DRAFT Environmental Assessment

Bellingham Harbor – Squalicum Waterway Federal Navigation Channel Maintenance Dredging and Disposal

Whatcom County, Washington

February 2019

Photo courtesy of Washington State Department of Ecology

US Army Corps of Engineers®
Seattle District

Environmental Assessment and Public Interest Review

Bellingham Harbor – Squalicum Waterway Federal Navigation Channel Maintenance Dredging and Disposal

Responsible Agency: The responsible agency for this navigation project is the U.S. Army Corps of Engineers, Seattle District.

Abstract:

In accordance with the National Environmental Policy Act, this Draft Environmental Assessment (EA) evaluates the impacts of the proposed maintenance of the Federal navigation channel in the Squalicum Creek Waterway of Bellingham Bay. Bellingham Bay is located on the northwest coast of Washington in the Salish Sea in Whatcom County, Washington. Shoaling of the channel requires maintenance dredging approximately every 10 years to facilitate safe navigation. The document provides analysis of three action alternatives compared to taking no action (Alternative 1). In all action alternatives, the navigation channel would undergo maintenance between stations 0+00 to 33+88 to the authorized depth of -26 feet mean lower low water (MLLW) plus two feet of allowable overdepth and two feet of authorized advance maintenance. The total quantity estimated to be dredged is up to 351,000 cubic yards (cy) of sediment. For Alternative 2, the majority of dredged material, up to 320,000 cy, would be placed at Rosario Strait dispersive PSDDA site, which is 25 miles from the dredging site. The remaining 31,000 cy from the head of the channel is suitable for non-dispersive disposal only. This material would therefore go to the Bellingham Bay non-dispersive PSDDA site, which is 3 miles from the channel to be dredged. The duration of Alternative 2 would be approximately 65 days. Alternative 3 would be largely the same as Alternative 2 in which the majority of dredged material, up to 320,000 cy, would be placed at Rosario Strait dispersive PSDDA site. However, the remaining 31,000 cy from the head of the channel would go 60 miles away to Port Gardner non-dispersive PSDDA site. The duration of the work for Alternative 3 would be approximately 70 days. Alternative 4 would place all material at the Bellingham Bay non-dispersive PSDDA site. The duration of the work for Alternative 4 would be approximately 50 days. The key difference between the three action alternatives is the location of disposal and the duration of dredging.

This document is available online:
http://www.nws.usace.army.mil/Missions/Environmental/Environmental-Documents/

Under the project name “Bellingham Harbor – Squalicum Waterway Federal Navigation Channel Maintenance Dredging and Disposal”.

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1 Proposal for Federal Action

Under the Council on Environmental Quality regulations, 40 CFR § 1500.1(c) and 40 CFR § 1508.9(a)(1), implementing the National Environmental Policy Act (NEPA) of 1969 (as amended), the purpose of an Environmental Assessment (EA) is to "provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact" on actions authorized, funded, or carried out by the Federal government, and to assist agency officials to make decisions that are based on understanding of "environmental consequences, and take actions that protect, restore, and enhance the environment." This EA evaluates potential impacts of maintenance dredging of the Squalicum Waterway of Bellingham Harbor in Whatcom County, Washington. Pending funding availability, the U.S. Army Corps of Engineers (USACE) would perform dredging in 2019.

This document also integrates a review of factors underlying a determination of whether executing the project would be in the public interest, pursuant to Clean Water Act Section 404 and rules and regulations published as 33 CFR Part 335, "Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving the Discharge of Dredged or Fill Material into Waters of the U.S. or Ocean Waters"; 33 CFR Part 336, "Factors to be Considered in Evaluation of Army Corps of Engineers Dredging Projects Involving the Discharge of Dredged Material into Waters of the U.S. and Ocean Waters"; 33 CFR Part 337, "Practice and Procedure"; and 33 CFR Part 338, "Other Corps Activities Involving the Discharge of Dredged Material or Fill into Waters of the U.S."

The Squalicum Waterway Federal Navigation Channel is located at the northern end of Bellingham Harbor in northern Puget Sound. The channel provides deep draft access to the pier that hosts Bellingham Cold Storage as well as other smaller businesses. The authorized navigation channel dimensions allow safe navigation during all tide levels. When shoaling creates shallow areas within the channel, it presents a safety hazard to deep draft vessels, and deep draft vessels must wait for high tide to transit. Dredging would occur between 16 July and 15 February of each scheduled maintenance-dredging event.

1.1 Project Location

The city of Bellingham, Washington is on the west side of Bellingham Bay in northeastern Puget Sound in Whatcom County, Washington (T38N, R2E, Section 43; Figure 1). The Squalicum Waterway navigation channel is one of three waterways in Bellingham Harbor, operated by the Port of Bellingham (Figure 2). The Squalicum Waterway is downstream from the mouth of Squalicum Creek in the north end of Bellingham Bay. This creek drains 22 square miles into Bellingham Bay; Bellingham Bay experiences continual sedimentation from this creek as well as the surrounding Nooksack, Whatcom, and Little Squalicum creeks as a function of natural and human-caused sediment sources. The Squalicum Waterway is adjacent to and utilized by the Bellingham Cold Storage site and the Squalicum Harbor. This company's dock and the neighboring harbor are high traffic areas that support the commercial fishing industry of the Pacific Northwest including tribal interests.

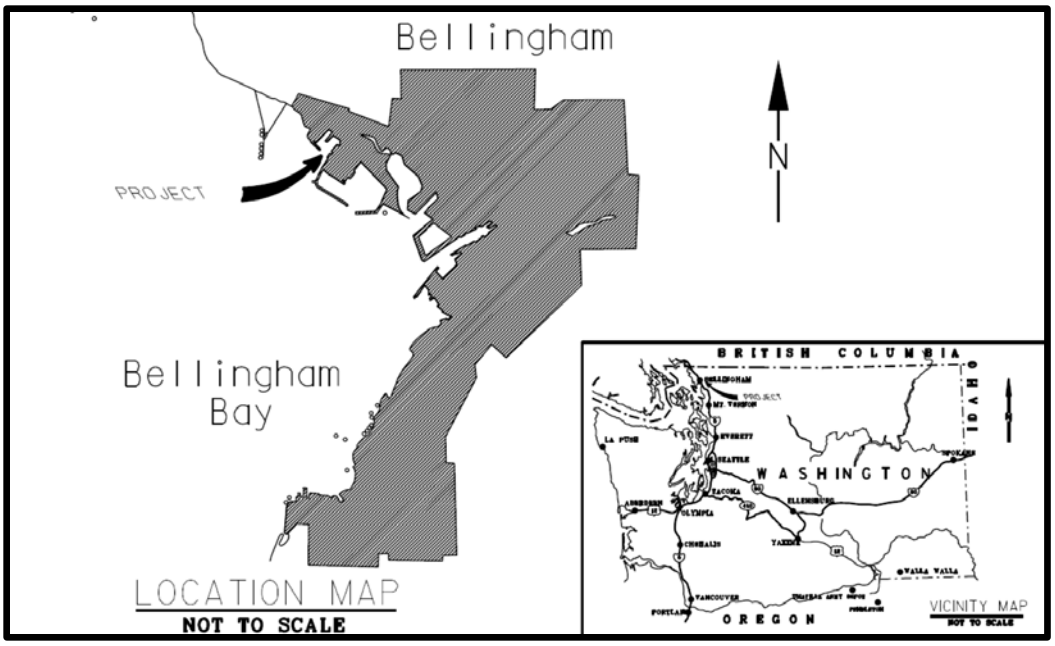

Figure 1. Location and vicinity map of Squalicum Waterway in Bellingham, Whatcom County, Washington.

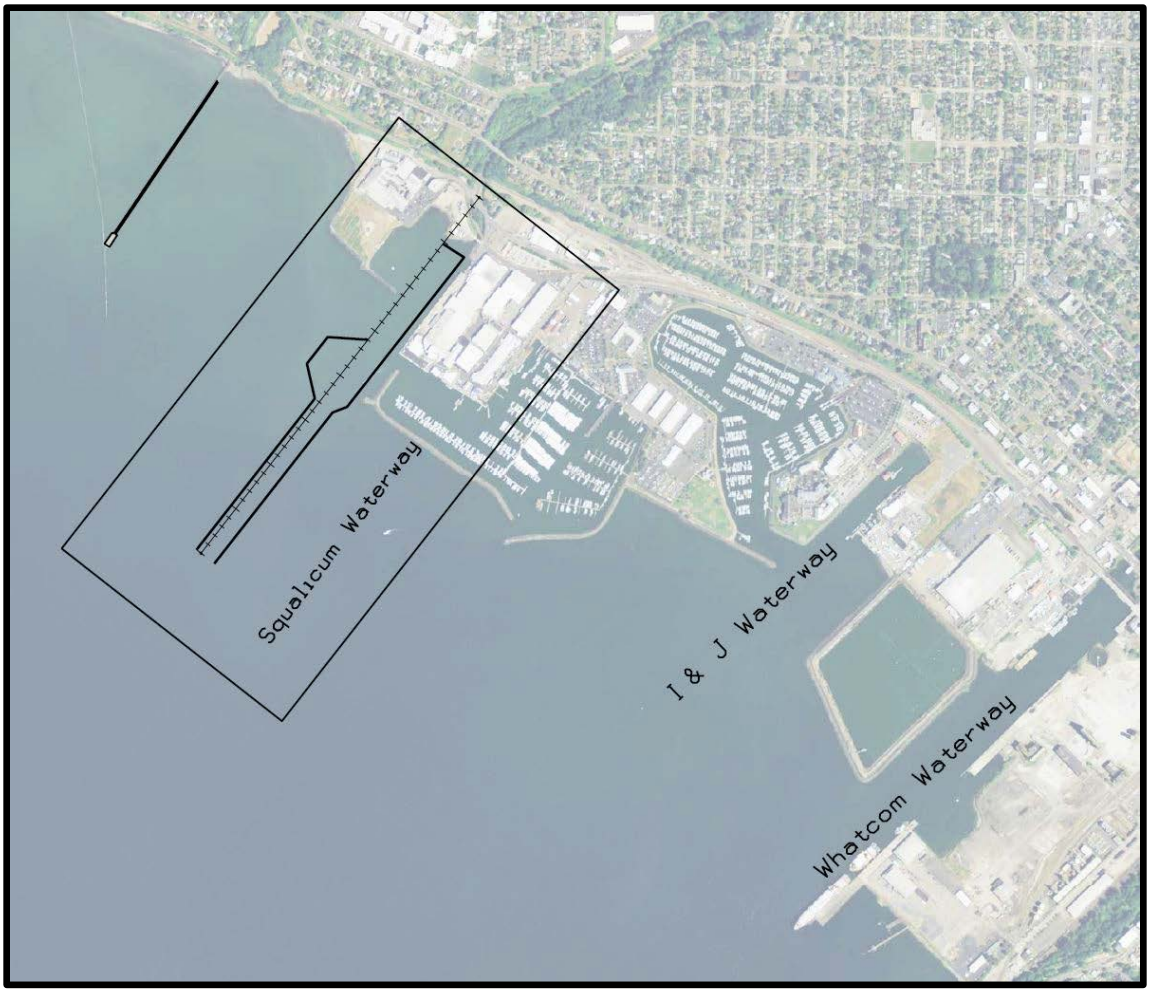

Figure 2. Bellingham Harbor includes Squalicum, I&J, and Whatcom Waterways.

1.2 Authority

The Squalicum Waterway and maintenance dredging by the Department of the Army were authorized by the Rivers and Harbors Act of 3 July 1930 (House Document 290, 71st Congress, 2nd Session).

The project was constructed in 1931; additional congressional action in 1937 authorized dredging of berthing areas adjacent to the inner portion of the channel and a turning basin at mid-channel on the northwest side, both authorized at -26 feet MLLW. Federal maintenance began in 1949 and has continued to the present. Authorized features of the Federal navigation project include the following:

- From deep water to the pierhead line, a waterway entrance channel 200 feet wide and 26 feet deep at MLLW.
- A turning basin 700 feet long, 26 feet deep, and 216 to 516 feet wide.
- A channel 300 feet wide by approximately 3,500 feet long.

Due to the imprecise nature of dredging equipment, up to two feet of allowable overdepth plus two feet of advance maintenance may occur. This amount is factored into the total material to be removed.

1.3 Purpose and Need

The purpose of the action is to provide for safe navigation by maintaining the authorized depth of -26 feet MLLW, plus 2 feet of allowable overdepth and 2 feet of advance maintenance at the pier that hosts Bellingham Cold Storage and provides sea-going vessels with commercial access to the City of Bellingham. Shoaling of sediments from the Nooksack River and Squalicum Creek reduce the depth of the channel and cause the need for maintenance dredging. The primary commercial activities are fishing and frozen food processing and storage, which make Squalicum Waterway an important processing and intake harbor for the entire region, utilized by commercial fishers from Alaska, Canada, and the northwest U.S. The channel must be maintained to support the navigation for the commercial activities and regular shipping traffic.

2 Proposed Action and Alternatives

Based on the identification of the need for maintenance dredging of Squalicum Waterway, the USACE has formulated, evaluated, and screened alternatives for determining the action that maximizes net benefits and minimizes costs. This chapter describes the range of alternatives selected for detailed analysis. Dredging practices and disposal options were evaluated in the Bellingham Harbor Navigation Project Final Environmental Impact Statement (USACE 1979) and an assessment of environmental degradation of the bay was evaluated in the Bellingham Bay Action Program (PTI 1991). This project is consistent with these evaluations. Additionally, the environmental impacts of disposal at all proposed disposal sites in this document have been evaluated in the following two documents, which are incorporated by reference:

- Puget Sound Dredged Disposal Analysis (PSDDA). 1989. Final Environmental Impact Statement Unconfined Open-Water Disposal for Dredged Material, Phase 2. (North and South Puget Sound). September 1989, 585 pages.
- Biological Evaluation: Continued Use of Multiuser Dredged Material Disposal Sites in Puget Sound and Grays Harbor. U.S. Army Corps of Engineers – Seattle District. June 2015

2.1 Alternative 1 – No Action

The No-Action Alternative is analyzed as the future without-project conditions for comparison with the action alternatives. If the USACE takes no action to clear shoaling sediment from the Squalicum Waterway, this would cause continued shoaling posing a risk to the larger shipping vessels that may run aground or may be unable to transfer cargo at the pier. Eventually, access to the pier would become unavailable, which would have economic impacts to the Port of Bellingham, affecting businesses and the local community. This alternative would not meet the project purpose and need, but iscarried forward for evaluation purposes.

2.2 Alternative 2 – Dredging Squalicum Waterway with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

The USACE proposes to conduct routine maintenance dredging of accumulated sediments from the Squalicum Waterway at Bellingham Harbor (Figure 2). The project consists of removing up to 351,000 cy of material dredged from station 0+00 to station 33+88 of the main channel and the turning basin from station 17+00 to 24+00 (Figure 3). The project includes 2 feet of allowable overdepth and an additional 2 feet of advance maintenance dredging. Shoaled sediments are predominantly silt in the main channel and a combination of silt, sand, gravel and cobble at the head of the waterway.

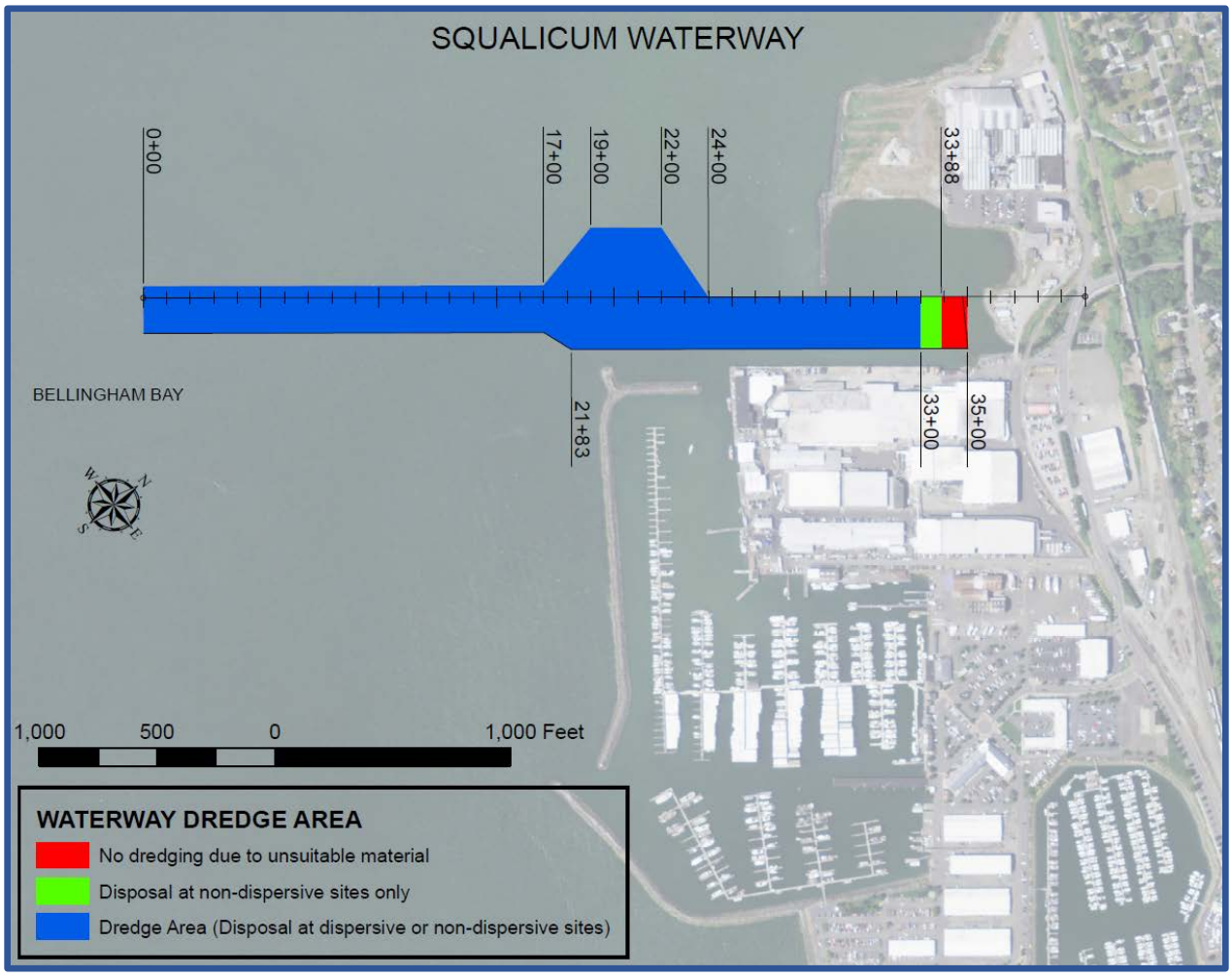

Figure 3 Squalicum Waterway proposed dredging areas

According to sediment sampling and the associated Suitability Determination of May 3, 2017 (DMMP 2017), sediments in the main channel and turning basin have been determined suitable for aquatic disposal and are up to 320,000 cy in volume. Sediments at the head of the waterway from station 33+00 to 33+88 contain low levels of dioxin and are approved for aquatic disposal at non-dispersive sites only; this quantity is up to 31,000 cy (Appendix A). Sediments from station 33+88 to 35+00 will not be dredged due to higher levels of contamination. Quantities have been estimated conservatively for environmental impacts analysis.

Maintenance dredging removes sediments that accumulate along the length of the channel. A clamshell dredge operation includes a dredge barge with a deck-mounted crane, a clamshell bucket, at least one tugboat, and at least one sediment transport barge. During active dredging, a transport barge is tied to the dredge barge. The clamshell dredge (a type of mechanical dredge) utilizes a bucket deployed by a crane, mounted on a dredge barge, to remove the sediment. The bucket is sufficiently heavy to sink into the substrate. The dredge bucket has two jaws that are hinged in such a fashion that the bucket is open while descending through the water column (Figure 3). After closing, the top portion of the bucket

remains open as the bucket is retrieved. A “controlled lowering” of the bucket reduces turbulence and the amount of suspended sediment generated. After the bucket penetrates the substrate, the bucket is closed, taking a “bite” out of the substrate. The bucket is retrieved and swung over to a transport barge where the sediment is placed for transport to a disposal site. With the top and/or bottom of the bucket open, the probability of catching and retaining mobile organisms is minimal.

The dredge barge is equipped with vertical steel pipes, called spuds that are sunk into the substrate to anchor the dredge barge in one location. To move the dredge barge, the spuds are retrieved and a tug moves the dredge barge to a new location. The spuds are again sunk into the substrate to secure the dredge barge and dredging continues. Dredge barges are not self-propelled, but some dredge barges can, on occasion, move short distances by setting the dredge bucket into the substrate, retrieving the spuds, then pulling on the dredge bucket cable, and then inserting the spuds in the new location.

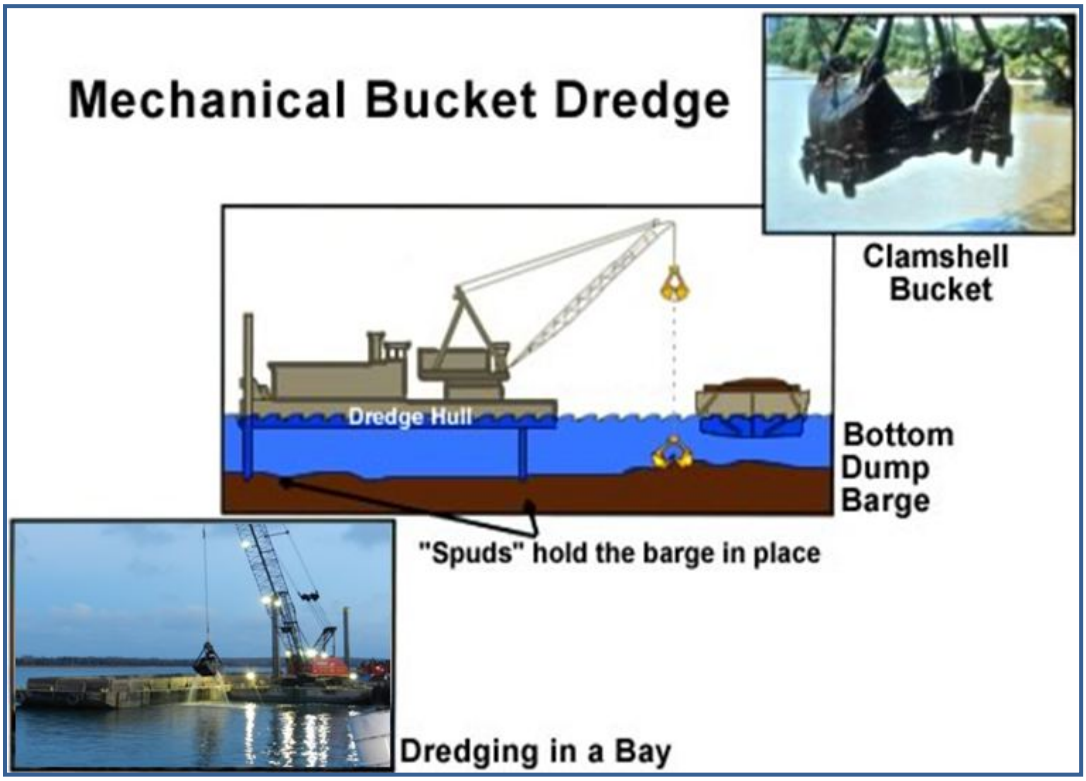

Figure 4 Rendering of a mechanical dredge barge and bottom dump barge, with photographs of a mechanical (clamshell) dredge bucket and an operating mechanical dredge barge.

Once arriving at the disposal site, a bottom-dump barge drops the material into its intended location. Work performed at Squalicum Waterway would consist of clamshell dredging with a bucket holding 5-25 cy. Dredged material would be placed on a bottom-dump barge holding approximately 2,000 to 2,500 cy. The dredger would manage barge loading such that the dredged sediment load does not exceed the capacity of the barge. The dredger would load the barge to maintain stability and avoid tilting. A filter media, such as straw bales and/or geotextile fabric, would cover the sideboards and scuppers of the barge to filter and retain suspended sediment while allowing the filtered water to drain back into the waterway.

For Alternative 2, the majority of the material would be hauled 25 miles to the Rosario Strait PSDDA site for disposal. Material approved for open-water disposal but restricted to non-dispersive sites would be taken to the Bellingham Bay Disposal site that is 3 miles from the Squalicum Waterway (Figure 4). The Bellingham Bay PSDDA site is an unconfined, non-dispersive, open-water site approved in 1989 through a full NEPA analysis (PSDDA Agencies 1989). It has a capacity of 9 million cy. The USACE last placed dredged material there in 1992 and 1995. Disposal at Bellingham Bay PSDDA site represents the least cost alternative that achieves the project purpose. If the Bellingham Bay disposal site is selected for use, the in-water work window is restricted to 16 July through 31 October. No disposal may occur at the Bellingham Bay site 1 November through 28 February to protect crab and shrimp (USACE 2015) and the closure continues through 15 July to protect juvenile salmonids. Total dredging time would take approximately 65 days with 60 days of transport to the Rosario Strait site and 5 days of transport to Bellingham Bay site.

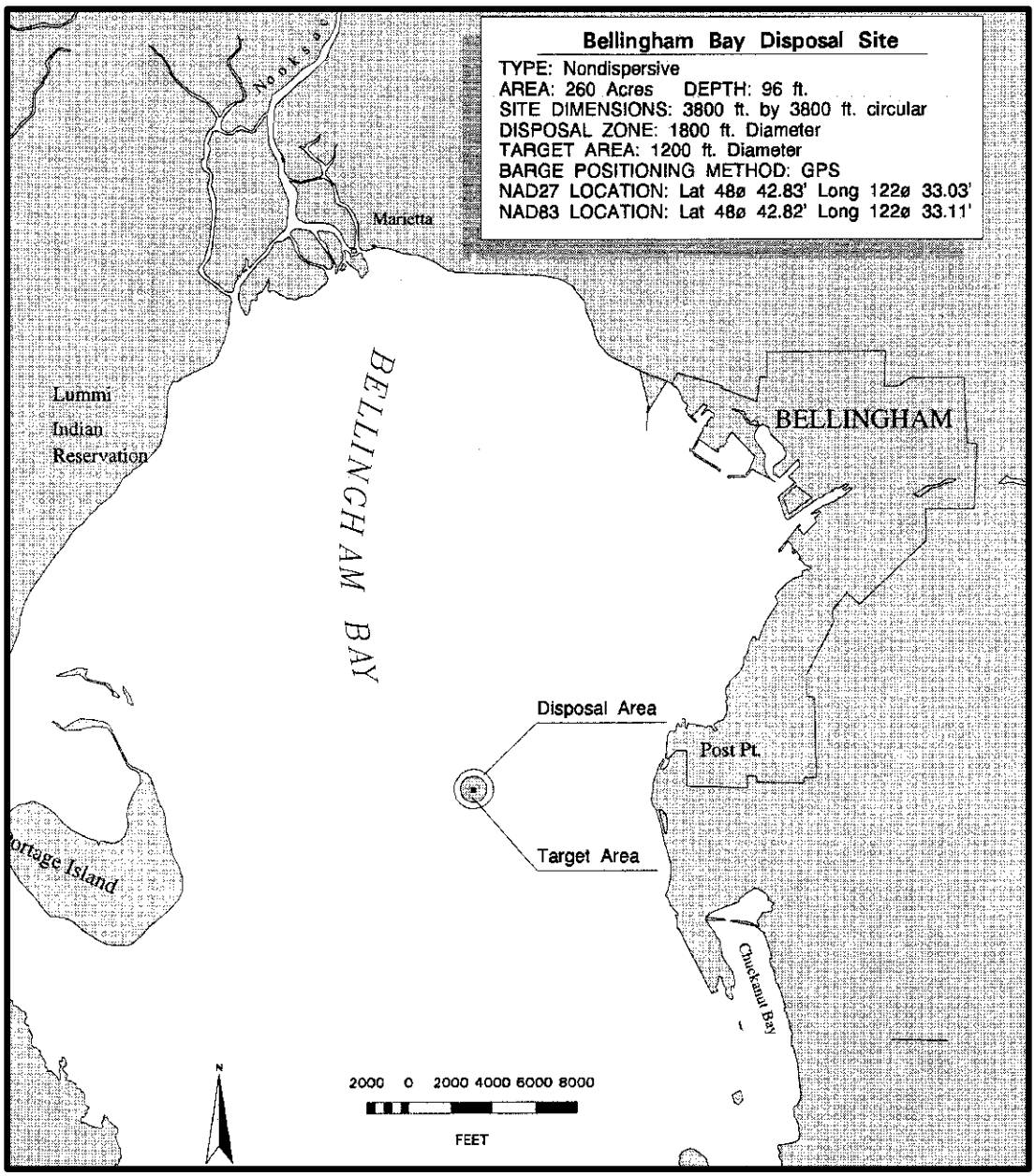

Figure 5. Bellingham Bay PSDDA open-water, non-dispersive designated dredged material disposal site.

2.3 Alternative 3 – Dredging with Disposal at Rosario and Port Gardner PSDDA Sites (preferred alternative)

Alternative 3 would occur in the same manner as Alternative 2 with the exception of disposal at Port Gardner instead of Bellingham Bay for the 31,000 cy that must go to a non-dispersive site. Dredging and disposal would take approximately 70 days, depending on total quantity of material removed, mechanical breakdowns, and weather conditions. Dredging would occur 24 hours per day except for periods of machinery maintenance and crew changes. Timing of this project would adhere to the July 16 through February 15 in-water work window to avoid vulnerable life stages of ESA-listed species. The Port Gardner disposal site does not have the same in-water work window restriction as the Bellingham Bay site.

For Alternative 3, the material would be transported to the appropriate approved disposal sites for disposal, which are the Rosario Strait PSDDA open-water dispersive site for dispersive disposal approved dredged material and Port Gardner open-water non-dispersive site for the material that is known to contain low levels of dioxin. Approximately 320,000 cy of material dredged from Squalicum Waterway would be transported 25 miles to Rosario Strait for material approved for dispersive sites, and 60 miles to Port Gardner for approximately 10% (31,000 cy) of the material dredged. Total dredging and disposal time for this alternative would take approximately 60 days for material going to Rosario Strait and an additional 10 days for material transport to Port Gardner for a total of 70 days. The long distance from the dredging site to the disposal locations would accommodate approximately 2 round trips per day.

The NEPA process requires each Federal action agency to identify the preferred alternative. Based on analysis of costs, feasibility, application of the Federal Standard, and effects to environmental resources detailed in this document, Alternative 3 is the agency-preferred alternative due to the Port of Bellingham's request not to use Bellingham Bay as a disposal site (further explained in 2.5). The Port of Bellingham is required to pay the difference in cost between the cost to dispose of material in the Bellingham Bay disposal site (the Federal Standard) and the Alternative 3 material disposal sites. A Memorandum of Agreement (MOA) is required to document the cost share requirements for the placement of dredged material using other than the Federal Standard alternative if a non-federal interest pays all additional costs. A MOA between USACE and the Port of Bellingham will be executed before disposal of dredged materials can be placed at sites in excess of the costs of the Federal Standard dredged material placement alternative. The Port of Bellingham shall provide to USACE funds to pay all costs, including the costs of environmental compliance, supervision and administration, and engineering and design, associated with the dredged material placement that exceed the costs of the Federal Standard dredged material placement alternative.

2.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Alternative 4 would be executed in the same manner as Alternative 2 and 3 with the exception that the disposal of all suitable material would be at the Bellingham Bay site. If the Bellingham Bay disposal site is selected for use, the in-water work window is restricted to 16 July through 31 October. USACE estimates that the total dredging time would be approximately 50 days of dredging and transport to the Bellingham Bay site.

2.5 Alternative Selection

The USACE rejected Alternative 1 because it would not meet the project purpose and need. Alternative 4 is the Federal standard, meaning the least costly alternative, at the most practicable location, consistent with sound engineering practices, that meets environmental standards established by the CWA 404(b)(1) evaluation process. Alternatives 2 and 3 would have slightly greater environmental impacts and would cost more than Alternative 4. However, the local sponsor, the Port of Bellingham, made an agreement with the Lummi Tribe not to dispose of materials at the Bellingham Bay site so alternatives 2 and 4 were rejected and Alternative 3 was selected as the preferred alternative. Because alternative 4 is considered the Federal Standard, the Port of Bellingham will pay the difference in cost between alternative 3 and 4 as further explained in 2.3.

3 Issues for Comparison of Alternatives

3.1 Resources Analyzed and Screened Out from Further Analysis

The environmental analysis conducted in the NEPA process should provide the decision maker with relevant and timely information about the environmental effects of his or her decision and reasonable alternatives to mitigate those impacts. Table 1 identifies the resources evaluated for detailed analysis with a rationale for inclusion or exclusion. Resources were excluded from detailed analysis if they are not potentially affected by the alternatives or have no material bearing on the decision-making process.

Table 1. List of resources considered for detailed effects analysis and rationale for inclusion or exclusion

Resource	Included in Detailed Analysis (Y/N)	Rationale for inclusion or exclusion
Hydraulics and Geomorphology	Y	Problems identified center on the relationship between hydraulics and geomorphology. The proposed action requires study of these characteristics.
Groundwater	N	The proposed action is limited to the subtidal environment. No groundwater would be affected.
Water and Sediment Quality	Y	Analysis is required to determine the intensity of potential changes to turbidity and dissolved oxygen, and impacts from potential removal of contaminated sediments.
Vegetation	Y	Marine vegetation exists in Bellingham Bay, although not in the navigation channel.
Fish	Y	Many different fish species may be present. Analysis is required to determine which species would be present, the intensity of effects, and how to avoid or minimize effects.
Wildlife (mammals and birds)	Y	Species that may occur in the study area include harbor seals, killer whales, sea lions, and a variety of marine birds. Noise and turbidity from construction may be temporarily disruptive. Underwater noise from construction would occur during periods when sensitive receptors may be present. These include marine mammals, fish, and diving birds. Analysis is required to determine the intensity of effects, and how to avoid or minimize impacts.
Benthic Invertebrates	Y	Benthic macroinvertebrate populations are known to recover quickly from the type of action proposed. Significant effects are not anticipated, but analysis is required to determine intensity of effects.
Threatened and Endangered Species	Y	The proposed action may affect ESA-listed species in the study area. Analysis is required to determine the intensity of effects and how to avoid or minimize impacts.
Cultural Resources	Y	Analysis is required to investigate cultural resources and to determine the extent of any potential effects.

Resource	Included in Detailed Analysis (Y/N)	Rationale for inclusion or exclusion
Tribal Treaty Rights	Y	The study area is within treaty-reserved fishing areas, called Usual & Accustomed areas. No substantial negative effects are anticipated, but analysis is required to avoid and minimize effects.
Air Quality	Y	The air-pollutant concentrations in the study area have consistently been below the National Ambient Air Quality Standards; however, an analysis of pollutants emissions from construction is necessary to disclose to the public.
Greenhouse Gas Emissions	Y	Emissions that would occur during construction are analyzed for impacts.
Noise	Y	The action has the potential to impact sensitive noise receptors during construction, including fish and wildlife. Analysis is required to determine the intensity of effects. Noise will be evaluated under the fish and wildlife sections. Impacts to human receptors will be minimal to none given the dredging will occur in a highly industrial area where ambient noise is high.
Hazardous, Toxic, and Radiological Waste	N	Although there are known contaminants in Bellingham Bay, this is a navigation channel, with an associated sediment suitability determinations (SSD). The most recent SSD indicated that all materials meet criteria for aquatic disposal. Potential impacts will be evaluated under the sediment section.
Invasive Species	N	Maintenance dredging would not increase the number of vessels entering Bellingham Bay, nor would the origin of the vessels change. Introduction of invasive species from outside sources in not a concern.
Aesthetics	N	The proposed action would have no permanent effect to scenic resources or visual characteristics of the study area.
Recreation Resources	Y	Recreational resources within the study area may be temporarily impacted during construction. Analysis is required to determine the intensity of effects.
Public Services and Utilities	N	The proposed action would have no substantial effect on electricity, water, wastewater and stormwater collection, sewer and solid waste, natural gas, oil/petroleum, or telecommunications services.
Socioeconomics	Y	The purpose of the project is to have beneficial effects to national and regional economic conditions.
Public Health and Safety	Y	All material is deemed suitable for open-water disposal and will go to the DMMP designated open-water sites. Sediment deemed suitable only for a non-dispersive site will go the Port Gardner PSSDA site. The proposed dredging will improve safe navigation. Analysis required to determine the intensity of effects.

Resource	Included in Detailed Analysis (Y/N)	Rationale for inclusion or exclusion
Land-based Transportation and Traffic	N	None of the alternatives would cause changes to local traffic or surface transport of import and export goods and commodities. The same amount of material would move through the area in the future with and without project.

Transportation and disposal of sediments at all designated PSDDA disposal sites have undergone NEPA review in the 1989 PSDDA Environmental Impact Statement (EIS) (PSDDA 1989) and have completed ESA consultation in 2015 (USACE 2015, NMFS 2015, USFWS 2015); these documents are incorporated by reference.

3.2 Context for Cumulative Effects Analysis

Cumulative effects/impacts result from the "individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). NEPA requires the evaluation of cumulative impacts of the proposed dredging and disposal operations to assess the overall effect of the proposed action on resources, ecosystems, or human communities in light of past, current, and reasonably foreseeable future actions within Bellingham Bay. The cumulative impact analysis includes actions by Federal, non-Federal, and private entities.

The shoreline of the City of Bellingham has endured significant modifications to support the Port of Bellingham activities and commercial developments. The area has substantially changed from historical, natural conditions where extensive mudflats and estuarine wetland existed, and is now functioning as a developed, industrial port. Parts of Bellingham Bay are determined unsuitable from past industrial practices along the waterfront, including pulp and tissue mills. The Port of Bellingham and others are working with the Washington Department of Ecology (Ecology) to clean up the contamination. Ecology is currently managing cleanups of 12 sites in Bellingham Bay, two of which are completed and the other 10 in various stages of the process. All are on or near the Bellingham waterfront (WDOE 2019). The Port of Bellingham performs maintenance dredging in Squalicum Harbor, a 1,400 slip boat marina, and the Bellingham Cold Storage periodically dredges a swath around their dock and berthing areas. These actions are likely to continue into the future.

Actions with the highest potential for cumulative impacts in the project area would be continuation of commercial and recreational vessels utilizing the Bellingham Bay, coupled with repeated dredging of and disposal of dredged material generated by dredging operations. Cumulative impacts of the preferred alternative on specific resources are discussed in the following section.

3.3 Resources Analyzed for Effects of the Alternatives

3.3.1 Hydraulics and Geomorphology

Prior to industrial development, large tidal flats were at the mouths of Squalicum, Whatcom, and Padden Creeks and when dredging was federally authorized for the three navigation waterways, much of the dredged material was used as fill on the mud flats to provide sites for wharves, buildings, factories, and streets. Urban development, historic dredging and filling, and shoreline modifications have reduced habitat quality along the eastern shore of Bellingham Bay. From the mouth of the Nooksack River in the northwest corner of Bellingham Bay extending for nearly 9 miles clockwise around the Bay, the entire shoreline is armored and developed. This armoring has eliminated the natural shoreline process that support habitat for aquatic and marine riparian life. Filling in Bellingham Bay caused the loss of approximately 330 acres of intertidal and shallow subtidal lands.

Hydrologic conditions in Squalicum Creek and the Nooksack River as well as tidal fluctuations and currents particular to Bellingham Bay influence the sedimentation rate of the Squalicum Waterway. Squalicum Creek has a drainage area of approximately 25 square miles and empties into Bellingham Bay. The Squalicum Waterway is located near the mouth of Squalicum Creek, which developers have moved several times in the last 100 hundred years to make way for infrastructure and marine facilities. Sediment deposition from the creek has created an alluvium at its mouth and is beginning to encroach on the eastern end of Squalicum Waterwinay outside of the proposed dredging area. The Nooksack River drains a watershed of approximately 959 square miles and empties into Bellingham Bay north of Squalicum Waterway. Sub-surface currents and tidal fluctuations in Bellingham Bay carry suspended sediments from the Nooksack River along the eastern shore with the eventual deposition of sediments in slack water areas including the Squalicum Waterway. Over the past 50 years, maintenance dredging occurred in 1980, 1992, 1996, 1998, 2001, and 2004 of quantities ranging from 11,000 cubic yards (cy) up to 226,000 cy.

3.3.1.1 Alternative 1 – No-Action

Under the No-Action alternative, sediment would continue to accumulate in the navigation channel. Shoaling of sediment begins to hamper vessel passage to and from the berthing area. The current patterns in the channel would change and become more difficult to navigate. Continued shoaling would result in less water depth throughout the channel and, if allowed to continue unimpeded, could reduce or eliminate vessel traffic. Eventually, enough sediment would accumulate that the channel would no longer be navigable.

3.3.1.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

For Alternative 2, the USACE would dredge the entire Squalicum Waterway to -26 feet MLLW with 2 feet of authorized advance maintenance and another 2 feet of allowable overdepth. This would return the channel to its authorized depth of -26 feet MLLW and allow for a minor quantity of accumulation between dredging events that occur as funding allows, approximately every 7 to 12 years.

Natural erosion and sediment transport causes navigation projects to fill with sediment on different time scales that range from annual to over 10 years. Maintenance dredging removes accumulated sediment from authorized navigation projects and does not change authorized dimensions. Repeated maintenance dredging is often necessary to maintain a navigation project. The outcome of maintenance dredging is to cause a navigation project to remain fixed in space through time, allowing vessel

operators predictability in the location of navigable waters. Currents are unlikely to have measurable changes due to removal of accumulated sediment in a navigation channel because a navigation project (channel) is typically a minor proportion of an associated river delta and/or associated estuary. The forces that determine current speed and direction are typically much greater than the change of a few feet to remove accumulated sediment in an established channel. Therefore, the slow current speeds of less than 1 foot per second in the action area would not change due to the maintenance dredging of Squalicum Waterway. No significant impacts to hydraulics or geomorphology are anticipated.

Impacts to hydraulics and geomorphology at the open water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.1.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

Effects to hydraulics and geomorphology of Alternative 3 would be the same as those described for Alternative 2. The area and depths of dredging are the same; the haul distance to disposal is the only difference and this would not affect channel geomorphology or hydraulics in Bellingham Bay.

3.3.1.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Effects to hydraulics and geomorphology of Alternative 4 would be the same as those described for Alternative 2. The area and depths of dredging are the same; the haul distance to disposal is the only difference and this would not affect channel geomorphology or hydraulics in Rosario Strait.

3.3.1.5 Cumulative Impacts of the Preferred Alternative

No cumulative impacts to hydraulics and geomorphology would accrue from this action because the project area would be maintained as it has been since channel construction in 1931 and the disposal sites would be used as designed to avoid cumulative impacts.

3.3.2 Sediments

Sediments at the creek mouth, located at the head of the waterway, are comprised of a mixture of clay, silt, and sand with a smaller portion of gravel. The outer channel material is almost entirely fine substrates with less than 2% of sand and gravel (**Table 1**).

Table 2. Mean percentages of sediment types sampled in 2017 in the Squalicum Waterway.

	Gravel	Sand	Silt	Clay	Percent Fines (sum of silt and clay fractions)
Subarea A (main channel)	0.18	1.67	78.84	17.99	96.83
Subarea B (head of waterway)	16.82	39.66	29.45	13.41	42.86

Sediments in the action area are considered unsuitable primarily due to historical dumping of industrial wastes into the water near the shore. Past wood treating practices, industrial waste disposal practices, and landfill locations have left sites surrounding Bellingham Harbor to require clean up (Ecology 2015). Clean-up efforts have occurred at several sites for past contamination events. According to the

Washington State Department of Ecology (Ecology) online database, cleanup has started at 6 contamination sites and another 4 contamination sites are awaiting cleanup within a half mile of the Squalicum Waterway. Contaminants include mercury, phenolic compounds, PAH compounds, and dioxin/furan compounds. The Squalicum Waterway contains a small area that is listed as Category 5 on the 303(d) list for sediment bioassay.

3.3.2.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect on the sediments in Squalicum Waterway or surrounding nearshore zone. This alternative would allow sediment to continue accumulating, which would eventually jeopardize the ability for safe navigation through the channel. This alternative would not meet the project purpose and need because the Squalicum Waterway Navigation Channel would not maintain its authorized depth; therefore, safety of navigation of marine vessels would decrease as the depth to substrate decreases.

3.3.2.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

This alternative would return the navigation channel to its authorized depth. The direct effect of this alternative on sediments would be removal of accumulated surface sediments and exposure of underlying sediments to the water and currents of the channel.

Dredged sediments proposed for aquatic disposal must meet specific requirements set forth by the DMMP for material taken to the PSDDA aquatic disposal sites. Sediment sampling occurred within the navigation channel in 2017 to determine suitability of sediments for aquatic disposal. Based on results from the most recent sediment sampling and suitability determination (DMMP 2017), material from Subarea A, most of the navigation channel, can go to any open-water disposal site. Composited samples from Subarea A were analyzed for dioxin and were all below 4 ng/kg toxic equivalents (TEQ) thereby meeting the State's antidegradation standard. Additionally, the newly exposed material after dredging is complete would also meet the antidegradation standard for DMMP contaminants of concern. Subarea B showed more than half of the sampling sites to exceed dioxin concentration suitable for DMMP disposal site management objective of 4 ng/kg for dispersive sites. To dispose material at a non-dispersive PSDDA site, the material must have a volume-weighted average dioxin concentration that is below 4 ng/kg TEQ. The material meets this criterion and is therefore eligible to be disposed at the Bellingham Bay non-dispersive PSDDA site. Effects at the Bellingham Bay disposal site would be negligible. The dredged material placed at Bellingham Bay disposal site would have the same grain size distribution and would match the coarseness of the material in place. No significant impacts to sediment are anticipated.

Impacts to sediment at the open water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.2.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

The effects to sediments in Squalicum Waterway would be the same as those described for Alternative 2. Sediments are rigorously tested for chemicals of concern and potential for biological effects before they are determined suitable for disposal at PSDDA sites. The disposal sites were selected to minimize impacts to commercial invertebrate and fish resources. Minimal exposure to contaminants would occur if fish move through the water column of a disposal site immediately after a dump event.

3.3.2.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

The effects to sediments in Squalicum Waterway would be the same as those described for Alternative 2. Although with greater impacts to the Bellingham Bay disposal site since all the material would be placed there and no impacts to sediments at the Rosario Strait disposal site since no material would be placed there.

3.3.2.5 Cumulative Impacts of the Preferred Alternative

Cumulative impacts are not expected because dredging would not affect the dominant sediment transport processes in Bellingham Bay, which are primarily affected by Nooksack River flows and tidal action.

3.3.3 Water Quality

Historically, Bellingham Bay has experienced the dumping of municipal and toxic wastes from point and non-point sources, which had resulted in decreased water quality in much of the aquatic environments near industrial areas, including the Port of Bellingham. Within the Federal navigation channel, the substrate is a mix of gravel, sand, silt, and clay throughout most of the area to be dredged. Sediments in the project area have been determined to be suitable for aquatic disposal, although low levels of dioxin are present in sediment at the head of the waterway.

As reported in the Water Quality Atlas for Washington State (Ecology 2016), Ecology provides an assessment of water quality and a 303(d) list of impaired waterbodies for fresh and marine waters in Washington State. Surface water and sediment quality in Bellingham Bay are limited with several areas appearing on the State of Washington's 303(d) list (Figure 5; Ecology 2016). Squalicum Creek is listed as Category 5 for fecal coliform. The City of Bellingham's stormwater collection and conveyance system empties directly to Bellingham Bay, which makes stormwater discharges a potential source of contamination to water and sediment in the action area.

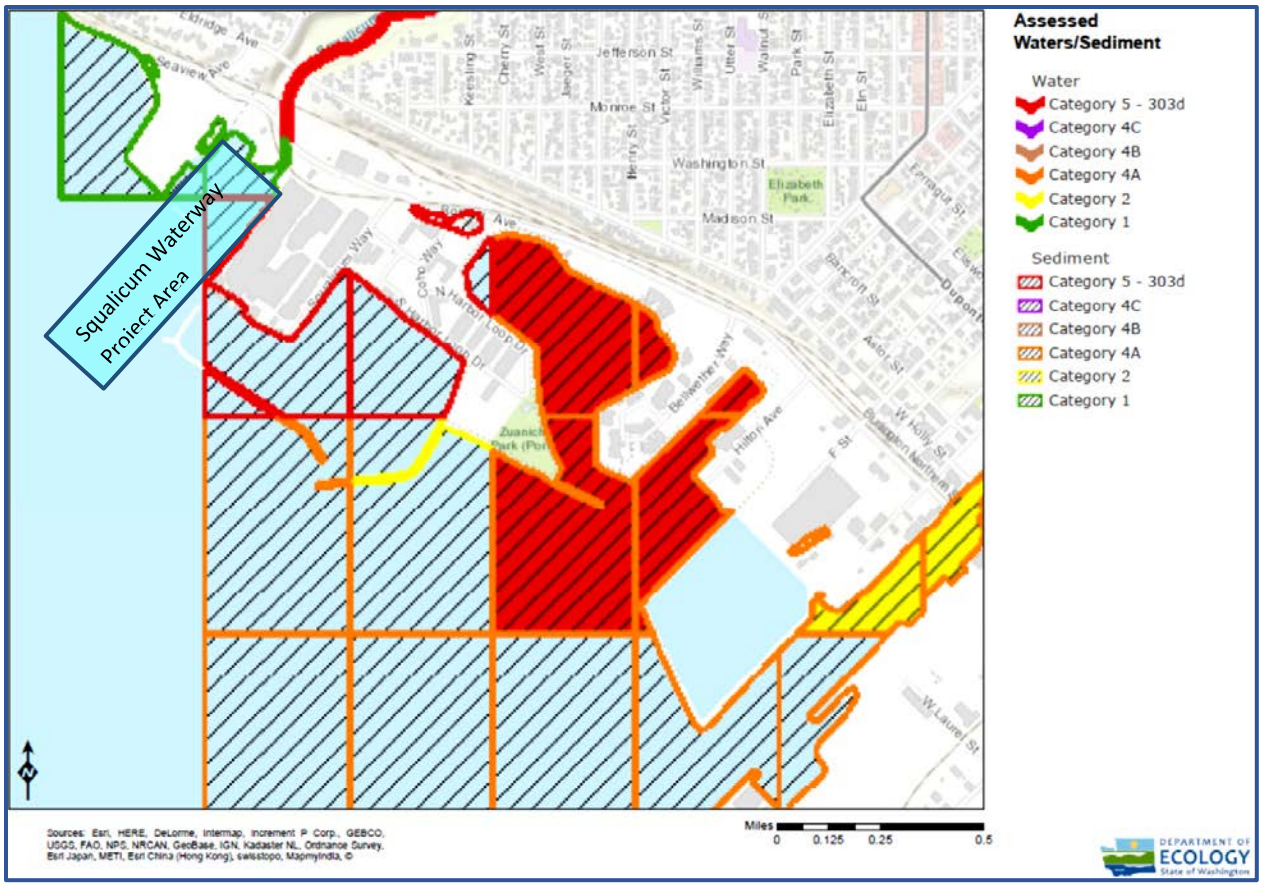

Figure 6. Map of assessed waters and sediments in Bellingham Bay with 303(d) listing status (Ecology 2016).

3.3.3.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect to water quality for the Squalicum Waterway and the surrounding inner Bellingham Bay.

3.3.3.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

This alternative would have a minor, short-term degradation of water quality related to turbidity and dissolved oxygen (DO) in a small area immediately down-current from the active dredging operations. Dredging operations would cause turbidity due to short-term resuspension of sediments in the water column; the amount of resuspended sediment would decrease with distance from the dredging. The area affected by turbidity would be only slightly wider than the dredging equipment as currents move the suspended sediments. The down-current distance would likely be 300 feet or less as a small quantity of sediment escapes the clamshell bucket as it rises through the water column. These water quality characteristics are of low concern for the aquatic biota in the project area because most mobile organisms that could be affected by turbidity or minor reductions in dissolved oxygen would be able to avoid or escape the affected area without measurable harm. Dredging is expected to take approximately 65 days for this alternative.

Dissolved oxygen (DO) may decline around dredging operations when the suspension of anoxic sediments creates elevated chemical oxygen demand. Temporary decreases in DO associated with increased suspended sediments are possible in the immediate dredging plume area. During dredging

operations, DO in the navigation channel is not expected to reach levels sufficiently low to cause aquatic organisms harm (below 4 mg/L) because flushing from tidal currents would keep the water oxygenated. Short-term effects of decreases in DO could include avoidance of the dredging area by mobile aquatic organisms, and reduced foraging opportunity during and immediately after dredging as fish avoid areas of depressed DO. Given the amount of tidal exchange in the project area, it is unlikely that DO would have measurable changes due to dredging and would therefore not cause harm to aquatic organisms. Compared to the No-Action Alternative, effects to water quality would have minor and temporary negative effects to aquatic life, but would not constitute a significant impact. Given the temporary and localized effects to water quality, no significant impacts are anticipated.

Impacts to water quality at the open-water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.3.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

The effects to water quality parameters would be the same as those described for Alternative 2 for Rosario Strait. However, Minor and temporary impacts to water quality would occur at the Port Gardiner disposal site instead the Bellingham Bay site. .

3.3.3.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

The effects to water quality in Squalicum Waterway would be the same as those described for Alternative 2. Although with greater impacts to water quality at the Bellingham Bay disposal site because all the material would be placed there and no impacts to sediments at the Rosario Strait disposal site because no material would be placed there.

3.3.3.5 Cumulative Impacts of the Preferred Alternative

Since water quality impacts would be temporary, cumulative impacts would occur only if other construction activities occur at the same time as the proposed dredging and disposal, which is possible but not likely due to the duration of the in-water work window. The majority of water quality issues in Bellingham Bay stem from land use practices, runoff, and past industrial uses, not from in-water construction. Therefore, cumulative impacts to water quality would be insignificant.

3.3.4 Vegetation

At its mouth, Squalicum Creek exhibits a severely degraded estuary that lacks several key characteristics that if present, would make it a more biologically productive system. Some of the key characteristics missing are submergent and emergent vegetation, a salt marsh transition zone, and adequate fish cover. Riprap, pier footings, remnant dock facilities, and bulkheads cover the shoreline surrounding the mouth of Squalicum Creek and prevent establishment of any natural vegetation. Impervious surfaces such as roads and parking areas cover the upland area. Shoreline riparian vegetation has been removed and replaced with riprap armoring and bulkheads to support upland development. In 2014, the Port of Bellingham worked with Ecology to restore a small cove in marine nearshore habitat to regrade the shoreline, remove concrete structures, and replace substrate to host plantings.

Historical information, including hydrographic charts from the late 1800s, indicates no eelgrass present in the bay west of Bellingham (Thom and Hallum 1990). Gackle (2009) speculates this could be due to the dynamic nature of the Nooksack delta. The project area contains no eelgrass (*Zostera marina*) according to Washington Department of Natural Resources surveys; however, eelgrass occurs near the shoreline around the southeast portion of the action area (WDNR 2017). The non-native form of eelgrass (*Z. japonica*) occurs to the northwest and both species occur at the Nooksack River delta approximately 1 mile away from the Squalicum Waterway.

Impacts to any possible vegetation at the open-water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.4.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect to any vegetation or tidal wetlands in the project area. While shoaling may eventually create shallower aquatic habitats within the estuary, the processes that allow tidal wetlands to develop are substantially degraded making low likelihood for wetlands to develop.

3.3.4.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Since there is no aquatic vegetation in the channel, dredging operations in the Squalicum Waterway would have no effect to any shore, intertidal, or submerged aquatic vegetation or any habitats that might support vegetation establishment. Given the lack of vegetation in the channel, no significant impacts are anticipated.

3.3.4.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

The effects to vegetation would be the same as described for Alternative 2.

3.3.4.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

The effects to vegetation would be the same as described for Alternative 2.

3.3.5 Cumulative Impacts of the Preferred Alternative

No cumulative impacts to vegetation are anticipated since there is no vegetation within the channel.

3.3.6 Fish

Bellingham Bay hosts several habitat types including salt marshes, eelgrass, mud/sand flats, sand/gravel beaches, open water, and boulder/bedrock shoreline (WDOE 2000). Each one of these habitat types contributes to the survival of one or more fish species. For example, several species of juvenile salmon use intertidal habitats consisting of salt marsh and mud/sand flats that occur at the mouths of the Nooksack River, Whatcom Creek, Padden Creek, and Chuckanut Creek. As a result, the Nooksack River has the largest salmon runs in Bellingham Bay, followed by Whatcom Creek (Ecology 2000). Although other river and creek mouths may support salmon usage, Squalicum Creek mouth at the project area is heavily impacted and not in its natural condition.

The in-water work window for protection of sensitive life stages of fish is established by location and Bellingham Bay is in Tidal Reference Area 9. The in-water work window of July 16 through February 15 protects bull trout and juvenile salmon as well as spawning Pacific herring. A more restrictive work

window applies to the disposal area in Bellingham Bay to protect commercially harvested shellfish; disposal may occur July 16 through October 31.

Forage Fish

Forage fish are a critical prey item for many fish and wildlife species. Surf smelt and sand lance spawning have been documented along the shore to the northwest of the project area and herring spawning occurs around Portage Island across the bay to the west; however, the nearest pre-spawning holding area is more than 6 miles away to the southwest of the project area and outside of the action area (WDFW 2017a). Herring spawning in Puget Sound occurs primarily in February and March with the exception of the Cherry Point stock that spawns primarily in April and May (WDFW 2014). Longfin smelt are abundant in Bellingham Bay as well.

Salmonids

Squalicum Creek has documented spawning populations of cutthroat trout and winter steelhead; according to SalmonScape mapping, Chinook, chum, coho, and bull trout have been recorded as present but do not have spawning populations there (WDFW 2017b, 2017c). The Nooksack River to the north of the action area hosts populations of Chinook, coho, chum, pink, and sockeye salmon as well as steelhead, bull trout, and coastal cutthroat trout. Juvenile Chinook outmigration occurs in late winter, peaks in spring, and continues through June into July. Adult fall Chinook return in July through September (Green 2003). Winter-run steelhead enter freshwater between November and April at an advanced stage of maturation and spawn shortly thereafter, usually from March through June. Juvenile steelhead outmigrate from freshwater between mid-March and early June. Juvenile steelhead enter marine waters at a much larger size and have a higher rate of survival than other salmonid species. The majority of steelhead smolts appear to migrate directly to the open ocean and do not rear extensively in the estuarine or coastal environments (Burgner et al. 1992).

According to the NMFS status review (Ford 2011), the Puget Sound Chinook and steelhead ESA-listed populations are likely to become endangered and no change from this 2005 risk category is warranted. The Nooksack River Chinook population has been trending downward over the past 30 years; Nooksack steelhead are assumed to follow the overall downward trend of the Puget Sound Distinct Population Segment (Ford 2011).

