Elim Subsistence Harbor Feasibility Study
Appendix H: Essential Fish Habitat

Elim, Alaska

April 2020

U.S. Army Corps
of Engineers
Alaska District

DEPARTMENT OF THE ARMY
ALASKA DISTRICT, U.S. ARMY CORPS OF ENGINEERS
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7 January 2020

Mr. Matt Eagleton
Regional Essential Fish Habitat Coordinator
Habitat Conservation Division
National Marine Fisheries Service – Alaska Region
222 W 7th Ave, Room 552
Anchorage, AK, 99513

Dear Mr. Eagleton,

Attached please find an Essential Fish Habitat (EFH) Assessment for the U.S. Army Corps of Engineers (USACE) "Elim Tribal Partnership" project at Elim, Alaska. The Corps requests a review of this document and recommendations on EFH conservation from the National Marine Fisheries Service (NMFS). The USACE has determined that the project will not adversely affect EFH for Pacific salmon.

The USACE looks forward to working with the NMFS on this project. Please contact Chris Floyd at Christopher.B.Floyd@usace.army.mil, or by telephone at (907) 753-2700 if you need additional information.

Sincerely,

Michael R. Salyer
Chief, Environmental Resources Section

DRAFT
ESSENTIAL FISH HABITAT ASSESSMENT

ELIM TRIBAL PARTNERSHIP
ELIM, ALASKA

Prepared by:
U.S. ARMY ENGINEER DISTRICT, ALASKA
ENVIRONMENTAL RESOURCES SECTION

January 2020

ESSENTIAL FISH HABITAT ASSESSMENT

Elim Tribal Partnership
Elim, Alaska

1.0 INTRODUCTION

1.1 Preface

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act established the essential fish habitat (EFH) provision to identify and protect important habitats of Federally-managed marine and anadromous fish species. Federal agencies that fund, permit, or undertake activities that may adversely affect EFH are required to consult with the National Marine Fisheries Service (NMFS) regarding the potential effects of their actions on EFH and respond in writing to NMFS recommendations.

EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. “Waters” include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may consist of aquatic areas historically used by fish where appropriate. ”Substrate” includes sediment, hard bottom, structures underlying the waters, and associated biological communities.

1.2 Project Purpose

The United States Army Corps of Engineers (USACE) is evaluating alternatives for providing the community of Elim with a small boat harbor, in combination with other marine transport infrastructure such as a sheltered barge landing and/or a tender dock.

1.3 Project Area Description

1.3.1 General

Elim is on the north coast of Norton Sound, about 95 miles by air east of Nome, Alaska (Figure 1). The community is situated where Norton Sound narrows into Norton Bay, and where the shallow waters of Norton Sound (typically less than 100 feet deep) begin to shelve to depths of less than 10 feet (Figure 2). The coastline near Elim consists of rocky headlands alternating with sand and gravel beaches; Elim sits on a broad, shallow cove between two headlands (Figure 3). The shoreline at Elim is primarily sand, with weathered gravel accumulating where bedrock is exposed. A small stream, Elim Creek, cuts through the beach and discharges into the cove. The intertidal sediments on the exposed beach are regularly displaced and re-deposited by storm surge and wave action, and Elim Creek must frequently cut a new channel through the lower beach sediments.

Figure 1. Elim location and vicinity.

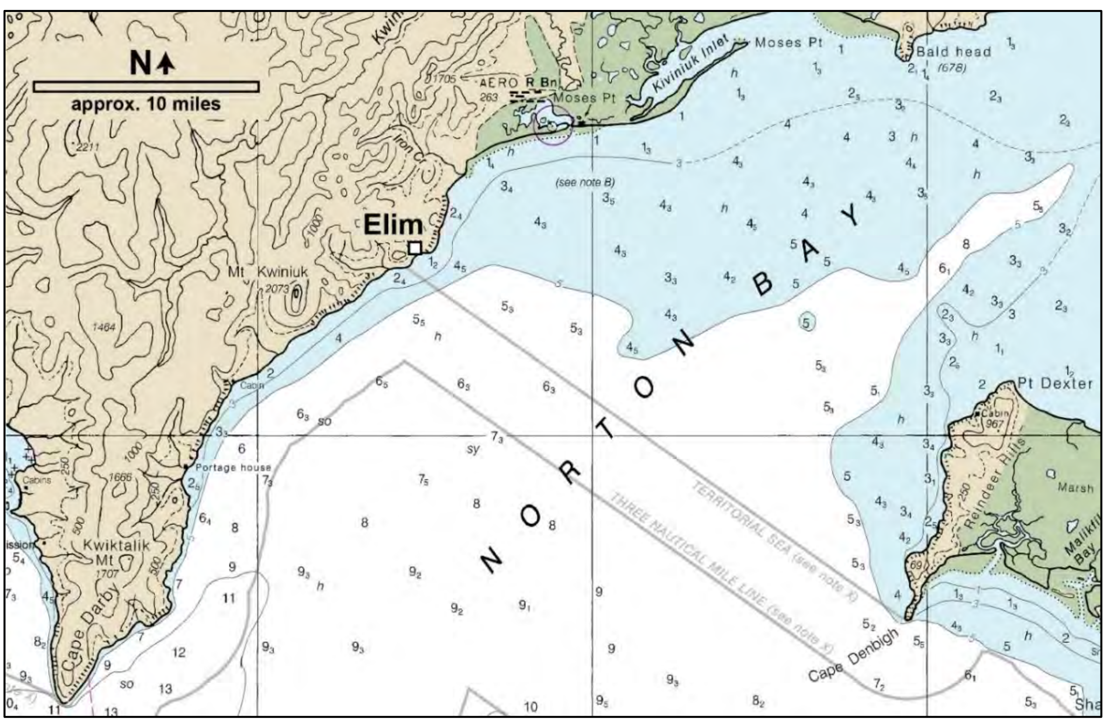

Figure 2. Elim in relation to regional bathymetry (excerpted and annotated from NOAA chart 16200; soundings are in fathoms/feet).

Figure 3. Elim and adjacent coastline.

The USACE contracted a detailed bathymetric survey of the seabed offshore of Elim in June 2019. Figure 4 presents preliminary data from that survey, showing the very gradual and uniform shelving of the seafloor, and depths of less than 14 feet below MLLW within 600 yards of shore.

