

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE BELLINGHAM COLD STORAGE, SQUALICUM WATERWAY, BELLINGHAM, WASHINGTON (NWS-2015-785), FOR OPEN-WATER DISPOSAL AT THE ROSARIO STRAIT DISPERSIVE DISPOSAL SITE.

1. Introduction. This memorandum reflects the consensus determination of the Dredged Material Management Program (DMMP) agencies (U.S. Army Corps of Engineers, Environmental Protection Agency, and Washington Departments of Ecology and Natural Resources) regarding the suitability of up to a total 14,200 cubic yards (CY) of dredged material from the Squalicum Waterway for disposal at the DMMP open-water Rosario Strait dispersive disposal site.

Bellingham Cold Storage is a large portside cold storage facility that supports commerce and shipping as well as fishing vessels. The BCS port consists of a 1,000 ft. dock and a 200-foot fishing vessel dock along the eastern Squalicum Waterway. The proposed dredging is not located at the BCS port facility, but in the federally-maintained navigation channel that provides access to BCS from Bellingham Bay. Federal funding to dredge the Squalicum Waterway has not been allocated in recent years, resulting in sediment accumulation that has caused navigation impediments to the BCS facilities. This dredging targets some "high spots" in the Squalicum Waterway that will allow safe navigational access to the BCS facility.

2. Project Summary. Dredging of accumulated sediments within the Squalicum Waterway navigation channel is proposed to restore navigable depths for access to the BCS port facilities. Proposed dredging is 14,200 CY from an area of 1.46 acres, to a depth of -24 ft. MLLW, plus an additional two feet of allowable overdepth to -26 ft. MLLW. Disposal will be at a DMMP disposal site, most likely the Rosario Strait dispersive site.

Table 1. Project Tracking

SAP received	July 6, 2015
SAP received	July 23, 2015
Sampling dates	August 12 – 13, 2015
Data report received	October 12, 2015
DMMP Tracking number	BCSSQ-1-A-F-372
EIM Project number	BCSSQ15
USACE Permit Number	NWS-2015-785
Suitability Expiration (Moderate Rank)	August 2020 (5 years)

3. Project Ranking and Sampling Requirements. Per the 2014 DMMP User Manual, Squalicum Waterway in the area of this project is ranked "moderate." For a moderate-ranked

project with heterogeneous sediment, the number of samples and analyses are calculated using the following guidelines (DMMP 2014):

- Maximum volume of sediment represented by each field sample = 4,000 CY
- Maximum volume of sediment represented by each analysis in the upper 4-feet of the dredging prism (surface sediment) = 16,000 CY
- Maximum volume of sediment represented by each analysis in the subsurface portion of the dredging prism = 24,000 CY

The projected project volume at the time the sampling and analysis plan (SAP) was submitted was 13,000 CY, including a two-foot overdredge allowance and side slopes, to a depth of -26 ft. MLLW. All material was considered "surface" material. To meet DMMP sampling requirements, four core samples were required, with samples composited for one analysis in one DMMU. The Public Notice for this project (NWS-2015-785) anticipates slightly more volume--up to 14,200 CY--to dredge to the proposed depth. Since the increased volume estimate still falls within the sampling guidelines, the greater amount will be considered for this determination. Figure 2 shows the DMMUs and target sampling locations.

Table 2. Sampling Details for Bellingham Cold Storage DMMU 1

Station	Location (NAD83 WASPN)		Dredged Material Surface Sample (A) Elevation Interval (ft. MLLW)	Z-layer Sample Elevation Interval (ft. MLLW)	Drive Penetration (ft.)	Recovery (ft.)	Recovery (%)
	X Coordinate	Y Coordinate					
C-1	1235382.13	645732.26	-19.5 to -26.0	-26.0 to -28.0	14.0	11.5	82.1
C-2	1235463.53	645806.39	-18.4 to -26.0	-26.0 to -28.0	14.0	11.0	78.6
C-3	1235506.16	645893.23	-17.1 to -26.0	-26.0 to -28.0	14.0	13.1	93.6
C-4	1235595.53	645961.83	-20.0 to -26.0	-26.0 to -28.0	14.0	11.5	82.1

Adapted from Anchor OEA 2015

Coordinates are in NAD83 WA State Plane North, U.S. Feet.

