CENWS-OD-TS-DMMO

MEMORANDUM FOR: RECORD November 4, 2010

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE PORT OF BELLINGHAM'S GATE 3 - FLOATS F&G REPLACEMENT PROJECT, BELLINGHAM, WHATCOM COUNTY, FOR UNCONFINED OPEN-WATER DISPOSAL AT A DMMP SITE OR BENEFICIAL USE.

1. Introduction. This memorandum reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Washington Departments of Ecology and Natural Resources, and the Environmental Protection Agency) regarding the suitability of 49,884 cubic yards (cy) of dredged material from the Port of Bellingham's Gate 3 project for disposal at a DMMP open-water site or beneficial use.

2. Background. Gate 3 is located within the Squalicum Outer Harbor in Bellingham (see Figure 1). The Port of Bellingham proposes to renovate Floats F & G of the existing Gate 3 dock system. Renovation includes replacement of creosote-treated pilings with concrete pilings and replacement of floats. The project also includes harbor maintenance dredging to remove sediment that has accumulated within the boat basin. In conjunction with the maintenance dredging, replenishment of a habitat bench - created in 2004 along the Outer Squalicum Harbor breakwater - with a portion of the dredged material was envisioned (Landau, 2010).

   Sampling for this project first took place in March 2007. Unexpectedly high concentrations of dioxin were detected and the project was put on hold by the Port of Bellingham. In early 2010 the Port resumed discussions with the DMMP agencies regarding disposal alternatives. Supplemental sampling and testing was conducted in May 2010 to provide data for an antidegradation determination.

3. Project Summary. Table 1 includes project summary and tracking information.

Table 1. Project Summary

Project ranking	Moderate
Dredging volume	49,884 cubic yards
Proposed dredging depth	-11 feet MLLW plus 1 foot overdepth
1st draft sampling and analysis plan (SAP) received	December 18, 2006
DMMP comments provided on 1st draft	December 28, 2006
2nd draft SAP received	January 16, 2007
DMMP comments provided on 2nd draft	February 1, 2007
Final revisions to SAP received	February 14, 2007
SAP revisions approved	February 21, 2007
Sampling dates	March 8-9, 2007

SAP addendum received for supplemental sampling	March 23, 2010
SAP addendum approved	March 31, 2010
Supplemental sampling dates	May 6-7, 2010
Draft data report received	October 13, 2010
DMMP comments provided on draft report	October 27, 2010
Final data report received	November 3, 2010
DAIS Tracking number	POBG3-1-A-F-228
USACE Permit Application Number	NWS-2010-1235
Recency Determination (moderate rank = 5-7 years)	March 2012 – March 2014

4. Project Ranking and Sampling Requirements. In a moderate-ranked area the number of samples and analyses are calculated using the following guidelines (DMMP, 2008a):
    - Maximum volume of sediment represented by each field sample = 4,000 cubic yards
    - Maximum volume of sediment represented by each analysis in the upper 4-feet of the dredging prism (surface sediment) = 16,000 cubic yards

    For this project, all dredged material was considered surface sediment, with dredging depths ranging from 1 to 5 feet. Based on the guidelines, the proposed dredging volume of 49,884 cy required a minimum of 13 field samples and 4 dredged material management units (DMMUs). The approved SAP included the required 4 DMMUs, each represented by a composite of sediment from 4 core samples (see Figures 2 and 3).

5. Sampling. The original sampling took place March 8-9, 2007 using a vibracore sampler. Table 2 includes the coordinates of the sampling stations and compositing information. All work took place in compliance with the approved sampling plan. However, the SAP contained an error, stating that the design depth was -12 feet rather than -11 feet. Consequently, samples characterizing the dredged material were taken to -13 (including one foot of overdepth) instead of -12 feet. This has the potential to bias the results, but the dioxin data (see section 7 of this suitability determination) appear to indicate that there was no significant difference between the dredged material and the underlying z-samples. Therefore, the DMMP agencies accepted the collected samples as representative of the dredged material. It should be noted that the volumes listed in this suitability determination were correctly calculated using a design depth of -11 feet plus one foot of overdepth.

6. Chemical Analysis. The approved SAP was followed and quality control guidelines specified by DMMP were generally met. The sediment conventional and chemistry results can be found in Table 3. The grain-size data show that the proposed dredged material is predominantly silt, with a fines fraction ranging from 85 to 96% for the four DMMUs. The total organic carbon content ranged from 1.12 to 1.65%. The chemistry results indicated that there were no detected exceedances of screening levels for the standard DMMP chemicals of concern or tributyltin (TBT).

    Dioxins in the dredged material were analyzed twice, by different labs using different methods. In the first round of dioxin testing, Frontier Analytical Laboratory – using EPA method 8290 – reported concentrations of 10.6, 6.2, 27.3 and 47.1 parts per trillion (pptr) toxicity equivalents (TEQ, with undetects = ½ estimated detection limit) for POB 1 through POB 4 respectively. The Port of

Bellingham independently initiated a second round of dioxin testing for POB 1 and POB 2 to verify the first-round results and to achieve better spatial resolution of the dioxin concentrations in those DMMUs. The second round of testing was conducted by Analytical Perspectives, using EPA method 1613B. The concentrations for POB 1 and POB 2 were 22.4 and 9.6 pptr TEQ respectively. The individual cores from both DMMUs were also analyzed. The results ranged from 15.4 to 23.6 pptr TEQ for the POB 1 cores and 7.3 to 14.2 pptr TEQ for the POB 2 cores. Detailed results for the two rounds of testing can be found in Tables 4 and 5. Table 4 also includes dioxin results for the habitat bench. The dioxin data underwent Stage 4 manual validation by EcoChem.

7. Sediment Exposed by Dredging. Sediment exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) (Ecology, 1995) or the State's antidegradation standard (DMMP, 2008b). For this project, dioxin was the main concern since all other chemicals were below the DMMP SLs. During the three years that the project was on hold, the holding time for the archived z-samples expired and the samples were discarded. When project planning resumed in 2010, additional sampling was required in order to collect new z-samples to assess the project's compliance with the State's antidegradation standard.

   Supplemental vibracore sampling was conducted in May 2010 at the same stations occupied in 2007. Between 2007 and 2010 the DMMP guidance for z-samples had changed from sampling one foot beyond the overdepth to sampling two feet beyond the overdepth. Therefore, the z-samples were collected from the -12 to -14 foot MLLW stratum. Z-sample composites were formed for each of the DMMUs and tested for dioxin, using EPA method 1613B. Table 6 includes the coordinates of the sampling stations and compositing information. The results for the z-samples can be found in Table 7.

   When the dioxin concentrations in the z-samples are compared to those in the DMMUs (the A-layer), the results indicate that the State's antidegradation standard would be met for POB 1, 2 and 3 but not POB 4. Table 8 provides a summary of the data. The z-layer results for POB 1 and POB 2 fall within the range of concentrations reported for the A-layer using the same method (1613B). Similarly, the z-layer result for POB 3 can be considered equivalent to the concentration seen for the POB-3 A-layer, given the analytical variability seen in the laboratory replicates conducted for the POB-1 z-layer. It is only for POB 4 that the z-layer result clearly exceeds the A-layer result.

Table 8. Gate 3 Dioxin Summary (from Landau, 2010)

Location	Round 1 A-Layer Results (Method 8290)	Round 2 A-Layer Results (Method 1613B)	Supplemental Z-Layer Results (Method 1613B)	Meets AD Standard?
DMMU POB 1	10.6	22.4 [19.7, 17.1, 15.4, 23.6][1]	21.0, 18.5[2]	Yes
DMMU POB 2	6.2	9.6 [14.2, 7.3, 10.8, 7.6][1]	11.4	Yes
DMMU POB 3	27.3	---	28.9	Yes
DMMU POB 4	47.1	---	85.3	No
Habitat Bench	2.7	---	---	NA

Concentrations in pptr TEQ (u = ½ DL)
[1]Individual cores shown in brackets
[2]These are analytical replicates

Based on this analysis, the DMMP agencies concluded that DMMUs POB 1, 2 and 3 can be dredged to a depth of -12 feet without violating the DMMP antidegradation guidelines. POB 4 cannot be dredged without taking additional steps, such as overdredging and/or dredging with placement of a clean sand layer, to avoid leaving a degraded sediment surface. Such steps would likely require additional sampling and testing.

8. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from the Port of Bellingham Gate 3 for open-water disposal. The approved sampling and analysis plan was followed and the data gathered were deemed sufficient and acceptable for regulatory decision-making under the DMMP program.

   There were no SL exceedances for standard DMMP chemicals of concern or TBT. Therefore, with respect to these chemicals, the dredged material is suitable for open-water disposal. With regard to dioxin, in 2007 the DMMP agencies formulated interim disposal guidelines for each of the nondispersive disposal sites in Puget Sound. The interim guidelines include a maximum concentration for each site. Any DMMU with a concentration above this maximum value is considered unsuitable for open-water disposal. The interim guidelines also include a mean concentration for each site. The volume-weighted mean concentration of all DMMUs proposed for disposal from a project must be less than the site mean. The interim guidelines are provided in Table 9.

   Table 9 – DMMP Interim Dioxin Guidelines (pptr TEQ)

Disposal Site	Mean	Maximum
Port Gardner	4.1	5.2
Anderson Ketron	3.6	6.8
Bellingham Bay	6.9	10.5
Elliott Bay	8.7	12.2
Commencement Bay	2.4	5.2

   The Round-1 dioxin result for POB 2, by itself, might have supported disposal at either the Elliott Bay or Bellingham Bay site. However, the Round-2 result for composite POB 2 (9.6 pptr TEQ) was elevated with respect to the Round-1 result and exceeded the site mean for each of the disposal sites. The results for POB 1, 3 and 4 all exceeded the disposal-site means as well. Therefore, none of the composited DMMUs was determined to be eligible for open-water disposal under the interim guidelines at any of the DMMP disposal sites. However, because the individual core samples from POB 2 had been analyzed separately, the DMMP agencies were able to make a more granular determination with regard to this DMMU. The dioxin concentrations for POB-2 cores S06, S07 and S08 are low enough (mean = 8.6 pptr TEQ, maximum = 10.8 pptr TEQ) to be eligible for disposal at the Elliott Bay site under the interim guidelines. None of the material would be eligible for disposal at any of the other sites.

   Figure 4 shows the portion of POB 2 (labeled 2A) that would be eligible for disposal at the Elliott Bay site. The original boundary between POB 2 and POB 4 was moved closer to the sampling stations for SS07 and SS08 as a conservative measure because of the much higher dioxin concentrations in POB 4. The volume represented by subsection POB 2A is 5,200 cy.

With respect to the habitat bench (2.7 pptr TEQ), all DMMUs had higher dioxin concentrations than that found at the habitat bench itself and are not suitable for beneficial use there.

In summary, based on the results of the previously described testing, the DMMP agencies concluded that 5,200 cubic yards from the Port of Bellingham Gate 3 project are suitable for open-water disposal at the Elliott Bay non-dispersive site under the interim guidelines. The remainder of POB 2 and all of POB 1, 3 and 4 (a total of 44,684 cy) are unsuitable for open-water disposal.

The local health district and/or the Department of Ecology Toxics Cleanup Program should be contacted for guidance on upland disposal depending on where the material is planned for disposal. If found acceptable for upland disposal, POB 1, 2 and 3 may be dredged without violating the State's antidegradation standard. POB 4 may not be dredged without further measures such as overdredging or capping.

This suitability determination does ***not*** constitute final agency approval of the project. During the public comment period that follows a public notice, the resource agencies will provide input on the overall project. A final decision will be made after full consideration of agency input, and after an alternatives analysis is done under section 404(b)(1) of the Clean Water Act.

If open-water disposal at the Elliott Bay site is included in the final plan, a pre-dredge meeting with DNR, Ecology and the Corps of Engineers is required at least 7 days prior to dredging. A dredging quality control plan must be developed and submitted to the Regulatory Branch of the Seattle District Corps of Engineers at least 7 days prior to the pre-dredge meeting. A DNR site use authorization must also be acquired. Disposal at the Elliott Bay site must be by bottom-dump barge.

9. References.

Landau, 2007. *Sediment Sampling and Analysis Plan – Gate 3 Float F & G Replacement Project, Squalicum Outer Harbor, Bellingham, Washington.* Prepared by Landau Associates for the Port of Bellingham, January 2007.

Landau, 2010. *Sediment Characterization Report – Gate 3 Float F & G Replacement Project, Squalicum Outer Harbor, Bellingham, Washington.* Prepared by Landau Associates for the Port of Bellingham, November 2010.

DMMP, 2008a. *Dredged Material Evaluation and Disposal Procedures (Users Manual)*. Prepared by the Seattle District Dredged Material Management Office for the Dredged Material Management Program, July 2008.

DMMP, 2008b. *Quality of Post-Dredge Sediment Surfaces (Updated).* A Clarification Paper Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program, June 2008.

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

10. **Agency Signatures**.

Concur:

11/4/10 — David Fox
Date — David Fox - Seattle District Corps of Engineers

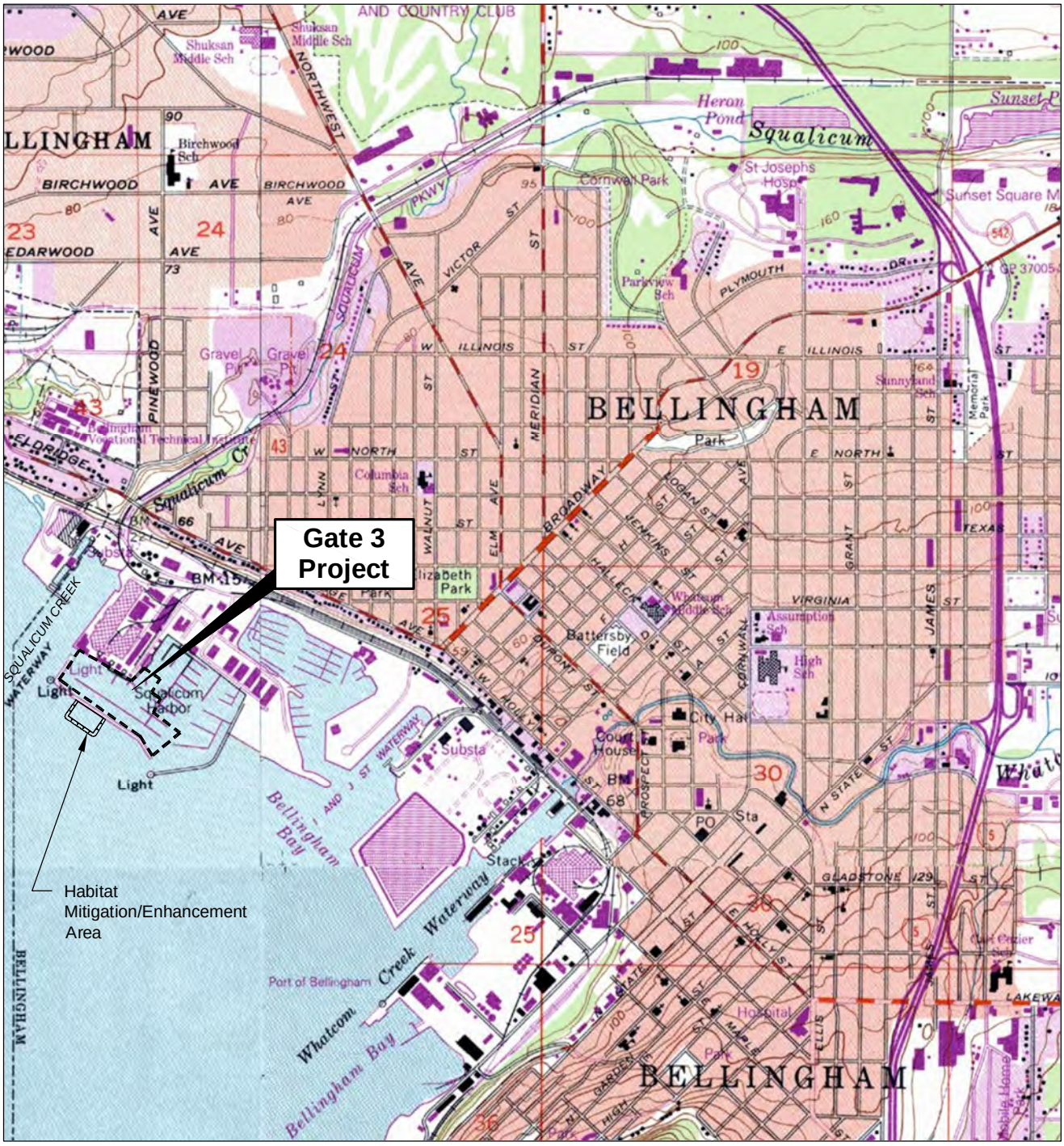
11/4/10 — Erika Hoffman
Date — Erika Hoffman - Environmental Protection Agency

