FINAL
SITE DATA REVIEW AND RISK SCREENING
STARRIGAVAN BAY SEDIMENTS
SITKA, ALASKA
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Prepared for

Alaska Department of Environmental Conservation
Spill Prevention and Response
Contracts and Grants Unit
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ACRONYMS

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADOT&PF	Alaska Department of Transportation and Public Facilities
AET	apparent effect threshold
ARCS	assessment and remediation of contaminated sediments
bgs	below ground surface
BT	bioaccumulation trigger
BTEX	benzene, toluene, ethylbenzene, and xylenes
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
COPC	contaminant of potential concern
DRO	diesel range organics
Ecology	Washington State Department of Ecology
ER-L	effects range-low
ER-M	effects range-median
ESA	environmental site assessment
FDEP	Florida Department of Environmental Protection
Golder	Golder Associates, Inc.
GRO	gasoline range organics
HPAH	heavy molecular weight polynuclear aromatic hydrocarbon
LCV	lowest chronic value
LPAH	light molecular weight polynuclear aromatic hydrocarbon
mg/kg	milligrams per kilogram
ML	maximum level
NAWQC	national ambient water quality criteria
NEC	no effect concentrations
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
ORNL	Oak Ridge National Laboratory

PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEC	probable effect concentrations
PEL	probable effect level
PID	photoionization detector
ppm	parts per millions
PRG	preliminary remediation goals
PSDDA	Puget Sound dredge disposal analysis
PSP	paralytic shellfish poisoning
QAR	quality assurance review
RBC	risk-based concentration
RCRA	Resource Conservation and Recovery Act
RCRAInfo	Resource Conservation and Recovery Act Information
RRO	residual range organics
SCV	secondary chronic value
SL	screening level
SLR	SLR Alaska
Squirts	screening quick reference tables
SVOC	semi-volatile organic compound
TBT	tributyl tin
TOC	total organic carbon
TVS	total volatile solids
USACE	United States Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1 INTRODUCTION

SLR Alaska (SLR) performed this data review and risk screening at the request of the Alaska Department of Environmental Conservation (ADEC) to assess existing information for the study area at Starrigavan Bay. This site is located approximately five miles north of Sitka, Alaska, as shown on Figure 1. The site is composed of approximately nine intertidal acres seaward of a trap and skeet range. The general study area boundaries are Harbor Point to the west and the Allen Marine Shipyard to the east, as shown on Figure 2. The study area extends approximately 300 feet seaward from high water.

1.1 Objectives

The objectives of the current effort are as follows:

1.1.1 Land Use Review

The objective of this task was to focus on potential risks from present and past land use practices, with recognition of potential risks from nearby sites, including commercial/industrial business practices, underground storage tanks, and other potential sources of contamination. To accomplish this task, we reviewed aerial photographs, researched standard historical sources, and contacted individuals knowledgeable of the historical, current, and future use of the area of concern. Additionally, Golder Associates Inc. (Golder) and the ADEC were contacted regarding findings from past environmental assessment activities.

1.1.2 Risk Screening

The objective of the risk screening was to review available analytical data that have been collected in the study area as part of previous investigations, and summarize how samples were collected and the analytical data, as well as the appropriateness of the sampling methodology employed and whether it provides definitive conclusions as to the impact in this area.

Potential risk to human health and the environment were evaluated based on various scenarios that are appropriate to the research conducted and the limitations of data that are available.

2 GENERAL SITE CHARACTERISTICS

The location and setting of the study area is described as follows:

2.1 Site Location and Legal Description

The primary area of concern encompasses approximately nine intertidal acres seaward of the Sitka Sportsman's Association trap and skeet range. The study area, as initially defined, is bounded by Harbor Point to the west and No Name Creek to the east and extends approximately 300 feet seaward from high water. In order to complete this assessment, and based on our conversations with Mr. William Janes of ADEC, the study area was extended to include the adjoining intertidal area near the Allen Marine Shipyard. Additionally, nearby upland sites were included in our land use investigation in order to determine potential sources of contamination. Figures 1, 2, and 3 are included as a general vicinity map, site map, and aerial photograph of the study area, respectively.

The area consists of intertidal area and several parcels located in the 5200 and 5300 blocks of Halibut Point Road mile 6 (approximately). The primary parcels of concern have legal descriptions of U.S. Survey No. 3670, Alaska, Lot 3 (Sitka Sportsman's Association trap and skeet shooting range) and Lot 4 (Allen Marine Shipyard), Sitka Recording District, State of Alaska. The study area is located in Section 3, Township 55 South, Range 63 East, Copper River Meridian.

2.2 Site and Vicinity General Characteristics

The study area is located on the shore of Starrigavan Bay, north of the City of Sitka, in an area with some commercial development and recreational facilities. Starrigavan Creek and the Russian Fort settlement historic site are located to the northeast of the Sitka Ferry Terminal. Forest surrounds the developed areas. General site characteristics can be seen in Figures 2 and 3.

The intertidal zone adjacent to the trap and skeet range contains fucus, eelgrass, and macrocystis. Bivalves include littleneck clams, butter clams, cockle clams, and blue mussels. Herring are known to spawn in the area.

The current pattern is generally from the southwest to the northeast due to prevailing winds and storm events. Currents move along the shoreline and eddy around the dredged bight near the Allen Marine Shipyard. No Name Creek also contributes to sediment loading in the vicinity.

2.3 Description of Development

Structures and other improvements in the study area are described in Section 2 of a Phase I Environmental Site Assessment (ESA) prepared by Golder (Golder, 2002a). One parcel, the lot across Halibut Point Road from the shooting range, is not described in the Phase I ESA. The parcel is used by Service Transfer, Inc., a fuel supply company in Sitka, for warehousing materials, storing vehicles, and performing minimal vehicle maintenance.

3 SITE RECORDS REVIEW

SLR researched standard historical sources regarding developed use of the area of concern. Federal, state, and local agencies were contacted to obtain historical information on land use and environmental concerns. Information significant to the study area and the sources accessed are described below.

3.1 Prior Environmental Studies

Prior environmental studies pertaining to the study area were reviewed as part of this preliminary site assessment. In 2002, Golder performed five distinctive site assessment activities near the Allen Marine Shipyard. These studies, conducted for the Alaska Department of Transportation and Public Facilities (ADOT&PF) in anticipation of future ferry terminal upgrades and expansion, include Phase I and Phase II Site Assessments (Golder, 2002b and 2002c), intertidal sediment sampling (Golder, 2002e), and an eelgrass survey (Golder, 2002a). Additionally, Golder conducted clam sampling near the Sitka Sportsman's Association trap and skeet shooting range (Golder, 2002d). Subsequent clam tissue sampling was performed by ADEC (ADEC, 2002a). Approximate locations of study and sample areas are shown on Figure 2, and specific locations are shown on figures in the respective reports.

3.1.1 Phase I ESA - Allen Marine Shipyard

A Phase I ESA was conducted at the Allen Marine Shipyard in February 2002 (Golder, 2002b). Based on the current and past use of the site as a shipyard and marine maintenance facility, Golder concluded there was a potential for the release of hazardous substances to the environment.

A personal interview conducted with Mr. Bob Allen and Mr. Tom Scheidt of Allen Marine indicated that the marine railway was built in 1976 and that Allen Marine operated a barge repair facility for the Sitka Pulp Mill until about 1990. There had not been any heating fuel tanks on the property and equipment was serviced using a commercial fuel company. The barge repair operation consisted of removing the buildup on the bottom of the barges by sandblasting, repairing damage, and applying a zinc rust preventative. Since that time, the facility has been used for repairing and launching other craft. Individuals interviewed by

SLR indicated that the Allen Marine Shipyard is relatively inactive at the current time.

According to the Phase I assessment, potential contaminants commonly associated with shipyards and marine maintenance facilities include the following:

- Petroleum hydrocarbons.
- Resource Conservation and Recovery Act (RCRA) metals (especially lead, tin, and zinc from sandblasting and other methods of rust removal).
- Anti-fouling agents (such as arsenic and tributyl tin [TBT]) added to paints to inhibit growth on vessel hulls.
- Polynuclear aromatic hydrocarbons (PAHs) from heavy oil that may be present in vessels.
- Polychlorinated biphenyls (PCBs) from ship components that may be present in ships.

Additionally, a letter documenting a 1991 hazardous waste inspection performed by ADEC at the Allen Marine Shipyard was included in the report. According to the letter, portions of the site that were inspected were found to be in compliance with state and federal hazardous waste regulations. The ADEC was concerned, however, about the presence of sandblast grit on the beach. Subsequent sampling indicated low concentrations of seven RCRA metals, none of which exceeded the Toxicity Characteristic levels of a hazardous waste as set forth in 40 CFR 261, Subpart C. Based on the sampling results, the ADEC concluded that no cleanup was required. Analytical results and a location map were not available for use in this assessment. At the time of the Phase I assessment, Golder observed sandblasting grit near the marine railway.

3.1.2 Phase II ESA - Allen Marine Shipyard

Based on the findings of the Phase I ESA, the ADOT&PF contracted Golder to conduct soil sampling at the shipyard property in April 2002 (Golder, 2002c). During the Phase II ESA, stained areas (6 inches to 2 feet in diameter) were observed in the maintenance shop, and sandblasting grit, which had the appearance of black sand, was observed covering most of the area between the concrete marine rails. Bags of sandblasting grit stored at the maintenance shop were labeled as TRU GRIT™, which is copper slag. According to the labeling, the grit contained iron, silicon, calcium, aluminum, magnesium, potassium, titanium, and phosphorus in oxidized states. Composite samples were collected from the marine railway area and the gravel floor of the shop. The letter report noted that the marine railway might be considered part of the intertidal zone, based on the presence of algae and other flotsam and the washed appearance of the sandblasting grit and sand.