DMMU = Dredged Material Management Unit

MLLW = mean lower low water

NAD83 = North American Datum of 1983

WASPN = Washington State Plane North

Sample intervals were corrected for length based on core recovery. Cores are assumed to have uniform compaction throughout the core.

Surface Sample and Z-layer Sample intervals composited for analysis.

4. Sampling. Sampling took place on August 12th, 2015, using a vessel-mounted vibracore. Table 2 includes station coordinates, depths and recovery. Target penetration depth was -28 ft. MLLW, which included the dredge prism and overdredge (to -26 ft. MLLW) as well as 2-foot Z-samples (-26 to -28 ft. MLLW). All cores were accepted on the first attempt and penetrated sufficiently to obtain Z-samples. Cores were capped and refrigerated at the BCS facility overnight, then processed at BCS on August 13, 2015. After logging, sampling and compositing, the samples were submitted to the laboratory for analysis, per the approved SAP.

5. Chemical Analysis. Samples were analyzed at Analytical Resources, Inc. (ARI) in Tukwila, Washington. The approved sampling and analysis plan was followed and quality control guidelines specified by the PSEP and DMMP programs were met (Anchor OEA 2015). All chemical and sediment conventional analytical results were subjected to EPA Stage 2B (EPA 2009) validation and dioxin/furan results were subjected to EPA Stage 4 validation by Laboratory Data Consultants in Carlsbad, California. Only minor QA/QC issues were reported. All data were considered sufficient and acceptable for regulatory decision-making, as qualified, under the DMMP program. Both dredge prism sediment (DMMU1-A) and Z-sample sediment (DMMU1-Z) were analyzed concurrently for DMMP standard chemicals of concern (COCs), as well as for dioxins/furans and bulk TBT.

Sediment conventional results (Table 3) show that the proposed dredged material is predominantly silt, with approximately 95% total fines (silt + clay), and relatively high sulfides (estimated at 1,980 and 2,120 mg/kg in the A and Z-samples, respectively). Detected and undetected concentrations were below the DMMP SL guidelines for all COCs except for benzyl alcohol, which was detected at 170 µg/g dry weight in the dredge prism, and 190 µg/g in the Z-samples (Table 4).

Table 3. BCS Sediment Conventionals

Sample ID		DMMU1-A	DMMU1-Z
Total Organic Carbon		2.53	2.03
Total Solids		59.2	60.4
Total Volatile Solids		6.5	6.1
Ammonia (NH ₃) as N		56.2	98.9
Sulfide		1980 J	2120 J
Grain Size	Gravel (> 2000 µm)	0.0	0.0
	Sand (63-2000 µm)	4.5	6.2
	Silt	80.7	78.4
	Clay	14.8	15.7
	Total Fines (Silt + Clay)	95.5	94.1

- a. **Benzyl alcohol.** In typical projects, a detected or undetected exceedance of any COC results in a requirement to conduct bioassays to determine suitability for open water disposal. But in recent years the DMMP has seen an increase in cases of benzyl alcohol detection, often as the only elevated COC, and has used best professional judgment (BPJ) to waive bioassays in some of these cases. Benzyl alcohol is produced naturally by the decay of vegetation and is often associated in marine sediments with plant material and woody deposits. Anthropogenic sources of benzyl alcohol include pharmaceuticals, soap, perfume and flavor products. In this project, as in several previous recent projects (e.g. Snohomish DY12, La Conner Marina DY15, and Shelter Bay DY15) elevated benzyl alcohol has been seen under similar conditions: evidence of organic matter (leaves, twigs etc.) in the cores, relatively high levels of sulfide, and no apparent anthropogenic sources. Organic matter was noted on core logs in three out of the four cores composited for this project. High sulfides are another indicator of decomposing plant material, since hydrogen sulfide is generated by the bacterial decomposition of organic material under anoxic conditions. The DMMP agencies used BPJ to determine that the benzyl alcohol found in these Squaticum Waterway sediments was most likely derived from natural sources and

was unlikely to be anthropogenic in nature. On the basis of this judgment, the agencies determined that bioassays would not be required.

