Sediment Characterization Study
Budd Inlet, Olympia, WA

Sampling and Analysis Plan

PRELIMINARY FINAL

Prepared for

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List of Acronyms

AAS	Axys Analytical Services
CAS	Columbia Analytical Services
CFR	Code of Federal Regulations
COC	chain-of-custody
CRM	certified reference material
CSL	cleanup screening level
DGPS	differential global positioning system
DMMP	Dredged Material Management Program
DO	dissolved oxygen
ECD	electron capture detector
Ecology	Washington State Department of Ecology
FOA	frequency of analysis
GC/MS	gas chromatography/mass spectrophotometry
GPC	gel permeation chromatography
GPM	Government Project Manager
HPAH	high molecular polynuclear aromatic hydrocarbon
HR	high resolution
LAET	lowest apparent effects threshold
LCS	laboratory control sample
LOTT	Lacey, Olympia, Tumwater, and Thurston County
LPAH	low molecular polynuclear aromatic hydrocarbon
MDL	method detection limit
MLLW	mean lower low water
MTCA	Model Toxics Control Act
NAD83	North American Datum of 1983
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
pg	picogram
PNNL	Pacific Northwest National Laboratory
PPE	personal protective equipment
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
RI	remedial investigation
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SEDQUAL	sediment quality
SMARM	Sediment Management Annual Review Meetings
SMS	Sediment Management Standards
SQS	Sediment Quality Standard
SVOC	semi-volatile organic compound
TEF	toxic equivalent factor

TEQ	toxic equivalent quotient
TOC	total organic carbon
TS	total solids
TVS	total volatile solids
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code
WHO	World Health Organization

1.0 Introduction

A recent sediment characterization study of the Olympia Harbor Navigation Channel and Port of Olympia berthing area, Budd Inlet, WA, has found elevated concentrations of dioxins/furans in sediments from proposed dredging areas and has raised concerns regarding the potential for increased risk to human health and the environment (DMMP 2006). The Washington State Department of Ecology (Ecology) is proposing additional studies to better understand the distribution of dioxins/furans in sediments throughout Budd Inlet, Olympia, WA. The objectives of the Budd Inlet Sediment Investigation study are to:

1) Determine the overall nature and extent of dioxin/furan sediment contamination in Budd Inlet,

2) Evaluate the potential sources of dioxins/furans in sediments, including potential source identification,

3) Delineate the nature and extent of dioxins/furans (vertically and spatially) in sediments from proposed dredging areas in the navigation channel and berthing area, and

4) Identify potential priority areas for remediation based on potential for disturbance due to navigation access to the Port of Olympia facilities, and areas that may pose a risk based on dioxin/furan sediment contamination.

This Sampling and Analysis Plan (SAP) describes the approach proposed by Ecology to address the objectives of the Budd Inlet Sediment Investigation study. The study design was guided by the review of existing information and identification of data gaps in Budd Inlet (SAIC 2007). The study will include the collection of surface sediment grabs, subsurface sediment cores, intertidal benthic tissue samples, and bottom trawling to collect fish tissue samples. In addition to dioxin/furan analyses, a subset of samples will be analyzed for the Sediment Management Standards (SMS) chemicals of concern to evaluate sediment quality and potential source areas in Budd Inlet.

1.1 Site History

Budd Inlet is a small embayment located in southern Puget Sound, near the city of Olympia, WA (Figure 1). Inner Budd Inlet has historically supported wood product industries, recreational marinas, and boat industries, and is home to the Port of Olympia. Low near-bottom dissolved oxygen (DO) concentrations have been a persistent problem in the inner bay, and have been attributed to decay or large phytoplankton blooms in combination with stratification of the water column during summer and early fall (Ecology 1997). Wastewater treatment plant effluent discharged into inner Budd Inlet through the Lacey, Olympia, Tumwater, and Thurston County (LOTT) outfall and diffuser has been a major source of nutrients.

The Olympia Harbor federal navigation channel and turning basin are maintained in inner West Bay. Recent sediment characterization studies in support of proposed maintenance dredging of the navigation channel and turning basin have identified elevated levels of dioxins/furans in

sediments from proposed dredging areas (DMMP 2006). From 1957 until 1986, the Cascade Pole Company operated a wood-treating facility on property leased from the Port of Olympia. Other wood-treating businesses also operated at the site prior to 1957. During numerous investigations of the site, many toxic chemicals related to wood preserving substances (polycyclic aromatic hydrocarbons [PAHs], pentachlorophenol [PCPs], and dioxins) were found at elevated concentrations in soils, groundwater, surface water, intertidal sediments, and marine organisms adjacent to the site (Ecology 2006).

For a more complete site history for Budd Inlet, please refer to the *Summary of Existing Information and Identification of Data Gaps for Sediments* report (SAIC 2007). For the purposes of the literature review, Budd Inlet was divided into three areas: East Bay, West Bay, and North Inlet (Figure 1). In addition, the Cascade Pole site and the Olympia Harbor navigation channel and turning basin were identified as areas of interest based on intensive environmental investigations conducted in these areas (Landau 1993, DMMP 2006).

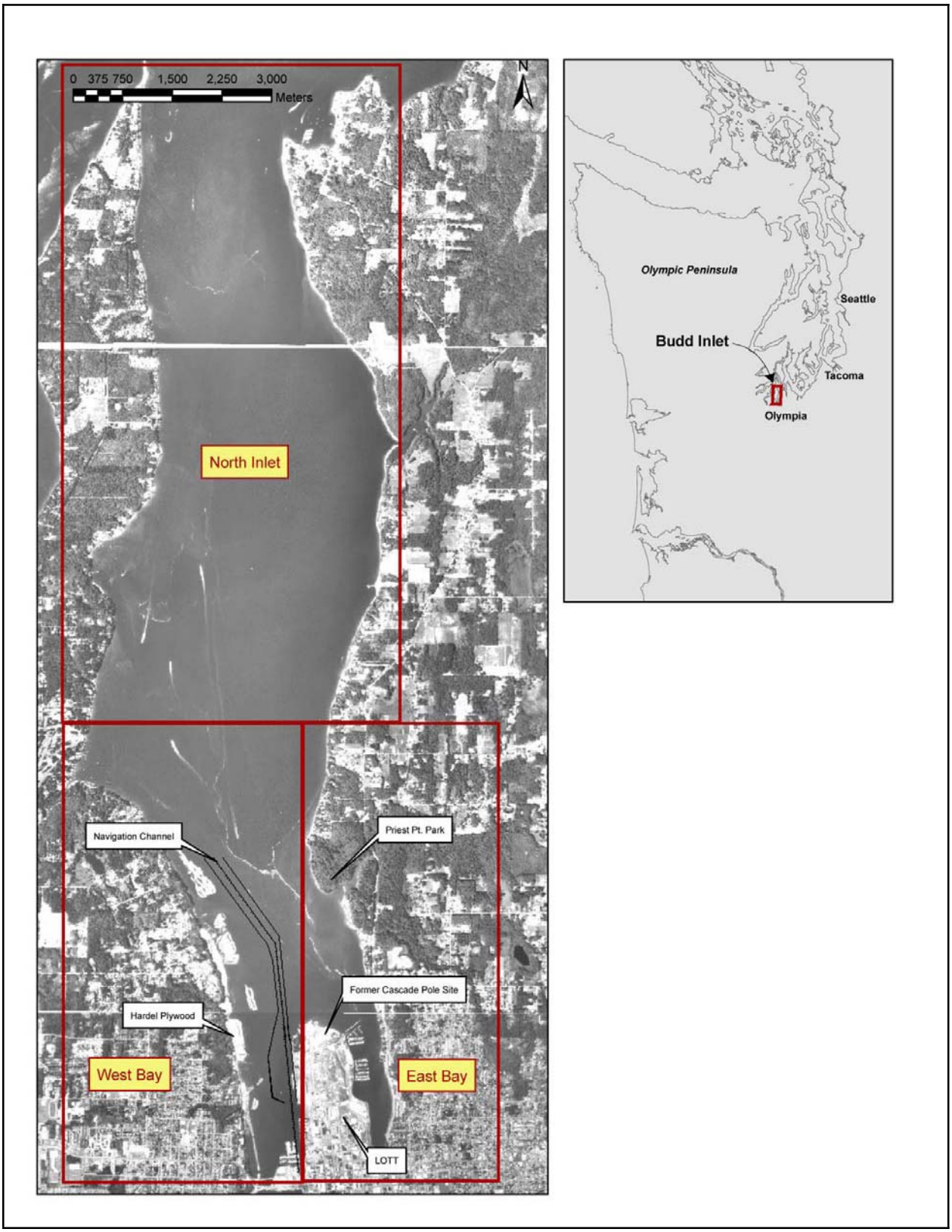

Figure 1. Budd Inlet Site Overview

2.0 Objectives and Design of the Investigation

The Budd Inlet Sediment Investigation program objectives and constraints are summarized below:

- Conduct a more intensive sampling and analysis effort in Budd Inlet to characterize the overall extent of dioxin/furan sediment contamination.

- Collect, process, and analyze representative sediment core, sediment grab, and tissue samples to characterize Budd Inlet in accordance with protocols, timing, and quality assurance/quality control (QA/QC) requirements outlined by Washington State SMS protocols, Puget Sound Estuary Program (PSEP) protocols, and subsequent Sediment Management Annual Review Meetings (SMARM) updates.

- Analyze for dioxins/furans in Budd Inlet sediments so that Ecology can evaluate the dioxin/furan concentrations relative to human health and ecological health concerns. Analysis of dioxins/furans will follow U.S. Environmental Protection Agency (USEPA) Method 1613B for 2,3,7,8-substituted chlorinated dioxins and furans. Tissue collection and analysis are also proposed to assess the uptake of dioxins/furans in ecological receptors, and will follow USEPA Method 1613B.

- Analyze for metals, semi-volatile organic compounds (SVOC), polychlorinated biphenyls (PCB), sediment conventional parameters, and sedimentation rate and biological surface mixed layer in Budd Inlet. Metals will be analyzed according to USEPA Methods 6010B and 6020. SVOCs will be analyzed according to USEPA Methods 8270C and 1625C. PCB Aroclors® will be analyzed according to USEPA Method 8082. Sediment conventional parameters will be analyzed according to PSEP protocols. Sedimentation rate and mixed layer analyses will be conducted according to Pacific Northwest National Laboratory (PNNL) protocols.

- Better delineate the extent of dioxin/furan contamination (vertically and spatially) in sediments from proposed dredging areas in the navigation channel and turning basin, and identify potential priority areas for remediation based on potential for disturbance due to navigation access to the Port of Olympia.

- Examine uptake of dioxin/furan congeners in ecological receptors.

- Measure the sedimentation rate and surface mixed layer in inner Budd Inlet through radioisotope analysis.

2.1 Regulatory Framework

The Budd Inlet Sediment Investigation will be conducted in accordance with the Model Toxics Control Act (MTCA) cleanup regulations (Washington Administrative Code [WAC] 173-340-350) and will follow regulatory classifications specified by the Washington State SMS for

chemicals of concern, and the regional Dredged Material Management Program (DMMP) for dioxins/furans.

The concentration of dioxin/furan compounds will be normalized to the toxicity of 2,3,7,8-TCDD using toxic equivalent factors (TEFs) updated by the World Health Organization (WHO) in 2005 (Van den Berg et al. 2006). The toxic equivalent quotient (TEQ) is equivalent to the sum of the concentrations of individual congeners multiplied by their TEF (potency relative to 2,3,7,8-TCDD). Non-detected values will be assessed as half of the method detection limit for data evaluation purposes.

2.2 Proposed Samples and Analyses

2.2.1 Budd Inlet

The proposed sampling strategy for dioxin/furan testing in the Budd Inlet project area is guided by the literature review and data gaps identification for Budd Inlet (SAIC 2007) and is intended to supplement and expand upon existing environmental studies. Sediment samples will be collected from the surface (0–10 cm) and subsurface (core samples) to delineate the vertical and spatial distribution of dioxins/furans. Sediment samples will also be analyzed for the SMS chemicals of concern in areas of potential sources or where historical contamination has been reported. Trawling is proposed for the collection of Starry flounder (*Platichthys stellatus*), which is expected to be the most abundant flat fish in Budd Inlet. Littleneck and/or Manila clams, and ghost shrimp (*Neotrypaea californiensis*) will also be targeted for collection at intertidal areas. A summary of proposed sample collection is provided in Table 1.

A total of 18 core sample locations and 38 surface sediment sample locations have been identified in the Budd Inlet project area. Geographic coordinates for all proposed sampling locations are provided in Table 2 and presented in Figures 2 and 3. Twelve of the 18 core samples and 24 of the 38 surface sediment samples will be analyzed. In addition, four intertidal beach samples will be collected at low tide and analyzed. The remaining samples will be archived for potential future analysis.[1]

The sediment core samples will be processed at 1-foot intervals as described in Section 3.4.1. Ten-foot cores are proposed, for a maximum of 10 samples collected per core. Three samples will be analyzed at each of the 12 core sample locations. Two subsurface samples per core will be selected for analysis of dioxins/furans in consultation with Ecology. The surface interval (0–1 foot) will be archived for all core samples, with the exception of core samples C3, C4, and C5 (under pier core locations). Surface grab samples (0–10 cm) will be collected at all remaining core sampling locations to maintain a consistent depth interval for all surface sediment chemistry results.

[1] The samples selected for archiving may be modified in the field in consultation with an Ecology representative.

Table 1. Summary of Samples to be Collected and Analyzed

Parameter	Samples Collected	Samples Analyzed
Budd Inlet		
Core Samples for Analytical Chemistry (18 Cores – 10 Samples per Core)		
Dioxins/Furans	180	36
Metals	180	3
SVOCs	180	3
PCB Aroclors®	180	3
Conventionals (Total Solids, Total Volatile Solids, Total Organic Carbon, and Grain Size)	180	36
Surface Grab Samples (0–10 cm, 38 Stations)		
Dioxins/Furans	38	24
Metals	38	8
SVOCs	38	8
PCB Aroclors®	38	8
Conventionals (Total Solids, Total Volatile Solids, Total Organic Carbon, and Grain Size)	38	24
Intertidal Beach Samples (0–10 cm, 4 Stations) [2]		
Dioxins/Furans	4	4
Metals	4	1
SVOCs	4	1
PCB Aroclors®	4	1
Conventionals (Total Solids, Total Volatile Solids, Total Organic Carbon, and Grain Size)	4	4
Sedimentation Core Samples (3 Cores)		
Sedimentation Rate/Mixed Layer Analysis	3	3
Tissue Samples		
Starry Flounder (Dioxins/Furans, % Lipids, % Moisture)	3	3
Ghost Shrimp (Dioxins/Furans, % Lipids, % Moisture)	3	3
Littleneck and Manila Clams (Dioxins/Furans, % Lipids, % Moisture)	9	9
Capitol Lake		
Surface Grab Samples (0–10 cm, 6 Stations)		
Dioxins/Furans	6	2
Metals	6	1
SVOCs	6	1
PCB Aroclors®	6	1
Conventionals (Total Solids, Total Volatile Solids, Total Organic Carbon, and Grain Size)	6	2

[2] Surface (0–10 cm) intertidal sediment samples will be collected at station BI-S34 and at the three tissue stations where clams and ghost shrimp are proposed for collection.

A total of 12 surface samples (see Table 1) will be analyzed for the SMS chemicals of concern (metals, SVOCs, and PCBs; see Figures 2 and 3). A total of 60 samples will be analyzed for sediment conventional parameters (total solids [TS], total volatile solids [TVS], total organic carbon [TOC], and grain size).

Core samples to determine sedimentation rate and surface mixed layer will be collected at three locations. A total of 31 samples from each of three cores will be analyzed to determine sedimentation rate and the surface mixed layer. The analysis for each core will include 5 samples for Berillium-7 (Be-7) analysis, 16 samples for lead-210 (Pb-210) analysis, and 10 samples for Cesium-137 (Cs-137) analysis.