A test pit was excavated at the southwest portion of the site. An oily layer (1 to 2 inches thick), appearing to be old bunker oil, was observed at about 6 feet below ground surface (bgs). Headspace samples measured with a photoionization detector (PID) indicated 639 and 1,139 ppm volatile organic vapors in soil from the oily layer.

The site assessment results indicated that contaminated materials are present at some locations on the Property. Diesel range organics (DRO), residual range organics (RRO), arsenic, chromium, and cadmium were measured at concentrations exceeding ADEC cleanup levels. The sample from the maintenance shop contained DRO and RRO at concentrations of 1,900 milligrams per kilogram (mg/kg) and 13,000 mg/kg, respectively. Arsenic and chromium concentrations of 41 to 512 mg/kg and 67 mg/kg to 102 mg/kg, respectively, were found in all samples. The sample from the sandblasting area contained 7.6 mg/kg of cadmium.

3.1.3 Intertidal Sediment Sampling

Concurrent with the upland soil sampling, ADOT&PF requested that Golder sample intertidal sediments at the Allen Marine Shipyard (Golder, 2002e). Three samples were collected, two within the shipyard's marine railway (with high concentrations of sandblasting grit), and another on a berm seaward of the shipyard. Elevated levels of arsenic, copper, lead, zinc, TBT, PAHs, and PCBs were found. It was anticipated that metal concentrations would be high, based on the presence of used sandblasting grit (indicating the deposition of antifouling paint debris containing copper, arsenic, lead, and TBT). The letter report stated that if ADOT&PF proposed dredging the intertidal and subtidal portions of the shipyard, obtaining a permit would likely require a cleanup or remediation plan for the contaminated sediments.

3.1.4 Clam Tissue Sampling by Golder

At the request of the Alaska Department of Fish and Game (ADF&G), the ADOT&PF also hired Golder to conduct a preliminary study of metals in clams and mussels adjacent to the Sitka Sportsman's Association trap and skeet shooting range (Golder, 2002d). The sampling was completed during the same general time period as the upland and intertidal sampling described above (end of March 2002). Composite samples of clams (or mussels in one instance) were collected from three locations. Results showed elevated concentrations of lead in the clam samples. The study concluded that results were preliminary; however, because the clams in the study area were regularly harvested (according to a footnote citing Mr. Robert Laquire of the Sitka Sportsman's Association), it would be important to recognize that a potential health risk, especially to children and pregnant women, may exist from consumption of clams at the site as indicated by concentrations of arsenic (a known carcinogen) and lead (a physiological toxin) that exceeded risk-based concentration (RBC) values. A photo in the report shows clam harvesters at the same location from which the clam samples were taken. Also noted in the report, abundant clay pigeon remains and the shooting range orientation indicated that shooting was conducted over the intertidal zone.

3.1.5 Eelgrass Survey

Golder also conducted an eelgrass survey in March 2002, delineating a contiguous bed of eelgrass near the marine railway (Golder, 2002a). ADF&G had reported similar conditions in August 2001. The letter report briefly describes the issues associated with the presence of eelgrass in light of potential ferry terminal development.

3.1.6 Clam Sampling by ADEC

ADEC conducted additional clam sampling in Starrigavan Bay in mid-August 2002 (ADEC, 2002a). Two of the three samples collected near the trap and skeet range had lead levels that slightly exceeded recommended levels for pregnant women and children aged 2-5 years. Of the remaining samples, one was collected near the Allen Marine Shipyard and four were collected near the Sitka Historical Site, presumably northeast of the ferry terminal. Mr. Ron Grimm, a chemist at the ADEC Food Lab in Palmer, clarified that the clam samples were thoroughly cleaned of sand and sediment to avoid skewing the tissue data. Based on follow-up sampling results, ADEC decided that a consumption advisory was unnecessary. The ADEC news release includes a reminder that people should not harvest clams from the area anyway because of the risk of paralytic shellfish poisoning (PSP). According to Mike Ostasz of the ADEC Shellfish program, additional sampling will be conducted in June, July, and August 2003 in the same areas.

3.2 State and Federal Government Database Search

The following federal and state databases were searched for information regarding sites at or near the subject area. The databases were queried on June 2, 2002.

- National Priorities List (NPL)
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)
- Resource Conservation and Recovery Act Information (RCRAInfo)
- ADEC Contaminated Sites Database
- ADEC Underground Storage Tank Database
- ADEC Leaking Underground Storage Tank Database

3.3 Government Database Search Results

Three sites within the study area were listed in the government databases.

- Allens Boatyard is listed in RCRAInfo, with handler identification number AK983072992, based on data extracted on December 9, 2002. No additional handler/facility classification information was available.
- The Sitka Ferry Terminal, Facility 3214, is listed on the ADEC Underground Storage Tank Database, with two registered tanks. One 375-gallon diesel tank (Tank 1) installed in 1988 was removed from the ground and another 375-gallon diesel tank (Tank 2) was installed in April 2000 and is currently in use.
- The intertidal area of concern is listed as an active, unranked contaminated site (Reckey number 2002120921901). The site name is listed as Starrigavan Bay Sediments and the address shown is the 5200 block of Halibut Point Road. It was added to the database March 25, 2003. The narrative states, "Sediments contaminated with various persistent bioaccumulative and toxic chemicals from a shooting range and a shipyard. An ADOT&PF contractor documented elevated lead in clam samples in spring 2002. Follow-up clam sampling by ADEC's Division of Environmental Health in August 2002 showed somewhat conflicting data. Additional tissue sampling will occur in 2003."

No other sites listed in the databases are within 1 mile of the study area. Subsequent to the above database queries, SLR gained knowledge of the 2002 Phase I ESA conducted by Golder. A review of the Phase I ESA did not reveal any additional database findings.

3.4 Aerial Photographs

The aerial photographs examined in the Golder Phase I ESA included photographs of the study area in 1966, 1982, and 2001. Additionally, SLR examined a 1985 aerial photograph of the area.

In 1966, properties in the area appear to be either developed or used for storage. The Samson Tug and Barge lot, ferry terminal, Allen Marine Shipyard, and shooting range are all developed. The lots across Halibut Point Road appear to be used for storage. Two Quonset huts, as well as numerous conexes or other stored items and a floating dock, are visible at Samson Tug and Barge.

The 1982 photo shows similar development to the 1966 photo. The marine railways are clearly visible in the 1982 photo. Also, log piles are visible on the shooting range lot and the Samson Tug and Barge lot. Numerous trailers can be seen on the lot across from the ferry terminal.

The 2001 photo shows additional development on the properties, including new buildings and a motor home parking area at the shooting range, an expanded ferry terminal loading area, and new buildings on the Service Transfer lot across from the shooting range. The trailers noted previously across from the ferry terminal are no longer present, and small boats appear to be stored on the lot.

3.5 Ownership Information

The Sitka Assessor's office provided current ownership information for the properties in the study area. Ownership and property use are adequately described in Section 2 of the Golder Phase I ESA. In addition to the information provided by Golder, the Snowden Group LLC owns the lot across Halibut Point Road from the shooting range. Service Transfer uses the lot for warehousing materials.

3.6 Interviews

SLR representative Laurie Silfven conducted phone interviews in early June 2003 with individuals knowledgeable about historical or current use of properties in the area. Significant information pertaining to this environmental study follows.

3.6.1 Sitka Sportsman's Association Interview

Mr. Linn Shipley, a member of the Sitka Sportsman's Association, was interviewed for information regarding the history and use of the trap and skeet shooting range. The Sitka Sportsman's Association purchased the parcel from the U.S. Department of the Interior in 1961, although the lot has been informally used as a shooting range since the road was built in the 1950s. According to Mr. Shipley, a stipulation in the deed is that the Sitka Sportsman's Association will operate a trap and skeet shooting range on the property. There are no environmental restrictions about shooting lead shot over the tidelands that apply to the Sitka Sportsman's Association. Shotguns with lead shot are currently used at the trap and skeet range, which is directed seaward, while pistols are used at the indoor range. Prior to construction of the indoor range, the Sitka Sportsman's Association used a dry land bank as part of the pistol and shotgun range. At that time, lead bullets and lead shot would have been used on the site.

The site is connected to city water, and sewage is disposed of through an ADEC-approved sewage pipe with marine outfall. An aboveground heating oil tank was installed in 1991 when the current building was constructed. A building module was removed at that time and information regarding the prior source of heat was not readily available. Mr. Shipley was not aware of any spills or releases of petroleum hydrocarbons or other fluids or illegal dumping on the site or surrounding properties. Ammunition, clay pigeons, and a small quantity of paint are stored on site.

When questioned about recreational clamming near the trap and skeet range, Mr. Shipley stated that the property is fenced off, although the fence could be skirted near No Name Creek to gain access to the beach, and clamming near the trap and skeet range is restricted based on PSP potential.

3.6.2 ADOT&PF Interview

Van Sundberg, ADOT&PF Environmental Coordinator, was interviewed regarding future plans for development at the ferry terminal. According to Mr. Sundberg, ADOT&F expansion plans have been scaled down. Two or three mooring dolphins (clusters of two to four steel pilings welded together) will be constructed on the current structure to allow one ferry to unload while another ferry moves. The current plan involves minor changes to the uplands. To his knowledge, dredging is not planned. Previous development plans included two new berths, significantly larger scale than the current plan. According to Mr. Sundberg, the ADOT&PF is not buying the Allen Marine property.

Similar to the shooting range, the ferry terminal uses city water and has oil heat. A septic jet plant with marine outfall is used for sewage. Mr. Sundberg was not aware of any spills or releases of petroleum hydrocarbons or other fluids on the site.