- b. **Dioxins.** The DMMP dioxin guidelines (DMMP 2010) require at least limited dioxin testing for all projects using dispersive sites, even when there is no reason to believe that dioxin may be present at elevated concentrations. For dispersive sites, all tested material must show TEQs equal or less than the Dispersive Site Management Objective of 4 pptr TEQ. Results of this analysis were well below this objective, estimated at 1.7 pptr TEQ (with U=½ DL), for the dredge prism and 1.6 pptr TEQ for the Z-samples. These results were consistent with sample results taken from the project area in 2012 (DMMP 2012), which had dioxin concentrations of 2.4 and 2.1 pptr TEQ.

7. Post-Dredge Sediment Quality. The sediment to be exposed by dredging must meet the State of Washington Antidegradation standard (Ecology 2013) as outlined by DMMP guidance (DMMP 2008). For this project, the sediment exposed by dredging—as represented by the Z-samples—exceeds no DMMP SLs, except for benzyl alcohol, which is discussed above. Therefore, the sediment to be exposed by dredging is not considered to be degraded relative to the currently exposed sediment surface, and the DMMP agencies concluded that this project is in compliance with the State of Washington anti-degradation policy.

8. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from the Bellingham Cold Storage access area in the Squalicum Waterway, for open-water disposal at a DMMP dispersive or non-dispersive site. 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. Based on the results of the previously described testing, the DMMP agencies conclude that **all tested material is suitable** for open-water disposal at the Rosario Strait site or any other DMMP disposal site.

This suitability determination does **not** constitute final agency approval of the expanded 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.

A pre-dredge conference call with DNR, Ecology and the Corps of Engineers will be required. A dredging quality control plan must be developed and submitted to the DMMP prior to the pre-dredge conference call. A DNR site use authorization must also be acquired.

9. References.

Anchor QEA 2015. *Data Report: Bellingham Cold Storage – Squalicum Waterway, Navigational Maintenance Sediment Characterization.* Prepared on behalf of Bellingham Cold Storage, October 2015.

DMMP 2014. *Dredged Material Evaluation and Disposal Procedures (User Manual).* Dredged Material Management Program, updated December 2014.

DMMP 2012. *Memorandum for Record: Determination of the Suitability of Dioxin Concentrations Measured Within the Federal Channel in Bellingham Harbor.* Decisions Document dated 5 January 2012.

- DMMP 2010. *DMMP Issue Paper: Dredged Material Management Program New Interim Guidelines for Dioxins*. Prepared by the DMMP agencies, December 6, 2010.
- DMMP 2008. *DMMP Clarification Paper: Quality of Post-Dredge Sediment Surfaces (Updated)*. Prepared by David Fox (USACE), Erika Hoffman (EPA) and Tom Gries (Ecology) for the Dredged Material Management Program, June 2008.
- EPA, 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*.
- PSDDA, 1988. *Evaluation Procedures Technical Appendix – Phase I – Central Puget Sound*. U.S. Army Corps of Engineers Seattle District, U.S. Environmental Protection Agency Region 10, Washington State Department of Ecology, Washington State of Natural Resources. June 1988.

signed copy on file in DMMO USACE office

10. Agency Signatures.

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Concur:

Date Lauran Cole Warner - Seattle District Corps of Engineers

Date Erika Hoffman - Environmental Protection Agency

Date Laura Inouye, Ph.D. - Washington Department of Ecology

Date Celia Barton - Washington Department of Natural Resources

Copies furnished:

- DMMP signatories
- Randel Perry, Seattle District Regulatory
- Joy Dunay & Valerie Oster, Anchor QEA
- Gary White, Bellingham Cold Storage
- Merle Jefferson, Lummi Nation