1.3.2 July 2019 Underwater Video Survey of Marine Substrate

In July 2019, USACE employees used a towed underwater video camera to observe and record the seafloor substrate and habitat types offshore of Elim and Airport Point. The locations and orientations of the video transects are shown in Figure 5; Figure 6 provides representative screenshots of the different types of substrate and benthic habitat encountered.

The seafloor observed along the transects was predominantly sand, featureless except for wave ripples and tracks from various benthic organisms. The only organisms seen on the sand surface were occasional sea stars (probably *Asterias* sp.) and a single unidentified crab. Fragments of mollusk shell on the sand surface indicated clams or cockles living within the sand. Numerous unidentified sea jellies and salmonid fish appeared on the videos.

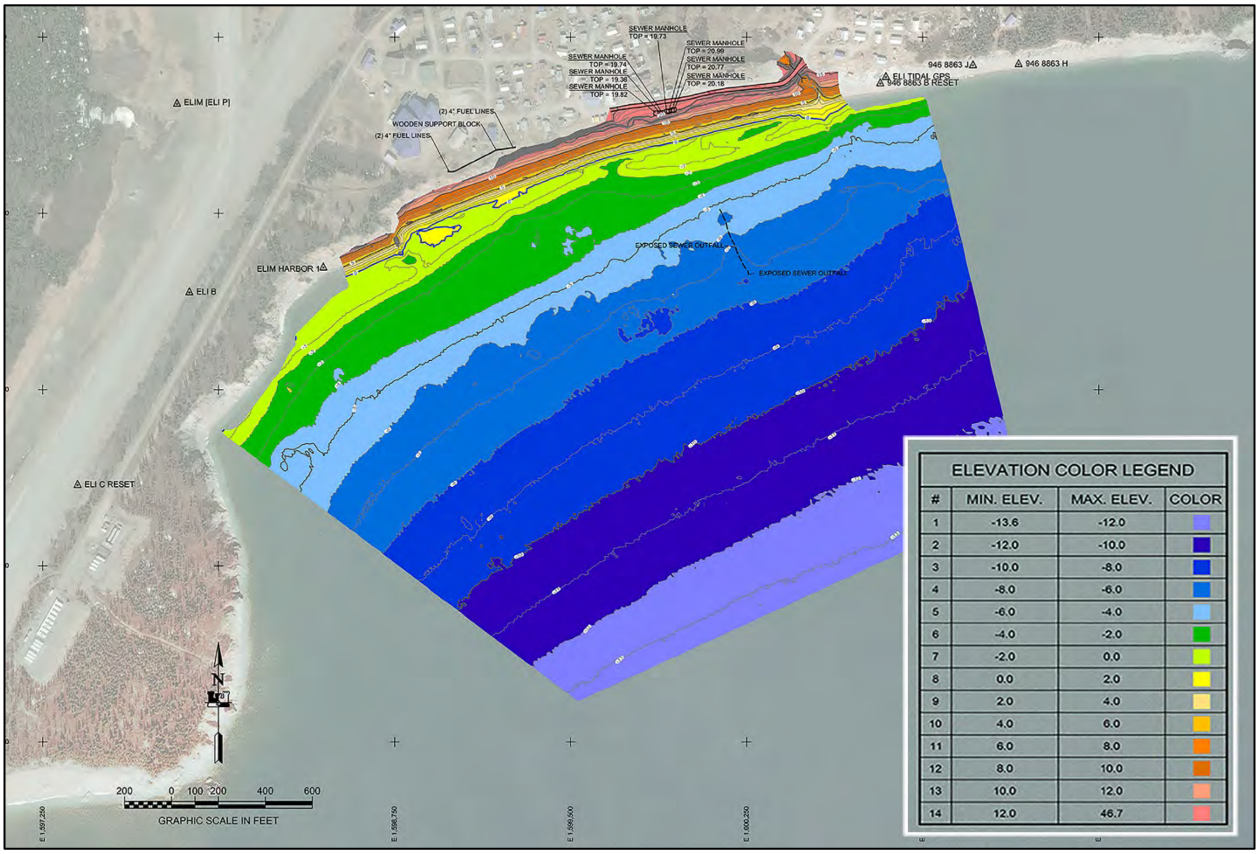

Figure 4. Preliminary bathymetric data from June 2019 survey.

Scattered areas of cobbles and low-relief rock slabs appeared in some areas, increasing in the more easterly transects (Figure 6). The low-relief rock substrates tended to support little or algae or other marine growth. By contrast, higher-relief boulders and bedrock outcroppings, especially around Airport Point, supported dense communities of marine algae and invertebrates such as anemones and crabs (Figure 6).