3.6.3 Samson Tug and Barge Interview

A brief interview was conducted with Mr. Jay Sweeney of Samson Tug and Barge. According to Mr. Sweeney, Samson Tug and Barge has occupied the site northeast of the ferry terminal since the late 1970's. The Alaska Pulp Corporation occupied the site prior to that time. Mr. Sweeney was under the impression that the Alaska Pulp Corporation had a maintenance facility on the site, but did not have specific knowledge regarding their operations. Samson Tug and Barge, a common carrier of containers and freight, uses the site as a loading area, stores empty containers in the yard, and performs minor maintenance on heavy equipment. A small diesel tank (less than 500 gallons) is located at the site and the facility is heated with heating oil. According to Mr. Sweeney, a Phase I ESA recently performed at Samson Tug and Barge did not reveal concerns about contamination.

3.6.4 Service Transfer Interview

Service Transfer, a fuel supply company, warehouses materials on the lot across from the shooting range according to a Service Transfer employee. Vehicles and boats are stored on the lot, and some vehicle maintenance is done there. A large propane storage tank is located on the site. However, oil is not stored at that location; oil trucks are parked at another location in town. The building is heated by heating oil delivered by Service Transfer.

3.6.5 ADF&G Interview

Phone calls were made to the ADF&G in Sitka to obtain information about clamming in the area. No information had been received from ADF&G prior to submitting this report; however, other individuals familiar with the area provided information regarding clamming.

3.6.6 Clamming Interview

Michael Shephard, a resident of Sitka for over ten years who is employed by the United States Forest Service, confirmed from personal knowledge that local clamming is done to the northeast of the ferry terminal near Starrigavan Creek and the Russian Fort settlement historic site. To his knowledge, the intertidal area near the trap and shoot range is not a popular clamming site.

4 RISK SCREENING

The risk screening effort consisted of evaluation of the appropriateness of the existing data and screening of the data to established risk criteria.

4.1 Data Quality Review

An SLR chemist performed a quality assurance review (QAR) of the analytical laboratory data from Golder (2002d,e). The QAR is included as Appendix A. SLR concluded that the data was appropriate for the intended purpose.

4.2 Data Evaluation

In this section, the data collected from the site in relevant media are discussed in terms of number of samples, analytical methods, and results of laboratory analyses.

4.2.1 Soil Physical Data

Physical property information on nearshore sediments compiled by Golder (2002e) is summarized on Table 1. These parameters include grain size, total volatile solids (TVS), total organic carbon (TOC), and total solids. The sediments are primarily sands, with varying amounts of gravels. Silt and clay represent less than 4% of particles. TOC ranges from 0.33 to 5.65%. TOC is used in the ecological screening assessment to normalize concentrations of organic chemicals for comparison with screening values, which are typically developed based on sediments containing 1% organic carbon. TVS and total solids are not used in the screening assessment, but are reported here for completeness. These parameter values indicate that TVS is low, so not many volatiles are present in the sediments.

4.2.2 Soil Chemical Data

Three composite soil samples were collected from the Allen Marine property on April 1, 2002 (Golder, 2002c). These samples were collected from the maintenance shop floor (shop), the marine railway area (sandblast area), and a test pit area (test pit) west of the marine rail structure (Golder, 2002c). All samples were analyzed for metals by U.S. Environmental Protection Agency (USEPA) Method 6010B, arsenic by USEPA Method 7060A, mercury by Method 7471A, selenium by Method 7740, organochlorine pesticides by Method 8081A, volatile organic compounds (VOCs) by Method 8260C, PCBs by Method 8082, semivolatile organic compounds (SVOCs) by Method 8270C, DRO by Alaska Method AK102, gasoline range organics (GRO) by Alaska Method AK101, and RRO by Alaska Method AK103. The shop sample was not analyzed for GRO. The analytical data are summarized below and in Table 2 (Golder, 2002c).

- Metals – eight metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) were detected in all samples. The maximum detected concentration across all samples and metals was 538 mg/kg (for lead from the composite sandblast area sample).

- Organochlorine pesticides – no organochlorine pesticides were detected in any sample.

- VOCs – 2-hexanone, methylene chloride, naphthalene, and 1,2,3-trichlorobenzene were detected in at least one sample. The maximum detected concentration across all samples and analytes was 0.0028 mg/kg (for 2-hexanone from the composite test pit sample). According to the analytical results table included in the Golder report (2002c), benzene, toluene, ethylbenzene, and xylenes (BTEX) were not detected in any of the samples.

- PCBs – Aroclor 1254 was detected in one sample (sandblast area) at a concentration of 0.071 mg/kg. No other PCBs were detected in any sample.

- Petroleum Hydrocarbons – DRO, GRO, and RRO were each detected in at least one sample. The maximum detected petroleum hydrocarbon concentration across all samples was 13,000 mg/kg for RRO from the composite shop sample.

- SVOCs – acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, dimethylphthalate, di-n-butyl phthalate, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 4-methylphenol, naphthalene, phenanthrene, and pyrene were detected in at least one sample. Except for dimethylphthalate, di-n-butylphthalate, and 4-methylphenol, all of these

SVOCs are PAHs. The maximum detected concentration across all SVOCs was 3 mg/kg for fluoranthene from the composite sandblast area sample.

The majority of maximum concentrations were detected in samples collected at the sandblast area. Maximum DRO and RRO concentrations were detected in the samples obtained from the shop.

4.2.3 Sediment Data

Three shallow sediment samples were collected from the intertidal zone of the Allen Marine Shipyard in Starrigavan Bay, Sitka, Alaska during low tide on April 1, 2002 (Golder, 2002e). Two samples (ITZ 1 and ITZ 2) were collected within the boundaries of the shipyard's marine railway, and the third (ITZ 3) was collected on a berm seaward of the shipyard. All samples were collected from a depth of approximately 4 to 6 inches bgs. The samples were analyzed for metals by USEPA Method 200.8, mercury by USEPA Method 7471A, organochlorine pesticides by USEPA Method 8081A, PCBs by USEPA Method 8082, SVOCs by USEPA Method 8270C, VOCs by USEPA Method 8260B, and butyltins by USEPA Method Krone. Sample ITZ 3 was not analyzed for metals or mercury. The analytical data are summarized below (Golder, 2002e) and in Table 3.

- Metals – ten metals (antimony, arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc) were detected in the two samples collected from the marine railway (ITZ 1 and ITZ 2). The maximum detected concentration across all these metals was 7,590 mg/kg for zinc.

- Organochlorine pesticides – no organochlorine pesticides were detected in any of the samples.

- VOCs – acetone, 2-butanone, and methylene chloride were detected in at least one sample. The maximum detected concentration across all these VOCs was 0.015 mg/kg for acetone from sample location ITZ 1.

- PCBs – Aroclor 1254 was detected in both ITZ 1 and ITZ 2 at a maximum concentration of 0.51 mg/kg (ITZ 2). No other PCBs were detected at any sampling location.

- SVOCs – acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, butyl benzyl phthalate, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluorene, fluoranthene, indeno(1,2,3-cd)pyrene, 4-methylphenol, naphthalene, pentachlorophenol, phenanthrene, phenol, and pyrene were detected in at least one sample. Except for butyl benzyl phthalate, 4-methylphenol, pentachlorophenol, and phenol, all of these SVOCs are PAHs. The maximum detected concentration across all these SVOCs was 5.6 mg/kg for fluoranthene from ITZ 2.

- Butyltins – tri-n-butyltin was detected in all three samples at a maximum concentration of 13 mg/kg (ITZ 2).

The majority of samples containing maximum concentrations were collected from sample ITZ 2.

In order to allow for direct comparison with relevant ecological screening concentrations, detected concentrations of organic chemicals (including butyltin) were normalized based on the organic carbon content of the samples. The normalized concentrations (in units of milligrams chemical per kilogram organic carbon) and maximum values are also shown on Table 3.

4.3 Screening Evaluation

The data summarized above were compared with relevant and appropriate sediment screening criteria to identify chemicals that could pose risks to human health and the environment associated with the reported chemical concentrations. The following section describes the criteria used for the screening evaluation and the results of the screening evaluation. Upland soil samples are first evaluated with respect to human health, followed by evaluation of the sediment samples for potential ecological issues.

4.3.1 Human Health Screening Evaluation

To evaluate potential risk to human health, soil data were compared with risk-based cleanup values for soil developed by the ADEC for protection of human health. The criteria used and results of the human health screening evaluation are discussed below.

In addition to the soils data evaluated below, three samples of clam tissue were collected from the intertidal areas by Golder (2002d) and again by ADEC (2002a). Samples were collected because the area is reportedly used for recreational clam harvesting by Sitka residents, although other information has implied that clamming is not recommended due to the possibility of paralytic shellfish poisoning, which is not related to chemical contamination. Sampling by Golder was conducted on March 30, 2002, and included collection of two composite clam samples and one composite mussel sample. Results showed elevated concentrations of lead in composite clam samples. Concentrations in mussel tissues were lower, and other than lead overall concentrations of detected analytes were similar to “mussel watch” concentrations in samples collected near Ketchikan. ADEC was notified of these results in early August 2002, and conducted additional sampling in August 2002. Two of eight samples (one of littleneck clams and one of butter clams) demonstrated lead levels that slightly exceeded recommended levels for pregnant women and children aged 2-5 years. Both samples were collected near the trap and skeet range that is adjacent to the Allen Marine property. Based on follow-up sampling results, ADEC (2002a) decided that a consumption advisory was unnecessary. On this basis, no additional evaluation of clam or mussel tissue data was conducted in this document. If additional samples were collected, a more rigorous human health evaluation focusing on shellfish ingestion could be conducted, if warranted.