Starry flounder will be collected for tissue analysis using a bottom trawl. Single composite samples of each organism (five individual organisms per composite sample) will be collected from each of three locations and analyzed for dioxins/furans. Littleneck and Manila clams will also be collected, by hand, for tissue analysis. Triplicate clam samples will be collected at each of three locations. A minimum of five clams will be collected per replicate sample and a minimum tissue volume of 30 grams (shucked, wet weight) will be collected for dioxin/furan analysis. Based on a meat to whole clam ratio of 50 percent, a minimum of 60 grams (whole clams) will be collected for each composite sample. If ghost shrimp are found in abundance, a minimum of one replicate shrimp sample will be collected at each of three locations.

2.2.2 Capitol Lake

Surface sediment samples are proposed in Capitol Lake to determine the chemical character of sediments that would be transported into Budd Inlet, if the estuary restoration plan for Budd Inlet (i.e., dam removal) is implemented (Figure 4). A total of six surface grab samples (three in the North Basin, three in the Middle Basin) are proposed in areas of expected erosion as identified in Scenario A (dam removal only) of the Deschutes River Estuary Feasibility Study (USGS 2006). Two samples will be analyzed for dioxins/furans, and one sample will be analyzed for the SMS chemicals of concern (Table 1). The remaining samples will be archived for possible future analyses. Geographic coordinates for Capitol Lake sampling stations are provided in Table 2.

Table 2. Sampling Station Coordinates

Station ID	Northing (X)	Easting (Y)	Latitude N	Longitude W	Sample Type	Dioxin	SMS	Location Notes	Depth (ft MLLW)	Label
Budd Inlet Sample Locations										
BI-C1	1040461.706	635422.3681	47 03.0405566	122 54.4286736	Core	X		West Basin Outfall	-15	C1
BI-C2	1039601.894	636175.3843	47 03.1600591	122 54.6410680	Core	X	X	West Bay - SW of TC; co-loc with CP27S	-7	C2
BI-C3	1040965.076	635904.6782	47 03.1223907	122 54.3111105	Core	X		Under Pier	-36	C3
BI-C4	1040925.013	636539.8511	47 03.2266341	122 54.3254110	Core	X		Under Pier	-36	C4
BI-C5	1040924.536	637173.7971	47 03.3308742	122 54.3301787	Core	X		Under Pier	-36	C5
BI-C6	1040071.945	638740.9799	47 03.5842924	122 54.5468364	Core	X		b/w Hardel and Nav Channel	-18	C6
BI-C7	1041025.218	639208.5476	47 03.6659617	122 54.3208883	Core	X		CP Outfall	-5	C7
BI-C8	1041914.449	639173.5013	47 03.6646560	122 54.1066557	Core Archive			CP Bound	-5	C8
BI-C9	1043052.844	638649.0908	47 03.5841210	122 53.8288870	Core Archive			CP Bound	-7	C9
BI-C10	1043222.055	637336.4302	47 03.3691197	122 53.7785718	Core	X	X	East Basin	-3	C10
BI-C11	1037613.349	644766.9368	47 04.5627804	122 55.1829247	Core Archive			North Nav Channel	-29	C11
BI-C12	1036905.077	646414.4389	47 04.8301065	122 55.3655862	Core Archive			North Nav Channel	-35	C12
BI-C13	1042283.515	638605.826	47 03.5731585	122 54.0136892	Core	X		CP Bound	-4	C13
BI-C14	1040959.387	637705.5098	47 03.4184808	122 54.3256960	Core Archive			Old Marina north of berthing	0	C14
BI-C15	1040795.288	636116.1805	47 03.1563173	122 54.3535124	Core	X		DMMU Interface	-38	C15
BI-C16	1040693.785	636511.943	47 03.2208849	122 54.3808390	Core	X		Mound adjacent to berthing	-35	C16
BI-C17	1039282.899	643193.8995	47 04.3125341	122 54.7694853	Core Archive			Near north creek nav channel	-23	C17
BI-C18	1043622.228	634834.2453	47 02.9596716	122 53.6640051	Core	X	X	Moxlie Creek (previously S11)	0	C18
BI-D1	1039564.164	637261.115	47 03.3384004	122 54.6581324	SedRate Core	Sediment Dating		Co-located with BI-C1	-15	D1
BI-D2	1043622.585	634834.556	47 02.9597245	122 53.6639215	SedRate Core	Sediment Dating		Co-located with BI-C18	-1	D2
BI-D3	1040265.87	641902.7964	47 04.1051755	122 54.5234141	SedRate Core	Sediment Dating		Co-located with BI-S18	-19	D3
BI-S1	1039931.561	633614.8272	47 02.7406722	122 54.5429317	Surface	X	X	Captiol Lake	-17	S1
BI-S2	1040511.303	634591.6211	47 02.9042020	122 54.4106409	Surface	X		West Basin Outfall	-16	S2
BI-S3	1040002.475	634884.7024	47 02.9498397	122 54.5352050	Surface	X		West Basin - mid	-3	S3

Station ID	Northing (X)	Easting (Y)	Latitude N	Longitude W	Sample Type	Dioxin	SMS	Location Notes	Depth (ft MLLW)	Label
BI-S4	1040698.645	635045.5877	47 02.9797900	122 54.3689040	Surface	X		West Basin Outfall	-21	S4
BI-S5	1039172.772	636848.2887	47 03.2685494	122 54.7492643	Surface Archive			Hardell - South	11	S5
BI-S6	1039301.513	637942.5905	47 03.4491373	122 54.7263434	Surface Archive			Hardell	-5	S6
BI-S7	1039051.183	638557.6883	47 03.5490206	122 54.7911054	Surface	X		Hardell - North	0	S7
BI-S8	1041414.875	638494.4906	47 03.5505002	122 54.2218874	Surface	X	X	CP Outfall	4	S8
BI-S9	1043538.613	636828.2434	47 03.2871375	122 53.6986914	Surface	X	X	East Basin Nav Channel S	-1	S9
BI-S10	1043392.789	635555.2692	47 03.0770875	122 53.7244728	Surface Archive			Ensure location is within dredge basin	-3	S10
BI-S11	1040902.581	633996.0135	47 02.8082267	122 54.3121393	Surface	X	X	Olympic Yacht/old tank farm	0	S11
BI-S12	1042953.009	639512.3613	47 03.7255734	122 53.8592259	Surface	X	X	Priest Pt ; co-loc with CP25S	-7	S12
BI-S13	1042020.571	640332.8977	47 03.8558318	122 54.0896162	Surface	X		Priest Pt South	-11	S13
BI-S14	1041110.143	640120.9753	47 03.8164218	122 54.3071496	Surface	X		Nav converge	-8	S14
BI-S15	1042430.231	641281.1095	47 04.0138011	122 53.9979788	Surface Archive			CASCADERI	-2	S15
BI-S16	1039798.049	640389.0424	47 03.8539130	122 54.6248644	Surface Archive			West Bay Marina - South; co-loc with CP27S	-10	S16
BI-S17	1039233.531	641229.8877	47 03.9893371	122 54.7669033	Surface	X	X	West Bay Marina	-16	S17
BI-S18	1040265.87	641902.7964	47 04.1051755	122 54.5234141	Surface	X		N of NC converge	-19	S18
BI-S19	1041518.371	641896.6152	47 04.1104439	122 54.2219386	Surface Archive			Priest Pt SW	-2	S19
BI-S20	1040022.515	643067.4448	47 04.2954599	122 54.5905464	Surface Archive			b/w Nav Channel and Priest Pt	-20	S20
BI-S21	1038477.798	642421.5534	47 04.1814814	122 54.9575592	Surface	X		West Bay Marina - North	-23	S21
BI-S22	1039241.144	644383.9237	47 04.5080031	122 54.7883000	Surface Archive			E of mid-NC	-22	S22
BI-S23	1039203.111	646129.1092	47 04.7947771	122 54.8103112	Surface	X		PSAMP location	-20	S23
BI-S24	1035594.389	647789.1215	47 05.0495184	122 55.6912776	Surface Archive			North Nav Channel	-32	S24
BI-S25	1036079.296	650223.2976	47 05.4522274	122 55.5925782	Surface Archive			Mid-Budd	-60	S25
BI-S26	1038183.62	651117.2034	47 05.6098433	122 55.0925381	Surface	X		Mid-Budd	-46	S26

Station ID	Northing (X)	Easting (Y)	Latitude N	Longitude W	Sample Type	Dioxin	SMS	Location Notes	Depth (ft MLLW)	Label
BI-S27	1040223.767	649442.6142	47 05.3447576	122 54.5890014	Surface Archive			Mid-Budd	-26	S27
BI-S28	1039639.071	657802.1408	47 06.7163869	122 54.7913625	Surface Archive			Archive North	-47	S28
BI-S29	1039480.112	664186.0119	47 07.7652882	122 54.8767330	Surface Archive			Archive North	-38	S29
BI-S30	1043613.03	634180.4447	47 02.8521178	122 53.6614418	Surface	X	X	Moxlie Creek	0	S30
BI-S31	1042594.097	637881.6208	47 03.4556283	122 53.9336544	Surface	X		Boat Ramp	0	S31
BI-S32	1039335.434	637345.1154	47 03.3510628	122 54.7137843	Surface	X	X	Reliable Steel	-3	S32
BI-S33	1039554.753	637264.48	47 03.3389064	122 54.6604217	Surface	X		Reliable Steel East	-4	S33
BI-S34	1041026.495	635401.6735	47 03.0399874	122 54.2926429	Surface	X	X	Intertidal beach sample	0	S34
BI-S35	1040051.923	638168.2996	47 03.4900238	122 54.5474441	Surface	X		NW of turning basin	-6	S35
BI-S36	1040440.283	637590.6904	47 03.3969955	122 54.4497548	Surface	X		Turning basin	-36	S36
BI-S37	1040464.51	636926.3438	47 03.2878759	122 54.4390454	Surface	X		Turning basin	-37	S37
BI-S38	1040971.424	638057.1338	47 03.4763602	122 54.3253808	Surface Archive			NW Pt Port of Olympia	0	S38
BI-Tissue 1	1039345.14	636300.4933	47 03.1793402	122 54.7037616	Tissue	X		Old Veneer Plant	4	Tissue1
BI-Tissue 2	1042537.448	642167.5613	47 04.1601004	122 53.9786684	Tissue	X		Priest Pt	4	Tissue2
BI-Tissue 3	1041477.71	638355.239	47 03.5279174	122 54.2057465	Tissue	X		CP	-2	Tissue3
BI-Trawl 1	1040421.191	640942.0318	47 03.9479737	122 54.4789732	Trawl	X		Nav Channel converge	-35	Trawl1
BI-Trawl 2	1038663.543	647232.2612	47 04.9734541	122 54.9483275	Trawl	X		North Nav Channel	-37	Trawl2
BI-Trawl 3	1038958.798	654409.637	47 06.1551293	122 54.9301797	Trawl	X		North Budd	-41	Trawl3
Capitol Lake Sample Locations										
CL-S1	1040467.279	626205.2471	47 01.5249659	122 54.3596715	Surface Archive				0	CL-S1
CL-S2	1039924.139	627791.2646	47 01.7830373	122 54.5019291	Surface	X			0	CL-S2
CL-S3	1039855.209	629881.7353	47 02.1264382	122 54.5338645	Surface Archive				0	CL-S3
CL-S4	1039706.008	630924.3587	47 02.2971324	122 54.5774127	Surface Archive				0	CL-S4
CL-S5	1039897.673	631666.8407	47 02.4201853	122 54.5367677	Surface	X	X		0	CL-S5
CL-S6	1039766.706	632515.706	47 02.5591103	122 54.5745095	Surface Archive				0	CL-S6

Northings and Eastings are in Washington State Plane South, NAD 83 feet.
Depths are from combined bathymetry and topography of the Puget Lowland, Washington State (Finlayson 2005).

