12:40**					
Diesel Range Hydrocarbons	NWTPH-Dx	**0.529**	-----	0.253	mg/l	1x	6F06018	06/06/06 09:02	06/08/06 15:35	D-09
Lube Oil Range Hydrocarbons	"	ND	-----	0.505	"	"	"	"	"	
Surrogate(s): 2-FBP		*77.1%*			*50 - 150 %*	"			"	
Octacosane		*97.2%*			*50 - 150 %*	"			"	
BPF0087-16 (CB-MW2)		**Water**			**Sampled: 06/01/06 14:30**					
Diesel Range Hydrocarbons	NWTPH-Dx	ND	-----	5.05	mg/l	20x	6F06018	06/06/06 09:02	06/08/06 16:04	
Lube Oil Range Hydrocarbons	"	ND	-----	10.1	"	"	"	"	"	
Surrogate(s): 2-FBP		*114%*			*50 - 150 %*	"			"	
Octacosane		*128%*			*50 - 150 %*	"			"	
BPF0087-17 (CB-MW3)		**Water**			**Sampled: 06/01/06 11:05**					
Diesel Range Hydrocarbons	NWTPH-Dx	ND	-----	5.15	mg/l	20x	6F06018	06/06/06 09:02	06/08/06 16:19	
Lube Oil Range Hydrocarbons	"	ND	-----	10.3	"	"	"	"	"	
Surrogate(s): 2-FBP		*107%*			*50 - 150 %*	"			"	
Octacosane		*96.1%*			*50 - 150 %*	"			"	
BPF0087-18 (CB-MW3 D)		**Water**			**Sampled: 06/01/06 11:10**					
Diesel Range Hydrocarbons	NWTPH-Dx	**2.02**	-----	0.250	mg/l	1x	6F06018	06/06/06 09:02	06/08/06 16:45	D-06
Lube Oil Range Hydrocarbons	"	ND	-----	0.500	"	"	"	"	"	
Surrogate(s): 2-FBP		*98.8%*			*50 - 150 %*	"			—"	
Octacosane		*98.4%*			*50 - 150 %*	"			"	

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Bellevue, WA/USA 98005	Project Manager: Jill Frain	06/21/06 18:27

Total Metals by EPA 6000/7000 Series Methods

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Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-02 (CB-TP3-SS-4)		**Soil**				**Sampled: 06/01/06 13:15**				
Phosphorus	EPA 6010B	464	-----	6.24	mg/kg dry	1x	6F13057	06/13/06 16:20	06/16/06 11:32	
Potassium	"	1400	-----	187	"	10x	"	"	06/20/06 11:28	
BPF0087-06 (CB-TP5-SS-4)		**Soil**				**Sampled: 06/01/06 16:30**				
Phosphorus	EPA 6010B	670	-----	5.91	mg/kg dry	1x	6F13057	06/13/06 16:20	06/16/06 11:38	
Potassium	"	3060	-----	177	"	10x	"	"	06/20/06 11:34	
BPF0087-13 (CB-TP2-SS-4)		**Soil**				**Sampled: 06/01/06 11:00**				
Phosphorus	EPA 6010B	695	-----	6.12	mg/kg dry	1x	6F13057	06/13/06 16:20	06/16/06 11:43	
Potassium	"	3790	-----	184	"	10x	"	"	06/20/06 11:40	

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Dissolved Metals by EPA 6000/7000 Series Methods

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Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-15 (CB-MW1)		**Water**				**Sampled: 06/01/06 12:40**				
Iron	EPA 6010B - Diss	ND	-----	0.150	mg/l	1x	6F08027	06/08/06 11:13	06/08/06 15:01	
Manganese	"	0.605	-----	0.0100	"	"	"	"	"	
BPF0087-16 (CB-MW2)		**Water**				**Sampled: 06/01/06 14:30**				
Iron	EPA 6010B - Diss	16.4	-----	0.150	mg/l	1x	6F08027	06/08/06 11:13	06/08/06 15:07	
Manganese	"	2.95	-----	0.0100	"	"	"	"	"	
BPF0087-17 (CB-MW3)		**Water**				**Sampled: 06/01/06 11:05**				
Iron	EPA 6010B - Diss	5.55	-----	0.150	mg/l	1x	6F08027	06/08/06 11:13	06/08/06 15:14	
Manganese	"	3.46	-----	0.0100	"	"	"	"	"	

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12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

TCLP Volatile Organic Compounds by EPA Method 1311/8260B

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Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-06 (CB-TP5-SS-4)		**Soil**			**Sampled: 06/01/06 16:30**					
Benzene	EPA 8260B	**0.183**	-----	0.0800	mg/l	1x	6F06062	06/05/06 13:32	06/06/06 15:15	
Surrogate(s): 1,2-DCA-d4		*115%*			*67 - 135 %*	"			"	
Toluene-d8		*94.6%*			*70 - 130 %*	"			"	
4-BFB		*97.4%*			*70 - 130 %*	"			"	
BPF0087-11 (CB-TP1-SS-4)		**Soil**			**Sampled: 06/01/06 09:30**					
Benzene	EPA 8260B	ND	-----	0.0800	mg/l	1x	6F06062	06/05/06 13:32	06/06/06 15:40	
Surrogate(s): 1,2-DCA-d4		*115%*			*67 - 135 %*	"			"	
Toluene-d8		*94.1%*			*70 - 130 %*	"			"	
4-BFB		*97.0%*			*70 - 130 %*	"			"	

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12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Conventional Chemistry Parameters by APHA/EPA Methods

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-02 (CB-TP3-SS-4)		**Soil**				**Sampled: 06/01/06 13:15**				
Chemical Oxygen Demand	EPA 410.4	**119000**	-----	2990	mg/kg dry	1x	6F13071	06/12/06 14:00	06/12/06 18:55	B-14
Nitrate/Nitrite-Nitrogen	EPA 353.2	ND	-----	0.116	mg/kg as N dry	"	6F13049	06/13/06 15:01	06/13/06 15:02	
Total Kjeldahl Nitrogen	EPA 351.2	**254**	-----	116	"	"	6F07039	06/07/06 14:20	06/07/06 19:49	
Total Nitrogen	SM 4500N	**295**	-----	5.80	"	"	6F14046	06/14/06 14:26	06/14/06 14:26	
Total Organic Carbon	EPA 9060 mod.	**6350**	-----	580	mg/kg dry	"	6F10004	06/05/06 13:35	06/10/06 13:42	
BPF0087-06 (CB-TP5-SS-4)		**Soil**				**Sampled: 06/01/06 16:30**				
Chemical Oxygen Demand	EPA 410.4	**119000**	-----	2970	mg/kg dry	1x	6F13071	06/12/06 14:00	06/12/06 18:55	B-14
Nitrate/Nitrite-Nitrogen	EPA 353.2	**0.207**	-----	0.128	mg/kg as N dry	"	6F13049	06/13/06 15:01	06/13/06 15:02	
Total Kjeldahl Nitrogen	EPA 351.2	**197**	-----	128	"	"	6F07039	06/07/06 14:20	06/07/06 19:49	
Total Nitrogen	SM 4500N	**252**	-----	6.39	"	"	6F14046	06/14/06 14:26	06/14/06 14:26	
Total Organic Carbon	EPA 9060 mod.	**5530**	-----	639	mg/kg dry	"	6F10004	06/05/06 13:35	06/10/06 13:42	
BPF0087-13 (CB-TP2-SS-4)		**Soil**				**Sampled: 06/01/06 11:00**				
Chemical Oxygen Demand	EPA 410.4	**121000**	-----	3020	mg/kg dry	1x	6F13071	06/12/06 14:00	06/12/06 18:55	B-14
Nitrate/Nitrite-Nitrogen	EPA 353.2	ND	-----	0.127	mg/kg as N dry	"	6F13049	06/13/06 15:01	06/13/06 15:02	
Total Kjeldahl Nitrogen	EPA 351.2	**200**	-----	127	"	"	6F07039	06/07/06 14:20	06/07/06 19:49	
Total Nitrogen	SM 4500N	**255**	-----	6.37	"	"	6F14046	06/14/06 14:26	06/14/06 14:26	
Total Organic Carbon	EPA 9060 mod.	**3640**	-----	637	mg/kg dry	"	6F10004	06/05/06 13:35	06/10/06 13:42	
BPF0087-15 (CB-MW1)		**Water**				**Sampled: 06/01/06 12:40**				
Bicarbonate Alkalinity	SM 2320B	**1160**	-----	5.00	mg/L as CaCO3	1x	6F14075	06/14/06 17:43	06/14/06 17:45	
Biochemical Oxygen Demand	EPA 405.1	**12.9**	-----	2.00	mg/l	"	6F02060	06/02/06 17:45	06/07/06 15:50	
Chemical Oxygen Demand	EPA 410.4	ND	-----	150	"	10x	6F06072	06/06/06 11:00	06/06/06 17:41	D-14
Hardness	SM 2340B	**701**	-----	3.00	mg/L as CaCO3	1x	6F08027	06/08/06 11:13	06/08/06 15:01	
Salinity	SM 2520	**4.70**	-----	0.00100	g/kg (ppt)	"	6F09066	06/09/06 19:56	06/09/06 20:02	
Carbonate Alkalinity	SM 2320B	ND	-----	5.00	mg/L as CaCO3	"	6F14075	06/14/06 17:43	06/14/06 17:45	
Total Organic Carbon	EPA 415.1	**26.8**	-----	8.00	mg/l	4x	6F14066	06/13/06 13:00	06/13/06 16:05	
Hydroxide Alkalinity	SM 2320B	ND	-----	5.00	mg/L as CaCO3	1x	6F14075	06/14/06 17:43	06/14/06 17:45	
Total Alkalinity	"	**1160**	-----	5.00	"	"	"	"	"	

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Conventional Chemistry Parameters by APHA/EPA Methods

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-16 (CB-MW2)		**Water**			**Sampled: 06/01/06 14:30**					
Bicarbonate Alkalinity	SM 2320B	**705**	-----	5.00	mg/L as CaCO3	1x	6F14073	06/14/06 17:34	06/14/06 17:36	
Biochemical Oxygen Demand	EPA 405.1	**40.4**	-----	2.00	mg/l	"	6F02060	06/02/06 17:45	06/07/06 15:50	
Chemical Oxygen Demand	EPA 410.4	**119**	-----	15.0	"	"	6F06072	06/06/06 11:00	06/06/06 17:41	
Hardness	SM 2340B	**373**	-----	3.00	mg/L as CaCO3	"	6F08027	06/08/06 11:13	06/08/06 15:07	
Salinity	SM 2520	**0.700**	-----	0.00100	g/kg (ppt)	"	6F09066	06/09/06 19:56	06/09/06 20:02	
Carbonate Alkalinity	SM 2320B	ND	-----	5.00	mg/L as CaCO3	"	6F14073	06/14/06 17:34	06/14/06 17:36	
Total Organic Carbon	EPA 415.1	**47.6**	-----	8.00	mg/l	4x	6F14066	06/13/06 13:00	06/13/06 16:05	
Hydroxide Alkalinity	SM 2320B	ND	-----	5.00	mg/L as CaCO3	1x	6F14073	06/14/06 17:34	06/14/06 17:36	
Total Alkalinity	"	**705**	-----	5.00	"	"	"	"	"	
BPF0087-17 (CB-MW3)		**Water**			**Sampled: 06/01/06 11:05**					
Bicarbonate Alkalinity	SM 2320B	**734**	-----	5.00	mg/L as CaCO3	1x	6F14073	06/14/06 17:34	06/14/06 17:36	
Biochemical Oxygen Demand	EPA 405.1	**19.4**	-----	2.00	mg/l	"	6F02060	06/02/06 17:45	06/07/06 15:50	
Chemical Oxygen Demand	EPA 410.4	**156**	-----	150	"	10x	6F06072	06/06/06 11:00	06/06/06 17:41	D-14
Hardness	SM 2340B	**459**	-----	3.00	mg/L as CaCO3	1x	6F08027	06/08/06 11:13	06/08/06 15:14	
Salinity	SM 2520	**1.20**	-----	0.00100	g/kg (ppt)	"	6F09066	06/09/06 19:56	06/09/06 20:02	
Carbonate Alkalinity	SM 2320B	ND	-----	5.00	mg/L as CaCO3	"	6F14073	06/14/06 17:34	06/14/06 17:36	
Total Organic Carbon	EPA 415.1	**42.0**	-----	8.00	mg/l	4x	6F14066	06/13/06 13:00	06/13/06 16:05	
Hydroxide Alkalinity	SM 2320B	ND	-----	5.00	mg/L as CaCO3	1x	6F14073	06/14/06 17:34	06/14/06 17:36	
Total Alkalinity	"	**734**	-----	5.00	"	"	"	"	"	

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Anions by EPA Method 300.0

TestAmerica - Seattle, WA

Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-15 (CB-MW1)		**Water**			**Sampled: 06/01/06 12:40**					
Chloride	EPA 300.0	**2900**	-----	200	mg/l	500x	6F13022	06/12/06 00:00	06/12/06 00:00	
Nitrate-Nitrogen	"	ND	-----	4.00	mg/l as N	20x	6F14043	06/05/06 00:00	06/05/06 00:00	I-02, D-14
Sulfate	"	**12.8**	-----	8.00	mg/l	"	"	"	"	
BPF0087-16 (CB-MW2)		**Water**			**Sampled: 06/01/06 14:30**					
Chloride	EPA 300.0	**115**	-----	20.0	mg/l	50x	6F13022	06/12/06 00:00	06/12/06 00:00	
Nitrate-Nitrogen	"	ND	-----	0.400	mg/l as N	2x	6F14043	06/05/06 00:00	06/05/06 00:00	I-02, D-14
Sulfate	"	**7.83**	-----	0.800	mg/l	"	"	"	"	
BPF0087-17 (CB-MW3)		**Water**			**Sampled: 06/01/06 11:05**					
Chloride	EPA 300.0	**399**	-----	40.0	mg/l	100x	6F13022	06/12/06 00:00	06/12/06 00:00	
Nitrate-Nitrogen	"	ND	-----	1.00	mg/l as N	5x	6F14043	06/05/06 00:00	06/05/06 00:00	I-02, D-14
Sulfate	"	**19.4**	-----	2.00	mg/l	"	"	"	"	

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Physical Parameters by APHA/ASTM/EPA Methods

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Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-01 (CB-TP3-SS-1.5)		**Soil**				**Sampled: 06/01/06 13:05**				
Dry Weight	BSOPSPL003R08	93.9	-----	1.00	%	1x	6F06075	06/06/06 19:11	06/07/06 00:00	
BPF0087-02 (CB-TP3-SS-4)		**Soil**				**Sampled: 06/01/06 13:15**				
Dry Weight	BSOPSPL003R08	86.2	-----	1.00	%	1x	6F06075	06/06/06 19:11	06/07/06 00:00	
BPF0087-03 (CB-TP3-SS-6)		**Soil**				**Sampled: 06/01/06 13:30**				
Dry Weight	BSOPSPL003R08	89.2	-----	1.00	%	1x	6F06075	06/06/06 19:11	06/07/06 00:00	
BPF0087-04 (CB-TP4-SS-2)		**Soil**				**Sampled: 06/01/06 14:05**				
Dry Weight	BSOPSPL003R08	80.6	-----	1.00	%	1x	6F06075	06/06/06 19:11	06/07/06 00:00	
BPF0087-05 (CB-TP4-SS-4)		**Soil**				**Sampled: 06/01/06 14:15**				
Dry Weight	BSOPSPL003R08	80.4	-----	1.00	%	1x	6F06075	06/06/06 19:11	06/07/06 00:00	
BPF0087-06 (CB-TP5-SS-4)		**Soil**				**Sampled: 06/01/06 16:30**				
Dry Weight	BSOPSPL003R08	78.3	-----	1.00	%	1x	6F06075	06/06/06 19:11	06/07/06 00:00	
BPF0087-07 (CB-SD1-0.5)		**Soil**				**Sampled: 06/01/06 15:30**				
Dry Weight	BSOPSPL003R08	76.5	-----	1.00	%	1x	6F06076	06/06/06 19:13	06/07/06 00:00	
BPF0087-09 (CB-TP5-SS-4D)		**Soil**				**Sampled: 06/01/06 16:30**				
Dry Weight	BSOPSPL003R08	78.1	-----	1.00	%	1x	6F06076	06/06/06 19:13	06/07/06 00:00	
BPF0087-10 (CB-TP1-SS-2)		**Soil**				**Sampled: 06/01/06 09:20**				
Dry Weight	BSOPSPL003R08	92.4	-----	1.00	%	1x	6F06076	06/06/06 19:13	06/07/06 00:00	
BPF0087-11 (CB-TP1-SS-4)		**Soil**				**Sampled: 06/01/06 09:30**				
Dry Weight	BSOPSPL003R08	90.4	-----	1.00	%	1x	6F06076	06/06/06 19:13	06/07/06 00:00	
BPF0087-12 (CB-TP2-SS-2)		**Soil**				**Sampled: 06/01/06 10:45**				

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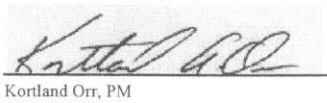

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PH: (425) 420.9200 FAX: (425) 420.9210

EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Physical Parameters by APHA/ASTM/EPA Methods

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Analyte	Method	Result	MDL*	MRL	Units	Dil	Batch	Prepared	Analyzed	Notes
BPF0087-12 (CB-TP2-SS-2)		**Soil**				**Sampled: 06/01/06 10:45**				
Dry Weight	BSOPSPL003R08	**84.7**	-----	1.00	%	1x	6F06076	06/06/06 19:13	06/07/06 00:00	
BPF0087-13 (CB-TP2-SS-4)		**Soil**				**Sampled: 06/01/06 11:00**				
Dry Weight	BSOPSPL003R08	**78.5**	-----	1.00	%	1x	6F06076	06/06/06 19:13	06/07/06 00:00	
BPF0087-14 (CB-TP2-SS-6)		**Soil**				**Sampled: 06/01/06 11:30**				
Dry Weight	BSOPSPL003R08	**81.7**	-----	1.00	%	1x	6F06076	06/06/06 19:13	06/07/06 00:00	

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Volatile Petroleum Products by NWTPH-Gx - Laboratory Quality Control Results

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QC Batch: 6F05025 **Soil Preparation Method: EPA 5030B (MeOH)**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F05025-BLK1)								**Extracted: 06/05/06 09:44**						
Gasoline Range Hydrocarbons	NWTPH-Gx	ND	---	10.0	mg/kg wet	1x	--	--	--	--	--	--	06/05/06 11:15	
Surrogate(s): 4-BFB (FID)		*Recovery: 102%*			*Limits: 50-150%*	"							*06/05/06 11:15*	
LCS (6F05025-BS1)								**Extracted: 06/05/06 09:44**						
Gasoline Range Hydrocarbons	NWTPH-Gx	106	---	10.0	mg/kg wet	1x	--	100	106%	(75-125)	--	--	06/05/06 11:44	
Surrogate(s): 4-BFB (FID)		*Recovery: 112%*			*Limits: 50-150%*	"							*06/05/06 11:44*	
Duplicate (6F05025-DUP1)					**QC Source: BPF0053-01**			**Extracted: 06/05/06 09:44**						
Gasoline Range Hydrocarbons	NWTPH-Gx	ND	---	7.18	mg/kg dry	1x	ND	--	--	--	31.9%	(40)	06/05/06 18:39	
Surrogate(s): 4-BFB (FID)		*Recovery: 103%*			*Limits: 50-150%*	"							*06/05/06 18:39*	
Duplicate (6F05025-DUP2)					**QC Source: BPF0087-11**			**Extracted: 06/05/06 09:44**						
Gasoline Range Hydrocarbons	NWTPH-Gx	2470	---	77.1	mg/kg dry	20x	2470	--	--	--	0.00%	(40)	06/06/06 01:05	
Surrogate(s): 4-BFB (FID)		*Recovery: 133%*			*Limits: 50-150%*	*1x*							*06/06/06 01:05*	
Matrix Spike (6F05025-MS1)					**QC Source: BPF0053-01**			**Extracted: 06/05/06 09:44**						
Gasoline Range Hydrocarbons	NWTPH-Gx	73.7	---	7.18	mg/kg dry	1x	1.08	71.8	101%	(42-125)	--	--	06/05/06 23:06	
Surrogate(s): 4-BFB (FID)		*Recovery: 113%*			*Limits: 50-150%*	"							*06/05/06 23:06*	

QC Batch: 6F06041 **Soil Preparation Method: EPA 5030B (MeOH)**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F06041-BLK1)								**Extracted: 06/06/06 10:52**						
Gasoline Range Hydrocarbons	NWTPH-Gx	ND	---	5.00	mg/kg wet	1x	--	--	--	--	--	--	06/06/06 12:57	
Surrogate(s): 4-BFB (FID)		*Recovery: 81.7%*			*Limits: 50-150%*	"							*06/06/06 12:57*	
LCS (6F06041-BS1)								**Extracted: 06/06/06 10:52**						
Gasoline Range Hydrocarbons	NWTPH-Gx	45.9	---	5.00	mg/kg wet	1x	--	50.0	91.8%	(75-125)	--	--	06/06/06 13:28	
Surrogate(s): 4-BFB (FID)		*Recovery: 100%*			*Limits: 50-150%*	"							*06/06/06 13:28*	
Duplicate (6F06041-DUP1)					**QC Source: BPE0827-01**			**Extracted: 06/06/06 10:52**						
Gasoline Range Hydrocarbons	NWTPH-Gx	30.3	---	7.87	mg/kg dry	1x	32.7	--	--	--	7.62%	(40)	06/06/06 17:18	
Surrogate(s): 4-BFB (FID)		*Recovery: 94.9%*			*Limits: 50-150%*	"							*06/06/06 17:18*	
Matrix Spike (6F06041-MS1)					**QC Source: BPE0827-01**			**Extracted: 06/06/06 10:52**						
Gasoline Range Hydrocarbons	NWTPH-Gx	110	---	7.87	mg/kg dry	1x	32.7	78.7	98.2%	(42-125)	--	--	06/06/06 16:48	
Surrogate(s): 4-BFB (FID)		*Recovery: 104%*			*Limits: 50-150%*	"							*06/06/06 16:48*	

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Volatile Petroleum Products by NWTPH-Gx - Laboratory Quality Control Results

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Gasoline Hydrocarbons (Benzene to Naphthalene) and BTEX by NWTPH-G and EPA 8021B - Laboratory Quality Control Results

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QC Batch: 6F04009 **Water Preparation Method: EPA 5030B (P/T)**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F04009-BLK1)								**Extracted: 06/05/06 00:00**						
Gasoline Range Hydrocarbons	NWTPH-Gx/ 8021B	ND	---	50.0	ug/l	1x	--	--	--	--	--	--	06/05/06 12:24	
Benzene	"	ND	---	0.500	"	"	--	--	--	--	--	--	"	
Toluene	"	ND	---	0.500	"	"	--	--	--	--	--	--	"	
Ethylbenzene	"	ND	---	0.500	"	"	--	--	--	--	--	--	"	
Xylenes (total)	"	ND	---	1.00	"	"	--	--	--	--	--	--	"	
Surrogate(s): 4-BFB (FID)		*Recovery: 89.5%*			*Limits: 58-144%*	"							*06/05/06 12:24*	
4-BFB (PID)		*99.8%*			*68-140%*	"							"	
LCS (6F04009-BS1)								**Extracted: 06/05/06 00:00**						
Gasoline Range Hydrocarbons	NWTPH-Gx/ 8021B	902	---	50.0	ug/l	1x	--	1000	90.2%	(80-120)	--	--	06/05/06 12:55	
Surrogate(s): 4-BFB (FID)		*Recovery: 93.3%*			*Limits: 58-144%*	"							*06/05/06 12:55*	
LCS (6F04009-BS2)								**Extracted: 06/05/06 00:00**						
Benzene	NWTPH-Gx/ 8021B	29.7	---	0.500	ug/l	1x	--	30.0	99.0%	(80-120)	--	--	06/05/06 17:41	
Toluene	"	29.7	---	0.500	"	"	--	"	99.0%	"	--	--	"	
Ethylbenzene	"	30.7	---	0.500	"	"	--	"	102%	"	--	--	"	
Xylenes (total)	"	90.6	---	1.00	"	"	--	90.0	101%	"	--	--	"	
Surrogate(s): 4-BFB (PID)		*Recovery: 98.2%*			*Limits: 68-140%*	"							*06/05/06 17:41*	
Duplicate (6F04009-DUP1)					**QC Source: BPF0087-15**			**Extracted: 06/05/06 00:00**						
Gasoline Range Hydrocarbons	NWTPH-Gx/ 8021B	ND	---	50.0	ug/l	1x	ND	--	--	--	NR	(25)	06/06/06 10:33	
Benzene	"	ND	---	0.500	"	"	ND	--	--	--	NR	"	"	
Toluene	"	ND	---	0.500	"	"	ND	--	--	--	NR	"	"	
Ethylbenzene	"	ND	---	0.500	"	"	ND	--	--	--	NR	"	"	
Xylenes (total)	"	ND	---	1.00	"	"	ND	--	--	--	NR	"	"	
Surrogate(s): 4-BFB (FID)		*Recovery: 90.3%*			*Limits: 58-144%*	"							*06/06/06 10:33*	
4-BFB (PID)		*100%*			*68-140%*	"							"	
Duplicate (6F04009-DUP2)					**QC Source: BPF0087-16RE1**			**Extracted: 06/05/06 00:00**						
Gasoline Range Hydrocarbons	NWTPH-Gx/ 8021B	20300	---	5000	ug/l	100x	20300	--	--	--	0.00%	(25)	06/06/06 11:35	
Benzene	"	7300	---	50.0	"	"	7150	--	--	--	2.08%	"	"	
Toluene	"	ND	---	50.0	"	"	ND	--	--	--	0.542%	"	"	
Ethylbenzene	"	91.4	---	50.0	"	"	88.6	--	--	--	3.11%	"	"	
Xylenes (total)	"	ND	---	100	"	"	ND	--	--	--	4.49%	"	"	
Surrogate(s): 4-BFB (FID)		*Recovery: 89.5%*			*Limits: 58-144%*	*1x*							*06/06/06 11:35*	
4-BFB (PID)		*99.0%*			*68-140%*	"							"	

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12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Gasoline Hydrocarbons (Benzene to Naphthalene) and BTEX by NWTPH-G and EPA 8021B - Laboratory Quality Control Results

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QC Batch: 6F04009 **Water Preparation Method: EPA 5030B (P/T)**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Matrix Spike (6F04009-MS1)					**QC Source: BPF0087-16RE1**				**Extracted: 06/05/06 00:00**					
Gasoline Range Hydrocarbons	NWTPH-Gx/ 8021B	120000	---	5000	ug/l	100x	20300	100000	99.7%	(75-131)	--	--	06/05/06 18:43	
Surrogate(s): 4-BFB (FID)		*Recovery: 95.7%*			*Limits: 58-144%*	*1x*							*06/05/06 18:43*	
Matrix Spike (6F04009-MS2)					**QC Source: BPF0087-16RE1**				**Extracted: 06/05/06 00:00**					
Benzene	NWTPH-Gx/ 8021B	9610	---	50.0	ug/l	100x	7150	3000	82.0%	(46-130)	--	--	06/05/06 19:14	
Toluene	"	2920	---	50.0	"	"	18.4	"	96.7%	(60-124)	--	--	"	
Ethylbenzene	"	2980	---	50.0	"	"	88.6	"	96.4%	(56-141)	--	--	"	
Xylenes (total)	"	8630	---	100	"	"	39.2	9000	95.5%	(66-132)	--	--	"	
Surrogate(s): 4-BFB (PID)		*Recovery: 99.0%*			*Limits: 68-140%*	*1x*							*06/05/06 19:14*	

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Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Laboratory Quality Control Results

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QC Batch: 6F05035 **Soil Preparation Method: EPA 3550B**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F05035-BLK1)								**Extracted: 06/05/06 11:44**						
Diesel Range Hydrocarbons	NWTPH-Dx	ND	---	10.0	mg/kg wet	1x	--	--	--	--	--	--	06/08/06 21:44	
Lube Oil Range Hydrocarbons	"	ND	---	25.0	"	"	--	--	--	--	--	--	"	
Surrogate(s): 2-FBP		*Recovery: 99.4%*			*Limits: 50-150%*	"							*06/08/06 21:44*	
Octacosane		*98.9%*			*50-150%*	"							"	
Blank (6F05035-BLK2)								**Extracted: 06/05/06 11:44**						
Diesel Range Hydrocarbons	NWTPH-Dx	ND	---	10.0	mg/kg wet	1x	--	--	--	--	--	--	06/10/06 21:30	
Lube Oil Range Hydrocarbons	"	ND	---	25.0	"	"	--	--	--	--	--	--	"	
Surrogate(s): 2-FBP		*Recovery: 98.2%*			*Limits: 50-150%*	"							*06/10/06 21:30*	
Octacosane		*97.1%*			*50-150%*	"							"	
LCS (6F05035-BS1)								**Extracted: 06/05/06 11:44**						
Diesel Range Hydrocarbons	NWTPH-Dx	62.5	---	10.0	mg/kg wet	1x	--	66.7	93.7%	(71-120)	--	--	06/08/06 22:11	
Surrogate(s): 2-FBP		*Recovery: 106%*			*Limits: 50-150%*	"							*06/08/06 22:11*	
Octacosane		*94.0%*			*50-150%*	"							"	
LCS (6F05035-BS2)								**Extracted: 06/05/06 11:44**						
Diesel Range Hydrocarbons	NWTPH-Dx	62.3	---	10.0	mg/kg wet	1x	--	66.7	93.4%	(71-120)	--	--	06/10/06 21:59	
Surrogate(s): 2-FBP		*Recovery: 100%*			*Limits: 50-150%*	"							*06/10/06 21:59*	
Octacosane		*92.0%*			*50-150%*	"							"	
Duplicate (6F05035-DUP1)					**QC Source: BPF0087-10**			**Extracted: 06/05/06 11:44**						
Diesel Range Hydrocarbons	NWTPH-Dx	ND	---	11.0	mg/kg dry	1x	11.0	--	--	--	7.55%	(40)	06/08/06 22:26	
Lube Oil Range Hydrocarbons	"	ND	---	27.4	"	"	ND	--	--	--	7.53%	"	"	
Surrogate(s): 2-FBP		*Recovery: 101%*			*Limits: 50-150%*	"							*06/08/06 22:26*	
Octacosane		*106%*			*50-150%*	"							"	
Duplicate (6F05035-DUP2)					**QC Source: BPF0053-03**			**Extracted: 06/05/06 11:44**						
Diesel Range Hydrocarbons	NWTPH-Dx	ND	---	13.5	mg/kg dry	1x	ND	--	--	--	84.7%	(40)	06/08/06 22:55	DP-1
Lube Oil Range Hydrocarbons	"	ND	---	33.9	"	"	ND	--	--	--	109%	"	"	DP-1
Surrogate(s): 2-FBP		*Recovery: 110%*			*Limits: 50-150%*	"							*06/08/06 22:55*	
Octacosane		*112%*			*50-150%*	"							"	
Duplicate (6F05035-DUP3)					**QC Source: BPF0087-10RE1**			**Extracted: 06/05/06 11:44**						
Diesel Range Hydrocarbons	NWTPH-Dx	ND	---	11.0	mg/kg dry	1x	12.0	--	--	--	13.3%	(40)	06/10/06 22:28	
Lube Oil Range Hydrocarbons	"	ND	---	27.4	"	"	ND	--	--	--	6.35%	"	"	
Surrogate(s): 2-FBP		*Recovery: 95.7%*			*Limits: 50-150%*	"							*06/10/06 22:28*	
Octacosane		*98.6%*			*50-150%*	"							"	

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Semivolatile Petroleum Products by NWTPH-Dx (w/o Acid/Silica Gel Clean-up) - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F05035 **Soil Preparation Method: EPA 3550B**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Duplicate (6F05035-DUP4)					QC Source: BPF0053-03RE1			Extracted: 06/05/06 11:44						
Diesel Range Hydrocarbons	NWTPH-Dx	ND	---	13.5	mg/kg dry	1x	ND	--	--	--		(40)	06/10/06 22:58	
Lube Oil Range Hydrocarbons	"	ND	---	33.9	"	"	ND	--	--	--	131%	"	"	DP-1
Surrogate(s): 2-FBP		*Recovery: 103%*			*Limits: 50-150%*	"							*06/10/06 22:58*	
Octacosane		*103%*			*50-150%*	"							"	
Matrix Spike (6F05035-MS1)					QC Source: BPF0087-10			Extracted: 06/05/06 11:44						
Diesel Range Hydrocarbons	NWTPH-Dx	81.0	---	10.9	mg/kg dry	1x	11.0	72.4	96.7%	(45-144)	--	--	06/08/06 23:10	
Surrogate(s): 2-FBP		*Recovery: 113%*			*Limits: 50-150%*	"							*06/08/06 23:10*	
Octacosane		*104%*			*50-150%*	"							"	
Matrix Spike (6F05035-MS2)					QC Source: BPF0087-10RE1			Extracted: 06/05/06 11:44						
Diesel Range Hydrocarbons	NWTPH-Dx	80.8	---	10.9	mg/kg dry	1x	12.0	72.4	95.0%	(45-144)	--	--	06/10/06 23:28	
Surrogate(s): 2-FBP		*Recovery: 107%*			*Limits: 50-150%*	"							*06/10/06 23:28*	
Octacosane		*99.4%*			*50-150%*	"							"	

QC Batch: 6F06018 **Water Preparation Method: EPA 3520C**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F06018-BLK1)								Extracted: 06/06/06 09:02						
Diesel Range Hydrocarbons	NWTPH-Dx	ND	---	0.250	mg/l	1x	--	--	--	--	--	--	06/08/06 14:20	
Lube Oil Range Hydrocarbons	"	ND	---	0.500	"	"	--	--	--	--	--	--	"	
Surrogate(s): 2-FBP		*Recovery: 91.2%*			*Limits: 50-150%*	"							*06/08/06 14:20*	
Octacosane		*92.0%*			*50-150%*	"							"	
LCS (6F06018-BS1)								Extracted: 06/06/06 09:02						
Diesel Range Hydrocarbons	NWTPH-Dx	1.74	---	0.250	mg/l	1x	--	2.00	87.0%	(58-125)	--	--	06/08/06 14:50	
Surrogate(s): 2-FBP		*Recovery: 106%*			*Limits: 50-150%*	"							*06/08/06 14:50*	
Octacosane		*94.0%*			*50-150%*	"							"	
LCS Dup (6F06018-BSD1)								Extracted: 06/06/06 09:02						
Diesel Range Hydrocarbons	NWTPH-Dx	1.76	---	0.250	mg/l	1x	--	2.00	88.0%	(58-125)	1.14%	(40)	06/08/06 15:05	
Surrogate(s): 2-FBP		*Recovery: 106%*			*Limits: 50-150%*	"							*06/08/06 15:05*	
Octacosane		*94.4%*			*50-150%*	"							"	

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Total Metals by EPA 6000/7000 Series Methods - Laboratory Quality Control Results

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QC Batch: 6F13057 **Soil Preparation Method: EPA 3050B**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F13057-BLK1)								**Extracted: 06/13/06 16:20**						
Potassium	EPA 6010B	ND	---	15.0	mg/kg wet	1x	--	--	--	--	--	--	06/20/06 10:55	
Phosphorus	"	ND	---	5.00	"	"	--	--	--	--	--	--	06/16/06 10:15	
LCS (6F13057-BS1)								**Extracted: 06/13/06 16:20**						
Phosphorus	EPA 6010B	267	---	5.00	mg/kg wet	1x	--	250	107%	(70-130)	--	--	06/16/06 10:20	
Potassium	"	532	---	15.0	"	"	--	500	106%	(80-120)	--	--	06/20/06 11:01	
Duplicate (6F13057-DUP1)				**QC Source: BPF0053-01**				**Extracted: 06/13/06 16:20**						
Phosphorus	EPA 6010B	1060	---	59.7	mg/kg dry	10x	1070	--	--	--	0.939%	(30)	06/16/06 10:39	
Potassium	"	1040	---	89.6	"	5x	1020	--	--	--	1.94%	"	06/20/06 11:17	
Matrix Spike (6F13057-MS1)				**QC Source: BPF0053-01**				**Extracted: 06/13/06 16:20**						
Potassium	EPA 6010B	1700	---	179	mg/kg dry	10x	1020	597	114%	(70-130)	--	--	06/20/06 11:06	
Phosphorus	"	1290	---	59.7	"	"	1070	299	73.6%	"	--	--	06/16/06 10:25	
Post Spike (6F13057-PS1)				**QC Source: BPF0053-01**				**Extracted: 06/13/06 16:20**						
Phosphorus	EPA 6010B	23.1	---		ug/ml	10x	18.0	5.00	102%	(75-125)	--	--	06/16/06 10:31	
Potassium	"	19.2	---		"	"	17.1	10.0	21.0%	"	--	--	06/20/06 11:12	Q-13