4.3.2 Soil Screening Criteria

Maximum detected soil chemical concentrations were compared to Method 2 cleanup levels published by ADEC in Table B of 18 AAC 75.341 (ADEC, 2003). Chemicals present at concentrations above Table B levels are identified as chemicals of potential concern (COPCs) requiring either further analysis at a higher tier of the risk assessment (e.g., Method 3 or 4), or remediation based on Table B values as cleanup goals. Chemicals present at maximum concentrations below Table B cleanup levels are considered below levels of concern and do not require further evaluation.

Table B cleanup levels are “safe” chemical concentrations in soil that are expected to be without unacceptable carcinogenic or other adverse health effects over long-term human exposure. Cleanup levels are risk-based concentrations developed by ADEC on the basis of standard risk assessment equations and conservative, default assumptions (e.g., exposure and toxicity assumptions). Soil cleanup levels were separately developed by ADEC for the following exposure pathways: incidental ingestion, outdoor vapor inhalation (for VOCs), and dust inhalation (for metals and SVOCs). The target risk for cancer-causing chemicals is the state of Alaska target of one cancer case in one hundred thousand people (i.e., 10^{-5}), and the target for noncancer-causing chemicals is a hazard index of 1. These targets, in combination with the conservative methods used to develop the cleanup levels, indicate that chemical concentrations in soil below these levels are unlikely to substantially contribute to total risks and hazards estimated for a site.

Method 2 cleanup levels are designed to be protective of long-term exposures to soil in a residential setting. Residential exposures generally are greater than those for other receptors; therefore, a residential receptor is considered a maximally exposed receptor. Method 2 cleanup levels were developed by ADEC assuming a resident receptor would be present at a site 350 days per year for 30 years. This is a conservative assumption not often reflected in daily life. ADEC developed Method 2 cleanup levels for noncarcinogenic chemicals for child receptors only, and cleanup levels for carcinogenic chemicals for a child/adult resident receptor (e.g., age 0 through 30) were used for cancer chemicals (ADEC, 2001). Other assumptions such as soil ingestion and inhalation rates are also conservative. Such conservatism is appropriate for screening levels that are not site-specific. These conservative assumptions have the effect of lowering Method 2 cleanup levels (i.e., making them more stringent). Method 2 cleanup levels are, therefore, adequately conservative for use in screening-level risk assessments. Residents are not relevant at the subject site due to current land use and zoning restrictions. Instead, worker and recreator receptors are more relevant to the site. These receptors have lower anticipated exposures than do residential receptors. Therefore, direct use of Method 2 cleanup levels is very conservative. The lower of the Method 2 values for soil ingestion and inhalation are provided on Table 3 for all detected analytes.

Method 2 cleanup levels have also been developed by ADEC (2003) for "migration to groundwater". These levels were derived by ADEC by identifying a groundwater cleanup level assuming a residential drinking water scenario (i.e., Table C values from ADEC [2003]). A soil concentration was then calculated by ADEC using a conservative, infinite mass leaching algorithm, resulting in a soil concentration that would not exceed the target groundwater level. Therefore, the Method 2 evaluation also considers impacts from soil to groundwater. As such, these Method 2 soil cleanup levels for the protection of groundwater are more restrictive than necessary to protect groundwater at this site, where groundwater is likely not potable due to saltwater intrusion. The migration to groundwater based Table B cleanup levels are also provided on Table 3.

Chemicals with concentrations exceeding cleanup levels were identified as COPCs. Such exceedances do not necessarily imply that risks are elevated above acceptable levels, but that further evaluation is warranted with regard to these potential exposure and migration pathways.

4.3.3 Human Health Screening Results

Results of the comparison of Method 2 cleanup levels and maximum detected soil concentrations are shown on Table 4. Maximum concentrations of arsenic, lead, RRO, and benzo(a)pyrene exceed direct contact-based Method 2 values. Arsenic is the only chemical with a maximum concentration more than twice the direct contact-based value (512 mg/kg maximum compared with a Method 2 value of 4.5 mg/kg). Migration to groundwater based Method 2 values are also exceeded by the maximum concentration of arsenic and RRO (lead has no migration to groundwater based value).

In addition to the chemicals discussed above, maximum concentrations of three other analytes (cadmium, chromium, and DRO) exceed the protection of groundwater based Method 2 values.

No Method 2 cleanup levels are available in ADEC (2003) for several detected analytes in soil (i.e., 2-hexanone, 4-methyl phenol (p-cresol), 1,2,3-trichlorobenzene, phenanthrene, acenaphthylene, and benzo(g,h,i)perylene). These chemicals are typically evaluated using structurally similar surrogates. ADEC (2001b)has identified relevant surrogate chemicals and associated Method 2 cleanup levels for all of these chemicals except 2-hexanone and 4-methyl phenol (p-cresol). Consistent with ADEC (2001b), phenanthrene is evaluated based on values for anthracene, benzo(g,h,i)perylene is evaluated using values for pyrene(the most potent PAH from a noncancer perspective), and acenaphthylene is evaluated based on values for acenaphthene. Using these surrogate chemicals for comparison, detected concentrations of these analytes are much lower than relevant Method 2 cleanup levels. Therefore, these chemicals are unlikely to represent a health risk based on their relative toxicity to appropriate compounds with available Method 2 values. 2-hexanone, 1,2,3-trichlorobenzene, and 4-methyl phenol were identified as COPCs due to lack of available, ADEC approved surrogate compounds for screening.

4.3.4 Conclusions of the Human Health Evaluation

Arsenic is identified as a COPC in soil based on elevated concentrations relative to Method 2 direct contact cleanup levels. Further risk evaluation of arsenic should include a background evaluation to verify that site-specific concentrations exceed local ambient levels. Lead, RRO, and benzo(a)pyrene may warrant further evaluation as well, but statistically-based concentrations may be less than Method 2 direct contact cleanup levels because the maximum concentrations only slightly exceeded these levels. In addition, cleanup levels are based on residential exposure, which is not relevant at this site. If groundwater were potable, then cadmium, chromium, and DRO in soil may present a threat to groundwater quality. However, given the likely interaction of surface water and groundwater in this tidal location, it is unlikely the groundwater is usable for domestic purposes. Therefore, protection of groundwater on the basis of drinking water-based criteria is likely not relevant. We do not recommend further evaluation of lead, RRO, or benzo(a)pyrene beyond potential development of site-specific groundwater protection based values for RRO. Site-specific groundwater protection values could also be developed for cadmium, chromium, and DRO. Such values would likely be linked to protection of aquatic ecological receptors. The ecological evaluation is presented below.

4.4 Ecological Screening

To evaluate potential risk to ecological receptors, sediment data were compared to criteria from various government and literature sources in a weight of evidence approach to identify potential toxicity issues associated with detected chemicals. Sediment analytical data were directly compared with the screening values and the results were interpreted. Where relevant for comparison, sediment concentrations were normalized based on assumptions regarding the organic carbon content of the sediments. The following text discusses the sources and relevance of the screening criteria used and presents the results of the screening ecological evaluation.

4.4.1 Sediment Screening Criteria

Alaska has no sediment standards for protection of ecological receptors. Therefore, sediment numeric standards and ecological benchmarks used in this screening step were compiled from available sources, including the National Oceanic and Atmospheric Administration (NOAA), Oak Ridge National Laboratory (ORNL), the U.S. Army Corps of Engineer (USACE), and the Washington State Department of Ecology (Ecology).

NOAA has compiled criteria in its Screening Quick Reference Tables (Squirts) for organic and inorganic contaminants in various environmental media (NOAA, 1999). The sediment criteria compiled by NOAA include Effects Range-Low (ER-L), Effects Range-Median (ER-M), and Apparent Effect Threshold (AET) values, and Florida Department of Environmental Protection (FDEP) values. The ER-L represents the lower 10th percentile concentration associated with toxic effects observed in the environment. According to the method, concentrations below the ER-L should rarely be associated with adverse effects. The ER-M represents the 50th percentile concentration associated with toxic effects observed in the environment. Concentrations at the ER-M would often be expected to be associated with toxic effects. The ER-L and ER-M values are normalized to organic carbon, and therefore represent mass of chemical (in milligrams) per kilogram organic carbon. Of the NOAA values, ORNL uses only the ER-M values in developing preliminary remediation goals (PRGs). To maintain consistency with this approach, ER-Ls are not directly used in this assessment.

The AET levels are concentrations above which adverse biological impacts are expected. However AETs are not easily compared to other benchmarks and as such they are not used in this screening evaluation unless no other source of values was available. NOAA also publishes FDEP values, but these values are not normalized to organic carbon. This fact, in combination with the realization that the FDEP values are subsumed in the ORNL compendium discussed below, eliminates the relevance of presenting FDEP values in this assessment.

ORNL published sediment criteria in the form of Probable Effect Concentrations (PEC) and No Effect Concentrations (NEC) derived for the USEPA Assessment and Remediation of Contaminated Sediments (ARCS) program report (ORNL, 1997b).

ORNL also published a summary document on PRGs for several media, including sediment (ORNL, 1997a,b). This summary of sediment values included review of USEPA databases, national ambient water quality criteria (NAWQC), NOAA and FDEP values, and their own research. This summary document in essence is a compendium of the available sources on sediment toxicity at the time, and ORNL distilled that information into a lookup table that can be used for screening purposes to identify concentrations that may pose a threat to sediment quality. The ORNL values are considered more relevant than NOAA criteria for screening purposes because the ORNL compendium considered multiple sources of data, including those used to develop NOAA values. In addition, the ORNL values are intended to be used as screening values, which is consistent with the goals of this evaluation. ORNL used a hierarchy of criteria for identifying sediment PRGs based on their relevance to sediment-dwelling species. Specifically, ORNL identified the lowest value of the following sediment toxicity benchmarks for each chemical as the PRG:

- Sediment quality criteria proposed by USEPA
- Sediment criteria based on NAWQC
- Criteria calculated from the lowest chronic value (LCV) for fish, daphnids, or other invertebrates in surface water based on acute exposure
- ER-M values from NOAA (NOAA, 1999)
- Probable Effect Level (PEL) values from FDEP

- PEC values derived for the ARCS program (ORNL, 1997b).