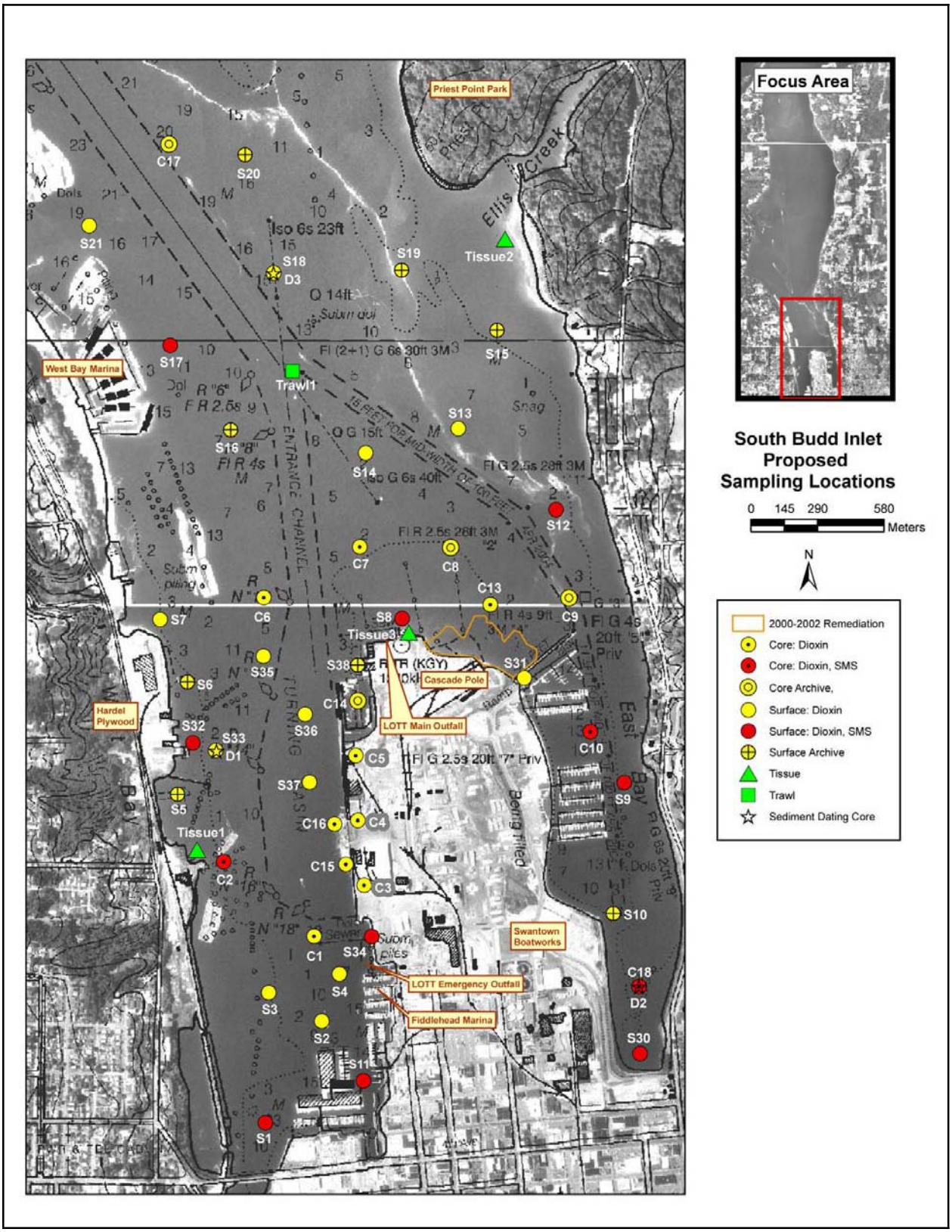

Figure 2. South Budd Inlet Proposed Sampling Locations

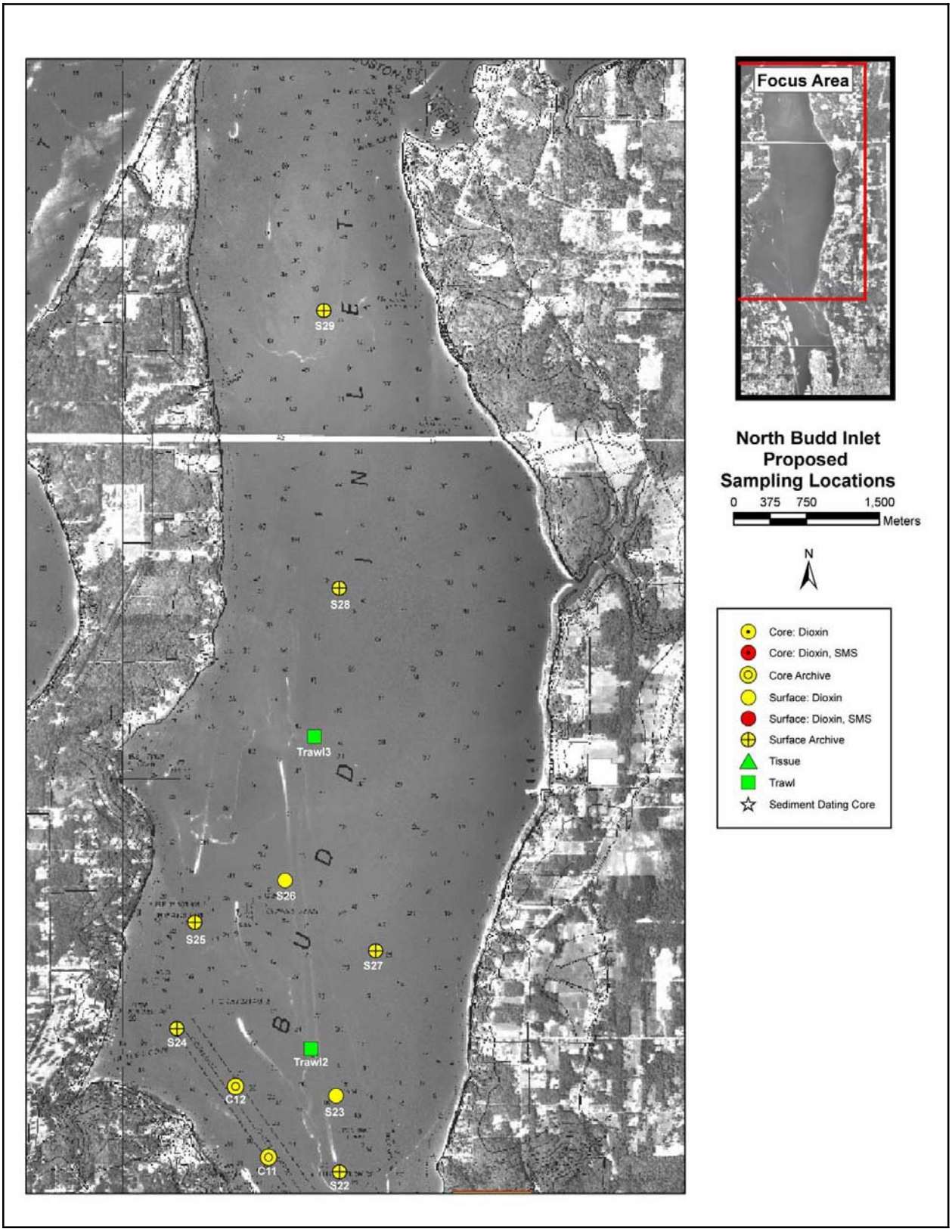

Figure 3. North Budd Inlet Proposed Sampling Locations

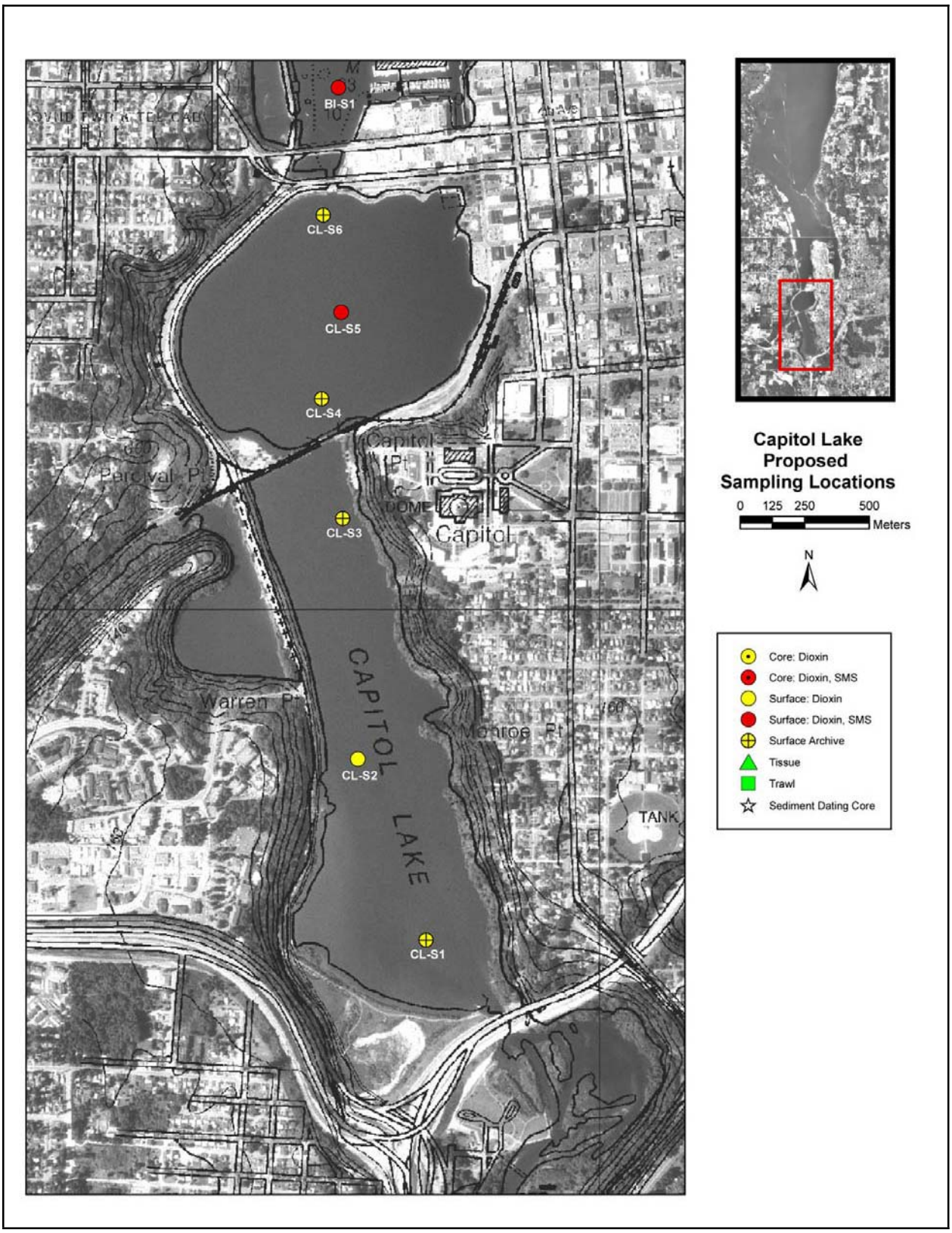

Figure 4. Capitol Lake Proposed Sampling Locations

3.0 Field Sampling Methods

The Budd Inlet Sediment Investigation program will include: (1) project planning and agency coordination, (2) field sample collection, (3) laboratory preparation and analysis, (4) QA/QC management, and (5) a draft and final data report. Staffing and responsibilities are outlined below.

3.1 Project Team and Responsibilities

3.1.1 Project Planning and Coordination

Mr. Russ McMillan, Ecology, will be the Government Project Manager (GPM) and will provide overall project coordination, supply government-furnished data and services, provide review comments on the report, and coordinate with the contractor, Science Applications International Corporation (SAIC). Mr. John Nakayama, SAIC, will be the contractor project manager and will be responsible for executing the approved SAP, collecting and storing field samples, and reporting analytical results.

3.1.2 Field Sample Collection

Mr. John Nakayama, SAIC, will be the contractor field manager and will be responsible for the collection and processing of sediment and tissue samples in accordance with the SAP, and transport of samples to the analytical laboratory for chemical analysis. He will coordinate with the proposed sampling vessels for this project (R/V *Kittiwake* – grab sampling and tissue collections; R/V *Nancy Anne* – sediment coring) and will ensure accurate station positioning and reporting.

3.1.3 Laboratory Sample Preparation and Analysis

Under the direction of Mr. John Nakayama, SAIC personnel will be responsible for the visual description of sediment core and grab samples, sample processing, and delivery of samples to the analytical laboratory. Established protocols for decontamination, sample preservation, holding times, and chain-of-custody documentation will be observed.

Ms. Georgina Brooks, Axys Analytical Services (AAS), will be responsible for dioxin/furan analysis of the collected samples using USEPA Method 1613B for 2,3,7,8-substituted chlorinated dioxins and furans. Mr. Harvey Jacky, Columbia Analytical Services (CAS), will be responsible for metals analysis using USEPA Methods 6010B and 6020, SVOCs analysis using USEPA Methods 8270C and 1625C, PCB Aroclors analysis using USEPA Method 8082, and conventionals analysis using PSEP methods. Ms. Linda Bingler, PNNL, will be responsible for sedimentation rate analysis of the collected samples using PNNL methods. AAS, CAS, and PNNL will handle and analyze the submitted samples in accordance with SMS analytical testing protocols and QA/QC requirements. A written report of analytical results and QA/QC procedures will be prepared by the analytical laboratories and included as an appendix in the data report.

3.1.4 QA/QC Management

Mr. Tim Hammermeister, SAIC, will perform quality assurance oversight for the laboratory programs. He will ensure that the laboratory analytical and QA/QC data are considered valid and procedures meet the required analytical quality control limits. He will oversee the Level III data validation of the analytical chemistry results, to be conducted by EcoChem, Seattle, WA.

3.1.5 Data Report

Mr. John Nakayama, SAIC, will coordinate the preparation of the Budd Inlet Remedial Investigation (RI) report, which will be prepared in accordance with the MTCA cleanup regulations (WAC 173-340-350).

3.2 Station Positioning Methods

SAIC will ensure that vessel navigation provides accurate station positioning, and that sample locations and water depths are recorded. A differential global positioning system (DGPS) will be used aboard the R/V *Kittiwake* and R/V *Nancy Anne* for station positioning. A U.S. Coast Guard differential correction signal will be utilized to obtain a minimum accuracy of ± 3 meters. The DGPS receiver will be placed above the block on the sampling device deployment boom to accurately record the position of the sampling device. Coordinates of the proposed sampling locations will be calculated in advance and programmed into the R/V *Kittiwake*'s and R/V *Nancy Anne*'s navigation systems. Once the sampling device has been deployed, the actual position will be recorded when the device reaches the seafloor and the deployment cable is in a vertical position. Horizontal coordinates will be referenced to the North American Datum of 1983 (NAD83).

At coring locations, water depths will be measured directly by lead-line and converted to mudline elevations referencing the mean lower low water (MLLW) elevation. At sediment grab locations, water depths will be measured using the winch meter wheel and verified by the ship's echo sounder.

3.3 Sample Collection Procedures

Sample collection efforts are planned for April 2007. Core sampling will be conducted using a vibracore sampler deployed from Marine Sampling System's R/V *Nancy Anne*. Grab sampling will be conducted using a 0.2 m^2 stainless steel dual van Veen grab sampler or single 0.1 m^2 stainless steel Young grab deployed from Bio-Marine Enterprise's R/V *Kittiwake*. In addition, biological sampling for fish tissue will be completed using an otter or beam trawl net deployed from the R/V *Kittiwake*. The collection of clam and ghost shrimp tissue samples will be conducted on foot during low tide. Surface grab samples in Capitol Lake will be collected using a 0.025 m^2 stainless van Veen grab sampler deployed from a small motorized skiff.

3.3.1 Sediment Core Samples

Core samples will be collected using a vibracore sampler deployed from the R/V *Nancy Anne*. The vibracore is equipped with 4-inch diameter pre-cleaned aluminum tubes, and the vibracore

quadrupod is mechanically lowered into position on the seafloor, activated, and allowed to penetrate to the target sampling depth or until refusal. Painted markers, spaced 1 foot apart along the deployment cable, are used to measure penetration depth. When sampling is completed, the vibracore quadrupod is retrieved and the core tube is removed and placed in a yoke for processing. A tape measure is used to determine the length of the recovered sediment core in the aluminum tube. Any excess core tube is removed, both ends of the core will be capped and sealed with duct tape, and the core will be labeled with station ID, date, time, and orientation of the core. The core will then be taken to a shore-side area for processing.

The core length is divided by the depth of penetration to calculate the decimal percent recovery. The actual recovery on a foot-by-foot basis cannot be determined with this coring system, so a uniform recovery factor will be applied to the entire core. The tube will then be cut open lengthwise using a circular saw. A vacuum hose is attached to the circular saw to collect aluminum shavings. Cuts will be made on opposite sides of the tube, and then the top of the tube will be removed. Decontaminated stainless steel spoons will be used to remove any aluminum shavings prior to collection of samples for analysis.

Once the core tube is opened, each core section will then be inspected and described. For each acceptable core sample, the following data will be recorded on the core log:

- Depth interval of each core section as measured from MLLW
- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (includes sediment type, density/consistency of sediment, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Visual stratifications and lenses
- Vegetation
- Debris
- Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

Sediment samples will be retained at 1-foot intervals, extending a minimum of 1 foot into the sand and/or gravel layer.[3] Sample processing procedures are described in Section 3.5.

Core samples collected for sedimentation rate and mixed layer analysis will not be composited. Rather, the core sample will be opened, and the core will be sectioned in 2 cm intervals (0–50 cm), 5 cm intervals (50–120 cm), and 10 cm intervals (>120 cm). The intervals will be placed in appropriate containers obtained from the analytical laboratory.

[3] The majority of core samples collected in support of the sediment characterization at the Olympia Harbor navigation channel and Port of Olympia's turning basin (SAIC 2006a) consisted of a 2–6-foot layer of silt-clays overlying sand and/or gravels. The silt-clay layer is interpreted to be recent sedimentation.

3.3.2 Sediment Grab Samples

Surface samples (0–10 cm) will be collected using a stainless steel dual van Veen or single Young grab sampler. Established deployment and recovery procedures for the sampling gear, as described in PSEP, will be followed to ensure that the best possible samples are recovered and risks to personnel and equipment are minimized. Once a grab sample is retrieved, the overlying water will be carefully siphoned off one side of the sampler. If the sample is judged to be acceptable according to PSEP specifications, the penetration depth will be measured with a decontaminated stainless steel ruler, and sample quality and texture will be described in the sample log.

For each acceptable grab sample, the following data will be recorded on the sample log:

- Depth
- Depth of sample recovered
- Physical soil description in accordance with the Unified Soil Classification System (includes sediment type, density/consistency of sediment, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Vegetation
- Debris
- Biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

3.3.3 Starry Flounder Samples

A 7.6-meter Otter trawl will be used to target collection of Starry flounder (*Platichthys stellatus*). Starry flounder are expected to be abundant in Budd Inlet. A 3-meter Gunderson beam trawl will also be available as backup. Based on trawling activities conducted by SAIC in Port Gardner in 2006 (SAIC 2006b), both trawls are effective at collecting bottom fish. However, if initial trawling activities are unsuccessful, trawling activities may be redirected to other areas of Budd Inlet, or an alternate bottom fish species may be targeted for collection. Alternate species may include English sole (*Parophrys vetulus*), rock sole (*Lepidopsetta bilineata*), or a species of sculpin.

