STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

In the Matter of Remedial Action by: **PORT OF ANACORTES**	AGREED ORDER for REMEDIAL INVESTIGATION/FEASIBILITY STUDY, DRAFT CLEANUP ACTION PLAN and INTERIM ACTION – CAP SANTE MARINE **No. DE-07TCPHQ-4197**

TO: Port of Anacortes
PO Box 297
Anacortes, WA 98221

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I. INTRODUCTION

The mutual objective of the State of Washington, Department of Ecology (Ecology) and the Port of Anacortes (the Port) under this Agreed Order (Order) is to provide for remedial action at a facility where there has been a release or threatened release of hazardous substances. This Order requires the Port to perform a remedial investigation/feasibility study (RI/FS) to collect, develop and evaluate sufficient information to develop a final cleanup action plan (CAP) for the Site; to perform an interim action to remove petroleum impacted soils at the Site; and to produce a draft CAP for the Site. Ecology believes the actions required by this Order are in the public interest.

II. JURISDICTION

This Agreed Order is issued pursuant to the Model Toxics Control Act (MTCA), RCW 70.105D.050(1).

III. PARTIES BOUND

This Agreed Order shall apply to and be binding upon the Parties to this Order, their successors and assigns. The undersigned representative of each party hereby certifies that he or she is fully authorized to enter into this Order and to execute and legally bind such party to comply with this Order. The Port agrees to undertake all actions required by the terms and conditions of this Order. The Port shall provide a copy of this Order to all agents, contractors, and subcontractors retained to perform work required by this Order, and shall ensure that all work undertaken by such agents, contractors, and subcontractors complies with this Order.

IV. DEFINITIONS

Unless otherwise specified herein, the definitions set forth in Chapter 70.105D RCW and Chapter 173-340 WAC shall control the meanings of the terms in this Order.

A. <u>Site</u>: The Site is referred to as Cap Sante Marine and is generally located at Cap Sante Waterway in Anacortes, Washington. The Site is defined by the extent of contamination caused by the release of hazardous substances at the Site. Based upon factors currently known to Ecology, the Site is more particularly described in Exhibit A to this Order, which includes a detailed Site diagram, location map and legal description. The Site constitutes a Facility under RCW 70.105D.020(4).

B. Parties: Refers to the State of Washington, Department of Ecology and the Port of Anacortes.

C. Potentially Liable Person (PLP): Refers to the Port of Anacortes.

D. Agreed Order or Order: Refers to this Order and each of the exhibits to this Order. All exhibits are integral and enforceable parts of this Order. The terms "Agreed Order" or "Order" shall include all exhibits to this Order.

V. FINDINGS OF FACT

Ecology makes the following findings of fact, without any express or implied admissions of such facts by the Port:

A. The fuel storage area at Cap Sante Marine is located at Cap Sante Boat Haven at the east end of 13th Street in Anacortes, Washington (the "Site"). The Cap Sante Marine Property is bounded by the Fidalgo Bay on the East, Q Avenue on the West, 11th Avenue on the North, and 13th Street on the South. Cap Sante Boat Haven historically operated a fueling dock which was connected to two underground storage tanks (USTs) located in the fuel storage area through a series of underground pipelines.

B. The Port has owned the Site since 1956. The Site has been operated as a boat yard and marina support area since approximately 1959.

C. In the early 1980's fuel was observed seeping into the waters of Fidalgo Bay adjacent to the Site. Pursuant to a subsequent order from the US Coast Guard, the Port installed a product recovery trench to intercept fuel flowing through the soil toward the bay. Several thousand gallons of fuel were recovered and the seepage was stopped. The Coast Guard Order is attached hereto as Exhibit C.

D. The seepage was later determined by the Port to be the result of leakage from the USTs and lines associated with the fuel dock operation. In 1985 the Port replaced the two existing USTs with new tanks, however impacted soils associated with historical petroleum product leakage from the tanks was not removed.

E. In 2004 and 2005 the Port conducted two investigations to define the extent of contamination at the Site. The Port's investigations revealed that soil and groundwater in a roughly fan-shaped area around the USTs and extending to the bay was contaminated with gasoline, diesel and benzene. Attached as Exhibit D is a figure showing the currently known approximate extent of soil and groundwater contamination. The full nature and extent of contamination has not been defined at the site.

F. Soil and groundwater samples were collected from six (6) locations near the former fuel recovery trench as part of the 2004 Site investigation. A total of nineteen (19) soil and six (6) groundwater samples were collected and analyzed for petroleum hydrocarbon contaminants. Soil concentrations of benzene and/or xylenes exceeded MTCA Method A cleanup levels at four (4) of the sampling locations. Cleanup levels for benzene/gasoline and diesel in groundwater were exceeded at two (2) of the sampling locations. Attached as Exhibit E is the 2004 Limited Environmental Due Diligence Investigation Results.

G. Soil and groundwater samples were collected from nine locations in the general vicinity of the USTs as part of the 2005 investigation. A total of thirteen (13) soil samples and five (5) groundwater samples were collected and analyzed for petroleum hydrocarbon contaminants. Soil concentrations of benzene and/or diesel exceeded MTCA Method A cleanup levels at five (5) of the sampling locations. Gasoline, diesel, and benzene exceeded groundwater cleanup levels at five of the sampling locations. Attached as Exhibit F is the 2005 Supplemental Site Investigation Results.

VI. ECOLOGY DETERMINATIONS

A. The Port is an "owner or operator" as defined in RCW 70.105D.020(12), of a "facility" as defined in RCW 70.105D.020(4) because it is the current owner of the Site and because it owned the site at the time of the above-described release.

B. Based upon all factors known to Ecology, a "release" or "threatened release" of "hazardous substance(s)" as defined in RCW 70.105D.020(20) and RCW 70.105D.020(7), respectively, has occurred at the Site.

C. Based upon credible evidence, Ecology issued a PLP status letter to the Port dated July 19, 2006, pursuant to RCW 70.105D.040, .020(16) and WAC 173-340-500. After providing for notice and opportunity for comment, reviewing any comments submitted, and concluding that credible evidence supported a finding of potential liability, Ecology issued a determination that the Port is a PLP under RCW 70.105D.040 and notified the Port of this determination by letter dated August 16, 2006.

D. Pursuant to RCW 70.105D.030(1) and .050(1), Ecology may require PLPs to investigate or conduct other remedial actions with respect to any release or threatened release of hazardous substances, whenever it believes such action to be in the public interest. Based on the foregoing facts, Ecology believes that the remedial actions required by this Order are in the public interest.

E. Under WAC 173-340-430, an interim action is a remedial action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance, that corrects a problem that may become substantially worse or cost substantially more to address if the remedial action is delayed, or that is needed to provide for completion of a site hazard assessment, remedial investigation/feasibility study or design of a cleanup action. The presence at the Site of significant concentrations of gasoline, diesel and benzene in soil and groundwater immediately adjacent to Fidalgo Bay, and the additional cost that will be incurred if removal of contaminated soils is delayed, presents circumstances which warrant an interim action consistent with WAC 173-340-430. The interim action will consists of the removal of total petroleum hydrocarbon (TPH) source(s) which includes the excavation of TPH contaminated soils and/or removal of any product present at the site. More details regarding the interim action are discussed in Exhibit B, Section 4.0.

VII. WORK TO BE PERFORMED

Based on the Findings of Fact and Ecology Determinations, it is hereby ordered that the Port take the following remedial actions at the Site and that these actions be conducted in accordance with Chapter 173-340 WAC unless otherwise specifically provided for herein:

A. The Port shall conduct the remedial actions fully described in Exhibit B to this Order. Generally, the Port shall develop a draft cleanup action plan (DCAP) for the Site and, prior to developing the DCAP, perform a remedial investigation/feasibility study and interim action including, but not limited to, the follow tasks:

- Installing five additional groundwater monitoring wells and performing a slug test;
- Collecting samples of groundwater, soil and sediments to determine the nature and extent of the contamination;
- Conducting testing to determine the effect of tidal action of contamination at the Site;
- Performing an interim action to remove contaminated soils identified by the remedial investigation;
- Evaluation of remedial alternatives;
- Identification of a preferred remedial alternative for the Site.

B. The Port shall perform the remedial actions required by this Order according to the schedule included in Exhibit B.

C. If, at any time after the first exchange of comments on drafts, Ecology determines that insufficient progress is being made in the preparation of any of the deliverables required by Exhibit B, Ecology may complete and issue the final deliverable.

VIII. TERMS AND CONDITIONS OF ORDER

A. Public Notice

RCW 70.105D.030(2)(a) requires that, at a minimum, this Order be subject to concurrent public notice. Ecology shall be responsible for providing such public notice and reserves the right to modify or withdraw any provisions of this Order should public comment disclose facts or considerations which indicate to Ecology that this Order is inadequate or improper in any respect.

B. Remedial Action Costs

The Port shall pay to Ecology costs incurred by Ecology pursuant to this Order and consistent with WAC 173-340-550(2). These costs shall include work performed by Ecology or its contractors for, or on, the Site under Chapter 70.105D RCW, including remedial actions and Order preparation, negotiation, oversight, and administration. These costs shall include work performed both prior (retroactive to August 1, 2006) to and subsequent to the issuance of this Order. Ecology's costs shall include costs of direct activities and support costs of direct activities as defined in WAC 173-340-550(2). The Port shall pay the required amount within ninety (90) days of receiving from Ecology an itemized statement of costs that includes a summary of costs incurred, an identification of involved staff, and the amount of time spent by involved staff members on the project. A general statement of work performed will be provided upon request. Itemized statements shall be prepared quarterly. Pursuant to WAC 173-340-550(4), failure to pay Ecology's costs within ninety (90) days of receipt of the itemized statement of costs will result in interest charges at the rate of twelve percent (12%) per annum, compounded monthly.

Pursuant to RCW 70.105D.055, Ecology has authority to recover unreimbursed remedial action costs by filing a lien against real property subject to the remedial actions.

C. Implementation of Remedial Action

If Ecology determines that the Port has failed without good cause to implement the remedial action, in whole or in part, Ecology may, after notice to the Port, perform any or all portions of the remedial action that remain incomplete. If Ecology performs all or portions of the remedial action because of the Port's failure to comply with its obligations under this Order, the Port shall reimburse Ecology for the costs of doing such work in accordance with Section VIII.B (Remedial Action Costs), provided that the Port is not obligated under this Section to reimburse Ecology for costs incurred for work inconsistent with or beyond the scope of this Order.

Except where necessary to abate an emergency situation, the Port shall not perform any remedial actions at the Site outside those remedial actions required by this Order, unless Ecology concurs, in writing, with such additional remedial actions.

D. Designated Project Coordinators

The project coordinator for Ecology is:

Panjini Balaraju
Toxics Cleanup Program
PO Box 47600, Olympia, WA 98504-7600
(360) 407-6161
E-mail: pbal461@ecy.wa.gov

The project coordinator for the Port is:

Connie Thoman
Port of Anacortes
PO Box 297
Anacortes, WA 98221
(360) 299-1818
E-mail: connie@portofanacortes.com

Each project coordinator shall be responsible for overseeing the implementation of this Order. Ecology's project coordinator will be Ecology's designated representative for the Site. To the maximum extent possible, communications between Ecology and the Port, and all documents, including reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Order shall be directed through the project coordinators. The project coordinators may designate, in writing, working level staff contacts for all or portions of the implementation of the work to be performed required by this Order.

Any party may change its respective project coordinator. Written notification shall be given to the other party at least ten (10) calendar days prior to the change.

E. Performance

All geologic and hydrogeologic work performed pursuant to this Order shall be under the supervision and direction of a geologist licensed in the State of Washington or under the direct supervision of an engineer registered in the State of Washington, except as otherwise provided for by Chapters 18.220 and 18.43 RCW.

All engineering work performed pursuant to this Order shall be under the direct supervision of a professional engineer registered in the State of Washington, except as otherwise provided for by RCW 18.43.130.

All construction work performed pursuant to this Order shall be under the direct supervision of a professional engineer or a qualified technician under the direct supervision of a professional engineer. The professional engineer must be registered in the State of Washington, except as otherwise provided for by RCW 18.43.130.

Any documents submitted containing geologic, hydrologic or engineering work shall be under the seal of an appropriately licensed professional as required by Chapter 18.220 RCW or RCW 18.43.130.

The Port shall notify Ecology in writing of the identity of any engineer(s) and geologist(s), contractor(s) and subcontractor(s), and others to be used in carrying out the terms of this Order, in advance of their involvement at the Site.

F. Access

Ecology or any Ecology authorized representative shall have the full authority to enter and freely move about all property at the Site that the Port either owns, controls, or has access rights to at all reasonable times for the purposes of, *inter alia*: inspecting records, operation logs, and contracts related to the work being performed pursuant to this Order; reviewing the Port's progress in carrying out the terms of this Order; conducting such tests or collecting such samples as Ecology may deem necessary; using a camera, sound recording, or other documentary type equipment to record work done pursuant to this Order; and verifying the data submitted to Ecology by the Port. The Port shall make all reasonable efforts to secure access rights for those properties within the Site not owned or controlled by the Port where remedial activities or investigations will be performed pursuant to this Order. Ecology or any Ecology authorized representative shall give reasonable notice before entering any Site property owned or controlled by the Port unless an emergency prevents such notice. All persons who access the Site pursuant to this Section shall comply with any applicable Health and Safety Plan(s). Ecology employees and their representatives shall not be required to sign any liability release or waiver as a condition of Site property access.

G. Sampling, Data Submittal, and Availability

With respect to the implementation of this Order, the Port shall make the results of all sampling, laboratory reports, and/or test results generated by it or on its behalf available to Ecology. Pursuant to WAC 173-340-840(5), all sampling data shall be submitted to Ecology in both printed and electronic formats in accordance with Section VII (Work to be Performed), Ecology's Toxics Cleanup Program Policy 840 (Data Submittal Requirements), and/or any subsequent procedures specified by Ecology for data submittal. Attached as Exhibit G is Ecology Policy 840, Data Submittal Requirements.

If requested by Ecology, the Port shall allow Ecology and/or its authorized representative to take split or duplicate samples of any samples collected by the Port pursuant to implementation of this Order. The Port shall notify Ecology seven (7) days in advance of any sample collection or work activity at the Site. Ecology shall, upon request, allow the Port and/or its authorized representative to take split or duplicate samples of any samples collected by Ecology pursuant to the implementation of this Order, provided that doing so does not interfere with Ecology's sampling. Without limitation on Ecology's rights under Section VIII.F (Access), Ecology shall notify the Port prior to any sample collection activity unless an emergency prevents such notice.

In accordance with WAC 173-340-830(2)(a), all hazardous substance analyses shall be conducted by a laboratory accredited under Chapter 173-50 WAC for the specific analyses to be conducted, unless otherwise approved by Ecology.

H. Public Participation

A Public Participation Plan is required for this Site. Ecology shall review any existing Public Participation Plan to determine its continued appropriateness and whether it requires amendment, or if no plan exists, Ecology shall develop a Public Participation Plan alone or in conjunction with the Port.

Ecology shall maintain the responsibility for public participation at the Site. However, the Port shall cooperate with Ecology, and shall:

1. If agreed to by Ecology, develop appropriate mailing list, prepare drafts of public notices and fact sheets at important stages of the remedial action, such as the submission of work plans, remedial investigation/feasibility study reports, cleanup action plans, and engineering design reports. As appropriate, Ecology will edit, finalize, and distribute such fact sheets and prepare and distribute public notices of Ecology's presentations and meetings.

2. Notify Ecology's project coordinator prior to the preparation of all press releases and fact sheets, and before major meetings with the interested public and local governments. Likewise, Ecology shall notify the Port prior to the issuance of all press releases and fact sheets, and before major meetings with the interested public and local governments. For all press releases, fact sheets, meetings, and other outreach efforts by the Port that do not receive prior Ecology approval, the Port shall clearly indicate to its audience that the press release, fact sheet, meeting, or other outreach effort was not sponsored or endorsed by Ecology.

3. When requested by Ecology, participate in public presentations on the progress of the remedial action RI/FS work at the Site. Participation may be through attendance at public meetings to assist in answering questions or as a presenter.

4. When requested by Ecology, arrange and/or continue information repositories to be located at the following locations:

a. Anacortes Public Library
1220 10th Street
Anacortes, WA 98221

b. Washington Department of Ecology
Headquarters Office
300 Desmond Drive
Lacey, WA 98503

At a minimum, copies of all public notices, fact sheets, and press releases; all quality assured monitoring data; remedial action plans and reports, supplemental remedial planning documents, and all other similar documents relating to performance of the remedial action required by this Order shall be promptly placed in these repositories.

I. Retention of Records

During the pendency of this Order, and for ten (10) years from the date of completion of work performed pursuant to this Order, the Port shall preserve all records, reports, documents, and underlying data in its possession relevant to the implementation of this Order and shall insert a similar record retention requirement into all contracts with project contractors and subcontractors. Upon request of Ecology, the Port shall make all records available to Ecology and allow access for review within a reasonable time.

J. Resolution of Disputes

1. In the event a dispute arises as to an approval, disapproval, proposed change, or other decision or action by Ecology's project coordinator, or an itemized billing statement under Section VIII.B (Remedial Action Costs), the Parties shall utilize the dispute resolution procedure set forth below.

   a. Upon receipt of Ecology’s project coordinator's written decision or the itemized billing statement, the Port has fourteen (14) days within which to notify Ecology's project coordinator in writing of its objection to the decision or itemized statement.

   b. The Parties' project coordinators shall then confer in an effort to resolve the dispute. If the project coordinators cannot resolve the dispute within fourteen (14) days, Ecology's project coordinator shall issue a written decision.

   c. The Port may then request regional management review of the decision. This request shall be submitted in writing to the Toxics Cleanup Land & Aquatic Lands Cleanup Section Manager within seven (7) days of receipt of Ecology's project coordinator's written decision.

   d. The Section Manager shall conduct a review of the dispute and shall endeavor to issue a written decision regarding the dispute within thirty (30) days of the Port's request for review. The Section Manager's decision shall be Ecology's final decision on the disputed matter.

2. The Parties agree to only utilize the dispute resolution process in good faith and agree to expedite, to the extent possible, the dispute resolution process whenever it is used.

3. Implementation of these dispute resolution procedures shall not provide a basis for delay of any activities required in this Order, unless Ecology agrees in writing to a schedule extension.

K. Extension of Schedule

1. An extension of schedule shall be granted only when a request for an extension is submitted in a timely fashion, generally at least thirty (30) days prior to expiration of the deadline for which the extension is requested, and good cause exists for granting the extension. All extensions shall be requested in writing. The request shall specify:

   a. The deadline that is sought to be extended;

   b. The length of the extension sought;

   c. The reason(s) for the extension; and

   d. Any related deadline or schedule that would be affected if the extension were granted.

2. The burden shall be on the Port to demonstrate to the satisfaction of Ecology that the request for such extension has been submitted in a timely fashion and that good cause exists for granting the extension. Good cause may include, but may not be limited to:

   a. Circumstances beyond the reasonable control and despite the due diligence of the Port including delays caused by unrelated third parties or Ecology, such as (but not limited to) delays by Ecology in reviewing, approving, or modifying documents submitted by the Port;

   b. Acts of God, including fire, flood, blizzard, extreme temperatures, storm, or other unavoidable casualty; or

   c. Endangerment as described in Section VIII.M (Endangerment).

However, neither increased costs of performance of the terms of this Order nor changed economic circumstances shall be considered circumstances beyond the reasonable control of the Port.

3. Ecology shall act upon any written request for extension in a timely fashion. Ecology shall give the Port written notification of any extensions granted pursuant to this Order. A requested extension shall not be effective until approved by Ecology. Unless the extension is a substantial change, it shall not be necessary to amend this Order pursuant to Section VIII.L (Amendment of Order) when a schedule extension is granted.

4. An extension shall only be granted for such period of time as Ecology determines is reasonable under the circumstances. Ecology may grant schedule extensions exceeding ninety (90) days only as a result of:

a. Delays in the issuance of a necessary permit which was applied for in a timely manner;

b. Other circumstances deemed exceptional or extraordinary by Ecology; or

c. Endangerment as described in Section VIII.M (Endangerment).

L. Amendment of Order

The project coordinators may verbally agree to minor changes to the work to be performed without formally amending this Order. Minor changes will be documented in writing by Ecology within seven (7) days of verbal agreement.

Except as provided in Section VIII.N (Reservation of Rights), substantial changes to the work to be performed shall require formal amendment of this Order. This Order may only be formally amended by the written consent of both Ecology and the Port. The Port shall submit a written request for amendment to Ecology for approval. Ecology shall indicate its approval or disapproval in writing and in a timely manner after the written request for amendment is received. If the amendment to this Order represents a substantial change, Ecology will provide public notice and opportunity to comment. Reasons for the disapproval of a proposed amendment to this Order shall be stated in writing. If Ecology does not agree to a proposed amendment, the disagreement may be addressed through the dispute resolution procedures described in Section VIII.J (Resolution of Disputes).

M. Endangerment

In the event Ecology determines that any activity being performed at the Site is creating or has the potential to create a danger to human health or the environment on or surrounding the Site, Ecology may direct the Port to cease such activities for such period of time as it deems necessary to abate the danger. The Port shall immediately comply with such direction.

In the event the Port determines that any activity being performed at the Site is creating or has the potential to create a danger to human health or the environment, the Port may cease such activities. The Port shall notify Ecology’s project coordinator as soon as possible, but no later than twenty-four (24) hours after making such determination or ceasing such activities. Upon Ecology’s direction the Port shall provide Ecology with documentation of the basis for the determination or cessation of such activities. If Ecology disagrees with the Port’s cessation of activities, it may direct the Port to resume such activities.

If Ecology concurs with or orders a work stoppage pursuant to Section VIII.M (Endangerment), the Port’s obligations with respect to the ceased activities shall be suspended until Ecology determines the danger is abated, and the time for performance of such activities, as well as the time for any other work dependent upon such activities, shall be extended in accordance with Section VIII.K (Extension of Schedule) for such period of time as Ecology determines is reasonable under the circumstances.

Nothing in this Order shall limit the authority of Ecology, its employees, agents, or contractors to take or require appropriate action in the event of an emergency.

N. Reservation of Rights

This Order is not a settlement under Chapter 70.105D RCW. Ecology's signature on this Order in no way constitutes a covenant not to sue or a compromise of any of Ecology’s rights or authority. Ecology will not, however, bring an action against the Port to recover remedial action costs paid to and received by Ecology under this Order. In addition, Ecology will not take additional enforcement actions against the Port regarding remedial actions required by this Order, provided the Port complies with this Order.

Ecology nevertheless reserves its rights under Chapter 70.105D RCW, including the right to require additional or different remedial actions at the Site should it deem such actions necessary to protect human health and the environment, and to issue orders requiring such remedial actions. Ecology also reserves all rights regarding the injury to, destruction of, or loss of natural resources resulting from the release or threatened release of hazardous substances at the Site.

O. Transfer of Interest in Property

No voluntary conveyance or relinquishment of title, easement, leasehold, or other interest in any portion of the Site shall be consummated by the Port without provision for continued implementation of all requirements of this Order and implementation of any remedial actions found to be necessary as a result of this Order.

Prior to the Port's transfer of any interest in all or any portion of the Site, and during the effective period of this Order, the Port shall provide a copy of this Order to any prospective purchaser, lessee, transferee, assignee, or other successor in said interest; and, at least thirty (30) days prior to any transfer, the Port shall notify Ecology of said transfer. Upon transfer of any interest, the Port shall restrict uses and activities to those consistent with this Order and notify all transferees of the restrictions on the use of the property.

P. Compliance with Applicable Laws

1. All actions carried out by the Port pursuant to this Order shall be done in accordance with all applicable federal, state, and local requirements, including requirements to obtain necessary permits, except as provided in RCW 70.105D.090. At this time, no federal, state or local requirements have been identified as being applicable to the actions required by this Order.

2. Pursuant to RCW 70.105D.090(1), the Port is exempt from the procedural requirements of Chapters 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 RCW and of any laws requiring or authorizing local government permits or approvals. However, the Port shall comply with the substantive requirements of such permits or approvals. The exempt permits or

approvals and the applicable substantive requirements of those permits or approvals, as they are known at the time of entry of this Order, have been identified in Exhibit B.

The Port has a continuing obligation to determine whether additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order. In the event either Ecology or the Port determines that additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order, it shall promptly notify the other party of its determination. Ecology shall determine whether Ecology or the Port shall be responsible to contact the appropriate state and/or local agencies. If Ecology so requires, the Port shall promptly consult with the appropriate state and/or local agencies and provide Ecology with written documentation from those agencies of the substantive requirements those agencies believe are applicable to the remedial action. Ecology shall make the final determination on the additional substantive requirements that must be met by the Port and on how the Port must meet those requirements. Ecology shall inform the Port in writing of these requirements. Once established by Ecology, the additional requirements shall be enforceable requirements of this Order. The Port shall not begin or continue the remedial action potentially subject to the additional requirements until Ecology makes its final determination.

3. Pursuant to RCW 70.105D.090(2), in the event Ecology determines that the exemption from complying with the procedural requirements of the laws referenced in RCW 70.105D.090(1) would result in the loss of approval from a federal agency that is necessary for the State to administer any federal law, the exemption shall not apply and the Port shall comply with both the procedural and substantive requirements of the laws referenced in RCW 70.105D.090(1), including any requirements to obtain permits.

Q. Indemnification

The Port agrees, to the extent allowed by law, to indemnify and save and hold the State of Washington, its employees, and agents harmless from any and all claims or causes of action for death or injuries to persons or for loss or damage to property to the extent arising from or on account of acts or omissions of the Port, its officers, employees, agents, or contractors in entering into and implementing this Order. However, the Port shall not indemnify the State of Washington nor save nor hold its employees and agents harmless from any claims or causes of action to the extent arising out of the negligent acts or omissions of the State of Washington, or the employees or agents of the State, in entering into or implementing this Order.

IX. SATISFACTION OF ORDER

The provisions of this Order shall be deemed satisfied upon the Port's receipt of written notification from Ecology that the Port has completed the remedial activity required by this Order, as amended by any modifications, and that the Port has complied with all other provisions of this Agreed Order.

X. ENFORCEMENT

Pursuant to RCW 70.105D.050, this Order may be enforced as follows:

A. The Attorney General may bring an action to enforce this Order in a state or federal court.

B. The Attorney General may seek, by filing an action, if necessary, to recover amounts spent by Ecology for investigative and remedial actions and orders related to the Site.

C. In the event the Port refuses, without sufficient cause, to comply with any term of this Order, the Port will be liable for:

a. Up to three (3) times the amount of any costs incurred by the State of Washington as a result of its refusal to comply; and

b. Civil penalties of up to twenty-five thousand dollars ($25,000) per day for each day it refuses to comply.

D. This Order is not appealable to the Washington Pollution Control Hearings Board.

This Order may be reviewed only as provided under RCW 70.105D.060.

Effective date of this Order: ___________________________________

PORT OF ANACORTES	**STATE OF WASHINGTON,** **DEPARTMENT OF ECOLOGY**
______________________________	______________________________
Robert W. Hyde Executive Director Telephone: (360) 299-1812	Timothy L. Nord Section Manager Toxics Cleanup Program Land & Aquatic Lands Cleanup Section Telephone: (360) 407-7226

EXHIBIT - A

CAP SANTE MARINE PROPERTY LEGAL DESCRIPTION

Cap Sante Marine Site:

The physical address is:
Cap Sante Marine
Cap Sante Waterway
Anacortes, WA 98221

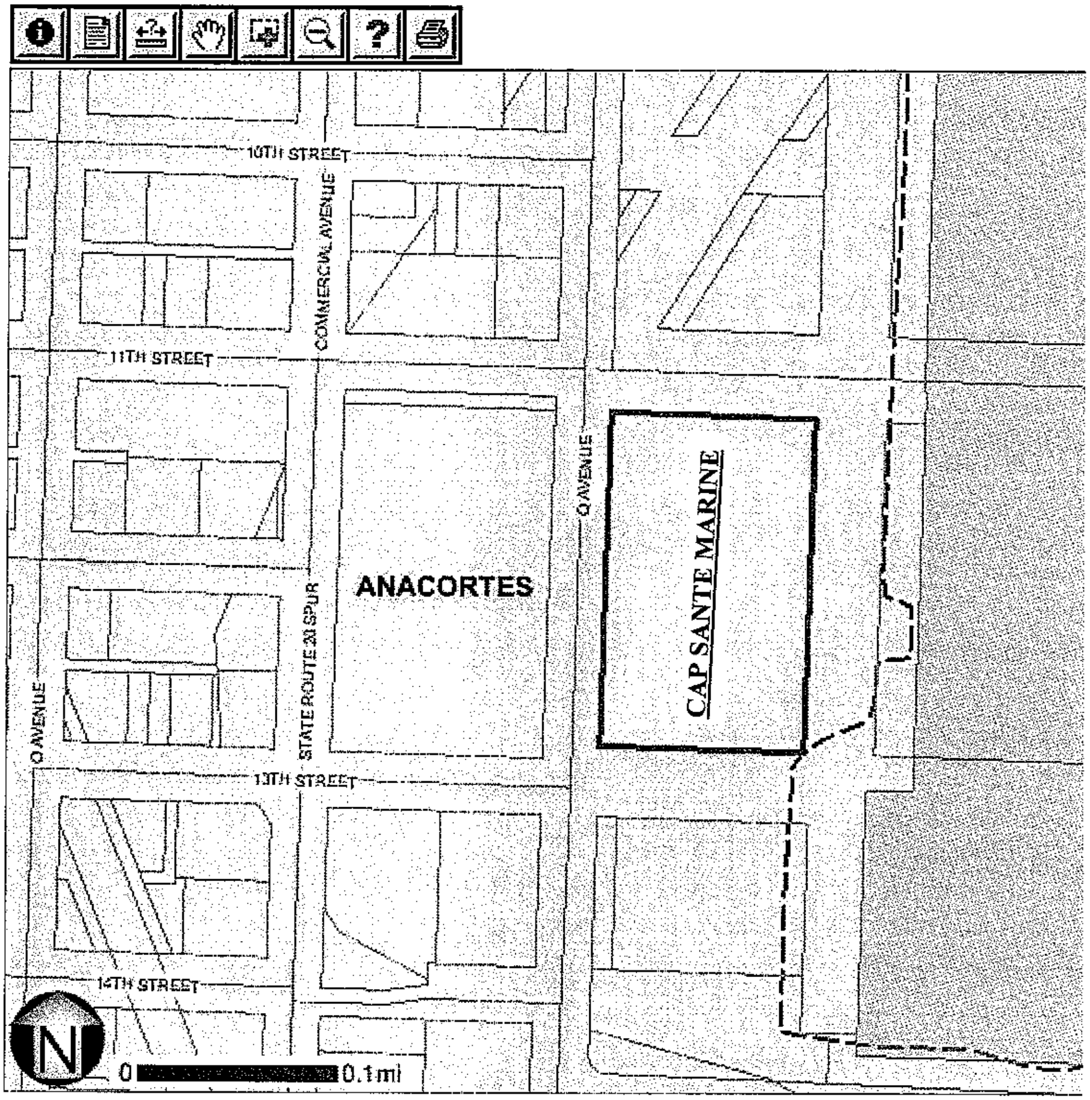
The Parcel # is P32951 and the site is located between 11th Street and 13th Street on the **east** side of Q Avenue in Anacortes.

The legal description (taken from the Port's lease with Cap Sante Marine) reads:

Tracts 7 and 8, all in Plate Number 10 (10), Anacortes Tide and Shore Lands, together with vacated streets and avenues adjoining, situated in Section Nineteen (19), Township Thirty-five (35) North, Range Two (2) East of W. M., according to the plat thereof on file in the office of the Commissioner of Public Lands at Olympia, WA.

Search by:

- Section
- Parcel Number
- Address
- Xref ID
- Road Name



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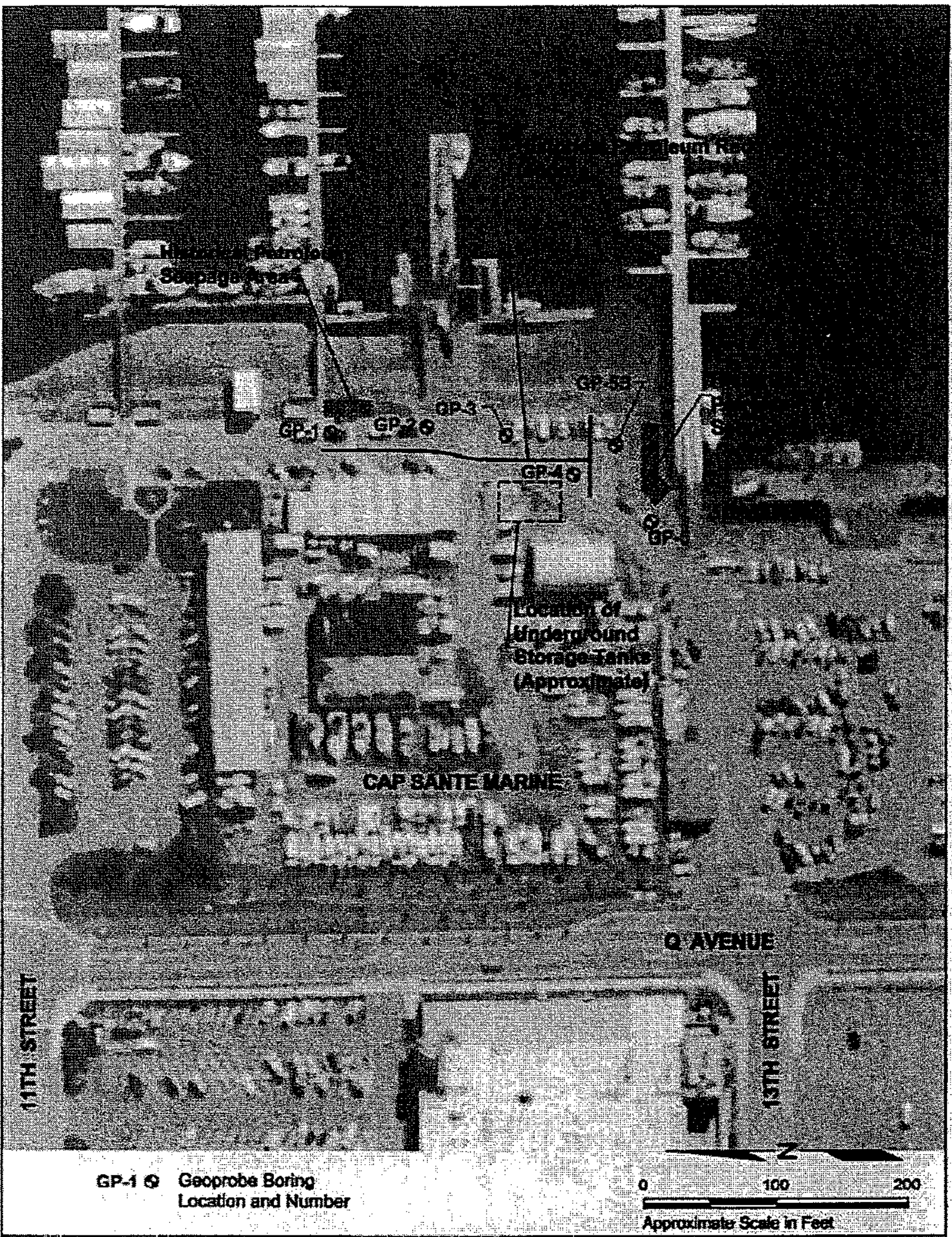

DWG NAME:
DATE: 04/30/04 12:14pm

Floyd
Snider
McCarthy, Inc.

Port of Anacortes
Cap Sante Boat Haven
Anacortes, Washington

Figure 1
Site Map: Exploration Locations and Existing Site Features

Public Review Draft Work Plan
Remedial Investigation/Feasibility Study and Interim Action
Cap Sante Marine Lease Area
Anacortes, Washington

April 2, 2007

Prepared for

Port of Anacortes
Anacortes, WA

Landau Associates
130 2nd Avenue South
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1.0 INTRODUCTION

This document integrates a work plan for a Remedial Investigation/Feasibility Study (RI/FS) and a scope of work for an Interim Action within the Cap Sante Marine (CSM) Lease Area (Site), located at the Port of Anacortes (Port) Cap Sante Boat Haven on the east end of 13th Street in Anacortes, Washington (Figure 1). Recent environmental investigations of the Site, completed by the Port, have confirmed that contamination is present in the subsurface soil and groundwater in the vicinity of two former underground storage tanks (USTs; Floyd Snider and McCarthy 2004, Floyd|Snider 2005). In order to assess the nature and extent of the contamination, the Port is performing an RI/FS under an Agreed Order with the Washington State Department of Ecology (Ecology). Ecology is overseeing the Site as part of Fidalgo and Padilla Bay efforts under the Governor's Puget Sound Initiative. This work plan serves as the Scope of Work for the Agreed Order. The activities described in this work plan will be conducted to fulfill the requirements set forth in the Agreed Order by assessing the nature and extent of contamination at the Site and providing sufficient information to select a cleanup action. It is anticipated that an interim action will be implemented at the Site prior to completion of the RI/FS and selection of the final remedy. The interim action will be considered after the site-specific cleanup levels are established for the Site. The interim action will be implemented to reduce potential threats to human health or the environment by eliminating known contaminant pathways or to correct a problem that may become worse over time. Pursuant to the Agreed Order, this work plan also includes provisions for an interim action to address petroleum-contaminated soil prior to and during Site redevelopment activities. A scope of work for the interim action is set forth in Section 4.0 of this document.

This work plan was prepared for submittal to Ecology in accordance with the provisions of the Agreed Order, and was developed to meet the general requirements of an RI and FS as defined by the Washington Model Toxics Control Act Cleanup (MTCA) Regulation (WAC 173-340-350). This work plan describes the RI activities to be performed, the FS activities to be performed, and the planned schedule and reporting. Appendices to this work plan consist of a Sampling and Analysis Plan (Appendix A); a Quality Assurance Project Plan (Appendix B); a project Health and Safety Plan (Appendix C); the Port of Anacortes Petroleum Seepage Study (Appendix D); 2004 and 2005 Environmental Due Diligence Reports (Appendix E); a Dredge Material Characterization Report for Cap Sante Marina (Appendix F); Background Information for Terrestrial Evaluation (Appendix G); and a Public Participation Plan (Appendix H).

2.0 BACKGROUND INFORMATION

This section describes the CSM Site, including its known history, current uses, existing property features, and geology, and summarizes previous environmental investigations.

2.1 PROPERTY DESCRIPTION

As described in Section 1.0, the Site is located within the Cap Sante Boat Haven in Anacortes, Washington. The Site is currently used as a boatyard, marina support area, and a marine fueling facility by Cap Sante Marine, Ltd., tenant of the Port. The property is bounded by Fidalgo Bay on the east, Q Avenue on the west, 11th Avenue on the north, and 13th Street to the south. The ground surface at the Site is asphalt in the roadway and a combination of asphalt, concrete slab, and gravel within the boatyard.

2.2 SITE HISTORY

Prior to 1947, the Site consisted of tide flats. In the late 1940s to early 1950s, the area was filled with dredged material from the adjacent federal waterway. The Port has owned the Site since 1956 and has leased it to various operators over time. The Site has been operated as a boatyard and marina support area, including a marine fueling facility, since approximately 1959. Cap Sante Marine, Ltd, the current tenant, has occupied the Site since the late 1970s and provides small vessel storage, launch, and minor maintenance services. Vessel fueling was provided from a float located offshore from the CSM Site. Fuel was supplied to the float via a series of underground pipelines from USTs located within the CSM Site area (see Figure 2).

Fuel releases have been recorded at the Site since the 1980s. In the early 1980s, petroleum fuel was observed seeping into the marine waters at the boat basin at several locations near the fuel float. In 1983, under order from the U.S. Coast Guard, the Port installed a trench to control the seepage of fuel. The trench intercepted the fuel flowing through the soil. According to the available documentation, approximately 1,250 gallons of fuel were recovered from the trench and the seepage stopped. It was determined that the seepage was the result of leakage from the USTs and supply lines that serviced the fuel float.

The USTs contained gasoline, diesel, and two-stroke oil pre-mix. The approximate total storage capacity of the original tanks was 22,000 gallons. In 1985, the Port replaced these USTs with two new 12,000 gallon tanks. Recently, the fuel float was demolished by the Port as part of the boat haven redevelopment. To date, the USTs and supply lines have not been removed.

2.3 PREVIOUS INVESTIGATIONS

In 1982, the USTs and supply lines were repaired; however, petroleum leakage continued to be observed at the Site. Following the continued petroleum seepage, a Petroleum Seepage Study was conducted that included hydrogeologic explorations and analyses (Hart Crowser 1983). The results of the Petroleum Seepage Study are presented in the Petroleum Seepage Study report provided in Appendix D.

In 1983, eight observation wells were installed and several test pits were excavated. The data obtained from the investigation indicated that petroleum present in the subsurface soil was migrating toward the shoreline on top of the water table. In 1984, a petroleum recovery system was installed that was comprised of an interceptor trench system coupled with a recovery well. The interceptor trench was excavated to a depth of approximately 8 to 10 ft at the approximate location shown on Figure 2, and was backfilled with coarse gravel. A petroleum recovery well was installed in direct hydraulic connection to the trench. Petroleum pumped from the well was directed into a separate storage tank. The recovery system operated for approximately 28 weeks, recovering approximately 1,250 gallons of petroleum. Groundwater wells were monitored for 6 months following the recovery system shutdown. Petroleum seepage into the harbor was not observed following these remedial actions.

In 2004 and 2005, the Port conducted a series of Environmental Due Diligence Investigations into the extent of soil and groundwater contamination at the Site (Floyd|Snider 2005). As part of the 2004 investigation, soil and groundwater samples were collected from six locations near the former fuel recovery trench. A total of 13 soil and 6 groundwater samples were collected and analyzed for petroleum hydrocarbon contaminants. Soil concentrations of benzene and/or xylenes exceeded MTCA Method A cleanup levels at four of the sampling locations, and gasoline-range petroleum hydrocarbons were detected at concentrations exceeding MTCA Method A cleanup levels at two sampling locations. Cleanup levels for benzene, gasoline, and diesel in groundwater were exceeded at two of the sampling locations. In 2005, soil and groundwater samples were collected from nine locations in the general vicinity of the USTs. A total of 7 soil samples and 5 groundwater samples were collected and analyzed for petroleum hydrocarbon contaminants. Soil concentrations of benzene and/or diesel-range petroleum hydrocarbons exceeded MTCA Method A cleanup levels at five of the sampling locations. Gasoline-range and diesel-range petroleum hydrocarbons and benzene exceeded groundwater cleanup levels at five of the sampling locations. The Port's investigations revealed soil and groundwater contaminated with gasoline-range and diesel-range petroleum hydrocarbon, and benzene in a roughly fan-shaped area around the USTs that extended to Fidalgo Bay. Analytical results for the 2004 and 2005 soil and groundwater investigations are summarized in Tables 1 and 2 and on Figure 3. The 2004 and 2005 Due Diligence Reports are provided in Appendix E.

Sediments adjacent to the Site were tested in February 1999 and January 2000 in conjunction with maintenance dredging of the boat haven. Dredged materials were subject to the chemical quality evaluations required by the Dredged Material Management Program and were found to be suitable for unconfined open-water disposal (Appendix F). The maintenance dredging was performed in two phases of work. Phase 1 was completed during the 2004/2005 dredging window and included dredging from the federal channel and from the entrance of the Marina to the A- and B-Docks. Phase 2 included dredging the marina area between B-Dock and E-Dock and was completed during the 2006/2007 dredging window (Figure 2).

2.4 CURRENT PROPERTY CONDITIONS

2.4.1 GEOLOGY AND HYDROLOGY

Based on previous investigations (Hart Crowser 1983), the subsurface geology at the Site consists of dredged fill material overlying native marine sediment and glacial deposits. The fill consists of gray silty, fine to medium sand. The native layer underlying the dredged fill material consists of a sandy, clayey silt. The native silt layer is encountered at about 9 ft below ground surface (BGS) and ranges from 3 to 6 ft in thickness. A shallow unconfined aquifer is present within the dredged fill material. Groundwater in this shallow aquifer has been encountered at depths ranging from 4 to 5.5 ft BGS. The native silt layer encountered at approximately 9 ft BGS separates the shallow aquifer from a deeper confined aquifer present in the native sand layer. Due to the proximity of the Site to Fidalgo Bay, Site groundwater is assumed to be tidally influenced with a general flow direction to the east toward the bay.

2.4.2 CHEMICALS OF POTENTIAL CONCERN

At the CSM Site, the chemicals of potential concern (COPCs) for soil and groundwater include those associated with the historical petroleum fuel tanks and supply lines associated with the fuel seepage in the early 1980s. COPCs include petroleum hydrocarbons; polycyclic aromatic hydrocarbons (PAHs); volatile organic compounds (VOCs) associated with petroleum fuel; and lead. The specific COPCs are listed below:

- Gasoline-range petroleum hydrocarbons
- Diesel-range petroleum hydrocarbons
- Carcinogenic PAHs (cPAHs)
- Napthalene
- 1-Methylnaphthalene
- 2-Methylnaphthalene

- Benzene, toluene, ethylbenzene, xylenes (BTEX)
- Methyl tert-butyl ether (MTBE)
- Lead
- 1,2-Dibromoethane (EDB)
- 1,2-Dichlorethane (EDC)
- N-Hexane.

Previous investigations at the Site focused on identifying the nature and extent of these COPCs. Further investigation of the Site will include analysis of the chemical parameters listed in Table 830-1 of the MTCA (Chapter 173-340 WAC). Also, because heavy oil was detected in groundwater during the 2005 groundwater investigation, heavy oil will be analyzed for in some or all of the soil and groundwater samples. Chromium, copper, zinc, and polychlorinated biphenyls (PCBs) will also be analyzed for in some samples collected in the vicinity of the waste oil tank. Unless detected, these additional parameters will not be carried forward as COPCs.

2.5 FUTURE SITE LAND USE

Currently, the Port is redeveloping the Cap Sante Boat Haven including parts of the CSM Site. Redevelopment activities include the following:

- Dredging of moorage areas to -12 ft mean lower low water
- Installation of new moorage floats for C-, D-, and E-Docks
- Demolition of the existing boat launch and fuel float facility and construction of a new fuel facility near the terminus of A-Dock
- Installation of a boat launch facility between the B-Dock and C-Dock
- Installation of a pedestrian esplanade along the shoreline.

Future plans may include the reconfiguration of the current upland boatyard.

3.0 REMEDIAL INVESTIGATION

The RI will evaluate existing soil, groundwater, and sediment quality data from the Site. Additional information will be collected, as needed, to characterize the Site for the purpose of developing and evaluating cleanup action alternatives and selecting a cleanup action. The scope of the RI will include a soil investigation, groundwater investigation, and a sediment investigation. To expedite the RI, the sediment investigation and monitoring well installation associated with the groundwater investigation will be done concurrently and in advance of the soil investigation. The results of the RI, as well as previous investigation results, will be compared to preliminary cleanup levels to determine the nature and extent of contamination. Although cleanup levels will be developed for soil and groundwater as part of the FS (discussed further in Section 5.0), preliminary cleanup levels will be established during the RI to evaluate the nature and extent of contamination and to select analytical methods with reporting limits at or below the cleanup levels to the extent possible.

This section presents preliminary cleanup levels, the rationale for the preliminary cleanup levels, and the activities associated with each investigation.

3.1 PRELIMINARY CLEANUP LEVELS

In accordance with MTCA, the development of preliminary cleanup levels included identifying potential exposure pathways for human and environmental impacts based on the planned land use. The Site is currently zoned commercial and, as discussed in Section 2.1, the Site is currently used as a boatyard and for retail. As discussed in Section 2.5, the Port plans to redevelop portions of the Site as part of an overall upgrade of the Cap Sante Boat Haven facility. Redevelopment plans include installation of new moorage floats, relocation of the fuel dock, installation of a boat launch facility, and installation of a pedestrian esplanade along the shoreline. It is not anticipated that the zoning will change following redevelopment.

3.1.1 DERIVATION OF SOIL AND GROUNDWATER TPH CLEANUP LEVELS PROTECTIVE OF OFFSHORE SEDIMENTS

Sediment total petroleum hydrocarbon (TPH) toxicity will be evaluated through bioassay testing to provide a basis for determining TPH cleanup levels in Site soil and groundwater. Site soil and groundwater TPH cleanup levels must be protective of benthic organisms in sediment and will prevent re-contamination of sediment. Sediment samples will be collected from three locations along the shoreline of the Site at the approximate elevation of the groundwater table and at multiple locations offshore of the Site. These samples will be analyzed for the COPCs, and the shoreline sample containing the highest TPH concentration will be subject to bioassay testing to evaluate the potential toxicity of the test sediments. If the sediment passes the bioassay tests, no further investigation of the sediment will be conducted because there are no demonstrated impacts to sediment resulting from historical releases at the Site. In this case, soil and groundwater cleanup levels will default to MTCA Method A cleanup levels for TPH. If the bioassay results show toxicity to benthic organisms related to TPH, then additional testing will be performed in consultation with Ecology. The additional testing will utilize the other sediment sample results to identify the range of sediment TPH concentration at the Site. Additional toxicity testing will focus on identification of TPH levels that do not pose adverse effects to benthic organisms. On identification of protective sediment TPH concentrations, groundwater and soil cleanup levels will be calculated using the U.S. Environmental Protection Agency (EPA) Equilibrium Partitioning Model for sediment.

3.1.2 GROUNDWATER

Groundwater at or potentially affected by the Site is not currently used for drinking water and is not a reasonable future source of drinking water due the availability of a municipal water supply and, in accordance with WAC 173-340-720(2)(d), due to its proximity to marine surface water. However, groundwater samples collected during the RI will be analyzed for additional parameters (total dissolved solids, salinity, etc.) that will support the conclusion that groundwater at the Site is not a reasonable source of drinking water. As a result, the potential exposure pathways for Site groundwater include:

- Human ingestion of marine organisms contaminated by releases of affected Site groundwater to adjacent marine surface water
- Acute or chronic effects to aquatic organisms resulting from exposure to constituents in groundwater discharging to adjacent marine surface water.

Groundwater cleanup criteria that are developed based on the exposure pathways identified in this subsection must be adequately protective of aquatic organisms and of humans that ingest these marine organisms. Except for TPH, MTCA Method B marine surface water cleanup levels will be developed in accordance with WAC 173-340-730(3) for the COPCs. TPH cleanup levels for groundwater will be based on the TPH concentration permissible in groundwater to prevent toxicity to benthic organisms and recontamination of sediment. The concentration value will be calculated using the EPA Equilibrium Partitioning Model for sediment, using the sediment TPH cleanup level. If a sediment TPH cleanup level is not calculated because bioassay tests pass, as discussed in Section 3.1.1, MTCA Method A cleanup levels will be used for TPH groundwater cleanup levels. Preliminary groundwater cleanup levels and the development of these cleanup levels, including the concentrations established under applicable state and federal laws, are presented in Table 3. However, in accordance with WAC 173-340-740(5)(c), further adjustment to the preliminary groundwater cleanup levels presented in Table 3 may be necessary if practical quantitation limits are greater than cleanup levels.

3.1.3 SOIL

Except for TPH, MTCA Method B cleanup levels will be used as preliminary soil cleanup levels. Because access to the property by the general public is currently allowed and will continue to be allowed after redevelopment, preliminary soil cleanup levels will be based on unrestricted land use, as defined in MTCA. During the FS, cleanup levels and/or risk-based remediation levels for specific land uses and associated institutional controls may be considered as a component of cleanup alternative development and evaluation. Under MTCA Method B, soil cleanup levels must be as stringent as:

- Concentrations established under applicable state and federal laws
- Concentrations protective of terrestrial ecological receptors
- Concentrations protective of direct human contact with soil
- Concentrations protective of groundwater.

Consideration of the above criteria was made, as follows, during development of preliminary soil cleanup levels:

- Except for MTCA, there are no soil cleanup levels established under applicable state or federal laws for the COPCs at the Site.

- A terrestrial ecological evaluation is not required for the Site because it does not meet any of the criteria in WAC 173-340-7491(2). Copies of the forms documenting this decision for the Site are included in Appendix G. As a result, the Site meets the exclusion for a terrestrial ecological evaluation. Therefore, human contact and leaching to groundwater are the only applicable pathways for Site soil.

- Except for TPH, standard MTCA Method B soil cleanup levels protective of direct human contact will be developed for the COPCs. These cleanup levels will be developed in accordance with WAC 173-340-740(3) using Ecology's on-line CLARC database (Ecology 2001). Table 4 shows the preliminary soil cleanup levels for protection of human health. The preliminary cleanup level for benzo(a)pyrene will be used for the sum of cPAHs using total equivalency factors (TEFs) in accordance with WAC 173-340-708(8)(e) and Ecology guidance (Ecology 2001). MTCA Method A cleanup levels will be used as TPH cleanup levels protective of direct human contact, as shown in Table 4.

- Unless nonaqueous phase liquid (NAPL) is present at the Site, preliminary soil cleanup levels for the saturated and unsaturated soil zones that are protective of groundwater will be determined for the COPCs (except TPH) using the fixed parameter three-phase partitioning model in accordance with WAC 173-340-747(4). Based on the exposure pathways identified in Section 3.1.2 for Site groundwater, because groundwater is not a current or likely future source of drinking water and because it discharges to marine surface water, marine surface water preliminary cleanup levels protective of human health and aquatic organisms developed in accordance with WAC 173-340-730 will be used in the calculation. Preliminary soil TPH cleanup levels protective of groundwater will be calculated using the TPH concentration permissible in groundwater to prevent sediment toxicity and recontamination (see Section 3.1.2). Table 4 shows the preliminary soil cleanup levels for protection of groundwater as marine surface water.

- If NAPL is present, preliminary soil cleanup levels protective of groundwater will be determined for the constituents present in the NAPL using the four-phase partitioning model in accordance with WAC 173-340-747(6). This methodology calculates a predicted groundwater concentration for each constituent present in the NAPL based on the concentrations of these constituents in soil. The predicted groundwater concentration is then compared to the applicable groundwater cleanup level. For each of the constituents present in the NAPL, except TPH, the predicted groundwater concentration will be compared to the groundwater cleanup level protective of marine surface water. For TPH, the predicted groundwater concentration will be compared to the TPH concentration permissible in groundwater to prevent sediment toxicity recontamination. If the predicted groundwater concentration for each constituent and for the TPH mixture is less than or equal to the applicable groundwater cleanup levels, then the soil concentrations measured at the Site will be considered protective. If the predicted groundwater concentrations for each constituent and for TPH is more than the applicable groundwater concentration, then the Site soil concentrations will not be considered protective and calculation of protective soil concentrations will be conducted iteratively using the four-phase partitioning model.

- If NAPL is present, the TPH preliminary cleanup levels protective of groundwater will be compared to residual saturation screening levels to ensure that the soil cleanup levels will not result in the accumulation of NAPL. Residual saturation screening levels for TPH will be established using the values specified in Table 747-5 of the MTCA (Chapter 173-340 WAC)

Preliminary soil cleanup levels may be adjusted to be no less than natural background in accordance with WAC 173-340-740(5)(c). Background concentrations for metals, based on statewide 90th percentile values (Ecology 1994), were compared to preliminary soil cleanup levels protective of human direct contact and groundwater. Preliminary cleanup levels for copper, mercury, and nickel were adjusted upward to the natural background level. Preliminary soil cleanup levels adjusted based on natural background are identified in Table 4. Also, in accordance with WAC 173-340-740(5)(c), further adjustment to the preliminary cleanup levels may be necessary if the practical quantitation limits are greater than the preliminary cleanup levels.

3.2 SEDIMENT INVESTIGATION

Initially, a sediment investigation will be performed to determine the sediment toxicity-based soil and groundwater cleanup criteria as described in 3.1.1 above. Twelve surface (0 to 10 cm) sediment samples (SED-1 through SED-12) will be collected from the locations shown on Figure 4. Initially, the sediment samples will be analyzed for petroleum hydrocarbon fractions using volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH), and NWTPH-Dx methodologies. A bioassay test will be performed using shoreline samples (SED-1, SED-2, or SED-3) containing the highest concentrations of TPH. Other sediment samples with significant TPH concentrations that are considered to be associated with historical upland releases of petroleum hydrocarbons may also be submitted for toxicity testing. If the sediment sample passes the bioassay tests, the concentrations of TPH in sediment will be considered protective of benthic organisms and MTCA Method A cleanup levels will be used. If the sediment sample fails the bioassay tests, additional bioassay testing will be performed on samples representative of the range of TPH at the Site as determined from the 12 sediment samples that will be collected. Additional toxicity testing will be identified and completed in consultation with Ecology. Sediment sample collection procedures are discussed in more detail in the SAP (Appendix A).

3.3 SOIL INVESTIGATION

The soil investigation will be initiated following completion of the sediment investigation. This will allow TPH cleanup levels protective of sediment to be developed for the soil prior to collecting and analyzing soil samples. The soil investigation will consist of collecting soil samples from twelve borings (SB-1 through SB-12) at the approximate locations shown on Figure 5. Three of the borings (SB-02, SB-03, and SB-12) are located upgradient of the former USTs to better delineate the extent of petroleum-impacted soil in the vicinity of the former USTs. Six of the borings (SB-01, SB-04, SB-05, SB-06, SB-08, and SB-11) are located along the CSM shoreline to characterize the extent of impacted soil shoreward of the recovery trench. One soil boring, SB-07, will be located downgradient of the former waste oil tank and another soil boring, SB-09, will be located between previous boring locations CSM-04 and CSM-14. Soil sampling at these boring locations will be conducted to fill data gaps associated with MTCA testing requirements for petroleum releases. One soil boring, SB-10, will be located in an area located near the B-Dock that was recently identified as potentially impacted by petroleum. Soil samples will also be collected at the proposed monitoring well locations (shown on Figure 5 and described in Section 3.4) if a zone of contamination is encountered during drilling of the monitoring well borehole.

At each boring location, a sample of the surface soil (0 to 0.5 ft BGS) will be collected and submitted for laboratory analysis. Additionally, if soil conditions at any of the twelve borings indicate a zone of potential contamination (e.g., debris, presence of oil or sheen, odors, and/or discoloration), a sample will be collected from that zone and submitted for laboratory analysis. A sample will also be collected from a depth below the zone of potential contamination where no evidence of contamination is present. If no evidence of potential contamination is observed at a boring, a soil sample will be collected from the 1- to 2-ft depth and from the capillary fringe, in addition to the surface soil sample, and submitted for laboratory analysis.

Boreholes for collecting soil samples will be drilled using a truck-mounted Geoprobe® direct-push drilling rig. Soil samples will be obtained from the soil borings using a closed-piston sampling device with a core sampler. Soil sample collection procedures are discussed in more detail in the SAP provided in Appendix A of this work plan.

Soil samples submitted for analysis will be analyzed for the COPCs identified in Section 2.4.2. Soil samples submitted for laboratory analysis from soil boring SB-07, located near the former waste oil tank, will be analyzed for the COPCs, as well as chromium, copper, zinc, and PCBs. If necessary for the development of TPH cleanup levels that are protective of sediment, 10 soil samples will be collected from the vadose zone at borings where petroleum hydrocarbon contamination is observed. The vadose zone samples will be analyzed for TPH fractions using EPH and VPH methodologies (Ecology 1997). Analytical methods and reporting limits goals for the analysis of each constituent are described further in the SAP provided in Appendix A of this work plan.

3.4 GROUNDWATER INVESTIGATION

Five groundwater monitoring wells will be installed at the Site to determine groundwater depth, flow direction, and other characteristics, and to determine if hazardous substances are present. Based on previous investigations (Hart Crowser 1983), it is expected that groundwater generally flows toward the shoreline (Cap Sante Waterway). As described in Section 3.1.2, the property groundwater is not a current or reasonable future drinking water source. The groundwater investigation will focus on characterization of groundwater quality migrating onto and off of the Site. The groundwater investigation will consist of installation of four shallow monitoring wells screened in the upper aquifer and one deep well screened in the lower aquifer, measurement of groundwater levels at each well location, collection of groundwater samples at each well, and collection of a groundwater sample at soil boring SB-01. Groundwater samples submitted for laboratory analysis will be analyzed for the COPCs identified in Section 2.4.2 and other parameters that will be used to evaluate the use of groundwater as drinking water and/or to evaluate natural attenuation as a potential cleanup option. Monitoring well locations and installation procedures, groundwater sampling and analysis, and measurement of groundwater levels are discussed below; more detailed procedures are provided in the SAP (Appendix A).

3.4.1 MONITORING WELL LOCATIONS

Four shallow monitoring wells (MW-01, MW-02, MW-03S, and MW-04) and one deep monitoring well (MW-03D) will be installed at the proposed locations shown on Figure 5. The proposed groundwater monitoring well locations were selected to provide additional information on the groundwater quality in the vicinity of the USTs and historical releases. Shallow monitoring well MW-01 is located upgradient from the former USTs to determine the chemical quality of groundwater entering the area. Shallow monitoring well MW-02 is located upgradient of one of the historical petroleum seepage areas and southeast of the former USTs. Monitoring wells MW-03S and MW-04 are located downgradient of the former USTs and historical petroleum recovery trench. The actual location of the monitoring wells may be modified slightly during installation activities, based on field conditions and to reduce possible conflict with current Site use or future Site development plans.

3.4.2 MONITORING WELL INSTALLATION

Boreholes for shallow and deep monitoring wells will be drilled using a hollow-stem auger drill rig. Step-down drilling procedures across the confining unit will be used for the deep well installed in the lower aquifer. Shallow monitoring well boreholes will be terminated at the top of the upper confining unit or will extend no more than 0.5 ft into the upper confining unit with total depths expected to be about 9 ft BGS. The deep monitoring well boreholes will be terminated approximately 10 to 15 ft below the base of the upper confining unit or at the top of the lower confining unit, if this unit is present at depths less than 10 ft below the upper confining unit. Monitoring well installation and construction will be performed in accordance with the *Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC).

3.4.3 GROUNDWATER MONITORING

Following well installation, each well will be developed and groundwater samples will be collected as described in the SAP. Groundwater sampling will occur within 1 hour before and 1 after a low tide so that samples collected will be of water discharging from the site that is minimally influenced by the tide. Two other groundwater monitoring events will be conducted in addition to this monitoring event. These monitoring events will be conducted during a dry season (typically August or September) and a wet season (typically April, May, or November). At least two quarters of groundwater monitoring may be completed prior to implementation of an interim action at the Site. Water levels will also be measured at each monitoring well and in Cap Sante Waterway during each sampling event. In addition to the groundwater samples collected at each monitoring well, a groundwater sample will be collected directly from soil boring SB-01 during the soil investigation. Collection of a groundwater sample at soil boring SB-01 will also occur within 1 hour before and 1 hour after low tide. Groundwater samples will be analyzed for the COPCs identified in Section 2.4.2 and other parameters that will be used to evaluate the use of groundwater as drinking water and/or to evaluate natural attenuation as a potential cleanup option. Analysis of groundwater samples for metals will include both total and dissolved; however, which result will be used for characterization of Site groundwater will depend on sample turbidity. For turbid groundwater samples, the dissolved metals results will likely be used to characterize Site groundwater. For non-turbid groundwater samples, total metals results will likely be used to characterize Site groundwater. However, the use of total or dissolved metal results for characterizing Site groundwater will be determined in consultation with Ecology.

To further delineate groundwater flow characteristics across the Site, specifically groundwater tidal influence information, a 72-hour tidal study will be conducted. Data collection will include continuous (every 15 minutes) water level measurements from monitoring wells located at the Site, and in the marina using electronic dataloggers and well transducers. Manual water levels will also be collected by field staff to confirm results of the electronic data collection. Net groundwater flow directions determined from the tidal study will be used along with the groundwater monitoring analytical results to more accurately define the nature and extent of potential groundwater contamination beneath the Site. In addition, aquifer hydraulic conductivity will be determined by conducting aquifer well slug tests.

Procedures for well development, water level monitoring, groundwater sample collection, slug tests, and the tidal study are provided in the SAP (Appendix A).

4.0 INTERIM ACTION

The purpose of an interim action at the CSM Site is to remove contaminated soil from the known source area to reduce the potential for transport of contamination off Site. The interim action will be implemented as early as is practical in the Site RI/FS and cleanup process, after site-specific cleanup criteria are established. The interim action will achieve an immediate reduction in source material volume and will lower, if not eliminate, the potential environmental threats posed by leaving the source material in place. The interim action would also be completed prior to redevelopment of the Site because delaying such action will result in substantially greater cost. Removal of soil meets the criteria of an interim action as defined by WAC 173-340-430(1)(b); if removal of the soil is not conducted prior to or during construction activities associated with the Site redevelopment, the cost of removing this soil will substantially increase due to restraints posed by new buildings and structures.

As described in Section 2.2, the source of the petroleum seeping into the marine waters in the early 1980's was determined to be leaking USTs and supply lines that serviced the fuel float (Figure 2). Although the leaky USTs were replaced and the supply lines repaired, contaminated soil surrounding the USTs is still present. The interim action will be conducted to remove the contaminated soil. The extent of soil to be removed will be identified based on the sample results for the previous investigations and the soil investigation described in Section 3.3. Soil sample results from these investigations will be compared to the preliminary cleanup levels described in Section 3.1. Soil located within the vicinity of the former USTs that contains concentrations of constituents exceeding the preliminary cleanup levels will be removed during the interim action, to the extent practicable. Although it is the intent of the Port to have the interim action be as complete as possible, the interim action may not constitute the cleanup action for the site; therefore, the proposed interim action will be implemented in a manner that does not foreclose reasonable alternatives for a future site cleanup action, if necessary.

Soil removal during the interim action is expected to include proper decommissioning of the existing USTs and service lines and be coordinated with habitat restoration opportunities, where appropriate. In all of the remedial actions under this Order, the Port will integrate cleanup options and habitat restoration objectives as determined appropriate by Ecology. Excavated soil will be disposed offsite at a disposal facility determined appropriate based on soil analytical results collected during the RI soil investigation and previous soil investigations. If the extent of contaminated soil extends below the groundwater table, temporary dewatering may be required to depress the water table to below the base of the excavation. The type of excavation dewatering used will be a function of the excavation method used and the preferences of the contractor. Wastewater generated during dewatering will be contained and disposed of appropriately.

Because the interim action will involve removal, handling, and disposal of known contaminated materials, MTCA compliance monitoring requirements specified in WAC 173-340-410 will be considered appropriate for this interim action.

MTCA compliance monitoring activities will include the following:

- Protection monitoring to confirm that human health and the environment are adequately protected during implementation of the interim action, as described in a health and safety plan

- Performance monitoring to confirm that the interim action has attained the cleanup standards established for the interim action and other performance standards (such as construction quality control monitoring necessary to demonstrate compliance with project permits)

- Performance monitoring to assess the effectiveness of the interim action subsequent to the completion of the interim action but prior to selection of the final remedy for the Site.

A compliance monitoring program for the interim action will be submitted for approval to Ecology and documented in an addendum to this work plan prior to conducting the interim action. However, in general, compliance monitoring will consist of monitoring the health and safety of workers during implementation of the interim action and collecting soil confirmation samples at the base and sidewalls of the excavation to determine that the preliminary soil cleanup levels have been achieved.

In accordance with MTCA, all cleanup actions conducted under MTCA will comply with applicable state and federal laws [WAC 173-340-710(1)]. MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate. Collectively, these requirements are referred to as ARARs. A brief overview of potential ARARs for the interim action is provided in the bullets below; however, the primary ARAR is the MTCA cleanup regulation (Chapter 173-340 WAC), especially with respect to the development of cleanup levels and procedures for development and implementation of a cleanup under MTCA. The ARARs that may be applicable to the interim action include the following:

- Washington Water Pollution Control Act and the following implementing regulation: Water Quality Standards for Surface Waters (Chapter 173-201A WAC). These regulations establish water quality standards for surface waters of the State of Washington consistent with public health and the propagation and protection of fish, shellfish, and wildlife. These standards will be used to develop groundwater cleanup levels for the Site, as discussed in Section 3.1.

- Washington Hazardous Waste Management Act (Chapter 70.105 RCW) and the following implementing regulation: Dangerous Waste Regulations (Chapter 173-303 WAC). These regulations establish a comprehensive statewide framework for the planning, regulation, control, and management of dangerous waste. The regulation designates those solid wastes that are dangerous or extremely hazardous to the public health and environment. The management of excavated contaminated soil from the Site will be conducted in accordance with these regulations to the extent that any dangerous wastes are discovered or generated during the cleanup action.

- Washington Solid Waste Management Act (Chapter 70.95 RCW) and the following implementing regulations: Solid Waste Handling Standards (Chapter 173-350 WAC) and Criteria for Municipal Solid Waste Landfills (Chapter 173-351 WAC). These regulations establish a comprehensive statewide program for solid waste management, including proper handling and disposal. The management of excavated contaminated soil from the Site will be conducted in accordance with these regulations to the extent that the soil can be managed as inert or solid waste instead of dangerous waste.

- Shoreline Management Act (SMA; Chapter 90.58 RCW). The SMA establishes permitting and other requirements for substantial development occurring within waters of the U.S. or within 200 ft of a shoreline, and requires that the activities in coastal zones be consistent with local regulations. MTCA exempts cleanup projects being conducted under an enforceable order or consent decree from the requirement of obtaining the shoreline permit; however, the cleanup must be conducted in accordance with the substantive requirements of the regulation.

- Hazardous Waste Operations (Chapter 296-843 WAC). This establishes safety requirements for workers providing investigation and cleanup operations at sites containing hazardous materials. These requirements would be applicable to onsite cleanup activities and would be addressed in a site health and safety plan prepared specifically for these activities.

- Washington Clean Air Act (WCAA, Chapter 70.94 RCW). The WCAA establishes permitting and other requirements for air emission controls.

- State Water Pollution Control Act (Chapter 90.48 RCW). This Act establishes permitting and other requirements for discharge to state surface waters. The procedural requirements of this chapter do not apply to any person conducting a remedial action at a facility pursuant to a consent decree, order, or agreed order issued pursuant to chapter 70.105D RCW. Ecology is required to ensure compliance with the substantive requirements of this chapter through the consent decree, order, or agreed order issued pursuant to chapter 70.105D RCW.

- Occupational Safety and Health Act (OSHA), 29 CFR Subpart 1910.120. OSHA establishes worker health and safety requirements for hazardous waste operations and emergency response.

- Washington State Industrial Safety and Health Act (WISHA). WISHA establishes standards governing workplace safety and health conditions in the State of Washington.

- National Toxics Rule (40 CFR Subpart 131.36). This Rule establishes federal water quality standards

- Clean Water Act (CWA, 33 U.S.C 1251 et seq). The CWA establishes wastewater standards for industry and water quality standards for contaminants in surface waters.

- City of Anacortes Engineering Standards. This establishes grading, filling, and other construction requirements.

- State Environmental Policy Act (SEPA). This policy requires consideration of likely environmental consequences of a proposed construction project.

- Sediment Management Standards (SMS, Chapter 173-204 WAC). The SMS establishes standards for the quality of surface sediments.

Prior to implementation of the interim action, an addendum to this work plan describing the specifics of the interim action will be prepared for Ecology review and approval. This addendum will identify the sustentative requirements of federal, state or local requirements as provided in RCW 70.105D.090. The addendum will also delineate the anticipated area and depth of the excavation based on data obtained during the RI and previous investigations, excavation methods, methods of disposal for the contaminated soil and other wastes generated during the interim action, and a compliance monitoring program.

5.0 FEASIBILITY STUDY

The RI/FS will develop cleanup levels for the Site and evaluate hazardous substances in soil and groundwater by comparing soil and groundwater data to these cleanup levels. If the RI data do not exceed cleanup levels, then an FS (other than establishment of cleanup levels and points of compliance) will not be necessary and will not be performed. If the RI data does exceed cleanup levels, then the FS will develop and evaluate cleanup action alternatives for contaminated media so that cleanup actions may be selected. The FS will:

- Develop cleanup levels and points of compliance and, as necessary, establish remediation levels.
- Delineate affected media where evaluation of remedial action is appropriate.
- Develop remedial action objectives.
- Screen and evaluate specific cleanup alternatives and recommend a preferred alternative.
- Identify opportunities for shoreline restoration.
- Be presented in a written report along with the results of the RI (the RI/FS report).

The following sections provide the details of the FS process that will be completed, if necessary, for the Site.

5.1 ESTABLISHMENT OF CLEANUP LEVELS, POINTS OF COMPLIANCE, AND REMEDIATION LEVELS

Cleanup standards, including cleanup levels and points of compliance, will be developed for soil and groundwater in accordance with MTCA requirements. Exposure pathways and receptors will be identified as part of cleanup level development. As needed, remediation levels may also be established for specific cleanup alternatives.

Cleanup levels for soil will be protective of human health, terrestrial ecological receptors, groundwater, and sediment based on current and likely future uses of the property. The point of compliance for soil will also be established.

Cleanup levels for groundwater will be based on protection of marine surface water and sediment. Groundwater at or potentially affected by the property is not a current or reasonable future source of drinking water. It is expected that information developed during the RI will be used to demonstrate that groundwater at the property meets the requirements of WAC 173-340-720 for non-potable groundwater.

A groundwater point of compliance will be developed. The point of compliance is likely to be conditional, located at or near the groundwater/surface water interface.

5.2 DELINEATION OF MEDIA REQUIRING REMEDIAL ACTION

The RI process will determine if soil and groundwater sample results exceed cleanup levels and, if so, identify the locations of the exceedances. Based on any exceedances and the established points of compliance, the FS will identify the extent or volume of soil or groundwater that requires remedial action.

5.3 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) that define the goals of the cleanup that must be achieved to adequately protect human health and the environment will be developed for each medium and area identified as requiring remedial action. These RAOs will be action-specific and/or media-specific. Action-specific RAOs are based on actions required for environmental protection that are not intended to achieve a specific chemical criterion. Media-specific RAOs are based on developed cleanup levels. The RAOs will specify the COPCs, the potential exposure pathways and receptors, and acceptable contaminant levels or range of levels for each exposure pathway, as appropriate.

5.4 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

In accordance with MTCA, all cleanup actions must comply with applicable state and federal laws (WAC 173-340-710(1)). MTCA defines applicable state and federal laws to include legally applicable requirements and those requirements that are relevant and appropriate. Collectively, these requirements are referred to as applicable or relevant and appropriate requirements (ARARs). The primary ARARs will likely be the MTCA cleanup levels and regulations that address implementation of a cleanup under MTCA. Other potential ARARs may include the following:

- Washington Pollution Control Act and the implementing regulations: Water Quality Standards for Surface Waters of the State of Washington (Chapter 173-201A WAC)
- Washington Hazardous Waste Management Act and the implementing regulations: Dangerous Waste Regulations (Chapter 173-303 WAC), to the extent that any dangerous wastes are discovered or generated during the cleanup action
- The federal Clean Water Act and the surface water quality criteria promulgated thereunder
- Washington's Shoreline Management Act with respect to construction activities conducted near the shoreline during the cleanup action.

The FS will identify ARARs for the Site cleanup.

5.5 SCREENING OF CLEANUP ALTERNATIVES

Cleanup alternatives will be developed for each medium of concern. Initially, general remediation technologies will be identified for the purpose of meeting RAOs for each medium. General remediation technologies consist of specific remedial action technologies and process options. General remediation technologies will be considered and evaluated based on the media type and the properties of any contaminant(s) and may include institutional controls, containment or other engineering controls, removal, *in situ* treatment, and natural attenuation.

Specific remedial action technologies are the engineering components of a general remediation technology. Examples include horizontal barriers, groundwater extraction, groundwater treatment, *in situ* oxidation, *in situ* bioremediation, and capping. Process options are those specific processes within each specific technology. For example, groundwater treatment technology could include process options such as air stripping, activated carbon, and UV/chemical oxidation. Several specific technologies may be identified for each general remediation technology and multiple process options may exist within each specific technology.

Specific remedial action technologies and representative process options will be selected for evaluation based on documented development or documented successful use for the particular medium and COPCs. Cleanup alternatives will be developed from the general and specific remedial technologies and process options consistent with Ecology expectations identified in WAC 173-340-370 using best professional judgment and guidance documents as appropriate [e.g., *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988)].

During the development of cleanup alternatives, both the current and planned future land use will be considered. For example, where property is already developed, containment alternatives may be given preferential consideration over soil cleanup alternatives that would be more disruptive to Site use.

If the RI identifies localized hot spots of contaminants in soil, active cleanup alternatives such as excavation or *in situ* treatment alternatives may be appropriate for those limited areas. If there are portions of the property with large volumes of materials with relatively low concentrations of hazardous substances, cleanup alternatives including engineering controls or natural attenuation will be developed. Current and planned future property uses will be considered during development of cleanup alternatives.

5.6 EVALUATION OF CLEANUP ALTERNATIVES

MTCA requires that cleanup alternatives be compared to a number of criteria as set forth in WAC 173-340-360 to evaluate the adequacy of each alternative in achieving the intent of the regulations, and as a basis for comparing the relative merits of the developed cleanup alternatives. Consistent with MTCA, the alternatives will be evaluated with respect to compliance with threshold requirements, permanence, and restoration timeframe, and the results of the evaluation will be documented in the RI/FS reports.

5.7 HABITAT RESTORATION

The Site is being overseen by Ecology and work is being done in an expedited manner under the Governor's Puget Sound Initiative. The initiative focuses on cleaning up contamination as well as restoring Puget Sound. Ecology recognizes that site cleanups can be designed and implemented in a manner that improves habitat values and provides for shoreline restoration in conjunction with remedial actions. While planning the cleanup, and making cleanup decisions, Ecology and the Port of Anacortes will evaluate opportunities to perform remedial actions in a fashion that coincidentally enhances habitat. Elements of the remedial action will be evaluated for restoration opportunities in consultation with Ecology as plans for cleanup are developed.

6.0 PUBLIC PARTICIPATION

Under the terms of the Agreed Order, a Public Participation Plan (PPP; presented in Appendix H) was prepared for the project that summarizes the RI/FS activities and potential Interim Action to be conducted at the CSM Site and will be provided to the public to present the opportunity for the public to learn about and provide input on the potential Interim Action, remedial investigation, and remedial alternatives as required under MTCA (WAC) 173-340-600.

7.0 SCHEDULE AND REPORTING

The Agreed Order establishes the RI/FS schedule and reporting requirements, which are summarized in this section. In an effort to expedite the implementation of an interim action at the Site, the initial sediment and groundwater studies may be initiated prior to Ecology's approval of the work plan. Early implementation of these studies will allow adequate time for the development of site-specific TPH cleanup numbers and sufficient groundwater quality monitoring. Soil and additional groundwater investigation will be completed on approval of the Work Plan. Following completion of all field activities and receipt of the analytical data, a RI/FS report will be prepared and submitted to Ecology. All sampling data will be submitted to Ecology in both printed and electronic formats in accordance with Ecology's Toxics Cleanup Program Policy 840.

If an interim action is planned, a work plan for this action will be prepared in accordance with WAC 173-340-430(7) and submitted to Ecology for approval. Following completion of the interim action, a report will be prepared in accordance with WAC 173-340-515(4).

* * * * *

This document has been prepared under the supervision and direction of the following key staff:

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8.0 REFERENCES

Ecology. 2006. *Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC). Washington State Department of Ecology. Update November.

Ecology. 2001. *Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulation.* CLARC Verison 3.1. http://www.ecy.wa.gov/biblio/94145.html. Washington State Department of Ecology Toxics Cleanup Program. Publication No. 94-145, updated November 2001.

Ecology. 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. June.

