CENWS-ODS-ND

MEMORANDUM FOR: RECORD May 16, 2017

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE MAKAH TRIBE, EMERGENCY SPILL DOCK EXTENSION, NEAH BAY, WASHINGTON (NWS-2016-826) FOR IN-WATER DISPOSAL AT THE DMMP PORT ANGELES DISPERSIVE DISPOSAL SITE, AT AN APPROVED BENEFICIAL USE SITE, OR PLACEMENT AT AN APPROVED UPLAND 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 of 208,031 cubic yards (cy) of dredged material from the Makah Tribe Emergency Spill Dock Extension project in Neah Bay for disposal at the DMMP Port Angeles open-water disposal site, placement within Neah Bay for intertidal and/or subtidal beneficial use, or placement at an approved upland site.

2. PROJECT SUMMARY. The Makah Tribe proposes to dredge areas around an existing commercial fishing dock and construct a large dock extension to establish a facility for emergency oil spill response vessels (Figure 1). The project proposes to increase the depths within the new berthing area to elevations ranging from -15 to -25 feet mean lower low water (MLLW) plus one foot allowable overdepth (-16 to -26 feet MLLW). Most of the berthing area will be dredged to an elevation of -25 feet MLLW (plus one foot of allowable overdepth) to accommodate spill response vessels and to provide access to deeper waters of Neah Bay. The portion of the dredge prism to the south and east of the existing commercial fishing dock (Figure 2) will be dredged to an elevation of -15 feet MLLW (plus one foot of allowable overdepth) to provide access for small boats. Dredging is proposed for the fall/winter of 2018/2019. Suitable material is proposed for placement using hydraulic pipeline or clamshell dredging equipment on permitted beneficial use sites within the bay. The area has never been previously dredged.

Table 1. Makah Tribe Emergency Spill Response Dock - Project Tracking

Draft SAP received	13 October 2016
Draft SAP comments submitted	27 October 2016
Final SAP received	7 November 2016
Final SAP approved	15 November 2016
Sampling date	21 November 2016
Data report received	8 February 2017
Updated data report received	4 April 2017
DMMP Tracking number	MAKAH-1-A-F-379
EIM Project number	MAKAH17
USACE Permit Number	NWS-2016-826
Recency Expiration Date (LM Rank = 6 years)	30 November 2022

3. PROJECT RANKING AND SAMPLING REQUIREMENTS. The sampling approach was based on the proposed dredge volume, dredge prism configuration, and sampling frequency, and also based on typical cross sections and conditions within the project area (Table 2). The area has never been dredged or previously characterized. The project was ranked “low-moderate” for this characterization,

based on DMMP general guidelines (DMMP 2016) for a site removed from major sources of contamination but without sufficient data to support a "low" rank.

Table 2. DMMUs and Sampling Strategy

DMMU ID	sub units	Assumed Elevation (ft MLLW)	Dredge Depth + 1' OD (ft MLLW)	Approximate Total DMMU Volume (cy)
DMMU 1	S-1	-23	-26	31,787
	S-2	-22		
	S-3	-24		
	S-4	-23.5		
DMMU 2	S-5	-23	-26	31,983
	S-6	-21		
	S-7	-20		
	S-8	-20.5		
DMMU 3	S-9	-19	-26	31,991
	S-10	-19		
	S-11	-18		
	S-12	-18		
DMMU 4	S-13	-19	-26	31,912
	S-14	-18		
	S-15	-19		
	S-16	-20		
DMMU 5	S-17	-17	-26	31,997
	S-18	-17.5		
	S-19	-16		
	S-20	-16		
DMMU 6	S-21	-17	-26	31,791
	S-22	-17		
	S-23	-14		
	S-24	-13		
DMMU 7	S-25	-16	-26	3,288
	S-26	-19		4,359
	S-27	-7	-16	4,262
	S-28	-12		4,661
Total				208,031

For a low-moderate project of heterogeneous sediment, the number of samples and analyses are calculated using the following guidelines:

- Maximum volume of sediment represented by each field sample = 8,000 cubic yards.
- Maximum volume of sediment represented by each analysis in the upper 4-feet of the dredging prism (surface sediment) = 32,000 cubic yards.
- Maximum volume of sediment represented by each analysis in the subsurface portion of the dredging prism = 48,000 cubic yards.

For this project, although the proposed dredge cut is greater than four feet deep in some locations, all material was considered "surface" material; sample density was one sample per 8,000 cy and one analysis (DMMU) per 32,000 cy. The DMMU that encompassed the shallow dredge area (to -15 ft MLLW) was considered most likely to be exposed to potential contamination, and that DMMU (DMMU-7) contained about half the sediment volume as the other DMMUs (Table 2).

Prior to submittal of the Sampling and Analysis Plan (BergerAbam 2016b), the Tribe proposed a sampling approach to characterize this project with surface samples rather than sediment cores. They

based this proposal on previous sampling and geotechnical borings in Neah Bay that found dense subsurface materials that were difficult to penetrate. In addition, there are few sources of sediment to Neah Bay and sediment deposition has been negligible in recent years. This information, along with the lack of any previous dredging in the area, allowed the DMMP to use BPJ (best professional judgment) to approve the use of surface samples to characterize this material. In this case, subsurface material is presumably native material with little chance for contamination. The Tribe's proposal to use a pneumatic power grab sampler was accepted, as the site history in this location indicates surface samples likely reflect a worst-case scenario for any potential chemicals of concern.

4. SAMPLING. Sampling took place on 21 November 2016, using a pneumatic power grab sampler. Twenty-eight grab samples were obtained per the approved SAP (Table 3). Two sample locations were revised in the field and coordinated with DMMO as required: sample S-3 was moved approximately 320 feet south because the proposed location was deeper than the design dredge depth, and sample S-24 was moved approximately 20 feet east because the planned GPS coordinates described in the SAP did not match the proposed location shown in the SAP (Figure 3).