11/04/2010 — Laura Inouye
Date — Laura Inouye, Ph.D. - Washington Department of Ecology

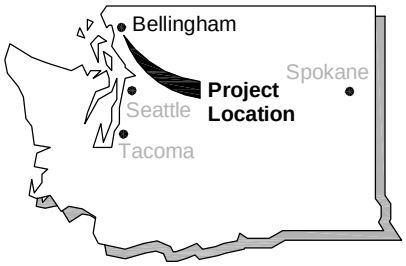
11-4-2010 — David Vagt
Date — David Vagt - Washington Department of Natural Resources

Copies furnished:

DMMP signatories
Randel Perry – Seattle District Regulatory
Dave Pischer – Landau Associates
Blaine McRae – Reid Middleton
Norm Gilbert – Port of Bellingham



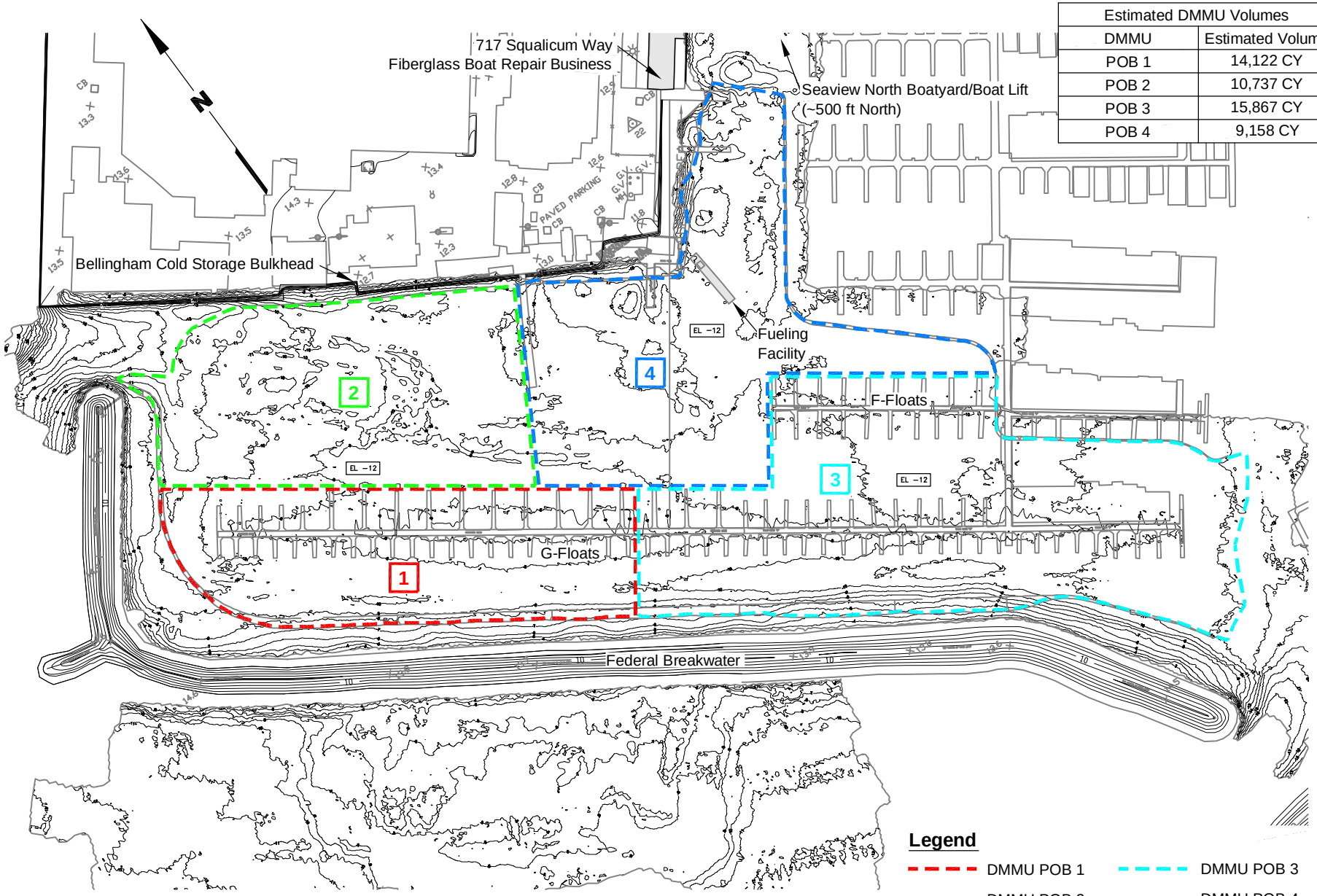
Map from DeLorme Street Atlas USA 2002



LANDAU ASSOCIATES	Port of Bellingham Gate 3 Floats F&G Bellingham, Washington	**Vicinity Map**

Figure
1

Port of Bellingham/Gate 3 Flaots F&G | V:\053\097\050.207\SAP Addendum\Figure 1.dwg (A) "Figure 1" 9/17/2010



Estimated DMMU Volumes	
DMMU	Estimated Volume
POB 1	14,122 CY
POB 2	10,737 CY
POB 3	15,867 CY
POB 4	9,158 CY