All of these salmonids use Bellingham Bay and the action area as a migration corridor and may feed in the action area. Few are homing into Squalicum Creek while most others are migrating toward Nooksack River. The overwater structures adjacent to Squalicum Waterway cause unfavorable conditions due to shading that juvenile salmon avoid and provide hiding areas where piscivorous predators reside as an advantageous position to consume juvenile salmon. Sources of pollution in Squalicum Creek include urban stormwater runoff, industrial runoff from the surrounding properties (pollutants include metals, oils, and coolants), septic systems, and the Squalicum Harbor Marina.

Other Pelagic and Demersal Fish

Fish species commonly occurring in Bellingham Bay include flatfish such as sole and starry flounder, shiner perch, surf perch, spiny dogfish, and threespine stickleback.

3.3.6.1 Alternative 1 – No-Action

The No-Action Alternative would have no effects to fish species.

3.3.6.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Potential impacts to fishes include the following: 1) entrainment, resulting in direct mortality, 2) physiological damage and elevated stress levels from suspended sediment, decreased DO, and elevated noise, and 3) a behavioral response to flee associated with suspended sediment, decreased DO, and noise. The proposed action may cause temporary effects to water quality including increased suspended solids and small decreases in DO in the immediate dredging area, which may have a minor effect to any fish present in the immediate dredging footprint.

Larger fish would generally be able to avoid the dredge with the exception of burrowed sand lance, if present this high up in the estuary. If the dredge encounters a sand lance "hot spot" then entrainment could be high, which was shown to be the case for hopper dredging at the mouth of the Columbia River (Larson and Moehl 1988). However, hopper dredging entrainment has a much higher rate of entrainment than clamshell dredging. Entrainment of sand lance and other benthic fish would be localized with no detectable decreases in populations in Bellingham Bay. Risk of entrainment of pelagic oriented fish such as salmonids is quite low (McGraw and Armstrong 1988), given their ability to avoid the dredge.

The temporary increases in suspended solids could affect juvenile salmon in the immediate dredging area through decreased visibility for foraging activities and impaired oxygen exchange due to clogged or lacerated gills. However, the available evidence indicates that total suspended solids (TSS) levels sufficient to cause such effects would be limited in extent. LeGore and Des Voigne (1973) conducted 96-hour bioassays on juvenile coho salmon using re-suspended Duwamish River sediments from five locations. Up to 5% sediment in suspension (28,800 mg/l dry weight), well above levels expected to be suspended during dredging, had no acute effects. Salo et al. (1979) reported a maximum of only 94 mg/l of sediment in solution in the immediate vicinity of a working dredge in Hood Canal. This indicates that turbidity would be elevated on a temporary and localized basis by dredging, but that TSS levels sufficient to cause adverse effects on salmon would be very limited in extent. Any turbidity would primarily be at the bottom of the water column in the center of the channel and juvenile salmon are surface-oriented in shallow water near the shoreline.

Impacts related to noise are likely to occur but should be temporary, and behavioral changes related to avoiding the noise are the most likely response by fish. High intensity underwater noise can result in temporary threshold shifts (TTS), non-injurious temporary reduction in hearing sensitivity. No permanent hearing loss has been documented in fish (NOAA 2016). Hearing varies depending upon the species of fish, however most react to sounds in the range of 50 Hz to 2 kHz with a minimum threshold around 70 dB (Hastings, 1995). Noise generated by hydraulic dredges are characterized as continuous (or non-pulsed), since the elevated sound pressure occurs over seconds (not milliseconds, as is the case with pulsed noise) (Agness, NMFS, personal comm., July 23, 2013). The following are noise thresholds for various forms of effects on salmonids for both impact and vibratory pile driving (note that, like dreging, vibratory pile driving is considered continuous):

- 150 dB_{RMS}[1] for harassment for continuous noise for fish of all sizes (Hastings 2002)

[1] Decibels root mean square over a period of time

- 187 dB cumulative SEL[2] for injury of fish ≥ 2 grams[3] (NMFS et al. 2008)
- 183 dB cumulative SEL for injury of fish < 2 grams (NMFS et al. 2008)
- 206 dB_{peak}[4] for injury of fish of all sizes (NMFS et al. 2008)

A more recent study lists the following continuous noise[2] thresholds based on Popper et al. 2014:

- For fish with swim bladders that are involved in hearing (e.g. herring, sardines, and anchovies)
  - 170 dB_{RMS} for 48 hours for recoverable injury
  - 158 dB_{RMS} for 12 hours for TTS (Temporary Threshold Shift, or complete recovery of hearing loss)
- There is no direct evidence for mortality or potential mortal injury for continuous noise
- There are no continuous noise thresholds set for fish without swim bladders (sculpins) or those with bladders that are not involved in hearing (salmonids)

The operation of most large marine vessels, including tugs that would have the barges for open-water sediment disposal, produce up to 180 dB. While the operation of the tug and barge would increase ambient noise levels along the immediate travel route, impacts of any sound disturbance would likely result in temporary, short-range displacement of animals rather than injury. A 2010 study recorded a tugboat with peak sound pressure levels in the range of 148-168 dB with the hydrophone placed 350 m away from the tugboat. This study also reported measurements of noise levels from clamshell dredging in the Snohomish River as high as 164 dB re µP (dB_{peak}) and 164 dB_{RMS} for a clamshell dredge when the bucket hits the bottom (Pentec Environmental 2010). Another study in Cook Inlet recorded a peak sound level of 124 dB re µP (dB_{peak}) when the clamshell hit a coarse substrate bottom (Dickerson et al. 2001). It is likely that the $_{RMS}$ noise levels for this study were lower than the peak noise levels, although they were not disclosed. This Cook Inlet study also found that softer substrates are more effective at absorbing sound from the impact of the dredge bucket, and the peak sound measurements in these softer substrates did not exceed thresholds for continuous sound. The sound levels generated in the Snohomish River study do exceed the NMFS harassment (all fish) and Popper TTS (fish with swim bladders used for hearing) thresholds, but no injury thresholds for fish. Furthermore, the substrate in Bellingham Bay is generally softer (dominated by clay and silt in most locations) than that of the Snohomish River (mostly sand). Therefore, sound levels (both in dB_{peak} and $_{RMS}$) are likely to be lower than the Snohomish study and thresholds are not expected to be exceeded.

Data for how continuous sound affects fish is limited and in the technical report of sound exposure guidelines prepared by Popper et al. (2014), they rank the level of risk of injury as high, moderate, or low for most categories of fish instead of presenting number thresholds for harm. According to Popper, the

[2] Decibels sound exposure level over a 24 hour period (cumulative)
[3] Injury thresholds are based on pile driving (pulsed noise)
[4] Peak sounds in decibels

risk of mortality for continuous sound such as this is low for all categories of fish at all distances from the sources of sound; the risk of recoverable injury is the same except for fish with a swim bladder used for hearing. Their threshold for recoverable injury is 170 dB rms, and 158 dB_{RMS} for a temporary threshold shifts. The peak sound level during the Snohomish River study falls between these thresholds. The risk of temporary threshold shift for the other groups of fish, those without swim bladders and those with swim bladders that do not use them for hearing, is moderate near the source of the sound but low for intermediate or far distances (Popper 2014).

The only fish in the study area that would be vulnerable to the physiological effects of noise generated by clamshell dredging would be herring, and possibly sardine and anchovy, although the effects would be recoverable since the noise would not exceed the injury thresholds. There is potential for behavioral responses of all fish via harassment since there is potential for the sound levels to exceed the Hastings and NMFS thresholds, but these impacts would be temporary. Furthermore, the impacts of noise on fish would be insignificant since there is a finite community of fish that would be affected within the limited confines of the study area, which already has higher levels of ambient noise from vessel traffic; and the size of this affected sub-population would be minimal compared to communities in the Puget Sound.

Additionally, the in-water work window avoids substantial overlap between the timing of dredging and salmon outmigration and forage fish spawning; therefore, any effects would occur to very few if any juvenile salmonids or forage fish. Due to very little coincidence of timing and location, effects of dredging would be insignificant.

Impacts to fish communities at the open water disposal sites are addressed in the aforementioned PSDDA Phase I EIS.

3.3.6.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

Alternative 3 would have the same effects as those described for Alternative 2 with the exception of the disposal of dredged material occurring at Port Gardner instead of the Bellingham Bay PSDDA Disposal Site. The total project duration for Alternative 3 would be approximately 70 days due to the longer haul distance, but the active dredging time would be the same because the total quantity is the same in both alternatives.

3.3.6.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Alternative 4 would have the same effects as those described for Alternative 2 with the exception of the disposal of all dredged material at the Bellingham Bay PSDDA Disposal Site and none at the Rosario Strait site. The total project duration for Alternative 4 would be approximately 50 days due to the shorter haul distance, but the active dredging time would be the same because the total quantity is the same in both alternatives.

3.3.6.5 Cumulative Impacts of the Preferred Alternative

There are a variety of factors that have contributed to low quality fish habitat in the Bellingham Bay including shoreline fill and armoring and subsequent loss of wetlands, persistent contaminants from past industrial practices, periodic dredging, vessel traffic, and other ongoing and future construction related activities that may result in elevated turbidity and noise. Given the degraded state of the river,

when combined with the proposed maintenance dredging, cumulative impacts to fish would be insignificant.

3.3.7 Wildlife

Although there is limited information on the presence and residence of marine mammals in Bellingham Bay, four species have been reported either in the Bay or the channel just beyond the entrance – harbor seal (*Phoca vitulina*), killer whale (*Orcinus orca*), gray whale (*Eschrichtius robustus*), and harbor porpoise (*Phocoena phocoena*). In addition, the Bellingham Bay area hosts six identified haulout sites for harbor seals: one in Chuckanut Bay, one on Eliza Island, one on Vendovi Island, one on Viti Rocks, one on Sinclair Island, and one off Cypress Island (WDFW 2000). The project area is approximately 1.5 miles from the nearest haulout site in which a few harbor seals regularly rest on log booms in the southeastern corner of the Port of Bellingham (WDFW 2000). California sea lions can also be occasional visitors in Bellingham Bay. Whale and porpoise sightings are rare due to the shallower and more confined area of Bellingham Bay compared to the preferred habitats of these species found in deeper open waters. Killer whales are not often seen in Bellingham Bay due to the shallow depths of the semi-enclosed area. The Whale Museum in Friday Harbor has maintained a database of killer whale sightings. In the period of 1990-2008, very few killer whales were recorded in Bellingham Bay and the months of occurrence were May and June (Osborne 2008).

3.3.7.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect on marine mammals, birds, or terrestrial wildlife.

3.3.7.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Maintenance dredging of the Federal navigation channel with its associated disposal sites would have a low level of disturbance to wildlife due to noise and presence of humans on the dredge vessel. This may have the effect of temporarily displacing a small number of birds and marine mammals including cormorants, Caspian terns, and harbor seals that commonly use the Nooksack River estuary.

The National Marine Fisheries Service (NMFS) has provided technical guidance on the effects of underwater noise on the hearing of marine mammal species. The hearing ranges and acoustic thresholds at which marine mammals are predicted to experience changes in hearing due to non-impulsive anthropogenic underwater noise, such as dredging, are summarized in Table 4. There are different thresholds for temporary (TTS) and permenant threshold shifts (PTS) of hearing sensitivity. For non-impulsive sounds the thresholds are presented using the cumulative sound exposure level (SEL_{cum}) (NMFS, 2016).

Table 3 Generalized Hearing Ranges, PTS, and TSS Thresholds for Non-impulsive Sounds

Hearing Group	Generalized Hearing Range	PTS Onset Acoustic Thresholds (received level)	Weighted TTS onset acoustic threshold (SEL_{cum})
Low frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz	L_E,LF,24h: 199 dB	179 dB

Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	105 Hz to 160 kHz	L_E,MF,24h: 198 dB	178 dB
High-frequency cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*)	275 Hz to 160 kHz	L_E,HF,24h: 173 dB	153 dB
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz	L_E,PW,24h: 201 dB	181 dB
Otariid pinnipeds (PW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz	L_E,OW,24h: 219 dB	199 dB

NMFS 2016. In the PTS column, L_E is the cumulative sound exposure level, other abbreviations, like LF, represent the auditory weighting function for that group of marine mammals, and the accumulation period is 24 hours.

Note that these noise units are not the same as those listed in the literature cited in section 3.3.6.2. There is no simple way convert the noise units in the literature to the NMFS threshold units without having the raw data. A 2018 BiOP issued to USACE for eight maintenance dredging projects assumed dB_{RMS} and dB_{SEL} to be equal for continuous noise (NMFS 2018). Behavioral changes from noise avoidance are the most likely impacts to marine mammals. Few marine mammals, other than seals and sea lions, frequent the protected waters within the bay, so the impacts within the bay itself are predicted to be low. The sound exposure level (SEL), the threshold that causes a temporary shift in hearing ability, is 181 dB and 199 dB for seals and sea lions, respectively, which is above the level of noise generated by studies cited in 3.3.6.2. Additionally, sound would attenuate quickly with distance from the dredge and would not cause any greater harm than avoidance of the immediate dredging area.

Overall, the dredge is not expected to cause more than the usual amount of disturbance that occurs to birds or marine mammals in Bellingham Harbor; however, the constant noise from the dredge may cause wildlife to avoid the immediate project area during the approximately 65 days of dredging and disposal. They would return to normal habits once the dredging is complete. No long-term significant impacts to wildlife populations are anticipated.

Impacts to wildlife at the open-water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.7.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

The effects of Alternative 3 to local wildlife would be slightly longer duration of disturbance in a broader area compared to those described for Alternative 2. The total duration of dredging and dredging for Alternative 3 would be approximately 70 days, which is 5 days longer than the duration of Alternative 2 due to the longer haul distance to Port Gardner PSDDA site. Additionally, the total area of underwater noise disturbance would be substantially greater as the tugboat would travel 60 miles to haul the barge to the Port Gardner PSDDA site compared to only 3 miles to the Bellingham Bay PSDDA site.

Effects of transportation and disposal of dredged materials at PSDDA disposal sites have been analyzed and documented for compliance under NEPA and ESA; however, the additional distance required for this alternative would be a cumulative effect added to the ambient underwater noise of Puget Sound from

human sources. This alternative would cause additional underwater noise of the tugboats hauling barges throughout the haul distance from Bellingham Bay 60 miles to the Port Gardner PSDDA site. Noise attenuation from the tugboat is expected to be approximately 500 m (Clarke et al. 2003).

3.3.7.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Alternative 4 would have the same effects as those described for Alternative 2 with the exception of the shorter duration (50 days) and haul distance, resulting in less exposure to wildlife.

3.3.7.5 Cumulative Impacts of the Preferred Alternative

There are a variety of factors that have contributed to low quality wildlife habitat along the Bellingham Bay waterfront including shoreline fill and armoring and subsequent loss of wetlands, persistent contaminants from past industrial practices, periodic dredging, vessel traffic, and other ongoing and future construction related activities that may result in elevated turbidity and noise that effect the wildlife itself and/or their prey resources. Given the degraded state of the river, when combined with the proposed maintenance dredging, cumulative impacts to wildlife would be insignificant.

3.3.8 Benthic Invertebrates

Several types of marine invertebrates live in Bellingham Bay near the project area including worms, clams, oysters, crabs, and shrimp. The predominant bivalves are intertidal and subtidal hard-shell clams; native oysters and Pacific geoduck also occur in Bellingham Bay.

Shellfish densities are relatively low from Little Squalicum Creek to south Post Point, which includes the project area of Squalicum Waterway. Scattered oysters occur on the shoreline of Little Squalicum Creek, Boulevard Park, Squalicum Harbor breakwater, Whatcom Creek estuary, and the Cornwall Avenue Landfill (WDOE 2000). Crab densities are moderate to abundant for purple crabs, rock crabs, and Dungeness crabs. The northern and eastern shorelines of Bellingham Bay serve as nursery/rearing habitat for juvenile Dungeness crab (Ecology 2000), which likely occur seasonally in these areas (Ecology 1999).

3.3.8.1 Alternative 1 – No-Action

The No-Action Alternative would have no effects to benthic invertebrates. Ceasing a maintenance dredging program may allow a larger alluvium to form at the mouth of Squalicum Creek, which may allow improved habitat for an intertidal invertebrate community in the channel over a period of many years after the last dredging event.

3.3.8.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Dredging the channel would disrupt the benthic community and cause direct mortality to smaller organisms that are unable to avoid the dredging operation. The dredging area is small relative to the total benthic area covered by the invertebrate populations; the loss of a relatively small number of crabs to dredging compared to total habitat available around the project area would not affect the total population. Rate of entrainment depends on the density of crabs in the dredging footprint. The USACE anticipates loss of a few crabs, but not enough to impact population abundance or commercial and recreational catch rates.

Within the dredged area, the dominant species of the benthic invertebrate community are expected to return to pre-dredging conditions quickly. Benthic fauna move in from neighboring habitat to recolonize these areas (McCauley et al. 1977, Richardson et al. 1977). Measurements of recolonization by invertebrates in sub-tidal habitats where the substrate texture does not change have reported a return to pre-disturbance conditions in hours and days and up to two months (Hiss and Boomer 1986). Recovery begins with the early colonizers and takes less than a year for the short-lived organisms with rapid growth and re-population strategies; this is followed by the longer-lived species that grow larger but have a slower recovery time of two to three years (Newell et al. 1998). The temporary loss and shift in community structure of benthic invertebrates would not substantially affect the broader estuarine community and biodiversity in the project area. Therefore, effects on benthic infauna are expected to be insignificant.

Impacts to benthic invertebrates at the open water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.8.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

The effects to benthic invertebrates would be the same as for Alternative 2.

3.3.8.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

The effects to benthic invertebrates would be the same as for Alternative 2.

3.3.8.5 Cumulative Impacts of the Preferred Alternative

As stated previously, there are a number of activities in the project area that prevent diverse and healthy invertebrate communities, including regular dredging, contamination, vessel traffic, and armored banks that lack riparian vegetation. Given all of the modifications to the shoreline, when combined with the proposed maintenance dredging cumulative impacts to benthic invertebrates would be insignificant because the reduction of invertebrates in the navigation channel would be discountable.

3.3.9 Threatened and Endangered Species

In accordance with Section 7(a)(2) of the Endangered Species Act of 1973 (ESA), federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed and proposed threatened or endangered species. To satisfy the requirements of the Act, the USACE has analyzed the potential effects to all ESA-listed species that may occur in the project area. These appear in Table 2 along with their critical habitat status.

Table 4. Species listed under the Endangered Species Act with their status and critical habitat.

Common Name	**Listing Date**	**Status: Threatened (T) Endangered (E)**	**Designated Critical Habitat**
Coastal/Puget Sound Bull Trout *Salvelinus confluentus*	Nov. 1, 1999	T	Yes Oct. 18, 2010
Puget Sound steelhead *Oncorhynchus mykiss*	May 11, 2007	T	Yes Feb. 24, 2016
Puget Sound Chinook salmon *Oncorhynchus tshawytscha*	Mar. 24, 1999	T	Yes Sept. 2, 2005

Common Name	Listing Date	Status: Threatened (T) Endangered (E)	Designated Critical Habitat
Bocaccio rockfish *Sebastes paucispinis*	Apr. 28, 2010	E	Yes* Nov. 13, 2014
Yelloweye rockfish *Sebastes ruberrimus*	Apr. 28, 2010	T	Yes* Nov. 13, 2014
Marbled Murrelet *Brachyramphus marmoratus*	Oct. 1, 1992	T	Yes* Aug. 4, 2016
Southern Resident Killer Whale *Orcinus orca*	Nov. 18, 2005	E	Yes Nov. 29, 2006
Humpback Whale *Megaptera novaeangliae*	June 2, 1970	E	No

* Critical habitat is designated for this species, but does not occur in the action area.

Other species that are listed as occurring in Whatcom County include North American Southern DPS green sturgeon (*Acipenser medirostris*) and leatherback sea turtle (*Dermochelys coriacea*). Due to the location of the project and the species' life history and habitat requirements, these species were determined highly unlikely to be found in the proposed project area.

3.3.9.1 Alternative 1 – No-Action

This alternative would have no effect on ESA-listed species or their designated critical habitat.

3.3.9.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Impacts to ESA-listed fish and wildlife would be similar to those described sections 3.3.6.2and 3.3.7.2. The USACE would transport material dredged from Squalicum Waterway 25 miles to Rosario Strait for most of the dredging and 3 miles to the Bellingham Bay PSDDA site for approximately 10% of the dredging. Total dredging and disposal time for this alternative would take approximately 60 days for material going to Rosario Strait and 5 days for material transport to Bellingham Bay. This duration and travel route have a low probability of overlapping with timing of marbled murrelet and Southern Resident killer whale presence in northern Puget Sound; however, the tugboat hauling the barge is no more disturbing than other vessels in the area. The probability of disturbance is so low as to be discountable and any effect that may occur would have a minor and insignificant response.

The USACE has determined the proposed action may affect but is not likely to adversely affect ESA-listed species because either they are not likely to be present in the action area or the effect would be minor and insignificant. Documentation of this analysis and determination was provided to NMFS and USFWS for consultation under Section 7 of the ESA and letters of concurrence with USACE's determination were received on 15 February 2018 and 9 May 2018, respectively (Appendix B). Impacts to ESA listed species, fish, and marine mammals at the open-water disposal sites are addressed in the aforementioned PSDDA Phase I EIS. In 2010, USACE submitted a BA for ESA consultation for the DMMP disposal sites. The USACE received a Biological Opinion on 17 December 2015 from NMFS and a letter of concurrence on 28 July 2015 from USFWS for the DMMO disposal sites (Appendix B). Note that all three disposal sites are covered under these consultations.

3.3.9.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

Effects to all ESA-listed species would be similar for Alternative 3 compared to those described for Alternative 2 except for a slightly longer duration of dredging (same quantity, but more time waiting for barges to return) and a greater total area of underwater noise. Dredging and disposal would take approximately 70 days due to the longer haul distance to the Port Gardner PSDDA site. Additionally, the underwater noise of the tugboat hauling the barge would occur along the 60-mile haul route between Bellingham Bay and Port Gardner. This would have a slightly greater probability of minor effects to orcas and marbled murrelets.

3.3.9.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Effects to all ESA-listed species would be similar for Alternative 4 compared to those described for Alternative 2 except for a shorter duration of dredging (less time waiting for barges to return) and a lesser total area of underwater noise. Dredging and disposal would take approximately 50 days due to the shorter haul distance to the Port Gardner PSDDA site. Additionally, the underwater noise of the tugboat hauling the barge would occur along the 3-mile haul route between Bellingham Bay and the dredging location. This would have a lesser probability of minor effects to orcas and marbled murrelets.

3.3.9.5 Cumulative Impacts of the Preferred Alternative

Cumulative impacts to ESA-listed fish and wildlife would be similar to those described in sections 3.3.6.5 and 3.3.7.5.

3.3.10 Cultural Resources

The USACE has coordinated its review of cultural resources impacts under Section 106 of the National Historic Preservation Act (NHPA). The USACE has determined the area of potential effect (APE) for both direct and indirect effects to be the Federal navigation channel and the two proposed disposal sites of Port Gardner and Rosario Strait.

A USACE staff archaeologist conducted a records search and literature review for the APE, including a records search of the archaeological and historic site records in the Washington Information System for Architectural and Archaeological Records Database (WISAARD) and reviewed internal documents related to the Squalicum Navigation Channel. The closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, recorded in 2007. According to WISAARD, this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the area of potential effect (APE) for the project. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. Historic geo-referenced T-sheets and historic maps were reviewed to understand how Squalicum developed over time. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along the waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel

depths ranging from 2¼ feet to 4¾ feet (U.S. Coast & Geodetic Survey 1928). The USACE's 1931 conditions map shows that the channel was dredged to its 1930 authorized depth of -26 feet MLLW (USACE 1931). Squalicum channel has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

3.3.10.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect to cultural resources.

3.3.10.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Alternative 2 would have no effect on cultural resources. There are no cultural resources located within the APE and the USACE has made a determination of no historic properties affected.

Impacts to cultural resources at the open water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.10.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

Alternative 3 would have the same level of effects as Alternative 2 and the USACE has made a determination of no historic properties affected.

3.3.10.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Alternative 4 would have the same level of effects as Alternative 2 and the USACE has made a determination of no historic properties affected.

3.3.10.5 Cumulative Impacts of the Preferred Alternative

Since there are no cultural resources located in the APE and the closest archaeological site is not eligible to the National Register avoided, there will be no cumulative impacts to cultural resources.

3.3.11 Tribal Treaty Rights

In addition to the Federal government's responsibilities under NHPA, the Federal government must consider the effects its actions may have on American Indian treaty rights. The Federal basis of a tribe's legal status rests within the context of U.S. Constitutional provisions for Federal government's powers for treaty making with other sovereign nations, and American Indian tribes' inherent sovereignty. One of the treaty-reserved rights is the ability to conduct fishing activities at all Usual and Accustomed locations. Tribal fisheries are central to the cultural and economic existence of the Tribes and their members.

Prior to Euro-American settlement, the Lummi, Nooksack, Samish, Nuwhaha, and Semiahmoo peoples occupied the lands around Bellingham in the area that is now Whatcom and Skagit Counties. Salmon fishing and shellfish collecting have been a huge part of native life and Bellingham Bay supported these activities until industrialization of the waterfront and development of the City of Bellingham.

In the project area of Bellingham Bay today, the tribes with Federal recognition and treaty-reserved fishing rights in Usual and Accustomed locations are the Lummi Nation, Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, and Tulalip Tribes.

3.3.11.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect to treaty-reserved rights.

3.3.11.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

The Lummi Nation lands surround Bellingham Bay and the tribe has taken an active interest in the water resources of the Bay, their usual and accustomed fishing areas, and the preservation of treaty rights. The tribe has voiced concern over disposal of unsuitable sediments at the Bellingham Bay PSDDA site and potential for interruption to tribal fishing activities.

The USACE has analyzed the potential for risks to environmental resources in Bellingham Bay and potential for interference with tribal fisheries activities. Based on these analyses, the USACE has found discountable effects to environmental resources and very low probability of interruption of any fishing activities in Bellingham Bay. The duration of dredging with transport to the Bellingham Bay site would be 5 days of the total 65 days of the project.

Material in Squalicum Waterway has been tested for contaminants of concern. Approximately 10% of the material to be dredged contains low levels of dioxin. The DMMP agencies have approved the material for aquatic disposal at any non-dispersive PSDDA site, which includes Bellingham Bay. The USACE placed material at the Bellingham Bay 1992 and 1995 for a minor portion of the dredging with the remainder hauled to the Rosario Strait PSDDA site. The proposed Federal action analyzed in this document is the same in that only the material not eligible for the Rosario Strait PSDDA site would be deposited at the Bellingham Bay site. The USACE would dispose up to 31,000 cy of material in the Bellingham Bay site, and this is expected to take approximately 5 days. The USACE can schedule the work to avoid tribal fishing activities within the in-water work window allowed for the site, 16 July through 31 October. Multiple analyses of environmental effects have concluded there are no significant impacts to environmental resources due to sediment disposal at the Bellingham Bay site (see reports incorporated by reference).

According to site monitoring, the material proposed for disposal is likely similar in contaminant level to material already in place at the disposal site (WDOE 2010). The criteria level of 4ng/kg has been determined sufficient to protect human health and aquatic resources (EPA 2017). The Bellingham Bay site was found to be the least dispersive of all the non-dispersive PSDDA sites and shows very low likelihood of sediment moving from the footprint of the designated disposal area (PSDDA 1989b). Therefore, there is low risk to the environment from disposal of the 31,000 cy at the Bellingham Bay site.

Impacts to tribal treaty rights at the open water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.11.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites

Alternative 3 would involve hauling the 31,000 cy of material to the Port Gardner non-dispersive disposal site 60 miles away. The same number of tugboat trips as Alternative 2 would be required to transit the bay to move material out to the Port Gardner site. This alternative would require 70 days of dredging; due to hauling material to Port Gardner that would take an additional 10 days.

3.3.11.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Impacts associated with dredging and transit to the disposal site would be the similar as those described for Alternative 2, although less so because the disposal site is closer requiring only 50 days total. Impacts

from disposal of all material at the Bellingham Bay PPSDA to tribal treaty rights would be of greater impact to the Lummi Tribe since the greater amount of material placed at the Bellingham Bay PSSDA site would require more time in their Usual and Accustomed fishing area. The Port of Bellingham made an agreement with the Lummi Tribe not to dispose of dredge materials at the Bellingham Bay PSSDA site.

3.3.11.5 Cumulative Impacts of the Preferred Alternative

Since impacts to Tribal fishing would be minimal and largely avoided, no cumulative impacts are anticipated.

3.3.12 Air Quality and Greenhouse Gas Emissions

Federal and state agencies set air quality standards for outdoor air. The purpose of the standards is to prevent air pollution from reaching levels that hurt human health. The U.S. Environmental Protection Agency (EPA) sets the national ambient air quality standards (NAAQS) for six criteria pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. The EPA established 100 tons per year (TPY) as the threshold level for the requirement of a conformity determination for key NAAQS pollutants in a non-attainment or maintenance area; the 100 TPY threshold applies separately to each pollutant (40 CFR 93 § 153). The Washington State Department of Ecology (Ecology) uses air quality monitoring data to determine whether air quality meets the standards and then designates areas as attainment or non-attainment.

The Northwest Clean Air Agency monitors air quality in northern Puget Sound counties including the project area. The air quality in Whatcom County is typically at low risk for health concerns; there are no non-attainment or maintenance areas in the County. The project area is in an attainment zone for all air quality parameters meaning that it meets NAAQS.

Anthropogenic sources of greenhouse gases (primarily carbon dioxide, methane, and water vapor) have been increasing over the past 150 years, and have reached a rate of contribution that is causing global climate change. The concern for Federal projects is the contribution of greenhouse gases to the atmosphere in such large quantities as to outweigh the benefit of executing the proposed action.

For the alternatives analysis in this section, the quantity of potential air emissions was estimated using a calculation tool that factors engine horsepower and running time for non-road diesel equipment; these emissions factors are from the South Coast Air Quality Management District (SCAQMD). SCAQMD is the regulatory authority over air emissions in the South Coast air basin in Southern California and is a model with stringent emission standards that we have used to calculate emissions for this project. The emissions estimate accounts for emissions associated with the operation of vessels and machinery with diesel engines used during dredging activities. These estimates are not intended as an exact calculation of the emissions associated with this project but rather as a means for comparison among the alternatives.

3.3.12.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect on regional or local air quality and would have no output of greenhouse gases.

3.3.12.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Construction activities associated with the proposal would create air emissions from operating equipment during dredging and transport to the disposal site, which would have a short-term effect and highly localized effect to air quality. To analyze effects of dredging on air quality, the USACE estimated dredging equipment emissions. The emissions estimate assumed one dredge operating with its associated tugboat and scow running 24 hours per day for 65 days to achieve the length, width, and depths proposed with disposal at Rosario Strait and Port Gardner PSDDA sites.

Metric tons of carbon monoxide, reactive organic gasses (ozone precursors), nitrogen oxides, and particulate matter (of 2.5 microns in size) were estimated and are reported below. As shown in Table 3, based on the SCAQMD model for non-road emissions (SCAQMD 2017), the estimated annual emissions from the operation of the dredges and associated support vessel would be less than 4 TPY for each pollutant of concern and would not exceed the 100 TPY threshold. The proposed action would not occur in a nonattainment or maintenance area. Emissions are not expected to cause adverse health effects or result in violation of applicable air quality standards, therefore, impacts would be inconsequential.

Table 5. Alternative 2 estimated emissions in metric tons for pollutants of concern using SCAQMD (2016).

Air Pollutant	Estimated annual emissions in metric tons
Reactive Organic Gasses (ROGs)	0.27
Carbon Monoxide (CO)	0.45
Nitrogen Oxides (NOx)	3.07
Sulfur Dioxide (SOx)	0.004
Particulate Matter (PM2.5)	0.12

Operation of the dredge and associated support vessel would emit greenhouse gasses, primarily carbon dioxide and nitrous oxides from burning fossil fuels. The approximately 65 days of work would emit an estimated 300 metric tons of carbon dioxide and 3.07 tons of nitrous oxides. When compared to the global emissions measured at nearly 7,000 million metric tons in 2014 (EPA 2016), the minor contribution of the proposed dredging would not constitute a measurable effect among the impacts of climate change and sea level rise and is therefore not considered a significant impact.

3.3.12.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

Alternative 3 would have slightly more emissions compared to those described for Alternative 2. The estimated total duration for dredging is 70 days. This work would emit air pollutants as shown in Table 4 and would contribute greenhouse gas emissions estimated at 323 tons of carbon dioxide and 3.3 tons of nitrous oxide.

Table 6. Alternative 3 estimated emissions in metric tons for pollutants of concern using SCAQMD (2016).

Air Pollutant	Estimated annual emissions in metric tons
Reactive Organic Gasses (ROGs)	0.29
Carbon Monoxide (CO)	0.48
Nitrogen Oxides (NOx)	3.3
Sulfur Dioxide (SOx)	0.005
Particulate Matter (PM2.5)	0.13

The difference between Alternative 2 and Alternative 3 is the disposal site selected for 31,000 cy of material that must go to a non-dispersive site. Alternative 3 would take twice as long to complete this portion of the work due to the haul distance of 60 miles to the Port Gardner disposal site compared to only 3 miles to the Bellingham Bay site. Therefore, the emissions from the tugboat for hauling the barge of sediment would be substantially greater for this portion of the work.

3.3.12.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Specific calculations of emissions were not done for this alternative, but they would be less given the transport distance to the Bellingham Bay site, and overall duration (50 days), is less than the distance to the other disposal sites and duration associated with alternatives 2 and 3.

3.3.12.5 Cumulative Impacts of the Preferred Alternative

GHG emissions and other air pollutants are cumulative by nature, but given the minor and temporary nature of the proposed dredging and placement when combined with emissions from other sources in

the Bellingham area, including industry and traffic, cumulative impacts are not expected to be significant.

3.3.13 Recreation and Scenic Values

No significant recreational resources occur in the immediate project area, as this is a commercial port with industrial infrastructure. Recreation opportunities in Bellingham Bay are primarily boating and fishing. Boat launch sites are outside the project area.

3.3.13.1 Alternative 1 – No-Action

The No-Action Alternative would have no effect on recreation.

3.3.13.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Maintenance dredging the channel would have no effect to recreational boat traffic and the limited public access to the shoreline would not change. Transport to disposal sites has been analyzed in other environmental compliance documents.

Impacts to recreation at the open water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.13.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

Maintenance dredging the channel would have no effect to recreational boat traffic and the limited public access to the shoreline would not change. Transport to disposal sites has been analyzed in other environmental compliance documents.

3.3.13.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Maintenance dredging the channel would have no effect to recreational boat traffic and the limited public access to the shoreline would not change. Transport to disposal sites has been analyzed in other environmental compliance documents.

3.3.13.5 Cumulative Impacts of the Preferred Alternative

There are a variety of factors that have caused the waterfront of Bellingham Bay to be undesirable for recreation, including shoreline armoring and subsequent loss of wetlands, hardened banks with little riparian vegetation, persistent contaminants from past industrial practices, and large vessel traffic. Given the degraded state of the waterfront and minor and temporary impacts of the proposed action, when combined with other past, present, and future actions, cumulative impacts to recreation would be insignificant.

3.3.14 Socioeconomic Resources

The project area is the northwestern portion of the City of Bellingham's commercial and industrial waterfront area. The Port of Bellingham is responsible to the citizens of Whatcom County for providing shipping and marine cargo facilities, general boating and maritime industry facilities, as well as maintaining and developing economic growth of the region. Commercial transportation of goods and services occurs in the Squalicum Waterway as well as the other two federally authorized waterways. Principal industrial tenants are Bellingham Cold Storage, Mount Baker Products, Seaview North Boat

Repair, and several seafood processing companies. The Port of Bellingham supports over 5,000 direct jobs and the economic impact of the tenants at the Port's marine facilities includes over 4,000 direct jobs bringing in over $200 million in direct salaries (Martin Associates 2013). These commercial activities and expenditures result in over $32 million in state and local taxes.

3.3.14.1 Alternative 1 – No-Action

The No-Action Alternative poses a substantial risk to the socioeconomic well-being of the local community. Access for fishing and fish processing vessels is critical for bringing the seafood products to market, which is a large source of income in Bellingham. Without maintenance dredging of the Squalicum Waterway, vessels bringing fish and other seafood for offloading would need to find another port, which would direct revenue away from the local area.

3.3.14.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

The dredging project would maintain the important socioeconomic benefits for the local area and continue supporting the indirect jobs associated with direct employment and local business expenditures.

The socioeconomic benefits of channel maintenance would be cumulative when added to the recent and near future improvements around the Waterfront District that include environmental clean-up and redevelopment for greater public access. Maintaining jobs in this location associated with greater opportunities for public enjoyment of the area help to ensure a vibrant community and further economic development.

Impacts to socioeconomics at the open water disposal sites are addressed in the aforementioned PSDDA EIS.

3.3.14.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites (preferred alternative)

Alternative 3 would have the same benefits to socioeconomic resources as those described for Alternative 2.

3.3.14.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Alternative 4 would have the same benefits to socioeconomic resources as those described for Alternative 2

3.3.14.5 Cumulative Impacts of the Preferred Alternative

There would be cumulative benefits to the economy from maintenance dredging in combination with other dredging in the area that supports industry by improving conditions for vessel access in the Squalicum Waterway.

3.3.15 Public Health and Safety

The harbor facilities are located on tideland fill below the bluffs and across the railroad tracks from the downtown and older residential neighborhoods of Bellingham. The principal vehicular connections between the harbor and the rest of the city are Roeder Avenue, "F" Street, and Squalicum Parkway. The city of Bellingham recently improved these arterials with walkways, streetscape enhancements, and intermittent bicycle lanes. Over the last several years, the Port has provided many public access features,

including the harbor promenade, boat launch, a 2-acre park, and a 1-acre urban commons area (Port of Bellingham 2011). Squalicum Waterway is somewhat distant from downtown Bellingham and is more industrial than the urban character of the central waterfront district. The primary activities of the project area are still commercial/industrial in nature.

Sediments within the head of the waterway are known to contain low levels of contaminants; however, the project area is not contaminated enough to become one of the sites around the Bellingham Bay shoreline that Ecology is tracking in its Toxics Cleanup Program.

3.3.15.1 Alternative 1 – No-Action

Lack of maintenance of the Federal navigation channel may cause less safe conditions for vessels accessing the wharf along the Squalicum Waterway. Ships may run aground or use unsafe methods of off-loading to the shoreside facilities.

3.3.15.2 Alternative 2 – Dredging with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites

Executing routine maintenance dredging to authorized depths would allow safe navigation of the channel and facilitate all appropriate safety precautions to transfer materials between ships and the shoreside facilities. Dredging of the 31,000 cy of sediment with low levels of dioxin content would move this material away from the shoreline out to the deep water of the Bellingham Bay non-dispersive disposal site where it would remain in place.

3.3.15.3 Alternative 3 – Dredging with Disposal at Rosario Strait and Port Gardner PSDDA Sites

Alternative 3 would have the same effects to public health and safety as those described for Alternative 2.

3.3.15.4 Alternative 4 – Dredging Squalicum Waterway with Disposal at the Bellingham Bay PSDDA Site

Alternative 4 would have the same effects to public health and safety as those described for Alternative 2.

3.3.15.5 Cumulative Impacts of the Preferred Alternative

No negative cumulative impacts would accrue from implementation of the proposed maintenance dredging.

4 Mitigation Measures and Monitoring

No compensatory mitigation is proposed for this action as no loss of wetlands, no substantial adverse effects to ESA-listed species, and no significant impacts to commercially important species are anticipated to occur based on the analyses in this document. The USACE will implement several avoidance and minimization measures to ensure impacts are no greater than minimal, short-term effects. The primary measures to minimize impacts are the timing of in-water work and location of dredged material disposal. Dredging would only occur within the allowed in-water work window for the protection of juvenile salmon. A secondary measure is to dredge as infrequently as possible. The shoaling rate for the past several decades has necessitated sediment removal every 7 to 12 years. Dangerous conditions develop when the waterway is dredged less frequently and becomes too shallow for the larger vessels. The proposed action includes several measures that would avoid and minimize adverse effects:

1) The USACE will use a clamshell (mechanical) dredge to minimize the possibility of entraining or otherwise harming ESA-listed species.

2) Barges used to transport the dredged material to the disposal or transfer sites will not be filled beyond their capacity, will maintain seals, and will completely contain the dredged material.

3) The USACE will conduct dredging operations during the prescribed work window of July 16 through February 15. If this cannot be done due to extenuating circumstances, then the USACE will notify the Services and reconsult if necessary.

4) No work would occur during the spring months when macroalgae are most susceptible to harm from increases in turbidity.

5) Maintenance dredging will be conducted based on the results of site-specific hydrographic condition surveys conducted for the year of dredging.

6) A draft water quality monitoring plan has been developed that is consistent with the conditions and adheres to applicable criteria issued in the water quality certifications (WQC) from WDOE associated with disposal of dredged material into the waters of the U.S. (Appendix F). Note that a WQC from WDOE associated with project is pending.

7) The dredge operator will adhere to the methods and criteria in the water quality monitoring plan.

8) The USACE will coordinate with the local Indian Tribes that have usual and accustomed fishing rights in the project area.

9) Dredge operators will limit the dredge prism and the volume of removed sediment to the authorized channels and minimum area necessary to achieve project goals.

10) Disposal operations at the DMMP site will be in conformance with the approved disposal site management standards.

11) Disposal of material will adhere to DMMP criteria for dispersive and non-dispersive aquatic disposal sites.

5 Coordination

The USACE has coordinated with Federal and state agencies and tribes regarding maintenance dredging of the Federal navigation channel. Coordination would continue through the period of proposed maintenance dredging to notify regulatory agencies and stakeholders and to adapt to changing conditions. During the development of this Draft EA, the USACE consulted the following entities and agencies:

- U.S. Environmental Protection Agency
- U.S. Fish and Wildlife Service
- National Marine Fisheries Service
- Washington Department of Archaeology and Historic Preservation

- Washington Department of Fish and Wildlife
- Washington Department of Natural Resources
- Washington State Department of Ecology
- Jamestown S'Klallam Tribe
- Lower Elwha Klallam Tribe
- Lummi Nation
- The Nooksack Tribe
- Port Gamble S'Klallam Tribe
- Suquamish Tribe
- Swinomish Indian Tribal Community
- The Tulalip Tribes
- The Samish Nation
- The Upper Skagit Indian Tribe
- The Stillaguamish Tribe of Indians
- Skagit River System Cooperative

6 Environmental Compliance

The USACE has analyzed the environmental effects of the alternatives and the following sections describe how the preferred alternative complies with all pertinent environmental laws and executive orders.

6.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA) (42 U.S.C. §4321 et seq.) commits Federal agencies to considering, documenting, and publicly disclosing the environmental effects of their actions and to solicit public comment on the proposal. As required by NEPA, this EA describes existing environmental conditions in the project area, the proposed action and alternatives, potential environmental effects of the proposed project, and measures to minimize environmental effects. Alternative 3 is the agency preferred alternative. The USACE is publishing this Draft EA for a 30-day public comment period per NEPA requirement. A draft Finding of No Significant Impact/Statement of Findings (FONSI/SOF) is found in Appendix C.

6.2 Endangered Species Act

The Endangered Species Act (16 U.S.C. §1531-1544), Section 7(a) requires that Federal agencies consult with NMFS and USFWS, as appropriate, to ensure that proposed actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their critical habitats. The USACE has determined that each alternative considered in this EA may affect but is not likely to adversely affect any ESA-listed species or designated critical habitat and has prepared documentation of this determination because either they are not likely to be present in the action area or the effect would be minor and insignificant. Documentation of this analysis and determination was provided to NMFS and USFWS for consultation under Section 7 of the ESA and letters of concurrence with USACE's determination were received on 15 February 2018 and 9 May 2018?, respectively (Appendix B). Impacts to ESA listed species, fish, and marine mammals at the open-water disposal sites are addressed in the aforementioned PSDDA Phase I EIS. In 2010, USACE submitted a BA for ESA consultation for the DMMP disposal sites. The

USACE received a Biological Opinion on 17 December 2015 from NMFS and a letter of concurrence on 28 July 2015 from USFWS for the DMMO disposal sites (Appendix B).

6.3 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. §1361-1407) restricts harassment of marine mammals and requires interagency consultation in conjunction with the ESA consultation for Federal activities. All marine mammals are protected under the MMPA regardless of whether they are endangered, threatened, or depleted. Marine mammal species that have been observed in the action area include harbor seal (*Phoca vitulina*) and California sea lion (*Zalophus californianus*). Killer whale (*Orcinus orca*) have not been known to enter Bellingham Bay.

The primary concern for marine mammals in dredging projects is underwater noise from construction. The USACE has compared the estimated noise from dredging and the guidance on assessing impacts and concluded that there is no requirement for an Incidental Harassment Authorization.

6.4 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), (16 U.S.C. §1801 et. seq.) requires Federal agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH). The objective of an EFH assessment is to determine whether the proposed action(s) "may adversely affect" designated EFH for relevant commercial, federally managed fisheries species within the proposed action area. The assessment also describes conservation measures proposed to avoid, minimize, or otherwise offset potential adverse effects to designated EFH resulting from the proposed action.

The project area previously described in this document is part of the Puget Sound Basin. The project area has been designated as Essential Fish Habitat (EFH) for various life stages 29 species of groundfish, four coastal pelagic species, and three species of Pacific salmon according to the NMFS Fisheries Management Plans (PFMC 1998, 2003, 2004). The USACE has determined that the proposed dredging would not reduce the quality and/or quantity of EFH for Pacific salmon, coastal pelagic, and groundfish EFH and no adverse effects to EFH are expected to result from the proposed action. The USACE submitted this determination to NMFS for their consideration and response. A letter of concurrence was received on 15 February 2018 (Appendix B).

USACE determined that use of the multiuser open-water placement sites for dredged material disposal may adversely affect EFH and received concurrence from NMFS on 17 December 2015. The USACE provided a detailed response to NMFS within 30 days as required by section 3.5(b)(4)(B) of the MSA.

NMFS provided three conservation recommendations to minimize and/or avoid the impacts of both dredging and disposal, and the recommended EFH conservation measures that are pertinent and productive in the context of dredging in a protected and heavily trafficked area such as Upper Duwamish Waterway have been incorporated as mitigation and monitoring measures.

6.5 Clean Water Act

The Clean Water Act (33 U.S.C. §1251 et seq.) establishes a Federal policy of protecting the waters of the U.S. The USACE's regulations implementing the Act require selecting the means of placement of dredged or fill material into water that, after considering all reasonable and practicable alternatives, represents the least costly alternative that is consistent with sound engineering practices and meets the environmental standards of the Section 404(b)(1) evaluation guidelines. The sections of the Clean Water Act that apply to the proposal are 401 regarding discharges to waterways and 404 regarding fill material in waters and wetlands.

Section 401

Any project that involves placing dredged or fill material in waters of the U.S. or wetlands, or mechanized clearing of wetlands, requires a water quality certification from EPA or the state agency as delegated by EPA. For this project, the USACE has initiated coordination with Ecology to certify that the proposed Federal action would not violate established water quality standards. The USACE will submit documentation necessary for Ecology's individual 401 review.

Section 404

Under the "Federal standard" implementing Section 404, no discharge of dredged or fill material may take place unless it can be demonstrated that disposal would occur in the least costly, environmentally acceptable manner, consistent with engineering requirements established for the project. To comply with Section 404, it is necessary to avoid negative effects to waters of the U.S. wherever practicable, minimize effects where they are unavoidable, and compensate for effects in some cases. The USACE has prepared a Section 404(b)(1) Evaluation and public interest review, which appears in Appendix D. The findings are that there would be no significant adverse effects to aquatic ecosystems functions and values and that this project is within the public interest. The incremental difference between Alternatives 2 and 3 is minimal and each has trade-offs such that they can be considered equivalent in terms of environmental impacts; therefore, either could be considered an environmentally acceptable practicable alternative. Alternative 4 has the least environmental impact due to the shorter haul distance. However, the Port of Bellingham has made an agreement with the Lummi Tribe not to dispose of dredge materials at the Bellingham Bay PSSDA site and is required to pay the difference to dispose at dredged material disposal sites that require a longer haul distance. The Port of Bellingham is required to pay the difference in cost between the cost to dispose of material in the Bellingham Bay disposal site (the Federal Standard) and the preferred alternative material disposal sites.

6.6 Coastal Zone Management Act

The Coastal Zone Management Act of 1972 as amended (16 U.S.C. §1451-1464) requires Federal agencies to conduct activities in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved State Coastal Zone Management Program. The USACE is substantively consistent with the enforceable polices of the City of Bellingham, City of Everett, and Skagit County Shoreline Master Programs and provided documentation of this consistency determination to Ecology for their consideration (Appendix E).

6.7 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (16 USC 470) requires Federal agencies to take into account the effects of proposed Federal undertakings on historic properties included or eligible for the National Register of Historic Places. The implementing regulations for Section 106 (36 C.F.R. § 800) require Federal agencies to consult with various parties, including the Advisory Council on Historic Preservation, the State Historic Preservation Office (SHPO), and Indian tribes, to identify and evaluate historic properties and to assess and resolve effects to historic properties.

No cultural resources have been identified within the Squalicum Navigation channel. The USACE has consulted with the SHPO, Lummi Nation, the Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Samish Nation, the Upper Skagit Indian Tribe, and the Stillaguamish Tribe of Indians. On August 23, 2017, the USACE sent an area of potential effects (APE) letter to the SHPO describing the project and APE. The SHPO responded on August 29, 2017, and agreed with the APE. On August 23, 2017, the USACE sent letters to the Lummi Nation, the Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Samish Nation, the Upper Skagit Indian Tribe, and the Stillaguamish Tribe of Indians asking if there are any properties of cultural or religious significance that would be affected by the project. On October 4, 2017, the USACE sent a letter to the SHPO detailing the USACE's finding of "no historic properties affected". The SHPO responded on October 5, 2017, concurring with the USACE's determination of "no historic properties affected". The USACE also sent letters to the Lummi Nation, the Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Samish Nation, the Upper Skagit Indian Tribe, and the Stillaguamish Tribe of Indians. To date, the USACE has not received a response from the Tribes. Copies of letters are in Appendix G.

6.8 Clean Air Act

The Clean Air Act (CAA) as amended (42 U.S.C. §7401, et seq.) prohibits Federal agencies from approving or conducting any action that does not conform to an approved state, tribal, or Federal implementation plan. Under the CAA General Conformity Rule (Section 176(c)(4)), Federal agencies are prohibited from approving any action that causes or contributes to a violation of a NAAQS in a nonattainment area. According to 40 CFR Section 93.153 (c)(2)(ix), the requirement for a conformity determination is waived where the proposal would result in a clearly *de miminis* increase in emissions, as long as the project involves maintenance dredging and disposal operations in which no new depths are required and approved disposal sites are used. The proposed action is maintenance dredging and placement at approved sites with no new widths or depths, in an attainment area where no more than *de minimis* increase in emissions would be generated, and is therefore exempt from the requirement for a General Conformity Determination.

6.9 Native American Tribal Treaty Rights

In the mid-1850s, the United States entered into treaties with many Native American tribes in the Northwest. These treaties guaranteed the signatory tribes the right to "take fish at usual and accustomed grounds and stations . . . in common with all citizens of the territory" [*U.S. v. Washington*, 384 F. Supp. 312 at 332 (WDWA 1974)]. In *U.S. v. Washington*, 384 F. Supp. 312 at 343 - 344, the court resolved that the Treaty tribes had the right to take up to 50 percent of the harvestable anadromous fish runs passing through those grounds, as needed to provide them with a moderate standard of living (Fair Share). Over

the years, the courts have held that this right comprehends certain subsidiary rights, such as access to their "usual and accustomed" fishing grounds. More than *de minimis* effects to access to usual and accustomed fishing area may violate this treaty right [*Northwest Sea Farms v. Wynn*, F. Supp. 931 F. Supp. 1515 at 1522 (WDWA 1996)]. In *U.S. v. Washington*, 759 F.2d 1353 (9th Cir 1985) the court indicated that the obligation to prevent degradation of the fish habitat would be determined on a case-by-case basis. The Ninth Circuit has held that this right encompasses the right to take shellfish [*U.S. v. Washington*, 135 F.3d 618 (9th Cir 1998)].

Nine Native American tribes have had representation in this process through coordination with the USACE regarding area of dredging to maintain navigability of the Squalicum Waterway and proposed locations of disposal of dredged material. Additionally, the USACE has initiated consultation with tribal biologists regarding avoiding impacts to tribal fisheries resources. As of the date of publication of this Draft EA, the tribes have not responded with objections to maintenance of the authorized depths of the navigation channel and disposal at approved aquatic disposal sites.

The USACE has concluded the following:

(1) The work does not prevent access to usual and accustomed fishing and gathering areas;

(2) The work would not cause the degradation of fish runs in usual and accustomed fishing grounds or with fishing activities or shellfish harvesting and habitat; and

(3) The work would not impair the Treaty tribes' ability to meet moderate living needs.

6.10 Migratory Bird Treaty Act and Executive Order 13186 Migratory Bird Habitat Protection

The Migratory Bird Treaty Act (16 U.S.C. §703-712) as amended protects over 800 bird species and their habitat, and commits that the U.S. will take measures to protect identified ecosystems of special importance to migratory birds against pollution, detrimental alterations, and other environmental degradations. EO 13186 directs Federal agencies to evaluate the effects of their actions on migratory birds, with emphasis on species of concern, and inform the USFWS of potential negative effects to migratory birds.

Implementation of the preferred alternative would not have any direct and deliberate negative effects to migratory birds: there would be no adverse effect on habitat and the project would only have minor and temporary effects to a small number of individual birds that may be present in the project area. No permit application for “take” of migratory birds is thus required. These birds are assumed to be habituated to the noise and activity of the project area. Dredging is scheduled to occur after the critical nesting period.

6.11 Executive Order 13175 Consultation and Coordination with Indian Tribal Governments

Executive Order 13175 (November 6, 2000) reaffirmed the Federal government’s commitment to a government-to-government relationship with Indian tribes, and directed Federal agencies to establish procedures to consult and collaborate with tribal governments when new agency regulations would have tribal implications. The USACE has a government-to-government consultation policy to facilitate the interchange between decision makers to obtain mutually acceptable decisions. In accordance with this

Executive Order, the USACE has contacted the federally recognized tribes in the project area to solicit their input regarding the proposed Federal action and alternatives. The USACE contacted all affected tribes via letters regarding cultural resources in the project area and environmental concerns with the proposed action. Additionally, the USACE invites all tribes in Western Washington to Semi-Annual Dredging Meetings for coordination with all relevant natural resources agencies regarding USACE maintenance dredging projects. The Draft EA in being provided to all tribes with potential concern for cultural resources or environmental concerns for their review and comment.

6.12 Executive Order 12898, Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" provides that each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations. Environmental justice concerns may arise from impacts on the natural and physical environment, such as human health or ecological impacts on minority populations, low-income populations, and Indian tribes or from related social or economic impacts.

The USACE evaluated the nature and location of the proposed construction site and used the EPA Environmental Justice Viewer to determine whether minority populations, low-income populations, or Indian tribes are present in the action area and may be affected. The USACE has analyzed the potential effects of the alternatives on communities within a 3-mile radius of the proposed action and found that there would be no disproportionately high and adverse human health impacts to any environmental justice communities.

6.13 Executive Order 11990, Protection of Wetlands

Executive Order 11990 entitled Protection of Wetlands (May 24, 1977) requires Federal agencies to take action to avoid adversely impacting wetlands wherever possible, to minimize wetlands destruction and to preserve the values of wetlands, and to prescribe procedures to implement the policies and procedures of this Executive Order. The preferred alternative of dredging and disposal of dredged material at Rosario Strait and Port Gardner would have no effect to any tidal wetlands, as dredging would maintain existing conditions and the disposal sites are sufficiently offshore so as not to influence any wetlands.

7 Public Interest Evaluation Factors for Maintenance Dredging Activities

The USACE conducted an evaluation of the dredging and placement activity in light of the public interest factors prescribed in 33 CFR 336.1(c). These factors include: navigation and the Federal standard for dredged material disposal; water quality; coastal zone consistency; wetlands; endangered species; historic resources; scenic and recreation values; fish and wildlife; marine sanctuaries; and applicable state/regional/local land use classifications, determinations, and/or policies. Of these, navigation and the Federal standard, water quality, coastal zone consistency, wetlands, endangered species, historic resources, scenic values, recreational values, and fish and wildlife have been evaluated in this EA. The

factor of marine sanctuaries established under the Ocean Dumping Act has been considered; there are no sanctuary effects of dredging or placement. The factor of application of non-Federal land use policies was considered in connection with the coastal zone consistency evaluation; no additional impacts to state/regional/local land use classifications, determinations, and/or policies are anticipated because the project would maintain a federally authorized channel that is already used for vessel traffic.

In accordance with 33 CFR 337.1(a)(14) and 325.3(c)(1), the USACE considered the following additional relevant factors:

- Conservation: This action would entail maintenance dredging, and would not involve any new channel construction or change to channel depths or widths. The effects on fish and wildlife, including marine mammals and ESA-listed species, have been fully evaluated.
- Economics: As reflected in this EA, the local community relies on the availability and full utility of the channel, the use of which this action would perpetuate. The preferred alternative is not the least costly alternative that would meet the project's purpose and need. However, the Port of Bellingham has agreed to pay the difference between the Federal Standard (alternative 4) and the preferred alternative (alternative 3). The economic benefits afforded through accomplishing maintenance dredging to the authorized depths outweigh the Federal costs of the action and the costs the region would incur with an eventual return to the pre-construction conditions that would ensue under the No-Action Alternative.
- Shoreline erosion and accretion: The effects on shoreline erosion and accretion appear in the hydraulics and geomorphology section of this EA. The proposed dredging and disposal would have no effect to shoreline erosion; maintaining the Squalicum Waterway prevents natural accretion at the mouth of Squalicum Creek.
- Safety: Maintenance dredging to the authorized depths and providing a navigable waterway for the safe and efficient transit of vessels serves the interests of safety.
- Property ownership: Maintaining use of the navigation channel provides full utilization of the Port of Bellingham's ownership interests by tenants of the wharf adjacent to the channel.

As provided in 33 CFR Sections 335.4, 336.1(c)(1) and 337.6, the USACE has fully considered, on an equal basis, all alternatives that are both reasonable and practicable, i.e., available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes. The necessary budget resources are available and adequate to fully support the action. The preferred alternative does not represent the least costly alternative, constituting the discharge of dredged or fill material into waters of the U.S. in the least costly manner and at the least costly and most practicable location. However, due to the agreement between the Port of Bellingham and the Lummi Tribe not to dispose of dredge sediments at the Bellingham Bay PSSDA site, and the Port's requirement to pay the cost difference, alternative 3 was selected. Alternative 3 is consistent with sound engineering practices, and meets the environmental standards established by the Clean Water Act Section 404(b)(1) evaluation process. Execution of the preferred alternative, following consideration of all applicable evaluation factors, would be in the public interest.