Starry flounder with a minimum length of 20 cm will be targeted for collection. Each fish sample will consist of five fish. Whole bodies of each fish will be utilized for analysis and will be homogenized separately. Equal volumes of each fish homogenate will be combined to create a final composite sample for dioxin/furan analysis. The laboratory will archive the remaining tissue from each fish as separate samples.

Dungeness crabs are not expected to be abundant in Budd Inlet. However, if present in abundance, male Dungeness crabs with a minimum carapace width of 9 cm will be targeted for

collection. Each crab sample will consist of five crabs. The crabs in each sample will be dissected for crab meat and hepatopancreas tissue samples. Samples will be archived for potential future dioxin/furan analyses.

SAIC will coordinate with Ecology, and other agencies as necessary, to obtain the necessary scientific collection permits for the collection of all marine organisms.

3.3.4 Clam and Ghost Shrimp Samples

Small shovels and trowels will be used to collect littleneck clams (*Protothaca staminea*) and Manila clams (*Ruditapes philippinarum*) at low tide from publicly accessible beaches in the vicinity of Budd Inlet. Ghost shrimp (*Neotrypaea californiensis*) may also be collected if it appears that the beaches sampled support a large enough population for chemical analyses. Depending on sample size, the shrimp may be dissected (head versus tail) for chemical analysis.

SAIC will coordinate with Ecology, and other agencies as necessary, to obtain the necessary scientific collection permits for the collection of all marine organisms.

3.4 Sample Compositing Strategy and Methods

3.4.1 Sediment Samples

After a core section has been logged, the sediment samples (1-foot intervals) will be placed into separate pre-cleaned stainless-steel pans and homogenized until a consistent color and texture is achieved for each sample. Sediment coming in direct contact with the core tube wall will be avoided for inclusion in the samples. The samples will then be placed into appropriately labeled sample jars.

Triplicate grab samples will be collected for each surface sediment sample composite. Sediment coming in direct contact with the grab sampler will be avoided for inclusion in the sample. Once all sections/samples for a composite have been collected and placed into the same stainless steel pan, the sample will be homogenized until a consistent color and texture is achieved. The pan will be covered with aluminum foil until all grab samples in the composite are collected.

Chemical and conventional samples will be taken from the same homogenate. Portions of each composite sample will be placed in appropriate containers obtained from the chemical laboratories. Table 3 lists sample container, volume, and preservation requirements. For dioxin samples, at least 250 mL of homogenized sample will be collected for chemical analysis.

3.4.2 Tissue Samples

Organisms collected for tissue chemistry analysis (Starry flounder, Littleneck and/or Manila clams, ghost shrimp) will be rinsed with site water following collection. Fish and crabs will be individually wrapped with heavy duty aluminum foil and placed in pre-labeled polyethylene bags. All organisms collected for a composite sample will be included in the same polyethylene bag. All clams and ghost shrimp for a composite sample will be placed directly into pre-cleaned sample jars (one per species). Sample preparations (i.e., whole fish compositing, shrimp

dissections, and clam shucking) will be conducted by the analytical laboratory. All fish will be euthanized humanely following collection. Tissue samples will be immediately placed on ice in coolers in the field. If not submitted immediately (within 24 hours) to the analytical laboratory, the tissue samples will be frozen at -18°C.

Starry flounder samples will include five organisms per composite. The composite sample identification number and the total length of each fish included in a composite sample will be recorded on data sheets included as part of the biological sampling log (see Appendix A). The whole body (skin on) from each individual fish will be homogenized separately and equal volumes from each fish homogenate will be combined to create a final composite sample for dioxin/furan, percent lipids, and percent moisture analysis. The laboratory will archive the remaining tissue from each fish as separate samples.

If collected, Dungeness crab samples will include five organisms per composite. The carapace width and sex of each crab retained for analysis will be recorded on data sheets in the biological sampling log. Upon receipt by the analytical laboratory, the crabs will be dissected to collect edible meat and hepatopancreas tissue samples. The edible meat and hepatopancreas samples will be homogenized separately and archived for potential future analysis.

Triplicate tissue samples of Littleneck and/or Manila clams will be collected at three beach locations in Budd Inlet. Total clam tissue volume required for dioxin/furan, percent lipids, and percent moisture analysis will be confirmed with the analytical laboratory prior to field collections. However, a minimum of five clams will be collected per composite. The shell length and weight for each clam retained for analysis will be recorded in the biological sampling log. Upon receipt by the analytical laboratory, the clams will be shucked to collect the edible tissues. The tissue from each sample will be homogenized and analyzed for dioxins/furans, percent lipids, and percent moisture.

Ghost shrimp may also be collected if they are abundant at the three beaches in Budd Inlet. Depending on sample size, the shrimp may be dissected (head versus tail) for chemical analysis. Total shrimp tissue volume required for dioxin/furan, percent lipids, and percent moisture analysis will be confirmed with the analytical laboratory prior to field collections. The total number of ghost shrimp collected per sample will be recorded in the biological sampling log.

3.5 Sample Containers and Labels

Samples will be identified based on the project sampling area, sample type, and location. All samples collected during the investigation will be labeled clearly and legibly. Each sample will be labeled with a unique alphanumeric sample identification number that identifies the characteristics of the sample. The sample identification structure for sediment samples is as follows:

1) Site Location – Budd Inlet (BI), Capitol Lake (CL)
2) Sample Type and Alphanumeric Identification: Core Sample (C1), Surface Grab (S1), Sedimentation Rate Core (D1)
3) Subsurface Designation (*Core Samples Only*): 1–2-foot interval

For example, a surface grab sample collected at station S10 will be identified as BI-S10. A subsurface core sample collected at station C9 collected from 3–4 feet will be identified as BI-C9-3-4ft.

The sample identification structure for tissue samples is as follows:

1) Site Location – Budd Inlet (BI)

2) Sample Type and Alphanumeric Identification: Trawl Collection (Trawl1), Intertidal tissue (Tissue1)

3) Species Type and Replicate: Starry Flounder (SF1), English sole (E1), Dungeness crab (D1), Littleneck clam (L1), Manila clam (M1), Ghost shrimp (G1)

4) Tissue Type:

    a. Ghost Shrimp: Head (head), Tail (tail)

    b. Dungeness Crab: Edible meat (meat), Hepatopancreas (hepato)

For example, the first tail tissue sample for ghost shrimp collected at intertidal location 2 will be identified as BI-Tissue2-G1-tail. The second replicate Littleneck clam sample collected at intertidal location 3 will be identified as BI-Tissue3-L2.

Sample aliquots submitted to the analytical laboratories will be placed in pre-cleaned sample containers and preserved as identified in Table 3. The procedure for sample storage and shipping is provided in Section 4.2.

Sample labels will be self-adhering, waterproof material. An indelible pen will be used to fill out each label. Each sample label will contain the project name, sample identification, date and time of collection, analyses, preservative (as applicable), and the initials of the person preparing the sample. In addition, a unique, sequentially numbered jar tag will be placed on each sample container for tracking purposes. Jar tag numbers will be recorded in a Sample Container Logbook (Appendix A). Sample labels and jar tags will be protected by packaging tape wrapped around the entire jar to prevent loss or damage of the labels during handling and storage.

3.6 Field Documentation Procedures

A complete record of field activities will be maintained. Documentation necessary to meet QA objectives for this project include field notes and field forms (Appendix A), sample container labels, and chain-of-custody (COC) forms. The field documentation will provide descriptions of all sampling activities, sampling personnel, and weather conditions, and will record all modifications, decisions, and/or corrective actions to the study design and procedures identified in this SAP.

Field logbook(s) will be kept on site during field operations. Daily activities will be recorded in a bound field logbook of water-resistant paper. Separate logbooks consisting of bound, paginated field forms will be kept for sediment core sampling, sediment grab sampling,

biological (i.e., trawl) sampling, and an inventory of sample containers (separate from the COC documentation). Examples of the various field forms to be used are presented in Appendix A. All entries will be made legibly, in indelible ink, and will be signed and dated. Information recorded will include the following:

- Date, time, place, and location of sampling
- Onsite personnel and visitors
- Daily safety discussion and any safety issues
- Quality control samples (i.e., duplicate samples, field blanks, etc.)
- Field measurements and their units
- Observations about site, location, and samples (weather, current, odors, appearance, etc.)
- Equipment decontamination verification

Field logbooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occur during project field activities. Entries should be factual, detailed, and objective. Unless restricted by weather conditions, all original data recorded in field logbooks and on sample identification tags, COC records, and field forms will be written in waterproof ink. If an error is made, the individual responsible may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. All corrections must be initialed and dated. All documentation, including voided entries, must be maintained within project files.

Table 3. Sediment and Tissue Samples, Budd Inlet Sediment Characterization, Olympia, WA

Sample Location	Subsurface Samples						Surface Sediment Samples					Tissue Samples		
Analyte(s)	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVC, TOC, Grain Size*	*Sedimentation Rate/Mixed Layer*	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVS, TOC, Grain Size*	*Dioxins/ Furans*	*Percent Lipids*	*Percent Moisture*
Method(s)	USEPA 1613B	USEPA 6010B; 6020	USEPA 8270C; 1625C	USEPA 8082	PSEP	PNNL	USEPA 1613B	USEPA 6010B; 6020	USEPA 8270C; 1625C	USEPA 8082	PSEP	USEPA 1613B	USEPA Gravimetric Method	---
Container(s)	125 mL glass	500 mL glass			500 mL glass	125 mL plastic	125 mL glass	500 mL glass			2–500 mL glass	1 L glass		
Preservative	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C	4°C
Holding Time	14 days	6 months	14 days	14 days	14 days	---	14 days	6 months	14 days	14 days	14 days	14 days	14 days	14 days
BI-C1	2X	---	---	---	2X		X	---	---	---	X			
BI-C2	2X	---	---	---	2X		X	X	X	X	X			
BI-C3	3X	---	---	---	3X									
BI-C4	3X	---	---	---	3X									
BI-C5	3X	---	---	---	3X									
BI-C6	2X	---	---	---	2X		X	---	---	---	X			
BI-C7	2X	---	---	---	2X		X	---	---	---	X			
BI-C8	---	---	---	---	---		---	---	---	---	---			
BI-C9	---	---	---	---	---		---	---	---	---	---			
BI-C10	2X	---	---	---	2X		X	X	X	X	X			
BI-C11	---	---	---	---	---		---	---	---	---	---			
BI-C12	---	---	---	---	---		---	---	---	---	---			
BI-C13	2X	---	---	---	2X		X	---	---	---	X			
BI-C14	---	---	---	---	---		---	---	---	---	---			
BI-C15	2X	---	---	---	2X		X	---	---	---	X			
BI-C16	2X	---	---	---	2X		X	---	---	---	X			
BI-C17	---	---	---	---	---		---	---	---	---	---			
BI-C18	2X	---	---	---	2X		X	X	X	X	X			
BI-S1	---	---	---	---	---		X	X	X	X	X			

Sample Location	Subsurface Samples						Surface Sediment Samples					Tissue Samples		
Analyte(s)	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVC, TOC, Grain Size*	*Sedimentation Rate/Mixed Layer*	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVS, TOC, Grain Size*	*Dioxins/ Furans*	*Percent Lipids*	*Percent Moisture*
BI-S2							X	---	---	---	X			
BI-S3							X	---	---	---	X			
BI-S4							X	---	---	---	X			
BI-S5							---	---	---	---	---			
BI-S6							---	---	---	---	---			
BI-S7							X	---	---	---	X			
BI-S8							X	X	X	X	X			
BI-S9							X	X	X	X	X			
BI-S10							---	---	---	---	---			
BI-S11							X	X	X	X	X			
BI-S12							X	X	X	X	X			
BI-S13							X	---	---	---	X			
BI-S14							X	---	---	---	X			
BI-S15							---	---	---	---	---			
BI-S16							---	---	---	---	---			
BI-S17							X	X	X	X	X			
BI-S18							X	---	---	---	X			
BI-S19							---	---	---	---	---			
BI-S20							---	---	---	---	---			
BI-S21							X	---	---	---	X			
BI-S22							---	---	---	---	---			
BI-S23							X	---	---	---	X			
BI-S24							---	---	---	---	---			
BI-S25							---	---	---	---	---			
BI-S26							X	---	---	---	X			
BI-S27							---	---	---	---	---			
BI-S28							---	---	---	---	---			
BI-S29							---	---	---	---	---			
BI-S30							X	X	X	X	X			

Sample Location	Subsurface Samples						Surface Sediment Samples					Tissue Samples		
Analyte(s)	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVC, TOC, Grain Size*	*Sedimentation Rate/Mixed Layer*	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVS, TOC, Grain Size*	*Dioxins/ Furans*	*Percent Lipids*	*Percent Moisture*
BI-S31							X	---	---	---	X			
BI-S32							X	X	X	X	X			
BI-S33							X	---	---	---	X			
BI-S34							X	X	X	X	X			
BI-S35							X	---	---	---	X			
BI-S36							X	---	---	---	X			
BI-S37							X	---	---	---	X			
BI-S38							---	---	---	---	---			
BI-Tissue1							X	---	---	---	X	4X	4X	4X
BI-Tissue2							X	---	---	---	X	4X	4X	4X
BI-Tissue3							X	---	---	---	X	4X	4X	4X
BI-Trawl1												X	X	X
BI-Trawl2												X	X	X
BI-Trawl3												X	X	X
BI-D1						X								
BI-D2						X								
BI-D3						X								
CL-S1							---	---	---	---	---			
CL-S2							X	---	---	---	X			
CL-S3							---	---	---	---	---			
CL-S4							---	---	---	---	---			
CL-S5							X	X	X	X	X			
CL-S6							---	---	---	---	---			
Number of Field Samples	***27***	***0***	***0***	***0***	***27***	***3***	***38***	***13***	***13***	***13***	***38***	***15***	***15***	***15***
Duplicate	2X						2X					X		
CRM	2X						2X							

Sample Location	Subsurface Samples						Surface Sediment Samples					Tissue Samples		
Analyte(s)	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVC, TOC, Grain Size*	*Sedimentation Rate/Mixed Layer*	*Dioxins/ Furans*	*Metals*	*SVOCs*	*PCBs*	*TS, TVS, TOC, Grain Size*	*Dioxins/ Furans*	*Percent Lipids*	*Percent Moisture*
Total Number of Samples	***31***	***0***	***0***	***0***	***27***	***3***	***42***	***13***	***13***	***13***	***38***	***16***	***15***	***15***

--- Samples will be collected and archived for potential future analysis.

3.7 Decontamination Procedures

The core and grab samplers, compositing pans, and sampling utensils will be thoroughly decontaminated prior to use in accordance with PSEP (1997) protocols (i.e., washed with Alconox™ soap and water, rinsed with fresh water, and rinsed with distilled water). If a noticeable oily sheen or petroleum odor is observed, sampling bowls and utensils used to process those samples will not be used for further sample processing.

All hand work will be conducted with disposable nitrile gloves, which will be changed after handling each individual sample, as appropriate, and between sampling locations to prevent cross contamination between samples and composites.

3.8 Waste Disposal Procedures

Two types of investigation-derived waste will be generated by sampling activities in Budd Inlet:

- Sediment core/grab samples not submitted to the laboratories
- Disposable protective clothing and supplies

During the surface sediment sampling activities, excess surface sediment from the grab sampler and sediment homogenate will be returned to the site at the time of collection. The subsurface cores will be processed at a shore-side processing facility in Budd Inlet. All excess subsurface sediment will be returned to the site following completion of core processing.

Used personal protective equipment (PPE) such as Tyvek suits or gloves and disposable supplies such as paper towels and packaging will be placed in plastic storage bags and disposed of as municipal waste. If PPE contains residual sediments, the PPE will be decontaminated using the procedures outlined in Section 3.3, and will be disposed of as non-hazardous waste. Waste material (i.e., cardboard, aluminum) will be recycled as feasible.