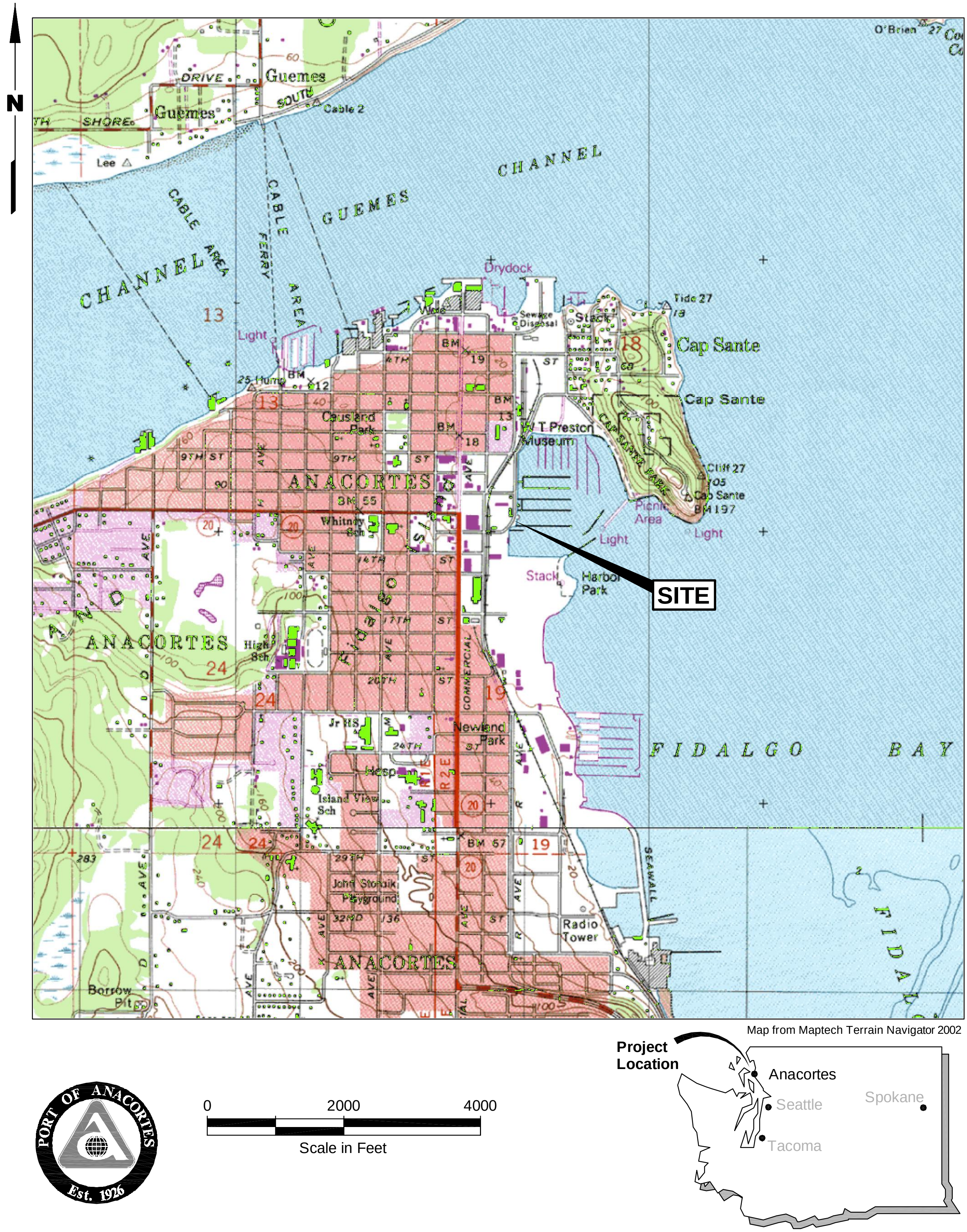
Ecology. 1994. *Natural Background Soil Metals Concentrations in Washington State*. Toxics Cleanup Program, Department of Ecology. Publication #94-115. October.

EPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final.* EPA 540/G/89/004, OSWER 9355.3-01. U.S. Environmental Protection Agency. October.

Floyd|Snider. 2005. *Limited Environmental Due Diligence Investigation Report, Former Shell Oil Tank Farm, Cap Sante Marine Lease Area.* Prepared for Port of Anacortes. November 8.

Floyd Snider McCarthy, Inc. (FSM). 2004. Letter Report, *Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven - Anacortes, Washington.* June 14.

Hart Crowser. 1983. *Petroleum Seepage Study, Port of Anacortes, Anacortes Washington.* Prepared for Port of Anacortes. November 1.



Map from Maptech Terrain Navigator 2002

Cap Sante Marine | V:\529\013\010\D\Work Plan\Fig1.dwg (A) "Figure 1" 3/2/2007

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Cap Sante Marine Anacortes, Washington	**Vicinity Map**	Figure 1

Data Source: Floyd Snider 2006

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Cap Sante Marine
Anacortes, WA

Site Plan

Figure
2

Notes

1) All historical and current UST locations are approximate.
2) Soil and groundwater samples collected in 2004 and 2005 were analyzed for BTEX, gasoline-, diesel-, and oil-range petroleum hydrocarbons.

Data Source: Floyd Snider 2006

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Cap Sante Marine
Anacortes, WA

Previous Sampling Locations

Figure
3

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Data Source: Floyd Snider 2006

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Cap Sante Marine
Anacortes, WA

Proposed Sediment Sampling Locations

Figure
4

Data Source: Floyd Snider 2006

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Cap Sante Marine
Anacortes, WA

Proposed Monitoring Well and Soil Sampling Locations

Figure
5

TABLE 1
SUMMARY OF 2004/2005 SOIL INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID Depth: Collection Date:	Preliminary Screening Level (a)	GP1 (5.0) 2004	GP1 (8.0) 2004	GP2 (5.0) 2004	GP2 (10.0) 2004	GP3 (6.0) 2004	GP3 (7.0) 2004	GP3 (9.0) 2004	GP4 (7.0) 2004	GP4 (10.0) 2004
TOTAL PETROLEUM HYDROCARBONS (mg/kg)										
Gasoline	100/30 (b)	35 U	31 U	$\boxed{250}$	40 U	630	320	38 U	20	190 U
Diesel	2,000	50 U	50 U	1,800	50 U	410	NA	50 U	20	190 U
Heavy Oil	2,000	100 U	100 U	67 U	100 U	340 U	NA	100 U	45	390 U
VOLATILE ORGANIC COMPOUNDS (µg/kg)										
Benzene	30	NA	NA	$\boxed{270}$	NA	$\boxed{2,300}$	$\boxed{2,300}$	NA	$\boxed{150}$	NA
Toluene	7,000	NA	NA	140	NA	600	430	NA	35 U	NA
Ethylbenzene	6,000	NA	NA	33 U	NA	4,600	3,100	NA	35 U	NA
Xylenes (total)	9,000	NA	NA	189	NA	$\boxed{19,200}$	$\boxed{12,400}$	NA	71 U	NA

TABLE 3
PRELIMINARY GROUNDWATER CLEANUP LEVELS FOR CONSTITUENTS ANALYZED
CAP SANTE MARINE SITE

				National Recommended Water Quality Criteria (a)						Other Factors			
Constituent	AWQC for Protection of Aquatic Life - Acute (b)	AWQC for Protection of Aquatic Life - Chronic (b)	AWQC for Protection of Human Health - Organisms Only (c)	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health - Organisms Only	MTCA Method B Standard Formula Surface Water Values Carcinogen	MTCA Method B Standard Formula Surface Water Values Non Carcinogen	Concentration Associated with 10^{-5} Risk (if carcinogen)	Protective of Benthic Organisms in Sediment (d)	MTCA Method A	Background	**Preliminary Cleanup Level** (e)
DISSOLVED METALS (mg/L)													
Chromium (III)	--	--	--	--	--	--	--	240	--	--	--	0.01	240
Chromium (VI)	1.1	0.05	--	1.1	0.05	--	--	0.49		--	0.05 (j)	--	0.05
Copper	0.005	0.003	--	0.0048	0.003	--	--	2.7	--	--		0.020 (f)	0.020
Lead	0.21	0.01	--	0.21	0.0081	--	--	--	--	--		--	0.0081
Zinc	0.090	0.081	--	0.09	0.081	26	--	16.5	--	--		0.16	0.16
TOTAL DIESEL RANGE PETROLEUM HYDROCARBONS (µg/L)													
Gasoline-Range										To be Determined (d)	800/1,000 (g,h)	--	To Be Determined
Diesel-Range	--	--	--	--	--	--	--	--	--	To be Determined (d)	500 (g)	--	To Be Determined
Motor Oil-Range	--	--	--	--	--	--	--	--	--	To be Determined (d)	500 (g)	--	To Be Determined
VOLATILES (µg/L)													
Methyl tert-butyl ether (MTBE)											20		20
1,2-Dibromoethane (EDB)	--	--	--	--	--	--	--	--	--	--	0.01	--	0.01
1,2-Dichloroethane (EDC)	--	--	99	--	--	37	59.4	--	594	--	5	--	37
n-Hexane			--	--	--	--	--	--	--	--	--	--	--
Benzene	--	--	71	--	--	51	22.7	1,496	227	--	5	--	51
Ethylbenzene	--	--	2900	--	--	2100	--	6,914	--	--	700	--	2,100
Toluene	--	--	200,000	--	--	15,000	--	19,000	--	--	1,000	--	15,000
Xylene			--	--	--	--	--	--	--	--	1,000	--	1,000
PAHs (µg/L)													
Naphthalene	--	--	--	--	--	--	--	4,940	--	--	160 (i)	--	4940
2-Methylnaphthalene			--	--	--	--	--	--	--	--	-- (i)	--	--
1-Methylnaphthalene			--	--	--	--	--	--	--	--	-- (i)	--	--
Benzo(a)pyrene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	0.1	--	0.018
Benzo(a)anthracene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Benzo(b)fluoranthene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Benzo(k)fluoranthene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Chrysene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Dibenzo(a,h)anthracene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Indeno(1,2,3-cd)pyrene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
cPAH TEQ	--	--	0.031	--	--	--	--	--	--	--	0.1	--	0.1
PCBs (µg/L)													
Total PCBs	10	0.03	0.00017	--	0.03	0.000064	--	--	--	--	0.1	--	0.000064

TABLE 2
SUMMARY OF 2004/2005 GROUNDWATER INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID	Preliminary Screening Level (a)	CSM09-W1	CSM10-W1	CSM11-W1
Collection Date:		2005	2005	2005
TOTAL PETROLEUM HYDROCARBONS (µg/L)				
Gasoline	800/1,000 (b)	6,700	4,000	2,900
Diesel	500	14,000	28,000	12,000
Heavy Oil	500	2,500 U	10,000 U	2,500 U
VOLATILE ORGANIC COMPOUNDS (µg/L)				
Benzene	5	21	930	270
Toluene	1,000	22	20	3.9
Ethylbenzene	700	190	260	71
Xylenes (total)	1,000	72.8	76	4.0

U = Indicates compound not detected at the given reporting limit
NA = Not analyzed.
Boxed cells indicate an exceedance of Model Toxics Control Act (MTCA) Method A cleanup levels for groundwater.

(a) MTCA Method A cleanup levels were used as preliminary screeining levels during the 2004 and 2005 Investigations.
(b) The MTCA Method A cleanup level for gasoline-range petroleum hydrocarbons is 1,000 µg/L when benzene is not present and 800 µg/L when benzene is present

Notes:
1. Source: Floyd Snider McCarthy. 2004. *Letter Report, Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven - Anacortes, Washington.*. June 14.
2. Source: Floyd Snider McCarthy. 2005. *Limited Environmental Due Diligence Investigation Report, Former Shell Oil Tank Farm, Cap Sante Marine Lease Area.* November 8.

TABLE 2
SUMMARY OF 2004/2005 GROUNDWATER INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID	Preliminary Screening Level (a)	GP1	GP2	GP3	GP4	GP5B	GP6	CSM07-W1	CSM08-W1
Collection Date:		2004	2004	2004	2004	2004	2004	2005	2005
TOTAL PETROLEUM HYDROCARBONS (µg/L)									
Gasoline	800/1,000 (b)	0.25 U	460	4,100	250 U	400	250 U	1,000	3,500
Diesel	500	250 U	2,400	NA	250	370	250 U	2,100	6,500
Heavy Oil	500	500 U	500 U	NA	500 U	500 U	500 U	500 U	2,500 U
VOLATILE ORGANIC COMPOUNDS (µg/L)									
Benzene	5	1.0 U	1.0 U	390	1.0 U	3.4	1.0 U	80	530
Toluene	1,000	1.0 U	1.0 U	18	1.0 U	1.4	1.0 U	3.5	22
Ethylbenzene	700	1.0 U	1.0 U	65	1.0 U	2.3	1.0 U	1.0	34
Xylenes (total)	1,000	1.0 U	1.3	212	1.0 U	1.9	1.0 U	4.1	36

TABLE 1
SUMMARY OF 2004/2005 SOIL INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID Depth: Collection Date:	Preliminary Screening Level (a)	CSM11-S1 (4.0-5.3) 2005		CSM11-S2 (8.0-10.3) 2005	
TOTAL PETROLEUM HYDROCARBONS (mg/kg)					
Gasoline	100/30 (b)	400	J	38	J
Diesel	2,000	3,800		6.8	U
Heavy Oil	2,000	270	U	14	U
VOLATILE ORGANIC COMPOUNDS (µg/kg)					
Benzene	30	250	J	40	U
Toluene	7,000	92	UJ	80	UJ
Ethylbenzene	6,000	560	J	80	UJ
Xylenes (total)	9,000	120	J	160	UJ

U = Indicates compound not detected at the given reporting limit
J = Sample exceeded allowable holding time at analytical laboratory
UJ = Compound not detected at the given reporting limit, sample exceeded allowable holding time at analytical laboratory.
NA = Not analyzed.
Boxed cells indicate an exceedance of Model Toxics Control Act (MTCA) Method A soil cleanup levels for unrestricted land use

(a) MTCA Method A cleanup levels were used as preliminary screening levels during the 2004 and 2005 Investigations.
(b) The MTCA Method A cleanup level for gasoline-range petroleum hydrocarbons is 100 mg/kg when benzene is not present and 30 mg/kg when benzene is present

Notes:
1. Source: Floyd Snider McCarthy. 2004. *Letter Report, Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven - Anacortes, Washington*. June 14.
2. Source: Floyd Snider McCarthy. 2005. *Limited Environmental Due Diligence Investigation Report, Former Shell Oil Tank Farm, Cap Sante Marine Lease Area.* November 8.

TABLE 1
SUMMARY OF 2004/2005 SOIL INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID	Preliminary	GP5B	GP5B	GP6	GP6	CSM07-SI	CSM08-S1	CSM09-S1	CSM09-S2	CSM10-S1
Depth:	Screening	(6.0)	(9.0)	(2.5)	(5.0)	(8.0-9.5)	(4.0-5.7)	(8.0-10.0)	(10.0-12.0)	(12.0-13.0)
Collection Date:	Level (a)	2004	2004	2004	2004	2005	2005	2005	2005	2005
TOTAL PETROLEUM HYDROCARBONS (mg/kg)										
Gasoline	100/30 (b)	510	230	31 U	37 U	320 J	1,500 J	490 J	36 J	1,100 J
Diesel	2,000	NA	390	50 U	50 U	1800	4,100	1,900	280	2,600
Heavy Oil	2,000	NA	330 U	100 U	100 U	120 U	240 U	130 U	120	140 U
VOLATILE ORGANIC COMPOUNDS (µg/kg)										
Benzene	30	580	NA	NA	NA	32 J	2,500 J	620 J	86 U	540 J
Toluene	7,000	350	NA	NA	NA	64 UJ	860 J	220 J	170 UJ	250 J
Ethylbenzene	6,000	710	NA	NA	NA	64 UJ	1,500 J	820 J	170 UJ	6,700 J
Xylenes (total)	9,000	560	NA	NA	NA	110 J	1,730 J	530 J	340 UJ	970 J

TABLE 3
PRELIMINARY GROUNDWATER CLEANUP LEVELS FOR CONSTITUENTS ANALYZED
CAP SANTE MARINE SITE

Note: Shaded cell indicates basis for preliminary cleanup level.

(a) National Recommmended Water Quality Criteria (EPA 2006).

(b) Ambient water quality criteria for protection of aquatic life from WAC 173-201A-040 and 40 C.F.R. Part 131.

(c) Ambient water quality criteria for protection of human health from 40 C.F.R. Part 131d (National Toxics Rule).

(d) Cleanup level will be calculated using sediment toxicity levels and the EPA Equilbrium Partitioning Model for Sediment. However, if current sediment conditions are protective of benthic organisms as determined by bioassay testing, groundwater TPH cleanup levels protective of benthic organisms will not be calculated.

(e) Preliminary cleanup level based on lowest soil criteria corrected for background, as indicated by shading. Further adjustments to those preliminary cleanup levels that are found to be lower than the practical quantitaion limits may be necessary, in accordance with WAC 173-340-720(7)(c).

(f) Natural background based on "Draft Report, Sections 1-7 Background Concentrations of Selected Chemicals in Water, Soil, Sediments, or Air of Washington State (PTI 1989).

(g) Preliminary cleanup level based on MTCA Method A groundwater cleanup level in accordance with WAC 173-340-730(a)(b)(iii)(c).

(h) MTCA Method A cleanup level is 800 µg/L when benzene is present and 1,000 µg/L when benzene is not present.

(i) MTCA Method A cleanup level is a total value for naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

(j) MTCA Method a cleanup level is for total chromium.

TABLE 1
SUMMARY OF 2004/2005 SOIL INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID	Preliminary	GP1	GP1	GP2	GP2	GP3	GP3	GP3	GP4	GP4
Depth:	Screening	(5.0)	(8.0)	(5.0)	(10.0)	(6.0)	(7.0)	(9.0)	(7.0)	(10.0)
Collection Date:	Level (a)	2004	2004	2004	2004	2004	2004	2004	2004	2004
TOTAL PETROLEUM HYDROCARBONS (mg/kg)										
Gasoline	100/30 (b)	35 U	31 U	250	40 U	630	320	38 U	20	190 U
Diesel	2,000	50 U	50 U	1,800	50 U	410	NA	50 U	20	190 U
Heavy Oil	2,000	100 U	100 U	67 U	100 U	340 U	NA	100 U	45	390 U
VOLATILE ORGANIC COMPOUNDS (µg/kg)										
Benzene	30	NA	NA	270	NA	2,300	2,300	NA	150	NA
Toluene	7,000	NA	NA	140	NA	600	430	NA	35 U	NA
Ethylbenzene	6,000	NA	NA	33 U	NA	4,600	3,100	NA	35 U	NA
Xylenes (total)	9,000	NA	NA	189	NA	19,200	12,400	NA	71 U	NA

TABLE 1
SUMMARY OF 2004/2005 SOIL INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID	Preliminary	GP5B	GP5B	GP6	GP6	CSM07-SI	CSM08-S1	CSM09-S1	CSM09-S2	CSM10-S1
Depth:	Screening	(6.0)	(9.0)	(2.5)	(5.0)	(8.0-9.5)	(4.0-5.7)	(8.0-10.0)	(10.0-12.0)	(12.0-13.0)
Collection Date:	Level (a)	2004	2004	2004	2004	2005	2005	2005	2005	2005
TOTAL PETROLEUM HYDROCARBONS (mg/kg)										
Gasoline	100/30 (b)	510	230	31 U	37 U	320 J	1,500 J	490 J	36 J	1,100 J
Diesel	2,000	NA	390	50 U	50 U	1800	4,100	1,900	280	2,600
Heavy Oil	2,000	NA	330 U	100 U	100 U	120 U	240 U	130 U	120	140 U
VOLATILE ORGANIC COMPOUNDS (µg/kg)										
Benzene	30	580	NA	NA	NA	32 J	2,500 J	620 J	86 U	540 J
Toluene	7,000	350	NA	NA	NA	64 UJ	860 J	220 J	170 UJ	250 J
Ethylbenzene	6,000	710	NA	NA	NA	64 UJ	1,500 J	820 J	170 UJ	6,700 J
Xylenes (total)	9,000	560	NA	NA	NA	110 J	1,730 J	530 J	340 UJ	970 J

TABLE 1
SUMMARY OF 2004/2005 SOIL INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID Depth: Collection Date:	Preliminary Screening Level (a)	CSM11-S1 (4.0-5.3) 2005		CSM11-S2 (8.0-10.3) 2005	
TOTAL PETROLEUM HYDROCARBONS (mg/kg)					
Gasoline	100/30 (b)	$\boxed{400}$	J	38	J
Diesel	2,000	$\boxed{3{,}800}$		6.8	U
Heavy Oil	2,000	270	U	14	U
VOLATILE ORGANIC COMPOUNDS (µg/kg)					
Benzene	30	$\boxed{250}$	J	40	U
Toluene	7,000	92	UJ	80	UJ
Ethylbenzene	6,000	560	J	80	UJ
Xylenes (total)	9,000	120	J	160	UJ

U = Indicates compound not detected at the given reporting limit
J = Sample exceeded allowable holding time at analytical laboratory
UJ = Compound not detected at the given reporting limit, sample exceeded allowable holding time at analytical laboratory.
NA = Not analyzed.
Boxed cells indicate an exceedance of Model Toxics Control Act (MTCA) Method A soil cleanup levels for unrestricted land use

(a) MTCA Method A cleanup levels were used as preliminary screening levels during the 2004 and 2005 Investigations.
(b) The MTCA Method A cleanup level for gasoline-range petroleum hydrocarbons is 100 mg/kg when benzene is not present and 30 mg/kg when benzene is present

Notes:
1. Source: Floyd Snider McCarthy. 2004. *Letter Report, Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven - Anacortes, Washington*. June 14.
2. Source: Floyd Snider McCarthy. 2005. *Limited Environmental Due Diligence Investigation Report, Former Shell Oil Tank Farm, Cap Sante Marine Lease Area.* November 8.

TABLE 2
SUMMARY OF 2004/2005 GROUNDWATER INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID	Preliminary Screening	GP1	GP2	GP3	GP4	GP5B	GP6	CSM07-W1	CSM08-W1
Collection Date:	Level (a)	2004	2004	2004	2004	2004	2004	2005	2005
TOTAL PETROLEUM HYDROCARBONS (µg/L)									
Gasoline	800/1,000 (b)	0.25 U	460	4,100	250 U	400	250 U	1,000	3,500
Diesel	500	250 U	2,400	NA	250	370	250 U	2,100	6,500
Heavy Oil	500	500 U	500 U	NA	500 U	500 U	500 U	500 U	2,500 U
VOLATILE ORGANIC COMPOUNDS (µg/L)									
Benzene	5	1.0 U	1.0 U	390	1.0 U	3.4	1.0 U	80	530
Toluene	1,000	1.0 U	1.0 U	18	1.0 U	1.4	1.0 U	3.5	22
Ethylbenzene	700	1.0 U	1.0 U	65	1.0 U	2.3	1.0 U	1.0	34
Xylenes (total)	1,000	1.0 U	1.3	212	1.0 U	1.9	1.0 U	4.1	36

TABLE 2
SUMMARY OF 2004/2005 GROUNDWATER INVESTIGATION ANALYTICAL RESULTS
CAP SANTE MARINE LEASE AREA
PORT OF ANACORTES, WASHINGTON

Sample ID	Preliminary Screening Level (a)	CSM09-W1	CSM10-W1	CSM11-W1
Collection Date:		2005	2005	2005
TOTAL PETROLEUM HYDROCARBONS (µg/L)				
Gasoline	800/1,000 (b)	$\boxed{6,700}$	$\boxed{4,000}$	$\boxed{2,900}$
Diesel	500	$\boxed{14,000}$	$\boxed{28,000}$	$\boxed{12,000}$
Heavy Oil	500	2,500 U	10,000 U	2,500 U
VOLATILE ORGANIC COMPOUNDS (µg/L)				
Benzene	5	$\boxed{21}$	$\boxed{930}$	$\boxed{270}$
Toluene	1,000	22	20	3.9
Ethylbenzene	700	190	260	71
Xylenes (total)	1,000	72.8	76	4.0

U = Indicates compound not detected at the given reporting limit
NA = Not analyzed.
Boxed cells indicate an exceedance of Model Toxics Control Act (MTCA) Method A cleanup levels for groundwater.

(a) MTCA Method A cleanup levels were used as preliminary screeining levels during the 2004 and 2005 Investigations.
(b) The MTCA Method A cleanup level for gasoline-range petroleum hydrocarbons is 1,000 µg/L when benzene is not present and 800 µg/L when benzene is present

Notes:
1. Source: Floyd Snider McCarthy. 2004. *Letter Report, Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven - Anacortes, Washington*. June 14.
2. Source: Floyd Snider McCarthy. 2005. *Limited Environmental Due Diligence Investigation Report, Former Shell Oil Tank Farm, Cap Sante Marine Lease Area.* November 8.

TABLE 3
PRELIMINARY GROUNDWATER CLEANUP LEVELS FOR CONSTITUENTS ANALYZED
CAP SANTE MARINE SITE

				National Recommended Water Quality Criteria (a)						Other Factors			
Constituent	AWQC for Protection of Aquatic Life - Acute (b)	AWQC for Protection of Aquatic Life - Chronic (b)	AWQC for Protection of Human Health - Organisms Only (c)	Protection of Aquatic Life - Acute	Protection of Aquatic Life - Chronic	Protection of Human Health - Organisms Only	MTCA Method B Standard Formula Surface Water Values Carcinogen	MTCA Method B Standard Formula Surface Water Values Non Carcinogen	Concentration Associated with 10^{-5} Risk (if carcinogen)	Protective of Benthic Organisms in Sediment (d)	MTCA Method A	Background	**Preliminary Cleanup Level** (e)
DISSOLVED METALS (mg/L)													
Chromium (III)	--	--	--	--	--	--	--	240	--	--	--	0.01	240
Chromium (VI)	1.1	0.05	--	1.1	0.05	--	--	0.49		--	0.05 (j)	--	0.05
Copper	0.005	0.003	--	0.0048	0.003	--	--	2.7	--	--		0.020 (f)	0.020
Lead	0.21	0.01	--	0.21	0.0081	--	--	--	--	--		--	0.0081
Zinc	0.090	0.081	--	0.09	0.081	26	--	16.5	--	--		0.16	0.16
TOTAL DIESEL RANGE PETROLEUM HYDROCARBONS (µg/L)													
Gasoline-Range										To be Determined (d)	800/1,000 (g,h)	--	To Be Determined
Diesel-Range	--	--	--	--	--	--	--	--	--	To be Determined (d)	500 (g)	--	To Be Determined
Motor Oil-Range	--	--	--	--	--	--	--	--	--	To be Determined (d)	500 (g)	--	To Be Determined
VOLATILES (µg/L)													
Methyl tert-butyl ether (MTBE)											20		20
1,2-Dibromoethane (EDB)	--	--	--	--	--	--	--	--	--	--	0.01	--	0.01
1,2-Dichloroethane (EDC)	--	--	99	--	--	37	59.4	--	594	--	5	--	37
n-Hexane			--	--	--	--	--	--	--	--	--	--	--
Benzene	--	--	71	--	--	51	22.7	1,496	227	--	5	--	51
Ethylbenzene	--	--	2900	--	--	2100	--	6,914	--	--	700	--	2,100
Toluene	--	--	200,000	--	--	15,000	--	19,000	--	--	1,000	--	15,000
Xylene			--	--	--	--	--	--	--	--	1,000	--	1,000
PAHs (µg/L)													
Naphthalene	--	--	--	--	--	--	--	4,940	--	--	160 (i)	--	4940
2-Methylnaphthalene			--	--	--	--	--	--	--	--	-- (i)	--	--
1-Methylnaphthalene			--	--	--	--	--	--	--	--	-- (i)	--	--
Benzo(a)pyrene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	0.1	--	0.018
Benzo(a)anthracene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Benzo(b)fluoranthene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Benzo(k)fluoranthene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Chrysene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Dibenzo(a,h)anthracene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
Indeno(1,2,3-cd)pyrene	--	--	0.031	--	--	0.018	0.0296	--	0.296	--	--	--	0.018
cPAH TEQ	--	--	0.031	--	--	--	--	--	--	--	0.1	--	0.1
PCBs (µg/L)													
Total PCBs	10	0.03	0.00017	--	0.03	0.000064	--	--	--	--	0.1	--	0.000064

TABLE 3
PRELIMINARY GROUNDWATER CLEANUP LEVELS FOR CONSTITUENTS ANALYZED
CAP SANTE MARINE SITE

Note: Shaded cell indicates basis for preliminary cleanup level.

(a) National Recommmended Water Quality Criteria (EPA 2006).

(b) Ambient water quality criteria for protection of aquatic life from WAC 173-201A-040 and 40 C.F.R. Part 131.

(c) Ambient water quality criteria for protection of human health from 40 C.F.R. Part 131d (National Toxics Rule).

(d) Cleanup level will be calculated using sediment toxicity levels and the EPA Equilbrium Partitioning Model for Sediment. However, if current sediment conditions are protective of benthic organisms as determined by bioassay testing, groundwater TPH cleanup levels protective of benthic organisms will not be calculated.

(e) Preliminary cleanup level based on lowest soil criteria corrected for background, as indicated by shading. Further adjustments to those preliminary cleanup levels that are found to be lower than the practical quantitaion limits may be necessary, in accordance with WAC 173-340-720(7)(c).

(f) Natural background based on "Draft Report, Sections 1-7 Background Concentrations of Selected Chemicals in Water, Soil, Sediments, or Air of Washington State (PTI 1989).

(g) Preliminary cleanup level based on MTCA Method A groundwater cleanup level in accordance with WAC 173-340-730(a)(b)(iii)(c).

(h) MTCA Method A cleanup level is 800 µg/L when benzene is present and 1,000 µg/L when benzene is not present.

(i) MTCA Method A cleanup level is a total value for naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene.

(j) MTCA Method a cleanup level is for total chromium.

TABLE 4
PRELIMINARY SOIL CLEANUP LEVELS FOR CONSTITUENTS ANALYZED
CAP SANTE MARINE SITE

	Protection of Human Health		Protection of Groundwater		Protection of Sediment	Other Factors		Preliminary Cleanup Level (e)	
			Unsaturated Zone	Saturated Zone					
Constituent	MTCA Method B Soil-Direct Contact Unrestricted Land Use Carcinogen	MTCA Method B Soil-Direct Contact Unrestricted Land Use Non Carcinogen	MTCA Method B Protective of Groundwater as Marine Surface Water (a)	MTCA Method B Protective of Groundwater as Marine Surface Water (b)	Protective of Benthic Organisms in Sediment (c)	MTCA Method A Unrestricted Land Use	Soil Background (d)	Unsaturated Zone	Saturated Zone
Total Metals (mg/kg)									
Chromium III	--	120,000	1,000,000	1,000,000		2,000	42	120,000	120,000
Hexavalent Chromium	--	240	19	1	--	19	--	19	1
Copper	--	2960	1.4	0.07	--	--	36	36	36
Lead	--	--	1,600	81	--	250	17	250	81
Zinc	--	24,000	101	5	--	--	86	101	86
TOTAL PETROLEUM HYDROCARBONS (mg/kg)									
Gasoline-Range	--	--	--	--	To Be Determined (c)	100/30 (f)		100/30 (g)	100/30 (g)
Diesel-Range	--	--	--	--	To Be Determined (c)	2,000	--	2,000 (g)	2,000 (g)
Motor Oil-Range	--	--	--	--	To Be Determined (c)	2,000	--	2,000 (g)	2,000 (g)
PAHs (µg/kg)									
Naphthalene	--	1,600,000	138,000	700	--	5	--	138,000	700
2-Methylnaphthalene	--	--	--	--	--	--	--	--	--
1-Methylnaphthalene	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	137	--	350	17	--	100	--	137	17
Benzo(a)anthracene	TEQ (h)	--	130	6.4	--	--	--	-- (h)	6.4
Benzo(b)fluoranthene	TEQ (h)	--	440	22	--	--	--	-- (h)	22
Benzo(k)fluoranthene	TEQ (h)	--	440	22	--	--	--	-- (h)	22
Chrysene	TEQ (h)	--	140	7	--	--	--	-- (h)	7
Dibenzo(a,h)anthracene	TEQ (h)	--	640	32	--	--	--	-- (h)	32
Indeno(1,2,3-cd)pyrene	TEQ (h)	--	1,200	62	--	--	--	-- (h)	62
Total cPAH - benzo(a)pyrene TEQ (i)	137	--	--	--	--	100	--	137	--
VOLATILES (µg/kg)									
Methyl tert-butyl ether (MTBE)	--	--	--	--	--	100		100	--
1,2-Dibromoethane (EDB)	11.8	--	--	--	--	5		12	--
1,2-Dichloroethane (EDC)	11,000	--	180	12	--	--		180	12
n-Hexane	--	4,800,000	--		--	--		4,800,000	4,800,000
Benzene	18,200	240,000	290	18	--	30		290	18
Ethylbenzene	--	8,000,000	18,000	1,030	--	6,000		18,000	1,030
Toluene	--	16,000,000	109,000	6,400	--	7,000		109,000	6,400
Xylene	--	160,000,000	--	--	--	--	--	160,000,000	160,000,000
PCBs (µg/kg)									
Total PCBs	--	--	--	--	--	1,000	--	1,000	--

TABLE 4
SOIL CLEANUP LEVELS
FOR CONSTITUENTS ANALYZED
CAP SANTE MARINE SITE

(a) Calculated using fixed parameter 3-phase partitioning model, WAC 173-340-747(4) and preliminary groundwater cleanup levels shown in Table 3 of this report.

(b) Calculated using fixed parameter 3-phase partitioning model, WAC 173-340-747(4)(e) and preliminary groundwater cleanup levels shown in Table 3 of this report.

(c) Cleanup level will be calculated using sediment toxicity levels and the EPA Equilbrium Partitioning Model for Sediment. However, if current sediment conditions are protective of benthic organisms as determined by bioassay testing, soil TPH cleanup levels protective of benthic organisms will not be calculated.

(c) Natural background (statewide 90th percentile value) from Natural Background Soil Metals Concentrations in Washington State, Ecology 1994.

(e) Preliminary cleanup level based on lowest soil criteria corrected for background, as indicated by shading. Further adjustments to those preliminary cleanup levels that are found to be lower than the practical quantitaion limits may be necessary, in accordance with WAC 173-340-740(5)(c).

(f) MTCA Method A cleanup level is 100 mg/kg when benzene is not present and 30 mg/kg when benzene is present.

(g) TPH cleanup levels will be adjusted downward, as necessary, to protect benthic organisms in sediment.

(h) In addition to this proposed cleanup level for individual PAHs, a TEQ will be computed for each sample containing carcinogenic PAHs above reporting limits and compared to the benzo(a)pyrene cleanup level in accordance with WAC 173-340-708(8)(e).

(i) Toxicity equivalency methodology in WAC 173-340-708(8).

Public Review Draft
Sampling and Analysis Plan
Remedial Investigation/Feasibility Study and Interim Action
Cap Sante Marine Lease Area
Anacortes, Washington

April 2, 2007

Prepared for

Port of Anacortes
Anacortes, WA

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1.0 INTRODUCTION

This sampling and analysis plan (SAP) describes the procedures for conducting field activities during the remedial investigation (RI) at the Cap Sante Marine site (Site) located in Anacortes, Washington. This SAP is an appendix to the Cap Sante Marine RI/FS work plan. The primary objective of this plan is to provide sampling methodology consistent with accepted procedures such that the data collected will be adequate for use in characterizing site conditions. The plan was prepared consistent with the requirements of WAC 173-340-820, the Sediment Management Standards program [SMS; WAC 173-204; Washington State Department of Ecology (Ecology) 1995], and the Sediment Sampling and Analysis Plan Appendix (Ecology 2003). This SAP provides field, sampling, and analytical procedures to be used during the RI.

2.0 FIELD INVESTIGATION PROCEDURES

Field investigations during the RI will consist primarily of the following:

- Collecting surface sediment samples for chemical analysis and bioassay testing
- Drilling of soil borings and collecting soil samples and a groundwater sample for chemical analysis to characterize Site soil and groundwater
- Installation of shallow and deep monitoring wells.
- Collection of groundwater samples for chemical analysis
- Performing a tidal study and slug testing (if conditions merit) to monitor groundwater levels and to determine groundwater flow direction.

This section describes the field procedures to be employed during the RI.

2.1 SEDIMENT INVESTIGATION

The initial Site investigation will be performed to determine the range of total petroleum hydrocarbon (TPH) concentrations offshore of the Site and to determine sediment toxicity-based soil and groundwater cleanup criteria as described in Section 3.1.1 of the work plan. Twelve surface (0 to 10 cm) sediment samples (SED-1 through SED-12) will be collected from the locations shown on Figure 4 of the work plan. Sediment Sampling will follow Puget Sound Estuary Program (PSEP) protocols.

2.1.1 SAMPLE COLLECTION METHODS

Surface sediment samples will be collected directly from intertidal areas or by using a grab-type sampler where sediments are submerged. Sample locations will be determined using Global Positioning System or by hand measuring from known landmarks using scaled maps.

2.1.1.1 Offshore Sediment

Grab samplers deployed from a work vessel will be used to collect surface sediments from open water areas or subtidal areas that are not accessible by foot. The general procedure for collecting grab sediment samples is as follows:

1. Make field notes and logbook entries, as necessary, throughout the sampling process to ensure thorough and accurate recordkeeping.
2. Maneuver the sampling vessel to the proposed sampling location using the project-specified positioning procedures.

3. Open the sampler and slide the locking pin into place.

4. Signal the winch operator to lift the sampler.

5. Guide the sampler overboard until it is clear of the vessel and remove the locking pin.

6. Lower the sampler through the water column to the bottom, on station at approximately 1.0 ft/sec.

7. Record the location and note the angle of the cable relative to the boat when sampler reaches bottom.

8. Signal the winch operator to begin retrieving the sampler and raise it at approximately 1.0 ft/sec.

9. Guide the sampler on board the vessel and place it on the work table on the deck; use care to avoid jostling that might disturb the integrity of the sample.

10. Examine the sample for the following sediment acceptance criteria:
    - Sampler jaw is closed
    - The sample does not contain foreign objects
    - The sampler is not overfilled so that the sediment surface presses against the top of the sampler
    - No leakage has occurred, as indicated by overlying water on the sediment surface
    - No sample disturbance has occurred, as indicated by limited turbidity in the overlying water
    - No winnowing has occurred, as indicated by a relatively flat undisturbed surface
    - A penetration depth of at least 11 cm has been achieved.

    If sample acceptance criteria are not achieved, the sample will be rejected and the location re-sampled. If unable to obtain a sample that meets the appropriate acceptance criteria within 50 ft of the proposed location, the sample will be relocated as determined by the Project Manager or Task Manager, as appropriate.

11. Siphon off any standing water from the surface of the sediment using a hose primed with Site water. Care should be taken to not disturb the integrity of the sediment surface.

12. Visually classify sediment. Record sediment descriptions on the field forms.

13. Collect the upper 10 cm of sediment from the sampler using a stainless-steel spoon or equivalent. Take care not to include any material that has been in contact with any interior sampler surface. Place sediment into an appropriate-sized stainless-steel homogenization bowl.

14. Thoroughly rinse the interior of the sampler until all loose sediment has been washed off.

15. Repeat the sampling process (if necessary) until sufficient volume is obtained to satisfy the sampling requirements for each location. Collect successive grab samples within a radius of 3 miles of the initial sampling location.

16. Homogenize the bulk sediment until the sediment appears uniform in color and texture. For toxicity testing, a pore water sample will be obtained (following homogenization) to determine salinity.

17. Distribute the homogenized sediment to appropriate sample containers according to the specified project requirements and ensure that sample labels are completely filled out and affixed to the containers.

18. Clean the exterior of all sample containers and store them in a cooled ice chest away from the immediate work area on board the boat.

19. Thoroughly decontaminate the sampler.

20. Ensure that sediment descriptions and supporting logbook entries are complete.

21. Proceed to the next proposed sampling location.

2.1.1.2 Intertidal Sediment

Along the intertidal bank area inaccessible by vessels, samples may be collected by hand using stainless-steel utensils. To collect the sample, field representatives will walk along the intertidal bank area to locate the sampling locations. Samples will be collected where significant sediment deposits are located. Sediment will be collected directly from the shoreline using a decontaminated stainless-steel spoon. Upon retrieval of all sediment for the composite, the samples will be processed as described in steps 15 through 20 described above.

2.1.1.3 Bioassay Sampling

At each of the surface sampling locations shown on Figure 4 of the work plan, additional volume will be collected and archived for toxicity tests (bioassays). The required wet sediment volume for the bioassays is 5 liters (Table A-1). Under SMS regulations, the interpretation of bioassay data requires the collection and analysis of clean reference sediment, similar in physical characteristics to the test sediments. One to two reference samples will also be collected from Samish Bay for use in the bioassays. These samples will be analyzed for chemical parameters during the first phase of sample analysis, with toxicity testing (bioassays) to be conducted in parallel with the test samples as described above.

2.1.1.4 Sediment Sample Handling

Sediment samples obtained for chemical analyses and laboratory bioassays will be placed in appropriate certified-clean, wide-mouth polyethylene or glass jars with Teflon lids and a certified cleaning certificate (summarized in Table A-1). Pre-cleaned sample containers are typically provided by the analytical laboratories. All sample containers will be filled leaving 0.5 inch of headspace to prevent the jars from breaking during storage. Each jar will be sealed, affixed with a completed label, and stored under appropriate conditions.

Sample labels will be pre-made for each jar. Each sample label will contain the project number, sample identification, preservation, analyses, date and time of collection, and initials of the person(s) preparing the sample. A completed sample label will be affixed to each sample container.

Immediately after the sample jars are filled with sediment and properly labeled and dated, they will be placed in the appropriate coolers with a sufficient number of ice packs to keep them cold until transport and delivery to the laboratories. Sample holding time will be relative to the time and date recorded for each sample.

2.1.1.5 Sediment Sample Documentation

Information to be collected for sediment samples includes bottom depth, sampler penetration depth, and information on sediment characteristics (e.g., sediment type, color, and odor). After surface sample collection, the following information will be recorded in field logbooks for the sediment samples:

- Date, time, and name of person logging sample
- Weather conditions
- Equipment used for sampling
- Sampling location number
- Confirmed location coordinates and tide elevation
- Project designation
- Physical description of sediment
- Vertical distribution of visible contamination
- Description of layering
- Description of sediment [American Society for Testing and Material (ASTM) D 2488-84]:
    - Lithology

  - Sorting
  - Color
  - Structure
  - Relative density or consistency
  - Relative moisture content
- Documentation of any unusual observations, such as noticeable sandblast grit, paint chips, or hydrocarbon sheens.

Any deviations or additions to this SAP will be documented in the field report(s) prepared upon completion of field activities.

2.1.2 FIELD GRAIN SIZE WET SIEVING

Field grain size wet sieving may be required for determining the appropriate reference sediments. This process separates the sediment sample into size fractions greater than 62.5 micrometers (pm) (i.e., sand and gravel) and less than 62.5 pm (i.e., silt and clay) for classification of sand and silt/clay fractions. This process helps determine appropriate reference stations with similar grain size fractions (by volume) during field operations. This procedure requires a 62.5-pm sieve, a funnel with a diameter slightly greater than that of the sieve frame, a 100-ml graduated cylinder, a squirt bottle, a supply of distilled water, and a bowl for collecting rinse water. Procedures for field grain size sieving are as follows:

- Place a 62.5-pm (4-phi or 0.0025-inch mesh or #230 mesh size) sieve in a funnel with a bowl underneath.
- Moisten the sieve using a light spray of distilled water.
- Place exactly 50 ml of sample in the 100-ml graduated cylinder, add 20 to 30 ml of distilled water, and stir to fluidize the sample.
- Pour the sample into the sieve and thoroughly rinse any residue from the 100-ml graduated cylinder and stir into the sieve.
- Wash the sediment onto the sieve with distilled water using a water pique or squirt bottle having low water pressure.
- Continue wet sieving until only clear water passes through the sieve. Take care to ensure that the rinsate does not exceed approximately 950 ml. This is accomplished by sieving an appropriate sample quantity (i.e., a sample volume that is not too large) and by efficient use of rinse water. Both of these techniques may require experimentation before routine wet sieving is started. Upon completion of sieving, carefully return the contents (i.e., sand and gravel fraction) of the sieve to the 100-ml graduated cylinder.

- Tap the graduated cylinder gently to settle the solid material.
- Read the volume of solid material from the scale on the side of the graduated cylinder and record the value. The fraction of sample with grain size greater than 62.5 pm is the ratio of the volume of material retained in the sieve to the original volume (50 ml).

2.1.3 REFERENCE SAMPLE COLLECTION FOR TOXICITY TESTING

Toxicity testing requires that appropriate reference sediment be collected and tested with Site sediments. Concurrent tests on reference sediment are conducted to control possible sediment grain size effects on bioassay organisms. Bioassays will be conducted using reference sediment samples with grain size and total organic carbon (TOC) concentrations that are similar to the Site sediment samples used for toxicity testing. The reference samples will be collected from an area where no known chemical contamination is present. However, chemical testing will also be conducted on the reference sediment samples to confirm that chemical contamination is not present. Reference sample(s) may be collected from Samish Bay or another appropriate location.

2.1.4 CHEMICAL ANALYSES

Sediment samples will be analyzed for petroleum hydrocarbon fractions using volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH), and NWTPH-Dx methodologies. Samples subject to bioassay testing will also be analyzed for TOC and grain size. Sample preparation, cleanup, and analytical methods will be in accordance with Ecology protocols (Ecology 1997) for the VPH, EPH, and NWTPH-Dx analyses and PSEP protocols (PSEP 1997a, 1997b, 1997c) for the TOC analysis. Grain size determination will use the Plumb (1981) method. All analytical testing and reporting will be conducted in accordance with the specified method, the QA/QC requirements described in this work plan, and, for sediments, PSEP guidelines (PSEP 1997d). Analytical methods and reporting limits goals for the analysis of each constituent are summarized in Table A-2.

2.1.5 TOXICITY TESTING

Initially, toxicity testing will be conducted on the shoreline sediment sample (SED-1, SED-2, or SED-3) containing the highest concentration of TPH. Other sediment samples with significant TPH concentrations that are considered to be associated with historical upland releases of petroleum hydrocarbons may also be submitted for bioassay testing. If the sediment sample passes the bioassay, the concentrations of TPH in sediment will be considered protective of benthic organisms and no further toxicity testing will be performed. If the sediment sample fails the bioassay, additional bioassay testing will be performed on archived sediment samples representative of the range of TPH at the site as determined from the 12 sediment sampling locations. Additional toxicity testing will be identified and completed in consultation with Ecology.

The purpose of the sediment toxicity testing is to evaluate the degree and nature of potential surface sediment toxicity to marine organisms resulting from historical activities and releases to the marine area surrounding the site. The tests are designed to provide data regarding the acute and chronic effects of sediments on both benthic and epibenthic organisms from the perspective of mortality, growth, and reproduction. The tests are also intended to provide data for evaluation of chemical (i.e., SMS) versus non-persistent, natural, compound-related (e.g., ammonia, sulfides) toxic effects. The evaluation framework and decision criteria will follow the SMS procedures. Toxicity test results will be interpreted against the SMS criteria.

Three sediment toxicity tests (bioassay) will be conducted on the samples:

- Acute 10-day amphipod mortality (*Rhepoxynius abronis, Eohaustoris estuaries,Ampelisca abdita*)
- Acute larval mortality/abnormality (*Strongylocentrotus purpuratus, Strongylocentrotus droebachiensis* or *Dendraster excentricus*)
- Chronic 20-day juvenile polychaete growth rate (*Neanthes arenoceodentata*).

Toxicity testing will be in compliance with the procedures and QA/QC performance standards described in PSEP (1995) as revised by subsequent agency-approved updates and as described in sub-appendix D of the Sampling and Analysis Plan Appendix (Ecology 2003). The biological laboratory SOPs will be provided once a lab is selected.

All samples for toxicity testing will be stored in coolers at approximately 4°C until transported to the laboratories. Chain-of-custody (COC) procedures (see Section 2.8) will be followed throughout laboratory sample handling.

2.1.5.1 Amphipod Bioassay

Short-term, adverse effects of potentially contaminated sediment will be evaluated by measuring survival in adult amphipods *Eohaustaurius estuaris*. Amphipods will be exposed to the CSM site sediment and reference sediment for a 10-day period.

In the acute amphipod bioassay, short-term, adverse effects of potentially contaminated sediment will be evaluated by measuring survival in adult phoxocephalid amphipods (e.g., *Rhepoxynius abronius*, *Ampelisca abdita*). Amphipods will be exposed to the site sediment and reference sediment for a 10-day period.

All amphipods used (either *Rhepoxynius abronius*, *Ampelisca abdita*) will be from natural populations and collected just prior to the tests. Experience with *Rhepoxynius abronius* exposed to sediments of varying grain size distributions has confirmed its sensitivity to sediment exhibiting high percentages of fine-grained sediments, particularly those with more than 60 percent fines. *Ampelisca abdita* and *Eohaustorius estuaries* do not exhibit this sensitivity. If grain size analysis indicates sediment grain size is more than 70 percent, *Ampelisca abdita* or *Eohaustorius* estuaries will be tested. Testing procedures will generally follow those described in PSEP (1995) protocols.

There will be five replicate tests per sediment sample. In addition to the control and reference samples required by PSEP, an ammonia-positive control test will be conducted. The purpose of conducting an ammonia-positive control test is to determine the toxicity of ammonia to the test organisms being used in this study. Quality control samples and procedures for the amphipod bioassay are discussed in more detail in the Quality Assurance Project Plan (QAPP) provided in Appendix B of the work plan.

2.1.5.2 Chronic Juvenile Polychaete Bioassay

The chronic juvenile polychaete sublethal bioassay is used to characterize the toxicity of potentially contaminated marine sediments based on the growth of juvenile polychaete worm growth (*Neanthes arenaceodendata*). Parameters measured after a sediment exposure duration of 20 days are survival and growth. The test will be performed according to the procedures and QA/QC performance standards described in PSEP (1995). Quality control samples and procedures for the chronic juvenile polychaete sublethal bioassay are discussed in more detail in the QAPP provided in Appendix B of this work plan.

2.1.5.3 Larval Development Bioassay

The larval development bioassay is primarily an indicator of the relative toxicity among different samples because larvae normally reside in the water column and are not intimately associated with sediments. In general, any one of five larval species can be used for this test. Selection of an appropriate test species is dependent on the seasonal availability of adult organisms that can produce viable gametes. Ecology has limited the test organism selection to those that are sensitive to petroleum hydrocarbon-contaminated sediments (i.e., echinoderm) However, experience with past larval tests indicates that, of the allowable echinoderm, larvae of the sanddollar *Dendraster excenticus* provide the most consistent and reliable results. Consequently, for this project, the laboratory will select the best available echinoderm larvae (e.g., *Strongylocentrotus purpuratus, Strongylocentrotus droebachiensis* or *Dendraster excentricus*) during the week preceding delivery of the initial sediment samples. Three endpoints are measured in larvae after a 48-hour exposure period: mortality, abnormal development, and combined mortality/abnormality. Test protocols and QA/QC performance standards will be in accordance with PSEP (1995). The purpose of conducting an ammonia-positive control test is to determine the toxicity of ammonia to the test organisms being used in this study. Quality control samples and procedures for the larval development bioassay are discussed in more detail in the QAPP provided in Appendix B of the work plan.

2.2 SOIL INVESTIGATION

Soil borings will be used to characterize site lithology, to collect soil samples for chemical analyses, and for installation of groundwater monitoring wells. Soil borehole drilling and soil sample collection methods and laboratory analyses to be used during the RI investigation are described below. The soil investigation will be initiated following completion of the sediment investigation. This will allow TPH cleanup levels protective of sediment to be developed for the soil prior to collecting and analyzing soil samples. The soil investigation will consist of collecting soil samples from twelve borings (SB-1 through SB-12) at the approximate locations shown on Figure 5 of the work plan.

2.2.1 SOIL BORINGS

Boreholes for collecting soil samples and one groundwater sample (see Section 2.2.3) will be drilled using a truck-mounted Geoprobe® direct-push drilling rig. The direct-push borings will be advanced to the water table [approximately 4 to 5.5 ft below ground surface (BGS)]. Borings will be accomplished by a licensed driller in the state of Washington and will be monitored and recorded by a Landau Associates' field representative. Soil will be described in accordance with the Unified Soil Classification System. Prior to initiation of drilling, or any other invasive subsurface activity, the locations of each proposed exploration will be checked in the field to locate aboveground utilities or physical limitations that would prevent drilling at the proposed location. In addition, a public utility locate service will be contacted to locate underground utilities at the perimeter of the site and a private utility locate service will be contacted to clear explorations for underground utilities. The final location for each borehole will be based on the findings of the field check.

Before and between drilling of each boring and at completion of the project, downhole drilling equipment will be cleaned using a high-pressure hot water or steam washer as described in Section 2.9.

2.2.2 SOIL SAMPLE COLLECTION METHODS

Continuous soil samples will be collected from each boring using a closed-piston sampling device with a 24-inch long, 1.5-inch inside-diameter (ID) core sampler. The sampler will be advanced to the top of the sample interval with the piston in a locked position. The piston tip will then be loosened and the sampler will be advanced over the desired depth interval, thereby coring the soil inside the sampler's disposable, single-use liner. The sampler will then be withdrawn to retrieve the liner and soil sample. The liner will be cut to remove the soil sample. A new liner will be placed in the core sampler and this process will be repeated until all desired soil samples have been obtained. Between locations, the core sampler, including the piston tip and rods, will be decontaminated as described in the Equipment Decontamination section below.

After the liner is cut, the soil type will be evaluated by the Landau Associates' field representative and recorded on a Log of Exploration form. The soil column retained in the sample liner will be field-screened for evidence of impact. Field-screening will be conducted by visually inspecting the soil for staining and other evidence of environmental impact, and monitoring soil vapors for volatile organic compounds (VOCs) using a portable photoionization detector (PID). Soil samples collected for analysis of gasoline-range petroleum hydrocarbons by Method NWTPH-Dx and for analysis of VOCs will be collected in accordance with EPA Method 5035A. Soil samples to be submitted for chemical analysis of constituents other than VOCs and gasoline-range petroleum hydrocarbons will be placed into decontaminated stainless-steel bowls and homogenized using a decontaminated stainless-steel spoon.

At each boring location, a sample of the surface soil (0 to 0.5 ft BGS) will be collected and submitted for laboratory analysis. Additionally, if soil conditions at any of the twelve borings indicate a zone of potential contamination based on the field screening (e.g., debris, presence of oil or sheen, odors, and/or discoloration), a sample will be collected from that zone and submitted for laboratory analysis and a third sample will be collected from a depth below the zone of potential contamination where no evidence of contamination is present. If no evidence of potential contamination is observed at a boring, a soil sample will be collected from the 1 to 2 ft depth and from the capillary fringe, in addition to the surface soil sample, and submitted for laboratory analysis.

2.2.3 DIRECT PUSH GROUNDWATER SAMPLE COLLECTION

One groundwater sample will be collected from boring SB-01. The sample will be collected using a groundwater sampler consisting of a 4-ft long, wire-wrapped, stainless-steel screen (0.010-inch slot size) with a retractable protective steel sheath. The groundwater sampler will be advanced to the sample depth and the protective sheath will be retracted to expose the stainless-steel screen to the formation. Groundwater will be sampled using disposable polyethylene tubing and a peristaltic pump. Low-flow purging will be performed for 10 minutes or until purge water is clear. During purging, pH, conductivity, and temperature will be measured using a flow-through cell. The groundwater sample will be submitted to the laboratory for analysis as described in Section 2.4.5. Sufficient volume will be collected to perform all analyses identified in Section 2.4.5, except dissolved metals, using an aliquot of sample where the particulates were not allowed to settle and also using an aliquot where the particulates were allowed to settle.

2.2.4 SOIL SAMPLE LABORATORY ANALYSES

Soil Samples submitted for analysis will be analyzed for the chemicals of potential concern (COPCs) identified in Section 2.4.2 of this work plan, which consist of gasoline-range, diesel-range, and heavy oil range petroleum hydrocarbons; carcinogenic polycyclic aromatic hydrocarbons (cPAHs); napthalenes (naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene); benzene, toluene, ethylbenzene, and xylenes (BTEX); methyl tert-butyl ether (MTBE); 1,2-dibromoethane (EDB); 1,2-dichlorethane (EDC); n-Hexane, and lead. Soil samples submitted for laboratory analysis from soil boring SB-07, located near the former waste oil tank, will be analyzed for the COPCs, as well as, total chromium, hexavalent chromium, copper, zinc and polychlorinated biphenyls (PCBs). An acid/silica gel cleanup will be applied to all soil samples analyzed for diesel-range and heavy oil-range petroleum hydrocarbons.

If necessary for development of TPH cleanup levels that are protective of sediment, 10 soil samples will be collected from the vadose zone at borings where petroleum hydrocarbon contamination is observed. The vadose zone samples will be analyzed for TPH fractions using

EPH and VPH methodologies. Analytical methods and reporting limits goals for the analysis of each constituent are summarized in Table A-1.

2.3 GROUNDWATER INVESTIGATION

The groundwater investigation will consist of installing shallow groundwater monitoring wells and one deep groundwater monitoring well, collecting groundwater samples from each well and from one soil boring for chemical analyses, and measuring groundwater elevations in the monitoring wells to estimate the groundwater flow direction. This section provides procedures for constructing, developing and monitoring groundwater levels and groundwater quality.

2.3.1 MONITORING WELL INSTALLATION

Four new monitoring wells will be installed within the shallow (upper) aquifer and one new monitoring well will be installed in the deep (lower) aquifer (the shallow and deep aquifers are described in Section 2.4.1 of this work plan). The proposed locations of the new monitoring wells are shown on Figure 5 of the work plan. Monitoring wells will be constructed by a licensed drilling contractor in the state of Washington using the hollow-stem auger method, in accordance with the *Minimum Standards for Construction and Maintenance of Wells* (WAC 173-160; Ecology 2006). Oversight of drilling and well installation activities will be performed by an environmental professional familiar with environmental sampling and construction of resource protection wells. Prior to any drilling activities, an underground utility locate will be conducted by both private and public utility locating services at planned drilling locations.

During drilling, continuous soil samples will be collected at each well location to classify soil lithology in accordance with the Unified Soil Classification System (USCS). The soil samples will be obtained using a 3-inch diameter split-spoon sampler. A record of the soil and groundwater conditions observed during drilling will be recorded on a log of exploration form. The boring log will also show soil types; evidence of contamination, if indicated through visual observation; and other pertinent information. At each monitoring well location, soil samples will be submitted for laboratory analysis using the depth interval selection process described in Section 2.2.2.

The well names and the identification numbers assigned by Ecology will be marked on the well identification tags supplied by Ecology and will be attached to each well casing following well installation.

Shallow Monitoring Well Installation

Shallow monitoring wells will be installed within the dredged fill material that extends below ground surface about 9 ft. This fill unit overlies a thin silty, clay aquitard unit that ranges from about 3 to 6 ft thick. The shallow monitoring well boreholes will be advanced using a hollow-stem auger rig and will be terminated at the top of the confining unit, or will extend no more than 1 ft into the confining unit. Care will be taken to not drill through the aquitard unit when installing the shallow wells. Shallow monitoring wells will be screened in the upper water-bearing zone. The bottom of the screen will be near the top of the confining unit. The screened interval (approximately 5 to 10 ft) will extend upward across the water table to approximately 3.5 ft BGS. Shallow Monitoring wells will be constructed using flush-threaded 2-inch diameter Schedule 40 polyvinyl chloride (PVC) casing with PVC machine-slotted screens (0.010-inch). A filter pack will be installed around the screen, extending from the bottom of the end cap to 1.5 ft above the screen. Filter pack material consisting of commercially prepared, pre-sized, pre-washed No. 20-40 Colorado silica sand will be carefully poured down the annulus between the well casing and the auger flights as the auger is slowly withdrawn. During placement of the filter pack, the distribution and depth of the filter pack and sand will be monitored with a weighted tape. Once the well is installed, the total depth of the well will be verified by lowering a weighted tape to the bottom of the well casing. The annular space above the filter pack will be filled with at least 1 ft of bentonite grout or chips.

Deep Monitoring Well Installation

The deep monitoring well will be installed within the silty fine sand unit underlying the silty clay aquitard. The borehole will be advanced using the hollow-stem auger drilling and telescoping methods, as described below:

- The boring will be advanced from the ground surface to the silt and clay aquitard using a 10.25-inch inside-diameter auger. Within the upper dredged fill material unit, soil samples will be collected continuously to avoid penetration of the 3 to 6 ft thick aquitard unit.

- Once the boring is drilled approximately 1 ft into the aquitard, a temporary steel casing will be installed. A grout seal will be installed in the annulus between the steel casing and the soil as the auger is withdrawn. Sufficient time will be allowed for the grout to set, to completely seal off the upper transmissive unit.

- Once the grout is set, a 4.25-inch inside diameter auger will be used to drill within the steel casing through the aquitard and to the total depth of the boring (approximately 10 to 15 ft below the base of the confining unit with a total depth expected to range between about 30 to 45 ft BGS).

The deep monitoring well will be screened over a 5 to 10-ft interval in the lower water-bearing zone. The well screen will be placed at a depth that will allow proper installation of the filter pack as described below. The deep monitoring well will be constructed using flush-threaded 2-inch diameter Schedule 40 PVC casing with a PVC machine-slotted screen (0.010-inch). A filter pack will be installed around the screen, extending from the bottom of the end cap to the base of the confining unit with at least 2 ft of filter pack extending above the well screen. Filter pack material consisting of commercially prepared, pre-sized, pre-washed No. 20-40 Colorado silica sand will be carefully poured down the annulus between the well casing and the auger flights as the auger is slowly withdrawn. During placement of the filter pack, the distribution and depth of the filter pack and sand will be monitored with a weighted tape. Once the well is installed, the total depth of the well will be verified by lowering a weighted tape to the bottom of the well casing. The annular space above the filter pack will be filled with a high solids bentonite grout mixture to about 2 ft BGS. The remaining annular space will be filled with concrete as described for the shallow zone monitoring wells.

2.3.2 MONITORING WELL DEVELOPMENT

The monitoring wells will be developed after construction to remove formation material from the well borehole and the filter pack prior to groundwater level measurement and sampling. Development will be achieved by repeatedly surging the well with a surge block and purging up to 10, but no less than 5, well casing volumes. During development, the purged groundwater will be monitored for the following field parameters:

- pH
- Conductivity
- Temperature
- Turbidity.

The wells will be developed until the turbidity of the purged groundwater decreases to 5 Nephelometric turbidity units (NTUs), if practicable. If the well dewaters during the initial surging and purging effort, one final well casing volume will be removed after the well has fully recharged, if practicable. Well development activities will be recorded on a Well Development form.

2.3.3 MONITORING WELL SURVEYING

The location of each well will be surveyed using differential global positioning system (DGPS) equipment to facilitate accurate placement of these features on project figures and drawings, as well for submittal to Ecology. Surveying will be accomplished after completion of the well installations.

Monitoring well reference elevations will be surveyed by a professional licensed surveyor to the nearest 0.01 ft for use in evaluating groundwater and lithologic unit elevations. Both the top of monitoring well casing elevation and ground surface elevation adjacent to the monitoring well will be obtained. This information will be used to develop groundwater elevation contour maps, which are crucial in evaluating the groundwater flow direction and gradient.

2.4 GROUNDWATER MONITORING

Groundwater monitoring consists of obtaining water level measurements for calculation of groundwater elevations and estimation of groundwater flow directions, determining tidal influence on site groundwater, and collecting groundwater samples from each of the monitoring wells for chemical analysis. The scope and procedures for conducting these activities are described below.

2.4.1 72-HOUR TIDAL STUDY

Water levels in monitoring wells will be recorded using a combination of pressure transducers with internal dataloggers and an electronic water level indicator. The data collection will include continuous (every 15 minutes) transducer-based water level measurements in wells and in the marina. The datalogger will be programmed to automatically convert pressure changes to water levels. If possible, a vented transducer will be used that internally corrects for fluctuations in atmospheric pressure.

Procedures for conducting the 72-hour tidal study are summarized below:

1. At each monitoring well, a pressure transducer will be lowered into the well and securely fastened to the top of the well casing for the duration of the monitoring period. A transducer will also be lowered into Cap Sante Waterway from a secured location.

2. The transducers will be set to record the height of the water column above the transducer at 15-minute intervals.

3. Pressure transducers will be rated to a minimum 15 pounds per square inch range capable of measuring a water level change of 23 ft with a resolution of 0.01 ft.

4. Depth to water will also be measured from the top of the well casing to the nearest 0.01 ft with a manual electronic water level indicator. Depth-to-water level will be manually measured a minimum of four times during the monitoring period.

5. At the end of the monitoring period, the pressure transducers will be removed and the water level data will be uploaded to a computer.

Similar procedures will be used to monitor surface water levels in the marina.

2.4.2 HYDRAULIC CONDUCTIVITY DETERMINATION

The groundwater hydraulic conductivity at the Site will be estimated using slug tests. Slug tests will be performed in all monitoring wells to identify the range of hydraulic conductivities present in the vicinity of the former USTs. Slug tests can be performed prior to or following the 72-hour tidal study. The tests will be performed at a low tidal stage to minimize the interference of tidal fluctuations on the aquifer and the determination of the hydraulic conductivities.

Slug tests will be performed using a PVC slug rod, a down-hole pressure transducer as described above, and a water level indicator in general accordance with ASTM D 4044-96 (1999). The general procedure for conducting the slug tests in monitoring wells is summarized below:

1. At each monitoring well, the static depth of groundwater will be measured prior to placing the pressure transducer near the bottom of the well.

2. After stabilization of the groundwater level (from the displacement of the transducer), the slug rod will be lowered into the well until it is submerged in the water column.

3. The recovery of the perturbed water level will be monitored until it has returned to within 95 percent of the initial head indicated by the transducer prior to the introduction of the slug rod.

4. Once the water level has re-equilibrated, the slug rod will be quickly removed from the water column and the groundwater level will be monitored for recovery.

*5. After the water level has recovered to within tolerance (95 percent), depth to groundwater will be manually measured again and the transducer will be removed and the well secured.

The slug test response data will be analyzed using the Bouwer and Rice method (Bouwer and Rice 1976, Bouwer 1989).

2.4.3 WATER LEVEL MEASUREMENTS

Water level measurements will be obtained at each monitoring well prior to purging and sample collection. Water levels will also be measured in Cap Sante Waterway during each sampling event. All water levels will be measured using an electronic water level indicator and will be recorded to the nearest 0.01 ft. Measurements will be taken from the top of the well casing. Water levels in Cap Sante Waterway will be measured from a surveyed point at the edge of a stationary dock or piling.

2.4.4 MONITORING WELL GROUNDWATER SAMPLE COLLECTION

The initial groundwater samples will be collected at least 2 days after well development. Samples from the shallow wells will be collected within 1 hour before and 1 after a low tide so that samples collected will be of water discharging from the site that is minimally influenced by the tide. Collection of groundwater samples will be completed at each monitoring well using the following procedures:

- Immediately following removal of each well monument cover, the well head will be observed for damage, leakage, and staining. Additionally, immediately following removal of the well head cap, any odors will be recorded and the condition of the well opening will be observed. Any damage, leakage, or staining to the well head or well opening will be recorded.

- Prior to sampling, each well will be purged using a pump that is attached to dedicated purge and sample collection tubing (types of pumps used may vary depending on purge volume and depth and include a centrifugal pump, a peristaltic pump, and an electric submersible pump). Purging will begin with a small pumping rate. The rate will be adjusted upward slowly to minimize drawdown (with a target drawdown of less than 0.33 ft) during purging. Purging will continue until at least three casing volumes of water have been removed and specific conductance and temperature have stabilized or until the well goes dry. The purge volume will be calculated based on the following formula:

  $$1 \text{ casing volume (gallons)} = \pi\, r^2 h \times 7.48 \text{ gal/ft}^3$$

  where: $\pi = 3.14$
  r = radius of well casing in ft
  h = height of water column from the bottom of the well, in feet.

- Field parameters, including pH, temperature, conductivity, dissolved oxygen, and turbidity, will be continuously monitored during purging using a flow cell. Purging of the well will be considered to be complete when all field parameters become stable for three successive readings. The successive readings should be within +/- 0.1 pH units for pH, +/- 3% for conductivity, and +/- 10% for dissolved oxygen and turbidity.

- Purge data will be recorded on a Groundwater Sample Collection form including purge volume; time of commencement and termination of purging; any observations regarding color, turbidity, or other factors that may have been important in evaluation of sample quality; and field measurements of pH, specific conductance, temperature, dissolved oxygen, and turbidity.

- Following the stabilization of field parameters, the flow cell will be disconnected and groundwater samples will be collected. Sample data will be recorded on a Groundwater Sample Collection form, including sample number and time collected; the observed physical characteristics of the sample (e.g., color, turbidity, etc.); and field parameters (pH, specific conductance, temperature, and turbidity).

- Four replicate field measurements of temperature, pH, specific conductance, dissolved oxygen, and turbidity will be obtained using the following procedures:

    - A 250-mL plastic beaker will be rinsed with deionized water followed by sample water.

    - The electrodes and temperature compensation probe will be rinsed with deionized water followed by sample water.

    - The beaker will be filled with sample water; the probes will be placed in the beaker until the readings are stabilized. Temperature, pH, specific conductance, dissolved oxygen, and turbidity measurements will be recorded on the Groundwater Sample Collection form.

    - The above step will be repeated to collect remaining replicates.

- Any problems or significant observations will be noted in the “comments” section of the Groundwater Sample Collection form.

- Groundwater samples will be collected into the appropriate sample containers using a peristaltic pump. To prevent degassing during sampling for VOCs and gasoline-range petroleum hydrocarbons, a pumping rate will be maintained below about 100 ml/min. The VOC and gasoline-range petroleum hydrocarbons containers will be filled completely so that no head space remains. Samples will be chilled to 4°C immediately after collecting the sample. Clean gloves will be worn when collecting each sample.

- Groundwater for dissolved metals analyses will be collected last and field filtered through a 0.45 micron, in-line disposable filter. Dissolved metal samples will be preserved, as specified in Table A-1. A note will be made on the sample label, sample collection form, and COC to indicate the sample has been field filtered and preserved, including the type of preservative used.

2.4.5 GROUNDWATER SAMPLE LABORATORY ANALYSES

Groundwater samples collected from the monitoring wells and soil boring SB-01 will be analyzed for the COPCs identified in Section 2.4.2 of this work plan, which consist of gasoline-range, diesel-range, and heavy oil-range petroleum hydrocarbons, PAHs, BTEX, MTBE, EDB, EDC, n-hexane, and lead. Both total and dissolved lead will be analyzed for in each groundwater sample. For turbid groundwater samples, the dissolved lead results will likely be used to characterize Site groundwater. For non-turbid groundwater samples, total lead results will likely be used to characterize Site groundwater. However, the use of total or dissolved metal results for characterizing Site groundwater will be determined in consultation with Ecology.

During the first groundwater monitoring event, each groundwater sample, including the direct-push groundwater sample, will also be analyzed for total dissolved solids (TDS), salinity, and chloride to support demonstration that groundwater at the Site should not be classified as potable. Also, during the first groundwater monitoring event, each groundwater sample, including the direct-push groundwater sample, will be analyzed for parameters that can be used to evaluate the feasibility of natural attenuation as a cleanup option. These parameters include nitrate, dissolved manganese, sulfate, and methane. Other parameters used to evaluate natural attenuation will be measured in the field. These parameters are described in Section 2.4.6. Analyzing samples collected during subsequent groundwater monitoring events for the constituents that are not considered COPCs will be evaluated in consultation with Ecology. For all analyses except dissolved metals, any suspended material in the sample will be allowed to settle and the sample will not be agitated prior to analysis of the supernatant. For the dissolved metal analyses, the samples will be filtered in the field to remove any suspended material. For the single direct-push groundwater sample, sufficient volume will be collected to perform all analyses using an aliquot of sample where the particulates were not allowed to settle and using an aliquot where the particulates were allowed to settle. An acid/silica gel cleanup will be applied to all groundwater samples analyzed for diesel-range and heavy oil-range petroleum hydrocarbons.

Methods and reporting limit goals for the analysis of each of the above constituents are summarized in Table A-2.

2.4.6 FIELD PARAMETERS

Field parameters, including pH, temperature, conductivity, dissolved oxygen, turbidity, and oxidation reduction potential (Redox) will be measured at each well using a flow-through cell. Ferrous iron will also be measured using a field test kit. Each parameter will be measured during all four groundwater monitoring events, except for the possibility of ferrous iron. Elimination of ferrous iron during future groundwater monitoring events will be determined in consultation with Ecology.

2.5 QUALITY ASSURANCE AND QUALITY CONTROL

Analytical samples collected during the RI will follow QA/QC procedures and standards outlined in the Quality Assurance Project Plan (QAPP; Appendix B of this work plan). Field QA/QC includes the collection of quality control samples, including blind field duplicate samples, matrix spike and matrix spike duplicate samples, and equipment rinsate blanks. Each of these quality control samples will be collected at the rate of 1 in every 20 samples collected for each sample media type with the following exception. Equipment rinsate blanks will be collected at a rate of one per sampling event (i.e., any continuous sampling period not interrupted by more than 2 working days). The procedures for collection of the quality control samples are provided in the QAPP (Appendix B of this work plan).

2.6 SAMPLE CONTAINERS, PRESERVATION, AND STORAGE

Soil and groundwater samples submitted to the analytical laboratory for analysis will be collected in the appropriate sample container provided by the analytical laboratory. The samples will be preserved by cooling to a temperature of 4°C and as required by the analytical method. Maximum holding and extraction times until analysis is performed will be strictly adhered to by field personnel and the analytical laboratory. Sample containers, preservatives, and holding times for each chemical analysis are presented in Table A-1.

2.7 SAMPLE TRANSPORTATION AND HANDLING

The transportation and handling of groundwater samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of samples. Samples will be logged on a COC form and will be kept in coolers on ice until delivery to the analytical laboratory. The COC will accompany each shipment of samples to the laboratory.

2.8 SAMPLE CUSTODY

The primary objective of sample custody is to create an accurate, written record that can be used to trace the possession and handling of samples so that their quality and integrity can be maintained from collection until completion of all required analyses. Adequate sample custody will be achieved by means of approved field and analytical documentation. Such documentation includes the COC record that is initially completed by the sampler and is, thereafter, signed by those individuals who accept custody of the sample. A sample is in custody if at least one of the following is true:

- It is in someone's physical possession.
- It is in someone's view.
- It is secured in a locked container or otherwise sealed so that tampering will be evident.
- It is kept in a secured area, restricted to authorized personnel only.

Sample control and COC in the field and during transportation to the laboratory will be conducted in general conformance with the procedures described below:

- As few people as possible will handle samples.
- Sample containers will be obtained new or pre-cleaned from the laboratory performing the analyses.
- The sample collector will be personally responsible for the completion of the COC record and the care and custody of samples collected until they are transferred to another person or dispatched properly under COC rules.
- The cooler in which the samples are shipped will be accompanied by the COC record identifying its contents. The original record and laboratory copy will accompany the shipment (sealed inside the shipping container). The other copy will be forwarded to Landau Associates along with sample collection forms.
- Coolers will be sealed with strapping tape and custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information will be entered in the "remarks" section of the COC record and traffic report.

When samples are transferred, the individuals relinquishing and receiving the samples will sign the COC form and record the date and time of transfer. The sample collector will sign the form in the first signature space. Each person taking custody will observe whether the shipping container is correctly sealed and in the same condition as noted by the previous custodian (if applicable); deviations will be noted on the appropriate section of the COC record.

A designated sample custodian at the laboratory will accept custody of the shipped samples, verify the integrity of the custody seals, and certify that the sample identification numbers match those on the COC record. The custodian will then enter sample identification number data into a bound logbook, which is arranged by a project code and station number. If containers arrive with broken custody seals, the laboratory will note this on the COC record and will immediately notify the sampler and Landau Associates.

2.9 EQUIPMENT DECONTAMINATION

The decontamination procedures described below are to be used by field personnel to clean drilling, sampling, and related field equipment. Deviation from these procedures must be documented in field records.

2.9.1 WATER LEVEL INDICATOR

The tape from the water level indicator will be rinsed with drinking water between each well measurement, and washed with alconox soap if petroleum product or sheen is encountered.

2.9.2 SAMPLING EQUIPMENT

All sampling equipment used (e.g., stainless-steel bowls, stainless-steel spoons, soil split-spoon samplers, etc.) will be cleaned using a three-step process, as follows:

1. Scrub surfaces of equipment that would be in contact with the sample with brushes using an Alconox solution
2. Rinse and scrub equipment with clean tap water.
3. Rinse equipment a final time with deionized water to remove tap water impurities.

Decontamination of the reusable sampling devices will occur between collection of each sample.

2.9.3 HEAVY EQUIPMENT

Heavy equipment (e.g., the drilling rigs and drilling equipment that is used downhole, or that contacts material and equipment going downhole) will be cleansed by a hot water, high pressure wash before each use and at completion of the project. Potable tap water will be used as the cleansing agent.

2.10 RESIDUAL WASTE MANAGEMENT

Soil cuttings generated during boring advancement will be temporarily stored onsite in 55-gal drums. Disposal methods for soil stored in 55-gal drums will be determined based on the analytical results for the soil.

Water generated during well development, purging, and decontamination, will be temporarily stored onsite in 55-gal drums or 5-gal buckets secured with a lid. Disposal methods for groundwater stored in drums and/or buckets will be determined based on the analytical results for the groundwater samples.

Excess sediment generated during sediment sampling will be returned to the water at the station where it was collected.

3.0 REFERENCES

ASTM. 1999. *Standard Test Method (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifers, (Method D 4044-096), Standards on Determining Subsurface Hydraulic Properties and Ground Water Modeling*. Second Edition, pp. 19-21. American Society for Testing and Materials.

Bouwer, H. 1989. *Slug Test – An Update*. Ground Water 27:15-20.

Bouwer, H. and M.R. Rice. 1976. *A Slug Test Determining the Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells*. Water Resources Research. 12:423-428.

Ecology. 2006. *Minimum Standards for Construction and Maintenance of Wells* (Chapter 173-160 WAC). Washington State Department of Ecology. Update November.

Ecology. 2003. *Sediment Sampling and Analysis Plan Appendix; Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards (Chapter 173-204 WAC)*. April.

Ecology. 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. Washington State Department of Ecology. June.

Ecology. 1995. *Sediment Management Standards.* Chapter 173-204 WAC. Washington State Department of Ecology. Amended December.

EPA. 1986. *Test Methods for Evaluating Solid Waste*. EPA/SW-846, Third Edition, with 1990 updates. U.S. Environmental Protection Agency.

EPA. 1983. *Methods for Chemical Analysis of Water and Wastes*. Publication EPA-600/4-79-020. U.S. Environmental Protection Agency. March.

Ferris. 1951. Ferris, J.G. 1951. *Cyclic fluctuations of water level as a basis for determining aquifer transmissibility.* Intl. Assoc. Sci. Hydrology, Publ. 33. pp. 148-155.

Plumb, R.H., JR. 1981. *Procedure for Handling and Chemical Analysis of Sediment and Water Samples.* Technical Report EPA/CE-81-1. U.S. Environmental Protection Agency and U.S. Corps of Engineers, Waterways Experiment Station, Vicksburg, MS.

PSEP. 1997a. *Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound.* Prepared by U.S. Environmental Protection Agency, Region 10 for Puget Sound Estuary Program. April.

PSEP. 1997b. *Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water Sediment and Tissue Samples.* Prepared by U.S. Environmental Protection Agency, Region 10 for Puget Sound Estuary Program. April.

PSEP. 1997c. *Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples.* Prepared by U.S. Environmental Protection Agency, Region 10 for Puget Sound Estuary Program. April.

PSEP. 1997d. *Recommended Quality Assurance and Quality Control Guidelines for the Collection of Environmental Data in Puget Sound.* Puget Sound Estuary Program. April.

PSEP. 1995. *Recommended Protocols for Conducting Laboratory Bioassays on Puget Sound Sediments.* Puget Sound Estuary Program.

TABLE A-1
SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES
CAP SANTE MARINE, ANACORTES, WA

Analyses	Sample Container	Preservation	Holding Time
Soil Samples			
NWTPH-G	2 - 40 ml vials	Methanol; Cool 4° C	7 days
NWTPH-Dx	1 - 8 oz wide mouth glass	Cool, 4°C	14 days
VPH	1 - 8 oz wide mouth glass	Cool, 4°C	14 days
EPH	1 - 8 oz wide mouth glass	Cool, 4°C	14 days
VOCs	3-40 ml vial	Sodium bisulfate - 2 vials Methanol - 1 vial	7 days
PCBs	1 - 8 oz wide mouth glass	Cool, 4°C	14 days
Metals (a)	1 - 4 oz wide mouth glass	Cool, 4°C	6 months
Chromium (total)	1 - 4 oz wide mouth glass	Cool, 4°C	28 days
PAHs	1 - 8 oz wide mouth glass	Cool, 4°C	14 days
Groundwater Samples			
NWTPH-G	3 - 40 ml vial	HCl to pH <2; Cool 4°C	14 days
NWTPH-Dx	1 - 1 L amber glass	Cool, 4°C	7 days
VOCs	3 - 40 ml vial	HCl to pH <2; Cool 4°C	14 days
PAHs	2 - 1 L amber glass	Cool, 4°C	7 days
Total lead	1 - 1 L polyethelene	5 ml - HNO_3 (c); Cool 4°C	6 months
Dissolved lead and manganese (b)	1 - 1 L polyethelene	5 ml - HNO_3 (c); Cool 4°C	6 months
Hexavalent Chromium	1 - 500 ml polyethylene	Cool, 4°C	24 hours
TDS	1 - 1 L polyethelene	Cool, 4°C	7 days
Chloride	1 - 500 ml polyethylene	Cool, 4°C	28 days
Nitrate	1 - 500 ml polyethylene	Cool, 4°C	48 hours
Sulfate	1 - 500 ml polyethylene	Cool, 4°C	48 hours
Salinity	1 - 500 ml polyethylene	Cool, 4°C	28 days
Methane	3 - 40 ml vial	Cool, 4°C	7 days
Sediment Samples			
NWTPH-Dx	1 - 8 oz wide mouth glass	Cool, 4°C Freeze, -18°C	14 days 1 year
VPH	1 - 8 oz wide mouth glass	Cool, 4°C	14 days
EPH	1 - 8 oz wide mouth glass	Cool, 4°C	14 days
TOC	1 - 8 oz wide mouth glass	Cool, 4°C Freeze, -18°C	28 days 6 months
Grain Size	1-16 oz wide mouth glass	Cool, 4°C	6 months
Bioassay	5L-HDPE bucket	Cool, 4°C	56 days

(a) Metals include total chromium, hexavalent chromium, copper, lead, and zinc.