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12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Dissolved Metals by EPA 6000/7000 Series Methods - Laboratory Quality Control Results

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QC Batch: 6F08027 **Water Preparation Method: EPA 3005A**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F08027-BLK1)								**Extracted: 06/08/06 11:13**						
Iron	EPA 6010B - Diss	ND	---	0.150	mg/l	1x	--	--	--	--	--	--	06/08/06 14:34	
Manganese	"	ND	---	0.0100	"	"	--	--	--	--	--	--	"	
LCS (6F08027-BS1)								**Extracted: 06/08/06 11:13**						
Iron	EPA 6010B - Diss	5.25	---	0.150	mg/l	1x	--	5.00	105%	(80-120)	--	--	06/08/06 14:40	
Manganese	"	5.10	---	0.0100	"	"	--	"	102%	"	--	--	"	
Duplicate (6F08027-DUP1)					**QC Source: BPF0087-15**			**Extracted: 06/08/06 11:13**						
Manganese	EPA 6010B - Diss	0.606	---	0.0100	mg/l	1x	0.605	--	--	--	0.165%	(20)	06/08/06 14:53	
Iron	"	ND	---	0.150	"	"	ND	--	--	--	NR	"	"	
Matrix Spike (6F08027-MS1)					**QC Source: BPF0087-15**			**Extracted: 06/08/06 11:13**						
Iron	EPA 6010B - Diss	5.39	---	0.150	mg/l	1x	ND	5.00	108%	(75-126)	--	--	06/08/06 14:46	
Manganese	"	5.81	---	0.0100	"	"	0.605	"	104%	(80-120)	--	--	"	

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Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

TCLP Volatile Organic Compounds by EPA Method 1311/8260B - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F06062 **TCLP Preparation Method: EPA 5030B**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F06062-BLK1)								**Extracted: 06/05/06 13:32**						
Benzene	EPA 8260B	ND	---	0.0800	mg/l	1x	--	--	--	--	--	--	06/06/06 13:35	
2-Butanone	"	ND	---	0.800	"	"	--	--	--	--	--	--	"	
Carbon tetrachloride	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
Chlorobenzene	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
Chloroform	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
1,2-Dichloroethane	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
1,1-Dichloroethene	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
Tetrachloroethene	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
Trichloroethene	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
Vinyl chloride	"	ND	---	0.0800	"	"	--	--	--	--	--	--	"	
Surrogate(s): 1,2-DCA-d4		*Recovery: 109%*			*Limits: 67-135%*	"							*06/06/06 13:35*	
Toluene-d8		*92.9%*			*70-130%*	"							"	
4-BFB		*102%*			*70-130%*	"							"	
LCS (6F06062-BS1)								**Extracted: 06/06/06 10:48**						
Benzene	EPA 8260B	0.694	---	0.0800	mg/l	1x	--	0.800	86.8%	(80-120)	--	--	06/06/06 11:26	
2-Butanone	"	8.47	---	0.800	"	"	--	8.00	106%	(67-132)	--	--	"	
Carbon tetrachloride	"	0.859	---	0.0800	"	"	--	0.800	107%	(60-143)	--	--	"	
Chlorobenzene	"	0.670	---	0.0800	"	"	--	"	83.8%	(80-120)	--	--	"	
Chloroform	"	0.752	---	0.0800	"	"	--	"	94.0%	(75-127)	--	--	"	
1,2-Dichloroethane	"	0.809	---	0.0800	"	"	--	"	101%	(66-132)	--	--	"	
1,1-Dichloroethene	"	0.821	---	0.0800	"	"	--	"	103%	(75-126)	--	--	"	
Tetrachloroethene	"	0.672	---	0.0800	"	"	--	"	84.0%	(69-125)	--	--	"	
Trichloroethene	"	0.734	---	0.0800	"	"	--	"	91.8%	(79-121)	--	--	"	
Vinyl chloride	"	0.805	---	0.0800	"	"	--	"	101%	(64-130)	--	--	"	
Surrogate(s): 1,2-DCA-d4		*Recovery: 109%*			*Limits: 67-135%*	"							*06/06/06 11:26*	
Toluene-d8		*94.1%*			*70-130%*	"							"	
4-BFB		*101%*			*70-130%*	"							"	
LCS Dup (6F06062-BSD1)								**Extracted: 06/06/06 10:48**						
Benzene	EPA 8260B	0.707	---	0.0800	mg/l	1x	--	0.800	88.4%	(80-120)	1.86%	(25)	06/06/06 11:51	
2-Butanone	"	8.73	---	0.800	"	"	--	8.00	109%	(67-132)	3.02%	"	"	
Carbon tetrachloride	"	0.862	---	0.0800	"	"	--	0.800	108%	(60-143)	0.349%	"	"	
Chlorobenzene	"	0.670	---	0.0800	"	"	--	"	83.8%	(80-120)	0.00%	"	"	
Chloroform	"	0.751	---	0.0800	"	"	--	"	93.9%	(75-127)	0.133%	"	"	
1,2-Dichloroethane	"	0.820	---	0.0800	"	"	--	"	102%	(66-132)	1.35%	"	"	
1,1-Dichloroethene	"	0.807	---	0.0800	"	"	--	"	101%	(75-126)	1.72%	"	"	
Tetrachloroethene	"	0.678	---	0.0800	"	"	--	"	84.8%	(69-125)	0.889%	"	"	
Trichloroethene	"	0.726	---	0.0800	"	"	--	"	90.8%	(79-121)	1.10%	"	"	
Vinyl chloride	"	0.778	---	0.0800	"	"	--	"	97.2%	(64-130)	3.41%	"	"	

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12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

TCLP Volatile Organic Compounds by EPA Method 1311/8260B - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F06062 **TCLP Preparation Method: EPA 5030B**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
LCS Dup (6F06062-BSD1)							**Extracted: 06/06/06 10:48**							
Surrogate(s): 1,2-DCA-d4		*Recovery: 107%*			*Limits: 67-135%*	"							*06/06/06 11:51*	
Toluene-d8		*93.2%*			*70-130%*	"							"	
4-BFB		*101%*			*70-130%*	"							"	

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Conventional Chemistry Parameters by APHA/EPA Methods - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F02060 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F02060-BLK1)								**Extracted: 06/02/06 16:15**						
Biochemical Oxygen Demand	EPA 405.1	ND	---	2.00	mg/l	1x	--	--	--	--	--	--	06/07/06 15:50	
LCS (6F02060-BS1)								**Extracted: 06/02/06 16:15**						
Biochemical Oxygen Demand	EPA 405.1	332	---	2.00	mg/l	1x	--	400	83.0%	(66-134)	--	--	06/07/06 15:50	
LCS Dup (6F02060-BSD1)								**Extracted: 06/02/06 16:15**						
Biochemical Oxygen Demand	EPA 405.1	306	---	2.00	mg/l	1x	--	400	76.5%	(66-134)	8.15%	(20)	06/07/06 15:50	

QC Batch: 6F06072 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F06072-BLK1)								**Extracted: 06/06/06 11:00**						
Chemical Oxygen Demand	EPA 410.4	ND	---	15.0	mg/l	1x	--	--	--	--	--	--	06/06/06 17:41	
LCS (6F06072-BS1)								**Extracted: 06/06/06 11:00**						
Chemical Oxygen Demand	EPA 410.4	81.7	---	15.0	mg/l	1x	--	75.0	109%	(80-120)	--	--	06/06/06 17:41	
Duplicate (6F06072-DUP1)				**QC Source: BPE0813-01**				**Extracted: 06/06/06 11:00**						
Chemical Oxygen Demand	EPA 410.4	ND	---	15.0	mg/l	1x	ND	--	--	--	33.0%	(25)	06/06/06 17:41	Q-06
Matrix Spike (6F06072-MS1)				**QC Source: BPE0813-01**				**Extracted: 06/06/06 11:00**						
Chemical Oxygen Demand	EPA 410.4	80.0	---	15.0	mg/l	1x	6.00	75.0	98.7%	(51-147)	--	--	06/06/06 17:41	

QC Batch: 6F07039 **Soil Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F07039-BLK1)								**Extracted: 06/07/06 14:20**						
Total Kjeldahl Nitrogen	EPA 351.2	ND	---	100	mg/kg as N wet	1x	--	--	--	--	--	--	06/07/06 19:49	
LCS (6F07039-BS1)								**Extracted: 06/07/06 14:20**						
Total Kjeldahl Nitrogen	EPA 351.2	1780	---	100	mg/kg as N wet	1x	--	1610	111%	(75-125)	--	--	06/07/06 19:49	
Duplicate (6F07039-DUP1)				**QC Source: BPF0087-02**				**Extracted: 06/07/06 14:20**						
Total Kjeldahl Nitrogen	EPA 351.2	274	---	116	mg/kg as N dry	1x	254	--	--	--	7.58%	(30)	06/07/06 19:49	

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12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Conventional Chemistry Parameters by APHA/EPA Methods - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F07039 **Soil Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Matrix Spike (6F07039-MS1)					QC Source: BPF0087-02				Extracted: 06/07/06 14:20					
Total Kjeldahl Nitrogen	EPA 351.2	238	---	232	mg/kg as N dry	2x	254	149	-10.7%	(75-125)	--	--	06/07/06 19:49	Q-14

QC Batch: 6F08027 **Water Preparation Method: EPA 3005A**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F08027-BLK1)									Extracted: 06/08/06 11:13					
Hardness	SM 2340B	ND	---	3.00	mg/L as CaCO3	1x	--	--	--	--	--	--	06/08/06 14:34	
LCS (6F08027-BS1)									Extracted: 06/08/06 11:13					
Hardness	SM 2340B	34.0	---	3.00	mg/L as CaCO3	1x	--	33.1	103%	(85-115)	--	--	06/08/06 14:40	
Duplicate (6F08027-DUP1)					QC Source: BPF0087-15				Extracted: 06/08/06 11:13					
Hardness	SM 2340B	706	---	3.00	mg/L as CaCO3	1x	701	--	--	--	0.711%	(20)	06/08/06 14:53	
Matrix Spike (6F08027-MS1)					QC Source: BPF0087-15				Extracted: 06/08/06 11:13					
Hardness	SM 2340B	773	---	3.00	mg/L as CaCO3	1x	701	33.1	218%	(80-120)	--	--	06/08/06 14:46	Q-02

QC Batch: 6F09066 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F09066-BLK1)									Extracted: 06/09/06 19:56					
Salinity	SM 2520	ND	---	0.00100	g/kg (ppt)	1x	--	--	--	--	--	--	06/09/06 20:02	
LCS (6F09066-BS1)									Extracted: 06/09/06 19:56					
Salinity	SM 2520	32.3	---	0.00100	g/kg (ppt)	1x	--	35.0	92.3%	(80-120)	--	--	06/09/06 20:02	
Duplicate (6F09066-DUP1)					QC Source: BPF0087-15				Extracted: 06/09/06 19:56					
Salinity	SM 2520	4.70	---	0.00100	g/kg (ppt)	1x	4.70	--	--	--	0.00%	(25)	06/09/06 20:02	

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Conventional Chemistry Parameters by APHA/EPA Methods - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F10004 **Soil Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F10004-BLK1)								Extracted: 06/10/06 13:35						
Total Organic Carbon	EPA 9060 mod.	ND	---	500	mg/kg wet	1x	--	--	--	--	--	--	06/10/06 13:42	
LCS (6F10004-BS1)								Extracted: 05/17/06 13:35						
Total Organic Carbon	EPA 9060 mod.	28300	---	500	mg/kg wet	1x	--	29900	94.6%	(72-130)	--	--	06/10/06 13:42	
Duplicate (6F10004-DUP1)							QC Source: BPE0920-01	Extracted: 06/05/06 13:35						
Total Organic Carbon	EPA 9060 mod.	1290	---	644	mg/kg dry	1x	1690	--	--	--	26.8%	(35)	06/10/06 13:42	
Duplicate (6F10004-DUP2)							QC Source: BPF0087-13	Extracted: 06/05/06 13:35						
Total Organic Carbon	EPA 9060 mod.	3480	---	637	mg/kg dry	1x	3640	--	--	--	4.49%	(35)	06/10/06 13:42	
Matrix Spike (6F10004-MS1)							QC Source: BPE0920-01	Extracted: 06/05/06 13:35						
Total Organic Carbon	EPA 9060 mod.	3160	---	644	mg/kg dry	1x	1690	1520	96.7%	(40-160)	--	--	06/10/06 13:42	

QC Batch: 6F13049 **Soil Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F13049-BLK1)								Extracted: 06/13/06 15:01						
Nitrate/Nitrite-Nitrogen	EPA 353.2	ND	---	0.100	mg/kg as N wet	1x	--	--	--	--	--	--	06/13/06 15:02	
LCS (6F13049-BS1)								Extracted: 06/13/06 15:01						
Nitrate/Nitrite-Nitrogen	EPA 353.2	9.55	---	0.100	mg/kg as N wet	1x	--	10.0	95.5%	(90-110)	--	--	06/13/06 15:02	
Duplicate (6F13049-DUP1)							QC Source: BPF0087-02	Extracted: 06/13/06 15:01						
Nitrate/Nitrite-Nitrogen	EPA 353.2	ND	---	0.115	mg/kg as N dry	1x	ND	--	--	--	NR	(25)	06/13/06 15:02	
Matrix Spike (6F13049-MS1)							QC Source: BPF0087-02	Extracted: 06/13/06 15:01						
Nitrate/Nitrite-Nitrogen	EPA 353.2	11.0	---	0.117	mg/kg as N dry	1x	ND	11.7	94.0%	(75-125)	--	--	06/13/06 15:02	

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Conventional Chemistry Parameters by APHA/EPA Methods - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F13071 **Soil Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F13071-BLK1)								Extracted: 06/12/06 14:00						
Chemical Oxygen Demand	EPA 410.4	ND	---	25.0	mg/kg wet	1x	--	--	--	--	--	--	06/12/06 18:55	
LCS (6F13071-BS1)								Extracted: 06/12/06 14:00						
Chemical Oxygen Demand	EPA 410.4	399	---	25.0	mg/kg wet	1x	--	400	99.8%	(80-120)	--	--	06/12/06 18:55	
Duplicate (6F13071-DUP1)				QC Source: BPF0087-02				Extracted: 06/12/06 14:00						
Chemical Oxygen Demand	EPA 410.4	117000	---	2910	mg/kg dry	1x	119000	--	--	--	1.69%	(50)	06/12/06 18:55	B-14
Matrix Spike (6F13071-MS1)				QC Source: BPF0087-02				Extracted: 06/12/06 14:00						
Chemical Oxygen Demand	EPA 410.4	109000	---	2740	mg/kg dry	1x	119000	43800	-22.8%	(50-150)	--	--	06/12/06 18:55	MS-4, B-14

QC Batch: 6F14066 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F14066-BLK1)								Extracted: 06/13/06 13:00						
Total Organic Carbon	EPA 415.1	ND	---	2.00	mg/l	1x	--	--	--	--	--	--	06/13/06 16:05	
LCS (6F14066-BS1)								Extracted: 06/13/06 13:00						
Total Organic Carbon	EPA 415.1	26.7	---	2.00	mg/l	1x	--	25.0	107%	(90-110)	--	--	06/13/06 16:05	
Duplicate (6F14066-DUP1)				QC Source: BPF0087-15				Extracted: 06/13/06 13:00						
Total Organic Carbon	EPA 415.1	22.0	---	8.00	mg/l	4x	26.8	--	--	--	19.7%	(25)	06/13/06 16:05	
Matrix Spike (6F14066-MS1)				QC Source: BPF0087-15				Extracted: 06/13/06 13:00						
Total Organic Carbon	EPA 415.1	50.0	---	8.00	mg/l	4x	26.8	25.0	92.8%	(60-140)	--	--	06/13/06 16:05	

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Conventional Chemistry Parameters by APHA/EPA Methods - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F14073 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F14073-BLK1)								**Extracted: 06/14/06 17:34**						
Bicarbonate Alkalinity	SM 2320B	ND	---	5.00	mg/L as CaCO3	1x	--	--	--	--	--	--	06/14/06 17:36	
Carbonate Alkalinity	"	ND	---	5.00	"	"	--	--	--	--	--	--	"	
Hydroxide Alkalinity	"	ND	---	5.00	"	"	--	--	--	--	--	--	"	
Total Alkalinity	"	ND	---	5.00	"	"	--	--	--	--	--	--	"	
LCS (6F14073-BS1)								**Extracted: 06/14/06 17:34**						
Total Alkalinity	SM 2320B	51.8	---	5.00	mg/L as CaCO3	1x	--	50.0	104%	(90-110)	--	--	06/14/06 17:36	
Duplicate (6F14073-DUP1)							**QC Source: BPF0087-16**						**Extracted: 06/14/06 17:34**	
Bicarbonate Alkalinity	SM 2320B	666	---	5.00	mg/L as CaCO3	1x	705	--	--	--	5.69%	(20)	06/14/06 17:36	
Carbonate Alkalinity	"	ND	---	5.00	"	"	ND	--	--	--	NR	"	"	
Hydroxide Alkalinity	"	ND	---	5.00	"	"	ND	--	--	--	NR	"	"	
Total Alkalinity	"	666	---	5.00	"	"	705	--	--	--	5.69%	"	"	

QC Batch: 6F14075 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F14075-BLK1)								**Extracted: 06/14/06 17:43**						
Bicarbonate Alkalinity	SM 2320B	ND	---	5.00	mg/L as CaCO3	1x	--	--	--	--	--	--	06/14/06 17:45	
Carbonate Alkalinity	"	ND	---	5.00	"	"	--	--	--	--	--	--	"	
Hydroxide Alkalinity	"	ND	---	5.00	"	"	--	--	--	--	--	--	"	
Total Alkalinity	"	ND	---	5.00	"	"	--	--	--	--	--	--	"	
LCS (6F14075-BS1)								**Extracted: 06/14/06 17:43**						
Total Alkalinity	SM 2320B	52.5	---	5.00	mg/L as CaCO3	1x	--	50.0	105%	(90-110)	--	--	06/14/06 17:45	
Duplicate (6F14075-DUP1)							**QC Source: BPF0087-15**						**Extracted: 06/14/06 17:43**	
Bicarbonate Alkalinity	SM 2320B	1050	---	5.00	mg/L as CaCO3	1x	1160	--	--	--	9.95%	(20)	06/14/06 17:45	
Carbonate Alkalinity	"	ND	---	5.00	"	"	ND	--	--	--	NR	"	"	
Hydroxide Alkalinity	"	ND	---	5.00	"	"	ND	--	--	--	NR	"	"	
Total Alkalinity	"	1050	---	5.00	"	"	1160	--	--	--	9.95%	"	"	

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Anions by EPA Method 300.0 - Laboratory Quality Control Results

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QC Batch: 6F13022 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F13022-BLK1)								Extracted: 06/12/06 00:00						
Chloride	EPA 300.0	ND	---	0.400	mg/l	1x	--	--	--	--	--	--	06/12/06 00:00	
LCS (6F13022-BS1)								Extracted: 06/12/06 00:00						
Chloride	EPA 300.0	2.03	---	0.400	mg/l	1x	--	2.00	102%	(90-110)	--	--	06/12/06 00:00	
Duplicate (6F13022-DUP1)				QC Source: BPF0085-01				Extracted: 06/12/06 00:00						
Chloride	EPA 300.0	260	---	20.0	mg/l	50x	258	--	--	--	0.772%	(25)	06/12/06 00:00	
Duplicate (6F13022-DUP3)				QC Source: BPF0087-16				Extracted: 06/12/06 00:00						
Chloride	EPA 300.0	117	---	20.0	mg/l	50x	115	--	--	--	1.72%	(25)	06/12/06 00:00	
Matrix Spike (6F13022-MS1)				QC Source: BPF0085-01				Extracted: 06/12/06 00:00						
Chloride	EPA 300.0	234	---	20.0	mg/l	50x	258	2.00	-1200%	(40-149)	--	--	06/12/06 00:00	MS-4
Matrix Spike (6F13022-MS3)				QC Source: BPF0087-16				Extracted: 06/12/06 00:00						
Chloride	EPA 300.0	115	---	20.0	mg/l	50x	115	2.00	0.00%	(40-149)	--	--	06/12/06 00:00	MS-4

QC Batch: 6F14043 **Water Preparation Method: General Preparation**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F14043-BLK1)								Extracted: 06/05/06 00:00						
Nitrate-Nitrogen	EPA 300.0	ND	---	0.200	mg/l as N	1x	--	--	--	--	--	--	06/05/06 00:00	
Sulfate	"	ND	---	0.400	mg/l	"	--	--	--	--	--	--	"	
LCS (6F14043-BS1)								Extracted: 06/05/06 00:00						
Sulfate	EPA 300.0	5.58	---	0.400	mg/l	1x	--	6.00	93.0%	(90-110)	--	--	06/05/06 00:00	
Nitrate-Nitrogen	"	0.928	---	0.200	mg/l as N	"	--	1.00	92.8%	"	--	--	"	
Duplicate (6F14043-DUP1)				QC Source: BPF0087-16				Extracted: 06/05/06 00:00						
Sulfate	EPA 300.0	7.91	---	0.800	mg/l	2x	7.83	--	--	--	1.02%	(25)	06/05/06 00:00	
Nitrate-Nitrogen	"	ND	---	0.400	mg/l as N	"	ND	--	--	--	NR	"	"	
Matrix Spike (6F14043-MS1)				QC Source: BPF0087-16				Extracted: 06/05/06 00:00						
Sulfate	EPA 300.0	13.1	---	0.800	mg/l	2x	7.83	6.00	87.8%	(54-124)	--	--	06/05/06 00:00	
Nitrate-Nitrogen	"	0.958	---	0.400	mg/l as N	"	ND	1.00	95.8%	(59-126)	--	--	"	

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Physical Parameters by APHA/ASTM/EPA Methods - Laboratory Quality Control Results

TestAmerica - Seattle, WA

QC Batch: 6F06075 **Soil Preparation Method: Dry Weight**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F06075-BLK1)													Extracted: 06/06/06 19:11	
Dry Weight	BSOPSPL00 3R08	99.8	---	1.00	%	1x	--	--	--	--	--	--	06/07/06 00:00	

QC Batch: 6F06076 **Soil Preparation Method: Dry Weight**

Analyte	Method	Result	MDL*	MRL	Units	Dil	Source Result	Spike Amt	% REC	(Limits)	% RPD	(Limits)	Analyzed	Notes
Blank (6F06076-BLK1)													Extracted: 06/06/06 19:13	
Dry Weight	BSOPSPL00 3R08	99.8	---	1.00	%	1x	--	--	--	--	--	--	06/07/06 00:00	

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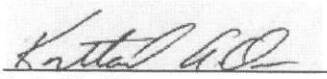

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EA Engineering, Science and Technology	Project Name:	**Cornet Bay Marina**	
12011 NE 1st Street, Suite 100	Project Number:	61994.01 4000	Report Created:
Bellevue, WA/USA 98005	Project Manager:	Jill Frain	06/21/06 18:27

Notes and Definitions

Report Specific Notes:

B-14	-	Result is greater than (>) stated value.
D-06	-	The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
D-09	-	Results in the diesel organics range are primarily due to overlap from a heavy oil range product.
D-10	-	The heavy oil range organics present are due to hydrocarbons eluting primarily in the diesel range.
D-14	-	Diluted due to matrix effect.
DP-1	-	Sample RPD exceeded the laboratory control limit.
G-02	-	The chromatogram for this sample does not resemble a typical gasoline pattern. Please refer to the sample chromatogram.
I-02	-	This sample was analyzed outside of the recommended holding time.
MS-4	-	Due to high levels of analyte in the sample, the Matrix Spike/Matrix Spike Duplicate calculation does not provide useful spike recovery information. See Laboratory Control Sample.
Q-02	-	The spike recovery for this QC sample is outside of NCA established control limits due to sample matrix interference.
Q-06	-	Analyses are not controlled on RPD values from sample concentrations less than 5 times the reporting limit.
Q-13	-	Multiple analyses indicate the percent recovery is outside the control limits due to a matrix effect.
Q-14	-	Visual examination indicates the RPD and/or matrix spike recovery is outside the control limit due to a non-homogeneous sample matrix.
Q-41	-	This analyte had a high bias in the associated calibration verification standard.
SR-4	-	Due to sample matrix effects, the surrogate recovery was outside laboratory control limits.

Laboratory Reporting Conventions:

DET	-	Analyte DETECTED at or above the Reporting Limit. Qualitative Analyses only.
ND	-	Analyte NOT DETECTED at or above the reporting limit (MDL or MRL, as appropriate).
NR/NA	-	Not Reported / Not Available
dry	-	Sample results reported on a Dry Weight Basis. Results and Reporting Limits have been corrected for Percent Dry Weight.
wet	-	Sample results and reporting limits reported on a Wet Weight Basis (as received). Results with neither 'wet' nor 'dry' are reported on a Wet Weight Basis.
RPD	-	RELATIVE PERCENT DIFFERENCE (RPDs calculated using Results, not Percent Recoveries).
MRL	-	METHOD REPORTING LIMIT. Reporting Level at, or above, the lowest level standard of the Calibration Table.
MDL*	-	METHOD DETECTION LIMIT. Reporting Level at, or above, the statistically derived limit based on 40CFR, Part 136, Appendix B. *MDLs are listed on the report only if the data has been evaluated below the MRL. Results between the MDL and MRL are reported as Estimated Results.
Dil	-	Dilutions are calculated based on deviations from the standard dilution performed for an analysis, and may not represent the dilution found on the analytical raw data.
Reporting Limits	-	Reporting limits (MDLs and MRLs) are adjusted based on variations in sample preparation amounts, analytical dilutions and percent solids, where applicable.

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Electronic Signature - Electronic Signature added in accordance with TestAmerica's *Electronic Reporting and Electronic Signatures Policy*. Application of electronic signature indicates that the report has been reviewed and approved for release by the laboratory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

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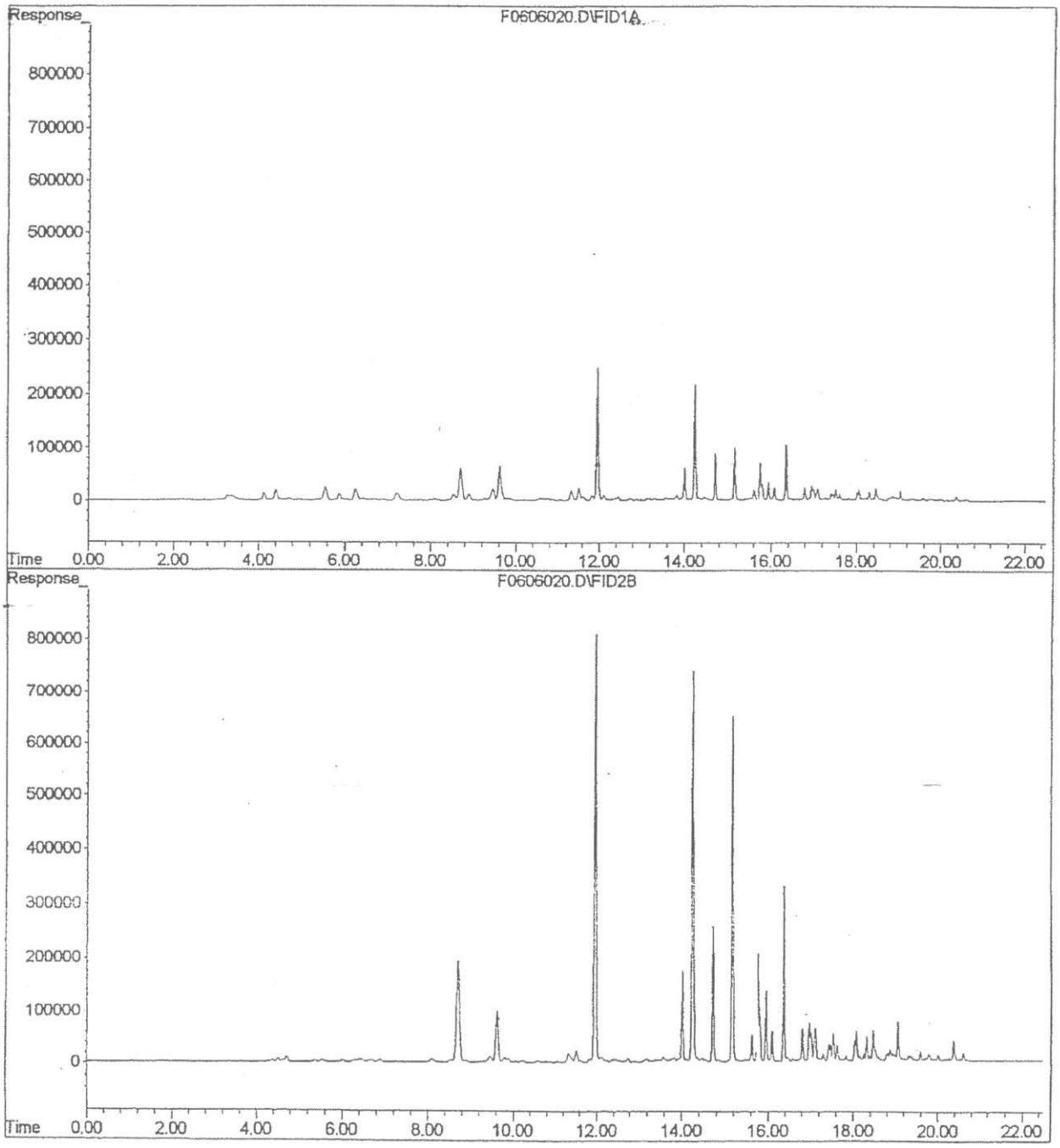
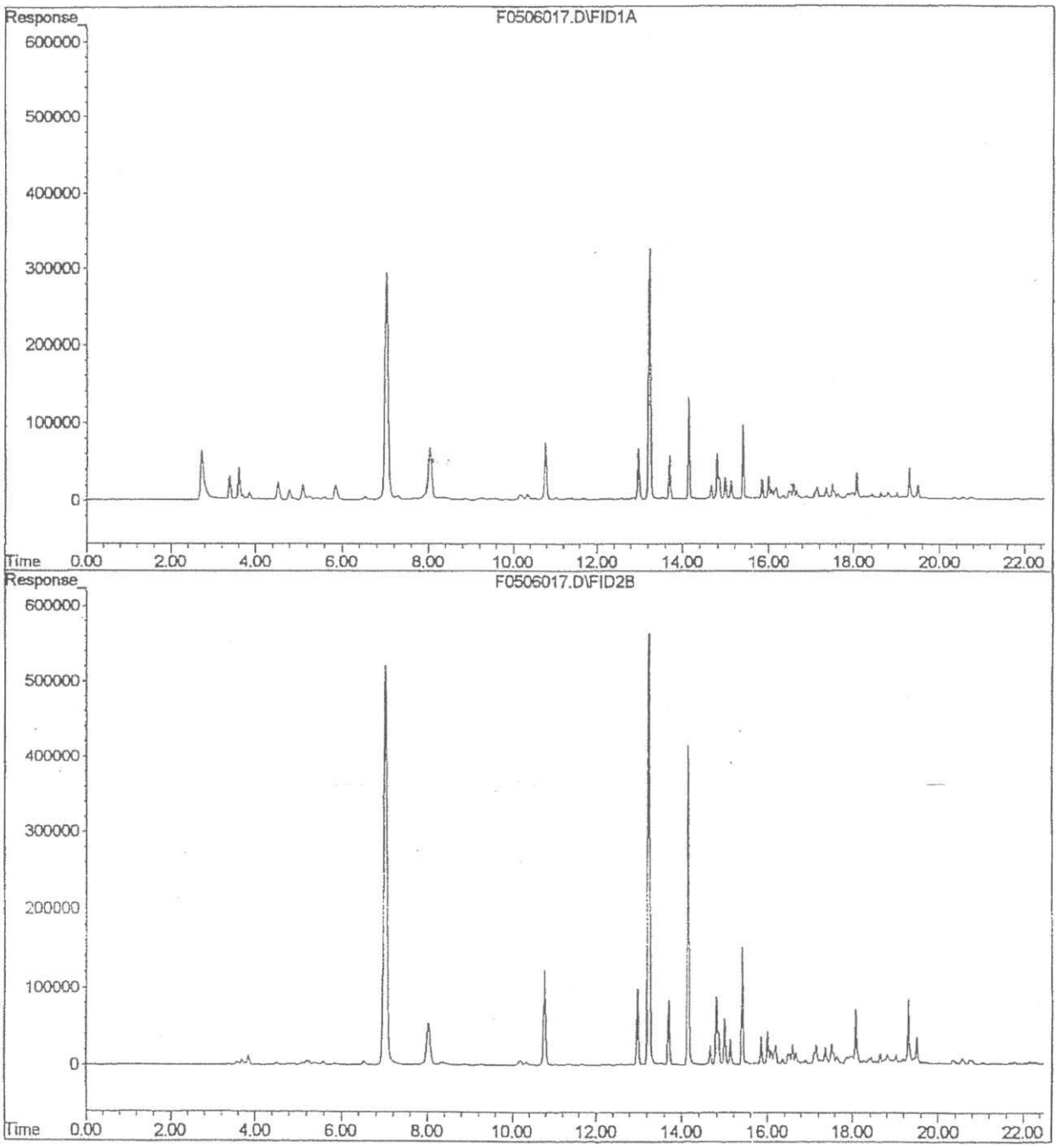
File : D:\HPCHEM\2\DATA\060606\F0606020.D
Operator : NSB
Acquired : 6 Jun 2006 22:53 using AcqMethod TGD0106A.M
Instrument : GC-12
Sample Name: bpf0087-01 r1
Misc Info : 10x 10 uL
Vial Number: 4



File : D:\HPCHEM\1\DATA\060506\F0506017.D
Operator : jlh
Acquired : 5 Jun 2006 19:38 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-02
Misc Info : 1x 100ul
Vial Number: 17



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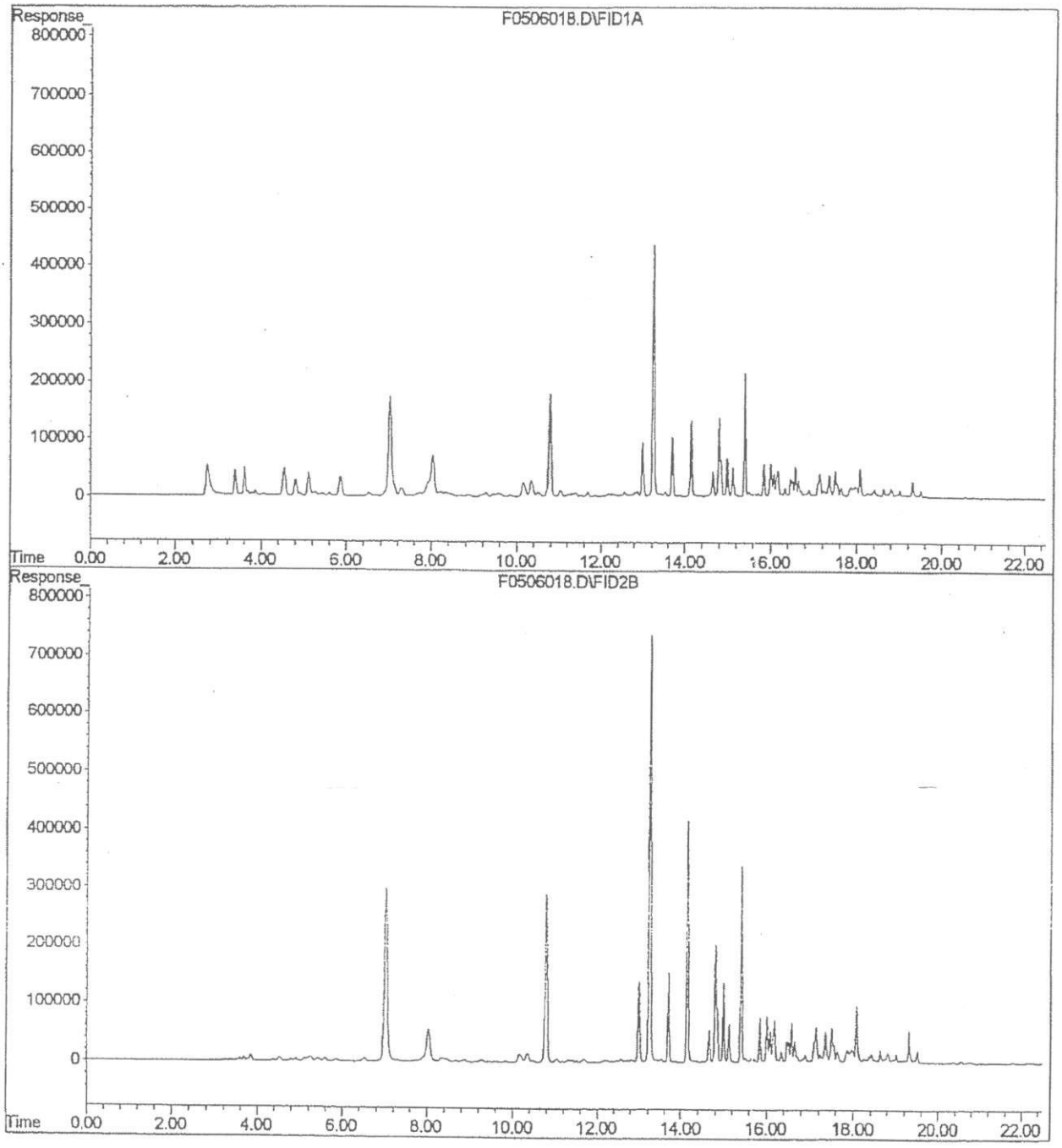
Operator : jlh
Acquired : 5 Jun 2006 20:08 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-03
Misc Info : 1x 100ul
Vial Number: 18