8 Summary

As described, the proposed Federal action of dredging for channel maintenance with disposal of dredged materials at Rosario Strait and Port Gardner would not have significant impacts to the environment of Bellingham Bay or the sediment disposal areas. Adhering to the in-water work window and limiting work to the designated project footprints is sufficient to avoid significant impacts to natural resources. The USACE would conduct sampling and analysis of the sediments to be dredged to assure continued suitability for aquatic disposal. If negative test results occur in future sediment testing, the USACE would revise this EA and its conclusion and reevaluate the finding of no significant impact (FONSI) as necessary. The USACE is pursuing compliance with all environmental laws including ESA, CWA, and CZMA, and expecting completion prior to the finalization of the EA and FONSI.

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Appendix A

Sediment Suitability Determination

CENWS-ODS-ND

MEMORANDUM FOR RECORD May 3, 2017

SUBJECT: DETERMINATION REGARDING THE SUITABILITY OF DREDGED MATERIAL FROM THE SQUALICUM CREEK WATERWAY AND PORT OF BELLINGHAM BERTHING AREAS, EVALUATED UNDER SECTION 404 OF THE CLEAN WATER ACT, FOR UNCONFINED OPEN-WATER DISPOSAL AT THE ROSARIO STRAIT DISPERSIVE AND PORT GARDNER NONDISPERSIVE SITES.

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 418,551 cubic yards (cy) of dredged material from the Squalicum Creek Waterway federal navigation channel and Port of Bellingham berthing areas for disposal at the Rosario Strait dispersive and Port Gardner nondispersive open-water disposal sites.

2. Background. As authorized by Congress in the Rivers and Harbors Acts of 1925 and 1930, the U.S. Army Corps of Engineers (USACE) Seattle District conducts maintenance dredging of the Squalicum Creek Waterway Federal Navigation Project in Bellingham, Washington (Figure 1). USACE is also authorized to conduct sediment characterization, but not dredging, in the Port of Bellingham's berthing areas adjacent to the federal channel. The authorized depth of the channel and berthing areas is -26 feet (ft) mean lower low water (MLLW).

   Sedimentation in Squalicum Creek Waterway is due to input from the Nooksack River and Squalicum Creek. Sediment in the waterway has been characterized by USACE under the Puget Sound Dredged Disposal Analysis (PSDDA) program or DMMP four times, including three full characterizations and a reconnaissance survey for dioxins. Bellingham Cold Storage, a tenant of the Port of Bellingham, has conducted sediment sampling in the waterway on two additional occasions. Table 1 provides a summary of the characterization and survey results. A complete description can be found in Attachment A.

   A bathymetric survey of the Squalicum Creek Waterway and berthing areas conducted by USACE in March 2016 showed that significant sedimentation had occurred. USACE contracted with Herrera Environmental and subcontractor NewFields to characterize the waterway and left berthing area to -30 ft MLLW (authorized depth of -26 ft plus 2 ft of advanced maintenance and 2 ft of overdepth). Characterization of the right berthing area, which is currently not in use, was restricted to -22 ft MLLW (-20 ft plus 2 ft of overdepth).

3. Project Summary. Table 2 includes project summary and tracking information.

Table 2. Project Summary and Tracking Information

Project ranking	Subarea A: low-moderate (LM) Subarea B: high (H)
Characterized volume	418,551 cubic yards
Characterized depth	channel and left berthing area: -30 ft MLLW (including advanced maintenance and overdepth) right berthing area: -22 ft MLLW (including overdepth)
Draft SAP received	October 21, 2016
Draft SAP returned for revisions	November 9, 2016
Revised SAP received	November 18, 2016
Revised SAP approved	November 23, 2016
Sampling dates	sonic drilling: November 30 to December 2, 2016 vibracoring: November 29 to December 2, 2016 and December 30, 2016
Draft data report received	March 17, 2017
Comments provided on draft report	April 6, 2017
Final data report received	April 14, 2017
DMMO tracking number	SQUAL-A-378-16
EIM Study ID	SQUAL16
Recency Determination	Subarea A: December 2022 (LM rank = 6 years) Subarea B: December 2019 (H rank = 3 years)

4. Project Ranking and Sampling Requirements. The project was divided into 2 subareas for characterization. Subarea A included the navigation channel and left berthing area waterward of station 7+00. Subarea B included the navigation channel and left berthing area between stations 5+00 and 7+00, and the entire right berthing area. The DMMP agencies reviewed data from the two previous characterizations of Subarea A, including the left berthing area. The only exceedance of the 2016 screening levels (SLs) was for benzyl alcohol in the left berthing area in 2015. This exceedance was attributed to natural sources and bioassays were not required. Based on the data review, Subarea A was ranked a "low-moderate" concern for potential contamination. Sediment in Subarea B had previously been found unsuitable for open-water disposal. Therefore, the DMMP agencies retained the rank of "high" listed in the DMMP User Manual (DMMP, 2016) for the head of the waterway. All material in both subareas is considered heterogeneous in nature due to the length of time between dredging events.

In the Dredged Material Management Program, "surface" material (i.e. the top 4 feet) is treated differently from "subsurface" material (deeper than 4 feet) for the purpose of calculating the number of field samples and dredged material management units (DMMUs) needed. The following guidelines applied to this project:

Subarea A (low-moderate ranked):

- Maximum volume of sediment represented by each field sample = 8,000 cy
- Maximum volume of sediment represented by each surface DMMU = 32,000 cy
- Maximum volume of sediment represented by each subsurface DMMU = 48,000 cy

Subarea B (high ranked):

- Maximum volume of sediment represented by each field sample = 4,000 cy
- Maximum volume of sediment represented by each surface DMMU = 4,000 cy
- Maximum volume of sediment represented by each subsurface DMMU = 12,000 cy

The volume of sediment requiring characterization was calculated using the March 2016 bathymetric survey data. It was not known at the time the sampling and analysis plan was developed when dredging might occur, so contingency factors were applied to the calculated volumes in the two subareas to cover additional sedimentation likely to occur over the time span covered by the recency period. The following contingency factors were calculated by USACE based on hydrosurveys conducted in 2009, 2010, 2013, 2015 and 2016:

Subarea A:

- main channel, turning basin and left berthing area (to -28 ft MLLW): 40%
- advanced maintenance in the main channel (-28 to -30 ft MLLW): 25%
- advanced maintenance in the turning basin (-28 to -30 ft MLLW): 0%
- advanced maintenance in the left berthing area (-28 to -30 ft MLLW): 15%

Subarea B:

- main channel and left berthing area (to -28 ft MLLW): 25%
- right berthing area (to -22 ft MLLW): 25%
- advanced maintenance in the main channel and left berthing area (-28 to -30 ft MLLW): 0%

Figures 2 and 3 are plan views of Subareas A and B, with insets showing cross-sections and schematics of the DMMU profiles. Figures 4-6 include the anticipated core profiles and compositing schemes. Tables 3 and 4 show the contingency factors and volume estimates for DMMUs in Subareas A and B respectively.

The volumes for all but one DMMU were within the DMMP volume limitations. DMMU AMA1, which represented the advanced maintenance material (-28 to -30 ft MLLW) underlying DMMUs A1 and A2 was allowed to slightly exceed the 48,000 cy limit for subsurface DMMUs in low-moderate ranked areas in order to maintain the same spatial coverage as DMMUs A1 and A2 combined.

Due to past findings of contamination in deeper sediment in Subarea B, subsurface DMMUs in this subarea were kept well below the limitation of 12,000 cy. In addition, DMMUs in the right and left berthing area were delineated separately from DMMUs in the main channel, so that independent determinations could be made for federal vs. non-federal dredged material.

Also, due to ambiguous results for past testing of dioxin in z-samples from Squalicum Creek Waterway (DMMP, 2012) and in order to potentially provide more precise vertical characterization of dioxin contamination if necessary to address antidegradation, USACE elected to collect z-samples in two one-foot increments at each station. Composites of the upper one-foot z-samples were slated to be analyzed for dioxin concurrently with testing of the DMMUs.

5. Sampling. Standard vibracoring was sufficient to collect samples from Subarea A, but gravel and cobble were anticipated in Subarea B, with cores up to 32 feet long needed to collect z-samples. Therefore, sonic drilling was required in that subarea.

   Field sampling was scheduled to be completed in a single week, however strong wind and waves were encountered prior to completion of the vibracoring. The sonic drilling in Subarea B was completed during the period November 30-December 2. Vibracoring began on November 29 but was suspended on December 2 due to safety concerns. Inclement weather throughout much of December prevented the sampling crew from returning until December 30. The remaining vibracore samples were collected that day.

   Other than the weather delay, vibracoring proceeded as described in the SAP, with one exception. DMMU AMA2 was to include a 2-ft core section (-28 to -30 ft MLLW) from all coring stations in DMMUs A3, A4 and A5. However, at the time of suspension of vibracoring due to weather, only 10 of the 12 cores from these three DMMUs had been collected. The two missing cores were from DMMU A3. Rather than risk exceeding holding times for AMA2, the DMMP agencies authorized analysis of AMA2 without contributions from the missing cores. Since A3 was farther away from likely sources of historical contamination than the other two DMMUs (A4 and A5) that made up AMA2, it was assumed that any sampling bias introduced by the missing cores would result in higher chemical concentrations in AMA2 rather than lower, so the decision to proceed with the processing of AMA2 was considered environmentally conservative by the DMMP agencies.

   For the sonic drilling, recovery rates in some sediment intervals – especially in the top 8 feet – were below the 75% target for recovery due to the presence of unconsolidated sand and gravel, which was difficult to retain in the cores. With vibracoring, low recovery can be an issue when long cores are being collected because it cannot be determined with certainty where the material that *is* recovered came from with regard to depth. The use of sonic drilling in Subarea B resolved this issue because the cores were advanced and collected in intervals that matched the upper and lower elevations of the DMMUs being sampled. Therefore, while recovery may have been less than the target fraction, it was known with certainty that the material being collected was representative of the DMMU being sampled. The DMMP agencies authorized the drillers to relax the acceptance criterion for recovery as long as sufficient material could be collected to conduct all the planned analyses.

   Two other issues were encountered during sonic drilling at station B3-2. A 20-ft length of drill casing was lost during drilling and could not be recovered. That casing remains buried within the sediment at B3-2. Also at this station, a hydrocarbon sheen and odor were encountered in the core section recovered from 27 to 32 ft below mudline. The mudline elevation at B3-2 was

-2.4 ft MLLW. Therefore, the elevation of the core section with the hydrocarbon sheen and odor was -29.4 to -34.4 ft MLLW. This core section was archived separately for possible later analysis.

Figures 7 and 8 show both the target and actual sampling stations in Subareas A and B respectively. There was good concurrence between the target coordinates and actual coordinates in Subarea A, with the exception of station A4-4. The sampling team discovered that the mudline elevation was -25.1 ft MLLW at the target coordinates for A4-4, which was significantly deeper than the mudline elevation of -20.9 ft MLLW anticipated in the SAP. This station was moved to shallower water, approximately 25 ft to the east of the target station, where the mudline elevation was -22.3 ft MLLW In Subarea B, concurrence between target and actual sampling stations was also good, with actual coordinates within 10 ft of the target coordinates in all cases. Tables 5 and 6 include sampling information for Subareas A and B respectively. Tables 7-11 include the core compositing schemes for all DMMUs.

One deviation from the SAP occurred during processing of core sections from station LBB-2, affecting three DMMUs:

- The core section from Core LBB-2 included in the composite representing DMMU LBBS1 was taken from 3.1 to 6.7 feet below mudline (-23.3 to -27.8 ft. MLLW); it should have been taken from 3.1 to 6.2 feet below mudline (-23.3 to -27.3 ft. MLLW).
- The core section from Core LBB-2 included in the composite representing DMMU LBBS2 was taken from 6.7 feet to 7.2 ft. below mudline (-27.8 to -28.5 ft. MLLW); it should have been taken from 6.2 to 6.7 feet below mudline (-27.3 to -28.0 ft. MLLW).
- The core section from Core LBB-2 included in the composite representing DMMU AMB2 was taken from 7.2 feet to 8.2 ft. below mudline (-28.5 to -30.0 ft. MLLW); whereas it should have been sampled from 6.7 to 8.2 feet below mudline (-28.0 to -30.0 ft. MLLW).

Following review of the chemical testing data – including dioxin – the DMMP agencies determined that this minor sample processing error at station LBB-2 had no effect on decision-making.

6. Chemical Analysis. Tables 12 and 13 present the sediment conventional and standard DMMP chemistry results for DMMUs and upper z-samples in Subareas A and B respectively. There were no detected SL exceedances in Subarea A and the detection limits for non-detects were all below SL as well. In Subarea B, two DMMUs had detected SL exceedances for at least one analyte. DMMU RB1-C exceeded the SL for 4-methylphenol. DMMU AMB1-C exceeded the SL for four individual PAHs, as well as Total LPAH. There were no bioaccumulation trigger (BT) exceedances for the standard DMMP chemicals of concern.

   Dioxin was analyzed in all DMMUs and in the upper composited z-samples. Tables 14 and 15 include the dioxin data for Subareas A and B respectively. Figure 9 shows the dioxin data for Subarea B. The dioxin concentrations for all DMMUs and z-samples in Subarea A were below the DMMP disposal site management objective of 4 nanograms per kilogram (ng/kg) toxic

equivalents (TEQ), with non-detected congeners set equal to one-half the estimated detection limit (EDL). In Subarea B, nine of the sixteen DMMUs exceeded 4 ng/kg TEQ. Of these, five DMMUs also exceeded the BT of 10 ng/kg. Three composited z-samples were tested for dioxin. The z-samples from the left berthing area and the main channel were both below 4 ng/kg TEQ, while the z-sample from the right berthing area had the highest concentration of all samples tested (19.3 ng/kg TEQ).

USACE evaluated the depth and spatial distribution of the chemical testing results within the context of planning an effective dredging project. Three decisions emerged from that evaluation:

a. It had already been determined that the Port of Bellingham's main tenant on the Squalicum Creek Waterway, Bellingham Cold Storage, no longer uses the right berthing area. Therefore, USACE determined that it was highly unlikely the right berthing area would be dredged within the recency period, thereby obviating the need to run bioassays to address the 4-methylphenol SL exceedance in DMMU RB1-C.
b. Given the SL exceedances for PAHs in the advanced maintenance material within the federal channel in Subarea B (DMMU AMB1-C), USACE decided that advanced maintenance dredging in that area would not be conducted. Under that scenario, bioassays on DMMU AMB1-C were not needed.
c. Finally, given the pattern of dioxin concentrations, it was suspected that dioxin contamination was likely higher toward the head of the waterway and lower in areas farther removed from the head. If this could be ascertained, USACE would be able to dredge more material from the outer portion of Subarea B, which would be beneficial for navigation. USACE hypothesized that the elevated concentration of dioxin found in DMMU BS3-C was likely due more to contributions from sediment collected from stations B2-1, B2-2, B3-1 and B3-2, rather than station B1-1. To test this hypothesis, USACE elected to analyze the individual core section from B1-1 that had been included in the composite for DMMU BS3-C (i.e. the sediment collected from 12 to 18 feet below mudline at B3-1). Similarly, in order to maximize the dredging that Bellingham Cold Storage could do in the left berthing area, USACE elected to analyze the individual core intervals from station LBB-2 that had been included in the composites for DMMUs LBB-C and LBBS2-C (0 to 4 ft below mudline and 8 to 9 feet below mudline respectively).

Results from the dioxin analysis of individual core sections can be found in Table 16. The hypothesis that cores farther removed from the head of the waterway would have lower dioxin concentrations was supported by the data. Whereas DMMU BS3-C – represented by composited material from five sampling stations – had a dioxin concentration of 11.8 ng/kg TEQ, the individual core section from station B1-1 had a dioxin concentration of only 2.44 ng/kg TEQ. Similarly, composited DMMUs LBB-C and LBBS2-C had dioxin concentrations of 13.0 and 13.4 ng/kg TEQ respectively, while corresponding individual core sections from station LBB-2 had dioxin concentrations of 7.34 and 5.33 ng/kg TEQ respectively.

In response to the Essential Fish Habitat conservation recommendations that accompanied the National Marine Fisheries Service's biological opinion on the effects of dredged material disposal on listed rockfish species (DMMO, 2016), USACE agreed to conduct limited analysis

of polybrominated diphenyl ethers (PBDEs) for federal dredging projects in urban areas. For the Squalicum Creek Waterway O&M project, three DMMUs were analyzed for PBDEs. Results from this analysis are included in Table 17.

All chemistry data were validated by Herrera and EcoChem. EcoChem provided EPA Stage 4 validation for the dioxin and PBDE congener analyses. Herrera provided Stage 4 validation for the remaining organics and Stage 3 validation for metals and conventional parameters. Data qualifiers assigned by Herrera and EcoChem are found in the columns labeled "VQ" in Tables 12 to 17.

Only minor QA/QC issues were encountered with the chemical analysis. The initial metals analysis for DMMU A5-C resulted in a cadmium concentration of 6.9 mg/kg, which exceeded the SL of 5.1 mg/kg. But a laboratory duplicate run on that sample resulted in a cadmium concentration of only 0.20 J, which was well below SL and similar to the cadmium concentrations in other DMMUs. The lab reran DMMU A5-C in duplicate. Cadmium was undetected in both replicates at reporting limits that were well below SL (0.16 U and 0.17 U mg/kg). The result reported in Table 12 for cadmium in A5-C is from the first replicate of the reanalysis (i.e. 0.16 U mg/kg). Based on the totality of analytical results, the DMMP agencies determined that cadmium was not likely an issue in DMMU A5-C and bioassays were not required to be run on this sample.

A second minor QA/QC issue concerned chlordane. While undetected in all samples in the initial analysis, the lab was unable to achieve detection limits that were below the SL. This initial analysis was calibrated using a technical chlordane standard. The lab reanalyzed all samples using calibration standards for the individual chlordane components, which had lower detection limits than technical chlordane. The reanalysis resulted in either detected concentrations below the SL or non-detects with detection limits below SL.

7. Biological Testing. No bioassays or bioaccumulation testing were conducted.

8. Suitability Determination. This memorandum documents the evaluation of the suitability of sediment from the federal navigation project and berthing areas in the Squalicum Creek Waterway for open-water disposal. The data gathered were determined to be sufficient and acceptable for regulatory decision-making under the DMMP program.

Subarea A

Based on the results of the previously described testing, the DMMP agencies concluded that all 336,199 cubic yards of sediment in Subarea A, including the advanced maintenance material, are suitable for open-water disposal at the Rosario Strait site. Material from Subarea A may also be taken to the Port Gardner site if needed to bring the volume-weighted average of Subarea B material going to that site below the 4 ng/kg TEQ site management objective.

Sediment exposed by dredging must either meet the State of Washington Sediment Quality Standards (SQS) (Ecology, 2013) or the State's antidegradation standard (DMMP, 2008). Comparison of the proposed dredged material to SQS serves as a first-tier indicator for this

purpose. The SQS for metals, phenols, benzoic acid and benzyl alcohol are the same as the SLs for these chemicals. Therefore, there were no SQS exceedances for these chemicals in Subarea A. The remaining SQS chemicals are normalized for organic carbon. The carbon-normalized results for these chemicals are included in Table 18. As can be seen from the table, there were no SQS exceedances. Also, as was discussed previously in this memorandum, the composited upper z-samples in Subarea A were analyzed for dioxin. The dioxin concentrations (Table 14) were all below 4 ng/kg TEQ, thereby meeting the antidegradation standard. In addition, the dioxin concentrations in the advanced maintenance material (-28 to -30 ft MLLW) in Subarea A were also below 4 ng/kg TEQ. If Subarea A is dredged without removing the advanced maintenance material, this material would become the newly exposed surface and meets the antidegradation standard.

In summary, the antidegradation standard will be met in Subarea A for standard DMMP COCs and dioxin, regardless of whether advanced maintenance is included in the dredge plan or not.

Subarea B

Until a specific dredging design is proposed, the DMMP agencies cannot definitively determine the suitability of material in Subarea B for disposal at the Rosario Strait or Port Gardner disposal sites. The extent of any future dredging by USACE in Squalicum Creek Waterway will depend on the level of funding received. Bellingham Cold Storage plans to dredge the left berthing area, but the design has not been finalized at this time. Therefore, for Subarea B, this suitability determination will present approximate volumes and discuss the requirements that must be met by any dredging in this subarea. If and when USACE has a defined project, it will be reviewed by the DMMP agencies for compliance with the requirements stipulated in this suitability determination and a supplemental suitability determination will be prepared and signed by the agencies. The same is true for any dredging by Bellingham Cold Storage.

Table 20 includes the approximate volumes in Subarea B that are suitable for disposal at the Rosario Strait and Port Gardner disposal sites, as well as volumes unsuitable for open-water disposal. Figure 10 provides this information graphically and also includes dioxin concentrations for reference. Several caveats are required when reviewing Table 20 and Figure 10:

a. The volumes shown suitable for disposal at the Rosario Strait site are based strictly on the chemical testing results, without regard to the dredgeability of these DMMUs. For example, DMMU LBBS1-C had no SL exceedances and had a dioxin concentration of 3.23 ng/kg TEQ. It is, therefore, ostensibly suitable for placement at the Rosario Strait site. However, it is sandwiched between layers with higher dioxin concentrations, which reduces the likelihood that LBBS1-C will be dredged as an independent unit for disposal in Rosario Strait.
b. The volumes shown suitable for disposal at the Port Gardner site are only suitable if the volume-weighted average dioxin concentration for all material taken to Port Gardner is below 4 ng/kg TEQ. For example, DMMU BS1-C had a dioxin concentration of 5.29 ng/kg TEQ, which exceeds the disposal site management objective of 4 ng/kg TEQ. Under the DMMP dioxin guidelines, it must be dredged and disposed with cleaner material such that the entire volume disposed has a

volume-weighted average under 4 ng/kg TEQ.

c. The volume splits for those DMMUs that had an individual core section analyzed for dioxin are to be considered rough estimates. These estimates were made for reporting purposes only and are subject to change. The supplemental suitability determination/s will include volumes calculated based on the actual dredge design.

Any dredging proposed for Subarea B must meet the following requirements:

a. The dioxin concentration of each individual DMMU taken to the Rosario Strait site must be at or below 4 ng/kg TEQ without volume-weighted averaging.
b. The volume-weighted average dioxin concentration for dredged material taken to the Port Gardner site must be at or below 4 ng/kg TEQ.
c. One-foot vertical buffers between suitable and unsuitable material and between material suitable for dispersive disposal and material suitable for nondispersive disposal must be incorporated in the dredging design at the discretion of the DMMP agencies.
d. Where possible, dredged material taken to the Port Gardner site must be sequenced, with material with the highest dioxin concentrations disposed first and dredged material with the lowest dioxin concentrations last.
e. The State of Washington's antidegradation standard must be met. This may mean leaving a one-foot vertical buffer of suitable material in place over sediment that does not meet the standard, or placing a one-foot clean sand cover following dredging.
f. Side slopes of the dredge design may not cut into unsuitable material or material that does not meet the antidegradation standard, unless the area of exposed surface is determined to be insignificant by the DMMP agencies.

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10. Agency Signatures.

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

Concur:

_____ _____
Date David Fox, P.E. - 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
Kym Anderson, CENWS-ODS-NS
Elizabeth Chien, CENWS-ODS-NS
John Pell, CENWS-ODS-NS
Randel Perry, CENWS-ODR
Mike Hogan, Port of Bellingham
Gary White, Bellingham Cold Storage

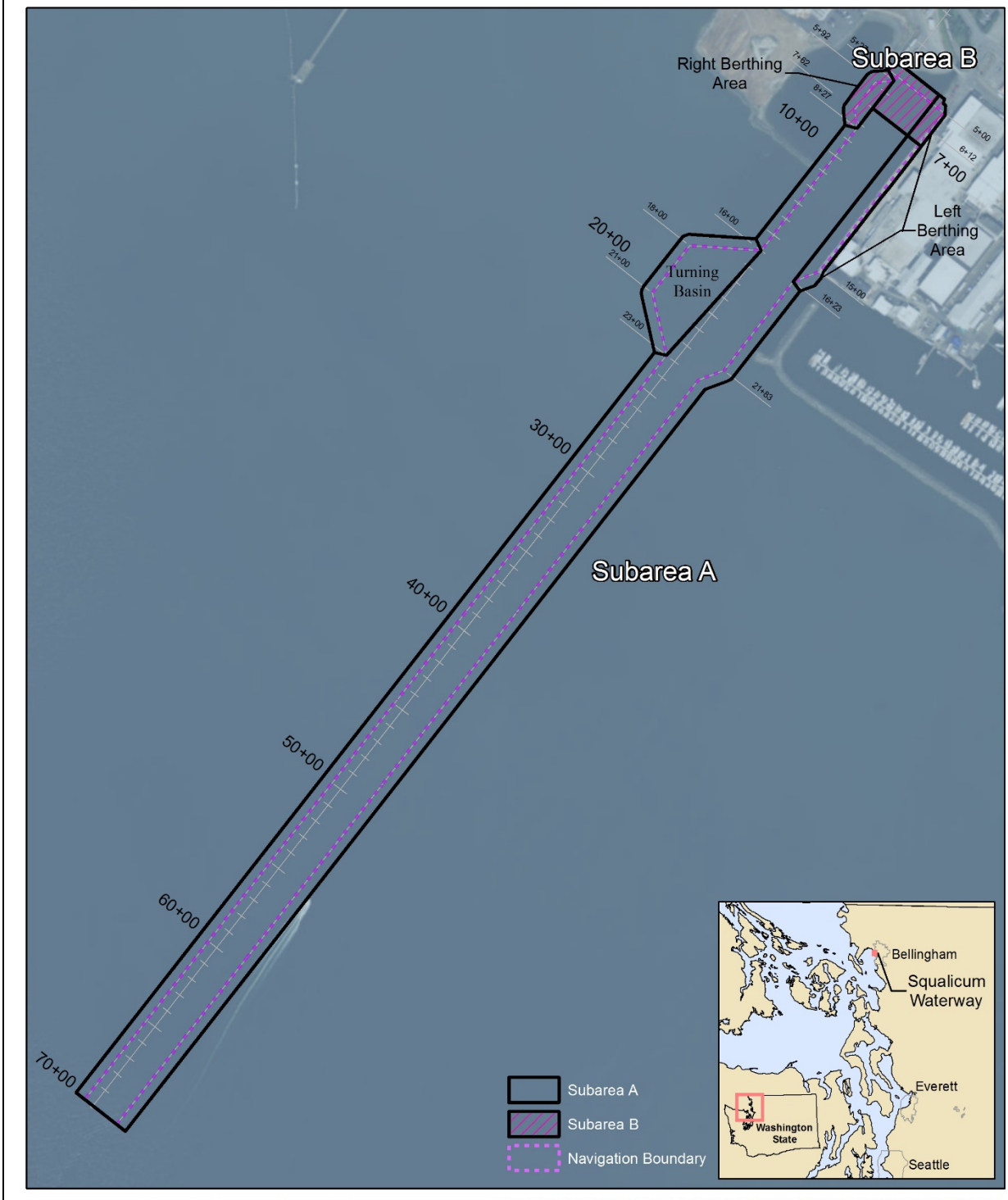
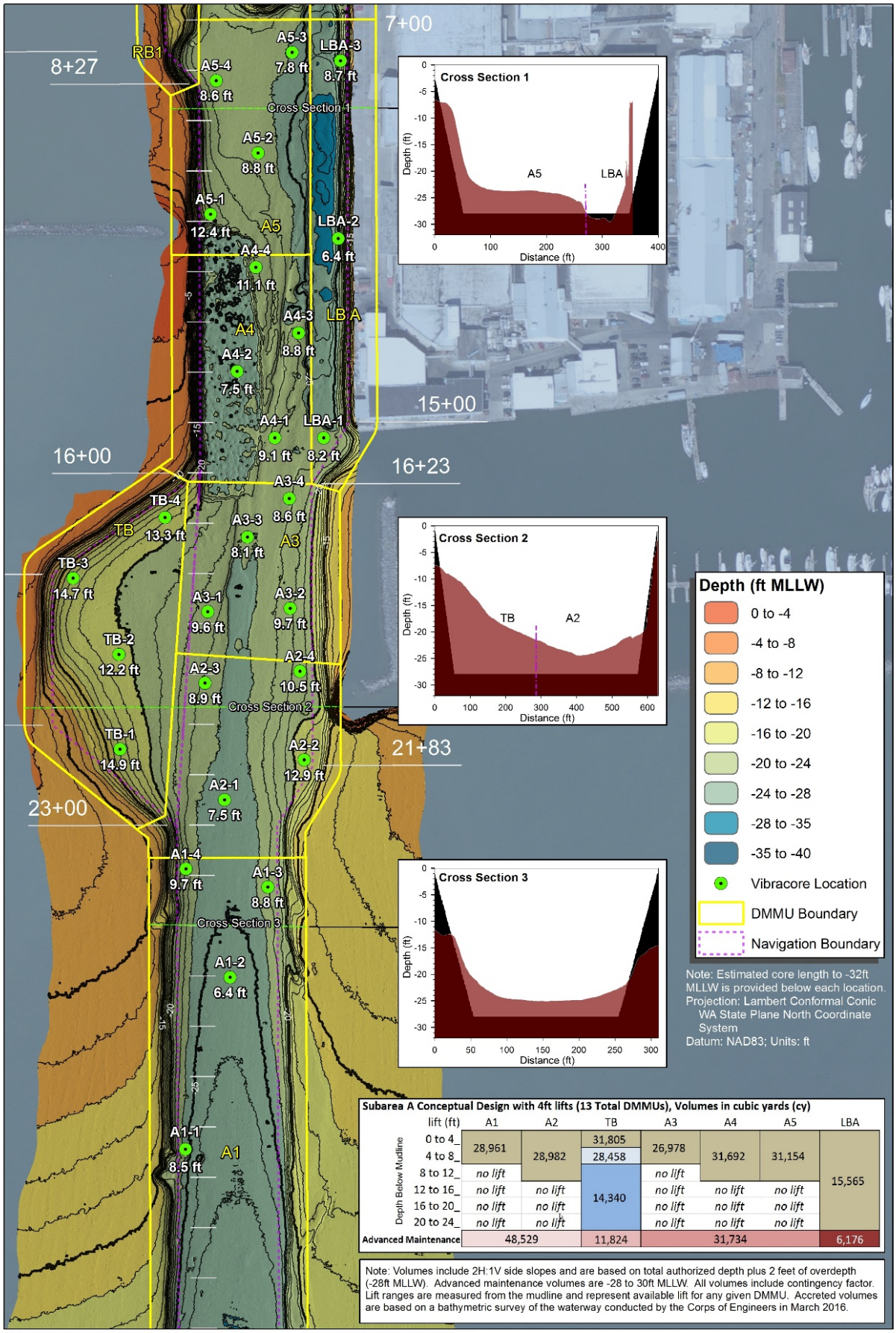


Figure 1. Squalicum Creek Waterway Study Area (NewFields 2017)

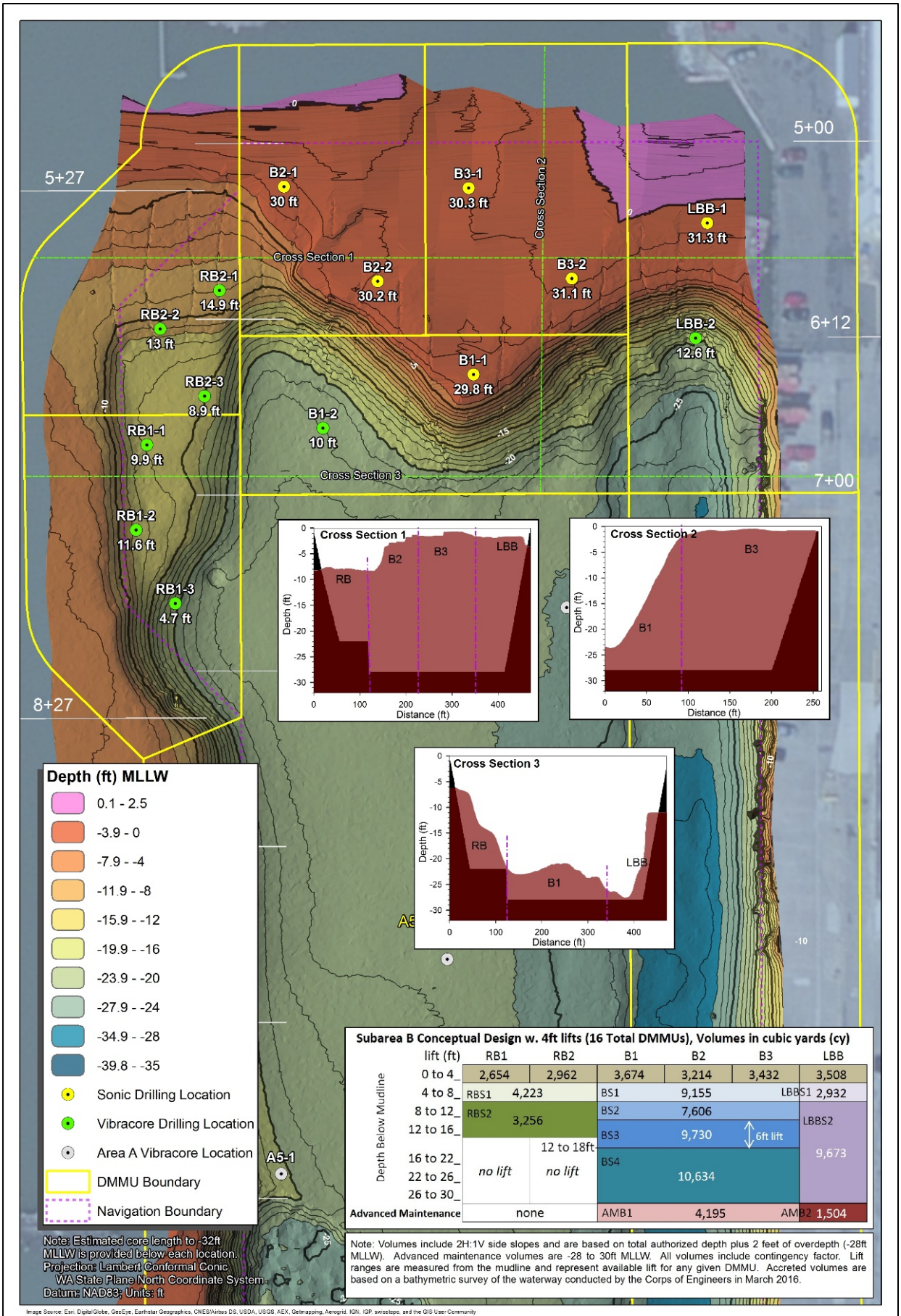


Subarea A Conceptual Design with 4ft lifts (13 Total DMMUs), Volumes in cubic yards (cy)

Depth Below Mudline lift (ft)	A1	A2	TB	A3	A4	A5	LBA
0 to 4	28,961	28,982	31,805	26,978	31,692	31,154	15,565
4 to 8			28,458				
8 to 12	*no lift*		14,340	*no lift*			
12 to 16	*no lift*	*no lift*		*no lift*	*no lift*	*no lift*	
16 to 20	*no lift*	*no lift*		*no lift*	*no lift*	*no lift*	
20 to 24	*no lift*	*no lift*		*no lift*	*no lift*	*no lift*	
Advanced Maintenance	48,529		11,824	31,734			6,176

Note: Volumes include 2H:1V side slopes and are based on total authorized depth plus 2 feet of overdepth (-28ft MLLW). Advanced maintenance volumes are -28 to 30ft MLLW. All volumes include contingency factor. Lift ranges are measured from the mudline and represent available lift for any given DMMU. Accreted volumes are based on a bathymetric survey of the waterway conducted by the Corps of Engineers in March 2016.

Figure 2. Subarea A DMMU Boundaries, Cross-Sections and DMMU Profiles (NewFields, 2016)



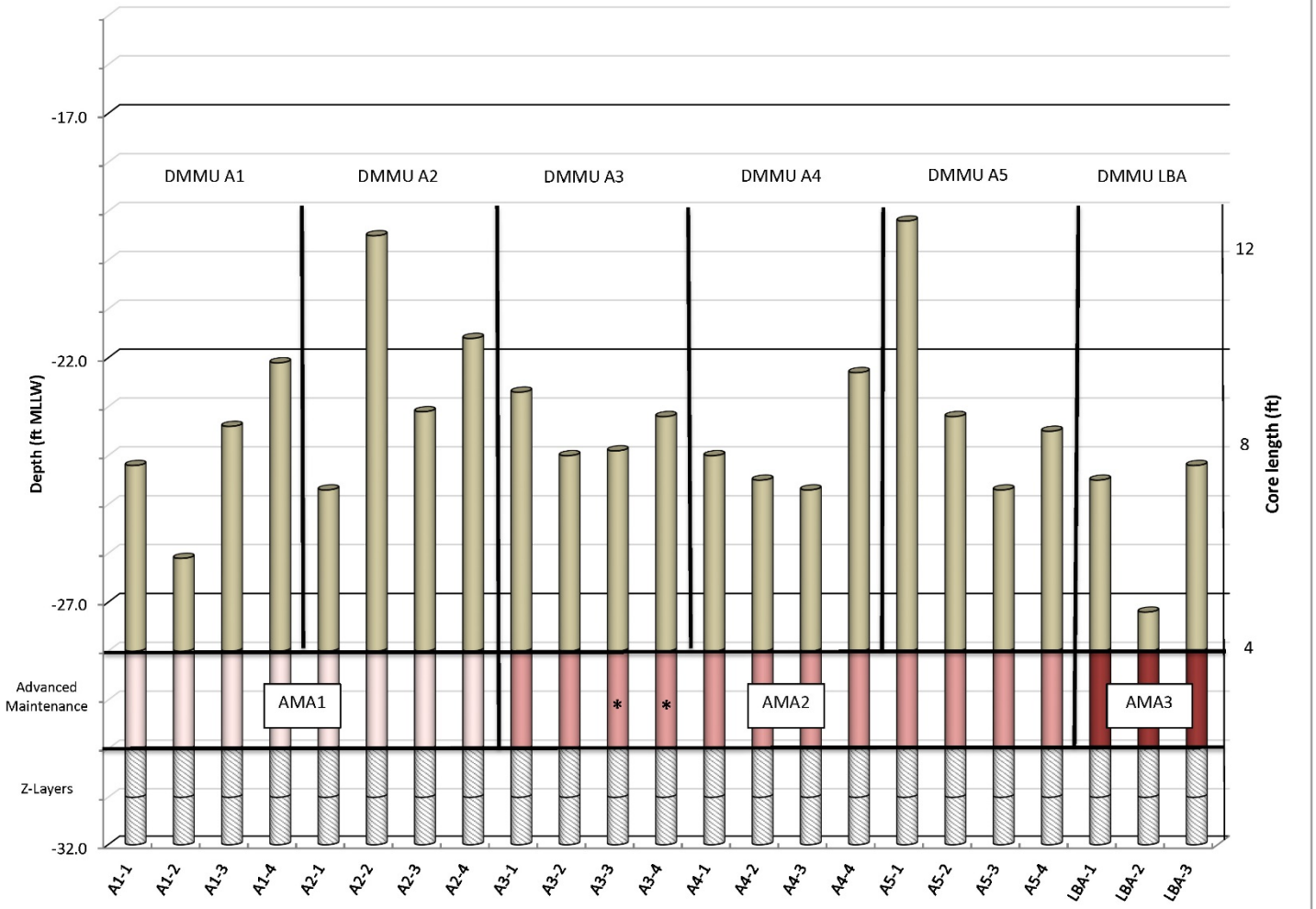
Subarea B Conceptual Design w. 4ft lifts (16 Total DMMUs), Volumes in cubic yards (cy)

Depth Below Mudline	lift (ft)	RB1	RB2	B1	B2	B3	LBB
	0 to 4_	2,654	2,962	3,674	3,214	3,432	3,508
	4 to 8_	RBS1 4,223		BS1 9,155			LBBS1 2,932
	8 to 12_	RBS2 3,256		BS2 7,606			LBBS2 9,673
	12 to 16_			BS3 9,730		6ft lift	
	16 to 22_	no lift	12 to 18ft no lift	BS4 10,634			
	22 to 26_						
	26 to 30_						
	Advanced Maintenance	none		AMB1 4,195		AMB2 1,504	

Note: Volumes include 2H:1V side slopes and are based on total authorized depth plus 2 feet of overdepth (-28ft MLLW). Advanced maintenance volumes are -28 to 30ft MLLW. All volumes include contingency factor. Lift ranges are measured from the mudline and represent available lift for any given DMMU. Accreted volumes are based on a bathymetric survey of the waterway conducted by the Corps of Engineers in March 2016.

Figure 3. Subarea B DMMU Boundaries, Cross-Sections and DMMU Profiles (NewFields, 2016)

Figure 4. Subarea A (Main Channel): Core Profiles and Compositing Scheme (NewFields, 2017)



Note: *core intervals not included in DMMU composite; see Section 5.7

Figure 5. Subarea A (Turning Basin): Core Profiles and Compositing Scheme (NewFields, 2017)

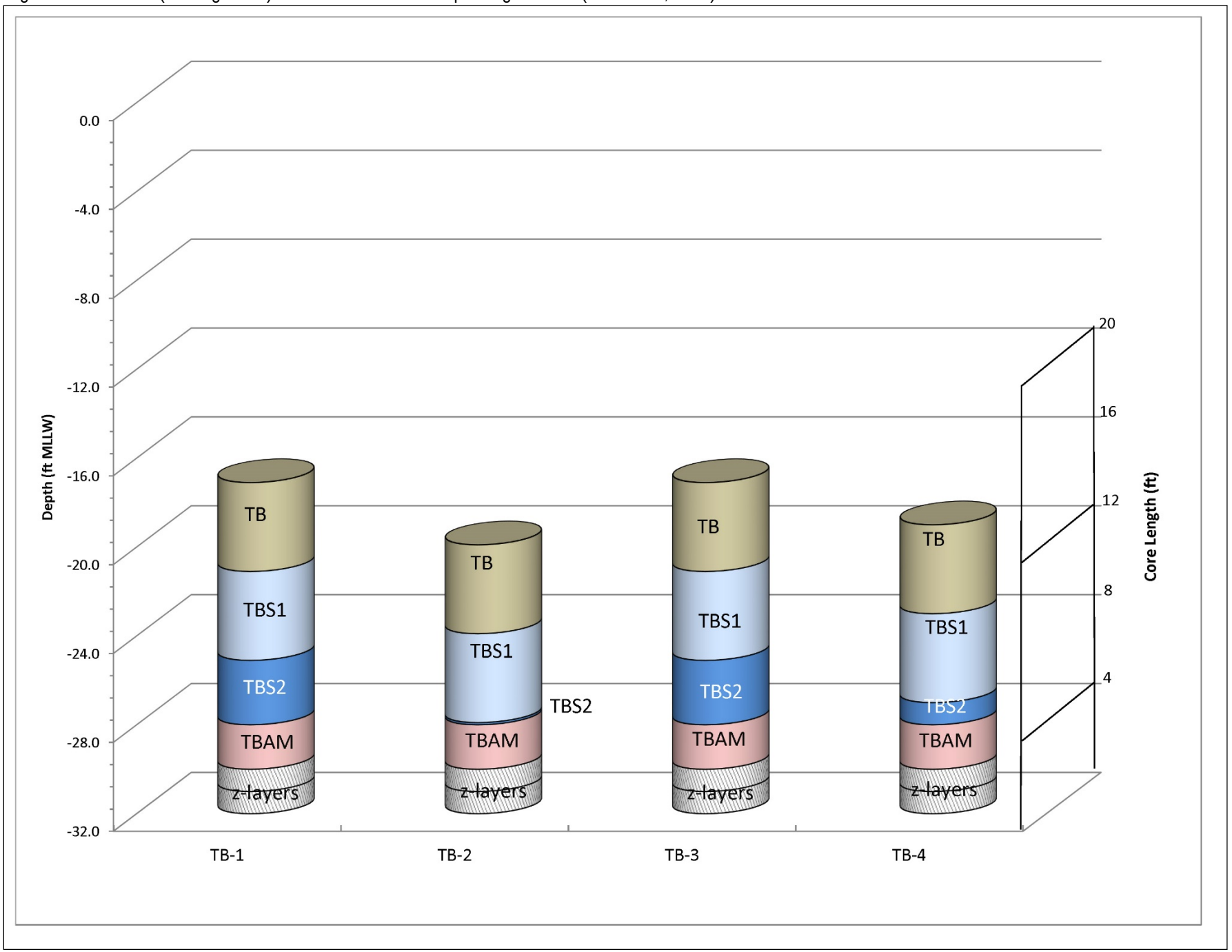
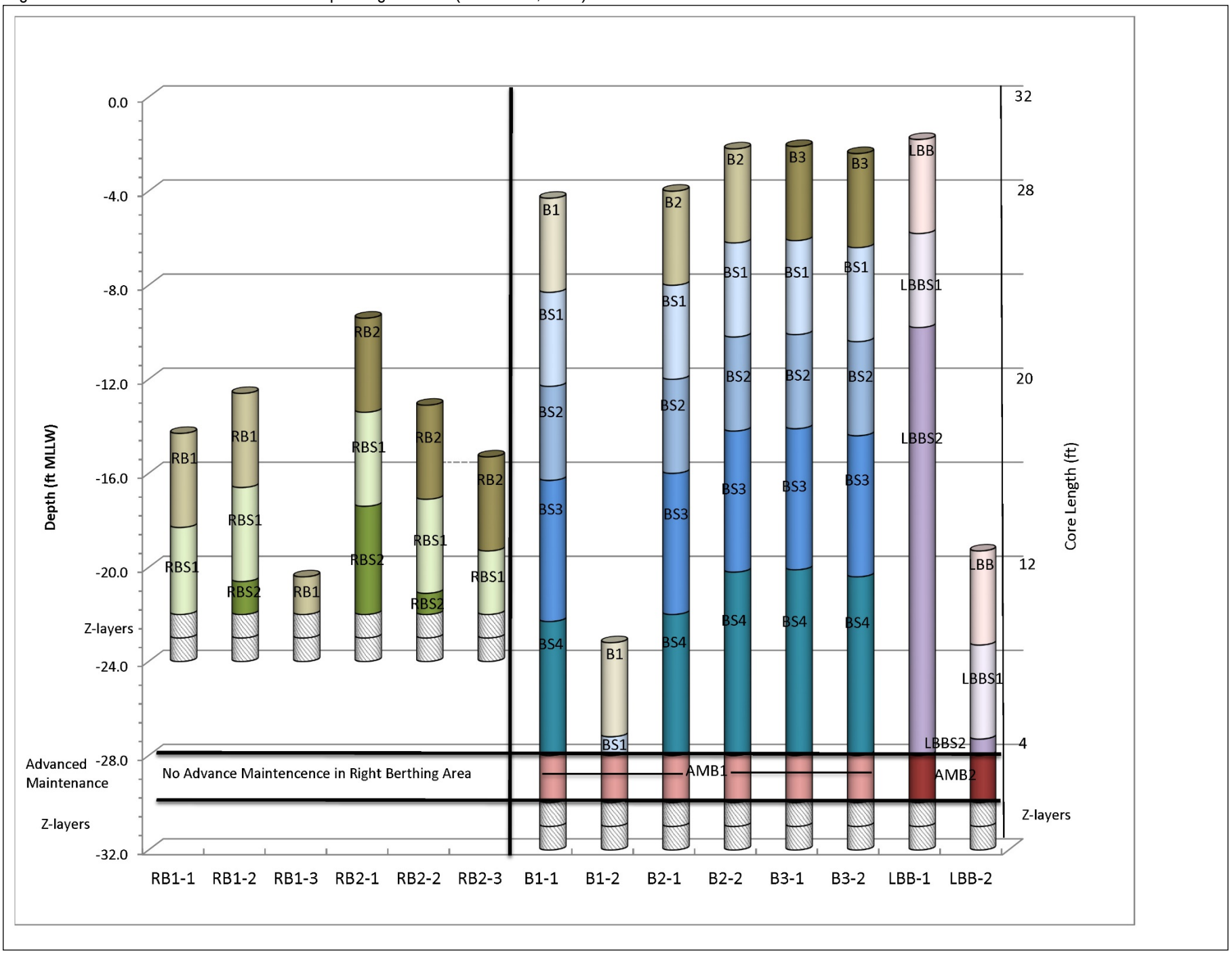


Figure 6. Subarea B: Core Profiles and Compositing Scheme (NewFields, 2017)



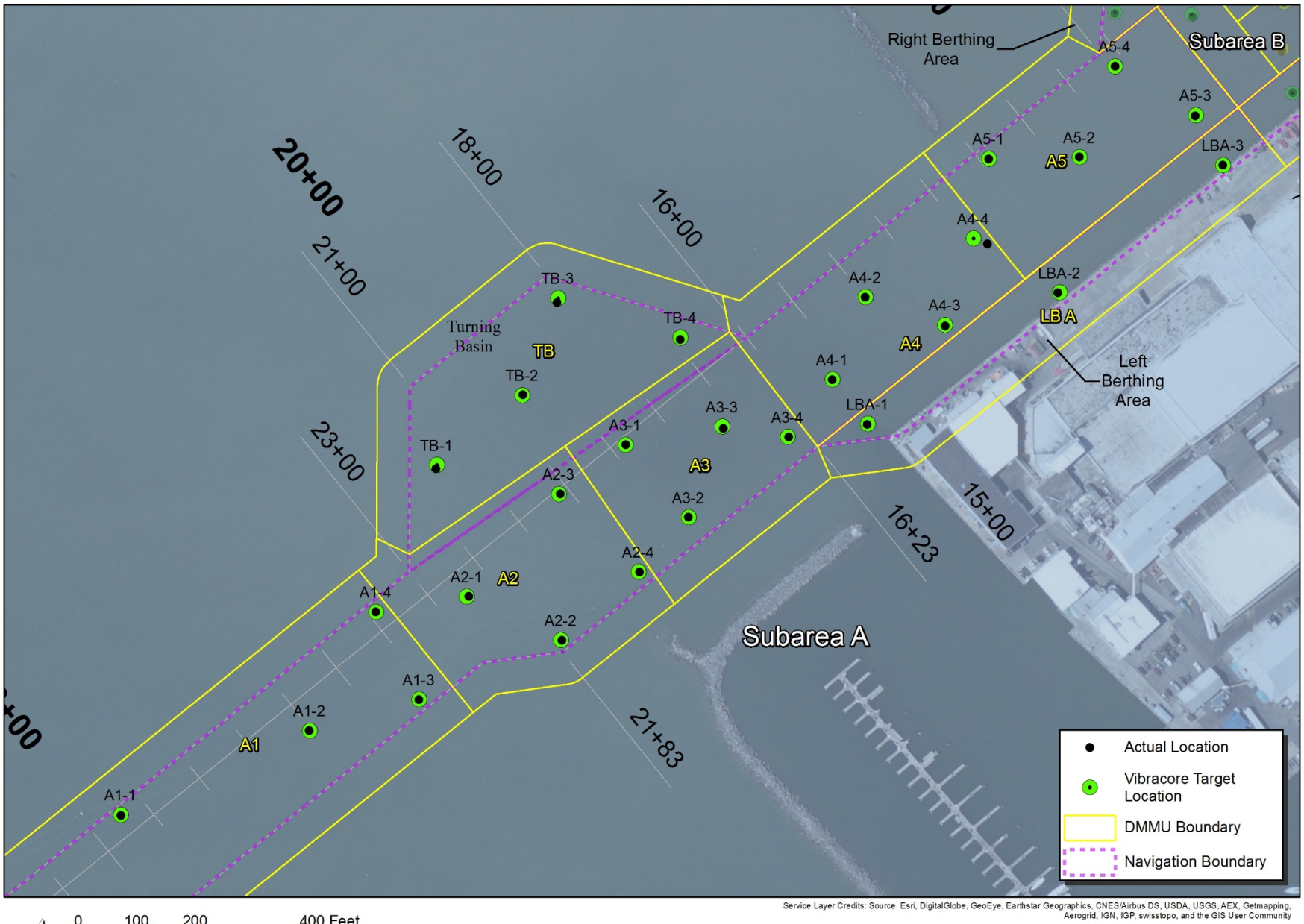


Figure 7. Squalicum Creek Waterway Target and Actual Sample Locations, Subarea A

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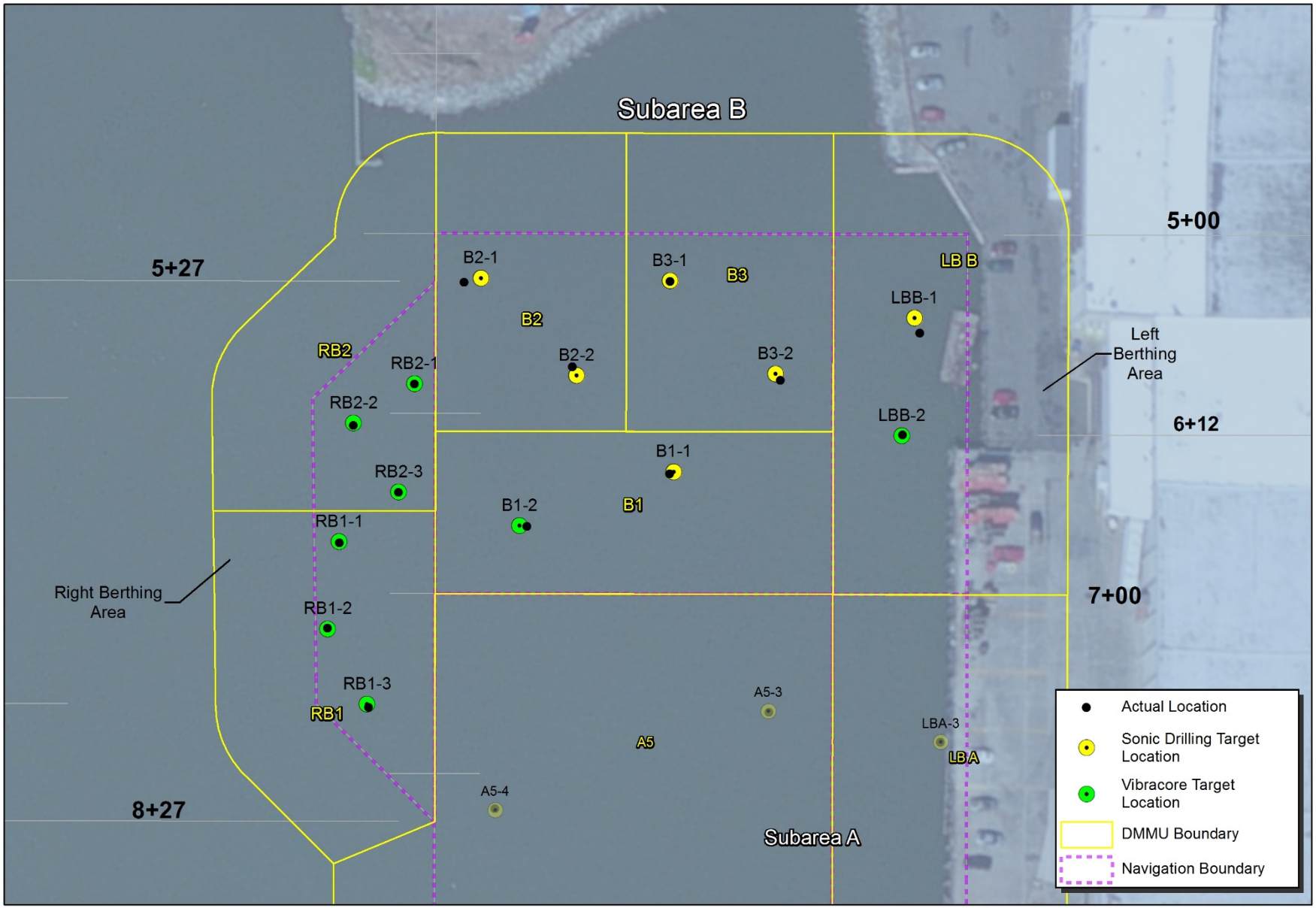

Figure 8. Squalicum Creek Waterway Target and Actual Sample Locations, Subarea B

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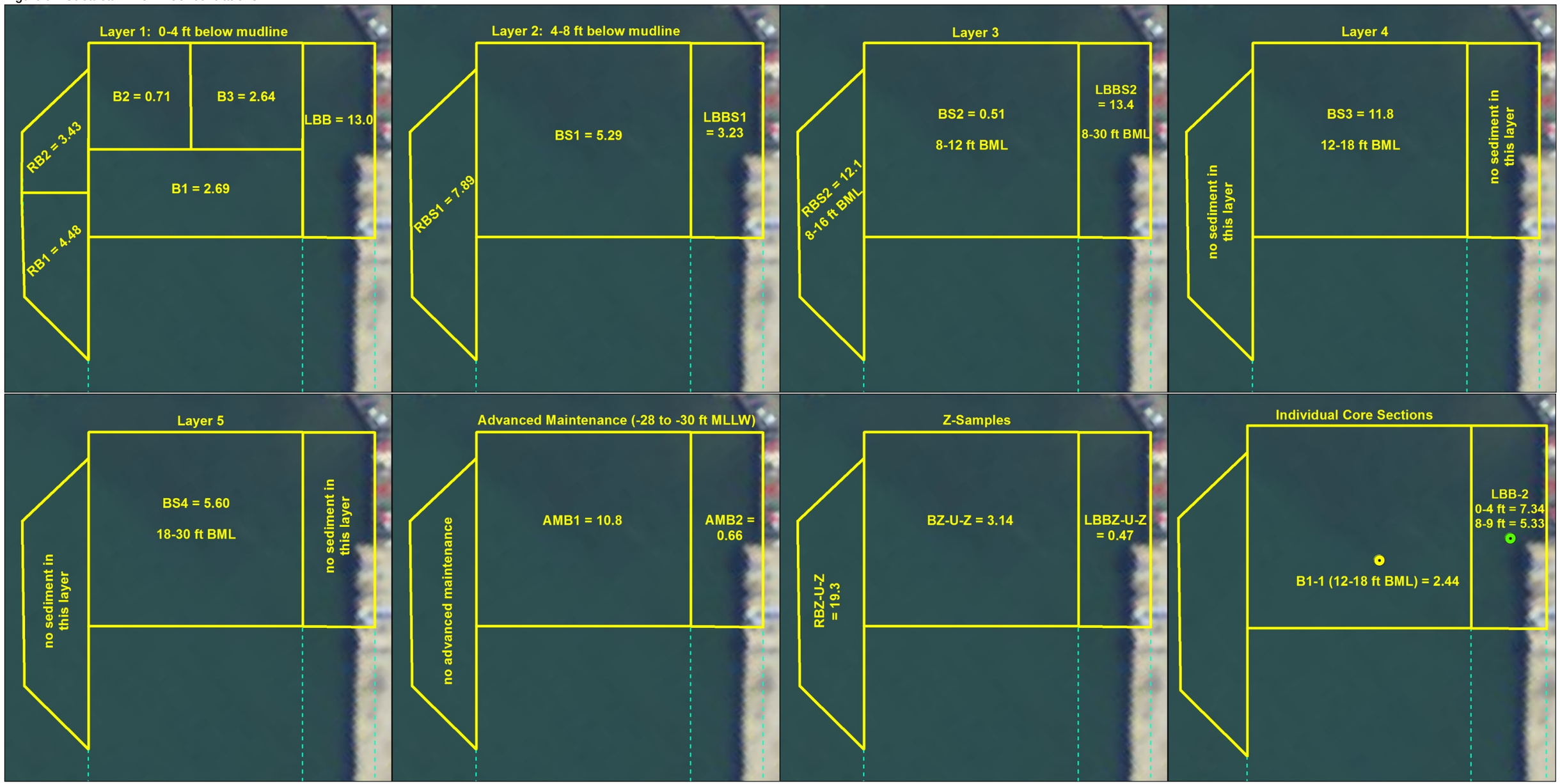
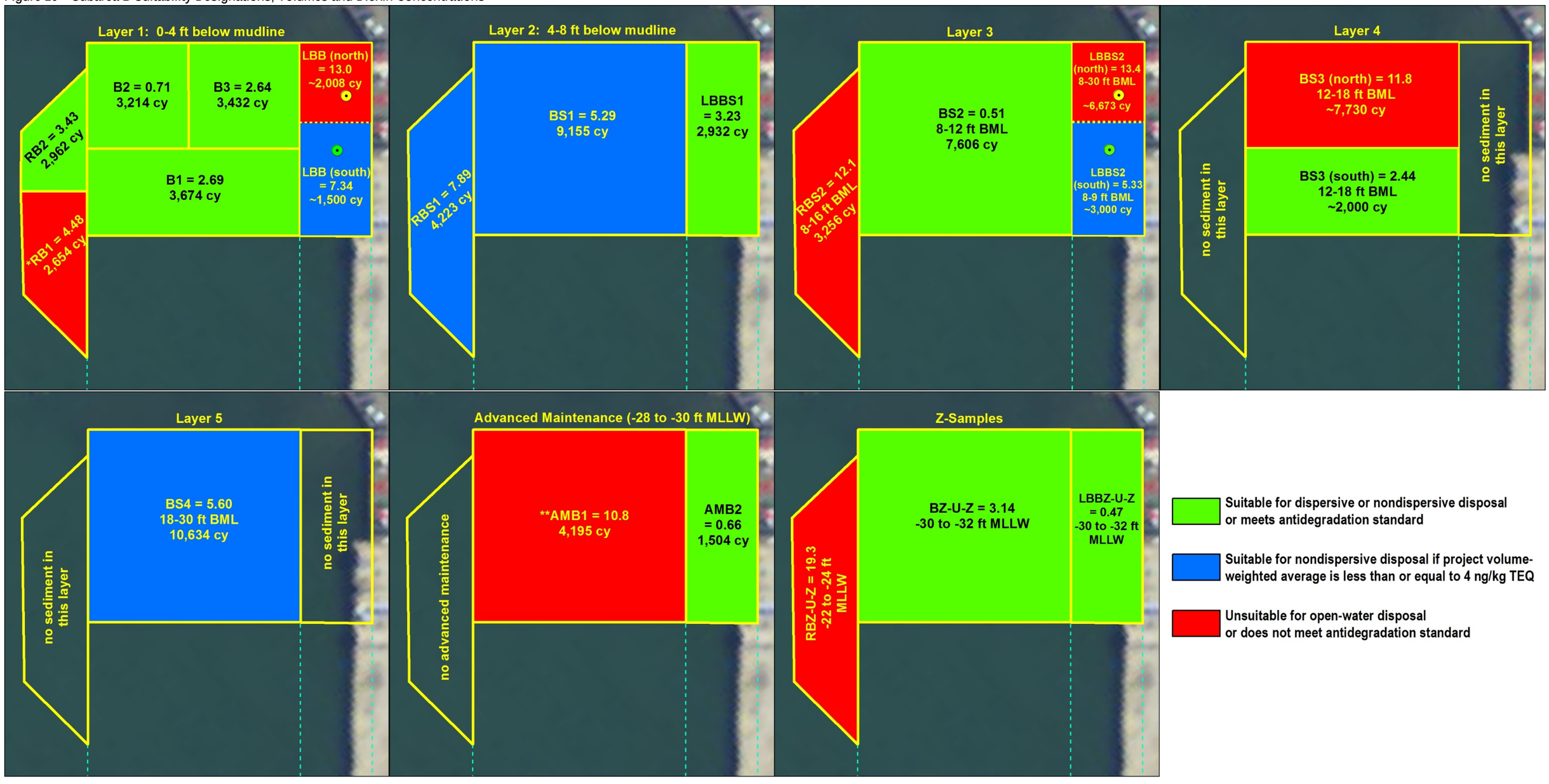
Figure 9 – Subarea B Dioxin Concentrations



Note: all dioxin concentrations in ng/kg toxic equivalents

BML = below mudline
MLLW = mean lower low water

Figure 10 – Subarea B Suitability Designations, Volumes and Dioxin Concentrations



Note: all dioxin concentrations in ng/kg toxic equivalents
BML = below mudline
MLLW = mean lower low water
TEQ – toxic equivalents

*DMMU RB1 exceeded the SL for 4-methylphenol but was not subjected to toxicity testing. It is therefore unsuitable for open-water disposal.
**In addition to the dioxin concentration exceeding 10 ng/kg TEQ, DMMU AMB1 exceeded the SL for several PAHs.