4.0 Sample Handling Procedures

4.1 Chain-of-Custody Procedures

Samples will be retained at all times in the field crew's custody until samples are delivered or shipped to the appropriate laboratory by SAIC personnel. COC forms will be initiated at the time of sample collection to ensure that all collected samples are properly documented and traceable through storage, transport, and analysis. When all line items on the form are completed or when the samples are relinquished, the sample collection custodian will sign and date the form, list the time, and confirm the completeness of all descriptive information contained on the form. Each individual who subsequently assumes responsibility for the samples will sign and date the COC form. The field COC terminates when the laboratory receives the samples. The field sample custodian should retain a copy of the completed, signed COC form(s) for project files.

4.2 Sample Storage and Delivery Procedures

All samples will be stored in insulated coolers and preserved by cooling with ice or frozen gel-packs to a temperature of 4ºC. Maximum sample holding and extraction times will be strictly adhered to by field personnel and the analytical and testing laboratories. Preparation of bottles for shipment will be performed in the following manner:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 Code of Federal Regulations (CFR) 173.6 and 49 CFR 173.24.
- Place sample containers in plastic zip-loc bubble-pack bags, or wrap in bubble pack and secure with packaging tape.
- Prepare an empty insulated cooler by placing three to four ice packs in a garbage bag at the bottom of the cooler. Place sample containers in a garbage bag and fill with the sample bottles. Add additional bags of ice as needed to surround the bag containing the samples.
- COC forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.
- Seal the cooler with strapping tape and a custody seal.

Samples for chemical analyses will be hand-couriered or shipped via overnight courier to the analytical laboratories once per day or whenever a cooler is filled, and accompanied by the COC record, which identifies the shipment contents. The COC will be signed by the individual relinquishing samples to the onsite laboratory representative. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples will be recorded by the receiver. The field personnel will be responsible for the following:

- Packaging the samples;
- Signing the COC before placing inside the cooler to be sealed;
- Applying a shipping label, a waybill, a custody seal, and strapping tape to the cooler;

- Shipping the samples in accordance with the maximum holding time allowed for the analyses to be performed;
- Notifying the laboratory of when the samples are shipped; and
- Confirming receipt of the samples by the laboratory and that the samples were received in good condition.

All sediment samples will be retained for a minimum of six months from the time they were received using standard laboratory handling procedures. They may be removed from the laboratory prior to the end of the six-month period only at the direction of the SAIC project manager.

5.0 Laboratory Analytical Methods

All of the chemical analytical procedures used in this program will be performed in accordance with the most current SMS, PSEP, and Puget Sound Dredged Disposal Analysis (PSDDA) documentation, where applicable. All procedural modifications proposed in the SMARM will be followed.

Dioxins and furans will be analyzed using USEPA Method 1613B (tetra- through octa-chlorinated dioxins and furans by isotope dilution high resolution (HR) gas chromatography/mass spectrophotometry [GC/MS]) (Table 4). Conventionals, metals, SVOCs, and PCBs will be analyzed using methods as outlined in the Sediment Sampling and Analysis Plan Appendix and Updates (Ecology 2003) and summarized in Table 5. Target detection limits are also given in Table 5.

Table 4. Dioxin/Furan Analytical Method and Sediment Method Detection Limit

Parameter	Analysis Method[1]	Sediment MDL[2]
2,3,7,8-TCDD	1613B	0.2 to 0.5
1,2,3,7,8-PeCDD	1613B	0.2 to 0.5
1,2,3,4,7,8-HxCDD	1613B	1 to 5
1,2,3,6,7,8-HxCDD	1613B	1 to 5
1,2,3,7,8,9-HxCDD	1613B	1 to 5
1,2,3,4,6,7,8-HpCDD	1613B	1 to 5
OCDD	1613B	10
Total Tetra-Dioxins (TCDD)	1613B	0.2 to 0.5
Total Penta-Dioxins (PeCDD)	1613B	1 to 5
Total Hexa-Dioxins (HxCDD)	1613B	1 to 5
Total Hepta-Dioxins (HpCDD)	1613B	1 to 5
2,3,7,8-TCDF	1613B	1 to 5
1,2,3,7,8-PeCDF	1613B	1 to 5
2,3,4,7,8-PeCDF	1613B	1 to 5
1,2,3,4,7,8-HxCDF	1613B	1 to 5
1,2,3,6,7,8-HxCDF	1613B	1 to 5
1,2,3,7,8,9-HxCDF	1613B	1 to 5
2,3,4,6,7,8-HxCDF	1613B	1 to 5
1,2,3,4,6,7,8-HpCDF	1613B	1 to 5
1,2,3,4,7,8,9-HpCDF	1613B	1 to 5
OCDF	1613B	10
Total Tetra-Furans (TCDF)	1613B	0.2 to 0.5
Total Penta-Furans (PeCDF)	1613B	1 to 5
Total Hexa-Furans (HxCDF)	1613B	1 to 5
Total Hepta-Furans (HpCDF)	1613B	1 to 5

[1] Method 1613 Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS. U.S. Environmental Protection Agency, Office of Water, Engineering and Analysis Division. October 1994.

[2] Method detection limit (MDL) is on a dry weight basis in pg/g.

Table 5. SMS Parameters—Analyte, Preparation Method, Analytical Method, Sediment Method Detection Limit, Sediment Quality Standards, and Cleanup Screening Levels

Parameter	Preparation Method[1]	Analytical Method[2]	Sediment MDL[3,4]	SQS	CSL
Conventionals					
Total Solids (%)	---	PSEP[5]	0.1	---	---
Total Volatile Solids (%)	---	PSEP[5]	0.1	---	---
Total Organic Carbon (%)	---	PSEP[5]	0.1	---	---
Grain Size	---	PSEP[5]	---	---	---
Metals (mg/kg dry wt)					
Arsenic	PSEP/3050B	6010B/6020	19	57	93
Cadmium	PSEP/3050B	6010B/6020	1.7	5.1	6.7
Chromium	PSEP/3050B	6010B/6020	87	260	270
Copper	PSEP/3050B	6010B/6020	130	390	390
Lead	PSEP/3050B	6010B/6020	150	450	530
Mercury	---	7471A/245.5	0.14	0.41	0.59
Silver	PSEP/3050B	6010B/6020	2	6.1	6.1
Zinc	PSEP/3050B	6010B/6020	137	410	960
Low-Molecular Polycyclic Aromatic Hydrocarbons (LPAHs) (mg/kg OC)					
Total LPAHs	3540C/3550B	8270C/1625C	---	370	780
Naphthalene	3540C/3550B	8270C/1625C	0.700	99	170
Acenaphthylene	3540C/3550B	8270C/1625C	0.433	66	66
Acenaphthene	3540C/3550B	8270C/1625C	0.167	16	57
Fluorene	3540C/3550B	8270C/1625C	0.180	23	79
Phenanthrene	3540C/3550B	8270C/1625C	0.500	100	480
Anthracene	3540C/3550B	8270C/1625C	0.320	220	1200
2-methylnaphthalene	3540C/3550B	8270C/1625C	0.223	38	64
High-Molecular Polycyclic Aromatic Hydrocarbons (HPAHs) (mg/kg OC)					
Total HPAH	3540C/3550B	8270C/1625C	---	960	5300
Fluoranthene	3540C/3550B	8270C/1625C	0.567	160	1200
Pyrene	3540C/3550B	8270C/1625C	0.867	1000	1400
Benzo(a)anthracene	3540C/3550B	8270C[6]/1625C	0.433	110	270
Chrysene	3540C/3550B	8270C[6]/1625C	0.467	110	460
Benzofluoranthenes	3540C/3550B	8270C[6]/1625C	1.067	230	450
Benzo(a)pyrene	3540C/3550B	8270C[6]/1625C	0.533	99	210
Indeno(1,2,3-c,d)pyrene	3540C/3550B	8270C[6]/1625C	0.200	34	88
Dibenzo(a,h)anthracene	3540C/3550B	8270C[6]/1625C	0.077	12	33
Benzo(g,h,i)perylene	3540C/3550B	8270C/1625C	0.223	31	78
Chlorinated Hydrocarbons (mg/kg OC)					
1,2-dichlorobenzene	3540C/3550B	8270C[6]/1625C	0.035	2.3	2.3
1,4-dichlorobenzene	3540C/3550B	8270C[6]/1625C	0.037	3.1	9
1,2,4-trichlorobenzene	3540C/3550B	8270C[6]/1625C	0.031	0.81	1.8
Hexachlorobenzene	3540C/3550B	8270C[6]/1625C	0.022	0.38	2.3
Phthalate Esters (mg/kg OC)					
Dimethyl phthalate	3540C/3550B	8270C/1625C	0.024	53	53
Diethyl phthalate	3540C/3550B	8270C/1625C	0.067	61	110
Di-n-butyl phthalate	3540C/3550B	8270C/1625C	0.467	220	1700
Butyl benzyl phthalate	3540C/3550B	8270C/1625C	0.021	4.9	64
Bis(2-ethylhexyl)phthalate	3540C/3550B	8270C/1625C	0.433	47	78
Di-n-octyl phthalate	3540C/3550B	8270C/1625C	2.067	58	4500

Parameter	Preparation Method[1]	Analytical Method[2]	Sediment MDL[3,4]	SQS	CSL
Miscellaneous Extractable Compounds (mg/kg OC)					
Dibenzofuran	3540C/3550B	8270C/1625C	0.180	15	58
Hexachlorobutadiene	3540C/3550B	8270C/1625C	0.011	3.9	6.2
N-nitrosodiphenylamine	3540C/3550B	8270C/1625C	0.047	11	11
Polychlorinated Biphenyls (mg/kg OC)					
Total PCBs	3540C/3550B	8082	0.028	12	65
Ionizable Organic Compounds (µg/kg dry wt)					
Phenol	3540C/3550B	8270C/1625C	0.140	420	1200
2-methyphenol	3540C/3550B	8270C/1625C	0.063	63	63
4-methylphenol	3540C/3550B	8270C/1625C	0.223	670	670
2,4-dimethylphenol	3540C/3550B	8270C/1625C	0.029	29	29
Pentachlorophenol	3540C/3550B	8270C/1625C	0.120	360	690
Benzyl alcohol	3540C/3550B	8270C/1625C	0.057	57	73
Benzoic acid	3540C/3550B	8270C/1625C	0.217	650	650

CSL = cleanup screening level; SQS = Sediment Quality Standards

1 Recommended sample preparation methods are: PSEP (1997a,b) and USEPA Method 3050B and 3500 series (sample preparation methods from SW-846 [USEPA 1986] and subject to changes by USEPA updates)

2 Recommended sample cleanup methods are: Sample extracts subjected to gel permeation chromatography (GPC) cleanup follow the procedures specified by USEPA SW-846 Method 3640A. Special care should be used during GPC to minimize loss of analytes. If sulfur is present in the samples (as is common in most marine sediments), cleanup procedures specified by USEPA SW-846 Method 3660B should be used. All PCB extracts should be subjected to sulfuric acid/permanganate cleanup as specified by USEPA SW-846 Method 3665A. Additional cleanup procedures may be necessary on a sample-by-sample basis. Alternative cleanup procedures are described in PSEP (1997a,b) and USEPA (1986).

3 MDL, SQS, and CSL are on a dry weight basis.

4 The recommended MDL is based on a value equal to one third of the 1988 dry weight lowest apparent effects threshold (LAET) value (Barrick et al. 1988) except for the following chemicals: 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, hexachlorobenzene, hexachlorabutadiene, n-nitrosodiphenylamine, 2-methylphenol, 2,4-dimethylphenol, and benzyl alcohol, for which the recommended MDL is equal to the full value of the 1988 dry weight LAET.

5 Recommended Protocols for Measuring Metals in Puget Sound Water, Sediment and Tissue Samples, Puget Sound Estuary Program, April 1997.

6 Selected ion monitoring may improve the sensitivity of USEPA Method 8270C and is recommended in cases when detection limits must be lowered to human health criteria levels or when TOC levels elevate detection limits above ecological criteria levels. See PSEP Organics Chapter, Appendix B – Guidance for Selected Ion Monitoring (1997).

All samples for chemical analyses will be maintained at the testing laboratory at the temperatures specified and analyzed within the holding times shown in Table 3.

6.0 Quality Assurance and Quality Control Requirements

6.1 QA/QC for Chemical Analyses

The chemistry QA/QC procedures, found in Table 6, will be followed.

Table 6. Minimum Laboratory QA/QC

Analysis Type	Method Blank[1]	Triplicate[1]	Duplicate[1]	CRM	LCS[1]	Matrix Spike[1]	Surrogate[2]
Dioxins/Furans			X	X			X
Metals	X		X	X		X	
SVOCs[3,4]	X		X[5]	X		X	X
PCB Aroclors[3,4]	X		X[5]	X		X	X
Total Solids		X					
Total Volatile Solids		X					
Total Organic Carbon	X	X		X			
Grain Size		X					

CRM = Certified Reference Material; LCS = Laboratory Control Sample

1 Frequency of Analysis (FOA) = 5 percent or one per batch, whichever is more frequent.

2 Surrogate spikes required for every sample, including matrix spiked samples, blanks, and reference materials.

3 Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria.

4 Ongoing calibration required at the beginning of each work shift, every 10–12 samples, or every 12 hours (whichever is more frequent), and at the end of each shift.

5 Matrix spike duplicate will be run.

A written report will be prepared by the analytical laboratory documenting all the activities associated with sample analyses. As a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results,
- All protocols used during analyses,
- COC procedures including explanation of any deviation from those identified herein,
- Any protocol deviations from the approved sampling plan, and
- Location and availability of the data.

In addition, QA2 data as required by Ecology for the Environmental Information Management sediment quality (SEDQUAL) database will be submitted along with the report (see Appendix B for QA2 requirements).

6.2 Data Quality Assurance Review Procedures

The analytical results will undergo a Level III data validation review by EcoChem of Seattle, WA. If data fail the review, the laboratory will be contacted and the data will be (a) reanalyzed, (b) qualified, or (c) unqualified with an explanation. For each data type, the quality of the data will be summarized in validation memos.

In addition, QA2 data packages will be provided for the chemistry data to allow independent data verification and validation. The QA2 data packages will consist of the sample results followed by a cover letter describing procedures used and analytical problems encountered, qualifiers used, reconstructed ion chromatogram (GC/MS), mass spectra of detected target compounds (GC/MS), chromatograms (GC/ electron capture detector [ECD]), quantification reports, and calibration data summaries. Dilution volumes, sample sizes, percent moisture, and surrogate recoveries will be presented on each summary sheet with the analytical results. A similar package is also assembled for each quality control sample (e.g., method blank).

7.0 Data Analysis, Record Keeping, and Reporting Requirements

7.1 Data Evaluation and Interpretation

The data evaluation of sediment grab data will include: (1) the tabulation of chemistry results, (2) comparison of chemistry results with SMS SQS and CSL criteria and DMMP interim criteria for dioxins/furans, (3) evaluation of chemical results on a spatial scale, (4) overlay maps with pertinent data, and (5) data quality assurance of chemistry results.

Evaluation of sediment core data will consist of: (1) the tabulation of chemistry results, (2) overlay maps with pertinent data, (3) comparison of chemistry results with SMS SQS and CSL values and historical data (where available) (4) evaluation of sediment stratification, (5) comparison to historical environmental data, where appropriate, and (6) data quality assurance of chemistry results. Additional data evaluations (i.e., spatial analysis, isopleth maps, measures of central tendency, and regression analysis) may be conducted, as needed, to discern origins and trends in contamination.

Evaluation of sedimentation rate and biological surface mixed layer data will consist of: (1) tabulation of radioisotope analysis results, (2) evaluation of sedimentation rates and surface mixed layer depth in inner Budd Inlet relative to dioxin/furan contamination, and (3) data quality assurance of analytical results.

Evaluation of tissue data will include: (1) the tabulation of dioxin/furan results, (2) comparison to historical environmental data, where appropriate, and (3) data quality assurance of dioxin/furan results.