Legend

- DMMU POB 1
- DMMU POB 2
- DMMU POB 3
- DMMU POB 4

Base map source: Reid Middleton 2006

0 200 400

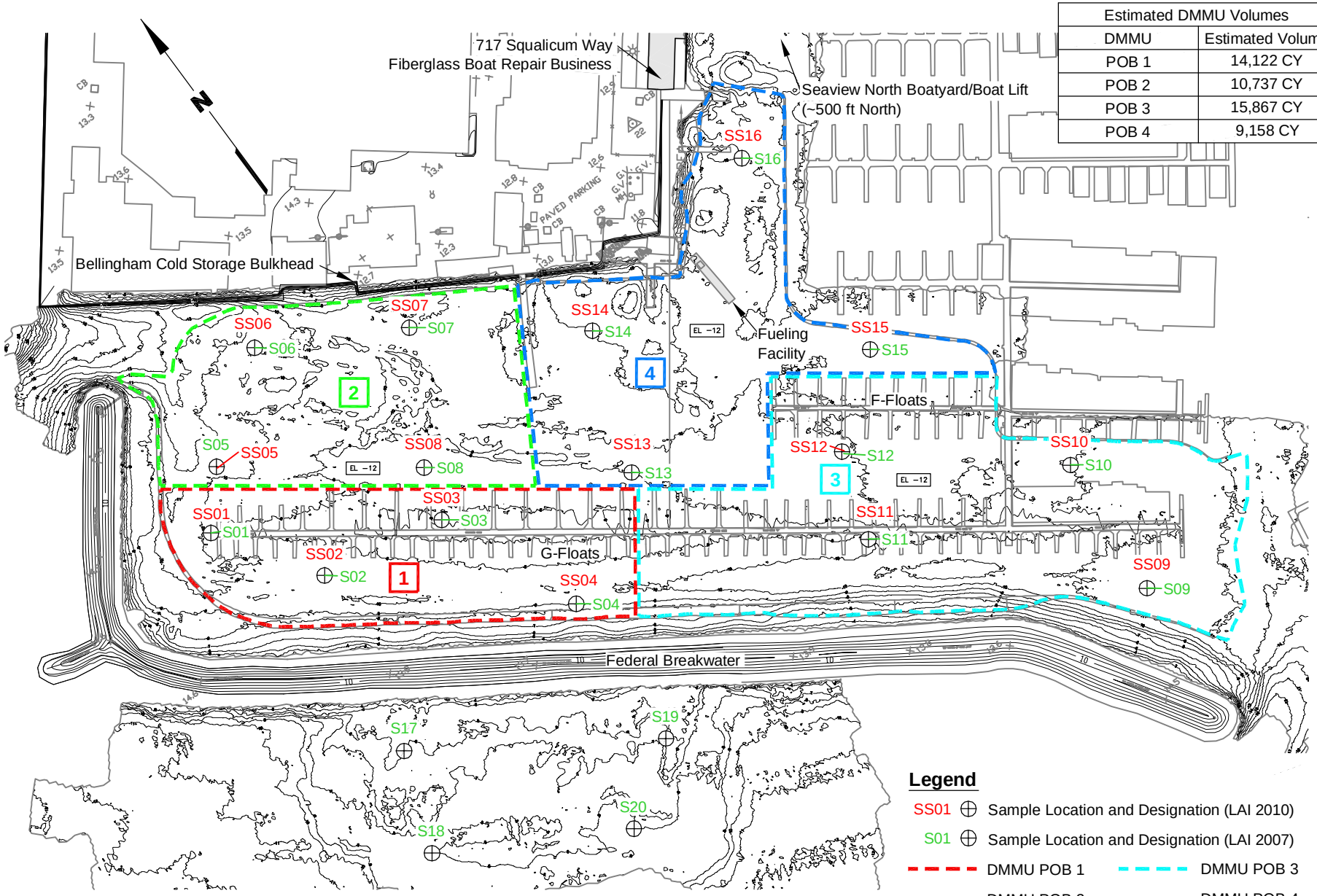
Scale in Feet

LANDAU ASSOCIATES

Port of Bellingham
Gate 3 Floats F&G
Bellingham, Washington

Site Plan

Figure
2



Estimated DMMU Volumes	
DMMU	Estimated Volume
POB 1	14,122 CY
POB 2	10,737 CY
POB 3	15,867 CY
POB 4	9,158 CY

Legend

- SS01 ⊕ Sample Location and Designation (LAI 2010)
- S01 ⊕ Sample Location and Designation (LAI 2007)
- DMMU POB 1
- DMMU POB 2
- DMMU POB 3
- DMMU POB 4

Base map source: Reid Middleton 2006

0 200 400
Scale in Feet

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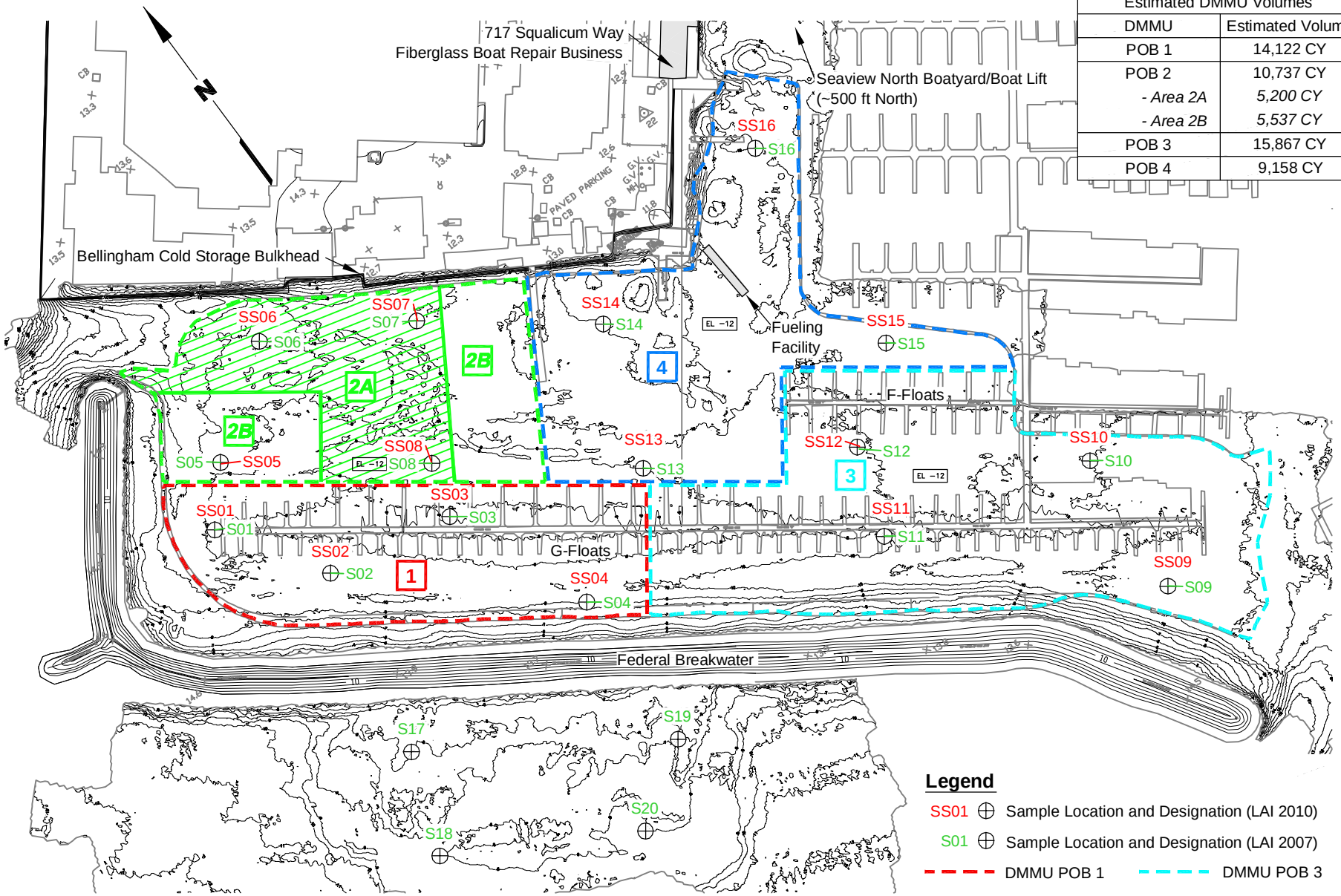
Port of Bellingham
Gate 3 Floats F&G
Bellingham, Washington

Sediment Sampling Locations

Figure
3



Estimated DMMU Volumes	
DMMU	Estimated Volume
POB 1	14,122 CY
POB 2	10,737 CY
- Area 2A	*5,200 CY*
- Area 2B	*5,537 CY*
POB 3	15,867 CY
POB 4	9,158 CY

Legend

SS01 ⊕ Sample Location and Designation (LAI 2010)

S01 ⊕ Sample Location and Designation (LAI 2007)