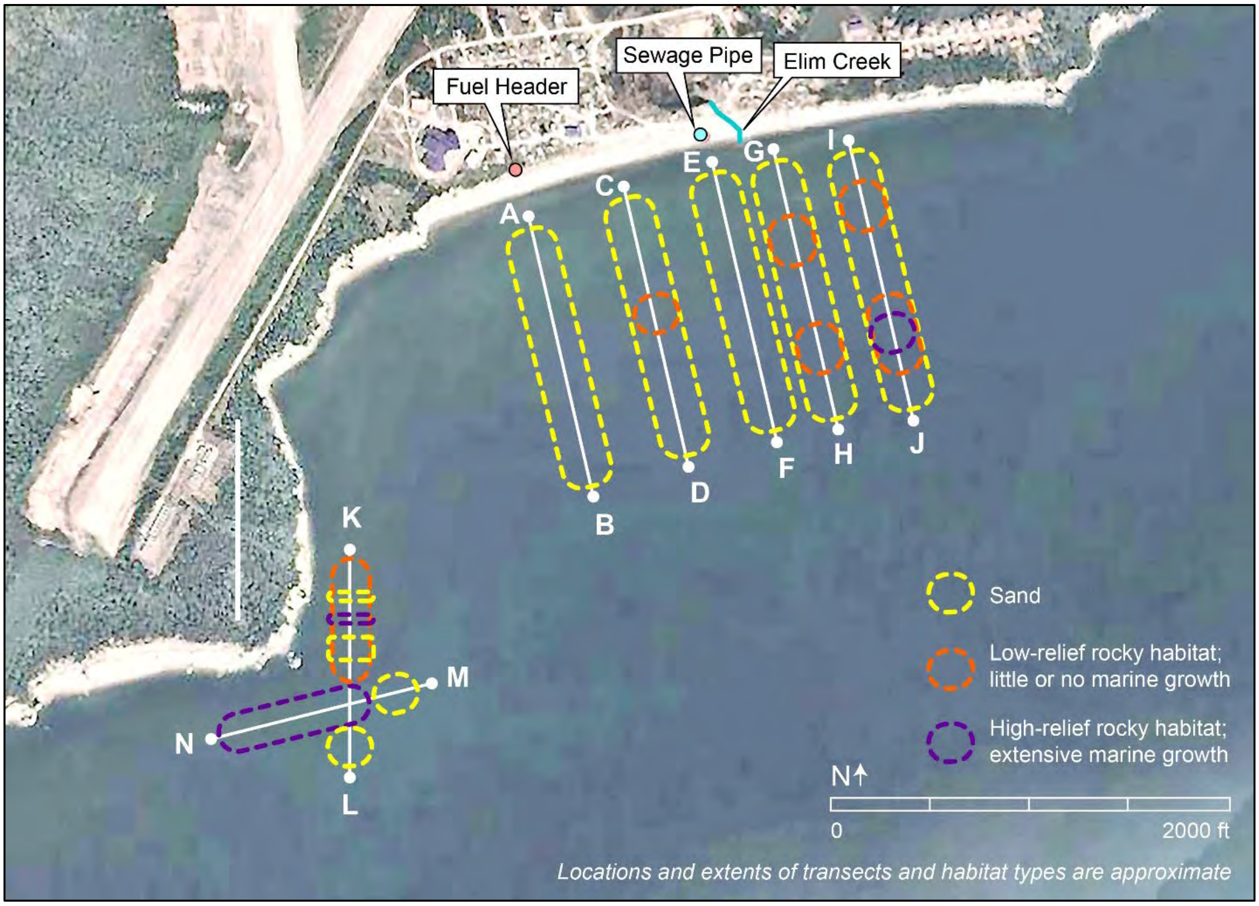

Figure 5. Underwater video transects performed 22 July 2019, and the generalized substrate types encountered.

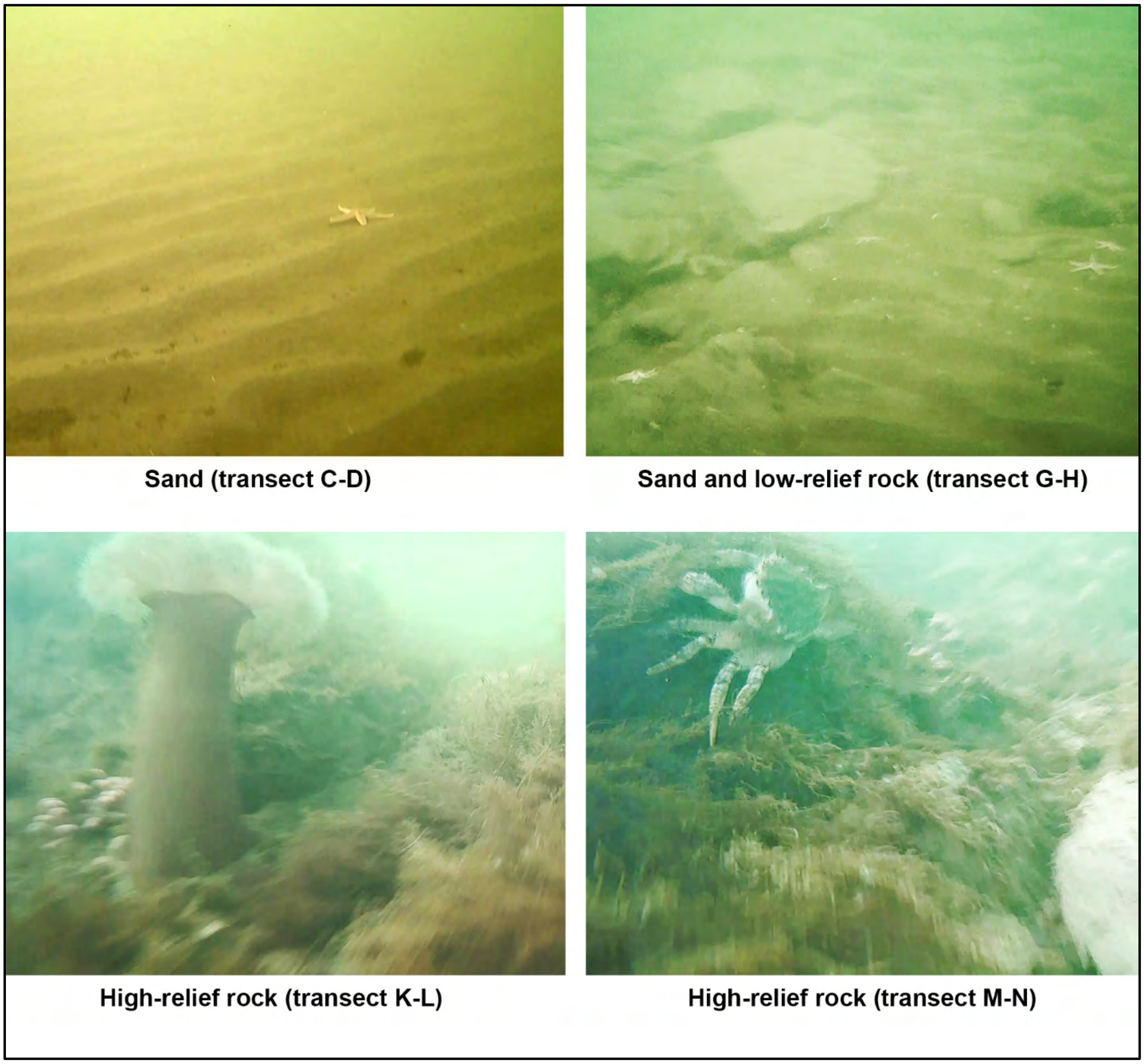

Figure 6. Screenshots from the July 2019 underwater videos, representative of the different substrates and benthic habitats encountered.

2.0 PROJECT DESCRIPTION

The USACE is currently evaluating four construction alternatives (Alternatives 2 through 5; Figures 3-1 through 3-4; Alternative 1 is the mandatory “no action” alternative) to identify the most useful, cost-effective, and least environmentally-damaging project.