7.2 Reporting Procedures

A written report shall be prepared by SAIC documenting all activities associated with collection, compositing, transportation of samples, and chemical analysis of samples. The analytical laboratory reports will be included as appendices. A summary of the project and reporting schedule is provided in Table 7.

Table 7. Project and Reporting Schedule

Work Item	Date
Begin Sediment Sampling	April 2, 2007
Draft RI Report	June 30, 2007
Data Submittal to Ecology	June 30, 2007
Final RI Report	One week following receipt of Ecology comments

At a minimum, the following will be included in the data report:

- Summary of sampling, positioning, chemical testing, QA/QC procedures, and any deviations from the approved SAP;
- Hard copy of analysis results and QA data for chemical testing;
- A plan view of the project showing the actual sampling location;
- COC procedures used and explanation of any deviations from the sampling plan procedures;
- Description of sampling and compositing procedures;
- Final QA report as described in Section 6.1;
- Chemical testing data, with comparisons to SMS guidelines where appropriate; and
- QA2 data to allow independent data validation by Ecology. The QA2 data will be submitted to Ecology upon receipt in order to allow an independent QA/QC review, if required. These data are listed in Appendix B.

8.0 Literature Cited

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Appendix A
Sample Field Forms

Appendix A
Sample Field Forms

SEDIMENT CORING LOG

Core Number _____

PROJECT NAME: 2007 Budd Inlet Sampling
DATE SAMPLED: _____
LOCATION: _____
TIME: _____
UNCORRECTED DEPTH (-FT) _____
NOS WATER LEVEL (TIDE): _____
WATER DEPTH MLLW: _____
_____
SAMPLED BY: _____
_____
_____

CORE PENETRATION: _____
CORE RECOVERY: _____
% RECOVERY: _____
SAMPLING METHOD: _____
POSITION METHOD: _____
LATITUDE: _____
LONGITUDE: _____
NORTHING: _____
EASTING: _____
WEATHER: _____
_____
_____

DEPTH				
Recovered Core Length	Feet Below Mudline Based on Actual % Recovery	SAMPLE ID	SEDIMENT DESCRIPTION	COMMENTS
1 2 3 4 5 6 7				

REVIEWED BY: _____ PAGE _____ OF _____

Surface Sediment Collection Form

Project: 2007 Budd Inlet Sediment Characterization

Sampling Event:____________________

Station:___________________________

Date:______________________________

Crew:____

Grab #:	**Bottom Depth:**	**Penetration Depth:**	**Time:**
Sediment Type:	***Sediment Color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H_2S	
Shell debris		Petroleum	
Grab #:	**Bottom Depth:**	**Penetration Depth:**	**Time:**
Sediment Type:	***Sediment Color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H_2S	
Shell debris		Petroleum	
Grab #:	**Bottom Depth:**	**Penetration Depth:**	**Time:**
Sediment Type:	***Sediment Color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H_2S	
Shell debris		Petroleum	
Grab #:	**Bottom Depth:**	**Penetration Depth:**	**Time:**
Sediment Type:	***Sediment Color:***	***Sediment Odor:***	***Comments:***
Cobble	Drab olive	None	
Gravel	Brown	Slight	
Sand C M F	Brown surface	Moderate	
Silt/clay	Gray	Strong	
Organic matter	Black	Overwhelming	
Woody debris	Other:	H_2S	
Shell debris		Petroleum	

Field Record for Tissue Collections — Budd Inlet Investigation

Project Number: _____ Sampling Date and Time: _____

Site Location: _____

Collection Method: _____ Vessel Name: _____

Data Recorder: _____ Personnel: _____

FISH OR SHELLFISH COLLECTED

Species Name: _____ **Replicate Number:** _____

Composite Sample ID: _____ Number of Individuals: _____

Count	Length (mm)	Weight (g)	Sex	Count	Length (mm)	Weight (g)	Sex
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

Minimum length / Maximum length X 100 = _____% Composite mean length _____mm

Notes (e.g., morphological anomalies): _____

Species Name: _____ **Replicate Number:** _____

Composite Sample ID: _____ Number of Individuals: _____

Count	Length (mm)	Weight (g)	Sex	Count	Length (mm)	Weight (g)	Sex
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

Minimum length / Maximum length X 100 = _____% Composite mean length _____mm

Notes (e.g., morphological anomalies): _____

Sample Container Logbook

2007 Budd Inlet Sediment Characterization	**Region:**
Project Number:	**Time Collected:**
Crew:	**Date:**
Comments:	

Sample Container Tag Number	Sample ID	Analysis	Laboratory

Notes:

SAIC From Science to Solutions

Completed by:_____

SAIC
From Science to Solutions

18912 North Creek Parkway, Suite 101
Bothell, Washington 98011
TEL: 425.485.5800 • FAX: 425.485.5566

CHAIN OF CUSTODY RECORD

Project No.: _____ Project Mgr: _____
Project Name: 2007 Budd Inlet Sediment Characterization
Project Location: Budd Inlet, Olympia, WA
Sample Collectors: _____
Client Name: _____

Sample ID	Depth	Matrix	Date	Time	# of Containers	Analyses / Tests	Comments

Shipping Information

Number of Shipping Containers:

Date Shipped:

Carrier:

Waybill No.:

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: _____	Signature: _____	Signature: _____	Signature: _____
Date/Time: _____	Date/Time: _____	Date/Time: _____	Date/Time: _____
Affiliation: _____	Affiliation: _____	Affiliation: _____	Affiliation: _____

• White: Lab Returns to Originator Upon Receipt of Samples; • Canary: Lab Retains; • Pink: Lab Returns to Project Manager with Final Report; • Goldenrod: Retained by Sampler

Appendix B
QA2 Data Requirements

QA2 Data Requirements
Chemical Variables

ORGANIC COMPOUNDS

The following documentation is needed for organic compounds:

- A cover letter referencing or describing the procedure used and discussing any analytical problems
- Reconstructed ion chromatograms for GC/MS analyses for each sample
- Mass spectra of detected target compounds (GC/MS) for each sample and associated library spectra
- GC/ECD and/or GC/flame ionization detection chromatograms for each sample
- Raw data quantification reports for each sample
- A calibration data summary reporting calibration range used (and decafluorotriphenylphosphine [DFTPP] and bromofluorobenzene [BFB] spectra and quantification report for GC/MS analyses)
- Final dilution volumes, sample size, wet-to-dry ratios, and instrument detection limit
- Analyte concentrations with reporting units identified (to two significant figures unless otherwise justified)
- Quantification of all analytes in method blanks (ng/sample)
- Method blanks associated with each sample
- Recovery assessments and a replicate sample summary (laboratories should report all surrogate spike recovery data for each sample; a statement of the range of recoveries should be included in reports using these data)
- Data qualification codes and their definitions

METALS

For metals, the data report package for analyses of each sample should include the following:

- Tabulated results in units as specified for each matrix in the analytical protocols, validated and signed in original by the laboratory manager
- Any data qualifications and explanation for any variance from the analytical protocols
- Results for all of the QA/QC checks initiated by the laboratory
- Tabulation of instrument and method detection limits

All contract laboratories are required to submit metals results that are supported by sufficient backup data and quality assurance results to enable independent QA reviewers to conclusively determine the quality of the data. The laboratories should be able to supply legible photocopies of original data sheets with sufficient information to unequivocally identify:

- Calibration results
- Calibration and preparation blanks
- Samples and dilutions
- Duplicates and spikes
- Any anomalies in instrument performance or unusual instrumental adjustments

Appendix C
Health and Safety Plan

Location: Budd Inlet, Olympia, WA

Site description: Budd Inlet is located in the southernmost portion of Puget Sound, just north of the Washington State Capitol of Olympia. The 60-acre Port of Olympia terminal contains three deepwater berths, an on-dock rail, and a container yard.

Scope of work to be performed by SAIC: SAIC will provide support to the Washington State Department of Ecology (Ecology) to better determine the extent of dioxins/furans (vertically and spatially) in the Olympia Harbor federal navigation channel and proposed dredged sediments, determine the overall extent of dioxin/furan contamination in Budd Inlet, evaluate the potential sources of dioxins/furans in Budd Inlet, and identify priority areas for remediation based on potential for disturbance due to navigation access to the Port of Olympia facilities.

Mr. Russ McMillan is the program manager for Ecology. Mr. John Nakayama, SAIC, will be the contractor field manager and will be responsible for the collection and processing of surface grabs and core samples in accordance with the Sampling and Analysis Plan (SAP) and transport of samples to the analytical laboratory for chemical analysis. He will be responsible for coordinating with the vessel captains of the R/V *Kittiwake* and R/V *Nancy Anne* to collect sediment cores, grab samples, and tissue samples. He will ensure that the vessels provide accurate station positioning.

Sediment Core Sample Collection

SAIC will be responsible for the collection of sediment core samples from 12 locations using a vibracore sediment sampler deployed from the R/V *Nancy Anne*, as described in the SAP. A differential global position system (DGPS) will be used to position the vessel to an accuracy of ±3 meters. The vibracore is equipped with an aluminum core barrel. The vibracore is deployed from the vessel by winch, lowered to the seafloor, the vibratory head is activated, and the core barrel advanced into the sediment until refusal or the desired penetration length is obtained. The vibracore sampler is then retrieved, and the core barrel is removed with the sediment sample. The core sample will be transferred to shore for processing by SAIC personnel. All excess sediment remaining after sampling and processing will be returned to the vicinity of the collection site.

On shore, SAIC personnel will open the core samples with a modified circular saw, and will then collect subsamples for chemical analyses (dioxins/furans, etc.). Sediment samples will be composited by SAIC in pre-cleaned stainless steel bowls, and transferred to pre-labeled sample jars and placed on ice in coolers. Following completion of coring operations, SAIC will pack the sample jars in iced coolers and send them by overnight courier to the analytical laboratories.

Sediment Grab Sample Collection

SAIC will be responsible for the collection sediment grab samples from 29 locations using a double van Veen or single Young grab sampler deployed from the R/V *Kittiwake*, as described in the SAP. A DGPS will be used to position the vessel to an accuracy of ±3 meters. The van Veen grab is deployed from the vessel by winch, lowered to the seafloor, the grab is activated, and the “jaws” of the grab advance into the sediment. The grab sampler is then retrieved, the overlying water is siphoned off, and the sediment is processed by SAIC personnel. All excess sediment remaining after sampling will be washed overboard in the vicinity of the collection site.

At the stern of the vessel, SAIC personnel will transfer the sediment to a pre-cleaned stainless steel bowl for compositing; sediment will then be transferred to pre-labeled sample jars and placed on ice in coolers. Following completion of sampling operations, SAIC will pack the sample jars in iced coolers and send them by overnight courier to the analytical laboratories.

Tissue Sample Collection

SAIC will be responsible for the collection of English sole and Dungeness crab tissue samples from three locations using both either a beam trawl net or an otter trawl net. The trawl net will be used to collect sole and crabs, and will be deployed from the R/V *Kittiwake*. The trawl net will be deployed from the vessel by winch, lowered to the seafloor, dragged along the seafloor, and retrieved. The contents of the trawl net will be emptied on deck by SAIC personnel, and the target organisms will be separated and removed. All non-target organisms (bycatch) will be deposited overboard in the vicinity of the collection site.

Target organisms will be placed into pre-labeled sample containers, and placed on ice in coolers. Following completion of sampling operations, SAIC will pack the sample jars in iced coolers and send them by overnight courier to the analytical laboratories.

SAIC will be responsible for collection of littleneck and Manila clam tissue samples from up to three locations using hand shovels and trowels. SAIC personnel will walk along the shoreline of publicly accessible beaches at low tide, and will dig clams from their burrows along the shore. Target organisms will be collected in buckets, and transferred to the R/V *Kittiwake* for processing.

Target organisms will be placed into pre-labeled sample containers, and placed on ice in coolers. If not sent immediately to the laboratory, the tissue samples will be taken to SAIC's warehouse in Bothell, WA, and frozen at -18°C. Following completion of sampling operations, SAIC will pack the sample jars in iced coolers and send them by overnight courier to the analytical laboratories.

Field Equipment Decontamination

Sample homogenization equipment, including stainless steel mixing utensils and bowls will be decontaminated following procedures in the SAP. The instrument will be scrubbed with site water, washed with phosphate-free detergent (i.e., Alconox™), and rinsed with distilled water. If a noticeable oily sheen or petroleum odor is observed, sampling gear and utensils used to process those samples will not be used for further sample processing. All hand work will be conducted with disposable nitrile gloves, which will be changed after handling each individual sample, as appropriate, to prevent cross contamination between samples and composites.

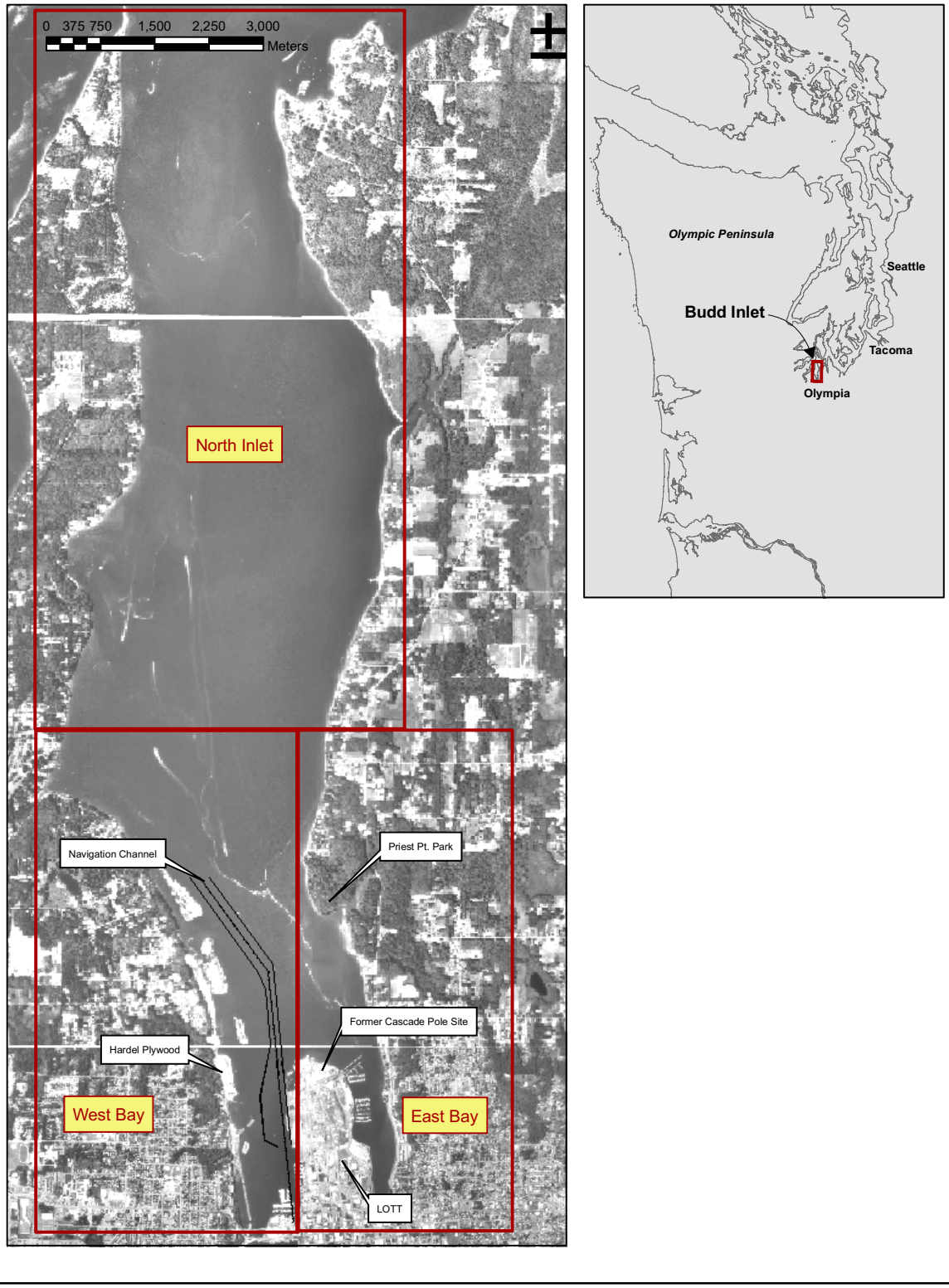

Figure 1. Budd Inlet Site Overview

SIGNATURES

Approval signatures: Signature below indicates review and approval of the plan and agreement that the anticipated hazards are correct and that planned hazard controls are sufficient.