If none of these criteria were available for a given chemical, then the PRG was identified as the lower of:

- Criteria calculated from the secondary chronic value (SCV) for aquatic toxicity
- Severe Effect Levels from the Ontario Ministry of the Environment
- High NEC value derived for the ARCS program (ORNL, 1997b).

The USACE has also compiled sediment criteria including screening levels (SLs), bioaccumulation triggers (BTs), and maximum levels (MLs) considered relevant in the Puget Sound area for managing dredged sediments in its Puget Sound Dredge Disposal Analysis (PSDDA; USACE, 2000). Sediment SLs are chemical levels in dredged sediment below which there is no reason to believe that the disposal of the dredged material would cause adverse effects to sediment dwelling organisms. Sediment MLs are chemical levels in dredged material above which there is reason to believe that dredged material would be unacceptable for unconfined open-water disposal. The USACE recommends biological testing when concentrations exceed the SLs to test the suitability for open-water disposal. This does not necessarily imply that sediments in place with concentrations exceeding MLs would cause toxicity.

Ecology recently updated their sediment management standards (Ecology, 2003). These values were also considered in the screening evaluation.

The sediment criteria used in this assessment are all presented in Table 5. In general, the ORNL PRGs are lower than other screening values. Therefore, the ORNL values were preferentially used in the evaluation, where available.

4.4.2 Ecological Screening Results

As previously mentioned the sediment criteria identified from NOAA, ORNL, USACE, and Ecology were used in a weight-of-evidence approach to identify potential toxicity issues associated with detected chemicals at the site. As discussed above, the ORNL values were preferentially used in the evaluation, where available. Sediment analytical data were directly compared with the screening values discussed above and the results interpreted. Where necessary, sediment concentrations were normalized based on assumptions regarding the organic carbon content of the nearshore sediments. This was relevant for PCBs, VOCs, and SVOCs (primarily PAHs), but not for metals. The screening comparison is presented in Table 5 and is described below.

VOCs. For VOCs, the maximum normalized concentration of acetone exceeded the PRG based on the LCV for daphnids. 2-Butanone has no available sediment screening values. Methylene chloride, the only other detected VOC, was below available screening values. Therefore, only acetone exceeded a screening value. The screening value for acetone is extremely low, and may be more stringent than necessary to protect the health of sediment organisms in general. Also, acetone is a common laboratory contaminant, and the screening level can be exceeded by concentrations that are due to laboratory contamination. Based on these results, further evaluation of acetone may be warranted.

Metals. Maximum concentrations of arsenic, copper, lead and zinc show that these metals were significantly higher than sediment criteria. All of these metals are known components of either bullets or traps and skeet used as targets at the shooting range. Cadmium also had a maximum concentration that exceeded screening levels.

The maximum normalized concentration of tri-n-butyltin was higher than the AET value, which is the only available screening number for this analyte. This indicates that further evaluation of organotins is warranted.

The remaining metals (antimony, chromium, mercury, nickel, and silver) did not exceed relevant screening levels, and no further evaluation of these metals is needed.

PCBs. The only detected PCB (Aroclor 1254) was present at a maximum concentration well below the screening level, indicating that PCBs need not be further evaluated.

PAHs and Other SVOCs. Two (butylbenzylphthalate and phenol) of the four SVOCs not classified as a PAH exceeded relevant screening values (4-methylphenol and pentachlorophenol are the others). Butylbenzylphthalate slightly exceeded the State of Washington Marine Sediment Quality Standard, while phenol exceeded only the ORNL PRG, which was based on equilibrium partitioning using the National Ambient Water Quality Criteria for phenol. Phenol was present at a level below the State of Washington Marine Sediment Quality Standard. These two SVOCs should be included as chemicals of potential ecological concern in future work at this site.

Ten of the 17 detected PAHs had normalized maximum concentrations exceeding ORNL PRGs. Maximum concentrations of anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, and fluorene exceeded the PRGs by more than a factor of 10, indicating that these four chemicals should be further evaluated. The other six PAHs (acenaphthene, acenaphthylene, benzo(a)anthracene, fluoranthene, phenanthrene, and pyrene) had maximum concentrations exceeding PRGs by factors ranging from 3 to 9. These other PAHs contribute to the problem, as indicated by the fact that the sum of light molecular weight PAHs (LPAHs), heavy molecular weight PAHs (HPAHs), and total PAHs all exceed ORNL PRGs.

The other seven detected PAHs (benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzofuran, indeno(1,2,3-cd)pyrene, and naphthalene) are below screening levels and need not be further evaluated.

4.4.3 Conclusions of the Ecological Evaluation

Preliminary data collected from the nearshore sediments at the site indicate that metals and SVOCs are present at levels above conservative screening levels for protection of sediment organisms. Overall, sixteen detected analytes exceeded screening values, including four metals, organotin, acetone, and ten PAHs. Maximum detected concentrations of arsenic, copper, and zinc most substantially exceeded screening values.

5 CONCLUSIONS

The conclusions for the land use review and the risk screening are as follows:

5.1 Land Use Review Conclusions

A review of available land use and environmental information obtained from previous assessments and from individuals knowledgeable of the area indicates that environmental risks exist in the study area from past and present land use practices.

Contamination is indicated near the Allen Marine Shipyard, based on the following sample results and observations, further described in Section 3.1:

- Composite soil sample results collected from the marine railway sandblasting area (near, if not in, the intertidal zone) of the Allen Marine Shipyard property indicate arsenic, chromium, and cadmium at concentrations exceeding ADEC cleanup levels.

- The sample from the maintenance shop contained high levels of DRO, RRO, arsenic, and chromium concentrations.

- An oily layer, appearing to be old bunker oil, in the test pit on the property had high headspace readings.

- In sediment samples seaward of the Allen Marine Shipyard, elevated levels of arsenic, copper, lead, zinc, TBT, PAHs, and polychlorinated biphenyls (PCBs) were found.

Potential for contamination exists near the Sitka Sportsman's Association trap and skeet range because of 40 years of lead shot use in the intertidal area, and use of lead bullets for a portion of that time. Based on previous sampling results, elevated concentrations of lead, cadmium, and chromium (exceeding RBC values) were present in composite clam samples collected near the Sitka Sportsman's Association trap and skeet range. While subsequent clam tissue sampling conducted by ADEC found lower levels, samples have not been collected in the area to determine lead concentration in the sediment.

Additionally, clay pigeons have been used regularly over the intertidal area. Whether ingredients used to manufacture clay pigeons (adhesive, paint, etc.) have contained toxic chemicals over the last 40 years was not researched as part of this assessment.

The parcels in the area have been developed or used since at least 1966. Additional potential contaminant sources include known heating oil tanks in the area, including potential use of heating oil tanks by the trailers seen in the 1982 aerial photo. In addition to the sources described above, other potential sources include release of petroleum products by marine vessels at the ferry terminal, Allen Marine shipyard, or Samson Tug and Barge facility. Land use practices at the tug and barge facility while occupied by the Alaska Pulp Corporation have not been clearly defined. Elevated metals could also result from natural sources, such as upstream mineral deposits, and transport from other areas by wind and tidal currents.

Contradictory information was received regarding use of the area by clam harvesters. The ADEC recommends that clams not be harvested in the area because of PSP. According to Mike Ostasz of the ADEC Shellfish program, additional sampling will be conducted in June, July, and August 2003 in the same areas.

5.2 Risk Screening Conclusions and Recommendations

Concentrations of some chemicals at this site exceed risk-based criteria for both human and ecological receptors. In view of the fact that only three samples for each media evaluated (i.e, sediment and soil) were available, it is recommended that further sampling be conducted to more fully characterize the site and better delineate areas where chemical concentrations may pose a threat to human health and the environment. If the additional data substantiate the potential concerns presented herein, a human health risk assessment and ecological risk assessment may be warranted to identify the extent of remedial measures that may be required to alleviate such concerns.

6 REFERENCES

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Golder Associates Inc. 2002b. Phase I Environmental Site Assessment, 5307 Halibut Point Road, Sitka, Alaska. Prepared for Alaska Department of Transportation & Public Facilities. February.

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LIMITATIONS

The services described in this report were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This report is solely for the use and information of our client unless otherwise noted. Any reliance on this report by a third party is at such party's sole risk.

Opinions and recommendations contained in this report apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

The purpose of an environmental assessment is to reasonably evaluate the potential for or actual impact of past practices on a given site area. In performing an environmental assessment, it is understood that a balance must be struck between a reasonable inquiry into the environmental issues and an exhaustive analysis of each conceivable issue of potential concern. The following paragraphs discuss the assumptions and parameters under which such an opinion is rendered.

No investigation is thorough enough to exclude the presence of hazardous materials at a given site. If hazardous conditions have not been identified during the assessment, such a finding should not therefore be construed as a guarantee of the absence of such materials on the site, but rather as the result of the services performed within the scope, limitations, and cost of the work performed.

Environmental conditions may exist at the site that cannot be identified by visual observation. Where subsurface work was performed, our professional opinions are based in part on interpretation of data from discrete sampling locations that may not represent actual conditions at unsampled locations.

Except where there is express concern of our client, or where specific environmental contaminants have been previously reported by others, naturally occurring toxic substances, potential environmental contaminants inside buildings, or contaminant concentrations that are not of current environmental concern may not be reflected in this document.