DMMU POB 1 — DMMU POB 3

DMMU POB 2 — DMMU POB 4

Base map source: Reid Middleton 2006

0 200 400

Scale in Feet

LANDAU ASSOCIATES

Port of Bellingham
Gate 3 Floats F&G
Bellingham, Washington

DMMU POB 2
Segregation for Disposal

Figure
4

TABLE 2
SAMPLING AND COMPOSITING
March 2007
(Adapted from Landau, 2010)

Sampling Station	Sample Location		Compositing			
	Latitude	Longitude	DMMU	mudline (MLLW)	A-layer depth (MLLW)	composited core length (ft)
S1	48.756665	122.511412	POB 1	-9.1	-13	3.9
S2	48.756272	122.511009	POB 1	-9.3	-13	3.7
S3	48.756184	122.510254	POB 1	-8.9	-13	4.1
S4	48.755610	122.509893	POB 1	-8.7	-13	4.3
S5	48.756864	122.511158	POB 2	-10.6	-13	2.4
S6	48.757157	122.510565	POB 2	-10.9	-13	2.1
S7	48.756871	122.509751	POB 2	-9.9	-13	3.1
S8	48.756390	122.510159	POB 2	-8.3	-13	4.7
S9	48.754366	122.507085	POB 3	-11.5	-13	1.5
S10	48.754933	122.507031	POB 3	-11.3	-13	1.7
S11	48.755154	122.508260	POB 3	-9.1	-13	3.9
S12	48.755482	122.508085	POB 3	-10.1	-13	2.9
S13	48.755905	122.509174	POB 4	-8.5	-13	4.5
S14	48.756445	122.508877	POB 4	-11.6	-13	1.4
S15	48.755757	122.507601	POB 4	-11	-13	2.0
S16	48.756657	122.507564	POB 4	-10.7	-13	2.3
S17	48.755532	122.511225	HB	-7.5	NA	2.0
S18	48.755143	122.511444	HB	-9	NA	2.0
S19	48.754977	122.509921	HB	-6	NA	2.0
S20	48.754762	122.510386	HB	-8.6	NA	2.0

HB = habitat bench
NA = not applicable
MLLW = mean lower low water
POB = Port of Bellingham

TABLE 3 (from Landau, 2010)
2007 A-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DMMP STANDARD CHEMICALS OF CONCERN - DRY WEIGHT BASIS
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMP Criteria (a)		**DMMU POB 1**	**DMMU POB 2**	**DMMU POB 3**	**DMMU POB 4**
	Screening Level	Bioaccum-ulation Trigger	Gate3-CMP1 KQ93A/KR14A 03/08/2007	Gate3-CMP2 KQ93C/KR14B 03/08/2007	Gate3-CMP3 KQ93F/KR14C 03/09/2007	Gate3-CMP4 KQ93H/KR14D 03/09/2007
TOTAL METALS						
EPA Methods 6010B/7470A/7740 (mg/kg)						
Antimony	150	--	9 UJ	9 U	9 U	8 U
Arsenic	57	507.1	9 U	9 U	9 U	**9**
Cadmium	5.1	11.3	**0.4**	**0.4**	**0.4**	**0.4**
Chromium	--	267	**73.9**	**75.1**	**74.5**	**73.9**
Copper	390	1,027	**57.0**	**53.7**	**62.4**	**60.4**
Lead	450	975	**11**	**9**	**10**	**11**
Mercury	0.41	1.5	**0.20**	**0.11**	**0.15**	**0.16**
Nickel	140	370	**116**	**123**	**118**	**118**
Selenium	--	3	**0.6**	0.3 U	**0.5**	**0.2**
Silver	6.1	6.1	0.5 U	0.5 U	0.5 U	0.5 U
Zinc	410	2,783	**105**	**104**	**116**	**114**
PORE WATER TBT						
Krone (µg/L)						
Tributyl Tin Ion	0.15	0.15	0.019 U	0.019 U	0.019 U	**0.064**
Dibutyl Tin Ion	--	--	0.029 U	0.029 U	0.029 U	0.029 U
Butyl Tin Ion	--	--	0.020 U	0.020 U	0.020 U	0.020 U
PAHs Method 8270 (µg/kg)						
Total LPAH	5,200	--	**82**	ND	**86**	
Naphthalene	2,100	--	61 U	62 U	62 U	61 U
Acenaphthylene	560	--	61 U	62 U	62 U	61 U
Acenaphthene	500	--	61 U	62 U	62 U	61 U
Fluorene	540	--	61 U	62 U	62 U	61 U
Phenanthrene	1,500	--	**82**	62 U	**86**	**130**
Anthracene	960	--	61 U	62 U	62 U	61 U
2-Methylnaphthalene	670	--	61 U	62 U	62 U	61 U
Total HPAH	12,000	--	**1,836**	**197**	**760**	**1,600**
Fluoranthene	1,700	4,600	**510**	**110**	**270**	**410**
Pyrene	2,600	11,980	**630**	**87**	**200**	**510**
Benzo(a)anthracene	1,300	--	**160**	62 U	62 U	**96**
Chrysene	1,400	--	**200**	62 U	**120**	**190**
Benzo(b)fluoranthene	3,200 (d)	--	**140**	62 U	**63**	**120**
Benzo(k)fluoranthene	3,200 (d)	--	**110**	62 U	**100**	**180**
Benzo(b,k)fluornathene	3,200 (d)	--	**250**	62 U	**163**	**300**
Benzo(a)pyrene	1,600	--	**76**	62 U	62 U	**84**
Indeno(1,2,3-cd)pyrene	600	--	61 U	62 U	62 U	61 U
Dibenzo(a,h)anthracene	230	--	**9.8**	6.2 U	**6.8**	**9.8**
Benzo(g,h,i)perylene	670	--	61 U	62 U	62 U	61 U

TABLE 3 (from Landau, 2010)
2007 A-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DMMP STANDARD CHEMICALS OF CONCERN - DRY WEIGHT BASIS
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMP Criteria (a)		**DMMU POB 1**	**DMMU POB 2**	**DMMU POB 3**	**DMMU POB 4**
	Screening Level	Bioaccum-ulation Trigger	Gate3-CMP1 KQ93A/KR14A 03/08/2007	Gate3-CMP2 KQ93C/KR14B 03/08/2007	Gate3-CMP3 KQ93F/KR14C 03/09/2007	Gate3-CMP4 KQ93H/KR14D 03/09/2007
CHLORINATED HYDROCARBONS						
EPA Method 8260B (µg/kg)						
1,3-Dichlorobenzene	170	--	1.8 U	1.8 U	1.8 U	1.6 U
1,4-Dichlorobenzene	110	--	1.8 U	1.8 U	1.8 U	1.6 U
1,2-Dichlorobenzene	35	--	1.8 U	1.8 U	1.8 U	1.6 U
1,2,4-Trichlorobenzene	31	--	9 U	8.9 U	8.8 U	8.1 U
Hexachlorobenzene	22	168	6.1 U	6.2 U	6.2 U	6.1 U
PHTHALATES						
EPA Method 8270B (µg/kg)						
Dimethylphthalate	71	--	61 U	62 U	62 U	61 U
Diethylphthalate	200	--	61 U	62 U	62 U	61 U
Di-n-Butylphthalate	1,400	--	61 U	62 U	62 U	**110**
Butylbenzylphthalate	63	--	6.1 U	6.2 U	6.2 U	6.1 U
bis(2-Ethylhexyl)phthalate	1,300	--	61 U	62 U	**78**	**240**
Di-n-Octyl phthalate	6,200	--	61 U	62 U	62 U	61 U
PHENOLS						
EPA Method 8270B (µg/kg)						
Phenol	420	--	61 U	62 U	62 U	61 U
2-Methylphenol	63	--	6.1 U	6.2 U	6.2 U	6.1 U
4-Methylphenol	670	--	61 U	62 U	62 U	61 U
2,4-Dimethylphenol	29	--	6.1 U	6.2 U	6.2 U	6.1 U
Pentachlorophenol	400	504	31 U	31 U	31 U	31 U
MISCELLANEOUS EXTRACTABLES						
EPA Method 8270B (µg/kg)						
Benzyl Alcohol	57	--	31 U	31 U	31 U	31 U
Benzoic Acid	650	--	610 U	620 U	620 U	610 U
Dibenzofuran	540	--	61 U	62 U	62 U	61 U
Hexachloroethane	1,400	--	61 U	62 U	62 U	61 U
Hexachlorobutadiene	29	--	6.1 U	6.2 U	6.2 U	6.1 U
N-Nitrosodiphenylamine	28	--	6.1 U	6.2 U	6.2 U	6.1 U
VOLATILE ORGANIC COMPOUNDS (VOCs)						
EPA Method 8260B (µg/kg)						
Trichloroethene	160	--	1.8 U	1.8 U	1.8 U	1.6 U
Tetrachloroethene	57	--	1.8 U	1.8 U	1.8 U	1.6 U
Ethylbenzene	10	--	1.8 U	1.8 U	1.8 U	1.6 U
m,p-Xylene	40 (c)	--	1.8 U	1.8 U	1.8 U	1.6 U
o-Xylene	40 (c)	--	1.8 U	1.8 U	1.8 U	1.6 U
Total Xylene		--				