Project Manager (PM) or Field Manager (FM) name and phone number:
PM/FM John Nakayama (425) 482-3313

Signature and date:

CIH, CSP or designee name and phone number:
Terry McMahon CSP, CPEA (510) 433-0835

Signature and date:

3/23/07 

Commitment to implement: Signature below indicates commitment to implement this plan and to ensure that project fieldwork is conducted safely.

Field Manager/Site Safety and Health Officer name and phone number:
SSHO John Nakayama (425) 482-3313

Signature and date:

Commitment to comply:
Signature below indicates that the individual has reviewed this plan, has received site-specific training (briefing), and agrees to comply with the requirements of this plan.

Name	Signature	Date

Potential Hazards and Emergency Information

Potential Hazards

Traffic accidents associated with travel to and from the site
Collision with other vessels or land structures (piers, unmarked navigation hazards)
Person overboard, drowning
Contact with powered rotating, vibrating, pressurized and/or hydraulic equipment, pinching hazards (winch drum, boom, moving cables)
Contact with swinging sampling gear (vibracore attached to winch cable over side of vessel)
Potential exposure to onsite contaminants (sediments)
Environmental exposure (weather, rain, temperature extremes)
Physical hazards (trip/fall, cuts/contusions, etc.)
Fire or explosion

Emergency Phone Numbers

Medical: 911	Port of Olympia: (360) 528-8000
Police/security: 911	
Fire: 911	
Coast Guard: 911 or (510) 437-3701	

Emergency Medical Facility (San Francisco)

Providence St. Peter Hospital

(360) 491-9480
1-888-492-9480 (toll-free)
413 Lilly Road NE
Olympia, WA 98506

Directions to Providence St. Peter Hospital:

1) From Swan Town Marina **(A)**, 1022 Marine Dr NE, head southeast and turn RIGHT onto E Bay Dr NE – go 0.3 miles
2) E Bay Dr NE becomes Plum St SE – go 0.1 miles
3) Turn LEFT onto 4th Ave E. – go 1.3 miles
4) 4th Ave E becomes Martin Way E. – go 1 mile.
5) Turn LEFT onto Lilly Rd NE – go 0.3 miles, arrive at hospital **(B)**.

Emergency Equipment Required On Site

Cellular phone (or verify immediate access to immediately available landline)
First aid kit (10 unit unitized kit or larger)
Fire extinguisher(s) rated at least 2A and 5B– Serviced annually and inspected monthly
Coast Guard approved floating devices (work vests or float coats)

Emergency Reporting

The FM will immediately report injuries or illnesses (requiring treatment other than first aid), vessel or vehicle accidents, releases (hazardous material, hazardous waste, or uncharacterized waste), inspections by regulatory agencies, and any incident that could reasonably have caused a significant injury or property damage (man overboard, fire, catastrophic equipment failure, capsized vessel, etc.). The FM will contact emergency response organizations (if needed) and the PM. The PM will notify the client (as appropriate), Division Manager, Program Manager, and H&S Manager. If the PM is not available, the FM will make the other notifications. See EC&HS Procedures 4, Accident Reporting and 24, Regulatory Agency Inspections and Incident Reporting for details.

This plan represents a good-faith effort to identify, evaluate, and prescribe controls for the hazards that will be posed by this work. Revisions to this plan will be documented. The Project Manager and CIH, CSP, or designee who originally approved the plan must approve revisions to the plan that result in decreasing or eliminating a hazard control.

This work is subject to the requirements of the SAIC Environmental Compliance and Health and Safety (EC&HS) program. The FM will insure that applicable provisions of EC&HS procedures are followed and that personnel have access to these procedures. Specifically applicable procedures include, but are not limited to; Procedure 4, Accident Reporting; Procedure 8, Hazard Communication and Hazardous Chemical Control; Procedure 13, Personal Protective Equipment; Procedure 15, Hearing Conservation and Noise Control; Procedure 24, Regulatory Agency Inspections and Incident Reporting; EC&HS Procedure 110, Vehicle Operation; EC&HS Procedure 150, Manual Lifting.

The FM will perform and document daily safety inspections to verify that the work is performed safely, that the requirements of this plan are met, that the public is not endangered by this work, and that no environmental releases or violations occur as a result of this work. All on-site personnel and subcontractors will be responsible to report unsafe, or potentially unsafe, conditions to the FM immediately. The FM will take action to correct any work that he/she judges to be unsafe or non-compliant with this plan. See EC&HS Procedure 20 for details.

Project training will include at least the following: The FM will have sufficient experience to understand the potential hazards. The FM will present a project kick-off safety briefing to cover this plan, physical hazards, potentially hazardous contaminants and chemicals, required hazard controls, and emergency contacts and additional safety briefings as needed (at least once per week). At least one person on site will have current first aid and cardiopulmonary resuscitation training. The FM will maintain documentation of completed training on site. See EC&HS Procedures 8 and 20 for details.

The Project Manager will be responsible for verifying that field personnel have received appropriate training or experience to safely perform their assigned tasks.

Field personnel will utilize personnel protective equipment (PPE) as directed in this plan and by EC&HS Procedure 13. PPE for fieldwork will include safety glasses (if splash hazards exist), steel toed rubber boots, rain gear or other waterproof protective clothing, hard hats if overhead hazards are present, ear plugs (if noise hazards exist) and chemical resistant gloves (nitrile, PVC, or similar) if handling sediments. The FM will evaluate PPE during routine inspections and will ensure that PPE is appropriate to the task. Respiratory protection is not required for this sampling program.

All vehicle operators must have valid driver licenses and operate in compliance with applicable laws and regulations. See EC&HS Procedure 110 for details.

No hot work or open flame is allowed in areas where flammable substances may be present. No hot work will be initiated without expressed authorization of the FM for each hot work event. Decontamination will consist of washing with a phosphate free detergent. Decontamination with flammable and combustible liquids and acids will not be conducted. MSDSs for any hazardous chemicals must be available on-site. Transportation of hazardous materials, if needed, must be performed per DOT or IATA requirements. See FTP 651 for guidance.

An exclusion zone is established around the back deck of the vessel when sediment processing operations (vibracore subsampling, sediment compositing and processing) are occurring to exclude unauthorized personnel. The back deck of the vessel is not considered an exclusion zone when sediment sampling operations are not occurring and the back deck of the vessel is free of sediment. No food or drink will be allowed in the exclusion zone. Personnel will wash their hands prior to eating or drinking. The FM will determine if additional personal decontamination is needed.

Excess sediments, wash water, or other site-derived materials (e.g., wood debris) will be washed overboard in the vicinity of the collection site.

Each employee is empowered and expected to stop his or her own work or the work of co-workers if any person's safety or the environment are at risk. The FM is expected to support and reinforce this expectation. Stopped work will not resume until the hazard has been controlled and a SPSA has been performed.

Job Safety Analysis

Organization: SAIC
Work Activity: Sediment sampling from vessel using a vibracore sampler or van Veen grab sampler

Personal Protective Equipment (PPE)	Selected	Comments
Clothing	X	Rain gear (tops and bottoms) as necessary
Safety Shoes	X	Steel toed rubber boots
Hard Hat	X	
Safety Glasses	X	As necessary
Fire Resistant Clothing		
Face Shields		
Goggles		
Coast Guard approved Personal Floatation Devices (PFDs)	X	To be worn during vessel operations over the side (e.g. equipment deployment/retrieval operations)
Hearing Protection	X	As necessary for vibracore operation
Air Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		
Welding/Pipe Clothing		
Welding Mask/Goggles		
Gloves	X	As necessary. Nitrile, PVC, or similar will be used when handling sediments to prevent cross contamination.
Other		
Safety Cones/Barricades		
Safety Vest		
Knee Pads		
Caution Tape		
Back Belt/Support		

Development Team Member Name	Primary Contact	Position
John Nakayama	Y	SSHO

No	Job Steps	Potential Hazard	Critical Actions
1	Mobilize to work site	Traffic accident	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving)

2	Sediment sampling from vessel	Being struck by sampling equipment attached to winch cable	The sampling vessel will provide a trained winch operator. The operator will keep the sampler low to the deck when deploying to minimize swinging. The sampler will be deployed and retrieved when the vessel is relatively stable (e.g., wait until wakes from passing vessels have dissipated). Personnel will not stand under the sampler when elevated and will stand clear of areas where the sampler can swing and strike personnel (e.g., between sampler and gunwale of vessel). If necessary, tag lines will be used to minimize the swing of the sampler during deployment. When not in use, the sampler should be securely fastened to the deck.
		Man overboard and drowning	Personnel will wear Coast Guard approved PFDs when working on the outside deck of the vessel. A vessel safety briefing will be conducted prior to the start of operations to discuss steps to be taken if a man overboard should occur. Life ring with deployable rescue line available on board.
		Slips, trips, and falls	Lines, hoses, hatch covers, and mud on the deck present tripping, slipping, and falling hazards. Every crew member should make an effort to keep the working surfaces of the deck clear and clean by coiling hoses and lines and rinsing accumulations of mud from the deck.
		Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area (vessel cabin).
		Lifting (musculoskeletal injuries)	Compliance with ECHS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
		Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use areas.
		Potential contaminant exposure through sediments	High levels of chemical contaminants in the sediments are not expected based on historical sampling. However, personnel will wear nitrile gloves when handing sediments. Safety glasses will be worn when splash hazards exist. If incidental skin contact occurs with sediments, rinse away sediment as soon as possible. Wash hands before eating or drinking.

Job Safety Analysis

Organization: SAIC
Work Activity: Equipment decontamination

Personal Protective Equipment (PPE)	Selected	Comments
Clothing	X	Rain gear (tops and bottoms) or Tyvek coveralls
Safety Shoes	X	Steel toed rubber boots
Hard Hat	X	
Safety Glasses	X	
Fire Resistant Clothing		
Face Shields		
Goggles	X	Goggles for splash hazards
Coast Guard approved Personal Floatation Devices (PFDs)	X	To be worn during vessel operations over the side (e.g. equipment deployment/retrieval operations)
Hearing Protection		
Air Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		
Welding/Pipe Clothing		
Welding Mask/Goggles		
Gloves	X	Nitrile, PVC, or similar for potentially contaminated material and decontamination fluids
Other		
Safety Cones/Barricades		
Safety Vest		
Knee Pads		
Caution Tape		
Back Belt/Support		

Development Team Member Name	Primary Contact	Position
John Nakayama	Y	SSHO

Job Steps			
No	Job Steps	Potential Hazard	Critical Actions
1	Mobilize to work site	Traffic accident	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving).
2	Equipment decontamination by Liquinox and water rinse	Lifting (musculoskeletal injury)	Compliance with EC&HS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
		Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area, and provisions for emergency heating or cooling).
		Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel/flammable liquid use areas.
		Chemical exposure	Nitrile gloves for possible chemical/contaminant contact. Wash hands before eating or drinking. Chemical containers labeled with identity and hazard. MSDSs on site for all chemicals in use. Site-specific training must address chemicals, hazards, and proper handling.

Job Safety Analysis		
Organization: SAIC Work Activity: Bottom trawling		
Personal Protective Equipment (PPE)	Selected	Comments
Clothing	X	Rain gear (tops and bottoms) or Tyvek coveralls
Safety Shoes	X	Steel toed rubber boots
Hard Hat	X	
Safety Glasses	X	
Fire Resistant Clothing		
Face Shields		
Goggles	X	Goggles for splash hazards
Coast Guard approved Personal Floatation Devices (PFDs)	X	To be worn during vessel operations over the side (e.g. equipment deployment/retrieval operations)
Hearing Protection		
Air Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		
Welding/Pipe Clothing		
Welding Mask/Goggles		
Gloves	X	Puncture resistant or similar for sharp spines and crab claws.
Other		
Safety Cones/Barricades		
Safety Vest		
Knee Pads		
Caution Tape		
Back Belt/Support		
Development Team Member Name	Primary Contact	Position
John Nakayama	Y	SSHO

Job Steps			
No	Job Steps	Potential Hazard	Critical Actions
1	Mobilize to work site	Traffic accident	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving).

2	Sediment sampling from vessel	Being struck by trawl net attached to winch cable or being entangled by the net	The sampling vessel will provide a trained winch operator. The operator will keep the net low to the deck when deploying to minimize swinging. The net will be deployed and retrieved when the vessel is relatively stable (e.g., wait until wakes from passing vessels have dissipated). Personnel will not stand under the net when elevated and will stand clear of areas where the net can swing and strike personnel (e.g., between sampler and gunwale of vessel). If necessary, tag lines will be used to minimize the swing of the net during deployment. When not in use, the net should be securely fastened to the deck. Personnel will also take care to ensure that they are not entangled in the net prior to deployment
		Man overboard and drowning	Personnel will wear Coast Guard approved PFDs when working on the outside deck of the vessel. A vessel safety briefing will be conducted prior to the start of operations to discuss steps to be taken if a man overboard should occur. Life ring with deployable rescue line available on board.
		Slips, trips, and falls	Lines, hoses, hatch covers, and mud on the deck present tripping, slipping, and falling hazards. Every crew member should make an effort to keep the working surfaces of the deck clear and clean by coiling hoses and lines and rinsing accumulations of mud from the deck.
		Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area (vessel cabin).
		Lifting (musculoskeletal injuries)	Compliance with ECHS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
		Fire	Fire extinguisher rated 2A and 5B (serviced annually and inspected monthly) in all fuel use areas.
		Potential contaminant exposure through sediments	High levels of chemical contaminants in the sediments are not expected based on historical sampling. However, personnel will wear nitrile gloves when handing sediments. Safety glasses will be worn when splash hazards exist. If incidental skin contact occurs with sediments, rinse away sediment as soon as possible. Wash hands before eating or drinking.

Job Safety Analysis		
Organization: SAIC Work Activity: Bivalve sampling		
Personal Protective Equipment (PPE)	Selected	Comments
Clothing	X	Rain gear (tops and bottoms) or Tyvek coveralls
Safety Shoes	X	Steel toed rubber boots
Hard Hat		
Safety Glasses	X	
Fire Resistant Clothing		
Face Shields		
Goggles	X	Goggles for splash hazards
Coast Guard approved Personal Floatation Devices (PFDs)		
Hearing Protection		
Air Purifying Respirator		
Supplied Air Respirator – SCBA		
Welding Hood		
Welding/Pipe Clothing		
Welding Mask/Goggles		
Gloves	X	Puncture resistant or similar for sharp spines and other sharp objects on beach
Other		
Safety Cones/Barricades		
Safety Vest		
Knee Pads		
Caution Tape		
Back Belt/Support		
Development Team Member Name	Primary Contact	Position
Brion Dolan	Y	Marine Scientist

Job Steps			
No	Job Steps	Potential Hazard	Critical Actions
1	Mobilize to work site	Traffic accident	Compliance with EC&HS Procedure 110, Vehicle Operation (valid drivers license, seat belt use, routine vehicle inspections, no cell phone use while driving).
2	Bivalve sampling	Drowning due to rising tide	Personnel will only sample beaches on falling tides. Tide tables will be consulted prior to sampling to ensure that personnel will not encounter rising tides.
		Temperature stress	If temperature is above 80°F or below 40°F, administrative controls will be implemented (cooled or warmed drinks, routine breaks in heated or shaded area (vessel cabin).
		Lifting (musculoskeletal injuries)	Compliance with ECHS Procedure 150, Manual Lifting. If equipment is to be moved, an evaluation of potential pinch points and/or weight strain will be conducted. Clear area of all unnecessary equipment and slip/trip hazards. Additional help will be obtained by workers or mechanical assistance used on-site if equipment to be moved is unwieldy, has a weight >50 lbs or has to be moved by maneuvering through awkward positioning.
		Potential contaminant exposure through sediments	High levels of chemical contaminants in the sediments are not expected based on historical sampling. However, personnel will wear nitrile gloves when handing sediments. Safety glasses will be worn when splash hazards exist. If incidental skin contact occurs with sediments, rinse away sediment as soon as possible. Wash hands before eating or drinking.
		Potential contaminant exposure through organisms	Personnel will not eat any organisms.
		Cuts/pinches due to handling organisms	Personnel will wear heavy gloves during sampling to protect against organisms (sharp bivalve shells, sharp objects on beach, etc.)