Table 1. Summary of Past Sediment Characterizations of Squalicum Creek Waterway

Characterization Event	Dredge Material Volume	Results	Suitability Determination	Outcome
1990-91 USACE Characterization	194,214 cy	DDT and PCBs exceeded SL/BT at the head of the waterway	164,912 cy suitable for open-water disposal; 29,302 not suitable for open-water disposal	Material determined suitable for open-water disposal was dredged in 1992; the unsuitable material was left in place.
1994-95 USACE Characterization	258,000 cy	No BTs exceeded; SL exceedances passed biological testing	258,000 cy suitable for open-water disposal	The majority of the material was dredged in 1995; remaining material dredged in 1998. Dredging appears to have occurred from Station 5+40 to the outer channel.
2000 USACE Characterization	171,888 cy	2,4-dimethylphenol exceeded SL and lead exceeded ML in right berthing area; no biological testing was conducted	All material suitable for open-water disposal except one DMMU in the right berthing area	The waterway was dredged in 2004, except for the unsuitable DMMU, and the overlying DMMU which were left in place. Dredging appears to have occurred from Station 6+12 to the outer channel.
2010 Bellingham Cold Storage Characterization	6,600 cy	No SLs exceeded; TBT< BT; Volume-weighted dioxin 6.3 ng/kg TEQ	Suitable for disposal at Elliott Bay open-water disposal site	The material was dredged and disposed of at the Elliott Bay disposal site in 2012. Dredging appears to have occurred from Station 6+12 to Station 15+00.
2011 USACE Dioxin Characterization	NA	Dioxin concentrations ranged from 2.0 to 5.1 ng/kg TEQ	NA	Sediment characterization was for planning purposes only; no dredging was performed
2015 Bellingham Cold Storage Characterization	14,200 cy	Benzyl alcohol exceeded SL	DMMP agencies determined material suitable for open-water disposal without requiring bioassays	Material was dredged and disposed at Rosario Strait dispersive disposal site in 2016.

cy: yards
NA: not applicable
DMMU: dredged material management unit

USACE: U.S. Army Corps of Engineers
DMMP: Dredged Material Management Program

SL: screening level
BT: bioaccumulation trigger
ML: maximum level

DDT: dichlorodiphenyltrichloroethane
PCBs: polychlorinated biphenyls
TBT: tributyltin
TEQ: toxic equivalents
ng/kg: nanograms per kilogram

Table 3. Subarea A: Contingency Factors and DMMU Volumes (NewFields, 2016)

DMMU	Contingency Factors (%)	Design Depth + Allowable Overdepth Volume (cy)	Advanced Maintenance Volume (cy)	Total Estimated Volume Including Overdepth and Advanced Maintenance (cy)
A1	40	28,961	-	28,961
A2	40	28,982	-	28,982
A3	40	26,978	-	26,978
A4	40	31,692	-	31,692
A5	40	31,154	-	31,154
TB	40	31,805	-	31,805
TBS1	40	28,458	-	28,458
TBS2	40	14,340	-	14,340
LBA	40	15,565	-	15,565
AMA1	25	-	48,529	48,529
AMA2	25	-	31,734	31,734
AMA3	15	-	6,176	6,176
TBAM	0	-	11,824	11,824
Totals		**237,936**	**98,263**	**336,199**

Table 4. Subarea B: Contingency Factors and DMMU Volumes (NewFields, 2016)

DMMU	Contingency Factors (%)	Design Depth + Allowable Overdepth Volume (cy)	Advanced Maintenance Volume (cy)	Total Estimated Volume Including Overdepth and Advanced Maintenance (cy)
RB1	25	2,654	-	2,654
RB2	25	2,962	-	2,962
RBS1	25	4,223	-	4,223
RBS2	25	3,256	-	3,256
B1	25	3,674	-	3,674
B2	25	3,214	-	3,214
B3	25	3,432	-	3,432
BS1	25	9,155	-	9,155
BS2	25	7,606	-	7,606
BS3	25	9,730	-	9,730
BS4	25	10,634	-	10,634
LBB	25	3,508	-	3,508
LBBS1	25	2,932	-	2,932
LBBS2	25	9,673	-	9,673
AMB1	0	-	4,195	6,887
AMB2	0	-	1,504	1,504
Totals		**76,653**	**5,699**	**82,352**

Table 5. Sampling Coordinates, Mudline Elevations, Penetration and Recovery for Subarea A

Surface DMMU	Subsurface DMMUs and Z-samples	Location Name	Date	State Plane WA-N, NAD83		Latitude (N) NAD83	Longtitude (W) NAD 83	Core Penetration (ft)	Core Recovery (ft)	Recovery (%)	Water Depth (ft)	Tidal Height (ft MLLW)	Mudline (ft MLLW)
				Northing	Easting								
Subarea A													
A1	AMA1, A1Z-U, A1Z-L	A1-1	12/1/2016	644698.6	1234498.3	48.755170	122.516101	9.5	7.9	83	30.5	6.3	-24.2
		A1-2	12/1/2016	644912.4	1234778.8	48.755773	122.514958	7.8	6.8	87	32.6	6.5	-26.1
		A1-3	12/1/2016	645006.7	1234949.2	48.756041	122.514260	10.0	9.7	97	30.1	6.7	-23.4
		A1-4	12/1/2016	645135.8	1234843.6	48.756389	122.514710	11.1	8.6	78	29.1	7.0	-22.1
A2		A2-1	12/30/2016	645197.6	1234992.5	48.756567	122.514098	8.0	6.2	78	31.0	6.3	-24.7
		A2-2	12/30/2016	645160.5	1235164.9	48.756476	122.513380	13.0	12.8	99	28.4	8.9	-19.5
		A2-3	12/30/2016	645403.7	1235104.9	48.757139	122.513651	9.9	7.7	78	29.5	6.4	-23.1
		A2-4	12/30/2016	645304.3	1235267.0	48.756876	122.512970	11.0	9.8	89	28.2	6.6	-21.6
A3	AMA2, A2Z-U, A2Z-L	A3-1	12/1/2016	645510.7	1235195.1	48.757437	122.513287	10.0	8.6	86	30.0	7.3	-22.7
		A3-2	12/2/2016	645414.5	1235327.5	48.757182	122.512729	9.4	8.0	85	31.5	7.5	-24.0
		A3-3	12/30/2016	645575.5	1235350.9	48.757624	122.512647	9.0	7.5	83	30.7	6.8	-23.9
		A3-4	12/30/2016	645586.4	1235463.0	48.757661	122.512183	9.0	7.5	83	30.2	7.0	-23.2
A4		A4-1	12/1/2016	645698.9	1235513.7	48.757972	122.511983	9.2	7.5	82	30.5	6.5	-24.0
		A4-2	11/30/2016	645848.7	1235536.5	48.758384	122.511902	7.5	6.1	81	32.3	7.8	-24.5
		A4-3	11/30/2016	645832.2	1235680.6	48.758347	122.511304	7.5	6.6	88	31.0	6.3	-24.7
		A4-4	12/1/2016	645985.1	1235719.0	48.758769	122.511158	11.1	10.2	92	29.5	7.2	-22.3
A5		A5-1	11/29/2016	646126.4	1235688.1	48.759154	122.511299	12.8	10.0	78	27.2	8.0	-19.2
		A5-2	11/29/2016	646164.9	1235838.6	48.759269	122.510679	9.7	7.2	75	30.2	7.0	-23.2
		A5-3	11/29/2016	646278.5	1236015.4	48.759590	122.509956	7.3	5.9	81	31.0	6.3	-24.7
		A5-4	11/29/2016	646329.8	1235862.4	48.759722	122.510595	8.5	6.8	80	30.1	6.6	-23.5
LBA	AMA3, LBAZ-U, LBAZ-L	LBA-1	11/29/2016	645637.8	1235589.1	48.757809	122.511665	7.5	6.0	80	30.6	6.1	-24.5
		LBA-2	11/29/2016	645931.0	1235855.2	48.758629	122.510589	5.0	4.1	82	33.4	6.2	-27.2
		LBA-3	11/29/2016	646206.9	1236080.4	48.759398	122.509681	8.0	7.3	91	31.4	7.3	-24.2
TB	TBS1, TBS2, TBAM, TBZ-U, TBZ-L	TB-1	12/30/2016	645397.2	1234888.7	48.757108	122.514546	15.4	13.0	84	25.3	8.2	-17.1
		TB-2	12/30/2016	645554.3	1235004.8	48.757545	122.514079	13.0	11.4	88	26.4	6.5	-19.9
		TB-3	12/30/2016	645720.7	1235025.9	48.758003	122.514007	15.4	14.3	93	24.6	7.5	-17.1
		TB-4	12/30/2016	645707.0	1235244.8	48.757978	122.513099	14.1	11.7	83	25.8	6.8	-19.0

Table 6. Sampling Coordinates, Mudline Elevations, Penetration and Recovery for Subarea B

Surface DMMU	Subsurface DMMUs and Z-samples	Location Name	Date	State Plane WA-N, NAD83		Latitude (N) NAD83	Longtitude (W) NAD 83	Core Penetration (ft)	Core Recovery (ft)	Recovery (%)	Water Depth (ft)	Tidal Height (ft MLLW)	Mudline (ft MLLW)
				Northing	Easting								
Subarea B													
B1	BS1, BS2, BS3, BS4, AMB1, BZ-U, BZ-L	B1-1	12/1/2016	646416.8	1236053.3	48.759972	122.509812	28.0	*	*	11.2	6.9	-4.3
		B1-2	11/30/2016	646442.6	1235972.8	48.760038	122.510148	9.7	7.5	77	29.5	6.3	-23.2
B2		B2-1	12/2/2016	646571.1	1236028.6	48.760393	122.509928	28.0	*	*	12.4	8.4	-4.0
		B2-2	12/2/2016	646497.1	1236047.1	48.760191	122.509845	32.0	*	*	10.4	8.2	-2.2
B3		B3-1	12/1/2016	646501.2	1236119.2	48.760207	122.509546	30.0	*	*	10.5	8.4	-2.1
		B3-2	12/1/2016	646420.0	1236133.8	48.759985	122.509478	32.0	*	*	9.0	6.6	-2.4
LBB	LBBS1, LBBS2, AMB2, LBBZ-U, LBBZ-L	LBB-1	11/30/2016	646393.2	1236211.1	48.759916	122.509156	32.0	*	*	8.6	6.8	-1.8
		LBB-2	12/1/2016	646354.5	1236168.6	48.759808	122.509328	13.0	10.0	77	27.9	8.6	-19.3
RB1	RBS1, RBS2, RBZ-U, RBZ-L	RB1-1	11/30/2016	646499.5	1235884.9	48.760188	122.510517	10.1	8.7	86	21.3	7.0	-14.3
		RB1-2	11/30/2016	646466.1	1235850.6	48.760094	122.510657	11.6	11.1	96	19.9	7.3	-12.6
		RB1-3	11/30/2016	646417.4	1235841.6	48.759961	122.510689	3.6	2.8	78	28.0	7.6	-20.4
RB2		RB2-1	12/2/2016	646543.3	1235972.1	48.760313	122.510160	15.3	11.8	77	16.7	7.3	-9.4
		RB2-2	12/2/2016	646546.2	1235931.2	48.760319	122.510330	13.1	9.9	76	19.4	6.3	-13.1
		RB2-3	12/2/2016	646501.4	1235928.2	48.760196	122.510338	9.5	8.1	85	23.4	8.1	-15.3

** This core was collected in discrete segments by sonic drilling. Recovery data for individual segments can be found in the core logs in Appendix B of NewFields (2017).*

Table 7. Core Compositing Scheme for DMMUs A1, A2, A3, A4, A5, LBA, AMA1, AMA2, and AMA3

DMMU	Station ID	Mudline Depth MLLW (ft.)	Surface DMMU MLLW (ft.)		Advanced Maintenance MLLW (ft.)		Z-Layer Upper MLLW (ft.)		Z-Layer Lower MLLW (ft.)	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
					AMA1					
A1	A1-1	-24.2	-24.2	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A1-2	-26.1	-26.1	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A1-3	-23.4	-23.4	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A1-4	-22.1	-22.1	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
A2	A2-1	-24.7	-24.7	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A2-2	-19.5	-19.5	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A2-3	-23.1	-23.1	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A2-4	-21.6	-21.6	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
					AMA2					
A3	A3-1	-22.7	-22.7	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A3-2	-24.0	-24.0	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A3-3	-23.9	-23.9	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A3-4	-23.2	-23.2	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
A4	A4-1	-24.0	-24.0	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A4-2	-24.5	-24.5	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A4-3	-24.7	-24.7	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A4-4	-22.3	-22.3	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
A5	A5-1	-19.2	-19.2	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A5-2	-23.2	-23.2	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A5-3	-24.7	-24.7	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	A5-4	-23.5	-23.5	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
					AMA3					
LBA	LBA-1	-24.5	-24.5	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	LBA-2	-27.2	-27.2	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	LBA-3	-24.2	-24.2	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0

Table 8. Core Compositing Scheme for DMMUs TB, TBS1, TBS2, and TBAM

DMMU	Station ID	Mudline Depth MLLW (ft.)	Surface DMMU MLLW (ft.)		Subsurface DMMU TBS1 MLLW (ft.)		Subsurface DMMU TBS2 MLLW (ft.)		TBAM MLLW (ft.)		Z-Layer Upper MLLW (ft.)		Z-Layer Lower MLLW (ft.)	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
TB	TB-1	-17.1	-17.1	-21.1	-21.1	-25.1	-25.1	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	TB-2	-19.9	-19.9	-23.9	-23.9	-27.9	-27.9	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	TB-3	-17.1	-17.1	-21.1	-21.1	-25.1	-25.1	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	TB-4	-19.0	-19.0	-23.0	-23.0	-27.0	-27.0	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0

Table 9. Core Compositing Scheme for DMMUs B1, B2, B3, BS1, BS2, BS3, BS4, and AMB1

DMMU	Station ID	Mudline Depth MLLW (ft.)	Surface DMMU MLLW (ft.)		Subsurface DMMU BS1 MLLW (ft.)		Subsurface DMMU BS2 MLLW (ft.)		Subsurface DMMU BS3 MLLW (ft.)		Subsurface DMMU BS4 MLLW (ft.)		AMB1 MLLW (ft.)		Z-Layer Upper MLLW (ft.)		Z-Layer Lower MLLW (ft.)	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
B1	B1-1	-4.3	-4.3	-8.3	-8.3	-12.3	-12.3	-16.3	-16.3	-22.3	-22.3	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	B1-2	-23.2	-23.2	-27.2	-27.2	-28.0	*no sample interval*						-28.0	-30.0	-30.0	-31.0	-31.0	-30.0
B2	B2-1	-4.0	-4.0	-8.0	-8.0	-12.0	-12.0	-16.0	-16.0	-22.0	-22.0	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	B2-2	-2.2	-2.2	-6.2	-6.2	-10.2	-10.2	-14.2	-14.2	-20.2	-20.2	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
B3	B3-1	-2.1	-2.1	-6.1	-6.1	-10.1	-10.1	-14.1	-14.1	-20.1	-20.1	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	B3-2	-2.4	-2.4	-6.4	-6.4	-10.4	-10.4	-14.4	-14.4	-20.4	-20.4	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0

Table 10. Core Compositing Scheme for DMMUs RB1, RB2, RBS1, and RBS2

DMMU	Station ID	Mudline Depth MLLW (ft.)	Surface DMMU MLLW (ft.)		Subsurface DMMU RBS1 MLLW (ft.)		Subsurface DMMU RBS2 MLLW (ft.)		Z-Layer Upper MLLW (ft.)		Z-Layer Lower MLLW (ft.)	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
RB1	RB1-1	-14.3	-14.3	-18.3	-18.3	-22.0	*no sample interval*		-22.0	-23.0	-23.0	-24.0
	RB1-2	-12.6	-12.6	-16.6	-16.6	-20.6	-20.6	-22.0	-22.0	-23.0	-23.0	-24.0
	RB1-3	-20.4	-20.4	-22.0	*no sample interval*				-22.0	-23.0	-23.0	-23.0
RB2	RB2-1	-9.4	-9.4	-13.4	-13.4	-17.4	-17.4	-22.0	-22.0	-23.0	-23.0	-24.0
	RB2-2	-13.1	-13.1	-17.1	-17.1	-21.1	-21.1	-22.0	-22.0	-23.0	-23.0	-24.0
	RB2-3	-15.3	-15.3	-19.3	-19.3	-22.0	*no sample interval*		-22.0	-23.0	-23.0	-24.0

Table 11. Core Compositing Scheme for DMMUs LBB, LBBS1, LBBS2, and AMB2

DMMU	Station ID	Mudline Depth (ft. MLLW)	Surface DMMU		Subsurface DMMU LBBS1		Subsurface DMMU LBBS2		AMB2 -28 to -30 MLLW		Z-Layer Upper -30 to -31 ft. MLLW		Z-Layer Lower -31 to -32 ft. MLLW	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
LBB	LBB-1	-1.8	-1.8	-5.8	-5.8	-9.8	-9.8	-28.0	-28.0	-30.0	-30.0	-31.0	-31.0	-32.0
	LBB-2	-19.3	-19.3	-23.3	-23.3	-27.8[1]	-27.8[2]	-28.5[3]	-28.5[4]	-30.0	-30.0	-31.0	-31.0	-32.0

Notes

1: The bottom of this interval should have been -27.3 ft. MLLW; see Section 2.7 for discussion.

2: The top of this interval should have been -27.3 ft. MLLW; see Section 2.7 for discussion.

3: The bottom of this interval should have been -28.0 ft. MLLW; see Section 2.7 for discussion.

4: The top of this interval should have been -28.0 ft. MLLW; see Section 2.7 for discussion.

Table 12. Subarea A Chemistry and Conventionals Results

	SL	ML	BT	A1-C 12/1/16	LQ	VQ	A2-C 12/30/16	LQ	VQ	A3-C 12/30/16	LQ	VQ	A4-C 12/1/16	LQ	VQ	A5-C 11/29/16	LQ	VQ	AMA1-C 12/30/16	LQ	VQ	AMA2-C 11/29/16	LQ	VQ	AZ1-U-Z 12/30/16	LQ	VQ	AZ2-U-Z 11/29/16	LQ	VQ
Conventionals																														
Total Solids (%)	--	--	--	57.1			56.2			55.6			59.6			55.1			57.7			57			55.2			57		
Total Organic Carbon (%)	--	--	--	2.24			2.06			1.96			2.19			2.55			1.86			2.22			1.98			2.16		
Sulfides (mg/kg)	--	--	--	1100			1210			1090			640			830			1340			1030			--			--		
Ammonia (mg/kg)	--	--	--	34.1			39.7			41.4			39.6			46.3			70.8			90.6			--			--		
Total Volatile Solids (%)	--	--	--	6.4	*		5.7			5.6			6.2	*		6.7			5.2			6.4	*		5.9			6.3	*	
Grain Size (%)																														
Gravel	--	--	--	0			0			0			0.33			0			0			0			0			0		
Sand	--	--	--	0.9			0.2			0.46			1.05			3.13			0.4			2.47			0.72			3		
Silt	--	--	--	81.18			72.21			80.56			83.05			82.23			75.89			81.05			73.57			78.32		
Clay	--	--	--	18.26			22.3			17.54			14.9			14.68			20.26			17.28			22.81			18.29		
Percent Fines[a]	--	--	--	99.44			94.51			98.1			97.95			96.91			96.15			98.33			96.38			96.61		
Metals (mg/kg)																														
Antimony	150	200	--	1.5	T		4.9	U		4.5	U		0.7	T		2.4	T	J	4.9	U		6.2	U		--			--		
Arsenic	57	700	507.1	10.1			9.7			9.1			7.5			12.6			9.3			8.4			--			--		
Cadmium	5.1	14	11.3	0.06	T		0.05	T		0.22	U		0.13	T		0.16	U		0.24	U		0.31	U		--			--		
Chromium	260	--	--	62.4			61.6			59.9			57.7			72.3		J	62.6			62.4			--			--		
Copper	390	1300	--	45.4			44.3			42.5			40.9			52.3		J	43.9			43.5			--			--		
Lead	450	1200	975	8.6			7.5			7.6			7.9			16.4		J	8			8.1			--			--		
Mercury	0.41	2.3	1.5	0.077			0.072			0.068			0.07			0.074			0.069			0.075			--			--		
Selenium	--	--	3	0.54			0.48			0.46			0.47			0.45			0.45			0.5			--			--		
Silver	6.1	8.4	--	1.3	U		0.97	U		0.9	U		1.3	U		0.5	T	J	0.97	U		1.2	U		--			--		
Zinc	410	3800	--	82.8			82.7			79.2			79.4			105		J	79.8			84.9			--			--		
Polycyclic Aromatic Hydrocarbons (ug/kg)																														
Naphthalene	2100	2400	--	4.7	T		4.5	T		5	T		6	T		5.4	T		5.3	T		9.3			--			--		
Acenaphthylene	560	1300	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
Acenaphthene	500	2000	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		3.9	T		--			--		
Fluorene	540	3600	--	3.5	T		8.9	U		4.4	T		5.3	T		5.7	T		3.9	T		8	T		--			--		
Phenanthrene	1500	21000	--	13			12			15			19			19			15			25			--			--		
Anthracene	960	13000	--	8.7	U		8.9	U		4.6	T		4.6	T		6.4	T		8.7	U		6.5	T		--			--		
2-Methylnaphthalene	670	1900	--	8.1	T		7	T		8	T		9			7.9	T		8.3	T		13			--			--		
Total LPAH[b]	5200	29000	--	21.2			16.5			29			34.9			36.5			24.2			52.7			--			--		
Fluoranthene	1700	30000	4600	17			17			19			37			46			17			49			--			--		
Pyrene	2600	16000	11980	11			11			13			23			32			11			34			--			--		
Benzo(a)anthracene	1300	5100	--	4.5	T		4.9	T		8.8	T		9.9			15			4.8	T		15			--			--		
Chrysene	1400	21000	--	11			9.3			20			23			31			11			29			--			--		
Benzo(b)fluoranthene	--	--	--	9.6			9.5			12			20			30			10			29			--			--		
Benzo(k)fluoranthene	--	--	--	8.7	U		8.9	U		4.8	T		5.4	T		9.6			8.7	U		11			--			--		
Benzofluoranthene	3200	9900	--	9.6			9.5			16.8			25.4			39.6			10			40			--			--		
Benzo(a)pyrene	1600	3600	--	3.8	T		4.3	T		5.8	T		7.6	T		14			4.4	T		13			--			--		
Indeno(1,2,3-cd)pyrene	600	4400	--	3.8	T		4.3	T		5.5	T		7.9	T		15			4.4	T		13			--			--		
Dibenzo(a,h)anthracene	230	1900	--	8.7	U		8.9	U		9	U		8.4	U		3.6	T		8.7	U		3.2	T		--			--		
Benzo(ghi)perylene	670	3200	--	5	T		5.4	T		5.9	T		8.6			16			5.4	T		14			--			--		
Total HPAH[c]	12000	69000	--	65.7			65.7			94.8			142.4			212.2			68.0			210.2			--			--		
Phenols (ug/kg)																														
2,4-Dimethylphenol[g]	29	210	--	6.3	U		6.3	U	UJ	6.3	U		6.3	U		6.3	U		6.3	U		6.2	U		--			--		
2-Methylphenol	63	77	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
4-Methylphenol	670	3600	--	8.5	T		7.4	T	J	44			35			27			5.7	T		6.8	T		--			--		
Pentachlorophenol	400	690	504	87	U		89	U		90	U		84	U		89	U		87	U		88	U		--			--		
Phenol	420	1200	--	110			77			52			140			110			56			100			--			--		
Phthalates (ug/kg)																														
Butylbenzylphthalate	63	970	--	5.1	T		4.6	T		6.3	T		6.1	T		6.3	T		5.8	T		8.8	U		--			--		
Di-N-Butylphthalate	1400	5100	--	8.6	T		11	T		8.1	T		8.5	T		9	T		7.9	T		8.2	T		--			--		
Di-N-Octyl Phthalate	6200	6200	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		

Table 12. Subarea A Chemistry and Conventionals Results (cont.)

				A1-C			A2-C			A3-C			A4-C			A5-C			AMA1-C			AMA2-C			AZ1-U-Z			AZ2-U-Z		
	SL	**ML**	**BT**	**12/1/16**	**LQ**	**VQ**	**12/30/16**	**LQ**	**VQ**	**12/30/16**	**LQ**	**VQ**	**12/1/16**	**LQ**	**VQ**	**11/29/16**	**LQ**	**VQ**	**12/30/16**	**LQ**	**VQ**	**11/29/16**	**LQ**	**VQ**	**12/30/16**	**LQ**	**VQ**	**11/29/16**	**LQ**	**VQ**
Diethylphthalate	200	1200	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
Dimethylphthalate	71	1400	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
Bis(2-Ethylhexyl) Phthalate	1300	8300	--	87	U		14	T		90	U		12	T		27	T		87	U		24	T		--			--		
Other Semi-Volatile Organic Compounds (ug/kg)																														
Dibenzofuran	540	1700	--	8.7	U		8.9	U		3.7	T		4.5	T		5.4	T		8.7	U		6.8	T		--			--		
Benzoic Acid	650	760	--	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	--			--		
Benzyl Alcohol	57	870	--	7.1	T		6	T		7.5	T		6.6	T		6.4	T		6.9	T		7.7	T		--			--		
1,2-Dichlorobenzene	35	110	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
1,4-Dichlorobenzene	110	120	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
Hexachlorobenzene	22	230	168	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
Hexachlorobutadiene	11	270	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
N-Nitrosodiphenylamine	28	130	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
1,2,4-Trichlorobenzene	31	64	--	8.7	U		8.9	U		9	U		8.4	U		8.9	U		8.7	U		8.8	U		--			--		
Polychlorinated Biphenyl Aroclors (ug/kg)																														
PCB-aroclor 1016	--	--	--	8.7	U		8.9	U		9	U		8.4	U		8.8	U		8.6	U		8.8	U		--			--		
PCB-aroclor 1221	--	--	--	18	U		18	U		18	U		17	U		18	U		18	U		18	U		--			--		
PCB-aroclor 1232	--	--	--	8.7	U		8.9	U		9	U		8.4	U		8.8	U		8.6	U		8.8	U		--			--		
PCB-aroclor 1242	--	--	--	8.7	U		8.9	U		9	U		8.4	U		8.8	U		8.6	U		8.8	U		--			--		
PCB-aroclor 1248	--	--	--	8.7	U		8.9	U		9	U		8.4	U		8.8	U		8.6	U		8.8	U		--			--		
PCB-aroclor 1254	--	--	--	8.7	U		8.9	U		9	U		8.4	U		8.8	U		8.6	U		8.8	U		--			--		
PCB-aroclor 1260	--	--	--	8.7	U		8.9	U		9	U		8.4	U		8.8	U		8.6	U		8.8	U		--			--		
Total PCBs[d]	130	3100	--	18	U		18	U		18	U		17	U		18	U		18	U		18	U		--			--		
Total PCBs (OC)	--	--	38	0.804	U		0.874	U		0.918	U		0.776	U		0.706	U		0.968	U		0.811	U		--			--		
Pesticides (ug/kg)																														
Heptachlor[g]	1.5	270	--	0.25	U		0.25	U		0.25	U		0.25	U		0.25	U		0.25	U		0.25	U		--			--		
Aldrin	9.5	--	--	4.4	U		4.5	U		4.5	U		4.2	U		4.4	U		4.3	U		4.4	U		--			--		
Dieldrin[g]	1.9	1700	--	0.4	U		0.4	U		0.4	U		0.4	U		0.4	U		0.4	U		0.4	U		--			--		
4,4'-DDE	9	--	--	4.4	U		0.11	T		0.086	T		0.14	T		0.096	T		0.087	T		0.097	T		--			--		
4,4'-DDD	16	--	--	4.4	U		4.5	U		4.5	U		4.2	U		4.4	U		4.3	U		4.4	U		--			--		
4,4'-DDT	12	--	--	4.4	U		0.093	T		4.5	U		0.099	T		4.4	U		4.3	U		4.4	U		--			--		
Total DDT[e]	--	69	50	4.4	U		0.203	T		0.086	T		0.239	T		0.096	T		0.087	T		0.097	T		--			--		
gamma-Chlordane	--	--	--	0.88	U		0.89	U		0.9	U		0.84	U		0.091	JP		0.87	U		0.09	JP		--			--		
cis-Chlordane	--	--	--	0.88	U		0.89	U		0.9	U		0.84	U		0.11	J		0.87	U		0.09	J		--			--		
cis-Nonachlor	--	--	--	0.88	U		0.89	U		0.9	U		0.84	U		0.89	U		0.87	U		0.88	U		--			--		
trans-Nonachlor	--	--	--	0.88	U		0.89	U		0.9	U		0.84	U		0.89	U		0.87	U		0.88	U		--			--		
Oxychlordane	--	--	--	0.88	U		0.89	U		0.9	U		0.84	U		0.89	U		0.87	U		0.88	U		--			--		
Total Chlordane[f]	2.8	--	37	0.88	U		0.89	U		0.9	U		0.84	U		0.201	J		0.87	U		0.18	J		--			--		

Notes: LQ: laboratory qualifier **VQ**: validation qualifier **SL**: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT

* analyzed after expiration of the holding time

U the analyte was analyzed for, but not detected

i the LOQ is elevated due to chromatographic interference

T the result is detected above the method detection limit, but below the limit of quantitation

J the result is estimated

P RPD difference greater than 40% between the two column results

--not targeted for analysis

a. sum of silt and clay fractions

b. sum of detected values of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene

c. sum of detected values of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(ghi)perylene

d. sum of detected PCB Aroclors

e. sum of 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT

f. sum of gamma-chlordane, cis-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane

g. non-detect results reported at the method detection limit

Table 12. Subarea A Chemistry and Conventionals Results (cont.)

				LBA-C 11/29/16	LQ	VQ	AMA3-C 11/29/16	LQ	VQ	LBAZ-U-Z 11/29/16	LQ	VQ	TB-C 12/30/16	LQ	VQ	TBS1-C 12/30/16	LQ	VQ	TBS2-C 12/30/16	LQ	VQ	TBAM-C 12/30/16	LQ	VQ	TBZ-U-Z 12/30/16	LQ	VQ
Conventionals																											
Total Solids (%)	--	--	--	53.4			54			53.2			55.2			56.8			56.4			57.2			59.1		
Total Organic Carbon (%)	--	--	--	2.61			2.33			2.28			2.53			2.15			2.25			2.11			2.05		
Sulfides (mg/kg)	--	--	--	157			530			1350			690			1570			1050			1230			--		
Ammonia (mg/kg)	--	--	--	53.2			88.3			--			36.3			68.5			91.4			101			--		
Total Volatile Solids (%)	--	--	--	6.9			6.5			6.7	*		6.7			6			6			5.8			5.6		
Grain Size (%)																											
Gravel	--	--	--	0.19			1.62			0.62			0			0			0.24			0			0		
Sand	--	--	--	5.29			5.01			2.99			0.36			0.95			0.84			0.15			0.54		
Silt	--	--	--	79.18			79.81			80.02			78.27			79.29			80.96			77.96			76.73		
Clay	--	--	--	15.52			13.48			16.47			19.22			17.23			18.21			20.08			19.22		
Percent Fines[a]	--	--	--	94.7			93.29			96.49			97.49			96.52			99.17			98.04			95.95		
Metals (mg/kg)																											
Antimony	150	200	--	1.1	T		0.8	T		--			5.1	U		1	T		4.3	U		0.5	T		--		
Arsenic	57	700	507.1	9.4			9.5			--			9.8			9.2			9.6			10.6			--		
Cadmium	5.1	14	11.3	0.25	T		0.16	T		--			0.26	U		0.12	T		0.04	T		0.05	T		--		
Chromium	260	--	--	69.1			67.4			--			59.3			61.7			65.1			66.4			--		
Copper	390	1300	--	54			51.2			--			45.4			43.9			44.9			46.4			--		
Lead	450	1200	975	11.2			10			--			8.6			7.3			7.7			8.1			--		
Mercury	0.41	2.3	1.5	0.099			0.079			--			0.072			0.068			0.068			0.072			--		
Selenium	--	--	3	0.56			0.52			--			0.49			0.43			0.44			0.47			--		
Silver	6.1	8.4	--	1.4	U		1.2	U		--			1	U		0.92	U		0.86	U		0.93	U		--		
Zinc	410	3800	--	110			102			--			80			80.8			81.9			83.3			--		
Polycyclic Aromatic Hydrocarbons (ug/kg)																											
Naphthalene	2100	2400	--	15			15			--			5.2	T		5.2	T		7.4	T		4.6	T		--		
Acenaphthylene	560	1300	--	5.3	T		6.3	T		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Acenaphthene	500	2000	--	11			21			--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Fluorene	540	3600	--	21			23			--			3.5	T		3.4	T		4.6	T		8.7	U		--		
Phenanthrene	1500	21000	--	47			67			--			16			12			17			14			--		
Anthracene	960	13000	--	22			30			--			9.1	U		5.8	T		8.9	U		8.7	U		--		
2-Methylnaphthalene	670	1900	--	19			18			--			8.6	T		8.4	T		11			6.9	T		--		
Total LPAH[b]	5200	29000	--	121.3			162.3			--			24.7			26.4			29			18.6			--		
Fluoranthene	1700	30000	4600	140			290			--			26			18			22			32			--		
Pyrene	2600	16000	11980	130			200			--			16			12			14			19			--		
Benzo(a)anthracene	1300	5100	--	67			110			--			5.6	T		5.6	T		5.7	T		6	T		--		
Chrysene	1400	21000	--	91			130			--			11			19			11			18			--		
Benzo(b)fluoranthene	--	--	--	84			120			--			11			11			13			13			--		
Benzo(k)fluoranthene	--	--	--	29			41			--			9.1	U		8.8	U		8.9	U		4.3	T		--		
Benzofluoranthene	3200	9900	--	113			161			--			11			11			13			17.3			--		
Benzo(a)pyrene	1600	3600	--	44			60			--			4.1	T		5.1	T		5.4	T		5.3	T		--		
Indeno(1,2,3-cd)pyrene	600	4400	--	34			39			--			4.4	T		4.7	T		4.8	T		5	T		--		
Dibenzo(a,h)anthracene	230	1900	--	8.2	T		9.4	T		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Benzo(ghi)perylene	670	3200	--	31			36			--			5.2	T		5.7	T		6	T		5.7	T		--		
Total HPAH[c]	12000	69000	--	658.2			1035.4			--			83.3			81.1			81.9			108.3			--		
Phenols (ug/kg)																											
2,4-Dimethylphenol[g]	29	210	--	6.7	U		6.5	U		--			6.3	U		6.3	U		6.3	U		6.3	U		--		
2-Methylphenol	63	77	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
4-Methylphenol	670	3600	--	16			58			--			22			8.2	T		9.3			6.6	T		--		
Pentachlorophenol	400	690	504	110	U		110	U		--			91	U		88	U		89	U		87	U		--		
Phenol	420	1200	--	30	T		27	T		--			76			92			60			60			--		
Phthalates (ug/kg)																											
Butylbenzylphthalate	63	970	--	11	T		11	U		--			10			6.3	T		7.8	T		5	T		--		
Di-N-Butylphthalate	1400	5100	--	11	T		11	T		--			8.4	T		9.5	T		9	T		6.9	T		--		

Table 12. Subarea A Chemistry and Conventionals Results (cont.)

				LBA-C			AMA3-C			LBAZ-U-Z			TB-C			TBS1-C			TBS2-C			TBAM-C			TBZ-U-Z		
				11/29/16	LQ	VQ	11/29/16	LQ	VQ	11/29/16	LQ	VQ	12/30/16	LQ	VQ	12/30/16	LQ	VQ	12/30/16	LQ	VQ	12/30/16	LQ	VQ	12/30/16	LQ	VQ
Di-N-Octyl Phthalate	6200	6200	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Diethylphthalate	200	1200	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Dimethylphthalate	71	1400	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Bis(2-Ethylhexyl) Phthalate	1300	8300	--	38	T		29	T		--			9.4	T		11	T		9	T		87	U		--		
Other Semi-volatile Organic Compounds (ug/kg)																											
Dibenzofuran	540	1700	--	21			23			--			9.1	U		8.8	U		3.6	T		8.7	U		--		
Benzoic Acid	650	760	--	220	U	UJ	210	U	UJ	--			200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	--		
Benzyl Alcohol	57	870	--	11	T		7.9	T		--			10	T		7.9	T		7.6	T		6.1	T		--		
1,2-Dichlorobenzene	35	110	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
1,4-Dichlorobenzene	110	120	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Hexachlorobenzene	22	230	168	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Hexachlorobutadiene	11	270	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
N-Nitrosodiphenylamine	28	130	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
1,2,4-Trichlorobenzene	31	64	--	11	U		11	U		--			9.1	U		8.8	U		8.9	U		8.7	U		--		
Polychlorinated Biphenyl Aroclors (ug/kg)																											
PCB-aroclor 1016	--	--	--	11	U		11	U		--			9	U		8.8	U		8.9	U		8.7	U		--		
PCB-aroclor 1221	--	--	--	21	U		21	U		--			18	U		18	U		18	U		18	U		--		
PCB-aroclor 1232	--	--	--	11	U		11	U		--			9	U		8.8	U		8.9	U		8.7	U		--		
PCB-aroclor 1242	--	--	--	11	U		11	U		--			9	U		8.8	U		8.9	U		8.7	U		--		
PCB-aroclor 1248	--	--	--	11	U		11	U		--			9	U		8.8	U		8.9	U		8.7	U		--		
PCB-aroclor 1254	--	--	--	11	U		11	U		--			9	U		8.8	U		8.9	U		8.7	U		--		
PCB-aroclor 1260	--	--	--	11	U		11	U		--			9	U		8.8	U		8.9	U		8.7	U		--		
Total PCBs[d]	130	3100	--	21	U		21	U		--			18	U		18	U		18	U		18	U		--		
Total PCBs (OC)	--	--	38	0.805	U		0.901	U		--			0.711	U		0.837	U		0.8	U		0.853	U		--		
Pesticides (ug/kg)																											
Heptachlor[g]	1.5	270	--	0.27	U		0.26	U		--			0.25	U		0.25	U		0.25	U		0.25	U		--		
Aldrin	9.5	--	--	5.3	Ui		5.2	U		--			4.5	U		4.4	U		4.5	U		4.4	U		--		
Dieldrin[g]	1.9	1700	--	0.42	Ui		0.41	U		--			0.4	U		0.4	U		0.4	U		0.4	U		--		
4,4'-DDE	9	--	--	0.14	T		0.13	T		--			0.1	T		0.12	T		4.5	U		0.11	T		--		
4,4'-DDD	16	--	--	0.15	T		5.2	Ui		--			4.5	U		4.4	U		4.5	U		4.4	U		--		
4,4'-DDT	12	--	--	5.3	Ui		5.2	Ui		--			4.5	U		4.4	U		4.5	U		0.088	T		--		
Total DDT[e]	--	69	50	0.29	T		0.13	T		--			0.1	T		0.12	T		4.5	U		0.198	T		--		
gamma-Chlordane	--	--	--	0.12	JP		0.23	J		--			0.91	U		0.88	U		0.88	U		0.87	U		--		
cis-Chlordane	--	--	--	0.12	J		0.23	J		--			0.91	U		0.88	U		0.88	U		0.87	U		--		
cis-Nonachlor	--	--	--	1.1	U		1.1	U		--			0.91	U		0.88	U		0.88	U		0.87	U		--		
trans-Nonachlor	--	--	--	1.1	U		1.1	U		--			0.91	U		0.88	U		0.88	U		0.87	U		--		
Oxychlordane	--	--	--	1.1	U		1.1	U		--			0.91	U		0.88	U		0.88	U		0.87	U		--		
Total Chlordane[f]	2.8	--	37	0.24	J		0.46	J		--			0.91	U		0.88	U		0.88	U		0.87	U		--		

Notes: LQ: laboratory qualifier **VQ**: validation qualifier **SL**: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT

***** analyzed after expiration of the holding time

U the analyte was analyzed for, but not detected

i the LOQ is elevated due to chromatographic interference

T the result is detected above the method detection limit, but below the limit of quantitation

J the result is estimated

P RPD difference greater than 40% between the two column results

--not targeted for analysis

a. sum of silt and clay fractions

b. sum of detected values of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene

c. sum of detected values of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(ghi)perylene

d. sum of detected PCB Aroclors

e. sum of 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT

f. sum of gamma-chlordane, cis-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane

g. non-detect results reported at the method detection limit

Table 13. Subarea B Chemistry and Conventionals Results

				B1-C 12/1/16	LQ	VQ	B2-C 12/2/16	LQ	VQ	B3-C 12/1/16	LQ	VQ	BS1-C 12/2/16	LQ	VQ	BS2-C 12/2/16	LQ	VQ	BS3-C 12/2/16	LQ	VQ	BS4-C 12/2/16	LQ	VQ	AMB1-C 12/2/16	LQ	VQ	BZ-U-Z 12/2/16	LQ	VQ	LBB-C 12/1/16	LQ	VQ
Conventionals																																	
Total Solids	--	--	--	57.9			91.6			81.5			80.4			85.7			62.9			79.5			68.1			73.3			68.9		
Total Organic Carbon	--	--	--	3.48			2.64			7.15			3.84			2.64			5.53			4.93			5.93			2.17			5.56		
Sulfides	--	--	--	1320			67			390			240			55			1300			470			840			--			480		
Ammonia	--	--	--	24.7			0.78			4.07			14.5			2.73			85.8			34.5			63.6			--			15		
Total Volatile Solids	--	--	--	7.6	*		4.2	*		13.1	*	J	8.8	*		7.8	*		10.8	*		9	*		9.1	*		7.8	*		10.9	*	
Grain Size (%)																																	
Gravel	--	--	--	25.06			38.45			22.89			32.45			25.44			17.9			27.15			9.78			23.34			29.77		
Sand	--	--	--	28.14			52.21			68.63			51.76			70.26			27.24			42.44			36.67			17.69			47.71		
Silt	--	--	--	55.97			2.45			4.61			8.58			2.18			12.93			17.04			31.92			31.67			16.65		
Clay	--	--	--	12.21			2.05			2.66			5.41			1.65			18.34			12.62			21.31			29.67			5.76		
Percent Fines[a]	--	--	--	68.18			4.5			7.27			13.99			3.83			31.27			29.66			53.23			61.34			22.41		
Metals (mg/kg)																																	
Antimony	150	200	--	0.9	J		3.5	U		4.2	U		4.9	U		4.2	U		5.7	U		4.9	U		5.8	U		--			5.1	U	
Arsenic	57	700	507.1	7.6			4.4			5.9			3.8	J		3.2	J		5.9			5			8.8			--			5	J	
Cadmium	5.1	14	11.3	0.32	U		0.17	U		0.04	J		0.07	J		0.21	U		0.29	U		0.25	U		0.29	U		--			0.25	U	
Chromium	260	--	--	47			17.7			27.5			27.1			26.2			51.9			48.1			46.9			--			37.1		
Copper	390	1300	--	36.8			25.3			42.9			33.6			27.2			48.5			43.6			64.4			--			34.9		
Lead	450	1200	975	8.2			5.7			11.4			8.7			5.8			20.7			19.5			17.4			--			8.8		
Mercury	0.41	2.3	1.5	0.062			0.02	J		0.035			0.047			0.032			0.296			0.099			0.159			--			0.059		
Selenium	--	--	3	0.33			0.065	J		0.084	J		0.15			0.17			0.34			0.2			0.34			--			0.19		
Silver	6.1	8.4	--	1.3	U		0.69	U		0.85	U		0.98	U		0.84	U		0.3	J		0.98	U		1.2	U		--			1	U	
Zinc	410	3800	--	79.4			58.2			77.8			59.1			51.7			88.7			65.9			78.9			--			61		
PAH (ug/kg)																																	
Naphthalene	2100	2400	--	6.2	J		12			38			29			20			31			390			2000			--			21		
Acenaphthylene	560	1300	--	8.4	U		6	U		6.1	U		6.3	U		6	U		9.6			18			17			--			7.3	U	
Acenaphthene	500	2000	--	3.3	J		6	U		6.5			5.7	J		3.3	J		12			68			590			--			16		
Fluorene	540	3600	--	7.4	J		6	U		6.1	U		11			5.4	J		24			73			600			--			20		
Phenanthrene	1500	21000	--	26			10			28			35			17			61			240			2600			--			65		
Anthracene	960	13000	--	10			3.5	J		10			18			6.3			41			65			510			--			16		
2-Methylnaphthalene	670	1900	--	9.2			23			68			47			38			36			120			240			--			28		
Total LPAH[b]	5200	29000	--	52.9			25.5			82.5			98.7			52			178.6			854			6317			--			138		
Fluoranthene	1700	30000	4600	61			14			85			100			20			210			330			2000			--			110		
Pyrene	2600	16000	11980	55			14			84			88			21			230			300			1000			--			89		
Benzo(a)anthracene	1300	5100	--	35			5.4	J		23			30			6.5			70			120			280			--			38		
Chrysene	1400	21000	--	53			7.4			41			42			7.7			100			150			330			--			56		
Benzo(b)fluoranthene	--	--	--	46			7.7			38			49			7.6			100			160			190			--			56		
Benzo(k)fluoranthene	--	--	--	16			6	U		14			16			6	U		37			57			68			--			21		
Benzofluoranthene	3200	9900	--	62			7.7			52			65			7.6			137			217			258			--			77		
Benzo(a)pyrene	1600	3600	--	28			4.5	J		17			30			4.2	J		63			110			120			--			36		
Indeno(1,2,3-cd)pyrene	600	4400	--	14			6	U		5.4	J		11			6	U		12			39			35			--			22		
Dibenzo(a,h)anthracene	230	1900	--	3.1	J		6	U		6.1	U		3.3	J		6	U		7.3	U		9.9			9.7			--			5	J	
Benzo(ghi)perylene	670	3200	--	11			6	U		4.9	J		7.8			6	U		8.5			25			22			--			20		
Total HPAH[c]	12000	69000	--	322.1			53			312.3			377.1			67			830.5			1300.9			4054.7			--			453		
Phenols (ug/kg)																																	
2,4-Dimethylphenol[g]	29	210	--	6.3	U		6.3	U		6.3	U		6.3	U		6.3	U		6.3	U		19	J		23	J		--			6.3	U	
2-Methylphenol	63	77	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		5.7	J		7.3	U		--			7.3	U	
4-Methylphenol	670	3600	--	7.5	J		6	U		7.9			5.8	J		6	U		22			13			9.6			--			7.3	U	
Pentachlorophenol	400	690	504	84	U		55	U		61	U		19	J		59	U		34	J		63	U		29	J		--			73	U	
Phenol	420	1200	--	12	J		17	U		19	U		19	U		18	U		26			5	J		19	J		--			22	U	
Phthalates (ug/kg)																																	
Butylbenzylphthalate	63	970	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			33		
Di-N-Butylphthalate	1400	5100	--	9.9	J		5	J		7.6	J		6.8	J		5.1	J		10	J		20			16			--			6.2	J	
Di-N-Octyl Phthalate	6200	6200	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
Diethylphthalate	200	1200	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	

Table 3-4. Subarea B Chemistry and Conventionals Results (cont.)

				B1-C 12/1/16	LQ	VQ	B2-C 12/2/16	LQ	VQ	B3-C 12/1/16	LQ	VQ	BS1-C 12/2/16	LQ	VQ	BS2-C 12/2/16	LQ	VQ	BS3-C 12/2/16	LQ	VQ	BS4-C 12/2/16	LQ	VQ	AMB1-C 12/2/16	LQ	VQ	BZ-U-Z 12/2/16	LQ	VQ	LBB-C 12/1/16	LQ	VQ
Dimethylphthalate	71	1400	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
Bis(2-Ethylhexyl) Phthalate	1300	8300	--	52	J		18	J		370			49	J		55	J		110			22	J		21	J		--			67	J	
Other SVOC (ug/kg)																																	
Dibenzofuran	540	1700	--	7.3	J		16			45			34			26			30			81			500			--			29		
Benzoic Acid	650	760	--	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	--			200	U	UJ
Benzyl Alcohol	57	870	--	9.6	J		11	U		13	U		13	U		12	U		15	U		13	U		15	U		--			5	J	
1,2-Dichlorobenzene	35	110	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
1,4-Dichlorobenzene	110	120	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
Hexachlorobenzene	22	230	168	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
Hexachlorobutadiene	11	270	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
N-Nitrosodiphenylamine	28	130	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
1,2,4-Trichlorobenzene	31	64	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
PCB Aroclors (ug/kg)																																	
PCB-aroclor 1016	--	--	--	8.4	U		5.5	U		6.1	U		6.2	U		5.9	U		7.3	U		6.3	U		7.4	U		--			7.3	U	
PCB-aroclor 1221	--	--	--	17	U		11	U		13	U		13	U		12	U		15	U		13	U		15	U		--			15	U	
PCB-aroclor 1232	--	--	--	8.4	U		5.5	U		6.1	U		6.2	U		5.9	U		7.3	U		6.3	U		7.4	U		--			7.3	U	
PCB-aroclor 1242	--	--	--	8.4	U		5.5	U		6.1	U		6.2	U		5.9	U		22	Ui		6.4	P		28	P		--			7.3	U	
PCB-aroclor 1248	--	--	--	8.4	U		5.5	U		6.1	U		6.2	U		5.9	U		7.3	U		6.3	U		7.4	U		--			7.3	U	
PCB-aroclor 1254	--	--	--	8.4	U		5.5	U		3.6	J		10			3	J		32			6.9			10			--			3.3	JP	
PCB-aroclor 1260	--	--	--	8.4	U		5.5	U		6.1	U		6.2	U		5.9	U		8.9			3.5	J		4.5	J		--			7.3	U	
Total PCBs[d]	130	3100	--	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
Total PCBs (OC)	--	--	38	8.4	U		6	U		6.1	U		6.3	U		6	U		7.3	U		6.3	U		7.3	U		--			7.3	U	
Pesticides (ug/kg)																																	
Heptachlor[g]	1.5	270	--	0.25	Ui		0.25	U		0.25	U		0.25	U		0.25	U		0.25	U		0.25	U		0.25	U		--			0.25	Ui	
Aldrin	9.5	--	--	4.2	Ui		2.8	U		3.1	Ui		3.1	U		3	U		3.7	Ui		3.2	Ui		3.7	Ui		--			3.7	U	
Dieldrin[g]	1.9	1700	--	1.6	Ui		0.4	U		0.4	Ui		0.55	Ui		0.4	Ui		1.7	Ui		0.4	Ui		0.41	Ui		--			0.7	Ui	
4,4'-DDE	9	--	--	0.13	J		2.8	U		0.52	J		0.14	JP		0.097	J		0.96	JP		3.2	Ui		3.7	U		--			0.18	JP	
4,4'-DDD	16	--	--	4.2	Ui		2.8	U		1	J		0.28	JP		3	U		1.6	J		0.38	J		0.74	J		--			3.7	U	
4,4'-DDT	12	--	--	4.2	Ui		2.8	Ui		3.1	Ui		3.1	Ui		0.27	JP		3.7	Ui		3.2	Ui		3.7	Ui		--			3.7	Ui	
Total DDT[e]	--	69	50	0.13	J		2.8	U		1.52	J		0.42	JP		0.367	J		2.56	J		0.38	J		0.74	J		--			0.18	JP	
gamma-Chlordane	--	--	--	0.17	JP		0.55	U		0.16	JP		0.18	JP		0.079	JP		0.79	Ui		0.63	U		0.74	Ui		--			0.29	JP	
cis-Chlordane	--	--	--	0.24	J		0.55	U		0.19	J		0.21	J		0.087	J		0.79	Ui		0.63	U		0.74	U		--			0.35	J	
cis-Nonachlor	--	--	--	0.87	U		0.68	U		0.68	U		0.68	U		0.68	U		2.5			0.68	U		0.56	JP		--			0.72	U	
trans-Nonachlor	--	--	--	0.87	U		0.68	U		0.68	U		0.68	U		0.68	U		0.88	Ui		0.68	U		0.74	U		--			0.72	U	
Oxychlordane	--	--	--	0.87	U		0.68	U		0.68	U		0.68	U		0.68	U		0.79	U		0.68	U		0.74	U		--			0.72	U	
Total Chlordane[f]	2.8	--	37	0.41	J		0.68	U		0.35	J		0.39	J		0.166	J		2.5			0.68	U		0.56	J		--			0.64	J	

Notes:

LQ: laboratory qualifier **VQ**: validation qualifier **SL**: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT

* analyzed after expiration of the holding time

U the analyte was analyzed for, but not detected

i the LOQ is elevated due to chromatographic interference

T the result is detected above the method detection limit, but below the limit of quantitation

J the result is estimated

P RPD difference greater than 40% between the two column results

--not targeted for analysis

a. sum of silt and clay fractions

b. sum of detected values of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene

c. sum of detected values of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(ghi)perylene

d. sum of detected PCB Aroclors

e. sum of 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT

f. sum of gamma-chlordane, cis-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane

g. non-detect results reported at the method detection limit

Table 13. Subarea B Chemistry and Conventionals Results (cont.)