The seafloor off of Elim is flat and sandy, but ridges of bedrock are believed to lie under the surface. At this stage of project planning, the USACE assumes that all the alternatives will require some amount of mechanical rock-breaking using an excavator with a hydraulic “ripping” attachment, along with more typical mechanical dredging techniques. Alternative 5 could potentially require a limited amount of subsurface blasting to break up bedrock at depth; the extent and location of any such blasting cannot be evaluated at this time.

The dredged material is expected to be sand, gravel, and broken rock. There is no history of significant pollutant releases along the Elim shoreline. Wave action continues to redistribute the nearshore sediments; the dredging of sand and rock materials are expected to be free of chemical contamination. The dredged material would most likely be disposed of in Norton Bay to the southeast of Elim.

Because of the anticipated shallow bedrock, the small sheet pile dock included in Alternatives 3, 4, and 5 will most likely be a closed or open-cell design, requiring minimal driving of the sheet pile into the substrate.

Alternative 2 (Figure 7-1). Two rubble mound breakwaters would provide a mooring basin approximately 3.9 acres with a required dredged depth of -8.0 feet Mean Lower Low Water (MLLW) with a maximum pay depth of -10.0 feet MLLW. The west breakwater would be 985 feet long and the east breakwater 457 feet long. The entrance channel and turning basin would also have a required dredged depth of -8.0 feet MLLW with a maximum pay depth of -10.0 feet MLLW. Local service facilities needed would include a single boat launch, uplands with an area of 3.2 acres for parking and turn-around at the boat launch, and a road connecting the uplands to Front St. to the harbor uplands. The road would be approximately 0.15 miles and relatively flat.

Alternative 2 would require a total of roughly 47,000 cubic yards of construction dredging, followed by about 10,000 cubic yards of maintenance dredging at estimated intervals of 10 years.

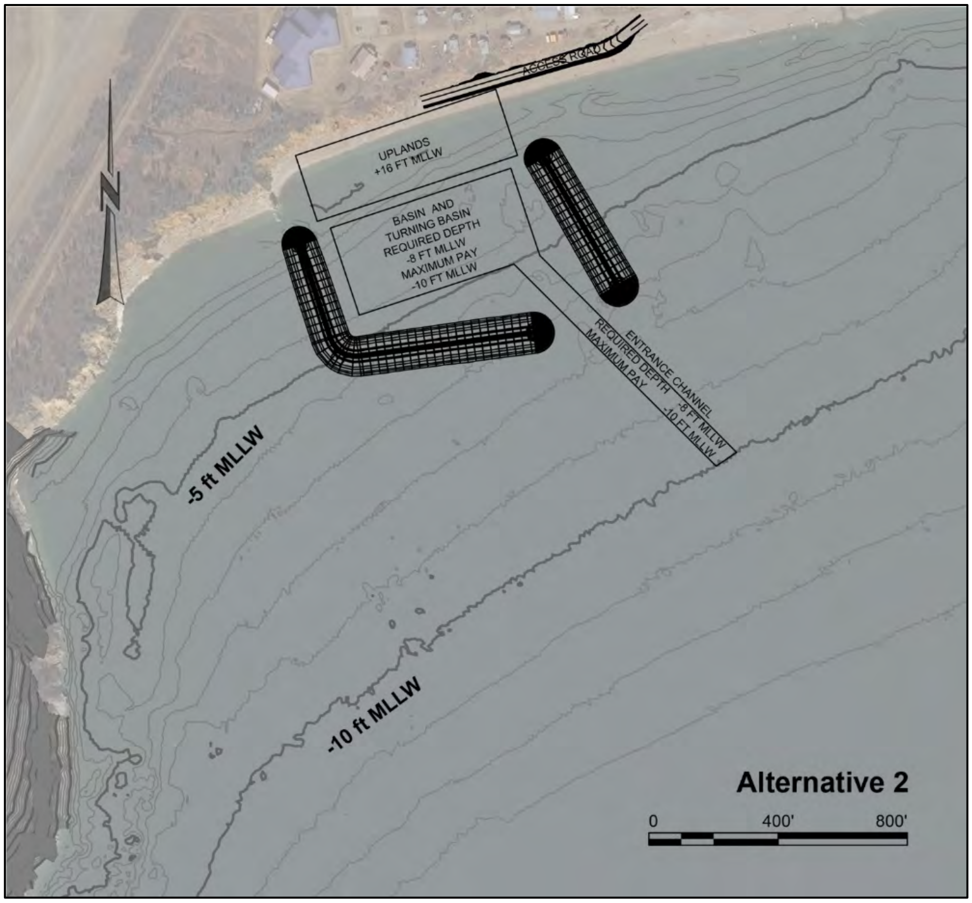

Figure 7-1. Alternative 2 layout.

Alternative 3 (Figure 7-2). Two rubble mound breakwaters would provide a mooring basin approximately 4.6 acres with a required dredged depth of -8.0 feet MLLW with a maximum pay depth of -10.0 feet MLLW. The west breakwater would be 1,068 feet long and the east breakwater 463 feet long. The entrance channel, tender dock access, and turning basin would also have a required dredged depth of -9.0 feet MLLW with a maximum pay depth of -11.0 feet MLLW. Local service facilities required would include a single boat launch, uplands with an area of 3.9 acres for parking and turn-around at the boat launch, a tender dock, and a road connecting the uplands to Front St. to the harbor uplands. The road would be approximately 0.15 miles and relatively flat. Construction of the tender dock would require about 200 linear feet of sheet pile.

Alternative 3 would require a total of roughly 53,000 cubic yards of construction dredging, followed by about 20,000 cubic yards of maintenance dredging at estimated intervals of 15 years.