TABLE 3 (from Landau, 2010)
2007 A-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DMMP STANDARD CHEMICALS OF CONCERN - DRY WEIGHT BASIS
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMP Criteria (a)		**DMMU POB 1**	**DMMU POB 2**	**DMMU POB 3**	**DMMU POB 4**
	Screening Level	Bioaccum-ulation Trigger	Gate3-CMP1 KQ93A/KR14A 03/08/2007	Gate3-CMP2 KQ93C/KR14B 03/08/2007	Gate3-CMP3 KQ93F/KR14C 03/09/2007	Gate3-CMP4 KQ93H/KR14D 03/09/2007
PESTICIDES						
PSDDA Method 8081A (µg/kg)						
4,4'-DDE	6.9 (e)	--	2.0 U	2.0 U	2.0 U	2.0 U
4,4'-DDD	6.9 (e)	--	2.0 U	2.0 U	2.0 U	2.0 U
4,4'-DDT	6.9 (e)	--	2.0 U	2.0 U	2.0 U	2.0 U
Total DDT		50	ND	ND	ND	ND
Aldrin	10	---	0.99 U	1.0 U	0.98 U	0.98 U
gamma Chlordane	--	37 (f)	1.7 U	1.0 U	0.98 U	0.98 U
alpha Chlordane	--	37 (f)	0.99 U	1.0 U	0.98 U	0.98 U
Total Chlordane	10		0.99 U	1.0 U	0.98 U	0.98 U
Dieldrin	10	--	2.0 U	2.0 U	2.0 U	2.0 U
Heptachlor	10	--	0.99 U	1.0 U	0.98 U	0.98 U
gamma-BHC (Lindane)	10	--	0.99 U	1.0 U	0.98 U	0.98 U
POLYCHLORINATED BIPHENYLS (PCBs)						
PSDDA Method 8082 (µg/kg)						
Aroclor 1016	--	--	20 U	20 U	20 U	20 U
Aroclor 1242	--	--	20 U	20 U	20 U	20 U
Aroclor 1248	--	--	20 U	20 U	20 U	20 U
Aroclor 1254	--	--	20 U	20 U	20 U	20 U
Aroclor 1260	--	--	20 U	20 U	20 U	20 U
Aroclor 1221	--	--	20 U	20 U	20 U	20 U
Aroclor 1232	--	--	20 U	20 U	20 U	20 U
Total PCBs	130	38 (g)	ND	ND	ND	ND

TABLE 3 (from Landau, 2010)
2007 A-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DMMP STANDARD CHEMICALS OF CONCERN - DRY WEIGHT BASIS
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMP Criteria (a)		**DMMU POB 1**	**DMMU POB 2**	**DMMU POB 3**	**DMMU POB 4**
	Screening Level	Bioaccum-ulation Trigger	Gate3-CMP1 KQ93A/KR14A 03/08/2007	Gate3-CMP2 KQ93C/KR14B 03/08/2007	Gate3-CMP3 KQ93F/KR14C 03/09/2007	Gate3-CMP4 KQ93H/KR14D 03/09/2007
CONVENTIONAL CHEMISTRY PARAMETERS (mg/kg, unless noted)						
Total Solids (%, Method 160.3)	--	--	**56.00**	**56.80**	**54.10**	**55.90**
Total Volatile Solids (%, Method 160.4)	--	--	**5.55**	**5.43**	**5.74**	**5.44**
Preserved Total Solids (%, Method 160.3)	--	--	**55.10**	**53.60**	**52.70**	**58.6**
Total Organic Carbon (%, PLUMB81TC)	--	--	**1.65**	**1.27**	**1.12**	**1.61**
Ammonia (NH3) as Nitrogen (N) (Method 350.1)	--	--	**24.0** J	**24.2** J	**16.0**	**22.4**
Sulfide (Method 376.2)	--	--	**1,980**	**1,850**	**1,350**	**12.8**
PARTICLE/GRAIN SIZE (%) Method PSEP-PS						
Gravel - Phi Size > -1 (> 2000 µm)	--	--	**0.3**	**0.2**	**0.0**	**0.1**
Sand - Phi Size -1 to 0 (2000 to 1000 µm)	--	--	**0.3**	**0.7**	**6.3**	**0.8**
Sand - Phi Size 0 to 1 (1000 to 500 µm)	--	--	**1.0**	**0.8**	**3.1**	**1.1**
Sand - Phi Size 1 to 2 (500 to 250 µm)	--	--	**2.5**	**0.6**	**2.0**	**1.5**
Sand - Phi Size 2 to 3 (250 to 125 µm)	--	--	**1.5**	**0.7**	**1.8**	**2.0**
Sand - Phi Size 3 to 4 (125 to 62.5 µm)	--	--	**1.4**	**1.0**	**1.5**	**1.2**
Silt - Phi Size 4 to 5 (62.5 to 31.0 µm)	--	--	**6.3**	**6.9**	**4.0**	**4.7**
Silt - Phi Size 5 to 6 (31.0 to 15.6 µm)	--	--	**17.9**	**26.6**	**15.3**	**16.3**
Silt - Phi Size 6 to 7 (15.6 to 7.8 µm)	--	--	**23.1**	**24.5**	**21.0**	**27.4**
Silt - Phi Size 7 to 8 (7.8 to 3.9 µm)	--	--	**15.9**	**12.1**	**13.2**	**13.4**
Clay - Phi Size 8 to 9 (3.9 to 2.0 µm)	--	--	**5.6**	**7.7**	**9.0**	**8.8**
Clay - Phi Size 9 to 10 (2.0 to 1.0 µm)	--	--	**9.3**	**6.7**	**8.4**	**8.3**
Clay - Phi Size <10 (< 1.0 µm)	--	--	**14.7**	**11.6**	**14.4**	**14.4**
Total Fines (Silt & Clay) (<62.5 µm)	--	--	**92.9**	**96.0**	**85.3**	**93.3**

µg/kg = micrograms per kilogram (ppb).
mg/kg = milligrams per kilogram (ppm).
µg/L = micrograms per liter (ppb).
U = Indicates the compound was not detected at the given reporting limit.
UJ = Indicates the compound was not detected; the given reporting limit is an estimate.
J = Indicates the compound was detected; the given concentration is an estimate.
J* = Analyte concentration is below calibration range.
ND = Not detected.
Bold cells indicate a detected compound.
Boxed cells indicate an exceedance of one or more criteria.
-- = Indicates no criteria established for this compound.
(a) Dredged Material Management Program (DMMP) marine guideline values; DMMP Users' Manual Table 6-1.
(b) Ecology Sediment Management Standards (SMS) Marine Sediment Quality Standards and Cleanup Screening Levels, WAC 173-204.
(c) Value for total xylenes (sum of o-xylene and m,p-xylene).
(d) Value for total benzofluoranthenes [sum of benzo(b)fluoranthene and benzo(k)fluoranthene].
(e) Value for total DDT (sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT).
(f) Value for total Chlordane (sum of gamma Chlordane and alpha Chlordane).
(g) Value is normalized to total organic carbon (TOC) and is expressed in mg/kg TOC.