(b) Dissolved metals samples must be filtered prior to preservation; therefore, samples will be filtered in the field.

TABLE A-2
SUMMARY OF SOIL, SEDIMENT, AND GROUNDWATER SAMPLE ANALYTICAL METHODS AND TARGET REPORTING LIMITS
CAP SANTE MARINE
ANACORTES, WASHINGTON

	Analytical	Target Reporting Limits (b)	
Analyte	Method (a)	Soil/Sediment	Groundwater
Semivolatile Petroleum Hydrocarbons			
Diesel-Range Petroleum Hydrocarbons	NWTPH-Dx (c)	5 mg/kg	0.25 mg/L
Heavy Oil-Range Petroleum Hydrocarbons	NWTPH-Dx	10 mg/kg	0.5 mg/L
C_8-C_{10} Aliphatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{10}-C_{12} Aliphatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{12}-C_{16} Aliphatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{16}-C_{21} Aliphatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{21}-C_{34} Aliphatics	EPH (d)	2 mg/kg	0.04 mg/L
C_8-C_{10} Aromatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{10}-C_{12} Aromatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{12}-C_{16} Aromatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{16}-C_{21} Aromatics	EPH (d)	2 mg/kg	0.04 mg/L
C_{21}-C_{34} Aromatics	EPH (d)	2 mg/kg	0.04 mg/L
Volatile Petroleum Hydrocarbons			
Gasoline-Range Petroleum Hydrocarbons	NWTPH-Gx (e)	5 mg/kg	0.25 mg/l
C_5-C_6 Aliphatics	VPH (f)	5 mg/kg	--
C_6-C_8 Aliphatics	VPH (f)	5 mg/kg	--
C_8-C_{10} Aliphatics	VPH (f)	5 mg/kg	--
C_{10}-C_{12} Aliphatics	VPH (f)	5 mg/kg	--
C_5-C_6 Aromatics	VPH (f)	5 mg/kg	--
C_6-C_8 Aromatics	VPH (f)	5 mg/kg	--
C_8-C_{10} Aromatics	VPH (f)	5 mg/kg	--
C_{10}-C_{12} Aromatics	VPH (f)	5 mg/kg	--
PAHs			
Naphthalene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
1-Methylnaphthalene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
2-Methylnaphthalene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Benzo(a)anthracene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Chrysene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Benzo(b)fluoranthene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Benzo(k)fluoranthene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Benzo(a)pyrene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Indeno(1,2,3-cd)pyrene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Dibenz(a,h)anthracene	EPA Method 8270-SIM (g)	6.7 µg/kg	0.01 µg/L
Volatile Organic Compounds			
Benzene	EPA Method 8260	1.0 µg/kg	1 µg/L
Toluene	EPA Method 8260	1.0 µg/kg	1 µg/L
Ethylbenzene	EPA Method 8260	1.0 µg/kg	1 µg/L
Xylenes	EPA Method 8260	1.0 µg/kg	1 µg/L
n-Hexane	EPA Method 8260	1.0 µg/kg	1 µg/L
Methyl-t-butyl ether (MTBE)	EPA method 8260	1.0 µg/kg	1 µg/L
1,2-Dibromoethane (EDB)	EPA method 8260	1.0 µg/kg	1 µg/L
1,2-Dichloroethane (EDC)	EPA method 8260	1.0 µg/kg	1 µg/L

TABLE A-2
SUMMARY OF SOIL, SEDIMENT, AND GROUNDWATER SAMPLE ANALYTICAL METHODS AND TARGET REPORTING LIMITS
CAP SANTE MARINE
ANACORTES, WASHINGTON

		Target Reporting Limits (b)	
Analyte	Analytical Method (a)	Soil/Sediment	Groundwater
Total Metals			
Lead	EPA Method 6010/6020 (j)	2 mg/kg	0.001 mg/L
Chromium (total)	EPA Method 6010	0.5 mg/kg	--
Copper	EPA Method 6010	0.2 mg/kg	--
Zinc	EPA Method 6010	0.6 mg/kg	--
Dissolved Metals			
Lead	EPA Method 6020	--	0.001 mg/L
Manganese	EPA Method 6020	--	0.0005 mg/L
PCBs			
PCB Aroclors	EPA Method 8082	33 µg/kg	--
Conventionals			
Chloride	EPA Method 325.2 (h)	--	1 mg/L
TOC	EPA Method 9060	0.1% dry weight	--
Grain size	Plumb (1981) (i)	1% dry weight	--
Total Dissolved Solids	Method 160.1	--	10 mg/L
Sulfate	EPA Method 300.0	--	2.0 mg/L
Salinity	Standard Method 2520	--	0.1 g/kg
Nitrate	EPA Method 353.2	--	0.01 mg/L
Methane	RSK 175	--	1 µg/L

(a) Analytical methods are from SW-845 (EPA 1986) and upddates, unless otherwise noted.

(b) Reporting limits goals are based on current laboratory data and may be modified during the investigation process as methodology is refined. Laboratory reporting will be based on the lowest standard on the calibration curve. Instances may arise where high sample concentrations, nonhomogeneity of samples, or matrix interferences preclude achieving the desired reporting limits.

(c) Method NWTPH-DX as described in *Analytical Methods for Petroleum Hydrocarbons* , Washington State Department of Ecology, Publication ECY97-602, June 1997.

(d) Extractable Petroleum Hydrocarbons as described in *Analytical Methods for Petroleum Hydrocarbons* , Washington State Department of Ecology, Publication ECY97-602, June 1997,

(e) NWTPH-Gx Method as described in *Analytical Methods for Petroleum Hydrocarbons* , Washington State Department of Ecology, Publication ECY97-602, June 1997.

(f) Volatile Petroleum Hydrocarbons as described in_ *Analytical Methods for Petroleum Hydrocarbons* , Washington State Department of Ecology, Publication ECY97-602, June 1997,

(g) PAHs in groundwater will be analyzed using EPA Method 8270-SIM LIV.

(h) EPA method 325.2 as described in *Methods for Chemical Analysis of Water and Wastes* , EPA, Publication EPA-600/4-79-020, March 1983.

(i) Plumb (1981) - EPA/U.S. Army Corps of Engineers Technical report EPA/CE-81-1.

(j) Method 6010 will be used for the analysis of lead in soil and method 6020 will be used for the analysis of lead in groundwater.

Public Review Draft QAPP
Remedial Investigation/Feasibility Study and Interim Action
Cap Sante Marine Lease Area
Anacortes, Washington

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) establishes the quality assurance (QA) objectives for soil, sediment, and groundwater sampling and sediment biological toxicity testing associated with the remedial investigation (RI) at the Cap Sante Marine site (site) located in Anacortes, Washington. Data from the RI will supplement the existing data collected as part of the Environmental Due Diligence Investigations (Floyd Snyder and McCarthy 2004 and Floyd|Snider 2005) to evaluate appropriate and protective remedial alternatives in the Feasibility Study (FS). This plan presents the quality control (QC) procedures developed to meet project QA objectives. Soil, groundwater, and sediment sampling QC procedures and QA criteria are described in Sections

1.1 DATA QUALITY OBJECTIVES

The overall data quality objectives (DQOs) for this project are to develop and implement procedures that will ensure collection of representative data of known, acceptable, and defensible quality. The data quality parameters used to assess the acceptability of the data are precision, accuracy, representativeness, comparability, and completeness. There parameters are discussed in the following sections.

1.1.1 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average values. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD) samples for organic analysis and through laboratory duplicate samples for inorganic analyses.

Analytical precision measurements will be carried out on project-specific samples at a minimum frequency of 1 per sampling event or 1 in 20 samples, whichever is more frequent per matrix analyzed, as practical. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria provided by the laboratory.

Field precision will be evaluated by the collection of blind field duplicates at a minimum frequency of 1 per laboratory analysis group or 1 in 20 samples. Control limits for the field duplicates will be 20 percent for groundwater and 35 percent for soil and sediment unless the duplicate sample values are within five times the reporting limit, in which case the control limit interval will be plus or minus the reporting limit for water, and plus or minus two times the reporting limit for soil.

Precision measurements can be affected by the nearness of a chemical concentration to the method detection limit, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$RPD = \left| \frac{D_1 - D_2}{(D_1 + D_2)/2} \right| x\ 100$$

where: D_1 = first sample value

D_2 = second sample value (duplicate).

1.1.2 ACCURACY

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures as outlined.

Analytical accuracy may be assessed by analyzing "spiked" samples with known standards (surrogates, laboratory control samples, and/or matrix spike) and measuring the percent recovery. Accuracy measurements on matrix spike samples will be carried out at a minimum frequency of 1 in 20 samples per matrix analyzed. Because MS/MSDs measure the effects of potential matrix interferences of a specific matrix, the laboratory will perform MS/MSDs only on samples from this investigation and not from other projects. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative matrix spike and surrogate spike recovery performance criteria provided by the laboratory. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\begin{matrix}\text{Percent} \\ \text{Recovery}\end{matrix} = \frac{(\text{Spiked Sample Result - Unspiked Sample Result})}{\text{Amount of Spike Added}}\ x\ 100$$

Control limits for percent recovery for soil and groundwater samples will be laboratory acceptance limits generated according to U.S. Environmental Protection Agency (EPA) guidelines. Control limits for percent recovery for sediment samples will be as specified in Washington State Department of Ecology's (Ecology) *Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards* (Ecology 2003).

1.1.3 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent an actual condition or characteristic of a population. Representativeness can be evaluated using replicate samples, representative sampling locations, and blanks. Representativeness for the RI sampling will be accomplished using appropriate selection of sampling location and collection of field equipment blanks for nondedicated sampling equipment and analyzing method blanks to verify that the analytical results are representative of the sampled item and not influenced by cross-contamination.

1.1.4 COMPARABILITY

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this work, comparability of data will be established through the use of standard analytical methodologies and reporting formats and of common traceable calibration and reference materials.

1.1.5 COMPLETENESS

Completeness is a measure of the proportion of data obtained from a task sampling plan that is determined to be valid. It is calculated as the number of valid data points divided by the total number of data points requested. The QA objective for completeness during this project will be 95 percent. Completeness will be routinely determined and compared to this control criteria.

1.2 FIELD AND LABORATORY QUALITY CONTROL PROCEDURES

This section describes the procedures that will be implemented to: 1) ensure sample integrity from the time of sample collection to the time of analysis in the laboratory; 2) obtain the appropriate chemical and physical data; 3) collect field and laboratory quality control samples; 4) monitor performance of the laboratory and field measurement systems; 5) correct any deviations from the methods or QA requirements established in this QAPP; and 6) report and validate the data.

1.2.1 FIELD EQUIPMENT CALIBRATION

Field meters, including pH, conductivity, dissolved oxygen, temperature probes, and PID will be calibrated and maintained in accordance with the manufactures specifications. All routine maintenance will be recorded in the field sampling logs.

1.2.2 FIELD DOCUMENTATION

A complete record of all field activities will be maintained for the duration of the field phase of the work. Documentation will include the following:

- Daily recordkeeping by field personnel of all field activities
- Recordkeeping of all samples collected for analysis (field sampling forms)
- Use of sample labels and tracking forms for all samples collected for analysis.

The field logs will provide a description of all sampling activities, sampling personnel, weather conditions, and a record of all modifications to the procedures and plans identified in the work plan. The field logs are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the sampling period.

Sample possession and handling will also be documented so that it is traceable from the time of sample collection to the laboratory and data analysis. Sample Chain-of-Custody (COC) Records and procedures are described in Section 2.8 of the Sampling and Analysis Plan (SAP) provided in Appendix A of this work plan.

1.2.3 SAMPLE HANDLING PROCEDURES AND TRANSFER OF CUSTODY

Samples submitted to the analytical laboratories will be collected in the appropriate sample containers and preserved as specified in Table A-1 of the SAP (Appendix A of this work plan). The storage temperatures and maximum holding times for physical/chemical analyses are also presented in Table A-1.

The transportation and handling of groundwater samples will be accomplished in a manner that not only protects the integrity of the sample, but also prevents any detrimental effects due to release of samples. Samples will be logged on a COC form (Figure B-1) and will be kept in coolers on ice until delivery to the analytical laboratory. The COC will accompany each shipment of samples to the laboratory. Procedures for sample transportation and handling are described in Section 2.7 of the SAP (provided in Appendix A of this work plan).

1.2.4 FIELD AND LABORATORY QUALITY CONTROL SAMPLES

Field and analytical laboratory control samples will be collected to evaluate data precision, accuracy, representativeness, completeness, and comparability of the analytical results for this investigation. A summary of the quality control samples and the frequency at which they will be collected and/or analyzed is described in the following subsections.

1.2.4.1 Blind Field Duplicates

A blind field duplicate will be collected at a frequency of at least 1 per 20 samples per sample type per chemical analysis, not including QC samples, but not less than one field duplicate per sampling event (any continuous sampling period not interrupted by more than 2 days). The blind field duplicate will consist of a split sample collected at a single sample location. Except for soil and sediment samples collected for volatile organic compounds (VOCs) or gasoline analysis, soil and sediment samples will be homogenized by mixing in a stainless-steel bowl, split into duplicate sample containers, and submitted blind to the laboratory as discrete samples. No soil or sediment blind field duplicate samples will be collected for VOC or gasoline analysis. Groundwater blind field duplicates will be collected by alternately filling sample containers for both the original and the corresponding duplicate sample at the same location to decrease variability between the duplicates. Blind field duplicate sample results will be used to evaluate data precision.

1.2.4.2 Field Trip Blanks

Field trip blanks will consist of deionized water sealed in a sample container by the analytical laboratory. The trip blank will accompany VOCs; volatile petroleum hydrocarbon (VPH); and gasoline-range petroleum hydrocarbon (NWTPH-G) sample containers for soil, sediment, and groundwater samples during transportation to and from the field, and then will be returned to the laboratory with each shipment of VOC, VPH, and NWTPH-G samples. The trip blank will remain unopened until submitted to the laboratory for analysis of VOCs, VPH, and NWTPH-G. One trip blank per cooler containing samples for VOC, VPH, and NWTPH-G analysis will be evaluated to determine possible sample contamination during transport.

1.2.4.3 Laboratory Matrix Spike

A minimum of 1 laboratory matrix spike per 20 samples, not including QC samples, or 1 matrix spike sample per batch of samples if fewer than 20 samples are obtained, will be analyzed for all constituents except dioxins/furans. The matrix spikes will be performed using a project sample. These analyses will be performed to provide information on accuracy and to verify that extraction and concentration levels are acceptable. The laboratory spikes will follow EPA guidance for matrix and blank spikes.

1.2.4.4 Laboratory Matrix Spike Duplicate

A minimum of 1 laboratory matrix spike duplicate per 20 samples, not including QC samples, or one matrix spike duplicate sample per batch of samples if fewer than twenty samples are obtained, will be analyzed for all constituents except metals. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory spikes will follow EPA guidance for matrix and blank spike duplicates.

1.2.4.5 Laboratory Duplicates

A minimum of 1 laboratory duplicate per 20 samples, not including QC samples, or 1 laboratory duplicate sample per batch of samples if fewer than 20 samples are obtained, will be analyzed for metals. These analyses will be performed to provide information on the precision of chemical analyses. The laboratory duplicate will follow EPA guidance in the method.

1.2.4.6 Laboratory Triplicates

A minimum of 1 laboratory triplicate per 20 sediment samples, not including QC samples, or 1 laboratory triplicate sample per batch of samples if fewer than 20 samples are obtained, will be analyzed for grain size; total organic carbon (TOC); and total solids. Laboratory triplicates will not be collected for soil and groundwater samples.

1.2.4.7 Laboratory Method Blanks

A minimum of 1 laboratory method blank per 20 samples, 1 every 12 hours, or 1 per batch of samples analyzed (if fewer than 20 samples are analyzed) will be analyzed for all parameters (except grain size and total solids) to assess possible laboratory contamination. Dilution water will be used whenever possible. Method blanks will contain all reagents used for analysis. The generation and analysis of additional method, reagent, and glassware blanks may be necessary to verify that laboratory procedures do not contaminate samples.

1.2.4.8 Laboratory Control Sample

A minimum of 1 laboratory control sample per 20 samples, not including QC samples, or 1 laboratory control sample per sample batch if fewer than 20 samples are obtained, will be analyzed for all parameters, except grain size and total solids.

1.2.4.9 Surrogate Spikes

All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined by the analytical methods.

1.2.5 SAMPLE ANALYSIS

Analytical procedures for the chemical analysis of soil, sediment, and groundwater samples collected during this investigation will include petroleum hydrocarbons; VOCs; carcinogenic polycyclic aromatic hydrocarbons (PAHs); metals (copper, lead, chromium, and zinc); chloride; polychlorinated biphenyls (PCBs); and conventional parameters (including total solids, grain size, and TOC). Laboratory chemical analyses will be conducted by an Ecology-certified laboratory.

Standard EPA sample preparation, cleanup, and analytical methods will be used for most chemical analyses, with the exception of petroleum hydrocarbons and some conventional parameters. An acid/silica gel cleanup will be applied to all soil samples analyzed for diesel-range and motor oil-range petroleum hydrocarbons by Ecology Method NWTPH-Dx. Cleanup procedures and analytical methods for TPH analyses described in Ecology's publication *Analytical Methods for Petroleum Hydrocarbons* (Ecology 1997), including the use of gas chromatogram calibration standards that have undergone acid/silica-gel cleanup, will be strictly adhered to by the laboratory. PSEP recommended guidelines for the measurement of conventional parameters in sediment will also be followed (PSEP 1986; 1997a,b). Sample preparation methods, cleanup methods, and analytical methods are summarized in Table A-1 of the SAP (Appendix A of this work plan). The laboratory QAPPs and standard operating procedures (SOP) will provide data quality procedures according to the protocols for the analytical method and cleanup steps, and at a level sufficient to meet the sampling program DQOs.

1.2.6 REPORTING LIMITS

The reporting limits for each chemical analysis are summarized in Table A-2 of the SAP (Appendix A of this work plan). These reporting limits are targeted to be lower than this preliminary cleanup levels presented in Section 3.1 of this work plan. The reporting limits listed are goals only, insofar as instances may arise where high sample concentrations, non-homogeneity of samples, or matrix interferences preclude achieving the desired reporting limit and associated QC criteria. In such instances, the laboratory will report the reasons for deviations from these reporting limits.

1.3 DATA REDUCTION, VALIDATION, AND REPORTING

Sufficient backup data and QC results to enable reviewers to determine the quality of the data will accompany project analytical reports from the laboratory. The Landau Associates quality assurance officer (QAO) for this project is responsible to the project manager for conducting checks for internal consistency, transmittal errors, laboratory protocols, and for complete adherence to the QC elements in this work plan. The QAO will also prepare a laboratory data quality evaluation report, based on appropriate sections of the EPA validation guidelines (EPA 1994a,b). This report will include evaluations of the following:

- Chain-of-custody methods
- Holding times
- Laboratory method blanks
- Surrogate recoveries
- Laboratory matrix spikes and matrix spike duplicates
- Blank spikes and blank spike duplicates
- Laboratory duplicates
- Completeness
- Overall assessment of data quality.

1.4 BIOLOGICAL ANALYSES QUALITY CONTROL PROCEDURES

The detailed bioassay procedures for this study can be provided on request. The following sections discuss and summarize the components of the bioassay QA/QC program.

1.4.1 PROJECT-SPECIFIC STANDARD OPERATING PROCEDURES

Three sediment toxicity tests (bioassay) will be conducted on the samples:

- Acute 10-day amphipod mortality (*Rhepoxynius abronis, Eohaustoris estuaries, Ampelisca abdita*)
- Acute larval mortality/abnormality (*Strongylocentrotus purpuratus, Strongylocentrotus droebachiensis*, or *Dendraster excentricus*)
- Chronic 20-day juvenile polychaete growth rate (*Neanthes arenoceodentata*)

Each of these tests is also described in Section 2.1.5 of the SAP (provided in Appendix A of this work plan).

1.4.2 TOXICITY TEST QUALITY CONTROL

All three sediment toxicity tests will incorporate standard QA/QC procedures to ensure that the test results are valid. Standard QA/QC procedures include the use of negative controls, positive controls, reference sediment samples, laboratory replicates, and measurements of water quality during testing.

The negative control to be used for the sediment toxicity test will be a clean control, which consists of a clean, inert material and the same diluent seawater used in testing sediment toxicity.

The positive control to be used for the sediment toxicity test will be a toxic control in which a reference toxicant is used to establish the relative sensitivity of the test organism. The positive control for sediment tests is typically conducted with diluent seawater and without sediment. Sodium dodecyl sulfate will be used as the reference toxicant in the larval tests. Cadmium chloride will be used as the reference toxicant for the amphipod and juvenile polychaete tests.

In addition to the positive control described above, an additional positive control may be conducted using ammonia. Ammonia may be present in marine sediments and can be a significant cause of toxicity observed in toxicity tests. The purpose of the ammonia-positive control is to determine the toxicity of ammonia to the test organisms. Of the three test organisms, the polychaete *Neanthes arenaceodentata* is relatively insensitive to environmental concentrations of ammonia, while both the amphipod and the larval stages of the bivalve can be sensitive to concentrations observed in the environment. For this reason, a positive control may be conducted for only the amphipod and bivalve larval tests. A sediment-spiked ammonia reference toxicant test will be used for the amphipod test series. In addition to these standard ammonia measurements, test chamber interstitial ammonia levels will be evaluated prior to initiating and at the termination of both the amphipod and juvenile polychaete tests. If interstitial ammonia levels are greater than or equal to 20 mg/L, then a purging procedure will be followed until interstitial ammonia levels that are below this limit. For the larval test, test chambers will be aerated if unionized ammonia concentrations exceed 0.014 mg/L in test waters (PSEP 1995).

A reference sediment sample will also be included with each toxicity test series. Reference sediments provide toxicity data that can be used to separate toxicant effects from unrelated effects, such as those of sediment grain size. They are also used in statistical comparisons to determine if test sediments are toxic. Sediment samples selected to be the test reference sediment should be collected from an area documented to be free from chemical contamination and should represent the range of important natural, physical, and chemical characteristics of the test sediments (specifically, sediment grain size and TOC). The Puget Sound Reference Areas survey was conducted by EPA and Ecology (PSDDA 1989) to document suitable reference conditions in Puget Sound and define reference area performance standards. Based on the results of this survey, Sammish Bay will be utilized as the biological reference site and will form the basis for assessing compliance with the biological criteria. This reference area was selected for the following reasons: 1) availability of chemical and biological data to document suitability of the reference site, 2) geographic locations, and 3) broad range of grain size distributions available to match those anticipated within the site.

Five laboratory replicates of each test sediments, reference sediments, and negative controls will be run for each bioassay. Bioassays require that proper water quality conditions be maintained to ensure survival of the organisms, and to ensure that undue stress is not exerted on the organisms unrelated to test sediments. Salinity, dissolved oxygen, pH, ammonia, total sulfides, and temperature will be measured to monitor water quality during testing.

1.4.3 QA/QC PERFORMANCE STANDARDS

The amphipod bioassay test will be performed according to the procedures and QA/QC performance standards described in PSEP (1995) as revised by subsequent agency-approved updates and as described in sub-appendix D of the Sampling and Analysis Plan Appendix (SAPA; Ecology 2003), with survival as the endpoint. These standards are defined as a maximum of 10 percent mortality in control treatments and less than 25 percent mortality in treatments using reference sediment.

The juvenile polychaete bioassay test will be performed according to the procedures and QA/QC performance standards described in PSEP protocols (PSEP 1995) and as described in sub-appendix D of the SAPA (Ecology 2003), with survival and growth as the endpoint. The growth rate of organisms exposed to test sediments is compared to the growth rate of organisms in reference sediments. The control sediment has a performance standard of 10 percent mortality. The reference sediment has a performance standard of 80 percent of the control growth rate. The control growth rate guideline is 0.38 mg/individual/day. The test will be performed according to the procedures and QA/QC performance standards described in PSEP protocols (PSEP 1995) as revised by subsequent agency-approved updates and as described in sub-appendix D of the SAPA (Ecology 2003). These standards are defined as an initial worm weight within the range 0.5-1.0 mg (Ecology 1995), a maximum of 10 percent mortality in control treatments and mean individual growth of ≥ 0.38 mg/ind/day, on a dry weight basis (PSDDA 1996). The reference sediment will have a mean individual growth rate that is at least 80 percent of the mean individual growth rate found in control sediment.

The larval development bioassay test protocols and QA/QC performance standards will be in accordance with PSEP (1995) as revised by subsequent agency-approved updates and as described in sub-appendix D of the SAPA (Ecology 2003). The seawater control has a performance standard of less than 30 percent combined abnormality and mortality (i.e., a 70 percent normal survivorship). The reference sediment has a performance standard of less than 35 percent effective mortality normalized to seawater control (i.e., a 65 percent normal survivorship of seawater control result).

1.4.4 DATA DELIVERABLES

The laboratories will be responsible for internal checks on data reporting and will correct errors identified during the quality assurance review. The toxicity testing for this study will be required to report results that are supported by all information recommended by PSEP protocols for quality assurance review, including:

- A cover letter discussing analytical problems (if any) and procedures
- Sources of test organisms and control sediment
- Test methods used for biological testing and statistical analyses
- Protocol references and description of any nonstandard procedures
- Results for survival, growth, reburial, abnormalities, water quality parameters, reference toxicants, and statistical analyses, as appropriate
- Original data sheets for water quality, survival, growth, reburial, abnormalities, reference toxicant, and statistics
- Identification for each control, reference, and sample duplicate
- Original quality control checklists
- Chain-of-custody records.

Close contact with the laboratories will be maintained to resolve any quality control problems in a timely manner.

2.0 REFERENCES

Ecology. 2003. *Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards.*

Ecology. 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. June.

Ecology. 1995. *Sediment Management Standards.* Chapter 173-204 WAC. Washington State Department of Ecology. Amended December.

EPA. 1994a. *USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review.* Publication 9240.1-05, EPA-540/R-94/012. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. February.

EPA. 1994b. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review.* Publication 9240.1-05-01, EPA-540/R-94/013. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. February.

Floyd Snider McCarthy, Inc. (FSM). 2004. Letter Report, *Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven--Anacortes, Washington.* June 14.

Floyd|Snider. 2005. *Limited Environmental Due Diligence Report, Former Shell Oil Tank Farm, Cap Sante Marine Lease Area.* Prepared for Port of Anacortes. November 8.

PSDDA. 1996. *Sediment Management Program Biennial Report. Dredging Years 1994/1995. PSDDA/SMS Clarification Paper.* Neanthes *20-day Growth Bioassay - Further Clarifications on Negative Control Growth Standard, Initial Size, and Feeding Protocol.* Puget Sound Dredged Disposal Analysis Program. March.

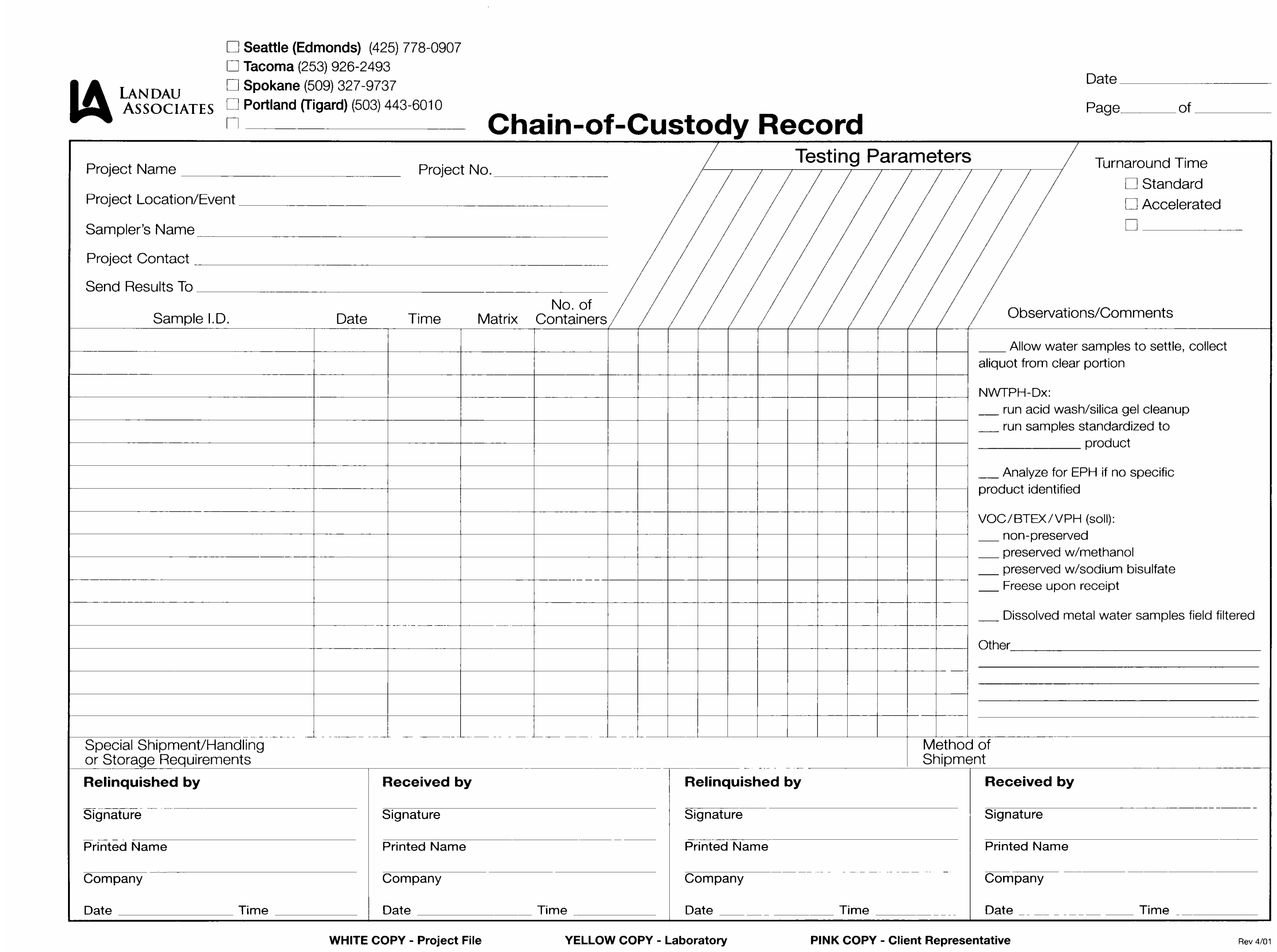
PSDDA. 1989. *Puget Sound Dredged Disposal Analysis: Management Plan Report, Unconfined Open-Water Disposal of Dredged Material, Phase II.* U.S. Army Corps of Engineers – Seattle District, U.S. Environmental Protection Agency - Region 10, Washington State Department of Natural Resources, Washington State Department of Ecology.

PSEP. 1997a. *Recommended Guidelines for Measuring Organic Compounds in Puget Sound Water Sediment and Tissue Samples.* Prepared by U.S. Environmental Protection Agency, Region 10 for Puget Sound Estuary Program. April.

PSEP. 1997b. *Recommended Guidelines for Measuring Metals in Puget Sound Marine Water, Sediment, and Tissue Samples.* Prepared by U.S. Environmental Protection Agency, Region 10 for Puget Sound Estuary Program. April.

PSEP. 1995. *Recommended Protocols for Conducting Laboratory Bioassays on Puget Sound Sediments.* Puget Sound Estuary Program.

PSEP. 1986. *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound.* Final Report. Prepared by U.S. Environmental Protection Agency, Region 10 for Puget Sound Estuary Program. March.



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Date ______________
Page ______ of ______

Chain-of-Custody Record

Project Name ______________ Project No. ______________
Project Location/Event ______________
Sampler's Name ______________
Project Contact ______________
Send Results To ______________

Testing Parameters

Turnaround Time
☐ Standard
☐ Accelerated
☐ ______________

Sample I.D.	Date	Time	Matrix	No. of Containers													Observations/Comments

Observations/Comments:

____ Allow water samples to settle, collect aliquot from clear portion

NWTPH-Dx:
___ run acid wash/silica gel cleanup
___ run samples standardized to
______________ product

___ Analyze for EPH if no specific product identified

VOC/BTEX/VPH (soil):
___ non-preserved
___ preserved w/methanol
___ preserved w/sodium bisulfate
___ Freese upon receipt

___ Dissolved metal water samples field filtered

Other ______________

Special Shipment/Handling or Storage Requirements

Method of Shipment

Relinquished by	**Received by**	**Relinquished by**	**Received by**
Signature	Signature	Signature	Signature
Printed Name	Printed Name	Printed Name	Printed Name
Company	Company	Company	Company
Date ______ Time ______	Date ______ Time ______	Date ______ Time ______	Date ______ Time ______

WHITE COPY - Project File **YELLOW COPY - Laboratory** **PINK COPY - Client Representative**

Rev 4/01

LANDAU ASSOCIATES

Cap Sante Marine
Anacortes, Washington

Chain-of-Custody Form

Figure
B-1

Public Review Draft
Health and Safety Plan Plan
Remedial Investigation/Feasibility Study and Interim Action
Cap Sante Marine Lease Area
Anacortes, Washington

April 2, 2007

Prepared for

Port of Anacortes
Anacortes, WA

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LIST OF ATTACHMENTS

Site Health and Safety Plan
Summary

Site Name: Cap Sante Marine Site

Location: Anacortes, Washington

Client: Port of Anacortes

Proposed Dates of Activities: 2007, 2008

Type of Facility: A boatyard, marina support area, and a marine fueling facility

Land Use of Area Surrounding Facility: Commercial, industrial, and marine

Site Activities: Drilling soil boreholes, soil sampling, monitoring well installation, groundwater sampling, and sediment sampling

Potential Site Contaminants: chromium (Cr), copper (Cu), lead (Pb), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), naphthalenes, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons, and volatile organic compounds (VOCs),

Routes of Entry: Skin contact with soil, groundwater, or sediment; incidental ingestion of soil, water, or sediment; and inhalation of airborne droplets, dusts, or vapors

Protective Measures: Hard hat, safety glasses, gloves, protective clothing, steel-toed boots, personal flotation device if offshore

1.0 INTRODUCTION

This site-specific health and safety plan (HSP) addresses procedures to minimize the risk of chemical exposures, physical accidents to onsite workers, and environmental contamination.

1.1 PURPOSE AND REGULATORY COMPLIANCE

The HSP covers each of the required elements as specified in 29 CFR 1910.120 or equivalent Washington State Department of Labor and Industries regulations. When combined with the Landau Associates Health and Safety Program, this site-specific plan meets all applicable regulatory requirements.

This HSP will be made available to all Landau Associates' personnel and subcontractors involved in field work on this project. For subcontractors, this HSP represents minimum safety procedures. Subcontractors are responsible for their own safety while present onsite or conducting work for this project. Subcontractor work may involve safety and health procedures not addressed in the HSP. The HSP was originally prepared by a Certified Industrial Hygienist and has been reviewed by the Landau Associates' Corporate Health and Safety Officer. By signing the documentation form provided with this plan (Attachment 2), project workers also certify their agreement to comply with the plan. Both Landau Associates and its subcontractors are independently responsible for the health and safety of their own employees on the project.

1.2 CHAIN OF COMMAND

The Landau Associates chain of command for health and safety on this project involves the following individuals:

Landau Associates' Task Manager: Stacy Pischer

The Task Manager in conjunction with the Project Manager (John Herzog of Herzog LLC) has overall responsibility for the successful outcome of the project. The Task Manager, in consultation with the contracted Certified Industrial Hygienist or Corporate Health and Safety (H&S) Manager and the Project Manager, makes final decisions regarding questions concerning the implementation of the site HSP.

Landau Associates' Project H&S Coordinator: To be determined

As the Project H&S Coordinator, this individual is responsible for implementing the HSP in the field. The Project H&S Coordinator informs subcontractors of the minimum requirements of this plan. This person will also assure that proper protective equipment is available and used in the correct manner, decontamination activities are carried out properly, and that employees have knowledge of the local emergency medical system.

Landau Associates' Corporate H&S Manager: Chris Kimmel

The Landau Associates Corporate H&S Manager has overall responsibility for preparation and modification of this HSP. In the event that health and safety issues arise during site operations, the H&S Manager will attempt to resolve them in discussion with the appropriate members of the project team.

Project Team Members

Project team members are responsible for understanding the H&S requirements for this project, and implementing these procedures in the field. Team members will receive technical guidance from the Project H&S Coordinator.

1.3 SITE WORK ACTIVITIES

This HSP covers field site activities to be conducted throughout the remedial investigation (RI) at the Cap Sante Marine site. The field activities associated with the RI include:

- Drilling shallow and deep boreholes
- Collection of soil samples
- Installation of shallow groundwater monitoring wells, including well development
- Collection of groundwater samples following installation of the monitoring wells
- Water level monitoring at the monitoring wells and in Fidalgo Bay and the Cap Sante Waterway.

Additional activities related to sediment sampling will also be performed. The field activities that may be associated with the Marine Area RI include:

- Collection of on shore and off shore surface sediment samples

1.4 SITE DESCRIPTION

The site currently includess a boatyard, a marina support area, and a marine fueling facility, and traffic related to each of these.

2.0 HAZARD EVALUATION AND CONTROL MEASURES

2.1 TOXICITY OF CHEMICALS OF CONCERN

Based on previous site information and knowledge of the types of activities conducted at the site, the following chemicals may be present at this site: chromium (Cr), copper (Cu), lead (Pb), Zinc (Zn), carcinogenic polycyclic aromatic hydrocarbons (cPAHs), naphthalenes, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons, and volatile organic compounds (VOCs).

Human health hazards of these chemicals are summarized in Table C-1. The information provided in this table covers potential toxic effects that might occur if relatively significant acute and/or chronic exposure occurred. However, this information does not indicate that such effects are likely to occur from the planned site activities. The chemicals that may be encountered at this site are not expected to be present at concentrations that could cause significant health hazards from short-term exposures. The types of planned work activities and use of monitoring procedures and protective measures will further limit potential exposures at this site.

Health standards are presented using the following abbreviations:

- PEL – Permissible exposure limit
- TWA – Time-weighted average exposure limit for any 8-hour work shift
- STEL – Short-term exposure limit expressed as a 15-minute time-weighted average and not to be exceeded at any time during a work day.

2.2 POTENTIAL EXPOSURE ROUTES

2.2.1 INHALATION

Inhalation of dusts generated during soil sampling and drilling or sediment sampling could be an issue if the weather is dry, windy, or warm. Exposure via this route could potentially occur if chemicals are present in the soil or sediment and dust particles become airborne during site activities or if VOCs are liberated when samples are exposed to air or during drilling of soil boreholes.

2.2.2 SKIN CONTACT

Exposure via this route could occur if contaminated soil, groundwater, or sediment contacts the skin or clothing. Protective clothing and decontamination activities specified in this plan will minimize the potential for skin contact with the contaminants.

2.2.3 INGESTION

Exposure via this route could occur if individuals eat, drink, or perform other hand-to-mouth contact in the contaminated (exclusion) zones. Decontamination procedures established in this plan will minimize the inadvertent ingestion of contaminants.

2.3 HEAT STRESS AND HYPOTHERMIA

2.3.1 HEAT STRESS

Use of impermeable clothing reduces the cooling ability of the body due to evaporation reduction. This may lead to heat stress. If such conditions occur during site activities, appropriate work-rest cycles will be utilized and water or electrolyte-rich fluids (Gatorade or equivalent) will be made available to minimize heat stress effects.

Also, when ambient temperatures exceed 70°F, monitoring of employee pulse rates will be conducted. Each employee will check his or her pulse rate at the beginning of each break period. Take the pulse at the wrist for 6 seconds, and multiply by 10. If the pulse rate exceeds 110 beats per minute, then reduce the length of the next work period by one-third.

Example: After a 1-hour work period at 80°F, a worker has a pulse rate of 120 beats per minute. The worker must shorten the next work period by one-third, resulting in a work period of 40 minutes until the next break.

2.3.2 HYPOTHERMIA

Hypothermia can result from abnormal cooling of the core body temperature. It is caused by exposure to a cold environment and wind-chill. Wetness or water immersion can also play a significant role.

Typical warning signs of hypothermia include fatigue, weakness, lack of coordination, apathy, and drowsiness. A confused state is a key symptom of hypothermia. Shivering and pallor are usually absent, and the face may appear puffy and pink. Body temperatures below 90°F require immediate treatment to restore temperature to normal.

Current medical practice recommends slow re-warming as treatment for hypothermia, followed by professional medical care. This can be accomplished by moving the person into a sheltered area and wrapping with blankets in a warm room. In emergency situations, where body temperature falls below 90°F and heated shelter is not available, use a sleeping bag, blankets, and body heat from another individual to help restore normal body temperature.

2.4 OTHER PHYSICAL HAZARDS

2.4.1 SLIPS/FALLS

As with all field work sites, caution will be exercised to prevent slips on rain slick surfaces, stepping on sharp objects, etc. Work will not be performed on elevated platforms without fall protection. With offshore work, there is a possibility of falling overboard. When possible, personnel will stand well in from the edges of the deck. Personal flotation devices will be worn at all times when on a vessel. At least one person with current training in first aid and CPR will be onsite at all times.

2.4.2 MACHINERY/MOVING PARTS

The drilling equipment or sampling vessel may be equipped with various winches, motors, booms, and other machines. These present a general physical hazard from moving parts. Personnel will stand clear of machinery at all times unless specific instructions are given by the drill rig operator, vessel skipper, or other person in authority. Steel-toed shoes or boots will be worn at all times when on the site or on the vessel. When possible, appropriate guards will be in place during equipment use.

Lifting equipment used to raise and lower sediment sampling equipment may also present a physical hazard. Field personnel should be careful to keep loose clothing, hands, and feet away from winches and capstones. Sampling equipment, especially grab samplers, can present a severe pinch hazard and personnel must make sure they understand how the device works before operating it.

2.4.3 CONFINED SPACES

Confined space entry is not anticipated for this project. Personnel will not enter any confined space without specific approval of the Project Manager, Task Manager, and Corporate H&S Manager.

2.4.4 NOISE

Appropriate hearing protection (ear muffs or ear plugs with a noise reduction rating of at least 20 dBA) will be used if individuals work near high-noise generating equipment (> 85 dBA). Determination of the need for hearing protection will be made by the Project H&S Coordinator.

2.5 SEDIMENT SAMPLING

All sediment sampling activities conducted from boats will be conducted using basic principles of water safety, including:

- Use Coast Guard-approved life jackets for all offshore activities
- Avoid standing near edge of boat
- Secure workers with lifeline if work must be conducted over edge
- Avoid sampling on stormy days or when seas are high
- Use caution when transferring from land to sea; make sure barges and boats are firmly secured to dock or pier before boarding or disembarking
- Wear hard hats and appropriate personal protective equipment in exclusion areas.

3.0 PROTECTIVE EQUIPMENT AND AIR MONITORING

3.1 PROTECTIVE EQUIPMENT

Work for this project will be conducted in Level D protection. Level C protection is presented as a contingency only and represents a modified protection level, incorporating respiratory protection only where required by site conditions. Situations requiring Levels A or B protection are not anticipated for this project; should they occur, work will stop and the HSP will be amended, as appropriate, prior to resuming work.

Workers performing general site activities where skin contact with highly contaminated materials is unlikely and inhalation risks are not expected will wear coveralls, eye protection, gloves (whenever handling samples), and safety boots. Offshore activities require use of a Coast Guard-approved life jacket. Level D protection will consist of the following:

- Hard hats
- Rain gear or poly-coated Tyvek (wet operations) or uncoated Tyvek (dry operations)
- Safety glasses
- Steel-toed, chemical-resistant boots
- Nitrile, neoprene, or equivalent inner and outer gloves.

Workers performing site activities where heavily contaminated materials are detected will wear chemical-resistant gloves (nitrile, neoprene, or other appropriate outer and inner gloves) and coated Tyvek or other chemical-resistant suits. Workers will use face shields or goggles, as necessary, to avoid splashes.

When performing activities in which inhalation of chemical vapors and dusts is a concern, workers will wear half-mask or full-face air-purifying respirators with combination cartridges. Cartridges should be changed on a daily basis, at a minimum. They should be changed more frequently if chemical vapors are detected inside the respirator or other symptoms of breakthrough are noted (e.g., irritation, dizziness, breathing difficulty).

3.2 AIR MONITORING

Direct reading instruments give immediate, real time readings of contaminant levels. Reliable direct reading instruments, such as the combustible gas indicator, photoionization detector (PID), flame ionization detector, and colorimetric tubes, are available for situations commonly encountered at hazardous and contaminated substance sites. The appropriate type of monitoring equipment depends on the suspected type and concentration of chemical contaminants. The primary limitation of direct reading instruments is that most do not quantify specific chemical compounds.

Air monitoring for VOCs will be conducted during drilling or other intrusive activities. A PID will be used to monitor for VOCs (Table C-1). The instrument will be calibrated prior to each day's activity according to manufacturer's instructions. Calibration will be recorded in the health and safety logbook or field notes. Readings shall be entered into the logbook at a minimum of 30-minute intervals.

4.0 SAFETY EQUIPMENT LIST

The following safety equipment must be available onsite:

- First aid kit
- Mobile telephone
- Steel-toed safety boots
- Chemical-resistant coveralls and gloves
- Safety glasses
- Hard hat
- Life jackets (during offshore activities only)
- Air monitoring instruments (during onshore activities only)
- Half-face respirator with cartridges.

5.0 EXCLUSION AREAS

If migration of chemicals from the work area is a possibility, or as otherwise required by regulations or client specifications, site control will be maintained by establishing clearly identified work zones. These will include the exclusion zone, contaminant reduction zone, and support zone, as discussed below.

5.1 EXCLUSION ZONE

Exclusion zones will be established around each contaminated substance activity location. Only persons with appropriate training and authorization from the Project H&S Coordinator will enter this perimeter while work is being conducted.

5.2 CONTAMINATION REDUCTION ZONE

A contamination reduction zone will consist of a decontamination station that must be used to exit the exclusion zone. The station will have the brushes and wash fluids necessary to decontaminate personnel and equipment leaving the exclusion zone. Care will be taken to prevent the spread of contamination from this area.

5.3 SUPPORT ZONE

A support zone will be established outside the contamination reduction area to stage clean equipment, don protective clothing, take rest breaks, etc. For sediment sampling conducted from a vessel, this zone will include the cabin of the vessel.

6.0 MINIMIZATION OF CONTAMINATION

To make the work zone procedure function effectively, the amount of equipment and number of personnel allowed in contaminated areas must be minimized. In addition, the amounts of sample collected should not exceed what is needed for laboratory analysis and record samples. Do not kneel on contaminated ground, stir up unnecessary dust, or perform any practice that increases the probability of hand-to-mouth transfer of contaminated materials. Eating, drinking, chewing gum, smoking, or using smokeless tobacco are forbidden in the exclusion zone.

7.0 DECONTAMINATION

Decontamination is necessary to limit the migration of contaminants from the work zone(s) onto the site or from the site into the surrounding environment. Equipment and personnel decontamination are discussed in the following sections, and the following types of equipment will be available to perform these activities:

- Boot and glove wash bucket and rinse bucket
- Scrub brushes – long handled
- Spray rinse applicator
- Plastic garbage bags
- 5-gallon container with soap solution.

Proper decontamination (decon) procedures will be employed to ensure that contaminated materials do not contact individuals and are not spread from the site. These procedures will also ensure that contaminated materials generated during site operations and during decontamination are managed appropriately. All nondisposable equipment will be decontaminated in the contamination reduction zone.

Personnel working in exclusion zones will perform a limited decontamination in the contamination reduction zone prior to changing respirator cartridges (if worn), taking rest breaks, drinking liquids, etc. They will decontaminate fully before eating lunch or leaving the site. The following describes the procedures for decon activities:

1. In the contamination reduction zone, wash and rinse outer gloves and boots in portable buckets.
2. Inspect protective outer suit, if worn, for severe contamination, rips, or tears.
3. If suit is highly contaminated or damaged, full decontamination will be performed.
4. Remove outer gloves. Inspect and discard if ripped or damaged.

8.0 DISPOSAL OF CONTAMINATED MATERIALS

All disposable sampling equipment and personal protective equipment will be rinsed to remove gross contamination and placed inside of a 10 mil polyethylene bag or other appropriate containers. These disposable supplies and containers will be removed from the site by the field personnel and disposed of in a normal refuse container (dumpster) and/or solid waste landfill, unless visibly contaminated with hazardous substances. In such cases, the Project Manager and/or Task Manager will determine the need for special handling and disposal, according to applicable regulations.

9.0 SITE SECURITY AND CONTROL

Site security and control will be the responsibility of the Project H&S Coordinator. The “buddy-system” will be used when working in designated hazardous areas. Any security or control problems will be reported to the client or appropriate authorities.

10.0 SPILL CONTAINMENT

Sources of bulk chemicals subject to spillage are not expected to be used in this project. Accordingly, a spill containment plan is not required for this project.

11.0 EMERGENCY RESPONSE PLAN

The Emergency Response Plan outlines the steps necessary for appropriate response to emergency situations. The following paragraphs summarize the key Emergency Response Plan procedures for this project.

11.1 PLAN CONTENT AND REVIEW

The principal hazards addressed by the Emergency Response Plan include the following: fire or explosion, medical emergencies, uncontrolled contaminant release, and situations such as the presence of chemicals above exposure guidelines or inadequate protective equipment for the hazards present. However, in order to help anticipate potential emergency situations, field personnel should always exercise caution and look for signs of potentially hazardous situations, including the following as examples:

- Visible or odorous chemical contaminants
- Drums or other containers
- General physical hazards (e.g., traffic, cranes, moving equipment, ships, sharp or hot surfaces, slippery or uneven surfaces)
- Possible sources of radiation
- Live electrical wires or equipment; underwater pipelines or cables; and poisonous or dangerous animals.

These and other potential problems should be anticipated and steps taken to avert problems before they occur. All personnel will certify (Attachment 2) that they are familiar with the contents of this plan and acknowledge their agreement to comply with the provisions of the plan.

The Emergency Response Plan will be reviewed during the onsite health and safety briefing so that all personnel will know what their duties are should an emergency occur.

11.2 PLAN IMPLEMENTATION

The Project H&S Coordinator will act as the lead individual in the event of an emergency situation and evaluate the situation. This individual will determine the need to implement the emergency procedures, in concert with other resource personnel including client representatives, and the Corporate H&S Manager. Other onsite field personnel will assist the H&S Coordinator as required during the emergency.

If the Emergency Response Plan is implemented, the Project H&S Coordinator or designees are responsible for alerting all personnel at the affected area by use of a signal device (such as a hand-held air horn), visual, or shouted instructions, as appropriate.

Emergency evacuation routes and safe assembly areas will be identified and discussed in the onsite health and safety briefing, as appropriate. The buddy-system will be employed during evacuation to ensure safe escape, and the Project H&S Coordinator will be responsible for roll-call to account for all personnel.

11.3 EMERGENCY RESPONSE CONTACTS

Site personnel must know whom to notify in the event of Emergency Response Plan implementation. The following information will be readily available at the site in a location known to all workers:

- Emergency Telephone Numbers: see list in Attachment 1
- Route to Nearest Hospital: see directions and map in Attachment 1
- Site Descriptions: see the description at the beginning of this plan
- If a significant environmental release of contaminants occurs, the federal, state, and local agencies noted in this plan must be notified within 24 hours. Contact the Project Manager as soon as possible and he/she will be responsible for notifying agencies listed in Attachment 1. If the release to the environment includes navigable waters, also notify the National Response Center.

In the event of an emergency situation requiring implementation of the Emergency Response Plan (e.g., fire or explosion, serious injury, tank leak or other material spill, presence of chemicals above exposure guidelines, inadequate personnel protection equipment for the hazards present), cease all work immediately. Offer whatever assistance is required, but do not enter work areas without proper protective equipment. Workers not needed for immediate assistance will decontaminate per normal procedures (if possible) and leave the work area, pending approval by the Project H&S Coordinator for re-start of work. The following general emergency response safety procedures should be followed.

11.4 FIRES

Landau Associates personnel will attempt to control only very small fires. If an explosion appears likely, evacuate the area immediately. If a fire occurs that cannot be readily controlled, then immediate intervention by the local fire department or other appropriate agency is imperative. Use these steps:

- If aboard a vessel, abandon the vessel, using life rafts or swimming, to reach a previously agreed-upon upwind location; exit the water as quickly as possible to minimize the risk of hypothermia
- Contact fire agency identified in the site-specific plan
- Inform Project Manager/Project H&S Coordinator of the situation.

Contact 911 if a medical emergency occurs. If a worker leaves the site to seek medical attention, another worker should accompany the patient. When in doubt about the severity of an accident or exposure, always seek medical attention as a conservative approach. Notify the Project Manager of the outcome of the medical evaluation as soon as possible. For minor cuts and bruises, an onsite first aid kit will be available.

If a worker is seriously injured or becomes ill or unconscious, immediately request assistance from the emergency contact sources noted in the site-specific plan. Do not attempt to assist an unconscious worker in an untested confined space without applying confined space entry procedures or without using proper respiratory protection, such as a self-contained breathing apparatus.

In the event that a seriously injured person is also heavily contaminated, use clean plastic sheeting to prevent contamination of the inside of the emergency vehicle. Less severely injured individuals may also have their protective clothing carefully removed or cut off before transport to the hospital. If it is deemed appropriate to transport the victim to the hospital, follow the route map on Attachment 1.

11.5 PLAN DOCUMENTATION AND REVIEW

The Project Manager/Project H&S Coordinator will notify the Corporate H&S Manager as soon as possible after an emergency situation has been stabilized. The Project Manager will also notify the appropriate client contacts, and regulatory agencies, if applicable. If an individual is injured, the Project Manager will file a detailed Accident Report with the Corporate H&S Manager within 24 hours.

The Project Manager and Corporate H&S Manager will critique the emergency response action following the event. The results of the critique will be used in to improve future Emergency Response Plans and actions.

12.0 MEDICAL SURVEILLANCE

A medical surveillance program has been instituted for Landau Associates and will also be in effect for Subcontractor employees having exposures to hazardous substances. For Landau Associates, exams are given before employment; annually, thereafter; and upon termination. Content of exams is determined by the Occupational Medicine physician, in compliance with applicable regulations, and is detailed in the Landau Associates General Health and Safety Program.

Each team member will have undergone a physical examination as noted above in order to verify that he/she is physically able to use protective equipment, work in hot environments, and not be predisposed to occupationally induced disease. Additional exams may be needed to evaluate specific exposures or unexplainable illness.

TABLE C-1
HUMAN HEALTH INFORMATION FOR CHEMICALS OF CONCERN

Contaminant	PEL (ppm)	IDLH (ppm)	Route of Exposure	Symptoms of Acute Exposure	Instruments Used to Monitor Contaminant
Total Petroleum Hydrocarbons	N/A	Unknown	Inhalation, ingestion, dermal contact	Skin and mucous membrane irritation; dizziness, nausea	Olfactory, visual, photoionization detector (PID)
Polychlorinated biphenyls	0.5 mg/m^3	5.0 mg/m^3	Inhalation, ingestion, dermal contact	Irritated eyes, nose, and throat; skin irritation including burning, itching, redness; vomiting, jaundice, abdominal pain, and fatigue.	Visual (dust)
Chromium	1 mg/m^3	250 mg/m^3	Inhalation, ingestion, dermal contact	Irritated eyes and skin	Visual (dust)
Copper	1.0 mg/m^3	100 mg/m^3	Inhalation, ingestion, dermal or eye contact	Respiratory irritation, vomiting, skin irritation	Visual (dust)
Lead	0.05 mg/m^3	100 mg/m^3	Inhalation, ingestion, dermal contact	Weakness, lassitude, facial pallor	Visual (dust)
Carcinogenic Polycyclic Aromatic Hydrocarbons	N/A	Unknown	Inhalation, ingestion, dermal and eye contact	Nausea, vomiting, low blood pressure, abdominal pain, convulsions, and coma	Visual (dust)
Benzene	1 ppm	500 ppm	Inhalation, ingestion, dermal or eye contact	Skin, nose, throat irritation; dizziness, vomiting	PID
Toluene	100 ppm	500 ppm	Inhalation, ingestion, dermal contact	Skin, nose, throat irritation; dizziness, vomiting	PID
Ethylbenzene	100 ppm	800 ppm	Inhalation, ingestion, dermal and eye contact	Eye, skin, mucous membrane irritation; headache, narcosis	PID
Xylenes	100 ppm	900 ppm	Inhalation, ingestion, dermal or eye contact	Skin, nose, eye, throat irritation; dizziness, drowsiness, excitement, vomiting, abdominal pain	PID
VOCs (as solvents- Benzene as the indicator contaminant)	1 ppm	500 ppm	Inhalation, ingestion, adsorption, and dermal or eye contact	Skin, nose, throat irritation; dizziness, vomiting	PID/ Benzene Draeger tubes
Naphthalene	10 ppm	250 ppm	Inhalation, ingestion, adsorption, and dermal or eye contact	Skin, nose, eye, irritation; dizziness; drowsiness; dermatitis	Visual (dust)

Notes:
OSHA ceiling value not to be exceeded during any part of the working day

PEL = Permissible exposure limit.
IDLH = Immediately dangerous to life and health (NIOSH).
N/A = Not applicable.
DNA = Data not available.

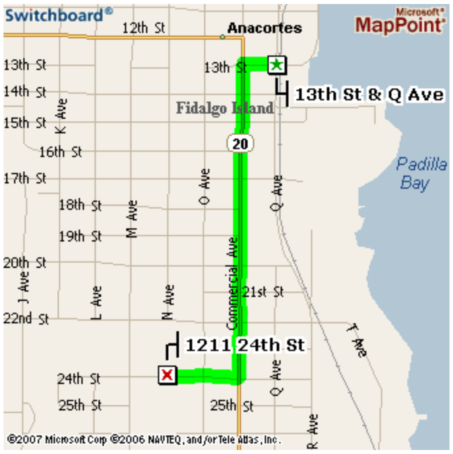
ATTACHMENT 1
EMERGENCY INFORMATION

HOSPITAL

Island Hospital
1211 24th Street
Anacortes, Washington 98221
Information: (360) 299-1300

DIRECTIONS:

1. Determine your location and call 911 if the situation warrants.
2. If the situation is not an emergency, but medical attention is required, get to your vehicle parked at the site and:
   - Start out going WEST on 13TH ST toward Q AVE (0.1 mile).
   - Turn LEFT onto COMMERCIAL AVE / WA-20 SPUR (0.6 mile).
   - Turn RIGHT onto 24TH ST (<0.1 mile).
   - End at Island Hospital (estimated time 3 minutes).



TELEPHONE – Cellular telephones to be carried by each team on/off shore.

EMERGENCY TRANSPORTATION SYSTEMS (Fire, Police, Ambulance) – **911**

EMERGENCY ROUTES – See map above

EMERGENCY CONTACTS –

Poison Control Center:	(800) 222-1222
Project Manager – John Herzog	(206) 406-6431
Corporate H&S Manager – Chris Kimmel	(425) 778-0907
Port of Anacortes Contact – Connie Thoman	(360) 299-1818
National Response Center:	(800) 424-8802
Washington Division of Emergency Management	(800) 258-5990
U.S. Coast Guard	(800) 982-8813

In the event of an uncontrolled emergency, call for help as soon as possible. Dial **911**; give the following information:

- WHERE the emergency is – use cross streets or landmarks
- PHONE NUMBER you are calling from
- WHAT HAPPENED – type of injury
- HOW MANY persons need help
- WHAT is being done for the victim(s)
- YOU HANG UP LAST – let the person you called hang up first.

ATTACHMENT 2
CERTIFICATION

All field members are required to read and familiarize themselves with the contents of this Health & Safety Plan and acknowledge their agreement to comply with the provisions of the plan through the entry of a signature and date on the section below.

By my signature, I certify that:

- I have read,
- I understand, and
- I will comply with this site health and safety plan for Port of Anacortes environmental investigations.

Printed Name	Signature	Date	Affiliation

Personnel health and safety briefing conducted by:

_____________________________ _____________________________ _____________________________
Name Signature Date

Plan prepared by/reviewed by:

______________/___________ ______________/___________ ______________/___________
Name Signature Date

APPENDIX D

Port of Anacortes Seepage Study

Port of Anacortes
Petroleum Seepage Study
Anacortes, Washington

November 1, 1983
J-1302

HART
CROWSER &
associates inc.
GEOTECHNICAL & HYDROGEOLOGIC CONSULTANTS
1910 Fairview Avenue East • Seattle WA 98102-3699 • (206) 324-9530

J-1302

CONTENTS

J-1302

PORT OF ANACORTES
PETROLEUM SEEPAGE STUDY
ANACORTES, WASHINGTON

INTRODUCTION

This report presents the results and conclusions of our hydrogeologic explorations and analyses related to petroleum seepage into the harbor within the Port of Anacortes, Washington. The purpose of our work is to define the hydrogeologic system and cause of petroleum seepage into the harbor and to recommend corrective actions.

We conducted the following work to meet the project objectives:

- Drilled and soil sampled eight hollow-stem auger borings, observed the excavation of three test pits, and installed nine observation wells (in all borings and one test pit, TP-3).
- Surveyed well head elevations and made water level measurements.
- Measured the thickness of petroleum that had entered the wells.
- Obtained samples of liquid from the wells to identify the type of petroleum.
- Conducted grain size analyses on two soil samples.
- Prepared geologic cross sections.
- Completed hydrogeologic analyses.

Boring and observation well locations are shown on Figure 1. A geologic cross section is presented on Figure 2. Boring logs, well construction features, water level data, grain size curves and results of the chemical analyses are included in Appendix A and Appendix B along with description of our field and laboratory procedures.

This report has been prepared for specific application to the referenced project according to standard hydrogeologic practices. No other warranty, expressed or implied, is made.

SUMMARY AND RECOMMENDATIONS

Below is a summary of our work and resulting recommendations. The main text of the report should be consulted for more complete information and project data.

- Refined petroleum product was observed seeping into the Port of Anacortes Harbor at two locations (see Figure 1).

- Free petroleum (petroleum that can migrate in the subsurface) was measured in observation wells B-2, B-3, B-5, B-7 and B-8 (Figure 1). Up to 0.89 feet of petroleum (B-5) has entered the wells (Table 1). Generally the thickness of petroleum measured in a well is about four times greater than in the adjacent soil.

- Chemical analyses of liquid samples from the wells indicate that the petroleum consists of an approximately equal mix of gasoline and diesel. Dissolved contaminants are also contained in the water (Appendix B).

- The likely source of the petroleum was the subsurface storage tanks that serve the marina. These tanks are known to have leaked in the past but apparently are not leaking now based upon leakage testing by Petroleum Equipment Service.

- Boring data indicate that the petroleum is moving above the water table within a silty, fine sand stratum (Figure 2). During our field work the water table was measured 3 to 6 feet below the existing grade (Table A-1).

- The direction of petroleum migration is generally toward the harbor. Reported buried bulkheads appear to restrict groundwater and petroleum seepage into the harbor. Their presence would tend to allow pooling and lateral migration beneath the street.

- The volume of petroleum seepage should naturally decrease with time assuming that additional petroleum is not introduced into the subsurface; however, it could take months to several years to decrease to an acceptable level because of the fine grained sols and reported positions of the bulkheads.

- An interceptor (recovery) system of either a trench or wells could be used to alleviate the seepage (Figure 3). An interceptor trench will likely be more effective than wells.

- An interceptor trench system is the preferred recovery alternative. The trench should be approximately situated as shown on Figure 1. The drain should extend to a depth of 8 to 10 feet and be backfilled with coarse sand and gravel (Figure 3). The down-gradient trench wall should have an impermeable liner and the drain should connect to a sump.

- We recommend that an experienced contractor who specializes in installing these types of systems be contacted to design and install the recovery system. We should review the proposed system prior to construction.

- Effluent pumped from the system will probably require treatment with at least a water/oil separator. The Department of Ecology should be contacted as to their treatment requirements.

- We recommend that the Port consider either abandoning the petroleum tanks or installing an above ground storage system.

BACKGROUND

Petroleum has been seeping into the Port of Anacortes harbor for several years. Near the seepage sites, a series of buried storage tanks serve the Cap Sante Marina which contain gasoline, diesel and pre-mix. The owner reports that the total available storage is approximately 22,000 gallons.

In 1982 the petroleum seepage was particularly severe and the tanks were the suspected source of the petroleum. Exposing the tanks and piping indicated that both gasoline and diesel had leaked from the system. Repairs were made and a decrease in the volume of seepage was reported; however, some petroleum seepage continued. In July 1983, Norm Blanchard of the U. S. Coast Guard contacted the Port to discuss and initiate a program to correct the petroleum seepage into the harbor.

HYDROGEOLOGY

Soil samples were obtained in borings B-1 to B-8 to a maximum depth of 25 feet. The samples indicate that the geology beneath the project area is relatively consistent from boring to boring. A schematic geologic cross section is shown in Figure 2.

The upper sand is likely dredged sand fill, while the remaining units are natural deposits typical of a tidal flat environment. The top of the silt stratum forms the bottom of a relatively thin water table aquifer located within the upper sand. Fluctuation in the water table will determine the thickness of the aquifer at a given location. During our field explorations in September and October of 1983 the aquifer ranged between approximately 4.5 to 7.5 feet thick. We estimate the hydraulic conductivity of the upper sand to be approximately 10-4 centimeters per second (cm/sec) using the grain size curves, supplemented with field test results for similiar soils.

GROUNDWATER FLOW DIRECTIONS

Water level measurements were made in the observation wells on September 26 and October 12, 1983. The data are contained in Table A-1.

The measurements indicate that groundwater is flowing towards the harbor from upland areas. Our measurements also indicate that water table fluctuation caused by tidal changes is minimal. During our field work the observed changes were on the order of a foot or less with tidal fluctuations of 5 or more feet.

PETROLEUM MIGRATION

Free petroleum was measured in the following wells.

	September 26 Petroleum Thickness (Feet)	October 12 Petroleum Thickness (Feet)
B-2	0.58	0.26
B-3	0.04	None detected
B-5	0.81	0.89
B-7	Not analyzed	0.38
B-8	Not analyzed	0.05

The available data indicate that petroleum is concentrated along the street adjacent to the harbor between "C" and "B" docks. The source of the petroleum appears to be the buried storage tanks which are known to have leaked in the past. Borings and test pits up gradient of the harbor did not encounter petroleum which indicates the local tank source. Recent tank and system testing of the storage facility by Petroleum Equipment Service of Mt. Vernon, Washington, indicate that the tanks are not currently leaking.

Once petroleum has seeped into the ground and reaches the water table it generally moves in the prevailing direction of groundwater flow. The migration direction is complicated by the reported presence of the buried bulkheads which can block the flow of groundwater and petroleum into the harbor. The bulkheads will tend to allow pooling and lateral migration of petroleum beneath the street.

Mitigative Measures

In our opinion the current petroleum seepage into the harbor can best be mitigated by installing an interceptor drain or interceptor wells. Our evaluation is that an interceptor drain will be more effective and less costly (over the long run) than interceptor wells.

Interceptor wells rely upon creating a cone of depression which causes petroleum to migrate to the well. The cone of depression is created by pumping the well which causes the water table to decline in the area surrounding the well. Application of this technique to the Port's situation is limited by the fine grained nature of the soils and relative thinness of the upper sand aquifer. These factors limit the development of a cone of depression over a large area; because of this, we estimate that two to four wells would be required with individual pumping systems.

An interceptor drain is expected to be more effective than wells because it can intercept petroleum over a larger area. The general features of such a system are presented in Figure 3.

The system consists of a trench excavated to three to four feet below the water table. Coarse sand and gravel are placed in the trench and the trench is connected to a sump which removes water and petroleum. An impermeable barrier may also be placed on the down gradient side of the trench. We estimate that the trench drain system would pump less than 500 gallons per day with a lowering of the water table one foot within the trench.

Excavation of a trench appears feasible based upon the excavation of TP-3. This test pit was excavated to a depth of 11.0 feet and penetrated more than four feet below the water.

Treatment of the effluent pumped from the trench will probably be necessary. At a minimum, treatment using an oil/water separator is recommended. Prior to installation of a recovery system we recommend that the system be presented to the U. S. Coast Guard and Department of Ecology for their review and approval.

We also recommend that a contractor experienced in designing and installing this type of system be contacted and that we review the proposed system prior to installation. We would be glad to recommend a contractor to you if desired.

Sincerely,

HART-CROWSER & ASSOCIATES, INC.

Matthew G. Dalton

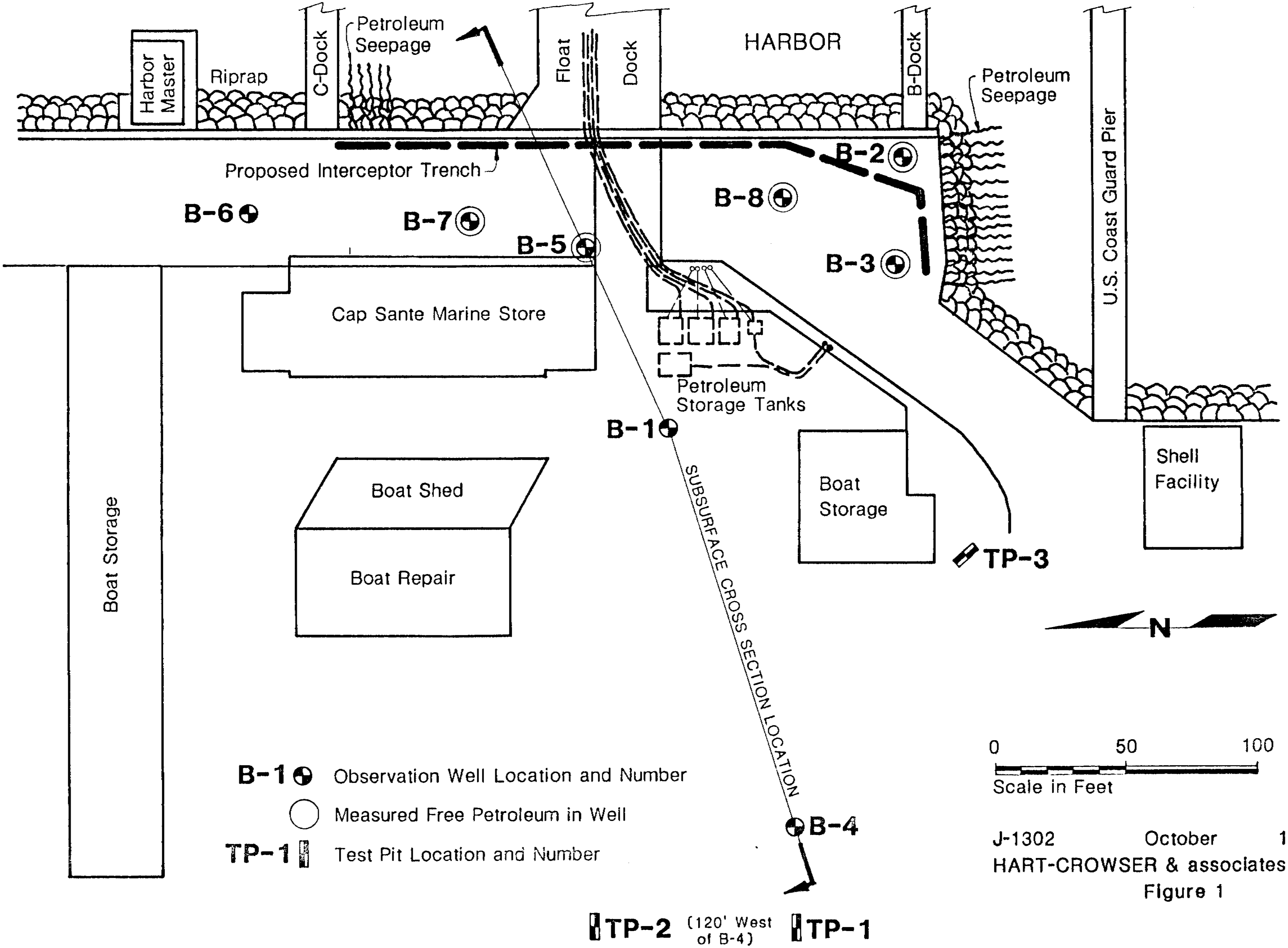
MATTHEW G. DALTON
Associate Hydrogeologist

Terry L. Olmsted

TERRY L. OLMSTED
Vice President

MGD/TLO/mgv

Site Location Plan



J-1302 October 1983
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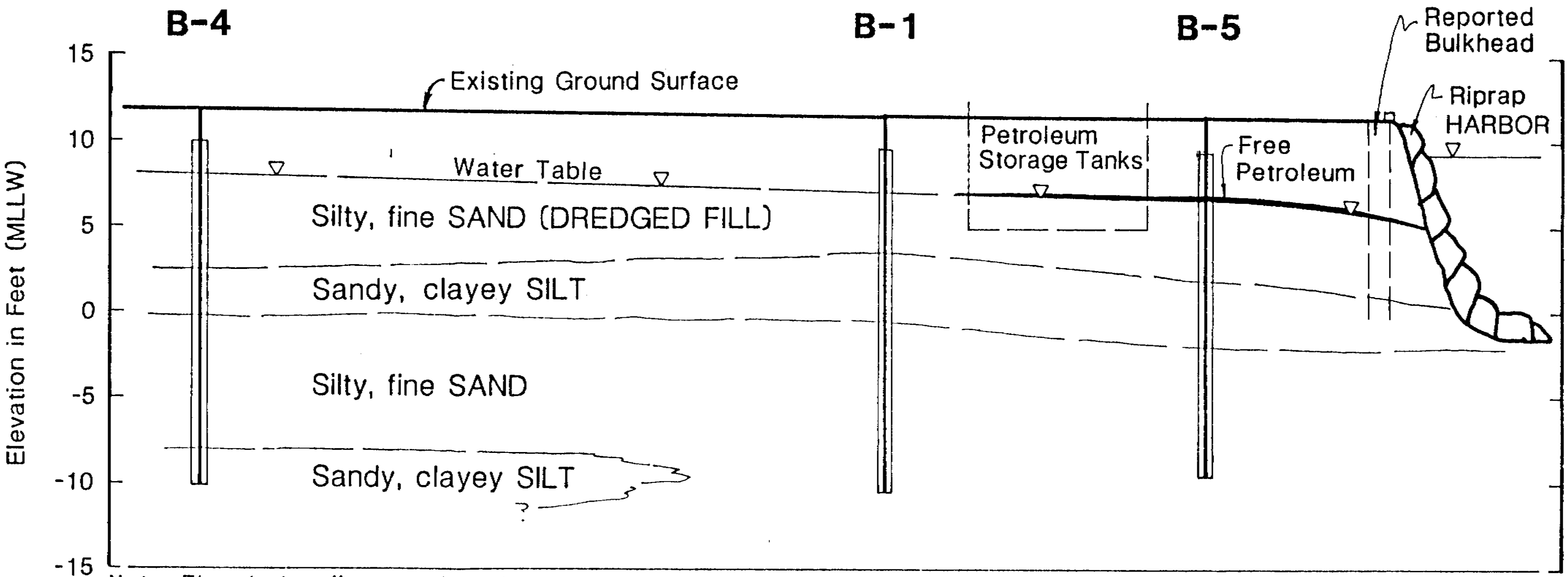
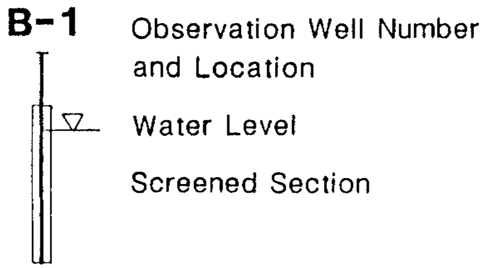
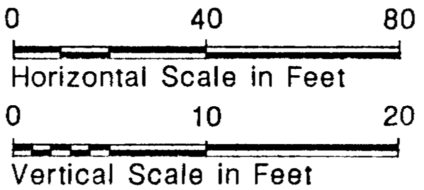
Figure 1

Generalized Subsurface Cross Section



Note: The stratum lines are based upon interpolation between observation wells and may not represent actual subsurface conditions.





Vertical Exaggeration x 4

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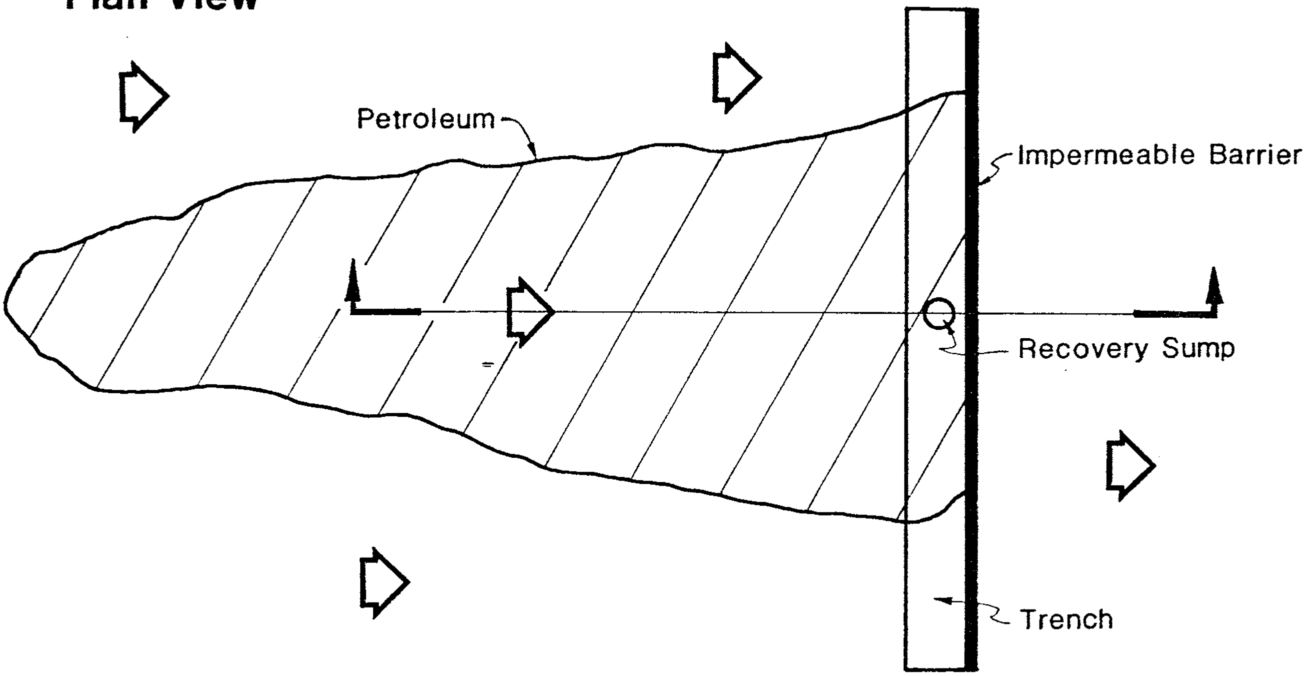
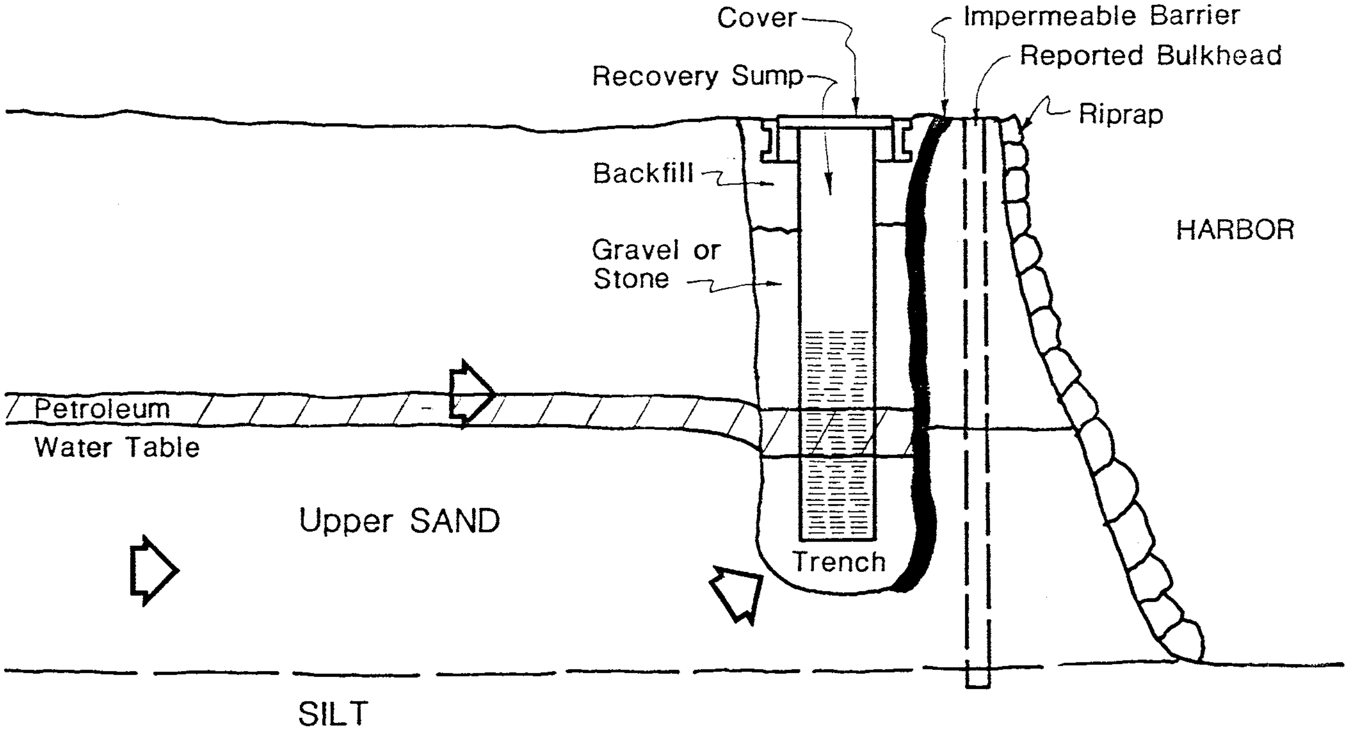
Figure 2

Proposed Interceptor Trench

Plan View



Cross Section



J-1302 October 1983
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Figure 3

APPENDIX A
FIELD PROCEDURES

Drilling and Well Installation

Eight wells were completed during September and early October 1983. Scott Wright, a geologist from Hart-Crowser, observed the drilling and well installations, and based upon these observations, prepared geologic logs and drawings of the "as-built" wells. These logs and well construction features are presented in Figures A-1 to A-8.