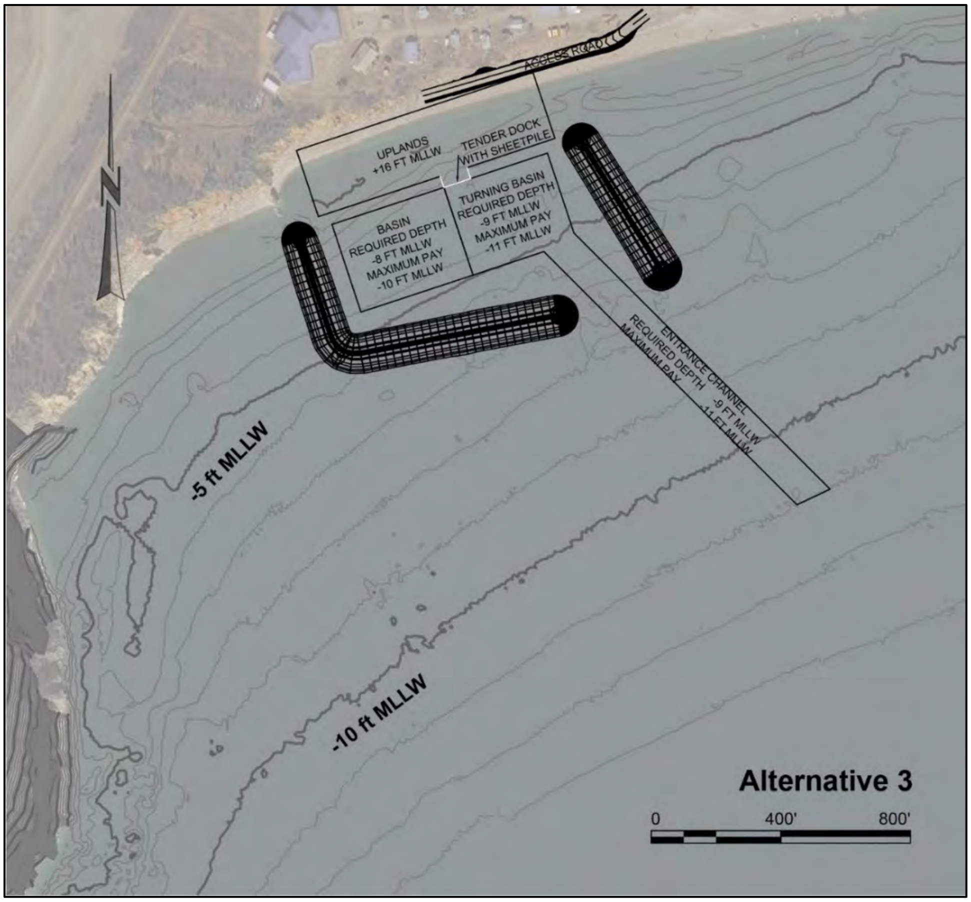

Figure 7-2. Alternative 3 layout.

Alternative 4 (Figure 7-3). Two rubble mound breakwaters would provide a mooring basin approximately 5.1 acres with a required dredged depth of -9.0 feet MLLW with a maximum pay depth of -11.0 feet MLLW. The west breakwater would be 1,099 feet long and the east breakwater 463 feet long. The entrance channel, tender dock access, and turning basin would also have a required dredged depth of -9.0 feet MLLW with a maximum pay depth of -11.0 feet MLLW. Local service facilities required would include a single boat launch, uplands with an area of 3.9 acres for parking and turn-around at the boat launch, a tender dock, and a road connecting the uplands to Front St. to the harbor uplands. The road would be approximately 0.15 miles and relatively flat. Construction of the tender dock would require about 200 linear feet of sheet pile.

Alternative 4 would require a total of roughly 73,000 cubic yards of construction dredging, followed by about 20,000 cubic yards of maintenance dredging at estimated intervals of 15 years.

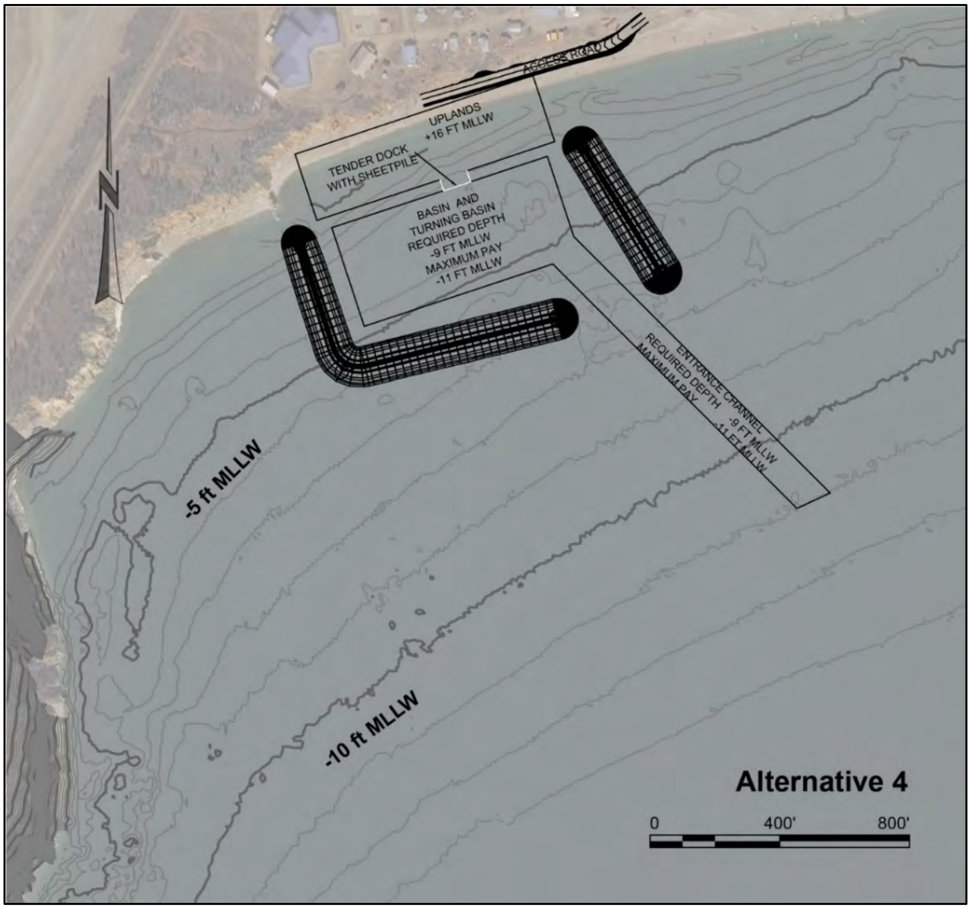

Figure 7-3. Alternative 4 layout.

Alternative 5 (Figure 7-4). Two rubble mound breakwaters would provide a mooring basin approximately 6.2 acres with a required dredged depth of -9.0 feet MLLW with a maximum pay depth of -11.0 feet MLLW. The west breakwater would be 1,082 feet long and the east breakwater 468 feet long. The entrance channel, tender dock access, barge landing access, and turning basin would have a required dredged depth of -12.0 feet MLLW with a maximum pay depth of -14.0 feet MLLW. Local service facilities required would include an extension to the fuel header located on Elim Beach, a single boat launch, uplands with an area of 3.9 acres for parking and turn-around at the boat launch, a tender dock, a barge landing, two mooring points, and a road connecting the uplands to Front St. to the harbor uplands. The road would be approximately 0.15 miles and relatively flat. Construction of the tender dock would require about 200 linear feet of sheet pile, and two moorage points (pilings) would be installed in the uplands adjacent to the barge landing.