				LBBS1-C 12/1/16	LQ	VQ	LBBS2-C 11/30/16	LQ	VQ	AMB2-C 11/30/16	LQ	VQ	LBBZ-U-Z 11/30/16	LQ	VQ	RB1-C 11/30/16	LQ	VQ	RB2-C 12/2/16	LQ	VQ	RBS1-C 12/2/16	LQ	VQ	RBS2-C 12/2/16	LQ	VQ	RBZ-U-Z 12/2/16	LQ	VQ
Conventionals																														
Total Solids	--	--	--	76.8			79.6			81.8			83.1			57.8			55.5			56.5			58.2			58.1		
Total Organic Carbon	--	--	--	12.5			7.64			4.53			10.8			2.62			2.98			2.6			2.99			6.42		
Sulfides	--	--	--	640			450			560	J		--			1410			1840			990			2.4			--		
Ammonia	--	--	--	15.5			16.9	*		13			--			35.6			37.6			61.8			61.4			--		
Total Volatile Solids	--	--	--	13	*		8.2	*		6.6	*		13	*		6.7			7.7	*		7.4	*		7.9	*		11.8	*	
Grain Size (%)																														
Gravel	--	--	--	18.52			33			4.87			9.87			0.1			0.46			0.12			0.1			0.25		
Sand	--	--	--	66.28			43.09			88.64			81.52			3.91			8.03			3.67			8			7.59		
Silt	--	--	--	8.36			15.84			3.44			4.91			76			73.45			71.38			62.05			60.12		
Clay	--	--	--	4.59			8.5			1.76			3.14			20.77			16.32			24.77			31.08			32.18		
Percent Fines[a]	--	--	--	12.95			24.34			5.2			8.05			96.77			89.77			96.15			93.13			92.3		
Metals (mg/kg)																														
Antimony	150	200	--	4.4	U		1.2	J		0.6	J		--			35.8			6.6	U		1	J		6.6	U		1.5	J	
Arsenic	57	700	507.1	4	J		4.4	J		3.1	J		--			11.2			9.1			11.8			10.6			10.4		
Cadmium	5.1	14	11.3	0.07	J		0.1	J		0.07	J		--			0.37	U		0.33	U		0.32	U		0.33	U		0.34	U	
Chromium	260	--	--	30.6			36.5			24.7			--			75.9			64.6			77.5			71.7			61.8		
Copper	390	1300	--	25.9			40.1			24			--			54.5			48.5			57.3			60.4			65.1		
Lead	450	1200	975	10.4			12.8			4.7			--			12.6			12.7			15.6			36.2			33		
Mercury	0.41	2.3	1.5	0.064			0.07			0.053			--			0.088			0.084			0.143			0.319			0.531		
Selenium	--	--	3	0.14			0.18			0.276			--			0.56			0.43			0.54			0.37			0.48		
Silver	6.1	8.4	--	0.88	U		0.96	U		0.95	U		--			1.5	U		1.3	U		1.3	U		1.3	U		1.3	U	
Zinc	410	3800	--	58.2			54.9			51.9			--			117			103			116			115			98.3		
PAH (ug/kg)																														
Naphthalene	2100	2400	--	43			120			63			--			83		J	18			9.6			11			--		
Acenaphthylene	560	1300	--	6.5	U		6.3	U		6.1	U		--			43		J	3.5	J		7.7	J		5.4	J		--		
Acenaphthene	500	2000	--	18			54			19			--			13		J	5.8	J		5.4	J		3.6	J		--		
Fluorene	540	3600	--	22			48			19			--			26		J	11			24			8.1	J		--		
Phenanthrene	1500	21000	--	60			100			41			--			230		J	40			100			29			--		
Anthracene	960	13000	--	21			41			14			--			76		J	14		J	100			16			--		
2-Methylnaphthalene	670	1900	--	47			97			48			--			31		J	12			9.9			13			--		
Total LPAH[b]	5200	29000	--	164			363			156			--			471		J	92.3			246.7			73.1			--		
Fluoranthene	1700	30000	4600	130			120			76			--			280		J	110		J	1200	D		60			--		
Pyrene	2600	16000	11980	120			310			65			--			230		J	110		J	840			95			--		
Benzo(a)anthracene	1300	5100	--	44			43			19			--			69		J	39		J	450			31			--		
Chrysene	1400	21000	--	60			75			29			--			110		J	65		J	580			54			--		
Benzo(b)fluoranthene	--	--	--	67			66			28			--			89		J	72		J	390			53			--		
Benzo(k)fluoranthene	--	--	--	24			26			10			--			30		J	26		J	130			20			--		
Benzofluoranthene	3200	9900	--	91			92			38			--			119		J	98		J	520			73			--		
Benzo(a)pyrene	1600	3600	--	39			42			16			--			41		J	39		J	180			31			--		
Indeno(1,2,3-cd)pyrene	600	4400	--	23			21			12			--			28		J	21			52			14			--		
Dibenzo(a,h)anthracene	230	1900	--	5.8	J		5.2	J		6.1	U		--			6.6	J		5.3	J		18			4.1	J		--		
Benzo(ghi)perylene	670	3200	--	20			19			11			--			27		J	16			32			11			--		
Total HPAH[c]	12000	69000	--	532.8			727.2			266			--			910.6		J	503.3			3872			373.1			--		
Phenols (ug/kg)																														
2,4-Dimethylphenol[g]	29	210	--	6.3	U		22	J		11	J		--			6.3	U	UJ	6.3	U		6.3	U		6.3	U		--		
2-Methylphenol	63	77	--	6.5	U		5.5	J		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		
4-Methylphenol	670	3600	--	5.8	J		18			8.5			--			830		J	8.8	J		6.1	J		6.6	J		--		
Pentachlorophenol	400	690	504	65	U		28	J		61	U		--			99	U	UJ	90	U		89	U		86	U		--		
Phenol	420	1200	--	13	J		12	J		4.6	J		--			410		J	63			110			110			--		
Phthalates (ug/kg)																														
Butylbenzylphthalate	63	970	--	6.5	U		6.3	U		6.1	U		--			12		J	9	U	UJ	8.9	U		8.6	U		--		
Di-N-Butylphthalate	1400	5100	--	11	J		9.5	J		6	J		--			13	J		11	J		7.5	J		23			--		
Di-N-Octyl Phthalate	6200	6200	--	6.5	U		6.3	U		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		

Table 3-4. Subarea B Chemistry and Conventionals Results (cont.)

				LBBS1-C 12/1/16	LQ	VQ	LBBS2-C 11/30/16	LQ	VQ	AMB2-C 11/30/16	LQ	VQ	LBBZ-U-Z 11/30/16	LQ	VQ	RB1-C 11/30/16	LQ	VQ	RB2-C 12/2/16	LQ	VQ	RBS1-C 12/2/16	LQ	VQ	RBS2-C 12/2/16	LQ	VQ	RBZ-U-Z 12/2/16	LQ	VQ
Diethylphthalate	200	1200	--	6.5	U		6.3	U		6.1	U		--			9.1	J		9	U		8.9	U		8.6	U		--		
Dimethylphthalate	71	1400	--	6.5	U		6.3	U		6.1	U		--			4.6	J		9	U		4.1	J		5.9	J		--		
Bis(2-Ethylhexyl) Phthalate	1300	8300	--	100			24	J		15	J		--			75	J		95		J	58	J		33	J		--		
Other SVOC (ug/kg)																														
Dibenzofuran	540	1700	--	40			83			36			--			39		J	12			9.6			9.1			--		
Benzoic Acid	650	760	--	200	U	UJ	200	U	UJ	200	U	UJ	--			200	U	UJ	200	U	UJ	200	U	UJ	200	U	UJ	--		
Benzyl Alcohol	57	870	--	24			13	U		13	U		--			7.7	J		6.6	J		18	U		18	U		--		
1,2-Dichlorobenzene	35	110	--	6.5	U		6.3	U		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		
1,4-Dichlorobenzene	110	120	--	6.5	U		6.3	U		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		
Hexachlorobenzene	22	230	168	6.5	U		6.3	U		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		
Hexachlorobutadiene	11	270	--	6.5	U		6.3	U		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		
N-Nitrosodiphenylamine	28	130	--	6.5	U		6.3	U		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		
1,2,4-Trichlorobenzene	31	64	--	6.5	U		6.3	U		6.1	U		--			9.9	U	UJ	9	U		8.9	U		8.6	U		--		
PCB Aroclors (ug/kg)																														
PCB-aroclor 1016	--	--	--	6.5	U		6.3	U		6.1	U		--			9.8	U		9	U		8.8	Ui		8.6	U		--		
PCB-aroclor 1221	--	--	--	13	U		13	U		13	U		--			20	U		18	U		18	U		18	U		--		
PCB-aroclor 1232	--	--	--	6.5	U		6.3	U		6.1	U		--			9.8	U		9	U		8.8	Ui		8.6	U		--		
PCB-aroclor 1242	--	--	--	6.5	U		42			6.1	U		--			9.8	U		9	U		8.8	Ui		8.6	Ui		--		
PCB-aroclor 1248	--	--	--	6.5	U		6.3	U		6.1	U		--			9.8	U		9	U		8.8	Ui		8.6	U		--		
PCB-aroclor 1254	--	--	--	3.2	JP		16			6.1	U		--			2.6	J		9	U		8.8	Ui		18			--		
PCB-aroclor 1260	--	--	--	6.5	U		4.8	J		6.1	U		--			9.8	U		9	U		74			13			--		
Total PCBs[d]	130	3100	--	3.2	JP		62.8			13	U		--			2.6	J		18	U		74			31			--		
Total PCBs (OC)	--	--	38	0.026			0.822			0.287	U		--			0.099	J		0.604	U		2.85			1.04			--		
Pesticides (ug/kg)																														
Heptachlor[g]	1.5	270	--	0.25	U		0.25	U		0.25	U		--			0.25	U	UJ	0.25	U		0.25	U		0.25	U		--		
Aldrin	9.5	--	--	3.3	Ui		3.2	Ui		3.1	U		--			4.9	U	UJ	4.5	U		4.4	U		4.3	U		--		
Dieldrin[g]	1.9	1700	--	0.4	U		0.84	J		0.4	Ui		--			0.4	Ui	UJ	0.36	JP		0.4	U		0.4	U		--		
4,4'-DDE	9	--	--	0.31	JP		3.2	Ui		0.094	JP		--			0.22	J		4.5	Ui		4.4	Ui		4.3	U		--		
4,4'-DDD	16	--	--	0.44	J		0.91	J		3.1	Ui		--			0.15	JP		4.5	Ui		0.4	JP		0.79	J		--		
4,4'-DDT	12	--	--	3.3	Ui		3.2	Ui		3.1	Ui		--			4.9	U	UJ	4.5	U		4.4	Ui		4.3	Ui		--		
Total DDT[e]	--	69	50	0.75	J		0.91	J		0.094	J		--			0.37	J		4.5	U		0.4	JP		0.79	J		--		
gamma-Chlordane	--	--	--	0.55	JP		0.63	Ui		0.15	J		--			0.87	U		0.13	JP		0.89	Ui		0.86	Ui		--		
cis-Chlordane	--	--	--	0.5	J		0.63	U		0.082	J		--			0.11	J		0.17	J		0.89	Ui		0.86	Ui		--		
cis-Nonachlor	--	--	--	0.67	J		0.91			0.68	U		--			0.87	U		0.9	U		0.89	Ui		1.5			--		
trans-Nonachlor	--	--	--	0.68	U		0.68	U		0.68	U		--			0.87	U		0.9	U		0.89	U		0.86	U		--		
Oxychlordane	--	--	--	0.68	U		0.68	U		0.68	U		--			0.87	U		0.9	U		0.89	U		0.86	U		--		
Total Chlordane[f]	2.8	--	37	1.72	J		0.91			0.232	J		--			0.11	J		0.9	J		0.89	U		1.5			--		

Notes:
LQ: laboratory qualifier **VQ**: validation qualifier **SL**: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT
* analyzed after expiration of the holding time
U the analyte was analyzed for, but not detected
i the LOQ is elevated due to chromatographic interference
T the result is detected above the method detection limit, but below the limit of quantitation
J the result is estimated
P RPD difference greater than 40% between the two column results
--not targeted for analysis
a. sum of silt and clay fractions
b. sum of detected values of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene
c. sum of detected values of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(ghi)perylene
d. sum of detected PCB Aroclors
e. sum of 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT
f. sum of gamma-chlordane, cis-chlordane, cis-nonachlor, trans-nonachlor, and oxychlordane
g. non-detect results reported at the method detection limit

Table 14. Subarea A Dioxin/Furan Congener Results

	TEF		A1-C			A2-C			A3-C			A4-C			A5-C			AMA1-C			AMA2-C			AZ1-U-Z			AZ2-U-Z		
	SL	BT	12/1/2016	LQ	VQ	12/30/2016	LQ	VQ	12/30/2016	LQ	VQ	12/1/2016	LQ	VQ	11/29/2016	LQ	VQ	12/30/2016	LQ	VQ	11/29/2016	LQ	VQ	12/30/2016	LQ	VQ	11/29/2016	LQ	VQ
Dioxin/Furan Concentration (ng/kg DW)																													
2,3,7,8-TCDD	1	--	0.156	U		0.138	U		0.137	U		0.151	U		0.242	U		0.161	U		0.266	U		0.134	U		0.374	U	
1,2,3,7,8-PeCDD	1	--	0.468	JK	U	0.217	JK	U	0.359			0.296	U	UJ	0.693	JK	U	0.339	JK	U	0.422	JK	U	0.485			0.475		
1,2,3,4,7,8-HxCDD	0.1	--	0.595	JK	U	0.494	JK	U	0.501	JK	U	0.448	JK	U	0.64	JK	U	0.423	JK	U	0.664			0.646			0.584	JK	U
1,2,3,6,7,8-HxCDD	0.1	--	1.57			1.54			1.68			1.31	JK	U	2.46	JK	U	1.56			2.71			1.73	JK	U	2.56		
1,2,3,7,8,9-HxCDD	0.1	--	1.02	JK	U	1.09			1.1			0.421	JK	U	1.31	JK	U	0.804			1.54			1.08			1.21		
1,2,3,4,6,7,8-HpCDD	0.01	--	32.9			56.1			34.7			44.1			57			37.8			60.7			42.1			54.4		
OCDD	0.0003	--	297			599			352			378			534			420			623			444			559		
2,3,7,8-TCDF	0.1	--	0.41			0.303			0.0928	U		0.092	U		0.129	U		0.077	U		0.286			0.563			0.203	U	
1,2,3,7,8-PeCDF	0.03	--	0.277	JK	U	0.263	JK	U	0.299			0.293	JK	UJ	0.432	JK	U	0.203	JK	U	0.306			0.267	JK	U	0.177	U	
2,3,4,7,8-PeCDF	0.3	--	0.52			0.425			0.541			0.568	U	UJ	0.195	U		0.437	JK	U	0.533			0.613			0.55	JK	U
1,2,3,4,7,8-HxCDF	0.1	--	0.565			0.456	JK	U	0.465	JK	U	0.262	JK	U	0.884	JK	U	0.723			0.776	JK	U	0.732			0.906		
1,2,3,6,7,8-HxCDF	0.1	--	0.318		U	0.291		U	0.347		U	0.216	JK	U	0.225	JK	U	0.326		U	0.421		U	0.328	JK	U	0.365		U
1,2,3,7,8,9-HxCDF	0.1	--	0.527			0.381			0.276	JK	U	0.428			0.38			0.263	JK	U	0.396			0.412	JK	U	0.433		
2,3,4,6,7,8-HxCDF	0.1	--	0.65			0.39			0.395	JK	U	0.208	U		0.341	JK	U	0.557			0.708			0.502	JK	U	0.517	JK	U
1,2,3,4,6,7,8-HpCDF	0.01	--	4.55	K	U	5.74			5.19			4.01	JK	U	8.45	K	U	5.54			8.33			5.95			7.55		J
1,2,3,4,7,8,9-HpCDF	0.01	--	0.519			0.549	JK	U	0.4	JK	U	0.373			0.298	JK	U	0.618			0.724			0.586	JK	U	0.527	JK	U
OCDF	0.0003	--	17.4			38.3			20.1			4.21	JK	U	31			21.9			33.2			24.2			29.5		
Dioxin/Furan 1/2 DL TEC (ng TEC/kg DW)																													
2,3,7,8-TCDD	1	--	0.078	U		0.069	U		0.0685	U		0.0755	U		0.121	U		0.0805	U		0.133	U		0.067	U		0.187	U	
1,2,3,7,8-PeCDD	1	--	0.234	JK	U	0.109	JK	U	0.359			0.148	U	UJ	0.347	JK	U	0.17	JK	U	0.211	JK	U	0.485			0.475		
1,2,3,4,7,8-HxCDD	0.1	--	0.0298	JK	U	0.0247	JK	U	0.0251	JK	U	0.0224	JK	U	0.032	JK	U	0.0212	JK	U	0.0664			0.0646			0.0292	JK	U
1,2,3,6,7,8-HxCDD	0.1	--	0.157			0.154			0.168			0.0655	JK	U	0.123	JK	U	0.156			0.271			0.0865	JK	U	0.256		
1,2,3,7,8,9-HxCDD	0.1	--	0.051	JK	U	0.109			0.11			0.0211	JK	U	0.0655	JK	U	0.0804			0.154			0.108			0.121		
1,2,3,4,6,7,8-HpCDD	0.01	--	0.329			0.561			0.347			0.441			0.57			0.378			0.607			0.421			0.544		
OCDD	0.0003	--	0.0891			0.18			0.106			0.113			0.16			0.126			0.187			0.133			0.168		
2,3,7,8-TCDF	0.1	--	0.041			0.0303			0.00464	U		0.0046	U		0.00645	U		0.00385	U		0.0286			0.0563			0.0102	U	
1,2,3,7,8-PeCDF	0.03	--	0.00416	JK	U	0.00395	JK	U	0.00897			0.0044	JK	UJ	0.00648	JK	U	0.00305	JK	U	0.00918			0.00401	JK	U	0.00266	U	
2,3,4,7,8-PeCDF	0.3	--	0.156			0.128			0.162			0.0852	U	UJ	0.0293	U		0.0656	JK	U	0.16			0.184			0.0825	JK	U
1,2,3,4,7,8-HxCDF	0.1	--	0.0565			0.0228	JK	U	0.0233	JK	U	0.0131	JK	U	0.0442	JK	U	0.0723			0.0388	JK	U	0.0732			0.0906		
1,2,3,6,7,8-HxCDF	0.1	--	0.0159		U	0.0146		U	0.0174		U	0.0108	JK	U	0.0113	JK	U	0.0163		U	0.0211		U	0.0164	JK	U	0.0183		U
1,2,3,7,8,9-HxCDF	0.1	--	0.0527			0.0381			0.0138	JK	U	0.0428			0.038			0.0132	JK	U	0.0396			0.0206	JK	U	0.0433		
2,3,4,6,7,8-HxCDF	0.1	--	0.065			0.039			0.0198	JK	U	0.0104	U		0.0171	JK	U	0.0557			0.0708			0.0251	JK	U	0.0259	JK	U
1,2,3,4,6,7,8-HpCDF	0.01	--	0.0228	K	U	0.0574			0.0519			0.0201	JK	U	0.0423	K	U	0.0554			0.0833			0.0595			0.0755		J
1,2,3,4,7,8,9-HpCDF	0.01	--	0.00519			0.00275	JK	U	0.002	JK	U	0.00373			0.00149	JK	U	0.00618			0.00724			0.00293	JK	U	0.00264	JK	U
OCDF	0.0003	--	0.00522			0.0115			0.00603			0.000632	JK	U	0.0093			0.00657			0.00996			0.00726			0.00885		
Dx/F TEQ (0 DL)	4	10	0.957			1.31			1.32			0.601			0.778			0.937			1.69			1.59			1.78		
Dx/F TEQ (1/2 DL)	4	10	1.39			1.56			1.49			1.08			1.62			1.31			2.1			1.81			2.14		

Notes:
LQ: laboratory qualifier **VQ**: validation qualifier **DW**: dry weight **DL**: detection limit
TEF: toxicity equivalent factor **TEC**: toxicity equivalent concentration **TEQ**: toxicity equivalents
SL: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT
U the analyte was analyzed for, but not detected
J the result is estimated
K estimated maximum potential concentration

Table 14. Subarea A Dioxin/Furan Congener Results (cont.)

			LBA-C			AMA3-C			LBAZ-U-Z			TB-C			TBS1-C			TBS2-C			TBAM-C			TBZ-U-Z		
			11/29/2016	LQ	VQ	11/29/2016	LQ	VQ	11/29/2016	LQ	VQ	12/30/2016	LQ	VQ	12/30/2016	LQ	VQ	12/30/2016	LQ	VQ	12/30/2016	LQ	VQ	12/30/2016	LQ	VQ
Dioxin/Furan Concentration (ng/kg DW)																										
2,3,7,8-TCDD	1	--	0.347	U		0.119	U		0.152	U		0.118	U		0.134	U		0.313	U		0.105	U		0.29	U	
1,2,3,7,8-PeCDD	1	--	0.82			0.317	U		1.03			0.294			0.339			0.364			0.335	JK	U	0.368		
1,2,3,4,7,8-HxCDD	0.1	--	0.822	JK	U	0.197	U		0.762	JK	U	0.632			0.349	JK	U	0.347	JK	U	0.543			0.407	JK	U
1,2,3,6,7,8-HxCDD	0.1	--	3.91			3.41			3.06	JK	U	1.58			1.46			1.59			1.34	JK	U	1.72		
1,2,3,7,8,9-HxCDD	0.1	--	1.84	JK	U	1.13	JK	U	1.66	JK	U	0.827	JK	U	0.741			0.674	JK	U	0.706	JK	U	0.819		
1,2,3,4,6,7,8-HpCDD	0.01	--	150			134			115			48.7			32.1			37.4			36.2			44.8		
OCDD	0.0003	--	1540			1310			1090			391			308			391			381			516		
2,3,7,8-TCDF	0.1	--	0.26	U		0.28	U		0.188	U		0.0824	U		0.0731	U		0.171	U		0.158	JK	U	0.231		
1,2,3,7,8-PeCDF	0.03	--	0.573	JK	U	0.126	U		0.281	JK	U	0.0889	U		0.109	U		0.192	JK	U	0.233	JK	U	0.255	JK	U
2,3,4,7,8-PeCDF	0.3	--	0.539	JK	U	0.232	U		0.167	U		0.438			0.342	JK	U	0.497			0.439	JK	U	0.469	JK	U
1,2,3,4,7,8-HxCDF	0.1	--	1.24			0.977	JK	U	1.13	JK	U	0.447	JK	U	0.558			0.643			0.557	JK	U	0.705		
1,2,3,6,7,8-HxCDF	0.1	--	0.74			0.344	JK	U	0.248	JK	U	0.244	JK	U	0.258	JK	U	0.287	JK	U	0.412	JK	U	0.336		U
1,2,3,7,8,9-HxCDF	0.1	--	0.237	U		0.617	JK	U	0.67	JK	U	0.336	JK	U	0.239	JK	U	0.22	JK	U	0.259	JK	U	0.407		
2,3,4,6,7,8-HxCDF	0.1	--	0.71	JK	U	0.398	JK	U	0.805			0.433			0.412			0.368	JK	U	0.466			0.435	JK	U
1,2,3,4,6,7,8-HpCDF	0.01	--	13.4			13.3			12.2			3.7			4.04			5.05			5.1			5.73		
1,2,3,4,7,8,9-HpCDF	0.01	--	0.901	JK	U	0.668	JK	U	0.421	JK	U	0.0798	U		0.441			0.494			0.534	JK	U	0.537	JK	U
OCDF	0.0003	--	44.4			48.9			44.8			2.47	JK	U	16			18.7			19			21.4		
Dioxin/Furan 1/2 DL TEC (ng TEC/kg DW)																										
2,3,7,8-TCDD	1	--	0.1735	U		0.0595	U		0.076	U		0.059	U		0.067	U		0.157	U		0.0525	U		0.145	U	
1,2,3,7,8-PeCDD	1	--	0.82			0.159	U		1.03			0.294			0.339			0.364			0.168	JK	U	0.368		
1,2,3,4,7,8-HxCDD	0.1	--	0.0411	JK	U	0.00985	U		0.0381	JK	U	0.0632			0.0175	JK	U	0.0174	JK	U	0.0543			0.0204	JK	U
1,2,3,6,7,8-HxCDD	0.1	--	0.391			0.341			0.153	JK	U	0.158			0.146			0.159			0.067	JK	U	0.172		
1,2,3,7,8,9-HxCDD	0.1	--	0.092	JK	U	0.0565	JK	U	0.083	JK	U	0.0414	JK	U	0.0741			0.0337	JK	U	0.0353	JK	U	0.0819		
1,2,3,4,6,7,8-HpCDD	0.01	--	1.5			1.34			1.15			0.487			0.321			0.374			0.362			0.448		
OCDD	0.0003	--	0.462			0.393			0.327			0.117			0.0924			0.117			0.114			0.155		
2,3,7,8-TCDF	0.1	--	0.013	U		0.014	U		0.0094	U		0.00412	U		0.00366	U		0.00855	U		0.0079	JK	U	0.0231		
1,2,3,7,8-PeCDF	0.03	--	0.008595	JK	U	0.00189	U		0.00422	JK	U	0.00133	U		0.00164	U		0.00288	JK	U	0.0035	JK	U	0.00383	JK	U
2,3,4,7,8-PeCDF	0.3	--	0.08085	JK	U	0.0348	U		0.0251	U		0.131			0.0513	JK	U	0.149			0.0659	JK	U	0.0704	JK	U
1,2,3,4,7,8-HxCDF	0.1	--	0.124			0.0489	JK	U	0.0565	JK	U	0.0224	JK	U	0.0558			0.0643			0.0279	JK	U	0.0705		
1,2,3,6,7,8-HxCDF	0.1	--	0.074			0.0172	JK	U	0.0124	JK	U	0.0122	JK	U	0.0129	JK	U	0.0144	JK	U	0.0206	JK	U	0.0168		U
1,2,3,7,8,9-HxCDF	0.1	--	0.01185	U		0.0309	JK	U	0.0335	JK	U	0.0168	JK	U	0.012	JK	U	0.011	JK	U	0.013	JK	U	0.0407		
2,3,4,6,7,8-HxCDF	0.1	--	0.0355	JK	U	0.0199	JK	U	0.0805			0.0433			0.0412			0.0184	JK	U	0.0466			0.0218	JK	U
1,2,3,4,6,7,8-HpCDF	0.01	--	0.134			0.133			0.122			0.037			0.0404			0.0505			0.051			0.0573		
1,2,3,4,7,8,9-HpCDF	0.01	--	0.004505	JK	U	0.00334	JK	U	0.00211	JK	U	0.000399	U		0.00441			0.00494			0.00267	JK	U	0.00269	JK	U
OCDF	0.0003	--	0.0133			0.0147			0.0134			0.000371	JK	U	0.0048			0.00561			0.0057			0.00642		
Dx/F TEQ (0 DL)	4	10	3.52			2.22			2.72			1.33			1.12			1.29			0.634			1.42		
Dx/F TEQ (1/2 DL)	4	10	3.98			2.68			3.22			1.49			1.29			1.55			1.1			1.7		

Notes:
LQ: laboratory qualifier **VQ**: validation qualifier **DW**: dry weight **DL**: detection limit
TEF: toxicity equivalent factor **TEC**: toxicity equivalent concentration **TEQ**: toxicity equivalents
SL: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT
U the analyte was analyzed for, but not detected
J the result is estimated
K estimated maximum potential concentration

Table 15. Subarea B Dioxin/Furan Congener Results

			B1-C 12/1/2016	LQ	VQ	B2-C 12/2/2016	LQ	VQ	B3-C 12/1/2016	LQ	VQ	BS1-C 12/2/2016	LQ	VQ	BS2-C 12/2/2016	LQ	VQ	BS3-C 12/2/2016	LQ	VQ	BS4-C 12/2/2016	LQ	VQ	AMB1-C 12/2/2016	LQ	VQ	BZ-U-Z 12/2/2016	LQ	VQ	LBB-C 12/1/2016	LQ	VQ
Dioxin/Furan Concentration (ng/kg DW)																																
2,3,7,8-TCDD	1	--	0.481	U		0.0318	U		0.159	JK	U	0.169	JK	U	0.188	U		0.472	JK	U	0.273	U		0.42	JK	U	0.203	U		3.49		
1,2,3,7,8-PeCDD	1	--	0.466	JK	U	0.306	J		0.337	JK	U	0.753	J		0.104	J		1.32	JK	U	0.604	J		1.21	J		0.447	JK	U	1.97	JK	U
1,2,3,4,7,8-HxCDD	0.1	--	1.04	J		0.231	J		0.726	J		1.25	J		0.151	J		2.43	J		0.778	JK	U	1.68	J		1.16	J		1.4	J	
1,2,3,6,7,8-HxCDD	0.1	--	3	J		0.47	J		3.02			5.48			0.538	JK	U	14			4.82			11.6			3.83			8.84		
1,2,3,7,8,9-HxCDD	0.1	--	2.53	J		0.344	J		1.63	J		2.75	J		0.362	J		5.88			1.76	J		4.15			2	J		4.72		
1,2,3,4,6,7,8-HpCDD	0.01	--	90.1			8.26			82.9			165			10.6			377			153			317			111			269		
OCDD	0.0003	--	947			61.2			655			1260			92.6			3360			1410			3170			979			3120		
2,3,7,8-TCDF	0.1	--	0.518	U		0.116	JK	U	0.235	JK	U	0.841	J		0.361	U		1.82	J		0.761	J		0.646	J		0.305	U		25.1		
1,2,3,7,8-PeCDF	0.03	--	0.25	U		0.199	J		0.173	JK	U	0.693	JP	J	0.0889	U		0.931	J		0.733	JK	U	0.625	J		0.182	U		1.37	J	
2,3,4,7,8-PeCDF	0.3	--	0.261	U		0.258	J		0.223	JK	U	1.44	J		0.0937	U		2.92	J		2.42	J		2.3	J		0.439	JK	U	1.75	J	
1,2,3,4,7,8-HxCDF	0.1	--	0.814	J		0.229	J		1.39	J		2.97	J		0.295	J		6.13			4.03			4.63			1.35	J		0.959	J	
1,2,3,6,7,8-HxCDF	0.1	--	0.349	JK	U	0.189	J		0.72	JK	U	0.992	J		0.115	JK	U	2.33	J		1.59	JK	U	2.03	J		0.606	J		0.49	J	
1,2,3,7,8,9-HxCDF	0.1	--	0.301	U		0.256	JK	U	0.33	J		1.13	J		0.101	J		0.827	U		0.881	J		1.28	U		0.465	U		0.301	U	
2,3,4,6,7,8-HxCDF	0.1	--	0.655	J		0.248	J		1.23	J		1.56	J		0.161	J		4.63			2.85	J		4.27			1.04	J		0.602	JK	U
1,2,3,4,6,7,8-HpCDF	0.01	--	10.8			1.44	J		39.2			23.2			2.78	J		118			46.8			131			27.2			13.9		
1,2,3,4,7,8,9-HpCDF	0.01	--	0.621	J		0.238	JK	U	1.64	J		1.85	J		0.175	JK	U	6.33			2.47	J		5.98			1.9	J		0.827	JK	U
OCDF	0.0003	--	29.3			3.93	J		127			70.1			10.9			664			165			680			55.9			65.4		
Dioxin/Furan 1/2 DL TEC (ng TEC/kg DW)																																
2,3,7,8-TCDD	1	--	0.241	U		0.0159	U		0.0795	JK	U	0.0845	JK	U	0.094	U		0.236	JK	U	0.137	U		0.21	JK	U	0.102	U		3.49		
1,2,3,7,8-PeCDD	1	--	0.233	JK	U	0.306	J		0.169	JK	U	0.753	J		0.104	J		0.66	JK	U	0.604	J		1.21	J		0.224	JK	U	0.985	JK	U
1,2,3,4,7,8-HxCDD	0.1	--	0.104	J		0.0231	J		0.0726	J		0.125	J		0.0151	J		0.243	J		0.0389	JK	U	0.168	J		0.116	J		0.14	J	
1,2,3,6,7,8-HxCDD	0.1	--	0.3	J		0.047	J		0.302			0.548			0.0269	JK	U	1.4			0.482			1.16			0.383			0.884		
1,2,3,7,8,9-HxCDD	0.1	--	0.253	J		0.0344	J		0.163	J		0.275	J		0.0362	J		0.588			0.176	J		0.415			0.2	J		0.472		
1,2,3,4,6,7,8-HpCDD	0.01	--	0.901			0.0826			0.829			1.65			0.106			3.77			1.53			3.17			1.11			2.69		
OCDD	0.0003	--	0.284			0.0184			0.197			0.378			0.0278			1.01			0.423			0.951			0.294			0.936		
2,3,7,8-TCDF	0.1	--	0.0259	U		0.0058	JK	U	0.0118	JK	U	0.0841	J		0.0181	U		0.182	J		0.0761	J		0.0646	J		0.0153	U		2.51		
1,2,3,7,8-PeCDF	0.03	--	0.00375	U		0.00597	J		0.0026	JK	U	0.0208	JP	J	0.00133	U		0.0279	J		0.011	JK	U	0.0188	J		0.00273	U		0.0411	J	
2,3,4,7,8-PeCDF	0.3	--	0.0392	U		0.0774	J		0.0335	JK	U	0.432	J		0.0141	U		0.876	J		0.726	J		0.69	J		0.0659	JK	U	0.525	J	
1,2,3,4,7,8-HxCDF	0.1	--	0.0814	J		0.0229	J		0.139	J		0.297	J		0.0295	J		0.613			0.403			0.463			0.135	J		0.0959	J	
1,2,3,6,7,8-HxCDF	0.1	--	0.0175	JK	U	0.0189	J		0.036	JK	U	0.0992	J		0.00575	JK	U	0.233	J		0.0795	JK	U	0.203	J		0.0606	J		0.049	J	
1,2,3,7,8,9-HxCDF	0.1	--	0.0151	U		0.0128	JK	U	0.033	J		0.113	J		0.0101	J		0.0414	U		0.0881	J		0.064	U		0.0233	U		0.0151	U	
2,3,4,6,7,8-HxCDF	0.1	--	0.0655	J		0.0248	J		0.123	J		0.156	J		0.0161	J		0.463			0.285	J		0.427			0.104	J		0.0301	JK	U
1,2,3,4,6,7,8-HpCDF	0.01	--	0.108			0.0144	J		0.392			0.232			0.0278	J		1.18			0.468			1.31			0.272			0.139		
1,2,3,4,7,8,9-HpCDF	0.01	--	0.00621	J		0.00119	JK	U	0.0164	J		0.0185	J		0.000875	JK	U	0.0633			0.0247	J		0.0598			0.019	J		0.00414	JK	U
OCDF	0.0003	--	0.00879			0.00118	J		0.0381			0.021			0.00327			0.199			0.0495			0.204			0.0168			0.0196		
Dx/F TEQ (0 DL)	4	10	2.11			0.677			2.3			5.2			0.376			10.8			5.34			10.5			2.71			12		
Dx/F TEQ (1/2 DL)	4	10	2.69			0.713			2.64			5.29			0.537			11.8			5.60			10.8			3.14			13		

Notes:
LQ: laboratory qualifier **VQ**: validation qualifier **DW**: dry weight **DL**: detection limit
TEF: toxicity equivalent factor **TEC**: toxicity equivalent concentration **TEQ**: toxicity equivalents
SL: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT
U the analyte was analyzed for, but not detected
J the result is estimated
K estimated maximum potential concentration

Table 15. Subarea B Dioxin/Furan Congener Results (cont.)

			LBBS1-C			LBBS2-C			AMB2-C			LBBZ-U-Z			RB1-C			RB2-C			RBS1-C			RBS2-C			RBZ-U-Z		
			12/1/2016	LQ	VQ	11/30/2016	LQ	VQ	11/30/2016	LQ	VQ	11/30/2016	LQ	VQ	11/30/2016	LQ	VQ	12/2/2016	LQ	VQ	12/2/2016	LQ	VQ	12/2/2016	LQ	VQ	12/2/2016	LQ	VQ
Dioxin/Furan Concentration (ng/kg DW)																													
2,3,7,8-TCDD	1	--	0.249	JK	U	0.259	JK	U	0.259	U		0.346	U		0.432	U		0.809	U		0.601	J		0.399	JK	U	0.469	JK	U
1,2,3,7,8-PeCDD	1	--	0.454	JK	U	0.887	J		0.0683	JK	U	0.17	U		0.715	JK	U	0.493	J		1.37	J		1.79	JK	U	2.26	J	
1,2,3,4,7,8-HxCDD	0.1	--	0.664	JK	U	1.44	J		0.185	J		0.148	U		1.42	J		0.992	J		2.02	J		3.78	JK	U	3.5	J	
1,2,3,6,7,8-HxCDD	0.1	--	4.29			14.8			0.859	J		0.338	JK	U	5.63			3.58	J		7.4			14.5			21		
1,2,3,7,8,9-HxCDD	0.1	--	1.83	J		4.02			0.512	J		0.143	U		2.94	J		2.02	J		4.2			7.13			7.91		
1,2,3,4,6,7,8-HpCDD	0.01	--	115			449			15.1			6.3			143			107			252			455			566		
OCDD	0.0003	--	892			3170			119			58.9			1210			1010			2350			3710			5010		
2,3,7,8-TCDF	0.1	--	1.82	J		0.564	J		0.195	U		0.401	U		0.584	J		0.798	U		1.47	JK	U	2.91			1.62	J	
1,2,3,7,8-PeCDF	0.03	--	0.494	J		0.439	J		0.0716	U		0.191	U		0.586	J		0.381	U		0.507	J		0.974	J		1.11	J	
2,3,4,7,8-PeCDF	0.3	--	0.476	JK	U	0.322	U		0.224	JK	U	0.204	U		1.05	JK	U	0.401	U		1.45	J		3.05	J		4.2		
1,2,3,4,7,8-HxCDF	0.1	--	1.64	J		4.03			0.361	J		0.133	U		2.3	J		1.03	J		2.5	J		4.99			10.6		
1,2,3,6,7,8-HxCDF	0.1	--	0.619	J		2.93	J		0.115	U		0.121	U		0.894	JK	U	0.486	U		0.929	JK	U	1.86	JK	U	3.93	J	
1,2,3,7,8,9-HxCDF	0.1	--	0.578	JK	U	1.09	JK	U	0.154	U		0.184	U		1.21	J		0.681	U		0.616	U		1.24	JK	U	2.81	J	
2,3,4,6,7,8-HxCDF	0.1	--	1.07	J		6.34			0.256	JK	U	0.145	U		1.8	J		0.738	J		1.64	JK	U	3.13	J		7.26		
1,2,3,4,6,7,8-HpCDF	0.01	--	16.4			274			4.12			1.26	J		25.5			13.8			35.5			69.4			206		
1,2,3,4,7,8,9-HpCDF	0.01	--	1.06	J		11.8			0.337	JK	U	0.184	U		2.25	J		1.02	J		2.13	J		3.59	JK	U	11.7		
OCDF	0.0003	--	50			1870			15.4			6.93			105			50.7			68.9			121			1160		
Dioxin/Furan 1/2 DL TEC (ng TEC/kg DW)																													
2,3,7,8-TCDD	1	--	0.125	JK	U	0.13	JK	U	0.13	U		0.173	U		0.216	U		0.405	U		0.601	J		0.2	JK	U	0.235	JK	U
1,2,3,7,8-PeCDD	1	--	0.227	JK	U	0.887	J		0.0342	JK	U	0.085	U		0.358	JK	U	0.493	J		1.37	J		0.895	JK	U	2.26	J	
1,2,3,4,7,8-HxCDD	0.1	--	0.0332	JK	U	0.144	J		0.0185	J		0.0074	U		0.142	J		0.0992	J		0.202	J		0.189	JK	U	0.35	J	
1,2,3,6,7,8-HxCDD	0.1	--	0.429			1.48			0.0859	J		0.0169	JK	U	0.563			0.358	J		0.74			1.45			2.1		
1,2,3,7,8,9-HxCDD	0.1	--	0.183	J		0.402			0.0512	J		0.00715	U		0.294	J		0.202	J		0.42			0.713			0.791		
1,2,3,4,6,7,8-HpCDD	0.01	--	1.15			4.49			0.151			0.063			1.43			1.07			2.52			4.55			5.66		
OCDD	0.0003	--	0.268			0.951			0.0357			0.0177			0.363			0.303			0.705			1.11			1.5		
2,3,7,8-TCDF	0.1	--	0.182	J		0.0564	J		0.00975	U		0.0201	U		0.0584	J		0.0399	U		0.0735	JK	U	0.291			0.162	J	
1,2,3,7,8-PeCDF	0.03	--	0.0148	J		0.0132	J		0.00107	U		0.00287	U		0.0176	J		0.00572	U		0.0152	J		0.0292	J		0.0333	J	
2,3,4,7,8-PeCDF	0.3	--	0.0714	JK	U	0.0483	U		0.0336	JK	U	0.0306	U		0.158	JK	U	0.0602	U		0.435	J		0.915	J		1.26		
1,2,3,4,7,8-HxCDF	0.1	--	0.164	J		0.403			0.0361	J		0.00665	U		0.23	J		0.103	J		0.25	J		0.499			1.06		
1,2,3,6,7,8-HxCDF	0.1	--	0.0619	J		0.293	J		0.00575	U		0.00605	U		0.0447	JK	U	0.0243	U		0.0465	JK	U	0.093	JK	U	0.393	J	
1,2,3,7,8,9-HxCDF	0.1	--	0.0289	JK	U	0.0545	JK	U	0.0077	U		0.0092	U		0.121	J		0.0341	U		0.0308	U		0.062	JK	U	0.281	J	
2,3,4,6,7,8-HxCDF	0.1	--	0.107	J		0.634			0.0128	JK	U	0.00725	U		0.18	J		0.0738	J		0.082	JK	U	0.313	J		0.726		
1,2,3,4,6,7,8-HpCDF	0.01	--	0.164			2.74			0.0412			0.0126	J		0.255			0.138			0.355			0.694			2.06		
1,2,3,4,7,8,9-HpCDF	0.01	--	0.0106	J		0.118			0.00169	JK	U	0.00092	U		0.0225	J		0.0102	J		0.0213	J		0.018	JK	U	0.117		
OCDF	0.0003	--	0.015			0.561			0.00462			0.00208			0.0315			0.0152			0.0207			0.0363			0.348		
Dx/F TEQ (0 DL)	4	10	2.75			13.2			0.424			0.0953			3.71			2.87			7.66			10.6			19.1		
Dx/F TEQ (1/2 DL)	4	10	3.23			13.4			0.661			0.468			4.48			3.43			7.89			12.1			19.3		

Notes:
LQ: laboratory qualifier **VQ**: validation qualifier **DW**: dry weight **DL**: detection limit
TEF: toxicity equivalent factor **TEC**: toxicity equivalent concentration **TEQ**: toxicity equivalents
SL: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT
U the analyte was analyzed for, but not detected
J the result is estimated
K estimated maximum potential concentration

Table 16. Dioxin Congener Results for Individual Core Sections

			LBB-LBB-2-S			LBBS2-LBB-2-S			BS3-B1-1-S		
			12/1/2016	LQ	VQ	12/1/2016	LQ	VQ	12/1/2016	LQ	VQ
Dioxin/Furan Concentration (ng/kg DW)											
2,3,7,8-TCDD	1	--	0.52	U		0.574	U		0.258	U	
1,2,3,7,8-PeCDD	1	--	0.818	JK	U	0.514	JK	U	0.145	U	
1,2,3,4,7,8-HxCDD	0.1	--	2.46	J		1.32	JK	U	0.11	U	
1,2,3,6,7,8-HxCDD	0.1	--	8.01			5.32			0.166	JK	U
1,2,3,7,8,9-HxCDD	0.1	--	4.58	J		2.44	J		0.102	U	
1,2,3,4,6,7,8-HpCDD	0.01	--	206			145			3.01		
OCDD	0.0003	--	1690		J	1300			20.4		
2,3,7,8-TCDF	0.1	--	0.601	U		1.2	J		0.204	U	
1,2,3,7,8-PeCDF	0.03	--	0.512	JK	U	0.564	JK	U	0.081	U	
2,3,4,7,8-PeCDF	0.3	--	1.24	J		1.58	J		0.0871	U	
1,2,3,4,7,8-HxCDF	0.1	--	2.17	J		2.03	J		0.104	U	
1,2,3,6,7,8-HxCDF	0.1	--	0.971	JK	U	0.82	J		0.0915	U	
1,2,3,7,8,9-HxCDF	0.1	--	0.939	J		0.608	U		0.126	U	
2,3,4,6,7,8-HxCDF	0.1	--	1.82	J		1.41	J		0.113	U	
1,2,3,4,6,7,8-HpCDF	0.01	--	27			27.2			0.723	J	
1,2,3,4,7,8,9-HpCDF	0.01	--	1.61	JK	U	1.78	J		0.0946	U	
OCDF	0.0003	--	100			113			1.72	J	
Dioxin/Furan 1/2 DL TEC (ng TEC/kg DW)											
2,3,7,8-TCDD	1	--	0.26	U		0.287	U		0.129	U	
1,2,3,7,8-PeCDD	1	--	0.409	JK	U	0.257	JK	U	0.0725	U	
1,2,3,4,7,8-HxCDD	0.1	--	0.246	J		0.066	JK	U	0.0055	U	
1,2,3,6,7,8-HxCDD	0.1	--	0.801			0.532			0.0083	JK	U
1,2,3,7,8,9-HxCDD	0.1	--	0.458	J		0.244	J		0.0051	U	
1,2,3,4,6,7,8-HpCDD	0.01	--	2.06			1.45			0.0301		
OCDD	0.0003	--	0.507		J	0.39			0.00612		
2,3,7,8-TCDF	0.1	--	0.0301	U		0.12	J		0.0102	U	
1,2,3,7,8-PeCDF	0.03	--	0.00768	JK	U	0.00846	JK	U	0.00122	U	
2,3,4,7,8-PeCDF	0.3	--	0.372	J		0.474	J		0.0131	U	
1,2,3,4,7,8-HxCDF	0.1	--	0.217	J		0.203	J		0.0052	U	
1,2,3,6,7,8-HxCDF	0.1	--	0.0486	JK	U	0.082	J		0.00458	U	
1,2,3,7,8,9-HxCDF	0.1	--	0.0939	J		0.0304	U		0.0063	U	
2,3,4,6,7,8-HxCDF	0.1	--	0.182	J		0.141	J		0.00565	U	
1,2,3,4,6,7,8-HpCDF	0.01	--	0.27			0.272			0.00723	J	
1,2,3,4,7,8,9-HpCDF	0.01	--	0.00805	JK	U	0.0178	J		0.000473	U	
OCDF	0.0003	--	0.03			0.0339			0.000516	J	
Dx/F TEQ (0 DL)	4	10	5.24			3.96			0.044		
Dx/F TEQ (1/2 DL)	4	10	6.00			4.61			0.311		

Notes:

LQ: laboratory qualifier **VQ**: validation qualifier **DW**: dry weight **DL**: detection limit

TEF: toxicity equivalent factor **TEC**: toxicity equivalent concentration **TEQ**: toxicity equivalent quotient

SL: screening level **ML**: maximum level **BT**: bioaccumulation trigger Exceeds SL Exceeds BT

U the analyte was analyzed for, but not detected

J the result is estimated

K estimated maximum potential concentration

Table 17. Polybrominated Diphenyl Ether Results

	A5-C 11/29/2016	LQ	VQ	BS3-C 12/2/2016	LQ	VQ	LBA-C 11/29/2016	LQ	VQ
Polybrominated diphenyl ethers (ng/kg DW)									
BDE 8/11	13	R		3.16	J		11.4		
BDE 15	10	R		4.23			7.12		
BDE 17/25	75.1			16.4			67.3		
BDE 28/33	12.7			3.86	M		12.7		
BDE 32	1.75	J		0.63	U		1.5	JR	
BDE 35	0.23	MJR		2.8	JR		0.23	U	
BDE 37	0.81	JR		0.584	J		0.94	J	
BDE 47	156			37.2			199		
BDE 49	88.5	M		19.6	M		99.5	M	
BDE 51	10.9	M		2.59	J		10.4		
BDE 66	7.31	J		1.93	J		9.58		
BDE 71	4.6	MJ		0.831	MJ		4.6	MR	
BDE 75	0.39	U		0.185	J		0.46	J	
BDE 77	0.37	U		0.22	MJR		0.31	U	
BDE 79	0.33	U		0.13	MJR		0.27	U	
BDE 85	4.41	J		1.2	J		8.8		
BDE 99	120			16.4			196		
BDE 100	32.2	M		5.25			47.5	M	
BDE 105	0.84	U		0.42	J		0.8	U	
BDE 118	0.83	U		0.54	MJ		1.3	MJR	
BDE 119/120	4.85	MJ		0.87	MJ		7.55	MJ	
BDE 126	0.59	U		0.48	J		0.5	U	
BDE 128	2.5	U		0.74	U		2.4	U	
BDE 138/166	1.9	U		0.56	U		1.8	U	
BDE 140	1.2	U		0.36	U		1.1	U	
BDE 153	14.1	J		1.86	J		23.5		
BDE 154	13.9	MJ		1.4	U		24.7	J	
BDE 155	2.22	J		1.4	U		2.4	MJR	
BDE 156	2.8	U		0.83	U		2.7	U	
BDE 181	1.2	U		0.25	U		1.3	U	
BDE 183	6.97	J		1.13	J		8.89	J	
BDE 184	1.96	MJ		0.54	J		1.88	MJ	
BDE 190	1.7	U		0.35	U		1.8	U	
BDE 191	1.4	U		0.28	U		1.4	U	
BDE 196	4.6	JR		0.32	U		6.9	JR	
BDE 197	7.6	MJ		0.89	J		9.1	J	
BDE 203	4.8	MJR		0.35	U		8.5	MJR	
BDE 206	70.2	J		5.96	J		150		
BDE 207	44.4	J		5.3	J		64.2		
BDE 208	36.5	J		2.45	J		40		
BDE 209	1940			156			4280		

Notes:

LQ: laboratory qualifier **VQ**: validation qualifier **DW**: dry weight **BDE:** brominated diphenyl ether

M a peak has been manually integrated

R the ion abundance ratio(s) did not meet the acceptance criteria. Value is an estimated maximum.

J the analyte was detected below the calibrated range but above the EDL

U the analyte was not detected above the EDL

Table 18. Subarea A Carbon-Normalized Chemistry Results Compared to SQS

	SQS	CSL	A1-C LQ	A1-C VQ	A2-C LQ	A2-C VQ	A3-C LQ	A3-C VQ	A4-C LQ	A4-C VQ	A5-C LQ	A5-C VQ	AMA1-C LQ	AMA1-C VQ	AMA2-C LQ	AMA2-C VQ	LBA-C LQ	LBA-C VQ	AMA3-C LQ	AMA3-C VQ	TB-C LQ	TB-C VQ	TBS1-C LQ	TBS1-C VQ	TBS2-C LQ	TBS2-C VQ	TBAM-C LQ	TBAM-C VQ
Conventionals																												
Total Organic Carbon	--	--	2.24		2.06		1.96		2.19		2.55		1.86		2.22		2.61		2.33		2.53		2.15		2.25		2.11	
PAH (mg/kg OC)																												
Naphthalene	99	170	0.21	T	0.218	T	0.255	T	0.274	T	0.212	T	0.285	T	0.419		0.575		0.644		0.206	T	0.242	T	0.329	T	0.218	T
Acenaphthylene	66	66	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.203	T	0.27	T	0.36	U	0.409	U	0.396	U	0.412	U
Acenaphthene	16	57	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.176	T	0.421		0.901		0.36	U	0.409	U	0.396	U	0.412	U
Fluorene	220	1200	0.156	T	0.432	U	0.224	T	0.242	T	0.224	T	0.21	T	0.36	T	0.805		0.987		0.138	T	0.158	T	0.204	T	0.412	U
Phenanthrene	23	79	0.58		0.583		0.765		0.868		0.745		0.806		1.13		1.8		2.88		0.632		0.558		0.756		0.664	
Anthracene	100	480	0.388	U	0.432	U	0.235	T	0.21	T	0.251	T	0.468	U	0.293	T	0.843		1.29		0.36	U	0.27	T	0.396	U	0.412	U
2-Methylnaphthalene	38	64	0.362	T	0.34	T	0.408	T	0.411		0.31	T	0.446	T	0.586		0.728		0.773		0.34	T	0.391	T	0.489		0.327	T
Total LPAH[a]	370	780	0.946		0.801		1.48		1.59		1.43		1.3		2.37		4.65		6.97		0.976		1.23		1.29		0.882	
Fluoranthene	160	1200	0.759		0.825		0.969		1.69		1.8		0.914		2.21		5.36		12.4		1.03		0.837		0.978		1.52	
Pyrene	1000	1400	0.491		0.534		0.663		1.05		1.25		0.591		1.53		4.98		8.58		0.632		0.558		0.622		0.9	
Benzo(a)anthracene	110	270	0.201	T	0.238	T	0.449	T	0.452		0.588		0.258	T	0.676		2.57		4.72		0.221	T	0.26	T	0.253	T	0.284	T
Chrysene	110	460	0.491		0.451		1.02		1.05		1.22		0.591		1.31		3.49		5.58		0.435		0.884		0.489		0.853	
Benzo(b)fluoranthene	--	--	0.429		0.461		0.612		0.913		1.18		0.538		1.31		3.22		5.15		0.435		0.512		0.578		0.616	
Benzo(k)fluoranthene	--	--	0.388	U	0.432	U	0.245	T	0.247	T	0.376		0.468	U	0.495		1.11		1.76		0.36	U	0.409	U	0.396	U	0.204	T
Benzofluoranthene	230	450	0.429		0.461		0.857		1.16		1.55		0.538		1.8		4.33		6.91		0.435		0.512		0.578		0.82	
Benzo(a)pyrene	99	210	0.17	T	0.209	T	0.296	T	0.347	T	0.549		0.237	T	0.586		1.69		2.58		0.162	T	0.237	T	0.24	T	0.251	T
Indeno(1,2,3-cd)pyrene	34	88	0.17	T	0.209	T	0.281	T	0.361	T	0.588		0.237	T	0.586		1.3		1.67		0.174	T	0.219	T	0.213	T	0.237	T
Dibenzo(a,h)anthracene	12	33	0.388	U	0.432	U	0.459	U	0.384	U	0.141	T	0.468	U	0.144	T	0.314	T	0.403	T	0.36	U	0.409	U	0.396	U	0.412	U
Benzo(ghi)perylene	31	78	0.223	T	0.262	T	0.301	T	0.393		0.627		0.29	T	0.631		1.19		1.55		0.206	T	0.265	T	0.267	T	0.27	T
Total HPAH[b]	960	5300	2.71		2.93		4.54		6.11		7.69		3.37		8.84		24		42.9		3.09		3.51		3.37		4.86	
Phthalates (mg/kg OC)																												
Butylbenzylphthalate	4.9	64	0.228	T	0.223	T	0.321	T	0.279	T	0.247	T	0.312	T	0.396	U	0.421	T	0.472	U	0.395		0.293	T	0.347	T	0.237	T
Di-N-Butylphthalate	220	1700	0.384	T	0.534	T	0.413	T	0.388	T	0.353	T	0.425	T	0.369	T	0.421	T	0.472	T	0.332	T	0.442	T	0.4	T	0.327	T
Di-N-Octyl Phthalate	58	4500	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
Diethylphthalate	61	110	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
Dimethylphthalate	53	53	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
Bis(2-Ethylhexyl) Phthalate	47	78	3.88	U	0.68	T	4.59	U	0.548	T	1.06	T	4.68	U	1.08	T	1.46	T	1.24	T	0.372	T	0.512	T	0.4	T	4.12	U
Other SVOC (mg/kg OC)																												
Dibenzofuran	15	58	0.388	U	0.432	U	0.189	T	0.205	T	0.212	T	0.468	U	0.306	T	0.805		0.987		0.36	U	0.409	U	0.16	T	0.412	U
1,2-Dichlorobenzene	2.3	2.3	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
1,4-Dichlorobenzene	3.1	9	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
Hexachlorobenzene	0.38	2.3	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
Hexachlorobutadiene	3.9	6.2	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
N-Nitrosodiphenylamine	11	11	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
1,2,4-Trichlorobenzene	0.81	1.8	0.388	U	0.432	U	0.459	U	0.384	U	0.349	U	0.468	U	0.396	U	0.421	U	0.472	U	0.36	U	0.409	U	0.396	U	0.412	U
PCB Aroclors (mg/kg OC)																												
Total PCBs[c]	12	65	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U	0.804	U

Notes:

LQ: laboratory qualifier **VQ**: validation qualifier **SQS**: sediment quality standard **CSL**: cleanup screening level **OC:** organic carbon normalized Exceeds SQS Exceeds CSL

U the analyte was analyzed for, but not detected

T the result is detected above the method detection limit, but below the limit of quantitation

a. sum of detected values of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene

b. sum of detected values of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(ghi)perylene

c. sum of detected PCB Aroclors

Table 19. Subarea B Carbon-Normalized Chemistry Results Compared to SQS

			B1-C 12/1/16	LQ	VQ	B2-C 12/2/16	LQ	VQ	BS2-C 12/2/16	LQ	VQ	RB1-C 11/30/16	LQ	VQ	RB2-C 12/2/16	LQ	VQ	RBS1-C 12/2/16	LQ	VQ	RBS2-C 12/2/16	LQ	VQ
Conventionals	**SQS**	**CSL**																					
Total Organic Carbon	--	--	3.48			2.64			2.64			2.62			2.98			2.6			2.99		
PAH (mg/kg OC)																							
Naphthalene	99	170	0.178	J		0.455			0.758			3.17		J	0.604			0.369			0.368		
Acenaphthylene	66	66	0.241	U		0.227	U		0.227	U		1.64		J	0.117	J		0.296	J		0.181	J	
Acenaphthene	16	57	0.0948	J		0.227	U		0.125	J		0.496		J	0.195	J		0.208	J		0.12	J	
Fluorene	220	1200	0.213	J		0.227	U		0.205	J		0.992		J	0.369			0.923			0.271	J	
Phenanthrene	23	79	0.747			0.379			0.644			8.78		J	1.34			3.85			0.97		
Anthracene	100	480	0.287			0.133	J		0.239			2.9		J	0.47		J	3.85			0.535		
2-Methylnaphthalene	38	64	0.264			0.871			1.44			1.18		J	0.403			0.381			0.435		
Total LPAH	370	780	1.52			0.966			1.97			18		J	3.1			9.49			2.44		
Fluoranthene	160	1200	1.75			0.53			0.758			10.7		J	3.69		J	46.2	D		2.01		
Pyrene	1000	1400	1.58			0.53			0.795			8.78		J	3.69		J	32.3			3.18		
Benzo(a)anthracene	110	270	1.01			0.205	J		0.246			2.63		J	1.31		J	17.3			1.04		
Chrysene	110	460	1.52			0.28			0.292			4.2		J	2.18		J	22.3			1.81		
Benzo(b)fluoranthene	--	--	1.32			0.292			0.288			3.4		J	2.42		J	15			1.77		
Benzo(k)fluoranthene	--	--	0.46			0.227	U		0.227	U		1.15		J	0.872		J	5			0.669		
Benzofluoranthene	230	450	1.78			0.292			0.288			4.54		J	3.29		J	20			2.44		
Benzo(a)pyrene	99	210	0.805			0.17	J		0.159	J		1.56		J	1.31		J	6.92			1.04		
Indeno(1,2,3-cd)pyrene	34	88	0.402			0.227	U		0.227	U		1.07		J	0.705			2			0.468		
Dibenzo(a,h)anthracene	12	33	0.0891	J		0.227	U		0.227	U		0.252	J		0.178	J		0.692			0.137	J	
Benzo(ghi)perylene	31	78	0.316			0.227	U		0.227	U		1.03		J	0.537			1.23			0.368		
Total HPAH	960	5300	8.94			2.01			2.54			33.7		J	16.4			148			12.1		
Phthalates (mg/kg OC)																							
Butylbenzylphthalate	4.9	64	0.241	U		0.227	U		0.227	U		0.458		J	0.302	U	UJ	0.342	U		0.288	U	
Di-N-Butylphthalate	220	1700	0.284	J		0.189	J		0.193	J		0.496	J		0.369	J		0.288	J		0.769		
Di-N-Octyl Phthalate	58	4500	0.241	U		0.227	U		0.227	U		0.378	U	UJ	0.302	U		0.342	U		0.288	U	
Diethylphthalate	61	110	0.241	U		0.227	U		0.227	U		0.347	J		0.302	U		0.342	U		0.288	U	
Dimethylphthalate	53	53	0.241	U		0.227	U		0.227	U		0.176	J		0.302	U		0.158	J		0.197	J	
Bis(2-Ethylhexyl) Phthalate	47	78	1.49	J		0.682	J		2.08	J		2.86	J		3.19		J	2.23	J		1.1	J	
Other SVOC (mg/kg OC)																							
Dibenzofuran	15	58	0.21	J		0.606			0.985			1.49		J	0.403			0.369			0.304		
1,2-Dichlorobenzene	2.3	2.3	0.241	U		0.227	U		0.227	U		0.378	U	UJ	0.302	U		0.342	U		0.288	U	
1,4-Dichlorobenzene	3.1	9	0.241	U		0.227	U		0.227	U		0.378	U	UJ	0.302	U		0.342	U		0.288	U	
Hexachlorobenzene	0.38	2.3	0.241	U		0.227	U		0.227	U		0.378	U	UJ	0.302	U		0.342	U		0.288	U	
Hexachlorobutadiene	3.9	6.2	0.241	U		0.227	U		0.227	U		0.378	U	UJ	0.302	U		0.342	U		0.288	U	
N-Nitrosodiphenylamine	11	11	0.241	U		0.227	U		0.227	U		0.378	U	UJ	0.302	U		0.342	U		0.288	U	
1,2,4-Trichlorobenzene	0.81	1.8	0.241	U		0.227	U		0.227	U		0.378	U	UJ	0.302	U		0.342	U		0.288	U	
PCB Aroclors (mg/kg OC)																							
Total PCBs (OC)	12	65	0.489	U		0.417	U		0.114	J		0.099	J		0.604	U		2.85			1.04		

Notes:

For consistency with SMS, the table only includes results where TOC is less than 3.5 percent

LQ: laboratory qualifier **VQ**: validation qualifier **SQS**: sediment quality standard **CSL**: cleanup screening level **OC:** organic carbon normalized Exceeds SQS Exceeds CSL

U the analyte was analyzed for, but not detected

T the result is detected above the method detection limit, but below the limit of quantitation

a. sum of detected values of naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, and anthracene

b. sum of detected values of fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(ghi)perylene

c. sum of detected PCB Aroclors

Table 20. Suitability Volume Estimates for Subarea B

Portion of Subarea B	DMMU	DMMU Volume (cy)	Volume suitable for Rosario Strait	Volume suitable for Port Gardner	Volume unsuitable for open-water disposal
right berthing area	RB1-C	2,654	0	0	2,654
	RB2-C	2,962	2,962	---[a]	0
	RBS1-C	4,223	0	4,223[b]	0
	RBS2-C	3,256	0	0	3,256
main channel	B1-C	3,674	3,674	---[a]	0
	B2-C	3,214	3,214	---[a]	0
	B3-C	3,432	3,432	---[a]	0
	BS1-C	9,155	0	9,155 [b]	0
	BS2-C	7,606	7,606	---[a]	0
	BS3-C	9,730	~2,000[c]	---[a]	~7,730[c]
	BS4-C	10,634	0	10,634[b]	0
	AMB1-C	4,195	0	0	4,195
left berthing area	LBB-C	3,508	0	~1,500[bc]	~2,008[c]
	LBBS1-C	2,932	2,932	---[a]	0
	LBBS2-C	9,673	0	~3,000[bc]	~6,673[c]
	AMB2-C	1,504	1,504	---[a]	0
totals:		82,352	~27,324	~28,512	~26,516

[a]Dredged material suitable for Rosario Strait is also suitable for Port Gardner

[b]This material is only suitable for Port Gardner if the volume-weighted average of all sediment taken to Port Gardner is below 4 ng/kg TEQ for dioxin

[c]Testing was conducted for an individual core from this DMMU, resulting in a split volume. This volume is a rough estimate made for reporting purposed only. The supplement suitability determination/s for future dredging will include definitive volumes associated with the planned disposal option/s.