Drilling was completed using a truck-mounted CME drill rig equipped with a hollow-stem auger. Soil samples were obtained using a 2.5-nch split spoon sampler at selected intervals noted in the boring logs. Samples were placed in jars, capped and returned to the Hart-Crowser laboratory for further visual classification and selected grain size analyses. During sampling, evidence of petroleum contamination was noted.

After the drilling and soil sampling were completed, each boring was converted to an observation well. Two-inch PVC pipe and slotted screen (0.020 inch slot size) was installed through the center of the auger. Aqua No. 8 sand was placed around the screen and the auger was extracted. The wells were finished with a short bentonite seal and metal monument.

Three test pits were excavated by the Port while we were installing the wells. Their locations are shown on Figure 1. The pits were excavated to depths of 5.0 (TP-1), 9.5 (TP-2) and 11.0 (TP-3) feet. A PVC screen was installed in TP-3 from 1.0 to 11.0 feet. The test pits encountered similar soils as the borings.

Surveying and Well Water Level Measurement

Elevation surveying and well water level measurements were accomplished to determine groundwater flow directions. These data are presented in Table A-1.

Water levels were measured using an electric probe. Thickness of petroleum floating on the water table was measured using a tape coated with water and petroleum finding pastes.

Petroleum samples were obtained from wells B-2, B-5 and B-6 using a bailer with a check ball. Samples were placed in glass jars and transported to Am Test of Seattle for product identification.

TABLE A-1 Water Table Elevation and Product Thickness Data

OBSERVATION WELL NUMBER	MEASURING POINT ELEVATION IN FEET	September 26, 1983			October 12, 1983		
		DEPTH TO WATER IN FEET	WATER TABLE ELEVATION IN FEET	PRODUCT THICKNESS IN FEET	DEPTH TO WATER IN FEET	WATER TABLE ELEVATION IN FEET	PRODUCT THICKNESS IN FEET
B-1	11.67	4.52	7.15	0.01	3.79	7.97	ND
B-2	11.58	6.22	5.36	0.58	4.74	6.84	0.26
B-3	12.10	6.09	6.01	0.04	5.00	7.10	ND
B-4	11.92	3.48	8.44	0.01	NA	NA	NA
B-5	11.70	5.75	5.95	0.81	4.98	6.72	0.89
B-6	11.71	NA	NA	NA	4.09	7.62	ND
B-7	11.61	NA	NA	NA	5.37	6.24	0.38
B-8	11.95	NA	NA	NA	5.79	6.16	0.05

Note: Measuring point for all observation wells is top of metal monument bolt flange. Elevation datum referenced to MLLW with "B" Dock elevation assumed to be 12.00 feet.

NA - Not Available
ND - None Detected

Boring Log and Construction Data for Well B-1

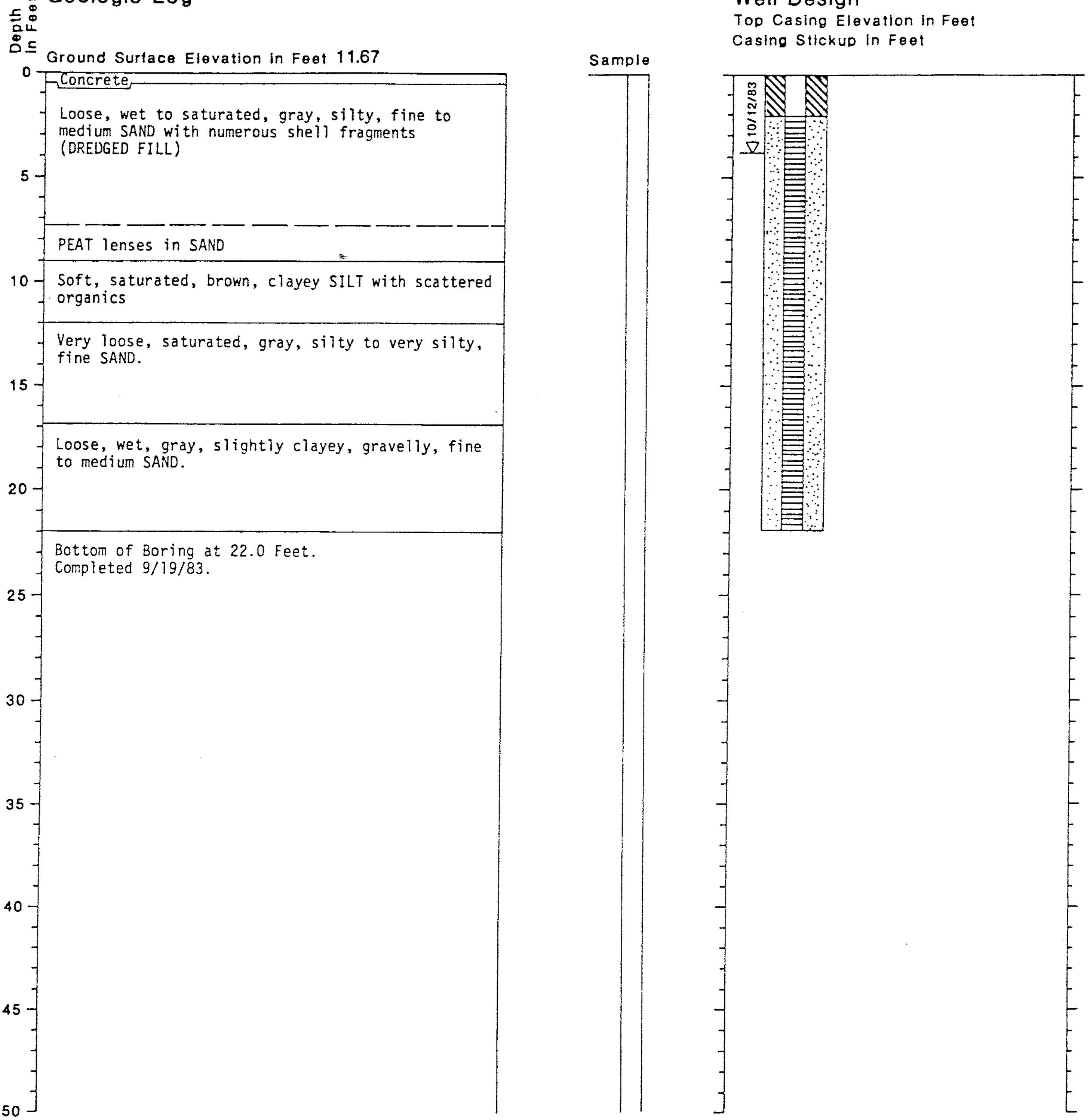
Geologic Log

Ground Surface Elevation in Feet 11.67

Well Design

Top Casing Elevation in Feet

Casing Stickup in Feet



Concrete

Loose, wet to saturated, gray, silty, fine to medium SAND with numerous shell fragments (DREDGED FILL)

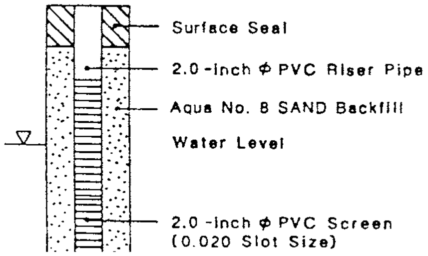
PEAT lenses in SAND

Soft, saturated, brown, clayey SILT with scattered organics

Very loose, saturated, gray, silty to very silty, fine SAND.

Loose, wet, gray, slightly clayey, gravelly, fine to medium SAND.

Bottom of Boring at 22.0 Feet.
Completed 9/19/83.



☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

NOTES:

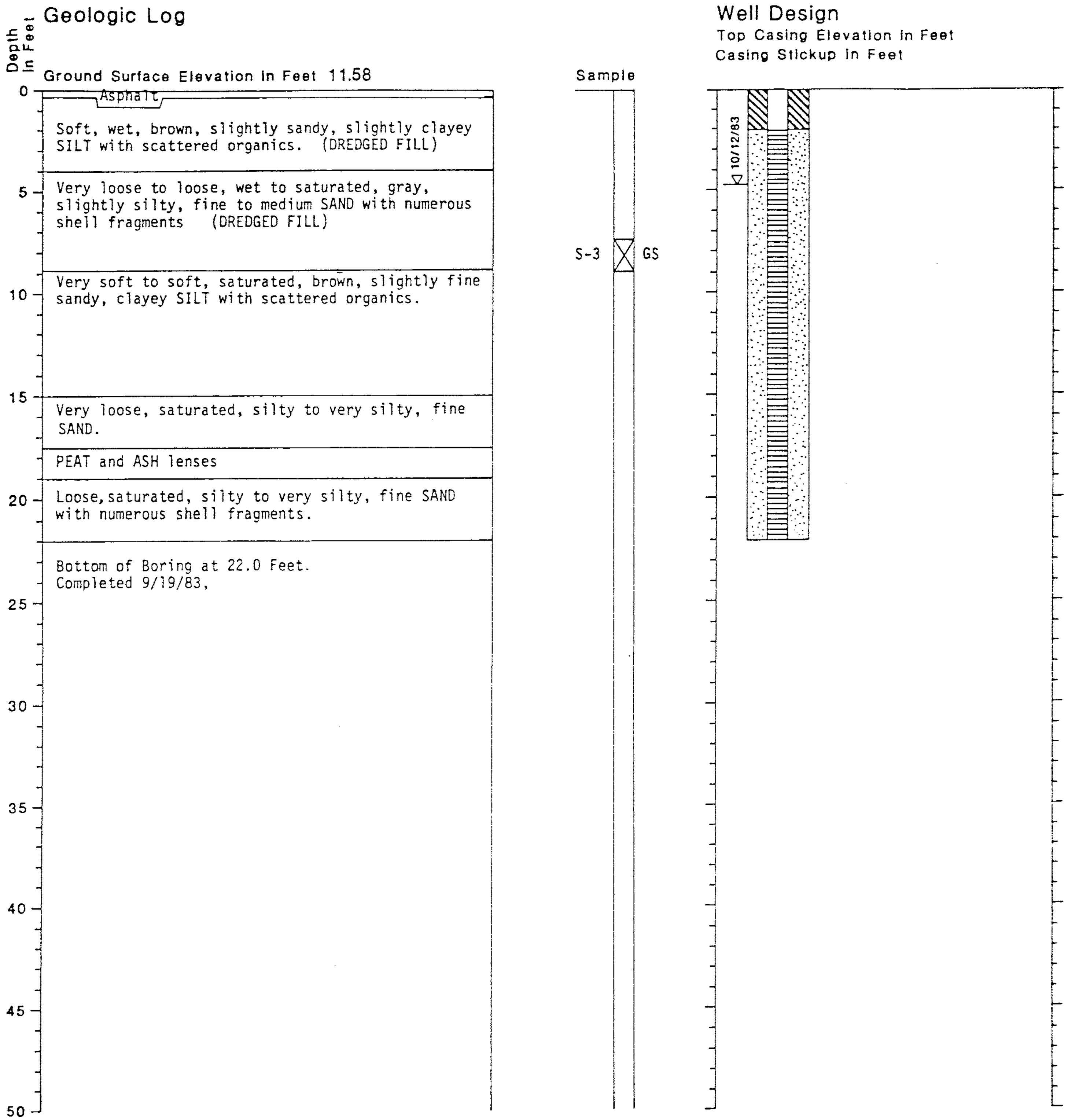
1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-1

Boring Log and Construction Data for Well B-2



Soft, wet, brown, slightly sandy, slightly clayey SILT with scattered organics. (DREDGED FILL)

Very loose to loose, wet to saturated, gray, slightly silty, fine to medium SAND with numerous shell fragments (DREDGED FILL)

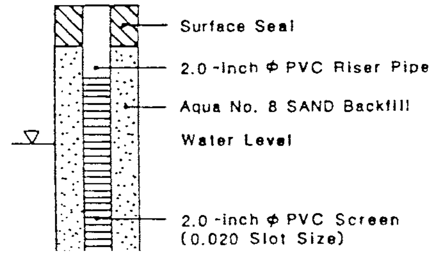
Very soft to soft, saturated, brown, slightly fine sandy, clayey SILT with scattered organics.

Very loose, saturated, silty to very silty, fine SAND.

PEAT and ASH lenses

Loose, saturated, silty to very silty, fine SAND with numerous shell fragments.

Bottom of Boring at 22.0 Feet.
Completed 9/19/83,



☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

NOTES:

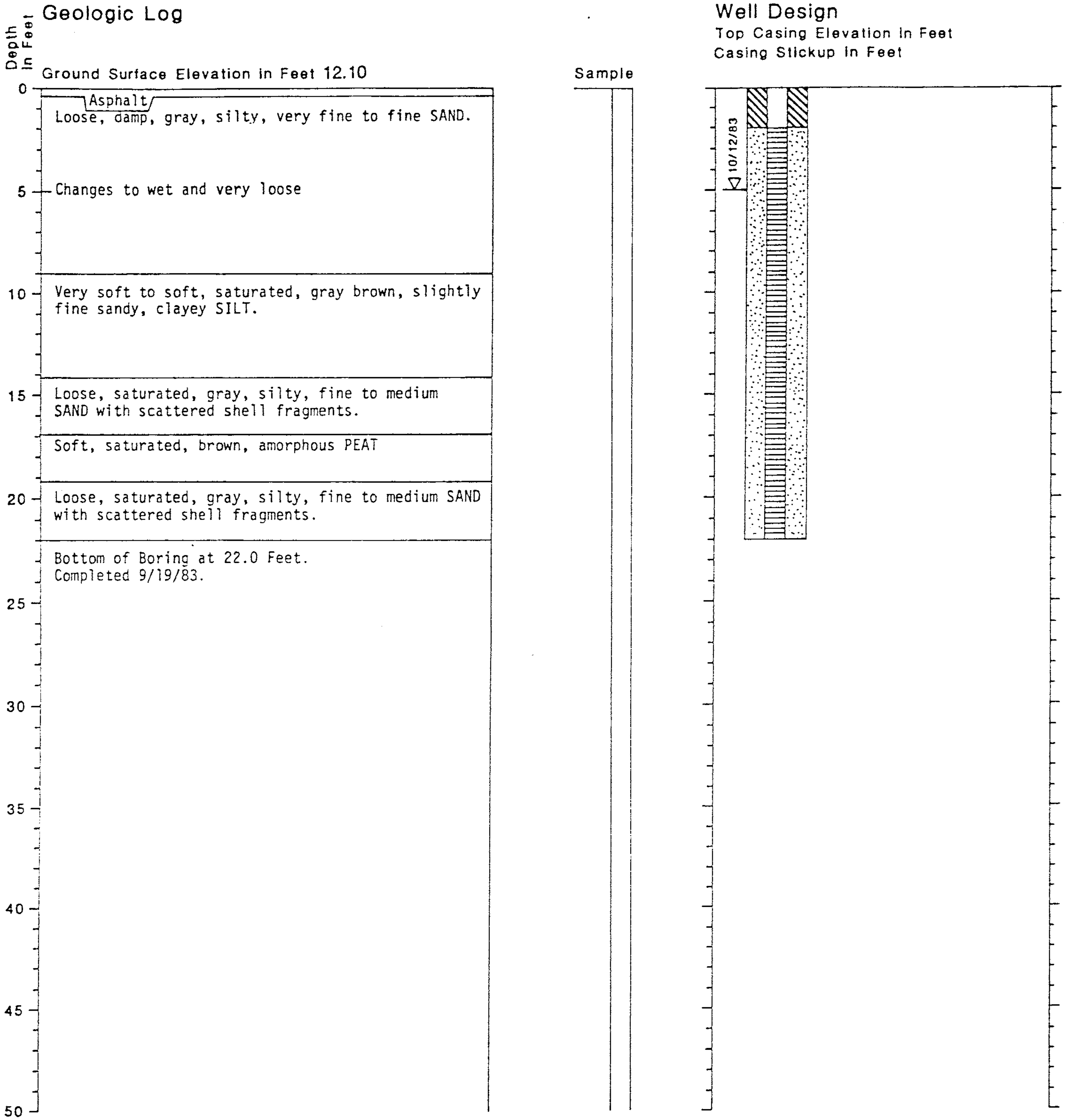
1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-2

Boring Log and Construction Data for Well B-3



Asphalt

Loose, damp, gray, silty, very fine to fine SAND.

Changes to wet and very loose

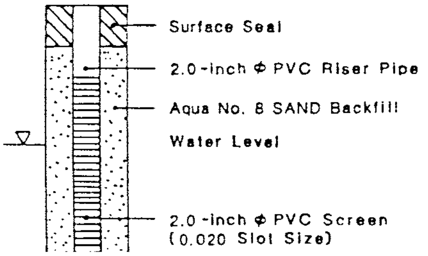
Very soft to soft, saturated, gray brown, slightly fine sandy, clayey SILT.

Loose, saturated, gray, silty, fine to medium SAND with scattered shell fragments.

Soft, saturated, brown, amorphous PEAT

Loose, saturated, gray, silty, fine to medium SAND with scattered shell fragments.

Bottom of Boring at 22.0 Feet.
Completed 9/19/83.



☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-3

Boring Log and Construction Data for Well B-4

Geologic Log

Depth in Feet

Ground Surface Elevation in Feet 11.92

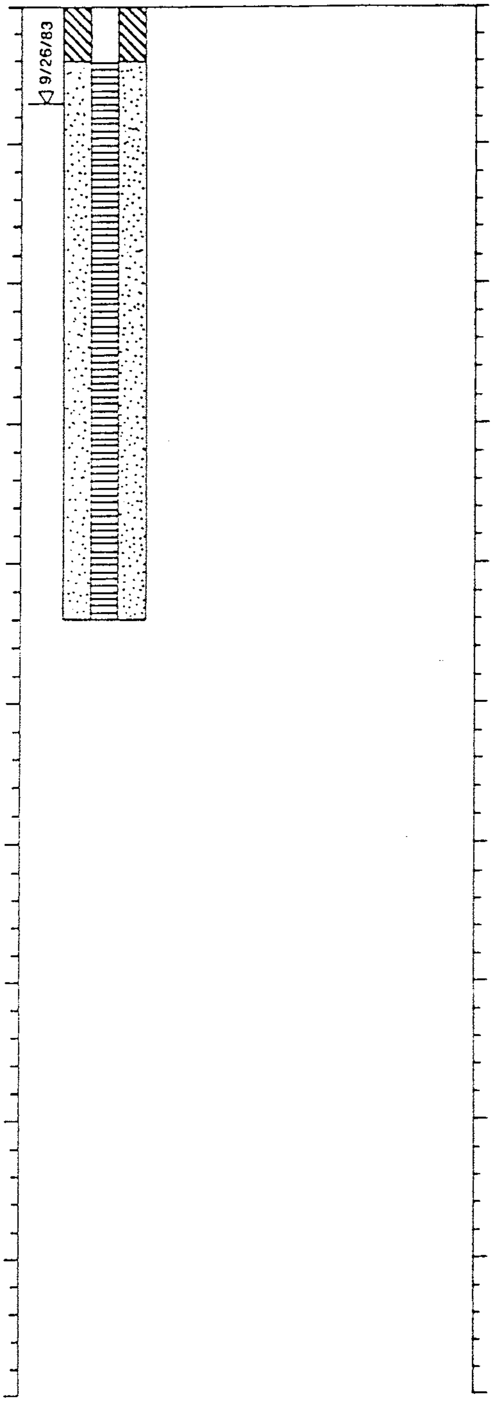
Sample

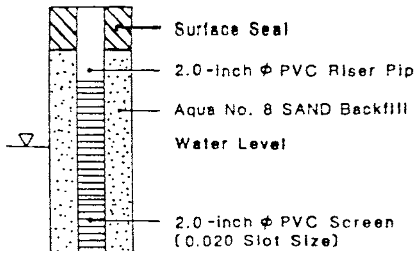
Depth in Feet	Description
0	Loose, moist, brown, gravelly, silty, fine to medium SAND with occasional cobble
5	Very loose, wet, brown, silty, fine to medium SAND with numerous shell fragments (DREDGED FILL)
10	Very soft, wet, brown, slightly sandy, clayey SILT
	Loose, wet, gray, silty, fine SAND with scattered shell fragments
	Changes to medium dense
20	Soft, saturated, gray, slightly sandy, clayey SILT
	Bottom of Boring at 22.0 Feet. Completed 9/19/83.

Well Design

Top Casing Elevation in Feet

Casing Stickup in Feet





☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

NOTES:

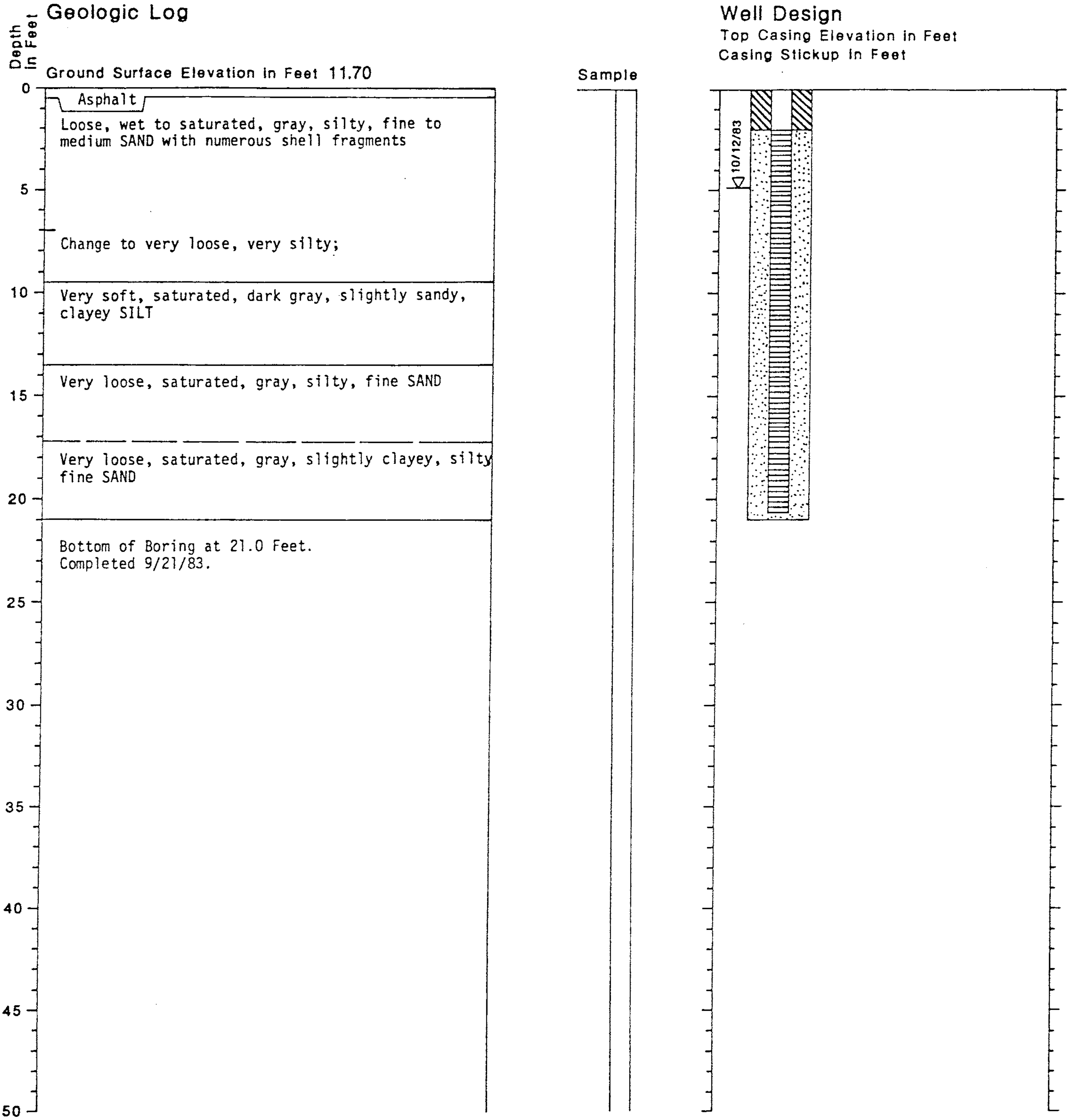
1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-4

Boring Log and Construction Data for Well B-5



Loose, wet to saturated, gray, silty, fine to medium SAND with numerous shell fragments

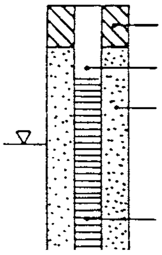
Change to very loose, very silty;

Very soft, saturated, dark gray, slightly sandy, clayey SILT

Very loose, saturated, gray, silty, fine SAND

Very loose, saturated, gray, slightly clayey, silty fine SAND

Bottom of Boring at 21.0 Feet.
Completed 9/21/83.



Surface Seal
2.0-inch ϕ PVC Riser Pipe
Aqua No. 8 SAND Backfill
Water Level
2.0-inch ϕ PVC Screen (0.020 Slot Size)

☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

NOTES:

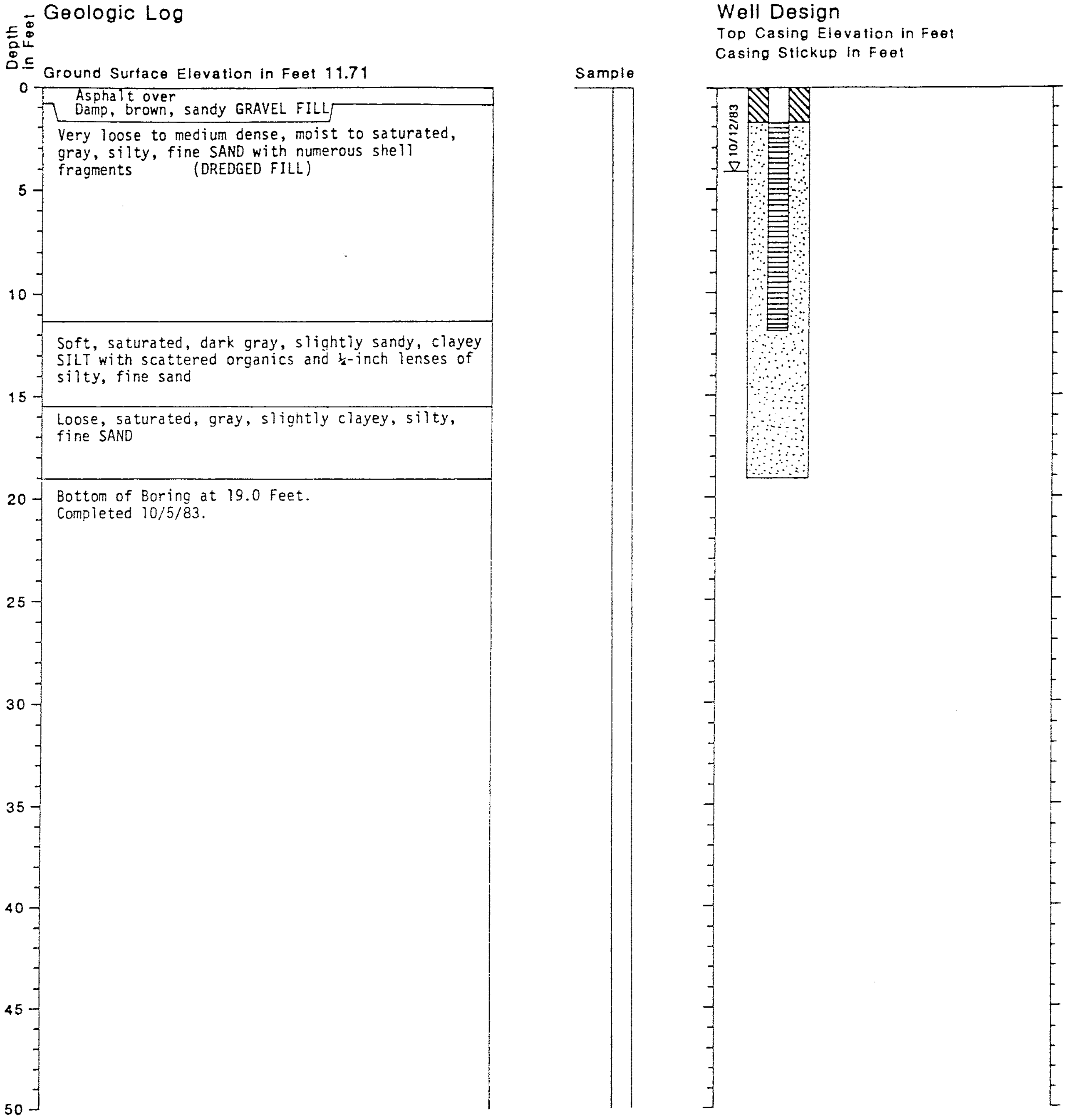
1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-5

Boring Log and Construction Data for Well B-6



Geologic Log

Ground Surface Elevation in Feet 11.71

Asphalt over
Damp, brown, sandy GRAVEL FILL

Very loose to medium dense, moist to saturated, gray, silty, fine SAND with numerous shell fragments (DREDGED FILL)

Soft, saturated, dark gray, slightly sandy, clayey SILT with scattered organics and ¼-inch lenses of silty, fine sand

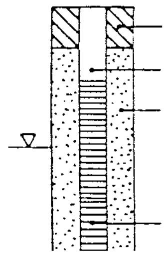
Loose, saturated, gray, slightly clayey, silty, fine SAND

Bottom of Boring at 19.0 Feet.
Completed 10/5/83.

Well Design

Top Casing Elevation in Feet

Casing Stickup in Feet



Surface Seal

2.0-inch ϕ PVC Riser Pipe

Aqua No. 8 SAND Backfill

Water Level

2.0-inch ϕ PVC Screen (0.020 Slot Size)

☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

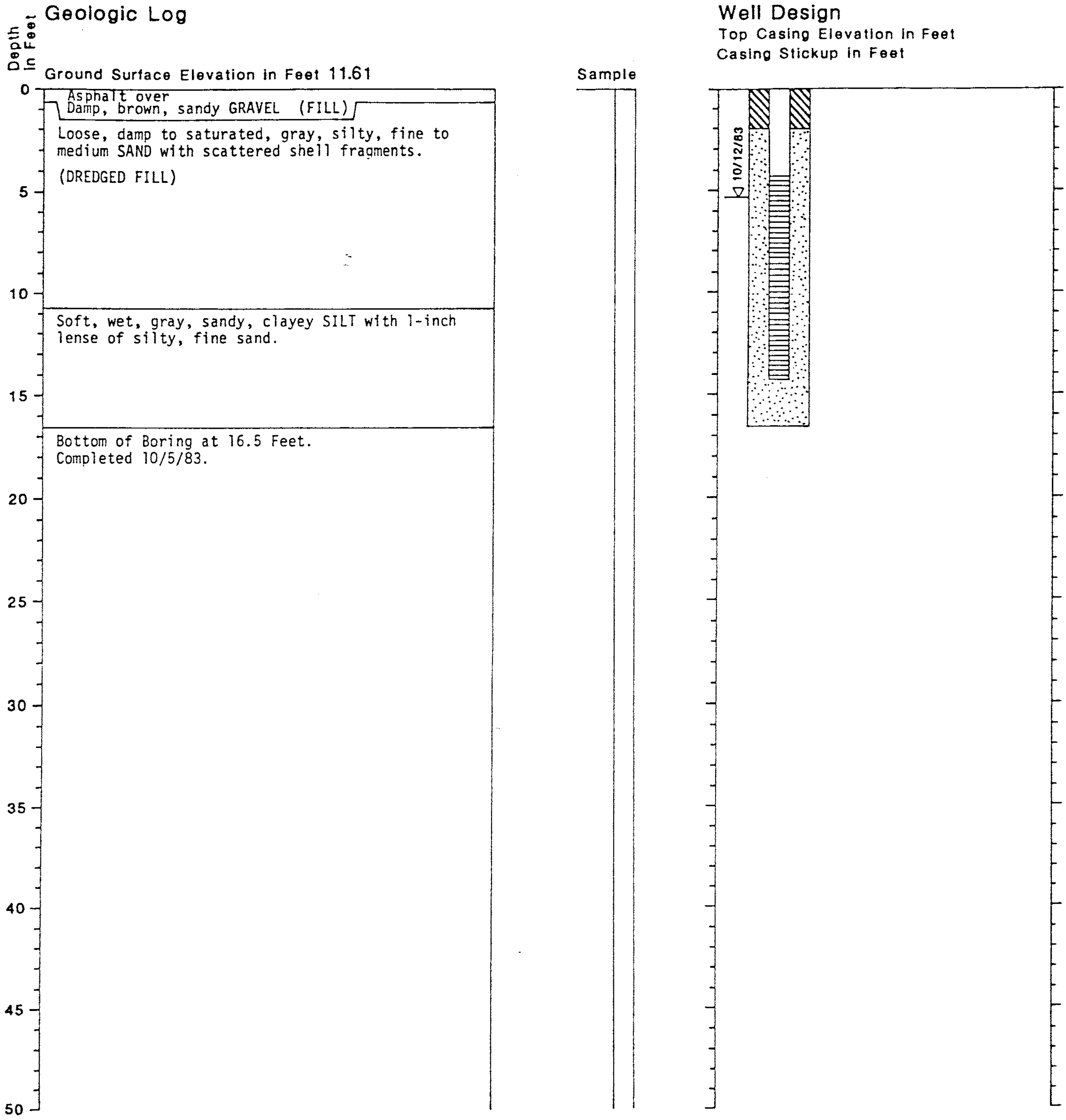
NOTES:
1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-6

Boring Log and Construction Data for Well B-7



Geologic Log

Ground Surface Elevation in Feet 11.61

Asphalt over
Damp, brown, sandy GRAVEL (FILL)

Loose, damp to saturated, gray, silty, fine to medium SAND with scattered shell fragments.

(DREDGED FILL)

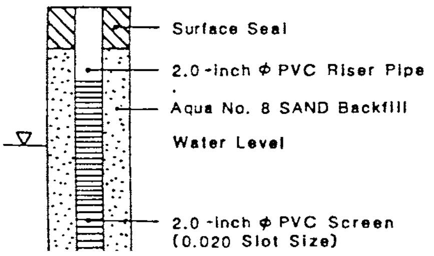
Soft, wet, gray, sandy, clayey SILT with 1-inch lense of silty, fine sand.

Bottom of Boring at 16.5 Feet.
Completed 10/5/83.

Well Design

Top Casing Elevation in Feet

Casing Stickup in Feet



☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

NOTES:

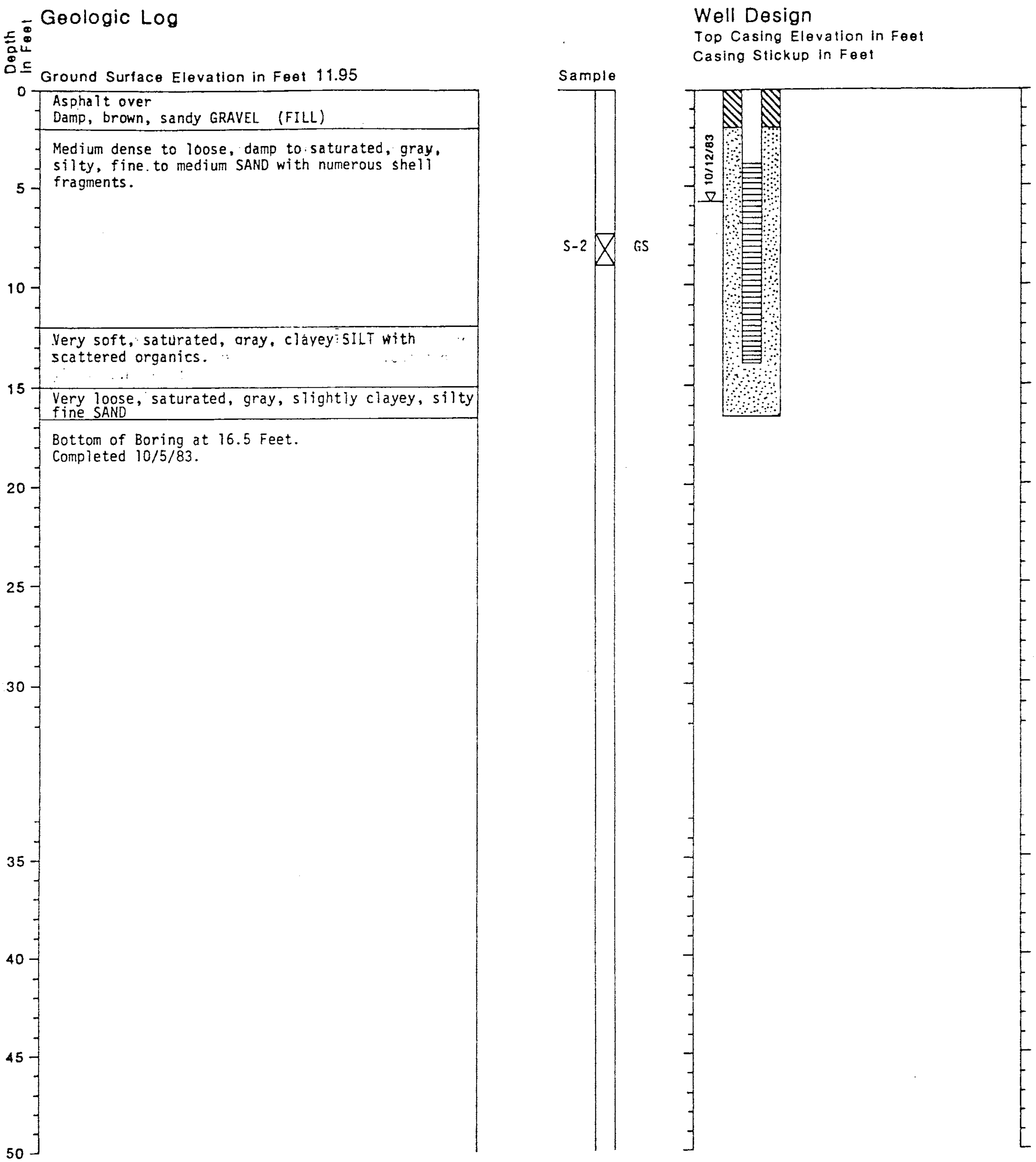
1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD:At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-7

Boring Log and Construction Data for Well B-8



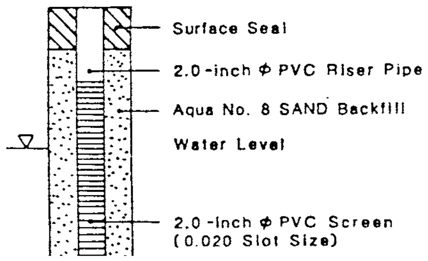
Asphalt over
Damp, brown, sandy GRAVEL (FILL)

Medium dense to loose, damp to saturated, gray, silty, fine to medium SAND with numerous shell fragments.

Very soft, saturated, gray, clayey SILT with scattered organics.

Very loose, saturated, gray, slightly clayey, silty fine SAND

Bottom of Boring at 16.5 Feet.
Completed 10/5/83.



☒	2-inch O.D. Split Spoon Sample
*	No Sample Recovery
N	Standard Penetration Resistance, Blows per foot
GS	Grain Size Analysis
K	Permeability Test

NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year. ATD: At Time of Drilling

J-1302 October 1983

HART-CROWSER & associates, inc.

Figure A-8

APPENDIX B
LABORATORY TEST PROCEDURES

Laboratory tests that were completed for this study included visual classification and grain size analysis of selected samples. The procedures are outlined below.

Visual Classification

All samples obtained from the test borings were visually classified in the field and then transported to our laboratory where their classifications were visually checked. Classifications were made in accordance with the Unified Soil Classification System. Visual classifications included soil consistency or density, color, moisture content and major soil type, as well as the modifying fractions in the sample. The visual classifications of the samples are presented in the boring logs (Appendix A).

Grain Size Analyses

Grain size analyses were performed on two selected granular samples in order to determine the grain size distribution and provide an evaluation of the permeability of the upper sand.

The tests were performed in general accordance with the procedures described in ASTM D422-63. The wet sieve analysis method which determines the size distribution greater than the No. 200 mesh sieve size was used. The results of the tests are presented as curves on Figure B-1, plotting percent finer by weight versus grain size.

Petroleum Identification

Laboratory analyses of three samples were completed by Am Test of Seattle. Free petroleum samples from B-2 and B-5 were analyzed using ASTM methods D-86 and D-121F. A third sample obtained from B-6 was analyzed for oil and grease using standard method 503B. The test results are presented in tables B-2 and B-3.

TABLE B-1

T-1302

am test inc.

4900 9TH AVENUE N.W., • SEATTLE, WASHINGTON 98107-3697 • 206/783-4700

ANALYSIS REPORT

CLIENT: Hart Crowser

DATE RECEIVED: 9/28/83

REPORT TO: Charles T. Ellingson
1910 Fairview Avenue East
Seattle, WA 98102

DATE REPORTED: 9/29/83

Laboratory Sample Number			9-566	9-567
Client Identification			B2	B5
Distillation Range :	Initial Boiling Point	(°C)	29	47
	10% Distilled	"	74	84
	20% " "	"	96	110
	30% " "	"	136	127
	40% " "	"	172	156
	50% " "	"	206	181
	60% " "	"	235	211
	70% " "	"	257	244
	80% " "	"	274	266
	90% " "	"	295	288
	End Point	"	306	304
Specific Gravity (60/60)			0.8003	0.8009

Sample #9-566 (B-2) has some very light ends and appears to be approximately 48% gasoline and 52% diesel fuel.

Sample #9-567 (B-5) has few light ends and appears to be approximately 55% gasoline and 45% diesel fuel.

REPORTED BY William A. Birch
William A. Birch

WAB:bc

TABLE B-2

5-1302

AT am test inc.

4900 9TH AVENUE N.W., • SEATTLE, WASHINGTON 98107-3697 • 206/783-4700

ANALYSIS REPORT

CLIENT: Hart Crowser & Associates

DATE SAMPLE RECEIVED: 10-11-83

REPORT TO: Mr. Charles Ellingson
1910 Fairview Avenue E.
Seattle, WA 98102

DATE SAMPLE REPORTED: 10-12-83

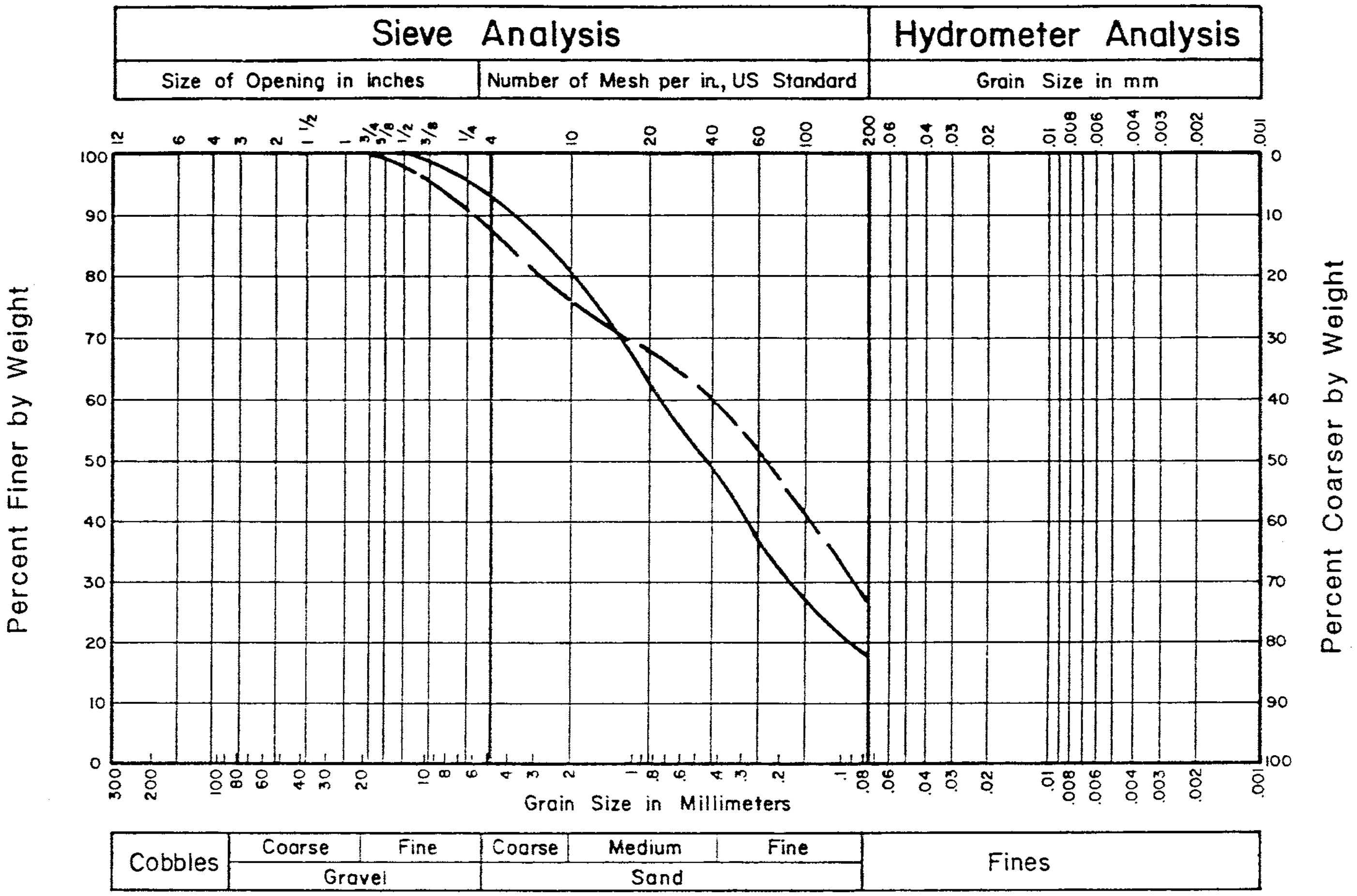
Laboratory Sample No.	71575
Client Identification	B-6 J-1302 10-10-83
Oil and Grease (mg/l)	386.

REPORTED BY

John M. Blunt

nr

Grain Size Classification



LINE SYMBOL	BORING NUMBER	SAMPLE NUMBER	DEPTH IN FEET	CLASSIFICATION	UNIFIED SOIL CLASS.	WATER CONTENT PERCENT
———	B-2	S-3	7.5- 9.0	Slightly gravelly, silty SAND with shell fragments	SM	28
— —	B-8	S-2	7.5- 9.0	Gravelly, silty SAND with shell fragments	SM	30

J-1302 October 1983
HART-CROWSER & associates, inc.
Figure B-1

Floyd
Snider
McCarthy, Inc.
Strategy & Technical Solutions for Contaminated Properties
83 South King Street Suite 614 Seattle, Washington 98104 tel: 206.292.2078 fax: 206.682.7867

June 14, 2004

Mr. Bob Elsner
Director of Planning and Projects
Port of Anacortes
Post Office Box 297
Anacortes, Washington 98221

SUBJECT: LETTER REPORT
RESULTS OF LIMITED ENVIRONMENTAL DUE DILIGENCE INVESTIGATION
CAP SANTE BOAT HAVEN - ANACORTES, WASHINGTON

Dear Mr. Elsner:

This letter report presents the results of the limited environmental due diligence investigation completed by Floyd Snider McCarthy, Inc. (FSM) near the Cap Sante Marine (CSM) facility located at the Cap Sante Boat Haven in Anacortes, Washington (Figure 1). Soil and groundwater sampling was performed to evaluate the potential impact to future development at the site from historical contamination.

Field sampling was completed on May 4, 2004 in accordance with approved FSM Task Order 05-04 dated April 19, 2004. The primary objective of the sampling and analysis was to establish concentrations of petroleum hydrocarbons present in soil and groundwater in an area that may be subject to redevelopment.

Results of this investigation show that benzene and gasoline contamination, as defined by the Washington State Model Toxics Control Act (MTCA) Method A cleanup levels, is present at the site in the depth range of about 5 to 9 feet below ground surface (bgs). In accordance with MTCA cleanup regulations (WAC 173-340-300), these findings should be reported to the Washington State Department of Ecology (Ecology) within ninety days of discovery.

PROPERTY HISTORY

In the early 1980's, petroleum fuel was observed seeping into the marine waters at the CSM boat basin at several locations near the fuel dock. In 1983, under order from the U.S. Coast Guard, the Port of Anacortes (POA) installed a trench to control the seepage of fuel. The trench intercepted the fuel flowing through the soil. According to the available site documentation, several thousand gallons of fuel were recovered from the trench and the seepage stopped.

The seepage was thought to be a result of leakage from the underground storage tanks (USTs) that supply the fuel docks at Cap Sante Boat Haven. In 1985, POA replaced these USTs with two new tanks. Impacts to the soils and groundwater in the vicinity of fuel leaks and recovery trench were not evaluated.

PROJECT AREA DESCRIPTION

The project area is located along the shoreline, east of the CSM property between Docks B and C. The ground surface is paved with asphalt and is fairly level. The approximate elevation of the ground surface is 12 feet above mean lower low water (MLLW).

The project area is located on fill material comprised mainly of dredged sand and silty sand as well as imported sand and gravel. At each of the sampling locations, groundwater was encountered at depths of 5 to 6 feet bgs at the time of drilling. It is assumed that the groundwater is tidally influenced with an overall flow and discharge to the waters of the Cap Sante Boat Haven.

FIELD INVESTIGATION

Six locations near the former fuel recovery trench, as shown on Figure 1, were sampled to determine the type and concentration of petroleum hydrocarbons in subsurface soil and groundwater. The subsurface exploration areas were cleared of underground utilities prior to drilling. Three sample cores were collected from each location using a hydraulically-powered Geoprobe® sampling device. The first core was advanced to a depth of 4 feet bgs, the second from 4 to 8 feet bgs and the third from 8 to12 feet bgs. After the core was retrieved, the core liner was cut open, and the soil sample examined and described. Each sample was screened for volatile organic vapors using a photoionization detector (PID). Petroleum odors or sheen were noted and soil samples were collected in laboratory-supplied jars. The presence of sheen was determined by mixing small amounts of soil with water to visually observe iridescence. The depth to groundwater was measured and also checked for free product at each sampling location. This was accomplished by lowering a steel tape coated with water-finding paste into the boring after the drilling rods were removed. No evidence of free (or floating) product were observed at any of the boring locations. Field observations were recorded on boring logs as presented in Attachment A.

A groundwater sample was collected from each boring after retrieving the deepest soil core. This was accomplished by advancing the rods with an expendable well point and retractable screen to a depth of about 3 to 4 feet below the observed water table. After the drill rod was retrieved, the screen was exposed to the formation, allowing groundwater to seep into the screen. To collect a sample, a narrow-diameter polyethylene tubing was inserted through the hollow drill rod to the base of the screen and the groundwater pumped out using a peristaltic pump. The water was pumped until the turbidity was observed to be reduced, or discharge stopped. After purging, the laboratory-supplied sample bottles were filled.

All down-hole tools and sampling equipment were decontaminated by washing with a solution of Alconox and water and rinsing with tap water. New plastic liners were used for collecting each soil core. Dedicated polyethylene and silicone tubing were used to collect each water sample and discarded after use.

The samples were stored in an iced cooler and delivered to the laboratory according to chain of custody protocols. Copies of the chain of custody records are included as part of the laboratory reports provided as Attachments B and C.

LABORATORY ANALYTICAL RESULTS

Nineteen soil and six groundwater samples were submitted to the laboratory. A representative subset of the soil samples and all groundwater samples were analyzed for the petroleum hydrocarbon constituents of concern (COCs). The testing program is summarized on Table 1, attached.

Nine soil samples were selected for total petroleum hydrocarbons (TPH) analysis via the hydrocarbon identification method (Method NWTPH-HCID) to determine the presence and concentrations of gasoline, diesel, or heavy (lube oil) range petroleum hydrocarbons. The HCID method is the preferred analytical method if the type of petroleum contamination is unknown. Based on the strong odors noted in the sample and the field PID readings, five soil samples were selected for laboratory testing for TPH-gasoline, benzene, toluene, ethylbenzene and xylenes (TPH-Gasoline/BTEX) and two samples were selected for diesel and heavy oil range hydrocarbons (NWTPH-Dx) analysis.

The soil data were compared to the MTCA Method A cleanup levels for TPH-gasoline, TPH-diesel and BTEX (Table 2). This comparison indicates that gasoline, xylenes, and benzene exceed the cleanup levels at the four interior locations (GP-2, GP-3, GP-4 and GP-5B). Diesel concentrations in soil do not exceed the cleanup level.

The groundwater data indicate that benzene, gasoline, and diesel are present in concentrations that exceed MTCA Method A cleanup levels (Table 3). Similar to the results found for the soil data, benzene exceedances in groundwater were greater than those found for other COCs. However, only two adjacent locations (GP-2 and GP-3) displayed groundwater exceedances, one for benzene/gasoline and the other for diesel. In comparison, soil exceedances were found in four locations.

Overall, the field observations and laboratory soil test data indicate mostly benzene and gasoline contamination is present in soil in the depth range of about 5 to 9 feet bgs in borings closest to the former recovery trench. This depth range likely corresponds to a tidally influenced "smear zone", which is a vertical range in the soil where gasoline has been spread (or smeared) due to tidal and seasonal changes in the water table elevation. The gasoline concentrations in soil decrease rapidly with depth below the bottom of the smear zone. Both the boring log observations and the analytical data show that the TPH concentrations appear to decrease significantly below a depth of about 10 feet bgs.

Please call to discuss any questions you may have regarding the results of this investigation.

Sincerely yours,
Floyd Snider McCarthy, Inc.

Thomas Colligan

John Herzog, Ph.D.
Principal

Thomas Colligan, L.G.
Senior Scientist

Attachments:	Figure 1 Site Map
	Table 1 Summary of Laboratory Testing Program
	Table 2 Summary of Soil Test Results
	Table 3 Summary of Groundwater Test Results
	Attachment A Boring Logs
	Attachment B Laboratory Analytical Report for Soil
	Attachment C Laboratory Analytical Report for Groundwater

Seal of Licensed Geologist:

State of Washington
805
Licensed Geologist
Thomas Mann Colligan

DWG NAME: 06/02/04 12:14pm
DATE: G:\project\Clients\Floyd and Snider\PortOfA\anacortes\portana003.dwg

Floyd Snider McCarthy, Inc.
Strategy & Technical Solutions for Contaminated Properties

Port of Anacortes
Cap Sante Boat Haven
Anacortes, Washington

Figure 1
Site Map: Exploration Locations and Existing Site Features

Table 1
Summary of Laboratory Testing Program

Sample ID	Matrix	TPH-HCID	TPH-Gasoline/ BTEX	TPH-Dx	Comments
GP1-5.0	Soil	X			
GP1-8.0	Soil	X			
GP2-5.0	Soil		X	X	
GP2-10.0	Soil	X			
GP3-6.0	Soil	X	X		
GP3-7.0	Soil		X		Insufficient sample for HCID
GP3-9.0	Soil	X			
GP4-7.0	Soil		X	X	
GP4-10.0	Soil	X			
GP5B-6.0	Soil		X		
GP5B-9.0	Soil	X			
GP6-2.5	Soil	X			
GP6-5.0	Soil	X			
GP1	Water		X	X	
GP2	Water		X	X	
GP3	Water		X		Insufficient sample for TPH-Dx
GP4	Water		X	X	
GP5B	Water		X	X	
GP6	Water		X	X	

Table 2
Summary of Soil Testing

Sample ID	Benzene	Toluene	Ethyl-benzene	Xylenes	Gasoline^{a,b}	Diesel^{a,b}	Heavy Oil
GP1-5.0	NA	NA	NA	NA	35 U	50 U	100 U
GP1-8.0	NA	NA	NA	NA	31 U	50 U	100 U
GP2-5.0	**0.270**	0.140	0.033 U	0.189	**250**	1800	67 U
GP2-10.0	NA	NA	NA	NA	40 U	50 U	100 U
GP3-6.0	**2.30**	0.600	4.60	**19.2**	**630**	410	340 U
GP3-7.0	**2.30**	0.430	3.10	**12.4**	**320**	NA	NA
GP3-9.0	NA	NA	NA	NA	38 U	50 U	100 U
GP4-7.0	**0.150**	0.035 U	0.035 U	0.071 U	20.0	20	45
GP4-10.0	NA	NA	NA	NA	190 U	190 U	390 U
GP5B-6.0	**0.580**	0.350	0.710	0.560	**510**	NA	NA
GP5B-9.0	NA	NA	NA	NA	**230**	390	330 U
GP6-2.5	NA	NA	NA	NA	31 U	50 U	100 U
GP6-5.0	NA	NA	NA	NA	37 U	50 U	100 U
MTCA Method A Cleanup Level							
	0.03	7.0	6.0	9.0	100/30	2000	2000

Notes:

Concentrations are in mg/Kg dry weight.
Bold font indicates a cleanup level exceedance.
[a] = HCID test results are not shown if NWTPH-G and NWTPH-DX results are also available.
[b] = The cleanup level for gasoline is 30 mg/Kg if benzene is present and 100 mg/Kg if not present.
U = Not detected at the given reporting limit.
NA = Not analyzed.

Table 3
Summary of Groundwater Test Results

Sample ID	**Benzene**	**Toluene**	**Ethyl-benzene**	**Xylenes**	**TPH-Gasoline[a]**	**TPH-Diesel**	**TPH-Motor Oil**
GP1	1.0 U	1.0 U	1.0 U	1.0 U	0.25 U	250 U	500 U
GP2	1.0 U	1.0 U	1.0 U	1.3	460	**2400**	500 U
GP3	**390**	18	65	212	**4100**	NA	NA
GP4	1.0 U	1.0 U	1.0 U	1.0 U	250 U	250	500 U
GP5B	3.4	1.4	2.3	1.9	400	370	500 U
GP6	1.0 U	1.0 U	1.0 U	1.0 U	250 U	250 U	500 U
MTCA Method A Cleanup Level							
	5.0	1,000	700	1000	800/1,000	500	500

Notes:

Concentrations are in µg/L.
Bold font indicates a cleanup level exceedance.
[a] = The cleanup level for gasoline is 800 µg/L if benzene is present and 1000 µg/L if not present.
U = Not detected at the given reporting limit.
NA = Not analyzed.

Log of Soil Boring GP1

Floyd Snider McCarthy, Inc.

Boring GP1 Date May 4, 2004 Sheet 1 of 1

Job Cap Sante Marine Job No. POA CSM Field T.2

Logged By John LaManna Weather Light Rain, Breezy, 57 degrees F

Drilled By Cascade Drilling

Drill Type/Method Geoprobe

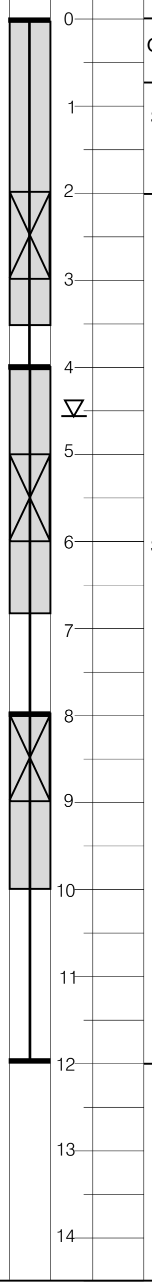
Sampling Method Direct Push, 4-Ft Cores

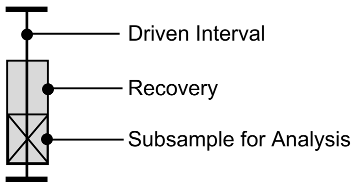
Bottom of Boring 12' ATD Water Level Depth 4.6'

Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. Yes [✓ No]

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				GW	Gray sandy GRAVEL, angular gravel. Dry. H_2S odor.	
				SP	Brown fine SAND with silty SAND lamellae and a dark brown peat bed 0.1-Ft. thick. Wet at 3 Ft. FILL.	
GP1-2.0	5	2.0	3.0	SP	Gray fine SAND with silt, locally some minor silty fine sand beds, gray silt beds, dark brown peat, and shell fragments. Wet below 5 Ft. FILL. H_2S odor.	No Sheen
GP1-5.0	4	5.0	6.0			No Sheen
GP1-8.0	5	8.0	9.0			No Sheen
					Bottom of Boring at 12' Note: Water sample GP-1 collected from temporary well point.	





Log of Soil Boring GP2

Floyd Snider McCarthy, Inc.

Boring GP2 Date May 4, 2004 Sheet 1 of 1

Job Cap Sante Marine Job No. POA CSM Field T.2

Logged By John LaManna Weather Cloudy, Breezy, 57 degrees F

Drilled By Cascade Drilling

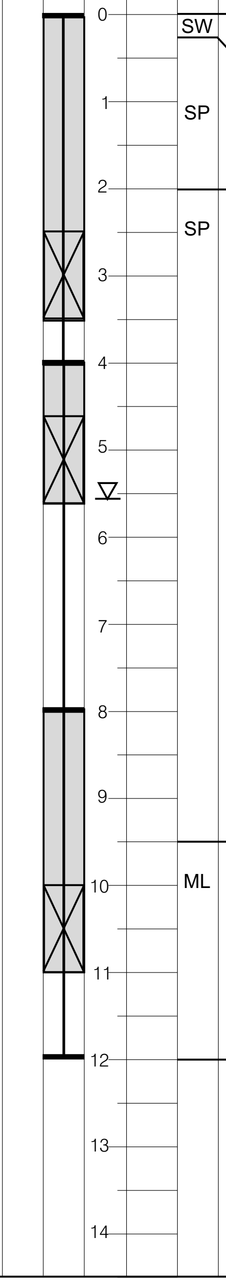
Drill Type/Method Geoprobe

Sampling Method Direct Push, 4-Ft Cores

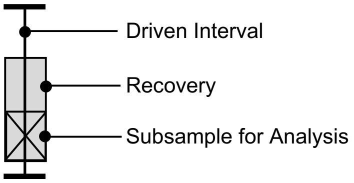
Bottom of Boring 12’ ATD Water Level Depth 5.6’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				SW	Gray gravelly SAND, well graded, dry, FILL	
				SP	Brown, fine SAND with silty fine sand, lamellae. Moist. FILL. Slight H_2S odor.	No Sheen
GP2-2.5	2	2.5	3.5	SP	Gray fine SAND with minor silty sand beds with shell fragments, wood fragments, and with brown peat lumps and lamellae. Moist to wet. FILL. Slight gasoline odor at 3 Ft.	
GP2-5.0	210	4.7	5.7			Sheen
						Sheen on Sluff over undisturbed sample
GP2-10.0	9	10.0	11.0	ML	Gray SILT with sandy silt and silty fine sand beds. No odor.	No Sheen at 9’ and 10’
					Bottom of Boring at 12’ Note: Water sample GP-2 collected from temporary well point.	



Log of Soil Boring GP3

Floyd Snider McCarthy, Inc.

Boring GP3 Date May 4, 2004 Sheet 1 of 1

Job Cap Sante Marine Job No. POA CSM Field T.2

Logged By John LaManna Weather Raining, Breezy, 53 degrees F

Drilled By Cascade Drilling

Drill Type/Method Geoprobe

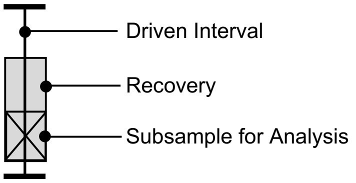
Sampling Method Direct Push, 4-Ft Cores

Bottom of Boring 12’ ATD Water Level Depth 6.2’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					GW	Gray sandy GRAVEL, angular. Dry. FILL	
					SM	Gray silty fine SAND with dark brown peat lamellae. Moist. FILL. H_2S odor.	
GP3-2.0	2	2.0	3.0		SM	Gray silty fine SAND with dark brown peat lamellae and some shell fragments. Moist. FILL.H_2S odor.	No Sheen
					SM	Gray fine SAND with silt, locally some minor silty fine sand beds, gray silt beds, dark brown peat, and shell fragments. Wet below 5 Ft. Probably FILL. H_2S odor.	
GP3-6.0	550	6.0	7.0		SP-SM	Gray fine SAND with silt and shell fragments. Wet. Strong gasoline odor.	Sheen at 6 Ft.
GP3-7.0 (sluff)							Sheen at 8 Ft.
GP3-9.0	21	9.0	10.0		ML	Dark gray SILT with dark brown peat lamellae. Moist	No Sheen at 9 Ft., but sudsy.
						Bottom of Boring at 12’ Note: Water sample GP-3 collected from temporary well point.	



Driven Interval

Recovery

Subsample for Analysis

Log of Soil Boring GP4

Floyd Snider McCarthy, Inc.

Boring GP4 Date May 4, 2004 Sheet 1 of 1

Job Cap Sante Marine Job No. POA CSM Field T.2

Logged By John LaManna Weather Raining, Breezy, 53 degrees F

Drilled By Cascade Drilling

Drill Type/Method Geoprobe

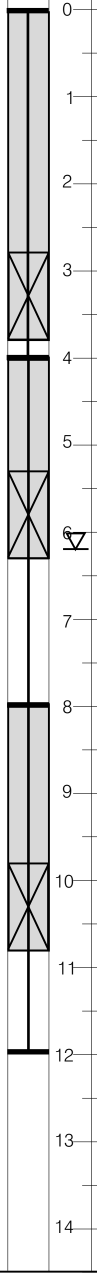
Sampling Method Direct Push, 4-Ft Cores

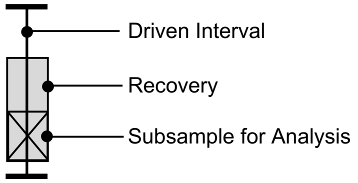
Bottom of Boring 12’ ATD Water Level Depth 6.2’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					GW	Gray and brown sandy GRAVEL, angular to rounded. FILL.	
GP4-3.0	32	2.8	3.8		SM	Mottled yellowish brown and brownish gray fine to medium SAND with white shell fragments. Fuel oil odor. Moist. Fill.	No Sheen but sudsy
GP4-7.0	300	5.6	6.6		SP	Gray fine to medium SAND with shell fragments, brown fiberous peat and local beds of sandy SILT and silty SAND. Moist to wet. Fuel oil odor above water table. Moist to wet. H_2S odor below 8 Ft..	No Sheen
GP4-10.0	20	9.8	10.8				No Sheen
						Bottom of Boring at 12’ Note: Water sample GP-4 collected from temporary well point.	



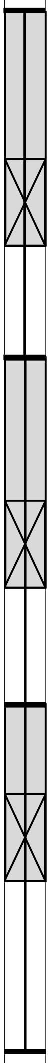


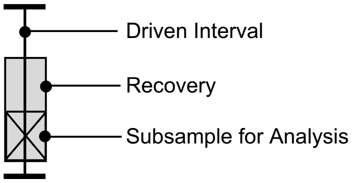
Log of Soil Boring GP5 B

Floyd Snider McCarthy, Inc.

Boring GP5 B Date May 4, 2004 Sheet 1 of 1
Job Cap Sante Marine Job No. POA CSM Field T.2
Logged By John LaManna Weather Raining, Breezy, 53 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 5.8'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					0	GW	Gray, fine to coarse GRAVEL with sand, angular. Dry FILL. No odor.	
					1	SP	Mottled, gray and brown, silty fine SAND. Moist. FILL. No odor	
GP5B-1.5	6	1.7	2.7		2	ML	Gray SILT and SILT with sand, brown peat lamellae. Wet at 5 Ft. FILL. Gasoline odor.	No Sheen Sheen
GP5B-6.0 GP5B-9.0	190 70	5.7 9.0	6.7 10.0		6	SP-SM	Gray fine SAND with silt and beds of silty fine sand and fine to medium sand, lamellae of brown peat, trace rounded to angular coarse gravel. Wet. Gasoline odor.	Sheen on soil at 9 Ft.
					10	ML	Black SILT with shell fragments. Wet. Gasoline odor.	
					12		Bottom of Boring at 12' Note: Water sample GP-5B collected from temporary well point.	

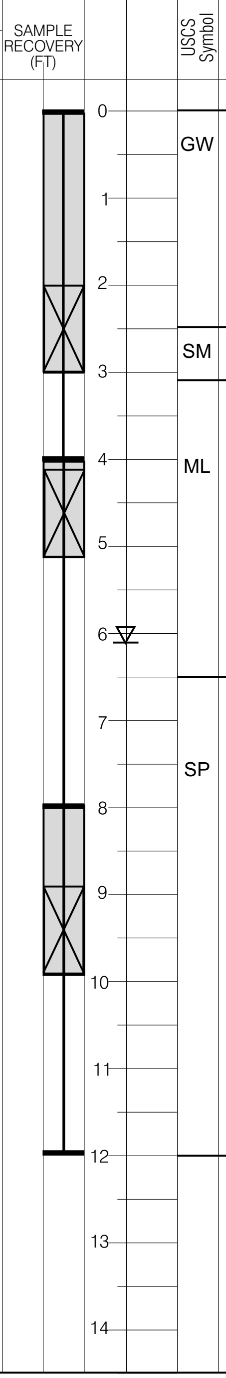


Log of Soil Boring GP6

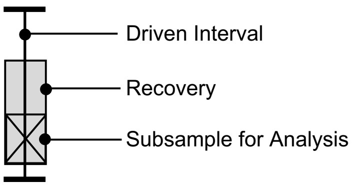
Floyd Snider McCarthy, Inc.

Boring GP6 Date May 4, 2004 Sheet 1 of 1
Job Cap Sante Marine Job No. POA CSM Field T.2
Logged By John LaManna Weather Cloudy, Breezy, 55 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 6.1'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				GW	Gray to dark gray sandy GRAVEL, well graded angular gravel. Dry. FILL.	
GP6-2.5	0.2	2.0	3.0	SM	Light brown, silty fine SAND with sandy silt and round gravel. No odor. FILL	
GP6-5.0	0.4	4.2	5.2	ML	Gray gravelly sandy SILT with red brick (?) and shell fragments, wood fibers. Some laminations. H_2S odor. FILL.	No Sheen
GP6-9.0	0.1	8.9	9.9	SP	Gray SAND with silty sand and abundant shell fragments, brown peat laminations. Wet. H_2S odor.	No Sheen
					Bottom of Boring at 12' Note: Water sample GP-6 collected from temporary well point.	



Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: GP70
Turn-around Requested: 2 week
Date: May 6 2004
Page: 1 of 3
ARI Client Company: Floyd Snider McCarthy
Phone: 206-292-2078
No. of Coolers: 2
Cooler Temps: 5.5, 5.5
Client Contact: TOM COLLIGAN
Client Project Name: CAP SANTE MARINE ENVIRONMENTAL
Client Project #: PDACSMF
Samplers: LAMANNA

Sample ID	Date	Time	Matrix	No. Containers	TPH-HCID	TPH-G/BTEX	TPH-Dx							Notes/Comments
GP1-2.0	5-4-04	252	S	2										
GP1-5.0		301		2	✓									
GP1-8.0		314		2	✓									
GP2-2.5		411		2										
GP2-5.0		423		2		✓	✓							
GP2-10.0		439		2	✓									
GP3-2.0		112		2										
GP3-6.0		120		2	✓	✓								
GP3-7.0		147		1		✓								2 oz ONLY
GP3-9.0		139		2	✓									

Analysis requests added per John LaManna mf 5/7/04

Comments/Special Instructions: HOLD FOR INSTRUCTIONS

Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Printed Name: JOHN LAMANNA	Printed Name: JEFF HAM	Printed Name:	Printed Name:
Company: FloydSnider McCarthy	Company: ARI	Company:	Company:
Date & Time: 5-6-04 250	Date & Time: 5/6/04 1450	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alernate retention schedules have been established by work-order or contract.

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number: GP70
Turn-around Requested: 2week
Date: MAY 6, 2004
Page: 2 of 3
ARI Client Company: FLOYD SNIDER McCARTHY
Phone: 206-292-2078
Client Contact: TOM COLLIGAN
No. of Coolers: 2
Cooler Temps: 5.5, 5.5
Client Project Name: CAP SANTE MARINE ENVIRONMENTAL
Client Project #: POACSMF
Samplers: LAMANNA

Sample ID	Date	Time	Matrix	No. Containers	TPH-HCID	TPH-G/BTEX	TPH-Dx						Notes/Comments
GP4-3.0	5-4-04	0947	S	2									
GP4-7.0	↓	1003	S	3		✓	✓						Extra 8-oz
GP4-10.0		1011	S	2	✓								
GP5B-1.5		1103	↓	2									
GP5B-6.0		1112		2		✓							
GP5B-9.0		1130		2	✓								~~2-oz only~~
GP6-2.5		821		2	✓								
GP6-5.0		828		2	✓								
GP6-9.0		835		2									~~8-oz only~~
~~GP6-9.0~~													

Comments/Special Instructions

Relinquished by: (Signature)	Received by: (Signature)	Relinquished by: (Signature)	Received by: (Signature)
Printed Name: JOHN LAMANNA	Printed Name: JEFF HAM	Printed Name:	Printed Name:
Company: FLOYD SNIDER McCARTHY	Company: ARI	Company:	Company:
Date & Time: 5-6-04 250	Date & Time: 5/6/04 1450	Date & Time:	Date & Time:

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alernate retention schedules have been established by work-order or contract.

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: MB-051304
METHOD BLANK

Lab Sample ID: MB-051304
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: NA
Date Received: NA

Date Analyzed: 05/13/04 12:44
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.10 g
Percent Moisture: NA

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	25	< 25 U	
108-88-3	Toluene	25	< 25 U	
100-41-4	Ethylbenzene	25	< 25 U	
	m,p-Xylene	50	< 50 U	
95-47-6	o-Xylene	25	< 25 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery

Trifluorotoluene	108%
Bromobenzene	103%

Gasoline Surrogate Recovery

Trifluorotoluene	110%
Bromobenzene	97.1%

BETX values reported in μg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP2-5.0
SAMPLE

Lab Sample ID: GP70E
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 14:20
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.075 g-dry-wt
Percent Moisture: 26.4%

CAS Number	**Analyte**	**RL**	**Result**	
71-43-2	**Benzene**	33	**270**	
108-88-3	**Toluene**	33	**140**	
100-41-4	Ethylbenzene	33	< 33 U	
	m,p-Xylene	67	**79**	
95-47-6	**o-Xylene**	33	**110**	
				GAS ID
	Gasoline Range Hydrocarbons	6.7	**250**	**GRO**

BETX Surrogate Recovery

Trifluorotoluene	76.3%
Bromobenzene	68.2%

Gasoline Surrogate Recovery

Trifluorotoluene	63.6%
Bromobenzene	72.3%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP3-6.0
SAMPLE

Lab Sample ID: GP70H
LIMS ID: 04-7163
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 14:47
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.079 g-dry-wt
Percent Moisture: 23.6%

CAS Number	Analyte	RL	Result	
71-43-2	Benzene	32	2,300	
108-88-3	Toluene	32	600	
100-41-4	Ethylbenzene	32	4,600	
	m,p-Xylene	64	17,000	
95-47-6	o-Xylene	32	2,200	
				GAS ID
	Gasoline Range Hydrocarbons	6.4	630	GAS

BETX Surrogate Recovery

Trifluorotoluene	96.2%
Bromobenzene	94.5%

Gasoline Surrogate Recovery

Trifluorotoluene	83.5%
Bromobenzene	104%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP3-7.0
SAMPLE

Lab Sample ID: GP70I
LIMS ID: 04-7164
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 15:15
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.070 g-dry-wt
Percent Moisture: 32.1%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	36	2,300	
108-88-3	Toluene	36	430	
100-41-4	Ethylbenzene	36	3,100	
	m,p-Xylene	72	11,000	
95-47-6	o-Xylene	36	1,400	
	Gasoline Range Hydrocarbons	7.2	320	GAS

BETX Surrogate Recovery	
Trifluorotoluene	74.0%
Bromobenzene	66.8%

Gasoline Surrogate Recovery	
Trifluorotoluene	61.3%
Bromobenzene	67.9%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP4-7.0
SAMPLE

Lab Sample ID: GP70L
LIMS ID: 04-7167
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 15:42
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.071 g-dry-wt
Percent Moisture: 30.6%

CAS Number	Analyte	RL	Result	
71-43-2	**Benzene**	**35**	**150**	
108-88-3	Toluene	35	< 35 U	
100-41-4	Ethylbenzene	35	< 35 U	
	m,p-Xylene	71	< 71 U	
95-47-6	o-Xylene	35	< 35 U	
				GAS ID
	Gasoline Range Hydrocarbons	**7.1**	**20**	**GRO**

BETX Surrogate Recovery

Trifluorotoluene	62.6%
Bromobenzene	60.5%

Gasoline Surrogate Recovery

Trifluorotoluene	64.1%
Bromobenzene	61.0%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP5B-6.0
SAMPLE

Lab Sample ID: GP70O
LIMS ID: 04-7170
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 16:09
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.080 g-dry-wt
Percent Moisture: 21.8%

CAS Number	Analyte	RL	Result	GAS ID
71-43-2	Benzene	31	580	
108-88-3	Toluene	31	350	
100-41-4	Ethylbenzene	31	710	
	m,p-Xylene	63	260	
95-47-6	o-Xylene	31	300	
	Gasoline Range Hydrocarbons	6.3	510	GRO

BETX Surrogate Recovery

Trifluorotoluene	94.1%
Bromobenzene	94.6%

Gasoline Surrogate Recovery

Trifluorotoluene	73.9%
Bromobenzene	112%

BETX values reported in μg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: LCS-051304
LCS/LCSD

Lab Sample ID: LCS-051304
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: PID2/AAR
LCSD: PID2/AAR
Date Analyzed LCS: 05/13/04 13:11
LCSD: 05/13/04 13:38

Sample Amount LCS: 0.10 g
LCSD: 0.10 g

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	1000	950	105%	1020	950	107%	2.0%
Toluene	4280	4410	97.1%	4300	4410	97.5%	0.5%
Ethylbenzene	1080	1390	77.7%	1100	1390	79.1%	1.8%
m,p-Xylene	4960	5410	91.7%	5000	5410	92.4%	0.8%
o-Xylene	1880	1990	94.5%	1910	1990	96.0%	1.6%

Results reported in µg/kg (ppb).
RPD calculated using sample concentrations per SW846.

Gasoline Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	120%	117%
Bromobenzene	106%	107%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHg - Toluene to Naphthalene
Page 1 of 1

Sample ID: LCS-051304
LCS/LCSD

Lab Sample ID: LCS-051304
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: PID2/AAR
LCSD: PID2/AAR
Date Analyzed LCS: 05/13/04 13:11
LCSD: 05/13/04 13:38

Sample Amount LCS: 0.10 g
LCSD: 0.10 g

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Gasoline Range Hydrocarbons	128	125	102%	128	125	102%	0.0%

Results reported in mg/kg (ppm).
RPD calculated using sample concentrations per SW846.