Table 3. Sample Locations and Depths

DMMU ID	Dredge Depth Elevation + 1-ft OD (ft MLLW)	Sample ID [1]	Northing [2]	Easting [2]	Adjusted Mudline Elevation [3] (ft MLLW)	Sample Depth Recovered (inches)
1	-26	S-1	522599.41	721118.52	24.21	10.5
		S-2	522338.53	721278.71	23.20	12
		S-3	522211.50	721526.42	24.32	8.5
		S-4	522076.18	721731.22	24.93	12
2	-26	S-5	521868.41	721772.38	24.51	8
		S-6	521956.54	721571.43	22.93	9
		S-7	522093.51	721400.31	21.97	10.5
		S-8	522190.44	721155.75	21.81	8.5
3	-26	S-9	522051.21	721116.85	20.05	11
		S-10	521949.58	721304.46	20.69	10.5
		S-11	521848.89	721127.36	19.28	11
		S-12	521753.59	721305.15	19.37	10
4	-26	S-13	521783.08	721490.90	20.70	10
		S-14	521617.10	721476.04	19.24	10
		S-15	521651.74	721627.71	20.33	10.5
		S-16	521625.40	721772.95	21.22	10
5	-26	S-17	521712.24	721107.34	18.82	11
		S-18	521627.72	721287.53	18.81	10.5
		S-19	521552.34	721119.78	17.55	8.5
		S-20	521491.09	721304.29	17.36	10
6	-26	S-21	521539.89	721425.13	18.68	9
		S-22	521476.01	721541.82	18.57	8
		S-23	521406.57	721450.00	15.59	10
		S-24	521320.59	721632.41	14.37	9.5
7	-26	S-25	521393.89	721712.53	16.87	6
		S-26	521482.26	721767.89	20.05	6
	-16	S-27	521237.51	721794.09	10.94	6.5
		S-28	521273.17	721914.74	12.66	8

NOTES:
[1] See Figure 3 for sample locations
[2] Northing and easting are based on the North American Datum of 1983 (NAD83) State Plane Coordinate System, Washington North
[3] Adjusted Mudline Elevation = Water Depth + Tidal Stage

5. CONVENTIONAL AND CHEMICAL ANALYSES. The approved sampling and analysis plan was followed and quality control guidelines specified by the PSEP and DMMP programs were met, with only minor quality control deviations (BergerABAM 2017). All laboratory analyses were performed by Analytical Resources Inc. (ARI) in Tukwila, Washington and their subcontractors. After results of the initial seven composite analyses were received, some follow-up analyses were done, per details below. Because the dredged material is being considered for a variety of disposal alternatives/beneficial use projects, the Tribe requested that material also be evaluated under the SMS program to assist review by other regulatory programs. The final data were considered sufficient and acceptable for regulatory decision-making under the DMMP program.

5.1 Sediment Conventionals. Sediment conventional results (Table 4) showed that the proposed dredged material is predominantly fine sand with some silt and clay. Total fine fractions (silt + clay) ranged from 17% in DMMU-7 to 51% in DMMU-3. Total organic carbon ranged from 0.4% to 1.7%. Organic materials such as algae, worms, roots and shells were incorporated into the sediment in several samples. Small debris such as bottles, cans, rubber gloves and a boat battery were also found in some samples, particularly in DMMU-7.

5.2 Sub-Sample Analyses. Results from the DMMU-7 composite indicated a DMMP exceedance of mercury and SMS exceedances of mercury as well as several PAHs. Previously archived separate subsamples of DMMU-7 (S-25, S-26, S-27 and S-28) were then submitted for analysis of total organic carbon, total solids, mercury, PAHs and phthalates. By the time the composite results were received from the lab, the 28-day holding time for mercury for the subsamples had expired by about 2 ½ weeks. Results for those subsamples are qualified by the lab (Tables 5 and 6).

Table 4. Makah Tribe Emergency Response Dock - Summary of Conventional Results

		Dredged Material Management Unit (DMMU)							DMMU 7 subsamples			
		1	2	3	4	5	6	7	S-25	S-26	S-27	S-28
DMMU Volume		31,787	31,983	31,991	31,912	31,997	31,791	16,570	3,288	4,359	4,262	4,661
Grain Size (% total)	Gravel	0.1	8.3	0.1	0	0	0	3.6	---	---	---	---
	Sand	76.2	67	48.6	72.3	66.8	79.7	79.7	---	---	---	---
	Silt	15.7	16.8	31.8	16	21.8	13.7	11	---	---	---	---
	Clay	8.2	7.7	19.6	11.7	11.3	6.5	5.5	---	---	---	---
	Total Fines (silt+clay)	23.9	24.5	51.4	27.7	33.1	20.2	16.5	---	---	---	---
Ammonia (mg/kg dry wt.)		24.9	8.86	17.7	4.35	11.8	4.15	4.83	---	---	---	---
Total Sulfides (mg/kg dry wt.)		5.93	133	845	227	564	88.7	638	---	---	---	---
Total Solids (%)		67.33	64.23	47.02	62.52	51.21	71.79	71.13	66.1	77.03	71.37	72.5
Total volatile solids (%)		2.98	3.56	6.81	3.84	6.31	2.36	2.54	---	---	---	---
Total organic carbon (%)		0.62	0.88	1.59	0.92	1.74	0.41	0.62	1.05	0.41	0.55	0.57

5.3 DMMP Guideline Comparisons.

5.3.1 Standard Chemicals of Concern: Chemical results for DMMUs 1 - 6 all indicated no detected or undetected exceedances of standard DMMP chemicals of concern screening levels (Table 5). Low levels of PAHs were detected in these DMMUs but were generally an order of magnitude below DMMP SLs. DMMU-7 was different: that composite had a slight mercury exceedance (0.46 mg/kg dry wt; the SL is 0.41 mg/kg dry wt) as well as higher PAH detections

compared to the other DMMUs. Though elevated over the other DMMUs, the total HPAHs of 6,411 ug/mg dry wt in DMMU-7 were still only about half the DMMP SL of 12,000 ug/mg dry wt.

5.3.2 Non-Standard Chemicals of Concern: Analyses for bulk TBT were done on composites from DMMUs adjacent to the nearby marina: DMMUs 1, 2, 4 and 7. TBT was undetected in all samples. Petroleum hydrocarbons were analyzed in DMMUs 6 and 7 and were either undetected or detected at low levels. No dioxin analyses were required.

5.3.3 Subsample Analyses. Each of the four samples that were composited for DMMU-7 underwent additional separate analyses in an attempt to qualify composite results and to provide further information should bioassay testing be pursued. Mercury analyses in the subsamples were all detected well below the DMMP guidelines, although the holding times were expired. These results were not considered sufficient evidence to set aside the mercury exceedance in the composite. In addition, two of the subsamples showed PAH exceedances over DMMP SLs, including an exceedance of total HPAHs in S-27. S-28 had no exceedances of PAHs but it did have an SL exceedance of dimethyl phthalate. Only S-26 had no exceedances. Thus, three out of four subsamples comprising DMMU-7 exceeded DMMP guidelines.

5.4 SMS Guideline Comparisons. All results of the chemical analyses were organic carbon normalized if necessary and compared to Washington State Sediment Management Standards. As with the DMMP comparison, the only detected exceedances of SMS standard chemicals of concern were found in DMMU-7 and its subsamples (Table 6). There was one undetected exceedance of OC normalized results for 1,2,4-trichlorobenzene in DMMU-6. That DMMU, however, had the lowest total organic carbon of all the analyzed composites (0.41% mg/kg dry wt.). For sediment samples lower than 0.5% TOC, use of the normalized value may not be appropriate (Michelsen 1992). In this case, the DMMP used BPJ to determine that the dry wt. concentration of the undetected value is sufficient to indicate that the chemical is not present at SMS guideline values.