File : D:\HPCHEM\1\DATA\060506\F0506019.D
Operator : jlh
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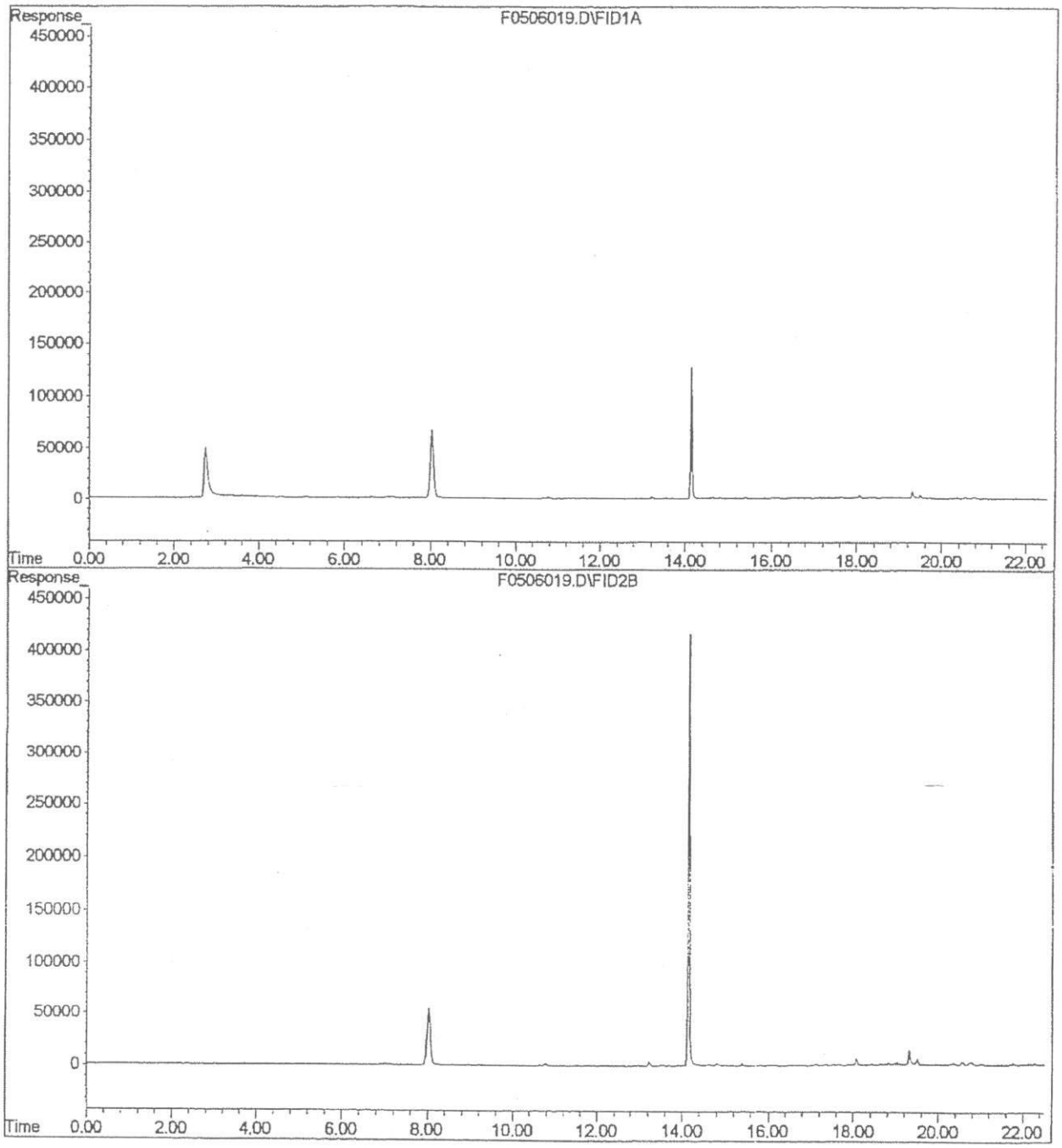
Instrument : GC-10
Sample Name: bpf0087-04
Misc Info : 1x 100ul
Vial Number: 19



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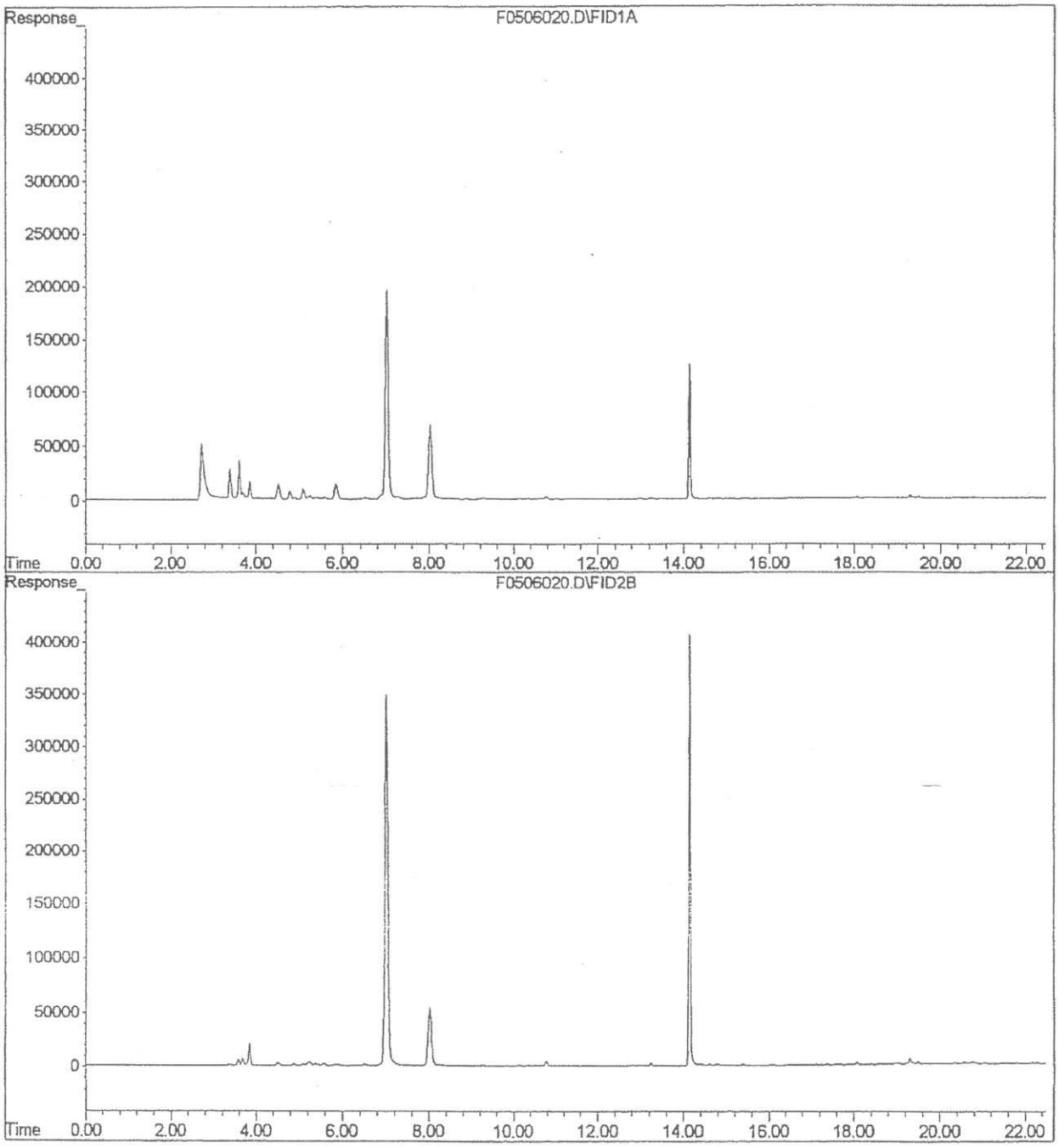
Operator : jlh
Acquired : 5 Jun 2006 21:07 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-05
Misc Info : 1x 100ul
Vial Number: 20



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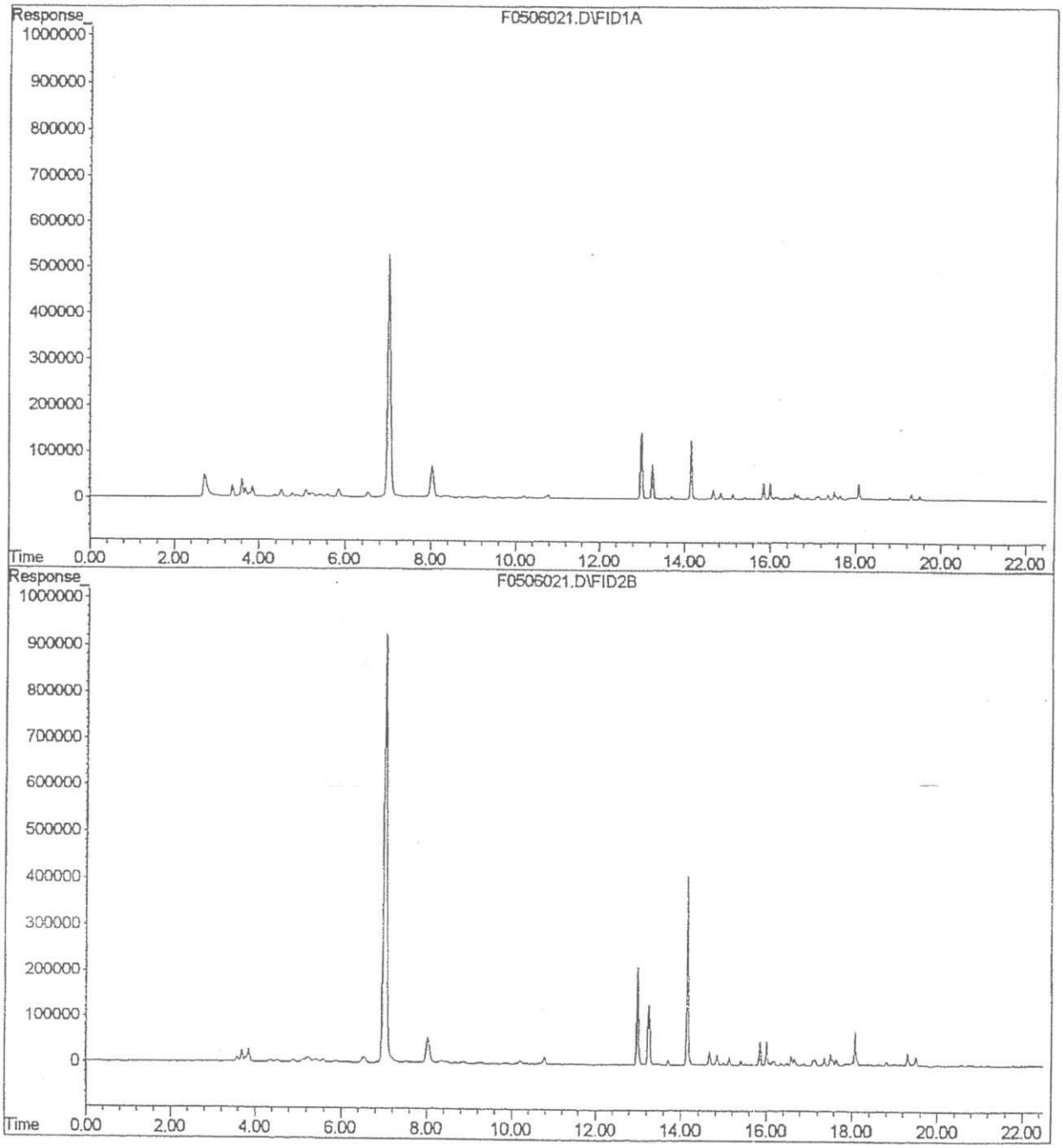
Operator : jlh
Acquired : 5 Jun 2006 21:37 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-06
Misc Info : 1x 100ul
Vial Number: 21



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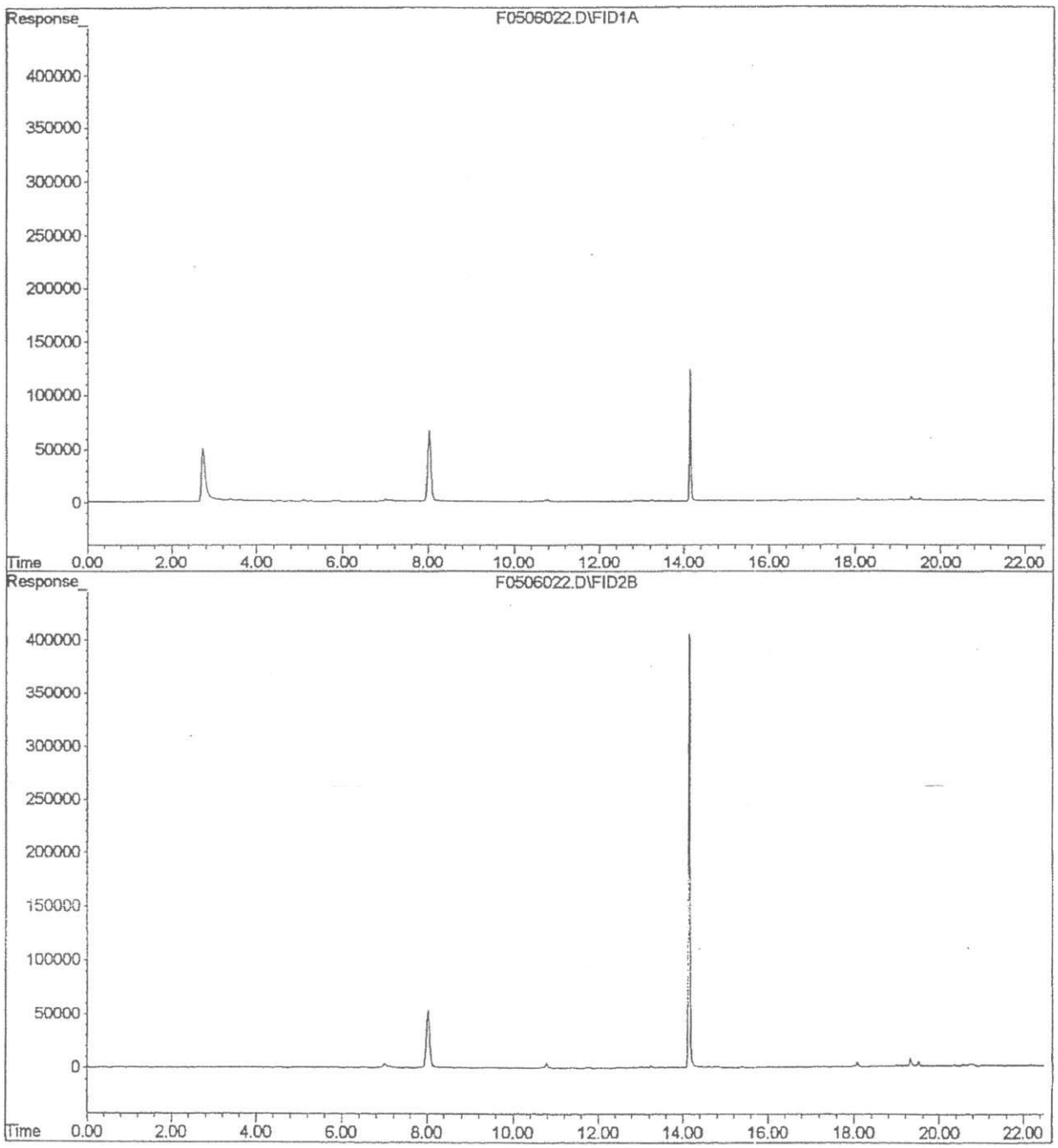
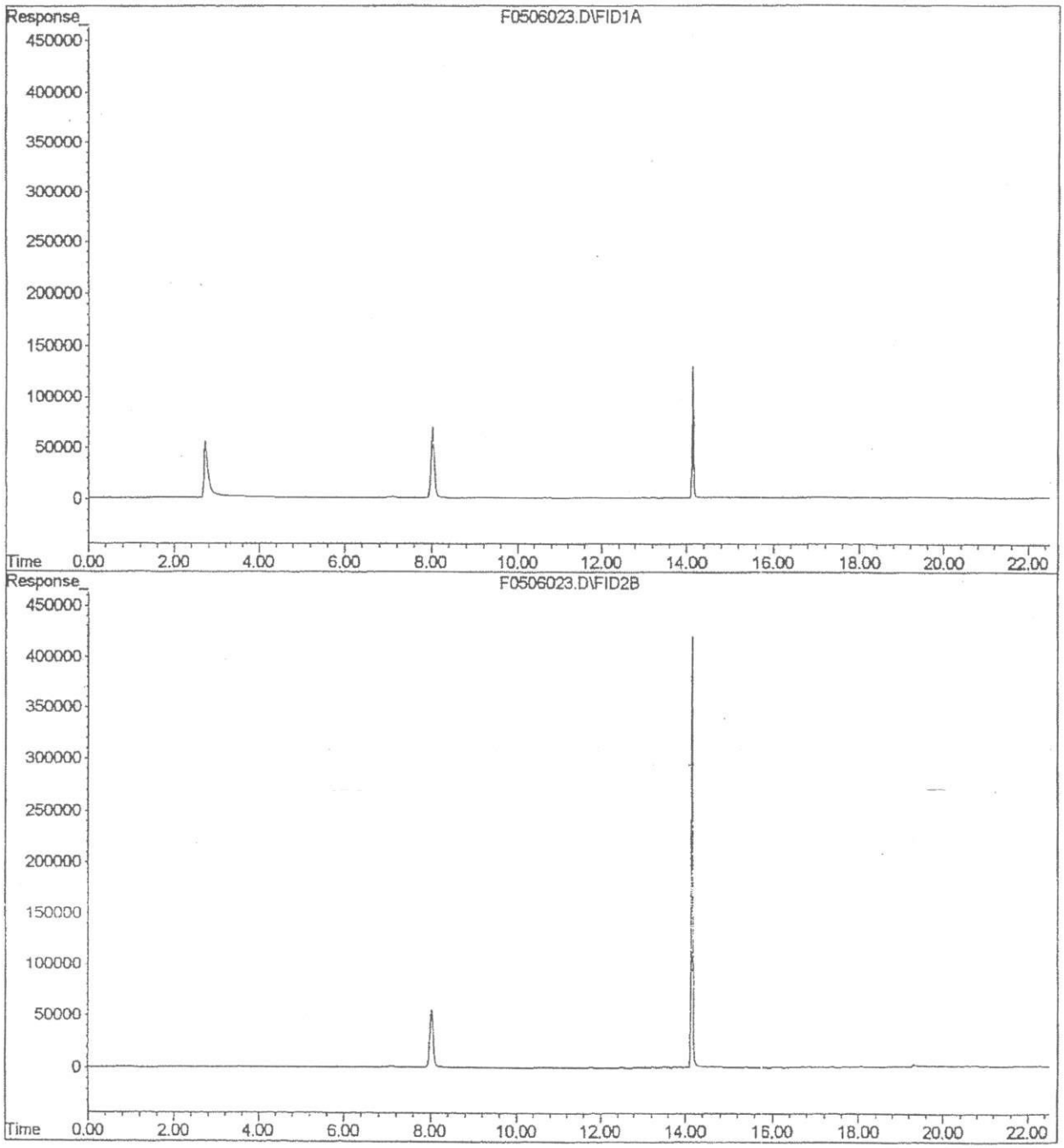
Operator : jlh
Acquired : 5 Jun 2006 22:07 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-07
Misc Info : 1x 100ul
Vial Number: 22



File : D:\HPCHEM\1\DATA\060506\F0506023.D
Operator : jlh
Acquired : 5 Jun 2006 22:36 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-08
Misc Info : 1x 100ul
Vial Number: 23



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Operator : jlh
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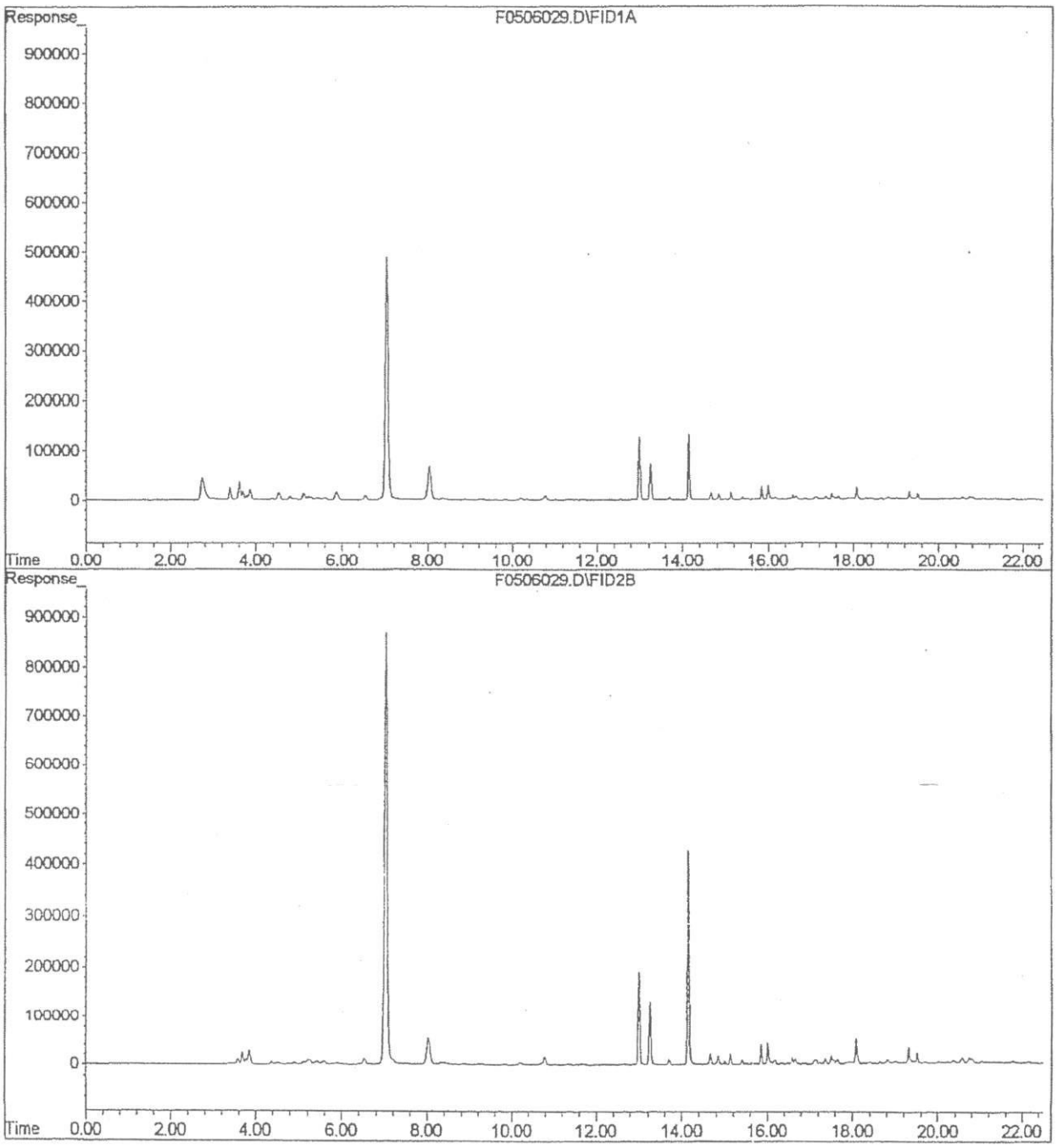
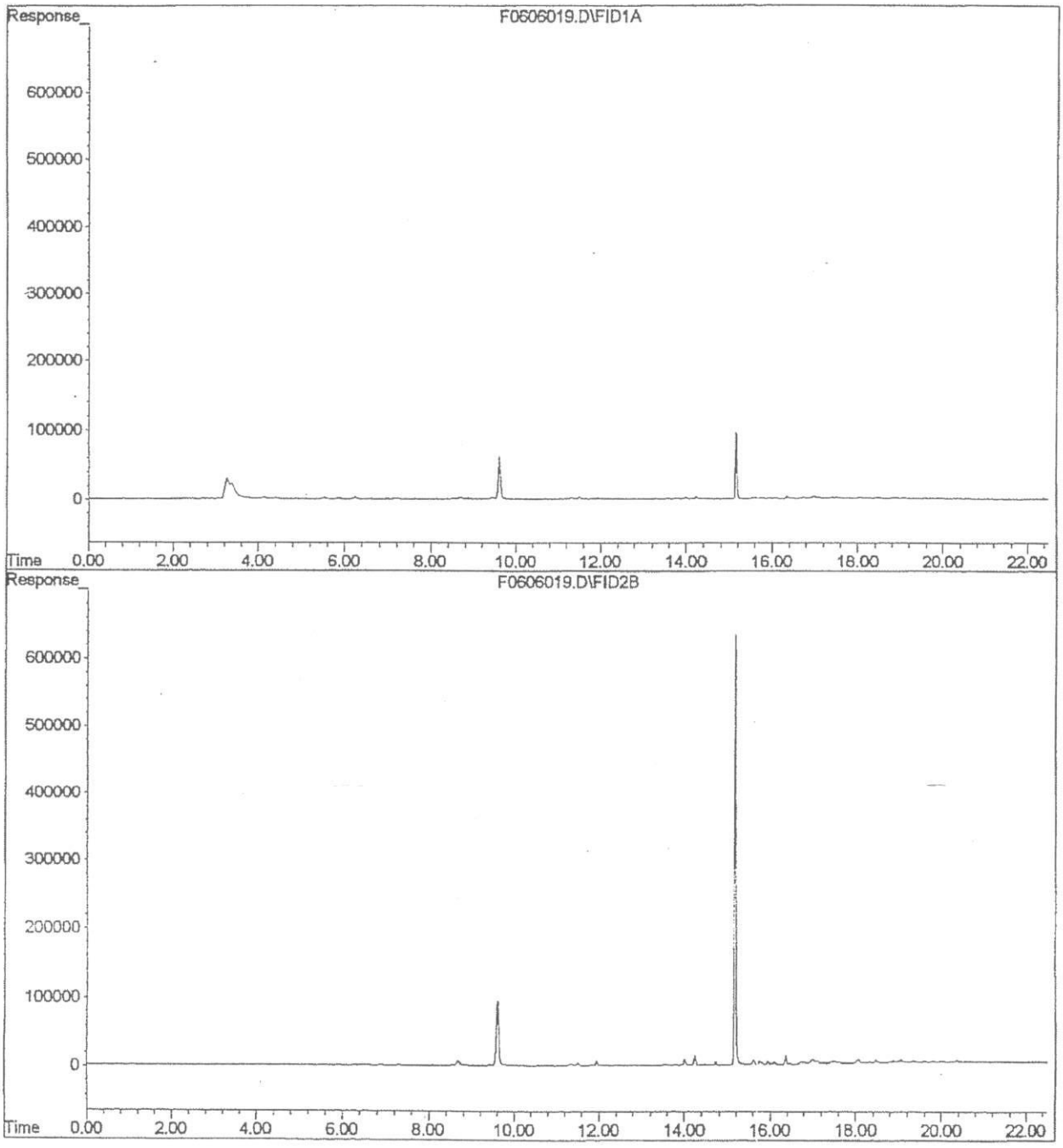
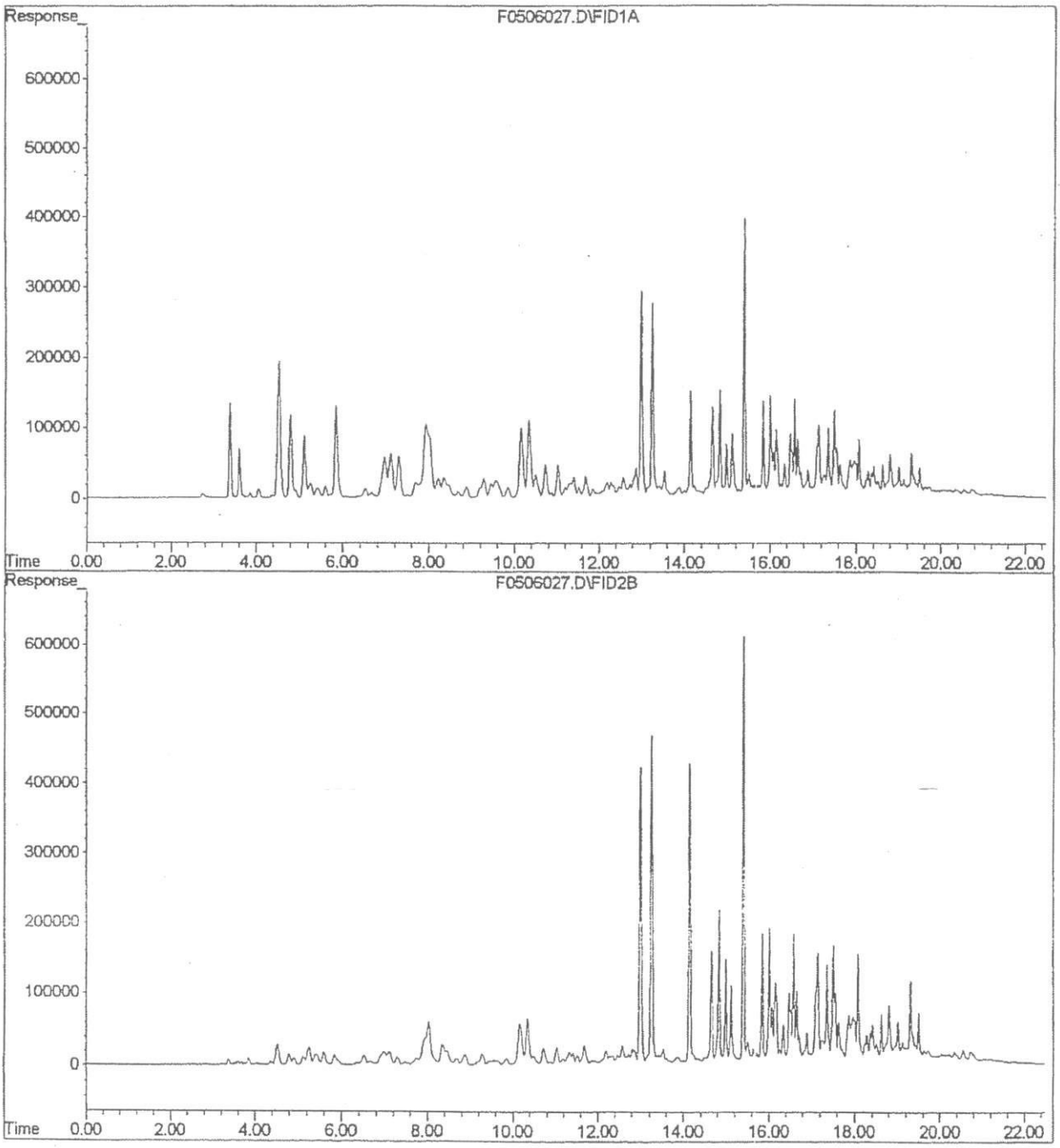
Instrument : GC-10
Sample Name: bpf0087-09
Misc Info : 1x 100ul
Vial Number: 29



File : D:\HPCHEM\2\DATA\060606\F0606019.D
Operator : NSB
Acquired : 6 Jun 2006 22:22 using AcqMethod TGD0106A.M
Instrument : GC-12
Sample Name: bpf0087-10
Misc Info : 1x 100 uL
Vial Number: 3



File : D:\HPCHEM\1\DATA\060506\F0506027.D
Operator : jlh
Acquired : 6 Jun 2006 00:35 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-11
Misc Info : 20x 5ul
Vial Number: 27