FIGURES

TABLES

Table 1
Physical Characterization of Intertidal Sediment Samples [a]
Human Health and Ecological Screening Assessment
Starrigavan Bay Sediments
Sitka, Alaska

Sample	Grain Size			Total Volatile Solids (TVS)	Total Organic Carbon (TOC)	Total Solids (TS)
	Gravel	Sand (0.064 to 2 mm)	Silt and Clay			
	(%)	(%)	(%)	(%)	(%)	(%)
ITZ 1	6.45	93.7	3.5	1.09	0.33	85.5
ITZ 2	31.1	64.1	3	2.87	0.68	76.4
ITZ 3	44.7	57.1	3.7	0.74	5.65	87.0

Abbreviations:
mm = millimeters.

Footnotes:
[a] Data from Golder, 2002.
Samples were collected on April 1st, 2002 and analyzed via method 160.4 for TVS, method PSEP for TOC, method 160.3 for TS.

References:
Golder Associates Inc. (Golder). 2002. Results of Intertidal Sediment Sampling and Analyses, Proposed Sitka Ferry Terminal Expansion, Alaska. June 3.

Table 2
Chemical Data for Soil Samples [a]
Human Health and Ecological Screening Assessment
Starrigavan Bay Sediments
Sitka, Alaska

Analytes	Analysis Method	Sample			Maximum
		Shop	Test Pit	Sandblast Area	Concentration
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Metals					
Arsenic	USEPA 7060A	64.3	41	512	512
Barium	USEPA 6010B	60.2	30.5	529	529
Cadmium	USEPA 6010B	1.7	0.8	7.64	7.64
Chromium	USEPA 6010B	88.7	67.1	102	102
Lead	USEPA 6010B	71.3	29.6	538	538
Mercury	USEPA 7471A	0.03	0.02	0.02	0.03
Selenium	USEPA 7740	0.5	0.5	0.5	0.5
Silver	USEPA 6010B	0.8	0.9	1.4	1.4
Petroleum Hydrocabons					
DRO	AK102	1900	8.6	150	1900
GRO	AK101	--	ND	3.8	3.8
RRO	AK103	13,000	9.3	780	13000
VOCs					
2-Hexanone	USEPA 8260C	0.0024	0.0028	ND	0.0028
Methylene Chloride	USEPA 8260C	0.0015	0.0013	0.0015	0.0015
Naphthalene	USEPA 8260C	0.001	ND	ND	0.001
1,2,3-Trichlorobenzene	USEPA 8260C	0.001	ND	ND	0.001
PCBs					
Aroclor 1254	USEPA 8082	ND	ND	0.071	0.071
SVOCs					
Acenaphthene	USEPA 8270C	ND	ND	0.089	0.089
Acenaphthylene	USEPA 8270C	ND	0.019	0.051	0.051
Anthracene	USEPA 8270C	ND	0.033	0.48	0.48
Benz(a)anthracene	USEPA 8270C	ND	0.032	1.7	1.7
Benzo(a)pyrene	USEPA 8270C	ND	0.037	1.6	1.6
Benzo(b)fluoranthene	USEPA 8270C	ND	0.049	2.2	2.2
Benzo(g,h,i)perylene	USEPA 8270C	ND	0.039	1	1
Benzo(k)fluoroanthene	USEPA 8270C	ND	0.015	0.78	0.78
Chrysene	USEPA 8270C	ND	0.036	2	2
Dibenz(a,h)anthracene	USEPA 8270C	ND	ND	0.3	0.3
Dimethyl Phthalate	USEPA 8270C	0.92	ND	ND	0.92
Di-n-butyl phthalate	USEPA 8270C	ND	0.013	0.48	0.48
Fluoranthene	USEPA 8270C	0.079	0.047	3	3
Fluorene	USEPA 8270C	ND	0.0065	0.13	0.13
Indeno(1,2,3-cd)pyrene	USEPA 8270C	ND	0.036	1.2	1.2
4-Methylphenol	USEPA 8270C	ND	ND	0.075	0.075
Naphthalene[b]	USEPA 8270C	0.001	0.0037	0.035	0.035
Phenanthrene	USEPA 8270C	ND	0.037	1.7	1.7
Pyrene	USEPA 8270C	0.7	0.1	2.8	2.8

Abbreviations:

DRO = Diesel Range Organics.
GRO = Gasoline Range Organics.
RRO = Residual Range Organics.
VOCs = Volatile organic compounds.
PCBs = Polychlorinated biphenyls.
SVOCs = Semi-volatile organic compounds.
USEPA = United States Environmental Protection Agency.
-- = Not analyzed.
ND = Not detected.

Footnotes:

[a] Data from Golder, 2002a. Only detected analytes are shown.
Samples were collected on April 1st, 2002.
[b] Analyzed as both a VOC and SVOC. Highest concentration in each sample shown.

References:

Golder Associates Inc. (Golder). 2002b. Phase II Site Assessment, Allen Marine Property, 5307 Halibut Point Road, Sitka, Alaska. July.

Table 3
Chemical Data for Intertidal Sediment Samples [a]
Human Health and Ecological Screening Assessment
Starrigavan Bay Sediments
Sitka, Alaska

Analyte	PAH Class	Raw Data			Carbon-Normalized Data			Normalized
		ITZ 1	ITZ 2	ITZ 3	ITZ 1	ITZ 2	ITZ 3	Maximum [c]
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Metals								
Antimony	--	58.9	114	--	NA	NA	--	114
Arsenic	--	1060	963	--	NA	NA	--	1,060
Cadmium	--	8.14	3.08	--	NA	NA	--	8.14
Chromium	--	75.8	83.1	--	NA	NA	--	83.10
Copper	--	2940	2100	--	NA	NA	--	2,940
Lead	--	833	1910	--	NA	NA	--	1,910
Mercury	--	0.02	0.07	--	NA	NA	--	0.07
Nickel	--	27	32.9	--	NA	NA	--	32.9
Silver	--	1.69	1.29	--	NA	NA	--	1.69
Zinc	--	7590	4860	--	NA	NA	--	7,590
VOCs								
Acetone	--	0.015	<0.066	<0.058	0.05	NA		0.05
2-Butanone	--	0.0032	<0.027	<0.023	0.01	NA		0.01
Methylene Chloride	--	0.0032	0.0025	0.0008	0.01	0.004	0.0001	0.01
Butyltins								
Tri-n-butyltin	--	11	13	0.0011	33.3	19.1	0.0002	33.3
PCBs								
Aroclor 1254	--	0.19	0.51	<0.012	0.58	0.75	NA	0.75
SVOCs								
Acenaphthene	LPAH	0.1	0.19	<0.023	0.30	0.28	NA	0.30
Acenaphthylene	LPAH	0.044	0.18	<0.023	0.13	0.26	NA	0.26
Anthracene	LPAH	0.2	0.81	<0.023	0.61	1.19	NA	1.19
Benz(a)anthracene	HPAH	0.77	2.9	0.017	2.33	4.26	0.0030	4.26
Benzo(a)pyrene	HPAH	0.72	2.6	0.014	2.18	3.82	0.0025	3.82
Benzo(b)fluoranthene	HPAH	1	4	0.03	3.03	5.88	0.0053	5.88

Table 3
Chemical Data for Intertidal Sediment Samples [a]
Human Health and Ecological Screening Assessment
Starrigavan Bay Sediments
Sitka, Alaska

Analyte	PAH Class	Raw Data			Carbon-Normalized Data			Normalized
		ITZ 1	ITZ 2	ITZ 3	ITZ 1	ITZ 2	ITZ 3	Maximum [c]
		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Benzo(g,h,i)perylene	HPAH	0.43	1.5	0.0084	1.30	2.21	0.0015	2.21
Benzo(k)fluoranthene	HPAH	0.34	1.1	0.011	1.03	1.62	0.0019	1.62
Butyl benzyl phthalate	--	<0.24	0.082	<0.023	NA	0.12	NA	0.12
Chrysene	HPAH	0.93	3.6	0.027	2.82	5.29	0.0048	5.29
Dibenz(a,h)anthracene	HPAH	0.14	0.48	<0.023	0.42	0.71	NA	0.71
Dibenzofuran	--	0.098	0.11	<0.023	0.30	0.16	NA	0.30
Fluorene	LPAH	0.12	0.21	<0.023	0.36	0.31	NA	0.36
Fluoranthene	HPAH	1.6	5.6	0.052	4.85	8.24	0.0092	8.24
Indeno(1,2,3-cd)pyrene	HPAH	0.48	1.7	0.0088	1.45	2.50	0.0016	2.50
4-Methylphenol	--	<0.24	0.1	<0.023	NA	0.15	NA	0.15
Naphthalene	LPAH	0.12	0.057	<0.023	0.36	0.08	NA	0.36
Pentachlorophenol	--	<1.2	0.19	<0.120	NA	0.28	NA	0.28
Phenanthrene	LPAH	1.1	2.4	0.0066	3.33	3.53	0.0012	3.53
Phenol	--	<0.7	0.073	<0.069	NA	0.11	NA	0.11
Pyrene	HPAH	1.3	4.5	0.039	3.94	6.62	0.0069	6.62
Total LPAHs [c]		1.684	3.847	0.0066	5.10	5.66	0.0012	5.66
Total HPAHs [c]		7.71	27.98	0.2072	23.36	41.15	0.0367	41.15
Total PAHs [c]		9.394	31.827	0.2138	28.47	46.80	0.0378	46.80

Abbreviations:
-- = Not analyzed.
<# = Not detected above the method reporting limit.
HPAH = High molecular weight petroleum aromatic hydrocarbon.
LPAH = Low molecular weight petroleum aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
SVOCs = Semi-volatile organic compounds.
VOCs = Volatile organic compounds.
TOC = Total organic carbon.