Attachment A

Description of Previous Sediment Characterizations
Squalicum Creek Waterway

Note: The following information was compiled by David Fox (USACE) during preparation of the scope of work for sediment characterization of the Squalicum Creek Waterway in 2016. Sources of information included suitability determinations made under the Puget Sound Dredged Disposal Analysis (PSDDA) program and the Dredged Material Management Program (DMMP), as well as other project documentation available to the Dredged Material Management Office (DMMO). The available documentation did always include enough detail to determine definitively what occurred. This was especially true in certain years for the depths of sampling and the extent of dredging. As a result, this compilation has limitations and the information included should not be considered definitive in nature.

Squalicum Creek Waterway is a federally maintained shallow-draft navigation channel initially authorized by Congress in 1930 as an entrance channel -26 ft deep (MLLW) by 200 feet wide. Construction was completed in 1931. Additional congressional action in 1937 authorized dredging of berthing areas adjacent to the inner portion of the channel and a turning basin at mid-channel on the northwest side. The authorized depth of the expanded dredging area was also -26 ft MLLW.

Sedimentation in Squalicum Creek Waterway is due to input from the Nooksack River and Squalicum Creek. Accreted sediment in the waterway has been characterized by USACE under the PSDDA program or DMMP four times, including three full characterizations and a reconnaissance survey for dioxin. Descriptions of these characterization efforts follows.

1990-1991 USACE Characterization

The first full characterization occurred in 1990-91, when 194,214 cubic yards (cy) of sediment from the waterway and adjacent Port of Bellingham berthing area on the southeast side of the waterway (hereafter referred to as the left berthing area) were tested. Testing difficulties were encountered, but, in the end, 164,912 cy were found suitable for disposal at the Bellingham Bay site. The remaining 29,302 cy were found unsuitable for open-water disposal. The unsuitable material was located at the head of the waterway (5+00 to 7+00). Of the 164,912 cy found suitable for disposal at the non-dispersive Bellingham Bay site, 145,338 cy were also suitable for disposal at the dispersive site in Rosario Strait, including all material from the left berthing area (USACE 1991; USACE 1992).

While not specifically stated in the suitability determination, it appears from the volumes included in the dredged material management units (DMMUs) that the waterway and berthing area were characterized under a 'low-moderate' or 'moderate' rank. It is also not clear to what depth the samples were taken, although it appears that -27 ft MLLW might have been the limit of characterization. TBT and dioxins/furans were not analyzed.

The material at the head of the waterway was found unsuitable due to DDT detected above the screening level (SL) or bioaccumulation trigger (BT) in two samples (concentrations of 8.2 and 63.7 B ug/kg). PCBs exceeded SL (concentration = 510 ug/kg) in the same sample with the highest DDT level. This sample was

a subsurface sample (i.e. > 4 feet deep). Supplemental sampling and testing conducted in late 1991 confirmed the presence of DDT in both surface and subsurface sediment at the head of the waterway (concentrations of 17.2 and 11.1 ug/kg respectively). PCBs were undetected in both surface and subsurface sediment samples, although the reporting limit for one of the subsurface samples was 190 ug/kg. Bioassays were not conducted on the DMMUs at the head of the waterway due to the BT exceedance and previous testing complications.

Squalicum Creek Waterway was subsequently dredged in 1992, with the exception of the unsuitable material at the head of the waterway, which was left in place.

1994-1995 USACE Characterization

Full characterization of Squalicum Creek Waterway occurred for the second time in 1994-95, when 258,000 cy were sampled and tested. DMMUs at the head of the waterway were ranked 'high', including those within the navigation channel, as well as in the left berthing area and an additional small berthing in the northwest corner of the channel (hereafter referred to as the right berthing area). The rest of the waterway and berthing area were ranked 'moderate'. The target characterization depth was -30 ft MLLW (-26 ft + 2 ft advanced maintenance + 2 ft overdepth), with the exception of the right berthing area where the target characterization depth was -22 ft (-20 ft + 2 ft overdepth).

All 258,000 cy were found suitable for disposal at the Bellingham Bay site. Of this volume, 214,000 cy were also found suitable for disposal at the Rosario Strait site. The 44,000 cy that were not eligible for disposal at the Rosario Strait site were contained in two DMMUs in the outer part of the channel, as well as a subsurface DMMU from the right berthing area. Chemicals exceeding SL in one or more DMMU included copper, mercury, lead, nickel, indeno(1,2,3-cd)pyrene and DDT. No BTs were exceeded. TBT and dioxins/furans were not analyzed. All DMMUs with SL exceedances passed biological testing.

The majority of the characterized material was dredged in 1995. Small volumes of material could not be dredged at the time and were covered by subsequent recency determinations, including up to 8,000 cy in the federal portion of the project and 1,200 cy in the left berthing area. The remaining material was dredged in 1998.

It should be noted that since the time this characterization was conducted, the SLs for copper, mercury, lead and indeno(1,2,3-cd)pyrene have all increased, such that the concentrations of these chemicals found in 1994-95 would no longer exceed SL. In addition, nickel has been dropped from the list of chemicals of concern for marine projects and the SL for total DDT has been eliminated. The bioaccumulation trigger for total DDT remains at 50 ug/kg. Screening levels have been added for 4,4'-DDD (16 ug/kg), 4-4'-DDE (9 ug/kg) and 4,4'-DDT (12 ug/kg).

2000 USACE Characterization

The third full characterization effort occurred in 2000, when 171,888 cy of material from the waterway and adjacent berthing areas were sampled and tested. As in the previous testing cycle, DMMUs at the head of the waterway were ranked 'high'. This included the entire right berthing area, the navigation channel from station 6+12 to station 7+00, and the left berthing area from station 6+12 to station 7+57. The remaining portions of the navigation channel and left berthing area were ranked 'moderate'. The target characterization depth in the federal channel and left berthing area was -30 ft (-26 ft + 2 ft advanced

maintenance + 2 ft overdepth). The full -30 ft MLLW dredge cut in those areas began at station 6+12. The target characterization depth in the right berthing area was -22 ft (-20 ft + 2 ft overdepth). The head end of the left berthing area extended to station 5+40.

All material was found suitable for open-water disposal at either the Bellingham Bay or Rosario Strait site, with the exception of one subsurface DMMU – consisting of 1,688 cy − in the right berthing area. Lead (2,100 mg/kg) and 2,4-dimethylphenol (62 ug/kg) exceeded their respective SLs in the unsuitable DMMU. The concentration of lead in this DMMU also exceeded the maximum level of 1,200 mg/kg. Nickel exceeded the SL in effect at the time in three other DMMUs. However, nickel has since been removed from the list of COCs for marine projects. The DMMP agencies required both bioassays and bioaccumulation to be conducted on the DMMU with the elevated lead concentration if open-water disposal were to be pursued as an option. Bellingham Cold Storage – the Port tenant using the right berthing area – elected not to conduct this testing. In the absence of biological testing data, this material was found unsuitable for open-water disposal. This DMMU, along with the overlying DMMU, were left in place. TBT was tested in porewater samples from four of the DMMUs. It was undetected in two samples and detected at concentrations below the BT in the other two. The highest concentration (0.13 ug/L) occurred in the left berthing area. Dioxins/furans were not analyzed.

The waterway was dredged in 2004, with the exception of the right berthing area, as noted previously.

2011 USACE Dioxin Characterization

In 2011, the Squalicum Creek Waterway was tested for dioxin to determine the feasibility of maintenance dredging under the 2010 revised DMMP dioxin guidelines for open-water disposal in Puget Sound. Samples were taken to an elevation of -28 ft MLLW (authorized depth of -26 ft plus 2 ft of overdepth) to represent potential dredged material. Dioxin/furan concentrations ranged from 2.0 to 5.1 ng/kg TEQ (n = 7). Dioxin/furan concentrations in Z-samples ranged from 0.94 to 6.3 ng/kg TEQ (n = 8).

2010 Bellingham Cold Storage Characterization

In addition to sediment characterization by USACE, Bellingham Cold Storage has conducted sampling and testing in the Squalicum Creek Waterway on two occasions. The first occurred in 2010, when 6,660 cy were characterized in the left berthing area between station 6+12 and 15+00. The project was ranked ‘moderate’.

There were no SL exceedances for standard COCs. TBT was also analyzed in porewater samples and was undetected well below the BT. The dioxin/furan concentration in one DMMU was 1.7 ng/kg TEQ. Both a field and laboratory duplicate were run on the second DMMU, yielding a mean concentration of 10.6 ng/kg TEQ for the three measurements. The volume-weighted average was less than the interim dioxin guideline of 8.7 ng/kg TEQ in effect at the time for the Elliott Bay site. The material was subsequently dredged and disposed at the Elliott Bay site.

2015 Bellingham Cold Storage Characterization

The second characterization event by Bellingham Cold Storage occurred in 2015 for 14,200 cy within the navigation channel itself. The purpose of the proposed dredging was to remove a shoal in the right-half of the channel, just northeast of the turning basin that was posing a navigation impediment for vessels using

the Bellingham Cold Storage facility. A rank of ‘moderate’ was applied. The target characterization depth was -26 ft MLLW (-24 ft + 2 ft overdepth).

There was a single SL exceedance, which occurred for benzyl alcohol. The DMMP agencies used best professional judgment in finding the dredged material suitable for open-water disposal without requiring bioassays. Bulk TBT was tested in both the dredged material and Z-sample; it was undetected in both at a reporting limit well below the BT. The dioxin/furan concentrations in the dredged material and Z-sample were 1.7 and 1.6 ng/kg TEQ respectively. The dredged material was found suitable for dispersive disposal and was subsequently dredged and placed at the Rosario Strait site.

Appendix B

Endangered Species Act Consultation Letters

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232

Refer to NMFS No:
WCR-2018- 8774

February 15, 2018

Evan R. Lewis
Corps of Engineers, Seattle District
Planning and Cultural Resources
Post Office Box 3755
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7 Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Bellingham Squalicum Harbor Navigational Dredging Project. (6th Field HUC: 171100020404 North Puget Sound)

Dear Mr. Lewis:

On January 26, 2018, NOAA's National Marine Fisheries Service (NMFS) received your request for a written concurrence that the U.S Army Corps of Engineers (COE) navigational dredging in Squalicum Harbor, Bellingham, Washington is not likely to adversely affect (NLAA) species listed as threatened or endangered or critical habitats designated under the Endangered Species Act (ESA). This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, and agency guidance for preparation of letters of concurrence.

NMFS also reviewed the proposed action for potential effects to Essential Fish Habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination that you made regarding the potential effects of the action. This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation. In this case, we determined that the action would not adversely affect EFH. Thus, consultation under the MSA is not required for this action.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Oregon Washington Coastal Office in Lacey, Washington.

Proposed Action and the Action Area

The Seattle District COE proposes routine maintenance dredging in the Squalicum Waterway Federal Navigation Channel in Bellingham Harbor, Whatcom County, Washington. The proposed plan would involve dredging the channel to minus 26 feet below Mean Lower Low Water (MLLW) plus two feet of allowable overdepth and two feet of advance maintenance. The work will be accomplished via mechanical (clamshell bucket) dredging and is expected to take up to 70 days. The planned dredge area is approximately 3,500 feet long, 200 feet wide, and includes a turning basin that is 700 feet long and 516 feet wide at the edge of the channel narrowing to 216 at the outer edge of the basin (Figure 1). Sediments in the main channel and turning basin have been determined suitable for aquatic disposal and are estimated at 320,000 cubic yards for this dredging event. Disposal of dredged material that meets open-water disposal criteria will occur at one or more Puget Sound Dredged Disposal Analysis sites, which were the subject of a previous consultation (NMFS No.: 2015/2975, dated December 17, 2015). All in-water work will occur between July 16 through February 15 to minimize effects to juvenile salmon.

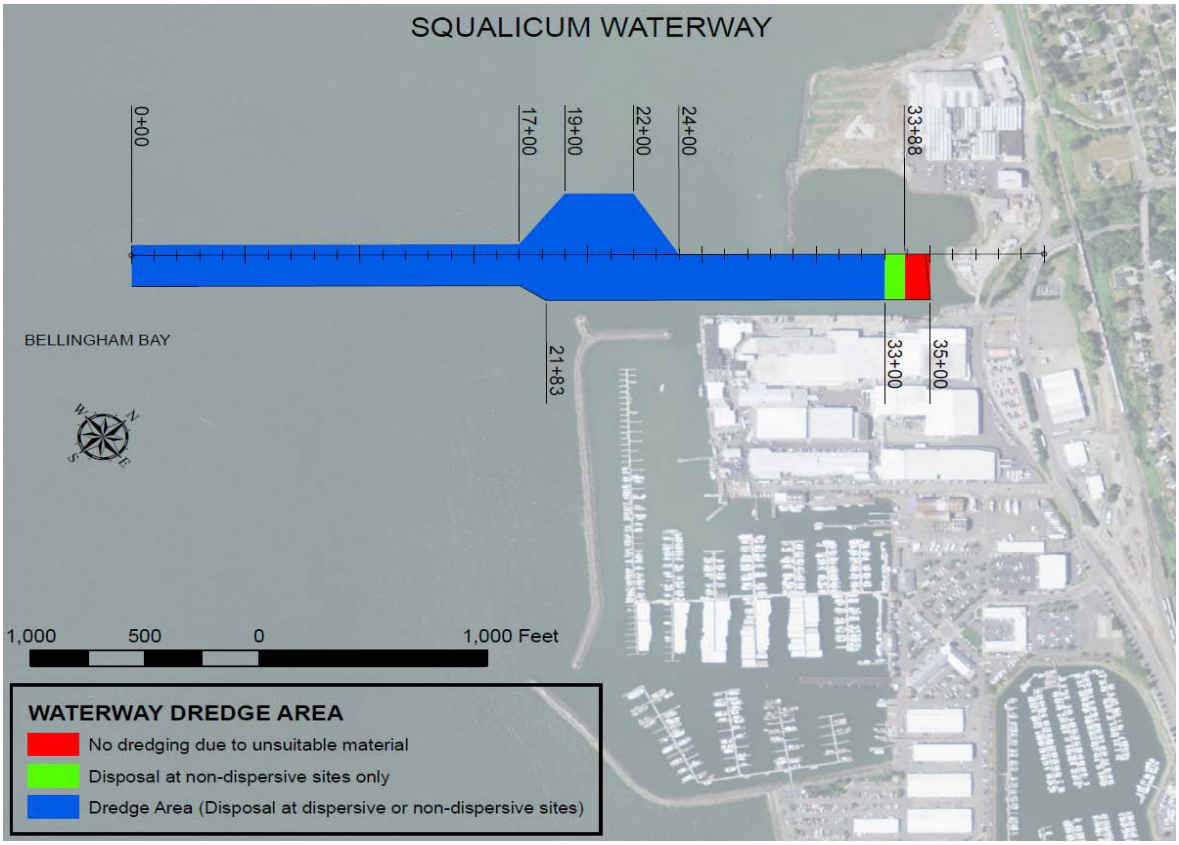


Figure 1. Project Dredge Area

The purpose of the action is to support safe access by maintaining the authorized depth for navigation. Squalicum Waterway is an important intake and processing harbor used by fishing fleets from Alaska, Canada, and the northwestern U.S.

The action area includes the entire length of the channel and a 1.2-mile radius around the channel. This distance is set conservatively at four times the reported distance for underwater sound attenuation of dredging equipment, and potential effects of sediment in a rearing and migration area for listed salmon and rockfish. Intertidal areas found around Bellingham Bay consist of marshlands, sandflats, and mudflats, and contain a diverse assemblage of infaunal and epibenthic organisms.a 300-foot radius around construction activities to account for any substrate-disturbing activity and suspended sediments/turbidity generated during dredging.

Action Agency's Effects Determination

The COE determined the proposed action is not likely to adversely affect the species and critical habitats listed in Table 1. The COE determined that that turbidity and noise would be temporary and not rise to adverse levels. This justified an NLAA determination for listed species and critical habitat as detailed in the Biological Assessment (BA) and transmittal letter for the project. The COE also determined that the action would have no adverse effect on EFH.

Table 1. Federal Register notices for final rules that list threatened and endangered species or designate critical habitats to listed species considered in this consultation.

Species	ESU or DPS	Listing Status	Critical Habitat
Chinook salmon (*Oncorhynchus tshawytscha*)	Puget Sound	8/15/11 76FR50448 Threatened	9/02/05 70 FR 52630
Steelhead (*O. mykiss*)	Puget Sound	8/15/11 76FR50448 Threatened	1/14/2013 78 FR 2725 Not in the action area
Yelloweye rockfish (*Sebastes ruberrimus*)	Puget Sound/ Georgia Basin	4/28/2010 75 FR 22276 Threatened	02/11/2015 80 CFR7977 Not in the action area
Bocaccio rockfish (*S. paucispinis*)	Puget Sound/ Georgia Basin	4/28/2010 75 FR 22276 Endangered	02/11/2015 80 CFR7977 Not in the action area
killer whale (*Orcinus orca*)	Southern Resident (SR)	11/18/2005 70 FR 69903 Endangered	11/29/2006 71 FR 69054
Humpback whale *(Megaptera novaeanglia)*	Mexico DPS Central America DPS	09/08/16 81 FR 62259 Threatened/Endangered	Not in the action area

Consultation History

The COE submitted a transmittal letter and a BA to NMFS for the project referenced above on January 26, 2018, on which date NMFS initiated informal consultation. A complete record of this consultation is on file at the Oregon and Washington Coastal Office in Lacey, Washington.

Effects of the Action

For purposes of the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). The applicable standard to find that a proposed action is NLAA for listed species or critical habitat is that all of the effects of the action are expected

to be discountable, insignificant, or completely beneficial.[1] Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur. The effects of the action on ESA listed salmonid species will primarily consist of increased suspended sediments. Effects to SR killer and humpback whales consist of elevated sound levels.

Effects to PS Chinook juveniles will be discountable because in-water work will be conducted between July 16 and February 15 when juvenile salmon are least likely to be present. Juvenile PS Chinook salmon generally migrate to sea before July 16th. Juvenile PS steelhead migrate seaward as smolts in March to early June and will not occur in the action area during construction. Adult salmon and/or steelhead would not be impeded by the proposed dredging, as they would be able to avoid construction activities and migrate past the operations. Furthermore, most adult salmonids would be migrating in deeper waters, outside of the immediate construction area, and would not be affected by temporary low level, localized turbidity. In addition, any elevations in turbidity and suspended sediments generated by dredging will be similar to the variations that occur normally within the environmental baseline of the marine nearshore, which is regularly subject to strong winds and currents that generate suspended sediments.

Rockfish at any life history stage are not expected to occur in the Squalicum Waterway navigation channel because the channel is in shallower brackish water away from typical rockfish deep-water rocky habitat, it is not near typical spawning locations, and has low likelihood for having larval rockfish drift through due to the distance from spawning habitat. According to Love et al. (2002), the larval stage of the ESA-listed rockfish species does not occur in the intertidal, subtidal nearshore, or shallow shelf habitats of Puget Sound. Juveniles may settle in nearshore rocky habitat or in kelp forests (Love et al. 1991), but this habitat type is not associated with the maintenance dredging project area. Because dredging occurs in an area where ESA-listed rockfish are not expected to occur, the effect of maintenance dredging is discountable.

SR killer whales and humpback whales may occur in the action area during the in-water work window. SR killer whales are common in Rosario Strait west of the work area, particularly in summer (http://www.orcanetwork.org/Main/). Humpback whales sightings are becoming more common in Puget Sound, although still quite rare. The project would cause temporary and insignificant levels of in-water noise and activity. As described in the acoustic assessments for similar work (NMFS 2016a), the highest expected source levels from this project would be caused by the operation of the supporting tugboat and the engine of the bucket dredge, both of which would be well below the thresholds for the onset of injury in marine mammals (NOAA 2016b). At most, SR killer and humpback whales may experience brief periods of virtually undetectable acoustic masking and barely discernable avoidance of the area within about 1.2 miles around dredging operations. Avoidance of that area within Bellingham Bay would not inhibit access to important habitat resources, nor would it hinder migration past the area. Additionally, the area of avoidance would likely be much smaller because the project related noise would be quickly masked by the relatively high ambient noise levels due to high levels of industrial activity in the bay.

[1] U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered Species Act consultation handbook: procedures for conducting section 7 consultations and conferences. March. Final. P. 3-12.

The action area includes designated critical habitat for PS Chinook salmon. Critical habitat consists of six Primary Constituent Elements (PCEs) for the PS Chinook Evolutionary Significant Unit. The action area contains PCE #5. This PCE includes nearshore marine areas free of obstruction and excessive predation with (1) water quality and quantity conditions and foraging opportunities, including aquatic invertebrates and fishes, supporting growth and maturation, and (2) natural cover including submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

The NMFS analyzed the potential impacts of the project on this PCE and determined that the potential effects will be insignificant. Potential adverse effects include temporary effects to water quality from noise and turbidity. These effects will be localized, of low intensity, and return to preconstruction conditions following the cessation of activity. Because of this, the conservation value of critical habitat in the action area will be maintained.

Critical habitat for SR killer whales was designated in three specific areas: 1) Summer Core Area in Haro Strait and waters around the San Juan Islands; 2) Puget Sound; and 3) the Strait of Juan de Fuca on November 29, 2006 (71 FR 69054). Critical habitat includes approximately 2,560 square miles of Puget Sound, excluding areas with water less than 20 feet deep relative to extreme high water. The PCEs for SR killer whale critical habitat are: (1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

The proposed action will have insignificant effects on the critical habitat PBF of water quality, as the most notable effect is elevated sediment or turbidity, which abates quickly and returns to baseline levels when activities cease. The project will not decrease the number of adult salmon in South Puget Sound, and thus has no mechanism to affect the SR killer whale prey base. As stated above, sound generated from construction, that may carry into deeper water, will be insignificant to passage conditions because it would not inhibit access to important habitat resources, nor would it hinder migration past the area. Although SR killer whales may experience brief periods of virtually undetectable acoustic masking and barely discernable avoidance of the area within about 1.2 miles around dredging operations, noise levels will dissipate and return to preconstruction conditions immediately after construction has ceased. Therefore, the conservation value of critical habitat in the action area will be maintained.

Conclusion

Based on this analysis, we concur with the COE's determination that the proposed action is not likely to adversely affect the subject listed species and designated critical habitats.

Reinitiation of Consultation

Reinitiation of consultation is required and shall be requested by the Federal agency**,** or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) new information reveals effects of the action that may affect listed species or critical

habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this concurrence letter; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16).

Please direct questions regarding this letter to Shandra O'Haleck of the Oregon Washington Coastal Office at (360) 753-9533, or by electronic mail at shandra.ohaleck@noaa.gov.

Sincerely,

Elizabeth Babcock for

Barry A. Thom
Regional Administrator

cc: Nancy Gleason, COE
Fred Goetz, COE

REFERENCES

Love, M.S., M. Carr, and L. Haldorson. 1991. The ecology of substrate-associated juveniles of the genus Sebastes. Env. Bio. Fish. 79: 533-545.

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National Marine fisheries Service (NMFS). 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commer., NOAA Technical Memorandum NMFS-OPR-55. July 2016. 189 pp.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

MAY - 9 2018

In Reply Refer To:
01EWFW00-2018-I-0578

Evan R. Lewis, Deputy Chief
Planning, Environmental, Cultural Resources Branch
Seattle District, U.S. Army Corps of Engineers
ATTN: Nancy Gleason
P.O. Box 3755
Seattle, Washington 98124-3755

Dear Mr. Lewis:

Subject: Squalicum Waterway Navigation Channel Maintenance

This letter is in response to your January 25, 2018, request for our concurrence with your determination that the proposed action in Bellingham Harbor, Whatcom County, Washington, "may affect, but is not likely to adversely affect" federally listed species. We received your letter and Biological Assessment, providing information in support of "may affect, but is not likely to adversely affect" determinations, on January 31, 2018. The proposed project would involve dredging the Squalicum Waterway Federal Navigation Channel to -26 feet below mean lower low water plus two feet of overdepth and two feet of advance maintenance. The project proposes to remove approximately 350,000 cubic yards of sand and silt by clamshell dredge, and dispose of the materials at one or more Puget Sound Dredged Disposal Analysis sites. The dredging will require approximately 70 days, may be conducted 24 hours a day, during 16 July through 31 October (if using the Bellingham Bay disposal site 1), and 16 July through 15 February for the two additional disposal sites.

Specifically, you requested informal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (ESA) for the federally listed species and critical habitat identified below.

- Bull trout (*Salvelinus confluentus*)
- Bull trout critical habitat
- Marbled murrelet (*Brachyramphus marmoratus*)

We believe that sufficient information has been provided to determine the effects of the proposed action and to conclude whether it would adversely affect federally listed species and/or designated critical habitat. Our concurrence is based on information provided by the action agency, best available science, and complete and successful implementation of the agreed-upon conservation measures.

EFFECTS TO BULL TROUT

Effects and Disturbance

Temporary and/or long-term effects from the action are not expected to measurably disrupt normal bull trout behaviors (i.e., the ability to successfully feed, move, and/or shelter), and are therefore considered insignificant and/or discountable:

- The action includes dredging (for up to 70 days) that will result in elevated turbidity. However, these effects will be intermittent and limited in physical extent and duration. In addition, because the work will be done when bull trout are least likely to be present, project-related effects are unlikely to result in injury to bull trout or to disrupt normal bull trout behaviors.

Effects to Bull Trout Habitat and Prey Sources

With successful implementation of the agreed-upon conservation measures, we expect that temporary impacts from the action will not measurably degrade or diminish habitat functions or prey resources in the action area, and effects are therefore considered insignificant and/or discountable:

- Construction methods and proposed permanent features may impact habitat that supports bull trout and/or their prey sources. These impacts will be limited in physical extent and/or duration, and will not measurably degrade habitat functions, including prey resources, that are important to bull trout within the action area:
    - The action will result in limited temporary and/or permanent impacts to native substrates, aquatic vegetation, the benthic invertebrate community, and complexity of instream or marine nearshore habitat; however, these effects will be intermittent and of short duration.
    - The action will maintain or reestablish authorized channel depths and contours at a location(s) dredged in the past. Any in-water disposal of dredged material will comply with a current, valid Site Use Authorization approved under the Dredged Material Management Program. The action will not degrade habitat functions that are important to bull trout or their prey resources, and will not diminish forage fish or salmonid production.
    - The action may impact prey resources for bull trout, including potential or documented forage fish spawning habitat; however, the action will not result in the permanent net loss of forage fish spawning habitat.

EFFECTS TO BULL TROUT CRITICAL HABITAT

The final revised rule designating bull trout critical habitat (75 FR 63898 [October 18, 2010]) identifies nine Primary Constituent Elements (PCEs) essential for the conservation of the species. The 2010 designation of critical habitat for bull trout uses the term PCE. The new critical habitat regulations (81 FR 7214) replace this term with physical or biological features (PBFs). This shift in terminology does not change the approach used in conducting our analysis, whether the original designation identified primary constituent elements, physical or biological features, or essential features. In this letter, the term PCE is synonymous with PBF or essential features of critical habitat.

The proposed action may affect the PCEs listed below. Because project-related impacts to the PCEs will be short in duration, limited in extent, and will not alter the function of the PCE, these effects are considered insignificant:

PCE 2: *Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.*

- The action may temporarily introduce an impediment or barrier within migration habitat; however, it will not preclude bull trout movement through the area, either during or after construction, and any effects will be temporary. The migration habitat will not be permanently altered, destroyed, or degraded.

PCE 3: *An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

- The action may temporarily reduce the food base via a small reduction of prey resources, degradation of aquatic habitat, and/or removal or alteration of riparian vegetation. However, the impacts will be temporary and/or components of the project design will avoid, reduce, or compensate for them.

PCE 4: *Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.*

- The action will maintain the degraded conditions of the habitat by continuing to preclude and/or degrade natural shoreline processes, but will not increase or result in further declines in shoreline/riparian complexity.

PCE 5: *Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.*

- The action may alter the water temperature in the immediate vicinity of the project area, but the effects will be short-term, and/or we would be unable to measure, detect, or evaluate the effects.

PCE 8: *Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.*

- The action may impact water quantity and/or quality. However, the effects will be temporary; components of the project design include actions to avoid, reduce, or compensate for the effects from the impacts; and/or we would be unable to measure, detect, or evaluate the effects.

EFFECTS TO MARBLED MURRELET

Effects - Marine Environment

Temporary exposures and effects from the action are not expected to measurably disrupt normal marbled murrelet behaviors (i.e., the ability to successfully feed, move, and/or shelter) and are therefore considered insignificant and/or discountable:

- The action includes dredging (for up to 70 days) that will result in elevated turbidity. However, these effects will be intermittent and limited in physical extent and duration.
- Long-term use and operations of the Squalicum Waterway Navigation Channel may result in increased sound levels or other temporary stressors that could disturb marbled murrelets. However, due to the present level of development and activity in the vicinity, the action is not expected to disrupt normal marbled murrelet behaviors (i.e., the ability to successfully feed, loaf, move, and/or shelter).

Effects to Marbled Murrelet Foraging Habitat and Prey Sources

With successful implementation of the agreed-upon conservation measures, we expect that temporary impacts from the action will not measurably degrade or diminish habitat functions or prey resources in the action area, and effects are therefore considered insignificant and/or discountable:

- Construction methods and proposed permanent features may impact habitat that supports marbled murrelets and/or their prey sources. These impacts will be limited in physical extent and/or duration and will not measurably degrade habitat functions, including prey resources that are important to marbled murrelets within the action area:
    - The action will result in limited temporary and/or permanent impacts to native substrates, aquatic vegetation, the benthic invertebrate community, and complexity of instream or marine nearshore habitat; however, these effects will be intermittent and of short duration.

- The action will maintain or reestablish authorized channel depths and contours at a location(s) dredged in the past. Any in-water disposal of dredged material will comply with a current, valid Site Use Authorization approved under the Dredged Material Management Program. The action will not degrade habitat functions that are important to marbled murrelets or their prey resources, and will not diminish forage fish production.
- The action may impact prey resources for marbled murrelets, including potential or documented forage fish spawning habitat; however, the action will not result in the permanent loss of forage fish spawning habitat.

Conclusion

This concludes consultation pursuant to the regulations implementing the ESA (50 CFR 402.13). Our review and concurrence with your effect determinations is based on the implementation of the project as described. It is the responsibility of the Federal action agency to ensure that projects that they authorize or carry out are in compliance with the regulatory permit and ESA. If a permittee or the Federal action agency deviates from the measures outlined in a permit or project description, the Federal action agency has the obligation to reinitiate consultation and comply with section 7(d).

This project should be re-analyzed and re-initiation may be necessary if 1) new information reveals effects of the action that may affect listed species or critical habitat in a manner, or to an extent, not considered in this consultation, 2) if the action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this consultation, and/or 3) a new species is listed or critical habitat is designated that may be affected by this project.

This letter constitutes a complete response by the U.S. Fish and Wildlife Service to your request for informal consultation. A complete record of this consultation is on file at the Washington Fish and Wildlife Office, in Lacey, Washington. If you have any questions about this letter or our shared responsibilities under the ESA, please contact the consulting biologist identified below.

U.S. Fish and Wildlife Service Consultation Biologist(s):
Steven Borrego (360-753-4410)

Sincerely,

for Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
7600 Sand Point Way N.E.
Seattle, Washington 98115

December 17, 2015

In Reply Refer to:
2015/2975

David Fox
Chief, Dredged Material Management Office
U.S Army Corps of Engineers, Seattle District
PO Box 3755
4735 E. Marginal Way South
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation and Fish and Wildlife Coordination Act Recommendations for the Continued Use of Multi-User Dredged Material Disposal Sites in Puget Sound and Grays Harbor, (Fourth Field HUCs 17110020 Dungeness-Elwha, 17110002 Strait of Georgia, 1711019 Puget Sound, and 17100105 Grays Harbor), Washington

Dear Mr. Fox:

Thank you for your letter received July 29, 2015, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the continued use of ten multi-user dredged material disposal sites in Puget Sound and Grays Harbor.

The enclosed document contains a biological opinion (opinion) that analyzes the effects of your proposal to permit the transport and disposal of dredged material at eight multi-user open-water disposal sites in Puget Sound and two multi-user open-water disposal sites in Grays Harbor. In this opinion, NMFS concludes that the action, as proposed, is not likely to adversely affect the Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionary Significant Unit (ESU), and the Lower Columbia River (LCR), Upper Willamette River Chinook salmon LCR coho salmon (*O. kisutch*), Hood Canal (HC) summer-run, Columbia River chum salmon (*O. keta*), and LCR steelhead (*O. mykiss*) ESUs. NMFS also concludes that the action, as proposed, is not likely to adversely affect the Southern Distinct Population Segment (DPS) of Pacific eulachon (*Thaleichthys pacificus*), the Southern DPS of North American green sturgeon (*Acipenser medirostris*), the Southern Resident (SR) killer whale DPS (*Orcinus orca*), and humpback whale (*Megaptera novaeangliae*). NMFS also concludes that the proposed action is not likely to jeopardize the continued existence of the PS/Georgia Basin DPSs of bocaccio (*Sebastes paucispinis*), canary rockfish (*S. pinniger*), and yelloweye rockfish (*S. ruberrimus*). Further, NMFS concludes that the proposed action would not result in the destruction or adverse modification of designated critical habitat for PS Chinook salmon, HC summer-run chum

salmon, PS/Georgia Basin bocaccio, canary rockfish, and yelloweye rockfish, Southern green sturgeon, SR killer whale, or leatherback sea turtle (*Dermochelys coriacea*). NMFS also concludes that the proposed action would have no effect on proposed critical habitat for PS steelhead.

As required by section 7 of the ESA, NMFS provided an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the COE and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions would be exempt from the ESA take prohibition.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes five conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on essential fish habitat. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

If the response is inconsistent with the essential fish habitat conservation recommendation, the COE must explain why the recommendation will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendation. In response to increased oversight of overall essential fish habitat program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each essential fish habitat consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the essential fish habitat portion of this consultation, you clearly identify the conservation recommendation(s) accepted.

Please contact Dan Tonnes of my staff at the Protected Resources Division in Seattle, Washington at (206) 526-4643, by e-mail at dan.tonnes@noaa.gov, or by mail at the letterhead address if you have questions regarding the rockfish portion of this section 7 consultation, or if you require additional information. Contact Matthew Longenbaugh of my staff at the Oregon/Washington Area Office in Lacey, Washington at (360) 753-7761, by e-mail at matthew.longenbaugh@noaa.gov, or by mail at the letterhead address for questions regarding questions on the salmonid, sturgeon, or eulachon portions of this section 7 consultation; and Teresa Mongillo of my staff at the Protected Resources Division in Seattle, Washington at (206) 526-4749, by e-mail at teresa.mongillo@noaa.gov, or by mail at the letterhead address for questions regarding the marine mammal portions of this section 7 consultation.

Sincerely,

For William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: Jeff Laufle, COE
Evan Lewis, COE
OWAO
Teresa Mongillo, PRD
Longenbaugh, OWAO
Evan Lewis, COE Evan.R.Lewis @ usace.army.mil
David Fox, COE David.F.Fox@usace.army.mil
Jeff Laufle, COE Jeffrey.C.Laufle@usace.army.mil
Administrative File: 151401WCR2015PR

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Washington Fish and Wildlife Office
510 Desmond Dr. SE, Suite 102
Lacey, Washington 98503

JUL 28 2015

In Reply Refer To:
01EWFW00-2015-I-0724

Evan Lewis, Chief
Environmental and Cultural Resources Branch
Seattle District, U.S. Army Corps of Engineers
ATTN: ERS Branch (Laufle)
P.O. Box 3755
Seattle, Washington 98124-3755

Dear Mr. Lewis:

Subject: Continued Use of Multiuser Dredged Material Disposal Sites in Puget Sound and Grays Harbor

This letter is in response to your June 2015 request for our concurrence with your determination that the proposed action in Puget Sound and Grays Harbor, Washington, "may affect, but is not likely to adversely affect" federally listed species. We received your letter, and Biological Evaluation, providing information in support of "may affect, not likely to adversely affect" determinations, on June 22, 2015.

Project Description

The Army Corps of Engineers (Corps) and the Dredged Material Management Program (DMMP) agencies propose to manage the operation and monitoring of ten open-water dredged material disposal sites, eight in Puget Sound and two in Grays Harbor. The disposal sites will be used by federal and non-federal entities for disposal of material that is suitable for open-water disposal. Three of the Puget Sound sites and both of the Grays Harbor sites will be used for dispersive disposal – currents will carry released dredged material so that sediments are dispersed. The remaining five Puget Sound sites will be used as non-dispersive sites – released dredged material will remain localized beneath the release site.

Specifically, you requested informal consultation pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) for the federally listed species and critical habitat identified below.

- Bull trout (*Salvelinus confluentus*)
- Bull trout critical habitat
- Marbled murrelet (*Brachyramphus marmoratus*)

We believe that sufficient information has been provided to determine the effects of the proposed action and to conclude whether it would adversely affect federally listed species and/or designated critical habitat. Our concurrence is based on information provided by the action agency, best available science, and complete and successful implementation of agreed-upon conservation measures.

EFFECTS TO BULL TROUT

Effects and Disturbance

Temporary and/or long-term effects from the action are not expected to measurably disrupt normal bull trout behaviors (i.e., the ability to successfully feed, move, and/or shelter), and are therefore considered insignificant and/or discountable:

- The action will result in temporary impacts to water quality, including potential temporary increases in elevated levels of turbidity and contaminants, although the threat of increased contaminants will be decreased by testing dredged material prior to disposal to ensure it does not have the potential to adversely affect biological resources. These effects will be intermittent and limited in physical extent and duration.
- Long-term use and operations of the dredged material disposal sites will not disrupt normal bull trout behaviors (i.e., the ability to successfully feed, loaf, move, and/or shelter).

Effects to Bull Trout Habitat and Prey Sources

With successful implementation of the agreed-upon conservation measures, we expect that temporary impacts from the action will not measurably degrade or diminish habitat functions or prey resources in the action area, and effects are therefore considered insignificant and/or discountable:

- Construction methods and proposed permanent features may impact habitat that supports bull trout and/or their prey sources. These impacts will be limited in physical extent and/or duration, and will not measurably degrade habitat functions, including prey resources, that are important to bull trout within the action area:
    - Use of the dredged material disposal sites may result in periodic and/or temporary impacts to water quality through elevated levels of turbidity and contaminants, although the threat of increased contaminants will be decreased by testing dredged material prior to disposal to ensure it does not have the potential to adversely affect biological resources; and these effects will be intermittent and of short duration.
    - Any in-water disposal of dredged material will comply with a current, valid Site Use Authorization approved under the Dredged Material Management Program. The action will not degrade habitat functions that are important to bull trout or their prey resources, including diminishing forage fish or salmonid production.

EFFECTS TO BULL TROUT CRITICAL HABITAT

The final revised rule designating bull trout critical habitat (75 FR 63898 [October 18, 2010]) identifies nine Primary Constituent Elements (PCEs) essential for the conservation of the species. The proposed action may affect the PCEs listed below; however, effects to these PCEs are not expected measurably affect them and are therefore considered insignificant or discountable:

PCE 2: *Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.*

- The DMMP disposal sites are all greater than 50 feet in depth. Concentration of suspended sediment in nearshore areas is not expected to reach levels that would impede migration.

PCE 3: *An abundant food base, including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.*

- The DMMP disposal sites are located offshore in deep water either where prey are not located or where the dredged material will rapidly disperse, not significanly altering the disposal area.

PCE 4: *Complex river, stream, lake, reservoir, and marine shoreline aquatic environments, and processes that establish and maintain these aquatic environments, with features such as large wood, side channels, pools, undercut banks and unembedded substrates, to provide a variety of depths, gradients, velocities, and structure.*

- The action will have no effect on this PCE.

PCE 5: *Water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range. Specific temperatures within this range will depend on bull trout life-history stage and form; geography; elevation; diurnal and seasonal variation; shading, such as that provided by riparian habitat; streamflow; and local groundwater influence.*

- The action will have no effect on this PCE.

PCE 8: *Sufficient water quality and quantity such that normal reproduction, growth, and survival are not inhibited.*

- The action may impact water quantity and/or quality. However, the effects will be temporary; components of the project design include actions to avoid, reduce, or compensate for the effects from the impacts; and/or we would be unable to meaningfully measure, detect, or evaluate the effects.

EFFECTS TO MARBLED MURRELET

Effects - Marine Environment

Temporary exposures and effects from the action are not expected to measurably disrupt normal marbled murrelet behaviors (i.e., the ability to successfully feed, move, and/or shelter) and are therefore considered insignificant and/or discountable:

- The action will result in temporary impacts to water quality, including potential temporary increases in elevated levels of turbidity and contaminants, although the threat of increased contaminants will be decreased by testing dredged material prior to disposal to ensure it does not have the potential to adversely affect biological resources. These effects would be intermittent and limited in physical extent and duration.

- Long-term use and operations of the dredged material disposal sites may result in increased sound levels or other temporary stressors that could disturb marbled murrelets. However, due to the present level of development and activity in the vicinity, the action is not expected to disrupt normal marbled murrelet behaviors (i.e., the ability to successfully feed, loaf, move, and/or shelter).

Effects to Marbled Murrelet Foraging Habitat and Prey Sources

With successful implementation of the included conservation measures, we expect that temporary impacts from the action will not measurably degrade or diminish habitat functions or prey resources in the action area, and effects are therefore considered insignificant and/or discountable:

- Construction methods and proposed permanent features may impact habitat that supports marbled murrelets and/or their prey sources. These impacts will be limited in physical extent and/or duration and will not measurably degrade habitat functions, including prey resources that are important to marbled murrelets within the action area:
    - Use of the dredged material disposal sites may result in periodic impacts to water quality through elevated levels of turbidity and contaminants, although the threat of increased contaminants will be decreased by testing dredged material prior to disposal to ensure it does not have the potential to adversely affect biological resources; and these effects will be intermittent and short duration.
    - Any in-water disposal of dredged material will comply with a current, valid Site Use Authorization approved under the Dredged Material Management Program. The action will not degrade habitat functions that are important to marbled murrelets or their prey resources, including diminishing forage fish.

Conclusion

This concludes consultation pursuant to the regulations implementing the Endangered Species Act (50 CFR 402.13). Our review and concurrence with your effect determination is based on the implementation of the project as described. It is the responsibility of the Federal action agency to ensure that projects that they authorize or carry out are in compliance with the regulatory permit and/or the Endangered Species Act, respectively. If a permittee or the Federal action agency deviates from the measures outlined in a permit or project description, the Federal action agency has the obligation to reinitiate consultation and comply with section 7(d).

This project should be re-analyzed and re-initiation may be necessary if 1) new information reveals effects of the action that may affect listed species or critical habitat in a manner, or to an extent, not considered in this consultation, 2) if the action is subsequently modified in a manner

that causes an effect to a listed species or critical habitat that was not considered in this consultation, and/or 3) a new species is listed or critical habitat is designated that may be affected by this project.

This letter and its enclosures constitute a complete response by the U.S. Fish and Wildlife Service to your request for informal consultation. A complete record of this consultation is on file at the Washington Fish and Wildlife Office, in Lacey, Washington. If you have any questions about this letter or our joint responsibilities under the Endangered Species Act, please contact the consulting biologist identified below.

U.S. Fish and Wildlife Service Consultation Biologist(s):
Lee Corum (360-753-5835)

Sincerely,

Martha L. Jensen

for Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office

Appendix C

Draft Finding of No Significant Impact/Statement of Findings

CENWS-PMP-E

DRAFT FINDING OF NO SIGNIFICANT IMPACT
AND
CLEAN WATER ACT SECTION 404 STATEMENT OF FINDINGS (FONSI/SOF)
Squalicum Waterway Maintenance Dredging and Disposal,
Whatcom County, Washington

1. Name of Waterway: Squalicum Waterway

2. Background: The U.S. Army Corps of Engineers (USACE) is undertaking the following project under the Rivers and Harbors Act of 3 July 1930 (House Document 290, 71st Congress, 2nd Session). The project was constructed in 1931; additional congressional action in 1937 authorized dredging of berthing areas adjacent to the inner portion of the channel and a turning basin at mid-channel on the northwest side, both authorized at -26 feet mean lower low water (MLLW). Federal maintenance began in 1949 and has continued to the present. Authorized features of the Federal navigation project include:

- From deep water to the pier head line, a waterway entrance channel 200 feet wide and 26 feet deep at MLLW.
- A turning basin 700 feet long, 26 feet deep, and 216 to 516 feet wide.
- A channel 300 feet wide by approximately 3,500 feet long.

Maintenance dredging of the navigation channel is needed because shoaling sediment from Squalicum Creek and the Nooksack River has reduced the depth of the navigation channel. The navigation channel was last dredged in 2004. The navigation channel provides access to the pier at Bellingham Cold Storage, one of the largest employers in Whatcom County, and Squalicum Harbor. The navigation channel provides access for commercial fishing vessels from the northwestern U.S, Alaska, and Canada. Commercial fishing intake and the associated fish and frozen food processing are important to the regional economy. The channel must be maintained to support safe navigation for commercial activities and regular shipping traffic.

3. Action: USACE proposes to conduct routine maintenance dredging of accumulated sediment from the Squalicum Waterway in Bellingham Bay with a clamshell dredge. The project consists of removing approximately 320,000 cubic yards (cy) of material dredged from the main channel and the turning basin, and 31,000 cy from the inner channel for a total of 351,000 cy. The project includes an additional 2 feet of allowable overdepth and may include an additional 2 feet of advance maintenance, for a total depth of up to 30 feet below MLLW. Sediments in the main channel, turning basin, and inner channel have been determined suitable for aquatic disposal.

Disposal of dredged material is proposed at two sites that are available in northern Puget Sound; the Rosario Strait Puget Sound Dredged Disposal Analysis Program (PSDDA) Site and the Port Gardner PSDDA Site near Everett, Washington. The Rosario Strait site is a dispersive site at 97-142 feet deep and permitted to receive the majority of the estimated quantity of sediments (320,000 cubic yards) as long as the dioxin level is below the threshold permitted. The Port Gardner site is non-dispersive site at 420 feet deep. The Port Gardner sites is eligible to receive material that has a dioxin level above the threshold permitted at Rosario (31,000 cubic yards). The haul distance to the Rosario Strait PSDDA dispersive disposal site is 25 nautical miles, and the haul distance to the Port Gardner PSDDA non-dispersive disposal site is 60 nautical miles.

Dredging may take up to 70 days, depending on total quantity of material removed, mechanical breakdowns, and weather conditions. Dredging will occur 24 hours per day except for periods of machinery maintenance and crew changes. Timing of this project will adhere to the July 16 through February 15 in-water work window to avoid vulnerable life stages of sensitive and ESA-listed species.

4. Coordination: The Federal action is described in the Draft Environmental Assessment (EA): Draft Environmental Assessment Bellingham Harbor – Squalicum Waterway Federal Navigation Channel Maintenance Dredging and Disposal February, 2019, and is hereby incorporated by reference.

a. Letters of Comment and Response: A public comment period on the Draft EA, the contents of which are consistent with a CWA Section 404 Public Notice, will take place from xxx to xxx.

b. Federal Agencies: The United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), and the Department of the Interior, U.S. Fish and Wildlife Service (USFWS) are responsible for the Endangered Species Act of 1973 (ESA) listed species in the Duwamish River. The USACE has determined that each alternative considered in this EA may affect but is not likely to adversely affect any ESA-listed species or designated critical habitat and has prepared documentation of this determination because either they are not likely to be present in the action area or the effect would be minor and insignificant. Documentation of this analysis and determination was provided to NMFS and USFWS for consultation under Section 7 of the ESA and letters of concurrence with USACE's determination were received on 15 February 2018 and 9 May 2019, respectively. In 2010, USACE submitted a BA for ESA consultation for the DMMP disposal sites. The USACE received a Biological Opinion on 17 December 2015 from NMFS and a letter of concurrence on 28 July 2015 from USFWS for the DMMO disposal sites.

The USACE has determined that the proposed dredging would not reduce the quality and/or quantity of EFH for Pacific salmon, coastal pelagic, and groundfish EFH and no adverse effects to EFH are expected to result from the proposed action. The USACE

submitted this determination to NMFS for their consideration and response. A letter of concurrence was received on 15 February 2018.

USACE determined that use of the multiuser open-water placement sites for dredged material disposal may adversely affect EFH and received concurrence from NMFS on 17 December 2015. The USACE provided a detailed response to NMFS within 30 days as required by section 3.5(b)(4)(B) of the MSA.

NMFS provided three conservation recommendations to minimize and/or avoid the impacts of both dredging and disposal, and the recommended EFH conservation measures that are pertinent and productive in the context of dredging in a protected and heavily trafficked area such as Upper Duwamish Waterway have been incorporated as mitigation and monitoring measures.

c. State and Local Agencies

(1) USACE has requested a 401 Water Quality Certification (WQC) from the Washington Department of Ecology (WDOE) and will comply with applicable conditions associated with the discharge of dredged material into the waters of the U.S.

(2) USACE has determined that the proposed project is consistent to the maximum extent practicable with the enforceable policies of the approved Washington State (State) Coastal Zone Management Program, particularly the City of Bellingham's, City of Everett's, and Skagit County's Shoreline Management Program. USACE has prepared a Coastal Zone Consistency Determination and has submitted it to WDOE.

(3) No cultural resources have been identified within the Squalicum Navigation channel.

(4) Treaty Tribes: Nine Native American tribes have had representation in this process through coordination with the USACE regarding area of dredging to maintain navigability of the Squalicum Waterway and proposed locations of disposal of dredged material. Additionally, the USACE has initiated consultation with tribal biologists regarding avoiding impacts to tribal fisheries resources. As of the date of publication of the Draft EA, the tribes have not responded with objections to maintenance of the authorized depths of the navigation channel and disposal at approved aquatic disposal sites.

5. Environmental Effects and Impacts.

a. Summary of Effects: The Draft EA for Bellingham Harbor – Squalicum Waterway Federal Navigation Channel Maintenance Dredging and Disposal, dated February 2019, describes the effects of the proposed project. Unavoidable adverse effects include disruption of benthic communities, minor and temporary water quality impacts through turbidity and depressed dissolved oxygen, and elevated noise, as well

as minor emissions of air pollutants and greenhouse gases. However, these effects will be temporary and localized and are not expected to be significant.

b. Compliance with Applicable Environmental Laws:

- Clean Water Act, Sections 404 and 401: USACE prepared a 404(b)(1) evaluation to document findings regarding this project pursuant to Section 404 of the Act, attached as Appendix D of the EA, and prepared a 404 public notice for public comment. USACE has requested a 401 Water Quality Certification from WDOE on xxx and will comply with all applicable requirements and conditions associated with the discharge of dredged material into waters of the U.S.

- Coastal Zone Management Act: USACE prepared a coastal zone consistency determination and determined that the proposed action is consistent to the maximum extent practicable. It is attached as Appendix E of the EA, and has submitted it to WDOE.

- National Environmental Policy Act: USACE prepared a Draft EA and is circulating the document for a 30-day public comment period.

- Endangered Species Act: USACE has determined that each alternative considered in this EA may affect but is not likely to adversely affect any ESA-listed species or designated critical habitat and has prepared documentation of this determination because either they are not likely to be present in the action area or the effect would be minor and insignificant. Documentation of this analysis and determination was provided to NMFS and USFWS for consultation under Section 7 of the ESA and letters of concurrence with USACE's determination were received on 15 February 2018 and 9 May 2019, respectively (Appendix B of the EA). Impacts to ESA listed species, fish, and marine mammals at the open-water disposal sites are addressed in the aforementioned PSDDA Phase I EIS. In 2010, USACE submitted a BA for ESA consultation for the DMMP disposal sites. The USACE received a Biological Opinion on 17 December 2015 from NMFS and a letter of concurrence on 28 July 2015 from USFWS for the DMMO disposal sites (Appendix B of the EA).

- Magnuson-Stevens Fishery Conservation and Management Act: The USACE has determined that the proposed action would not reduce the quality and/or quantity of EFH for Pacific salmon, coastal pelagic, and groundfish EFH and no adverse effects to EFH are expected to result from the proposed action. The USACE submitted this determination to NMFS for their consideration and response. A letter of concurrence was received on 15 February 2018.

USACE determined that use of the multiuser open-water placement sites for dredged material disposal may adversely affect EFH and received concurrence from NMFS on 17 December 2015. The USACE provided a detailed response to NMFS within 30 days as required by section 3.5(b)(4)(B) of the MSA.

NMFS provided three conservation recommendations to minimize and/or avoid the impacts of both dredging and disposal, and the recommended EFH conservation measures that are pertinent and productive in the context of dredging in a protected and heavily trafficked area such as Upper Duwamish Waterway have been incorporated as mitigation and monitoring measures.

- Clean Air Act: Maintenance dredging and disposal activities under this project will result in emissions that are clearly *de minimis* and will constitute maintenance dredging where no new depths are required and no new disposal sites are designated, so the project is exempt from any requirement to conform to a State Implementation Plan under 40 CFR 93.153 (c)(2)(ix).

- Marine Mammal Protection Act (MMPA): USACE has determined that the project will not disturb any marine mammal to the extent of causing disruption to behavioral patterns, and that it is thus not necessary to pursue an incidental harassment authorization under the MMPA for the following reasons: 1) the dredge bucket hitting the soft substrate is not likely to exceed established noise thresholds, 2) it is unlikely that an animal will be in the project vicinity during the dredging given their low densities in the Duwamish River, and 3) animals that may be in the project vicinity are likely acclimated to noise generated by regular boat traffic and can avoid the area during periods of elevated noise.

- National Historic Preservation Act: No cultural resources have been identified within the Squalicum Navigation channel. On 23 August 2017 the USACE sent an area of potential effects (APE) letter to the SHPO describing the project and APE. The SHPO responded on 29 August 2017, and agreed with the APE. On 23 August 2017 the USACE sent letters to the Lummi Nation, the Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Samish Nation, the Upper Skagit Indian Tribe, and the Stillaguamish Tribe of Indians asking if there are any properties of cultural or religious significance that would be affected by the project. On 4 October 2017 the USACE sent a letter to the SHPO detailing the USACE's finding of "no historic properties affected". The SHPO responded on October 5, 2017, concurring with the USACE's determination of "no historic properties affected". The USACE also sent letters to the Lummi Nation, the Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Samish Nation, the Upper Skagit Indian Tribe, and the Stillaguamish Tribe of Indians. To date, USACE has not received a response from the Tribes.

- Tribal Treaty Fishing Rights: Interference with treaty fishing rights will be avoided by performing dredging operations at times that do not conflict with treaty-protected fishing activities. Nine Native American tribes have had representation in this process through coordination with the USACE regarding area of dredging to maintain navigability of the Squalicum Waterway and proposed locations of disposal of

dredged material. Additionally, the USACE has initiated consultation with tribal biologists regarding avoiding impacts to tribal fisheries resources. As of the date of publication of the Draft EA, the tribes have not responded with objections to maintenance of the authorized depths of the navigation channel and disposal at approved aquatic disposal sites.