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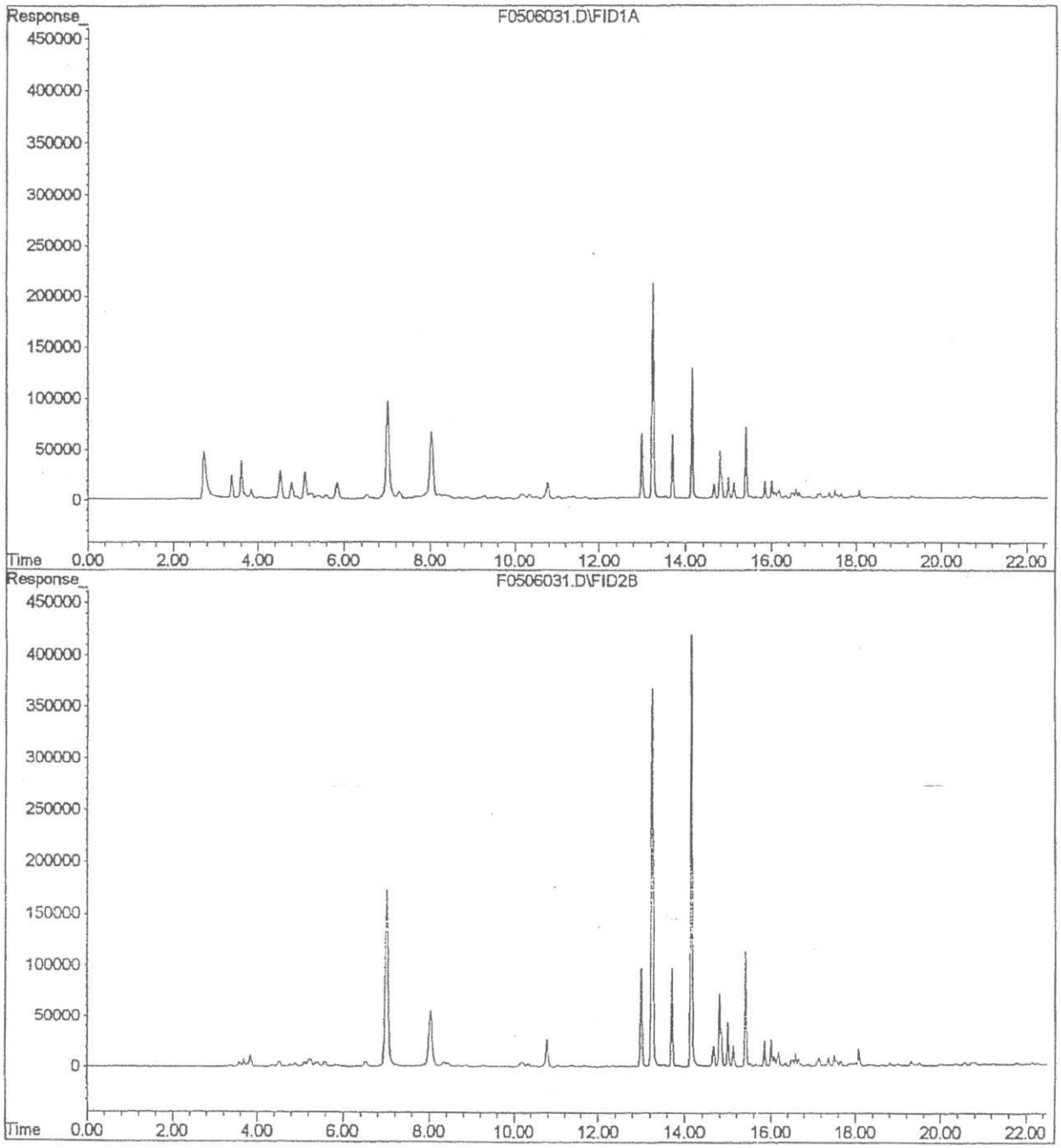
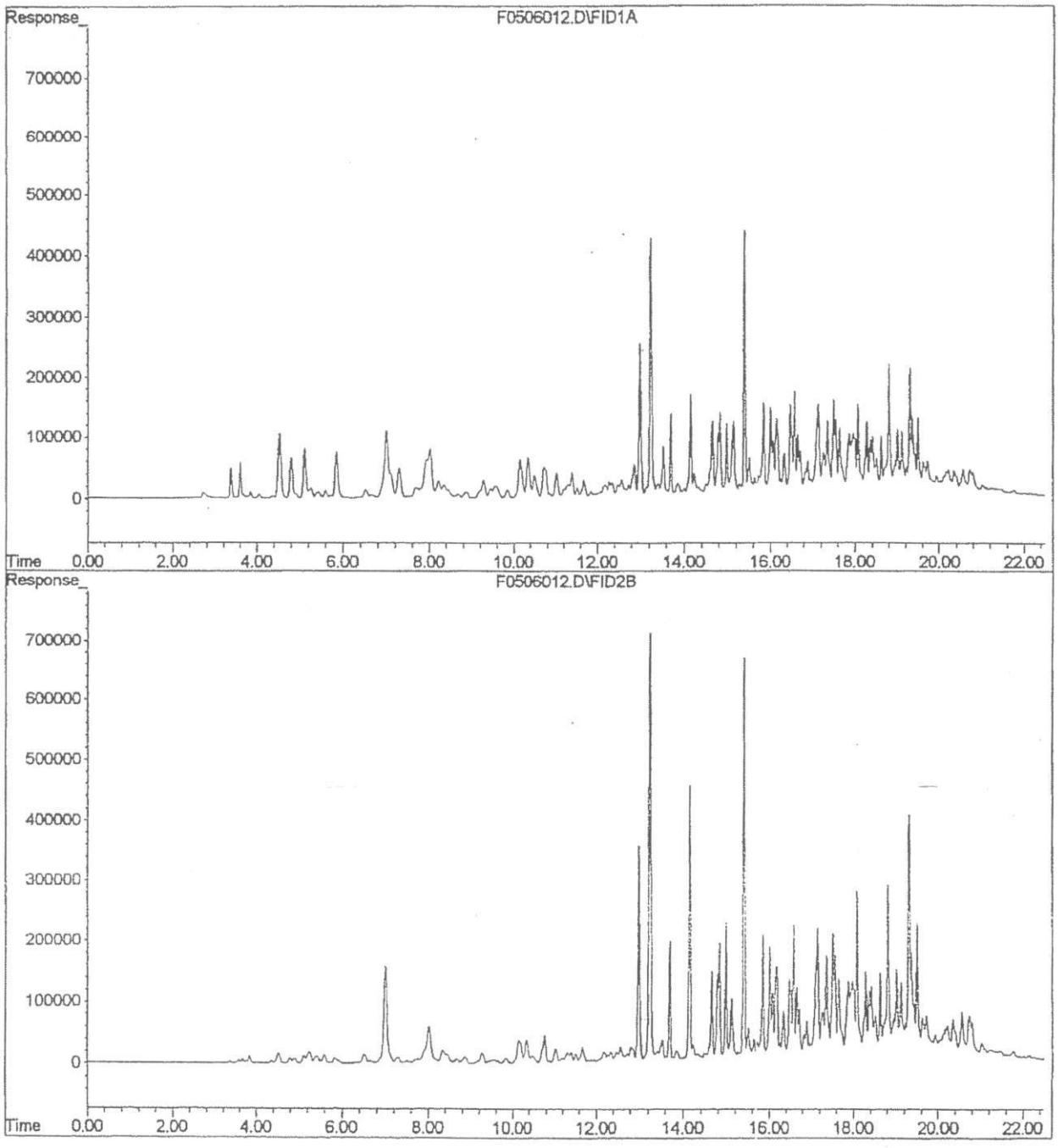
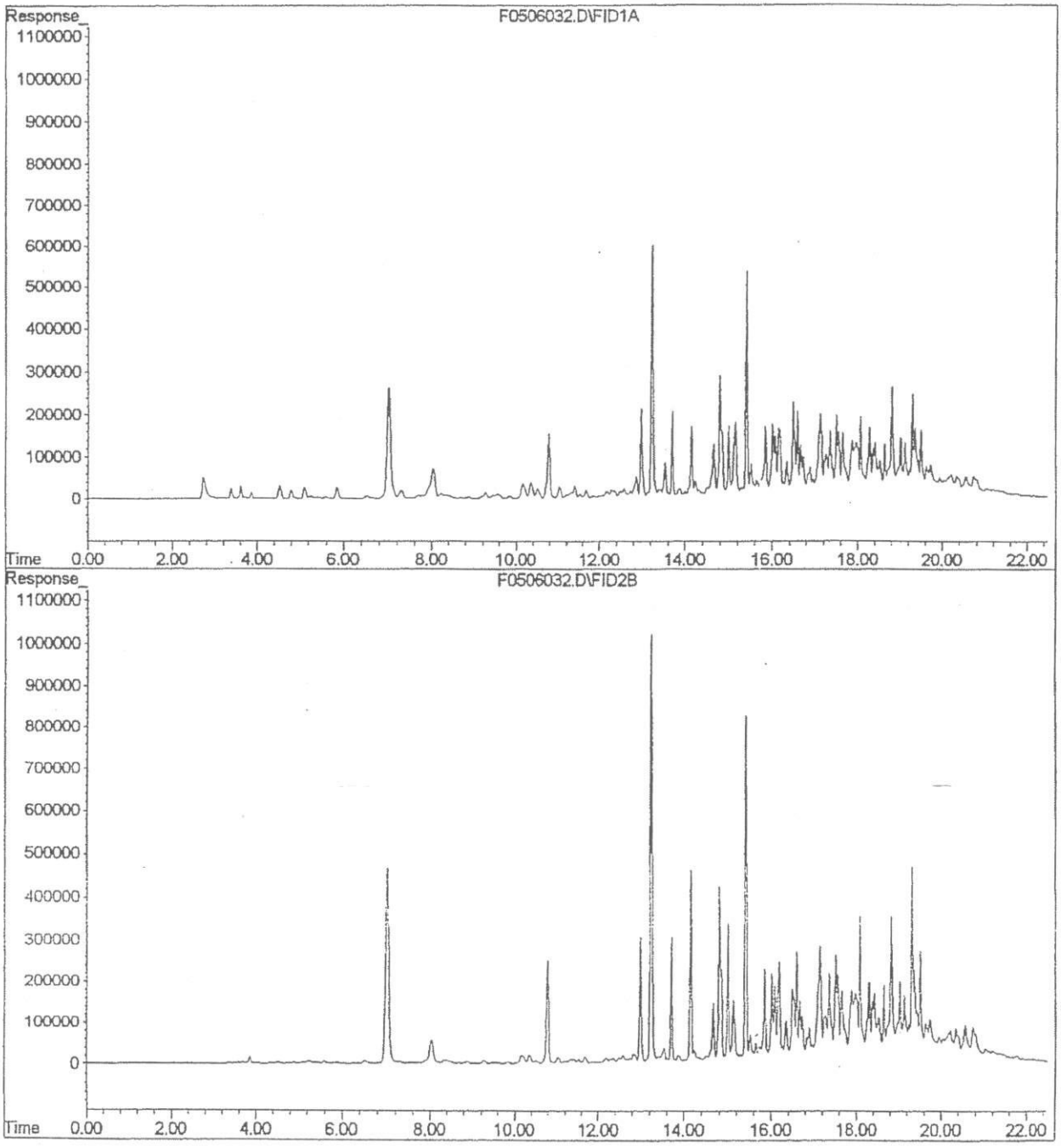
Operator : jlh
Acquired : 6 Jun 2006 2:34 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-12
Misc Info : 1x 100ul
Vial Number: 31



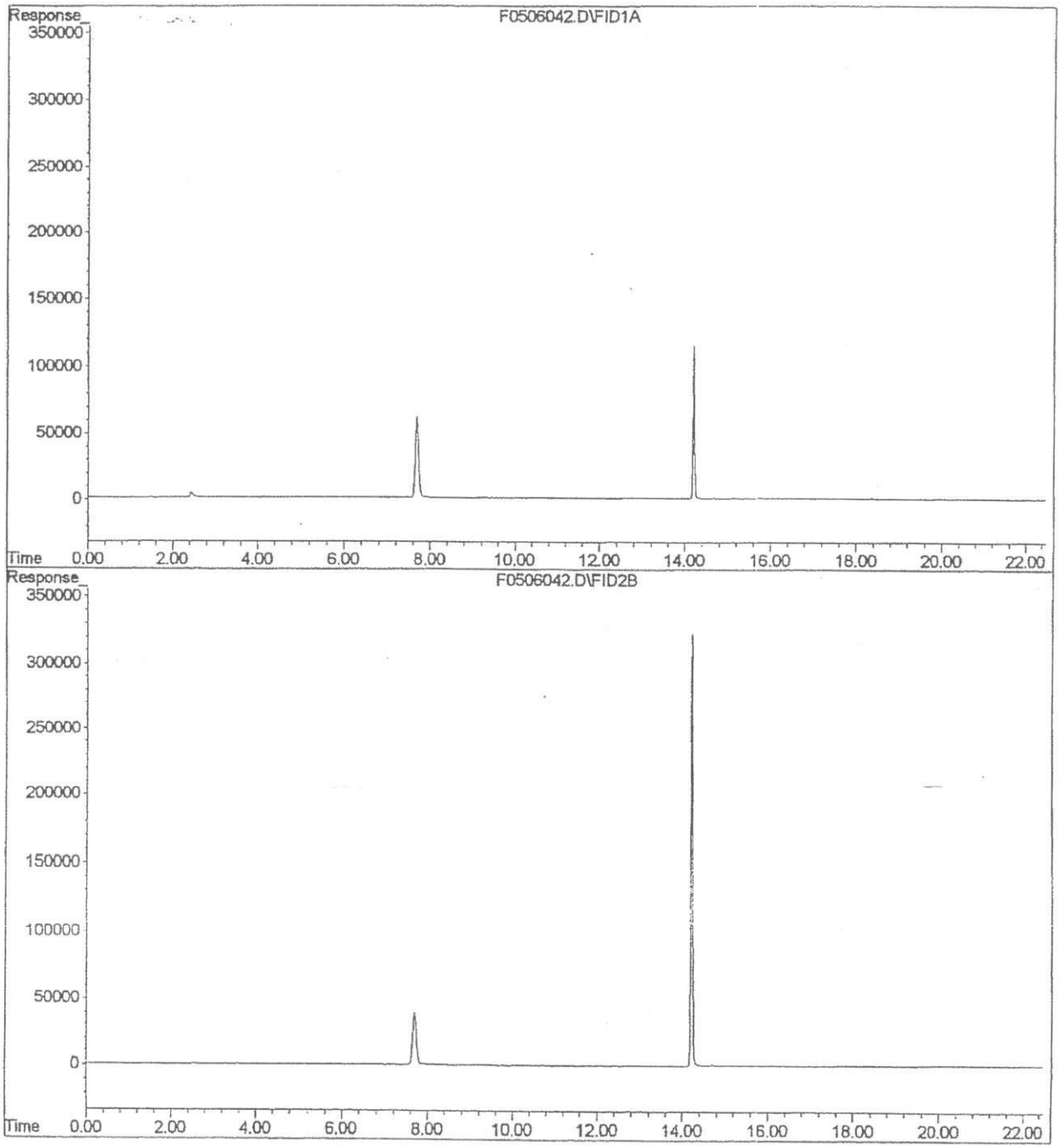
File : D:\HPCHEM\1\DATA\060506\F0506012.D
Operator : jlh
Acquired : 5 Jun 2006 17:07 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: BPF0087-13
Misc Info : 10x 10ul
Vial Number: 12



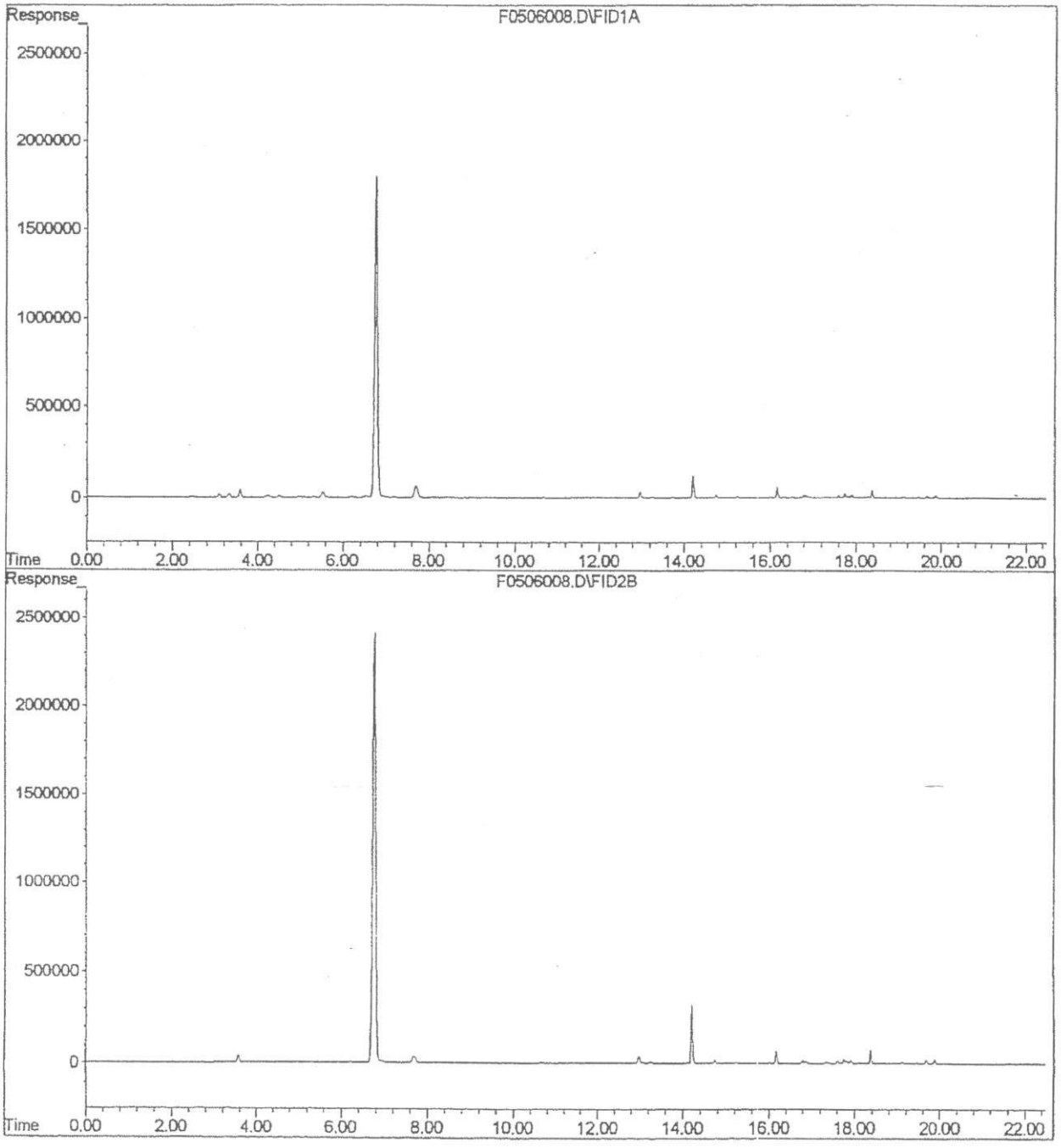
File : D:\HPCHEM\1\DATA\060506\F0506032.D
Operator : jlh
Acquired : 6 Jun 2006 3:03 using AcqMethod TGE0506.M
Instrument : GC-10
Sample Name: bpf0087-14
Misc Info : 1x 100ul
Vial Number: 32



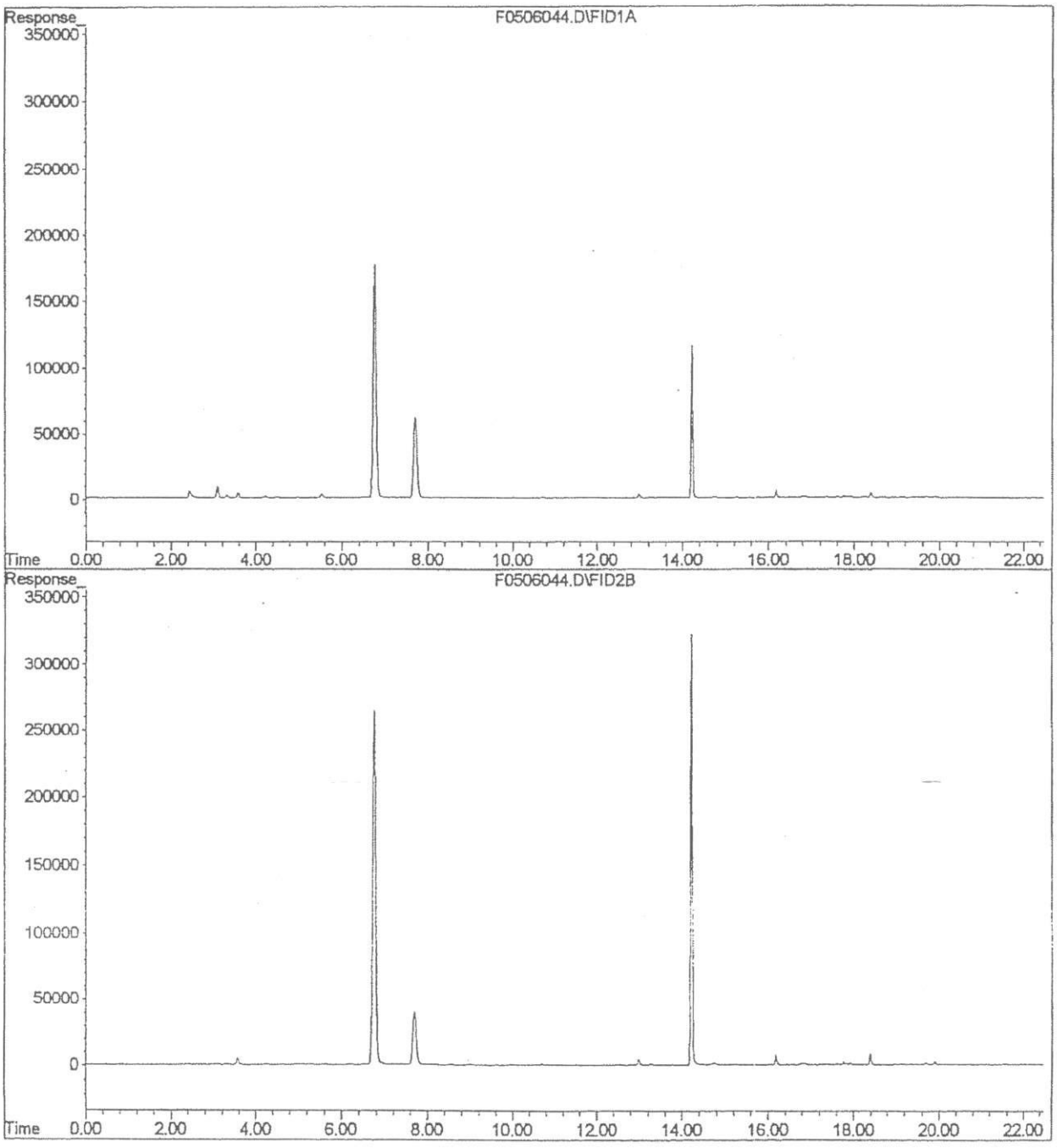
File : D:\HPCHEM\4\DATA\060506\F0506042.D
Operator : NSB
Acquired : 6 Jun 2006 10:02 using AcqMethod TGC1806A.M
Instrument : GC #8
Sample Name: bpf0087-15 r1
Misc Info : 1x 5ml
Vial Number: 42



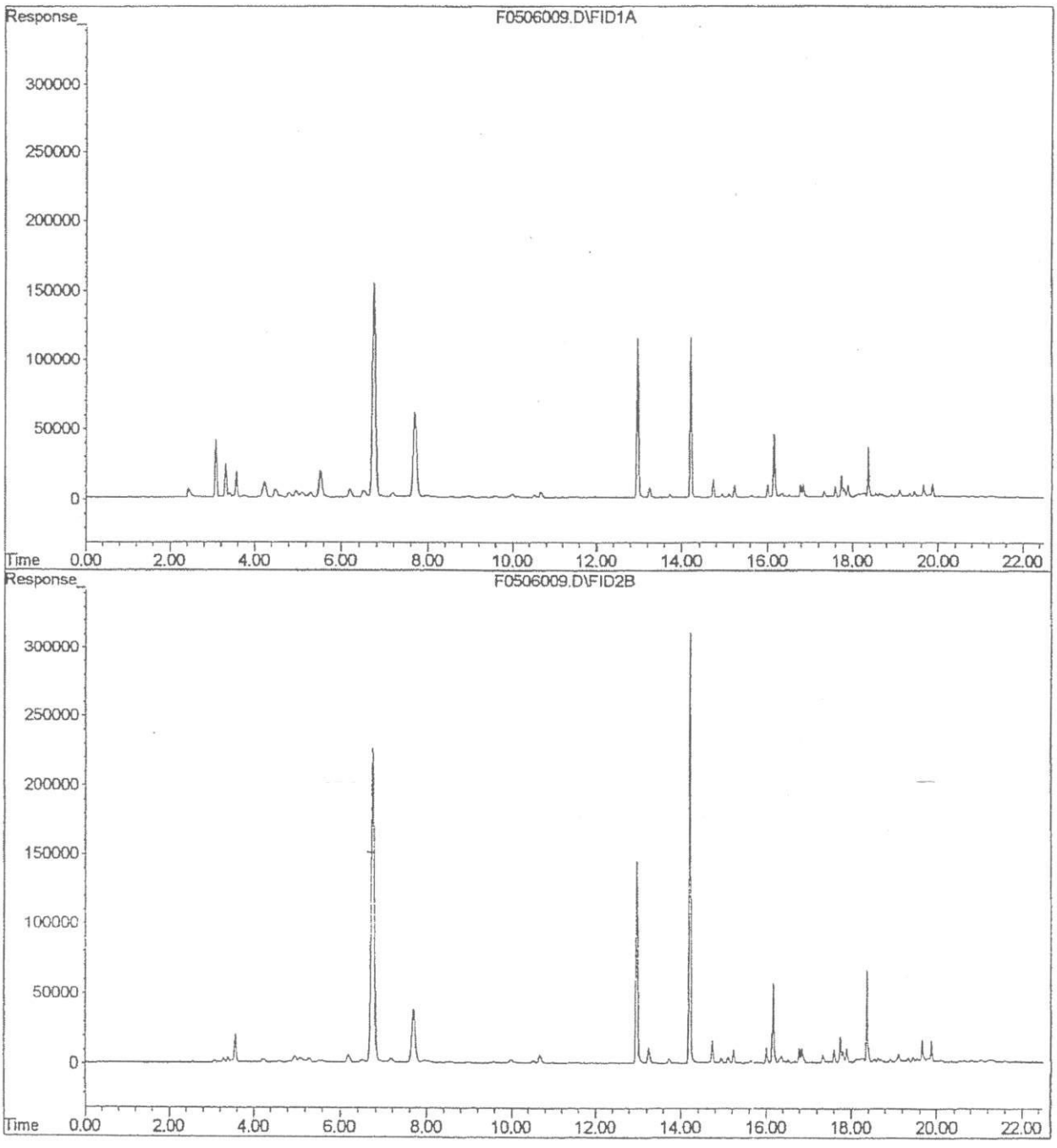
File : D:\HPCHEM\4\DATA\060506\F0506008.D
Operator : NSB
Acquired : 5 Jun 2006 13:57 using AcqMethod TGC1806A.M
Instrument : GC #8
Sample Name: BPF0087-16
Misc Info : 10x 500 uL
Vial Number: 8



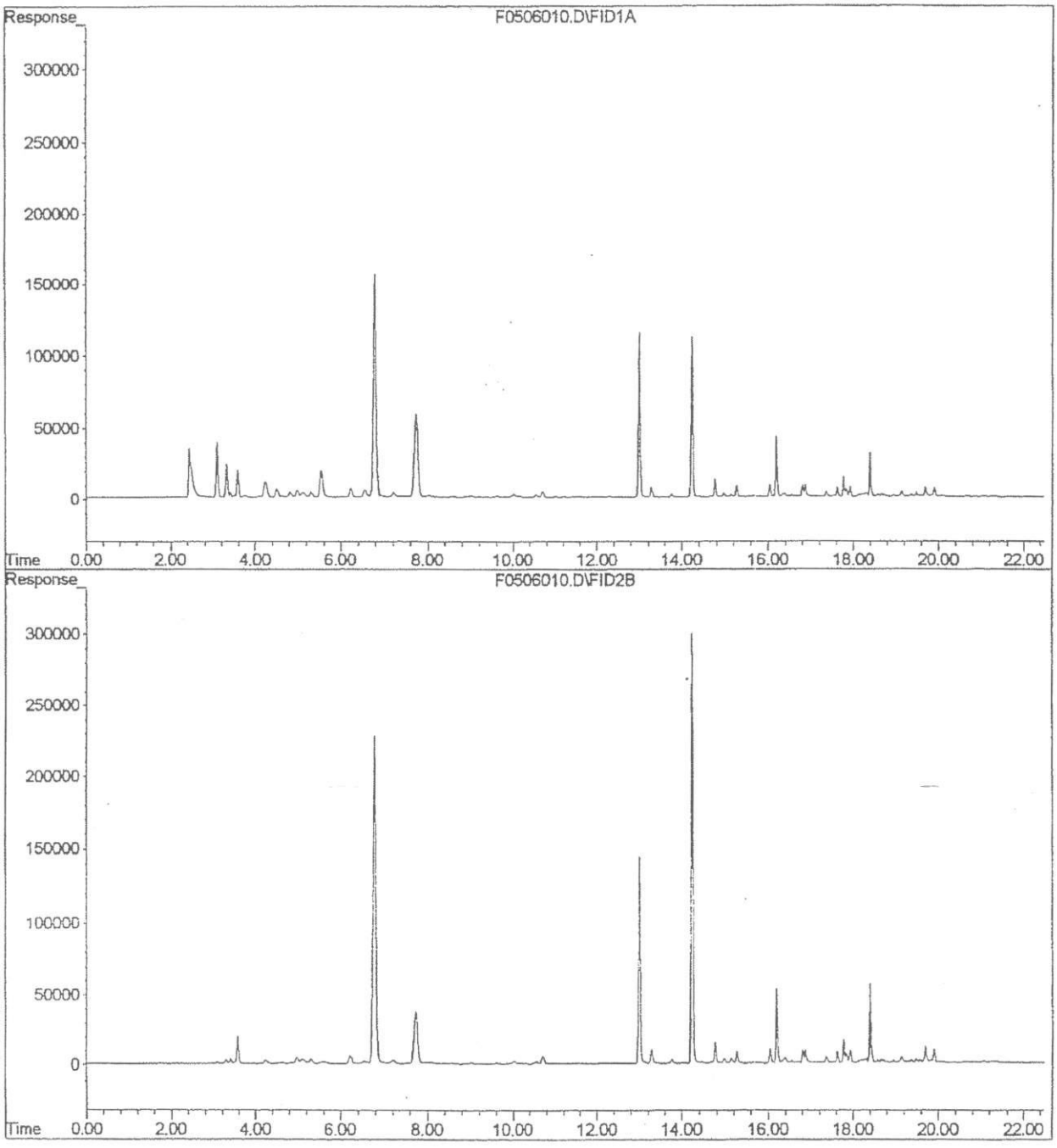
File : D:\HPCHEM\4\DATA\060506\F0506044.D
Operator : NSB
Acquired : 6 Jun 2006 11:04 using AcqMethod TGC1806A.M
Instrument : GC #8
Sample Name: bpf0087-16re1 r1
Misc Info : 100x 50ul
Vial Number: 44



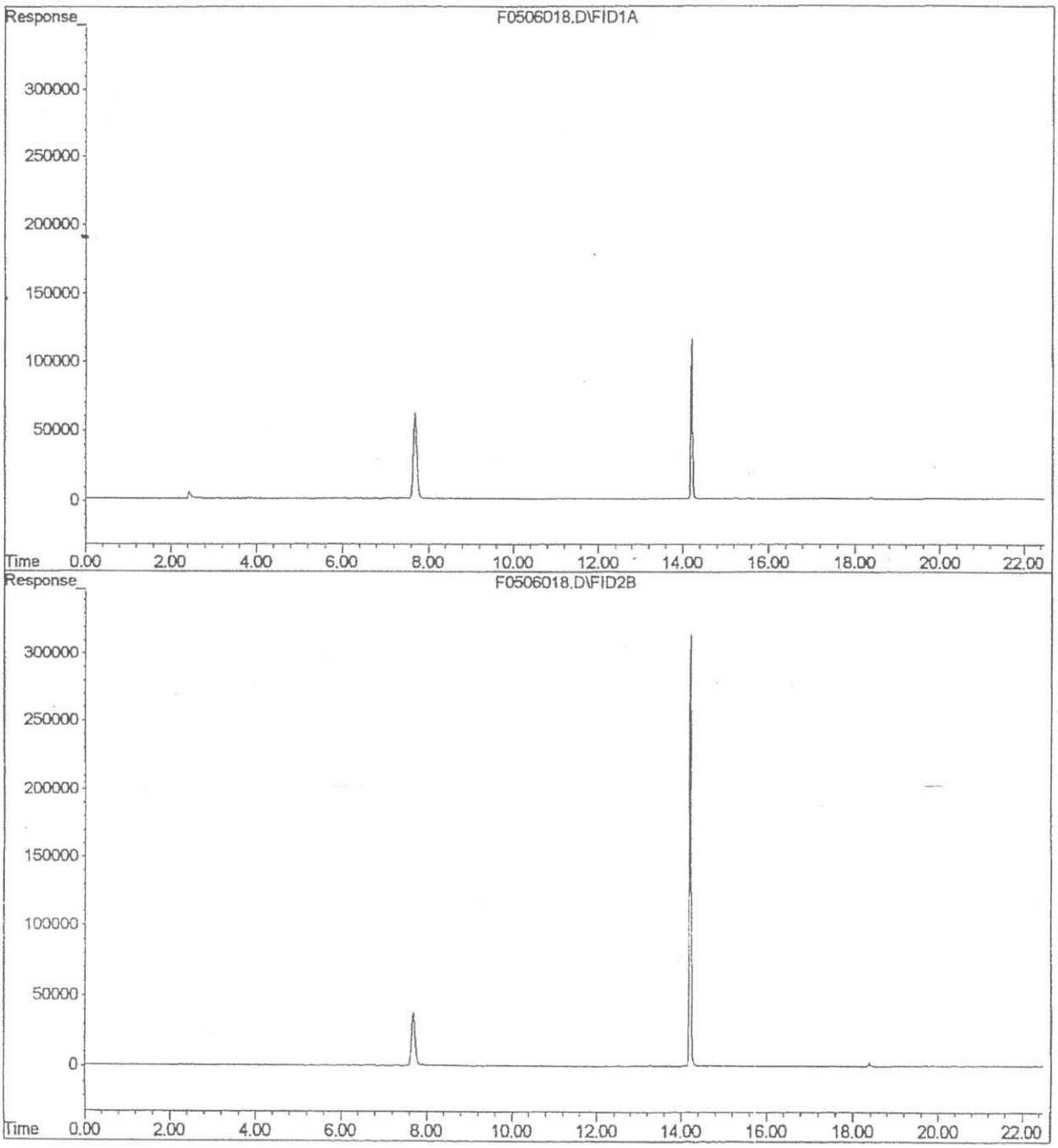
File : D:\HPCHEM\4\DATA\060506\F0506009.D
Operator : NSB
Acquired : 5 Jun 2006 14:28 using AcqMethod TGC1806A.M
Instrument : GC #8
Sample Name: BPF0087-17
Misc Info : 10x 500 uL
Vial Number: 9



File : D:\HPCHEM\4\DATA\060506\F0506010.D
Operator : NSB
Acquired : 5 Jun 2006 16:19 using AcqMethod TGC1806A.M
Instrument : GC #8
Sample Name: BPF0087-18
Misc Info : 10x 500 uL
Vial Number: 10



File : D:\HPCHEM\4\DATA\060506\F0506018.D
Operator : NSB
Acquired : 5 Jun 2006 21:19 using AcqMethod TGC1806A.M
Instrument : GC #8
Sample Name: bpf0087-19
Misc Info : 1x 5ml
Vial Number: 18

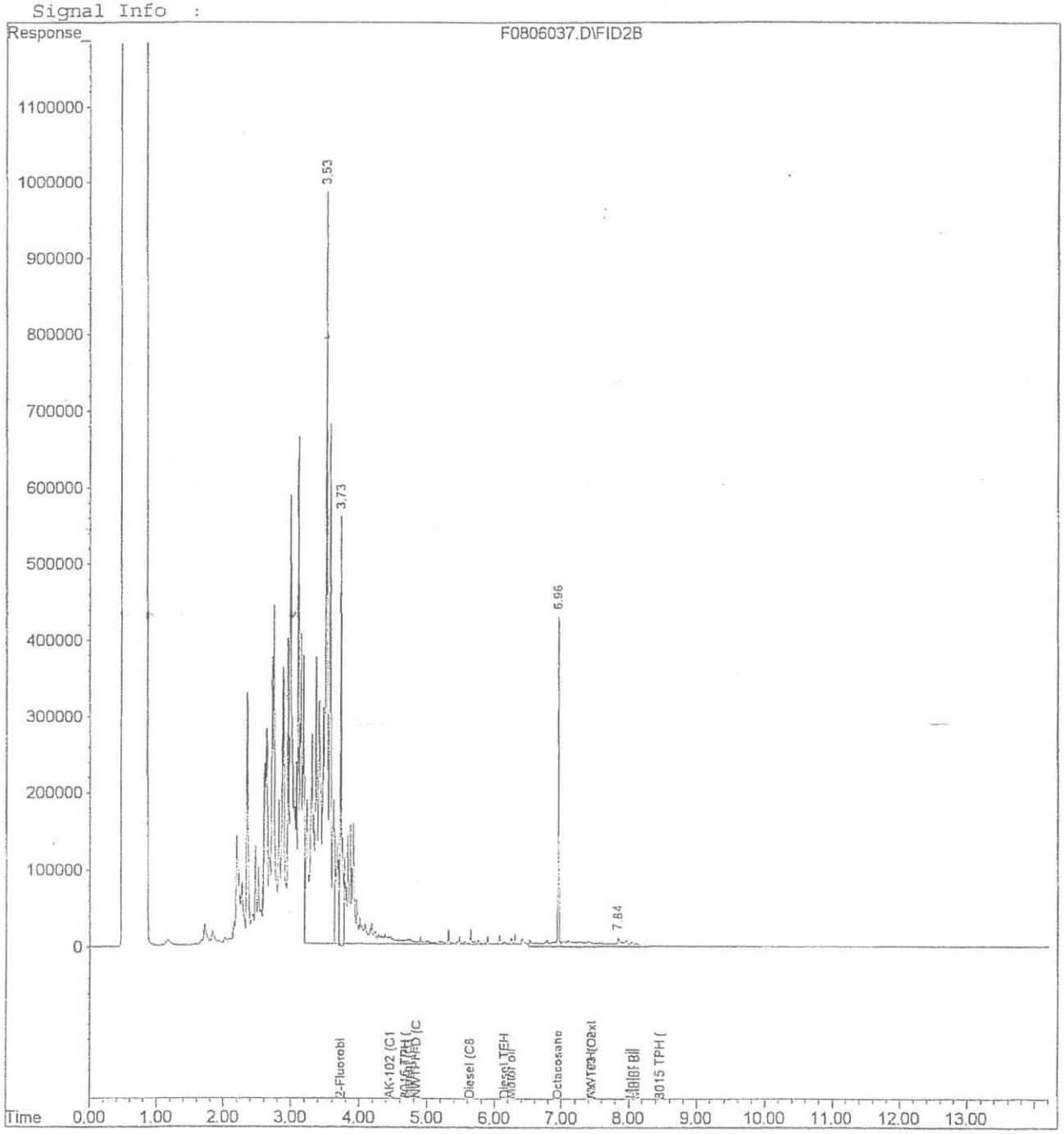


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806037.D Vial: 34
Acq On : 9 Jun 2006 2:29 Operator: GSM
Sample : bpf0087-01 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