Table 4. Summary of Chemical Results for Bellingham Cold Storage

CHEMICAL	DMMP Marine Guidelines			DMMU 1-A		DMMU 1-Z	
	SL	BT	ML	Value	LQ	Value	LQ
METALS (mg/kg dry weight)							
Antimony	150	---	200	3.0	J	3.6	J
Arsenic	57	507.1	700	18.2	J	19.8	J
Cadmium	5.1	11.3	14	0.8	U	0.8	U
Chromium	260	260	---	71		77	
Copper	390	1,027	1,300	42.7		43.4	
Lead	450	975	1,200	7.52	J	7.25	J
Mercury	0.41	1.5	2.3	0.08		0.08	
Selenium	---	3	---	0.47	J	0.52	J
Silver	6.1	6.1	8.4	1	U	1	U
Zinc	410	2,783	3,800	84		87	
PAHs (µg/kg dry weight)							
Naphthalene	2,100	---	2,400	25		37	
Acenaphthylene	560	---	1,300	20	U	19	U
Acenaphthene	500	---	2,000	11	J	18	J
Fluorene	540	---	3,600	24		32	
Phenanthrene	1,500	---	21,000	79		110	
Anthracene	960	---	13,000	11	J	14	J
2-Methylnaphthalene ⁽²⁾	670	---	1,900	42		65	
Total LPAH	5,200	---	29,000	150	J	211	J
Fluoranthene	1,700	4,600	30,000	76		93	
Pyrene	2,600	11,980	16,000	61		71	
Benz(a)anthracene	1,300	---	5,100	20		20	
Chrysene	1,400	---	21,000	39		48	
Benzofluoranthenes (b, j, k)	3,200	---	9,900	48		49	
Benzo(a)pyrene	1,600	---	3,600	15	J	15	J
Indeno(1,2,3-c,d)pyrene	600	---	4,400	13	J	13	J
Dibenz(a,h)anthracene	230	---	1,900	6.4		7.1	
Benzo(g,h,i)perylene	670	---	3,200	19	J	10	J
Total HPAH	12,000	---	69,000	291	J	326	J
CHLORINATED HYDROCARBONS (µg/kg dry weight)							
1,4-Dichlorobenzene	110	---	120	4.9	U	4.8	U
1,2-Dichlorobenzene	35	---	110	4.9	U	4.8	U
1,2,4-Trichlorobenzene	31	---	64	4.9	U	4.8	U
Hexachlorobenzene (HCB)	22	168	230	4.9	U	4.8	U
PHTHALATES (µg/kg dry weight)							
Dimethyl phthalate	71	---	1,400	4.9	U	4.8	U
Diethyl phthalate	200	---	1,200	21	U	19	U
Di-n-butyl phthalate	1,400	---	5,100	19	J	18	J
Butyl benzyl phthalate	63	---	970	8.6		14	
Bis(2-ethylhexyl) phthalate	1,300	---	8,300	43	J	35	J
Di-n-octyl phthalate	6,200	---	6,200	20	U	19	U
PHENOLS (µg/kg dry weight)							
Phenol	420	---	1,200	120		120	
2-Methylphenol	63	---	77	8.5		4.2	J
4-Methylphenol	670	---	3,600	24		28	
2,4-Dimethylphenol	29	---	210	24	U	24	U
Pentachlorophenol	400	504	690	65		19	U

CHEMICAL	DMMP Marine Guidelines			DMMU 1-A		DMMU 1-Z	
	SL	BT	ML	Value	LQ	Value	LQ
MISCELLANEOUS EXTRACTABLES (µg/kg dry weight)							
Benzyl alcohol	57	---	870	170		190	
Benzoic acid	650	---	760	570		540	
Dibenzofuran	540	---	1,700	20		26	
Hexachlorobutadiene	11	---	270	4.9	U	4.8	U
N-Nitrosodiphenylamine	28	---	130	20	UJ	19	U
PESTICIDES & PCBs (µg/kg dry weight)							
4,4'-DDD	16	---	---	0.99	U	0.97	U
4,4'-DDE	9	---	---	0.99	U	0.97	U
4,4'-DDT	12	---	---	0.99	UJ	0.97	U
sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT	---	50	69	0.99	UJ	0.97	U
Aldrin	10	---	---	0.5	UJ	0.48	U
Total Chlordane (sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane)	2.8	3.7		0.99	UJ	0.97	U
Dieldrin	2	---	1,700	0.99	UJ	0.97	U
Heptachlor	2	---	270	0.5	UJ	0.48	U
Total PCBs Aroclors (Sum of: 1016, 1221, 1242, 1248, 1254, 1260, 1268)	130	38*	3,100	9.9	U	9.7	U
ORGANOMETALLIC COMPOUNDS							
Tributyltin ion (bulk; ug/kg)	73	73	---	3.6	UJ	3.5	U