MATERIAL SAFETY DATA SHEETS

Liquinox
Dioxin

Material Safety Data Sheet (MSDS)

Section 1 — Chemical Product and Company Identification

Liquinox, Laboratory Cleaner

Flinn Scientific, Inc. P.O. Box 219 Batavia, IL 60510 (800)452-1261
CHEMTREC Emergency Phone Number: (800) 424-9300
MSDS #: 249
Revision Date: November 25, 2002

Section 2 — Composition, Information on Ingredients

Proprietary mixture manufactured by Alconox, Inc.
CAS #: None Established

Section 3 — Hazards Identification

Yellow liquid. Practically odorless.
Irritating to eyes. May be irritating to mucous membranes.

FLINN AT-A-GLANCE

Health-0
Flammability-0
Reactivity-0
Exposure-1
Storage-0
0 is low hazard, 3 is high hazard

Section 4 — First Aid Measures

Call a physician, seek medical attention for further treatment, observation and support after first aid.
Inhalation: Remove to fresh air at once. If breathing has stopped give artificial respiration immediately.
Eye: Immediately flush with fresh water for 15 minutes.
External: Wash continuously with fresh water for 15 minutes.
Internal: Rinse out mouth, give 1 to 2 cups of water or milk, and induce vomiting. Call a physician or poison control at once.

Section 5 — Fire Fighting Measures

Non flammable, non combustible liquid.
When heated to decomposition, emits toxic fumes of CO, CO2, and SO2.
Fire Fighting Instructions: Use triclass, dry chemical fire extinguisher. Firefighters should wear PPE and SCBA with full facepiece operated in positive pressure mode.

NFPA CODE

None Established

Section 6 — Accidental Release Measures

Material foams profusely. Cleaner is biodegradable. Restrict unprotected personnel from area and ventilate area. Contain spill with sand or absorbent material; deposit in sealed bag or container. See Sections 8 and 13 for further information.

Section 7 — Handling and Storage

Flinn Suggested Chemical Storage Pattern: Inorganic Miscellaneous, or near washing area.

Section 8 — Exposure Controls, Personal Protection

Avoid contact with eyes, skin, and clothing. Wear chemical splash goggles, chemical-resistant gloves and chemical-resistant apron.

Section 9 — Physical and Chemical Properties

Yellow liquid. Practically odorless.
Liquinox is a trade name. An anionic detergent.
Solubility: Completely soluble in water.
Specific Gravity: 1.065
Boiling Point: 210 C

Section 10 — Stability and Reactivity
Avoid contact with strong oxidizing agents.
Shelf life: Good.

Section 11 — Toxicological Information
Acute effects: Irritant
Chronic effects: N.A.
Target organs: N.A.
ORL-RAT LD50: N.A.
IHL-RAT LC50: N.A.
SKN-RBT LD50: N.A.

N.A. = Not available, not all health aspects of this substance have been fully investigated.

Section 12 — Ecological Information
Data not yet available.

Section 13 — Disposal Considerations
Please consult with state and local regulations.
Flinn Suggested Disposal Method #26b is one option.

Section 14 — Transport Information
Shipping Name: Not regulated
Hazard Class: N/A
UN Number: N/A

N/A = Not applicable

Section 15 — Regulatory Information
Not listed.

Section 16 — Other Information
Consult your copy of the Flinn Scientific Catalog/Reference Manual for additional information about laboratory chemicals. This Material Safety Data Sheet (MSDS) is for guidance and is based upon information and tests believed to be reliable. Flinn Scientific Inc. makes no guarantee of the accuracy or completeness of the data and shall not be liable for any damages relating thereto. The data is offered solely for your consideration, investigation, and verification. Flinn Scientific Inc. assumes no legal responsibility for use or reliance upon this data.

Liquinox, Laboratory Cleaner

DOD Hazardous Material Information (ANSI Format)

http://msds.ehs.cornell.edu/msds/msdsdod/a447/m223180.htm

DIOXIN MIX, M-8280A

Section 1 - Product and Company Identification
DIOXIN MIX, M-8280A

Product Identification: DIOXIN MIX, M-8280A
Date of MSDS: 06/15/1995 **Technical Review Date:** 08/27/1996
FSC: 6850 **NIIN: LIIN:** 00N072524
Submitter: N EN
Status Code: C
MFN: 01
Article: N
Kit Part: N

Manufacturer's Information

Manufacturer's Name: ACCUSTANDARD INC
Manufacturer's Address1: 25 SCIENCE PARK SUITE 687
Manufacturer's Address2: NEW HAVEN, CT 06511
Manufacturer's Country: US
General Information Telephone: 203-786-5290
Emergency Telephone: 203-786-5290
Emergency Telephone: 203-786-5290
MSDS Preparer's Name: N/P
Proprietary: N
Reviewed: N
Published: Y
CAGE: 0U4A8
Special Project Code: N

Contractor Information

Contractor's Name: ACCUSTANDARD INC
Contractor's Address1: 125 MARKET ST
Contractor's Address2: NEW HAVEN, CT 06513
Contractor's Telephone: 203-786-5290
Contractor's CAGE: 0U4A8

Section 2 - Composition/Information on Ingredients
DIOXIN MIX, M-8280A

Ingredient Name: DIBENZO-P-DIOXIN, 1,2,3,4,6,7,8,9-OCTACHLORO-; (OCTACHLORODIBENZO-P-DIOXIN)
Ingredient CAS Number: 3268-87-9 **Ingredient CAS Code:** M
RTECS Number: HP3350000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 0.0005
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: DIBENZO-P-DIOXIN, 1,2,3,4,6,7,8-HEPTACHLORO-; (1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN)
Ingredient CAS Number: 35822-46-9 **Ingredient CAS Code:** M
RTECS Number: HP3190000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 0.0005
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: DIBENZO-P-DIOXIN, 1,2,3,7,8-PENTACHLORO-; (1,2,3,7,8-PENTACHLORODIBENZO-P-DIOXIN)
Ingredient CAS Number: 40321-76-4 **Ingredient CAS Code:** M
RTECS Number: HP3395000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 0.0005
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: DIBENZO-P-DIOXIN, 2,3,7,8-TETRACHLORO-; (2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN) (TCDD) (CERCLA)
Ingredient CAS Number: 1746-01-6 **Ingredient CAS Code:** M
RTECS Number: HP3500000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 0.0005
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: DIBENZO-P-DIOXIN, HEXACHLORO-; (1,2,3,4,7,8-HEXACHLORODIBENZO-P-DIOXIN)
Ingredient CAS Number: 39227-28-6 **Ingredient CAS Code:** M
RTECS Number: HP3200000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:

% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 0.0005
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: N/K (FP N) **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: N/K (FP N) **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: TOLUENE (SARA 313) (CERCLA)
Ingredient CAS Number: 108-88-3 **Ingredient CAS Code:** M
RTECS Number: XS5250000 **RTECS Code:** M
=WT: =WT Code:
=Volume: =Volume Code:
>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: 99.99
% Environmental Weight:
Other REC Limits: N/K
OSHA PEL: 200 PPM **OSHA PEL Code:** M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: 50 PPM, S **ACGIH TLV Code:** M
ACGIH STEL: N/P **ACGIH STEL Code:**
EPA Reporting Quantity: 1000 LBS
DOT Reporting Quantity: 1000 LBS
Ozone Depleting Chemical: N

Section 3 - Hazards Identification, Including Emergency Overview
DIOXIN MIX, M-8280A

Health Hazards Acute & Chronic: ACUTE: HARMFUL OR FATAL IF SWALLOWED. VAPOR HARMFUL IF INHALED. SYMPTOMS: HEADACHE, DIZZINESS, HALLUCINATIONS, DISTORDED PERCEPTIONS, CHANGES IN MOTOR ACTIVITY, NAUSEA, RESPIRATORY IRRITATION, CENTRAL NERVOUS SYSTEM DEPRESSION, UNCONSCIOUSNESS, LIVER, KIDNEY AND LUNG DAMAGE. CONTACT MAY CAUSE SEVERE (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:
HLTH HAZ: EYE IRRITATION. MAY CAUSE SKIN IRRITATION. CHRONIC: TOLUENE APPEARS ON THE NAVY LISTING OF OCCUPATIONAL CHEMICAL REPRODUCTIVE HAZARDS. SEEK CONSULTATION FROM APPROPRIATE HELTH PROFESSIONALS CONCERNING LATEST HAZARD LIST INFORMATION AND SAFE HANDLING AND EXPOSURE INFORMATION (FP N).

Medical Conditions Aggravated by Exposure:
RESPIRATORY, LIVER AND KIDNEY CONDITIONS.

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route of Entry Indicators:
Inhalation: YES
Skin: YES
Ingestion: YES

Carcinogenicity Indicators
NTP: NO
IARC: NO
OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT.

Section 4 - First Aid Measures
DIOXIN MIX, M-8280A

First Aid:
GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE. EYES: IMMEDIATELY FLUSH THOROUGHLY W/WATER FOR AT LEAST 15 MINUTES. SKIN: IMMEDIATELY FLUSH THOROUGHLY W/LARGE AMOUNTS OF WATER. INHAL: REMOVE TO FRESH AIR; GIVE ARTIFICIAL RESPIRATION IF BREATHING HAS STOPPED. INGEST: CALL MD IMMEDIATELY. ONLY INDUCE VOMITING AT THE INSTRUCTIONS OF MD. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

Section 5 - Fire Fighting Measures
DIOXIN MIX, M-8280A

Fire Fighting Procedures:
WEAR NIOSH APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).
Unusual Fire or Explosion Hazard:
DANGEROUS FIRE AND EXPLOSION HAZARD. VAPOR CAN TRAVEL DISTANCES TO IGNITION SOURCE AND FLASH BACK.
Extinguishing Media:
USE DRY CHEMICAL, FOAM, and CARBON DIOXIDE. USE WATER SPRAY TO COOL EXPOSED CONTAINERS.
Flash Point: Flash Point Text: 40.0F, 4.4C

Autoignition Temperature:
Autoignition Temperature Text: N/A
Lower Limit(s): 1.30%
Upper Limit(s): 7.10%

Section 6 - Accidental Release Measures
DIOXIN MIX, M-8280A

Spill Release Procedures:
WEAR SUITABLE PROTECTIVE EQUIPMENT. ELIMINATE ANY IGNITION SOURCES UNTIL THE AREA IS DETERMINED TO BE FREE FROM EXPLOSION OR FIRE HAZARDS. CONTAIN THE RELEASE AND ELIMINATE ITS SOURCE, IF THIS CAN BE DONE WITHOUT RISK.

Section 7 - Handling and Storage
DIOXIN MIX, M-8280A

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection
DIOXIN MIX, M-8280A

Respiratory Protection:
IF WORKPLACE EXPOS LIM OF PROD/ANY COMPONENT IS EXCEEDED (SEE TLV/PEL), A NIOSH APPRVD AIR SUPPLIED RESP IS ADVISED IN ABSENCE OF PROPER ENVIRON CTL. OSHA REGS ALSO PERMIT OTHER NIOSH APPRVD RESPS (NE G PRESS TYPE) UNDER SPECIFIED (SUP DAT)
Ventilation:
MATERIAL SHOULD BE HANDLED OR TRANSFERRED IN AN APPROVED FUME HOOD OR WITH ADEQUATE VENTILATION.
Protective Gloves:
VITON OR EQUIVALENT.
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGS (FP N).
Other Protective Equipment: EMERGENCY EYEWASH & DELUGE SHOWER MEETING ANSI DESIGN CRITERIA (FP N).
Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING. DO NOT TAKE INTERNALLY.
Supplemental Health & Safety Information: RESP PROT: CNDTNS (SEE YOUR SFTY EQUIP SUPPLIER). ENGINEERING AND/OR ADMINISTRATIVE CONTROLS SHOULD BE IMPLEMENTED TO REDUCE EXPOSURE.

Section 9 - Physical & Chemical Properties
DIOXIN MIX, M-8280A

HCC:
NRC/State License Number:
Net Property Weight for Ammo:
Boiling Point: Boiling Point Text: 232F,111C
Melting/Freezing Point: Melting/Freezing Text: -139F,-95C
Decomposition Point: Decomposition Text: N/K
Vapor Pressure: 21.9 @ 20C **Vapor Density:** 3.2
Percent Volatile Organic Content:
Specific Gravity: 0.87 (H*2O=1)
Volatile Organic Content Pounds per Gallon:
pH: N/K
Volatile Organic Content Grams per Liter:
Viscosity: N/P
Evaporation Weight and Reference: 2.2 (BUTYL ACETATE=1)
Solubility in Water: INSOLUBLE
Appearance and Odor: CLEAR LIQUID, WITH AROMATIC ODOR
Percent Volatiles by Volume: >99
Corrosion Rate: N/K

Section 10 - Stability & Reactivity Data
DIOXIN MIX, M-8280A

Stability Indicator: YES
Materials to Avoid:
OXIDIZERS AND STRONG MINERAL ACIDS.
Stability Condition to Avoid:
HEAT; CONTACT WITH IGNITION SOURCES.
Hazardous Decomposition Products:
CO*X, HYDROCARBONS.
Hazardous Polymerization Indicator: NO
Conditions to Avoid Polymerization:
NOT RELEVANT.

Section 11 - Toxicological Information
DIOXIN MIX, M-8280A

Toxicological Information:
N/P

Section 12 - Ecological Information
DIOXIN MIX, M-8280A

Ecological Information:
N/P

Section 13 - Disposal Considerations
DIOXIN MIX, M-8280A

Waste Disposal Methods:
DISPOSE AS HAZARDOUS WASTE. COMPLY WITH FEDERAL, STATE AND LOCAL REGULATIONS.

Section 14 - MSDS Transport Information
DIOXIN MIX, M-8280A

Transport Information:
N/P

Section 15 - Regulatory Information
DIOXIN MIX, M-8280A

SARA Title III Information:
N/P
Federal Regulatory Information:
N/P
State Regulatory Information:
N/P

Section 16 - Other Information
DIOXIN MIX, M-8280A

Other Information:
N/P

HAZCOM Label Information

Product Identification: DIOXIN MIX, M-8280A
CAGE: 0U4A8
Assigned Individual: N
Company Name: ACCUSTANDARD INC
Company PO Box:
Company Street Address1: 125 MARKET ST
Company Street Address2: NEW HAVEN, CT 06513 US
Health Emergency Telephone: 203-786-5290
Label Required Indicator: Y
Date Label Reviewed: 08/27/1996
Status Code: C
Manufacturer's Label Number:
Date of Label: 08/27/1996
Year Procured: N/K
Organization Code: G
Chronic Hazard Indicator: Y
Eye Protection Indicator: YES
Skin Protection Indicator: YES
Respiratory Protection Indicator: YES
Signal Word: DANGER
Health Hazard: Severe
Contact Hazard: Moderate
Fire Hazard: Severe
Reactivity Hazard: None