Gasoline Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	103%	101%
Bromobenzene	99.8%	99.3%

SOIL BETX SYSTEM MONITORING COMPOUND SUMMARY

Matrix: Soil

QC Report No: GP70

LIMS ID	Lab ID	Client ID	TFT	BB	TOT OUT
04-7160MB	051304MB	Method Blank	108%	103%	0
04-7160LC	051304LC	Lab Control	120%	106%	0
04-7160LCD	051304LCD	LCDuplicate	117%	107%	0
04-7160	GP70E	GP2-5.0	76%	68%	0
04-7163	GP70H	GP3-6.0	96%	94%	0
04-7164	GP70I	GP3-7.0	74%	67%	0
04-7167	GP70L	GP4-7.0	63%	60%	0
04-7170	GP70O	GP5B-6.0	94%	95%	0

	MB/LCS QC LIMITS	SAMPLE QC LIMITS
(TFT) = Trifluorotoluene	(78-125)	(10-123)
(BB) = Bromobenzene	(78-123)	(10-149)

Limits Updated - 12/01/99

* Values outside of advisory QC limits

D System Monitoring Compound diluted out

SOIL TPHg SYSTEM MONITORING COMPOUND SUMMARY

Matrix: Soil

QC Report No: GP70

LIMS ID	Lab ID	Client ID	TFT	BB	TOT OUT
04-7160MB	051304MBS	Method Blank	110%	97%	0
04-7160LC	051304LCS	Lab Control	103%	100%	0
04-7160LCD	051304LCDS	LCDuplicate	101%	99%	0
04-7160	GP70E	GP2-5.0	64%	72%	0
04-7163	GP70H	GP3-6.0	84%	104%	0
04-7164	GP70I	GP3-7.0	61%	68%	0
04-7167	GP70L	GP4-7.0	64%	61%	0
04-7170	GP70O	GP5B-6.0	74%	112%	0

	MB/LCS QC LIMITS	SAMPLE QC LIMITS
(TFT) = Trifluorotoluene	(66-130)	(10-118)
(BB) = Bromobenzene	(74-118)	(10-158)

Limits Updated - 04/26/04

Column to be used to flag recovery values

D System Monitoring Compound diluted out

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ORGANICS ANALYSIS DATA SHEET
NWTPH-HCID Method by GC/FID
Page 1 of 1
Matrix: Soil

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF

Data Release Authorized:
Reported: 05/24/04

ARI ID	**Sample ID**	**Extraction Date**	**Analysis Date**	**DL**	**Range**	**Result mg/kg**
MB-051204	Method Blank	05/12/04	05/21/04	1.0	Gas	< 25 U
04-7157					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	91.9%
GP70B	GP1-5.0	05/12/04	05/21/04	1.0	Gas	< 35 U
04-7157					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	104%
GP70C	GP1-8.0	05/12/04	05/21/04	1.0	Gas	< 31 U
04-7158					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	101%
GP70F	GP2-10.0	05/12/04	05/21/04	1.0	Gas	< 40 U
04-7161					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	120%
GP70H	GP3-6.0	05/12/04	05/21/04	1.0	**Gas**	**220**
04-7163					**Diesel**	**410**
					Oil	< 340 U
					o-Terphenyl	97.1%
GP70J	GP3-9.0	05/12/04	05/21/04	1.0	Gas	< 38 U
04-7165					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	102%
GP70M	GP4-10.0	05/12/04	05/21/04	1.0	Gas	< 190 U
04-7168					Diesel	< 190 U
					Oil	< 390 U
					o-Terphenyl	102%
GP70P	GP5B-9.0	05/12/04	05/21/04	1.0	**Gas**	**230**
04-7171					**Diesel**	**390**
					Oil	< 330 U
					o-Terphenyl	117%
GP70Q	GP6-2.5	05/12/04	05/21/04	1.0	Gas	< 31 U
04-7172					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	107%
GP70R	GP6-5.0	05/12/04	05/21/04	1.0	Gas	< 37 U
04-7173					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	98.7%

Gas value based on total peaks in the range from Toluene to C12.
Diesel value based on the total peaks in the range from C12 to C24.
Oil value based on the total peaks in the range from C24 to C38.

ORGANICS ANALYSIS DATA SHEET
NWTPH-HCID Method by GC/FID
Page 1 of 1

Sample ID: LCS-051204
LAB CONTROL

Lab Sample ID: LCS-051204
LIMS ID: 04-7157
Matrix: Soil
Data Release Authorized:
Reported: 05/24/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Extracted: 05/12/04
Date Analyzed: 05/21/04 14:36
Instrument/Analyst: FID/LJR

Sample Amount: 10.0 g
Final Extract Volume: 10 mL
Dilution Factor: 1.0

Range	**Lab Control**	**Spike Added**	**Recovery**
Diesel	1220	1500	81.3%

HCID Surrogate Recovery	
o-Terphenyl	115%

Results reported in mg/kg

HCID SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF

Client ID	O-TER	TOT OUT
051204MB	91.9%	0
051204LCS	115%	0
GP1-5.0	104%	0
GP1-8.0	101%	0
GP2-10.0	120%	0
GP3-6.0	97.1%	0
GP3-9.0	102%	0
GP4-10.0	102%	0
GP5B-9.0	117%	0
GP6-2.5	107%	0
GP6-5.0	98.7%	0

	LCS/MB LIMITS	QC LIMITS
(O-TER) = o-Terphenyl	(68-122)	(45-136)

Prep Method: SW3550B
Log Number Range: 04-7157 to 04-7173

TOTAL HCID RANGE HYDROCARBONS-EXTRACTION REPORT

Matrix: Soil
Date Received: 05/06/04

ARI Job: GP70
Project: Cap Sante Marine Environmental
POACSMF

ARI ID	Client ID	Sample Amt	Final Vol	Basis	Prep Date
04-7157-051204MB	Method Blank	10.0 g	10.0 mL	-	05/12/04
04-7157-051204LCS	Lab Control	10.0 g	10.0 mL	-	05/12/04
04-7157-GP70B	GP1-5.0	7.17 g	10.0 mL	D	05/12/04
04-7158-GP70C	GP1-8.0	7.95 g	10.0 mL	D	05/12/04
04-7161-GP70F	GP2-10.0	6.29 g	10.0 mL	D	05/12/04
04-7163-GP70H	GP3-6.0	1.46 g	10.0 mL	D	05/12/04
04-7165-GP70J	GP3-9.0	6.62 g	10.0 mL	D	05/12/04
04-7168-GP70M	GP4-10.0	1.29 g	10.0 mL	D	05/12/04
04-7171-GP70P	GP5B-9.0	1.50 g	10.0 mL	D	05/12/04
04-7172-GP70Q	GP6-2.5	8.06 g	10.0 mL	D	05/12/04
04-7173-GP70R	GP6-5.0	6.82 g	10.0 mL	D	05/12/04

Basis: D=Dry Weight W=As Received

Chain of Custody Record & Laboratory Analysis Request

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila WA 98168
206-695-6200 206-695-6201 (fax)

ARI Assigned Number:
Turn-around Requested: 2-week
Date: MAY 6 2004
Page: 3 of 3
ARI Client Company: FLOYD SNIDER McCARTHY
Phone: 206-292-2078
No. of Coolers:
Cooler Temps: 5.5
Client Contact: TOM COLLIGAN
Client Project Name: CAP SANTE MARINE ENVIRONMENTAL
Client Project #: PUACSMF
Samplers: LAMANNA

Sample ID	Date	Time	Matrix	No. Containers	BTEX TPH-G	TPH-Dx							Notes/Comments
TRIP BLANK	—	-	W	2	✓								
GP1	5-4-04	330	↓	5	✓	✓							
GP2	↓	500	↓	5	✓	✓							
GP3	↓	200	↓	3	✓								3-40mL ONLY
GP4	↓	1020	↓	5	✓	✓							
GP5B	↓	1150	↓	5	✓	✓							
GP6	↓	841	↓	5	✓	✓							

Comments/Special Instructions

	Relinquished by:	Received by:	Relinquished by:	Received by:
(Signature)				
Printed Name:	JOHN LaMANNA	JEFF HAM		
Company:	FLOYD SNIDER McCARTHY	ARI		
Date & Time:	5-6-04 250pm	5/6/04 1450		

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the Invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alernate retention schedules have been established by work-order or contract.

Port of Anacortes

Limited Environmental Due Diligence Investigation Report

Former Shell Oil Tank Farm
Cap Sante Marine Lease Area

Prepared for
Port of Anacortes
First Avenue & Commercial
Anacortes, Washington 98221

Prepared by
FLOYD | SNIDER
601 Union Street, Suite 600
Seattle, Washington 98101

November 2005

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Certification

This letter report was prepared by the staff of Floyd|Snider under the supervision of the Geologist and/or Engineer whose signature and license appears on this page.

Matt Woltman, L.E.G.
Engineering Geologist

1.0 INTRODUCTION

This letter presents the results of the limited environmental due diligence investigation performed for the Port of Anacortes (Port) at the Former Shell Oil Tank Farm (Shell) and Cap Sante Marine Lease Area (CSM) sites located in Anacortes, Washington (Figures 1 and 2). Soil and groundwater sampling were completed at both sites to characterize subsurface environmental conditions relative to known or suspected historical petroleum hydrocarbon contamination. The sampling and analysis at the CSM site is supplemental to the previous investigation of this site completed by Floyd Snider McCarthy, Inc. in 2004 (FSM 2004).

Field sampling was completed from August 24 to 26, 2005 in accordance with the Port-approved Scope of Work dated June 16, 2005. Soil and groundwater samples were collected from a total of 21 sampling locations as shown on Figures 1 and 2. The sampling objective for each location is summarized in Table 1.

The results of this investigation show that soil and groundwater at both sites contain concentrations of petroleum hydrocarbon contaminants at levels greater than the Method A cleanup levels defined by the Washington State Model Toxics Control Act (MTCA). In accordance with MTCA cleanup regulations (WAC 173-340-300), these findings are required to be reported to the Washington State Department of Ecology (Ecology) within 90 days of discovery.

2.0 FORMER SHELL OIL TANK FARM PROPERTY

2.1 Shell Site Description

The Shell site is located between 13th Street and 14th Street on the west side of Q Avenue in Anacortes (Figure 1). The site is owned by the Port and used as a parking lot for vehicles and boat trailers. The site is composed of fill material, mainly dredged sand, with interbedded layers of silt and clay. Coarse gravel overlies the dredged material and comprises the parking lot surface. Groundwater was encountered at each sampling location at depths ranging from 4.5 to 9 feet below ground surface (bgs). Due to the close proximity of the site to Fidalgo Bay, groundwater is assumed to be tidally influenced with a general flow direction to the east.

2.2 Shell Site Use History

The Port acquired the property in 1929 and leased the site to the Shell Oil Company and various distributors of gasoline, diesel, oil, and other chemical products.

Site layout drawings from the 1930s show that the original bulk petroleum storage facility included three 25,000 gallon, aboveground storage tanks (ASTs), one for diesel and two for gasoline. Supply lines connected to the ASTs extended to the east across Q Avenue to a historical pier located in the Cap Sante Federal Waterway. Diesel and gasoline were pumped from the historical pier to the bulk facility ASTs, where the fuel was distributed. The approximate location of the three historical ASTs and associated piping are presented on Figure 1.

Subsequent to the original site layout, two 12,500 gallon ASTs and one 4,000 gallon underground storage tank (UST) were installed in the early 1950s (locations are unknown). Diesel, gasoline, and stove oil were stored in the ASTs and dry cleaning solvent was stored in the smaller UST.

The site was operated as a bulk handling facility until approximately 1985 when it was abandoned and structures demolished.

In 1987, the Port performed an environmental investigation of the site. Two monitoring wells (MW-1 and MW-2) were installed at locations shown on Figure 1 and limited environmental analyses were performed on soil and groundwater samples obtained at these locations (Hart Crowser 1987). Petroleum hydrocarbon contamination was identified by the site investigation and in response, the impacted soil was partially removed. The extent of impacted soil removal is, however, unknown but suspected to be in the vicinity of MW-2.

2.3 Shell Site Field Investigation

The 14 locations shown on Figure 1 were sampled to determine the nature and extent of potential petroleum hydrocarbon contamination in soil and groundwater on, and downgradient from the Shell site. Sampling was performed using a hydraulically-powered Geoprobe® sampling device. Samples were collected in three intervals at each location: 0 to 4 feet bgs, 4 to 8 feet bgs, 8 to12 feet bgs. After each sample interval was retrieved, the core liner was opened, and the recovered soil was examined and logged. Any petroleum odors or sheen were noted and soil samples were collected into laboratory-supplied jars. The presence of sheen was determined by mixing small amounts of soil with water to visually identify iridescence (sheen test). The depth to groundwater was estimated based on moisture observations in recovered soil samples at each sampling location. Field observations were recorded on boring logs, as presented in Appendix A.

A groundwater sample was collected from each sampling location after completion of soil sampling. Groundwater was sampled using an expendable well point and retractable screen placed at a depth of approximately 3 to 4 feet below the observed water table. Samples were collected using a narrow-diameter polyethylene tubing inserted through the drill rod to the base of the screen and the groundwater was pumped with a peristaltic pump. The water was pumped until turbidity was observed to be reduced, or discharge stopped. After purging, the laboratory-supplied sample bottles were filled.

All sampling tools and equipment were decontaminated by washing with a solution of Alconox and water and rinsing with distilled water. New plastic liners were used for each soil sample. Dedicated polyethylene and silicone tubing were used to collect each water sample and discarded after use.

The samples were stored in an iced cooler and delivered to the laboratory according to chain-of-custody protocols. Copies of the Chain-of-Custody Records are included in the analytical laboratory reports, presented as Appendices B and C.

2.4 Shell Site Laboratory Analytical Results

In total, 25 soil samples and 12 groundwater samples were collected and submitted to the analytical laboratory for analysis as shown in Table 2. Additionally, two groundwater samples (at locations CSM04 and CSM14) were collected and archived. All laboratory data was reviewed for quality assurance and completeness, including confirmation that holding and extraction times were in compliance with the NWTPH and EPA methodologies.

Fourteen of the soil samples were selected for total petroleum hydrocarbons (TPH) analysis using the hydrocarbon identification method (Method NWTPH-HCID) to determine the presence and concentrations of gasoline, diesel, or heavy oil range petroleum hydrocarbons. The HCID method is the preferred analytical method if the type of petroleum contamination is unknown. Based on strong odors noted in the samples and results of the NWTPH-HCID tests, 12 soil samples were selected for further laboratory testing including TPH-gasoline, benzene, toluene, ethylbenzene and xylenes (TPH-Gasoline/BTEX) and 16 soil samples were selected for diesel and heavy oil range hydrocarbons (NWTPH-Dx) analysis.

Table 3 presents a comparison of the soil analytical data results to the MTCA Method A cleanup levels for TPH-gasoline, TPH-diesel, and BTEX. This comparison indicates that gasoline and diesel exceed the cleanup levels at three locations (SHL02, SHL05, and CSM13). Heavy oil and BTEX concentrations in the soil do not exceed the cleanup levels. Gasoline and BTEX soil results were qualified as estimated ("J") because the sample analysis was not performed within the recommended holding time as required under the new USEPA Method 5035A. These samples were, however, delivered to the laboratory within the required holding time and then refrigerated.

A specific VOC analysis was performed by the analytical laboratory to investigate the potential loss of VOCs from uncontrolled aerobic processes. Results of this analysis indicate that the difference in VOC concentrations between the samples stored frozen versus those that were only refrigerated is less than the error of the method (Appendix D).

Twelve groundwater samples were analyzed for TPH-Gasoline/BTEX and NWTPH-Dx. The groundwater data indicate that diesel and heavy oil are present in concentrations that exceed MTCA Method A cleanup levels at locations SHL02, SHL04, and CSM12 (Table 4). Gasoline and BTEX concentrations in groundwater do not exceed the cleanup levels.

2.5 Shell Site Summary of Results

The results of the sampling and analysis at the Shell site are summarized on Figure 1. Diesel and gasoline contamination is present in soil located in the vicinity of the historical gasoline and diesel supply lines at the site. Soil contamination in this area ranges from approximately 4 to 9.5 feet bgs. Diesel contamination was identified in groundwater at sampling locations near the supply lines and below the ASTs. Downgradient from the site, near the historical supply lines, soil diesel contamination, and groundwater diesel and heavy oil contamination is present. In this location, the depth of soil contamination was found to be at 10.5 to 11.5 feet bgs

3.0 CAP SANTE MARINE LEASE AREA

3.1 CSM Site Description

The CSM site is located within the Cap Sante Boat Haven. The site is owned by the Port and leased to Cap Sante Marine Ltd., for operation of a boatyard. Cap Sante Marine Ltd. also operates a fuel float offshore from the site. The fuel supply tanks are located within the leased area and are connected to the float by underground pipelines.

The site is composed of fill material, mainly of dredged sand with interbedded layers of silt and clay of variable thickness. The ground surface is asphalt in the roadway and a combination of asphalt, concrete slab, and gravel within the boatyard. Groundwater was encountered at each sampling location at depths ranging from 4 to 5.5 feet bgs. Due to the proximity of the site to Fidalgo Bay, groundwater at the site is assumed to be tidally influenced with a general flow direction to the east.

3.2 CSM Site Use History

The Port acquired the CSM property in 1956. The site has been used as a boatyard since approximately 1959. In the early 1980s, petroleum fuel was observed seeping into the marine waters at the Cap Sante Boat Haven at several locations near the fuel dock. In 1983, under order from the US Coast Guard, the Port installed a trench to control the seepage of fuel. The trench intercepted the fuel flowing through the soil. The trapped fuel was pumped from the trench and disposed at an off-site disposal facility. Several thousand gallons of fuel were recovered from the trench and the seepage was stopped.

The seepage was determined to be a result of leakage from the USTs and supply lines for the fuel dock facility. In 1985, the Port replaced these USTs with two new tanks; however, impacted soil associated with the historical leaks was not removed.

In 2004, the Port conducted a limited due diligence investigation in the roadway near the historical petroleum recovery trench to evaluate the extent of impacted soil. The results from the 2004 investigation indicated that both soil and groundwater in the vicinity of the historical spill exceeded MTCA criteria for petroleum hydrocarbon contaminants. During this investigation, samples were not collected from within the Cap Sante Marine Lease Area, hence the purpose of this investigation.

3.3 CSM Site Field Investigation

The CSM Site field investigation was performed to supplement the 2004 investigation of the site. A total of nine sampling locations were completed within the project area shown on Figure 2. Four borings (CSM07 through CSM10) are located adjacent to the fuel float USTs. One boring (CSM11) is located along the southern end of the existing Cap Sante Marine office building. Two borings (CSM05 and CSM06) are located adjacent to the former waste oil tank location within the CSM site. Two of the sampling locations (CSM04 and CSM14) were positioned outside of the lease boundary to establish boundary conditions for the site. The sampling location objectives for each location are summarized in Table 1.

CSM site sampling was completed using the same methodology as employed at the Shell site, as described above. Boring logs for the CSM sampling locations are presented in Appendix A and copies of the Chain–of-Custody Records are included as part of the laboratory reports presented in Appendices B and C.

3.4 CSM Site Laboratory Analytical Results

In total, 13 soil samples and 5 groundwater samples were collected, submitted to the laboratory, and analyzed for the petroleum hydrocarbon contaminants as shown in Table 5. Four additional groundwater samples were collected and archived (from locations CSM04, CSM05, CSM06, and CSM14). All laboratory data was reviewed for quality assurance and completeness, including confirmation that holding and extraction times were in compliance with the NWTPH and EPA methodologies.

Six of the soil samples were selected for TPH analysis by method NWTPH-HCID to determine the presence and concentrations of gasoline, diesel, or heavy oil (lube oil). Based on strong odors and other indicators observed in the recovered soil, seven soil samples were selected for laboratory testing for TPH-Gasoline/BTEX and NWTPH-Dx analysis.

Table 6 presents a comparison of the soil analytical data results to the MTCA Method A cleanup levels for TPH-gasoline, TPH-diesel and BTEX. This comparison shows that gasoline and benzene exceed the cleanup levels at five locations (CSM07 through CSM11). Diesel soil concentrations exceed cleanup levels at three locations (CSM08, CSM10, and CSM11). Heavy oil, toluene, ethylbenzene, and xylene concentrations in soil do not exceed cleanup levels. Gasoline and BTEX soil results were qualified as estimated ("J") because the sample analysis was not performed within the recommended holding time as required under the new USEPA Method 5035A. These samples were, however, delivered to the laboratory within the required holding time and then refrigerated.

A specific VOC analysis was performed by the analytical laboratory to investigate the potential loss of VOCs from uncontrolled aerobic processes. Results of this analysis indicate that the difference in VOC concentrations between the samples stored frozen versus those that were only refrigerated is less than the error of the method (Appendix D).

Five groundwater samples were analyzed for TPH-Gasoline/BTEX and NWTPH-Dx. The groundwater data indicate that gasoline, diesel, and benzene are present in concentrations that exceed MTCA Method A cleanup levels at locations CSM07 through CSM11 (Table 7). Heavy oil, toluene, ethylbenzene, and xylene concentrations in the groundwater do not exceed the cleanup levels.

3.5 CSM Site Summary of Results

The results of the sampling and analysis at the CSM site are summarized on Figure 2. Gasoline, diesel, and benzene contamination is present in the soil and groundwater adjacent to the existing USTs at the site. The soil and groundwater contamination was found to extend north of the USTs to the CSM office building. Previous investigations indicate that downgradient of the USTs, soil contamination exists and is associated with the historical tank and supply line leaks. Contamination was detected at depths ranging from approximately 4 to 13 feet bgs. No soil or groundwater contamination was identified near the former waste oil tank location or at the boundary sampling locations.

4.0 REFERENCES

Floyd Snider McCarthy, Inc. 2004. Letter Report re: Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven – Anacortes, Washington. Prepared for Port of Anacortes. 14 June.

Hart Crowser, Inc. 1987. *Preliminary Environmental Site Assessment, Petroleum Bulk Storage Facility, Anacortes, Washington*. Prepared for Port of Anacortes.

ANALYTICAL
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ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: MB-051304
METHOD BLANK

Lab Sample ID: MB-051304
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: NA
Date Received: NA

Date Analyzed: 05/13/04 12:44
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.10 g
Percent Moisture: NA

CAS Number	**Analyte**	**RL**	**Result**	GAS ID
71-43-2	Benzene	25	< 25 U	
108-88-3	Toluene	25	< 25 U	
100-41-4	Ethylbenzene	25	< 25 U	
	m,p-Xylene	50	< 50 U	
95-47-6	o-Xylene	25	< 25 U	
	Gasoline Range Hydrocarbons	5.0	< 5.0 U	---

BETX Surrogate Recovery	
Trifluorotoluene	108%
Bromobenzene	103%

Gasoline Surrogate Recovery	
Trifluorotoluene	110%
Bromobenzene	97.1%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP2-5.0
SAMPLE

Lab Sample ID: GP70E
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 14:20
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.075 g-dry-wt
Percent Moisture: 26.4%

CAS Number	Analyte	RL	Result
71-43-2	**Benzene**	**33**	**270**
108-88-3	**Toluene**	**33**	**140**
100-41-4	Ethylbenzene	33	< 33 U
	m,p-Xylene	**67**	**79**
95-47-6	**o-Xylene**	**33**	**110**

			GAS ID
Gasoline Range Hydrocarbons	**6.7**	**250**	**GRO**

BETX Surrogate Recovery

Trifluorotoluene	76.3%
Bromobenzene	68.2%

Gasoline Surrogate Recovery

Trifluorotoluene	63.6%
Bromobenzene	72.3%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP3-6.0
SAMPLE

Lab Sample ID: GP70H
LIMS ID: 04-7163
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 14:47
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.079 g-dry-wt
Percent Moisture: 23.6%

CAS Number	Analyte	RL	Result	
71-43-2	Benzene	32	2,300	
108-88-3	Toluene	32	600	
100-41-4	Ethylbenzene	32	4,600	
	m,p-Xylene	64	17,000	
95-47-6	o-Xylene	32	2,200	
				GAS ID
	Gasoline Range Hydrocarbons	6.4	630	GAS

BETX Surrogate Recovery

Trifluorotoluene	96.2%
Bromobenzene	94.5%

Gasoline Surrogate Recovery

Trifluorotoluene	83.5%
Bromobenzene	104%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP3-7.0
SAMPLE

Lab Sample ID: GP70I
LIMS ID: 04-7164
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 15:15
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.070 g-dry-wt
Percent Moisture: 32.1%

CAS Number	**Analyte**	**RL**	**Result**	
71-43-2	**Benzene**	36	2,300	
108-88-3	**Toluene**	36	430	
100-41-4	**Ethylbenzene**	36	3,100	
	m,p-Xylene	72	11,000	
95-47-6	**o-Xylene**	36	1,400	
				GAS ID
	Gasoline Range Hydrocarbons	7.2	320	**GAS**

BETX Surrogate Recovery

Trifluorotoluene	74.0%
Bromobenzene	66.8%

Gasoline Surrogate Recovery

Trifluorotoluene	61.3%
Bromobenzene	67.9%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ANALYTICAL
RESOURCES
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ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP4-7.0
SAMPLE

Lab Sample ID: GP70L
LIMS ID: 04-7167
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 15:42
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.071 g-dry-wt
Percent Moisture: 30.6%

CAS Number	Analyte	RL	Result	
71-43-2	**Benzene**	**35**	**150**	
108-88-3	Toluene	35	< 35 U	
100-41-4	Ethylbenzene	35	< 35 U	
	m,p-Xylene	71	< 71 U	
95-47-6	o-Xylene	35	< 35 U	
				GAS ID
	Gasoline Range Hydrocarbons	**7.1**	**20**	**GRO**

BETX Surrogate Recovery

Trifluorotoluene	62.6%
Bromobenzene	60.5%

Gasoline Surrogate Recovery

Trifluorotoluene	64.1%
Bromobenzene	61.0%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
NWTPHg by GC/FID
Page 1 of 1

Sample ID: GP5B-6.0
SAMPLE

Lab Sample ID: GP70O
LIMS ID: 04-7170
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Analyzed: 05/13/04 16:09
Instrument/Analyst: PID2/AAR

Purge Volume: 5.0 mL
Sample Amount: 0.080 g-dry-wt
Percent Moisture: 21.8%

CAS Number	Analyte	RL	Result	
71-43-2	Benzene	31	580	
108-88-3	Toluene	31	350	
100-41-4	Ethylbenzene	31	710	
	m,p-Xylene	63	260	
95-47-6	o-Xylene	31	300	
				GAS ID
	Gasoline Range Hydrocarbons	6.3	510	GRO

BETX Surrogate Recovery

Trifluorotoluene	94.1%
Bromobenzene	94.6%

Gasoline Surrogate Recovery

Trifluorotoluene	73.9%
Bromobenzene	112%

BETX values reported in µg/kg (ppb)
Gasoline values reported in mg/kg (ppm)

GAS: Indicates the presence of gasoline or weathered gasoline.
GRO: Positive result that does not match an identifiable gasoline pattern.

Quantitation on total peaks in the gasoline range from Toluene to Naphthalene.

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
BETX by Method SW8021BMod
Page 1 of 1

Sample ID: LCS-051304
LCS/LCSD

Lab Sample ID: LCS-051304
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: PID2/AAR
LCSD: PID2/AAR
Date Analyzed LCS: 05/13/04 13:11
LCSD: 05/13/04 13:38

Sample Amount LCS: 0.10 g
LCSD: 0.10 g

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Benzene	1000	950	105%	1020	950	107%	2.0%
Toluene	4280	4410	97.1%	4300	4410	97.5%	0.5%
Ethylbenzene	1080	1390	77.7%	1100	1390	79.1%	1.8%
m,p-Xylene	4960	5410	91.7%	5000	5410	92.4%	0.8%
o-Xylene	1880	1990	94.5%	1910	1990	96.0%	1.6%

Results reported in µg/kg (ppb).
RPD calculated using sample concentrations per SW846.

Gasoline Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	120%	117%
Bromobenzene	106%	107%

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPHg - Toluene to Naphthalene
Page 1 of 1

Sample ID: LCS-051304
LCS/LCSD

Lab Sample ID: LCS-051304
LIMS ID: 04-7160
Matrix: Soil
Data Release Authorized:
Reported: 05/17/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: NA
Date Received: NA

Instrument/Analyst LCS: PID2/AAR
LCSD: PID2/AAR
Date Analyzed LCS: 05/13/04 13:11
LCSD: 05/13/04 13:38

Sample Amount LCS: 0.10 g
LCSD: 0.10 g

Analyte	**LCS**	**Spike Added-LCS**	**LCS Recovery**	**LCSD**	**Spike Added-LCSD**	**LCSD Recovery**	**RPD**
Gasoline Range Hydrocarbons	128	125	102%	128	125	102%	0.0%

Results reported in mg/kg (ppm).
RPD calculated using sample concentrations per SW846.

Gasoline Surrogate Recovery

	LCS	**LCSD**
Trifluorotoluene	103%	101%
Bromobenzene	99.8%	99.3%

SOIL BETX SYSTEM MONITORING COMPOUND SUMMARY

Matrix: Soil

QC Report No: GP70

LIMS ID	Lab ID	Client ID	TFT	BB	TOT OUT
04-7160MB	051304MB	Method Blank	108%	103%	0
04-7160LC	051304LC	Lab Control	120%	106%	0
04-7160LCD	051304LCD	LCDuplicate	117%	107%	0
04-7160	GP70E	GP2-5.0	76%	68%	0
04-7163	GP70H	GP3-6.0	96%	94%	0
04-7164	GP70I	GP3-7.0	74%	67%	0
04-7167	GP70L	GP4-7.0	63%	60%	0
04-7170	GP70O	GP5B-6.0	94%	95%	0

	MB/LCS QC LIMITS	SAMPLE QC LIMITS
(TFT) = Trifluorotoluene	(78-125)	(10-123)
(BB) = Bromobenzene	(78-123)	(10-149)

Limits Updated - 12/01/99

* Values outside of advisory QC limits

D System Monitoring Compound diluted out

SOIL TPHg SYSTEM MONITORING COMPOUND SUMMARY

Matrix: Soil

QC Report No: GP70

LIMS ID	Lab ID	Client ID	TFT	BB	TOT OUT
04-7160MB	051304MBS	Method Blank	110%	97%	0
04-7160LC	051304LCS	Lab Control	103%	100%	0
04-7160LCD	051304LCDS	LCDuplicate	101%	99%	0
04-7160	GP70E	GP2-5.0	64%	72%	0
04-7163	GP70H	GP3-6.0	84%	104%	0
04-7164	GP70I	GP3-7.0	61%	68%	0
04-7167	GP70L	GP4-7.0	64%	61%	0
04-7170	GP70O	GP5B-6.0	74%	112%	0

	MB/LCS QC LIMITS	SAMPLE QC LIMITS
(TFT) = Trifluorotoluene	(66-130)	(10-118)
(BB) = Bromobenzene	(74-118)	(10-158)

Limits Updated - 04/26/04

\# Column to be used to flag recovery values

D System Monitoring Compound diluted out

ANALYTICAL RESOURCES INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPH-HCID Method by GC/FID
Page 1 of 1
Matrix: Soil

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF

Data Release Authorized:
Reported: 05/24/04

ARI ID	**Sample ID**	**Extraction Date**	**Analysis Date**	**DL**	**Range**	**Result mg/kg**
MB-051204	Method Blank	05/12/04	05/21/04	1.0	Gas	< 25 U
04-7157					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	91.9%
GP70B	GP1-5.0	05/12/04	05/21/04	1.0	Gas	< 35 U
04-7157					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	104%
GP70C	GP1-8.0	05/12/04	05/21/04	1.0	Gas	< 31 U
04-7158					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	101%
GP70F	GP2-10.0	05/12/04	05/21/04	1.0	Gas	< 40 U
04-7161					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	120%
GP70H	GP3-6.0	05/12/04	05/21/04	1.0	**Gas**	**220**
04-7163					**Diesel**	**410**
					Oil	< 340 U
					o-Terphenyl	97.1%
GP70J	GP3-9.0	05/12/04	05/21/04	1.0	Gas	< 38 U
04-7165					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	102%
GP70M	GP4-10.0	05/12/04	05/21/04	1.0	Gas	< 190 U
04-7168					Diesel	< 190 U
					Oil	< 390 U
					o-Terphenyl	102%
GP70P	GP5B-9.0	05/12/04	05/21/04	1.0	**Gas**	**230**
04-7171					**Diesel**	**390**
					Oil	< 330 U
					o-Terphenyl	117%
GP70Q	GP6-2.5	05/12/04	05/21/04	1.0	Gas	< 31 U
04-7172					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	107%
GP70R	GP6-5.0	05/12/04	05/21/04	1.0	Gas	< 37 U
04-7173					Diesel	< 50 U
					Oil	< 100 U
					o-Terphenyl	98.7%

Gas value based on total peaks in the range from Toluene to C12.
Diesel value based on the total peaks in the range from C12 to C24.
Oil value based on the total peaks in the range from C24 to C38.

FORM I

ANALYTICAL
RESOURCES
INCORPORATED

ORGANICS ANALYSIS DATA SHEET
NWTPH-HCID Method by GC/FID
Page 1 of 1

Sample ID: LCS-051204
LAB CONTROL

Lab Sample ID: LCS-051204
LIMS ID: 04-7157
Matrix: Soil
Data Release Authorized:
Reported: 05/24/04

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF
Date Sampled: 05/04/04
Date Received: 05/06/04

Date Extracted: 05/12/04
Date Analyzed: 05/21/04 14:36
Instrument/Analyst: FID/LJR

Sample Amount: 10.0 g
Final Extract Volume: 10 mL
Dilution Factor: 1.0

Range	**Lab Control**	**Spike Added**	**Recovery**
Diesel	1220	1500	81.3%

HCID Surrogate Recovery	
o-Terphenyl	115%

Results reported in mg/kg

HCID SURROGATE RECOVERY SUMMARY

Matrix: Soil

QC Report No: GP70-Floyd, Snider, McCarthy
Project: Cap Sante Marine Environmental
POACSMF

Client ID	O-TER	TOT OUT
051204MB	91.9%	0
051204LCS	115%	0
GP1-5.0	104%	0
GP1-8.0	101%	0
GP2-10.0	120%	0
GP3-6.0	97.1%	0
GP3-9.0	102%	0
GP4-10.0	102%	0
GP5B-9.0	117%	0
GP6-2.5	107%	0
GP6-5.0	98.7%	0

	LCS/MB LIMITS	QC LIMITS
(O-TER) = o-Terphenyl	(68-122)	(45-136)

Prep Method: SW3550B
Log Number Range: 04-7157 to 04-7173

TOTAL HCID RANGE HYDROCARBONS-EXTRACTION REPORT

ARI Job: GP70
Project: Cap Sante Marine Environmental
POACSMF

Matrix: Soil
Date Received: 05/06/04

ARI ID	Client ID	Sample Amt	Final Vol	Basis	Prep Date
04-7157-051204MB	Method Blank	10.0 g	10.0 mL	-	05/12/04
04-7157-051204LCS	Lab Control	10.0 g	10.0 mL	-	05/12/04
04-7157-GP70B	GP1-5.0	7.17 g	10.0 mL	D	05/12/04
04-7158-GP70C	GP1-8.0	7.95 g	10.0 mL	D	05/12/04
04-7161-GP70F	GP2-10.0	6.29 g	10.0 mL	D	05/12/04
04-7163-GP70H	GP3-6.0	1.46 g	10.0 mL	D	05/12/04
04-7165-GP70J	GP3-9.0	6.62 g	10.0 mL	D	05/12/04
04-7168-GP70M	GP4-10.0	1.29 g	10.0 mL	D	05/12/04
04-7171-GP70P	GP5B-9.0	1.50 g	10.0 mL	D	05/12/04
04-7172-GP70Q	GP6-2.5	8.06 g	10.0 mL	D	05/12/04
04-7173-GP70R	GP6-5.0	6.82 g	10.0 mL	D	05/12/04

Basis: D=Dry Weight W=As Received

Port of Anacortes

Limited Environmental Due Diligence Investigation Report

Former Shell Oil Tank Farm
Cap Sante Marine Lease Area

Figures

Note : All historical feature locations are approximate.

⊕	MW-1	Previous Monitoring Well Location and Number (Hart Crowser 1987)
⦶	SHL01	Sampling Location and Number
◐		Sampling Location Exceeds MTCA A Criteria for Soil
◑		Sampling Location Exceeds MTCA A Criteria for Groundwater

N

0 100 200

Approximate Scale in Feet

DWG NAME: F:\projects\PortOfAnacortes\POA-CSMSHELL\Figures\Figure1.dwg
DATE: 9/29/2005

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Port of Anacortes
Limited Environmental Due Diligence Investigation

Figure 1
Former Shell Oil Tank Farm
Exploration Locations & Existing Site Features

Note : All historical feature and UST locations are approximate.

● GP-1	Previous Sampling Location and Number (FSM 2004)
⦶ SHL01	Sampling Location and Number
⦶	Sampling Location Exceeds MTCA A Criteria for Soil
◑	Sampling Location Exceeds MTCA A Criteria for Groundwater

N

0 100 200

Approximate Scale in Feet

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**Port of Anacortes
Limited Environmental Due
Diligence Investigation**

Figure 2
Cap Sante Marine
Exploration Locations &
Existing Site Features

DWG NAME: F:\projects\PortOfAnacortes\POA-CSM Shell\Figures\Figure2.dwg
DATE: 9/29/2005

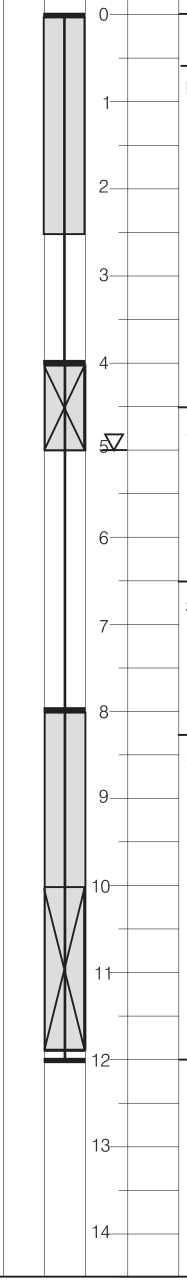
Log of Soil Boring CSM01

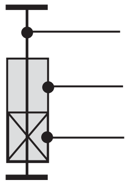
Floyd | Snider

Boring CSM01 Date August 24, 2005 Sheet 1 of 1
Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 75 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12’ ATD Water Level Depth 5.0’
Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					4-inches asphalt over 3-inches crushed base course gravel.	
				ML	Dark brown, dry, sandy SILT with rounded gravels. Soil transitions from dry to moist.	
CSM01-S1		4.0	5.0			
				CL	Gray, moist to wet, silty CLAY.	
				SP	Gray, wet, silty SAND with trace gravel.	
				CL	Gray, moist to wet, silty CLAY. Fine fibers of wood and layers of decayed organic matter to depth of 11 feet.	
CSM01-S2		10.0	11.8			
					Bottom of Boring at 12’ Note: Water sample CSM01-W1 collected from temporary well point.	



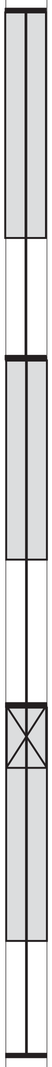


Log of Soil Boring CSM02

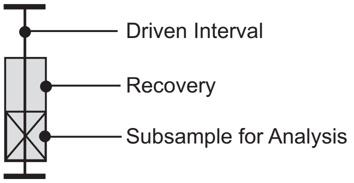
FLOYD | SNIDER

Floyd | Snider
Boring CSM02 Date August 24, 2005 Sheet 1 of 1
Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 75 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 8.0'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. ☐ Yes ☒ No



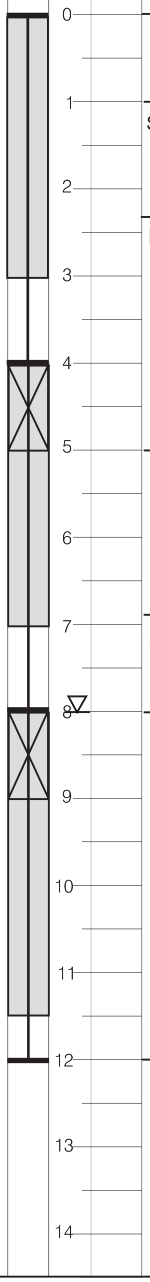
SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					0		2-inches asphalt over 5-inches crushed base course gravel.	
					1	SW	Dark gray to brown, dry to moist, very gravelly SAND.	
					2	SW	Dark gray, moist, slightly silty, slightly gravelly SAND.	
					3			
					4	ML	Gray to brown, moist, sandy SILT with wood fibers.	
					5	CL	Dark gray, moist to wet, silty CLAY with abundant wood fibers.	
					6			
					7			
CSM02-S1		8.0	8.7		8 ▽		Sand lenses and abundant wood debris.	
					9			
					10		No sand lenses and reduction in organic material below depth 10 feet.	
					11			
					12		Bottom of Boring at 12'	
					13		Note: Water sample CSM02-W1 collected from temporary well point.	
					14			



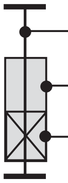
Log of Soil Boring CSM03

Floyd |Snider
Boring CSM03 Date August 24, 2005 Sheet 1 of 1
Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 75 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12’ ATD Water Level Depth 8.0’
Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No



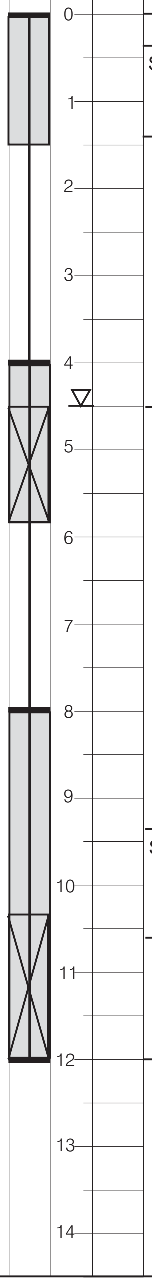
SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					0		6-inches asphalt over 6-inches crushed base course gravel.	
					1	SW	Dark brown to light gray, dry, slightly silty, very gravelly SAND.	
						ML	Light gray, dry to moist, slightly gravelly, sandy SILT with wood fibers and faint organic odor.	
CSM03-S1		4.0	5.0				Faint hydrocarbon odor.	
					5	CL	Gray, moist, silty CLAY.	
					7	SP	Dark brown to gray, moist to wet, slightly silty, slightly clayey SAND.	
CSM03-S2		8.0	9.0		8	CL	Dark brown to gray, wet, slightly sandy, silty CLAY with wood fibers and fuel odor.	
							No wood fibers below depth 9 feet.	
					12		Bottom of Boring at 12’ Note: Water sample CSM03-W1 collected from temporary well point.	



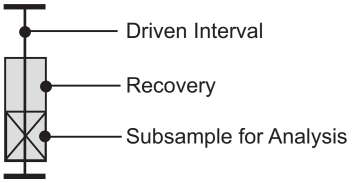
Log of Soil Boring CSM04

Floyd |Snider
Boring CSM04 Date August 25, 2005 Sheet 1 of 1
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 80 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 4.5'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. Yes [✓ No]



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					Asphalt.	
				SW	Brown, dry, silty, very gravelly SAND with scattered wood debris.	
				CL	Dark gray, moist, sandy silty CLAY with large wood chunk at depth 1.5 feet.	
CSM04-S1		4.5	5.8	ML	Dark gray, wet, sandy clayey SILT with abundant shell fragments.	No Sheen
				SW	Dark gray, wet, slightly silty, slightly gravelly SAND with abundant shell fragments and decayed organic odor. Chalky-white inclusion at bottom of sand unit.	
CSM04-S2		10.3	12.0	ML	Gray to brown, moist to wet, sandy, clayey SILT with decayed organic odor.	
					Bottom of Boring at 12' Note: Water sample CSM04-W1 collected from temporary well point.	



Log of Soil Boring CSM05

FLOYD | SNIDER

Floyd |Snider

Boring CSM05 Date August 25, 2005 Sheet 1 of 1

Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 65 degrees F

Drilled By Cascade Drilling

Drill Type/Method Geoprobe

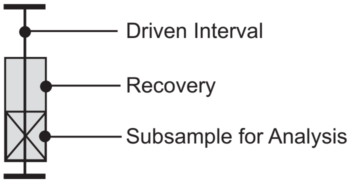
Sampling Method Direct Push, 4-Ft Cores

Bottom of Boring 12’ ATD Water Level Depth 5.0’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH		SAMPLE RECOVERY (FT)		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
		From	To					
					0	ML	1-inch crushed gravel over brown to gray, dry, sandy SILT with wood debris and faint fuel odor.	
					1	CL	Brown to gray, dry to moist, silty CLAY with wood debris.	
					2	SW	Brown to gray, moist to wet, slightly silty, gravelly SAND with abundant shell fragments.	
					3			
					4			
					5 ∇		No shell fragments depth 5 feet and 7.5 feet.	
CSM05-S1		5.0	6.5		6		Abundant wood debris in soil.	
					7		Abundant shell fragments.	
					8			
CSM05-S2		8.0	10.0		9	ML	Brown to gray, wet, slightly sandy, slightly clayey SILT with scattered organic material.	
					10			
					11			
					12		Bottom of Boring at 12’ Note: Water sample CSM05-W1 collected from temporary well point.	
					13			
					14			

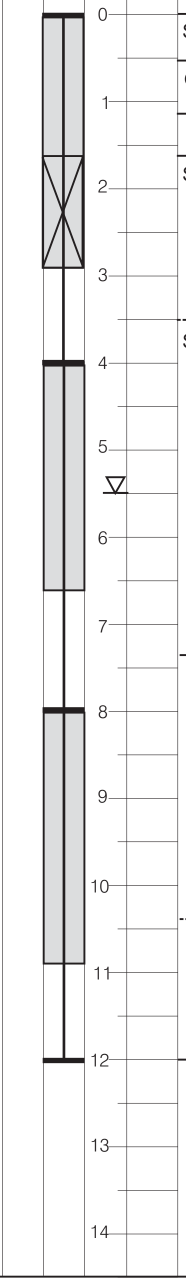


Log of Soil Boring CSM06

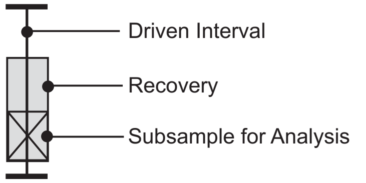
FLOYD | SNIDER

Floyd | Snider
Boring CSM06 Date August 25, 2005 Sheet 1 of 1
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 70 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12’ ATD Water Level Depth 5.5’
Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					SW	Brown to black, dry, gravelly SAND with black stain and odor.	
					GP	White to light gray, dry, sandy, angular GRAVEL.	
					CL	Dark brown, dry to moist CLAY with wood fibers.	
CSM06-S1		1.6	3.0		SW	Light to dark brown-gray, moist, silty SAND with shell fragments. Decayed wood observed in soil.	
					SW	Dark gray, wet, slightly clayey, silty, gravelly SAND with decayed organic material.	
					CL	Dark gray to brown, moist, slightly sandy, silty CLAY with decayed wood debris and pockets of organic material.	
					CL	Dark olive-green to gray, moist CLAY	
						Bottom of Boring at 12’ Note: Water sample CSM06-W1 collected from temporary well point.	



Log of Soil Boring CSM07

FLOYD | SNIDER

Floyd | Snider

Boring CSM07 Date August 25, 2005 Sheet 1 of 1

Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 80 degrees F

Drilled By Cascade Drilling

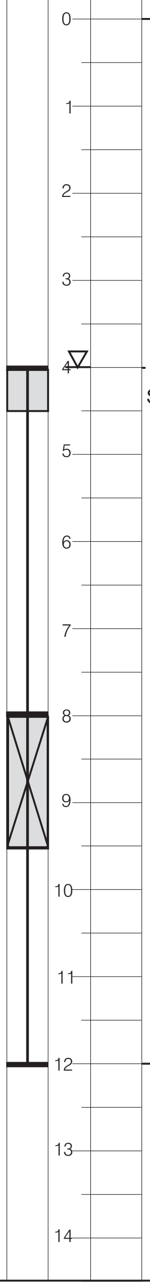
Drill Type/Method Geoprobe

Sampling Method Direct Push, 4-Ft Cores

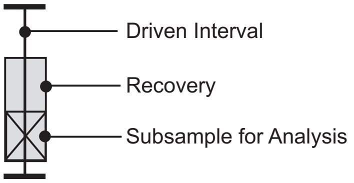
Bottom of Boring 12' ATD Water Level Depth 4.0'

Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. ☐ Yes ☒ No



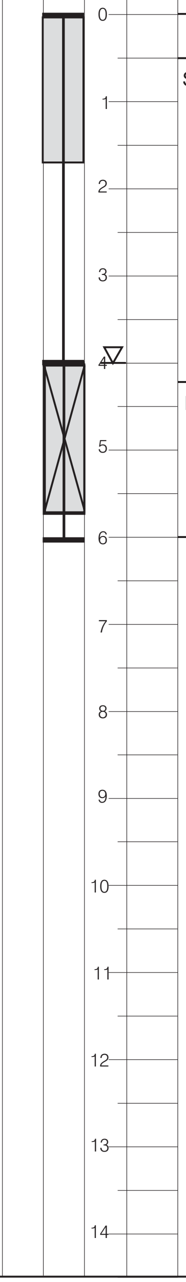
SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
						12-inches concrete slab over crushed base course gravel over clean SAND (Tank Fill).	
					SW	Gray, wet, gravelly SAND with trace silty clay layers and faint fuel odor (Tank Fill).	
CSM07-S1		8.0	9.5			Strong fuel odor in sample.	Sheen on Sample
						Bottom of Boring at 12' Notes: 1) Water sample CSM07-W1 collected from temporary well point. 2) Upper four feet of soil removed by Vac-Truck due to close proximity of boring to underground fuel tanks.	



Log of Soil Boring CSM08

Floyd | Snider
Boring CSM08 Date August 25, 2005 Sheet 1 of 1
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 80 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 6' (See Note 2) ATD Water Level Depth 4.0'
Ground Surface Elevation Approx. 12' MLLW

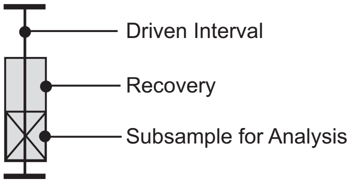
Obs. Well Install. Yes [✓ No]



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
						2-inches asphalt over 4-inches crushed base course.	
					SW	Light gray, dry to moist, gravelly SAND (Tank Fill) with light fuel odor. Clay lense in recovered sample.	
CSM08-S1		4.0	5.7		ML	Gray, wet, sandy SILT with shell fragments and strong fuel odor.	

Bottom of Boring at 6'

Notes:
1) Water sample CSM08-W1 collected from temporary well point.
2) Boring stopped at depth 6 feet due to presence of buried concrete slab.



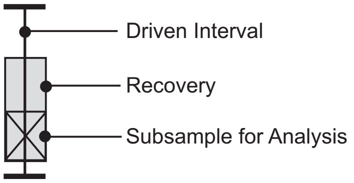
Log of Soil Boring CSM09

FLOYD | SNIDER

Floyd |Snider
Boring CSM09 Date August 25, 2005 Sheet 1 of 1
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 80 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 5.5'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. Yes [✓ No]

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					0		12-inches concrete slab over crushed base course gravel.	
					4	SP	Gray, moist, clayey, very silty SAND with shell fragments, decayed organic matter, and fuel odor.	
					▽ 5.5		3-inch, gray, silty clay layer with organic material	
					7.5	SP	Gray to black, slightly silty SAND with abundant shell fragments. Strong fuel odor in sample.	
CSM09-S1		8.0	10.0					
					10	ML	Dark gray, moist, clayey SILT with trace organic matter and light fuel odor.	
CSM09-S2		10.0	12.0					
					12		Bottom of Boring at 12' Notes: 1) Water sample CSM09-W1 collected from temporary well point. 2) Upper four feet of soil removed by Vac-Truck due to close proximity of boring to underground fuel tanks.	



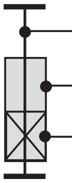
Log of Soil Boring CSM10

FLOYD | SNIDER

Floyd | Snider
Boring CSM10 Date August 25, 2005 Sheet 1 of 2
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 80 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 16’ ATD Water Level Depth See Note 3
Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	Depth	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					0		12-inches concrete slab over crushed base course gravel.	
					1			
					2			
					3			
				No Sample Recovery	4			
					5			
					6			
					7			
				No Sample Recovery	8			
					9			
					10			
					11			
CSM10-S1		12.0	13.0		12	CL	Dark brown to olive gray, moist, slightly silty CLAY with abundant shells and strong fuel odor.	Sheen on Sample
					13			
					14			



Notes:
1) Water sample CSM010-W1 collected from temporary well point.
2) Upper four feet of soil removed by Vac-Truck due to close proximity of boring to underground fuel tanks.
3) Water table depth not available due to no recovery in top 12 feet of boring.

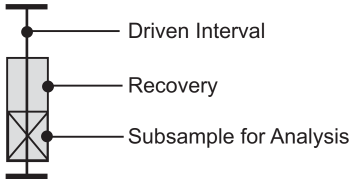
Log of Soil Boring CSM10

FLOYD | SNIDER

Floyd | Snider
Boring CSM10 Date August 25, 2005 Sheet 2 of 2
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 80 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 16’ ATD Water Level Depth See Note 3
Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					15	CL	Dark brown to olive gray, moist, slightly silty CLAY with abundant shells and strong fuel odor.	
					16			
					17		Bottom of Boring at 16’ Notes: 1) Water sample CSM010-W1 collected from temporary well point. 2) Upper four feet of soil removed by Vac-Truck due to close proximity of boring to underground fuel tanks. 3) Water table depth not available due to no recovery in top 12 feet of boring.	
					18			
					19			
					20			
					21			
					22			
					23			
					24			
					25			
					26			
					27			
					28			
					29			

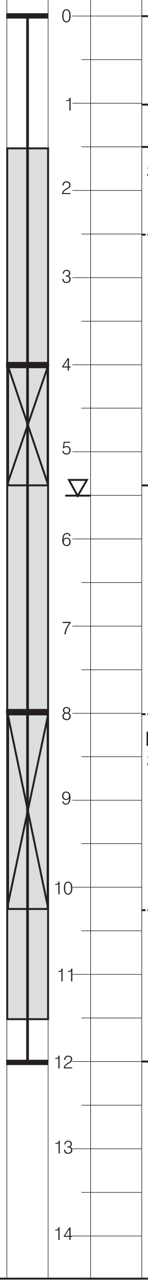


Log of Soil Boring CSM11

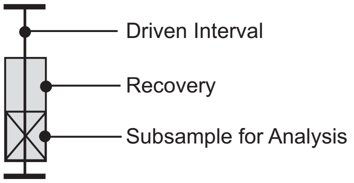
FLOYD | SNIDER

Floyd | Snider
Boring CSM11 Date August 25, 2005 Sheet 1 of 1
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 80 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 5.5'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					Concrete slab.	
					Crushed base course gravel.	
				SW	Light to dark gray, moist, slightly silty SAND with scattered gravel and abundant shell fragments.	
CSM11-S1		4.0	5.3	SP	Light gray to brown, moist, silty SAND with silt inclusions, organic matter, and scattered shell fragments.	No Sheen
				ML	Dark gray, moist to wet, slightly sandy, clayey SILT with shell fragments and decayed organic matter. Strong fuel odor.	
CSM11-S2		8.0	10.3	ML-SW	Dark gray, moist to wet, slightly sandy, clayey SILT with layers of wet, gray, silty SAND and decayed wood debris. Very strong fuel odor. Sheen observed on water within soil sample interval.	
				ML	Dark gray, moist to wet, slightly sandy, clayey SILT with shell fragments and decayed organic matter.	
					Bottom of Boring at 12' Notes: 1) Water sample CSM11-W1 collected from temporary well point.	

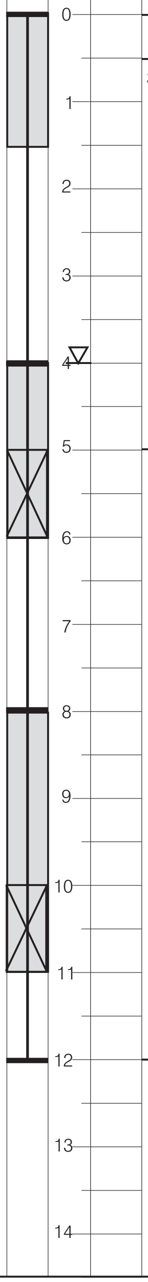


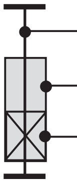
Log of Soil Boring CSM12

FLOYD | SNIDER

Floyd |Snider
Boring CSM12 Date August 26, 2005 Sheet 1 of 1
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 65 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12’ ATD Water Level Depth 4.0’
Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH		SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
		From	To				
						Asphalt with abundant gravel.	
					SW	Light brown to gray, moist to wet, slightly silty, gravelly SAND.	
CSM12-S1		5.0	6.0		ML	Light gray to brown, wet, sandy SILT.	
						Wood fibers present in recovered soil.	
						3-inch layer of black sand with wood debris and oil odor.	
CSM12-S2		10.0	11.0				Sheen on Sample
						Bottom of Boring at 12’ Notes: 1) Water sample CSM12-W1 collected from temporary well point.	

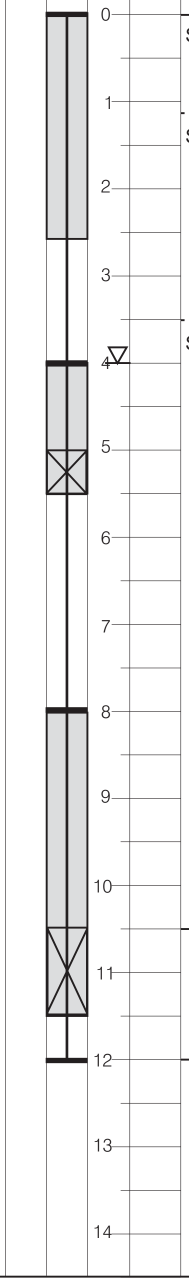


Log of Soil Boring CSM13

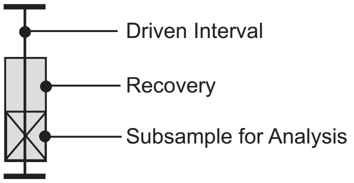
FLOYD | SNIDER

Floyd | Snider
Boring CSM13 Date August 26, 2005 Sheet 1 of 1
Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 65 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 4.0'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				SW	Light brown to gray, dry, silty, very gravelly SAND.	
				SW	Dark gray, moist to wet, slightly silty to silty SAND with abundant shell fragments.	
				SW	Brown, wet, slightly silty, slightly gravelly SAND with scattered wood fibers and lenses of fine gray sand.	
CSM13-S1		5.0	5.5			
					Faint petroleum odor and large wood debris.	
				CL	Dark gray to olive, moist, silty CLAY with scattered organic debris and scattered shell fragments.	
CSM13-S2		10.5	11.5			
					Bottom of Boring at 12' Notes: 1) Water sample CSM13-W1 collected from temporary well point.	



Log of Soil Boring CSM14

FLOYD | SNIDER

Floyd |Snider

Boring CSM14 Date August 26, 2005 Sheet 1 of 1

Job Cap Sante Marine Phase 2 Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 70 degrees F

Drilled By Cascade Drilling

Drill Type/Method Geoprobe

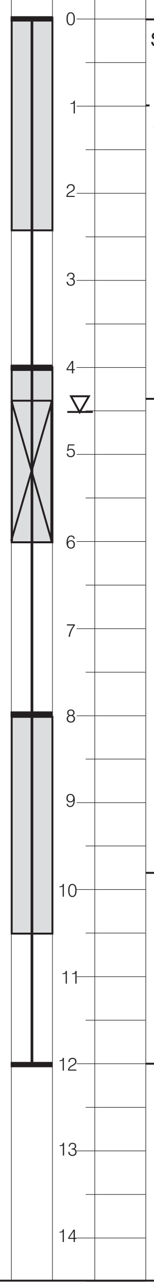
Sampling Method Direct Push, 4-Ft Cores

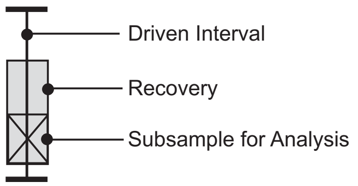
Bottom of Boring 12’ ATD Water Level Depth 4.5’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				SW	Light brown to gray, dry, silty, very gravelly SAND. 2-inch sandy silt layer.	
				SP	Dark gray, dry to moist SAND with black clay inclusions, silt lenses, and abundant shell fragments.	
CSM14-S1		4.3	6.0	ML	Dark gray, moist, sandy SILT with organic inclusions and interbedded layers of sand with shell fragments.	
				CL	Dark gray, moist, silty CLAY.	
					Bottom of Boring at 12’ Notes: 1) Water sample CSM14-W1 collected from temporary well point.	





Log of Soil Boring SHL01

FLOYD | SNIDER

Floyd |Snider

Boring SHL01 Date August 24, 2005 Sheet 1 of 1

Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 65 degrees F

Drilled By Cascade Drilling

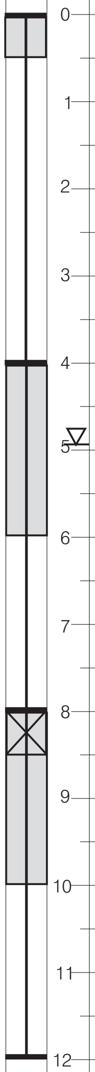
Drill Type/Method Geoprobe

Sampling Method Direct Push, 4-Ft Cores

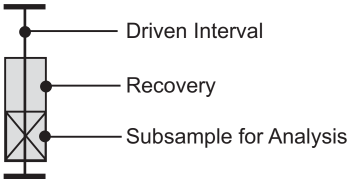
Bottom of Boring 12’ ATD Water Level Depth 4.9’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				0	SW	Light brown, dry, silty, gravelly SAND with angular debris. FILL.	
				6	GW-GM	Gray, moist to wet, SAND with varrying amounts of gravel, abundant shells, and scattered wood debris.	
SHL01-S1		8.0	8.5	8		Slight gas/diesel odor at top of sample.	No Sheen
				10		Contact with olive-green, sandy SILT at bottom of recovered soil.	
				12		Bottom of Boring at 12’ Note: Water sample SHL01-W1 collected from temporary well point.	



Log of Soil Boring SHL02

FLOYD | SNIDER

Floyd |Snider

Boring SHL02 Date August 24, 2005 Sheet 1 of 1

Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 70 degrees F

Drilled By Cascade Drilling

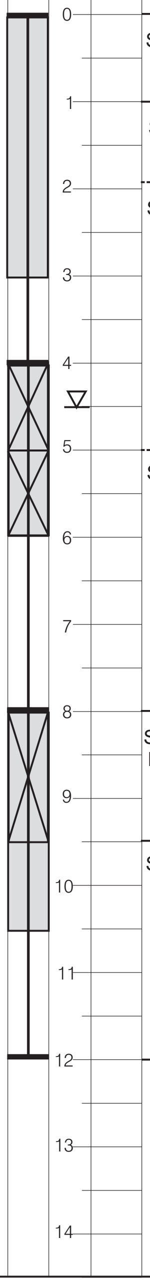
Drill Type/Method Geoprobe

Sampling Method Direct Push, 4-Ft Cores

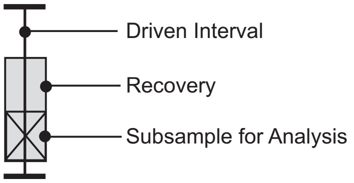
Bottom of Boring 12’ ATD Water Level Depth 4.5’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					SW	Light brown to gray, dry, gravelly SAND with scattered brick and shell fragments. Light fuel odor.	
					SP	Light brown, dry, silty SAND.	
					SM	Light to dark brown-gray, moist, silty SAND.	
SHL02-S1		4.0	5.0			Diesel odor in sample.	
SHL02-S2		5.0	6.0		SM	Dark gray to black, wet, slightly gravelly SAND with shell fragments. Strong diesel odor.	
SHL02-S3		8.0	9.5		SM-ML	Dark gray, wet, silty, clayey SAND grading to gray, silty CLAY. Slight odor in sample.	
					SW	Light gray, wet, gravelly SAND with shell fragments. Slight odor in soil.	
						Bottom of Boring at 12’ Note: Water sample SHL02-W1 collected from temporary well point.	



Log of Soil Boring SHL03

FLOYD | SNIDER

Floyd |Snider

Boring SHL03 Date August 24, 2005 Sheet 1 of 1

Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 70 degrees F

Drilled By Cascade Drilling

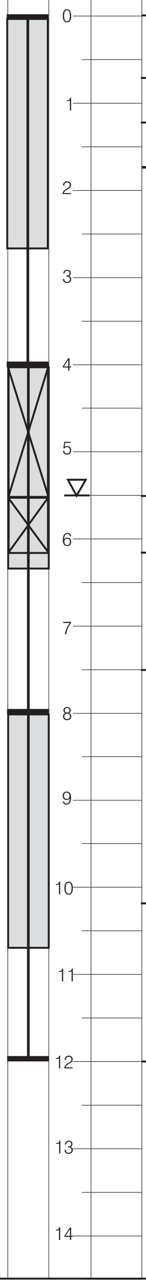
Drill Type/Method Geoprobe

Sampling Method Direct Push, 4-Ft Cores

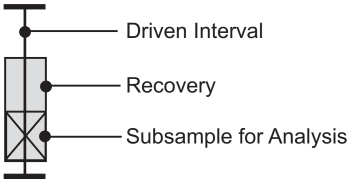
Bottom of Boring 12’ ATD Water Level Depth 5.5’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No



SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				SW	Light brown to gray, gravelly SAND with shell fragments.	
				CL	Light brown, dry, slightly sandy, silty CLAY with trace gravel.	
				SW	Light brown, dry, slightly silty, slightly gravelly SAND with shell fragments.	
SHL03-S1		4.0	5.5	ML	Brown, dry, clayey SILT with some sand, large gravels, shell fragments, and brown reduced veins of organic matter.	
SHL03-S2		5.5	6.2	SW	Dark gray, wet, slightly gravelly SAND with abundant shell fragments.	
				ML	Dark gray, wet, clayey SILT with trace sand. Fuel odor on soil.	
				SP	Dark gray, wet, slightly gravelly to gravelly SAND with abundant shell fragments.	
				ML	Dark gray, wet slightly clayey, sandy SILT.	
					Bottom of Boring at 12’ Note: Water sample SHL03-W1 collected from temporary well point.	



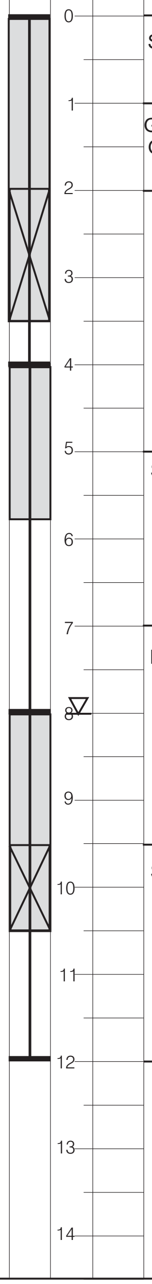
Log of Soil Boring SHL04

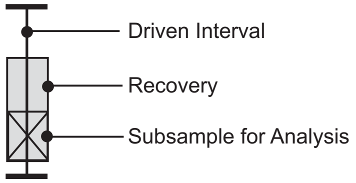
FLOYD | SNIDER

Floyd | Snider
Boring SHL04 Date August 24, 2005 Sheet 1 of 1
Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 75 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12' ATD Water Level Depth 8.0'
Ground Surface Elevation Approx. 12' MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
				SW	Light gray to brown, dry, silty, gravelly SAND.	
				GW-GM	Light gray, dry, silty, sandy GRAVEL.	
SHL04-S1		2.0	3.5	CL	Light to dark brown, moist, slightly sandy, silty CLAY with scattered gravel.	No Sheen
				SP	Brown to gray, moist, clayey, gravelly SAND with shell fragments. Slight fuel odor.	
				ML	Brown to gray, moist to wet, clayey SILT with some sand, shell fragments, and decaying wood. Fuel/petroleum odor on soil.	No Sheen
SHL04-S2		9.5	10.5	SP	Gray, wet SAND. Fuel/petroleum odor on sample.	
					Bottom of Boring at 12' Note: Water sample SHL04-W1 collected from temporary well point.	





Log of Soil Boring SHL05

FLOYD | SNIDER

Floyd |Snider

Boring SHL05 Date August 24, 2005 Sheet 1 of 1

Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 75 degrees F

Drilled By Cascade Drilling

Drill Type/Method Geoprobe

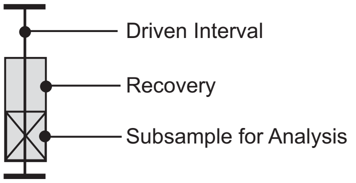
Sampling Method Direct Push, 4-Ft Cores

Bottom of Boring 12’ ATD Water Level Depth 9.0’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH From	DEPTH To	SAMPLE RECOVERY (FT)			USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
					0 1		SW	Light brown, dry, silty, gravelly SAND with trace shell fragments. Abundant shell fragments.	
SHL05-S1		2.0	3.5		2		ML	Light gray, dry, sandy SILT with black banding. Fuel odor on black bands.	
					3		GW	Dark gray, dry, sandy GRAVEL with shell fragments. Fuel odor on sample.	
SHL05-S2		4.4	6.2		4 5 6		CL	Gray to olive-green, moist, sandy, silty CLAY with shell fragments. Slight fuel odor on sample. Large wood fragment at depth 5.4 feet. Heavy fuel odor at depth 5.9 feet.	No Sheen
SHL05-S3		8.0	10.0		7 8 9 ∇ 10 11		SW	Gray, moist to wet, slightly silty, gravelly SAND with clay inclusions and scattered shell fragments. Slight to strong fuel odor throughout sample.	No Sheen
					12 13 14			Bottom of Boring at 12’ Note: Water sample SHL05-W1 collected from temporary well point.	



Log of Soil Boring SHL06

FLOYD | SNIDER

Floyd | Snider

Boring SHL06 Date August 26, 2005 Sheet 1 of 1

Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL

Logged By Woltman/Satterberg Weather Sunny, 70 degrees F

Drilled By Cascade Drilling

Drill Type/Method Geoprobe

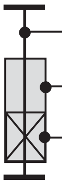
Sampling Method Direct Push, 4-Ft Cores

Bottom of Boring 12’ ATD Water Level Depth 5.0’

Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH		SAMPLE RECOVERY (FT)		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
		From	To					
					0	SP	3-inches gravel over dark brown, dry, silty, gravelly SAND.	
					1	ML	Dark brown to gray, dry, slightly clayey, slightly sandy SILT with trace gravel. 6-inch layer of light brown, dry, poorly graded sand.	
					3	ML	Gray, moist to wet, sandy SILT with increasing clay content at bottom of unit.	
SHL06-S1		4.0	6.0		5 ∇			
					6	SP	Dark gray, wet, slightly silty SAND with abundant shell fragments.	
					7	SP	Light to dark gray, wet SAND with abundant shell fragments.	
					12		Bottom of Boring at 12’ Note: Water sample SHL06-W1 collected from temporary well point.	
					13			
					14			



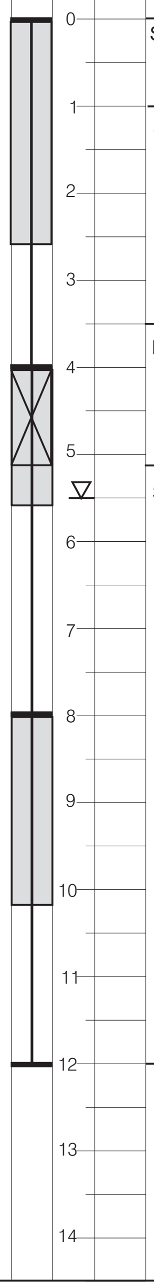
Log of Soil Boring SHL07

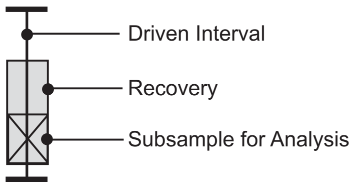
Floyd | Snider

Boring SHL07 Date August 26, 2005 Sheet 1 of 1
Job Former Shell Tank Farm Due Diligence Job No. POA CSMSHELL
Logged By Woltman/Satterberg Weather Sunny, 70 degrees F
Drilled By Cascade Drilling
Drill Type/Method Geoprobe
Sampling Method Direct Push, 4-Ft Cores
Bottom of Boring 12’ ATD Water Level Depth 5.5’
Ground Surface Elevation Approx. 12’ MLLW

Obs. Well Install. ☐ Yes ☒ No

SAMPLE ID	PID (ppm)	DEPTH		USCS Symbol	DESCRIPTION: color, texture, moisture MAJOR CONSTITUENT. NON-SOIL SUBSTANCES: Odor, staining, sheen, scrap, slag, etc.	Sheen Test
		From	To			
				SW	3-inches sandy GRAVEL over 3-inches dry, brown, silty SAND with gravel over 6-inches dry, light brown, gravelly SAND.	
				SP	Dark gray, moist, slightly gravelly SAND with silty clay inclusions.	
SHL07-S1		4.0	5.1	ML	Dark gray, moist to wet, slightly clayey, sandy SILT.	
				SP	Dark gray, wet, slightly gravelly, SAND with abundant shell fragments and silt inclusions.	
					Bottom of Boring at 12’ Note: Water sample SHL07-W1 collected from temporary well point.	





Port of Anacortes

Limited Environmental Due Diligence Investigation Report

Former Shell Oil Tank Farm
Cap Sante Marine Lease Area

Appendix B
Laboratory Analytical Report for Soil

AVAILABLE UPON REQUEST

Port of Anacortes

Limited Environmental Due Diligence Investigation Report

Former Shell Oil Tank Farm
Cap Sante Marine Lease Area

Appendix C
Laboratory Analytical Report for Groundwater

AVAILABLE UPON REQUEST

Port of Anacortes

Limited Environmental Due Diligence Investigation Report

Former Shell Oil Tank Farm Cap Sante Marine Lease Area

Appendix D
ARI Case Study
VOC Hold Time Analysis

AVAILABLE UPON REQUEST

APPENDIX F

Dredged Material Characterization Report for Cap Sante Marina

Port of Anacortes
Post Office Box 297
Anacortes, Washington 98221

Dredge Material Characterizatio
Cap Sante Marina
Anacortes, Washington

HARTCROWSER
Delivering smarter solutions

Prepared for
Cap Sante Marina

June 16, 2000
J-4974

CONTENTS

CONTENTS (Continued)

DREDGE MATERIAL CHARACTERIZATION
CAP SANTE MARINA
ANACORTES, WASHINGTON

1.0 INTRODUCTION

This report presents the results of the Dredged Material Management Program (DMMP) sediment characterization performed at the Cap Sante Marina (Cap Sante) located in Anacortes, Washington (Figure 1). The purpose of this study is to characterize the sediments proposed to be removed by dredging at the site relative to the DMMP chemical, biological toxicity, and bioaccumulation criteria for deposit at the DMMP-designated Rosario Strait open water disposal site. This characterization of proposed dredge material is necessary to complete the permitting for the dredging project.

To complete the dredge material characterization of Cap Sante, sediment core samples were collected from each of the twelve Dredge Material Management Units (DMMUs) designated in the project Sampling and Analysis Plan (Hart Crowser, 1998; Figure 2). Composite samples representative of each of the twelve DMMUs were analyzed for DMMP-specified chemical, conventional, and grain size parameters. Additionally, as the result of marginal Screening Level (SL) exceedences of select Polycyclic Aromatic Hydrocarbons (PAHs) in a single DMMU (C8), biological toxicity testing was performed on sediment samples from that DMMU. Further, bioaccumulation testing was performed on composite samples representative of the nine DMMUs exceeding the DMMP-Bioaccumulation Trigger (BT) value for tributyltin.

The results of this dredge material characterization show that the proposed Cap Sante dredge materials meet the chemical, biological toxicity, and bioaccumulation suitability criteria for open-water disposal. Biological toxicity testing results indicate that the chemical SL exceedences detected in DMMU C8 do not result in significant toxicity to marine test organisms. Bioaccumulation testing shows that significant biological accumulation effects are not likely to result from exposure to the dredged materials exceeding the tributyltin BT.

This sediment characterization program was performed in accordance with the DMMP-approved Sampling and Analysis Plan (SAP; Hart Crowser, 1998) and Sampling Plan Addendum (Addendum; Hart Crowser, 1999) prepared for this project. Sediment sampling, handling, and analysis were conducted in general accordance with the protocols established by the DMMP (1998), Puget Sound Estuary Program (PSEP, 1989a, 1989b, and 1989c), and US Environmental

Protection Agency (EPA, 1983a, 1983b, 1986, 1991a, 1991b, and 1991c), as specified in the SAP and Addendum.

1.1 Background Information

The Port of Anacortes proposes to perform maintenance and navigational dredging at the Cap Sante Marina (Cap Sante) located on the eastern shoreline of the City of Anacortes (Figure 1). The project design elevation for Cap Sante is -12 feet Mean Lower Low Water (MLLW). Presently, the current mudline of much of the central basin of the marina lies between elevations -8 and -13 feet MLLW; whereas, along the boundaries of the marina, sediments comprising the dredge prism range up to 14 feet in thickness. The proposed dredge project will be conducted in two phases. The initial phase will be maintenance dredging of the southern marina basin. The second phase will be performed in the northern portion of the marina basin and along the marina boundaries. The estimated volume of dredge material is approximately 345,000 cubic yards (cy). The preferred disposal option for this project is the DMMP-designated Rosario Straight unconfined open-water site.

2.0 SEDIMENT SAMPLING AND ANALYSIS

2.1 Sample and Survey Location Control

Sampling locations for this study were selected to provide adequate spatial coverage of the proposed dredge prism material located within each of the twelve DMMUs identified for the project. Samples collected were intended to be representative of the sediment conditions of the dredge prism. In total, 47 locations within the project area were sampled as shown on Figure 2. Proposed sampling location C1-04 was not sampled due to foul weather conditions. Subsequently, sediment representative of C1-04 was not included in the composite analysis of DMMU C1

Sediment sampling was accomplished using the hand coring methodology described in the SAP. Initial sediment sampling was performed on February 17-23, 1999. Re-sampling for the purpose of collecting bioaccumulation test sediments was performed on January 12-14, 2000. A summary of field sampling results is presented in Table 1.

The sampling locations were surveyed using an on-board Differential Global Positioning System (GPS). Latitude and longitude coordinates for the sampling locations are presented in Table 1 Based on poor GPS coverage, several sampling locations were hand surveyed using known points identified on a scaled map of the site.

2.2 Sediment Sampling, Handling, and Analysis

Upon retrieval of the sediment core samples, the acceptability of each core was assessed relative to the criteria established in the SAP. After acceptance, the core samples were logged and subsampled in the field. The composite samples were processed upon collection of the core sections contributing to each composite.

Processing of the sediment core samples consisted of opening the core sampler longitudinally and removing material representing the desired sample interval. After removal, material from each interval was placed into a designated stainless steel bowl for homogenization. Composite samples were created by homogenizing equal proportions of sediment from the respective core locations included in each composite. The sample compositing scheme used in this dredge material characterization study is presented in Table 2.

Once a given composite sample was retrieved, the sediment was well-homogenized before transfer to a specific sample container. After filling, sample containers were placed in a cooled ice chest for transport to the analytical laboratory under chain of custody procedures described in the SAP. Composite samples were analyzed for the DMMP chemicals of concern, including: metals, pore water tributyltin, semivolatile organics, chlorinated hydrocarbons, phthalates, phenols, volatile organics, pesticides, polychlorinated biphenyls (PCBs), and other miscellaneous extractables. Additionally, the sediment samples were analyzed for sediment conventionals and grain size. Sediment chemical analysis was performed by MultiChem Analytical Services and Columbia Analytical Services. Grain size analysis was performed by Hart Crowser. For the purposes of this investigation, only the composite samples representative of the proposed dredge material were collected and submitted for analysis, consistent with the DMMP-approved SAP.

Subsamples submitted for analysis of volatile and sulfide compounds were collected directly from the sediment sampler prior to homogenization. Volatile and sulfide subsamples are summarized in Table 2.

2.2.1 Biological Toxicity Testing

Based on the results of the chemical analysis, DMMP-specified biological toxicity testing was initiated on the composite sample collected from DMMU C8 during the initial round of sampling. Biological toxicity testing was performed by

Parametrix, Inc. Reference sediments for the biological toxicity testing were collected from Carr Inlet, Washington, by Bio-Marine Services.