This evaluation showed that all material suitable for open-water disposal may also be suitable for approved, in-water beneficial uses under Washington State Sediment Management Standards and DMMP guidelines, depending on the specifics of the proposed use. As always, actual beneficial uses must be approved in other applicable permits and/or authorizations.

6. BIOLOGICAL TESTING. The Tribe chose not to pursue further testing under DMMP's tiered evaluation program at this time and thus no biological testing was conducted. Thus, all material in DMMU-7 (16,750 cy) was found not suitable for unconfined open-water disposal. Further sampling and testing could be considered for this unsuitable material should the Tribe choose to pursue biological testing in the future.

7. UNSUITABLE MATERIAL BUFFERS. Since the true border between suitable and unsuitable material cannot be known due to the nature of sediment sampling, the DMMP agencies typically request that ½ the distance to the nearest sample in neighboring DMMUs be considered unsuitable and be dredged and disposed along with the unsuitable material. In this case, the unsuitable DMMU-7 surrounds the existing commercial fishing dock which appears to be the source of physical debris and chemical contamination. A video survey of debris within the dredge prism indicated that similar conditions may extend west into DMMU-6 but not north into DMMU-4 (see Figure 4). The Tribe and the Agencies agreed on an unsuitable buffer into DMMU-6 of approximately 13,070 ft^2 which includes an additional 4,700 cy of dredged material.

8. POST-DREDGE SEDIMENT QUALITY. The sediment to be exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) or the State's Antidegradation standard (Ecology 2013) as outlined by DMMP guidance (DMMP 2008). For this project, site history tells us that the proposed post-dredge material is native sediment most likely not exposed to any potential contaminant sources, and there is no reason to believe that the sediment to be exposed by dredging is degraded relative to the current sediment surface. Thus, the DMMP agencies concluded that this project is in compliance with the State of Washington anti-degradation policy.

9. SUITABILITY DETERMINATION. This memorandum documents the evaluation of the suitability of sediment proposed for dredging from the Makah Tribe Emergency Spill Dock Extension for open-water disposal at a DMMP dispersive disposal site. It also evaluates potential suitability for in-water beneficial uses. 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 concluded that 186,761 cy are suitable for open-water disposal. A total of 21,270 cy are NOT suitable for in-water disposal, as detailed below and in Figure 4:

    - Suitable for in-water disposal: DMMUs 1, 2, 3, 4, 5 and 27,091 cy in DMMU 6
    - Unsuitable for in-water disposal: DMMU 7 and 4,700 cy in DMMU 6

    DMMUs suitable for open-water disposal are also potentially suitable for in-water beneficial use. However, any proposed beneficial use site must be separately permitted and may have additional guidelines or requirements for use of this material.

    9.1 Debris Management. The DMMP agencies implemented a debris screening requirement in 2015 to prevent the disposal of solid waste and large debris at open-water disposal sites (DMMP 2015). It states that "all projects must use a screen to remove debris unless it can be demonstrated that debris is unlikely to be present or that the debris present is large woody debris that can be easily observed and removed by other means during dredging." For this project, a 12"x12" debris screen must be used for all material dredged by clamshell and placed on a barge for disposal, unless information is provided to the DMMP that meets the "reason to believe" criteria laid out in DMMP 2015. Equivalent debris management must be applied to material dredged via hydraulic dredge for in-water disposal. The Tribe has prepared a Mitigation Plan (BergerAbam 2017a) that includes debris removal as part of project mitigation, and states that debris will be removed prior to, or concurrent with, dredging.

    9.2 Permitting. This suitability determination does *not* constitute final agency approval of this project. During the comment period that follows a public notice, 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 DNR site use authorization must also be acquired for disposal at a DMMP open-water disposal site.

    9.3 Pre-Dredge Quality Control Plan and Meeting. A pre-dredge meeting with DNR, Ecology, EPA and the Corps of Engineers is required at least 7 days prior to dredging. A dredging quality control plan (QCP) must be developed and submitted to the Regulatory Branch of the Seattle District Corps of Engineers at least 14 days prior to the pre-dredge meeting. The dredging quality control plan must clearly show how the unsuitable material will be dredged and handled separately from suitable material. Dredging, positioning, de-watering, transloading and disposal must be addressed with enough detail to provide assurance to the agencies that the dredge plan will be properly implemented. The QCP must include a debris management plan.

10. REFERENCES

BergerABAM 2017a. *Dredged Material Characterization Report, Makah Tribe – Emergency Spill Dock Extension, Neah Bay, Washington*. Prepared by BergerABAM for US Army Corps of Engineers, Seattle District. 3 February 2017.

BergerABAM 2017. *Dredged Material Characterization Report, Makah Tribe – Emergency Spill Dock Extension, Neah Bay, Washington*. Prepared by BergerABAM for US Army Corps of Engineers, Seattle District. 3 February 2017.

BergerABAM 2016a. *Memorandum: Makah Emergency Spill Dock Expansion – Proposed Sampling Approach for Dredged Material Characterization*. Prepared by BergerABAM for US Army Corps of Engineers, Seattle District. 1 September 2016.

BergerABAM 2016b. *Sampling and Analysis Plan: Makah Tribe Emergency Spill Dock Extension, Dredged Material Characterization.* 12 October 2016.

DMMP 2016. *Dredged Material Evaluation and Disposal Procedures (User Manual)*. Dredged Material Management Program, updated August 2016.

DMMP 2015. *DMMP Clarification Paper: Debris Screening Requirements for Dredged Material Disposed at Open-Water Sites.* Prepared by Erika Hoffman (EPA), Celia Barton (DNR) and David Fox (USACE), for the Dredged Material Management Program, October 2, 2015.

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.

Ecology 2013. *Sediment Management Standards – Chapter 173-204 WAC*. Washington State Department of Ecology, February 2013.

Michelsen 1992. *Technical Information Memorandum: Organic Carbon Normalization of Sediment Data.* Prepared by Teresa C Michelsen, Ph.D., Washington Department of Ecology. Publication No. 05-09-050, December 1992.

11. AGENCY SIGNATURES

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF PROPOSED DREDGED MATERIAL FROM THE MAKAH TRIBE, EMERGENCY SPILL DOCK EXTENSION, NEAH BAY, WASHINGTON (NWS-2016-826) FOR IN-WATER DISPOSAL AT THE DMMP PORT ANGELES DISPERSIVE DISPOSAL SITE, AT AN APPROVED BENEFICIAL USE SITE, OR PLACEMENT AT AN APPROVED UPLAND SITE.