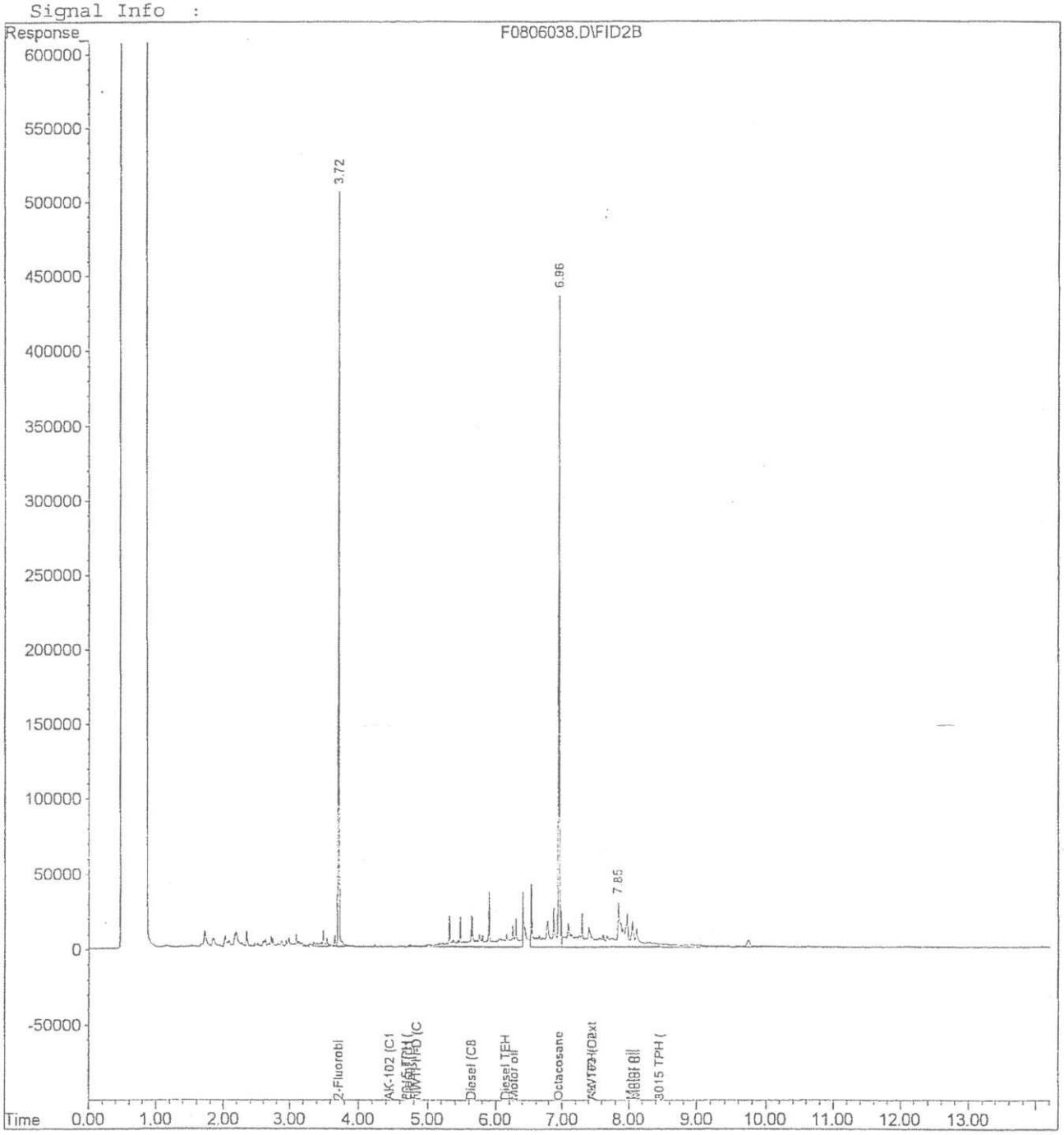


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806038.D Vial: 35
Acq On : 9 Jun 2006 2:59 Operator: GSM
Sample : bpf0087-02 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

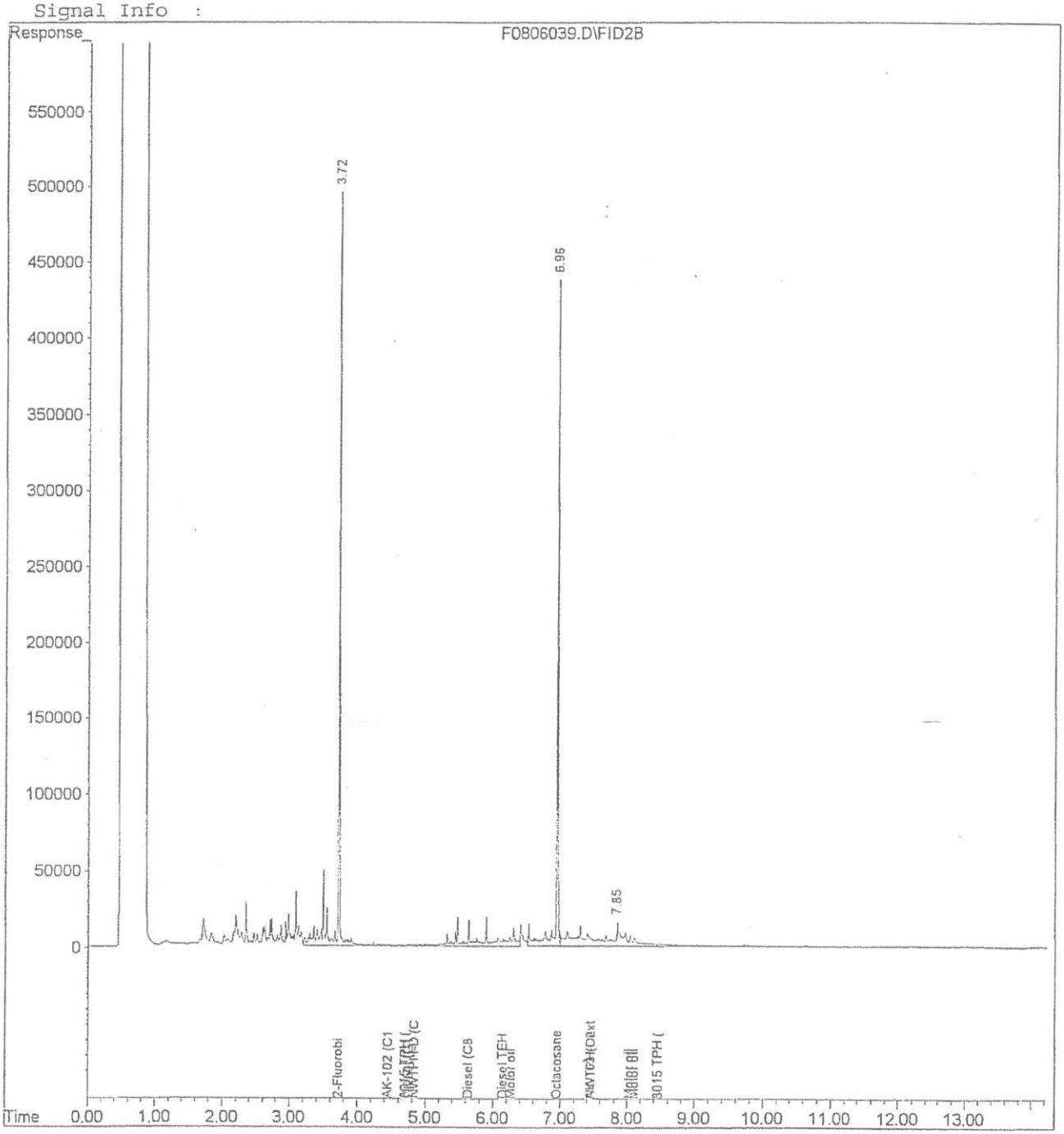


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806039.D Vial: 36
Acq On : 9 Jun 2006 3:24 Operator: GSM
Sample : bpf0087-03 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

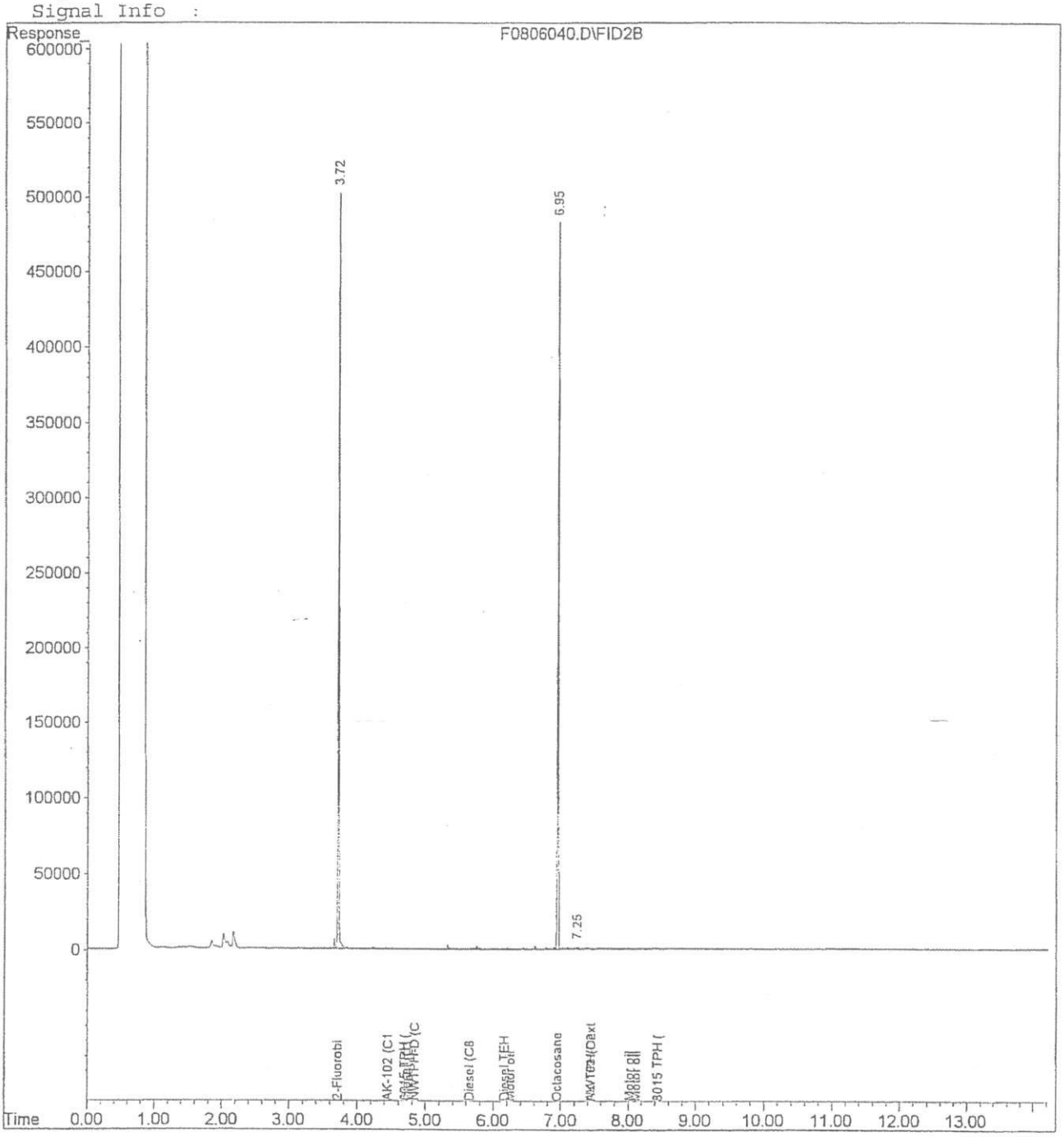


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806040.D Vial: 37
Acq On : 9 Jun 2006 3:50 Operator: GSM
Sample : bpf0087-04 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

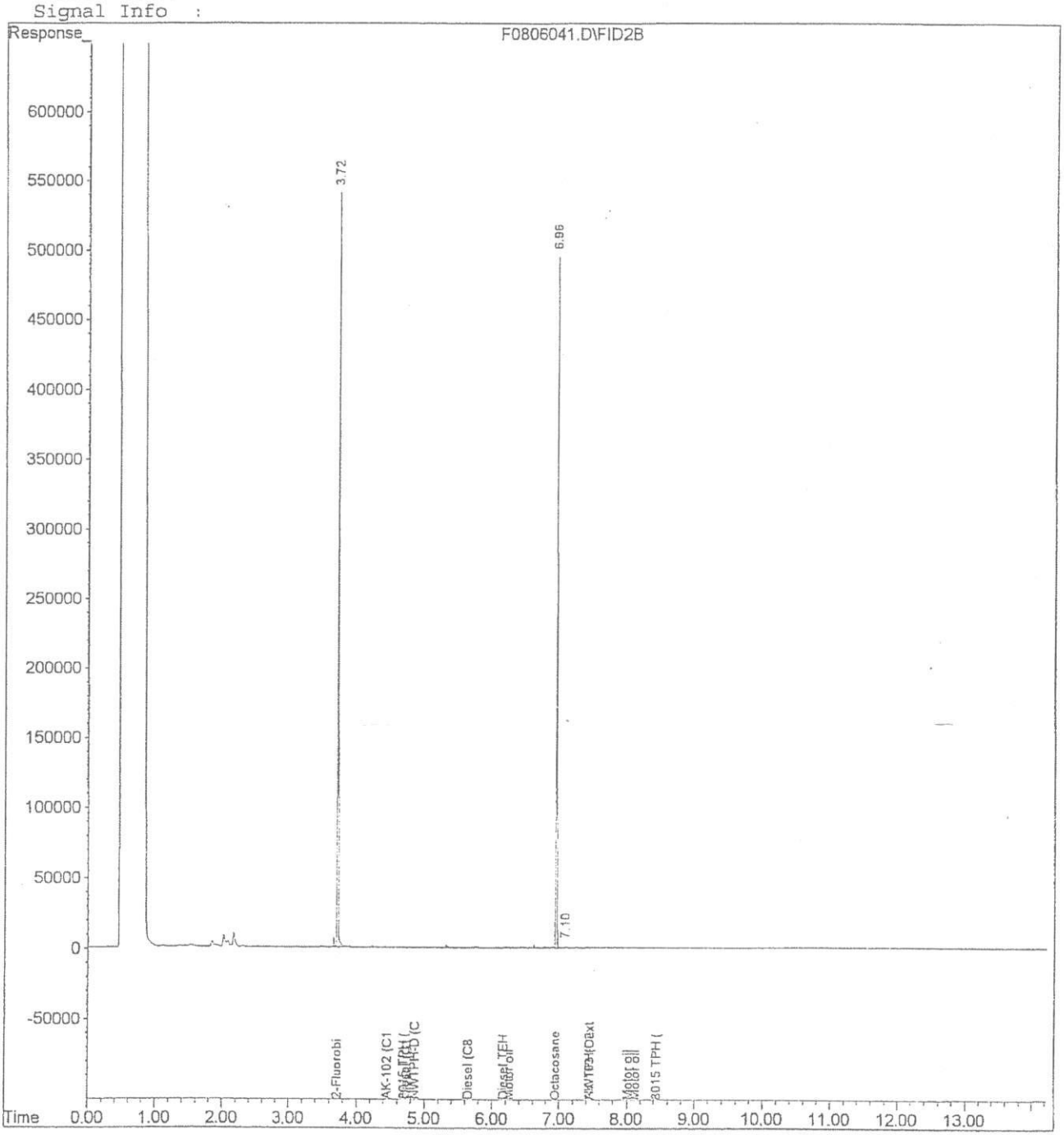


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806041.D Vial: 38
Acq On : 9 Jun 2006 4:04 Operator: GSM
Sample : bpf0087-05 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

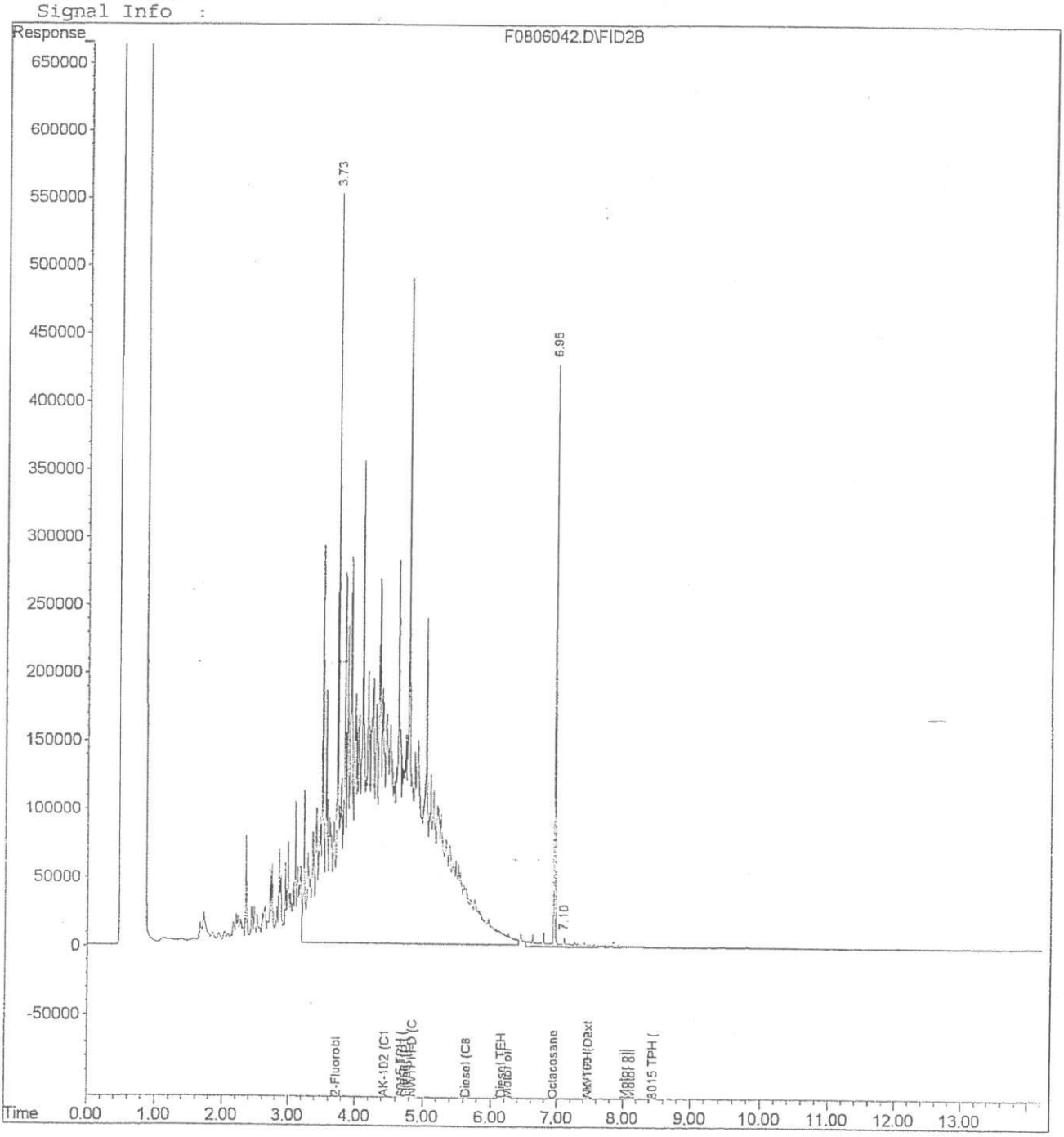


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806042.D Vial: 39
Acq On : 9 Jun 2006 4:34 Operator: GSM
Sample : bpf0087-06 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

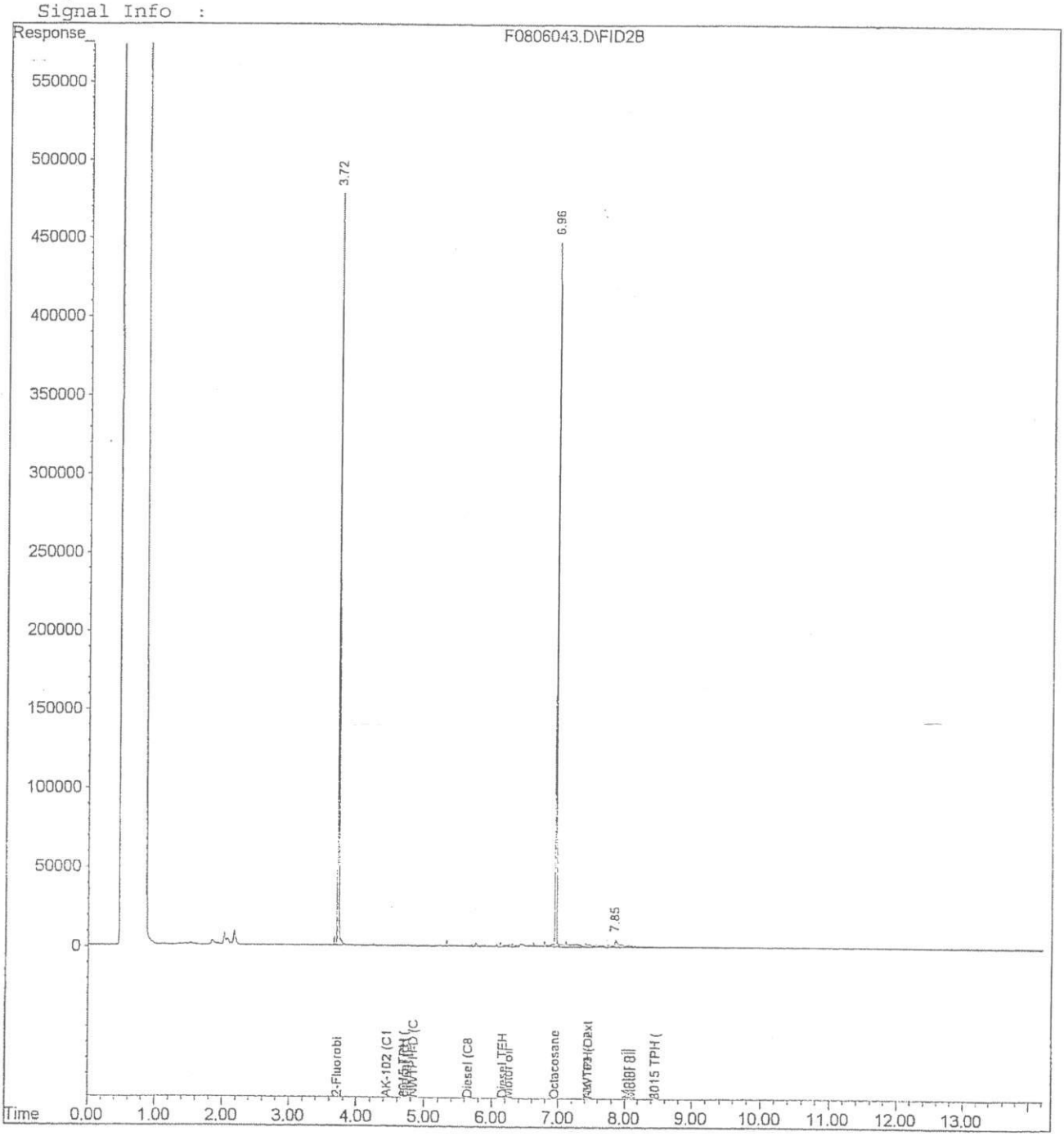


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806043.D Vial: 40
Acq On : 9 Jun 2006 4:49 Operator: GSM
Sample : bpf0087-07 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

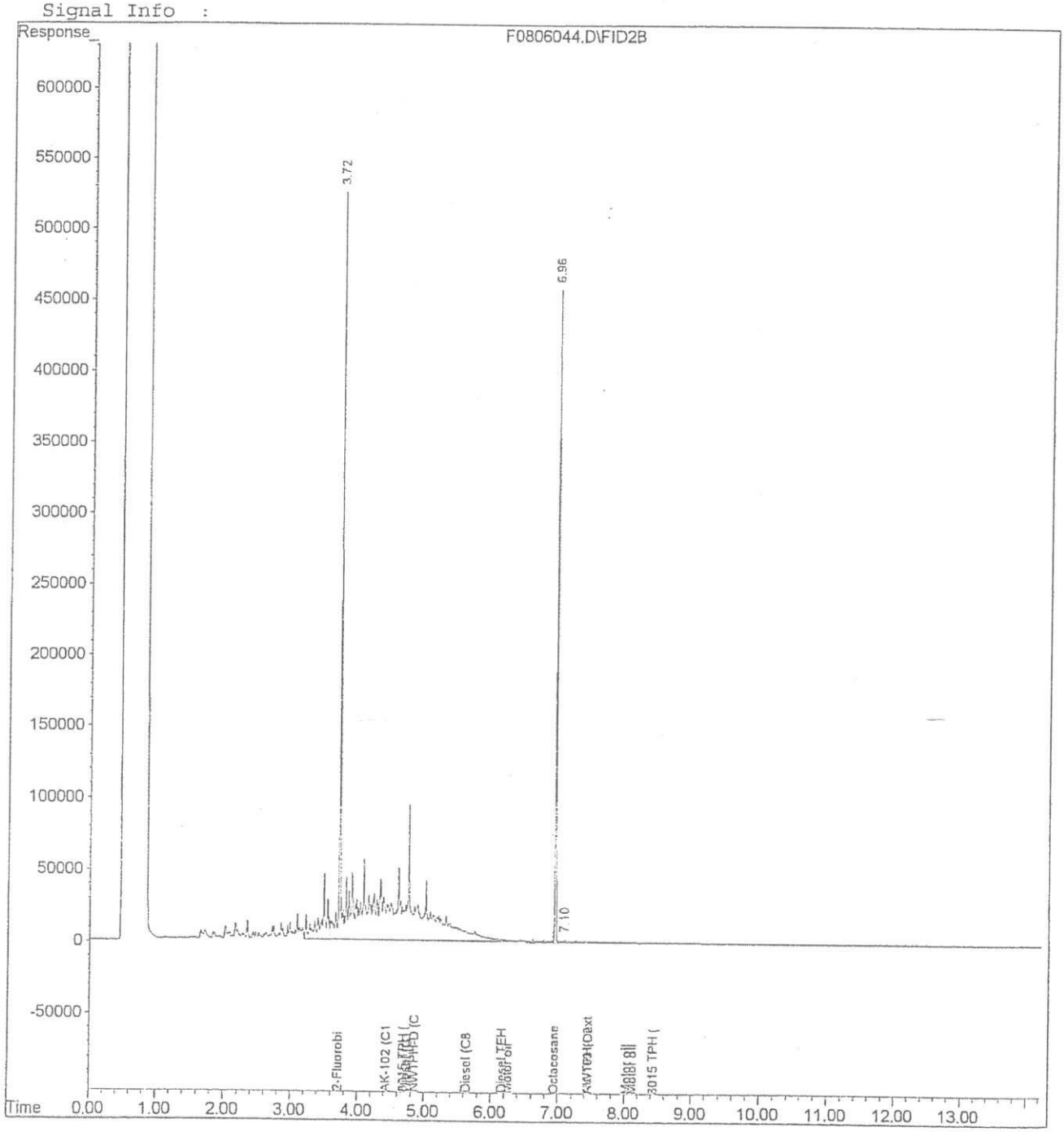


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806044.D Vial: 41
Acq On : 9 Jun 2006 5:16 Operator: GSM
Sample : bpf0087-09 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:22 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

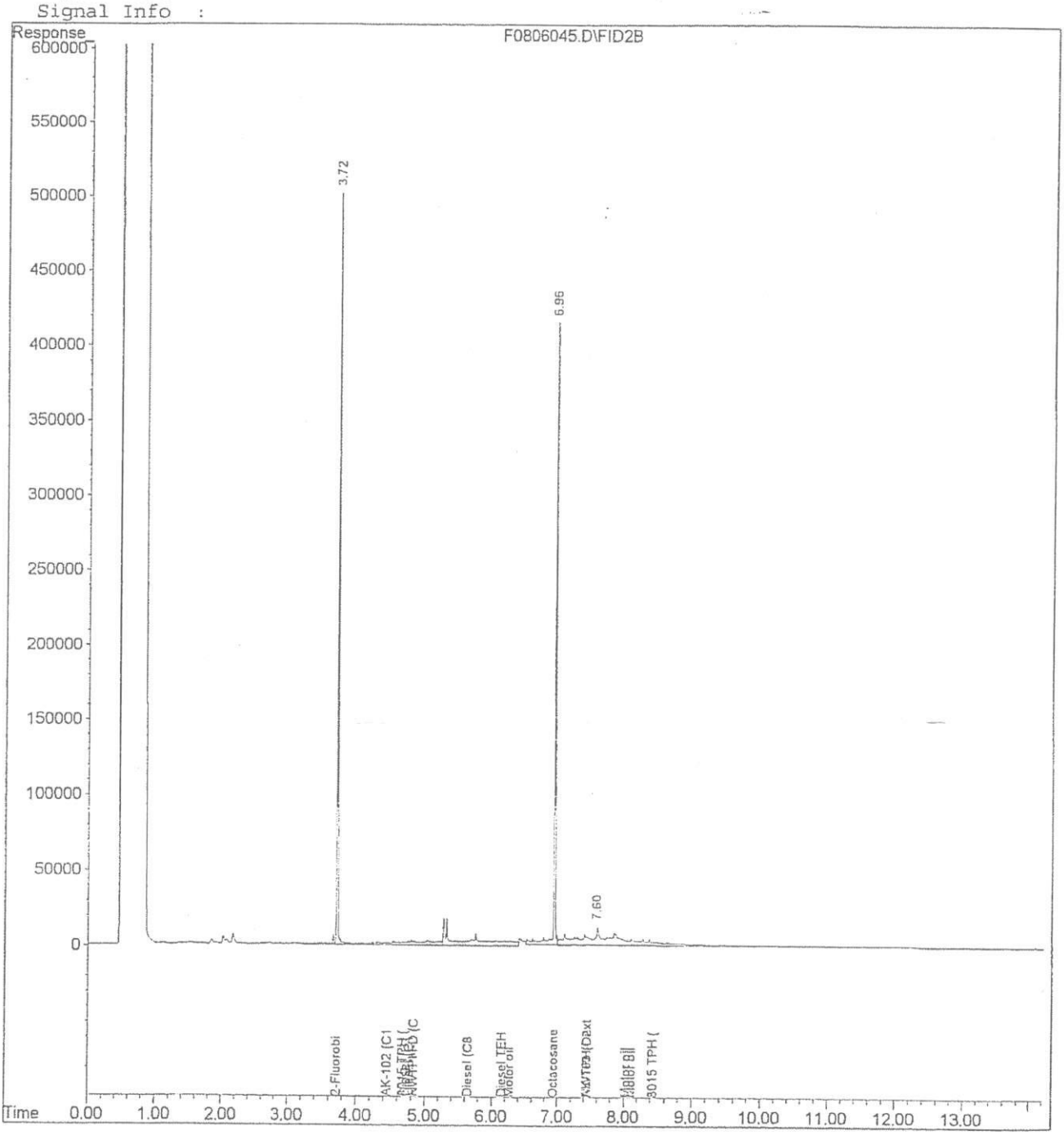


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806045.D Vial: 42
Acq On : 9 Jun 2006 5:31 Operator: GSM
Sample : bpf0087-10 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:23 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

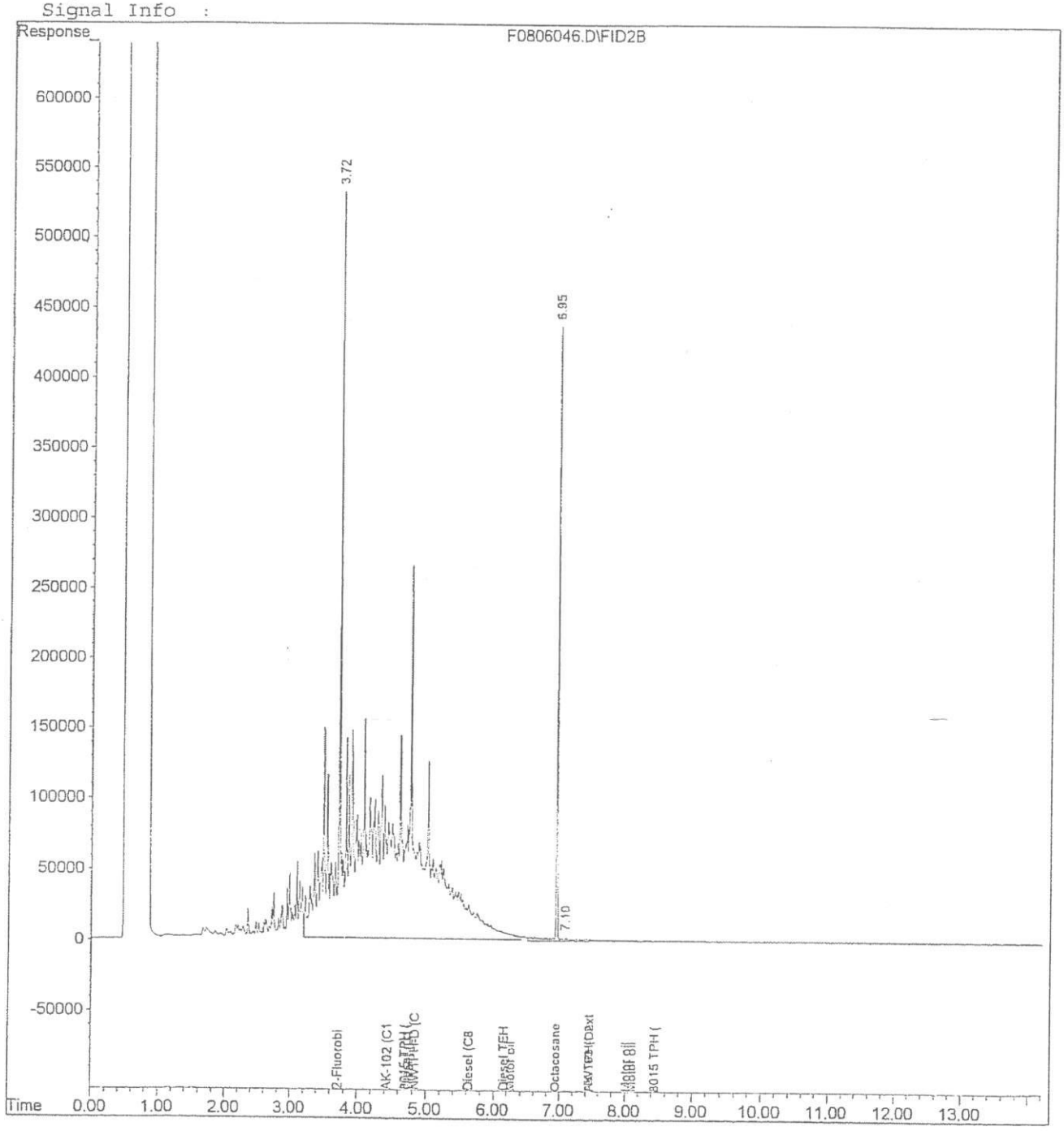


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806046.D Vial: 43
Acq On : 9 Jun 2006 6:00 Operator: GSM
Sample : bpf0087-11 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:23 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