TABLE 4 (from Landau, 2010)
2007 A-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DIOXINS (METHOD 8290) - ROUND 1
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMU POB 1	DMMU POB 2	DMMU POB 3	DMMU POB 4	Habitat Bench
	Gate3-CMP1	Gate3-CMP2	Gate3-CMP3	Gate3-CMP4	Gate3-CMPHab
	KQ93A/KR14A	KQ93C/KR14B	KQ93F/KR14C	KQ93H/KR14D	KQ93I
	03/08/2007	03/08/2007	03/09/2007	03/09/2007	03/09/2007
Chlorinated Dioxins (ng/kg)					
Method 8290					
2,3,7,8-TCDD	0.270	0.178	0.385	0.684	0.146
1,2,3,7,8-PeCDD	1.60	0.882	3.85	7.12	0.343
1,2,3,4,7,8-HxCDD	3.90	2.65	10.6	19.3	1.23
1,2,3,6,7,8-HxCDD	14.7	8.31	42.1	64.7	3.49
1,2,3,7,8,9-HxCDD	8.05	4.36	23.3	41.9	1.68
1,2,3,4,6,7,8-HpCDD	349	205	954	1670	73.6
OCDD	2,390	1,910	6,670	12400	656
Total TCDD	51.2	50.4	58.0	63.8	38.4
Total PeCDD	41.4	36.8	56.2	75.3	26.0
Total HxCDD	212	128	370	688	69.9
Total HpCDD	1,040	599	2,320	3680	185
Chlorinated Furans (ng/kg)					
Method 8290					
2,3,7,8-TCDF	2.04	1.52	2.79	2.93	1.48
1,2,3,7,8-PeCDF	1.05	0.581	2.92	3.12	0.371
2,3,4,7,8-PeCDF	1.13	0.493	1.85	3.65	0.442
1,2,3,4,7,8-HxCDF	3.45	1.99	7.47	12.5	0.958
1,2,3,6,7,8-HxCDF	1.50	0.951	3.91	6.15	0.542
2,3,4,6,7,8-HxCDF	2.39	1.38	5.54	9.22	0.681
1,2,3,7,8,9-HxCDF	1.30	0.757	3.13	4.62	0.442
1,2,3,4,6,7,8-HpCDF	34.8	17.1	87.3	136	8.53
1,2,3,4,7,8,9-HpCDF	2.08	1.27	3.68	6.83	0.707
OCDF	98.0	49.6	181	365	27.4
Total TCDF	14.7 J	9.49 J	18.4 J	23.8 J	8.91 J
Total PeCDF	30.5 J	15.2 J	80.2 J	100 J	8.13
Total HxCDF	87.3 J	47.0	248 J	332 J	20.5
Total HpCDF	131	67.4	291	480	34.1
TEQ (ND=1/2 DL) (a)	10.6	6.2	27.3	47.1	2.7
TEQ (ND=0) (b)	10.6	6.2	27.3	47.1	2.7

ng/kg = nanogram per kilogram (pptr)
J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
TEQ = Toxicity equivalent.
(a) TEQ calculated using 2005 World Health Organization (WHO) toxicity equivalency factors (TEFs) and one half the detection limit for non-detects.
(b) TEQ calculated using 2005 World Health Organization (WHO) toxicity equivalency factors (TEFs) and zero for non-detects.

TABLE 5 (from Landau, 2010)
2007 A-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DIOXINS (METHOD 1613B) - ROUND 2
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMU POB 1				
	Gate3-CMP1	Gate3-S1-A	Gate3-S2-A	Gate3-S3-A	Gate3-S4-A
	P8435_5277-001	P8435_5277-003	P8435_5277-004	P8435_5277-005	P8435_5277-006
	03/08/2007	03/08/2007	03/08/2007	03/08/2007	03/08/2007
Chlorinated Dioxins (ng/kg)					
Method 1613B					
2,3,7,8-TCDD	0.47	0.42	0.356 U	0.283	0.477
1,2,3,7,8-PeCDD	4.26	3.24	3.13	2.8	4.21
1,2,3,4,7,8-HxCDD	8.41	6.67	6.78	6.21	7.91
1,2,3,6,7,8-HxCDD	29.8	26.3	24.4	21.6	32.6
1,2,3,7,8,9-HxCDD	18.6	14.4	13.3	12.1	18.1
1,2,3,4,6,7,8-HpCDD	653	619	516	459	684
OCDD	4,820	4,800	3,610	3,250	4,860
Total TCDD	53.6	53.9	66.8	61	43.1
Total PeCDD	73.7	69.6	80.9	72.6	59.9
Total HxCDD	262	263	233	209	251
Total HpCDD	1,420	1,540	1,110	971	1,450
Chlorinated Furans (ng/kg)					
Method 1613B					
2,3,7,8-TCDF	3.03	2.99	3.15	2.5	3.4
1,2,3,7,8-PeCDF	1.9	1.46	1.45	1.17	2.28
2,3,4,7,8-PeCDF	3.71	3.12	2.81	2.55	4.47
1,2,3,4,7,8-HxCDF	6.26	5.73	4.79	3.97	7.63
1,2,3,6,7,8-HxCDF	3.29	2.87	2.52	2.07	3.57
2,3,4,6,7,8-HxCDF	4.62	4.16	3.63	3.27	5.25
1,2,3,7,8,9-HxCDF	2.02	1.93	1.6	1.39	2.58
1,2,3,4,6,7,8-HpCDF	79.2	80.9	60.7	54.7	96.2
1,2,3,4,7,8,9-HpCDF	3.82	4.03	2.85	2.7	4.94
OCDF	204	234	151	142	251
Total TCDF	19.5	20.2	18.7	14.6	22.4
Total PeCDF	38.7	34	29	24.7	48.6
Total HxCDF	142	128	105	94.1	172
Total HpCDF	278	291	200	181	339
TEQ (ND=1/2 DL) (a)	22.4	19.7	17.1	15.4	23.6
TEQ (ND=0) (b)	22.4	19.7	17.0	15.4	23.6