Notes:

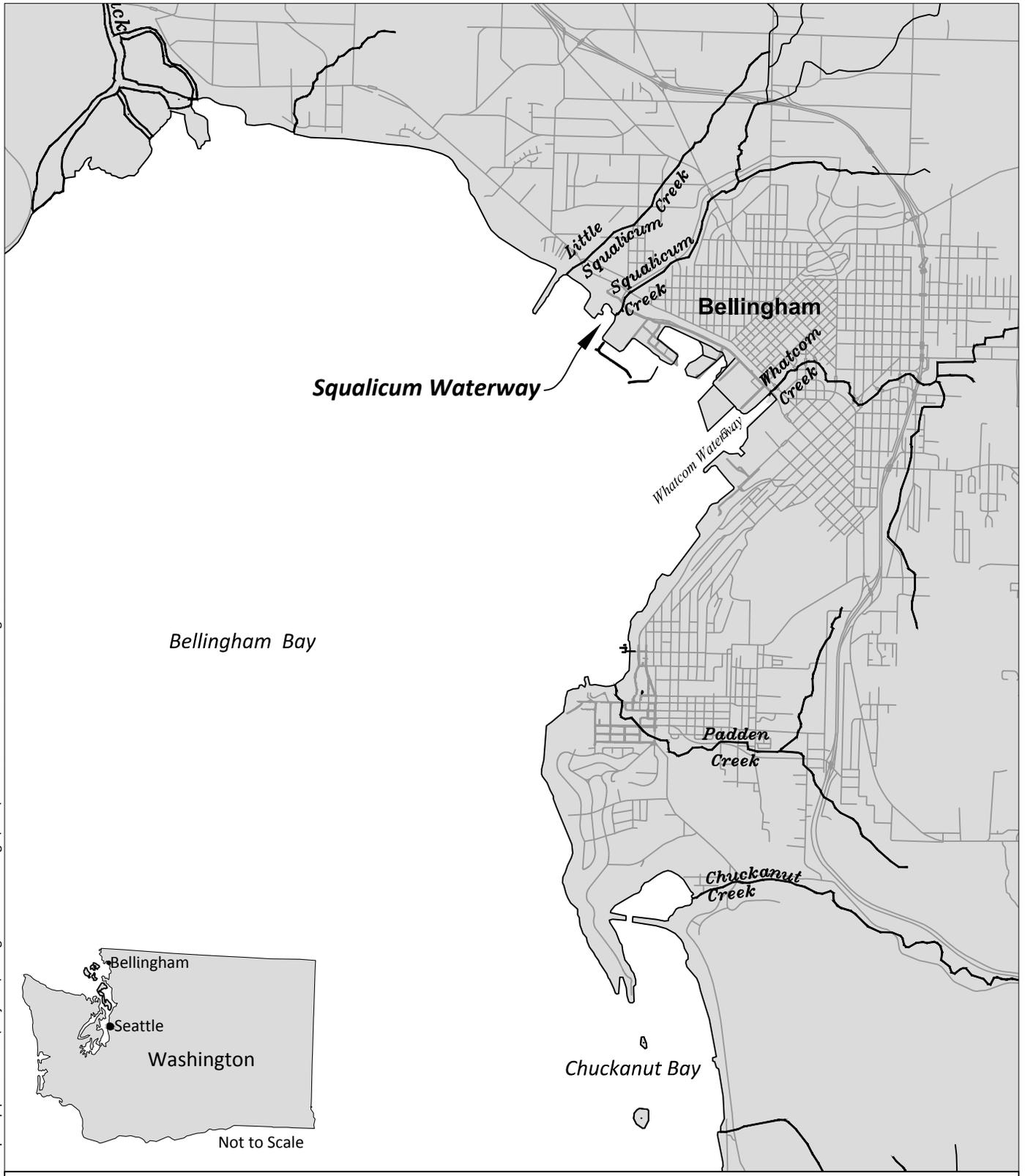
1. **Yellow shading** = detected concentration > SL
2. **Bold** = detected result
3. LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds. Total LPAH = Sum of acenaphthylene, acenaphthene, anthracene, fluorene, naphthalene and phenanthrene. Methylnaphthalene is not included in the summation for total LPAH.
4. HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds. Total HPAH = The sum of benzo(a)anthracene, benzo(a)pyrene, total benzofluoranthenes, benzo(g,h,i)perylene, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-c,d)pyrene and pyrene.
5. Total benzofluoranthenes = the sum of the "b," "j" and "k" isomers. The "j" isomer co-elutes with the "k" isomer, thus the concentration of the "j" isomer is included in the "k" isomer concentration
6. This value is normalized to total organic carbon, and is expressed in mg/kg organic carbon.
7. Lab Qualifiers (LQ):
 - U= Target analyte was not detected at the reported concentration.
 - J = Estimated concentration when the value is less than ARI's established reporting limits.
 - UJ = Compound analyzed, but not detected above estimated detection limit