Footnotes:
[a] Data from Golder, 2002a. Only detected analytes are shown.
Samples were collected on April 1st, 2002 and analyzed for metals, mercury, butyltins, VOCs, organochlorine pesticides, and SVOCs via methods 200.8, 7471A, Krone, 8260B, 8082, and 8270C, respectively.
[b] Equals raw data multiplied by the ratio of the measured organic carbon content (from Table 1) to 1% organic carbon used to develop the screening l
Normalization is not applied to metals.
[c] Sums were estimated using the PAH classification shown next to the chemical name.

References:
Golder Associates Inc. (Golder). 2002a. Results of Intertidal Sediment Sampling and Analyses, Proposed Sitka Ferry Terminal Expansion, Alaska. June 3.

Table 4
Human Health Screening Evaluation
Human Health and Ecological Screening Assessment
Starrigavan Bay Sediments
Sitka, Alaska

Target Analyte	Maximum Concentration [a]	ADEC Soil Cleanup Level (CL) [b]		Does maximum conc. exceed risk-based CL?	Does maximum conc. exceed migration to groundwater CL?	Does maximum conc. exceed lowest CL?[d]
		Risk-based CL (soil exposure) [c]	Migration to Groundwater CL			
	(mg/kg)	(mg/kg)	(mg/kg)	(Yes/No)	(Yes/No)	(yes/No)
Metals						
Arsenic	512	4.5	1.8	Yes	Yes	**Yes**
Barium	529	5800	982	No	No	No
Cadmium	7.64	83	4.5	No	Yes	**Yes**
Chromium[e]	102	250	23	No	Yes	**Yes**
Lead	538	400	--	Yes	--	**Yes**
Mercury	0.03	13	1.24	No	No	No
Selenium	0.5	420	3	No	No	No
Silver	1.4	420	19	No	No	No
Petroleum Hydrocabons						
DRO	1900	8250	230	No	Yes	**Yes**
GRO	3.8	1400	260	No	No	No
RRO	13000	8300	9700	Yes	Yes	**Yes**
VOCs						
2-Hexanone[a]	0.0028	--	--	--	--	**Yes**
Methylene Chloride	0.0015	135	0.01	No	No	No
Naphthalene	0.001	92	19	No	No	No
1,2,3-Trichlorobenzene[a]	0.001	--	--	--	--	**Yes**
PCBs						
Aroclor 1254[f]	0.071	1	--	No	No	No
SVOCs						
Acenaphthene	0.089	5000	190	No	No	No
Acenaphthylene[g]	0.051	5000	190	No	No	No
Anthracene	0.48	24,900	3900	No	No	No
Benz(a)anthracene	1.7	9	5.5	No	No	No
Benzo(a)pyrene	1.6	0.9	2.4	Yes	No	**Yes**
Benzo(b)fluoranthene	2.2	9	17	No	No	No
Benzo(g,h,i)perylene[h]	1	2500	1400	No	No	No
Benzo(k)fluoroanthene	0.78	93	170	No	No	No
Chrysene	2	930	550	No	No	No
Dibenz(a,h)anthracene	0.3	0.9	5	No	No	No
Dimethyl phthalate	0.92	830,000	1200	No	No	No
Di-n-butyl phthalate	0.48	8300	1500	No	No	No
Fluoranthene	3	3300	1900	No	No	No
Fluorene	0.13	3300	240	No	No	No
Indeno(1,2,3-cd)pyrene	1.2	9	50	No	No	No
4-Methylphenol[a]	0.075	--	--	--	--	**Yes**
Naphthalene	0.035	92	19	No	No	No
Phenanthrene[i]	1.7	24900	3900	No	No	No
Pyrene	2.8	2500	1400	No	No	No

Abbreviations:
mg/kg = Milligrams per kilogram.
DRO = Diesel Range Organics.
GRO = Gasoline Range Organics.
RRO = Residual Range Organics.
VOCs = Volatile organic compounds.
PCBs = Polychlorinated biphenyls.
SVOCs = Semi-volatile organic compounds.
-- = Not available.
COPCs = Chemicals of potential concern.

Footnotes:
[a] From Table 2. Chemicals without CLs (or relevant surrogates) are identified as COPCs.
[b] Values corresponding to the "over 40 inch zone" from the Alaska Department of Environmental Conservation (ADEC) 18 AAC 75.
[c] Risk-based value for direct contact with soil is lower of the ingestion and inhalation values.
[d] Chemicals with concentrations greater than the lowest CL are identified as COPCs.
[e] As total chromium. Risk-based CL for total Cr conservatively equals that for hexavalent Cr.
[f] Total PCBs value is used in the absence of a specific Aroclor value.
[g] CL for acenaphthene, a structurally similar chemical, used in the absence of a chemical-specific CL (ADEC, 2001b).
[h] CL for pyrene, a structurally similar chemical, used in the absence of a chemical-specific CL (ADEC, 2001b).
[i] CL for anthracene used in the absence of a chemical-specific CL (ADEC, 2001b).

References:

Alaska Department of Environmental Protection (ADEC). 2001b. Calculated Cleanup Levels for Compounds without Tabular Values in Site Cleanup Rules. Technical Memorandum - 01-007. December 18.
Alaska Department of Environmental Protection (ADEC). 2003. Oil and Other Hazardous Substances Pollution Control. 18 AAC 75. As amended through January 30.

Table 5
Ecological Screening Evaluation
Human Health and Ecological Risk Assessment
Starrigavan Bay Sediments

Target Analyte	Site Data[a]	Ecological Screening Levels									Ecological Screening Evaluation
	TOC-Normalized Maximum Concentration	NOAA [c]			ORNL [d]		Ecology Marine Sediment Quality Standard[e]	USACE [f]			Does site conc. exceed relevant screening level(s)?
		Effects Range-Low	Effects Range-Median	Apparent Effects Threshold	Preliminary Remediation Goal (PRG)			Screening Level	Bioaccumulation Trigger	Maximum Level	
		ERL	ERM	AET	Value	Source		SLs	BT	MLs	
	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	--	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(Yes/No)
Metals											
Antimony	114	--	--	9.3	--	--	--	150	150	200	No
Arsenic	1,060	8.2	70	35	42	PEL	57	57	507	700	**Yes**
Cadmium	8.14	1.2	9.6	3	4.2	PEL	5.1	5.1	--	14	**Yes**
Chromium	83.1	81	370	62	159	PEC	260	--	--	--	No
Copper	2,940	34	270	390	77.7	PEC	390	390	--	1,300	**Yes**
Lead	1,910	46.7	218	400	110	PEL	450	450	--	1,200	**Yes**
Mercury	0.07	0.15	0.71	0.41	0.7	PEL	0.41	0.41	1.50	2.3	No
Nickel	32.9	20.9	51.6	110	38.5	PEC	--	140	370	370	No
Silver	1.7	1	3.7	3.1	1.8	PEL	6.10	6.1	6.1	8.4	No
Zinc	7,590	150	410	410	270	PEL	410	410	--	3,800	**Yes**
VOCs											
Acetone	0.045	--	--	--	0.0091	LCV daphnids	--	--	--	--	**Yes**
Methylene Chloride	0.010	--	--	--	18	LCV fish	--	--	--	--	No
2-Butanone (MEK)	0.010	--	--	--	--	--	--	--	--	--	**Yes**
Butyltins											
Tri-n-butyltin	33	--	--	3.4	--	--	--	--	--	--	**Yes**
PCBs											
Aroclor 1254	0.75	--	--	--	72	LCV fish	--	--	--	--	No
SVOCs											
4-Methylphenol	0.30	--	--	0.1	--	--	0.67	0.67	--	3.6	No
Acenaphthene	0.26	0.016	0.5	0.13	0.089	PEL	16	0.5	--	2	**Yes**
Acenapthylene	1.19	0.044	0.64	0.071	0.13	PEL	66	0.56	--	1.3	**Yes**
Anthracene	4.26	0.085	1.1	0.28	0.25	PEL	220	0.96	--	13	**Yes**
Benzo(a)anthracene	3.82	0.261	1.6	0.96	0.69	PEL	110	1.3	--	5.1	**Yes**
Benzo(a)pyrene	5.88	0.43	1.6	1.1	0.394	PEC	99	1.6	3.60	3.6	**Yes**
Benzo(b)fluoranthene	2.21	--	--	1.8	4	NEC	230	3.2	--	9.9	No
Benzo(g,h,i)perylene	1.62	--	--	0.67	6.3	PEC	31	0.67	--	3.2	No
Benzo(k)fluoranthene	0.12	--	--	1.8	4	NEC	230	3.2	--	9.9	No
Butyl benzyl phthalate	5.29	--	--	0.063	--	--	4.9	0.97	--	--	**Yes**
Chrysene	0.71	0.384	2.8	0.95	0.85	PEL	110	1.4	--	21	No
Dibenzo(a,h)anthracene	0.30	0.0634	0.26	0.23	0.0282	PEC	12	0.23	--	1.9	**Yes**

Table 5
Ecological Screening Evaluation
Human Health and Ecological Risk Assessment
Starrigavan Bay Sediments