TABLE 5 (from Landau, 2010)
2007 A-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DIOXINS (METHOD 1613B) - ROUND 2
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMU POB 2				
	Gate3-CMP2	Gate3-S5-A	Gate3-S6-A	Gate3-S7-A	Gate3-S8-A
	P8435_5277-002	P8435_5277-007	P8435_5277-008	P8435_5277-009	P8435_5277-010
	03/08/2007	03/08/2007	03/08/2007	03/08/2007	03/08/2007
Chlorinated Dioxins (ng/kg)					
Method 1613B					
2,3,7,8-TCDD	0.21 U	0.294 U	0.181 U	0.101 U	0.0799 U
1,2,3,7,8-PeCDD	1.62	2.63	0.889	1.58	1.35 U
1,2,3,4,7,8-HxCDD	3.63	5.73	2.05	3.72	3.4
1,2,3,6,7,8-HxCDD	13.3	20.7	10.3	14.9	11.7
1,2,3,7,8,9-HxCDD	6.96	10.7	3.7	7.29	5.48
1,2,3,4,6,7,8-HpCDD	296	442	255	348	256
OCDD	2,290	3,170	2,110	2,880	1950
Total TCDD	53.1	75.2	39	46.6	55.2
Total PeCDD	62.1	88.3	42	56.8	64.3
Total HxCDD	140	223	99.9	145	137
Total HpCDD	624	997	503	736	560
Chlorinated Furans (ng/kg)					
Method 1613B					
2,3,7,8-TCDF	2.19	3.11	1.81	2	1.9
1,2,3,7,8-PeCDF	0.798	1.17	0.58	0.918	0.746
2,3,4,7,8-PeCDF	1.64	2.46	1.21	1.93	1.53
1,2,3,4,7,8-HxCDF	2.74	0.714	2.18	3.73	2.42
1,2,3,6,7,8-HxCDF	1.39	2.06	0.905 U	1.72	1.25
2,3,4,6,7,8-HxCDF	2.07	2.97	1.49	2.53	1.79
1,2,3,7,8,9-HxCDF	0.888	1.37	0.714	1.17	0.842
1,2,3,4,6,7,8-HpCDF	37.6	49.5	37.2	47.8	31.2
1,2,3,4,7,8,9-HpCDF	1.79 U	2.5	2.03	2.49	1.81
OCDF	123	129	182	155	103
Total TCDF	12.2	16.9	9.93	12	9.21
Total PeCDF	15.9	24.4	10.8	18	14.1
Total HxCDF	59.5	86	44.8	73.6	51.4
Total HpCDF	133	168	162	169	112
TEQ (ND=1/2 DL) (a)	9.6	14.2	7.3	10.8	7.6
TEQ (ND=0) (b)	9.5	14.1	7.1	10.8	6.9

ng/kg = nanogram per kilogram (pptr)
U = Indicates the compound was not detected at the given reporting limit.
TEQ = Toxicity equivalent.
(a) TEQ calculated using 2005 World Health Organization (WHO) toxicity equivalency factors (TEFs) and one half the detection limi
(b) TEQ calculated using 2005 World Health Organization (WHO) toxicity equivalency factors (TEFs) and zero for non-detects.

TABLE 6
SAMPLING AND COMPOSITING
May 2010
(Adapted from Landau, 2010)

Sampling Station	Sample Location		Compositing			
	Latitude	Longitude	Z-composite	mudline (MLLW)	Z-layer depth (MLLW)	composited core length (ft)
SS1	48.756657	122.511422	POB 1-Z	-9	-12 to -14	2.0
SS2	48.756268	122.511011	POB 1-Z	-9.3	-12 to -14	2.0
SS3	48.756182	122.510253	POB 1-Z	-7.8	-12 to -14	2.0
SS4	48.755608	122.509872	POB 1-Z	-9	-12 to -14	2.0
SS5	48.756859	122.511158	POB 2-Z	-10.2	-12 to -14	2.0
SS6	48.757165	122.510566	POB 2-Z	-9.3	-12 to -14	2.0
SS7	48.756869	122.509745	POB 2-Z	-8.5	-12 to -14	2.0
SS8	48.756395	122.510156	POB 2-Z	-8.1	-12 to -14	2.0
SS9	48.754359	122.507051	POB 3-Z	-11.7	-12 to -14	2.0
SS10	48.754937	122.507031	POB 3-Z	-10.7	-12 to -14	2.0
SS11	48.755157	122.508215	POB 3-Z	-9.6	-12 to -14	2.0
SS12	48.755491	122.508074	POB 3-Z	-9.4	-12 to -14	2.0
SS13	48.755922	122.509149	POB 4-Z	-8.4	-12 to -14	2.0
SS14	48.756446	122.508892	POB 4-Z	-10	-12 to -14	2.0
SS15	48.755756	122.507599	POB 4-Z	-10.5	-12 to -14	2.0
SS16	48.756655	122.507555	POB 4-Z	-10.2	-12 to -14	2.0

NA = not applicable
MLLW = mean lower low water
POB = Port of Bellingham

TABLE 7 (from Landau, 2010)
2010 Z-LAYER SEDIMENT SAMPLE ANALYTICAL RESULTS FOR DIOXINS (METHOD 1613B)
GATE 3 FLOATS F & G REPLACEMENT PROJECT
PORT OF BELLINGHAM - BELLINGHAM, WASHINGTON

	DMMU POB 1		DMMU POB 2	DMMU POB 3	DMMU POB 4
	Gate3-CMP1-Z	Gate3-CMP1-Z-REP	Gate3-CMP2-Z	Gate3-CMP3-Z	Gate3-CMP4-Z
	G1040-16-1	G1040-16-2	G1040-16-3	G1040-16-4	G1040-16-6
	5/6/2010	5/6/2010	5/6/2010	5/6/2010	5/7/2010
Chlorinated Dioxins (ng/kg)					
Method 1613B					
2,3,7,8-TCDD	0.635	0.535	0.439 U	0.668	1.17
1,2,3,7,8-PeCDD	3.41 J	3.26 J	2.15 J	6.53 J	10.1 J
1,2,3,4,7,8-HxCDD	6.79	5.41	3.70	11.2	14.8
1,2,3,6,7,8-HxCDD	26.9	23	14.8	34.8	103
1,2,3,7,8,9-HxCDD	17.3	13.2	8.92	25.6	59.6
1,2,3,4,6,7,8-HpCDD	626	585	350	830	3,230 J
OCDD	4,540 J	4,070 J	2,470	5,450 J	28,500 J
Total TCDD	27.5	27.1	33.3	26.9	65.7
Total PeCDD	46.4 J	48.3 J	47.1	80.4	107 J
Total HxCDD	230	209	138	289	779
Total HpCDD	1,550	1,460	822	1,810	5,960
Chlorinated Furans (ng/kg)					
Method 1613B					
2,3,7,8-TCDF	2.76	2.37	1.85	2.68	3.39
1,2,3,7,8-PeCDF	1.79	1.52	0.861	2.15	5.45
2,3,4,7,8-PeCDF	4.02 J	3.28 J	1.97 J	4.27 J	14.9 J
1,2,3,4,7,8-HxCDF	7.25 J	5.87 J	3.17 J	7.03 J	32.6 J
1,2,3,6,7,8-HxCDF	3.08 J	2.62 J	1.44 J	3.94 J	11.6 J
2,3,4,6,7,8-HxCDF	4.92 J	4.15 J	2.37 J	5.45 J	17.6 J
1,2,3,7,8,9-HxCDF	2.47 J	1.97 UJ	1.15 J	2.72 J	11.1 J
1,2,3,4,6,7,8-HpCDF	81.4	69.6	38.4	95.1	275
1,2,3,4,7,8,9-HpCDF	5.41	4.53	2.15	4.83	16.4
OCDF	233 J	214 J	102 J	227 J	716 J
Total TCDF	12.8	12	7.83	11.6	25.2 J
Total PeCDF	14.4 J	13.1 J	7.36 J	16.9 J	48.9 J
Total HxCDF	136 J	107 J	61.6	161 J	485 J
Total HpCDF	354	298	155	378	1,080
TEQ (ND=1/2 DL) (a)	21.0 J	18.5 J	11.4 J	28.9 J	85.3 J
TEQ (ND=0) (b)	21.0 J	18.4 J	11.2 J	28.9 J	85.3 J
CONVENTIONAL CHEMISTRY PARAMETERS					
Total Solids (%, Method 160.3)	54.70	54.70	57.10	56.10	58.10
Total Organic Carbon (%, PLUMB81TC)	1.80	1.80	1.39	1.44	2.23

ng/kg = nanogram per kilogram (pptr)

UJ = Indicates analyte was not detected; the given reporting limit is an estimate.

J = Indicates the analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U = Indicates the compound was not detected at the given reporting limit.

TEQ = Toxicity equivalent.

(a) TEQ calculated using 2005 World Health Organization (WHO) toxicity equivalency factors (TEFs) and one half the detection limit for non-detects.

(b) TEQ calculated using 2005 World Health Organization (WHO) toxicity equivalency factors (TEFs) and zero for non-detects.