Signed copy on file in the Dredged Material Management Office, Seattle District USACE

_____ _____
Date Lauran Cole Warner - Seattle District Corps of Engineers

_____ _____
Date Justine Barton - Environmental Protection Agency

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

_____ _____
Date Celia Barton - Washington Department of Natural Resources

Copies furnished:

DMMP signatories
Juliana Houghton, Seattle District Regulatory
Victoria England, BergerABAM
Norman Down, Makah Tribe
Bob Buckingham, Port of Neah Bay

Makah Tribe Emergency Spill Dock | Results of Chemical Analysis Compared to DMMP Guidelines | DMMP Suitability Determination

													DMMU 7 subsamples								DMMP Criteria (dry wt)		
	DMMU-1		DMMU-2		DMMU-3		DMMU-4		DMMU-5		DMMU-6		DMMU-7		S-25		S-26		S-27		S-28		SL	BT	ML
CONVENTIONALS (mg/kg dry weight)																									
Ammonia	24.9		8.86		17.7		4.35		11.8		4.15		4.83		---		---		---		---		---	---	---
Total sulfides	5.93		133		845		227		564		88.7		638		---		---		---		---		---	---	---
GENERAL CHEMISTRY (percent)																									
Total solids	67.33		64.23		47.02		62.52		51.21		71.79		71.13		66.1		77.03		71.37		72.5		---	---	---
Total volatile solids	2.98		3.56		6.81		3.84		6.31		2.36		2.54		---		---		---		---		---	---	---
Total organic carbon	0.62		0.88		1.59		0.92		1.74		0.41		0.62		1.05		0.41		0.55		0.57		---	---	---
METALS (mg/kg dry weight)																									
Antimony	18.2	U	1.45	J	1.23	J	1.09	J	1.32	J	1.08	J	1.26	J	---		---		---		---		150	---	200
Arsenic	18.2	U	6.48	U	8.83	U	7.58	U	8.72	U	14.1	U	6.15	U	---		---		---		---		57	507.1	700
Cadmium	0.55	JD	0.31		0.64		0.42		0.61		0.6		0.55		---		---		---		---		5.1	---	14
Chromium	30.1		23.7		41.6		26.8		37.6		24.1		19.1		---		---		---		---		260	---	---
Copper	16.6		12.5		32.5		17		22.4		16.5		23		---		---		---		---		390	---	1,300
Lead	7.36		6.97		15		7.97		12.2		7.93		7.68		---		---		---		---		450	975	1,200
Mercury	0.064		0.018	J	0.05		0.04		0.09		0.03		0.46		0.07	H	0.05	H	0.01	HJ	0.17	H	0.41	1.5	2.3
Selenium	1.1		1.41		1.82		1.21		1.49		0.79		0.92		---		---		---		---		---	3	---
Silver	1.09	U	0.39	U	0.53	U	0.46	U	0.52	U	0.85	U	0.37	U	---		---		---		---		6.1	---	8.4
Zinc	60.8	D	52.2		94.4		62.7		78.1		54		63.3		---		---		---		---		410	---	3,800
PAHs (µg/kg dry weight)																									
Naphthalene	8.9	J	9.4	J	17.6	J	9.6	J	10.2	J	18.6	U	10.1	J	16.8	J	6	J	11.3	J	13.2	J	2,100	---	2,400
Acenaphthylene	19.2	U	19.5	U	11.2	J	7.2	J	7.9	J	17.1	J	38.6		54.2		4.7	J	227		32.3		560	---	1,300
Acenaphthene	19.2	U	19.5	U	11.1	J	19.7	U	19.4	U	4.8	J	19.7	U	18.4	J	19.4	U	47.8		6.2	J	500	---	2,000
Fluorene	5.6	J	6.3	J	16.4	J	8.3	J	6.5	J	12	J	31		29.7		19.4	U	74.1		21.9		540	---	3,600
Phenanthrene	32.3		38.5		117		65.1		51.3		108		347		492		31.2		1,550		118		1,500	---	21,000
Anthracene	7.3	J	15.4	J	57.9		28		28.2		29.5		187		133		14.3	J	339		176		960	---	13,000
2-Methylnaphthalene	13	J	14.3	J	24		14.4	J	13	J	11.6	J	11.9	J	19.2	U	8	J	11.6	J	18	J	670	---	1,900
Total LPAH	93	J	109		231		138		124		190		633		744		95		2,249		368		5,200	---	29,000
Fluoranthene	32.2		56.7		233		124		170		194		1,340		2,090	E	80.1		3,840	E	388		1,700	4,600	30,000
Pyrene	33.4		53.2		202		112		144		193		1,050		1,730		89.7		3,680	E	395		2,600	11,980	16,000
Benzo(a)anthracene	15.8	J	25.8		90.1		47.5		48.4		62.5		442		346		29.6		835		233		1,300	---	5,100
Chrysene	24.5		43		152		102		96.1		146		1,080		770		65.4		2,400	E	431		1,400	---	21,000
Benzofluoranthenes (b, j ,k)	39.5		66.3		213		137		139		227		1,330		903		88.8		2,490		580		3,200	---	9,900
Benzo(a)pyrene	12.9	J	24.6		84.9		54.6		49.8		81.4		507		229		31.8		840		232		1,600	---	3,600
Indeno(1,2,3-c,d)pyrene	9.4	J	15.9	J	50.2		31.2		30.4		46.4		259		146		18.5	J	370		106		600	---	4,400
Dibenz(a,h)anthracene	5.6	Q	8.5	Q	19	Q	11.5	Q	11.2	Q	16.6	Q	93.3		49.9		7.4		131		44.6		230	---	1,900
Benzo(g,h,i)perylene	12	J	19.1	J	60.3		33.8		33.8		45.8		266		147		19.8		329		102		670	---	3,200
Total HPAH	186	JQ	313	JQ	1105	Q	654	Q	728	Q	1013	Q	6,367		6,411	E	431		14,915	E	2512		12,000	---	69,000

Makah Tribe Emergency Spill Dock | Results of Chemical Analysis Compared to DMMP Guidelines | DMMP Suitability Determination