2.2.1 Bioaccumulation Testing

As the result of tributyltin BT exceedences in DMMUs C1, C2, C6, C7, C8, C9, C10, C11, and C12, bioaccumulation testing was performed. Additional sediment was collected from Cap Sante in accordance with the project SAP and Addendum following the procedures described above. Sediment core samples were collected from the nine DMMUs containing sediments exceeding the tributyltin BT. Core samples were collected from the sampling locations established by the initial round of field work (Figure 2). Two test composite samples (COMP-1 and COMP-2) were created by mixing equal portions of sediment from DMMUs with pore water tributyltin concentrations less than 0.3 µg/L (C2, C6, C8, C9, C11, and C12) and greater than 0.3 µg/L (C1, C7, and C10) as shown on Figure 3. Composite test samples were submitted to Battelle Marine Sciences Laboratory for the bioaccumulation testing program described in the Addendum. Upon completion of the bioaccumulation test, tissue samples were transferred from Battelle to Columbia Analytical for analysis under the chain of custody procedures described in the SAP.

3.0 SEDIMENT PHYSICAL CHARACTERISTICS

Descriptions of the sediment core samples were recorded in the field. Discrete core sample descriptions are presented in Table 3.

Grain size distribution was determined for each composite sample following PSEP protocols. After analysis, the sample was classified in accordance with the Unified Soil Classification (USC) System. A summary of grain size results is presented in Table 4. Sediments composing the proposed dredge prism range from clayey Silt to slightly clayey, slightly gravelly Silt.

4.0 SEDIMENT CHEMICAL ANALYSIS RESULTS

4.1 Data Validation

Overall, the Data Quality Objectives (DQOs), as set forth in the Project Plan (Hart Crowser, 1998), were met, and the data for this project are acceptable for use as reported. No results were rejected as a result of the QA/QC review; therefore, data for this project are 100 percent complete.

A detailed chemical data quality review and laboratory certificates of analysis are presented in Appendix A. Results of the sediment chemical analysis, compared to DMMP chemical criteria are presented in Table 5.

4.2 Metals

Seven of the nine metals analyzed for were detected in twelve composite sediment samples. However, concentrations did not exceed DMMP Screening Levels (SL). Antimony and silver were not detected in the composite sediment samples.

4.3 Pore Water Tributyltin

Tributyltin was detected in the pore water of the twelve composite sediment samples initially analyzed. Concentrations exceeded DMMP SL and BT values in nine of the twelve samples. The SL and BT were not exceeded in composite samples C3, C4, and C5.

Pore water tributyltin was detected above the SL and BT in the two composite samples collected for bioaccumulation testing (Comp-1 and Comp-2).

4.4 Pesticide/PCBs

Neither pesticides nor PCBs were detected in the composite sediment samples analyzed.

4.5 Low Molecular Weight Polycyclic Aromatic Hydrocarbons (LPAHs)

Concentrations of LPAH compounds analyzed were detected in at least one of the composite sediment samples analyzed. The concentration of phenanthrene in composite sediment sample C8 exceeded its SL.

4.6 High Molecular Weight Polycyclic Aromatic Hydrocarbons (HPAHs)

Concentrations of HPAH compounds analyzed were detected in at least one of the composite sediment samples analyzed. The concentrations of chrysene, fluoranthene, pyrene, and total HPAHs exceeded their respective SL in composite C8.

4.7 Phenols

Five phenol constituents were detected in the composite sediment samples , however, the concentrations were below their respective SL.

4.8 Phthalates

Four of the six phthalate compounds analyzed for were detected in the twelve composite sediment samples analyzed. No phthalates exceeded their respective SL.

4.9 Semivolatile Organic Compounds

Benzoic acid, benzyl alcohol, and dibenzofuran were detected in at least one composite sediment sample. However, concentrations of these detected constituents were below their respective SL.

4.10 Volatiles Organic Compounds

No volatile constituents were detected in the composite sediment samples analyzed.

5.0 SEDIMENT BIOLOGICAL TOXICITY TESTING RESULTS

Sediment biological toxicity testing consisted of bioassays conducted on one test sediment (representative of DMMU 8) and one reference sediment using amphipod, *Ampelisca abdita*; the larvae of a purple sea urchin, *Strongylocentrutus purpuratus*, and the benthic dwelling polychaete worm, *Neanthes arenaceodentata.* These tests were conducted in accordance with the DMMP guidance on sediment characterization.

5.1 Data Validation

With the exception explained below, the overall Data Quality Objectives (DQOs), as set forth in the project SAP, were met. The data for this project are considered acceptable for use as reported. No results were rejected as the outcome of the QA/QC review.

Due to limited test organism availability and time constraints on the collection of appropriate reference sediment samples, the Amphipod and Juvenile Polychaete bioassay testing was initiated two days beyond the DMMO holding time guidance of 56 days. Communications with the DMMO on this issue resulted in the agency approval of the delayed start time. Based on the quality review of data, these data are considered to be of acceptable quality and usable for open-water disposal suitability determination.

A detailed data quality review and the Parametrix biological toxicity testing results report are presented in Appendix B. A summary of biological testing results compared to DMMP sediment quality guidelines is presented in Tables 5, 6, and 7.

5.2 10-Day Amphipod Acute Mortality Test (Ampelisca abdita)

Amphipod bioassay testing was performed on one Cap Sante composite sediment sample C8, one reference sediment, and one clean, negative control sediment using *Ampelisca abdita*. The results of this bioassay were interpreted relative to the DMMP Tier III Biological Testing Interpretive Criteria for dispersive disposal sites and summarized in Table 6. Results of the 10-day amphipod test show that sediments represented by composite sample C8 meet the DMMP suitability criteria for open-water disposal.

5.3 20-Day Juvenile Infaunal Growth Test (Neanthes arenaceodentata)

Juvenile infaunal growth testing was performed on one Cap Sante composite sediment sample C8, one reference sediment, and one clean, negative control sediment using *Neanthes arenaceodentata*. The results of this bioassay were interpreted relative to the DMMP Tier III Biological Testing Interpretive Criteria for dispersive disposal sites and summarized in Table 7. Results of the 20-day Juvenile infaunal growth test show that sediments represented by composite sample C8 meet the DMMP suitability criteria for open-water disposal.

5.4 Sediment Larval Test (Strongylocentrutus purpuratus)

Sediment larval testing was performed on one Cap Sante composite sediment sample C8, one reference sediment, and one clean, negative control sediment using *Strongylocentrutus purpuratus*. The results of this bioassay were interpreted relative to the DMMP Tier III Biological Testing Interpretive Criteria for dispersive disposal sites and summarized in Table 8. Results of the sediment larval test show that sediments represented by composite sample C8 exceed the numerical criteria for a 2-hit failure; however, the test results are not significantly different from the reference sediment test. In this case, the test sediment is considered to meet the DMMP suitability criteria for open-water disposal.

6.0 SEDIMENT BIOACCUMULATION TESTING RESULTS

Bioaccumulation testing consisted of a long-term exposure to sediments using adult bivalve, *Macoma nasuta*, and an adult polychaete, *Nephtys caecoides*, after which organism tissues were analyzed for tributyltin. Two test composite samples (COMP-1 and COMP-2) were created by mixing equal portions of sediment from DMMUs with pore water tributyltin concentrations less than 0.3 µg/L (C2, C6, C8, C9, C11, and C12) and greater than 0.3 µg/L (C1, C7, and

C10) as shown on Figure 3. The protocol is based on the EPA-approved methodology and guidance from the U.S. Army Corps of Engineers (Corps).

6.1 Data Validation

The overall DQOs, as set forth in the Addendum, were met. The data for this project are considered acceptable for use as reported. No results were rejected as the outcome of the QA/QC review.

A detailed data quality review and the Batelle bioaccumulation testing results report are presented in Appendix C. Analytical results of the bioaccumulation testing tributyltin analysis are presented in Table 9. A summary of bioaccumulation testing results compared to DMMP sediment quality guidelines is presented in Table 10.

6.2 45-Day Adult Bivalve Test (Macoma nasuta)

Adult bivalve bioaccumulation testing was performed on two Cap Sante composite sediment samples Comp-1 and Comp-2 and one reference sediment using *Macoma nasuta*. The results of this bioaccumulation test were interpreted relative to the DMMP Tier III Biological Testing Interpretive Criteria and summarized in Table 10. Results of the 45-day adult bivalve bioaccumulation test show that tributyltin did not accumulate at concentrations greater than the DMMP-specified target tissue concentration guidelines. Additionally, average tissue concentrations were determined to be significantly less than the action level. As a result, sediments represented by composite samples Comp-1 and Comp-2 are determined to meet the DMMP suitability criteria for open-water disposal.

6.3 45-Day Adult Polychaete Test (Nephtys caecoides)

Adult polychaete bioaccumulation testing was performed on two Cap Sante composite sediment samples Comp-1 and Comp-2 and one reference sediment using *Nephtys caecoides*. The results of this bioaccumulation test were interpreted relative to the DMMP Tier III Biological Testing Interpretive Criteria and summarized in Table 10. Results of the 45-day adult polychaete bioaccumulation test show that tributyltin did not accumulate at concentrations greater than the DMMP-specified target tissue concentration guidelines. Additionally, average tissue concentrations were determined to be significantly less than the action level. As a result, sediments represented by composite samples Comp-1 and Comp-2 are determined to meet the DMMP suitability criteria for open-water disposal.

7.0 REFERENCES

ASTM, 1993. ASTM standards on aquatic toxicology and hazard evaluation. Prepared by American Society for Testing and Materials, Philadelphia, PA.

DMMP, 1998. Dredge material evaluation and disposal procedures. Dredge Material Management Program. U.S. Army Corps of Engineers, Seattle, WA.

Ecology, 1992. Organic carbon normalization of sediment data. Technical information memorandum. Washington State Department of Ecology, Sediment Management Unit, Seattle, WA.

EPA, 1983a. Interim guidelines and specifications for preparing quality assurance project plans. U.S. Environmental Protection Agency, Office of Monitoring Systems and Quality Assurance, Office of Research and Development, Washington, DC.

EPA, 1983b. Methods for chemical analysis of water and wastes. EPA-600/4-79-020. U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, OH.

EPA, 1986. Test procedures for solid waste. Col. 1B. Laboratory manual physical/chemical methods. SW 846. Third edition. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

EPA, 1991a. Interim final: recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. U.S. Environmental Protection Agency Region 10, Office of Puget Sound, Seattle, WA.

EPA, 1991b. U.S. EPA Contract Laboratory Program statement of work for inorganic analysis, multi-media, multi-concentration. ILM 02.1. U.S. Environmental Protection Agency, Washington, DC.

EPA, 1991c. U.S. EPA Contract Laboratory Program statement of work for organic analysis, multi-media, multi-concentration. OLM 01.9. U.S. Environmental Protection Agency, Washington, DC.

EPA, 1996. Recommendations for a screening level for tributyltin in Puget Sound Sediment. U.S. Environmental Protection Agency Region 10, Office of Puget Sound, Seattle, WA.

Hart Crowser, 1999. Tributyltin Bioaccumulation Testing—Cap Sante Marina, Sampling and Analysis Plan Addendum. November 18, 1999.+—

Hart Crowser, 1998. Sampling and analysis plan, sediment characterization, Port of Anacortes, Anacortes, Washington. November 5, 1998.

Krone et al., 1989. A method for analysis of butyltin species in measurement of butyltins in sediment and English sole livers from Puget Sound. Marine Environmental Research 27:1-18.

PSEP, 1989a. Recommended protocols for metals in Puget Sound water, sediment, and tissue samples. Final Report TC-3090-04. Prepared for the Puget Sound Estuary Program, U.S. Environmental Protection Agency Region 10, Office of Puget Sound, Seattle, WA.

PSEP, 1989b. Recommended guidelines for measuring organic compounds in Puget Sound sediment and tissue samples. Prepared for the Puget Sound Estuary Program, U.S. Environmental Protection Agency Region 10, Office of Puget Sound, Seattle, WA.

PSEP, 1989c. Recommended protocols for measuring metals in Puget Sound Water, sediment, and tissue samples. Prepared for the Puget Sound Estuary Program, U.S. Environmental Protection Agency Region 10, Office of Puget Sound, Seattle, WA.

PTI, 1989. Data validation guidance manual for selected sediment variables. PTI, Bellevue, WA.

8.0 LIMITATIONS

Work for this project was performed, and this report prepared, in general accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of the Port of Anacortes for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied is made.

Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the undersigned.

We trust that this report meets your needs.

Sincerely,

HART CROWSER, INC.

DRAFT

JOHN M. HERZOG PH.D.
Sediment Quality Specialist

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Table 1 - Summary of Field Sampling Results

Sheet 1 of 2

Sample Location	North Coordinate	West Coordinate	Time	Tide Height in Feet	Mudline Elevation in Feet MLLW	Depth to Sediment in Feet	Core Length in Feet
DMMU C1							
C1-01	48° 30.804'	122°36.534'	12:00	4	-9.7	13.7	3.3
C1-02	48° 30.737'	122° 36.535'	13:40	4.3	-6.7	11.0	4.5
C1-03	48°30.752'	122°36.306'	15:00	5.7	-10.1	15.8	2.9
C1-04	No Data	No Data	NA	NA	NA	NA	NA
C1-05	48° 30.752'	122°36.306'	15:53	6.2	-8.3	14.5	4.7
C1-06	48°30.785'	122°36.269'	17:30	7.2	9.8	17.0	3.2
DMMU C2							
C2-01	48° 30.914'	122° 36.498'	15:20	1.3	-8.2	9.5	3.4
C2-02	48°30.936'	122°36.467'	17:00	1.4	-8.1	9.5	4.9
C2-03	48°30.941'	122°36.389'	17:40	1.9	-5.8	7.7	5.0
C2-04	No Data	No Data	16:30	1.2	1.2	0.0	3.8
DMMU C3							
C3-01	48° 30.933'	122° 36.259'	8:25	3.0	-8.0	3.3	5.0
C3-02	48°30.914'	122°36.253'	9:00	8.3	-0.2	8.5	5.0
C3-03	48°30.894'	122°36.224'	9:40	8.4	0.4	8.0	5.0
C3-04	48° 30.225'	122°36.211'	10:10	8.4	-0.9	7.5	5.0
DMMU C4							
C4-01	48° 30.858'	122° 36.227'	12:15	6.6	-2.7	9.3	5.0
C4-02	48° 30.847	122° 36.203'	11:40	7.4	-1.7	9.1	5.0
C4-03	48° 30.828'	122° 36.227'	12:30	6.3	-2.5	8.8	5.0
C4-04	48° 30.819'	122° 36.204'	12:00	6.9	-2.3	9.2	5.0
DMMU C5							
C4-01	48° 30.792'	122° 36.209'	14:15	2.5	-1.3	3.8	5.0
C4-02	48° 30.763'	122° 36.235'	13:00	3.3	-2.9	6.2	5.0
C4-03	48° 30.752'	122° 36.284'	11:00	4.3	-3.7	8.0	5.0
C4-04	No Data	No Data	10:00	6.9	-6.7	13.6	5.0
DMMU C6							
C6-01	No Data	No Data	15:00	4.0	-9.4	13.4	3.6
C6-02	48° 30.911'	122° 36.430'	15:20	4.3	-10.1	14.4	2.9
C6-03	48° 30.885'	122° 36.393'	15:45	4.8	-9.8	14.6	3.2
C6-04	48° 30.909'	122° 36.365'	16:15	5.3	-9.2	14.5	3.8
DMMU C7							
C7-01	48° 30.909'	122° 36.306'	15:45	1.2	10.5	11.7	2.5
C7-02	48° 30.877'	122° 36.251'	15:00	2.3	10.2	12.5	2.8
C7-03	48° 30.834'	122° 36.304'	16:00	1	11	12	2
C7-04	48° 30.831'	122° 36.267'	15:15	1.7	11.3	13	1.7

4974/CapTables.xls - Table 1

Table 1 - Summary of Field Sampling Results

Sheet 2 of 2

Sample Location	North Coordinate	West Coordinate	Time	Tide Height in Feet	Mudline Elevation in Feet MLLW	Depth to Sediment in Feet	Core Length in Feet
DMMU C8							
C8-01	48° 30.894'	122° 36.505'	12:00	4.8	10.2	15	3
C8-02	48° 30.854'	122° 36.507'	1420	6.3	-9.9	16.2	3.4
C8-03	48° 30.839'	122° 36.436'	14:45	6.5	-10.5	17	2.5
C8-04	48° 30.842'	122° 36.352'	15:17	6.9	-10.1	17	2.9
DMMU C9							
C9-01	48° 30.825'	122° 36.496'	8:50	7.2	-10.5	17.7	2.5
C9-02	48° 30.80'	122° 36.469'	11:15	4.7	-9.9	14.6	3.1
C9-03	No Data	No Data	10:00	5.7	-11	16.7	2
C9-04	48° 30.800'	122° 36.389'	10:30	5.2	-10.1	15.3	2.9
DMMU C10							
C10-01	No Data	No Data	11:15	6.6	-9.3	15.8	3.7
C10-02	No Data	No Data	11:15	6.6	-8.2	14.8	4.8
C10-03	No Data	No Data	11:15	6.6	-9.6	16.2	3.4
C10-04	No Data	No Data	11:15	6.6	-9.9	16.5	3.1
DMMU C11							
C11-01	48° 30.753'	122° 36.502'	9:00	7.8	-9.2	17	3.8
C11-02	48° 30.753'	122° 36.470'	9:30	6.7	-8.6	15.3	4.4
C11-03	48° 30.755'	122° 36.421'	10:15	5.7	-9.1	14.8	3.9
C11-04	48° 30.755'	122° 36.391'	10:40	5.1	-9	14.1	4
DMMU C12							
C12-01	48° 30.745'	122° 36.497'	12:00	3.4	-10.3	13.7	2.7
C12-02	48° 30.723'	122° 36.444'	12:40	3.2	-9.5	12.7	3.5
C12-03	No Data	No Data	13:45	3.3	-9	12.3	4
C12-04	48° 30.723'	122° 36.395'	13:15	3.2	-8.8	12	4.2

NA- Not Applicable

No Data- Data were not collected due to GPS outages. Samples were located using hand survey techniques.

Table 2 - Sample Compositing Plan

Composite Sample Number	Core Sections
C1	C1-01A, C1-02A, C1-03A, C1-05A, C1-06A
C2	C2-01A, C2-02A, C2-03A, C2-04A
C3	C3-01A, C3-02A, C3-03A, C3-04A
C4	C4-01A, C4-02A, C4-03A, C4-04A
C5	C5-01A, C5-02A, C5-03A, C5-04A
C6	C6-01A, C6-02A, C6-03A, C6-04A
C7	C7-01A, C7-02A, C7-03A, C7-04A
C8	C8-01A, C8-02A, C8-03A, C8-04A
C9	C9-01A, C9-02A, C9-03A, C9-04A
C10	C10-01A, C10-02A, C10-03A, C10-04A
C11	C11-01A, C11-02A, C11-03A, C11-04A
C12	C12-01A, C12-02A, C12-03A, C12-04A
Comp-1	C1-01A, C1-02A, C1-03A, C1-05A, C1-06A, C10-01A, C10-02A, C10-03A, C10-04A, C7-01A, C7-02A, C7-03A, C7-04A
Comp-2	C2-01A, C2-02A, C2-03A, C2-04A, C6-01A, C6-02A, C6-03A, C6-04A, C8-01A, C8-02A, C8-03A, C8-04A, C9-01A, C9-02A, C9-03A, C9-04A, C11-01A, C11-02A, C11-03A, C11-04A, C12-01A, C12-02A, C12-03A, C12-04A

4974/CapTables.xls - Table 2

Table 3 - Discrete Core Sample Description

Smple Identification	Sample Depth Interval in Feet	Visual Sediment Description
C1-01	0.0 to 1.5	Soft, wet, brown organic SILT; trace shell fragments and worms.
	1.5 to 3.3	Medium stiff, wet, brown, organic SILT; wood fragments at 3.2 feet.
C1-02	0.0 to 0.6	Soft, wet, black SILT; trace shell fragments.
	0.6 to 2.6	Medium stiff, wet, brown, organic SILT; wood fragments at 3.2 feet; sand lens at 2.0 feet.
	2.6 to 3.2	Dense, wet, gray, silty, gravelly SAND; shell fragments.
C1-03	0.0 to 1.2	Medium stiff, wet, black, slightly gravelly, sandy SILT; metal scale; wood/shell fragments; slight sheen.
	1.2 to 2.7	Hard, green, silty CLAY.
C1-04	NA	NA
C1-05	0.0 to 1.1	Very soft, wet, brown, organic SILT.
	1.1 to 2.8	Soft, wet, brown, organic SILT;trace shell fragments/wood at 1.1 and 1.6 feet.
	2.8 to 3.2	Medium stiff, gray SILT.
C1-06	0.0 to 1.1	Soft, wet, brown, organic SILT; worms and shell fragments.
	1.1 to 1.2	Loose, wet, brown SAND.
	1.2 to 2.3	Soft, wet, brown approximately 50% wood chip/sawdust in SILT matrix.
C2-01	0.0 to 1.3	Very soft, wet, brown SILT; trace shells.
	1.3 to 2.6	Hard, wet, gray SILT.
C2-02	0.0 to 1.1	Soft, wet, brown, organic SILT.
	1.1 to 2.2	Medium dense, wet, gray, silty, fine SAND; abundant shell fragments.
	2.2 to 2.4	Hard, wet, gray SILT.
C2-03	0.0 to 1.0	Soft, wet, dark gray SILT; scattered shells.
	1.0 to 2.1	Dense, wet, gray, very sandy GRAVEL; mix of round and angular.
	2.1 to 3.55	Very stiff, wet, gray, clayey SILT.
C2-04	0.0 to 1.6	Soft, wet, brown, slightly sandy, slightly gravelly SILT; trace wood.
	1.6 to 2.7	Medium dense, wet, gray, silty, fine SAND; abundant shell fragments.
C3-01	0.0 to 0.25	Very soft, wet, brown SILT.
	0.25 to 0.8	Medium dense, wet, gray, silty SAND.
	0.8 to 1.63	Dense, wet, gray, slightly silty, very gravelly SAND.
	1.63 to 1.83	Stiff, wet, gray SILT.
	1.83 to 2.8	Dense, wet, gray, slightly silty, gravelly SAND.
C3-02	0.0 to 1.1	Soft, wet, brown, organic SILT; trace shell/wood fragments.
	1.1 to 3.0	Medium dense, wet, gray, silty, fine SAND; abundant shell fragments.
	3.0 to 3.8	Dense, wet, gray, gravelly SAND.
C3-03	0.0 to 2.8	Soft, wet, brown to gray, slightly sandy SILT; shell fragments; areas of organics; occasional gravel; rusted iron.
	2.8 to 3.0	Soft, wet, gray SILT; shell fragments.
	3.0 to 3.7	Dense, wet, gray, silty, gravelly SAND.
C3-04	0.0 to 2.8	Soft, wet, dark gray, slightly sandy SILT; abundant shell fragments; live worm; trace wood.
	2.8 to 3.5	Dense, wet, gray, silty, gravelly SAND.
C4-01	0.0 to 0.4	Very soft, wet, brown SILT.
	0.4 to 1.3	Soft, wet, gray, slightly sandy SILT; scattered shell fragments.
	1.3 to 3.4	Stiff, wet, gray SILT; abundant shell fragments; trace wood.
	3.4 to 3.8	Fibrous PEAT, w/gray SILT interbeds.
C4-02	0.0 to 0.9	Very soft, wet, dark gray, slightly sandy SILT; scattered shell fragments.
	0.9 to 3.0	Medium stiff, wet, gray SILT; abundant shell fragments.
	3.0 to 4.1	Fibrous PEAT, w/ 1-inch SILT interbeds; scattered twigs and wood.

Table 3 - Discrete Core Sample Description

Smple Identification	Sample Depth Interval in Feet	Visual Sediment Description
C4-03	0.0 to 1.0	Very soft, wet, dark gray, slightly sandy SILT.
	1.0 to 3.9	Medium stiff, wet, gray SILT; abundant shell fragments.
C4-04	0.0 to 1.2	Soft, wet, dark gray, slightly sandy SILT; wood and trace shells.
	1.2 to 2.8	Medium stiff, wet, gray SILT; abundant shell fragments.
	2.8 to 3.6	PEAT, w/silt interbeds (up to 2inches).
C5-01	0.0 to 0.8	Very soft, wet, brown SILT; live clams; trace eel grass.
	0.8 to 2.2	Soft, wet, gray, slightly sandy SILT; abundant shell fragments.
	2.2 to 3.2	Soft, wet, brown, organic SILT; twigs and wood.
	3.2 to 3.6	Soft, wet, brown, clayey SILT.
	3.6 to 4.4	Soft, wet, brown, organic SILT; wood fragments.
C5-02	0.0 to 0.2	Very soft, wet, brown SILT; eelgrass.
	0.2 to 1.9	Medium dense, wet, gray, silty SAND; abundant shell fragments.
	1.9 to 3.8	Medium dense, wet, gray, very silty, fine SAND; abundant shell fragments.
	3.9 to 4.0	White, chalky volcanic ASH layer (1-inch).
	4.0 to 4.6	Soft, wet, brown, fibrous PEAT.
C5-03	0.0 to 1.0	Soft, wet, organic SILT; trace shells.
	1.0 to 2.0	Medium dense, wet, gray, slightly silty, gravelly SAND; abundant shells.
	2.0 to 2.55	Stiff, wet, gray, slightly sandy SILT; shells.
	2.55 to 3.0	Medium dense, wet, gray, slightly sandy SILT; scattered GRAVEL/shells.
	3.0 to 3.4	Stiff, wet, gray, sandy SILT; shells.
	3.4 to 4.3	Dense, wet, gray, fine SAND; shell fragments.
C5-04	0.0 to 0.25	Soft, wet, brown SILT.
	0.25 to 1.2	Medium dense, wet, gray, slightly silty, gravelly SAND; trace shell fragments.
	1.2 to 3.2	Soft, wet, brown to gray, organic SILT; abundant wood; trace shells; fibrous peat at 2.5 to 3.0 feet.
	3.2 to 4.3	Soft, wet, yellow ASH with abundant shells; SILT laminae interbedded.
C6-01	0.0 to 1.2	Very soft, wet, brown, organic SILT.
	1.2 to 2.0	Soft, wet, brown, organic SILT.
	2.0 to 3.0	Very stiff, wet, gray, clayey SILT; trace SAND.
C6-02	0.0 to 1.0	Very soft, wet, brown, organic SILT; trace shell fragments.
	1.0 to 2.2	Soft, wet, brown, organic SILT; approximately 20% sawdust and wood; SILT lenses (1.8 and 2.0 feet).
C6-03	0.0 to 1.6	Soft, wet, black to brown SILT; trace shell fragments; H_2S odor.
	1.6 to 2.3	Soft, wet, brown SILT; approximately 50% sawdust and wood chips.
C6-04	0.0 to 1.8	Soft, wet, brown, organic SILT; approximately 50% wood chips (1.0 to 1.2 feet).
	1.8 to 3.1	Dense, wet, gray, medium to fine SAND; brown, silty SAND laminae.
C7-01	0.0 to 0.6	Very soft, wet, dark gray SILT.
	0.6 to 2.6	Medium stiff, wet, gray SILT; abundant shell fragments.
C7-02	0.0 to 1.4	Very soft, wet, brown, organic SILT; wood and trace shells.
	1.4 to 2.0	Medium stiff, wet, gray SILT; abundant shells.
	2.0 to 2.3	Dense, wet, gray, gravelly SAND; shells.
C7-03	0.0 to 0.5	Soft, wet, gray SILT.
	0.5 to 1.8	Medium stiff, wet, gray SILT; abundant shell fragments.
C7-04	0.0 to 0.6	Very soft, wet, brown, organic SILT.
	0.6 to 2.2	Fibrous PEAT.
C8-01	0.0 to 0.8	Soft, wet, black SILT; trace shells.
	0.8 to 1.2	Medium dense, wet, gray, silty SAND.
	1.2 to 2.4	Hard, moist to wet, gray SILT; fine stratification/laminae.

4974/CapTables.xls - Table 3

Table 3 - Discrete Core Sample Description

Sheet 3 of 4

Smple Identification	Sample Depth Interval in Feet	Visual Sediment Description
C8-02	0.0 to 2.9	Soft, wet, black, organic SILT; shell fragments at surface and 2.0 feet.
C8-03	0.0 to 1.4	Soft, wet, brown, organic SILT.
	1.4 to 2.0	Medium stiff, wet, brown, organic SILT.
C8-04	0.0 to 2.2	Soft, wet, brown, organic SILT; wood at 0.4 and 1.8 feet.
C9-01	0.0 to 1.5	(Light green SILT dusting over) soft, wet, brown, organic SILT; trace shell fragments.
	1.5 to 2.7	Medium stiff, wet, brown, organic SILT.
C9-02	0.0 to 1.6	Soft, wet, brown, organic SILT; trace shells; strong H_2S odor.
	1.6 to 2.3	Soft, wet, brown, organic SILT; approximaely 25% sawdust/wood fiber.
C9-03	0.0 to 1.4	Soft, wet, brown, organic SILT; trace shell fragments; H_2S odor; metal scale at approximately 1.0 foot.
	1.4 to 2.2	Medium stiff, wet, brown, organic SILT; wood.
C9-04	0.0 to 1.5	Soft, wet, brown, organic SILT; trace shell fragments; H_2S odor.
	1.5 to 2.0	Soft-med. stiff, wet, brown, organic SILT; trace wood.
C10-01	0.0 to 0.8	Very soft, wet, brown, organic SILT; trace shell fragments/wood.
	0.8 to 2.1	Soft, wet, brown, organic SILT; occasional shell fragments.
	2.1 to 2.5	Medium stiff, wet, gray SILT; occasional shell fragments.
	2.5 to 2.9	Dense, wet, gray, slightly gravelly, silty SAND.
C10-02	0.0 to 0.7	Very soft, wet, brown, organic SILT; trace shell fragments.
	0.7 to 3.1	Soft, wet, brown, organic SILT; trace wood/ grasses.
	3.1 to 3.9	Medium stiff, wet, brown, organic SILT; abundant shell fragments; trace wood.
C10-03	0.0 to 0.8	Very soft, wet, dark gray SILT.
	0.8 to 1.6	Soft, wet, brown, organic SILT.
	1.6 to 2.3	Medium stiff, wet, light brown, clayey SILT.
C10-04	0.0 to 1.0	Very soft, wet, dark gray SILT.
	1.0 to 2.2	Soft, wet, brown, organic SILT.
C11-01	0.0 to 0.6	Very soft, wet, green-brown SILT.
	0.6 to 2.4	Soft, wet, brown, organic SILT; scattered shell fragments; trace wood.
	2.4 to 2.8	Medium stiff to stiff, wet, brown SILT; abundant shell fragments; trace wood.
	2.8 to 3.2	Dense, wet, gray, slightly silty, gravelly SAND; abundant shell fragments.
C11-02	0.0 to 1.3	Very soft, wet, green-brown, organic SILT; trace shell fragments; slight sheen.
	1.3 to 3.1	Soft, wet, brown, organic SILT; scattered shell fragments; 2- by 3-inch aluminum sheeting at 2.4 feet.
C11-03	0.0 to 2.0	Soft, wet, brown, organic SILT; shell fragments; wood/bark at 2.0 feet.
	2.0 to 2.8	Soft to medium stiff, wet, brown, organic SILT; wood/bark at 2.1 feet.
C11-04	0.0 to 1.1	Very soft, wet, brown, organic SILT.
	1.1 to 1.8	Soft, wet, brown, organic SILT.
	1.8 to 2.6	Medium stiff, wet, brown, organic SILT; trace shell fragments.
C12-01	0.0 to 0.63	Soft, wet, brown, organic SILT; trace shell fragments.
	0.63 to 0.96	Wood and sawdust.
	0.96 to 1.00	SAND lens.
	1.0 to 2.2	Stiff, wet, gray, slightly sandy SILT; abundant shell fragments.
C12-02	0.0 to 1.15	Soft, wet, brown, organic SILT; trace sea grasses/shell fragments.
	1.15 to 1.25	Sawdust and wood chips; trace SAND layer at 1.25 feet.
	1.25 to 2.4	Stiff, gray, slightly sandy SILT; abundant shell fragments.

4974/CapTables.xls - Table 3

Table 3 - Discrete Core Sample Description

Sheet 4 of 4

Smple Identification	Sample Depth Interval in Feet	Visual Sediment Description
C12-03	0.0 to 1.8	Very soft, wet, gray-black, organic SILT; piece of nylon rope at 0.6 foot.
	1.8 to 2.4	Sawdust and wood chips; trace SAND at 2.4 feet.
	2.4 to 3.0	Medium stiff, wet, gray SILT; abundant shell fragments.
C12-04	0.0 to 0.8	Very soft, wet, brown, organic SILT; trace shell fragments; H_2S odor.
	0.8 to 1.3	Sawdust and wood chips.
	1.3 to 1.34	Small SAND lens; scattered shells.
	1.34 to 3.1	Medium stiff, wet, gray, slightly sandy SILT; abundant shell fragments.

Table 4 - Summary of Grain Size Characterization Results

Sample Identification	Gravel in Percent	Sand in Percent	Silt in Percent	Clay in Percent	Sediment Description
C1	0	26	54	20	Clayey, sandy SILT
C2	3	27	50	20	Clayey, sandy SILT
C3	12	47	35	6	Slightly clayey, slightly gravelly silty SAND
C4	1	21	57	21	Clayey, sandy SILT
C5	15	47	28	10	Slightly clayey, slightly gravelly silty SAND
C6	0	44	41	15	Clayey, very sandy SILT
C7	0	13	65	22	Sandy, clayey SILT
C8	0	15	71	14	Clayey, sandy SILT
C9	0	5	73	22	Clayey SILT
C10	0	7	68	25	Slightly sandy, clayey SILT
C10 Dup	0	7	68	25	Slightly sandy, clayey SILT
C10 Trip	0	9	69	22	Slightly sandy, clayey SILT
C11	0	4	70	26	Clayey SILT
C12	0	16	59	25	Sandy, clayey SILT

Table 5 - Chemical Analysis Results for Sediment Samples

Sheet 1 of 6

Lab ID	PSDDA	902026-8	902036-8	902036-11	902036-14	902036-2
Sample ID	SL	C1	C2	C3	C4	C5
Conventionals in %						
Ammonia As Nitrogen		66	22	5.3	12	24
Moisture			50	34	40	56
Total Organic Carbon		3.6	3.5	1.4	1.8	4.5
Total Solids		53	53.4	68.6	60.7	59.2
Total Sulfide		270	200	310	100	200
Total Volatile Solids		9.39	6.94	3.36	4.35	8.29
Metals in mg/kg						
Antimony	150	5.8 U	5.5 U	3.9 U	4.6 U	4.7 U
Arsenic	57	6.4	5.2	5.1	4.8	5.5
Cadmium	5.1	0.58 U	0.55 U	0.39 U	0.46 U	0.47 U
Copper	390	55	43	21	20	22
Lead	450	26	12	7.6	7.2	8.6
Mercury	0.41	0.21 U	0.2 U	0.16 U	0.17 U	0.18 U
Nickel	140	26	28	15	19	18
Silver	6.1	1.2 U	1.1 U	0.78 U	0.92 U	0.95 U
Zinc	410	95 J	77 J	49 J	46	44 J
Pore Water TBT in µg/L						
Tributyltin	0.15 *	0.47	0.20	0.015	0.02	0.03
Tetra-n-butyltin						
Di-n-butyltin						
n-Butyltin						
LPAHs in mg/kg						
2-Methylnaphthalene	0.67	0.036	0.011 J	0.007 J	0.032 U	0.014 J
Acenaphthene	0.5	0.05	0.008 J	0.017 U	0.019 U	0.024
Acenaphthylene	0.56	0.023	0.033	0.012 J	0.021 U	0.005 J
Anthracene	0.96	0.11	0.072	0.034 J	0.01 J	0.034 J
Fluorene	0.54	0.045	0.027	0.021	0.016 J	0.028
Naphthalene	2.1	0.11	0.094	0.058	0.06	0.085
Phenanthrene	1.5	0.22	0.23	0.16	0.061	0.16
Total LPAHs	5.2	0.558	0.464	0.285	0.147	0.336
HPAHs in mg/kg						
Benzo(a)anthracene	1.3	0.2	0.26	0.093	0.025 J	0.082
Benzo(a)pyrene	1.6	0.13	0.29	0.099	0.026	0.067
Benzo(b)fluoranthene		0.33 T	0.61 T	0.15 T	0.052 TJ	0.17 T
Benzo(g,h,i)perylene	0.67	0.067	0.18	0.059	0.016 J	0.036
Benzo(k)fluoranthene		0.33 T	0.61 T	0.15 T	0.052 TJ	0.17 T
Chrysene	1.4	0.29	0.46	0.11	0.043	0.18
Dibenz(a,h)anthracene	0.23	0.035	0.027	0.012 J	0.021 U	0.019 U
Fluoranthene	1.7	1.1	0.47	0.39	0.089	0.34
Indeno(1,2,3-cd)pyrene	0.6	0.065	0.16	0.051	0.022 U	0.032
Pyrene	2.6	0.44	0.59	0.22	0.1	0.35
Total Benzofluoranthenes	3.2	0.33	0.61	0.15	0.052 J	0.17
Total HPAHs	12	2.987	3.657	1.334	0.403	1.427
Semivolatiles in mg/kg						
1,2,4-Trichlorobenzene	0.031	0.023 U	0.031 U	0.028 U	0.031 U	0.028 U
Dibenzofuran	0.54	0.047	0.009 J	0.02 U	0.022 U	0.024
N-Nitrosodiphenylamine	0.028	0.017 U	0.023 U	0.021 U	0.023 U	0.021 U
Semivolatiles in µg/kg						
Benzoic Acid	650	49 J	50 J	14 J	14 J	19 J

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Table 5 - Chemical Analysis Results for Sediment Samples

Lab ID	PSDDA	902026-8	902036-8	902036-11	902036-14	902036-2
Sample ID	SL	C1	C2	C3	C4	C5
Benzyl Alcohol	57	3.2 J	0.77 J	33 U	36 U	0.74 J
Phenols in µg/kg						
2,4-Dimethylphenol	29	3.4 J	1.3 J	0.65 J	15 U	0.96 J
2-Methylphenol	63	3.5 J	33 U	30 U	33 U	29 U
4-Methylphenol	670	190	74	51	67	63
Pentachlorophenol	400	6.5 J	2.7 J	48 U	53 U	1 J
Phenol	420	39 J	15 J	18 J	18 J	10 U
Phthalates in mg/kg						
Bis(2-ethylhexyl)phthalate	8.3	0.15	0.18	0.023 UJ	0.046 UJ	0.055 UJ
Butylbenzylphthalate	0.97	0.02 J	0.11 U	0.049 U	0.053 U	0.048 U
Di-n-butylphthalate	5.1	0.021 UJ	0.036 U	0.033 U	0.036 U	0.032 U
Di-n-octylphthalate	6.2	0.038 U	0.13	0.047 U	0.052 U	0.047 U
Diethylphthalate	1.2	0.028 U	0.038 U	0.035 U	0.038 U	0.034 U
Dimethylphthalate	1.4	0.025	0.014 J	0.031 U	0.034 U	0.03 U
Pesticide/PCBs in mg/kg						
Aroclor 1016		0.071 U	0.067 U	0.051 U	0.056 U	0.06 U
Aroclor 1221		0.071 U	0.067 U	0.051 U	0.056 U	0.06 U
Aroclor 1232		0.071 U	0.067 U	0.051 U	0.056 U	0.06 U
Aroclor 1242		0.071 U	0.067 U	0.051 U	0.056 U	0.06 U
Aroclor 1248		0.071 U	0.067 U	0.051 U	0.056 U	0.06 U
Aroclor 1254		0.071 U	0.067 U	0.051 U	0.056 U	0.06 U
Aroclor 1260		0.077 U	0.067 U	0.051 U	0.056 U	0.06 U
Total PCBs	0.13	0.071 U	0.067 U	0.051 U	0.056 U	0.06 U
Aldrin	0.01	0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
Alpha-Chlordane		0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
Dieldrin	0.01	0.007 U	0.007 U	0.005 U	0.006 U	0.006 U
Gamma-BHC (Lindane)		0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
Heptachlor	0.01	0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
Hexachlorobenzene	0.022	0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
Hexachlorobutadiene	0.029	0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
Hexachloroethane	1.4	0.029 U	0.04 UJ	0.037 UJ	0.04 UJ	0.036 UJ
P,P'-DDD		0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
P,P'-DDE		0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
P,P'-DDT		0.004 U	0.003 U	0.003 U	0.003 U	0.003 U
Volatiles in mg/kg						
1,2-Dichlorobenzene	0.035	0.004 U	0.004 U	0.003 U	0.003 U	0.005 U
1,3-Dichlorobenzene	0.17	0.004 U	0.004 U	0.003 U	0.003 U	0.005 U
1,4-Dichlorobenzene	0.11	0.004 U	0.004 U	0.003 U	0.003 U	0.005 U
Ethylbenzene	0.01	0.004 U	0.004 U	0.003 U	0.003 U	0.005 U
Tetrachloroethene	0.057	0.004 U	0.004 U	0.003 U	0.003 U	0.005 U
Total Xylenes	0.04	0.004 U	0.004 U	0.003 U	0.003 U	0.005 U
Trichloroethene		0.004 U	0.004 U	0.003 U	0.003 U	0.005 U

Table 5 - Chemical Analysis Results for Sediment Samples

Sheet 3 of 6

Lab ID	PSDDA	902028-8	902036-17	902026-2	902026-5	902036-5
Sample ID	SL	C6	C7	C8	C9	C10
Conventionals in %						
Ammonia As Nitrogen		20	40	58	80	67
Moisture		43	54			57
Total Organic Carbon		1.9 J	3	3.2	3.9	3.7
Total Solids			45.3	40	59	47.3
Total Sulfide		380	220	870	930	130
Total Volatile Solids		4.34	9.22	7.51	9.3	16.4
Metals in mg/kg						
Antimony	150	4.8 U	5.8 U	5.5 U	6.5 U	6.2 U
Arsenic	57	4.2	5.9	5.5	6.4	5.3
Cadmium	5.1	0.48 U	0.58 U	0.55 U	0.65	0.62 U
Copper	390	33	48	51	59	64
Lead	450	7.7	10	19	26	25
Mercury	0.41	0.18 U	0.21 U	0.2 U	0.24 U	0.27
Nickel	140	21	24	30	32	27
Silver	6.1	0.97 U	1.2 U	1.1 U	1.3 U	1.2 U
Zinc	410	58	120 J	90 J	110 J	92 J
Pore Water TBT in µg/L						
Tributyltin	0.15	0.18	0.34	0.29	0.24	0.32
Tetra-n-butyltin						
Di-n-butyltin						
n-Butyltin						
LPAHs in mg/kg						
2-Methylnaphthalene	0.67	0.022 U	0.017 J	0.003 J	0.004 J	0.005 J
Acenaphthene	0.5	0.011 J	0.02	0.03 J	0.024	0.019 U
Acenaphthylene	0.56	0.017	0.059	0.031 J	0.02	0.004 J
Anthracene	0.96	0.023 J	0.15	0.11	0.033	0.027 J
Fluorene	0.54	0.022	0.056	0.1	0.03	0.019 J
Naphthalene	2.1	0.016 J	0.063	0.014 J	0.027	0.028 J
Phenanthrene	1.5	0.071	0.34	1.8	0.13	0.13
Total LPAHs	5.2	0.16	0.688	2.085	0.264	0.208
HPAHs in mg/kg						
Benzo(a)anthracene	1.3	0.063	0.33	0.47	0.091	0.083
Benzo(a)pyrene	1.6	0.064	0.29	0.25	0.087	0.074
Benzo(b)fluoranthene		0.19 T	0.47 T	1.9 T	0.16 T	0.17 T
Benzo(g,h,i)perylene	0.67	0.035	0.21	0.13	0.058	0.042
Benzo(k)fluoranthene		0.19 T	0.47 T	1.9 T	0.16 T	0.17 T
Chrysene	1.4	0.12	0.41	1.5	0.14	0.19
Dibenz(a,h)anthracene	0.23	0.014 J	0.071	0.062 J	0.027	0.021 U
Fluoranthene	1.7	0.19	0.78	5.2	0.25	0.27
Indeno(1,2,3-cd)pyrene	0.6	0.034	0.18	0.14	0.054	0.037
Pyrene	2.6	0.22	0.7	3	0.25	0.26
Total Benzofluoranthenes	3.2	0.19	0.47	1.9	0.16	0.17
Total HPAHs	12	1.12	3.911	14.55	1.277	1.296
Semivolatiles in mg/kg						
1,2,4-Trichlorobenzene	0.031	0.021 U	0.029 U	0.022 U	0.022 U	0.031 U
Dibenzofuran	0.54	0.009 J	0.028	0.055 J	0.019	0.022 U
N-Nitrosodiphenylamine	0.028	0.016 U	0.022 U	0.016 U	0.016 U	0.023 U
Semivolatiles in µg/kg						
Benzoic Acid	650	18 J	26 J	43 J	43 J	53 J

4974\CapTables.xls - Table 5

Table 5 - Chemical Analysis Results for Sediment Samples

Lab ID	PSDDA	902028-8	902036-17	902026-2	902026-5	902036-5
Sample ID	SL	C6	C7	C8	C9	C10
Benzyl Alcohol	57	49 U	0.83 J	1.9 J	1.9 J	5 J
Phenols in µg/kg						
2,4-Dimethylphenol	29	21 U	1.4 J	1.3 J	1.4 J	1.3 J
2-Methylphenol	63	45 U	30 U	1.4 J	2.4 J	33 U
4-Methylphenol	670	26 J	56	55	130	140
Pentachlorophenol	400	2.1 J	2.2 J	11 J	8 J	4.5 J
Phenol	420	8 U	16 J	30 J	36 J	31
Phthalates in mg/kg						
Bis(2-ethylhexyl)phthalate	8.3	0.089	0.14	0.11	0.12	0.13
Butylbenzylphthalate	0.97	0.036 U	0.05 U	0.037 U	0.038 U	0.053 U
Di-n-butylphthalate	5.1	0.025 U	0.034 U	0.025 U	0.02 UJ	0.036 U
Di-n-octylphthalate	6.2	0.036 U	0.049 U	0.036 U	0.037 U	0.052 U
Diethylphthalate	1.2	0.026 U	0.035 U	0.026 U	0.027 U	0.038 U
Dimethylphthalate	1.4	0.009 J	0.008 J	0.014 J	0.017 J	0.034 U
Pesticide/PCBs in mg/kg						
Aroclor 1016		0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Aroclor 1221		0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Aroclor 1232		0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Aroclor 1242		0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Aroclor 1248		0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Aroclor 1254		0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Aroclor 1260		0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Total PCBs	0.13	0.061 U	0.072 U	0.068 U	0.079 U	0.078 U
Aldrin	0.01	0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
Alpha-Chlordane		0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
Dieldrin	0.01	0.006 U	0.007 U	0.007 U	0.008 U	0.008 U
Gamma-BHC (Lindane)		0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
Heptachlor	0.01	0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
Hexachlorobenzene	0.022	0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
Hexachlorobutadiene	0.029	0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
Hexachloroethane	1.4	0.028 UJ	0.038 UJ	0.028 U	0.029 U	0.04 UJ
P,P'-DDD		0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
P,P'-DDE		0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
P,P'-DDT		0.003 U	0.004 U	0.003 U	0.004 U	0.004 U
Volatiles in mg/kg						
1,2-Dichlorobenzene	0.035	0.004 U	0.004 U	0.003 U	0.005 U	0.004 U
1,3-Dichlorobenzene	0.17	0.004 U	0.004 U	0.003 U	0.005 U	0.004 U
1,4-Dichlorobenzene	0.11	0.004 U	0.004 U	0.003 U	0.005 U	0.004 U
Ethylbenzene	0.01	0.004 U	0.004 U	0.003 U	0.005 U	0.004 U
Tetrachloroethene	0.057	0.004 U	0.004 U	0.003 U	0.005 U	0.004 U
Total Xylenes	0.04	0.004 U	0.004 U	0.003 U	0.005 U	0.004 U
Trichloroethene		0.004 U	0.004 U	0.003 U	0.005 U	0.004 U

Table 5 - Chemical Analysis Results for Sediment Samples

Lab ID	PSDDA	902028-2	902028-5	902026-10	K2000363-002	K2000363-001
Sample ID	SL	C11	C12	TRIP BLANK	COMP-2	COMP-1
Conventionals in %						
Ammonia As Nitrogen		76	35			
Moisture		57	41			
Total Organic Carbon		4.1 J	3.9 J			
Total Solids						
Total Sulfide		640	70			
Total Volatile Solids		9.08	8.48			
Metals in mg/kg						
Antimony	150	6.2 U	5.6 U			
Arsenic	57	6.8	6.3			
Cadmium	5.1	0.78	0.6			
Copper	390	67	280			
Lead	450	33	23			
Mercury	0.41	0.23	0.22 U			
Nickel	140	33	27			
Silver	6.1	2.5 U	1.1 U			
Zinc	410	120	100			
Pore Water TBT in µg/L						
Tributyltin	0.15	0.27	0.20		0.30	0.29
Tetra-n-butyltin					0.05 U	0.05 U
Di-n-butyltin					0.05 U	0.05 U
n-Butyltin					0.05 U	0.05 U
LPAHs in mg/kg						
2-Methylnaphthalene	0.67	0.021 J	0.004 J			
Acenaphthene	0.5	0.022	0.017			
Acenaphthylene	0.56	0.03	0.021			
Anthracene	0.96	0.088	0.051			
Fluorene	0.54	0.036	0.029			
Naphthalene	2.1	0.053	0.04			
Phenanthrene	1.5	0.2	0.21			
Total LPAHs	5.2	0.429	0.368			
HPAHs in mg/kg						
Benzo(a)anthracene	1.3	0.22	0.14			
Benzo(a)pyrene	1.6	0.18	0.16			
Benzo(b)fluoranthene		0.46 T	0.48 T			
Benzo(g,h,i)perylene	0.67	0.14	0.093			
Benzo(k)fluoranthene		0.46 T	0.48 T			
Chrysene	1.4	0.33	0.26			
Dibenz(a,h)anthracene	0.23	0.057	0.045			
Fluoranthene	1.7	0.58	0.5			
Indeno(1,2,3-cd)pyrene	0.6	0.12	0.091			
Pyrene	2.6	0.56	0.39			
Total Benzofluoranthenes	3.2	0.46	0.48			
Total HPAHs	12	3.107	2.639			
Semivolatiles in mg/kg						
1,2,4-Trichlorobenzene	0.031	0.023 U	0.023 U			
Dibenzofuran	0.54	0.016 U	0.016			
N-Nitrosodiphenylamine	0.028	0.017 U	0.017 U			
Semivolatiles in µg/kg						
Benzoic Acid	650	46 J	32 J			

Table 5 - Chemical Analysis Results for Sediment Samples

Lab ID	PSDDA	902028-2	902028-5	902026-10	K2000363-002	K2000363-001
Sample ID	SL	C11	C12	TRIP BLANK	COMP-2	COMP-1
Benzyl Alcohol	57	2.1 J	1.6 J			
Phenols in µg/kg						
2,4-Dimethylphenol	29	2.9 J	1.9 J			
2-Methylphenol	63	2.7 J	2.4 J			
4-Methylphenol	670	140	190			
Pentachlorophenol	400	26 J	24 J			
Phenol	420	30 J	20 J			
Phthalates in mg/kg						
Bis(2-ethylhexyl)phthalate	8.3	0.16	0.2			
Butylbenzylphthalate	0.97	0.039 U	0.04 U			
Di-n-butylphthalate	5.1	0.026 U	0.021 J			
Di-n-octylphthalate	6.2	0.076 U	0.039 U			
Diethylphthalate	1.2	0.028 U	0.028 U			
Dimethylphthalate	1.4	0.015 J	0.017 J			
Pesticide/PCBs in mg/kg						
Aroclor 1016		0.078 U	0.072 U			
Aroclor 1221		0.078 U	0.072 U			
Aroclor 1232		0.078 U	0.072 U			
Aroclor 1242		0.078 U	0.072 U			
Aroclor 1248		0.078 U	0.072 U			
Aroclor 1254		0.078 U	0.072 U			
Aroclor 1260		0.078 U	0.072 U			
Total PCBs	0.13	0.078 U	0.072 U			
Aldrin	0.01	0.004 U	0.004 U			
Alpha-Chlordane		0.004 U	0.004 U			
Dieldrin	0.01	0.008 U	0.007 U			
Gamma-BHC (Lindane)		0.004 U	0.004 U			
Heptachlor	0.01	0.004 U	0.004 U			
Hexachlorobenzene	0.022	0.004 U	0.004 U			
Hexachlorobutadiene	0.029	0.004 U	0.004 U			
Hexachloroethane	1.4	0.029 UJ	0.03 UJ			
P,P'-DDD		0.004 U	0.004 U			
P,P'-DDE		0.004 U	0.004 U			
P,P'-DDT		0.004 U	0.004 U			
Volatiles in mg/kg						
1,2-Dichlorobenzene	0.035	0.005 U	0.003 U	0.002 U		
1,3-Dichlorobenzene	0.17	0.005 U	0.003 U	0.002 U		
1,4-Dichlorobenzene	0.11	0.005 U	0.003 U	0.002 U		
Ethylbenzene	0.01	0.005 U	0.003 U	0.001 U		
Tetrachloroethene	0.057	0.005 U	0.003 U	0.001 U		
Total Xylenes	0.04	0.005 U	0.003 U	0.001 U		
Trichloroethene		0.005 U	0.003 U	0.001 U		

* Bioaccumulation trigger.

U = Not detected at indicated detection limit.

J = Estimated value.

T = Value represents the total of benzo(b) and benzo(k)fluoranthene.

☐ = Concentration exceeds screening level.

Table 6- Results of Amphipod Sediment Bioassay (Percent Mortality Endpoint)

			Replicate Percent Mortality						Dispersive Disposal Site Interpretation Guidelines	
Test	**Test Species**	**Sample ID**	**1**	**2**	**3**	**4**	**5**	**Mean**	**1-hit rule** $M_T-M_C > 20\%$ **and** M_T **vs** M_R **SD (p=.05) and** $M_T-M_R > 10\%$	**2-hit rule** $M_T-M_C > 20\%$ **and** M_T **vs** M_R **SD (p=.05)**
Amphipod Mortality	*Ampelisca abdita*	Control	5	0	15	0	0	4		
		Reference (CR-02)	5	5	10	25	35	16		
		C8	10	20	20	30	15	19		Pass

SD: Statistically different

M: Percent mortality

Subscripts: R = reference sediment, C = negative control, T = test sediment

X: Bioassay exceeds the criteria

Table 7- Results of Sediment Larval Bioassay (Normality Endpoint)

			Replicate Raw Counts of Normal Larvae						Dispersive Disposal Site Interpretation Guidelines	
Test	**Test Species**	**Sample ID**	**1**	**2**	**3**	**4**	**5**	**Mean**	**1-hit rule $N_T/N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10) and $N_R/N_C-N_T/N_C >$ 0.15**	**2-hit rule $N_T/N_C < 0.80$ and N_T/N_C vs N_R/N_C SD (p=.10)**
Sediment Larval (unscreened)	*Strongylocentrotus purpuratus*	Control	233	221	183	187	157	196.20		
(Initial Count - 245 embryos)		Reference (CR-02)	163	163	181	110	157	154.80		
		C8	171	124	148	100	144	137.40		NSD

SD: Statistically different

NSD: Not statistically different

N: Counts of normal larvae

Subscripts: R = reference sediment, C = negative control, T = test sediment

X: Bioassay exceeds the criteria

Table 8- Results of Juvenile Polychaete Sediment Bioassay (Mean Individual Growth Rate Endpoint)

			Replicate Mean Individual Growth Rate in mg/ind/d						Dispersive Disposal Site Interpretation Guidelines	
Test	**Test Species**	**Sample ID**	**1**	**2**	**3**	**4**	**5**	**Mean**	**1-hit rule $MIG_T/MIG_C <$ 0.80 and MIG_T vs MIG_R SD (p=.05) and MIG_T/MIG_R < 0.70**	**2-hit rule $MIG_T/MIG_C <$ 0.80 and MIG_T vs MIG_R SD (p=.05)**
Juvenile Polychaete	Neanthes	Control	0.83	0.89	0.96	0.94	0.97	0.92		
		Reference (CR-02)	1.01	0.95	0.95	1.00	1.03	0.98		
		C8	0.84	0.92	0.84	0.54	0.78	0.78		Pass

* Reference sediment failed to meet performance criteria.

SD: Statistically different

NSD: Not statistically different

MIG: Mean individual growth rate (mg/individual/day)

Subscripts: R = reference sediment, C = negative control, T = test sediment

Table 9 - Analytical Results for Bioaccumulation Testing

Sheet 1 of 2

	Concentration in mg/kg wet weight				
	Tetra-n-butyltin	Tri-n-butyltin	Di-n-butyltin	n-Butyltin	Lipids in %
DMMP Tissue Guideline	0.6	0.6	0.6	0.6	
Comp-1					
MAC-2	0.001 U	0.011	0.0028	0.0003 J	1.05
MAC-3	0.001 U	0.01	0.0025	0.001 U	1.07
MAC-8	0.001 U	0.011	0.0027	0.001 U	0.97
MAC-12	0.001 U	0.015	0.0036	0.001 U	1.23
MAC-17	0.001 U	0.013	0.0025	0.001 U	1.16
Average	0.001 U	0.012	0.0028	0.0009 J	1.10
Variance	0	3E-06	2E-07	8E-08	0.0081
T-Test	NA	-5E+05	-9E+06	-2E+07	NA
NEP-2	0.001 U	0.0013	0.0011	0.001 U	1.11
NEP-3	0.001 U	0.0012	0.001 J	0.0002 J	1.20
NEP-8	0.001 U	0.0011	0.0008 J	0.001 U	1.20
NEP-12	0.001 U	0.001	0.0013	0.0003 J	1.25
NEP-17	0.001 U	0.0013	0.0005 J	0.0002 J	1.16
Average	0.001 U	0.0012	0.0009	0.0005 J	1.18
Variance	0	1E-08	7E-08	1E-07	0.0022
T-Test	NA	-1E+08	-2E+07	-1E+07	NA
Comp-2					
MAC-1	0.001 U	0.015	0.0035	0.0013	1.39
MAC-7	0.001 U	0.018	0.0043	0.0005 J	1.08
MAC-10	0.001 U	0.018	0.0029	0.001 U	1.07
MAC-11	0.001 U	0.017	0.0032	0.001 U	1.32
MAC-20	0.001 U	0.021	0.0048	0.0005 J	1.16
Average	0.001 U	0.0178	0.0037	0.0009	1.20
Variance	0	4E-06	5E-07	1E-07	0.0167
T-Test	NA	-4E+05	-3E+06	-1E+07	NA
NEP-1	0.001 U	0.0017	0.0013	0.001 U	1.66
NEP-7	0.001 U	0.0018	0.0016	0.0003 J	1.15
NEP-10	0.001 U	0.0021	0.0007 J	0.0005 J	1.24
NEP-11	0.001 U	0.002	0.0012	0.0003 J	1.21
NEP-20	0.001 U	0.0017	0.0013	0.001 U	1.20
Average	0.001 U	0.0019	0.0012	0.0006 J	1.29
Variance	0	3E-08	9E-08	1E-07	0.0347
T-Test	NA	-6E+07	-2E+07	-1E+07	NA

Table 9 - Analytical Results for Bioaccumulation Testing

Sheet 2 of 2

	Concentration in mg/kg wet weight				
	Tetra-n-butyltin	Tri-n-butyltin	Di-n-butyltin	n-Butyltin	Lipids in %
DMMP Tissue Guideline	0.6	0.6	0.6	0.6	
Reference					
MAC-5	0.001 U	0.0012	0.0024	0.001 U	1.01
MAC-6	0.001 U	0.0016	0.0018	0.001 U	1.25
MAC-9	0.001 U	0.0014	0.0016	0.001 U	1.04
MAC-15	0.001 U	0.0019	0.0034	0.001 U	1.06
MAC-19	0.001 U	0.0016	0.0014	0.001 U	1.06
Average	0.001 U	0.0015	0.0021	0.001 U	1.08
Variance	0	5E-08	5E-07	0	0.0072
T-Test	NA	-3E+07	-3E+06	NA	NA
NEP-5	0.001 U	0.001 U	0.0008 J	0.001 U	1.35
NEP-6	0.001 U	0.001 U	0.0006 J	0.001 U	1.24
NEP-9	0.001 U	0.001 U	0.0004 J	0.001 U	1.15
NEP-15	0.001 U	0.001 U	0.0014	0.0002 J	1.07
NEP-19	0.001 U	0.001 U	0.001 U	0.001 U	1.20
Average	0.001 U	0.001 U	0.0008	0.0008	1.20
Variance	0	0	1E-07	1E-07	0.0087
T-Test	NA	NA	-1E+07	-1E+07	NA
Background					
MAC-21	0.001 U	0.0067	0.0028	0.0009 J	1.26
MAC-22	0.001 U	0.0023	0.0021	0.001 U	1.27
MAC-23	0.001 U	0.0032	0.0027	0.001 U	1.29
Average	0.001 U	0.0041	0.0025	0.001 U	1.27
Variance	0	4E-06	1E-07	2E-09	0.0002
T-Test	NA	-3E+05	-1E+07	-5E+08	NA
NEP-24	0.001 U	0.001 U	0.001 U	0.001 U	1.19
NEP-25	0.001 U	0.001 U	0.001 U	0.001 U	1.48
NEP-26	0.001 U	0.001 U	0.001 U	0.001 U	1.41
Average	0.001 U	0.001 U	0.001 U	0.001 U	1.36
Variance	0	0	0	0	0.0153
T-Test	NA	NA	NA	NA	NA

U = Not detected at indicated detection limit.
J = Estimated value.

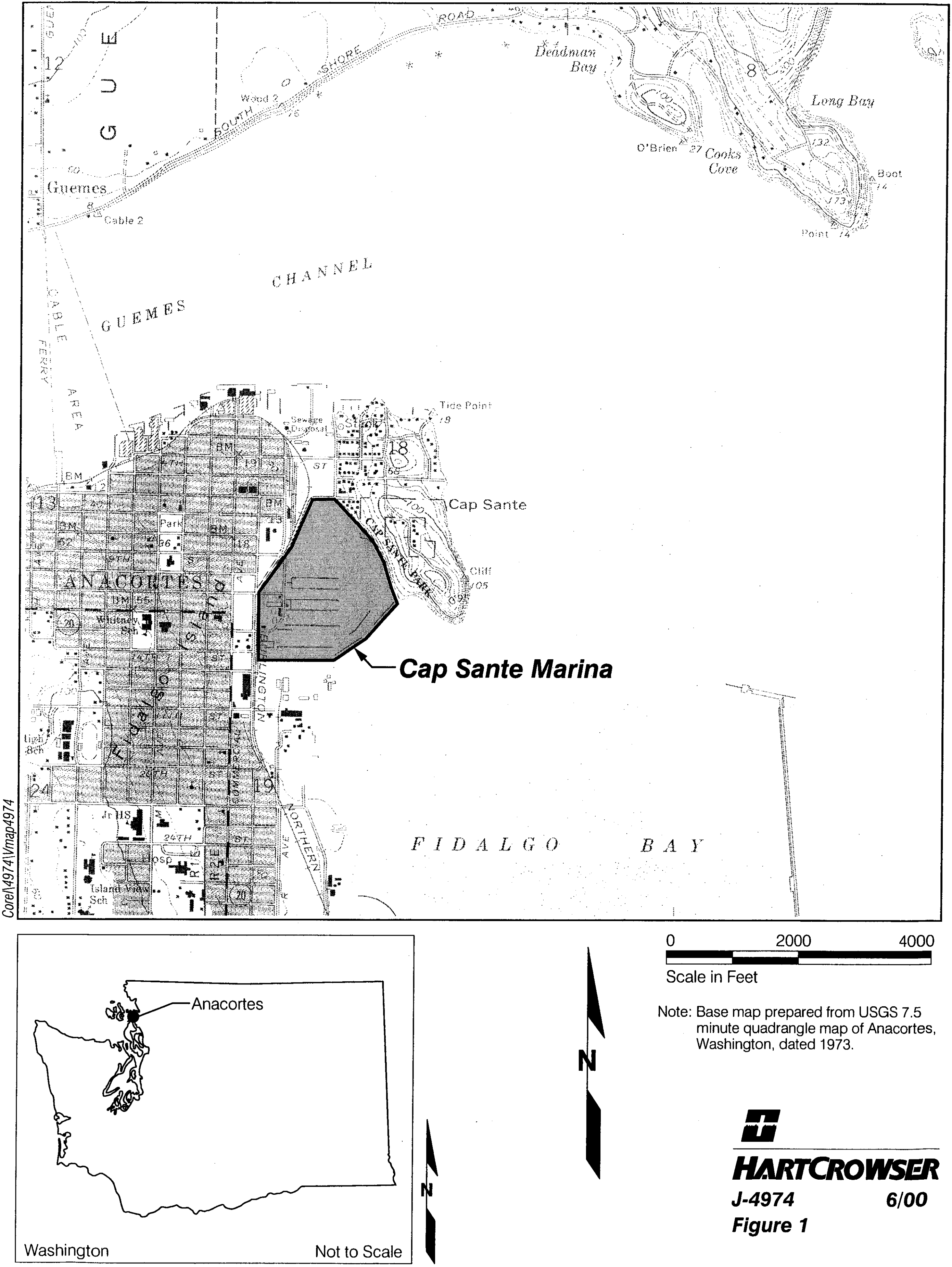
Table 10- Summary of Bioaccumulation Testing Analytical Results

	Concentration in mg/kg (wet weight)					
	Tetra-n-butyltin	Tri-n-butyltin		Di-n-butyltin	n-Butyltin	Lipids in %
DMMP Tissue Guideline	None	0.6		None	None	
Comp-1						
Initial testing (TBT porewater)		max value 0.47 ug/l				
Retest of composite (TBT porewater)		0.29 ug/l	Adjusted tissue			
ratio I/R		1.62	chemistry values			
MAC-2	0.001 U	0.011	0.0178	0.0028	0.0003 J	1.05
MAC-3	0.001 U	0.01	0.0162	0.0025	0.001 U	1.07
MAC-8	0.001 U	0.011	0.0178	0.0027	0.001 U	0.97
MAC-12	0.001 U	0.015	0.0243	0.0036	0.001 U	1.23
MAC-17	0.001 U	0.013	0.0211	0.0025	0.001 U	1.16
Average	0.001 U	0.012	0.0194	0.00282	0.00086 J	1.096
Variance	0	0.0000040	0.0000105	0.000000207	0.000000098	0.0102
t statistic (test vs guidelines)	NA	-657.4039854	-400.4940475 SD	NA	NA	NA
NEP-2	0.001 U	0.0013	0.0021	0.0011	0.001 U	1.11
NEP-3	0.001 U	0.0012	0.0019	0.001 J	0.0002 J	1.20
NEP-8	0.001 U	0.0011	0.0018	0.0008 J	0.001 U	1.20
NEP-12	0.001 U	0.001	0.0016	0.0013	0.0003 J	1.25
NEP-17	0.001 U	0.0013	0.0021	0.0005 J	0.0002 J	1.16
Average	0.001 U	0.00118	0.0019	0.00094	0.00054 J	1.18
Variance	0	0.00000002	0.00000004	0.0000001	0.0000001	0.0022
t statistic (test vs guidelines)	NA	-10269.67828	-6328.859723 SD	NA	NA	NA
Comp-2						
Initial testing (TBT porewater)		max value 0.29 ug/l				
Retest of composite (TBT porewater)		0.30 ug/l				
ratio I/R		0.966666667				
MAC-1	0.001 U	0.015		0.0035	0.0013	1.39
MAC-7	0.001 U	0.018		0.0043	0.0005 J	1.08
MAC-10	0.001 U	0.018		0.0029	0.001 U	1.07
MAC-11	0.001 U	0.017		0.0032	0.001 U	1.32
MAC-20	0.001 U	0.021		0.0048	0.0005 J	1.16
Average	0.001 U	0.0178		0.00374	0.00086	1.20
Variance	0	0.0000047		0.0000006	0.0000001	0.0167
t statistic (test vs guidelines)	NA	-600.4934496		NA	NA	NA
NEP-1	0.001 U	0.0017		0.0013	0.001 U	1.66
NEP-7	0.001 U	0.0018		0.0016	0.0003 J	1.15
NEP-10	0.001 U	0.0021		0.0007 J	0.0005 J	1.24
NEP-11	0.001 U	0.002		0.0012	0.0003 J	1.21
NEP-20	0.001 U	0.0017		0.0013	0.001 U	1.20
Average	0.001 U	0.00186		0.00122	0.00062 J	1.29
Variance	0	0.00000003		0.0000001	0.0000001	0.0347
t statistic (test vs guidelines)	NA	-7362.594441		NA	NA	NA
Reference						
MAC-5	0.001 U	0.0012		0.0024	0.001 U	1.01
MAC-6	0.001 U	0.0016		0.0018	0.001 U	1.25
MAC-9	0.001 U	0.0014		0.0016	0.001 U	1.04
MAC-15	0.001 U	0.0019		0.0034	0.001 U	1.06
MAC-19	0.001 U	0.0016		0.0014	0.001 U	1.06
Average	0.001 U	0.00154		0.00212	0.001 U	1.08
Variance	0	0.0000001		0.0000007	0.0000000	0.009
NEP-5	0.001 U	0.001 U		0.0008 J	0.001 U	1.35
NEP-6	0.001 U	0.001 U		0.0006 J	0.001 U	1.24
NEP-9	0.001 U	0.001 U		0.0004 J	0.001 U	1.15
NEP-15	0.001 U	0.001 U		0.0014	0.0002 J	1.07
NEP-19	0.001 U	0.001 U		0.001 U	0.001 U	1.20
Average	0.001 U	0.001 U		0.00084	0.00084	1.20
Variance	0	0		0.000000148	0.000000128	0.0109
Background						
MAC-21	0.001 U	0.0067		0.0028	0.0009 J	1.26
MAC-22	0.001 U	0.0023		0.0021	0.001 U	1.27
MAC-23	0.001 U	0.0032		0.0027	0.001 U	1.29
Average	0.001 U	0.004066667		0.002533333	0.000966667 U	1.27
Variance	0	0.0000054		0.0000001	0.000000003	0.0002
NEP-24	0.001 U	0.001 U		0.001 U	0.001 U	1.19
NEP-25	0.001 U	0.001 U		0.001 U	0.001 U	1.48
NEP-26	0.001 U	0.001 U		0.001 U	0.001 U	1.41
Average	0.001 U	0.001 U		0.001 U	0.001 U	1.36
Variance	0	0		0	0	0.0229

Notes:

SD- Result is significantly different than the tributyltin tissue guideline (0.6 mg/kg wet weight/ 3 mg/kg dry weight)
U = Not detected at indicated detection limit.
J = Estimated value.
NA = Not applicable.

Project Location Map



Note: Base map prepared from USGS 7.5 minute quadrangle map of Anacortes, Washington, dated 1973.

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Figure 1

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Confirmed Sampling Location Plan

Cap Sante Marina

1	SURFACE DMMU DESIGNATION
● C2-01	CONFIRMED SAMPLE LOCATION AND NUMBER
● C1-04	PROPOSED LOCATION NOT SAMPLED
·	FOUND C.O.E. BRASS CAP MONUMENTS.
ᐟ	FOUND PREVIOUS SURVEY CONTROL POINTS
⊘	SET 2" AL CAP ON #5 REBAR
•	SET PN&D NAIL WITH SHINER
-	WOOD PILE
— — —	WOOD PILE WAVE BARRIER
┄┄┄┤	CULVERT LOCATION

Note: Base map prepared from drawing provided by Partorvich, Nottingham & Drage, Inc. entitled "Plan View", dated September 7, 1998.

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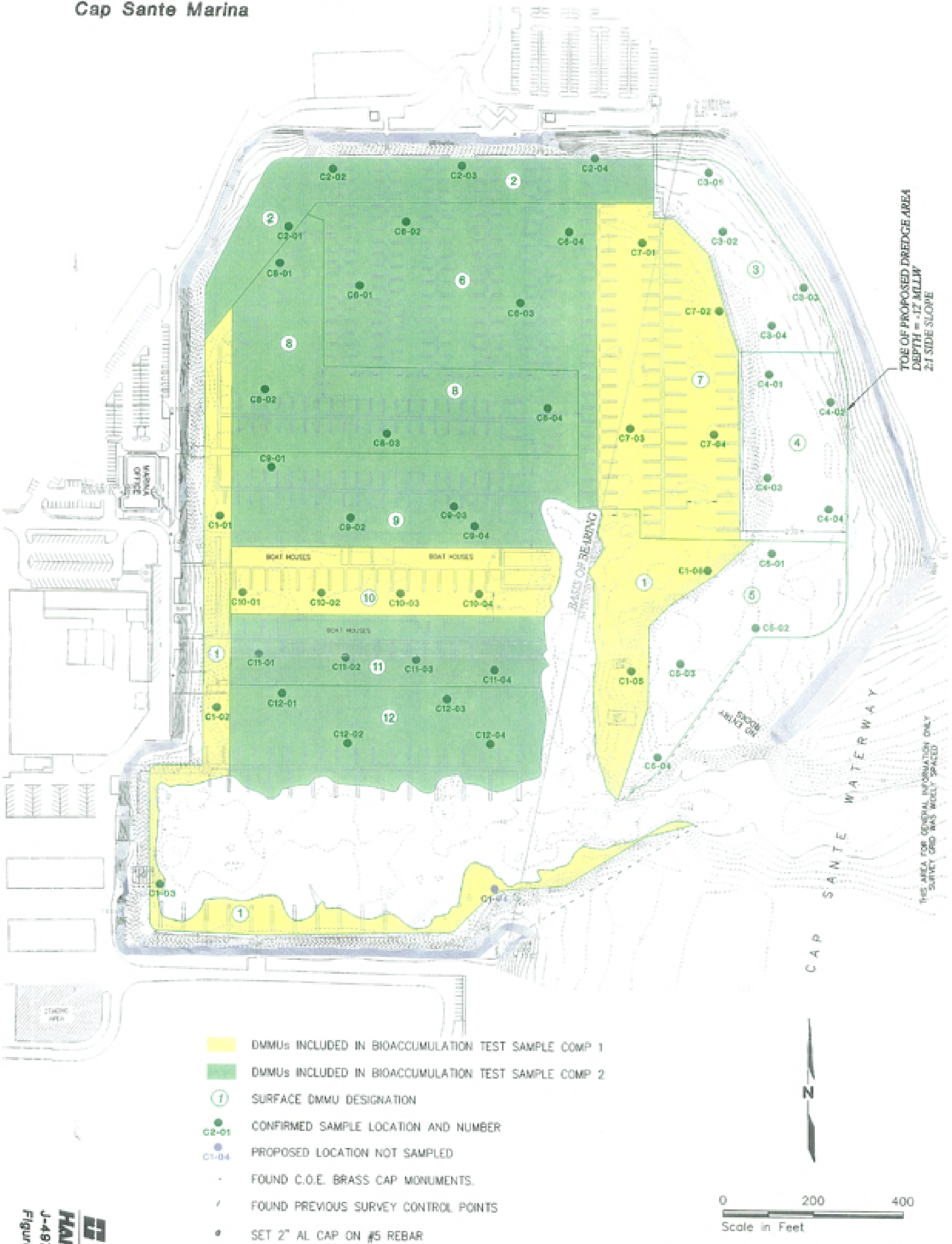
Figure 2

CVD 6/2/00 1=200 4974color.pe2
49740000

TBT Bioaccumulation Testing
Sampling Location Plan
Cap Sante Marina



Note: Base map prepared from drawing provided by Pertorvich, Nottingham & Drago, Inc. entitled "Plan View", dated September 7, 1998.

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Figure 3

DJH 1/10/00 1=200 4974color.pc2
49740007

APPENDIX A
CHEMICAL DATA QUALITY REVIEW AND CERTIFICATES OF ANALYSIS

APPENDIX A
CHEMICAL DATA QUALITY REVIEW AND CERTIFICATES OF ANALYSIS

A.1 Sediment Chemical Analysis

Twelve sediment samples and twelve subsamples for volatile organics and sulfide, were collected between February 17 and 23, 1999. The samples were submitted to MultiChem Analytical Services (MultiChem) of Seattle, WA for analysis of the following:

- Total Metals (EPA Method 6000/7000);
- Semivolatile Organics (EPA Method 8270, and 8270 SIM);
- Volatile Organics (EPA Method 8260);
- Pesticides/PCBs (EPA Method 8081/8082);
- Total Organic Carbon (EPA Method 9060 mod);
- Total Sulfide (PSEP);
- Ammonia (PSEP);
- Total Volatile Solids (PSEP); and
- Total Solids (PSEP).

The samples were also submitted to Columbia Analytical Services (CAS) of Kelso, WA for analysis of the following:

- Pore water Tributyltin (TBT, Krone et al., 1989);

The following criteria were evaluated in the standard data quality review process for the results:

- Holding times;
- Method blanks;
- Reporting limits;
- Surrogate recoveries;
- Blank spike/blank spike duplicate (BS/BSD) recoveries;
- Matrix spike/matrix spike duplicate (MS/MSD) recoveries; and
- Laboratory duplicates relative percent differences (RPDs).

Two batches of samples (SDG 909028 and 909026) were received by MultiChem at temperatures below the recommended 4± 2 °C. Results were not qualified based on sample temperature receipt.

Total Metals. All required holding times were met. Reporting limits were below DMMP SLs. Zinc was detected in the digestion blank; however, associated sample results were greater than five times the blank contamination so no results were qualified. BS and MS recoveries were within control limits. Serial dilution RPDs for zinc in several samples were greater than 10 percent. Associated sample results were qualified as estimated (J). Laboratory duplicate RPDs were acceptable with the exception of copper associated with C6, C11, and C12. Associated sample results were qualified as estimated (J).

Semivolatile Organics. All required holding times were met. Reporting limits were below DMMP SLs. Result for the individual isomers of benzofluoranthene could not be reported due to poor chromatographic resolution; results qualified with T indicate the result reported is the sum of the benzo(b) and benzo(k) isomers. Method blank contamination was present for phenol, benzoic acid, bis(2-ethylhexyl)phthalate, and di-n-butylphthalate. Associated sample results less than five times the phenol and benzoic acid contamination and ten times the phthalate contamination were qualified as not detected (U). Surrogate recoveries were within control limits with the following exceptions. 2,4,6-tribromophenol was below control limits in two method blanks. 2-fluorobiphenyl was below control limits in several samples. 2-fluorophenol and nitrobenzene was below control limits in C11. Qualifiers were not assigned since the other surrogate recoveries were acceptable.

BS/BSD recoveries were within control limits with the following exceptions. Hexachloroethane, 2,4-dimethylphenol, pentachlorophenol, and 1,2,4-trichlorobenzene recoveries were below control limits in the BS/BSD. BS/BSD and MS/MSD RPDs for these compounds were also out of control limits. MS/MSD recoveries of fluoranthene, benzo (a) pyrene, phenanthrene, 2,4-dimethylphenol, pentachlorophenol, and hexachloroethane were below control limits. 2,4-dimethylphenol and pentachlorophenol results from associated samples were already qualified as estimated by the laboratory. Hexachloroethane and results associated with low BS and MS recoveries were qualified as estimated (UJ/J).

BS/BSD RPDs of several compounds were out of control limits. No results were qualified since the associated BS recoveries and MS/MSD RPDs were acceptable. MS/MSD RPDs of several compounds were out of control limits. MS recoveries of several PAHs in sample C8 were not calculable due to sample inhomogeneity. Results were not qualified based on MS/MSD recoveries alone.

Volatile Organics. All required holding times were met. Reporting limits were below DMMP SLs. No method blank contamination was detected. Surrogate MS/MSD and BS recoveries were within laboratory control limits. MS/MSD RPDs were within control limits.

Pesticides/PCBs. All required holding times were met. Reporting limits were below DMMP SLs. No method blank contamination was detected. Surrogate and BS/BSD recoveries were within laboratory control limits with the following exceptions. Aldrin and heptachlor BS recoveries were below control limits. Results were not qualified since MS/MSD recoveries were acceptable. Recovery of TCMX in C4 was below control limits. No results were qualified since the remaining surrogate recovery was acceptable. Recoveries of several pesticides in the MS/MSD were below control limits because the MSD extract went dry during the concentrating step. The associated MS/MSD RPDs were also out of control limits. No results were qualified based on MS/MSD recoveries alone. Laboratory duplicate RPDs were within control limits.

Total Organic Carbon. All required holding times were met. No method blank contamination was detected. BS and MS recoveries were acceptable. Laboratory triplicates were not performed. The laboratory duplicate RPD associated with samples C11, C12, and C6 was out of control limits. Associated results were qualified as estimated (J).