Table 5. Dioxin results and TEQ calculations

	TEF	ng/kg				ND=1/2 RL TEQ				ND=0 TEQ			
	WHO 2005	DMMU 1-A		DMMU 1-Z		DMMU 1-A		DMMU 1-Z		DMMU 1-A		DMMU 1-Z	
2,3,7,8-TCDF	0.1	0.325	U	0.311	U	0.016	U	0.016	U	0		0	
2,3,7,8-TCDD	1	0.106	U	0.211	U	0.053	U	0.106	U	0		0	
1,2,3,7,8-PeCDF	0.03	0.289	U	0.227	U	0.004	U	0.003	U	0		0	
2,3,4,7,8-PeCDF	0.3	0.262	J	0.31	J	0.079	J	0.093	J	0.079	J	0.093	J
1,2,3,7,8-PeCDD	1	0.431	J	0.389	U	0.431	J	0.195	U	0.431	J	0	
1,2,3,4,7,8-HxCDF	0.1	0.704	U	0.939	J	0.035	U	0.094	J	0		0.094	J
1,2,3,6,7,8-HxCDF	0.1	0.337	U	0.321	U	0.017	U	0.016	U	0		0	
2,3,4,6,7,8-HxCDF	0.1	0.42	J	0.514	U	0.042	J	0.026	U	0.042	J	0	
1,2,3,7,8,9-HxCDF	0.1	0.4	J	0.504	U	0.040	J	0.025	U	0.040	J	0	
1,2,3,4,7,8-HxCDD	0.1	0.369	U	0.665	J	0.018	U	0.067	J	0		0.067	J
1,2,3,6,7,8-HxCDD	0.1	2.09		2.63		0.209		0.263		0.209		0.263	
1,2,3,7,8,9-HxCDD	0.1	1.18		1.29		0.118		0.129		0.118		0.129	
1,2,3,4,6,7,8-HpCDF	0.01	6.31		8.6		0.063		0.086		0.063		0.086	
1,2,3,4,7,8,9-HpCDF	0.01	0.2	U	0.602	U	0.001	U	0.003	U	0		0	
1,2,3,4,6,7,8-HpCDD	0.01	47.6		65		0.476		0.650		0.476		0.650	
OCDF	0.0003	21.6		28.6		0.006		0.009		0.006		0.009	
OCDD	0.0003	397		611		0.119		0.183		0.119		0.183	
Totals						1.7	J	2.0	J	1.6	J	1.6	J

- Lab Qualifiers (LQ):
 - U= Target analyte was not detected at the reported concentration.
 - J = Estimated concentration when the value is less than ARI's established reporting limits.