															DMMU 7 subsamples								DMMP Criteria (dry wt)		
	DMMU-1		DMMU-2		DMMU-3		DMMU-4		DMMU-5		DMMU-6		DMMU-7		S-25		S-26		S-27		S-28		SL	BT	ML
CHLORINATED HYDROCARBONS (µg/kg dry weight)																									
1,4-Dichlorobenzene	4.8	U	4.9	U	4.9	U	4.9	U	4.8	U	4.7	U	12.6		---		---		---		---		110	---	120
1,2-Dichlorobenzene	4.8	U	4.9	U	4.9	U	4.9	U	4.8	U	4.7	U	4.9	U	---		---		---		---		35	---	110
1,2,4-Trichlorobenzene	4.8	U	4.9	U	4.9	U	4.9	U	4.8	U	4.7	U	4.9	U	---		---		---		---		31	---	64
Hexachlorobenzene (HCB)	0.94	U	2.1	J	5.8		0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		22	168	230
PHTHALATES (µg/kg dry weight)																									
Dimethyl phthalate	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	34.8		19.4	U	19.1	U	187		71	---	1,400
Diethyl phthalate	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	19.2	U	19.4	U	19.1	U	19.3	U	200	---	1,200
Di-n-butyl phthalate	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	12.3	J	15.4	J	19.4	U	19.1	U	19.3	U	1,400	---	5,100
Butyl benzyl phthalate	4.8	U	4.9	U	4.9	U	4.9	U	4.8	U	4.7	U	4.9	U	4.8	U	4.8	U	4.8	U	4.8	U	63	---	970
Bis(2-ethylhexyl) phthalate	47.9	U	48.7	U	74.4		49.1	U	48.5	U	46.5	U	1,120		159		48.5	U	42.9	J	40	J	1,300	---	8,300
Di-n-octyl phthalate	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	1,520		19.2	U	19.4	U	19.1	U	19.3	U	6,200	---	6,200
PHENOLS (µg/kg dry weight)																									
Phenol	240		24.3		27.8		19.7	U	19.4	U	11.4	J	19.7	U	---		---		---		---		420	---	1,200
2-Methylphenol	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	---		---		---		---		63	---	77
4-Methylphenol	23.8		19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	---		---		---		---		670	---	3,600
2,4-Dimethylphenol	24	U	24.3	U	24.7	U	24.6	U	24.2	U	23.3	U	24.7	U	---		---		---		---		29	---	210
Pentachlorophenol	95.9	U	97.4	U	98.6	U	98.3	U	96.9	U	93	U	98.6	U	---		---		---		---		400	504	690
MISCELLANEOUS EXTRACTABLES (µg/kg dry weight)																									
Benzyl alcohol	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	---		---		---		---		57	---	870
Benzoic acid	192	U	195	U	197	U	197	U	194	U	186	U	197	U	---		---		---		---		650	---	760
Dibenzofuran	19.2	U	19.5	U	10	J	19.7	U	19.4	U	7.7	J	8.3	J	---		---		---		---		540	---	1,700
Hexachlorobutadiene	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		11	---	270
N-Nitrosodiphenylamine	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	---		---		---		---		28	---	130
PESTICIDES & PCBs (µg/kg dry weight)																									
4,4'-DDD	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		16	---	---
4,4'-DDE	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		9	---	---
4,4'-DDT	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	2.4	U	---		---		---		---		12	---	---
sum of 4,4'-DDD, 4,4'-DDE and 4,4'-DDT	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	2.4	U	---		---		---		---		---	50	69
Aldrin	0.47	U	0.49	U	0.49	U	0.42	U	0.49	U	0.48	U	0.48	U	---		---		---		---		9.5	---	---
Total Chlordane	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		2.8	37	---
cis-chlordane	0.47	U	0.49	U	0.49	U	0.42	U	0.49	U	0.48	U	0.48	U	---		---		---		---		---	---	---
trans-chlordane	0.47	U	0.49	U	0.49	U	0.42	U	0.49	U	0.48	U	0.48	U	---		---		---		---		---	---	---
cis-nonachlor	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		---	---	---
trans-nonachlor	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		---	---	---
oxychlordane	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		---	---	---
Dieldrin	0.94	U	0.97	U	0.98	U	0.84	U	0.98	U	0.97	U	0.96	U	---		---		---		---		1.9	---	1,700

Makah Tribe Emergency Spill Dock | Results of Chemical Analysis Compared to DMMP Guidelines | DMMP Suitability Determination

															DMMU 7 subsamples								DMMP Criteria (dry wt)		
	DMMU-1		DMMU-2		DMMU-3		DMMU-4		DMMU-5		DMMU-6		DMMU-7		S-25		S-26		S-27		S-28		SL	BT	ML
Heptachlor	0.47	U	0.49	U	0.49	U	0.42	U	0.49	U	0.48	U	0.48	U	---		---		---		---		1.5	---	270
Total PCBs Aroclors (Sum of: 1016, 1221, 1242, 1248, 1254, 1260, 1268)	6.3		10.5	P1	19.2		12.3		29.8		13.1		17.9		---		---		---		---		130	--	3,100
Total PCBs (mg/kg OC)	1		1.2		1.2		1.3		1.7		3.2		2.9		---		---		---		---		--	382	--
ORGANOMETALLIC COMPOUNDS																									
Tributyltin ion (bulk, ug/kg)	3.42	U	3.75	U	---		3.56	U	---		---		3.78	U	---		---		---		---		---	73	---
PETROLEUM HYDROCARBONS (mg/kg dry weight)																									
Gasoline Range Organics (Tol-Nap)	---		---		---		---		---		9.48	U	9.01	U	---		---		---		---		---	---	---
Diesel Range Organics (C12-C24)	---		---		---		---		---		12.8		17.1		---		---		---		---		---	---	---
Motor Oil Range Organics (C24-C38)	---		---		---		---		---		16.9		25.3		---		---		---		---		---	---	---

Notes:

Concentrations in bold red font failed DMMU guidelines and are not suitable for open-water disposal or beneficial use.

U - Analyte not detected at reported concentration

J = Estimated concentration when the value is less than ARI's established reporting limits

H = Hold time violation - Hold time was exceeded.

Q = Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF)

E = The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the intial calibration (ICAL)

D = The reported value is from a dilution

P1 = The reported value is greater than 40% difference between the concentrations determined on two GC columns where applicable.

Total PCB Aroclors = Sum of 1016, 1221, 1242, 1248, 1254, 1260, 1268

Total chlordane = sum of cis-chlordane, trans-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane

Total LPAHs = sum of naphthalene, acenaphthene, acenaphthylene, fluorene, phenanthrene, anthracene

Total HPAHs = fluoranthene, pyrene, benzo(a)anthracene, chrysene, total benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, benzo(g,h,i)perylene

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.