Total Sulfide. All required holding times were met. No method blank contamination was present. MS recoveries were acceptable. Laboratory duplicate RPDs were within control limits.

Ammonia. All required holding times were met. No method blank contamination was present. BS and MS recoveries were acceptable. Laboratory duplicate RPDs were within control limits.

Total Volatile Solids/Total Solids. All required holding times were met. No method blank contamination was present. Laboratory duplicate RPDs were within control limits.

Pore Water Tributyltin. All required holding times were met. Pore water was extracted within seven days. Reporting limits were below DMMP SLs. No method blank contamination was present. Surrogate recoveries were within control limits. LCS and MS/MSD recoveries were acceptable.

A.2 Tissue Chemical Analysis

Thirty-six tissue samples from bioaccumulation test on Comp-1 and Comp-2 were collected on April 1, 2000. The samples were submitted to Columbia Analytical Services of Kelso, WA for analysis of Butyltins (TBT) and Lipids (Gravimetric).

The following criteria were evaluated in the standard data quality review process for the results:

- Holding times;
- Method blanks;
- Surrogate recoveries;
- Laboratory control sample recoveries; and
- Matrix spike/matrix spike duplicate (ms/msd) recoveries and relative percent differences (RPD).

All required holding times were met. No method blank contamination was present. Surrogate recoveries were within laboratory control limits. LCS and MS/MSD recoveries and RPDs were within control limits.

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CERTIFICATES OF ANALYSIS
COLUMBIA ANALYTICAL SERVICES

APPENDIX B
SEDIMENT BIOLOGICAL TOXICITY DATA QUALITY REVIEW AND BIOLOGICAL TOXICITY TESTING REPORT

APPENDIX B
SEDIMENT BIOLOGICAL TOXICITY DATA QUALITY REVIEW AND BIOLOGICAL TOXICITY TESTING REPORT

B.1 Introduction

Parametrix, Inc., of Kirkland, Washington, was contracted to conduct bioassays of sediments collected as part of a Dredged Material Management Program (DMMP) sediment characterization study for Peratrovich, Nottingham & Drage, Inc., and Hart Crowser, Inc.

Bioassays were conducted by Parametrix's Environmental Toxicology Laboratory, a State of Washington-accredited laboratory (Lab accreditation number C033: Expiration September 30, 2000). Parametrix's Environmental Toxicology Laboratory is certified to perform the sediment bioassays under the Puget Sound Estuary Program (PSEP, 1995) and DMMP protocols.

B.2 Sediment Bioassay Data Quality Review

Three test sediments were collected by Hart Crowser personnel on February 17, 1999 (Sample ID C8) and February 18, 1999 (C9 and C1), and provided to Parametrix on February 22, 1999. A reference sediment sample was collected by Bio-Marine Services, of Seattle, Washington, from Carr Inlet and delivered to Parametrix on April 13, 1999.

A suite of three bioassays was conducted on one of the test sediments (C8) and the reference sediment:

- 10-day amphipod mortality test using *Ampelisca abdita*
- 20-day juvenile polychaete growth test using *Neanthes arenaceodentata*
- 96-hour sediment larval test using *Strongylocentrotus purpuratus*

The following criteria were evaluated as part of this data quality review:

- Chain of custody procedures and sample holding procedures;
- Evaluation of data completeness and transcription accuracy;
- Bioassay test conditions (water quality assurance parameters);
- Bioassay performance in negative control and reference sediments; and
- Bioassay performance in positive control tests.

Laboratory performances in the sediment bioassays were evaluated against the PSEP (1995) protocols, the Sediment Management Standards: Marine Bioassays Recommended Quality Assurance and Quality Control Deliverables (Ecology, 1996), and the Dredged Material Evaluation and Disposal Procedures Manual (Corps, 2000).

B.2.1 Chain of Custody Procedures and Sample Holding

Samples were transferred to the bioassay testing laboratory using established chain of custody procedures. Test and reference sediments were purged with nitrogen on receipt at the testing laboratory and held in the dark at 4°C until tested. Sediment larval bioassay testing was initiated on April 13, 1999, 55 days after sample collection. Amphipod and juvenile polychaete bioassays were initiated on April 16, 1999, 58 days after sample collection.

B.2.2 Data Evaluation

Copies of the raw data forms were reviewed for completeness. Summary tables were reviewed for fidelity of transcription of the raw data. No errors or omissions were noted.

B.2.3 Bioassay Test Conditions

Water quality parameters were compared to the PSEP (1995) and the PSDDA (1994) specifications. The water quality assurance parameters are summarized in Table 1 by test species and type.

Table 1 PSEP (1995) and PSDDA (1994) water quality assurance parameters for sediment bioassays.

Parameter	**Amphipod** *(Ampelisca abdita)*	**Juvenile Polychaete** *(Neanthes arenaceodentata)*	**Echinoderm Larval** *(Strongylocentrotus purpuratus)*
Temperature in °C	19 to 21	19 to 21	14 to 16
Salinity in ppt	27 to 29	28 to 35	27 to 29
Dissolved oxygen in mg/L	4 to 10	4 to 10	4 to 10
pH	7 to 9	7 to 9	7 to 9
Ammonia in mg/L unionized	0 to 1.0*	0 to 0.7	0 to 0.04
Sulfide in mg/L total	0 to 0.5	0 to 1.0	0 to 0.5

* total ammonia for amphipods

B.2.4 Amphipod Bioassay

There were no deviations of the water quality parameters for temperature, dissolved oxygen, or pH. Salinity had a minor water quality deviation in one of the reference toxicant series. Salinity was outside the protocol-specified range by +1 ppt on one day during the test. It is doubtful that this water quality deviation had significant effects on the results.

Total ammonia values for the reference and control sediments were within the water quality parameters. The test sediment (C8) exceeded the PSDDA warning limit of 1.0-mg/L total ammonia in the overlying water on Day 1 and Day 10. Total ammonia concentrations increased from 3.27 mg/L at the test initiation to 5.19 mg/L at test termination. The test sediment should be flagged for possible ammonia toxicity.

All sulfide concentrations were below the critical limit of 0.5 mg/L specified by PSDDA.

B.2.5 Juvenile Polychaete Bioassay

There were no deviations of the water quality parameters for temperature, salinity, dissolved oxygen, or pH. Unionized ammonia concentrations for the test, reference, and control sediments were below the critical value of 0.7 mg/L unionized ammonia specified by PSDDA. All sulfide concentrations were below the critical limit of 0.5 mg/L specified by PSDDA.

B.2.6 Sediment Larval Bioassay

There were no deviations of the water quality parameters for temperature, salinity, dissolved oxygen, or pH. Unionized ammonia concentrations for the test, reference, and control sediments were below the critical value of 0.04 mg/L unionized ammonia specified by PSDDA. All sulfide concentrations were below the critical limit of 0.5 mg/L specified by PSDDA.

B.3 Bioassay Performance–Positive Control

B.3.1 Amphipod Bioassay

The reference toxicant 50 percent Lethal Concentration (LC50) for this test was 0.50 mg/L cadmium, within the PSEP range of 0.07 to 0.91 mg/L cadmium and within Parametrix's control chart limits.

B.3.2 Juvenile Polychaete Bioassay

The reference toxicant LC50 for this test was 6.82 mg/L cadmium, within the PSDDA range of 6.0 to 19 mg/L cadmium but slightly below the PSEP-specified range of 7.1 to 17.9 mg/L cadmium. The LC50 value is within Parametrix's control chart warning limits of 3.72 and 12.53 mg/L cadmium.

B.3.3 Sediment Larval Bioassay

The reference toxicant LC50 for this test was 0.96 mg/L cadmium and within Parametrix's control chart limits.

B.4 Bioassay Performance–Negative Controls and Reference Sediments

B.4.1 Amphipod Bioassay

Negative control mean mortality was <10 percent and was considered acceptable by the current PSDDA and SMS criteria. The mean mortality response of the reference sediment was 16 percent, within the PSDDA limit of ≤20 percent over negative control and the SMS limit of ≤25 percent over the negative control.

B.4.2 Juvenile Polychaete Bioassay

Negative control and reference sample mortality was 0 percent and thus acceptable under the current PSDDA and SMS criteria. Mean individual growth rate in the control was ≥0.38 mg/individual/day and reference growth rate/control growth rate was ≥0.80. Both were considered acceptable by the current PSDDA criteria.

B.4.3 Sediment Larval Bioassay

The negative seawater control combined mortality/abnormality (19.8 percent) was <30 percent and was considered acceptable by the current PSDDA and SMS criteria. The mean combined mortality/abnormality for the reference sediment was 21.1 percent, normalized to the seawater control, well below the PSDDA limit of ≤35 percent.

B.5 Final QA Determination

B.5.1 Amphipod Bioassay

Testing for the amphipod bioassay using *Ampelisca abdita* began 58 days after sediment collection, which is slightly greater than the PSDDA holding time limitation and considerably longer than the 14 days recommended by PSEP (1995). In addition, the test sediment showed total ammonia levels at test initiation and test termination above the PSDDA warning level. Elevated ammonia levels may be the result of the extended holding times. The elevated ammonia levels do not appear to have resulted in significantly increased mortalities but should be flagged for possible ammonia toxicity effects. The significant protocol deviation resulting from the exceedence of the holding time limitations does not appear to have compromised data quality. Toxicity has been documented to remain the same or to increase with holding times in excess of 8 weeks (Becker and Ginn, 1990, as reported in Kendall and Fox, 1991). Test results should be more ecologically conservative with extended holding times. The slight salinity elevation observed in the positive control test is judged to be a minor deviation and should not have significantly affected the result. The positive control, reference, and negative control tests met the applicable performance criteria. The data are judged to be of acceptable quality and usable for any application.

B.5.2 Juvenile Polychaete Bioassay

Testing for the juvenile polychaete bioassay using *Neanthes arenaceodentata* began 58 days after sediment collection, which is slightly longer than the PSDDA holding time limitation of 8 weeks and considerably longer than the 14 days recommended by PSEP (1995). The positive control, reference, and negative control tests met the applicable performance criteria. The significant protocol deviation resulting from the exceedence of the holding time limitation indicates that the results of this test should be used with caution. Reduced growth rates may be the result of increased toxicity associated with extended holding times. The bioassay results should be judged to be ecologically conservative. Data are judged to be of acceptable quality. The protocol deviations do not appear to have compromised the quality of the results.

B.5.3 Sediment Larval Bioassay

Testing for the sediment larval bioassay using *Strongylocentrotus purpuratus* began 55 days after sediment collection, within the 8-week PSDDA holding time limitation, but considerably longer than the 14 days recommended by PSEP (1995). The positive control, reference, and negative control tests met the applicable performance criteria. All data collected appear to be of good quality and usable for any application.

B.6 References

Corps (US Army Corps of Engineers), 2000. Dredged material evaluation and disposal procedures: a users manual for the Puget Sound Dredged Disposal Analysis (PSDDA) Program. Prepared by the US Army Corps of Engineers, Seattle District, Seattle, Washington, US Environmental Protection Agency, Region X, Washington Department of Natural Resources, and Washington Department of Ecology.

Ecology (Washington State Department of Ecology), 1996. Sediment management standards: marine bioassays, Task II, recommended quality assurance and quality control deliverables. Ecology, Publication No 96-314, Olympia.

Kendall, D., and D. Fox, 1991. Modifications to holding time for biological testing [online report]. Dredged Material Management Program Issue Paper presented at the 3rd SMARM meeting. Dredged Material Management Office website [November 9, 1998].
URL:<http://www.nws.usace.army.mil/dmmo/3rd_arm/biotim91.htm>

PSDDA (Puget Sound Dredged Disposal Analysis), 1994. Dredged analysis information system (DAIS), version 4.4. Electronic database from the US Army Corps of Engineers, Seattle District, Seattle, Washington.

PSEP (Puget Sound Estuary Program), 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Final report by PTI Environmental Services for US Environmental Protection Agency, Region X, Office of Puget Sound, Seattle, Washington.

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SEDIMENT BIOLOGICAL TOXICITY TESTING REPORT
PARAMETRIX, INC.

APPENDIX C
SEDIMENT BIOACCUMULATION DATA QUALITY REVIEW AND BIOACCUMULATION TESTING REPORT

APPENDIX C
SEDIMENT BIOACCUMULATION DATA QUALITY REVIEW AND BIOACCUMULATION TESTING REPORT

C.1 Introduction

Battelle Marine Sciences Laboratory (Battelle), of Sequim, Washington, was contracted to conduct the exposure portion of a 45-day, dual species bioaccumulation test on sediments collected from Anacortes, Washington, as part of a Dredged Material Management Program (DMMP) sediment characterization study for Hart Crowser, Inc., Seattle, Washington. Bioaccumulation testing was conducted by Battelle's Sequim Bay Marine Sciences Laboratory, a State of Washington-accredited laboratory (Lab accreditation number C043: Expiration November 23, 2000).

C.2 Sediment Bioassay Data Quality Review

Two test sediments were collected by Hart Crowser personnel and delivered to Battelle on January 21, 2000. Reference sediment was collected by Battelle personnel from Sequim Bay, sieved through a 1-mm mesh sieve, and stored in a cold room until needed.

Bioaccumulation testing was conducted using two species: *Macoma nasuta* and *Nephtys caecoides*. Test protocols included the co-testing of the two species in the same aquaria. Test duration was 45 days. *M. nasuta* were collected from Discovery Bay, Washington. The animals were supplied by Johnson and Gunstone of Port Townsend, Washington, and arrived on February 8, 2000. Sequim Bay reference sediments were used for the *M. nasuta* control sediments. *N. caecoides* and control sediments from Tomales Bay, California, were supplied by Brezina and Associates of Dillon Beach, California, and arrived on February 10, 2000.

The following criteria were evaluated as part of this data quality review:

- Bioaccumulation test conditions (water quality parameters);
- Bioaccumulation test performance in positive control tests; and
- The bioaccumulation testing procedures were based on the US Environmental Protection Agency methods (Lee et al., 1989) and the Puget Sound Dredge Disposal Analysis (PSDDA) guidelines (Corps, 1998a) for dredged material.

Additional protocols developed by Battelle for the recent East Duwamish Waterway project were also used.

C.2.1 Bioaccumulation Test Conditions

Battelle's acceptable water quality parameters (Table 1) are within the range of values PSEP (1995) and PSDDA (1994) used in evaluating water quality for bioassay testing.

Table 1 Battelle's acceptable water quality parameters for bioaccumulation tests.

Parameter	Acceptable Ranges
Temperature in °C	14 to 18
Salinity in ppt	28 to 32
Dissolved oxygen in mg/L	4 to 10
pH	7.3 to 8.3

There were no deviations from Battelle's water quality parameters for dissolved oxygen, or pH. Salinity was slightly elevated (>32.0 ppt) on 5 of the 45 days of the test as a result of elevated ambient seawater salinity. The highest measured salinity was 32.3 ppt, barely above the acceptable range on two days during the test. It is doubtful that these water quality deviations will have any significant effects on the results.

Temperature was below the minimal acceptable value of 14.0°C on day 42 of the test due to a power failure. Temperature dropped to 12.0°C. The other parameters were within the acceptable ranges. There did not appear to be any observed adverse effects from the single day of low temperatures.

C.2.2 Bioassay Performance–Positive Control

A concurrent reference toxicant test using copper was conducted on each species using a geometrically increasing concentration series. The concentration range had at least one concentration with mortality of greater than 50 percent and one with mortality of less than 50 percent. The calculated median lethal concentration (LC50) for *M. nasuta* was 1.23 mg/L copper. This value was within Battelle's control chart warning limits. The LC50 for *N. caecoides* was 0.13 mg/L copper, also within Battelle's control chart warning limits. Battelle's control charts were based on nine data points which is more than the five data points needed to develop an initial set of warning limits (Corps, 1998b). The health and sensitivity of the test animals to the reference toxicant is similar to the response of other groups of test organisms used in previous studies.

C.2.3 Bioaccumulation Test Performance–Survivorship

Mean survivorship of *M. nasuta* in the two test sediments was 90 and 95 percent. The *M. nasuta* survivorship was 96 percent in the reference/*M. nasuta* control sediment and 94 percent in the *N. caecoides* control sediment. Mean survivorship of *N. caecoides* in the two test sediments was 91 and 93 percent. The *N. caecoides* survivorship was 89 percent in the reference/*M. nasuta* control sediment and 98 percent in the *N. caecoides* control sediment. Survivorship values were above Battelle's survivorship target value of 80 percent.

C.3 Final QA Determination

Bioaccumulation testing protocols are still being revised and updated by the agencies. There are few agency standards for the 45-day bioaccumulation testing using two species. The results of this study were compared to Battelle's internal standards developed during other bioaccumulation studies. Battelle's water quality parameters are within the range of values found in the animals' natural habitats and are similar to test conditions required in other bioassays with similar animals. Survivorship in the 45-day test was above 89 percent in all treatments. Minor protocol deviations in regards to salinity and temperature are unlikely to affect the results of the test or the quality of the data. Based on the data available regarding the test conditions, including the water quality measurements, reference toxicant test performance, and survivorship, the bioaccumulation test performance is acceptable and the data are usable for PSDDA dredge disposal determinations.

C.4 References

Corps (US Army Corps of Engineers), 1998a. Dredged material evaluation and disposal procedures: a user's manual for the Puget Sound Dredged Disposal Analysis (PSDDA) program. US Army Corps of Engineers, Seattle, Washington.

Corps, 1998b. Evaluation of dredged material proposed for discharge in waters of the US–inland testing manual [online report]. Prepared by the US Army Corps of Engineers and US Environmental Protection Agency. US EPA website [May 6, 1998]. URL: <http://www.epa.gov/OST/pubs/ITM/>.

Lee, H., B.L. Boese, J. Pelletier, M. Winsor, D.T. Specht, and R.C. Randall, 1989. Guidance manual: bedded sediment bioaccumulation tests. US Environmental Protection Agency ERL-N, Pacific Branch Bioaccumulation Team, EPA/600/X-89/302, ERLN-N111, Newport, Oregon.

PSDDA (Puget Sound Dredged Disposal Analysis), 1994. Dredged analysis information system (DAIS), version 4.4. Electronic database from the US Army Corps of Engineers, Seattle District, Seattle, Washington.

PSEP (Puget Sound Estuary Program), 1995. Recommended guidelines for conducting laboratory bioassays on Puget Sound sediments. Final report by PTI Environmental Services for US Environmental Protection Agency, Region X, Office of Puget Sound, Seattle, Washington.

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SEDIMENT BIOACCUMULATION TESTING REPORT
BATTELLE MARINE SCIENCES LABORATORY

APPENDIX G

Background Information for Terrestrial Ecological Evaluations

Washington State Department of Ecology
Toxics Cleanup Program

Terrestrial Ecological Evaluation Process- Simplified or Site-Specific Evaluation?

Documentation Form

	Terrestrial Concern	Response (Circle One)
*1	Is the site is located on or directly adjacent to an area where management or land use plans will maintain or restore native or semi-native vegetation?	Yes / [✓ No]
*2a	Is the site used by a threatened or endangered species?	Yes / [✓ No]
*2b	Is the site used by a wildlife species classified by the state department of fish and wildlife as a "priority species" or "species of concern" under Title 77 RCW?	Yes / [✓ No]
*2c	Is the site used by a plant species classified by the Washington state department of Natural Resources natural heritage program as "endangered," "threatened," or "sensitive" under Title 79 RCW.	Yes / [✓ No]
*3	Is the site (area where the contamination is located) located on a property that contains at least ten acres of native vegetation within 500 feet of the area where the contamination is located?	Yes [✓ No]
4	Has the department determined that the site may present a risk to significant wildlife populations?	Yes [✓ No]

*1 This includes for example, green-belts, protected wetlands, forestlands, locally designated environmentally sensitive areas, open space areas managed for wildlife, and some parks or outdoor recreation areas. This does not include park areas used for intensive sport activities such as baseball or football.

*2a What are the threatened or endangered species in Washington state?

*2b Which plant species are classified as threatened, endangered, or sensitive? Where can I find out more information about this topic?

*2c For plants, "used" means that a plant species grows at the site or has been found growing at the site. For animals, "used" means that individuals of a species have been observed to live, feed or breed at the site.

*3 For this analysis, do not include native vegetation beyond the property boundary.

> The following sources shall be used in making this determination: *Natural Vegetation of Oregon and Washington,* J.F. Franklin and C.T. Dyrness, Oregon State University Press, 1988, and L.C. Hitchcock, C.L. Hitchcock, J.W. Thompson and A. Cronquist, 1955-1969, *Vascular Plants of the Pacific Northwest*(5 volumes). Areas planted with native species for ornamental or landscaping purposes shall not be considered to be native vegetation. [WAC 173-340-7491(2)(c)(i)]

(Here's a link to the Seattle Public Library and the Washington State Library to borrow a copy of *Natural Vegetation of Oregon and Washington,* J.F. Franklin and C.T. Dyrness, Oregon State University Press, 1988, or you may purchase it through your favorite bookseller. Here's an additional link to a useful online Field Guide to Selected Rare Plants of Washington developed by the Washington State Department of Natural Resources' Natural Heritage Program (WNHP) and the Spokane District of the U.S.D.I. Bureau of Land Management (BLM) which contains fact sheets for 139 vascular plant species and one lichen species.

Here is an aid to calculating area and an aerial photo depicting a site, its 500 foot boundary and several labeled circles identifying various areas for reference in judging the area of native vegetation within the 500 foot radius.

[Exclusions Main] [TEE Definitions] [Simplified or Site-Specific?] [Simplified Ecological Evaluation] [Site-Specific Ecological Evaluation] [WAC 173-340-7493] [Index of Tables]

[TEE Home]

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Species of Concern

State Species of Concern

Include those species listed as State Endangered, State Threatened, State Sensitive, or State Candidate, as well as species listed or proposed for listing by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service.

Search Species Lists

SORT RESULTS BY:

● Common Name
○ Scientific Name
○ Animal Type

Search Listings

Advanced Search

Species of Concern Lists

- Endangered Species
- Threatened Species
- Sensitive Species
- State Candidate Species

- Complete SOC List
- Main SOC Page

Status Codes:

FE: Federal Endangered
FT: Federal Threatened
FC: Federal Candidate
FCo: Federal Species of Concern
SE: State Endangered
ST: State Threatened
SC: State Candidate
SS: State Sensitive

Mapping Criteria Codes:
(listed in order of decreasing specificity)
B: Breeding Location (Nest or Den)
CR: Communal Roost
RC,RLC,RSC: Regular (Large or Small) Concentration
RI: Regular Individual
IO: Individual Occurrence
(If a less specific criterion is listed,

Species of Concern in Washington State

Current through January 25, 2007

COMMON NAME	SCIENTIFIC NAME	ANIMAL TYPE	FEDERAL STATUS
PACIFIC LAMPREY	*LAMPETRA TRIDENTATA*	Fish	FCo
RIVER LAMPREY	*LAMPETRA AYRESI*	Fish	FCo
WESTERN BROOK LAMPREY	*LAMPETRA RICHARDSONI*	Fish	none
GREEN STURGEON	*ACIPENSER MEDIROSTRIS*	Fish	none
PACIFIC HERRING (CHERRY POINT)	*CLUPEA PALLASI*	Fish	FC
PACIFIC HERRING (DISCOVERY BAY)	*CLUPEA PALLASI*	Fish	FC
CHUM SALMON (HOOD CANAL SU)	*ONCORHYNCHUS KETA*	Fish	FT
CHUM SALMON (LOWER COLUMBIA)	*ONCORHYNCHUS KETA*	Fish	FT
COHO SALMON (PUGET SOUND)	*ONCORHYNCHUS KISUTCH*	Fish	FCo
COHO SALMON (LOWER COLUMBIA/SW WA)	*ONCORHYNCHUS KISUTCH*	Fish	FC
SOCKEYE SALMON (SNAKE R.)	*ONCORHYNCHUS NERKA*	Fish	FE
SOCKEYE SALMON (OZETTE LAKE)	*ONCORHYNCHUS NERKA*	Fish	FT
CHINOOK SALMON (PUGET SOUND)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish	FT
CHINOOK SALMON (UPPER COLUMBIA SP)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish	FE
CHINOOK SALMON (LOWER COLUMBIA)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish	FT
CHINOOK SALMON (SNAKE R. SP/SU)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish	FT
CHINOOK SALMON (SNAKE R. FALL)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish	FT
COASTAL CUTTHROAT	*ONCORHYNCHUS CLARKI CLARKI*	Fish	FCo
WESTSLOPE CUTTHROAT	*ONCORHYNCHUS CLARKI LEWISI*	Fish	FCo
STEELHEAD (SNAKE RIVER)	*ONCORHYNCHUS MYKISS*	Fish	FT
STEELHEAD (MIDDLE COLUMBIA)	*ONCORHYNCHUS MYKISS*	Fish	FT
STEELHEAD (UPPER COLUMBIA)	*ONCORHYNCHUS MYKISS*	Fish	FT
STEELHEAD (LOWER COLUMBIA)	*ONCORHYNCHUS MYKISS*	Fish	FT
BULL TROUT	*SALVELINUS CONFLUENTUS*	Fish	FT
BULL TROUT (COLUMBIA BASIN)	*SALVELINUS CONFLUENTUS*	Fish	FT
BULL TROUT (COASTAL/PUGET SOUND)	*SALVELINUS CONFLUENTUS*	Fish	FT
EULACHON	*THALEICHTHYS PACIFICUS*	Fish	FC
OLYMPIC MUDMINNOW	*NOVUMBRA HUBBSI*	Fish	none
PYGMY WHITEFISH	*PROSOPIUM COULTERI*	Fish	none
LAKE CHUB	*COUESIUS PLUMBEUS*	Fish	none
NOOKSACK DACE	*RHINICHTHYS CATARACTAE SSP.*	Fish	none
LEOPARD DACE	*RHINICHTHYS FALCATUS*	Fish	none
UMATILLA DACE	*RHINICHTHYS UMATILLA*	Fish	none
MOUNTAIN SUCKER	*CATOSTOMUS PLATYRHYNCHUS*	Fish	none
SALISH SUCKER	*CATOSTOMUS CATOSTOMUS*	Fish	none
SAND ROLLER	*PERCOPSIS TRANSMONTANA*	Fish	none

then the more specific criteria are implied as well)

Related Links

- State Monitor Species

PACIFIC COD (S&C PUGET SOUND)	*GADUS MACROCEPHALUS*	Fish	FCo
PACIFIC HAKE (C. PUGET SOUND)	*MERLUCCIUS PRODUCTUS*	Fish	FCo
WALLEYE POLLOCK (SO. PUGET SOUND)	*THERAGRA CHALCOGRAMMA*	Fish	FCo
SLIMY SCULPIN	*COTTUS COGNATUS*	Fish	none
BROWN ROCKFISH	*SEBASTES AURICULATUS*	Fish	FCo
COPPER ROCKFISH	*SEBASTES CAURINUS*	Fish	FCo
GREENSTRIPED ROCKFISH	*SEBASTES ELONGATUS*	Fish	none
WIDOW ROCKFISH	*SEBASTES ENTOMELAS*	Fish	none
YELLOWTAIL ROCKFISH	*SEBASTES FLAVIDUS*	Fish	none
QUILLBACK ROCKFISH	*SEBASTES MALIGER*	Fish	FCo
BLACK ROCKFISH	*SEBASTES MELANOPS*	Fish	none
CHINA ROCKFISH	*SEBASTES NEBULOSUS*	Fish	none
TIGER ROCKFISH	*SEBASTES NIGROCINCTUS*	Fish	none
BOCACCIO ROCKFISH	*SEBASTES PAUCISPINIS*	Fish	none
CANARY ROCKFISH	*SEBASTES PINNIGER*	Fish	none
REDSTRIPE ROCKFISH	*SEBASTES PRORIGER*	Fish	none
YELLOWEYE ROCKFISH	*SEBASTES RUBERRIMUS*	Fish	none
MARGINED SCULPIN	*COTTUS MARGINATUS*	Fish	FCo
PIUTE SCULPIN	*COTTUS BELDINGI*	Fish	none
RETICULATE SCULPIN	*COTTUS PERPLEXUS*	Fish	none
RIFFLE SCULPIN	*COTTUS GULOSUS*	Fish	none
WESTERN TOAD	*BUFO BOREAS*	Amphibian	FCo
WOODHOUSE'S TOAD	*BUFO WOODHOUSII*	Amphibian	none
RED-LEGGED FROG	*RANA AURORA*	Amphibian	FCo
CASCADES FROG	*RANA CASCADAE*	Amphibian	FCo
NORTHERN LEOPARD FROG	*RANA PIPIENS*	Amphibian	FCo
OREGON SPOTTED FROG	*RANA PRETIOSA*	Amphibian	FC
COLUMBIA SPOTTED FROG	*RANA LUTEIVENTRIS*	Amphibian	FCo
TIGER SALAMANDER	*AMBYSTOMA TIGRINUM*	Amphibian	none
CASCADE TORRENT SALAMANDER	*RHYACOTRITON CASCADAE*	Amphibian	none
COLUMBIA TORRENT SALAMANDER	*RHYACOTRITON KEZERI*	Amphibian	FCo
OLYMPIC TORRENT SALAMANDER	*RHYACOTRITON OLYMPICUS*	Amphibian	FCo
COPE'S GIANT SALAMANDER	*DICAMPTODON COPEI*	Amphibian	none
DUNN'S SALAMANDER	*PLETHODON DUNNI*	Amphibian	none
LARCH MOUNTAIN SALAMANDER	*PLETHODON LARSELLI*	Amphibian	FCo
VAN DYKE'S SALAMANDER	*PLETHODON VANDYKEI*	Amphibian	FCo
TAILED FROG	*ASCAPHUS TRUEI*	Amphibian	FCo
ROCKY MOUNTAIN TAILED FROG	*ASCAPHUS MONTANUS*	Amphibian	none
WESTERN POND TURTLE	*CLEMMYS MARMORATA*	Reptile	FCo
LEATHERBACK SEA TURTLE	*DERMOCHELYS CORIACEA*	Reptile	FE
GREEN SEA TURTLE	*CHELONIA MYDAS*	Reptile	FT
SAGEBRUSH LIZARD	*SCELOPORUS GRACIOSUS*	Reptile	FCo
LOGGERHEAD SEA TURTLE	*CARETTA CARETTA*	Reptile	FT
SOUTHERN ALLIGATOR LIZARD	*ELGARIA MULTICARINATA*	Reptile	none
SHORT-HORNED LIZARD	*PHRYNOSOMA DOUGLASSI*	Reptile	none
PACIFIC GOPHER SNAKE	*PITUOPHIS CATENIFER CATENIFER*	Reptile	none
RACER	*COLUBER CONSTRICTOR*	Reptile	none
RINGNECK SNAKE	*DIADOPHIS PUNCTATUS*	Reptile	none
SHARPTAIL SNAKE	*CONTIA TENUIS*	Reptile	none
STRIPED WHIPSNAKE	*MASTICOPHIS TAENIATUS*	Reptile	none
CALIFORNIA MOUNTAIN	*LAMPROPELTIS ZONATA*	Reptile	none

KINGSNAKE			
NIGHT SNAKE	*HYPSIGLENA TORQUATA*	Reptile	none
COMMON LOON	*GAVIA IMMER*	Bird	none
RED-NECKED GREBE	*PODICEPS GRISEGENA*	Bird	none
HORNED GREBE	*PODICEPS AURITUS*	Bird	none
WESTERN GREBE	*AECHMOPHORUS OCCIDENTALIS*	Bird	none
CLARK'S GREBE	*AECHMOPHORUS CLARKII*	Bird	none
SHORT-TAILED ALBATROSS	*PHOEBASTRIA ALBATRUS*	Bird	FE
AMERICAN WHITE PELICAN	*PELECANUS ERYTHRORHYNCHOS*	Bird	none
BROWN PELICAN	*PELECANUS OCCIDENTALIS*	Bird	FE
BRANDT'S CORMORANT	*PHALACROCORAX PENICILLATUS*	Bird	none
ALEUTIAN CANADA GOOSE	*BRANTA CANADENSIS LEUCOPAREIA*	Bird	FCo
TURKEY VULTURE	*CATHARTES AURA*	Bird	none
GOLDEN EAGLE	*AQUILA CHRYSAETOS*	Bird	none
SWAINSON'S HAWK	*BUTEO SWAINSONI*	Bird	none
BALD EAGLE	*HALIAEETUS LEUCOCEPHALUS*	Bird	FT
OSPREY	*PANDION HALIAETUS*	Bird	none
NORTHERN GOSHAWK	*ACCIPITER GENTILIS*	Bird	FCo
FERRUGINOUS HAWK	*BUTEO REGALIS*	Bird	FCo
MERLIN	*FALCO COLUMBARIUS*	Bird	none
PEREGRINE FALCON	*FALCO PEREGRINUS*	Bird	FCo
AMERICAN PEREGRINE FALCON	*FALCO PEREGRINUS ANATUM*	Bird	FCo
ARCTIC PEREGRINE FALCON	*FALCO PEREGRINUS TUNDRIUS*	Bird	FCo
PEALE'S PEREGRINE FALCON	*FALCO PEREGRINUS PEALEI*	Bird	FCo
PRAIRIE FALCON	*FALCO MEXICANUS*	Bird	none
GYRFALCON	*FALCO RUSTICOLUS*	Bird	none
SHARP-TAILED GROUSE	*TYMPANUCHUS PHASIANELLUS*	Bird	FCo
SAGE GROUSE	*CENTROCERCUS UROPHASIANUS*	Bird	FC
GREAT BLUE HERON	*ARDEA HERODIAS*	Bird	none
GREAT EGRET	*ARDEA ALBA*	Bird	none
BLACK-CROWNED NIGHT-HERON	*NYCTICORAX NYCTICORAX*	Bird	none
GREEN HERON	*BUTORIDES VIRESCENS*	Bird	none
SANDHILL CRANE	*GRUS CANADENSIS*	Bird	none
BLACK-NECKED STILT	*HIMANTOPUS MEXICANUS*	Bird	none
SNOWY PLOVER	*CHARADRIUS ALEXANDRINUS*	Bird	FT
BLACK OYSTERCATCHER	*HAEMATOPUS BACHMANI*	Bird	none
UPLAND SANDPIPER	*BARTRAMIA LONGICAUDA*	Bird	none
LONG-BILLED CURLEW	*NUMENIUS AMERICANUS*	Bird	none
BLACK TERN	*CHLIDONIAS NIGER*	Bird	FCo
ARCTIC TERN	*STERNA PARADISAEA*	Bird	none
CASPIAN TERN	*STERNA CASPIA*	Bird	none
FORSTER'S TERN	*STERNA FORSTERI*	Bird	none
COMMON MURRE	*URIA AALGE*	Bird	none
MARBLED MURRELET	*BRACHYRAMPHUS MARMORATUS*	Bird	FT
CASSIN'S AUKLET	*PTYCHORAMPHUS ALEUTICUS*	Bird	FCo
TUFTED PUFFIN	*FRATERCULA CIRRHATA*	Bird	FCo
YELLOW-BILLED CUCKOO	*COCCYZUS AMERICANUS*	Bird	FC
BURROWING OWL	*ATHENE CUNICULARIA*	Bird	FCo
SNOWY OWL	*NYCTEA SCANDIACA*	Bird	none
BOREAL OWL	*AEGOLIUS FUNEREUS*	Bird	none
GREAT GRAY OWL	*STRIX NEBULOSA*	Bird	none

FLAMMULATED OWL	*OTUS FLAMMEOLUS*	Bird	none
SPOTTED OWL	*STRIX OCCIDENTALIS*	Bird	FT
BLACK SWIFT	*CYPSELOIDES NIGER*	Bird	none
VAUX'S SWIFT	*CHAETURA VAUXI*	Bird	none
LEWIS' WOODPECKER	*MELANERPES LEWIS*	Bird	none
ACORN WOODPECKER	*MELANERPES FORMICIVORUS*	Bird	none
THREE-TOED WOODPECKER	*PICOIDES TRIDACTYLUS*	Bird	none
PILEATED WOODPECKER	*DRYOCOPUS PILEATUS*	Bird	none
WHITE-HEADED WOODPECKER	*PICOIDES ALBOLARVATUS*	Bird	none
BLACK-BACKED WOODPECKER	*PICOIDES ARCTICUS*	Bird	none
OLIVE-SIDED FLYCATCHER	*CONTOPUS BOREALIS*	Bird	FCo
ASH-THROATED FLYCATCHER	*MYIARCHUS CINERASCENS*	Bird	none
GRAY FLYCATCHER	*EMPIDONAX WRIGHTII*	Bird	none
WILLOW FLYCATCHER	*EMPIDONAX TRAILLII*	Bird	FCo
PURPLE MARTIN	*PROGNE SUBIS*	Bird	none
BOREAL CHICKADEE	*POECILE HUDSONICUS*	Bird	none
SLENDER-BILLED WHITE-BREASTED NUTHATCH	*SITTA CAROLINENSIS ACULEATA*	Bird	FCo
PYGMY NUTHATCH	*SITTA PYGMAEA*	Bird	none
WESTERN BLUEBIRD	*SIALIA MEXICANA*	Bird	none
LOGGERHEAD SHRIKE	*LANIUS LUDOVICIANUS*	Bird	FCo
NORTHERN WATERTHRUSH	*SEIURUS NOVEBORACENSIS*	Bird	none
GRASSHOPPER SPARROW	*AMMODRAMUS SAVANNARUM*	Bird	none
BOBOLINK	*DOLICHONYX ORYZIVORUS*	Bird	none
OREGON VESPER SPARROW	*POOECETES GRAMINEUS AFFINIS*	Bird	FCo
GREEN-TAILED TOWHEE	*PIPILO CHLORURUS*	Bird	none
LESSER GOLDFINCH	*CARDUELIS PSALTRIA*	Bird	none
SAGE SPARROW	*AMPHISPIZA BELLI*	Bird	none
SAGE THRASHER	*OREOSCOPTES MONTANUS*	Bird	none
STREAKED HORNED LARK	*EREMOPHILA ALPESTRIS STRIGATA*	Bird	FC
PYGMY SHREW	*SOREX HOYI*	Mammal	none
PREBLE'S SHREW	*SOREX PREBLEI*	Mammal	FCo
MERRIAM'S SHREW	*SOREX MERRIAMI*	Mammal	none
PACIFIC WATER SHREW	*SOREX BENDIRII*	Mammal	none
DESTRUCTION ISLAND SHREW	*SOREX TROWBRIDGII DESTRUCTIONI*	Mammal	FCo
KEEN'S MYOTIS	*MYOTIS KEENII*	Mammal	none
SMALL-FOOTED MYOTIS	*MYOTIS CILIOLABRUM*	Mammal	FCo
TOWNSEND'S BIG-EARED BAT	*CORYNORHINUS TOWNSENDII*	Mammal	FCo
PACIFIC TOWNSEND'S BIG-EARED BAT	*CORYNORHINUS TOWNSENDII TOWNSENDII*	Mammal	FCo
PALLID TOWNSEND'S BIG-EARED BAT	*CORYNORHINUS TOWNSENDII PALLESCENS*	Mammal	FCo
LONG-EARED MYOTIS	*MYOTIS EVOTIS*	Mammal	FCo
FRINGED MYOTIS	*MYOTIS THYSANODES*	Mammal	FCo
LONG-LEGGED MYOTIS	*MYOTIS VOLANS*	Mammal	FCo
WESTERN PIPISTRELLE	*PIPISTRELLUS HESPERUS*	Mammal	none
PALLID BAT	*ANTROZOUS PALLIDUS*	Mammal	none
YUMA MYOTIS	*MYOTIS YUMANENSIS*	Mammal	FCo
RED BAT	*LASIURUS BOREALIS*	Mammal	none
SPOTTED BAT	*EUDERMA MACULATUM*	Mammal	none
PYGMY RABBIT	*BRACHYLAGUS IDAHOENSIS*	Mammal	FE

WHITE-TAILED JACKRABBIT	*LEPUS TOWNSENDII*	Mammal	none
BLACK-TAILED JACKRABBIT	*LEPUS CALIFORNICUS*	Mammal	none
WESTERN GRAY SQUIRREL	*SCIURUS GRISEUS*	Mammal	FCo
WASHINGTON GROUND SQUIRREL	*SPERMOPHILUS WASHINGTONI*	Mammal	FC
RED-TAILED CHIPMUNK	*TAMIAS RUFICAUDUS*	Mammal	none
TOWNSEND'S GROUND SQUIRREL	*SPERMOPHILUS TOWNSENDII TOWNSENDII*	Mammal	none
OLYMPIC MARMOT	*MARMOTA OLYMPUS*	Mammal	none
BRUSH PRAIRIE POCKET GOPHER	*THOMOMYS TALPOIDES DOUGLASI*	Mammal	none
MAZAMA (WESTERN) POCKET GOPHER	*THOMOMYS MAZAMA*	Mammal	FC
SHELTON POCKET GOPHER	*THOMOMYS MAZAMA COUCHI*	Mammal	FC
CATHLAMET POCKET GOPHER	*THOMOMYS MAZAMA LOUIEI*	Mammal	FC
OLYMPIC POCKET GOPHER	*THOMOMYS MAZAMA MELANOPS*	Mammal	FC
YELM POCKET GOPHER	*THOMOMYS MAZAMA YELMENSIS*	Mammal	FC
WHITE SALMON POCKET GOPHER	*THOMOMYS TALPOIDES LIMOSUS*	Mammal	none
ORD'S KANGAROO RAT	*DIPODOMYS ORDII*	Mammal	none
KINCAID'S MEADOW VOLE	*MICROTUS PENNSYLVANICUS KINCAIDI*	Mammal	FCo
SHAW ISLAND TOWNSEND'S VOLE	*MICROTUS TOWNSENDII PUGETI*	Mammal	none
NORTHERN GRASSHOPPER MOUSE	*ONYCHOMYS LEUCOGASTER*	Mammal	none
GRAY-TAILED VOLE	*MICROTUS CANICAUDUS*	Mammal	none
SAGEBRUSH VOLE	*LEMMISCUS CURTATUS*	Mammal	none
NORTHERN BOG LEMMING	*SYNAPTOMYS BOREALIS*	Mammal	none
GRAY WOLF	*CANIS LUPUS*	Mammal	FE
GRIZZLY BEAR	*URSUS ARCTOS*	Mammal	FT
FISHER	*MARTES PENNANTI*	Mammal	FCo
BADGER	*TAXIDEA TAXUS*	Mammal	none
WOLVERINE	*GULO GULO*	Mammal	FCo
SEA OTTER	*ENHYDRA LUTRIS*	Mammal	FCo
SEA OTTER	*ENHYDRA LUTRIS LUTRIS*	Mammal	none
HARBOR SEAL	*PHOCA VITULINA*	Mammal	none
LYNX	*LYNX CANADENSIS*	Mammal	FT
GRAY WHALE	*ESCHRICHTIUS ROBUSTUS*	Mammal	none
MINKE WHALE	*BALAENOPTERA ACUTOROSTRATA*	Mammal	none
SEI WHALE	*BALAENOPTERA BOREALIS*	Mammal	FE
FIN WHALE	*BALAENOPTERA PHYSALUS*	Mammal	FE
BLUE WHALE	*BALAENOPTERA MUSCULUS*	Mammal	FE
HUMPBACK WHALE	*MEGAPTERA NOVAEANGLIAE*	Mammal	FE
BLACK RIGHT WHALE	*BALAENA GLACIALIS*	Mammal	FE
KILLER WHALE	*ORCINUS ORCA*	Mammal	FE
PACIFIC HARBOR PORPOISE	*PHOCOENA PHOCOENA*	Mammal	none
DALL'S PORPOISE	*PHOCOENOIDES DALLI*	Mammal	none
SPERM WHALE	*PHYSETER MACROCEPHALUS*	Mammal	FE
COLUMBIAN WHITE-TAILED DEER	*ODOCOILEUS VIRGINIANUS LEUCURUS*	Mammal	FE
WOODLAND CARIBOU	*RANGIFER TARANDUS*	Mammal	FE
CALIFORNIA BIGHORN SHEEP	*OVIS CANADENSIS CALIFORNIANA*	Mammal	FCo
STELLER SEA LION	*EUMETOPIAS JUBATUS*	Mammal	FT
GIANT PALOUSE EARTHWORM	*DRILOLEIRUS AMERICANUS*	Annelid	none
PINTO ABALONE	*HALIOTIS KAMTSCHATKANA*	Mollusk	FC
OLYMPIA OYSTER	*OSTREA LURIDA*	Mollusk	none
GIANT COLUMBIA RIVER LIMPET	*FISHEROLA NUTTALLI*	Mollusk	none

GREAT COLUMBIA SPIRE SNAIL	*FLUMINICOLA COLUMBIANA*	Mollusk	FCo
BARREN JUGA	*JUGA HEMPHILLI HEMPHILLI*	Mollusk	none
BROWN JUGA	*JUGA SP. 3*	Mollusk	none
CHELAN MOUNTAINSNAIL	*OREOHELIX SP. 1*	Mollusk	none
COLUMBIA DUSKYSNAIL	*AMNICOLA SP. 4*	Mollusk	none
CROWNED TIGHTCOIL (SNAIL)	*PRISTILOMA PILSBRYI*	Mollusk	none
DALLES HESPERIAN	*VESPERICOLA DEPRESSA*	Mollusk	none
DALLES JUGA	*JUGA HEMPHILLI DALLESENSIS*	Mollusk	none
GRAND COULEE MOUNTAINSNAIL	*OREOHELIX JUNII*	Mollusk	none
HELLS CANYON MOUNTAINSNAIL	*OREOHELIX SP. 29*	Mollusk	none
HOKO VERTIGO	*VERTIGO SP. 1*	Mollusk	none
HUMPED COIN	*POLYGYRELLA POLYGYRELLA*	Mollusk	none
MALONE JUMPING SLUG	*HEMPHILLIA MALONEI*	Mollusk	none
MASKED DUSKYSNAIL	*LYOGYRUS SP. 2*	Mollusk	none
NERITE RAMS-HORN	*VORTICIFEX NERITOIDES*	Mollusk	none
OREGON MEGOMPHIX (SNAIL)	*MEGOPMPHIX HEMPHILI*	Mollusk	none
PACIFIC VERTIGO	*VERTIGO ANDRUSIANA*	Mollusk	none
SALMON COIL	*HELICODISCUS SALMONACEUS*	Mollusk	none
THREE-BAND JUGA	*JUGA SP. 7*	Mollusk	none
UMATILLA MEGOMPHID	*MEGOMPHIX LUTARIUS*	Mollusk	none
WASHINGTON DUSKYSNAIL	*AMNICOLA SP. 2*	Mollusk	none
BLUE-GRAY TAILDROPPER	*PROPHYSAON COERULEUM*	Mollusk	none
COLUMBIA OREGONIAN	*CRYPTOMASTIX HENDERSONI*	Mollusk	none
DISC OREGONIAN	*CRYPTOMASTIX SP. 3*	Mollusk	none
POPLAR OREGONIAN	*CRYPTOMASTIX POPULI*	Mollusk	none
HELLS CANYON OREGONIAN	*CRYPTOMASTIX SP. 7*	Mollusk	none
DALLES SIDEBAND	*MONADENIA FIDELIS MINOR*	Mollusk	none
YUKON FLOATER	*ANODONTA BERINGIANA*	Mollusk	none
WINGED FLOATER	*ANODONTA NUTTALLIANA*	Mollusk	none
IDAHO SPRINGSNAIL	*PYRGULOPSIS IDAHOENSIS*	Mollusk	none
NEWCOMB'S LITTORINE SNAIL	*ALGAMORDA SUBROTUNDATA*	Mollusk	FCo
WESTERN PEARLSHELL	*MARGARITIFERA FALCATA*	Mollusk	none
CALIFORNIA FLOATER	*ANODONTA CALIFORNIENSIS*	Mollusk	FCo
WESTERN FLOATER	*ANODONTA KENNERLYI*	Mollusk	none
OREGON FLOATER	*ANODONTA OREGONENSIS*	Mollusk	none
WILLAMETE FLOATER	*ANODONTA WAHLAMETENSIS*	Mollusk	none
WESTERN RIDGED MUSSEL	*GONIDEA ANGULATA*	Mollusk	none
FENDER'S SOLIPERLAN STONEFLY	*SOLIPERLA FENDERI*	Other insect	FCo
MELTWATER LEDNIAN STONEFLY	*LEDNIA TUMANA*	Other insect	none
COLUMBIA CLUBTAIL	*GOMPHUS LYNNAE*	Other insect	none
PACIFIC CLUBTAIL	*GOMPHUS KURILIS*	Other insect	none
SUBARCTIC BLUET	*COENAGRION INTERROGATUM*	Other insect	none
SUBARCTIC DARNER	*AESHNA SUBARCTICA*	Other insect	none
SILVER-SPOTTED SKIPPER	*EPARGYREUS CLARUS CALIFORNICUS*	Butterfly	none
NORTHERN CLOUDY WING	*THORYBES PYLADES*	Butterfly	none
DREAMY DUSKYWING	*ERYNNIS ICELUS*	Butterfly	none
PROPERTIUS' DUSKYWING	*ERYNNIS PROPERTIUS*	Butterfly	none
AFRANIUS' DUSKYWING	*ERYNNIS AFRANIUS*	Butterfly	none
PERSIUS' DUSKYWING	*ERYNNIS PERSIUS*	Butterfly	none
ARCTIC SKIPPER	*CARTEROCEPHALUS PALAEMON MANDAN*	Butterfly	none

JUBA SKIPPER	*HESPERIA JUBA*	Butterfly	none
OREGON BRANDED SKIPPER	*HESPERIA COMMA OREGONIA*	Butterfly	none
YELLOWPATCH SKIPPER	*POLITES CORAS*	Butterfly	none
COASTAL WOODLAND SKIPPER	*OCHLODES SYLVANOIDES ORECOASTA*	Butterfly	none
BONNEVILLE SKIPPER	*OCHLODES SYLVANOIDES BONNEVILLA*	Butterfly	none
KIOWA SKIPPER	*EUPHYES VESTRIS KIOWA*	Butterfly	none
ROADSIDE SKIPPER	*AMBLYSCIRTES VIALIS*	Butterfly	none
CHECKERED WHITE	*PIERIS (PONTIA) PROTODICE*	Butterfly	none
ISLAND MARBLE	*EUCHLOE AUSONIDES INSULANUS*	Butterfly	FCo
WESTERN SULPHUR	*COLIAS OCCIDENTALIS OCCIDENTALIS*	Butterfly	none
RUDDY COPPER	*LYCAENA RUBIDA PERKINSORUM*	Butterfly	none
PURPLISH COPPER	*LYCAENA HELLOIDES*	Butterfly	none
MAKAH (QUEEN CHARLOTTE) COPPER	*LYCAENA MARIPOSA CHARLOTTENSIS*	Butterfly	FCo
BRAMBLE GREEN HAIRSTREAK	*CALLOPHRYS DUMETORUM DUMETORUM*	Butterfly	none
OREGON GREEN HAIRSTREAK	*CALLOPHRYS DUMETORUM OREGONENSIS*	Butterfly	none
CANYON GREEN HAIRSTREAK	*CALLOPHRYS SHERIDANII NEOPERPLEXA*	Butterfly	none
ARBORVITAE HAIRSTREAK	*MITOURA ROSNERI ROSNERI*	Butterfly	none
MOSS ELFIN	*INCISALIA MOSSII MOSSII*	Butterfly	none
SHELTON PINE ELFIN	*INCISALIA ERYPHON SHELTONENSIS*	Butterfly	none
EASTERN TAILED BLUE	*EVERES COMYNTAS COMYNTAS*	Butterfly	none
BRANDED AZURES	*CELASTRINA ARGIOLUS ECHO*	Butterfly	none
PUGET BLUE	*PLEBEJUS ICARIOIDES BLACKMOREI*	Butterfly	none
VALLEY SILVERSPOT	*SPEYERIA ZERENE BREMNERII*	Butterfly	FCo
HYDASPE FRITILLARY	*SPEYERIA HYDASPE RHODOPE*	Butterfly	none
NORTHERN CHECKERSPOT	*CHLOSYNE PALLA PALLA*	Butterfly	none
PASCO PEARL CRESCENT	*PHYCIODES COCYTA PASCOENSIS*	Butterfly	none
PERDICCAS CHECKERSPOT	*EUPHYDRYAS CHALCEDONA PERDICCAS*	Butterfly	none
SNOWBERRY CHECKERSPOT	*EUPHYDRYAS CHALCEDONA WALLACENSIS*	Butterfly	none
HOPFINGER'S CHECKERSPOT	*EUPHYDRYAS ANICIA HOPFINGERI*	Butterfly	none
ISLAND OCHRE RINGLET	*COENONYMPHA "TULLIA" INSULANA*	Butterfly	none
GREAT ARCTIC	*OENEIS NEVADENSIS GIGAS*	Butterfly	none
OREGON SILVERSPOT BUTTERFLY	*SPEYERIA ZERENE HIPPOLYTA*	Butterfly	FT
PACUVIUS' DUSKYWING	*ERYNNIS PACUVIUS LILIUS*	Butterfly	none
ALPINE CHECKERED SKIPPER	*PYRGUS CENTAUREAE LOKI*	Butterfly	none
GARITA SKIPPERLING	*OARISMA GARITA*	Butterfly	none
NEVADA SKIPPER	*HESPERIA NEVADA*	Butterfly	none
SONORA SKIPPER	*POLITES SONORA SIRIS*	Butterfly	none
LONG-DASH SKIPPER	*POLITES MYSTIC SSP.*	Butterfly	none
TAWNY-EDGED SKIPPER	*POLITES THEMISTOCLES*	Butterfly	none
MARDON SKIPPER	*POLITES MARDON*	Butterfly	FC
SONORA SKIPPER	*POLITES SONORA SONORA*	Butterfly	none
DUN SKIPPER	*EUPHYES VESTRIS VESTRIS*	Butterfly	none
LABRADOR SULPHUR	*COLIAS NASTES STRECKERI*	Butterfly	none
SHEPARD'S PARNASSIAN	*PARNASSIUS CLODIUS SHEPARDI*	Butterfly	none

EASTERN TIGER SWALLOWTAIL	*PAPILIO GLAUCUS CANADENSIS*	Butterfly	none
MELISSA ARCTIC	*OENEIS MELISSA BEANII*	Butterfly	none
PUGET SOUND SILVERSPOT	*SPEYERIA CYBELE PUGETENSIS*	Butterfly	none
EGLEIS FRITILLARY	*SPEYERIA EGLEIS MCDUNNOUGHI*	Butterfly	none
ASTARTE FRITILLARY	*BOLORIA ASTARTE*	Butterfly	none
FREYA'S FRITILLARY	*BOLORIA FREIJA FREIJA*	Butterfly	none
MEADOW FRITILLARY	*BOLORIA BELLONA SSP.*	Butterfly	none
SILVER-BORDERED FRITILLARY	*BOLORIA SELENE ATROCOSTALIS*	Butterfly	none
PALE CRESCENT	*PHYCIODES PALLIDUS BARNESI*	Butterfly	none
OREAS ANGLEWING	*POLYGONIA OREAS*	Butterfly	none
COMPTON TORTOISESHELL	*NYMPHALUS VAUALBUM WATSONI*	Butterfly	none
AMERICAN PAINTED LADY	*VANESSA VIRGINIENSIS*	Butterfly	none
EGLEIS FRITILLARY	*SPEYERIA EGLEIS OWENI*	Butterfly	none
CALIFORNIA SISTER	*ADELPHA BREDOWII CALIFORNICA*	Butterfly	none
NEVADA VICEROY	*LIMENITIS ARCHIPPUS*	Butterfly	none
CORAL HAIRSTREAK	*HARKENCLENUS TITUS IMMACULOSUS*	Butterfly	none
SYLVAN HAIRSTREAK	*SATYRIUM SYLVINUM SYLVINUM*	Butterfly	none
HOARY ELFIN	*INCISALIA POLIA OBSCURA*	Butterfly	none
THICKET HAIRSTREAK	*MITOURA SPINETORUM SPINETORUM*	Butterfly	none
JOHNSON'S HAIRSTREAK	*MITOURA JOHNSONI*	Butterfly	none
JUNIPER HAIRSTREAK	*MITOURA GRYNEA BARRYI*	Butterfly	none
IMMACULATE GREEN HAIRSTREAK	*CALLOPHRYS AFFINUS AFFINIS*	Butterfly	none
EDITH'S COPPER	*LYCAENA EDITHA EDITHA*	Butterfly	none
SYLVAN HAIRSTREAK	*SATYRIUM SYLVINUM PUTNAMI*	Butterfly	none
LUSTROUS COPPER	*LYCAENA CUPREA HENRYAE*	Butterfly	none
ARCTIC BLUE	*AGRIADES GLANDON*	Butterfly	none
CHINQUAPIN HAIRSTREAK	*HABRODAIS GRUNUS HERRI*	Butterfly	none
YUMA SKIPPER	*OCHLODES YUMA*	Butterfly	none
TAYLOR'S CHECKERSPOT	*EUPHYDRYAS EDITHA TAYLORI*	Butterfly	FC
CHRYXUS ARCTIC	*OENEIS CHRYXUS CHRYXUS*	Butterfly	none
VALERATA ARCTIC	*OENEIS CHRYXUS VALERATA*	Butterfly	none
MONARCH	*DANAUS PLEXIPPUS*	Butterfly	none
SAND-VERBENA MOTH	*COPABLEPHARON FUSCUM*	Beetle	none
KEEN'S STAG BEETLE	*PLATYCEROPSIS KEENI*	Other insect	none
COLUMBIA RIVER TIGER BEETLE	*CICINDELA COLUMBICA*	Other insect	none
SIUSLAW SAND TIGER BEETLE	*CICINDELA HIRTICOLLIS SIUSLAWENSIS*	Other insect	none
BOG IDOL LEAF BEETLE	*DONACIA IDOLA*	Other insect	none
HATCH'S CLICK BEETLE	*EANUS HATCHI*	Other insect	FCo
BELLER'S GROUND BEETLE	*AGONUM BELLERI*	Other insect	FCo
MANN'S MOLLUSK-EATING GROUND BEETLE	*SCAPHINOTUS MANNII*	Other insect	none
PASCO BEE	*PERDITA SIMILIS PASCOENSIS*	Other insect	none
WENATCHEE BEE	*PERDITA CRASSIHIRTA(ACCEPTA)*	Other insect	none
STEAMBOAT ROCK CUCKOO BEE	*EUCERA DOUGLASIANA*	Other insect	none
MORGAN'S FERRY BEE	*MACROPIS STEIRONEMA OPACA*	Other insect	none

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WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Species of Concern

State Endangered Species

"Any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state."
WAC 232-12-297, Section 2.4

Search Species Lists

SORT RESULTS BY:

● Common Name
○ Scientific Name
○ Animal Type

Search Listings

Advanced Search

Species of Concern Lists

- Endangered Species
- Threatened Species
- Sensitive Species
- State Candidate Species

- Complete SOC List
- Main SOC Page

Status Codes:
FE: Federal Endangered
FT: Federal Threatened
FC: Federal Candidate
FCo: Federal Species of Concern
SE: State Endangered
ST: State Threatened
SC: State Candidate
SS: State Sensitive

Related Links

- State Monitor Species

State Endangered Species

Current through January 25, 2007

COMMON NAME	SCIENTIFIC NAME	ANIMAI
NORTHERN LEOPARD FROG	*RANA PIPIENS*	Amphibia
OREGON SPOTTED FROG	*RANA PRETIOSA*	Amphibia
AMERICAN WHITE PELICAN	*PELECANUS ERYTHRORHYNCHOS*	Bird
BROWN PELICAN	*PELECANUS OCCIDENTALIS*	Bird
SANDHILL CRANE	*GRUS CANADENSIS*	Bird
SNOWY PLOVER	*CHARADRIUS ALEXANDRINUS*	Bird
UPLAND SANDPIPER	*BARTRAMIA LONGICAUDA*	Bird
SPOTTED OWL	*STRIX OCCIDENTALIS*	Bird
STREAKED HORNED LARK	*EREMOPHILA ALPESTRIS STRIGATA*	Bird
OREGON SILVERSPOT BUTTERFLY	*SPEYERIA ZERENE HIPPOLYTA*	Butterfly
MARDON SKIPPER	*POLITES MARDON*	Butterfly
TAYLOR'S CHECKERSPOT	*EUPHYDRYAS EDITHA TAYLORI*	Butterfly
PYGMY RABBIT	*BRACHYLAGUS IDAHOENSIS*	Mammal
GRAY WOLF	*CANIS LUPUS*	Mammal
GRIZZLY BEAR	*URSUS ARCTOS*	Mammal
FISHER	*MARTES PENNANTI*	Mammal
SEA OTTER	*ENHYDRA LUTRIS*	Mammal
SEA OTTER	*ENHYDRA LUTRIS LUTRIS*	Mammal
SEI WHALE	*BALAENOPTERA BOREALIS*	Mammal
FIN WHALE	*BALAENOPTERA PHYSALUS*	Mammal
BLUE WHALE	*BALAENOPTERA MUSCULUS*	Mammal
HUMPBACK WHALE	*MEGAPTERA NOVAEANGLIAE*	Mammal
BLACK RIGHT WHALE	*BALAENA GLACIALIS*	Mammal
KILLER WHALE	*ORCINUS ORCA*	Mammal
SPERM WHALE	*PHYSETER MACROCEPHALUS*	Mammal
COLUMBIAN WHITE-TAILED DEER	*ODOCOILEUS VIRGINIANUS LEUCURUS*	Mammal
WOODLAND CARIBOU	*RANGIFER TARANDUS*	Mammal
WESTERN POND TURTLE	*CLEMMYS MARMORATA*	Reptile
LEATHERBACK SEA TURTLE	*DERMOCHELYS CORIACEA*	Reptile

Find a bug or error in the system? Let us know about it!

E-mail <webmaster@dfw.wa.gov>

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Species of Concern

State Threatened Species

"Any wildlife species native to the state of Washington that is likely to become an endangered species within the foreseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats."
WAC 232-12-297, Section 2.5

Search Species Lists

SORT RESULTS BY:

● Common Name
○ Scientific Name
○ Animal Type

Search Listings
Advanced Search

Species of Concern Lists

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SC: State Candidate
SS: State Sensitive

Related Links

- State Monitor Species

State Threatened Species

Current through January 25, 2007

COMMON NAME	SCIENTIFIC NAME	ANIMAI
BALD EAGLE	*HALIAEETUS LEUCOCEPHALUS*	Bird
FERRUGINOUS HAWK	*BUTEO REGALIS*	Bird
SHARP-TAILED GROUSE	*TYMPANUCHUS PHASIANELLUS*	Bird
SAGE GROUSE	*CENTROCERCUS UROPHASIANUS*	Bird
MARBLED MURRELET	*BRACHYRAMPHUS MARMORATUS*	Bird
WESTERN GRAY SQUIRREL	*SCIURUS GRISEUS*	Mammal
MAZAMA (WESTERN) POCKET GOPHER	*THOMOMYS MAZAMA*	Mammal
LYNX	*LYNX CANADENSIS*	Mammal
STELLER SEA LION	*EUMETOPIAS JUBATUS*	Mammal
GREEN SEA TURTLE	*CHELONIA MYDAS*	Reptile
LOGGERHEAD SEA TURTLE	*CARETTA CARETTA*	Reptile

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WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Species of Concern

State Sensitive Species

"Any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened throughout a significant portion of its range within the state without cooperative management or removal of threats."
WAC 232-12-297, Section 2.6

Search Species Lists

SORT RESULTS BY:
● Common Name
○ Scientific Name
○ Animal Type

Search Listings
Advanced Search

Species of Concern Lists

- Endangered Species
- Threatened Species
- Sensitive Species
- State Candidate Species

- Complete SOC List
- Main SOC Page

Status Codes:
FE: Federal Endangered
FT: Federal Threatened
FC: Federal Candidate
FCo: Federal Species of Concern
SE: State Endangered
ST: State Threatened
SC: State Candidate
SS: State Sensitive

Related Links

- State Monitor Species

State Sensitive Species

Current through January 25, 2007

COMMON NAME	SCIENTIFIC NAME	ANIMAL
LARCH MOUNTAIN SALAMANDER	*PLETHODON LARSELLI*	Amphibian
COMMON LOON	*GAVIA IMMER*	Bird
PEREGRINE FALCON	*FALCO PEREGRINUS*	Bird
AMERICAN PEREGRINE FALCON	*FALCO PEREGRINUS ANATUM*	Bird
ARCTIC PEREGRINE FALCON	*FALCO PEREGRINUS TUNDRIUS*	Bird
PEALE'S PEREGRINE FALCON	*FALCO PEREGRINUS PEALEI*	Bird
OLYMPIC MUDMINNOW	*NOVUMBRA HUBBSI*	Fish
PYGMY WHITEFISH	*PROSOPIUM COULTERI*	Fish
MARGINED SCULPIN	*COTTUS MARGINATUS*	Fish
GRAY WHALE	*ESCHRICHTIUS ROBUSTUS*	Mammal

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WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Species of Concern

State Candidate Species

"Include fish and wildlife species that the Department will review for possible listing as State Endangered, Threatened, or Sensitive. A species will be considered for designation as a State Candidate if sufficient evidence suggests that its status may meet the listing criteria defined for State Endangered, Threatened, or Sensitive."
WDFW Policy M-6001

Search Species Lists

SORT RESULTS BY:
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○ Animal Type

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Related Links

- State Monitor Species

State Candidate Species

Current through January 25, 2007

COMMON NAME	SCIENTIFIC NAME	ANIM
WESTERN TOAD	*BUFO BOREAS*	Amph
COLUMBIA SPOTTED FROG	*RANA LUTEIVENTRIS*	Amph
CASCADE TORRENT SALAMANDER	*RHYACOTRITON CASCADAE*	Amph
DUNN'S SALAMANDER	*PLETHODON DUNNI*	Amph
VAN DYKE'S SALAMANDER	*PLETHODON VANDYKEI*	Amph
ROCKY MOUNTAIN TAILED FROG	*ASCAPHUS MONTANUS*	Amph
SAND-VERBENA MOTH	*COPABLEPHARON FUSCUM*	Beetl
WESTERN GREBE	*AECHMOPHORUS OCCIDENTALIS*	Bird
SHORT-TAILED ALBATROSS	*PHOEBASTRIA ALBATRUS*	Bird
BRANDT'S CORMORANT	*PHALACROCORAX PENICILLATUS*	Bird
GOLDEN EAGLE	*AQUILA CHRYSAETOS*	Bird
NORTHERN GOSHAWK	*ACCIPITER GENTILIS*	Bird
MERLIN	*FALCO COLUMBARIUS*	Bird
COMMON MURRE	*URIA AALGE*	Bird
CASSIN'S AUKLET	*PTYCHORAMPHUS ALEUTICUS*	Bird
TUFTED PUFFIN	*FRATERCULA CIRRHATA*	Bird
YELLOW-BILLED CUCKOO	*COCCYZUS AMERICANUS*	Bird
BURROWING OWL	*ATHENE CUNICULARIA*	Bird
FLAMMULATED OWL	*OTUS FLAMMEOLUS*	Bird
VAUX'S SWIFT	*CHAETURA VAUXI*	Bird
LEWIS' WOODPECKER	*MELANERPES LEWIS*	Bird
PILEATED WOODPECKER	*DRYOCOPUS PILEATUS*	Bird
WHITE-HEADED WOODPECKER	*PICOIDES ALBOLARVATUS*	Bird
BLACK-BACKED WOODPECKER	*PICOIDES ARCTICUS*	Bird
PURPLE MARTIN	*PROGNE SUBIS*	Bird
SLENDER-BILLED WHITE-BREASTED NUTHATCH	*SITTA CAROLINENSIS ACULEATA*	Bird
LOGGERHEAD SHRIKE	*LANIUS LUDOVICIANUS*	Bird
OREGON VESPER SPARROW	*POOECETES GRAMINEUS AFFINIS*	Bird
SAGE SPARROW	*AMPHISPIZA BELLI*	Bird
SAGE THRASHER	*OREOSCOPTES MONTANUS*	Bird
ISLAND MARBLE	*EUCHLOE AUSONIDES INSULANUS*	Butter
MAKAH (QUEEN CHARLOTTE) COPPER	*LYCAENA MARIPOSA CHARLOTTENSIS*	Butter
PUGET BLUE	*PLEBEJUS ICARIOIDES BLACKMOREI*	Butter
VALLEY SILVERSPOT	*SPEYERIA ZERENE BREMNERII*	Butter
GREAT ARCTIC	*OENEIS NEVADENSIS GIGAS*	Butter
SHEPARD'S PARNASSIAN	*PARNASSIUS CLODIUS SHEPARDI*	Butter
SILVER-BORDERED FRITILLARY	*BOLORIA SELENE ATROCOSTALIS*	Butter
JOHNSON'S HAIRSTREAK	*MITOURA JOHNSONI*	Butter
JUNIPER HAIRSTREAK	*MITOURA GRYNEA BARRYI*	Butter

CHINQUAPIN HAIRSTREAK	*HABRODAIS GRUNUS HERRI*	Butter
YUMA SKIPPER	*OCHLODES YUMA*	Butter
RIVER LAMPREY	*LAMPETRA AYRESI*	Fish
PACIFIC HERRING (CHERRY POINT)	*CLUPEA PALLASI*	Fish
PACIFIC HERRING (DISCOVERY BAY)	*CLUPEA PALLASI*	Fish
CHUM SALMON (HOOD CANAL SU)	*ONCORHYNCHUS KETA*	Fish
CHUM SALMON (LOWER COLUMBIA)	*ONCORHYNCHUS KETA*	Fish
SOCKEYE SALMON (SNAKE R.)	*ONCORHYNCHUS NERKA*	Fish
SOCKEYE SALMON (OZETTE LAKE)	*ONCORHYNCHUS NERKA*	Fish
CHINOOK SALMON (PUGET SOUND)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish
CHINOOK SALMON (UPPER COLUMBIA SP)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish
CHINOOK SALMON (LOWER COLUMBIA)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish
CHINOOK SALMON (SNAKE R. SP/SU)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish
CHINOOK SALMON (SNAKE R. FALL)	*ONCORHYNCHUS TSHAWYTSCHA*	Fish
STEELHEAD (SNAKE RIVER)	*ONCORHYNCHUS MYKISS*	Fish
STEELHEAD (MIDDLE COLUMBIA)	*ONCORHYNCHUS MYKISS*	Fish
STEELHEAD (UPPER COLUMBIA)	*ONCORHYNCHUS MYKISS*	Fish
STEELHEAD (LOWER COLUMBIA)	*ONCORHYNCHUS MYKISS*	Fish
BULL TROUT	*SALVELINUS CONFLUENTUS*	Fish
BULL TROUT (COLUMBIA BASIN)	*SALVELINUS CONFLUENTUS*	Fish
BULL TROUT (COASTAL/PUGET SOUND)	*SALVELINUS CONFLUENTUS*	Fish
EULACHON	*THALEICHTHYS PACIFICUS*	Fish
LAKE CHUB	*COUESIUS PLUMBEUS*	Fish
LEOPARD DACE	*RHINICHTHYS FALCATUS*	Fish
UMATILLA DACE	*RHINICHTHYS UMATILLA*	Fish
MOUNTAIN SUCKER	*CATOSTOMUS PLATYRHYNCHUS*	Fish
PACIFIC COD (S&C PUGET SOUND)	*GADUS MACROCEPHALUS*	Fish
PACIFIC HAKE (C. PUGET SOUND)	*MERLUCCIUS PRODUCTUS*	Fish
WALLEYE POLLOCK (SO. PUGET SOUND)	*THERAGRA CHALCOGRAMMA*	Fish
BROWN ROCKFISH	*SEBASTES AURICULATUS*	Fish
COPPER ROCKFISH	*SEBASTES CAURINUS*	Fish
GREENSTRIPED ROCKFISH	*SEBASTES ELONGATUS*	Fish
WIDOW ROCKFISH	*SEBASTES ENTOMELAS*	Fish
YELLOWTAIL ROCKFISH	*SEBASTES FLAVIDUS*	Fish
QUILLBACK ROCKFISH	*SEBASTES MALIGER*	Fish
BLACK ROCKFISH	*SEBASTES MELANOPS*	Fish
CHINA ROCKFISH	*SEBASTES NEBULOSUS*	Fish
TIGER ROCKFISH	*SEBASTES NIGROCINCTUS*	Fish
BOCACCIO ROCKFISH	*SEBASTES PAUCISPINIS*	Fish
CANARY ROCKFISH	*SEBASTES PINNIGER*	Fish
REDSTRIPE ROCKFISH	*SEBASTES PRORIGER*	Fish
YELLOWEYE ROCKFISH	*SEBASTES RUBERRIMUS*	Fish
MERRIAM'S SHREW	*SOREX MERRIAMI*	Mamn
KEEN'S MYOTIS	*MYOTIS KEENII*	Mamn
TOWNSEND'S BIG-EARED BAT	*CORYNORHINUS TOWNSENDII*	Mamn
PACIFIC TOWNSEND'S BIG-EARED BAT	*CORYNORHINUS TOWNSENDII TOWNSENDII*	Mamn
PALLID TOWNSEND'S BIG-EARED BAT	*CORYNORHINUS TOWNSENDII PALLESCENS*	Mamn
WHITE-TAILED JACKRABBIT	*LEPUS TOWNSENDII*	Mamn
BLACK-TAILED JACKRABBIT	*LEPUS CALIFORNICUS*	Mamn
WASHINGTON GROUND SQUIRREL	*SPERMOPHILUS WASHINGTONI*	Mamn
TOWNSEND'S GROUND SQUIRREL	*SPERMOPHILUS TOWNSENDII TOWNSENDII*	Mamn
BRUSH PRAIRIE POCKET GOPHER	*THOMOMYS TALPOIDES DOUGLASI*	Mamn

SHELTON POCKET GOPHER	*THOMOMYS MAZAMA COUCHI*	Mamn
CATHLAMET POCKET GOPHER	*THOMOMYS MAZAMA LOUIEI*	Mamn
OLYMPIC POCKET GOPHER	*THOMOMYS MAZAMA MELANOPS*	Mamn
YELM POCKET GOPHER	*THOMOMYS MAZAMA YELMENSIS*	Mamn
GRAY-TAILED VOLE	*MICROTUS CANICAUDUS*	Mamn
WOLVERINE	*GULO GULO*	Mamn
PACIFIC HARBOR PORPOISE	*PHOCOENA PHOCOENA*	Mamn
PINTO ABALONE	*HALIOTIS KAMTSCHATKANA*	Mollus
OLYMPIA OYSTER	*OSTREA LURIDA*	Mollus
GIANT COLUMBIA RIVER LIMPET	*FISHEROLA NUTTALLI*	Mollus
GREAT COLUMBIA SPIRE SNAIL	*FLUMINICOLA COLUMBIANA*	Mollus
BLUE-GRAY TAILDROPPER	*PROPHYSAON COERULEUM*	Mollus
COLUMBIA OREGONIAN	*CRYPTOMASTIX HENDERSONI*	Mollus
POPLAR OREGONIAN	*CRYPTOMASTIX POPULI*	Mollus
DALLES SIDEBAND	*MONADENIA FIDELIS MINOR*	Mollus
NEWCOMB'S LITTORINE SNAIL	*ALGAMORDA SUBROTUNDATA*	Mollus
CALIFORNIA FLOATER	*ANODONTA CALIFORNIENSIS*	Mollus
COLUMBIA CLUBTAIL	*GOMPHUS LYNNAE*	Other
COLUMBIA RIVER TIGER BEETLE	*CICINDELA COLUMBICA*	Other
BOG IDOL LEAF BEETLE	*DONACIA IDOLA*	Other
HATCH'S CLICK BEETLE	*EANUS HATCHI*	Other
BELLER'S GROUND BEETLE	*AGONUM BELLERI*	Other
MANN'S MOLLUSK-EATING GROUND BEETLE	*SCAPHINOTUS MANNII*	Other
SAGEBRUSH LIZARD	*SCELOPORUS GRACIOSUS*	Reptil
SHARPTAIL SNAKE	*CONTIA TENUIS*	Reptil
STRIPED WHIPSNAKE	*MASTICOPHIS TAENIATUS*	Reptil
CALIFORNIA MOUNTAIN KINGSNAKE	*LAMPROPELTIS ZONATA*	Reptil

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Threatened & Endangered

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Federal and State Protected Plants in Washington

288 records returned

Click on an accepted name below to view its PLANTS Profile with more information. Cl
name in the reference list to view its T&E list, or click on the reference link to see pub
learn more about each law. Protected plants that are synonyms are indented beneath
PLANTS accepted name; common names are from PLANTS.

United States	USFWS Endangered Species Program. 2006. *All plants* (20 Janua Fish and Wildlife Service.
Washington	Washington Natural Heritage Program. 2002. *Endangered, threat sensitive vascular plants of Washington* (20 October 2002). Wasl Department of Natural Resources.