Alternative 5 would require a total of roughly 159,000 cubic yards of construction dredging, followed by about 75,000 cubic yards of maintenance dredging at estimated intervals of 20 years.

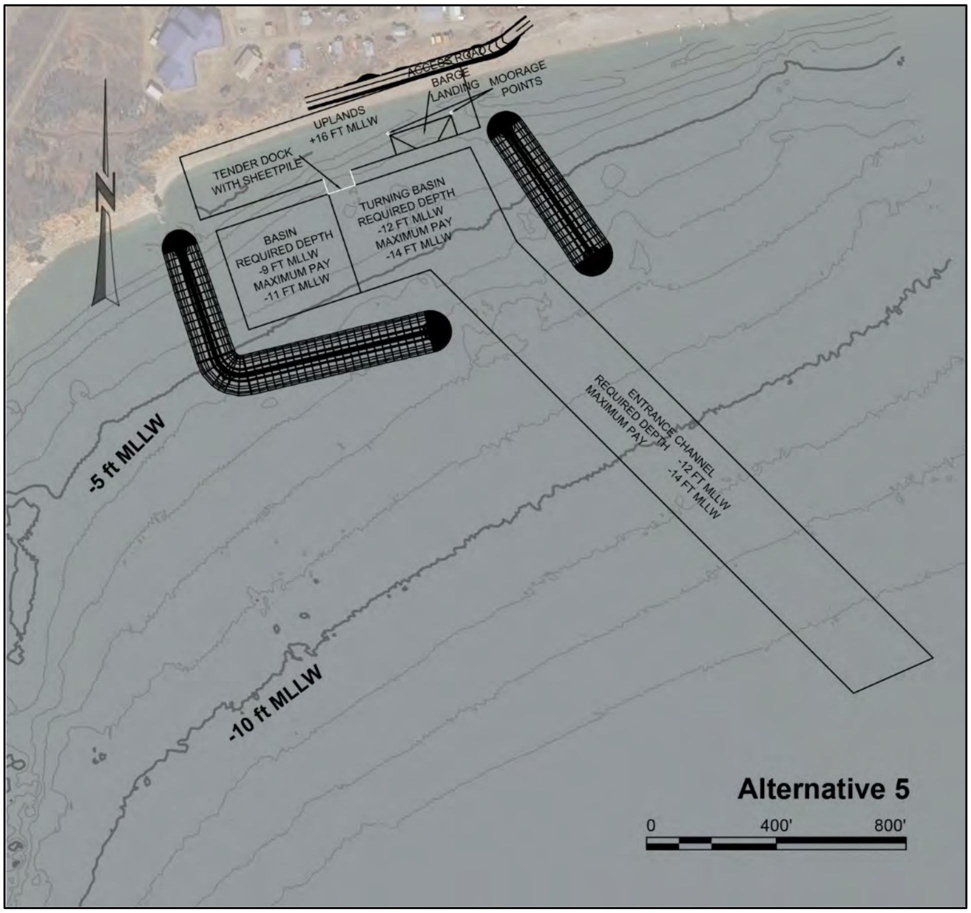

Figure 7-4. Alternative 5 layout

3.0 ESSENTIAL FISH HABITAT IN THE PROJECT AREA

The nearshore marine waters in the vicinity of Elim include EFH for all five species of Pacific salmon. Full descriptions of EFH, life-stages, and habitat requirements for these species are available in the Alaska salmon fishery management plan (FMP; NPFMC 2018).

3.1 Pacific Salmon EFH

Based on EFH maps and descriptions in the Pacific salmon FMP (NPFMC 2018), the nearshore marine waters near Nome contain EFH for the five Pacific salmon species at the following life-stages:

- Pink salmon – juvenile and mature.
- Chum salmon – juvenile, immature, and mature.
- Sockeye salmon – juvenile, immature, and mature.
- Coho salmon – juvenile and mature.
- Chinook salmon – immature.

3.1.1 Pink Salmon (Oncorhynchus gorbuscha)

Pink salmon are distinguished from other Pacific salmon by having a fixed 2-year life span, being the smallest of the Pacific salmon as adults, and the young migrate to sea soon after emerging from the spawning beds. Newly emerged pink salmon fry show a preference for saline water over freshwater, and schools of pink salmon fry may move quickly from the natal stream area or remain to feed along shorelines up to several weeks. Early marine schools of pink salmon fry, often in tens or hundreds of thousands of fish, tend to follow shorelines and, during the first weeks at sea, spend much of their time in shallow water of only a few centimeters deep. In many areas, pink salmon and chum salmon fry of similar age and size co-mingle in both large and small schools during early sea life (NPFMC 2018a).

Estuarine EFH for juvenile pink salmon is defined as the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters and generally present from late April through June (NPMFC 2018a).

- Marine EFH for juvenile pink salmon is defined as the general distribution area for this life stage, located in marine waters off the coast of Alaska from the mean higher tide line to the 200-nautical mile limit of the U.S. Exclusive Economic Zone, (EEZ), including the Gulf of Alaska (GOA), Eastern Bering Sea (EBS), Chukchi Sea, and Arctic Ocean. Juvenile pink salmon distribute within coastal waters along the entire shelf (0 to 200 m) from mid-summer until December; then migrate to pelagic waters (upper 50m) of the slope (200 to 3,000 m).

3.1.2 **Chum Salmon** (*Oncorhynchus keta*)

After emerging from the streambed, schooling juvenile chum salmon fry migrate downstream, mostly at night, to the estuaries where they tend to feed in the intertidal grass flats and along the shore. Chums can utilize these intertidal wetlands for several months before actively migrating out of bays and into channels on the way to the outside waters. Pink salmon, on the other hand, tend to move directly to open water areas. Chum salmon utilize a wide variety of food items, including mostly invertebrates (including insects), and gelatinous species. Offshore movement of larger juveniles occurs mostly in July to September (NPFMC 2018).