SL = Screening Level

BT = Bioaccumulation Trigger

ML = Maximum Level

--- = not analyzed

Makah Tribe Emergency Spill Dock | Results of Chemical Analysis Compared to SMS Guidelines | DMMP Suitability Determination

	DMMU-1		DMMU-2		DMMU-3		DMMU-4		DMMU-5		DMMU-6		DMMU-7		DMMU 7 subsamples								SMS Criteria	
															S-25		S-26		S-27		S-28		SQS	CSL
CONVENTIONALS (mg/kg dry weight)																								
Total organic carbon	0.62		0.88		1.59		0.92		1.74		0.41		0.62		1.05		0.41		0.55		0.57		---	---
METALS (mg/kg dry weight)																								
Arsenic	18.20	U	6.48	U	8.83	U	7.58	U	8.72	U	14.10	U	6.15	U	---		---		---		---		57	93
Cadmium	0.55	JD	0.31		0.64		0.42		0.61		0.60		0.55		---		---		---		---		5.1	6.7
Chromium	30.1		23.7		41.6		26.8		37.6		24.1		19.1		---		---		---		---		260	270
Copper	16.6		12.5		32.5		17.0		22.4		16.5		23.0		---		---		---		---		390	390
Lead	7.36		6.97		15.00		7.97		12.20		7.93		7.68		---		---		---		---		450	530
Mercury	0.06		0.02	J	0.05		0.04		0.09		0.03		0.46		0.07		0.05		0.01		0.17		0.41	0.59
Silver	1.09	U	0.39	U	0.53	U	0.46	U	0.52	U	0.85	U	0.37	U	---		---		---		---		6.1	6.1
Zinc	60.8	D	52.2		94.4		62.7		78.1		54		63.3		---		---		---		---		410	960
PAHs (mg/kg Organic Carbon)																								
Naphthalene	1.4	J	1.1	J	1.1	J	1	J	0.6	J	4.5	U	1.6	J	1.6	J	1.5	J	2.1	J	2.3	J	99	170
Acenaphthylene	3.1	U	2.2	U	0.7	J	0.8	J	0.5	J	4.2	J	6.2		5.2		1.1	J	41.3		5.7		66	66
Acenaphthene	3.1	U	2.2	U	0.7	J	2.1	U	1.1	U	1.2	J	3.2	U	1.8	J	4.7	U	8.7		1.1	J	16	57
Fluorene	0.9	J	0.7	J	1.0	J	0.9	J	0.4	J	2.9	J	5.0		2.8		4.7	U	13.5		3.8		23	79
Phenanthrene	5.2		4.4		7.4		7.1		2.9		26.3		56.0		46.9		7.6		281.8		20.7		100	480
Anthracene	1.2	J	1.8	J	3.6		3		1.6		7.2		30.2		12.7		3.5	J	61.6		30.9		220	1,200
2-Methylnaphthalene[(1)]	2.1	J	1.6	J	1.5		1.6	J	0.7	J	2.8	J	1.9	J	1.8	U	2.0	J	2.1	J	3.2	J	38	64
Total LPAH	15.0	J	12.4	J	14.5	J	15.0	J	7.1	J	46.3	J	102.1	J	70.9		23.2		408.9	J	64.6		370	780
Fluoranthene	5.2		6.4		14.7		13.5		9.8		47.3		216.1		199.0	E	19.5		698.2	E	68.1		160	1,200
Pyrene	5.4		6.0		12.7		12.2		8.3		47.1		169.4		164.8		21.9		669.1	E	69.3		1,000	1,400
Benzo(a)anthracene	2.5	J	2.9		5.7		5.2		2.8		15.2		71.3		33.0		7.2		151.8		40.9		110	270
Chrysene	4.0		4.9		9.6		11.1		5.5		35.6		174.2		73.3		16.0		436.4	E	75.6		110	460
Benzofluoranthenes (b, j ,k)	6.4		7.5		13.4		14.9		8.0		55.4		214.5		86.0		21.7		452.7		101.8		230	450
Benzo(a)pyrene	2.1	J	2.8		5.3		5.9		2.9		19.9		81.8		21.8		7.8		152.7		40.7		99	210
Indeno(1,2,3-c,d)pyrene	1.5	J	1.8	J	3.2		3.4		1.7		11.3		41.8		13.9		4.5	J	67.3		18.6		34	88
Dibenz(a,h)anthracene	0.9	Q	1.0	Q	1.2	Q	1.3	Q	0.6	Q	4.0	Q	15.0		4.8		1.8		23.8		7.8		12	33
Benzo(g,h,i)perylene	1.9	J	2.2	J	3.8		3.7		1.9		11.2		42.9		14.0		4.8		59.8		17.9		34	88
Total HPAH	30	J	36	J	69	Q	71	Q	42	Q	247	Q	1,027		611		105	J	2,712		441		960	5,300
CHLORINATED HYDROCARBONS (mg/kg Organic Carbon)																								
1,4-Dichlorobenzene	0.8	U	0.6	U	0.3	U	0.5	U	0.3	U	1.1	U	2.0		---		---		---		---		3.1	9
1,2-Dichlorobenzene	0.8	U	0.6	U	0.3	U	0.5	U	0.3	U	1.1	U	0.8	U	---		---		---		---		2.3	2.3
1,2,4-Trichlorobenzene	0.8	U	0.6	U	0.3	U	0.5	U	0.3	U	*1.1*	*U*	0.8	U	---		---		---		---		0.81	1.8
Hexachlorobenzene (HCB)	0.2	U	0.2	J	0.4		0.1	U	0.1	U	0.2	U	0.2	U	---		---		---		---		0.38	2.3
PHTHALATES (mg/kg Organic Carbon)																								

Dimethyl phthalate	3.1	U	2.2	U	1.2	U	2.1	U	1.1	U	4.5	U	3.2	U	3.3		4.7	U	3.5	U	32.8		53	53
Diethyl phthalate	3.1	U	2.2	U	1.2	U	2.1	U	1.1	U	4.5	U	3.2	U	1.8	U	4.7	U	3.5	U	3.4	U	61	110
Di-n-butyl phthalate	3.1	U	2.2	U	1.2	U	2.1	U	1.1	U	4.5	U	2.0	J	1.5	J	4.7	U	3.5	U	3.4	U	220	1,700
Butyl benzyl phthalate	0.8	U	0.6	U	0.3	U	0.5	U	0.3	U	1.1	U	0.8	U	0.5	U	1.2	U	0.9	U	0.8	U	4.9	64
Bis(2-ethylhexyl) phthalate	7.7	U	5.5	U	4.7		5.3	U	2.8	U	11.3	U	180.6		15.1		11.8	U	7.8	J	7.0	J	47	78
Di-n-octyl phthalate	3.1	U	2.2	U	1.2	U	2.1	U	1.1	U	4.5	U	245.2		1.8	U	4.7	U	3.5	U	3.4	U	58	4,500
PHENOLS (µg/kg dry weight)																								
Phenol	240		24.3		27.8		19.7	U	19.4	U	11.4	J	19.7	U	---		---		---		---		420	1,200
2-Methylphenol	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	---		---		---		---		63	63
4-Methylphenol	23.8		19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	---		---		---		---		670	670
2,4-Dimethylphenol	24	U	24.3	U	24.7	U	24.6	U	24.2	U	23.3	U	24.7	U	---		---		---		---		29	29
Pentachlorophenol	95.9	U	97.4	U	98.6	U	98.3	U	96.9	U	93	U	98.6	U	---		---		---		---		360	690
MISCELLANEOUS EXTRACTABLES																								
Benzyl alcohol (µg/kg dry weight)	19.2	U	19.5	U	19.7	U	19.7	U	19.4	U	18.6	U	19.7	U	---		---		---		---		57	73
Benzoic acid (µg/kg dry weight)	192	U	195	U	197	U	197	U	194	U	186	U	197	U	---		---		---		---		650	650
Dibenzofuran (mg/kg OC)	3.1	U	2.2	U	0.6	J	2.1	U	1.1	U	1.9	J	1.3	J	---		---		---		---		15	58
Hexachlorobutadiene (mg/kg OC)	0.2	U	0.1	U	0.1	U	0.1	U	0.1	U	0.2	U	0.2	U	---		---		---		---		3.9	6.2
N-Nitrosodiphenylamine (mg/kg OC)	3.1	U	2.2	U	1.2	U	2.1	U	1.1	U	4.5	U	3.2	U	---		---		---		---		11	11
Total PCB Aroclors (mk/kg OC)	1.0		1.2		1.2		1.3		1.7		3.2		2.9		---		---		---		---		12	65