Symbol	Scientific Name	Common Name	Federal Protected Status†
ABUMB	*Abronia umbellata* Lam. ssp. *breviflora* (Standl.) Munz	pink sand verbena	
ABUMA2	*Abronia umbellata* Lam. ssp. *acutalata* (Standl.) Tillett		
ACEL4	*Actaea elata* (Nutt.) Prantl	tall bugbane	
CIEL	*Cimicifuga elata* Nutt.		
AGEL	*Agoseris elata* (Nutt.) Greene	tall agoseris	
AGME3	*Agrostis mertensii* Trin.	northern bentgrass	
AGBO2	*Agrostis borealis* Hartman		
ALLE7	*Aliciella leptomeria* (Gray) J.M. Porter	sand gilia	
GILE3	*Gilia leptomeria* Gray		
ALCA2	*Allium campanulatum* S. Wats.	dusky onion	
ALCO3	*Allium constrictum* (Ownbey & Mingrone) P. Peterson, Annable & Rieseberg	Grand Coulee onion	
ALDI3	*Allium dictuon* St. John	Blue Mountain onion	
AMRO3	*Ammannia robusta* Heer & Regel	grand redstem	
ANCO	*Antennaria corymbosa* E. Nels.	flat-top pussytoes	
ANPA4	*Antennaria parvifolia* Nutt.	small-leaf pussytoes	
ARCR	*Arabis crucisetosa* Constance & Rollins	wetsoil rockcress	
ARPA7	*Arenaria paludicola* B.L. Robins.	marsh sandwort	E

▷ PLANTS Links

ARCAW	*Artemisia campestris* L. ssp. *borealis* (Pallas) Hall & Clements var. *wormskioldii* (Bess. ex Hook.) Cronq.	field sagewort
ASAR7	*Astragalus arrectus* Gray	Palouse milkvetch
ASAR8	*Astragalus arthurii* M.E. Jones	waha milkvetch
ASCO9	*Astragalus columbianus* Barneby	Columbian milkvetch
ASCO13	*Astragalus cottonii* M.E. Jones	Cotton's milkvetch
ASAUO	*Astragalus australis* (L.) Lam. var. *olympicus* Isely	
ASCUC2	*Astragalus cusickii* Gray var. *cusickii*	Cusick's milkvetch
ASDI2	*Astragalus diaphanus* Dougl. ex Hook.	transparent milkvetch
ASGE	*Astragalus geyeri* Gray	Geyer's milkvetch
ASKED2	*Astragalus kentrophyta* Gray var. *douglasii* Barneby	Douglas' spiny milkvetch
ASMI4	*Astragalus microcystis* Gray	dwarf milkvetch
ASMIP	*Astragalus misellus* S. Wats. var. *pauper* Barneby	pauper milkvetch
ASPUS	*Astragalus pulsiferae* Gray var. *suksdorfii* (T.J. Howell) Barneby	Suksdorf's milkvetch
ASRI	*Astragalus riparius* Barneby	woodyroot milkvetch
ASSI5	*Astragalus sinuatus* Piper	Whited's milkvetch
BOOR	*Bolandra oregana* S. Wats.	northern false coolwort
BOAS2	*Botrychium ascendens* W.H. Wagner	trianglelobe moonwort
BOCA5	*Botrychium campestre* W.H. Wagner & Farrar	Iowa moonwort
BOCR	*Botrychium crenulatum* W.H. Wagner	scalloped moonwort
BOHE5	*Botrychium hesperium* (Maxon & Clausen) W.H. Wagner & Lellinger	western moonwort
BOLI7	*Botrychium lineare* W.H. Wagner	narrowleaf grapefern
BOLU	*Botrychium lunaria* (L.) Sw.	common moonwort
BOPA9	*Botrychium paradoxum* W.H. Wagner	peculiar moonwort
BOPE4	*Botrychium pedunculosum* W.H. Wagner	stalked moonwort
BOSI	*Botrychium simplex* E. Hitchc.	little grapefern
CALOL	*Calochortus longebarbatus* S. Wats. var. *longebarbatus*	longbeard mariposa lily
CAMAM	*Calochortus macrocarpus* Dougl. var. *maculosus* (A. Nels. & J.F. Macbr.) A. Nels. & J.F. Macbr.	Nez Perce mariposa lily
CANI	*Calochortus nitidus* Dougl.	broadfruit mariposa lily
CAPY5	*Camissonia pygmaea* (Dougl. ex Lehm.) Raven	dwarf suncup
CASC18	*Camissonia scapoidea* (Nutt. ex Torr. & Gray) Raven	Paiute suncup

CALA7	*Campanula lasiocarpa* Cham.	mountain harebell	
CAAN10	*Carex anthoxanthea* J.& K. Presl	grassyslope arctic sedge	
CAAT8	*Carex atrosquama* Mackenzie	lesser blackscale sedge	
CABU6	*Carex buxbaumii* Wahlenb.	Buxbaum's sedge	
CACA12	*Carex capillaris* L.	hairlike sedge	
CACH5	*Carex chordorrhiza* Ehrh. ex L. f.	creeping sedge	
CACI5	*Carex circinata* C.A. Mey.	coiled sedge	
CACO8	*Carex comosa* Boott	longhair sedge	
CADE8	*Carex densa* (Bailey) Bailey	dense sedge	
CADU6	*Carex duriuscula* C.A. Mey.	needleleaf sedge	
CAEL2	*Carex eleocharis* Bailey		
CAFL4	*Carex flava* L.	yellow sedge	
CAGY2	*Carex gynocrates* Wormsk. ex Drej.	northern bog sedge	
CADIG	*Carex dioica* L. ssp. *gynocrates* (Wormsk. ex Drej.) Hultén		
CAHE8	*Carex heteroneura* W. Boott	different-nerve sedge	
CAHY4	*Carex hystericina* Muhl. ex Willd.	bottlebrush sedge	
CAMA11	*Carex macrochaeta* C.A. Mey.	longawn sedge	
CAMAI2	*Carex magellanica* Lam. ssp. *irrigua* (Wahlenb.) Hultén	boreal bog sedge	
CANO2	*Carex norvegica* Retz.	Norway sedge	
CAOB4	*Carex obtusata* Lilj.	obtuse sedge	
CAPA19	*Carex pauciflora* Lightf.	fewflower sedge	
CAPH8	*Carex ×physocarpioides* Lepage [*saxatilis* × *utriculata*]		
CASAM	*Carex saxatilis* L. var. *major* Olney		
CAPL6	*Carex pluriflora* Hultén	manyflower sedge	
CAPR10	*Carex proposita* Mackenzie	Great Smoky Mountain sedge	
CARO6	*Carex rostrata* Stokes	beaked sedge	
CASC10	*Carex scirpoidea* Michx.	northern singlespike sedge	
CASI12	*Carex siccata* Dewey	dryspike sedge	
CAFO3	*Carex foenea* Willd.		
CAST10	*Carex stylosa* C.A. Mey.	variegated sedge	
CASY	*Carex sychnocephala* Carey	manyhead sedge	
CATE5	*Carex tenuiflora* Wahlenb.	sparseflower sedge	
CAVA3	*Carex vallicola* Dewey	valley sedge	
CAXE	*Carex xerantica* Bailey	whitescale sedge	
CALY4	*Cassiope lycopodioides* (Pallas) D. Don	clubmoss mountain heather	
CACR14	*Castilleja cryptantha* Pennell & G.N. Jones	obscure Indian paintbrush	
CALE27	*Castilleja levisecta* Greenm.	golden Indian paintbrush	T
CEMU2	*Centaurium muehlenbergii* (Griseb.) W. Wight ex Piper	Muhlenberg's centaury	

CHTH	*Chaenactis thompsonii* Cronq.	Thompson's pincushion
CHFE	*Cheilanthes feei* T. Moore	slender lipfern
CHCH7	*Chrysolepis chrysophylla* (Dougl. ex Hook.) Hjelmqvist	giant chinquapin
CHTE3	*Chrysosplenium tetrandrum* (Lund ex Malmgr.) Th. Fries	northern golden saxifrage
CIBU	*Cicuta bulbifera* L.	bulblet-bearing water hemlock
CIRO2	*Cistanthe rosea* (S. Wats.) Hershkovitz	rosy pussypaws
CARO	*Calyptridium roseum* S. Wats.	
CLLAP	*Claytonia lanceolata* Pall. ex Pursh var. *pacifica* McNeill	Pacific springbeauty
COGR6	*Cochlearia groenlandica* L.	Danish scurvygrass
COOFA	*Cochlearia officinalis* L. ssp. *arctica* (Schlecht.) Hultén	
COSPB	*Collinsia sparsiflora* Fisch. & C.A. Mey. var. *bruceae* (M.E. Jones) Newsom	spinster's blue eyed Mary
COMA3	*Collomia macrocalyx* Leib. ex Brand	bristleflower collomia
COAS	*Coptis aspleniifolia* Salisb.	fernleaf goldthread
COTR2	*Coptis trifolia* (L.) Salisb.	threeleaf goldthread
COCAA	*Corydalis caseana* Gray ssp. *aquae-gelidae* (M.E. Peck & Wilson) Zetterlund & Lidén	coldwater fumewort
COAQ	*Corydalis aquae-gelidae* M.E. Peck & Wilson	
CRCO34	*Crassula connata* (Ruiz & Pavón) Berger	sand pygmyweed
CRFL4	*Cryptantha flaccida* (Dougl. ex Lehm.) Greene	weakstem cryptantha
CRRO4	*Cryptantha rostellata* (Greene) Greene	
CRLE6	*Cryptantha leucophaea* (Dougl. ex Lehm.) Payson	gray cryptantha
CRSC2	*Cryptantha scoparia* A. Nels.	Pinyon Desert cryptantha
CRSP4	*Cryptantha spiculifera* (Piper) Payson	Snake River cryptantha
CRST2	*Cryptogramma stelleri* (Gmel.) Prantl	fragile rockbrake
CUDE2	*Cuscuta denticulata* Engelm.	desert dodder
CUDO3	*Cusickiella douglasii* (Gray) Rollins	alkali cusickiella
CYBI6	*Cyperus bipartitus* Torr.	slender flatsedge
CYFA	*Cypripedium fasciculatum* Kellogg ex S. Wats.	clustered lady's slipper
CYPA19	*Cypripedium parviflorum* Salisb.	lesser yellow lady's slipper
DACA12	*Damasonium californicum* Torr. ex Benth.	California damsonium
DENUO	*Delphinium nuttallii* Gray ssp. *ochroleucum* (Nutt.) Warnock	upland larkspur

DELE	*Delphinium leucophaeum* Greene	
DEVI2	*Delphinium viridescens* Leib.	Wenatchee larkspur
DOAU	*Dodecatheon austrofrigidum* sp. nov. ined.	tundra shootingstar
DRAU	*Draba aurea* Vahl ex Hornem.	golden draba
DRBRC	*Draba breweri* S. Wats. var. *cana* (Rydb.) Rollins	cushion draba
DRCA4	*Draba cana* Rydb.	
DRJU2	*Draba juvenilis* Komarov	longstalk draba
DRLO2	*Draba longipes* Raup	
DRDR	*Dryas drummondii* Richards. ex Hook.	Drummond's mountain-avens
DRCR4	*Dryopteris cristata* (L.) Gray	crested woodfern
EANI	*Eatonella nivea* (D.C. Eat.) Gray	white false tickhead
ELAT	*Eleocharis atropurpurea* (Retz.) J.& K. Presl	purple spikerush
ELRO2	*Eleocharis rostellata* (Torr.) Torr.	beaked spikerush
ERAL3	*Erigeron aliceae* T.J. Howell	Alice Eastwood's fleabane
ERBA4	*Erigeron basalticus* Hoover	basalt fleabane
EREL10	*Erigeron elatus* (Hook.) Greene	swamp boreal-daisy
TREL10	*Trimorpha elata* (Hook.) Nesom	
ERHO3	*Erigeron howellii* Gray	Howell's fleabane
EROR2	*Erigeron oreganus* Gray	gorge fleabane
ERPET2	*Erigeron peregrinus* (Banks ex Pursh) Greene ssp. *peregrinus* var. *thompsonii* (Blake ex J.W. Thompson) Cronq.	subalpine fleabane
ERPI3	*Erigeron piperianus* Cronq.	Piper's fleabane
ERSA17	*Erigeron salishii* G.W. Douglas & Packer	Star Peak fleabane
ERCO43	*Eriogonum codium* Reveal, Caplow, & K. Beck	basalt desert buckwheat
ERMA2	*Eriogonum maculatum* Heller	spotted buckwheat
ERVI9	*Eriophorum viridicarinatum* (Engelm.) Fern.	thinleaf cottonsedge
ERNAE	*Eritrichium nanum* (Vill.) Schrad. ex Gaudin var. *elongatum* (Rydb.) Cronq.	arctic alpine forget-me-not
ERAR14	*Eryngium articulatum* Hook.	beethistle
ERPE7	*Eryngium petiolatum* Hook.	rushleaf eryngo
ERRE5	*Erythronium revolutum* Sm.	mahogany fawnlily
EUOC9	*Euonymus occidentale* Nutt. ex Torr.	western burning bush
EUOC8	*Euonymus occidentalis* Nutt. ex Torr. [orthographic variant]	
EUME17	*Eurybia merita* (A. Nels.) Nesom	subalpine aster
ASSIM	*Aster sibiricus* L. var. *meritus* (A. Nels.) Raup	
FIOC	*Filipendula occidentalis* (S. Wats.) T.J. Howell	queen of the forest
FRCA5	*Fritillaria camschatcensis* (L.) Ker-	Kamchatka fritillary

	Gawl.		
GAKA	*Galium kamtschaticum* Steller ex J.A. & J.H. Schultes	boreal bedstraw	
GAHI2	*Gaultheria hispidula* (L.) Muhl. ex Bigelow	creeping snowberry	
GEDO	*Gentiana douglasiana* Bong.	swamp gentian	
GEGL	*Gentiana glauca* Pallas	pale gentian	
GETE4	*Gentianella tenella* (Rottb.) Böerner	Dane's dwarf gentian	
GERI2	*Geum rivale* L.	purple avens	
GEROD	*Geum rossii* (R. Br.) Ser. var. *depressum* (Greene) C.L. Hitchc.	Ross' avens	
GISP3	*Githopsis specularioides* Nutt.	common bluecup	
HACI2	*Hackelia cinerea* (Piper) I.M. Johnston	gray stickseed	
HADID	*Hackelia diffusa* (Lehm.) I.M. Johnston var. *diffusa*	spreading stickseed	
HAHID	*Hackelia hispida* (Gray) I.M. Johnston var. *disjuncta* R.L. Carr	rough stickseed	
HAHIH	*Hackelia hispida* (Gray) I.M. Johnston var. *hispida*	showy stickseed	
HAVE4	*Hackelia venusta* (Piper) St. John	lesser showy stickseed	E
HEGRT	*Heuchera grossulariifolia* Rydb. var. *tenuifolia* (Wheelock) C.L. Hitchc.	gooseberryleaf alumroot	
HOAQ	*Howellia aquatilis* Gray	water howellia	T
HYMA2	*Hypericum majus* (Gray) Britt.	large St. Johnswort	
ILLO2	*Iliamna longisepala* (Torr.) Wiggins	longsepal wild hollyhock	
ILRIR	*Iliamna rivularis* (Dougl. ex Hook.) Greene var. *rivularis*	streambank wild hollyhock	
ILCO4	*Iliamna corei* Sherff		E
ISNU	*Isoetes nuttallii* A. Braun ex Engelm.	Nuttall's quillwort	
JUHEH	*Juncus hemiendytus* F.J. Herm. var. *hemiendytus*	Herman's dwarf rush	
JUKE	*Juncus kelloggii* Engelm.	Kellogg's dwarf rush	
JUTI	*Juncus tiehmii* Ertter	Nevada rush	
KUCO	*Kumlienia cooleyae* (Vasey & Rose) Greene	Cooley's false buttercup	
RACO2	*Ranunculus cooleyae* Vasey & Rose		
LAHO2	*Lathyrus holochlorus* (Piper) C.L. Hitchc.	thinleaf pea	
LATO	*Lathyrus torreyi* Gray	Torrey's pea	
LEOX	*Lepidium oxycarpum* Torr. & Gray	forked pepperweed	
LEBO9	*Leptosiphon bolanderi* (Gray) J.M. Porter & L.A. Johnson	Bolander's linanthus	
LIBO2	*Linanthus bolanderi* (Gray) Greene		
LETU7	*Lesquerella tuplashensis* Rollins, K. Beck & F.E. Kaplow	White Bluffs bladderpod	
LILO	*Liparis loeselii* (L.) L.C. Rich.	yellow widelip orchid	

LIAR6	*Lipocarpha aristulata* (Coville) G. Tucker	awned halfchaff sedge	
LIBO4	*Listera borealis* Morong	northern twayblade	
LODO	*Lobelia dortmanna* L.	Dortmann's cardinalflower	
LOKA	*Lobelia kalmii* L.	Ontario lobelia	
LOSQ	*Loeflingia squarrosa* Nutt.	spreading pygmyleaf	
LOPR	*Loiseleuria procumbens* (L.) Desv.	alpine azalea	
LOBR	*Lomatium bradshawii* (Rose ex Mathias) Mathias & Constance	Bradshaw's desertparsley	E
LOCU	*Lomatium cusickii* (S. Wats.) Coult. & Rose	Cusick's biscuitroot	
LOLA3	*Lomatium laevigatum* (Nutt.) Coult. & Rose	Slickrock biscuitroot	
LORO2	*Lomatium rollinsii* Mathias & Constance	Rollins' biscuitroot	
LOSE2	*Lomatium serpentinum* (M.E. Jones) Mathias	sweetscented biscuitroot	
LOSU4	*Lomatium suksdorfii* (S. Wats.) Coult. & Rose	Suksdorf's desertparsley	
LOTU	*Lomatium tuberosum* Hoover	Hoover's desertparsley	
LUORK	*Lupinus oreganus* Heller var. *kincaidii* C.P. Sm.	Kincaid's lupine	T
LUSUK2	*Lupinus sulphureus* Dougl. ex Hook. var. *kincaidii* (C.P. Sm.) C.L. Hitchc.		
LUSA3	*Lupinus sabinianus* Dougl. ex Lindl.	Sabin's lupine	
LUSA4	*Lupinus sabinei* Dougl. ex Hook.		
LUAR5	*Luzula arcuata* (Wahlenb.) Sw.	curved woodrush	
LYIN2	*Lycopodiella inundata* (L.) Holub	inundated clubmoss	
LYDE	*Lycopodium dendroideum* Michx.	tree groundpine	
MEOR	*Meconella oregana* Nutt.	white fairypoppy	
MIBI	*Microseris bigelovii* (Gray) Schultz-Bip.	coastal silverpuffs	
MIBO	*Microseris borealis* (Bong.) Schultz-Bip.	apargidium	
MIJU	*Mimulus jungermannioides* Suksdorf	liverwort monkeyflower	
MIPU2	*Mimulus pulsiferae* Gray	candelabrum monkeyflower	
MISU2	*Mimulus suksdorfii* Gray	Suksdorf's monkeyflower	
MINUF	*Minuartia nuttallii* (Pax) Briq. ssp. *fragilis* (Maguire & A. Holmgren) McNeill	brittle sandwort	
MODI3	*Montia diffusa* (Nutt.) Greene	spreading minerslettuce	
MUGL3	*Muhlenbergia glomerata* (Willd.) Trin.	spiked muhly	
NATA3	*Navarretia tagetina* Greene	marigold pincushionplant	

NIAT	*Nicotiana attenuata* Torr. ex S. Wats.	coyote tobacco
NYTE	*Nymphaea tetragona* Georgi	pygmy waterlily
OECAC2	*Oenothera caespitosa* Nutt. ssp. *caespitosa*	tufted evening-primrose
OECAM4	*Oenothera caespitosa* Nutt. ssp. *marginata* (Nutt. ex Hook. & Arn.) Munz	tufted evening-primrose
OEFL	*Oenothera flava* (A. Nels.) Garrett	yellow evening-primrose
OPPU3	*Ophioglossum pusillum* Raf.	northern adderstongue
ORBR	*Orthocarpus bracteosus* Benth.	rosy owl's-clover
OXSU	*Oxalis suksdorfii* Trel.	Suksdorf woodsorrel
OXBOV	*Oxytropis borealis* DC. var. *viscida* (Nutt.) Welsh	viscid locoweed
OXCAC2	*Oxytropis campestris* (L.) DC. var. *columbiana* (St. John) Barneby	field locoweed
OXCAW	*Oxytropis campestris* (L.) DC. var. *wanapum* E. Joyal	field locoweed
OXMO2	*Oxytropis monticola* Gray	yellowflower locoweed
OXCAG	*Oxytropis campestris* (L.) DC. var. *gracilis* (A. Nels.) Barneby	
PAFIH	*Parnassia fimbriata* Koenig var. *hoodiana* C.L. Hitchc.	fringed grass of Parnassus
PAKO3	*Parnassia kotzebuei* Cham. ex Spreng.	Kotzebue's grass of Parnassus
PAPAT	*Parnassia palustris* L. var. *tenuis* Wahlenb.	marsh grass of Parnassus
PAPAN	*Parnassia palustris* L. var. *neogaea* Fern.	
PERA6	*Pedicularis rainierensis* Pennell & Warren	Mt. Rainier lousewort
PEBR3	*Pellaea brachyptera* (T. Moore) Baker	Sierra cliffbrake
PEBR4	*Pellaea breweri* D.C. Eat.	Brewer's cliffbrake
PEBA7	*Penstemon barrettiae* Gray	Barrett's beardtongue
PEDEV2	*Penstemon deustus* Dougl. ex Lindl. var. *variabilis* (Suksdorf) Cronq.	scabland penstemon
PECI4	*Petrophyton cinerascens* (Piper) Rydb.	halfshrub rockmat
PHLE12	*Phacelia lenta* Piper	sticky phacelia
PHMI7	*Phacelia minutissima* Henderson	small phacelia
PHTE	*Phacelia tetramera* J.T. Howell	fourpart phacelia
PHSE20	*Phemeranthus sediformis* (Poelln.) Kiger	Okanogan fameflower
TASE	*Talinum sediforme* Poelln.	
PHDID	*Physaria didymocarpa* (Hook.) Gray var. *didymocarpa*	common twinpod
PIAM	*Pilularia americana* A. Braun	American pillwort

PICA9	*Pityopus californica* (Eastw.) Copeland f.	California pinefoot
PLMA	*Plantago macrocarpa* Cham. & Schlecht.	seashore plantain
PLCH3	*Platanthera chorisiana* (Cham.) Reichenb.	Chimissso's orchid
PLOB	*Platanthera obtusata* (Banks ex Pursh) Lindl.	bluntleaved orchid
PLSP2	*Platanthera sparsiflora* (S. Wats.) Schlechter	sparse-flowered bog orchid
POLA3	*Poa laxiflora* Buckl.	looseflower bluegrass
PONE2	*Poa nervosa* (Hook.) Vasey	Wheeler bluegrass
POUN	*Poa unilateralis* Scribn.	San Francisco bluegrass
POCA4	*Polemonium carneum* Gray	royal Jacob's-ladder
POPE14	*Polemonium pectinatum* Greene	Washington Jacob's-ladder
POVI	*Polemonium viscosum* Nutt.	sticky polemonium
PODOA2	*Polygonum douglasii* Greene ssp. *austiniae* (Greene) E. Murr.	Austin knotweed
POAU2	*Polygonum austiniae* Greene	
POCA25	*Polystichum californicum* (D.C. Eat.) Diels	California swordfern
POOB2	*Potamogeton obtusifolius* Mert. & Koch	bluntleaf pondweed
PODIP	*Potentilla diversifolia* Lehm. var. *perdissecta* (Rydb.) C.L. Hitchc.	mountainmeadow cinquefoil
PODRB2	*Potentilla drummondii* Lehm. ssp. *breweri* (S. Wats.) Ertter	Drummond's cinquefoil
POBR6	*Potentilla breweri* S. Wats.	
PONI2	*Potentilla nivea* L.	snow cinquefoil
PONIP	*Potentilla nivea* L. var. *pentaphylla* Lehm.	fiveleaf cinquefoil
POQU	*Potentilla quinquefolia* (Rydb.) Rydb.	
PUNU	*Puccinellia nutkaensis* (J. Presl) Fern. & Weatherby	Nootka alkaligrass
PUPAM	*Pulsatilla patens* (L.) P. Mill. ssp. *multifida* (Pritz.) Zamels	cutleaf anemone
ANNU5	*Anemone nuttalliana* DC.	
PYLI	*Pyrrocoma liatriformis* Greene	smallhead goldenweed
HALI2	*Haplopappus liatriformis* (Greene) St. John	
RAPO	*Ranunculus populago* Greene	popular buttercup
RATR6	*Ranunculus triternatus* Gray	obscure buttercup
RARE5	*Ranunculus reconditus* A. Nels. & J.F. Macbr.	
RICEC	*Ribes cereum* Dougl. var. *colubrinum* C.L. Hitchc.	wax currant
RIOXI	*Ribes oxyacanthoides* L. ssp. *irriguum* (Dougl.) Sinnott	Idaho gooseberry

ROCO3	*Rorippa columbiae* (Suksdorf ex B.L. Robins.) Suksdorf ex T.J. Howell	Columbian yellowcress	
RORA	*Rotala ramosior* (L.) Koehne	lowland rotala	
RUARA2	*Rubus arcticus* L. ssp. *acaulis* (Michx.) Focke	dwarf raspberry	
RUAC	*Rubus acaulis* Michx.		
RUNI	*Rubus nigerrimus* (Greene) Rydb.	dark raspberry	
SACA4	*Salix candida* Flueggé ex Willd.	sageleaf willow	
SAGL	*Salix glauca* L.	grayleaf willow	
SAMA12	*Salix maccalliana* Rowlee	McCalla's willow	
SASE3	*Salix sessilifolia* Nutt.	northwest sandbar willow	
SATW	*Salix tweedyi* (Bebb ex Rose) Ball	Tweedy's willow	
SAVE	*Salix vestita* Pursh	rock willow	
SAVEE	*Salix vestita* Pursh var. *erecta* Anderss.		
SAVAP	*Samolus valerandi* L. ssp. *parviflorus* (Raf.) Hultén	seaside brookweed	
SAPA9	*Samolus parviflorus* Raf.		
SAME6	*Sanguisorba menziesii* Rydb.	Menzies' burnet	
SAAR9	*Sanicula arctopoides* Hook. & Arn.	footsteps of spring	
SAMA2	*Sanicula marilandica* L.	Maryland sanicle	
SACE2	*Saxifraga cernua* L.	nodding saxifrage	
SARI8	*Saxifraga rivularis* L.	weak saxifrage	
SAFR5	*Saxifragopsis fragarioides* (Greene) Small	strawberry saxifrage	
SCDI5	*Sclerolinon digynum* (Gray) Rogers	digynum flax	
SCBO	*Scribneria bolanderi* (Thurb.) Hack.	Scribner's grass	
SERI4	*Sericocarpus rigidus* Lindl.	Columbian whitetop aster	
ASCU2	*Aster curtus* Cronq.		
SIHI3	*Sidalcea hirtipes* C.L. Hitchc.	bristlystem checkerbloom	
SIMAV	*Sidalcea malviflora* (DC.) Gray ex Benth. ssp. *virgata* (T.J. Howell) C.L. Hitchc.	dwarf checkerbloom	
SINE2	*Sidalcea nelsoniana* Piper	Nelson's checkerbloom	T
SIORC2	*Sidalcea oregana* (Nutt. ex Torr. & Gray) Gray ssp. *oregana* var. *calva* C.L. Hitchc.	Oregon checkerbloom	E
SISE2	*Silene seelyi* Morton & J.W. Thompson	Seely's catchfly	
SISP2	*Silene spaldingii* S. Wats.	Spalding's silene	T
SIMO2	*Sisyrinchium montanum* Greene	strict blue-eyed grass	
SISA4	*Sisyrinchium sarmentosum* Suksdorf ex Greene	mountain blue-eyed grass	
SISE4	*Sisyrinchium septentrionale* Bickn.	northern blue-eyed grass	
SPPE	*Spartina pectinata* Bosc ex Link	prairie cordgrass	
SPDI6	*Spiranthes diluvialis* Sheviak	Ute lady's tresses	T

SPPO7	*Spiranthes porrifolia* Lindl.	creamy lady's tresses
SUOR	*Sullivantia oregana* S. Wats.	Oregon coolwort
SYBO2	*Symphyotrichum boreale* (Torr. & Gray) A.& D. Löve	northern bog aster
ASBO7	*Aster borealis* (Torr. & Gray) Prov.	
SYJE	*Symphyotrichum jessicae* (Piper) Nesom	Jessica's aster
ASJE	*Aster jessicae* Piper	
SYPIL	*Synthyris pinnatifida* S. Wats. var. *lanuginosa* (Piper) Cronq.	featherleaf kittentails
TAHO	*Tauschia hooveri* Mathias & Constance	Hoover's umbrellawort
TATE3	*Tauschia tenuissima* (Geyer ex Hook.) Mathias & Constance	Leiberg's umbrellawort
THDA	*Thalictrum dasycarpum* Fisch. & Avé-Lall.	purple meadow-rue
TRDO	*Trifolium douglasii* House	Douglas' clover
TRPL2	*Trifolium plumosum* Dougl. ex Hook.	plumed clover
TRTH2	*Trifolium thompsonii* Morton	Thompson's clover
TRPA11	*Trillium parviflorum* Soukup	smallflower wakerobin
UTIN2	*Utricularia intermedia* Hayne	flatleaf bladderwort
VAMY	*Vaccinium myrtilloides* Michx.	velvetleaf huckleberry
VEIN	*Veratrum insolitum* Jepson	Siskiyou false hellebore
VIRE2	*Viola renifolia* Gray	white violet
WOFI	*Woodwardia fimbriata* Sm.	giant chainfern

†Code	**Protected Status**
E	Endangered
PX	Possibly Extirpated
S	Sensitive
T	Threatened

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APPENDIX H

Public Participation Plan

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1.0 Introduction and Overview of the Public Participation Plan

1.1 PUBLIC PARTICIPATION AT HAZARDOUS WASTE SITES

Public participation is an integral element of the Model Toxics Control Act (MTCA), Chapter 70.105D Revised Code of Washington (RCW). The citizen-mandated hazardous waste cleanup law went into effect in March 1989. The implementing regulation, found in Chapter 173-340 of the Washington Administrative Code (WAC), prescribes the process and standards to identify, investigate, and clean up facilities where hazardous substances may be located. The law and associated regulations for implementation include requirements and guidelines for involving the public in the investigation and cleanup of hazardous waste sites.

Under Part VI WAC 173-340-600 of the regulations, a Public Participation Plan (PPP) is required for sites undergoing investigation and cleanup of hazardous substances that are conducted under the Washington State Department of Ecology (Ecology) or its oversight. The plan must be updated for each new phase of work at the site.

The PPP is a document designed to provide a process for meaningful public participation during the technical studies and cleanup of a site. While certain aspects of the plan are prescribed by regulation, PPPs are developed to meet the needs of a specific community and to encourage participation by members of the community. According to cleanup regulations, “the scope of the plan shall be commensurate with the nature of the proposed remedial actions, the level of public concern, and the risks posed by the facility.”

This PPP addresses public participation in the cleanup of the Cap Sante Marine (CSM) Site as it is today under current conditions. This PPP also addresses public participation in cleanup activities that would be implemented under potential future developed conditions, where public access and site conditions may be different from their existing conditions. This plan will be reviewed at each phase of the cleanup, and amended or rewritten as appropriate. This plan includes information about basic public participation requirements, which include:

- Notifying the public about available site-specific reports and studies
- Notifying the public about public comment opportunities during specific phases of the cleanup
- Providing for appropriate public participation methods such as informational mailing or meetings
- Considering public comments received during public comment periods

1.2 GOAL OF THIS PUBLIC PARTICIPATION PLAN

The goal of this plan is to promote public understanding of the cleanup regulations and process and to encourage the public’s meaningful participation in achieving a cleanup that is protective of human health and the environment. The actions in this plan will provide a channel for the public to be notified of, comment on, and assist in the cleanup process for the CSM Site.

The main objectives of this plan are to:

a) Promote public understanding of the cleanup and meaningful participation in the cleanup process.
b) Ensure that people will be appropriately informed of the status of cleanup activities for the existing site conditions and of cleanup activities that would be a component of potential future development on the site.
c) Solicit and respond to community concerns, questions, and comments regarding the present cleanup as well as future development.

1.3 PUBLIC PARTICIPATION FOR THE SELECTION OF CLEANUP ACTIONS

This PPP has been prepared by the owner of the CSM Site, the Port of Anacortes (Port). The PPP accompanies an Agreed Order that sets forth the legal agreements that Ecology and the Port will follow during the cleanup of the CSM Site.

Documents that will be presented for public comment are listed below and defined in detail in the paragraphs that follow:

- Agreed Order (which includes a scope of work for environmental studies and interim actions on the site and a schedule for their implementation)
- Public Participation Plan (PPP)
- Remedial Investigation/Feasibility Study (RI/FS) and Interim Action Work Plan
- Remedial Investigation (RI)
- Interim Action Completion Report (if an Interim Action is performed)
- Feasibility Study (FS)
- Cleanup Action Plan (CAP; which includes a scope of work and schedule for cleanup and a compliance monitoring and contingency plan)
- State Environmental Policy Act (SEPA) and associated SEPA Checklist

An Agreed Order is a legal contract signed by Ecology and the Potentially Liable Party that contain the agreements to perform the site investigation and cleanup actions.

The Scope of Work and Schedule attached to the Agreed Order will describe the specific activities required by the Agreed Order that will be completed and their required schedule for completion. The Scope of Work will also contain a preferred schedule for completion of the cleanup action.

A RI/FS is a comprehensive study of site conditions (RI), combined with an evaluation of alternatives for remediating those conditions in a way that satisfies state cleanup standards and remedial selection criteria (FS). The central concern with conducting an RI/FS is to make sure that the process fulfills its proper purpose, which is to select the most cost-effective remedy that meets cleanup standards and is protective of human health and the environment. In addition, redevelopment plans for the CSM Site may require interim actions at the CSM Site prior to completion of the RI/FS and selection of the final remedy.

A CAP is a document prepared under WAC 173-340-360 that selects the cleanup actions and specifies cleanup standards and other requirements for the cleanup actions. The CAP is a decision and summary document based on a RI/FS. The CAP for the CSM Site will define cleanup actions that must be accomplished at the site as it is in its present condition and cleanup actions that may be required under certain conditions when redevelopment of the site occurs.

SEPA determinations, which evaluate a development's potential adverse impacts to the environment, are required on all proposed cleanup actions.

1.4 ROLES AND RESPONSIBILITIES

Public participation activities for the cleanup process are coordinated between Ecology and the Port. Ecology maintains overall responsibility and approval authority for the activities outlined in this plan in accordance with the cleanup regulation requirements. The Port and Ecology will conduct public notice, which includes soliciting, receiving, and considering comments, and preparing a record that documents comments received. The public will be notified of comment periods that occur at specific points in the site investigation and cleanup process (usually following submission of specific reports to Ecology) as required by the state's cleanup law. The community is provided with the opportunity to review and, through public comment, share concerns or contribute information that may influence decisions about the cleanup.

1.5 ORGANIZATION OF THE PUBLIC PARTICIPATION PLAN

This plan provides an overview of the cleanup process, background information about the site, an overview of the community and plans for public involvement regarding the site. Proposed activities that will be used to raise awareness and to seek input from the community are also described. Other information needed to implement the public participation plan (e.g., locations of information centers and a list of organizations contacted) is includes. Ecology and the Port urge the public to become involved in the cleanup process. This plan will be updated as more information becomes available during the cleanup process. If more information is needed or groups have questions or comments on the plan or other aspects of the cleanup, they can contact the individuals listed in Section 4.2.

Ecology's website and information centers also provide more detailed information.

2.0 Site Background

2.1 SITE DESCRIPTION AND LOCATION

The CSM Site is within the Cap Sante Boat Haven, located at the east end of 13th Street, along the Eastern shoreline of downtown Anacortes, WA. The CSM Site is bounded by Q Street to the West. Directly across Q Street are a Safeway store and a vacant gravel lot used for boat trailer parking. East of the CSM Site is the marina area of the Cap Sante Boat Haven and to the South of the CSM Site is the Seafarers' Memorial Park.

Soils at the CSM Site are generally composed of fill material, mainly of dredged sand with interbedded layers of silt and clay of variable thickness. The ground surface is asphalt in the roadway and a combination of asphalt, concrete slab, and gravel within the boatyard. The Port has owned the CSM Site since 1956. The CSM Site has been operated as a boat yard and marina support area since approximately 1959.

2.2 GENERAL SITE HISTORY

The Port has owned the CSM Site since 1956, and currently leases it to Cap Sante Marine Ltd. Cap Sante Marine Ltd. has been a Port tenant since the late 1970s, providing small vessel storage, launch and minor maintenance services. The CSM Site has been operated as a boatyard and marina support area, including a marine fueling facility since approximately 1959. The fuel float is located on a float offshore from the CSM Site. The fuel supply tanks, underground storage tanks (USTs), are located within the leased area and are connected to the float via a series of underground pipelines. In the early 1980s, petroleum fuel was observed seeping into the marine waters at the boat basin at several locations near the fuel float. In 1983, under order from the U.S. Coast Guard, the Port installed a trench to control the seepage of fuel. The trench intercepted the fuel flowing through the soil. According to the available site documentation, 1,250 gallons of fuel were recovered from the trench and the seepage stopped.

It was determined that the seepage resulted from leaking USTs that supplied the fuel docks at Cap Sante Boat Haven. In 1985, the Port replaced these USTs with two new 12,000 gallon tanks. Impacts to the soils and groundwater in the vicinity of fuel leaks and recovery trench were not evaluated, nor were any potentially impacted soil reported to have been removed.

In 2004 and 2005 the Port conducted a series of Environmental Due Diligence Investigations into the extent of soil and groundwater contamination at the CSM Site. The Port's investigations revealed soil and groundwater contaminated with gasoline, diesel, and benzene in a roughly fan-shaped area around the USTs and extending to Fidalgo Bay. Ecology and the Port are performing a RI/FS at the CSM Site under an Agreed Order.

2.3 CONTAMINANTS OF CONCERN

Contaminants of concern (COCs) for soil, groundwater, and shoreline sediment include those associated with the historical petroleum fuel tanks and supply lines located at the CSM Site. Therefore, COCs include petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs), volatile organic compounds associated with petroleum fuel, and lead. The specific constituents are listed below:

- Gasoline-range hydrocarbons
- Diesel-range hydrocarbons
- Oil-range hydrocarbons
- PAHs
- Benzene, toluene, ethylbenzene, xylenes (BTEX)
- Methyl tert-butyl ether (MTBE)
- Lead

2.4 THE CLEANUP PROCESS

The steps involved in Washington State's cleanup process are summarized in Figure B.1. The general process is to investigate the site for contaminants, identify and select cleanup options, and conduct a cleanup. At any time during the cleanup process, an interim cleanup action may be conducted. Issuance of a draft remedial investigation report, a draft feasibility study report, a draft CAP, or an interim action work plan are activities for which a public notice and comment period of at least 30 days are conducted. The cleanup process is further described in the following sections and the opportunities for public involvement are identified.

When public notice is required, the law states that at a minimum, the "potentially affected vicinity" must be notified by mail and an advertisement must be placed in the newspaper with the largest circulation in the community. Additionally, during any public comment period, by request of 10 or more people, Ecology or the Port will hold a public meeting about the proposal that is undergoing public review. These requirements will be followed for each public comment opportunity.

2.5 INTERIM ACTIONS

During the cleanup process, interim actions may be conducted if required or approved by Ecology. An Interim Action is any action that partially addresses the cleanup of the site. An Interim Action may be implemented to address any of the following circumstances:

- When it is technically necessary to reduce the threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance at a site.
- When it corrects a problem that may become substantially worse or cost substantially more to address if the action is delayed.
- When it is necessary to provide completion of a site hazard assessment, state RI/FS, or design of a CAP.

Ecology will hold a public comment period of at least 30 days for planned interim actions.

2.6 REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT

The goal of the remedial investigation is to determine what contaminants are on the CSM Site. The draft RI report provides baseline data bout environmental conditions that will be used to develop cleanup actions. The draft FS report identifies the site cleanup alternatives based on data compiled during the remedial investigation. These studies contain information that enables the selection of a cleanup action. The draft RI and FS will be made available for public review and comment.

The remedial investigation and feasibility study process may include the following phases:

- Project scoping
- Site characterization
- Interim Action
- Development and screening of alternatives for cleanup
- Treatability investigations
- Detailed analyses

The RI report will include analyses of existing site data and planned supplemental data. The data analyses will be used to determine the appropriate interim action, if it is determined to be necessary. Following Ecology approval and completion of the Interim Action, a draft FS report will be prepared to identify and screen potential remedial alternatives and evaluate the interim action that was performed.

2.7 CLEANUP ACTION PLAN

After public comment is received on the draft RI and FS reports, preferred cleanup alternatives will be selected and a draft CAP will be prepared. This plan specifies the cleanup standards that will be applied to the CSM Site, the selected the preferred cleanup alternatives, and may provide for additional cleanup requirements, if necessary. This plan also outlines the work to be performed during the actual site remediation. The CAP for the CSM Site may also evaluate the completeness and effectiveness of any interim actions that were performed at the site. The draft CAP will be submitted for public review and comment. Once public comments are received and reviewed and any necessary comments made, Ecology provides final approval.

3.0 Community Profile

3.1 COMMUNITY PROFILE

Anacortes is Skagit County's second largest city and its busiest seaport. The current population of Anacortes is approximately 16,000 people, situated within 14.8 square miles. The City of Bellingham is the nearest medium city, located approximately 18 miles north of Anacortes. The majority of jobs are within the fields of refining, manufacturing, casino resort, education, and healthcare.

3.2 KEY COMMUNITY CONCERNS

For the past approximately 47 years, the project site has operated as a boat yard and marina support area. In the early 1980s fuel was observed seeping into the waters of Fidalgo Bay adjacent to the CSM Site. In 1983, under order from the U.S. Coast Guard, the Port installed a trench to control the seepage of fuel. The trench intercepted the fuel flowing through the soil. According to available site documentation, approximately 1,250 gallons of fuel were recovered from the trench and the seepage stopped.

It was determined that the seepage resulted from leakage from the USTs that supplied the fuel docks at Cap Sante Boat Haven. In 1985 the Port replaced these USTs with two new 12,000 gallon tanks. Impact to the soils and groundwater in the vicinity of the fuel leaks and the recovery trench were not evaluated, nor was any potentially impacted soil reported to have been removed.

Following the completion of Environmental Due Diligence investigations conducted in 2004 and 2005, the Port submitted the results of the investigations to Ecology (FSM 2004, Floyd|Snider 2006). The CSM Site was then placed on the Hazardous Sites List and Ecology and the Port are entering into an Agreed Order for the remediation of the historical fuel releases at the CSM Site. Beyond this action, there has been no evident reaction from citizens or neighbors.

4.0 Public Participation Activities

4.1 INTRODUCTION

This section describes the objectives and desired outcomes of public participation for the CSM Site and summarizes the overall strategy for public participation. The activities will be coordinated with the release of the studies and plans described in Section 1.3.

The public participation strategy is designed to accomplish the following goals:

- Help the public understand the issues at the CSM Site
- Inform the public about opportunities for input
- Solicit input to the draft cleanup studies and draft action plans
- Provide feedback to the public about how decisions are made and how their input is incorporated

The outcomes of a successful public involvement process will include an increase in:

- Awareness in the community about plans for the cleanup at the CSM Site and the opportunity for public involvement
- Public participation throughout the cleanup
- Community understanding regarding how their input will be considered in the decision-making process

4.2 PUBLIC CONTACTS

Department of Ecology

Panjini Balaraju, Site Project Manager
300 Desmond Dr SE, Lacey
Olympia, WA 98504-7600
360-407-6161
Pbal461@ecy.wa.gov

Port of Anacortes

Connie Thoman
Environmental Administrator
Port of Anacortes
P.O. Box 297
Anacortes, WA 98221
(360) 299-1818
Connie@portofanacortes.com

4.3 ECOLOGY ACTIVITIES AND RESPONSIBILITIES

4.3.1 Public Comment Period

A public comment period will be scheduled following the completion of the Agreed Order and the RI/FS and Interim Action Work Plan. The public comment period will take place for 30 days and comments will be taken on the following documents:

- Agreed Order
- RI/FS and Interim Action Work Plan
- Public Participation Plan
- State Environmental Policy Act (SEPA) application and associated SEPA Checklist

Additional public comment periods may be scheduled by Ecology and the Port, of which the public will be notified.

4.3.2 Notice of Public Comment Periods

Public notice of the comment periods will be given using the following methods:

- A fact sheet describing the activity and how the public may comment. The fact sheet will be mailed to all addresses on the Ecology mailing list. The list contains residents and property owners of the area and other interested community members.
- A display ad will be placed in the *Anacortes American*.
- A notice will be published in Ecology's *SEPA Register*.
- A notice will be published in Ecology's MTCA *Site Register*.

Ecology's MTCA Site Register is a semi-monthly electronic publication that provides updates of the cleanup activities occurring throughout the state. The most current information regarding public meetings, public comment periods, and cleanup-related reports is produced in this newsletter for all sites in Washington State.

4.3.3 Information Repositories

Information repositories will be available to the public to ensure that the community has access to relevant documents at the following locations:

Anacortes Public Library
1209 9th Street
Anacortes, WA 98221
360-293-1926
Major documents will be available
Hours: Mon–Thurs 11am to 8pm
Friday 11am to 5pm
Sat–Sun 12pm to 5pm

Washington State Department of Ecology
3190 160th Avenue SE
Bellevue, WA 98008
425-649-7190
Major documents will be available
Hours: Weekdays 8am to 5pm

In addition to the information repositories listed above, the Port will also have a copy of all relevant documents regarding the investigation and cleanup at the CSM Site.

4.3.4 Public Hearing

A public hearing will be held during the public comment period to describe the documents and answer questions from the community on the documents. When the public hearing is scheduled, a reminder will be published in the *Anacortes American*.

4.3.5 Responsiveness Summary

A responsiveness summary will be prepared following the public comment period that addresses the comments. The responsiveness summary will be available at the information repositories listed above.

4.4 PORT ACTIVITIES AND RESPONSIBILITIES

4.4.1 Notification to Neighborhood Organizations

There are a number of conditions that may occur in which the Port is required to notify Ecology. For these conditional reporting requirements, the Port will also notify the local neighborhood organizations of these conditions by telephone or by email within 1 week of occurrence or confirmation. These conditions are:

- Notification of the intent to transfer properties.
- Notification of SEPA and permitting public comment periods for development actions that will trigger cleanup requirements. All major documents will be submitted to the official information repository.
- Notification and stop work for any activities performed on the site that is not allowable under the restrictive covenant for the site.

4.4.2 Library Information Repository

The Port will place all major documents in the Anacortes Public Library in the official information repository for the CSM Site. These documents include all reports submitted to Ecology under the agreements in the Agreed Order and CAP and all reports submitted to Ecology regarding the status of cleanup actions, monitoring and development.

4.4.3 Neighborhood Meetings

The designated Port contact will be available to attend neighborhood meetings upon request and will give updates on the status of cleanup activities.

4.4.4 Citizen’s Public Involvement Committee

At the discretion of community members, the community may establish a committee of neighborhood representatives focused on monitoring cleanup activities. If such a committee were formed, the designated Port contact would be available to attend committee meetings upon request and give updates on the status of cleanup activities.

The designated Port contact will be available to attend neighborhood meetings upon request and will give updates on the status of cleanup activities.

4.5 PUBLIC PARTICIPATION GRANT ACTIVITIES

Citizens of the local neighborhoods are eligible to apply for a Public Participation Grant from Ecology. Additional public participation activities may be defined under the scope of such a grant. Those additional activities would not reduce the scope of required public involvement activities defined by this plan. Activities conducted under this plan would be conducted to coordinate with potential additional activities defined under the grant.

5.0 References

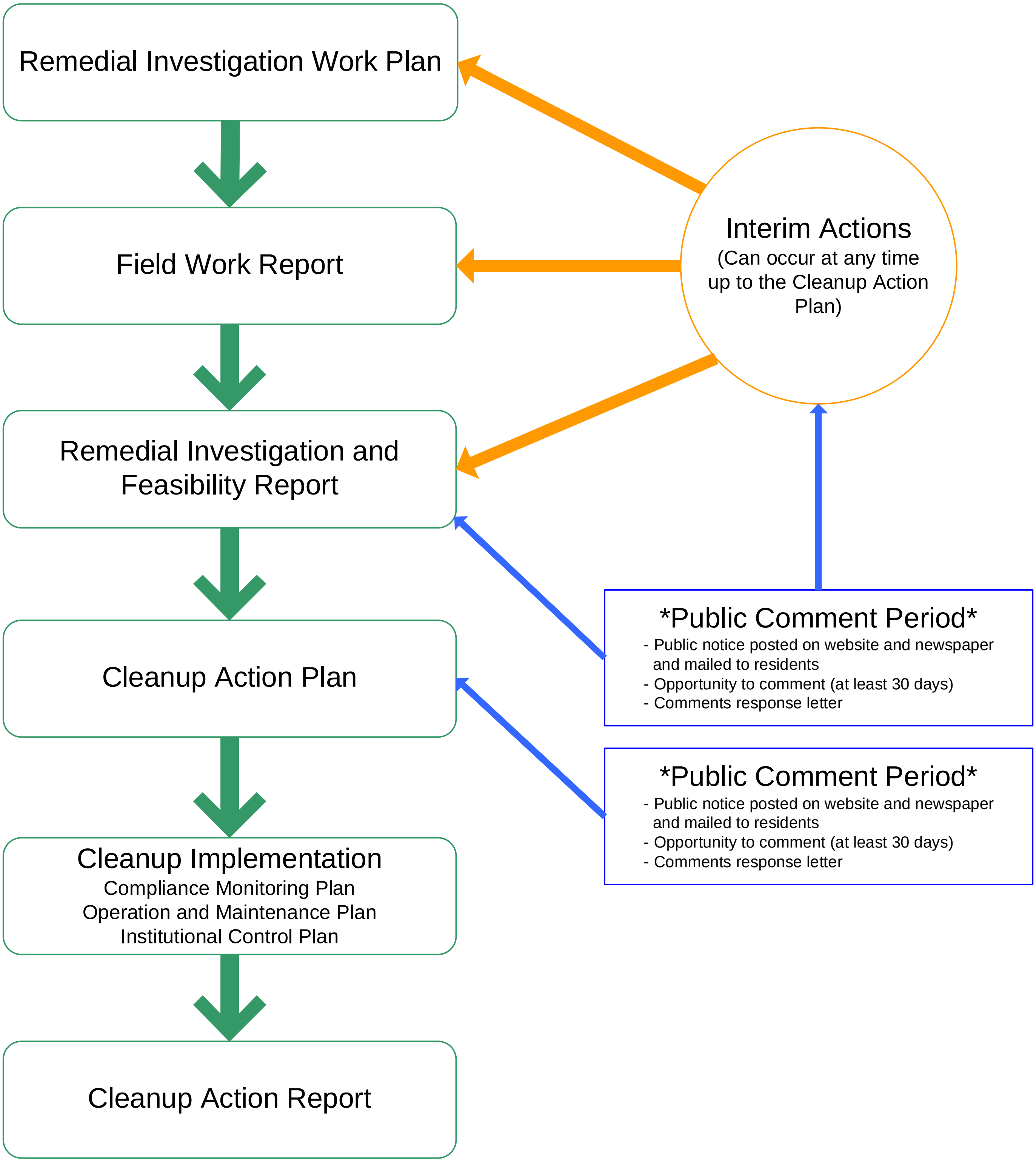
Floyd Snider McCarthy, Inc. (FSM). 2004. *Results of Limited Environmental Due Diligence Investigation, Cap Sante Boat Haven--Anacortes, Washington.* 14 June.

Floyd|Snider. 2006. *Limited Environmental Due Diligence Report, Former Shell Oil Tank Farm, Cap Sante Marine Lease Area.* Prepared for Port of Anacortes. 8 November.

Port of Anacortes
Cap Sante Marine Lease Area

Remedial Investigation/ Feasibility Study and Interim Action Work Plan

Appendix B
Figures



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strategy ▪ science ▪ engineering

RI/FS and Interim Action
Work Plan
Cap Sante Marine
Port of Anacortes, Washington

Figure B.1
Washington State Cleanup Process

F:\projects\STOEL-CSM\Work Plan\Appendices\Appendix B\CSM Draft WP ApxB FB1.vsd

October 24, 2006

EXHIBIT - C

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

U. S. Coast Guard
Captain of the Port
1519 Alaskan Way S.
Seattle, Wa 98134

16460/PCN-SEA-   -
Date 7/25/83

MR. BAIER
Owner/Operator

Gentlemen,

This is to inform you that I am aware of a potential pollution incident at CAP SANTE BASIN (location/body of water) on 25 JULY 83 (date) and that your vessel/facility CAP SANTE MARINA may be the source of the discharge. Under Federal statutes, the United States Government has an interest in this incident and may take appropriate action to minimize damages which may be caused by this incident.

The discharge of a prohibited quantity of oil or a hazardous substance is a violation of the Federal Water Pollution Control Act, as amended. Under this act, the Federal On Scene Coordinator is responsible for determining the feasibility of removing the discharge and ensuring that removal is conducted properly. When removal of the discharge is deemed necessary, the owner or operator of the source may undertake removal action, or he may be held financially responsible for actions taken by the Federal government to remove the pollutant and adequately mitigate its effects. Removal is being done properly if it is done in accordance with Federal and State statutes and regulations and the criteria of the National Oil and Hazardous Substances Pollution Contingency Plan. The adequacy of any removal actions undertaken shall be determined by the United States Coast Guard On-Scene Coordinator. The On-Scene Coordinator for this area is Captain J. F. ECKMAN.

So long as you are taking adequate actions in this matter, Federal action will be limited to monitoring of the progress of your actions and provision of guidance as necessary. If it is determined that you are not taking prompt and appropriate actions to clean up, contain, and remove the pollutant, Federal response may be initiated. You may then be responsible for all actual costs incurred by the Federal government as set forth in section (311(f) of the Federal Water Pollution Control Act, as amended.

An investigation into this incident will be conducted and the findings will be forwarded to the Commander, Thirteenth Coast Guard District for appropriate action.

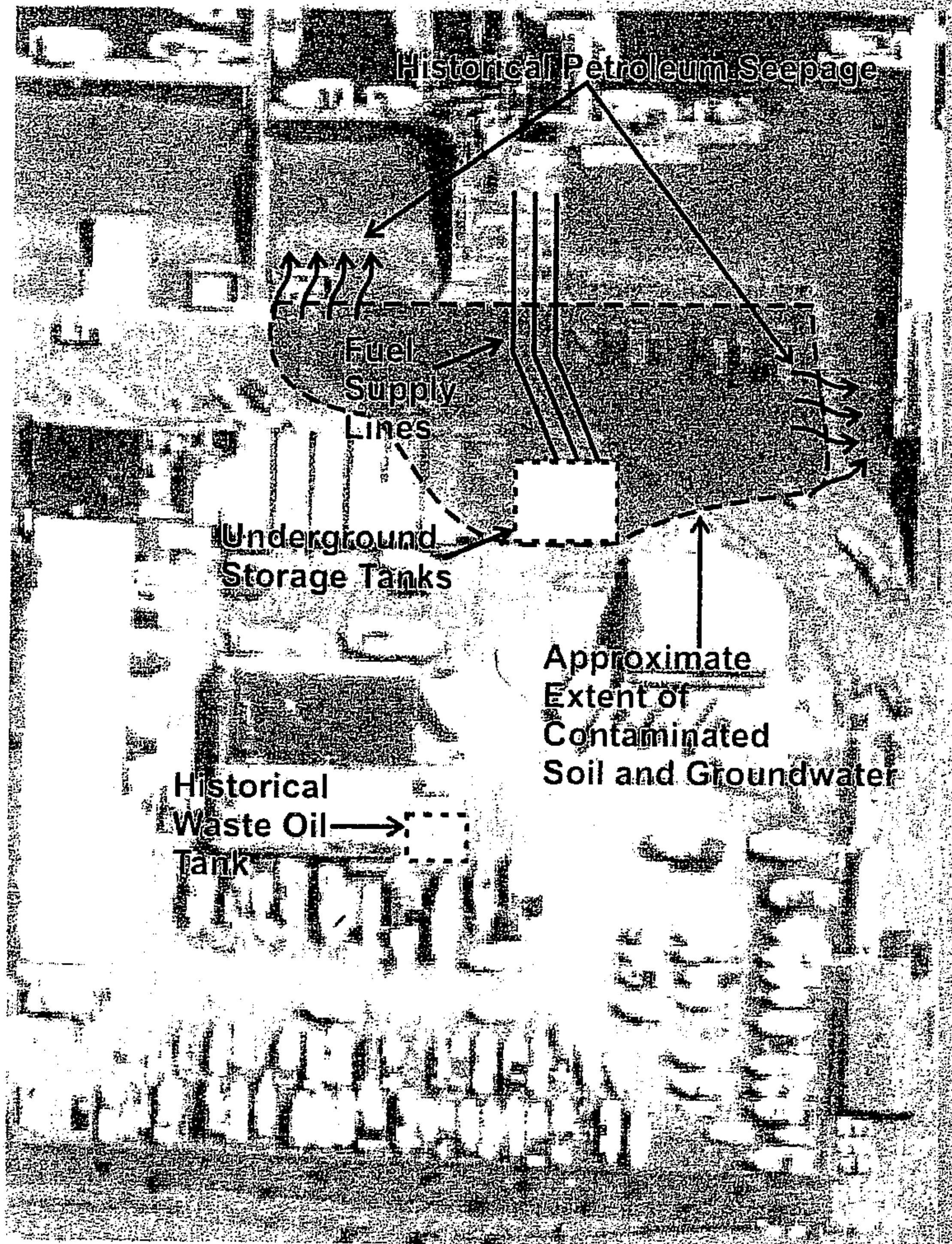
Should you require further information on this matter, please contact thes Marine Environmental Protection officer at (206) 442-1853.

M.J BLANCHARD BM2 USCG
Predesignated Federal On Scene Coordinator/Representative

Received and acknowledged,

J. E BAIER   1106, 7/29/83
Name of addressee   (Date/time)
PORT OF ANACORTES

EXHIBIT - D



Cap Sante Marine

EXHIBIT - E

Floyd Snider McCarthy, Inc. 83 South King Street Suite 614 Seattle, Washington 98104 tel: 206.292.2078 fax: 206.682.7867
Strategy & Technical Solutions for Contaminated Properties

June 14, 2004

Mr. Bob Elsner
Director of Planning and Projects
Port of Anacortes
Post Office Box 297
Anacortes, Washington 98221

SUBJECT: LETTER REPORT
RESULTS OF LIMITED ENVIRONMENTAL DUE DILIGENCE INVESTIGATION
CAP SANTE BOAT HAVEN - ANACORTES, WASHINGTON

Dear Mr. Elsner:

This letter report presents the results of the limited environmental due diligence investigation completed by Floyd Snider McCarthy, Inc. (FSM) near the Cap Sante Marine (CSM) facility located at the Cap Sante Boat Haven in Anacortes, Washington (Figure 1). Soil and groundwater sampling was performed to evaluate the potential impact to future development at the site from historical contamination.

Field sampling was completed on May 4, 2004 in accordance with approved FSM Task Order 05-04 dated April 19, 2004. The primary objective of the sampling and analysis was to establish concentrations of petroleum hydrocarbons present in soil and groundwater in an area that may be subject to redevelopment.

Results of this investigation show that benzene and gasoline contamination, as defined by the Washington State Model Toxics Control Act (MTCA) Method A cleanup levels, is present at the site in the depth range of about 5 to 9 feet below ground surface (bgs). In accordance with MTCA cleanup regulations (WAC 173-340-300), these findings should be reported to the Washington State Department of Ecology (Ecology) within ninety days of discovery.

PROPERTY HISTORY

In the early 1980's, petroleum fuel was observed seeping into the marine waters at the CSM boat basin at several locations near the fuel dock. In 1983, under order from the U.S. Coast Guard, the Port of Anacortes (POA) installed a trench to control the seepage of fuel. The trench intercepted the fuel flowing through the soil. According to the available site documentation, several thousand gallons of fuel were recovered from the trench and the seepage stopped.

Table 1
Summary of Laboratory Testing Program

Sample ID	Matrix	TPH-HCID	TPH-Gasoline/ BTEX	TPH-Dx	Comments
GP1-5.0	Soil	X			
GP1-8.0	Soil	X			
GP2-5.0	Soil		X	X	
GP2-10.0	Soil	X			
GP3-6.0	Soil	X	X		
GP3-7.0	Soil		X		Insufficient sample for HCID
GP3-9.0	Soil	X			
GP4-7.0	Soil		X	X	
GP4-10.0	Soil	X			
GP5B-6.0	Soil		X		
GP5B-9.0	Soil	X			
GP6-2.5	Soil	X			
GP6-5.0	Soil	X			
GP1	Water		X	X	
GP2	Water		X	X	
GP3	Water		X		Insufficient sample for TPH-Dx
GP4	Water		X	X	
GP5B	Water		X	X	
GP6	Water		X	X	

Table 2
Summary of Soil Testing

Sample ID	Benzene	Toluene	Ethyl-benzene	Xylenes	Gasoline[a,b]	Diesel[a,b]	Heavy Oil
GP1-5.0	NA	NA	NA	NA	35 U	50 U	100 U
GP1-6.0	NA	NA	NA	NA	31 U	50 U	100 U
GP2-5.0	**0.270**	0.140	0.033 U	0.189	**260**	1800	67 U
GP2-10.0	NA	NA	NA	NA	40 U	50 U	100 U
GP3-6.0	**2.30**	0.600	4.60	**19.2**	**630**	410	340 U
GP3-7.0	**2.30**	0.430	3.10	**12.4**	**320**	NA	NA
GP3-9.0	NA	NA	NA	NA	38 U	50 U	100 U
GP4-7.0	**0.150**	0.035 U	0.035 U	0.071 U	20.0	20	45
GP4-10.0	NA	NA	NA	NA	190 U	190 U	390 U
GP5B-6.0	**0.580**	0.350	0.710	0.560	**510**	NA	NA
GP5B-9.0	NA	NA	NA	NA	**230**	390	330 U
GP6-2.5	NA	NA	NA	NA	31 U	50 U	100 U
GP6-5.0	NA	NA	NA	NA	37 U	50 U	100 U
MTCA Method A Cleanup Level							
	0.03	7.0	6.0	9.0	100/30	2000	2000

Notes:

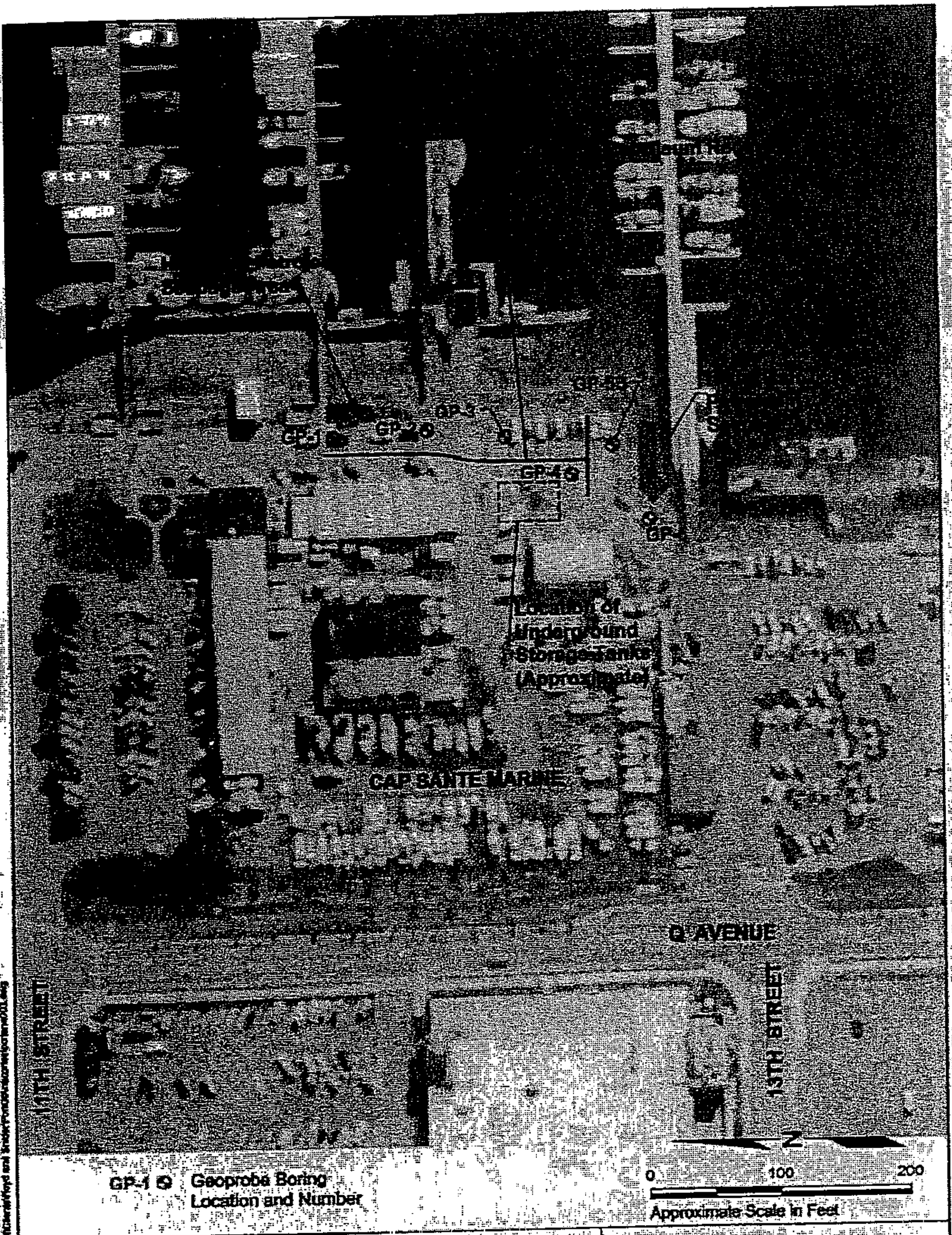
Concentrations are in mg/Kg dry weight.
Bold font indicates a cleanup level exceedance.
[a] = HCID test results are not shown if NWTPH-G and NWTPH-DX results are also available.
[b] = The cleanup level for gasoline is 30 mg/Kg if benzene is present and 100 mg/Kg if not present.
U = Not detected at the given reporting limit.
NA = Not analyzed.

Table 3
Summary of Groundwater Test Results

Sample ID	Benzene	Toluene	Ethyl-benzene	Xylenes	TPH-Gasoline^a	TPH-Diesel	TPH-Motor Oil
GP1	1.0 U	1.0 U	1.0 U	1.0 U	0.25 U	250 U	500 U
GP2	1.0 U	1.0 U	1.0 U	1.3	460	**2400**	500 U
GP3	**390**	18	65	212	**4100**	NA	NA
GP4	1.0 U	1.0 U	1.0 U	1.0 U	250 U	250	500 U
GP5B	3.4	1.4	2.3	1.9	400	370	500 U
GP6	1.0 U	1.0 U	1.0 U	1.0 U	250 U	250 U	500 U
MTCA Method A Cleanup Level							
	5.0	1,000	700	1000	800/1,000	500	500

Notes:

Concentrations are in µg/L.
Bold font indicates a cleanup level exceedance.
^{a} = The cleanup level for gasoline is 800 µg/L if benzene is present and 1000 µg/L if not present.
U = Not detected at the given reporting limit.
NA = Not analyzed.



Floyd Snider McCarthy, Inc.

Port of Anacortes
Cap Sante Boat Haven
Anacortes, Washington

Figure 1
Site Map: Exploration Locations and Existing Site Features

EXHIBIT - F

Port of Anacortes

Limited Environmental Due Diligence Investigation Report

Former Shell Oil Tank Farm
Cap Sante Marine Lease Area

Prepared for
Port of Anacortes
First Avenue & Commercial
Anacortes, Washington 98221

Prepared by
FLOYD | SNIDER
601 Union Street, Suite 600
Seattle, Washington 98101

November 2005

Table 5
Cap Sante Marine Lease Area Summary of Laboratory Analyses

Sample ID	Matrix	Depth in Feet	TPH-HCID	TPH-Gasoline/ BTEX	TPH-Dx	Archive
CSM04-S1	Soil	4.5 - 5.8	X			
CSM04-S2	Soil	10.3 - 12.0	X			
CSM04-W1	Water	> 4.5				X
CSM05-S1	Soil	5.0 - 6.5	X			
CSM05-S2	Soil	8.0 - 10.0	X			
CSM05-W1	Water	> 5.0				X
CSM06-S1	Soil	1.6 - 3.0	X			
CSM06-W1	Water	> 5.5				X
CSM07-S1	Soil	8.0 - 9.5		X	X	
CSM07-W1	Water	> 4.0		X	X	
CSM08-S1	Soil	4.0 - 5.7		X	X	
CSM08-W1	Water	> 4.0		X	X	
CSM09-S1	Soil	8.0 - 10.0		X	X	
CSM09-S2	Soil	10.0 - 12.0		X	X	
CSM09-W1	Water	> 5.5		X	X	
CSM10-S1	Soil	12.0 - 13.0		X	X	
CSM10-W1	Water	NA		X	X	
CSM11-S1	Soil	4.0 - 5.3		X	X	
CSM11-S2	Soil	8.0 - 10.3		X	X	
CSM11-W1	Water	> 5.5		X	X	
CSM14-S1	Soil	4.3 - 6.0	X			
CSM14-W1	Water	> 4.5				X

Table 6
Cap Sante Marine Lease Area Analytical Results for Soil

Sample ID	Interval (feet bgs)		Total Petroleum Hydrocarbons (mg/kg)			Volatile Organic Compounds (mg/kg)			
	Upper	Lower	Gas[1]	Diesel	Heavy Oil	Benzene	Toluene	Ethylbenzene	Xylenes
CSM07-S1	8.0	9.5	**320** J	1,800	120 U	**0.032** J	0.064 UJ	0.064 UJ	0.11 J
CSM08-S1	4.0	5.7	**1,500** J	**4,100**	240 U	**2.5** J	0.86 J	1.5 J	1.73 J
CSM09-S1	8.0	10.0	**490** J	1,900	130 U	**0.62** J	0.22 J	0.82 J	0.53 J
CSM09-S2	10.0	12.0	36 J	280	120	0.086 U	0.17 UJ	0.17 UJ	0.34 UJ
CSM10-S1	12.0	13.0	**1,100** J	**2,600**	140 U	**0.54** J	0.25 J	6.7 J	0.97 J
CSM11-S1	4.0	5.3	**400** J	**3,800**	270 U	**0.25** J	0.092 UJ	0.56 J	0.12 J
CSM11-S2	8.0	10.3	38 J	6.8 U	14 U	0.04 U	0.08 UJ	0.08 UJ	0.16 UJ
MTCA Method A Cleanup Level (mg/kg)									
			100/30	2,000	2,000	0.03	7.0	6.0	9.0

Notes:

Concentrations in **bold** exceed MTCA Method A cleanup levels.

1 If benzene and the total of ethylbenzene, toluene, and xylenes are greater than 1% of the gasoline concentration, then the MTCA Method A cleanup level is 30 mg/kg.

J Sample exceeded allowable holding time at analytical laboratory.

NA Not analyzed

U Not detected

Table 7
Cap Sante Marine Lease Area Analytical Results for Groundwater

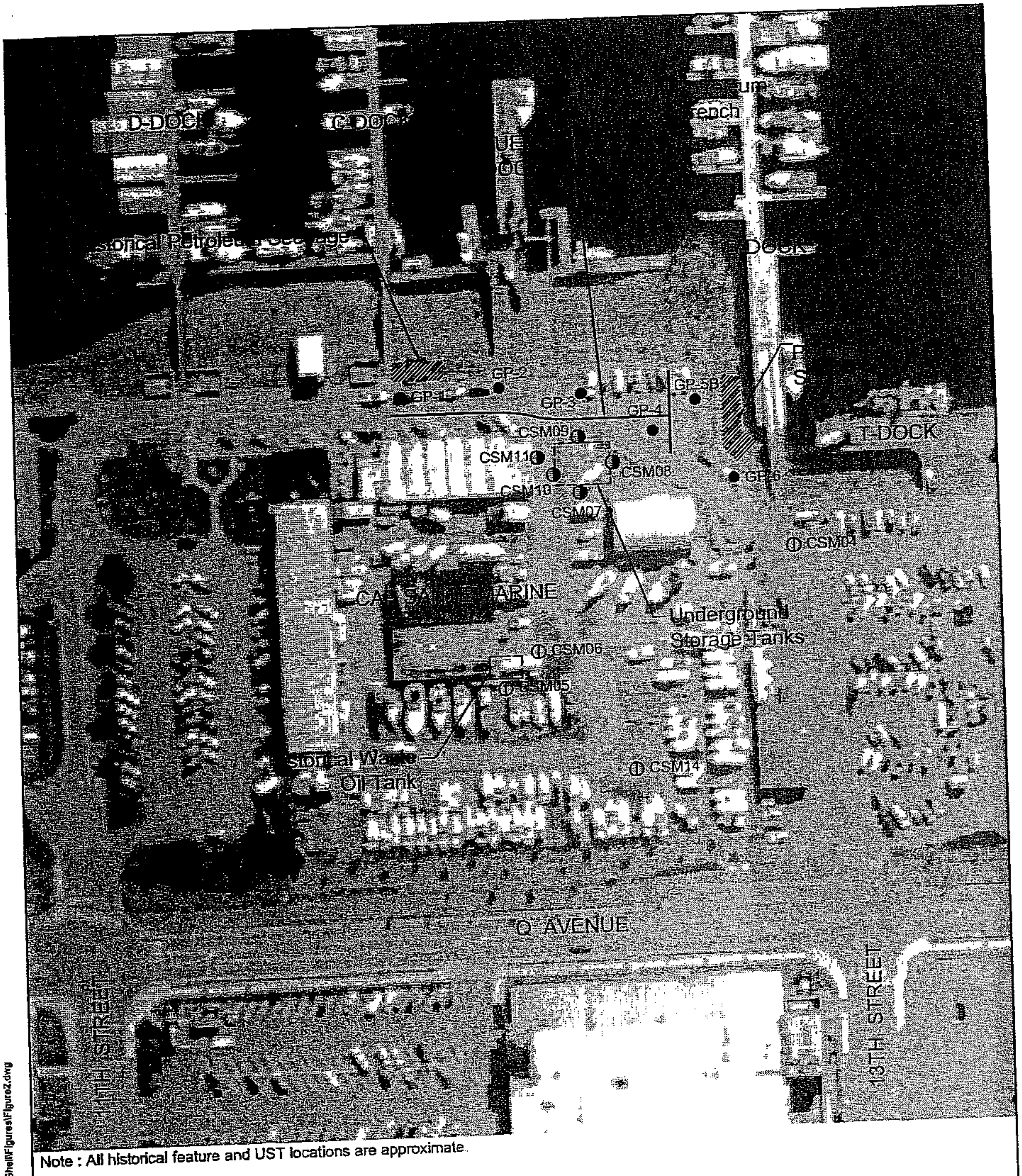
Sample ID	Total Petroleum Hydrocarbons (µg/L)			Volatile Organic Compounds (µg/L)			
	Gas	Diesel	Heavy Oil	Benzene	Toluene	Ethylbenzene	Xylenes
CSM07-W1	**1,000**	**2100**	500 U	**80**	3.5	1.0	4.1
CSM08-W1	**3,500**	**6500**	2500 U	**530**	22	34	36.0
CSM09-W1	**6,700**	**14000**	2500 U	**21**	22	190	72.8
CSM10-W1	**4,000**	**28000**	10000 U	**930**	20	260	76.0
CSM11-W1	**2,900**	**12000**	2500 U	**270**	3.9	71	4.0
MTCA Method A Cleanup Level (µg/L)							
	1,000/800	500	500	5.0	1,000	700	1,000

Notes:

Concentrations in **bold** exceed MTCA Method A cleanup levels.

1 If benzene and the total of ethylbenzene, toluene, and xylenes are greater than 1% of the gasoline concentration, then the MTCA Method A cleanup level is 800 µg/L.

U Not detected



Note : All historical feature and UST locations are approximate

● GP-1 Previous Sampling Location and Number (FSM 2004)

Ⓘ SHL01 Sampling Location and Number

◍ Sampling Location Exceeds MTCA A Criteria for Soil

◐ Sampling Location Exceeds MTCA A Criteria for Groundwater

Z

0 100 200

Approximate Scale in Feet

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Port of Anacortes
Limited Environmental Due Diligence Investigation

Figure 2
Cap Sante Marine
Exploration Locations &
Existing Site Features

DWG NAME: F:\projects\PortOfAnacortes\POA-CSM Shell\Figures\Figure2.dwg
DATE: 9/29/2006

EXHIBIT - G

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Toxics Cleanup Program Policy

Policy 840

Resource Contact: Policy and Technical Support Staff *Effective* *August 1, 2005*
References. *WAC 173-340-840(5)* *Revised* *September 9, 2005*
http://www.ecy.wa.gov/eim/
http://www.ecy.wa.gov/programs/tcp/smu/sedqualfirst.htm
http://www.ecy.wa.gov/biblio/0309043.html
Replaces *Procedure 840*

Policy 840: Data Submittal Requirements

Purpose: Contaminated site investigations and cleanups generate a large volume of environmental monitoring data that need to be properly managed to facilitate regulatory decisions and access to this data by site owners, consultants, and the general public. The purpose of this policy is to describe the requirements for submitting environmental monitoring data generated/collected during the investigation and cleanup of contaminated sites under the Model Toxics Control Act (MTCA) and the Sediment Management Standards

Application: This policy applies to Ecology staff, potentially liable parties, prospective purchasers, state and local agencies, and Ecology contractors that investigate or manage the cleanup of contaminated sites.

1. Unless Otherwise Specified by Ecology, all Environmental Monitoring Data Generated during Contaminated Site Investigations and Cleanups shall be Required to be Submitted to Ecology in both a Written and Electronic Format.

Environmental monitoring data include biological, chemical, physical, and radiological data generated during site investigations and cleanups under the Model Toxics Control Act Cleanup Regulation (WAC 173-340) and the Sediment Management Standards (WAC 173-204).

Data generated/collected during site investigations and cleanups conducted under an order, agreed order or consent decree, permit, grant, loan, contract, interagency agreement, memorandum of understanding or during an independent remedial action, are considered environmental monitoring data under this policy.

Data generated/collected for non site-specific studies, site hazard assessments that result in no further action and initial site investigations are not considered environmental monitoring data under this policy.

2. Orders, Agreed Orders, Consent Decrees, or Permits Issued After the Effective Date of this Policy Shall Include a Condition that Site-Specific Data be Submitted in Compliance with this Policy.

Reports on such work that do not include documentation that the data have been submitted in compliance with this policy shall be deemed incomplete and a notice of such provided to the submitter. These reports generally should not be reviewed until that information is provided. The assistant attorney general assigned to the site should be consulted in these situations.

3. Reports on Independent Remedial Actions Submitted for Review After October 1, 2005, Under Ecology's Voluntary Cleanup Program Shall Not be Reviewed Until the Data Have Been Submitted in Compliance with this Policy.

Such reports shall be deemed incomplete, and a notice to this effect provided to the submitter.

4. Grants, Contracts, Interagency Agreements or Memoranda of Understanding Issued After the Effective Date of this Policy Shall Include a Condition that Site-Specific Data be Submitted in Compliance with this Policy.

Reports on such work shall not be accepted as complete until the data have been submitted in compliance with this policy If a payment or transfer of funds is involved in the transaction, the relevant payment or transfer shall be withheld until this requirement has been met.

Example language to include in these documents is attached in Appendix A.

5. Data Generated During Upland Investigations and Cleanups Shall be Submitted Electronically Using Ecology's Environmental Information Management System (EIM).

EIM is Ecology's main database for environmental monitoring data. Proper submission of data through this system meets the requirement of submitting such data in an electronic format. Electronic data shall be submitted to Ecology simultaneously with the accompanying printed report.

Additional information on EIM, including instructions for data submittal, can be found on Ecology's EIM web site at http://www.ecy.wa.gov/eim/. TCP's EIM Coordinator also is available for technical assistance to site managers and consultants using EIM.

6. Data Submitted Electronically Using EIM Shall be Checked by the Toxics Cleanup Program's EIM Coordinator Prior to Loading the Data into EIM.

Normally, notice that data have been submitted through EIM will come to TCP's EIM Coordinator. Upon receipt of such a notice the EIM Coordinator should notify the site manager. Similarly, if the Ecology site manager receives a notice of an EIM submittal, they should notify TCP's EIM Coordinator. Upon receipt of the data, TCP's EIM Coordinator reviews the submittal for quality control and officially loads the data into the system.

7. Data Generated During Sediment Investigations and Cleanups shall be Submitted Electronically Using Ecology's Sediment Quality Information System (SEDQUAL).

SEDQUAL is Ecology's data management system for sediment-related data. Proper submission of data through this system meets the requirement of submitting such data in an electronic format. Electronic data shall be submitted to Ecology simultaneously with the accompanying printed report.

8. Sediment Sampling Data Shall be Submitted to Ecology Using the SEDQUAL Data Entry Templates.

At a minimum, the following SEDQUAL data entry templates must be completed:

1. **Reference & Bibliography:** Describes lab reports and publications that relate to the data being entered;
2. **Survey:** Sample number;
3. **Station:** Specifies geographic location of the sediment sample. Sample latitude/longitude coordinates must be entered using the North American Datum of 1983 in U.S. Survey feet (NAD 83, U.S. feet);
4. **Sample:** Describes sample characteristics such as depth; and
5. **Sediment Chemistry:** Reports chemical concentration data in dry weight units.

The following additional templates must also be completed where these measurements/observations have been made:

1. **Bioassay:** Bioassay test results;
2. **Bioassay Control:** Bioassay control test results;
3. **Benthic Infauna:** Species abundance & diversity;
4. **Tissue:** Describes the organism collected;
5. **Bioaccumulation:** Reports tissue chemical concentrations; and
6. **Histopathology:** Reports tissue pathology such as tumors or lesions

9. Electronic Data Formats Shall be Verified to be Compatible with SEDQUAL Prior to Submittal.

Because SEDQUAL uses ASCII protocol and comma delimited text files, data format verification shall be conducted prior to submittal to Ecology. Data shall be verified by downloading the SEDQUAL database, importing the data into the database, correcting errors, and then exporting the corrected templates.

For additional information on sediment sampling and analysis plan requirements, see Ecology publication 03-09-043 "Sediment Sampling and Analysis Plan Appendix", April, 2003. A copy of this document can be obtained from Ecology's publication office or downloaded from the following web site: http://www.ecy.wa.gov/biblio/0309043.html
Additional information on SEDQUAL can be found at:
http://www.ecy.wa.gov/programs/tcp/smu/sedqualfirst.htm. TCP's SEDQUAL Coordinator is also available for technical assistance to site managers and consultants using SEDQUAL.

10. Sediment Sampling Data Shall Also be Submitted to Ecology in a Printed Report.

Printed reports shall present the data in both dry weight and total organic carbon normalized units in data tables that compare the results to applicable state regulatory criteria.

11. Data Submitted Electronically Using SEDQUAL Shall be Checked by the Toxics Cleanup Program's SEDQUAL Coordinator Prior to Loading the Data into SEDQUAL.

Normally, SEDQUAL data submittals will come to TCP's SEDQUAL Coordinator. Upon receipt of a submittal, the Coordinator should notify the site manager. Similarly, if the Ecology site manager receives a SEDQUAL submittal, they should notify TCP's SEDQUAL Coordinator. Upon receipt of the data, TCP's SEDQUAL Coordinator reviews the submittal for quality control and officially loads the data into the system.

Approved

James J. Pendowski, Program Manager
Toxics Cleanup Program

Policy Disclaimer: This policy is intended solely for the guidance of Ecology staff. It is not intended, and cannot be relied on, to create rights, substantive or procedural, enforceable by any party in litigation with the state of Washington. Ecology may act at variance with this policy depending on site-specific circumstances, or modify or withdraw this policy at any time.

APPENDIX A: MODEL GRANT AND PERMIT CONDITION

The following condition is to be inserted in permits, grants, loans, contracts, interagency agreements, memorandum of understandings where site-specific environmental monitoring data is expected to be generated:

All sampling data shall be submitted to Ecology in both printed and electronic formats in accordance with WAC 173-340-840(5) and Ecology Toxics Cleanup Program Policy 840: Data Submittal Requirements. Electronic submittal of data is not required for site hazard assessments that result in no further action and initial site investigations. (FOR GRANTS & CONTRACTS ADD: Failure to properly submit sampling data will result in Ecology withholding payment and could jeopardize future grant funding.)