Adult chum salmon reside in the ocean for about 1 to 6 years. Throughout their range, 3-, 4-, and 5-year olds are common, but 4-, 5-, and 6-year-old chum salmon dominate the northern stocks. Chum salmon eat a variety of foods during their ocean life, e.g., amphipods, euphausiids, pteropods, copepods, fish, and squid larvae (NPFMC 2018).

- Estuarine EFH for juvenile chum salmon is defined as the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters from late April through June.

- Marine EFH for juvenile chum salmon is defined as the general distribution area for this life stage, located in marine waters off the coast of Alaska to approximately 50 m in depth from the mean higher tide line to the 200-nm limit of the EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean.

- EFH for immature and maturing adult chum salmon is defined as the general distribution area for this life stage, located in marine waters off the coast of Alaska to depths of 200 m and ranging from the mean higher tide line to the 200-nm limit of the EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean (NPFMC 2018).

3.1.3 **Sockeye Salmon (*Oncorhynchus nerka*)**

After emergence from their natal river systems in spring or early summer, juvenile sockeye enter the marine environment where they reside for 1 to 4 years, usually 2 or 3 years, before returning to spawn. Depending on the stock, they may reside in the estuarine or nearshore environment before moving into oceanic waters. They are typically distributed in offshore waters by autumn following outmigration. During the initial marine period, yearling sockeye forage actively on a variety of organisms, apparently preferring copepods and insects, but also eating amphipods, euphausiids, and fish larvae when available. After entering the open sea during their first summer, juvenile sockeye salmon remain in a band relatively close to the coast (NPFMC 2018).

- Estuarine EFH for juvenile sockeye salmon is defined as the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters. Under-yearling, yearling, and older smolts occupy estuaries from March through early August.

- Marine EFH for juvenile sockeye salmon is defined as the general distribution area for this life stage, located in marine waters off the coast of Alaska to depths of 50 m and range from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean from mid-summer until December of their first year at sea (NPFMC 2018).

3.1.4 Coho Salmon (Oncorhynchus kisutch)

After leaving freshwater, juvenile coho (also commonly called silver salmon) in Alaska spend up to 4 months in coastal waters before migrating offshore and dispersing throughout the North Pacific Ocean and Bering Sea. Marine invertebrates are the primary food when coho first enter saltwater, and fish prey increase in importance as the coho grow. Most immature and maturing coho occupy upper pelagic areas in the central GOA and BS during the 12 to 14 months after leaving coastal areas. Some maturing coho also use coastal and inshore waters at this life stage, but those are likely to be smaller at maturity. The bioenergetics of growth is best in the epipelagic offshore habitat where forage is abundant, and sea surface temperature is between 12 and 15°C. Coho rarely use areas where sea surface temperature exceeds 15°C. Most coho remain at sea for about 16 months before returning to coastal areas and entering freshwater to spawn, although some precocious males will return to spawn after about 6 months at sea (NPFMC 2018).

- Estuarine EFH for juvenile coho salmon is the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters. Juvenile coho salmon require year-round rearing habitat and also migration habitat from April to November to provide access to and from the estuary.

- Marine EFH for juvenile coho salmon is the general distribution area for this life stage, located in marine waters off the coast of Alaska from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean. Marine juvenile coho salmon inhabit these marine waters from June to September.

- EFH for immature and maturing adult coho salmon is the general distribution area for this life stage, located in marine waters off the coast of Alaska to 200 m in depth and range from the mean higher tide line to the 200-nm limit of the U.S. EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean. Marine mature coho salmon inhabit pelagic marine waters in the late summer, by which time the mature fish migrate out of marine waters (NPFMC 2018).

3.1.5 Chinook Salmon (Oncorhynchus tshawytscha)

Chinook salmon, also commonly called king salmon, display diverse and complex life history patterns, and use a wide range of spawning habitat. They are separated generally into two races: stream- and ocean-type fish. Stream-type fish have long freshwater residence as juveniles (1 to 2 years), migrate rapidly to oceanic habitats, enter freshwater as immature or “bright” fish, and spawn far upriver in late summer or early fall. Ocean-type fish have short, highly variable freshwater residency (lasting up to a year), extensive estuarine residency, a more coastal-oriented ocean distribution, and spawn within a few weeks of freshwater entry in the lower portions of the watershed. In Alaska, the stream-type life history predominates although ocean-type life histories have been documented in a few Alaska watersheds. Chinook salmon also have a distinctly different distribution in ocean habitats than do other species of Pacific salmon. While other species of salmon generally are surface-oriented, utilizing primarily the upper 20 m, Chinook salmon tend to be at greater depths and are often associated with bottom topography (NPFMC 2018).

Residency in freshwater and size and timing of seawater migration are highly variable amongst juvenile Chinook salmon. Ocean-type fish can migrate seaward immediately after yolk absorption. The majority of ocean-type fish migrate at 30 to 90 days after emergence, but some fish move seaward as fingerlings in the late summer of their first year, while others overwinter and migrate as yearling fish. Stream-type fish, in contrast, generally spend at least one year in freshwater, migrating as 1- or 2-year-old fish. After entering saltwater, Chinook juveniles disperse to oceanic feeding areas; the seaward migration of smolts is timed so that the smolts arrive in the estuary when food is plentiful. Ocean-type fish have more extended estuarine residency, tend to be more coastal oriented, and do not generally migrate as far as stream-type fish. Food in estuarine areas include epibenthic organisms, insects, and zooplankton (NPFMC 2018).

- Estuarine EFH for juvenile Chinook salmon is defined as the general distribution area for this life stage, located in estuarine areas, as identified by the salinity transition zone (ecotone) and the mean higher tide line, within nearshore waters. Chinook salmon smolts and post-smolt juveniles may be present in these estuarine habitats from April through September.

- Marine EFH for juvenile Chinook salmon is defined as the general distribution area for this life stage, located in marine waters off the coast of Alaska from the mean higher tide line to the 200-nm limit of the EEZ, including the GOA, EBS, Chukchi Sea, and Arctic Ocean. Juvenile marine Chinook salmon are at this life stage from April until annulus formation in January or February during their first winter at sea (NPFMC 2018).