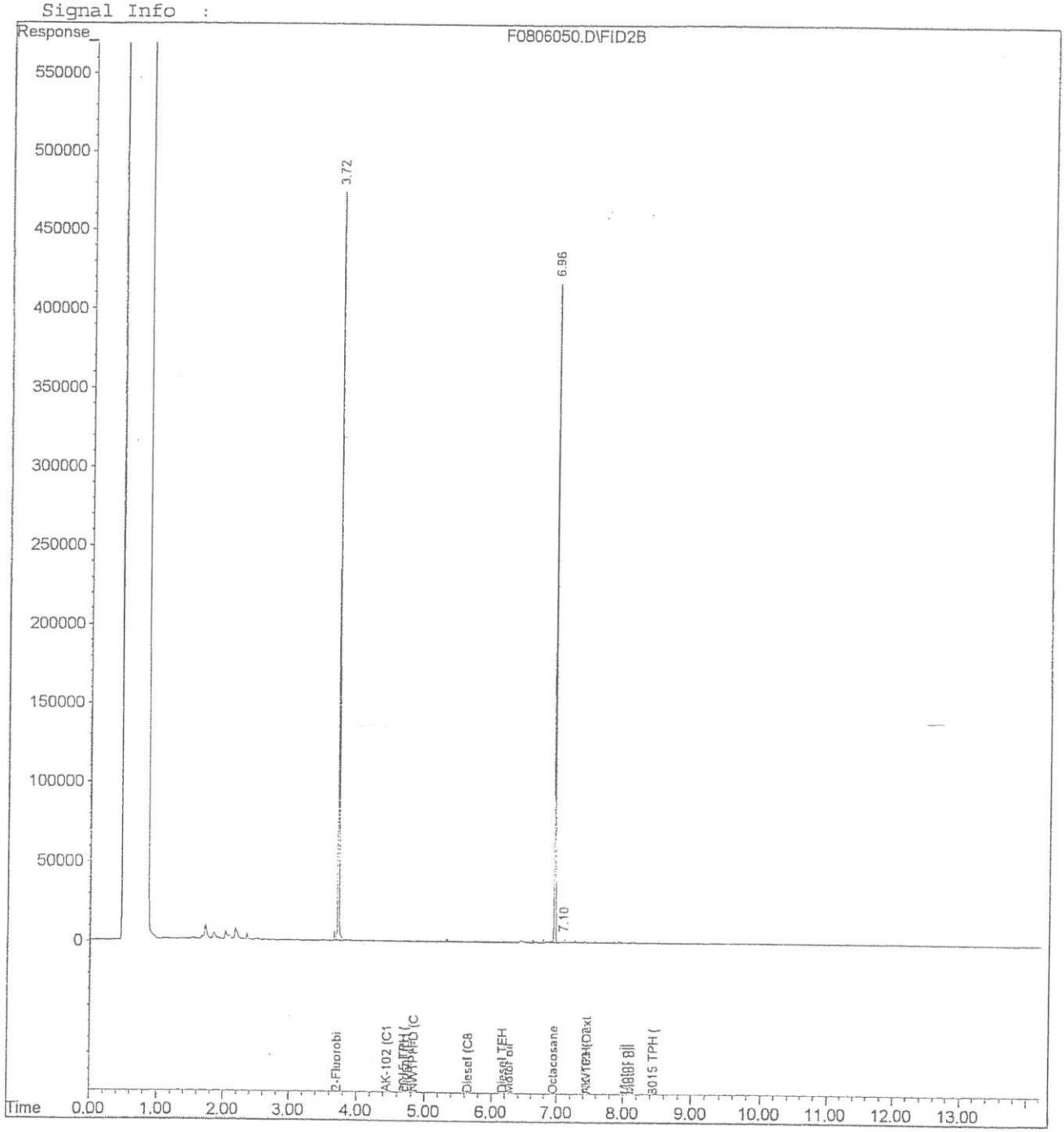


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806050.D Vial: 46
Acq On : 9 Jun 2006 7:35 Operator: GSM
Sample : bpf0087-12 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:23 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

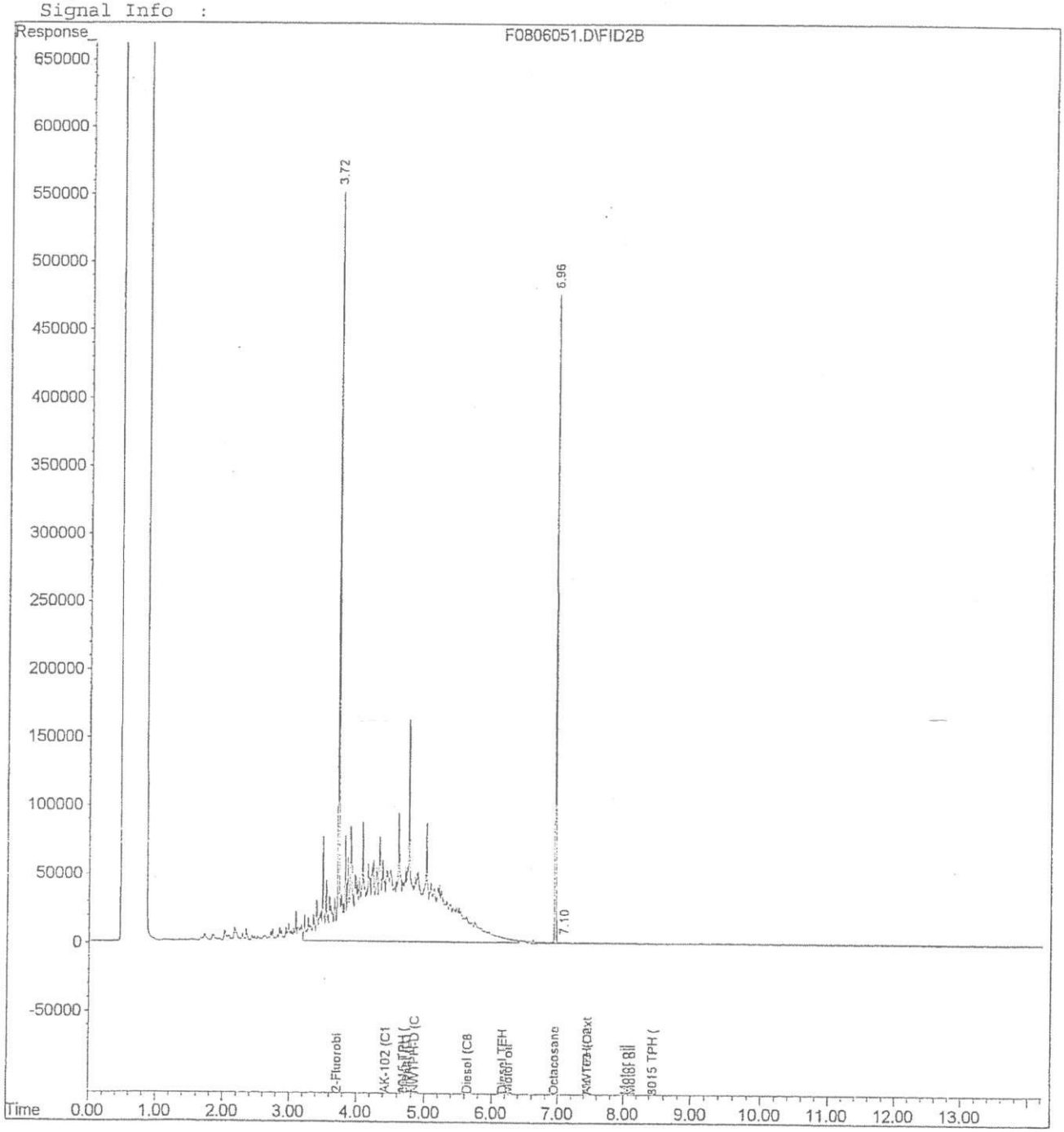


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806051.D Vial: 47
Acq On : 9 Jun 2006 7:48 Operator: GSM
Sample : bpf0087-13 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:23 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

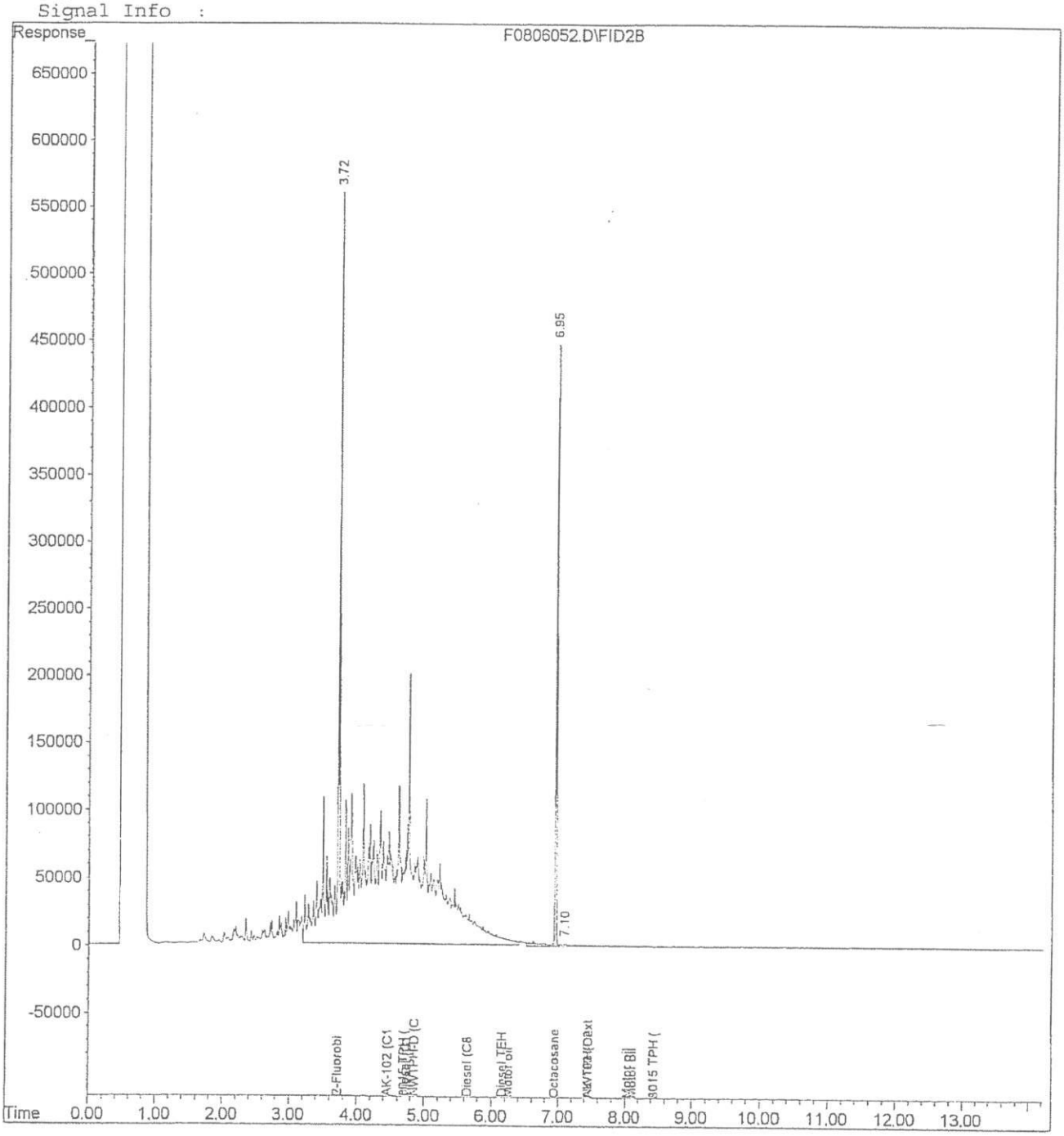


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806052.D Vial: 48
Acq On : 9 Jun 2006 8:18 Operator: GSM
Sample : bpf0087-14 Inst : GC-7
Misc : 1x nwtph-dx , tph-dx soil Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 13:58 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:25:31 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

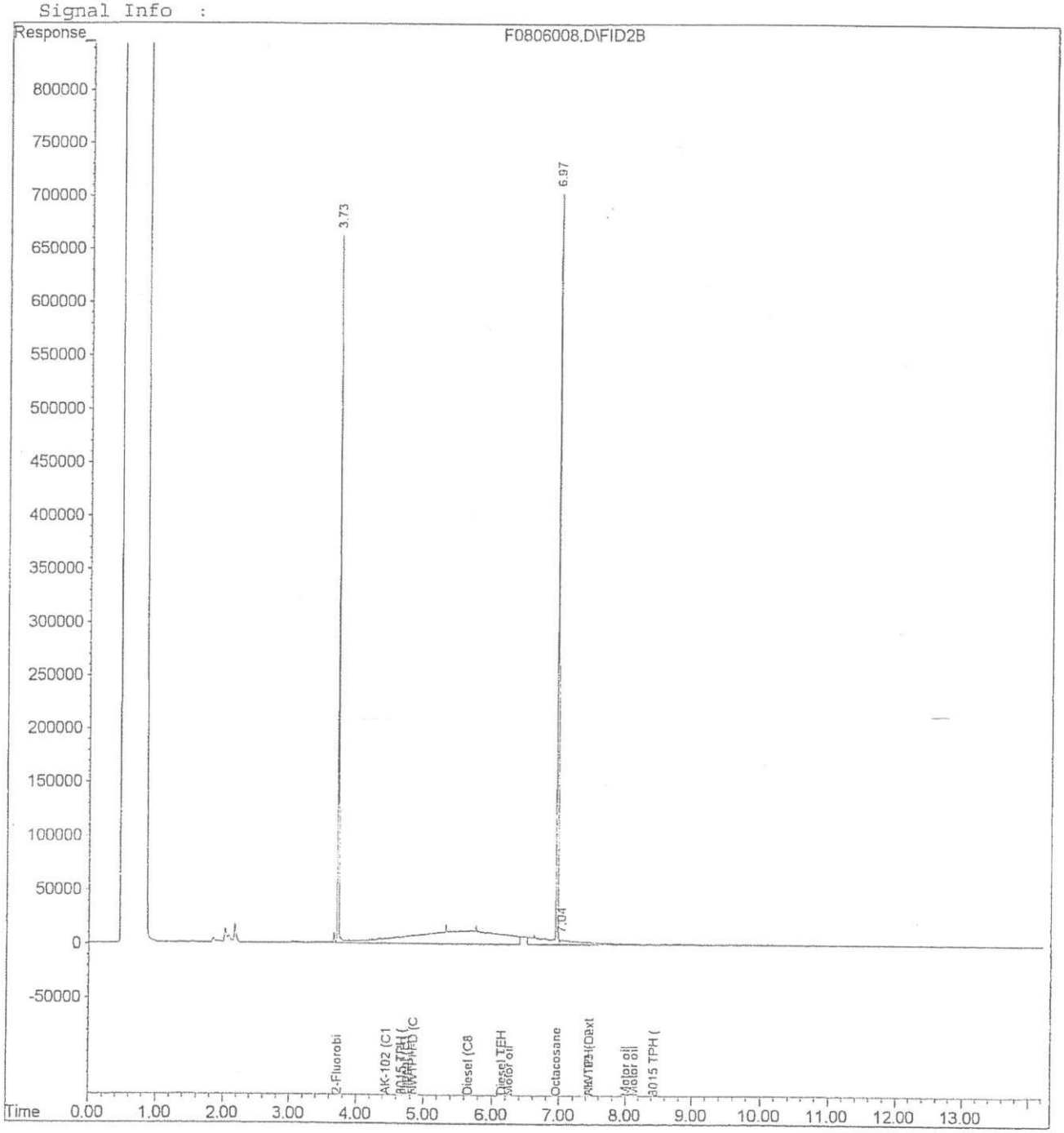


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806008.D Vial: 54
Acq On : 8 Jun 2006 15:35 Operator: GSM
Sample : bpf0087-15 Inst : GC-7
Misc : 1x nwtph-dx water Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:17 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

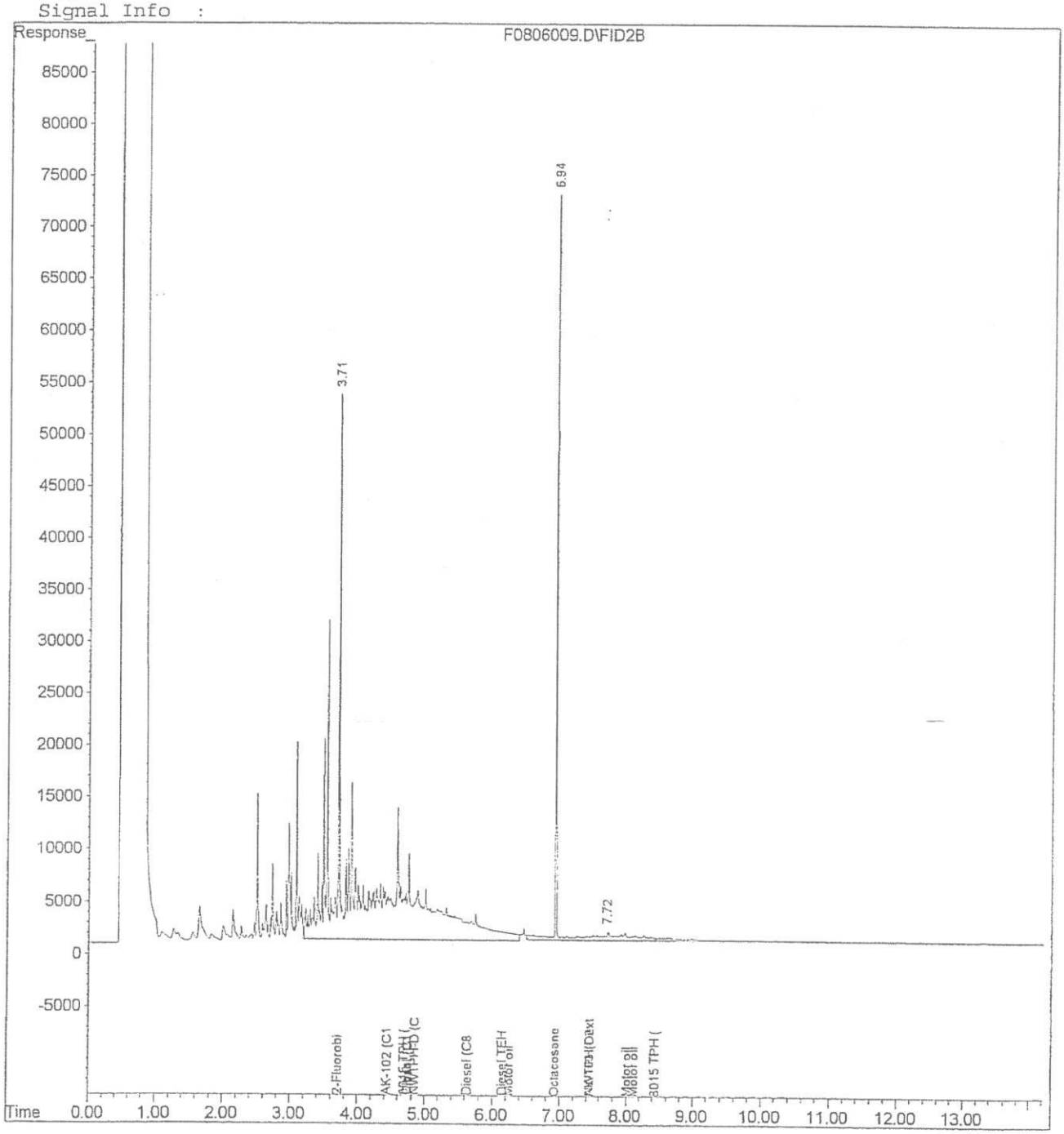


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806009.D Vial: 55
Acq On : 8 Jun 2006 16:04 Operator: GSM
Sample : bpf0087-16 Inst : GC-7
Misc : 20x nwtph-dx water Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:17 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

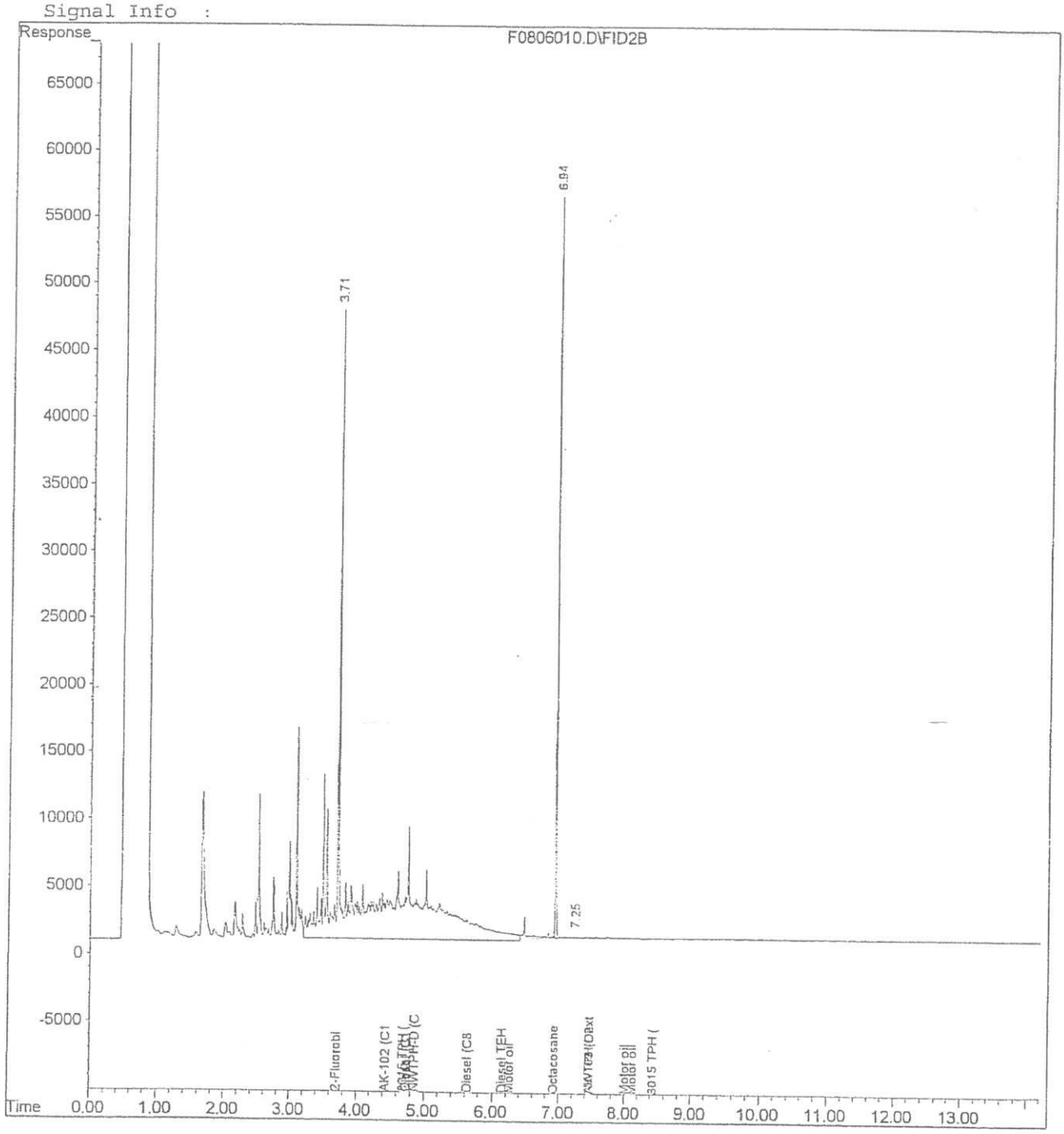


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806010.D Vial: 56
Acq On : 8 Jun 2006 16:19 Operator: GSM
Sample : bpf0087-17 Inst : GC-7
Misc : 20x nwtph-dx water Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:18 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :

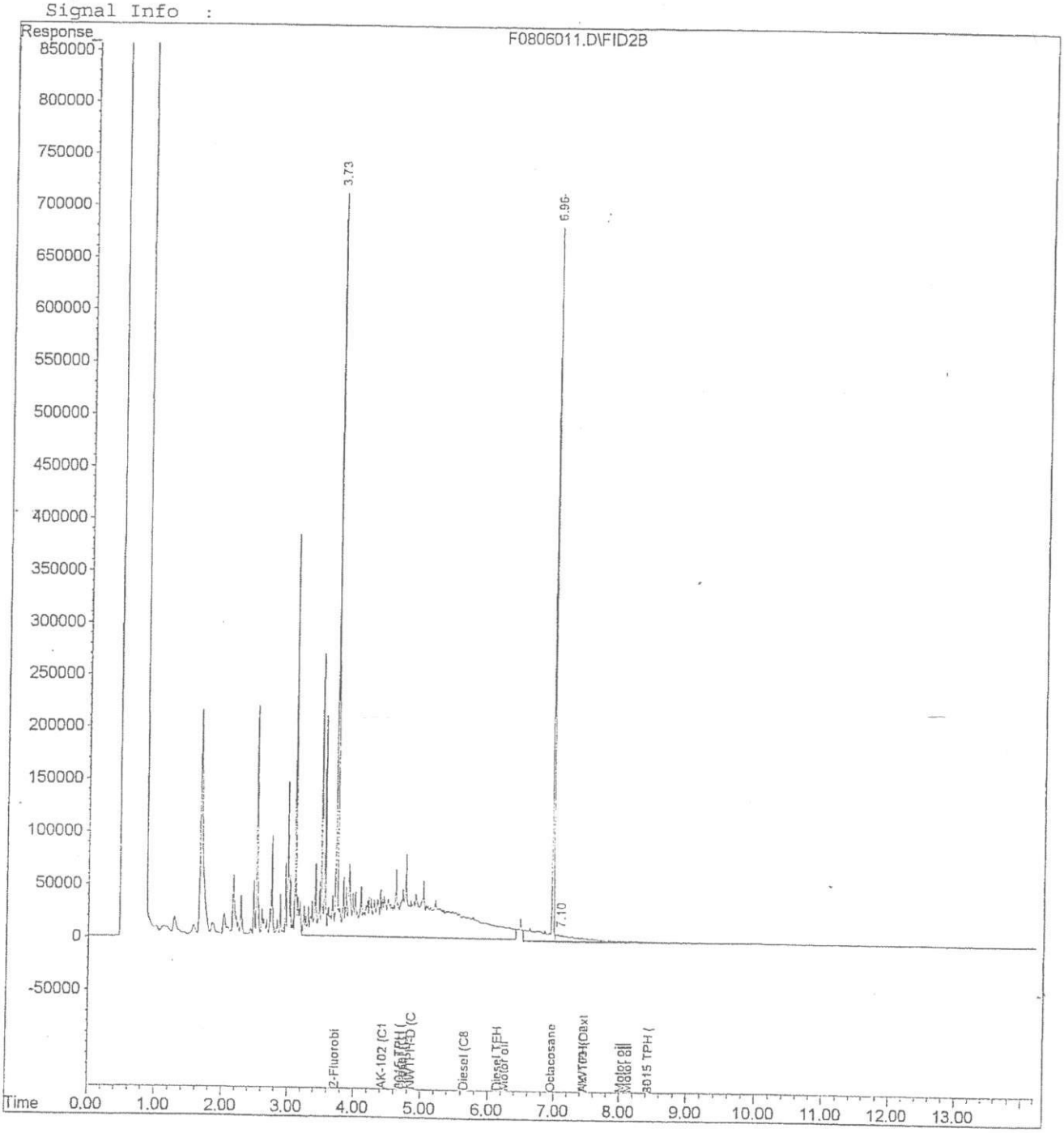


Quantitation Report

Data File : C:\HPCHEM\1\DATA\060806.SEC\F0806011.D Vial: 57
Acq On : 8 Jun 2006 16:45 Operator: GSM
Sample : bpf0087-18 Inst : GC-7
Misc : 1x nwtph-dx water Multiplr: 1.00
IntFile : TPH.E
Quant Time: Jun 9 8:18 2006 Quant Results File: RRF0706.RES

Quant Method : C:\HPCHEM\1\METHODS\RRF0706.M (Chemstation Integrator)
Title : GC#7 TPH-Dx Rear Column
Last Update : Thu Jun 08 12:24:52 2006
Response via : Multiple Level Calibration
DataAcq Meth : TPHF.M

Volume Inj. :
Signal Phase :
Signal Info :



APPENDIX D

Test Pit Logs

Cornet Bay Marina
Test Pit Logs

Test Pit CB-TP1

Date: 6/1/2006 Time: 0900 - 1015

Depth (ft bgs)		Soil Description	Sample Number	Sample Time	PID Reading (ppm)	Analyses	Comments
surface		Gravel					Scraped away.
0 -	4	Medium dense, dark gray, slightly silty, gravelly SAND to sandy GRAVEL; moist. Some cobbles.	CB-TP1-SS-2 at 2 ft bgs	0920	--	GRO, DRO	
4 -	5	Dense, dark gray, silty gravelly SAND; moist to wet; strong HC odor.	CB-TP1-SS-4 at 4 ft bgs	0930	402	GRO, DRO, TCLP benzene	Water seeping into pit at 5 ft bgs. Possible product entering pit. Soil stained darker from ~3.5 ft bgs to bottom of pit. Sheen, strong odor.

Test Pit CB-TP2

Date: 6/1/2006 Time: 1030 - 1230

Depth (ft bgs)		Soil Description	Sample Number	Sample Time	PID Reading (ppm)	Analyses	Comments
surface		Gravel					Scraped away.
0 -	1	Brown, silty SAND.					
1 -	3.5	Dense, dark gray, silty, sandy GRAVEL with cobbles; moist. No odor.	CB-TP2-SS-2 at 2 ft bgs	1045	12.8	GRO, DRO	A small diameter (~1/2 in) section of copper pipe pulled up at about 1 ft bgs. Looked old - possilbly buried debris?
3.5 -	4	Increasing silt content.					Strong HC odor while excavating at 3.5 ft.
4 -	5	Dense, gray, clayey SILT, trace sand; moist. Strong HC odor.	CB-TP2-SS-4 at 4 ft bgs	1100	1781	GRO, DRO, COD, TOC, TN, P, K	Shelby tube (vertical) collected from bottom of pit at 4 - 4.5 ft bgs. Different odor from that at TP1 - more biting.
5 -	6	Dense, gray, clayey SILT/silty CLAY. Some gravel and cobbles. Strong HC odor. Water seeping into hole.	CB-TP2-SS-6	1130	240	GRO, DRO	Very strong HC odor while excavating at 5 ft. Sheen on water dipped from hole.

Test Pit CB-TP3

Date: 6/1/2006 Time: 1255 - 1535

Depth (ft bgs)		Soil Description	Sample Number	Sample Time	PID Reading (ppm)	Analyses	Comments
surface		Gravel					Scraped away.
0 -	1	Brown sandy GRAVEL with cobbles.					
1 -	2.5	Dense gray, silty CL:AY/clayey SILT. Strong HC odor.	CB-T3-SS-1.5 at 1.5 ft bgs	1305	>2000	GRO, DRO	
2.5 -	6	Medium dense, gray, silty, gravelly SAND; moist; HC odor.	CB-TP3-SS-4 at 4 ft bgs	1315	360	GRO, DRO, COD, TOC, TN, P, K	Collected 2 Shelby tubes - 1 horizontal at 4 ft bgs, 1 vertical at 4 - 4.5 ft bgs.
	>6	More silt/clay with depth. Clayey material observed at base of excavation (below 6 ft).	CB-TP3-SS-6 at 6 ft bgs	1330	211	GRO, DRO	Wet at 6 ft; water seeping into hole. Left hole open temporarily for water to collect.

Test Pit CB-TP4

Date: 6/1/2006 Time: 1350 - ***1600***

Depth (ft bgs)		Soil Description	Sample Number	Sample Time	PID Reading (ppm)	Analyses	Comments
surface		Gravel					Scraped away.
0 -	0.6	Sand and gravel.					
0.6 -	4	Dense, gray, silty CLAY/clayey SILT; moist. No HC odor.	CB-TP4-SS-2 at 2 ft bgs	1405	0.0	GRO, DRO	
3.5 -	4	Dense, gray, silty CLAY/clayey SILT; trace to slightly sandy; wet. No HC odor.	CB-TP4-SS-4 at 4 ft bgs	1415	0.0	GRO, DRO	Left hole open temporarily to let water collect. Possible sheen on water.

Test Pit CB-TP5

Date: 6/1/2006 Time: 1600 - 1700

Depth (ft bgs)		Soil Description	Sample Number	Sample Time	PID Reading (ppm)	Analyses	Comments
surface		Gravel					Scraped away.
0 -	3	Dense silt/clay.					No 2 ft sample collected from this location, per plan.
3 -	6	Clayey SILT with sand and gravel, grades to clayey, gravelly SAND with depth. At 4 ft, dense, gray clayey SILT with sand and gravel; moist to wet; HC odor.	CB-TP5-SS-4 at 4 ft bgs	1630	172	GRO (+ dup), DRO (+ dup), TCLP benzene, COD, TOC, TN, P, K	PID readings in breathing zone reached 75 ppm while excavating this hole. Moved upwind. Digging below 4 ft, pulled up piece of cable with crimped-on bolt attachements on both ends. Buried debris?

APPENDIX E

Shelby Tube Analytical Results

Analytical Resources, Incorporated
Analytical Chemists and Consultants

June 15, 2006

Mr. Kortland Orr
Test America, Inc.
11720 North Creek Parkway North, Suite 400
Bothell, WA 98011

Subject: Project No.: BPF0059;
ARI Project No.: JK82

Dear Mr. Orr;

The following pages provide the information you requested. The report consists of tables, plots and a narrative describing the testing methods. Please call me to discuss any questions, or comments you may have on the data or its presentation.

Best Regards,
Analytical Resources Incorporated

Harold Benny

Harold Benny
Geotechnical Division Manager
206-695-6246
haroldb@arilabs.com

Enclosures

cc: File JK82

Analytical Resources, Incorporated
Analytical Chemists and Consultants

Client: Test America	Project No.: JK82
Client Project: BPF0059	

Case Narrative

1. The samples were submitted for grain size analysis according to ASTM methodology, and hydraulic conductivity by ASTM D5084.
2. Sample BPF0059-01 was sandy clayey silt with balls of soft gray clay. It had a strong fuel odor. It also had a large rock, about 1.5" in diameter near the top of the specimen. This was not found until after the conductivity test. The presence of fuel and large rock may have affected the testing.
3. Sample BPF0059-02 was gravelly silty sand with occasional balls of clay.
4. Sample BPF0059-03 was gravelly silty sand and contained a layer of decomposed woody material and occasional balls of soft clay. The bits of wood were up to 1" in length. The woody layer was not seen until after the test when the sample was split for examination.
5. The grain size tests were run according to ASTM D422, both sieve and hydrometer analysis.
6. The after test saturation of samples 2 and 3 was very low due partially to the initially low saturation, and also to the balls of clay which may not have had time to fully saturate during the test.
7. The data is provided in summary tables and plots.
8. There were no other noted anomalies in the samples or methods on this project.