Target Analyte	Site Data[a]	Ecological Screening Levels									Ecological Screening Evaluation
	TOC-Normalized Maximum Concentration	NOAA [c]			ORNL [d]		Ecology Marine Sediment Quality Standard[e]	USACE [f]			Does site conc. exceed relevant screening level(s)?
		Effects Range-Low	Effects Range-Median	Apparent Effects Threshold	Preliminary Remediation Goal (PRG)			Screening Level	Bioaccumulation Trigger	Maximum Level	
		ERL	ERM	AET	Value	Source		SLs	BT	MLs	
	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	--	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(mg/kg_{dw})	(Yes/No)
Dibenzofuran	0.36	--	--	0.11	0.42	SCV	15	0.54	--	1.7	No
Fluoranthene	8.24	0.6	5.1	1.3	0.834	PEC	160	1.7	4.60	30	**Yes**
Fluorene	2.50	0.019	0.54	0.12	0.14	PEL	23	0.54	--	3.6	**Yes**
Indeno(1,2,3-cd)pyrene	0.15	--	--	0.6	0.837	PEC	34	0.6	--	4.4	No
Naphthalene	0.36	0.16	2.1	0.23	0.39	PEL	99	2.1	--	2.4	No
Pentachlorophenol	0.28	--	--	0.017	--	--	0.36	0.4	0.504	0.69	No
Phenanthrene	3.53	0.24	1.5	0.66	0.54	PEL	100	1.5	--	21	**Yes**
Phenol	0.11	--	--	0.13	0.032	chronic NAWQC	0.42	0.42	0.88	1.2	**Yes**
Pyrene	6.62	0.665	2.6	2.4	1.4	PEL	1,000	2.6	--	16	**Yes**
Total LPAHs	5.66	4.02	44.8	--	3.37	PEC	--	--	--	--	**Yes**
Total HPAHs	41.15	0.552	3.16	1.2	4.35	PEC	370	5.2	--	29	**Yes**
Total PAHs	46.80	1.7	9.6	7.9	13.7	PEC	960	12	--	69	**Yes**

Abbreviations:

HPAH = High molecular weight polynuclear aromatic hydrocarbons.
LPAH = Low molecular weight polynuclear aromatic hydrocarbons.
NA = Not available.
PAH = Polynuclear aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
SVOCs = Semi-volatile organic compounds.
VOCs = Volatile organic compounds.
PEC = Probable effect concentration.
NEC = No effects concentration.
NAWQC = National ambient water quality criteria.

All values for organic chemicals were normalized to organic carbon; lowest relevant screening levels are boxed.
Chemicals with maximum site concentration exceeding relevant benchmarks are shown in bold type.

Footnotes:

[a] From Table 3.
[b] Florida Department of Environmental Protection values from MacDonald (1997).
[c] From NOAA (1999).
[d] From ORNL (1997a).
[e] From Ecology (2003).
[d] Sediment Quality Chemical Criteria "no-effects" level. For PAHs and PCBs, values are adjusted based on 0.1% organic carbon in sediment. If organic carbon content is higher than 0.1%, the criteria would be higher.
[e] From USACE (2000).

References:

MacDonald Environmental Sciences Ltd. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Volume 1 - Development and Assessment of Sediment Quality Assessment Guidelines. Prepared for Flordia Department of Environmental Protection, Office of Water Policy.
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APPENDIX A

QUALITY ASSURANCE REVIEW OF GOLDER (2002D,E) ANALYTICAL DATA

LABORATORY DATA VALIDATION REVIEW
ADEC STARRIVAGAN BAY
PROJECT NUMBER: 005.0065.03001

This report summarizes a review of analytical results of service request number K2202038 for sediment and tissue samples collected on 4/1/02 for the Sitka Dredge/023-5524 project. Samples were collected by Golder Associates, Inc., and submitted to Columbia Analytical Services, Inc. (CAS) in Kelso, WA.

Sediment samples were analyzed for the following parameters: Particle Size Determination by the Puget Sound Estuary Program (PSEP) Protocol, Total Volatile Solids by U.S. Environmental Protection Agency (USEPA) Method 160.4, Total Organic Carbon by the PSEP Protocol, Trace Elements (Sb, As, Cd, Cr, Cu, Pb, Ni, Ag and Zn) in Water & Wastes by Inductively Coupled Plasma-Mass Spectrometry (ICP/MS) by USEPA Method 200.8, Mercury in Solid or Semisolid Waste by USEPA Method 7471A, Organochlorine Pesticides Cap Column GC by USEPA Method 8081A, Polychlorinated Biphenyls GC by USEPA Method 8082, Semivolatile Organic Compounds analyzed by Gas Chromatography/Mass Spectrometry (GC/MS) USEPA Method 8270C, Volatile Organic Compounds (VOCs) analyzed by GC/MS USEPA Method 8260B, and Tri-n-butyltin by the Krone method.

Tissue samples were analyzed for the following parameters: Trace Elements (Sb, As, Cd, Cu, Pb, Ni, Ag and Zn) in Water & Wastes ICP/MS by USEPA Method 200.8, Mercury in Solid or Semisolid Waste by USEPA Method 7471A, Total Chromium by USEPA Method SW846 6010B.

Table 1 below summarizes sample identification, laboratory-assigned sample numbers, dates collected, and qualifiers.

QUALITY ASSURANCE PROGRAM

Data validation consisted of the following:

- Reviewing the chain-of-custody (COC) records and overall laboratory data package for completeness, signatures, dates and anomalies.
- Verifying laboratory analysis of samples within proper holding times.
- Verifying that surrogate analyses (where applicable) are within recovery acceptance limits.

- Verifying that Laboratory Control Samples (LCS) and Laboratory Control Samples Duplicates (LCSD) are within recovery acceptance limits, and that the relative percent differences (RPDs) between the LCS and LCSD are acceptable.

- Reviewing the Matrix Spike (MS) and Matrix Spike Duplicate (MSD) recoveries and RPDs data as part of the overall evaluation of laboratory data quality.

- Evaluating the RPDs between original and duplicate samples.

- Providing an overall assessment of laboratory data quality and qualifying sample results if necessary.

DATA QUALIFICATIONS

The comments presented in this report refer to the field procedures and the laboratory's performance in meeting the QC specifications. The sample results were reviewed using the following documents:

- USEPA Document 530/SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, fourth edition (USEPA, November 1991)

- USEPA Document 540/R-94/013, USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, February 1994)

Data qualifiers were assigned to the results in this report.

DATA VALIDATION

Data Package

The data packages were checked for transcription errors, omissions, or other anomalies. No anomalies were found.

The data reviewed from the analytical report included only the COCs, case narratives and sample results, and did not include the full contents of the Level III report. Therefore, only the information provided in the case narrative and seen in the sample results could be examined.

Holding Times and Preservation

Samples were received at CAS in good condition.

Analysis of tri-n-butyltin was originally conducted within sample holding time criteria, but due to quality assurance/quality control (QA/QC) failures in the analysis the samples, the samples were reanalyzed. The second analysis passed QA/QC criteria. Sample results were flagged with the qualifier "J", indicating that the associated values are estimated quantities.

Laboratory Method Blanks

Method blanks for Total Organic Carbon and Total Volatile Solids analyses did not detect analytes at or above the method detection limit (MDL). No other data on method blank analyses were provided.

Trip Blanks

No known trip blanks were collected with this sample set.

Method Reporting Limits

The Organochlorine Pesticide method reporting limits (MRLs) were raised for 4,4'-DDE and 4,4'-DDT in samples ITZ 1 and ITZ 2 due to matrix interference. These sample results were flagged with the qualifier "UJ", indicating that while the analytes were not detected, the MRL is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analytes in these samples.

Surrogate Recovery Results

Recovery of the VOCs surrogate toluene d-8 exceeded acceptance limits in samples ITZ 1, ITZ 2 and ITZ 3. However, none of the target compounds were detected above the MRL. No qualifiers were assigned to this data.

Laboratory Control Sample

Recovery of benzoic acid in the LCSD was below acceptance limits, and the analyte was not detected in the corresponding field samples. Recovery of benzoic acid in the LCS was acceptable, and the RPD between the LCS and LCSD was acceptable. Results for benzoic acid in samples ITZ 1, ITZ 2 and ITZ 3 were flagged with the qualifier "R", indicating that the presence or absence of the analyte cannot be verified, and the sample results are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria.

Matrix Spike/Matrix Spike Duplicate

MS recoveries were below acceptance limits for antimony and cadmium in sample ITZ 1, and antimony in samples ITZ 2 and ITZ 3. However, the LCS analyses for these analytes were in control. No qualifiers were assigned to this data.

MSD recoveries were below acceptance limits for phenol and MS/MSD recoveries were low pentachlorophenol in sample ITZ 1. However, LCS recoveries were acceptable. No qualifiers were assigned to this data.

Duplicates

No field duplicates were collected.

Duplicate analyses conducted for cadmium and antimony in sample ITZ 1 exceeded RPD control limits. Sample results for cadmium and antimony in ITZ 1 were flagged with the qualifier "J", indicating that the associated values are estimated quantities.

No duplicate analyses were conducted for the Total Solids analyses.

OVERALL ASSESSMENT

The data are judged acceptable for use, with the caveats stated above.

PRECISION, ACCURACY, AND COMPLETENESS

Precision: Duplicate sample analyses were not conducted for Total Solids. Duplicate analysis RPDs exceeded control limits in analysis of antimony and cadmium in sample ITZ-1. Other indicators of precision appear to be adequate.

Accuracy: Indicators of accuracy appear to be adequate, with the exception of the surrogate recovery and LCSD anomalies discussed above.

Completeness: Notable anomalies are the lack of field duplicate and trip blank samples. The data package otherwise appears to be complete.

Table 1

Sample Summary

Sample ID	Laboratory ID	Matrix	Date/Time Sampled	Analyte	Qualifier
ITZ 1	K22020238-001	Sediment	4/1/02 11:03	Antimony, Cadmium	J
				4,4'-DDE and 4,4'-DDT	UJ
				Benzoic acid	R
				Tri-n-butyltin	J
ITZ 2	K22020238-002	Sediment	4/1/02 11:35	4,4'-DDE and 4,4'-DDT	UJ
				Benzoic acid	R
				Tri-n-butyltin	J
ITZ 3	K22020238-003	Sediment	4/1/02 11:35	Benzoic acid	R
				Tri-n-butyltin	J
Clam 1	K22020238-004	Tissue	4/1/02 9:50		NQ
Clam 2	K22020238-005	Tissue	4/1/02 10:40		NQ
Clam 3	K22020238-006	Tissue	4/1/02 10:56		NQ

NQ – no qualifier assigned