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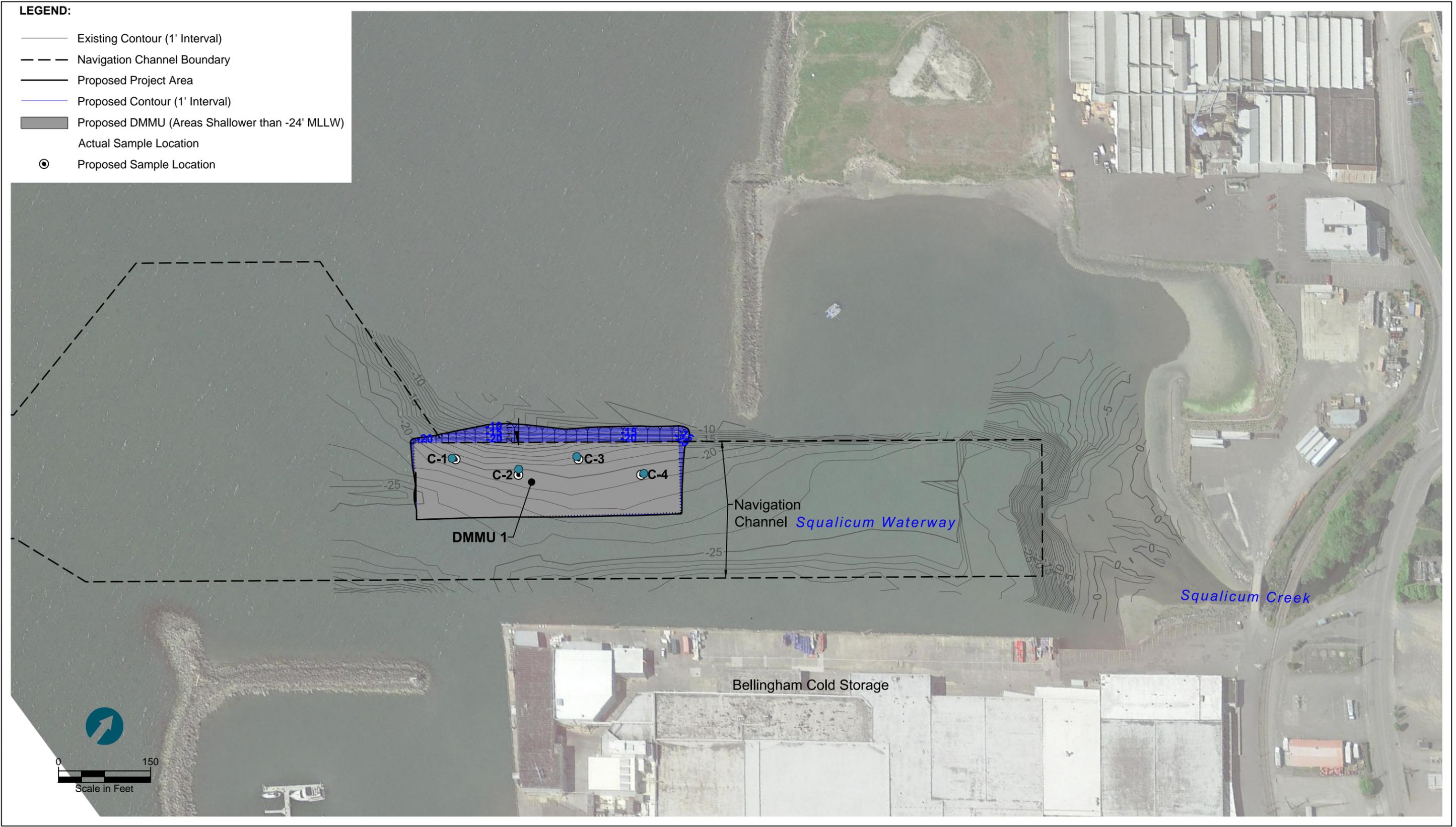


SOURCE: Prepared from GIS data



Figure 1
Vicinity Map
Sampling and Analysis Plan
Bellingham Cold Storage Sediment Characterization
Bellingham Cold Storage

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HORIZONTAL DATUM: Washington State Plane North, NAD83, U.S. Feet.
VERTICAL DATUM: Mean Lower Low Water (MLLW).
SOURCE:
1. Bathymetry acquired from Squalicum Waterway Condition Survey, July 29/30 2013. Survey file number E-9-7-76.
2. Aerial image is Google Earth Pro (v.7.1.1.1888). Image date is July 10, 2014.



Figure 2
Target and Actual Sample Locations
Bellingham Cold Storage Sediment Characterization
Bellingham Cold Storage