Approved by: Heidi Berry Date: 6/15/06
Title: Geotechnical Division Manager

SUBCONTRACT ORDER

TestAmerica - Seattle, WA

5182

BPF0059 19.6°C Ice-No

SENDING LABORATORY:	RECEIVING LABORATORY:
TestAmerica - Seattle, WA	ARI
11720 North Creek Parkway North, Suite 400	4611 S 134th Pl Ste 100
Bothell, WA 98011-8223	Tukwila, WA/USA 98168
Phone: (425) 420-9200	Phone :206-621-6490
Fax: (425) 420-9210	Fax: 206-621-7523
Project Manager: Kortland Orr	

Analysis	Due	Expires	Laboratory ID	Comments
Sample ID: BPF0059-01 Soil	**Sampled: 06/01/06 12:00**			**Client is Jil Frain of EA Engineering**
Misc. Subcontract 3	06/14/06 23:59	11/28/06 12:00		Particle Size to ARI
Misc. Subcontract 1	06/14/06 23:59	11/28/06 12:00		Hydraulic Conductivity to ARI
Misc. Subcontract 2	06/14/06 23:59	11/28/06 12:00		Porosity to ARI to ARI
Dry Weight	06/14/06 23:59	06/29/06 12:00		(Sp. G)
Containers Supplied:				
Metal Core (A)				
Sample ID: BPF0059-02 Soil	**Sampled: 06/01/06 12:00**			**Client is Jil Frain of EA Engineering**
Misc. Subcontract 3	06/14/06 23:59	11/28/06 12:00		Particle Size to ARI
Misc. Subcontract 1	06/14/06 23:59	11/28/06 12:00		Hydraulic Conductivity to ARI
Misc. Subcontract 2	06/14/06 23:59	11/28/06 12:00		Porosity to ARI to ARI
Dry Weight	06/14/06 23:59	06/29/06 12:00		(Sp G)
Containers Supplied:				
Metal Core (A)				
Sample ID: BPF0059-03 Soil	**Sampled: 06/01/06 12:00**			**Client is Jil Frain of EA Engineering**
Misc. Subcontract 3	06/14/06 23:59	11/28/06 12:00		Particle Size to ARI
Misc. Subcontract 1	06/14/06 23:59	11/28/06 12:00		Hydraulic Conductivity to ARI
Misc. Subcontract 2	06/14/06 23:59	11/28/06 12:00		Porosity to ARI to ARI
Dry Weight	06/14/06 23:59	06/29/06 12:00		(Sp G)
Containers Supplied:				
Metal Core (A)				

Released By	Date	Received By	Date
Cathy Gamble	6/5/06	B. Zuk	6/5/06 1330
Released By	Date	Received By	Date

Cooler Receipt Form

ANALYTICAL RESOURCES INCORPORATED

ARI Client: Test America — Project Name: BPF0059

COC NO.: — — Delivered By: Hand

Tracking NO.: — — Date: 6/5/06

ARI Job No.: 5L82 — Lims NO.: —

Preliminary Examination Phase:

1. Were intact, properly signed and dated custody seals attached To the outside of the cooler?	(YES)	NO
2. Were custody papers included with the cooler	(YES)	NO
3. Were custody papers properly filled out (ink, signed etc.)?	(YES)	NO
4. Complete custody forms and attach all shipping documents	(OK)	NA

Cooler Accepted BY: [signature] Date: 6/5/06 Time: 1330

Log-IN Phase:

5. Was a temperature blank include in the cooler?	YES	(NO)
6. Record Cooler Temperature	19.6 °C	
7. What kind of packing material was used?	—	
8. Was sufficient ice used (if appropriate)?	YES	(NO)
9. Were all bottles sealed in separate plastic bags?	YES	(NO)
10. Did all bottles arrive in good condition (unbroken)?	(YES)	NO
11. Were all bottle labels complete and legible?	(YES)	NO
12. Did all bottle labels and tags agree with custody papers?	(YES)	NO
13. Were all bottles used correct for the requested analyses?	(YES)	NO
14. Do any of the analyses (bottles) require preservative? (If so, Preservation checklist must be attached)	YES	(NO)
15. Were all VOA vials free of air bubbles?	~~YES~~	~~NO~~
16. Was sufficient amount of sample sent in each bottle?	(YES)	NO
17. Notify Project Manager of any discrepancies or concerns	(OK)	NA

Cooler Opened By: [signature] Date: 6/5/06 Time 1330

Explain any discrepancies or negative responses:

ANALYTICAL RESOURCES INCORPORATED

Test America
BPF0059

Test Results for Flexible Wall Hydraulic Conductivity Testing

Sample Identification	Depth (ft)	As Received Sample Parameters				After Test Sample Parameters				Gradient (h/l)	Hydraulic Conductivity (cm/s)
		Wet Density (lbs/ft^3)	Total Porosity	Saturation	Moisture Content (%)	Wet Density (lbs/ft^3)	Total Porosity	Saturation	Moisture Content (%)		
BPF0059-01	NA	125.9	0.410	0.941	23.6	127.3	0.400	0.955	23.0	9.30	1.74E-07
BPF0059-02	NA	126.6	0.334	0.794	15.0	126.6	0.355	0.908	18.9	8.20	3.13E-07
BPF0059-03	NA	104.3	0.499	0.835	33.2	108.5	0.480	0.913	33.7	1.20	8.97E-06

Notes:

1. The samples were tested in accordance with ASTM D-5084.
2. The tests were performed using tap water for the permeant.
3. The porosity and the saturation were calculated using measured specific gravity values.

Sample Description and Dimensions

Sample ID	Depth (ft)	Visual Description	Confining Pressure (psi)	Initial Average Length (cm)	Initial Average Diameter (cm)	Final Average Length (cm)	Final Average Diameter (cm)
BPF0059-01	NA	Sandy, Clayey Silt; Balls of soft gray clay present. Fuel Odor	5.0	10.62	7.19	10.37	7.22
BPF0059-02	NA	Gravelly, Silty, Sand with occ balls of clay	5.0	10.98	7.10	10.75	7.30
BPF0059-03	NA	Gravelly, Silty Sand, contained up to 1" woody pieces and balls of clay.	5.0	9.66	7.30	9.43	7.26

JK82

ANALYTICAL RESOURCES INCORPORATED

Test America
BPF0059

Percent Finer (Passing) Than the Indicated Size

Sieve Size (microns)	2"	1"	3/4"	1/2"	3/8"	#4 (4750)	#10 (2000)	#20 (850)	#40 (425)	#60 (250)	#100 (150)	#200 (75)	32	22	13	9	7	3.2	1.3
BPF0059-01	100	100	100	100	100	99	97	96	91	83	79	76	67	61	54	48	43	32	24
BPF0059-02	100	100	91	84	79	74	68	62	51	34	25	19	16	14	14	11	10	8	6
BPF0059-03	100	91	80	68	66	60	53	48	38	24	16	12	11	9	8	8	7	5	4

Testing performed according to ASTM D421/D422

JK82

ANALYTICAL RESOURCES INCORPORATED

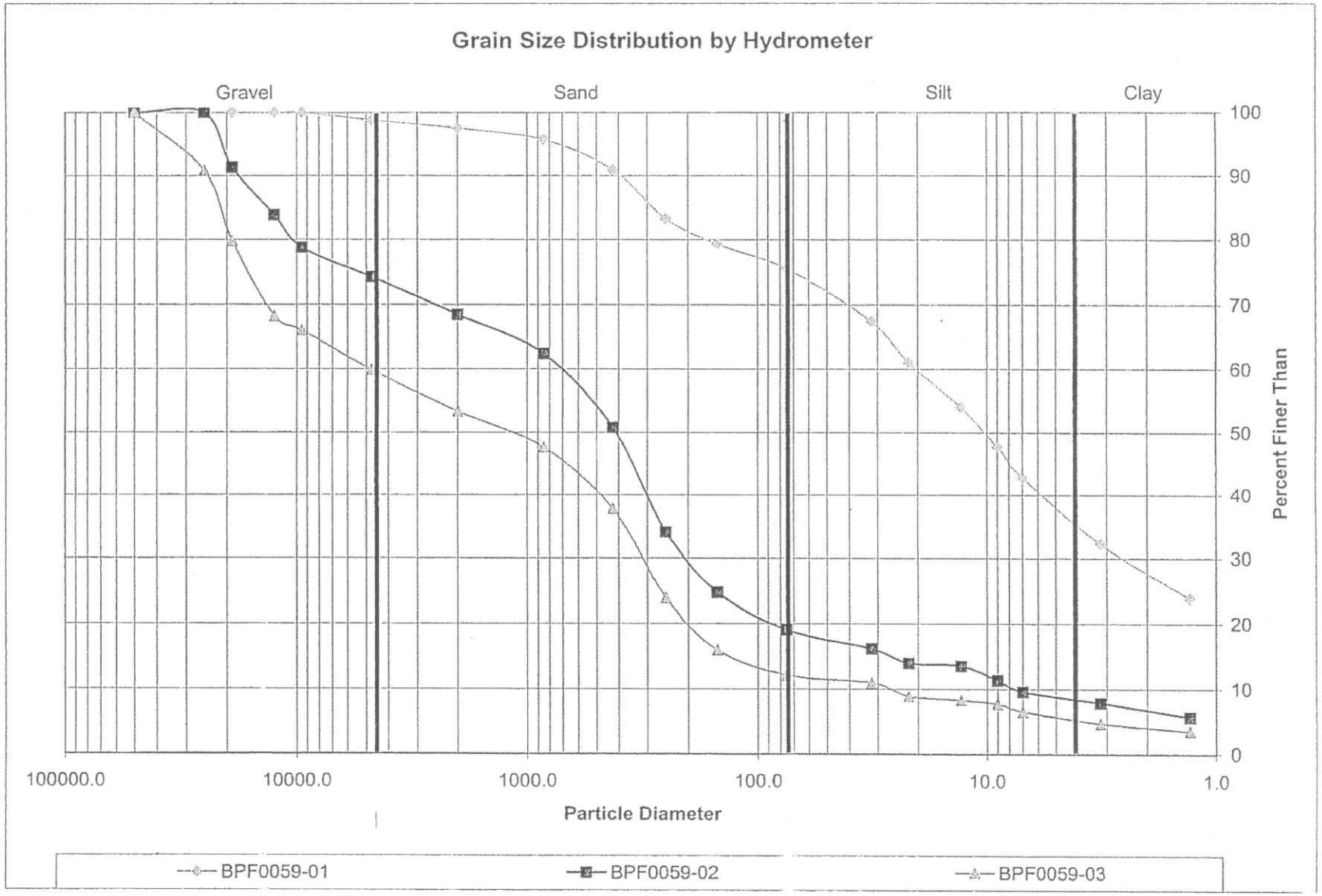
Test America
BPF0059

Percent Retained in Each Size Fraction

Description	% Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Very Coarse Silt	% Coarse Silt	% Medium Silt	% Fine Silt	% Fine Silt	% Very Fine Silt	% Clay
Particle Size (microns)	> 4750	4750-2000	2000-425	425-75	75-32	32-22	22-13	13-9	9-7	7-3.2	<3.2
BPF0059-01	1.2	1.3	6.5	15.4	8.2	6.3	7.0	6.3	4.9	10.5	32.3
BPF0059-02	25.7	5.9	17.6	31.7	2.9	2.2	0.4	2.2	1.7	1.7	7.9
BPF0059-03	40.1	6.5	15.5	25.7	1.1	2.1	0.6	0.6	1.2	1.8	4.7

JK82

ANALYTICAL RESOURCES INCORPORATED



APPENDIX F

Bulkhead Assessment

Cornet Bay Marina
Bulkhead Assessment

November 8, 2006

ReidMiddleton
728 134th Street SW, Suite 200
Everett, WA 98204-5322
www.reidmiddleton.com
Ph. (425) 741-3800
Fax (425) 741-3900
File No. 242006.015

ReidMiddleton

November 8, 2006
File No. 242006.015

Engineers
Planners
Surveyors

Ms. Jil Frain
EA Engineering, Science, and Technology
12011 NE First Street, Suite 100
Bellevue, WA 98005

Subject: Cornet Bay Marina Bulkhead Assessment

Reference: Agreement for Professional Services, dated September 1, 2006

Dear Ms. Frain:

The Washington State Department of Ecology (DOE) will conduct environmental restoration involving soil cleanup at Cornet Bay Marina in Oak Harbor, Washington. Prior to performance of the environmental work, Reid Middleton was contracted to perform an assessment of a timber bulkhead at the Marina. Reid Middleton, Inc. is a civil and structural engineering, planning, and surveying firm that provides multidisciplinary development services in the Pacific Northwest and Alaska. We specialize in designing and managing projects in the aviation, military, public works, commercial and industrial, state and institutional, and waterfront areas.

The assessment will determine the condition of the timber bulkhead, comment on proposed construction activities and constraints to protect the bulkhead, and provide an opinion of probable design and construction costs for a replacement bulkhead (if required).

Bulkhead Field Investigation

Reid Middleton conducted the field investigation on September 7, 2006. The weather was partly sunny. The tide was falling to a low tide of 0.0 feet (MLLW=0.0) during the first three hours; high tide was about seven hours later. Field observation at the base of the bulkhead was performed without tidal water present. The tidewater did not reach the bulkhead during the entire field investigation.

The bulkhead was constructed in the 1960s and is approximately 300 feet long. The investigation was performed on foot by a two-person team. The investigation included visual, sounding, and limited destructive evaluations. Sounding involves hitting the timber elements with a hammer and listening for hollow areas. Limited destructive evaluation for a timber structure involves drilling timber elements to determine the size of rot pockets and remaining element thickness.

Washington
Oregon
Alaska

Reid Middleton, Inc.
728 134th Street SW
Suite 200
Everett, WA 98204

Ph: 425 741-3800
Fax: 425 741-3900

The investigation began at the north junction of the bulkhead at the "Shell" sign and proceeded south to the walkway to the marina. Subsequent numbering of elements is from north to south, see Figure 1. The main focus of the investigation is a section of bulkhead approximately 170 feet long. The 40-foot long section of bulkhead north of the "Shell" sign was also investigated.

Construction plans are not available for the bulkhead, which consists of creosote-treated timber piling spaced 4 feet on center. Four creosote-treated horizontal walers are behind the piling. Vertical creosote-treated timber planks are attached to the walers. Steel cable tie-backs are wrapped around the top of the piling and angled into the retained fill material. Due to the presence of fill behind the bulkhead, field personnel were unable to determine the type, arrangement, and location of the tie-back anchors. Excavation to the anchors was not included in this scope of work.

Investigation Results

There are three areas of notable deterioration of piling. The following groups of piling are rotten: Piling 4, 5, 13, 14, 15, 45, and 46. Cable tie-backs have some minor surface rust.

There are several locations where the lowest level walers are rotten. The most notable location is the rotten waler that spans from Pile 28 to Pile 33.

Several timber planks were rotten, typically from the mudline up to 3 feet above the mudline. There were a few areas where a small amount of fine fill material has migrated through the timber plank joint or deteriorated location.

The locations of deterioration for piling, walers, and planks did not overlap; so there were no compounding effects on the bulkhead integrity.

Estimated Life Expectancy

A visual and limited destructive evaluation was performed on the timber bulkhead at Cornet Bay Marina. The bulkhead is rated as fair condition. This rating is due primarily to the condition of the piling and lowest level walers. The deteriorated state of the piling and walers is due to checks, splits, construction notching, or mechanical damage that allows water and marine borers to enter the members.

Based on the age and condition of the bulkhead, the life expectancy of the timber planks is estimated to be between seven and ten years. The life expectancy of the piling is anticipated to be between eight and twelve years. Life expectancy of the lowest level walers is estimated at five to eight years. Life expectancy is defined as

individual member failure. Total failure of a portion of the bulkhead would be due to failure of numerous individual elements. There should be evidence of partial failure of the bulkhead in about 10 years. This would likely involve failure of a small section of bulkhead or localized bulging of the bulkhead.

Construction Activities Measures

The following are proposed construction activities that may occur adjacent to the bulkhead.

- Remove soil on the shore side of bulkhead using an excavator to a maximum depth of 9 feet below finished grade.
- Drill holes 4 to 6 feet shore side from the bulkhead using a drill rig to a depth of approximately 15 feet from finished grade.
- Dig and fill trenches 2 to 4 feet deep within 4 to 6 feet shore side of bulkhead.
- Move and replace the store and its concrete foundation.

The following constraints or measures to protect the bulkhead are recommended for each activity.

Remove Soil

Soil material may be removed on the shore side of the bulkhead to a maximum depth of 9 feet below finished grade if the following criteria are followed. No equipment will be allowed within the "no load zone" adjacent to the bulkhead. This no load zone is defined as 16 feet landward from the bulkhead. Any equipment used must be able to reach from 16 feet away. Equipment beyond the no load zone must be placed on a timber raft to distribute the equipment load so that the maximum loading is 100 pounds per square foot. See Figure 6 for an example of equipment on a timber raft. During the excavation procedure, a slope of 30 degrees must be maintained for the excavation area for soil stability under the equipment. In addition, the existing cable tie-backs are not to be removed until 7 feet of depth of soil material is removed from behind the bulkhead. Maximum wall length where tie-backs are removed should be limited to 50 feet. See the attached Figure 2 for details.

Drill Rig

A drill rig may be used on soil that has not been disturbed; thus, no excavation shall occur prior to use of a drill rig. The drill rig should stay a minimum of 6 feet

landward from the bulkhead. The drill rig must be placed on a timber raft to distribute the load so the maximum loading is 100 pounds per square foot. Maximum weight of the drill rig is limited to 20,000 pounds. In addition, the drill rig should only be used for a maximum duration of 4 hours at any location. See attached Figure 3 for details.

If the drill rig is used in an area located 19 feet or farther land side of the bulkhead, then no restrictions are required.

Trenches

Digging and filling trenches 2 to 4 feet wide within 4 to 6 feet from the bulkhead will be allowed with a 16-foot wide no load zone. This requires trenching equipment to stand off 16 feet from the bulkhead and reach 10 to 12 feet. The equipment must use a timber raft to distribute loads, so the maximum loading is 100 pounds per square foot.

Store

The equipment used to move and replace the store and its concrete foundation shall be located east of the store; however, if equipment needs to get close to the west side of the store, a 19-foot wide no load zone must be followed, see Figure 4. No weight restrictions are required beyond the 19-foot no load zone.

General Constraint

There are no restrictions on equipment weight or construction activities if they occur beyond a 19-foot no load zone from the bulkhead, see Figure 4. A minimum of 2 feet of undisturbed soil cover over the existing tie-back anchor must be maintained to avoid loss of integrity of anchor, see Figure 5. Once an anchor is encountered, the maximum depth of excavation is limited to 2 feet above any anchor throughout the project.

Bulkhead Replacement

We recommend a steel sheet pile and steel tie-back system as the most appropriate replacement bulkhead for the site conditions. The preferred location of the new bulkhead would be water side of the existing bulkhead, with the existing bulkhead abandoned in place. Abandonment of the bulkhead in place would be based on permitting approval. The opinion of probable cost is based on replacing the entire bulkhead. This includes the same segments of bulkhead that were inspected, which are approximately 170 and 40 feet long, plus a 105-foot long section not investigated, for a total of 315 linear feet.

Opinion of Probable Costs

A preliminary opinion of probable cost to design and construct a replacement steel sheet pile bulkhead for the 315 linear feet is $1,070,000. The following elements are included in the design cost: Site surveying, permitting, soil report (include site sample testing), structural calculations, construction cost estimate, specifications, and drawings. An additional $50,000 should be added to the budget if assistance during the bidding phase of the construction contract is required.

Conclusion

Approximately 210 linear feet of bulkhead was investigated during a visual, sounding, and limited destructive evaluation of the timber bulkhead at the Cornet Bay Marina. The bulkhead is in fair condition due to the piling and lowest level walers. Life expectancy is defined as individual member failure. There should be evidence of partial failure of the bulkhead in about 10 years. This would typically involve failure of a small section of bulkhead or localized bulging of the bulkhead.

Based on the age and condition of the bulkhead, the life expectancy is anticipated to be between seven and ten years for the timber planks, eight and twelve years for the piling, and five to eight years for the lowest level walers.

Soil removal may be performed with a no load zone 16 feet landward from the bulkhead. Additional constraints include equipment placed on a timber raft to distribute load to 100 pounds per square foot maximum, maintaining a 30-degree slope during excavation, and not removing cable tie-backs until 7 feet of soil material behind the bulkhead is removed. Maximum wall length where tie-backs are removed should be limited to 50 feet.

A drill rig with a maximum weight of 20,000 pounds may be used on undisturbed soil. Added constraints include using a timber raft to distribute the load to 100 pounds per square foot maximum and using the drill rig for no more than four hours at any location.

Trenches may be dug and filled adjacent to the bulkhead if a no load zone 16 feet landward from the bulkhead is used. In addition, trenching equipment must use a timber raft to distribute loads to 100 pounds per square foot maximum, in an area 16 to 19 feet landward of the bulkhead.

Equipment used to move and replace the store and its concrete foundation should be located east of the store. If equipment needs to access the west side of the store, a 19-foot no load zone landward from the bulkhead must be followed.

There are no restrictions on construction activity 19 feet landward from the bulkhead. Any construction activity that occurs 16 to 19 feet landward from the bulkhead requires using a timber raft to distribute equipment loading to 100 pounds per square foot maximum.

A sheet pile with steel tie-back system is the recommended replacement bulkhead if necessary. A budgetary cost estimate of $1,070,000 should be planned for the design and construction of the replacement steel sheet pile bulkhead. This estimate is for the entire length of bulkhead, which is approximately 315 linear feet. The replacement bulkhead is to be installed waterward of the existing bulkhead. Abandonment of the existing bulkhead in place is conditioned on permitting approval.

Sincerely,

Reid Middleton, Inc.

Jason K. Kikuta, P.E.
Project Engineer

Attachments:

Figure 1 - Marina Site Map
Figure 2 – Construction Activity Measures
Figure 3 – Construction Activity Measures
Figure 4 – Construction Activity Measures
Figure 5 – Construction Activity Measures
Figure 6 – Equipment on Timber Raft

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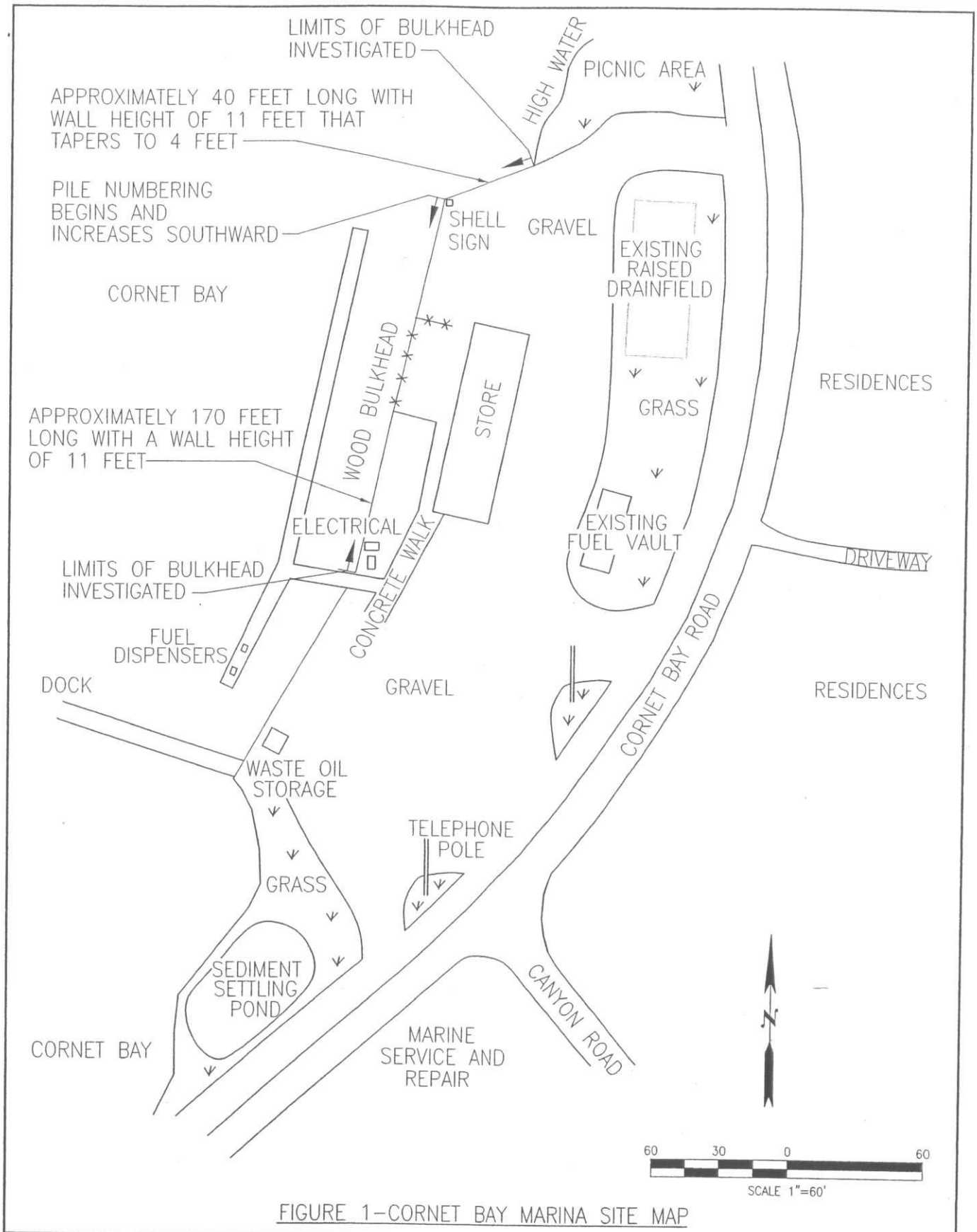


FIGURE 1–CORNET BAY MARINA SITE MAP

CORNET BAY MARINA	REFERENCE TO SHEET		
	DES. JKK	SCALE AS SHOWN	SHEET NO.
ReidMiddleton	DR. CSM	F.B.	FIG. 1
728 134th Street SW · Suite 200 Everett, Washington 98204 Ph: 425 741-3800	CH.	DATE 9-29-06	
	FILE NO. 24.06.015		OF X SHEETS

11/01/2006 10:25am I:\24\06\015\ASSESSMENT\1415-FIG1.dwg

11/01/2006 10:25am I:\24\06\015\ASSESSMENT\1415-FIG2.dwg

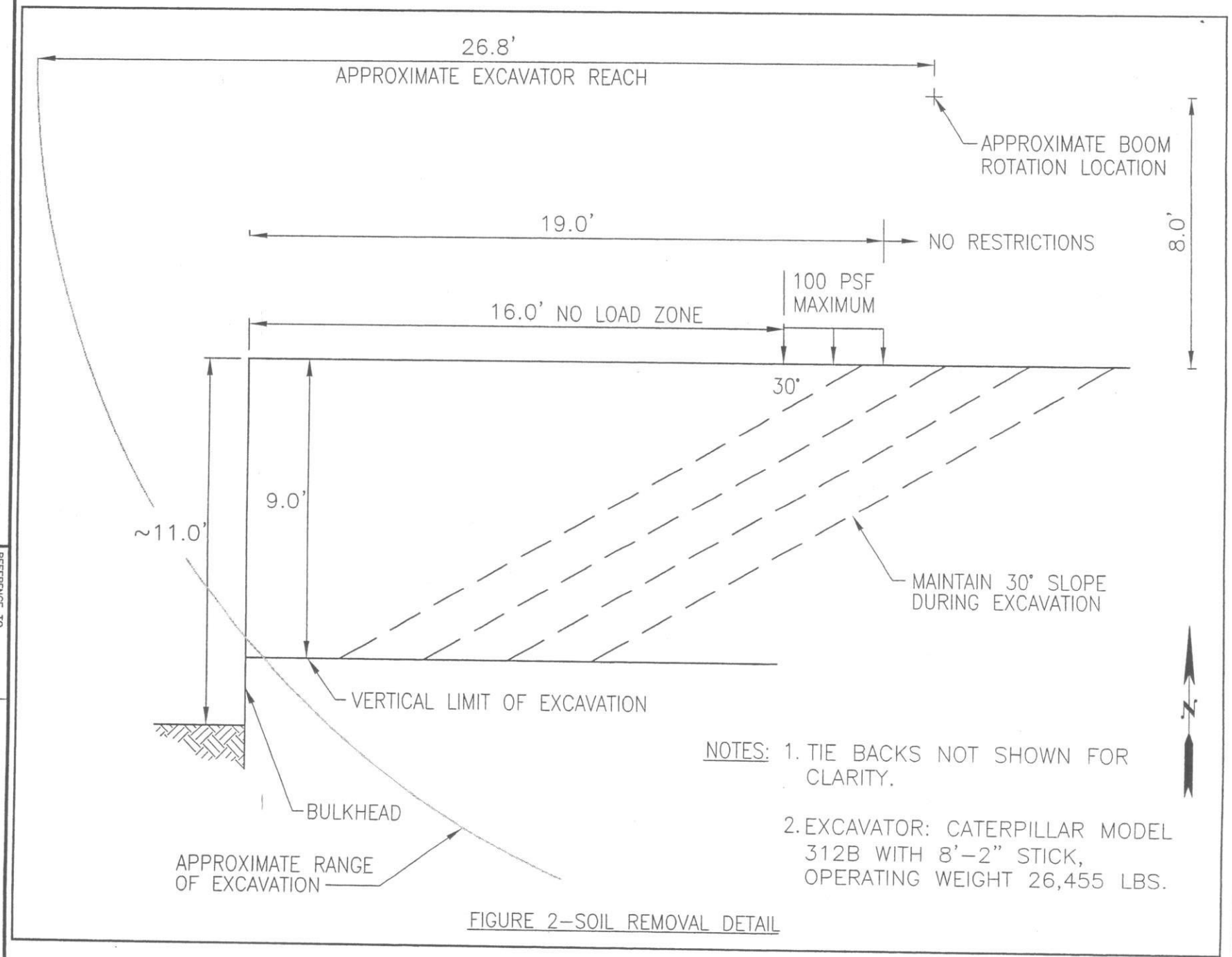
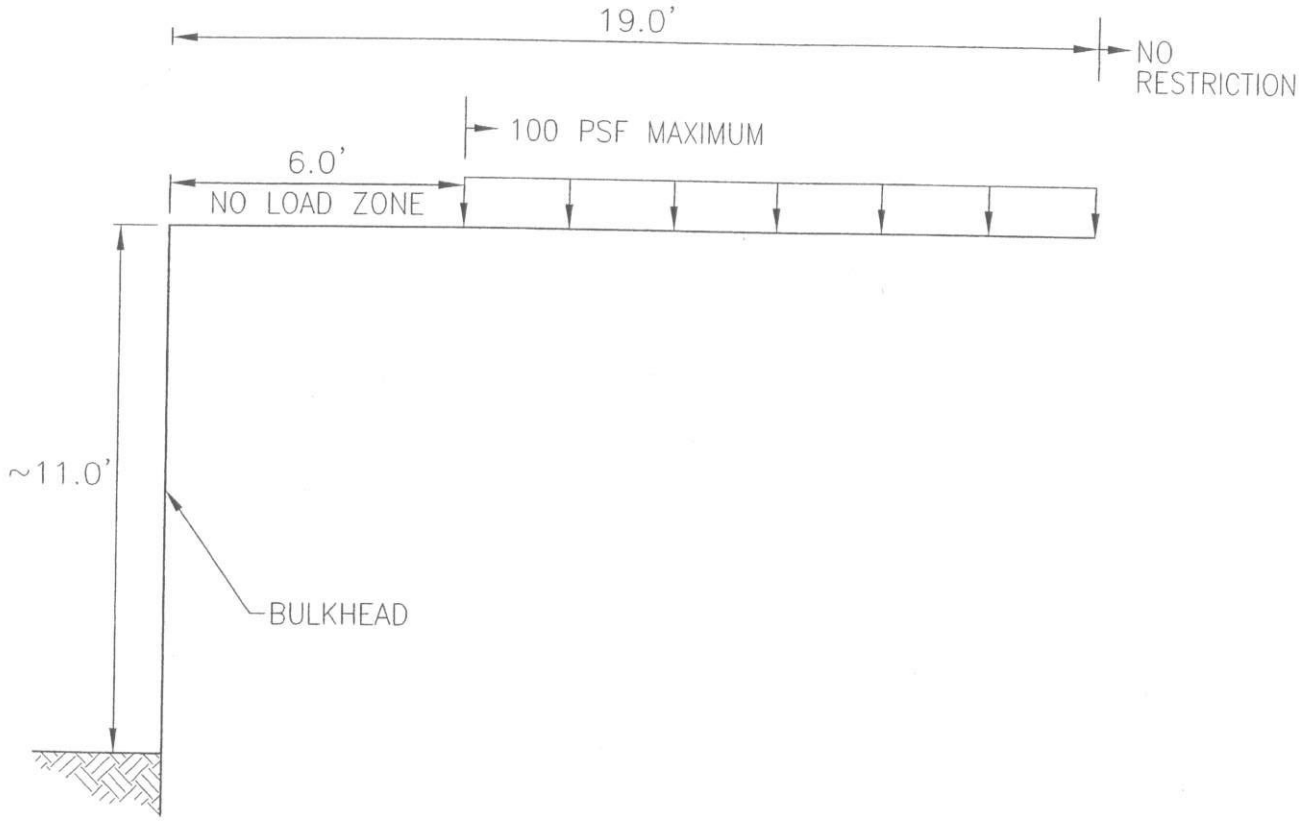


FIGURE 2-SOIL REMOVAL DETAIL

ReidMiddleton
728 134th Street SW · Suite 200
Everett, Washington 98204
Ph: 425 741-3800

CORNET BAY MARINA
CONSTRUCTION ACTIVITY MEASURES

REFERENCE TO SHEET	
DES. JKK	SCALE NONE
DR. CSM	F.B.
CH.	DATE 9-29-06
FILE NO. 24.06.015	SHEET NO. FIG. 2 OF X SHEETS



NOTE: DRILL RIG ALLOWED ONLY ON UNDISTURBED SOIL.

THIS DETAIL IS FOR DRILL RIG APPLICATION ONLY.