- Executive Order 12898, Environmental Justice: Maintenance dredging in the Squalicum Waterway and associated aquatic disposal in dispersive sites is not expected to result in any disproportionate adverse environmental effects or impacts on the health of minority/low-income populations. Maintenance of the existing navigation project would not negatively affect property values in the area, or socially stigmatize local residents or businesses.

- Executive Order 11988, Floodplain Management: USACE has determined that the proposed action does not induce development in the base floodplain, does not increase flood risk, and there is no practicable alternative that meets the project purpose.

6. Determination.

a. Results of the Environmental Analysis for the Squalicum Maintenance Dredging Project: The draft EA prepared for this project recommended this (FONSI). The proposed project will not constitute a major Federal action significantly affecting the quality of the human environment.

b. Alternatives: Four alternatives were considered in the draft EA for the Maintenance Dredging of the Squalicum Waterway, dated February 2019: (1) no action, (2) dredging with disposal at the Rosario Strait and Bellingham Bay PSDDA open-water sites, (3) dredging with disposal at Rosario Strait and Port Gardner PSDDA open-water sites, and (4) dredging with disposal at the Rosario Strait and Bellingham Bay PSDDA open-water sites

The USACE rejected Alternative 1 because it would not meet the project purpose and need. Alternative 4 is the Federal standard, meaning the least costly alternative, at the most practicable location, consistent with sound engineering practices, that meets environmental standards established by the CWA 404(b)(1) evaluation process. Alternatives 2 and 3 would have slightly greater environmental impacts and would cost more than Alternative 4. However, the local sponsor, the Port of Bellingham, made an agreement with the Lummi Tribe not to dispose of materials at the Bellingham Bay site so alternatives 2 and 4 were rejected and Alternative 3 was selected as the preferred alternative. Because alternative 4 is considered the Federal standard, the Port of Bellingham is required to pay the difference in cost between alternative 3 and 4. The Port of Bellingham is required to pay the difference in cost between the cost to dispose of material in the Bellingham Bay disposal site (the Federal Standard) and alternative material disposal sites. A Memorandum of

Agreement is required between USACE and the Port of Bellingham and will be executed before disposal of dredged materials can be placed at sites in excess of the costs of the Federal Standard dredged material placement alternative. The Port of Bellingham shall provide to USACE funds to pay all costs, including the costs of environmental compliance, supervision and administration, and engineering and design, associated with the dredged material placement that exceed the costs of the Federal Standard dredged material placement alternative.

c. Individual and Cumulative Environmental Effects: Based on the analysis presented in the draft EA, the additional incremental effect of the preferred alternative beyond the already accumulated degradation of the industrial harbor is insignificant. No significant adverse effects on recreation, aesthetics, or the economy are anticipated. USACE has determined that there will be no significant adverse effects to aquatic ecosystem functions and values.

7. Summary of Impacts and Compliance: Impacts of the proposed work will be minor, short-term, and temporary. This project complies with the Endangered Species Act: a biological assessment addressing the dredging activity has been prepared and was transmitted to NMFS and USFWS; NMFS and USFWS issued a concurrence letter dated on 15 February 2018 and 9 May 2019, respectively. Consultation has been concluded on transportation of dredged material to, and placement at, multi-user aquatic disposal sites. USACE has determined that it is not necessary to pursue a permit under the MMPA for noise impacts to harbor seals and California sea lions. This project will comply with Sections 401 and 404 of the Clean Water Act. A 404(b)(1) analysis has been prepared, and USACE has requested a Water Quality Certification and a consistency determination under the Coastal Zone Management Act from the WDOE. The project complies with the NHPA and USACE has coordinated with the Washington SHPO, the Lummi Nation, the Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Samish Nation, the Upper Skagit Indian Tribe, and the Stillaguamish Tribe of Indians.

8. District Engineer's Findings and Conclusions: I have evaluated the dredging and disposal activity in light of the public interest factors prescribed in 33 CFR 336.1(c). The following factors were evaluated as considerations potentially impacting the quality of the human environment in the accompanying EA and coastal zone consistency evaluation: Navigation and the Federal standard, water quality, coastal zone consistency, wetlands, endangered species, historic resources, scenic values, recreational values, fish and wildlife, and application of non-Federal land use policies. No additional impacts to state/regional/local land use classifications, determinations, and/or policies are anticipated as the project will maintain a federally authorized boat basin that is already used for vessel moorage. In accordance with 33 CFR 337.1(a)(14) and 325.3(c)(1), the following additional relevant factors were also considered: conservation, economics, shoreline erosion and accretion, safety, and property ownership.

The preferred alternative does not represent the least costly alternative, constituting the discharge of dredged or fill material into waters of the U.S. in the least costly manner and at the least costly and most practicable location. However, due to the agreement between the Port of Bellingham and the Lummi Tribe not to dispose of dredge sediments at the Bellingham Bay PSDDA site, and the Port's requirement (and agreement) to pay the cost difference, alternative 3 was selected. Alternative 3 is consistent with sound engineering practices, and meets the environmental standards established by the Clean Water Act Section 404(b)(1) evaluation process. Execution of the preferred alternative, following consideration of all applicable evaluation factors, would be in the public interest. The selected alternative is consistent with sound engineering practices, and meets the environmental standards established by the Clean Water Act Section 404(b)(1) evaluation process. Execution of the selected alternative, following considerations of all applicable evaluation factors, is in the public interest.

Furthermore, based on the attached draft EA, I have determined that the selected action will not have significant effects on the quality of the human environment and does not require preparation of an environmental impact statement.

_____ _____

Date

MARK A. GERALDI
COL, EN
Commanding

Appendix D

Clean Water Act, Section 404(b)(1) Evaluation

CENWS-PMP-E January 2019

Squalicum Waterway Federal Navigation Project Maintenance Dredging

Bellingham, Whatcom County, Washington

Substantive Compliance for Clean Water Act, Section 404(b)(1) Evaluation

1. Introduction. The purpose of this document is to record the evaluation and findings regarding this project pursuant to Section 404 of the Clean Water Act (CWA).

The following action is covered by this document: the Squalicum Waterway Federal Navigation Channel would be maintained between stations 0+00 to 33+88 to the authorized depth of -26 feet mean lower low water (MLLW) plus two feet of allowable overdepth and two feet of authorized advance maintenance. The total quantity estimated to be dredged is 351,000 cy of material. For two action alternatives under consideration, the majority of dredged material would be placed at Rosario Strait dispersive PSDDA site, which is 25 miles from the dredging site. The remaining material that is suitable for non-dispersive disposal only (typically from the head of the channel) and would go to either the Bellingham Bay non-dispersive PSDDA site, which is 3 miles from the channel to be dredged (Alternative 2), or to the Port Gardner non-dispersive site, which is 60 miles away (Alternative 3). The duration of Alternative 2 would be approximately 65 days. The duration of the work for Alternative 3 would be approximately 70 days. The key difference between the first two action alternatives is the location of disposal of the material that must go to a non-dispersive site and the duration of dredging for this portion of the project; the work would take 5 days for disposal in Bellingham Bay and, due to the longer hauling distance, 10 days for disposal at Port Gardner. A fourth alternative was also considered, with all material going to the Bellingham Bay non-dispersive site (Alternative 4). The duration of alternation 4 is estimated to take 50 days, which is minimum needed to dredge all the material.

The information contained in this document reflects the findings of the project record. Specific sources of information included the following:

a. Puget Sound Dredged Disposal Analysis Final Environmental Impact Statement Phase II North Puget Sound 1989. PSDDA Agencies.

b. Biological Evaluation: Continued Use of the Multi-user Puget Sound Dredged Disposal Analysis sites. USACE – Seattle District 2015.

c. Draft Environmental Assessment and Public Interest Review: Bellingham Harbor – Squalicum Waterway Federal Navigation Channel Maintenance Dredging and Disposal. USACE – Seattle District 2017

d. CWA, 404(b)(1) Evaluation (see below).

e. Public Interest Review (see Draft EA and content below).

This document addresses the substantive compliance issues of the Clean Water Act 404(b)(1) Guidelines [40 CFR §230.12(a)] and the Regulatory Program of the Corps of Engineers [33 CFR §320.4(a)].

2. Description of the Proposed Discharge. The USACE is proposing to dispose of up to 351,000 sediments from the Squalicum Waterway of the Port of Bellingham as part of routine

maintenance of the Federal navigation channel. According to sediment sampling and the associated Suitability Determination of May 3, 2017 (DMMP 2017), sediments in the main channel and turning basin have been determined suitable for aquatic disposal and are estimated at 320,000 cy for this dredging event. Sediments at the head of the waterway from station 33+00 to 33+88 contain low levels of dioxin and are approved for aquatic disposal at non-dispersive sites only; this quantity is estimated at 31,000 cy. Sediments to be dredged are predominantly silt in the main channel and a combination of silt, sand, gravel and cobble at the head of the waterway. Disposal for the majority of the dredged material would occur at the Rosario Strait PSDDA site. The remaining materials that contains low levels of dioxin must be disposed at a non-dispersive site; the nearest 2 available sites are Bellingham Bay PSDDA site (3 miles away) and the Port Gardner PSDDA site (60 miles away).

3. Project Need. Maintenance dredging of the navigation channel is needed because of the shoaling of sediments from the Nooksack River and Squalicum Creek that reduce the depth of the channel by as much as 20 feet, with an average of six to eight feet is most locations. The primary commercial activities are fishing and frozen food processing and storage, which makes Squalicum Waterway an important processing and intake harbor for the entire region, utilized by fishermen from Alaska, Canada, and the northwest U.S. The channel must be maintained to support the navigation for the commercial activities and regular shipping traffic.

4. Project Purpose. The purpose of the action is to provide for safe navigation by maintaining the authorized depth of -26 feet MLLW, plus 2 feet of allowable overdepth and 2 feet of advance maintenance at the pier that hosts Bellingham Cold Storage and provides sea-going vessels with commercial access to the City of Bellingham.

5. Availability of Less Environmentally Damaging Practicable Alternatives to Meet the Project Purpose. The alternatives evaluated for this project were as follows:

a. *Alternative 1 (No Action)*. The No-Action Alternative is analyzed as the future without-project conditions for comparison with the action alternatives. If the USACE takes no action to clear shoaling sediment from the Squalicum Waterway, this would cause continued shoaling posing a risk to the large shipping vessels that may run aground or may be unable to load and unload cargo at the pier. Eventually, access to the pier would become unavailable, which would have economic impacts to the Port of Bellingham affecting businesses and the local community. This alternative would not meet the project purpose and need, but is carried forward for evaluation purposes.

b. *Alternative 2 – Dredging Squalicum Waterway with Disposal at Rosario Strait and Bellingham Bay PSDDA Sites.*

The USACE proposes to conduct routine maintenance dredging of accumulated sediments from the Squalicum Waterway at Bellingham Harbor. The project consists of removing up to 351,000 cy of material dredged from station 0+00 to station 33+88 of the main channel and the turning basin from station 17+00 to 24+00. The project includes 2 feet of allowable overdepth and an additional 2 feet of advance maintenance. According to sediment sampling and the associated Suitability Determination of May 3, 2017 (DMMP 2017), sediments in the main channel and turning basin have been determined suitable for aquatic disposal and are estimated at 320,000 cy for the upcoming dredge event. Sediments at the head of the waterway from station 33+00 to 33+88 contain low levels of

dioxin and are approved for aquatic disposal at non-dispersive sites only; this quantity is estimated at 31,000 cy for the upcoming dredge event. Work performed at Squalicum Waterway would consist of clamshell dredging with a bucket holding 5-25 cy. Dredged material would be placed on a bottom-dump barge holding approximately 2,000 to 2,500 cy. The majority of the material would be hauled 25 miles to the Rosario Strait PSDDA site for disposal. Material approved for open-water disposal but restricted to non-dispersive sites would be taken to the Bellingham Bay Disposal site that is 3 miles from the Squalicum Waterway. If the Bellingham Bay disposal site is selected for use, the in-water work window is restricted to 16 July through 31 October. USACE estimates that the total dredging time would be approximately 65 days with 60 days of dredging and transport to the Rosario Strait site and 5 days of dredging and transport to Bellingham Bay site.

c. *Alternative 3 – Dredging Squalicum Waterway with Disposal at Rosario Strait and Port Gardner PSDDA Sites.*

Alternative 3 would be executed in the same manner as Alternative 2 with the exception of disposal at Port Gardner instead of Bellingham Bay for the 31,000 cy that must go to a non-dispersive site. Dredging would occur 24 hours per day except for periods of machinery maintenance and crew changes. Timing of this project would adhere to the July 16 through February 15 in-water work window to avoid vulnerable life stages of ESA-listed species. The Port Gardner disposal site does not have the same in-water work window restriction as the Bellingham Bay site. For Alternative 3, the material would be transported to the appropriate disposal sites for disposal, which are Rosario Strait PSDDA open-water dispersive site for approved material and Port Gardner open-water non-dispersive site for the material that is known to contain low levels of dioxin. The Port Gardner disposal site is 60 miles away from the dredging site. Total dredging time for this alternative would take approximately 60 days for material going to Rosario Strait and 10 days for material going to Port Gardner for a total of 70 days. The long distance of the dredging site from Port Gardner means that transport of dredged material would occur approximately 2 times per day.

d. Alternative 4 – *Dredging Squalicum Waterway with Disposal at Bellingham Bay PSDDA Site*

Alternative 4 would be executed in the same manner as Alternative 2 and 3 with the exception the disposal of all material at the Bellingham Bay site. If the Bellingham Bay disposal site is selected for use, the in-water work window is restricted to 16 July through 31 October. USACE estimates that the total dredging time would be approximately 50 days of dredging and transport to the Bellingham Bay site.

Findings. The USACE rejected Alternative 1 because it would not meet the project purpose and need. Alternative 4 is the Federal standard, meaning the least costly alternative, at the most practicable location, consistent with sound engineering practices, that meets environmental standards established by the CWA 404(b)(1) evaluation process.Alternatives 2 and 3 would have slightly greater environmental impacts and would cost more than Alternative 4. However, the local sponsor, the Port of Bellingham, made an agreement with the Lummi Tribe not to dispose of materials at the Bellingham Bay site so alternatives 2 and 4 were rejected and Alternative 3 was selected as the preferred alternative. Because alternative 4

is considered the Federal standard, the Port of Bellingham will pay the difference in cost between alternative 3 and 4.

6. Significant Degradation, Either Individually or Cumulatively, to the Aquatic Environment

a. *Impacts on Ecosystem Function*.

The disposal of dredged material onto the substrate within the footprint of the disposal sites would disturb benthic habitat and would bury the less mobile benthic organisms. Disposal at the PSDDA sites means that any benthic species present are at risk of displacement and potential smothering; however, organisms re-populate the area within days to weeks and the habitat characteristics remain stable according to DMMP monitoring. Potential effects from open water disposal would be localized to previously-disturbed areas solely within the footprint of the disposal site, short in duration as the benthic community recovers within several months, and minor in spatial scope limited to the designated area for receipt of dredged sediments. Turbidity has been determined to be a negligible effect according to DMMP Environmental Impact Statement (EIS) prepared for the PSDDA sites (PSSDA 1989).

Current velocities are slow enough at the Port Gardner site that the material with low levels of dioxin content would not distribute beyond the site. Only material that meets criteria for dispersive PSDDA sites would be disposed at the Rosario Strait dispersive site; current velocities in this area would move the sediment into a natural gradation along the sea floor resulting in no significant impact to the environment.

Timing restrictions for material disposal would minimize effects of disposal operations on salmonids by avoiding periods when they are abundant. Negative effects to the aquatic environment would not be significant either individually or cumulatively.

b. *Impacts on Recreational, Aesthetic, and Economic Values*. The USACE expects no significant adverse effects on recreation, aesthetics, or the economy as the purpose of the areas are designated for open-water disposal, and the action is temporary in nature.

Findings. The USACE has determined that there would be no significant adverse effects to aquatic ecosystem functions and values.

7. Appropriate and Practicable Measures to Minimize Potential Harm to the Aquatic Ecosystem

a. *Impact Avoidance Measures*. The primary avoidance measure concerns the timing of in-water work and placement of dredged materials. The USACE would adhere to the in-water work windows for protection of crab, shrimp, and juvenile salmonids. This limits work to July 16 through February 15 for disposal at Port Gardnerand Rosario Strait. Avoiding dredging in the springtime also prevents introducing turbidity into eelgrass beds during a sensitive time of year. Another avoidance measure is to dredge as infrequently as possible.

b. *Impact Minimization Measures*. The USACE would minimize impacts by adhering to the DMMP criteria for disposal of materials at open water sites. The dioxin criteria level of no more than 4 ng/kg has been determined sufficient to protect human health and aquatic resources; however, the material with low dioxin content is only eligible for disposal at

the non-dispersive Port Gardner site. Disposal at a non-dispersive site allows greater certainty of the fate of the material through post-disposal monitoring compared to monitoring of dispersive sites.

c. *Compensatory Mitigation Measures*. There would be no compensatory mitigation measures because the work would not have more than a negligible change to any habitat characteristics.An environmental assessment (EA) is being prepared per the National Environmental Policy Act (NEPA) that concludes that the action would not result in significant impacts to the human environment, and a Biological Assessment was prepared per the Endangered Species Act (ESA) that determined the action is "may effect, but is not likely to adversely effect" ESA listed species.

Findings. The USACE has determined that all appropriate and practicable measures have been taken to minimize potential harm. The disposal alternative that would cost less and still be consistent with engineering and environmental requirements while meeting the project need (alternative 4) was not selected due to concerns from the Lummi Tribe. The preferred alternative is alternative 3, and the Port of Bellingham will pay the difference in cost between alternative 3 and 4.

8. Other Factors in the Public Interest.

a. *Fish and Wildlife*. The USACE is coordinating with State and Federal agencies to assure careful consideration of fish and wildlife resources. The USACE prepared a Programmatic Biological Evaluation in December 2015 to assess potential effects of disposal at the DMMP-managed sites on federally Endangered Species Act (ESA) protected species. This document concluded that continued disposal at the PSDDA disposal sites, including Rosario Strait and Port Gardner, is not likely to adversely affect ESA-listed species. The National Marine Fisheries Service (NMFS) concurred with the finding with the exception of the three ESA-listed rockfish species. NMFS provided a Biological Opinion to conclude the ESA consultation process for the PSDDA disposal sites. USFWS provided a letter of concurrence with the USACE's findings. This programmatic consultation under Section 7 of the ESA fulfills the consultation requirements for aquatic disposal of sediments dredged for the proposed action.

b. *Water Quality*. The USACE willobtain a Section 401 Water Quality Certification from the Washington State Department of Ecology. The USACE would abide by the conditions in the Water Quality Certification to ensure compliance with State water quality standards.

c. *Historic and Cultural Resources*. Since the proposed dredging is confined to the removal of recently deposited sediments within the previously dredged channel width and depth boundaries, no submerged cultural resources would be affected by the project.

d. *Activities Affecting Coastal Zones*. The USACE is substantively consistent with the enforceable polices of the City of Bellingham, City of Everett, and SkagitCounty Shoreline Master Programs and provided documentation of this consistency determination to Ecology for their review.

e. *Environmental Benefits*. The USACE has not identified any substantial environmental benefits of the proposed maintenance dredging action.

f. *Navigation*. A minor, temporary disruption of navigation traffic may result from dredging and placement operations. A "Notice to Mariners" would be issued before dredging and placement operations are initiated. The disposal sites are located in open-water, with plenty of room on either side of the disposal vessels, so impacts to vessel traffic should be minimal. There is a slight chance that vessels may be need to manuaver around the disposal vessels. Dredging will occur 24 hours per day and disposal will occur intermittently as it travels between the dredge location and disposal site. The action would have an overall benefit for navigation by returning the Federal navigation channel to its authorized depth.

Findings. The USACE has determined that this project is within the public interest based on review of the public interest factors.

9. Conclusions. Based on the analyses presented in the Environmental Assessment, as well as the following 404(b)(1) Evaluation and General Policies analysis, the USACE finds that this project complies with the substantive elements of Section 404 of the Clean Water Act.

404(b)(1) Evaluation [40 CFR §230]

Potential Impacts on Physical and Chemical Characteristics (Subpart C)

1. **Substrate [230.20]** The Port Gardner open water disposal site is a non-dispersive site and therefore bathymetric surveys are conducted to monitor the accumulation of dredged material. This site receives much of its material from the Snohomish River, which is a mixture of sand and silt. Substrate at the Rosario Strait disposal site is slightly coarser (more sand and gravel) than the material proposed for disposal from the Squalicum Waterway because the site is dispersive and finer material travels away from its direct disposal area.
2. **Suspended Particulate/Turbidity [230.21]**. The discharge of dredged material would cause a temporary increase in turbidity and suspended particulate levels in the water column, particularly in near-bottom waters. The dredge material is mostly silt and clay, with a small fraction of sand (>5%). This material would rapidly sink to the bottom, while a small percentage of finer material is expected to remain in suspension. Increases in turbidity associated with disposal operations would be minimal (confined to the areas in the immediate vicinity of the disposal sites) and of short duration (currents would disperse any suspended material within hours of disposal).
3. **Water Quality [230.22].** No significant water quality effects are anticipated. During disposal operations, a localized turbidity plume may persist for a short period during the descent of dredged material through the water column. A minor reduction in dissolved oxygen may be associated with this plume, primarily during disposal of silty sediments. Because disposal operations consist of a series of instantaneous, discrete discharges over the dredging schedule, any water quality effects should be short lived (hours) and localized (immediate vicinity). All of the sediments have been tested and approved for open water disposal under the guidelines of the DMMP administered by USACE, U.S. Environmental Protection Agency, Ecology, and Washington Department of Natural Resources.
4. **Current Patterns and Water Circulation [230.23]** The placement of material will not obstruct flow, change the direction or velocity of water flow/circulation, or otherwise change the dimensions of the receiving water body.
5. **Normal Water Fluctuations [230.24]** The placement of material will not impede normal tidal fluctuations.
6. **Salinity Gradients [230.25]** The placement of material will not divert or restrict tidal flows and thus will not affect salinity gradients.

Potential Impacts on Biological Characteristics of the Aquatic Ecosystem (Subpart D)

1. **Threatened and Endangered Species [230.30]** Pursuant to Section 7 of the ESA, the USACE prepared a Programmatic Biological Evaluation in December 2015 to assess potential effects of disposal at the DMMP-managed sites on protected species. This document concluded that continued disposal at the PSDDA disposal sites, including Bellingham Bay, Rosario Strait, and Port Gardner, is not likely to adversely affect ESA-listed species. The National Marine Fisheries Service (NMFS) concurred with the finding with the exception of the three ESA-listed rockfish species. NMFS provided a Biological Opinion to conclude the ESA consultation process for the PSDDA disposal sites. USFWS provided a

letter of concurrence with the USACE's findings. This programmatic consultation under Section 7 of the ESA fulfills the consultation requirements for aquatic disposal of sediments dredged for the proposed action.

2. **Aquatic Food Web [230.31]**. Turbidity associated with disposal operations may interfere with feeding and respiratory mechanisms of benthic, epibenthic, and planktonic invertebrates. Some sessile invertebrates at the disposal site will suffer mortality from disposal of dredged material. Species characteristic of these sites are opportunistic species, often small, tube-dwelling, surface-deposit feeders that exhibit patchy distribution patterns in space and time. Several studies have found that benthic infauna recolonize disposal sites quickly (several months), but that they may never reach mature equilibrium because of the frequent burying of organisms during disposal of dredged material. More mobile epibenthic organisms are expected to escape the immediate area without significant injury. Potential effects of disposal operations on salmonids will be reduced and/or avoided through implementation of timing restrictions.
3. **Wildlife [230.32]** Noise associated with placement operations may have an effect on bird and marine mammals, mainly seals and sea lions, in the project area. The effects of intermittent sound during disposal and transport would likely result in displacement of animals, but not injury. Dumping would occur for up to five minutes a couple of times per day. Increases in turbidity associated with dredged material placement could reduce visibility, thereby reducing foraging success for any animals in the area. Any reduction in availability of food would be highly localized and would subside rapidly upon completion of the placement operations. Placement operations are not expected to result in a long-term reduction in the abundance and distribution of prey items.

Potential Impacts to Special Aquatic Sites (Subpart E)

1. **Sanctuaries and Refuges [230.40]**. There are no marine protected areas or sanctuaries at or near the disposal sites proposed for use in this project.
2. **Wetlands [230.41]** Dredged material will not be discharged in wetlands. Use of the designated placement sites will not alter the inundation patterns of wetlands in the project area.
3. **Mudflats [230.42]** Dredged material will not be discharged onto mudflats.
4. **Vegetated Shallows [230.43]** Dredged material will not be discharged onto or directly adjacent to vegetated shallows.
5. **Coral Reefs [230.44**] Not applicable.
6. **Riffle and Pool Complexes [230.45]** Not applicable.

Potential Effects on Human Use Characteristics (Subpart F)

1. **Municipal and Private Water Supplies [230.50]** Not applicable.
2. **Recreational and Commercial Fisheries [230.51]** Sport fishing for crab, shrimp, and salmon occurs near the disposal sites. Work is timed and located to minimize effects to

fishing seasons in the disposal area, as well as critical migration periods for salmonids. A notice to mariners will be issued prior to dredge activities.

3. **Water-related Recreation [230.52]**. The presence of the tugboat and disposal barge would not pose an obstruction or have an appreciable effect on recreational vessel traffic. The disposal sites are not located in areas of recreational swimming activities.
4. **Aesthetics [230.53]**. Disposal operations will not change the appearance of the project area. Localized, temporary increases in noise, lighting, and turbidity will occur while equipment is operating, but are not expected to be significant.
5. **Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves [230.54]**. There are no marine protected areas or preserves at or near the disposal sites proposed for use in this project.

Evaluation and Testing (Subpart G)

1. **General Evaluation of Dredged or Fill Material [230.60]** The material to be disposed is predominantly fines (silt and clay). The areas to be dredged have been tested in accordance with DMMP guidelines and only material that is within those guidelines would be disposed of in water.
2. **Chemical, Biological, and Physical Evaluation and Testing [230.61]**. Sediment sampling occurred within the navigation channel in 2017 to determine suitability of sediments for aquatic disposal. Based on results from the most recent sediment sampling and suitability determination (DMMP 2017), material from Subarea A, most of the navigation channel, can go to any open-water disposal site. Composited samples from Subarea A were analyzed for dioxin and which were all below 4 ng/kg toxic equivalents (TEQ) thereby meeting the State's antidegradation standard. Additionally, the newly exposed material after dredging is complete would also meet the antidegradation standard for DMMP contaminants of concern and dioxin. Subarea B showed more than half of the sampling sites to exceed dioxin concentration suitable for DMMP disposal site management objective of 4 ng/kg for dispersive sites. To dispose material at a non-dispersive PSDDA site, the material must have a volume-weighted average dioxin concentration that is below 4 ng/kg TEQ. The material meets this criterion and is therefore eligible to be disposed at the Port Gardner non-dispersive PSDDA site).

Action to Minimize Adverse Effects (Subpart H)

1. **Actions Concerning the Location of the Discharge [230.70]** The effects of the discharge are minimized by the choice of placement sites. The placement sites have been designated for dredged material discharge. The discharge will not disrupt tidal flows. The location of the proposed discharge has been planned to minimize negative effects to the environment.
2. **Actions Concerning the Material to be Discharged [230.71]** Concentrations of chemicals of concern in the materials to be discharged are low, therefore no treatment substances nor chemical flocculates will be added before placement. The potency and availability of any pollutants present in the dredged material will remain unchanged. Subarea B showed more than half of the sampling sites to exceed dioxin concentration suitable for DMMP disposal

site management objective of 4 ng/kg for dispersive sites. To dispose material at a non-dispersive PSDDA site, the material must have a volume-weighted average dioxin concentration that is below 4 ng/kg toxic equivalents (TEQ). The material meets this criterion and is therefore eligible to be disposed at the Port Gardner non-dispersive PSDDA site.

3. **Actions Controlling the Material after Discharge [230.72]** Because only the dredged materials that have been approved for unconfined open water disposal by the inter-agency DMMP will be placed at the disposal site, no containment levees or capping are necessary. Post-disposal monitoring will occur per DMMP protocols.
4. **Actions Affecting the Method of Dispersion [230.73]**. The disposal sites have been selected by taking into account currents and circulation patterns to minimize negative effects of the discharge. The Port Gardner site is non-dispersive and is therefore appropriate for the 31,000 cy of material with low dioxin content for the upcoming dredge event. The Rosario Strait site is dispersive and analysis has determined the site is appropriate for minimizing harm to the environment where there is a need to dispose of dredged materials.
5. **Actions Related to Technology [270.74]** Appropriate machinery and methods of transport of the material for discharge will be employed. All machinery will be properly maintained and operated.
6. **Actions Affecting Plant and Animal Populations [270.75]** The USACE has coordinated with State and Federal resource agencies to assure there will be no greater than minimal effects to plant, fish, and wildlife resources.
7. **Actions Affecting Human Use [230.76]** The discharge will not result in damage to aesthetic features of the aquatic landscape. The discharge will not increase incompatible human activity in remote fish and wildlife areas.
8. **Other actions [230.77]** Not applicable.

Application by Analogy of the General Policies for the Evaluation of Public Interest [33 CFR §320.4, used as a reference]

1. **Public Interest Review [320.4(a)]** The USACE finds these actions to be in compliance with the 404(b)(1) guidelines and not contrary to the public interest.
2. **Effects on Wetlands [320.4(b)]** No wetlands will be altered by the placement of material from dredging operations.
3. **Fish and Wildlife [320.4(c)]** The USACE has coordinated with the local Native American Tribes and the State and Federal resource agencies to assure there will be no greater than minimal effects to fish and wildlife resources. The list of contacted agencies includes:

    - U.S. Environmental Protection Agency
    - U.S. Fish and Wildlife Service
    - National Marine Fisheries Service
    - Washington Department of Archaeology and Historic Preservation
    - Washington Department of Fish and Wildlife
    - Washington Department of Natural Resources

- Washington State Department of Ecology
- Jamestown S'Klallam Tribe
- Lower Elwha Klallam Tribe
- Lummi Nation
- The Nooksack Tribe
- Port Gamble S'Klallam Tribe
- Suquamish Tribe
- Swinomish Indian Tribal Community
- The Tulalip Tribes
- The Samish Nation
- The Upper Skagit Indian Tribe
- The Stillaguamish Tribe of Indians
- Skagit River System Cooperative

4. **Water Quality [320.4(d)]** The USACE will obtain a 401 Water Quality Certification from the Washington State Department of Ecology and will abide by the conditions of the Certification to ensure compliance with water quality standards.
5. **Historic, Cultural, Scenic, and Recreational Values [320.4(e)]** The USACE has consulted with representatives of interested Tribes, the State Historic Preservation Office (SHPO), and other parties and has determined that no historic properties would be affected by the planned undertaking (in a letter dated 4 October 2017, the Washington SHPO concurred with this determination). No wild and scenic rivers, historic properties, National Landmarks, National Rivers, National Wilderness Areas, National Seashores, National Recreation Areas, National Lakeshores, National Parks, National Monuments, estuarine and marine sanctuaries, or archeological resources will be adversely affected by the proposed work.
6. **Effects on Limits of the Territorial Sea [320.4(f)].** Not applicable.
7. **Consideration of Property Ownership [320.4(g)].** Not applicable.
8. **Activities Affecting Coastal Zones [320.4(h)].** The project is substantively consistent with the enforceable polices of the approved State Coastal Zone Management Program including the City of Bellingham, City of Everett, and SkagitCounty Shoreline Master Programs Shoreline Master Program. The USACE has prepared a consistency determination in compliance with the Coastal Zone Management Act.
9. **Activities in Marine Sanctuaries [320.4(i)].** Not applicable.
10. **Other Federal, State, or Local Requirements [320.4(j)].**

a. National Environmental Policy Act. An Environmental Assessment (EA) has been prepared to satisfy the documentation requirements of NEPA. Following a 30-day public review and comment period, the USACE will determine whether preparation of an Environmental Impact Statement is warranted

b. Endangered Species Act. In accordance with Section 7(a)(2) of the Endangered Species Act of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take

into consideration impacts to federally listed threatened or endangered species. A Programmatic Biological Evaluation (PBE) was submitted to USFWS and NMFS in May 2015 for continued disposal at the DMMP multiuser sites. USACE received a letter from USFWS on July 28, 2015 concurring with the determinations made in the PBE and a Biological Opinion from NMFS on 17 December 17, 2015, which concludes the requirements for Section 7 consultation regarding the aquatic disposal of dredged materials associated with this project.

c. Clean Water Act. The USACE must demonstrate compliance with the substantive requirements of the Clean Water Act. This document records the USACE's evaluation and findings regarding this project pursuant to Section 404 of the Act. The USACE will provide a Joint Aquatic Resources Permit form and other supporting documents as the basis for requesting a Section 401 Water Quality Certification from the Washington State Department of Ecology. The USACE will abide by applicable conditions of the Water Quality Certification associated with the discharge of dredged material into the waters of the U.S. to ensure compliance with water quality standards.

d. Coastal Zone Management Act. The Coastal Zone Management Act of 1972 (CZMA), as amended, requires Federal agencies to carry out their activities in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved Coastal Zone Management Program. The proposed action is considered consistent to the maximum extent practicable with the State Program.

e. Marine Protection, Research, and Sanctuaries Act. Section 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) authorizes the EPA to promulgate ocean dumping criteria and designate ocean disposal sites. This project will not involve ocean disposal of dredged material.

f. National Historic Preservation Act. The National Historic Preservation Act (16 USC 470) requires that the effects of proposed actions on sites, buildings, structures, or objects included or eligible for the National Register of Historic Places must be identified and evaluated. The USACE has initiated consultation with the Washington SHPO and the following tribes: Lummi Nation, Nooksack Tribe, Samish Tribe, Stillaguamish Tribe, Suquamish Tribe, Swinomish Tribal Community, Tulalip Tribes, and Upper Skagit Indian Tribe. The USACE has determined no historic properties would be affected and the Washington SHPO concurred with this determination.

g. Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act (16 USC 470) requires that wildlife conservation receive equal consideration and be coordinated with other features of water resource development projects. A Fish and Wildlife Coordination Act Report (FWCA) is not required for the proposed disposal of sediments because the FWCA does not apply to operations and maintenance activities on existing projects.

11. Safety of Impoundment Structures [320.4(k)]. Not applicable.

12. Floodplain Management [320.4(l)]. Disposal operations will not alter any floodplain areas.

13. Water Supply and Conservation [320.4(m)]. Not applicable.

14. Energy Conservation and Development [320.4(n)]. Not applicable.

15. Navigation [320.4(o)]. This project will maintain the navigability of the Federal Navigation Channel. The placement activities will not impede navigation.

16. Environmental Benefits [320.4(p)]. The USACE has not identified any environmental benefits of the maintenance dredging project.

17. Economics [320.4(q)]. The economic benefits of the proposed action are important to the local and regional economies. USACE has determined that this project is economically justified.

18. Mitigation [320.49(r)]. Potential effects of placement operations will be avoided and minimized through implementation of timing restrictions. No compensatory mitigation is required for the project.

Appendix E

Coastal Zone Management Act Consistency Determination

COASTAL ZONE MANAGEMENT ACT

CONSISTENCY DETERMINATION

Squalicum Waterway at Bellingham Harbor

Maintenance Dredging and Disposal

Whatcom County, Washington

Submitted by the U.S. Army Corps of Engineers,

Seattle District

US Army Corps
of Engineers®
Seattle District

January 2019

1 INTRODUCTION AND PROJECT DESCRIPTION

The Coastal Zone Management Act of 1972, as amended, requires Federal agencies to carry out their activities in a manner which is consistent to the maximum extent practicable with the enforceable policies of the approved state Coastal Zone Management (CZM) Programs. The Shoreline Management Act of 1972 (SMA; RCW 90.58) is the core of Washington's CZM Program. Primary responsibility for the implementation of the SMA is assigned to the local government.

According to 15 CFR Ch. IX § 930.30, the Federal Government is directed to ensure "that all Federal agency activities including development projects affecting any coastal use or resource will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of approved management programs." The Bellingham Harbor – Squalicum Waterway Maintenance Dredging and Disposal project occurs within the coastal zone governed by the City of Bellingham Shoreline Master Program, Title 22 of Bellingham Municipal Code finalized in 2013.

Maintenance dredging and disposal are activities undertaken by a Federal agency; the following constitutes a Federal consistency determination with the enforceable provisions of the Washington Coastal Zone Management Program.

1.1 Authority

The Squalicum Waterway and maintenance dredging by the Department of the Army was authorized by the Rivers and Harbors Act of 3 July 1930 (House Document 290, 71st Congress, 2nd session). T The project was constructed in 1931; additional congressional action in 1937 authorized dredging of berthing areas adjacent to the inner portion of the channel and a turning basin at mid-channel on the northwest side, both authorized at -26 feet MLLW. Federal maintenance began in 1949 and has continued to the present. Authorized features of the Federal navigation project include the following:

- From deep water to the pierhead line, a waterway entrance channel 200 feet wide and 26 feet deep at MLLW.
- A turning basin 700 feet long, 26 feet deep, and 216 to 516 feet wide.
- A channel 300 feet wide by approximately 3,500 feet long.

Routine maintenance channel dredging may include an advance maintenance depth up to two feet and an allowable overdepth of two feet.

1.2 Action Area

The proposed action will occur within the Squalicum Waterway at the Port of Bellingham in Whatcom County, Washington (Figure 1). The location of the navigation channels at the Port of Bellingham is shown in Figure 2 and the channel lengths and widths to be dredged are shown in Figure 3.

1.3 Background

The City of Bellingham, Washington is on the west side of Bellingham Bay in northeastern Puget Sound in Whatcom County, Washington. The Squalicum Waterway navigation channel is one of three

waterways in Bellingham Harbor, operated by the Port of Bellingham. The channel provides deep draft access to the pier that hosts Bellingham Cold Storage. The authorized navigation channel dimensions allow safe navigation during all tide levels. When shoaling creates shallow areas within the channel, it presents a safety hazard to deep draft vessels, or deep draft vessels must wait for high tide to transit. The channel was last dredged in 2003.

Squalicum Creek flows into Bellingham Bay near the project site. This creek deposits sediment annually into Bellingham Bay resulting shoaling in Squalicum Waterway. The City of Bellingham is located around Bellingham Bay and benefits from commerce that occurs at the Port of Bellingham.

2 PURPOSE

The purpose for the project is to maintain the congressionally authorized depth at the waterway in the Port of Bellingham to facilitate the waterborne commerce important to the local economy.

3 PROPOSED ACTION

USACE proposes to conduct routine maintenance dredging of up to 351,000 cy of accumulated sediment in the Squalicum Waterway in Bellingham Bay (Figure 2). The dredging consists of removing approximately 320,000 cubic yards (cy) of sediment from the main channel and turning basin and 31,000 cy from the head of the waterway. The project includes 2 feet of allowable overdepth and an additional 2 feet of advance maintenance. Sediments in the main channel, turning basin, and inner channel have been determined suitable for aquatic disposal by the Dredge Materials Management Program (DMMP 2017).

USACE will use a clamshell dredge to remove sediments that have accumulated along the length of the Federal navigation channel. A clamshell bucket is dropped to the bottom of the waterway in an open position and is then closed to “trap” sediment. This sediment is hauled to the surface and deposited on an awaiting barge and then transported to the disposal site. Once arriving at the disposal site, a bottom-dump barge drops the material into its intended location.

Work performed at Squalicum Waterway will use a clamshell bucket holding 5-25 cy. Dredged material will be placed on a bottom-dump barge holding approximately 2,000 cy. The barge will be managed such that the dredged sediment load does not exceed the capacity of the barge. The load will be placed in the barge to remain level and avoid listing. The sideboards and scuppers of the barge will be covered by a filter media, such as straw bales and/or geotextile fabric, to filter and retain suspended sediment while allowing the filtered water to drain back into the waterway. The material will be transported to the appropriate disposal site for disposal. USACE estimates that this project will involve two round-trips per day between the dredging area and the disposal site.

A Sediment Suitability Determination (SSD) was prepared May 3, 2017 by the Dredge Material Management Program (DMMP). The DMMP is administered collectively by USACE, the Environmental Protection Agency (EPA), and Washington State Departments of Ecology (Ecology) and Natural Resources (DNR). The DMMP determined that the sediments from station 0+00 to 33+00 are approved for aquatic disposal at an open-water dispersive site. Sediments at the head of the waterway from

station 33+00 to 33+88 contain low levels of dioxin and are approved for aquatic disposal at a non-dispersive site. Quantities have been estimated conservatively for environmental impacts analysis.

4 JURISDICTION AND CONSISTENCY REQUIREMENTS

Washington's CZM Program defines the State's coastal zone to include the 15 counties with marine shorelines, which includes Whatcom County. Primary responsibility for the implementation of the SMA is assigned to local government. The City of Bellingham, in which the proposed maintenance dredging will occur, fulfilled this requirement with the Shoreline Master Program (SMP) for the City of Bellingham. The City of Bellingham has elected to implement the State Shoreline Management Act, Chapter 90.58 RCW, through the adoption of goals and policies in Title 22 of the City of Bellingham's Municipal Code.

The proposed maintenance dredging location is the Squalicum Waterway of the Port of Bellingham, located in Bellingham Bay and designated in the City of Bellingham's Shoreline Management Program as Urban Maritime – Water Oriented Uses. Bellingham Bay is a Shoreline of Statewide Significance seaward of extreme low tide. The Port Gardner PSSDA Site is located near the City of Everett and designated as an "Aquatic" environmental designation. The City of Everett implemented the state's Shoreline Management Act, Chapter 90.58 RCW, through preparation of the original Shoreline Master Program (SMP) in 1976 and updated on July 11, 2016. The Rosario Strait PSSDA site is located between Fidalgo and Decatur Islands in northern Puget Sound and is designated in Skagit County's Shoreline Master Program as an "Aquatic" shoreline and a Shoreline of Statewide Significance. Skagit County implemented the State's Shoreline Management Act, Chapter 90.58 RCW, through preparation of the Shoreline Master Program (SMP) in 1976 and updated on July 10, 1995. Skagit County is updating its 1970s-era shoreline regulations through a process called the SMP Update. Preliminary adoption by the Board of County Commissioners is expected in June 2019, then preliminary approval from the Washington Department of Ecology is expected within 12 months.

4.1 Consistency Requirements

USACE is seeking state concurrence with the Coastal Zone Management Act (CZMA) Consistency Determination for the proposed routine maintenance dredging from the Washington Department of Ecology (Ecology) per CZMA Section 307 (c) and 15 CFR 923.33 (a) & (b). Under Washington's program, Federal projects that would affect land use, water use, or natural resources strive to demonstrate consistency with the policies of these six laws. Each of these laws is addressed below.

4.1.1 State Environmental Policy Act (SEPA)

The proposed action is a Federal action subject to NEPA, but not SEPA as there is no state action to be taken for this project.

4.1.2 Clean Water Act

The Clean Water Act requires Federal agencies to protect waters of the United States. The Act disallows the placement of dredged or fill material into waters (and excavation) unless it can be demonstrated there are no practicable alternatives to meet the need for the proposal. USACE prepared a 404(b)(1)

evaluation to document findings regarding this project pursuant to Section 404 of the Act. USACE prepared and distributed a Section 404 public notice for public comment as part of an Environmental Assessment prepared for this project. Dredged material will be discharged at an approved open-water disposal site. No wetlands would be affected by the project.

Water Quality Certification under Section 401 of the Act for discharges of dredged or fill material into the waters of the U.S. assures compliance with state water quality standards. USACE is pursuing a 401 Water Quality Certification from Ecology and will comply with all requirements and conditions.

4.1.3 Clean Air Act

Section 176 of the Clean Air Act (CAA), 42 USC 7506(c), prohibits Federal agencies from approving any action that does not conform to an approved state or Federal implementation plan. Maintenance dredging and disposal activities will occur in an attainment zone, therefore *de minimus* thresholds and conformity determination requirements do not apply [40 CFR 93.153 (c)(2)(ix)].

4.1.4 Ocean Resources Management Act

The enforceable policies of Chapter 43.143 RCW apply to coastal waters of the Pacific Ocean. The proposed action does not include sites in or near the Pacific Ocean. There would be no significant long-term impacts to coastal or marine resources or uses of the Pacific Ocean.

4.1.5 Energy Facility Site Evaluation Council

The proposed project does not involve siting of energy facilities in the State of Washington and does not apply to the proposed action.

4.1.6 Shoreline Management Act

The determination of consistency with the CZMA for this proposed action is based on review of the policies and standards of the Shoreline Management Plan for the City of Bellingham in Whatcom County, Washington, the City of Everett in Snohomish County, Washington, and Skagit County in Washington as defined in RCW 90.58 and WAC Chapter 173-26. Applicable sections of each plan are presented below with USACE's consistency determination in bold italics.

5 CONSISTENCY DETERMINATION

5.1 City of Bellingham Shoreline Master Program (applies to dredging of 351,000 cy)

The City of Bellingham SMP includes goals, policies and regulations. The general purpose, goals and policies are found in BMC 22.01 and 22.02. Together they provide direction and context for the specific policies and regulations in the Program. Policies are broad statements of intention. In contrast, regulations are requirements that are necessary to implement the policies. BMC 22.03 describes the shoreline jurisdiction consistent with state regulations as well as the shoreline environment designations that are applied to each shoreline reach. The environment designation section includes information on interpretation, purpose, management policies and general regulations. The shoreline designations determine which uses are allowed, which are conditional, and which are prohibited in shoreline areas.

Each relevant section of BMC appears below with USACE's description of how the proposed Federal action is consistent with the code in ***bold italic*** text.

22.03.30 Shoreline Environment Designations

D. Urban Maritime

1. Purpose – Preserve areas for water-oriented public, commercial, transportation, and industrial uses. Urban Maritime shorelines are a finite resource and should be utilized for these purposes while protecting existing ecological functions, restoring previously degraded areas and providing the general public with maximum access opportunities. Development in Urban Maritime shoreline areas should be managed such that it protects existing ecological functions.

Consistent. The proposed Federal action will preserve commercial, transportation, and industrial uses of the Squalicum Waterway. No aspect of the action will alter the existing ecological functions.

2. Management Policies

a. Where navigability is adjacent to upland areas, priority should be given to water-dependent uses. Water-related and water-enjoyment uses should be given second and third priorities respectively.

Consistent. The purpose of the maintenance dredging is to support water-dependent uses at the Port of Bellingham.

g. All impacts to ecological function and values should be fully mitigated with the mitigation sequencing specified in BMC 22.08.20 *Mitigation Sequencing*.

Consistent. The project is designed to avoid dredging any new areas and will minimize the total quantity to be dredged to only meet the purpose and need for the project with no unnecessary work. The dredging operation will use all applicable Best Management Practices to minimize disturbance and impacts to fish and wildlife. The project will not change any habitat types. MC 22.08.20 is addressed in this determination.

l. Full utilization of existing urban and previously developed areas should be achieved before further expansion is allowed.

Consistent. The project will not expand any development or utilization. The current uses of the navigation channel will continue and will remain limited to the established channel and berthing area footprints.

5. Regulations

a. Development within Urban Maritime shorelines shall not result in a net loss of shoreline ecological functions.

Consistent. The project does not constitute new development and no shoreline ecological functions will be lost by maintaining the existing navigation channel to authorized depth and footprint.

22.04.30 General Policies

A. Statewide Interest. The statewide interest should be recognized and protected over the local interest in shorelines of statewide significance. To recognize and protect statewide interest over local interest, the City shall consult with applicable state agencies, affected Indian tribes, and statewide interest groups and consider their recommendations in preparing shoreline Master Program provisions. The City shall also recognize and take into account state agencies' policies, programs, and recommendations in developing use regulations. For example, if an anadromous fish species is affected, the Washington State Departments of Fish and Wildlife and Ecology and the governor's salmon recovery office, as well as affected Indian tribes, should, at a minimum, be consulted.

1. For Bellingham Bay the resources that are of statewide interest include but are not limited to:

a. Anadromous fisheries, forage fish spawning areas, eelgrass and kelp beds, marine mammal, avian, and other marine biota habitat, and the city's four estuarine systems including pocket estuaries

Consistent. The Federal action will have no impacts to kelp and eelgrass beds since none occur within the project footprint, and only minor and temporary impacts to fish and wildlife. Fish and wildlife are expected to avoid the area during dredging and disposal. No long-term impacts to biota are anticipated.

d. Deep draft moorage available for the Bellingham Shipping Terminal, the Alaska State Highway Ferry system and the United States Coast Guard.

Consistent. The Federal action will maintain access to the deep draft moorage for Bellingham Shipping Terminal. The project is designed to avoid affecting anadromous fish. USACE is consulting with all relevant natural resources agencies and affected tribes.

C. Priority Uses. Uses of shorelines of statewide significance should result in long-term benefits to the people of the state. Shoreline environment designation policies, boundaries, and use provisions should give preference to those uses described in RCW 90.58.020 (1) through (7). More specifically:

1. Identify the extent and importance of ecological resources of statewide importance and potential impacts to those resources, both inside and outside the City's geographic jurisdiction. In 2004, the City conducted a Shoreline Characterization that has identified ecological resources within Bellingham Bay and Lake Whatcom.

Consistent. USACE consulted multiple sources including the Washington Department of Fish and Wildlife's Priority Habitat and Species database. Resources identified include a Caspian Tern breeding colony and harbor seal haulout site on the south side of the Port of Bellingham. Within Bellingham Bay, there are Pacific herring, Dungeness crab, and shrimp. Squalicum Creek hosts Chinook, coho, and chum salmon as well as steelhead and cutthroat trout. Bull trout have been recorded in the lowest half mile of the stream. Potential impacts to all of these resources are documented in the Environmental Assessment in accordance with the National Environmental Policy Act. No effects of the project constitute a significant impact to any resources.

2. Preserve sufficient shorelands and submerged lands to accommodate current and projected demand for economic resources of statewide importance, such as commercial shellfish beds and navigable harbors. Base projections on statewide or regional analyses, requirements for essential public

facilities, and comment from related industry associations, affected Indian tribes, and state agencies. This analysis has been conducted and the result is the shoreline designations and allowed uses specified in BMC 22.03.

Consistent. The proposed action will not reduce availability of any economic resources of statewide importance. The project will preserve access and availability of a navigable harbor that serves local industry.

22.08.140 Dredging and Disposal

A. Policies

3. Navigational dredging should be permitted provided that it minimizes adverse impacts on critical area habitats, shoreline ecological function and water quality.

Consistent. The project is navigational dredging and is designed to minimize adverse impacts on any habitats present. The project will have no change to shoreline ecological function or overall water quality in Bellingham Bay. Short-term and minor pulses of turbidity are associated with dredging; however, this temporary effect will be minimized and will not continue beyond the end of dredging.

5. Where dredging occurs within marine waters for any purpose, except as specified in 2., above, the result should be suitable for establishment of a variety of aquatic organisms including salmonids and forage fish, with guidance provided by the Washington State Department of Fish and Wildlife, the United States Army Corps of Engineers and the City's Environmental Resources Department.

Consistent. The result of the proposed dredging project will not change any aspects of the habitat at the project site, which has been an established navigation channel for over 80 years. The area will remain as a corridor for salmonids to access Squalicum Creek and the habitat will remain open for forage fish. The benthic invertebrate community will reestablish quickly after the removal of sediment. USACE is consulting with all relevant natural resources agencies to ensure impacts are minimized.

7. When dredging occurs within marine waters, sufficient notice should be publicized for those individuals or groups who crab, fish or manage aquaculture activities so that proper adjustments to schedule, timing or practices can be made.

Consistent. USACE will coordinate with the Port of Bellingham and the U.S. Coast Guard and will issue a Notice to Mariners in advance of the maintenance dredging. USACE expects no interruptions to any crabbing, fishing, or aquaculture activities.

B. Regulations

2. Dredging requires a shoreline conditional use except for maintenance dredging, dredging to implement a hazardous substance remedial action under RCW 90.58.355 or, for habitat purposes pursuant to #7 below. Dredging of contaminated materials shall be consistent with the conditional use criteria specified in BMC 22.06.50.C. 1 – 6, Conditional Uses, and shall be demonstrated by the applicant / owner to be in compliance with said criteria.

Consistent. The proposed action is maintenance dredging of a Federal navigation channel. Sediments were tested prior to dredging to determine whether contaminated materials are present. The Dredged Material Management Program has determined that the material is suitable for aquatic disposal.

3. Dredging, for any purpose, that occurs within the waters of Bellingham Bay or Lake Whatcom shall comply with the applicable requirements in BMC 22.03, Shoreline Designations; BMC 22.04, Shorelines of Statewide Significance; and BMC 22.08, General Policies and Regulations.

Consistent. The dredging for navigation channel maintenance is located in Bellingham Bay and will comply substantively will all applicable requirements of BMC 22.03 as described in this document.

5. Beneficial reuse of dredged material shall be consistent with the guidance of the Bellingham Bay Comprehensive Strategy and its associated Habitat Restoration Documentation Report, as amended or updated.

Consistent. USACE has pursued potential beneficial use of the dredged materials. No opportunities are present in the timeframe needed for placement of the dredged material as of 2017. Should a beneficial use placement site become available prior to the start of dredging and need for placement, USACE will consult the Bellingham Bay Comprehensive Strategy and associated Habitat Restoration Documentation Report.

22.08.20 MITIGATION SEQUENCING

A. For all developments, applicants shall demonstrate that all reasonable efforts have been examined with the intent to avoid and minimize impacts to shoreline ecological functions. Applicants shall follow the mitigation sequential descending order of preference below:

1. Avoiding the impact altogether by not taking a certain action or parts of an action;

Consistent. The project is designed to avoid dredging any new areas and will minimize the total quantity to be dredged to only meet the purpose. Dredging and disposal will only occur during the in-water work windows to avoid impact to sensitive species.

2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps, such as project redesign, relocation, or timing, to avoid or reduce impacts;

Consistent. The dredging operation will use all applicable Best Management Practices (BMPs) to minimize disturbance and impacts to fish and wildlife including adhering to methods and criteria issued in the water quality certification (WQC) from the Washington Department of Ecology (WDOE).

B. Mitigation for individual actions may include a combination of the above measures. In determining mitigation measures, lower priority measures shall be applied only where higher priority measures are determined to be infeasible or inapplicable.

Consistent. No compensatory mitigation is proposed for this action as no loss of wetlands, no substantial adverse effects to ESA-listed species, and no significant impacts to commercially important species are anticipated to occur. BMPs will both avoid and minimize impacts from the proposed action.

5.2 City of Everett Shoreline Master Program (applies to disposal of 31,000 cy at the Port Gardner PSSDA site)

The City of Everett SMP includes goals, policies and regulations. These provide direction and context for the specific policies and regulations in the SMP. Policies are broad statements of intention. In contrast, regulations are requirements that are necessary to implement the policies. Everett's SMP describes the shoreline jurisdiction consistent with state regulations as well as the shoreline environment designations that are applied to each shoreline reach. The environment designation section includes information on interpretation, purpose, management policies and general regulations. The shoreline designations determine which uses are allowed, which are conditional, and which are prohibited in shoreline areas.

Each relevant section of Everett's SMP appears below with the USACE's description of how the proposed Federal action is consistent with the code in ***bold italic*** text.

4.13 Aquatic

Management Policies

9. Dredging should be allowed for environmental restoration, including milfoil removal, maintenance of existing water dependent uses, including recreational uses, navigation channel maintenance, and for new water dependent uses to get from the shore to the dredged navigation channel.

New deep draft uses, if allowed, should not occur in areas requiring extensive initial or maintenance dredging.

Consistent. The purpose of the proposed dredging is to maintain the federally authorized depths of the Squalicum Waterway, to facilitate safe transit through the channel. However, the dredging is covered under the jurisdiction of the City of Bellingham Master Program.

4.14 Aquatic Conservancy

Management Policies

6. Dredging should only be allowed for environmental restoration, maintenance of existing water dependent uses, and for maintenance of the federal navigation channel.

Consistent. The purpose of the proposed dredging is to maintain the federally authorized depths of the Squalicum Waterway, to facilitate safe transit through the channel. However, the dredging is covered under the jurisdiction of the City of Bellingham Master Program.

6.4 Dredging and Dredge Material Disposal Policies

1. Dredging and placement of dredged material should be conducted in a manner which avoids or minimizes impacts to water quality, critical areas, and ecological functions and ecosystem wide

processes.

Consistent. The USACE is in coordination with the WDOE for Section 401 Water Quality Certification (WQC) for routine Operations and Maintenance (O&M) dredging in the Squalicum Waterway and disposal of such materials at DMMP approved open-water sites, which includes a water quality monitoring plan. Dredging and disposal will occur during the authorized in-water work window to minimize potential impacts to federally listed species. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 3, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites.

3. Dredging for the purpose of establishing, expanding, or relocating navigation channels and basins should be allowed only when significant adverse impacts are minimized and when suitable mitigation is provided.

Consistent. The proposed dredging will only occur within the authorized dimensions of the Squalicum Waterway, which is covered under the jurisdiction of the City of Bellingham Master Program. The disposal of part of the material will occur at the existing DMMP approved Port Gardner open-water non-dispersive site.

4. Maintenance dredging of established navigation channels and basins should be restricted to maintaining previously dredged and/or existing authorized location, depth, and width unless necessary to improve navigation.

Consistent. The purpose of the proposed dredging is to maintain the federally authorized depths of the Squalicum Waterway, with partial disposal at the Port Gardner non-dispersive open-water site PSSDA, to facilitate safe transit through the channel.

5. Depositing of dredge material in water areas should be allowed only for the improvement of habitat, or where the alternative of depositing material on land is more detrimental to the shoreline resource than depositing it in the water, or as approved by state agencies at an approved deep water disposal site.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. The material is not approved for beneficial use.

6. Beneficial use of dredge material for environmental remediation projects and ecological enhancement and restoration should be encouraged, and deep water disposal of dredge materials should be allowed only as a last resort after all other alternatives have been

exhausted.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. The material is not approved for beneficial use.

7. Land disposal of dredge material in diked areas should be conducted in a manner which minimizes the potential adverse effects on the adjacent water body. Design of the disposal ponds, dikes, or lagoon will consider location of the inlet and outlet to prevent short circuiting; installing adequate discharge controls; providing a capacity and a detention time based on the settling characteristics.

Consistent. No land disposal is proposed.

8. The City should work with the Port of Everett, USACE of Engineers, and appropriate state agencies to develop a long-range plan for the deposit and use of dredge material on land and in water areas.

Consistent. The Dredged Material Management Program (DMMP) monitors all open-water disposal sites. The USACE Navigation Branch monitors and tracks all upland disposals, although the proposed action does not include any upland disposal.

9. Dredging of bottom materials for the single purpose of obtaining fill material should be prohibited.

Consistent. The purpose of the proposed dredging is to maintain the federally authorized depths of the Squalicum Waterway, to facilitate safe transit through the channel.