Notes:

Concentrations in bold red font exceed SQS guidelines and are not suitable for beneficial use.

Concentrations in bold red font and orange shading do not meet CSL guidelines and are not suitable for beneficial use.

Undetected concentrations in italicized bold red font exceed SQS guidelines.

SMS = Sediment Management Standards (February 2013)

SQS = Sediment Quality Standard

CSL = Cleanup Screening Levels

LPAH = low molecular weight polynuclear aromatic hydrocarbon compounds

HPAH = high molecular weight polynuclear aromatic hydrocarbon compounds

TOC = Total organic carbon

Total LPAH = The sum of acenaphthylene, acenaphthene, anthracene, fluorene, naphthalene and phenanthrene.

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

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

U - Analyte not detected at reported concentration

Q = Indicates a detected analyte with an initial or continuing calibration that does not meet established acceptance criteria (<20% RSD, <20% drift or minimum RRF)

J = Estimated concentration when the value is less than ARI's established reporting limits

E = The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the intial calibration (ICAL)

--- = not analyzed

PURPOSE: Construct an extension to the existing commercial fishing dock to provide adequate, dedicated infrastructure to support an enhanced oil spill prevention and response capacity in Neah Bay. Dredging is required to accommodate vessels.

APPLICANT: Makah Tribe
SITE OWNER: Makah Tribe

ADJACENT PROPERTY OWNERS:
Department of Natural Resources

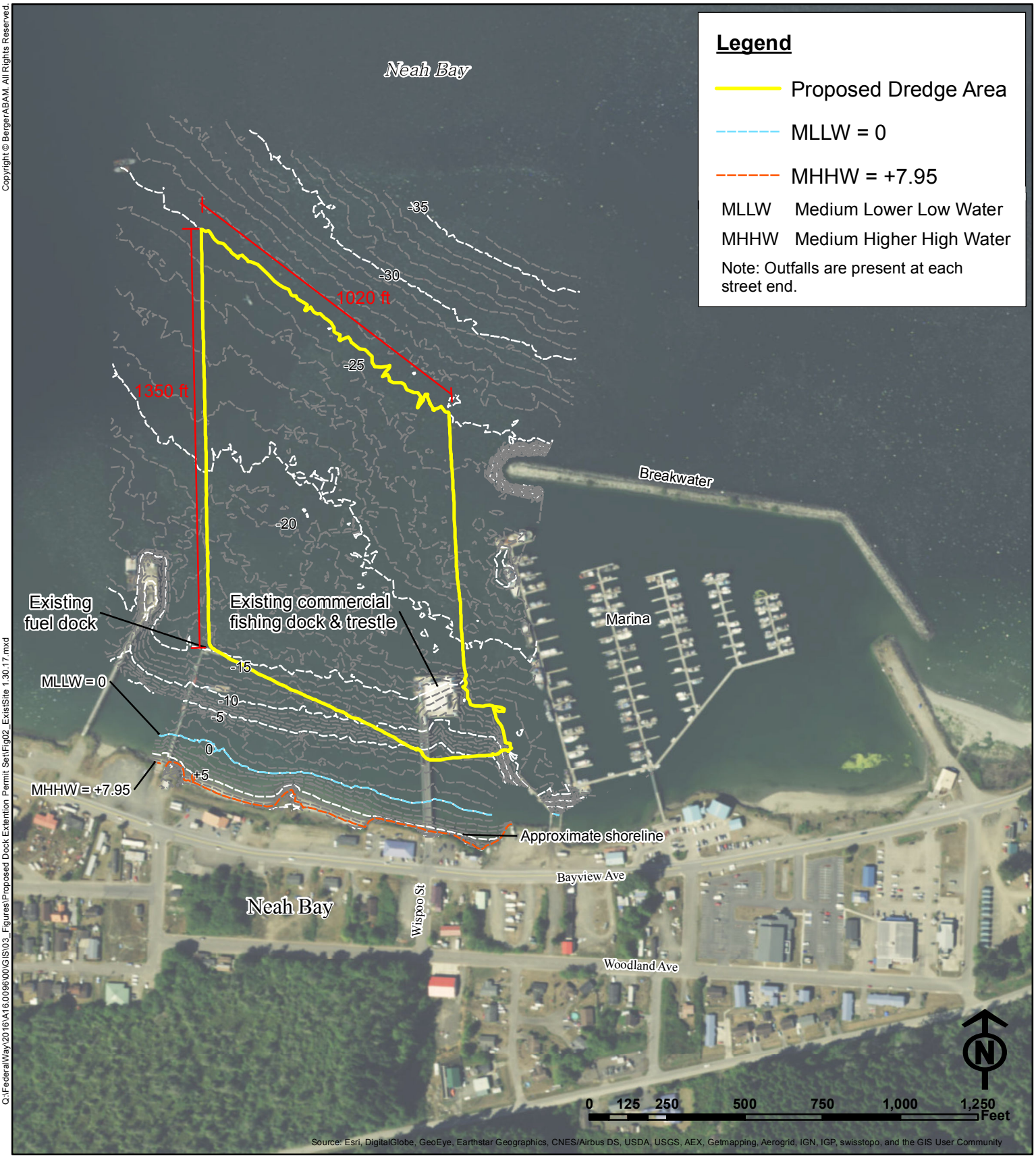
PORT OF NEAH BAY

PROPOSED DOCK EXTENSION

Figure 1. Project Vicinity

REFERENCE: NWS-2016-826
WATERWAY: Neah Bay
AT: Neah Bay
COUNTY: Clallam

LAT/LONG: 48.36746 N/-124.61416 W
S/T/R: S11/T33N/R15W
DATUM: MLLW=0.0
DATE: 16 March 2017



PURPOSE: Construct an extension to the existing commercial fishing dock to provide adequate, dedicated infrastructure to support an enhanced oil spill prevention and response capacity in Neah Bay. Dredging is required to accommodate vessels.