N

FIGURE 3–DRILL RIG DETAIL

11/01/2006 10:25am I:\24\06\015\ASSESSMENT\1415-FIG3.dwg

CORNET BAY MARINA
CONSTRUCTION ACTIVITY MEASURES

ReidMiddleton
728 134th Street SW · Suite 200
Everett, Washington 98204
Ph: 425 741-3800

REFERENCE TO SHEET		
DES. JKK	SCALE NONE	SHEET NO.
DR. CSM	F.B.	FIG. 3
CH.	DATE 9-29-06	
FILE NO. 24.06.015		OF X SHEETS

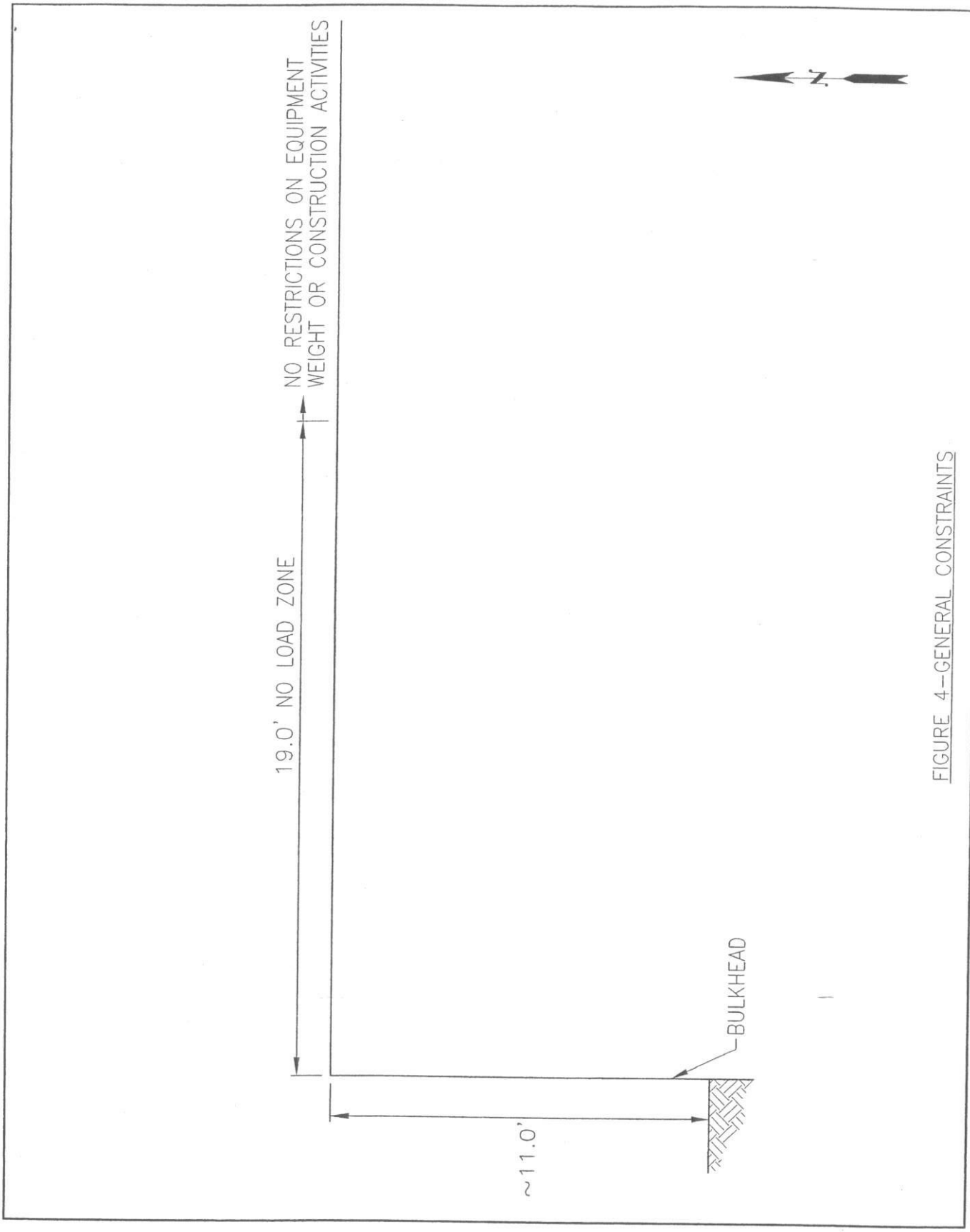


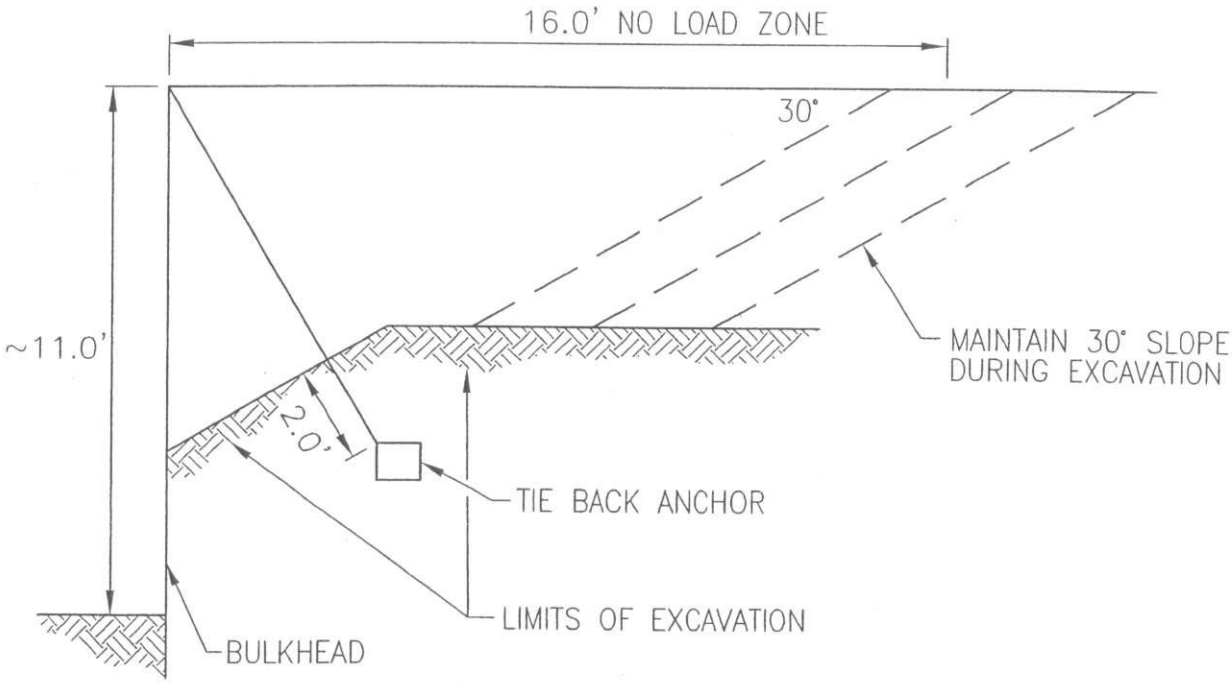
FIGURE 4-GENERAL CONSTRAINTS

11/01/2006 10:49am I:\24\06\015\ASSESSMENT\1415-FIG4.dwg

CORNET BAY MARINA
CONSTRUCTION ACTIVITY MEASURES

ReidMiddleton
728 134th Street SW · Suite 200
Everett, Washington 98204
Ph: 425 741-3800

REFERENCE TO SHEET		
DES. JKK	SCALE NONE	SHEET NO.
DR. CSM	F.B.	FIG. 4
CH.	DATE 9-29-06	
FILE NO. 24.06.015		OF X SHEETS



LIMITS ON EXCAVATION WHEN TIE BACK ANCHOR ENCOUNTERED ABOVE MAXIMUM EXCAVATION DEPTH OF 9 FEET

N

FIGURE 5–GENERAL CONSTRAINTS

CORNET BAY MARINA
CONSTRUCTION ACTIVITY MEASURES

ReidMiddleton
728 134th Street SW · Suite 200
Everett, Washington 98204
Ph: 425 741-3800

REFERENCE TO SHEET		
DES. JKK	SCALE NONE	SHEET NO. FIG. 5
DR. CSM	F.B.	
CH.	DATE 9-29-06	
FILE NO. 24.06.015		OF X SHEETS

11/01/2006 10:50am I:\24\06\015\ASSESSMENT\1415-FIG5.dwg

Figure 6. Equipment on Timber Raft.

APPENDIX G

Building Assessment

INITIAL PROPOSAL

HASSLER BUILDERS, INC.

Contractor's License #HASSLBIO44LL
1840 HASSLER LANE, POB 614
BURLINGTON, WA 98233
(360-757-4393)

This Proposal is effective for no more than 30 days after the date of submittal. If the Owner agrees to the terms set forth below, a separate and binding **Proposal and Contract** will be drawn up to cover the entire scope of work to be accomplished and all relevant information contained herein shall be transferred to said **Proposal and Contract.**

SUBMITTED TO: (hereinafter called "Owner") E.A. Engineering
Attn: Jill Frain

ADDRESS: 12011 N.E. 1st Ste 100, Bellevue, WA 98005 PHONE: 425-451-7400

Job Site Location: Coronet bay

Place steel beams beneath store; set jacking towers; lift store up and hold on cribbing; place moving dollies; lower store onto moving dollies; secure store to moving dollies and move building approximately 100' West; store building on cribbing until contaminated dirt is removed and new fill brought in; move store back into place; let on cribbing ready for foundation; after foundation poured, lower store onto new foundation and remove steel beams and equipment

$49,325+tax

NON-DISCLOSURE AGREEMENT: The terms and conditions of this Proposal are confidential and not to be released to anyone except Subcontractors, financial institutions, agents and/or attorneys acting in the interests of the two parties concerned. Release of any and all information, to include total estimated cost of the project, to any party submitting competitive estimates for the same scope of work contained herein will result in the termination of this Proposal by the Contractor.

HASSLER BUILDERS, INC.

Gene Hassler

GENE HASSLER, Pres.

June 8, 2006

APPENDIX H

Onsite Sewage System As-builts

ISLAND COUNTY PUBLIC HEALTH

ALWAYS WORKING FOR SAFER AND HEALTHIER COMMUNITIES

P.O. BOX 5000
ONE NE SIXTH ST.
COUPEVILLE, WA 98239-5000

FAX COVER SHEET

DATE: 5/3/07

TO: Roger Nye **PHONE:** _____

DOE **FAX:** 425 649 7098

FROM: *Kathleen Parvin, R.S.* **PHONE:** (360) 679-7350 x 7914
Environmental Health Specialist **FAX:** (360) 679-7390

RE: Deception Pass Marina

Number of pages including cover sheet: 7

MESSAGE:

Asbuilt # 78-63 for 506-2420
Asbuilt # 489-90R for 517-2500

Kathleen

P.S.
Spoke to Marie Peiper 679-7350 x 7913
& she sent this information to EA Engineering
last July. CB

ISLAND COUNTY PUBLIC HEALTH
ALWAYS WORKING FOR SAFER AND HEALTHIER COMMUNITIES

Received Time May. 3. 7:20AM

Septic Permit Saved 08/22/2000 9:54 AM

78-63

ISLAND COUNTY HEALTH DEPARTMENT
COURT HOUSE
Post Office Box 66 PH: Orange 8-4008
Coupeville, Washington

$5.00 fee for permit.
Final inspection of septic tank MUST be made by this department.

LOT APPROVAL SHEET

NAME Whidbey Marine & ADDRESS R13436-506-2420

ADDRESS OF PROPOSED BUILDING Penn Cove

LEGAL DESCRIPTION: LOT — SEC. 36 TWP. 34 BLK. X RGE. 1E ADDITION

TYPE OF USE Commercial NO. OF BEDROOMS — SIZE OF LOT more than acre

SOURCE OF DRINKING WATER: Public Supply Community Private Well ✓

A. SURFACE DRAINAGE

1. Is disposal field site well drained? yes
2. Any water course (stream, drainage ditch, etc.) through site? no

B. TOPOGRAPHY gravel layer under clay, about three ft thick gives excellent percolation

1. Any heavy slopes in field area? no
2. Will present topsoil in field area be removed or graded before field tiles are installed? Fill area
3. Will any fill material be used in the disposal field site? yes

C. SOIL CONDITIONS

1. Has a hole at least 4 feet deep been dug in the disposal field area to determine the type of soil present? yes
2. After the hole is dug record the soil conditions at the following depths: (Record as sand, gravel, clay, packed sand, loam, etc.)

12 inches clay 36 inches gravel
24 inches clay 48 inches

3. Any ground water encountered before reaching a depth of 4 feet? ______ if so, at what depth? ______

D. WATER TEST

A simple water test will show how well this soil will drain or percolate water. To perform this test:

1. Dig a hole at least 36 inches deep. Use a shovel or post hole digger; size of hole makes no difference only depth.
2. Fill hole with water. Now let all water run out of hole. This soaks the ground and will give a more accurate reading.
3. Again pour water in hole to a height of 12 inches from the bottom. Let water run out until there is just 6 inches from bottom left in hole.
4. Note how many minutes it takes for this last 6 inches to seep away. Record the time. Number of minutes for last 6 inches to seep away
5. Divide this time by 6 to obtain the rate per inch Dissipates quickly
6. Date water test was performed 18 Feb 1963 in gravel area

(OVER)

Septic Permit Saved 08/22/2000 9:58 AM

78-63

SEPTIC TANK AND PLOT PLAN

A detailed plot plan showing property lines, location of house, and proposed location of septic tank and disposal field lines shall be submitted along with the lot approval sheet. The location of the test holes shall be clearly marked on the plan and shall be performed in the area of the proposed disposal field.

MAKE SKETCH IN SPACE BELOW

Septic Tank Capacity 750 Disposal Trench 255 Yards Gravel 15 yds
(Sq. Footage)

Other _____ Estimated Date of Completion April 16, 1963

CERTIFICATION

The undersigned hereby certifies that he performed the above test in the manner described on the reverse side of this sheet and that he has truly and accurately recorded the results by these test procedures; furthermore, I hereby certify that the sewage disposal system complies with the written requirements of the Leland County Sanitary Code, and that the sub-surface disposal area is adequate for the absorption of all household liquids discharged into it.

Home Owner's signature. Marine Co.

Contractor's signature.

AS BUILT

cc: Owner
Installer
Permit Center
Bldg Dept

ISLAND COUNTY HEALTH DEPARTMENT
PO BOX 5000
COUPEVILLE, WA 98239-5000

489-90M

APPLICATION TO REPAIR A SEWAGE DISPOSAL SYSTEM

OWNER'S NAME: Cornet Bay Marina PHONE #: 5-5411
MAILING ADDRESS: 5191 N. Cornet Bay OAK HARBOR WA. 98277

LEGAL DESCRIPTION: PARCEL #: R15430-517-2580

NAME OF PLAT: _____ DIVISION ____ BLOCK _____ LOT ____

SITE INFORMATION: TYPE OF USE: Commercial # OF BEDROOMS: ____
LOT WIDTH: _____ LOT DEPTH: _____ AREA: _____

SOIL TYPES:	DEPTH:	
(Fill) Silt,	0-8	IV
(Regional) Blue Till	8-26	
Gravel Sandy Matrix	26-32	III

SAT- 32" STANDING 39"

Mens Head 1-Toilet 1-Urinal 1-Sink

Womens Head 1-Toilet 1-Sink

PROPOSED REPAIRS:

NEW SEPTIC TANK: yes 1200 PUMP CHAMBER: yes 550

DRAINFIELD LENGTH: 10X45 NUMBER OF LINES: 3 SQUARE FEET: 450

FILL: WIDTH 35' LENGTH 70' DEPTH D-24"

COMMENTS: Mound Guidelines - Refer to Cross Section on back - Labs or Barriers to be placed around area of Drainfield 360 G.P.D. Max Peak Flow No Guarantee Due to Soils & Water Elevations.

EXISTING SYSTEM INFORMATION: APPROXIMATE AGE _____ ASBUILT FILE # 713-76X

SIZE OF TANK _____ LENGTH OF DRAINFIELD _____ # OF LINES _____

CAUSE OF FAILURE: Kreig Const. tore out lines in process of Removing GAS TANKS and Slabs

INSTALLER'S SIGNATURE: Brian Silva DATE: 6-18-90

OWNER'S SIGNATURE: _____ DATE: _____

PLAN APPROVED: ✓ PERMIT # 90-71 RECEIPT # 10889 DATE: 7/5/90

PLAN DISAPPROVED _____

MARGINAL

CONSTRUCTION INSPECTION:
DATE 7-31 BY CB

APPROVED - Not For Additional Drainfield Load

FINAL INSPECTION: APPROVED ✓ REJECTED

SIGNATURE: Catherine Austin DATE: 8-16-90

PER SANITARY CODE OF ISLAND COUNTY EACH INDIVIDUAL SEWAGE DISPOSAL SYSTEM MUST BE AVAILABLE FOR HEALTH DEPARTMENT INSPECTION (24 HOURS NOTICE IS REQUIRED).

ISLAND COUNTY ASSUMES NO RESPONSIBILITY FOR THE RE-DIRECTION OF DRAINAGE WATER.

PERMIT EXPIRES 90 DAYS FROM DATE ISSUED

AS-BUILT

ICHD #4.1 10/88

Septic Permit Saved 06/18/2001 8:30 AM

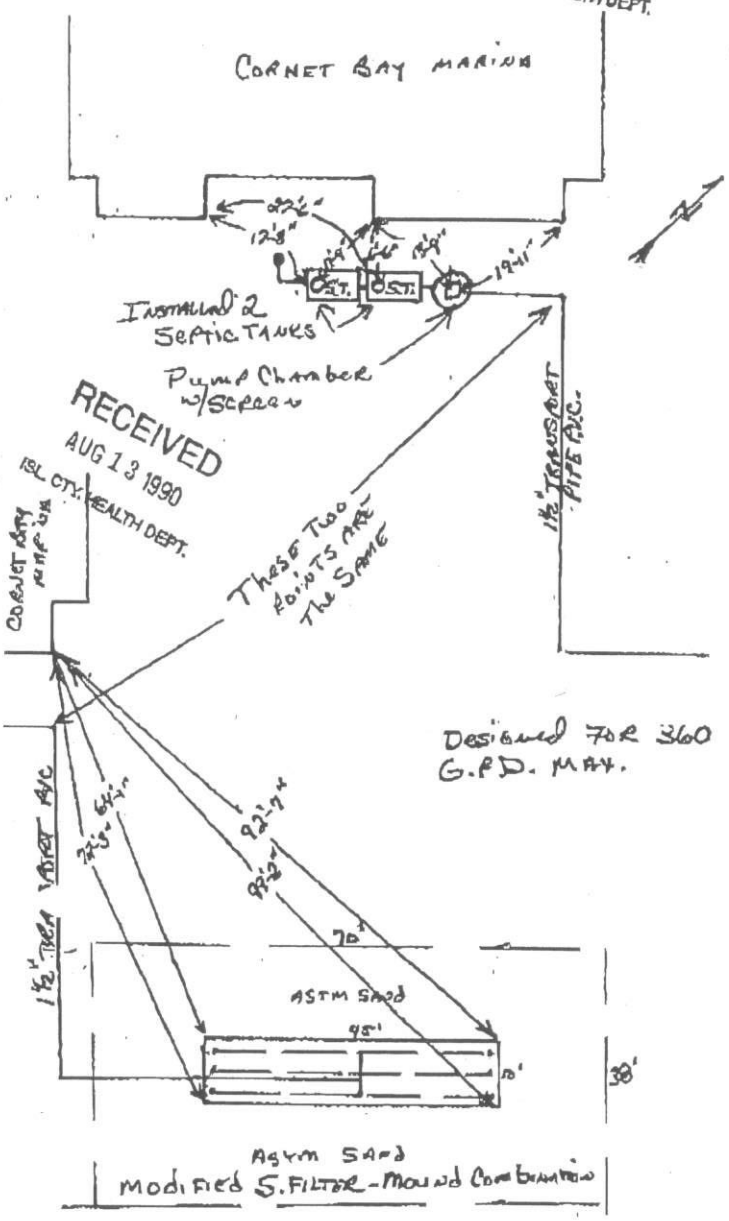
INDICATE LOCATION OF THE FOLLOWING: (On both proposed and asbuilt drawings)
a. Location of buildings (distance from roads, etc.)
b. Size of building
c. Location of septic tank (distance from building, etc.)
d. Location of drainfields (distance from house, septic tank, property lines, wells, banks, water of the State, trench drain, roads, driveways, large trees, etc.)

RECEIVED AUG 9 1990 ISL CTY. HEALTH DEPT.

SCALE DRAWING: Proposed Design [ ] Asbuilt [X]

ICHD #4.1 10/88

SCALE USED: 20'



Alternative & Pressure System Information:

TRANSPORT PIPE DIAMETER: 1½ LENGTH:
MANIFOLD PIPE DIA:

ELEVATION FROM PUMP TO DRAINFIELD BED, OR LOWEST LATERAL: 3'
LATERAL DIA: 1½
LATERAL(S) LENGTH:
#1 42' #2 42' #3 42'
#4 #5 #6
LATERAL SPACING: 3'
LATERAL ELEVATIONS:
#1 3' #2 3' #3 3'
#4 #5 #6
ORIFICE DIA: 3/16
ORIFICE SPACING: LATERAL
#1 42" #2 42" #3 42"
#4 #5 #6

BED SIZE: 18x45'

DEPTH OF FILL UNDER BED: D=24"

VERTICAL SEPARATION: 36"

TOTAL DEPTH OF FILL: Mound

UPSLOPE WIDTH OF FILL FROM BED: 14' ENDSLOPE WIDTH: 14'
TOTAL SIZE OF FILL: 38x70
PERCENT OF SLOPE IN DRAINFIELD/BED AREA: -0-

DOSE VOLUME: 90
DOSES PER DAY: 4

PUMP SIZE: GPM: 36
HEAD: 20

SAND FILTER SIZE:
TRANSPORT LINE DIA:
TRANSPORT LINE LENGTH:
MANIFOLD DIA: MANIFOLD PIPE LENGTH: LATERAL DIA: LATERAL LENGTHS: # OF LATERALS: LATERAL SPACING: ORIFICE DIAMETER: ORIFICE SPACING
ELEVATION FROM PUMP TO SAND FILTER: PUMP SIZE: GPM: HEAD: DOSE VOLUME: DOSES PER DAY:
OSR33M PUMP CHAMBER SIZE(S):
#1 1000/1000 GALLONS
#2 330 GALLONS
SPECIAL FEATURES OR CONDITIONS: CONCRETE

ASBUILT DATA: Name CORNET BAY MARINA Permit # Parcel #

Drainfield: Square Feet 450 Total Length 45' Width 10' Depth 12" D=24"

VERTICAL SEPARATION BETWEEN BOTTOM OF TRENCH OR BED AND SATURATED OR IMPERVIOUS SOIL: 36"

COMMENTS: Modified Sand Filter Mound Combination CW OSR

Bruce Silva
Installer Signature
Date 8-30-90

RECEIVED

Septic Permit Saved 07/24/2001 4:19 PM

Date 7-15-82

ISLAND COUNTY HEALTH DEPARTMENT
SITE REGISTRATION SHEET

Receipt # 2418
SR# 82-443 N
Installer Bothwell

THIS IS NOT A SEWAGE DISPOSAL PERMIT NOR A GUARANTEE ONE WILL BE ISSUED - THIS SITE REGISTRATION IS FOR ONE BUILDING SITE ONLY--ANY OTHER PERMITS OR FURTHER SUBDIVISIONS WILL REQUIRE ADDITIONAL SITE REGISTRATION FEES AT THAT TIME.

OWNERS NAME Bellmond Realty ADDRESS 919-124th AVE Bellevue WA 98005

Parcel No. R13436-517-250

NAME OF PLAT _____ DIV. ___ BLOCK ___ LOT ___

OR Short Plat No. _____ S/P Parcel No. _____

OR Legal Description _____

Location of Construction Site Cornet Bay [redacted] RD

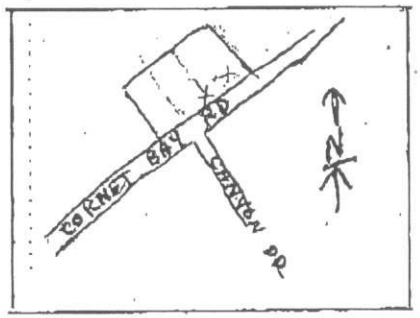
INSTRUCTIONS: Fill out this form completely - both sides. Soil logs and percolation rate determinations should be made per Island County Health Department Rules and Regulations. On the reverse side, a blank space is reserved for a scale drawing of the site to include soil log holes (numbered), perc holes (numbered), property lines and dimensions, wells, bodies of water, topological depictions, curtain drains, roads, etc. Also located on the reverse side is a small space for a vicinity map to show the proximity of the property to local landmarks.

A receipt number reflecting the payment of the $40.00 NON-REFUNDABLE fee and the property's parcel number must appear on the form prior to site inspection by Island County Health Department personnel.

This form must be completed and submitted to the Island County Health Department within FIVE working days after the Island County Health Department has evaluated the soil or the site information sheet will not be recorded.

INSTALLER'S COMMENTS: _____

VICINITY MAP



The undersigned Island County Health Department representative has witnessed these soil logs and finds them to be accurately represented. It appears that this site is not capable of supporting an on-site sewage disposal system for a single family residence meeting CURRENT Island County Health Department policies and regulations, subject to any of the above comments and restriction. To guarantee a Health Department approval of a sewage disposal permit, we recommend submitting an application for a permit at this time. NOTE: Changes to this site, such as grading, filling or clearing could make this certification null and void.

Signature of Health Dept. Representative — Date 7/16/82

HS
Title

Date Inspected by the Health Department _____ _____

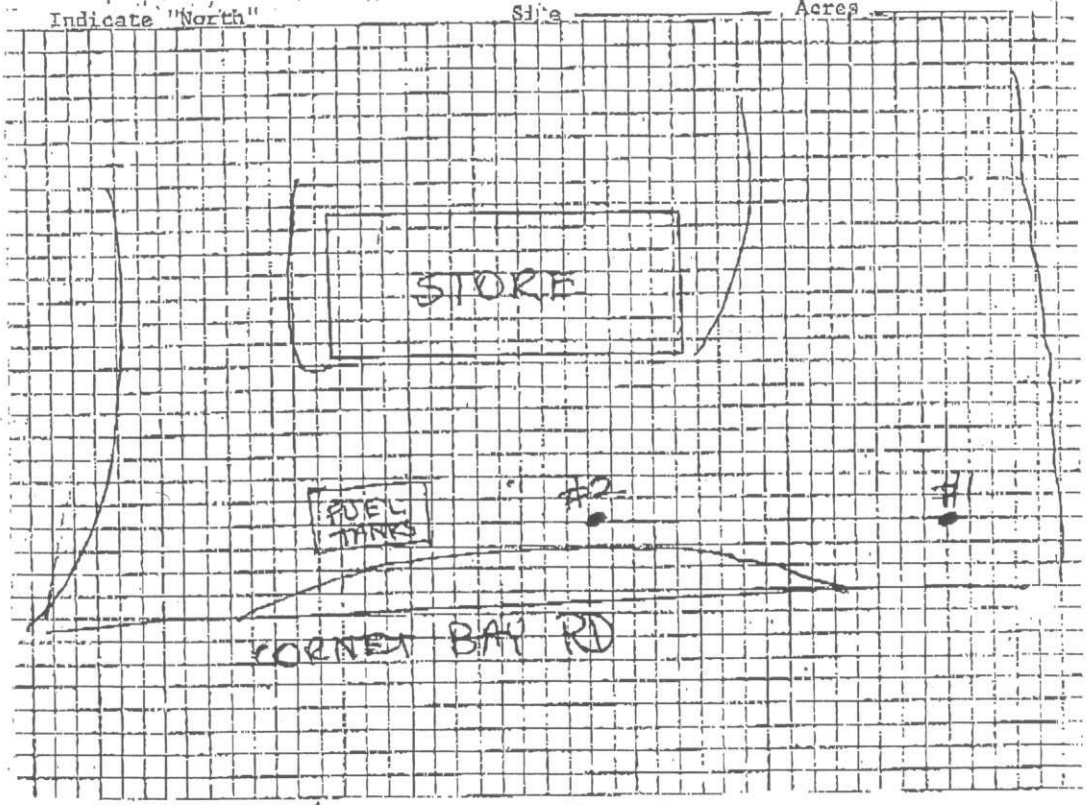
(HEALTH DEPT.)
Comments:

The site evaluation was done as a preliminary assessment for marina expansion. The site is not suitable for the use.

Received Time May. 3. 7:20AM

Septic Permit Saved 07/24/2001 4:20 PM

SCALE DRAWING
Soil Logs (Δ) Perc Test (o) Parcel # _____ SR# 82-443
Indicate "North" Site _____ Acres _____



Soil Log #1
0 to 30" In. Sand
30 to 60" In. Peat
60" to 92" In. clay
___ to ___ In. _____
Depth of Water Table 60"+ est
Depth of Impervious soil 30"

Soil Log #2
0 to 72" In. clay
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
Depth of Water Table 60"
Depth of Impervious soil _____

Soil Log #3
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
Depth of Water Table _____
Depth of Impervious Soil _____

Soil Log #4
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
Depth of Water Table _____
Depth of Impervious soil _____

Soil Log #5
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
Depth of Water Table _____
Depth of Impervious soil _____

Soil Log #6
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
___ to ___ In. _____
Depth of Water Table _____
Depth of Impervious Soil _____

Percolation Tests - Depth of Perc Hole

Hole #1 ___ Min/inch at ___ inches.
Hole #2 ___ Min/inch at ___ inches.
Hole #3 ___ Min/inch at ___ inches.
AVERAGE PERC RATE _____ Min/inch.

Percolation Tests-Depth of Perc Hole

Hole #4 ___ Min/inch at ___ inches.
Hole #5 ___ Min/inch at ___ inches.
Hole #6 ___ Min/inch at ___ inches.

CERTIFICATION: I hereby certify the above information to be correct and the above tests were performed by me as prescribed on 6-16-82 (date)

Irene Patton by Bruce A. Patton 7-1-82
Signature of licensed installer, registered sanitarian, Professional engineer or home owner/installer.

NOTE: Changes to this site, such as grading, filling or clearing could make this certification null and void.

APPENDIX I

Cost Estimates

Cornet Bay Marina
Alternative 1: Containment

Mobilization/Demobilization	$	124,000
Sheet Pile Wall/Pavement Cap/Impermeable Bulkhead	$	1,542,000
New Monitoring Wells	$	9,000
Engineering & Management	$	319,000
Contingency (25%)	$	499,000
Taxes	$	177,000
Monitoring and Operations (for 15 years)	$	106,000
TOTAL BUDGETARY COST ESTIMATE	**$**	**2,776,000**

Assumptions

- Costs rounded to nearest thousand
- Due to spacial constraints only sheet piling or one-pass trenching techniques can be used to construct the containment wall
- The UST and fuel lines for the marina will be left in place within the containment area
- The mounded drainfield for the onsite sewage system will be left in place outside the containment area
- Includes cost to install 3 new monitoring wells
- Pavement cap includes 6" stone base, 2" binder course, 1" topping

Engineering and Mananagement

- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 15 years)

- Quarterly sampling for 15 years following cleanup, in reality monitoring will have to continue indefinitely
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included

Cornet Bay Marina
Alternative 2: In-Situ Thermal Desorption

ISTD System	$	2,083,000
Cost to install 3-phase power to the site	$	500,000
Engineering & Management	$	491,000
Contingency (25%)	$	769,000
Taxes	$	274,000
Monitoring and Operations (for 3 years)	$	21,000
TOTAL BUDGETARY COST ESTIMATE	**$**	**4,138,000**

* Costs provided by Thermal Remediation Services (June 2006), +/- 20% estimated cost

Assumptions

- Costs rounded to nearest thousand
- ISTD system cost includes O&M
- Cost to install 3-phase power is a worst case estimate based on initial estimate from Puget Sound Energy to bring in infrastructure from approximately 2 miles away
- Treatment time ranges from 75-130 days
- Costs are for 100% below ground completion of wells and piping
- Includes removal and replacement of exising UST

Engineering and Mananagement

- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 3 years)

- Monthly groundwater sampling for 12 months
- Quarterly sampling for 3 years following cleanup
- Samples analyzed for diesel and gasoline range organics
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included

Cornet Bay Marina
Alternative 3A: Excavation (restoration to preconstruction conditions)

Mobilization/Demobilization	$	150,000
Site Preparation	$	1,178,000
Excavation and Backfilling	$	1,644,000
Site Restoration	$	86,000
Engineering and Mananagement	$	528,000
Contingency (25%)	$	897,000
Taxes	$	319,000
Monitoring and Operations (for 3 years)	$	21,000
Periodic Costs	$	-
TOTAL BUDGETARY COST ESTIMATE	**$**	**4,823,000**

Assumptions

- Costs rounded to nearest thousand
- No staging of soil will be necessary

Excavation

- Excavation of approximately 11,200 cubic yards of soil
- Requires moving store building temporarily during excavation, replacing building and foundation upon completion of activities.
- Soil disposal cost based on current rate of $33/ton
- Includes 80,000 pounds product to enhance bioremediation (to be placed in excavation)
- Includes cost to remove and replace exisitng UST
- Includes bulkhead shoring and replacement
- Includes cost of up to 250 confirmation samples
- Includes cost to abandon 3 monitoring wells

Site Restoration

- Includes cost to bring in clean fill, spread, and compact
- Cover material will be 3/4 in. crushed stone base, 3 in. thick
- Includes cost to install 3 new monitoring wells
- Includes cost of new drainfield

Engineering and Mananagement

- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 3 years)

- Quarterly sampling for 3 years following cleanup
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included

Cornet Bay Marina
Alternative 3B: Excavation (restoration to natural conditions)

Mobilization/Demobilization	$	100,000
Site Preparation	$	213,000
Excavation and Backfilling	$	1,452,000
Site Restoration	$	12,000
Engineering and Mananagement	$	285,000
Contingency (25%)	$	516,000
Taxes	$	184,000
Monitoring and Operations (for 3 years)	$	26,000
Periodic Costs	$	-
TOTAL BUDGETARY COST ESTIMATE	**$**	**2,788,000**

Assumptions
- Costs rounded to nearest thousand
- No staging of soil will be necessary

Excavation
- Excavation of approximately 11,200 cubic yards of soil
- Requires demolition of store building and foundation
- Soil disposal cost based on current rate of $33/ton
- Includes 80,000 pounds product to enhance bioremediation (to be placed in excavation)
- Includes cost to remove USTand piping
- Includes cost of up to 250 confirmation samples
- Includes cost to abandon 3 monitoring wells

Site Restoration
- Includes cost to bring in clean fill, spread, and compact
- Cover material will be vegetation
- Includes cost to install 3 new monitoring wells
- Does not include cost associated with demolition or disposal of floating docks/slips

Engineering and Mananagement
- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 3 years)
- Quarterly sampling for 3 years following cleanup
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included

Cornet Bay Marina
Alternative 4A: *Ex-situ* Bioremediation
(restoration to preconstruction conditions)

Mobilization/Demobilization	$	150,000
Site Preparation	$	1,188,000
Excavation and Soil Treatment (Over 3 to 5 years)	$	649,000
Backfilling	$	418,000
Site Restoration	$	171,000
Engineering and Construction Management	$	437,000
Contingency (25%)	$	753,000
Taxes	$	268,000
Monitoring (for 3 years)	$	441,000
TOTAL BUDGETARY COST ESTIMATE	**$**	**4,475,000**

Assumptions

- Costs rounded to nearest thousand

Excavation & Soil Treatment

- Excavation and treatment of approximately 11,200 cubic yards of soil
- Requires demolition of store building and replacing building and foundation upon completion of activities.
- Soil disposal cost based on current rate of $33/ton
- Includes 80,000 pounds product to enhance bioremediation (to be placed in excavation)
- Includes cost to remove/replace existing UST
- Includes bulkhead shoring and replacement
- Includes cost of up to 250 confirmation samples
- Includes cost to abandon 3 monitoring wells

Site Restoration

- Includes cost to replace treated soil, spread, and compact
- Cover material will be 3/4 in. crushed stone base, 3 in. thick
- Includes cost to install 3 new monitoring wells
- Includes cost of new drainfield

Engineering and Mananagement

- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 3 years)

- Quarterly sampling for 3 years following cleanup
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included

Cornet Bay Marina Alternative 4B: *Ex-situ* Bioremediation (restoration to natural conditions)		
Mobilization/Demobilization	$	100,000
Site Preparation	$	256,000
Excavation and Soil Treatment (Over 3 to 5 years)	$	961,000
Backfilling	$	402,000
Site Restoration	$	12,000
Engineering and Construction Management	$	276,000
Contingency (25%)	$	502,000
Taxes	$	179,000
Monitoring (for 3 years)	$	446,000
TOTAL BUDGETARY COST ESTIMATE	**$**	**3,134,000**

Assumptions

- Costs rounded to nearest thousand

Excavation & Soil Treatment

- Excavation and treatment of approximately 11,200 cubic yards of soil
- Requires demolition of store building and foundation
- Soil disposal cost based on current rate of $33/ton
- Includes 80,000 pounds product to enhance bioremediation (to be placed in excavation)
- Includes cost to remove existing UST
- Includes cost of up to 250 confirmation samples
- Includes cost to abandon 3 monitoring wells

Site Restoration

- Includes cost to replace treated soil, spread, and compact
- Cover material will be vegetation
- Includes cost to install 3 new monitoring wells
- Does not include cost associated with demolition or disposal of floating docks/slips

Engineering and Mananagement

- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 3 years)

- Quarterly sampling for 3 years following cleanup
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included

Cornet Bay Marina
Alternative 5: Partial Excavation with *In-Situ* Bioremediation

Mobilization/Demobilization	$	100,000
Site Preparation	$	83,000
Partial Excavation and Backfilling	$	269,000
Product Cost	$	3,881,000
Application Cost	$	283,000
Site Restoration	$	69,000
Engineering and Mananagement	$	152,000
Contingency (25%)	$	1,209,000
Taxes	$	430,000
Monitoring and Operations (for 3 years)	$	46,000
Periodic Costs	$	1,007,000
TOTAL BUDGETARY COST ESTIMATE	**$**	**7,529,000**

Assumptions
- Costs rounded to nearest thousand
- No staging of soil will be necessary
- Direct push application of product

Excavation
- Excavation of approximately 2,400 cubic yards of soil
- Soil disposal cost based on current rate of $33/ton
- Includes cost to remove and replace existing UST
- Includes cost to abandon 1 monitoring well
- Does not include dewatering costs if nessecary for excavation

Site Restoration
- Includes cost to bring in clean fill, spread, and compact
- Cover material will be 3/4 in. crushed stone base, 3 in. thick
- Includes cost to install 3 new monitoring wells

Engineering and Mananagement
- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 3 years)
- Monthly groundwater sampling for 12 months
- Quarterly sampling for 3 years following cleanup
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included

Cornet Bay Marina
Alternative 6: Partial Excavation with *In-Situ* Chemical Oxidation

Mobilization/Demobilization	$	100,000
Site Preparations	$	1,153,000
Partial Excavation & Backfilling	$	269,000
Product Cost	$	618,000
Application Cost	$	385,000
Site Restoration	$	69,000
Engineering and Mananagement	$	494,000
Contingency (25%)	$	772,000
Taxes	$	275,000
Monitoring and Operations (for 3 years)	$	46,000
TOTAL BUDGETARY COST ESTIMATE	**$**	**4,181,000**

Assumptions
- Costs rounded to nearest thousand
- No staging of soil will be necessary
- Soil mixing application of product

Excavation
- Excavation of approximately 2,400 cubic yards of soil
- Soil disposal cost based on current rate of $33/ton
- Includes cost to remove and replace existing UST
- Includes cost to abandon 1 monitoring well
- Does not include dewatering costs if nessecary for excavation

Site Restoration
- Includes cost to bring in clean fill, spread, and compact
- Cover material will be 3/4 in. crushed stone base, 3 in. thick
- Includes cost to install 3 new monitoring wells

Engineering and Mananagement
- 5% project management fee
- 8% remedial design fee
- 6% construction manangment fee

Monitoring and Operations (for 3 years)
- Monthly groundwater sampling for 12 months
- Quarterly sampling for 3 years following cleanup
- Samples analyzed for diesel and gasoline range organics
- Annual reporting included