10. Dredge material re-handling/transfer sites which can be used on a continuing basis are encouraged.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites.

6.4 Dredging and Dredge Material Disposal Regulations

4. In designating areas for the placement of dredge materials or in approving placement of dredge materials at a specific site, consideration shall be given, but not limited to, the

following:

a. Existing and proposed use of the site.

b. Project phasing.

c. Impacts on critical areas, ecological functions and ecosystem-wide processes.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. The material is not approved for beneficial use.

5. Dredging and dredge material placement shall be scheduled to avoid conflicts with commercial fisheries.

Consistent. Dredging and disposal will occur during the authorized in-water work window to minimize potential impacts to federally listed species. The contractor issues a notice to mariners and the U.S. Coast Guard prior to dredging and disposal activities, and the USACE and the Ports issue a joint public release about upcoming dredging activities.

6. Proposals for dredging and dredge materials placement shall include all feasible mitigating measures, including scheduling, to protect marine, riverine, and lacustrine habitats and to minimize adverse impacts such as turbidity, adverse modifications on littoral drift, release of nutrients, heavy metals, sulfides, organic material or toxic substances, dissolved oxygen depletion, disruption of food chains, loss of benthic productivity, and disturbance of fish migration and important localized biological communities.

Consistent. As part of the Section 401 WQC process, the USACE prepared and will submit a Joint Aquatic Resources form to WDOE for the project. As part of the NEPA process, a Draft Environmental Assessment (EA) has been prepared for the project. Both the WQC and NEPA document include Best Management Practices (BMPs) that will avoid and/or minimize impacts to water quality, and biological communities.

7. Dredging and dredge material placement shall be prohibited on or in archaeological sites which are on-record with the Washington State Office of Archaeology and Historic Preservation until such time as they are released by the state.

Consistent. As part of the NEPA process for PSSDA sites, an archeological review for the projects were conducted and a determination was made that no archeologic or historic properties will be affected.

8. Except for open water disposal of dredge material at a PSDDA site, all dredge materials placement shall comply with the landfill regulations and shoreline stabilization regulations, as applicable. In addition, upland hydraulic dredge material disposal activities shall adhere to the

following conditions:

a. Containment dikes shall be built and maintained so as to prevent the return of settleable solids into a water body.

b. An adequate settling basin shall be built and maintained so that the site's discharge water carries a minimum of suspended sediment. Basins shall be designed to maintain at least one (1) foot of standing water at all times to encourage proper settling.

c. Runoff water from dredge materials deposit must enter the waterway through an outfall at a location that maximizes circulation and flushing, and minimizes erosion.

d. The outside face of dikes shall be sloped at 1-1/2 to 1 (horizontal to vertical) or flatter, and protected from erosion by revegetating the slope (i.e. grass or native vegetation). Landscaping and buffer areas may be required.

Consistent. All material designated for a non-dispersive aquatic disposal will be placed at the Port Gardner PSSDA open-water disposal site.

9. Unconfined, open-water disposal of dredged material in Puget Sound shall only occur at permitted PSDDA sites as a last resort if no other options are available. Any party utilizing the PSDDA site must comply with all PSDDA requirements.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. Dredged sediment will be disposed of at the DMMP approved Port Gardner PSSDA site.

10. Dredge material placement in shoreline areas shall not impair scenic views. When necessary, sites shall be adequately screened from view, except for short-term preloading/stockpiling.

Consistent. All material will be placed at PSSDA open-water disposal sites.

11. Dredge material placement shall have highest priority in the Urban Industrial Environment. Dredge material placement shall also be permitted in the Urban Deep Water Port, Urban Mixed-Use Industrial, Urban Maritime, Urban Multi-Use, Urban Conservancy – Recreation, and Municipal Water Quality Environments.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. Dredged sediment will be disposed of at the DMMP approved Port Gardner open-water disposal site.

12. Except for ecological restoration and enhancement activities, dredge material placement in

the Urban Conservancy, Municipal Watershed, Aquatic and Aquatic Conservancy Environments shall require a shoreline conditional use permit.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. Dredged sediment will be disposed of at the DMMP approved Port Gardner open-water disposal site.

13. Dredge material placement shall be prohibited in the Urban Residential Environment.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. Dredged sediment will be disposed of at the DMMP approved Port Gardner open-water disposal site.

5.3 Skagit County Shoreline Master Program (applies to disposal of 320,000 cy at the Rosario Strait PSSDA site)

The Skagit County SMP includes goals, policies and regulations. Together they provide direction and context for the specific policies and regulations in the Program. Policies are broad statements of intention. In contrast, regulations are requirements that are necessary to implement the policies. The environment designation section includes information on interpretation, purpose, management policies and general regulations. The shoreline designations determine which uses are allowed, which are conditional, and which are prohibited in shoreline areas.

Each relevant section of SMP appears below with USACE' description of how the proposed Federal action is consistent with the code in ***bold italic*** text.

CHAPTER 5 SHORELINE OF STATEWIDE SIGNIFICANCE

5.03 Policies for Shorelines of Statewide Significance

The legislature determined that in order to fulfill the goal of statewide public interest in shorelines of statewide significance, local Master Programs shall give preference to uses that are consistent with the policies applied in the following order, pursuant to RCW 90.58.020:

1. The statewide interest should be recognized and protected over the local interest.

2. The natural character of shorelines of statewide significance should be preserved.

3. Uses of shorelines of statewide significance should result in long-term benefits to the people of the state.

4. The natural resources and ecological systems of shorelines of statewide significance should be protected.

5. Public access to publicly owned areas in shorelines of statewide significance should be increased.

6. Recreational opportunities for the public should be increased on shorelines of statewide significance.

Consistent. The proposed disposal will occur at the DMMO approved Rosario open-water disposal site, which has been determined to accommodate dredge material disposal. This disposal site is in deep water in the middle of Rosario Strait. No changes to natural character, natural resources, public access and recreation, or changes to long-term benefits to people of the state would result from the action.

CHAPTER 6 SHORELINE AREA DESIGNATIONS

6.04 Shoreline Area Designations

6. Aquatic Shoreline Area

a. Definition: The Aquatic Shoreline Area is all water bodies, including marine waters, lakes, and all rivers of the state together with their underlying lands and their water column, including but not limited to bays, straits, harbor areas, waterways, coves, estuaries, lakes, streamways, tidelands, bedlands, and shorelands.

b. Objective: The Aquatic Shoreline Area designation is intended to encourage and protect appropriate multiple uses of the water or, in some cases, single purpose, dominant uses in limited areas; to manage and protect the limited water surfaces and foreshores from inappropriate activities or encroachment; and, to preserve and wisely use the area's natural features and resources which are substantially different and diverse in character from those of the adjoining uplands and backshores.

Consistent. The proposed disposal will occur at the DMMO approved Rosario open-water disposal site, which has been determined to accommodate dredge material disposal. Disposal will occur during the in-water work window to minimize impacts to sensitive species. There will not be any long-term impacts to uses, natural features, or natural resources.

c. Designation Criteria: Areas to be designated as an Aquatic Shoreline Area should possess one or more of the following criteria:

(1) All marine water areas seaward of the ordinary high water mark including estuarine channels, sloughs, and associated wetlands.

(2) All lakes subject to this program below the ordinary high water mark.

(3) All streamways of rivers designated shorelines of the State.

(4) All natural swamps, marshes, and wetlands adjoining the above three categories of water bodies and all those which are not designated a Natural Shoreline Area.

d. Management Policies

(1) Aquatic Shoreline Areas should allow for compatible, appropriate uses that do not conflict with natural and cultural processes and features of the water body and associated wetlands. Such uses should be shoreline and water dependent.

Consistent. The proposed disposal will occur at the DMMO approved Rosarioopen-water disposal site, which has been determined to accommodate dredge material disposal. No impacts to natural and cultural processes and/or features of the water body would result from the proposed action.

(7) Priority should be given to those activities which create the least environmental impact to this shoreline area.

Consistent. The proposed disposal will occur at the DMMO approved Rosario open-water disposal site in deep water in the middle of Rosario Strait, which has been determined to accommodate dredge material disposal. Disposal will occur during the in-water work window to minimize impacts to sensitive species.

CHAPTER 7 POLICIES AND REGULATIONS

7.04 DREDGING

1. POLICIES

A. General

(1) Coordination - All proposals for dredging operations should be coordinated and consistent with plans, policies, guidelines and regulations of federal, state, and/or local agencies.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. All DMMO PSSDA sites have an Environmental Impact Statement and have completed Endangered Species Act (ESA) consultation. USACE is seeking 401 water quality certification (WQC) from the Washington Department of Ecology (WDOE).

(2) All dredging and spoil disposal operations should not:

a. adversely alter natural drainage patterns, currents, river and tidal flows.

b. interfere with or adversely affect water flows and capacities.

c. create conditions that would endanger public health and safety.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. It will not adversely alter currents, tides, water flows and capacities, or public health and safety.

(3) Fill material - The dredging of bottom materials for the single purpose of obtaining landfill material should be prohibited.

Consistent. The proposed action purpose is to maintain the federally authorized depths of the Squalicum Waterway, to facilitate safe transit through the channel, not obtain landfill materials.

(4) Construction material - The dredging of sand and gravel for the purpose of construction materials should be prohibited except for emergency shoreline stabilization and flood protection measures.

Consistent. The proposed action purpose is to maintain the federally authorized depths of the Squalicum Waterway, to facilitate safe transit through the channel, not obtain construction materials.

(5) Review of proposals for dredging and spoil disposal should assess:

a. The value of the dredge and disposal site in their present state versus the proposed shoreline use to be created by dredging and/or disposal, expressed in short and long range economic, social, and environmental terms.

b. The value of the present site for other future potential public or private shoreline uses including but not necessarily limited to aquaculture, fish, shellfish, and wildlife research and resource preservation, commercial fishing, and recreation opportunities.

Consistent. ***The purpose of the proposed dredging is to maintain the federally authorized depths of the Squalicum Waterway, to facilitate safe transit through the channel. However, the dredging is covered under the jurisdiction of the City of Bellingham Master Program. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. No changes to the shoreline or other uses will occur at the sites.***

(6) Water quality - All dredging and spoil disposal operations should comply with the water quality standards, guidelines, and regulations of federal, state, and local agencies.

Consistent. As part of the Section 401 WQC process, the USACE prepared and will submit a Joint Aquatic Resources form to WDOE for the project. As part of the NEPA process, an Environmental Impact Statement was prepared for the PSSDA disposal sites. Endangered Species Act (ESA) consultation has also commenced on the PSSDA disposal sites. The WQC and NEPA and ESA documents include Best Management Practices (BMPs) that will avoid and/or minimize impacts to water quality, and biological communities.

(7) Quality of spoils - Proposals for dredging and spoil disposal projects should include a thorough analysis by qualified personnel of the quality and characteristics of the material to be dredged.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the DMMP, which includes regulatory agencies that have jurisdiction over dredged material disposal in open-

water sites. Only material that is suitable for disposal at a dispersive open-water site would be placed at the Rosario Strait PSSDA site.

(8) Public uses - Proposals for dredging and spoil disposal projects should demonstrate that the operation will not be detrimental to the public interest and uses of the shoreline and water body.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal, and would not impact the public interest or uses of the water body.

C. Spoils Disposal

(1) Location

a. Deposition of dredge spoils in water should be discouraged, except when alternatives of depositing material on land is more detrimental to shoreline resources and uses than depositing in water areas.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. Disposal on land is not economically feasible.

b. Land spoils disposal should not be located upon, adversely affect, or diminish:

- Estuaries, natural wetlands, and marshes.
- Prime agricultural land.
- Natural resources including but not necessarily limited to sand and gravel deposits, timber, or natural recreational beaches and waters.
- Designated wildlife habitat and concentration areas.
- Water quality, quantity, and drainage characteristics.
- Public access to publicly owned shorelines and water bodies.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. No land disposal is proposed.

c. Polluted and soft spoils should be deposited in safe upland areas with measures taken to contain runoff and potential discharge to groundwaters and shoreline and water bodies.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic

disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the DMMP, which includes regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. No upland disposal will occur.

d. Upland disposal of non-polluted dredge spoils should be made available to other users and beneficial purposes such as for recreational beaches, shore rehabilitation and enhancement, beach feeding, or construction materials.

Consistent. The proposed dredged material has been tested and determined suitable for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the regulatory agencies that have jurisdiction over dredged material disposal in open-water sites. The material will not be disposed of upland nor is it approved for beneficial use.

e. If alternatives for land disposal are not available or infeasible, water disposal sites should be identified and meet the following criteria:

- the site is in an area protected from significant storms, tidal and submarine currents, stratification, and turbulence that would cause shifting and dispersal of the spoils.

- the area is proven to be biologically, chemically, and physically degraded by past spoil depositing and other aquatically degrading activities; water quality will not be degraded further.

- disposal will not interfere with geohydraulic processes.

- The dredge spoils have been analyzed by qualified personnel and found to be minimal or nonpolluting.

- spoil disposal will not impede water and tidal current flows or adversely affect floodwater flows and capacities.

- aquatic and aquatic related life will not be adversely affected.

- the site and method of disposal meet all requirements and qualifications of applicable regulatory agencies and are designated with their cooperation.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water PSSDA disposal site, which is a dispersive site, and has been determined to accommodate dredge material disposal. No long-term impacts to biological, chemical, and physical processes, water quality, and/or currents will occur. As part of the Section 401 WQC process, the USACE prepared and will submit a Joint Aquatic Resources form to WDOE for the project. As part of the NEPA process, an Environmental Impact Statement was prepared for the PSSDA disposal sites. Endangered Species Act (ESA) consultation has also commenced on the PSSDA disposal sites. The WQC and NEPA and ESA documents include Best Management Practices (BMPs) that will avoid and/or minimize impacts to water quality, and biological communities. The proposed dredged material has been tested and determined suitable

for aquatic disposal, as found in the most recent Suitability Determination dated May 7, 2017, by the DMMP, which includes regulatory agencies that have jurisdiction over dredged material disposal in open-water sites.

(2) Technique

a. Spoil disposal, if allowed in water; should utilize techniques that cause the least dispersal and broadcast of materials.

b. Sidecast disposal and agitation dredging should be prohibited.

Consistent: **No side cast disposal or agitation dredging will occur.** ***As part of the Section 401 WQC process, the USACE prepared and will submit a Joint Aquatic Resources form to WDOE for the project. As part of the NEPA process, an Environmental Impact Statement was prepared for the PSSDA disposal sites. Endangered Species Act (ESA) consultation has also commenced on the PSSDA disposal sites. The WQC and NEPA and ESA documents include Best Management Practices (BMPs) that will avoid and/or minimize impacts to water quality, and biological communities.***

E. Impacts

(1) Review of proposed dredging and spoil disposal operations should adhere to applicable local, state, or federal environmental impact statement (EIS) procedures and guidelines.

Consistent. The USACE prepared and will submit a Joint Aquatic Resources form to WDOE for the project to obtain a Clean Water Act 401 WQC. As part of the NEPA process, an Environmental Impact Statement was prepared for the PSSDA disposal sites. Endangered Species Act (ESA) consultation has also commenced on the PSSDA disposal sites.

(2) Recognizing the diverse and variable impacts of dredging and spoil disposal on the aquatic and shoreline environment, then such operations should minimize and take measures to mitigate all impacts.

Consistent: The aforementioned environmental compliance documents include Best Management Practices (BMPs) that will avoid and/or minimize impacts to the shoreline, including water quality and biological communities.

2. REGULATIONS

A. Shoreline Areas

(6) Aquatic

1. Dredging is permitted subject to the General Regulations and, if applicable, those of the landward Shoreline Area.

2. Dredge spoil disposal in the Aquatic Shoreline Area is permitted as a conditional use.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water PSSDA disposal site, which is a dispersive site, and has been determined to accommodate dredge material disposal. It conforms to the General Regulations below.

B. General

(1) Shoreline permit/statement of exemption - In order to assure that dredging and spoil disposal operations, including maintenance dredging, are consistent with this program as required by RCW 90.58.140 (1), no operation may commence without the responsible person or agency having obtained either a shoreline permit or statement of exemption from this department.

Consistent. The proposed action is a Federal action and thus does not require local permits. However, it is consistent with this program.

(2) Related Uses - Dredging shall be allowed for those shoreline and water uses consistent with this Master Program and the Shoreline Management Act.

Consistent. The proposed disposal is consistent with this Master Program and the Shoreline Management Act.

(3) Locations - Dredging shall not occur in the following, except for maintenance work and for beneficially public purposes consistent with this program:

a. in estuaries, natural wetlands, and marshes.

b. along net positive drift sectors and where geohydraulic processes are active and accretion shoreforms would be damaged or irretrievably lost.

c. in shoreline areas and bottom soils that are prone to sluffing, refilling, and continual maintenance dredging.

d. in officially designated fish, shellfish, and wildlife spawning, nesting, harvesting, concentration areas as defined by the Washington Marine Atlas (DNR), as amended, and other recognized, official documents.

e. where water quality would be irretrievably degraded below state and federal standards.

f. where current and tidal activity are significant, requiring excessive maintenance dredging.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water PSSDA disposal site, which is a dispersive site, and has been determined to accommodate dredge material disposal. It will not occur in/ or impact the aforementioned places.

(4) Landfill material - Dredging of bottom materials for the sole purpose of obtaining landfill material is prohibited.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. No land disposal is proposed.

(5) Spoil disposal sites - Dredge spoil disposal shall occur at sites consistent with this Master Program and the Shoreline Management Act. Where applicable, the Skagit County Dredge Disposal Site Analysis Study shall serve as an advisory guide in selecting and determining the qualifications of disposal sites. Proposals for spoil disposal must show that ultimate use of the site will be for a use permitted within the shoreline area.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal.

(6) Prohibited spoil locations - Dredge spoil disposal is prohibited on lake shores and beds, in streamways, estuaries, natural wetlands and on marine accretion beaches EXCEPT as an element of an approved shore restoration or beach enhancement program.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. No disposal will occur on the aforementioned shorelines.

(7) Adverse effects - Dredging and spoil disposal shall not adversely infringe upon existing and adjacent water and shoreline uses, properties and access.

Consistent. The proposed disposal will occur at the DMMO approved Port Gardiner open-water disposal site, which has been determined to accommodate dredge material disposal. No long-term impacts to water and shoreline uses, properties, or access are anticipated.

6 STATEMENT OF CONSISTENCY

Based on the above evaluation, USACE has determined that the proposed maintenance dredging and disposal activities are consistent with the applicable policies and regulations specified in the City of Bellingham, City of Everett, and Skagit County Shoreline Master Programs. The proposed action is thus considered to be consistent to the maximum extent practicable with the enforceable policies of the State of Washington Shoreline Management Program and policies and standards of the City of Bellingham Shoreline Master Program.

7 FIGURES

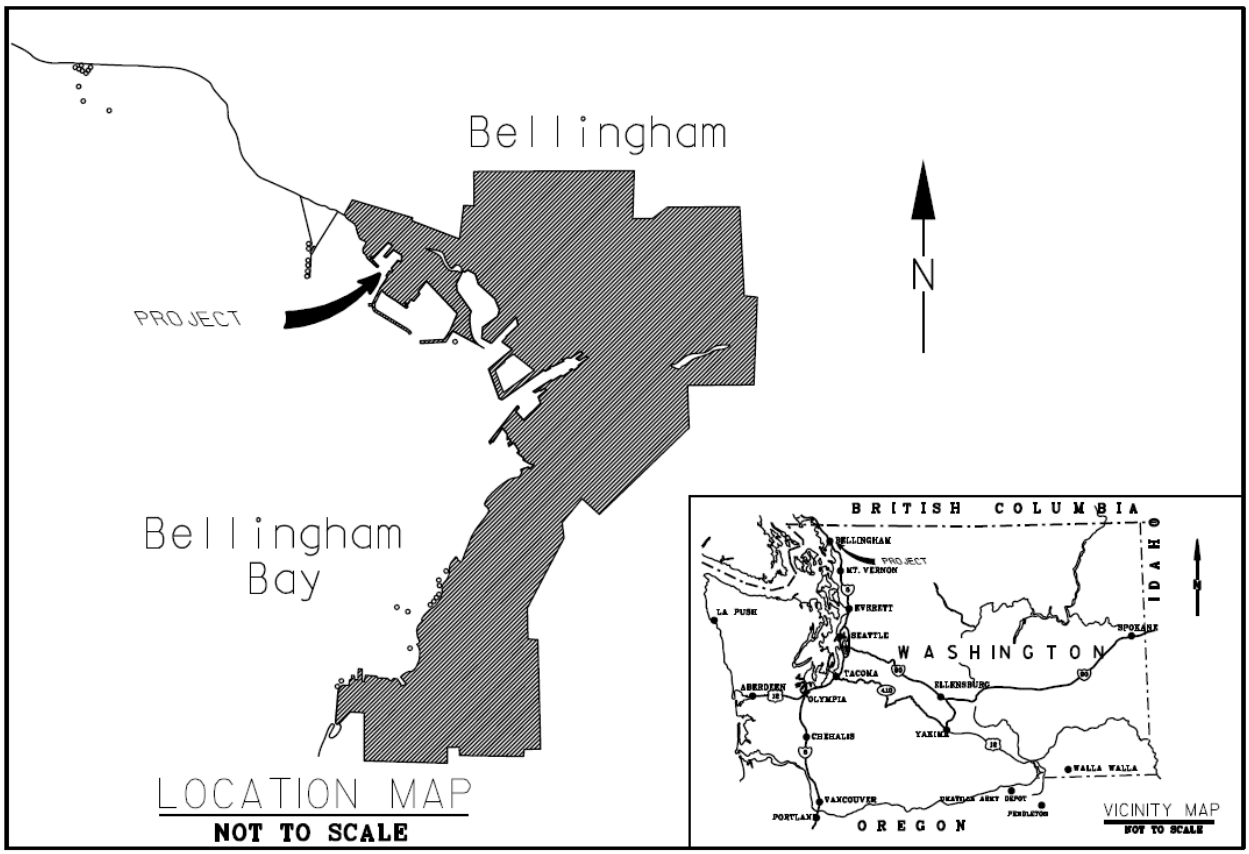

Figure 1. Location and vicinity map.

Figure 2. Location of the Squalicum Waterway Federal Navigation Channel at Port of Bellingham.

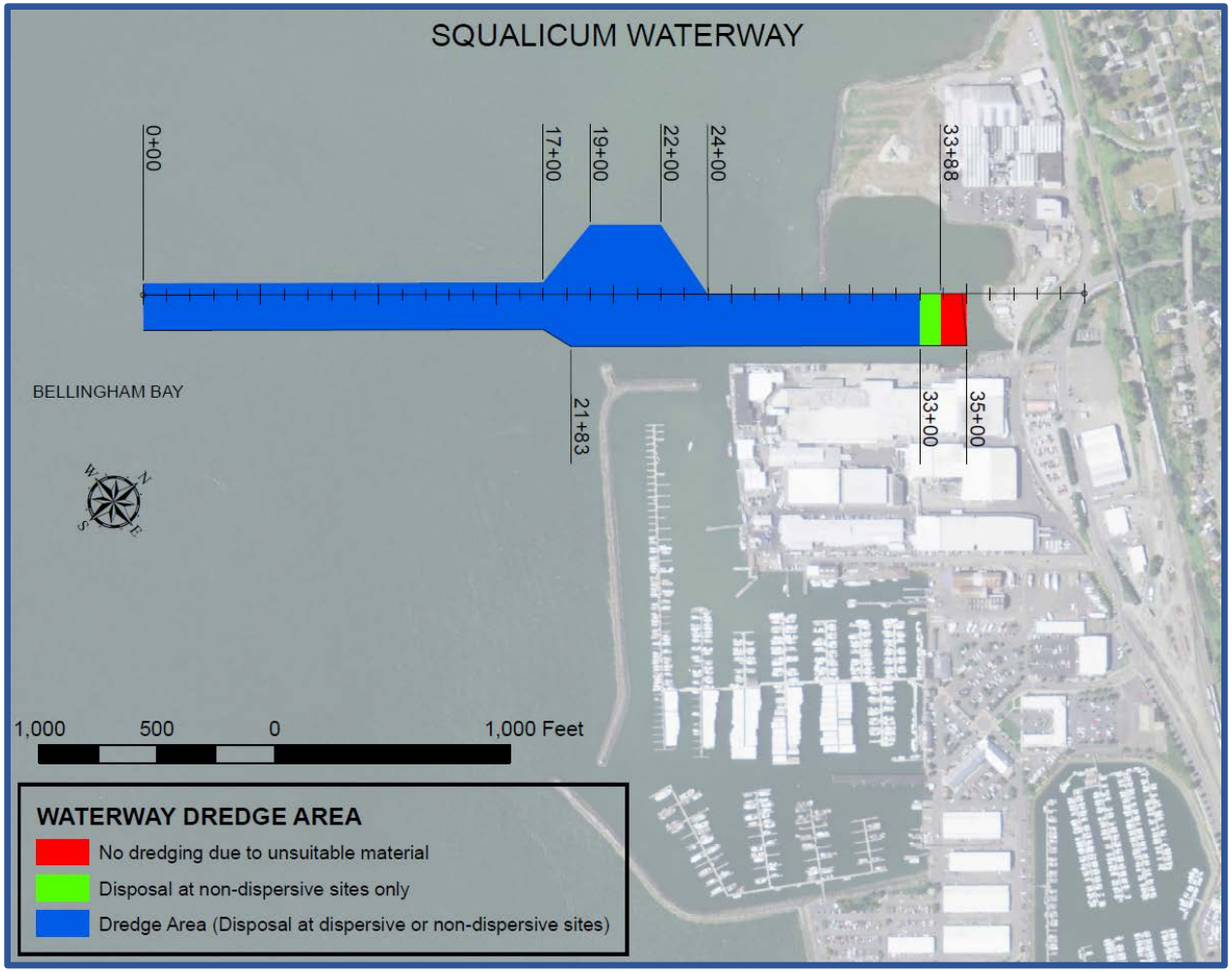

Figure 3. Squalicum Waterway areas proposed for maintenance dredging.

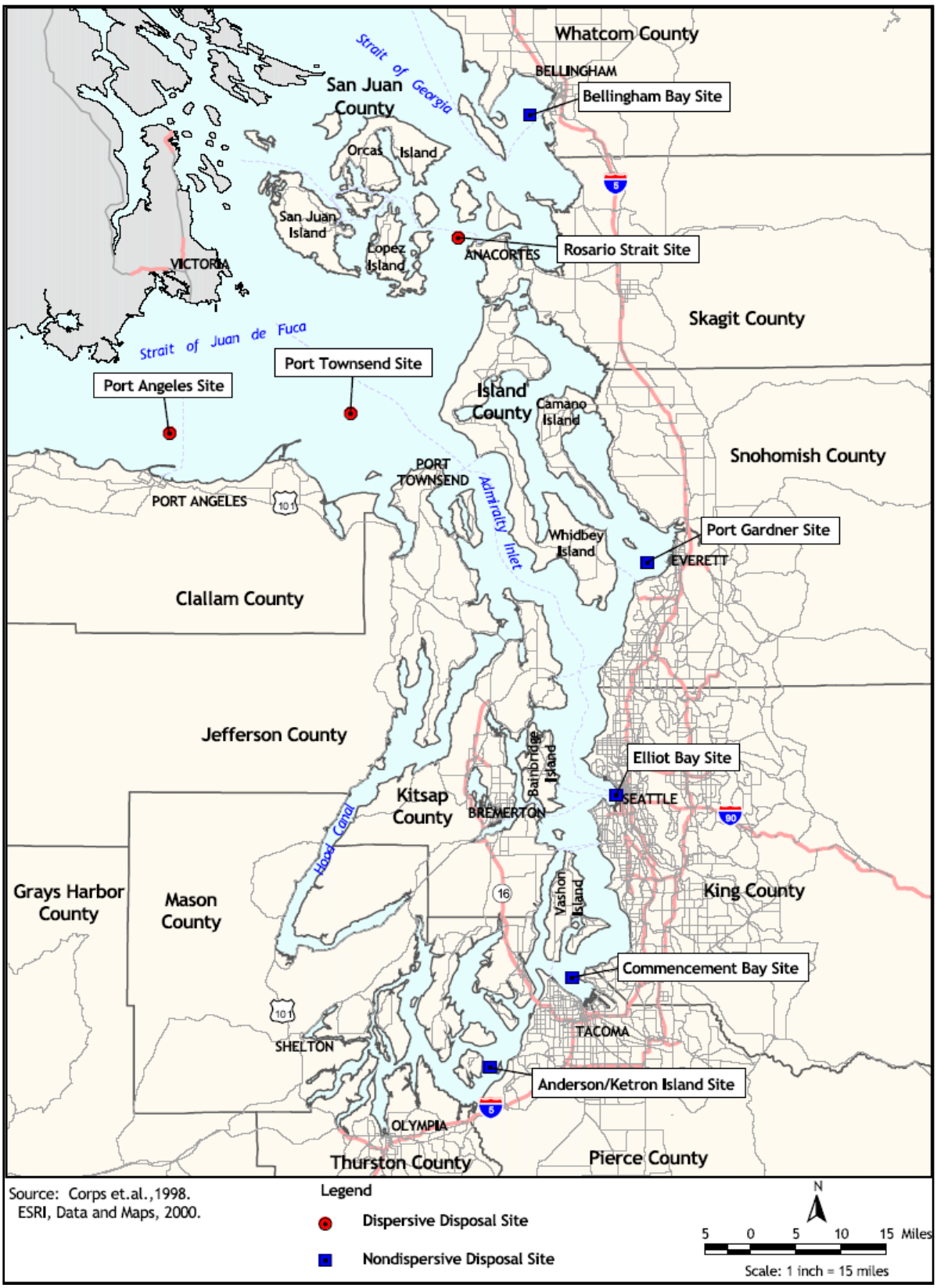

Figure 4. Location of approved dredged material disposal sites.

Appendix F

Water Quality Monitoring Plan

Draft Water Quality Monitoring Plan
Squalicum Waterway Maintenance Dredging and Disposal
January 2019

Constituents Monitored:

The Squalicum Waterway Federal Navigation Maintenance Dredging and Disposal project requires the following water quality monitoring parameters pursuant to Water Quality Certification (WQC) # XXXXX/Public Notice of Application CENWS-PMP-XX-XX Squalicum Waterway, Bellingham, WA for State of Washington 401 Water Quality Certification and Coastal Zone Management Act Consistency (10 Oct 2017) and WAC 173-201A-210:

- Turbidity applicable criteria:
  - Point of Compliance (POC) is 300 feet down-current from the activity
  - Turbidity readings at the POC shall not exceed 5 NTU (nephelometric turbidity units) over background when the background is 50 NTU or less, or a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
  - Visual turbidity anywhere at or past the POC from the activity and/or the disposal location shall be considered a possible exceedance of the standard and shall be verified through measured turbidity sampling.

Frequency of Monitoring:

- The contractor's dredging equipment shall operate for at least one hour prior to the collection of turbidity readings to ensure readings and observations are representative of water quality conditions during active operations.
- The contractor's water quality monitoring will correspond with; 1) slack tide and 2) ebb or flood tidal conditions to the extent these times adequately reflect periods of active dredging and occur during daylight hours.
- The contractor's water quality monitoring sampling times will be at least two (2) hours apart, to the extent these times adequately reflect periods of active dredging and occur during daylight hours.
- The contractor shall monitor for turbidity, instrument measured and visual, during daily dredging activities during daylight hours:
  - Take and record readings twice daily at one (1) up-current and three (3) down-current locations the first five (5) consecutive days of dredging, assuming no exceedances.
  - Record visible turbidity down-current of the point of compliance recorded at each reading collected at the point of compliance the first five (5) consecutive days of dredging, assuming no exceedances.
  - Take and record readings once a day along a transect across the navigation channel at the point of compliance the first five (5) consecutive days of dredging, assuming no exceedances.
  - Record visible turbidity within the disposal area for every disposal action during daylight hours the first five (5) consecutive days of dredging and disposal, assuming no exceedances.
  - No monitoring shall occur before sunrise or after sunset unless authorized by the Corps.

- Upon completion of the instrument measured monitoring days, the contractor shall send the monitoring data report daily to the Corps within 24 hours of completion of monitoring activity.
  - If there are no exceedances in water quality within the five (5) consecutive days, the contractor shall discontinue instrument monitoring, unless otherwise directed by the Corps, if required by WA Ecology.
  - If there are exceedances in water quality within the five (5) consecutive days, the contractor shall continue monitoring following the steps listed in "Exceedances and Exceedances Protocol."
- The contractor shall continue to monitor and record (written) daily visual turbidity monitoring at the dredging Point of Compliance and at the disposal site during every disposal event every day (daylight hours only) the dredge is in operation. At any point, if visual monitoring indicates a turbidity plume, the contractor shall take a physical reading to confirm/verify if an exceedance has occurred. If an exceedance is confirmed/verified through physical monitoring, the exceedance protocol listed below shall be followed.

Sampling Approach:

- The contractor shall establish water quality conditions according to the following:
  - The contractor shall measure turbidity with a meter (HydroLab or similar), starting at least one hour after the dredging equipment has been operating, to ensure readings and observations are reflective of conditions during active operations.
  - The contractor shall verify the calibration of the meter and calibrate as necessary with standardized samples prior to the start of each day's monitoring, per the manufacturer's specifications.
  - The contractor shall collect readings within the water strata:
    - near the surface (~ 2 feet below)
    - mid-depth
    - near the bottom (~2 feet above)
- The contractor shall compare water quality readings taken at the point of compliance to background levels within the water column strata (i.e., surface level at points of compliance compared to surface level at background stations) to determine compliance with constituent standards.
- The contractor shall visually observe turbidity during daylight hours beyond the point of compliance and record the findings at the same time the turbidity levels are measured.
- The contractor shall visually observe turbidity within the disposal area and record the findings every disposal action during daylight hours.

Monitoring Locations:

- The area of mixing point of compliance for turbidity during clamshell dredging is 300 feet down-current from the point of clamshell dredging/bucket and thus will move as the dredging progresses.
- The contractor shall establish Monitoring Points at:
  - Measured Background: A minimum of 300 feet up-current from the dredging.

- Measured down-current Early Warning – a 150 feet radius down-current of the dredging.
- Measured down-current Point of Compliance – a 300 feet radius down-current of the dredging.
- Measured down-current Extended Point – a 600 feet radius down-current of the dredging.
- Visual down-current of Point of Compliance - visual turbidity observed at or beyond a 300 feet radius of the dredging will be recorded at the same time the turbidity levels are measured.

❖ The contractor shall establish channel transect Monitoring Points across the navigation channel located at the Point of Compliance. This transect shall be:

- Monitored once per day
- Located at a minimum of three (3) points spaced roughly equidistant across the navigation channel
- Collect three (3) readings within the water strata; 1) just below the surface (~ 2 feet below), 2) mid- depth, and 3) near the bottom (~2 feet above)

❖ The contractor shall observe and record visible turbidity within the disposal area for every disposal action during daylight hours.

❖ A map of sample locations will be included in the final plan, which will be developed by the dredge contractor.

Elevations at the Early Warning and Extended Point Locations

❖ If measurements taken at the Early Warning and/or Extended Point locations show recorded turbidity is greater than 5 NTU over background where the background is less than 50 NTU, or if more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU, that sample is recorded as an ELEVATION. Assuming dredging continues, the contractor shall continue to monitor per the protocol below:

- Review existing BMPs, including, but not limited to:
  - Check the seal on the bucket, remove any obstructions, repair/replace bucket if point of closure does not fully close
  - Do not overfill bucket – only fill to bucket's capacity
  - Slow speed of lifts from bottom to surface and swing from surface to barge
  - Do not allow water in barge to excessively overtop
- Evaluate potential new BMPs.

Exceedances and Exceedance Protocol

❖ If measurements taken at the Point of Compliance or in the disposal site show recorded turbidity are greater than 5 NTU over background where the background is less than 50 NTU, or if more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU, that sample is recorded as an EXCEEDANCE. Assuming dredging continues, the contractor shall continue to monitor per the exceedance protocol below:

- *Step 1: Verification of the problem*
    - If monitoring indicates an exceedance, the contractor shall collect, within ten (10) minutes of the initial reading, another series of readings (~ 2 feet below), mid-depth, and near the bottom (~2 feet above) in the same location.
    - If the exceedance still exists, the contractor shall photograph conditions at the point of compliance and then collect another series of readings at the nearest up-current background station to determine if the exceedance is caused by the dredging and disposal or by a change in background conditions (for example due to a heavy rainfall event).
    - The contractor shall notify the Corps by telephone within 30 minutes after there has been a measured confirmed exceedance.
    - The Corps will direct the contractor to implement best management practices (BMPs), as appropriate and applicable, to reduce turbidity. Example BMPs include, but not limited to:
        - ✓ Check the seal on the bucket, remove any obstructions, repair/replace bucket if point of closure does not fully close
        - ✓ Do not overfill bucket – only fill to bucket's capacity
        - ✓ Slow speed of lifts from bottom to surface and swing from surface to barge
        - ✓ Do not allow water in barge to excessively overtop
    - In the event of exceedances such that dredging is temporarily stopped by the Contracting Officer during the five (5) consecutive days of monitoring, the Corps will consult with WA Ecology and five (5) additional consecutive days monitoring will be required with no exceedances in order to discontinue monitoring.
- *Step 2: Increased monitoring*
    - The contractor shall collect another reading no more than one (1) hour after the exceedance is recorded to verify the dredging operation has been altered to reduce the exceedance to within acceptable limits.
    - If this second reading, taken 1 hour later, still shows an exceedance, the contractor shall immediately notify the Corps by telephone that there is still a measured exceedance.
    - The Corps will again direct the contractor of the situation and require the contractor take all measures possible to reduce turbidity.
    - Finally, the contractor shall collect a third reading, taken no more than two (2) hours after the first exceedance is recorded.
    - Contractor shall notify Corps that a reportable exceedance occurred, the reason for the exceedance, as well as BMPs to prevent reoccurrence, and provide documentation from the incident to the Corps to forward to WA Ecology. Based on Wa Ecology's response, the Contracting Officer may order the contractor to stop dredging until compliance is achieved.
- *Step 3a: Continued sampling until compliance is achieved, assuming dredging continues*
    - Once a reportable exceedance is confirmed and reported, monitor every 2 hours until sunset or until two consecutive readings that do not exceed standards.

- Return to twice per day for 5 consecutive days of no further exceedances of water quality monitoring.
- The Corps will again direct the contractor to take all measures possible to reduce turbidity.
- The contractor shall resume the normal schedule of water quality monitoring as per specific requirements above until directed by the Corps to cease monitoring.
- If compliance cannot be achieved, the Contracting Officer may order the contractor to stop dredging until compliance is achieved.

o *Step 3b: Continued sampling until compliance is achieved, assuming dredging has been stopped.*

- After the contractor has stopped dredging, the contractor shall collect readings at hourly intervals until sunset and resume the following morning until water quality levels return to background.
- Once compliance has again been achieved, the Contracting Officer will order the contractor to resume dredging.
- The Corps notify WA Ecology that dredging has resumed.
- Once dredging has resumed, the contractor will return to twice a day for 5 consecutive days of no further exceedances of water quality monitoring, which shall become the responsibility of the contractor.
- The contractor shall continue the normal schedule of water quality monitoring as per specific requirements above until directed by the Corps to cease monitoring.

Reporting:

❖ The Corps will report exceedances, including potential causes and BMPs to prevent reoccurrence, and/or dredging shut downs to WA Ecology by telephone and email as soon as is practicable, but within 24 hrs.

❖ The contractor shall document any dredging shut downs with an Incident Report, which will be transmitted to the Corp by email and through the QCS/RMS system within 24 hours of the exceedance.

❖ The Incident Report shall document all exceedances and will include the date, time, location, activity, turbidity data collected, name of person collecting the data, names of persons notified of the exceedance, photographs if taken, and summary of how the exceedance was resolved following the above protocol.

❖ The Incident Report shall be sent to WA Ecology within five (5) days of the exceedance, per the 401 Certification.

❖ WA Ecology will require the restart of the five (5) consecutive days of instrument measured turbidity monitoring, which shall be the responsibility of the contractor, until compliance is achieved for 5 consecutive days.

❖ Per the 401 WQC, weekly turbidity (visual or measured) reporting will be sent to WA Ecology.

❖ Within 60 days of termination of the dredging and disposal activities, the Corps will submit a summary report of the measured turbidity results to WA Ecology.

Responsibility and Communication Plan:

- The Corps will oversee turbidity monitoring conducted by the contractor.
- The Corps will be responsible for coordinating with WA Ecology and submitting the Turbidity Monitoring Reports and data provided by the contractor.
- The Corps will notify WA Ecology within 24 hours if an exceedance occurs.
- The Corps will coordinate with the dredging contractor.
- The contractor shall provide Turbidity Monitoring Report and data to the Corps, as directed.
- The contractor shall notify the Corps within 30 minutes of a confirmed exceedance and follow required notifications per the exceedance protocols.
- The contractor POC will be provided in the Contractor Water Quality Monitoring Plan.
- The Corps Points of Contact for turbidity monitoring will be Hans Miller, Project Manager (206-316-3832), and Chemine Jackels, Environmental Coordinator (206-764-3646).
- The WA Ecology Point of Contact is First Last, Federal Permit Coordinator, (360-407-XXXX).
- Official reporting of any incidents are to be sent to both the WA Ecology Point of Contact AND to the fednotification@ecy.wa.gov inbox.

Appendix G

Cultural Resources Letters

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

Allyson Brooks, Ph.D.
Washington State Historic Preservation Officer
P.O. Box 48343
Olympia, WA 98504

OCT 04 2017

Subject: Section 106 Review for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington. Log No.: 2017-08-06169-COE-S

Dear Dr. Brooks:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps documented the area of potential effect (APE). This letter provides agency findings as provided at 36 CFR §800.4. We request your agreement with our finding that there will be *no historic properties affected* by the proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (Enclosures 1 and 2).

In 1930, Congress authorized construction of the Squalicum Waterway and construction was completed in 1931. Additional authorization occurred in 1937, which authorized maintenance of the southern half and western end of the Squalicum Creek basin to a depth of -26 feet (MLLW) and stipulated no dredging could be done within 75 feet of wharves, piers or similar structures.

For the upcoming project, the Corps is proposing to conduct maintenance dredging in the Squalicum Waterway to its congressionally authorized depth of -26 feet MLLW plus an additional 2 feet of allowable overdepth and 2 feet of authorized advanced maintenance. Areas that will not be dredged include the berthing areas and the turning area.

The Corps has determined the APE for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500 feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

The Corps has sought information from the Lummi Nation, the Nooksack Tribe, Suquamish Tribe, Swinomish Indian Tribal Community, the Tulalip Tribes, the Samish Nation, the Upper Skagit Indian Tribe, and the Stillaguamish Tribe of Indians regarding places which they attach religious and cultural significance and to identify any concerns they have with the project. In a letter to the Tribes dated August 23, 2017, the Corps described the undertaking and the APE. None of the aforementioned Tribes have identified any concerns with the project or resources within the APE.

The Corps has made a reasonable and good faith effort to identify archaeological resources that might be affected by the undertaking. Based on the results of the records search, previous dredging episodes in the channel and information gathered through consultation, the Corps has made a determination of *no historic properties affected* by the proposed maintenance dredging in Squalicum Waterway.

At this time, the Corps is requesting the Washington SHPO's review and agreement with our finding that there will be no historic properties affected by the project. We appreciate your consideration of our request. If you have specific questions or we can

provide any clarification, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

References:

Corps of Engineers. 1931. *Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931*. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

US Coast and Geodetic Survey. 1898. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/BELLING. Chart Number 6378

US Coast and Geodetic Survey. 1906. Navigation Chart of Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/CP2541C. Chart Number 6378

US Coast and Geodetic Survey. 1928. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/6378-1-1928. Chart Number 6378.

Enclosure 1: Area of potential effect for Squalicum Waterway in Bellingham, Washington

Enclosure 2: Ariel map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Timothy Ballew II
Chairman, Lummi Nation
2665 Kwina Road
Bellingham, WA 98226

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Chairman Ballew:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Lummi Nation for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be *no historic properties affected* by this proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (Enclosures 1 and 2).

In 1930, Congress authorized construction of the Squalicum Waterway and construction was completed in 1931. Additional authorization occurred in 1937, which authorized maintenance of the southern half and western end of the Squalicum Creek basin to a depth of -26 feet (MLLW) and stipulated no dredging could be done within 75 feet of wharves, piers or similar structures.

For the upcoming project, the Corps is proposing to conduct maintenance dredging in the Squalicum Waterway to its congressionally authorized depth of -26 feet MLLW plus an additional 2 feet of allowable overdepth and 2 feet of authorized advanced maintenance. Areas that will not be dredged include the berthing areas and the turning area.

The Corps has determined the area of potential effect (APE) for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500

feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Based on the results of the records search, previous dredging of the channel and information gathered through consultation, the Corps has made a determination of *no historic properties affected* by the by the proposed maintenance dredging in Squalicum Waterway.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

Lena Tso
Tribal Historic Preservation Officer
Lummi Nation
2665 Kwina Rd
Bellingham, WA 98226

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

US Coast and Geodetic Survey. 1898. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/BELLING. Chart Number 6378

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US Coast and Geodetic Survey. 1928. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/6378-1-1928. Chart Number 6378.

Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Aerial map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Robert Kelly
Chairman, Nooksack Indian Tribe
P.O. Box 157
Deming, WA 98244

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Chairman Kelly:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Nooksack Indian Tribe for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be no historic properties affected by this proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (enclosures 1 and 2).

In 1930, Congress authorized construction of the Squalicum Waterway and construction was completed in 1931. Additional authorization occurred in 1937, which authorized maintenance of the southern half and western end of the Squalicum Creek basin to a depth of -26 feet (MLLW) and stipulated no dredging could be done within 75 feet of wharves, piers or similar structures.

For the upcoming project, the Corps is proposing to conduct maintenance dredging in the Squalicum Waterway to its congressionally authorized depth of -26 feet MLLW plus an additional 2 feet of allowable overdepth and 2 feet of authorized advanced maintenance. Areas that will not be dredged include the berthing areas and the turning area.

The Corps has determined the area of potential effect (APE) for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500

feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Based on the results of the records search, previous dredging of the channel and information gathered through consultation, the Corps has made a determination of *no historic properties affected* by the by the proposed maintenance dredging in Squalicum Waterway.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

George D. Swanaset, Jr.
Tribal Historic Preservation Officer
Nooksack Indian Tribe
P.O. Box 157
Deming, WA 98244-0157

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

US Coast and Geodetic Survey. 1898. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/BELLING. Chart Number 6378

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US Coast and Geodetic Survey. 1928. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/6378-1-1928. Chart Number 6378.

Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Aerial map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF
Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Tom Wooten
Chairman, Samish Indian Nation
P.O. Box 217
Anacortes, WA 98221-0217

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Chairman Wooten:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Samish Indian Nation for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be *no historic properties affected* by this proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (enclosures 1 and 2).

In 1930, Congress authorized construction of the Squalicum Waterway and construction was completed in 1931. Additional authorization occurred in 1937, which authorized maintenance of the southern half and western end of the Squalicum Creek basin to a depth of -26 feet (MLLW) and stipulated no dredging could be done within 75 feet of wharves, piers or similar structures.

For the upcoming project, the Corps is proposing to conduct maintenance dredging in the Squalicum Waterway to its congressionally authorized depth of -26 feet MLLW plus an additional 2 feet of allowable overdepth and 2 feet of authorized advanced maintenance. Areas that will not be dredged include the berthing areas and the turning area.

The Corps has determined the area of potential effect (APE) for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500

feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Based on the results of the records search, previous dredging of the channel and information gathered through consultation, the Corps has made a determination of *no historic properties affected* by the by the proposed maintenance dredging in Squalicum Waterway.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

Jacquelyn Ferry
Tribal Historic Preservation Officer
Samish Indian Nation
2918 Commercial Avenue
Anacortes, WA 98221

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

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Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Aerial map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF
Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Shawn Yanity
Chairman, Stillaguamish Tribe of Indians
3322 236th St. NE
Arlington, WA 98223

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Chairman Yanity:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Stillaguamish Tribe of Indians for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be *no historic properties affected* by this proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (enclosures 1 and 2).

In 1930, Congress authorized construction of the Squalicum Waterway and construction was completed in 1931. Additional authorization occurred in 1937, which authorized maintenance of the southern half and western end of the Squalicum Creek basin to a depth of -26 feet (MLLW) and stipulated no dredging could be done within 75 feet of wharves, piers or similar structures.

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The Corps has determined the area of potential effect (APE) for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500

feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Based on the results of the records search, previous dredging of the channel and information gathered through consultation, the Corps has made a determination of *no historic properties affected* by the by the proposed maintenance dredging in Squalicum Waterway.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

Kerry Lyste
Tribal Historic Preservation Officer
Stillaguamish Tribe of Indians
P.O. Box 277
Arlington, WA 98223

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

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Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Aerial map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF
Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Leonard Forsman
Chairman, The Suquamish Tribe
P.O. Box 498
Suquamish, WA 98392-0498

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Chairman Forsman:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Suquamish Tribe for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be no historic properties affected by this proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (enclosures 1 and 2).

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For the upcoming project, the Corps is proposing to conduct maintenance dredging in the Squalicum Waterway to its congressionally authorized depth of -26 feet MLLW plus an additional 2 feet of allowable overdepth and 2 feet of authorized advanced maintenance. Areas that will not be dredged include the berthing areas and the turning area.

The Corps has determined the area of potential effect (APE) for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500

feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Based on the results of the records search, previous dredging of the channel and information gathered through consultation, the Corps has made a determination of *no historic properties affected* by the by the proposed maintenance dredging in Squalicum Waterway.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

Dennis E. Lewarch
Tribal Historic Preservation Officer
Suquamish Tribe
P.O. Box 498
Suquamish, WA 98392-0498

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

US Coast and Geodetic Survey. 1898. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/BELLING. Chart Number 6378

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US Coast and Geodetic Survey. 1928. Bellingham Bay, WA. http://historicalcharts.noaa.gov/historicals/preview/image/6378-1-1928. Chart Number 6378.

Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Aerial map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF
Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Brian Cladoosby
Chairman, Swinomish Indian Tribal Community
11404 Moorage Way
LaConner, WA 98257-9450

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Chairman Cladoosby:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Swinomish Indian Tribal Community for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be *no historic properties affected* by this proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (enclosures 1 and 2).

In 1930, Congress authorized construction of the Squalicum Waterway and construction was completed in 1931. Additional authorization occurred in 1937, which authorized maintenance of the southern half and western end of the Squalicum Creek basin to a depth of -26 feet (MLLW) and stipulated no dredging could be done within 75 feet of wharves, piers or similar structures.

For the upcoming project, the Corps is proposing to conduct maintenance dredging in the Squalicum Waterway to its congressionally authorized depth of -26 feet MLLW plus an additional 2 feet of allowable overdepth and 2 feet of authorized advanced maintenance. Areas that will not be dredged include the berthing areas and the turning area.

The Corps has determined the area of potential effect (APE) for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500

feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

The Corps has made a reasonable and good faith effort to identify historic properties that might be affected by the undertaking. Based on the results of the records search, previous dredging of the channel and information gathered through consultation, the Corps has made a determination of *no historic properties affected* by the by the proposed maintenance dredging in Squalicum Waterway.

For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

Josephine Peters
Tribal Historic Preservation Officer
Swinomish Indian Tribal Community
11404 Moorage Way
LaConner, WA 98257-9450

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

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Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Aerial map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF

Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Marie Zackuse
Chairwoman, Tulalip Tribes
6404 Marine Drive
Tulalip, WA 98271-9775

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Madam Chair:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Tulalip Tribes for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be no historic properties affected by this proposed undertaking.

Squalicum Waterway is located in Section 43 of Township 38 North and Range 2 East in Bellingham, Whatcom County, Washington. The authorized project extends from deep water to the U.S. pierhead line, is 200 feet wide, and has an authorized depth of -26 feet below mean lower low water (-26 feet MLLW) with 2 feet of allowable overdepth and 2 feet of authorized advance maintenance (enclosures 1 and 2).

In 1930, Congress authorized construction of the Squalicum Waterway and construction was completed in 1931. Additional authorization occurred in 1937, which authorized maintenance of the southern half and western end of the Squalicum Creek basin to a depth of -26 feet (MLLW) and stipulated no dredging could be done within 75 feet of wharves, piers or similar structures.

For the upcoming project, the Corps is proposing to conduct maintenance dredging in the Squalicum Waterway to its congressionally authorized depth of -26 feet MLLW plus an additional 2 feet of allowable overdepth and 2 feet of authorized advanced maintenance. Areas that will not be dredged include the berthing areas and the turning area.

The Corps has determined the area of potential effect (APE) for the Squalicum Waterway to be the federally authorized limits. The authorized limits for the Squalicum Waterway are 3,500 feet long; 150 feet wide, and a maximum of -30 feet MLLW in depth. Dredged material would be disposed at the Port Gardiner non-dispersive site and the Rosario Strait dispersive site.

For the upcoming maintenance dredging of the Squalicum Navigation Waterway, the Corps has conducted a Washington Information System Architectural and Archaeological Records Data (WISAARD) search and reviewed internal documents related to the Squalicum Navigation Channel. A review of the WISAARD database shows the closest archaeological site (45WH757) is located outside of the navigation channel. Site 45WH757 is the Squalicum Pier, which was recorded in 2007. According to WISAARD this site has been determined not eligible for the National Register of Historic Places. No other archaeological sites are recorded in or near the APE. The closest cultural resources survey to the project area was for the Squalicum Creek Delta Restoration project. No cultural resources were identified during the survey. A review of historic nautical charts revealed the stages of development of the waterfront of Bellingham Bay. Prior to the construction of the navigation channel, the 1898 nautical chart shows Squalicum Creek flowing into the bay and extensive tidelands. The depth of the tidelands range between 6 to 9 feet (U.S. Coast & Geodetic Survey 1898, 1906). By 1928, extensive development had occurred along waterfront in and near the project area. The nautical chart of 1928 indicates that the tidelands had been filled, a railroad and pier had been constructed, and a channel improvement had been completed in the current location of the Squalicum channel with channel depths ranging from 2 ¼ feet to 4 ¾ feet (U.S. Coast & Geodetic Survey 1928). The 1931 conditions map shows that the channel had been dredged to its 1930 authorized depth of -26 feet MLLW (Corps of Engineers 1931). Squalicum Waterway has been dredged repeatedly since 1931 to the authorized depth and was last dredged in 2004.

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For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

Richard Young
Preservation Officer
Hibulb Cultural Center
6410 23rd Avenue NE
Tulalip, WA 98271

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

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Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Aerial map of Squalicum Waterway

DEPARTMENT OF THE ARMY
SEATTLE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 3755
SEATTLE, WASHINGTON 98124-3755

REPLY TO
ATTENTION OF
Environmental and Cultural Resources Branch

OCT 04 2017

The Honorable Jennifer Washington
Chairwoman, Upper Skagit Tribe
25944 Community Plaza Way
Sedro Woolley, WA 98284-9739

Subject: Section 106 Review and Tribal Notification for the Squalicum Waterway Maintenance Dredging Project, in Bellingham, Washington.

Dear Madam Chair:

The United States Army Corps of Engineers (Corps) is continuing consultation on the proposed maintenance dredging in Squalicum Waterway to maintain its congressionally authorized depths for ongoing commerce. Maintenance dredging would occur at least once within the next ten years. In our letter dated August 23, 2017, the Corps described the proposed project and asked the Upper Skagit Tribe for any information or concerns that the Tribe might have. This letter summaries the efforts the Corps has taken to identify historic properties and provide agency determination and findings provided at 36 CFR § 800.4 and 5. The Corps has determined that there will be *no historic properties affected* by this proposed undertaking.

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For more information about this project, clarification about this request, or to request a formal government-to-government meeting about Section 106 or any other concerns with this project, please contact Ms. Kara Kanaby (Lead Archaeologist) by telephone at (206) 764-6857 or by email at Kara.M.Kanaby@usace.army.mil or Ms. Lori Morris (Tribal Liaison) at (206) 764-3625 or by email at frances.morris@usace.army.mil.

Sincerely,

Evan R. Lewis,
Chief, Environmental and
Cultural Resources Branch

cc with enclosures

Scott Schuyler, Cultural Resources
Upper Skagit Tribe
25944 Community Plaza
Sedro Woolley, WA 98284

References

Corps of Engineers. 1931. Bellingham Harbor, Wash. Squalicum Creek Waterway. Condition after Dredging March 1931. Scale 1in=200 feet. U.S. Engineers Office, Seattle, EA. Mar. On file at the Army Corps of Engineers Seattle District.

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Enclosure 1: Area of potential effect for the Squalicum Waterway project in Bellingham, Washington.

Enclosure 2: Ariel map of Squalicum Waterway

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

October 4, 2017

Mr. Evan Lewis
Environmental & Cultural Resources
Seattle District
Corps of Engineers
PO Box 3755
Seattle, Washington 98124

Re: Squalicum Waterway Maintenance Dredging Project
Log No.: 2017-08-06169-COE-S

Dear Mr. Lewis:

Thank you for contacting our department. We have reviewed the materials you provided for the proposed Squalicum Waterway Maintenance Dredging Project, Bellingham, Whatcom County, Washington

We concur with your Determination of No Historic Properties Affected.

We would appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

In the event that archaeological or historic materials are discovered during project activities, work in the immediate vicinity must stop, the area secured, and the concerned tribe's cultural staff and cultural committee and this department notified.

These comments are based on the information available at the time of this review and on behalf of the State Historic Preservation Officer in compliance with the Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations 36CFR800.4. Should additional information become available, our assessment may be revised, including information regarding historic properties that have not yet been identified. Thank you for the opportunity to comment and a copy of these comments should be included in subsequent environmental documents.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 890-2615
email: *rob.whitlam@dahp.wa.gov*

Allyson Brooks Ph.D., Director
State Historic Preservation Officer

August 29, 2017

Mr. Evan R. Lewis
Environmental Resources Section
Corps of Engineers – Seattle District
PO Box 3755
Seattle, Washington 98124-3755

Re: Squalicum Waterway Maintenance Dredging Project
Log No.: 2017-08-06169-COE-S

Dear Mr. Lewis:

Thank you for contacting our department. We have reviewed the materials you provided for the Area of Potential Effect (APE) for the proposed Squalicum Waterway Maintenance Dredging Project, Bellingham, Whatcom County, Washington

We concur with your determination of the Area of Potential Effect (APE) as described and presented in your figures and text.

We look forward to further consultations as consult you with the concerned tribal governments, provide the results of the professional cultural resources review, and your finalized determination of effect.

We would also appreciate receiving any correspondence or comments from concerned tribes or other parties that you receive as you consult under the requirements of 36CFR800.4(a)(4).

These comments are based on the information available at the time of this review and on behalf of the State Historic Preservation Officer in compliance with the Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations 36CFR800.4. Should additional information become available, our assessment may be revised. Thank you for the opportunity to comment.

Sincerely,

Robert G. Whitlam, Ph.D.
State Archaeologist
(360) 890-2615
email: *rob.whitlam@dahp.wa.gov*