APPLICANT: Makah Tribe
SITE OWNER: Makah Tribe

ADJACENT PROPERTY OWNERS:
Department of Natural Resources

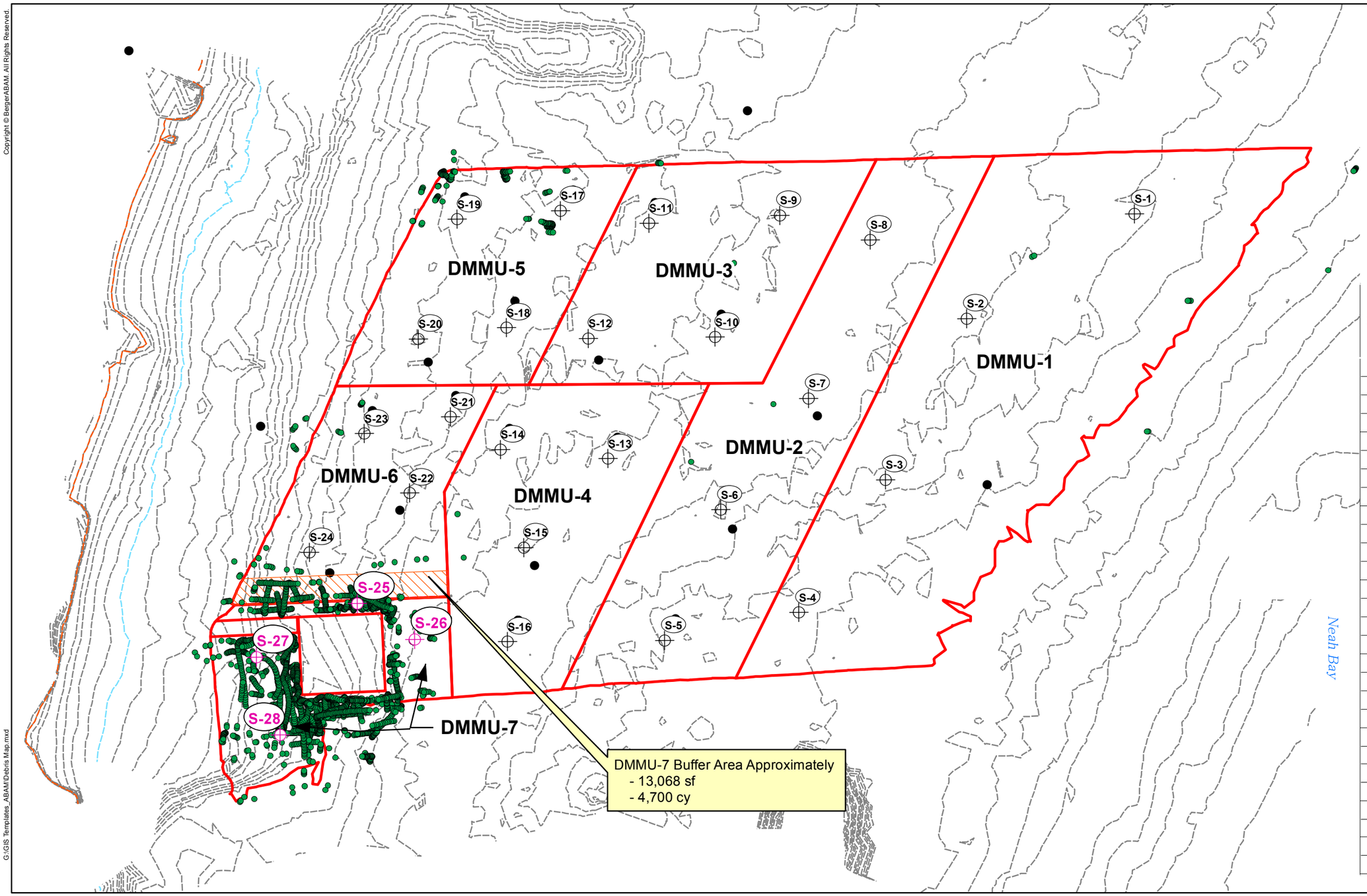
PORT OF NEAH BAY

PROPOSED DOCK EXTENSION

Figure 2. Project Area Details

REFERENCE: NWS-2016-826
WATERWAY: Neah Bay
AT: Neah Bay
COUNTY: Clallam

LAT/LONG: 48.36746 N/-124.61416 W
S/T/R: S11/T33N/R15W
DATUM: MLLW=0.0
DATE: 16 March 2017



Legend

- DMMU 7 Buffer
- Debris Location
- DMMU Boundary
- MLLW = 0
- MHHW = +7.95
- Existing Contour
- S-20 DMMU Sub Sample Locations
- S-25 DMMU-7 Sub Sample Location

Sample ID[1]	Northing[2]	Easting[2]
S-1	522599.41	721118.52
S-2	522338.53	721278.71
S-3	522211.50	721526.42
S-4	522076.18	721731.22
S-5	521868.41	721772.38
S-6	521956.54	721571.43
S-7	522093.51	721400.31
S-8	522190.44	721155.75
S-9	522051.21	721116.85
S-10	521949.58	721304.46
S-11	521848.89	721127.36
S-12	521753.59	721305.15
S-13	521783.08	721490.90
S-14	521617.10	721476.04
S-15	521651.74	721627.71
S-16	521625.40	721772.95
S-17	521712.24	721107.34
S-18	521627.72	721287.53
S-19	521552.34	721119.78
S-20	521491.09	721304.29
S-21	521539.89	721425.13
S-22	521476.01	721541.82
S-23	521406.57	721450.00
S-24	521320.59	721632.41
S-25	521393.89	721712.53
S-26	521482.26	721767.89
S-27	521237.51	721794.09
S-28	521273.17	721914.74

G:\GIS Templates_ABAM\Debris Map.mxd

PURPOSE: Construct an extension to the existing commercial fishing dock to provide adequate, dedicated infrastructure to support an enhanced oil spill prevention and response capacity in Neah Bay.

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SITE OWNER: Makah Tribe

ADJACENT PROPERTY OWNERS:
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PORT OF NEAH BAY

MAKAH TRIBE EMERGENCY SPILL
DOCK EXTENSION DREDGED
MATERIAL CHARACTERIZATION

Figure 4. DMMUs with debris locations and buffer area.

WATERWAY: Neah Bay
AT: Neah Bay
COUNTY: Clallam

LAT/LONG: 48.36746 N/-124.61416 W
S/T/R: S11/T33N/R15W
DATUM: MLLW=0.0
DATE: June 2016

N
0 80 160 320
Feet
1 inch = 154.71 feet