3.2 Freshwater EFH

Designations of EFH for all Pacific salmon species include freshwater habitat, and extends to all streams, lakes, wetlands, and other water bodies currently or historically assessable to salmon. These waters and their salmon fisheries are managed by the State of Alaska. The location of many freshwater water bodies used by salmon are contained in documents organized and maintained by the Alaska Department of Fish and Game (ADFG). Alaska Statute 16.05.870 requires ADFG to specify the various streams that are important for spawning, rearing, or migration of anadromous fishes. This is accomplished through the *Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes* and the *Atlas to the Catalog of Waters Important for Spawning, Returning or Migration of Anadromous Fishes*. (NPFMC 2018).

An annotated screenshot from the ADFG’s Anadromous Waters Catalog (AWC) interactive mapping website (ADFG 2019) is seen in Figure 8 . Numerous major salmon streams discharge into Norton Bay and eastern Norton Sound, but mostly well to the east or south of Elim. Elim Creek is not currently cataloged by the ADFG as an anadromous stream, although pink salmon are known to enter it (Figure 9).

3.3 Habitat Areas of Particular Concern (HAPCs)

Habitat areas of particular concern (HAPCs) are specific sites within EFH that are of particular ecological importance to the long-term sustainability of managed species, are of a rare type, or are especially susceptible to degradation or development. HAPCs are meant to provide greater focus of conservation and management efforts and may require additional protection from adverse effects. The fishery management council may designate specific sites as HAPCs and may develop management measures to protect habitat features within HAPCs.

There are no HAPCs designated within Norton Sound or near the project area.

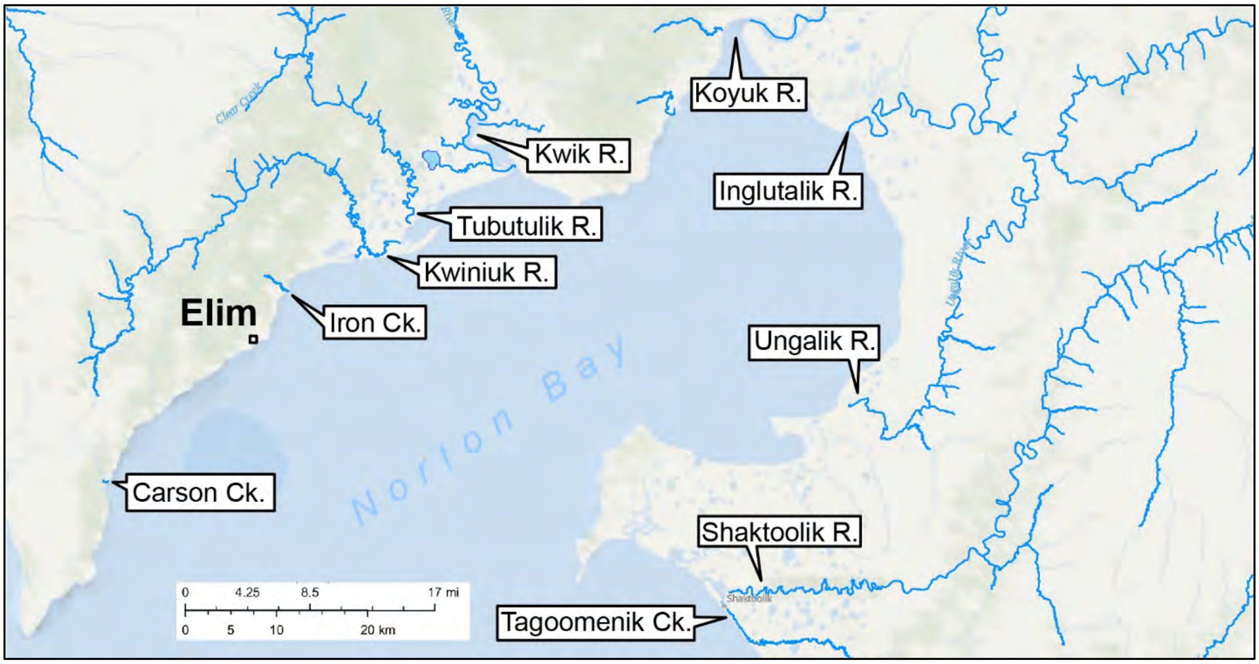

Figure 8. ADFG-cataloged anadromous streams (in bright blue) discharging into Norton Bay (ADFG 2019).

Figure 9. Mature pink salmon caught in Elim Creek, August 2019.

4.0 EFFECTS ON EFH

The major in-water construction activities will consist of:
(1) dredging of the seafloor;
(2) placement or disposal of dredged material;
(3) placement of rubble mound rock breakwaters;
(4) construction of the sheet pile tender dock.

4.1 Dredging

Dredging activities can adversely affect benthic, and water column habitats; the potential environmental effects of dredging on managed species and their habitats include:

- the direct removal and/or burial of organisms;
- increased turbidity and siltation, including light attenuation from turbidity;
- contaminant release and uptake, including nutrients, metals, and organics;
- the release of oxygen-consuming substances (e.g., chemicals and bacteria);
- entrainment;
- noise disturbances; and

- alterations to hydrodynamic regimes and physical habitat (Limpinsel et al. 2017)

Many fish species forage on infaunal and bottom-dwelling organisms. Dredging may adversely affect these prey species by directly removing or burying them. Although macrobenthic communities may recover total abundance and biomass within a few months or years, their taxonomic composition and species diversity may remain different from pre-dredging for more than three to five years. Recovery of microbenthic communities in colder, high latitude environments may require even more time.

Dredging can elevate levels of suspended sediment and organic matter in the water column. The associated turbidity plumes of suspended particulates may reduce light penetration and lower the rate of photosynthesis for subaquatic vegetation. Fish may sustain gill injury and suffer reduced feeding ability if exposed to high suspended sediment levels for extended periods of time. Dredging can also re-suspend and release nutrients and toxic substances that may then become more biologically available to aquatic organisms, or cause short-term oxygen depletion.

Dredges have the potential to entrain fishes and invertebrates during all life cycle phases, including adults, juveniles, larvae, and eggs depending upon the equipment used. Entrainment is the direct uptake of aquatic organisms caused by the suction field generated by hydraulic dredges. Benthic infauna is particularly vulnerable to entrainment by dredging, although some mobile epibenthic and demersal species, such as shrimp, crabs, and fish, can be susceptible to entrainment as well. Salmonids are frequently cited in studies of fish entrainment.

The noise generated by pumps, cranes and the mechanical action of the dredge has the ability to alter the behavior of fish and other aquatic organisms. The noise levels and frequencies produced from dredging depend on the type of dredging equipment being used, the depth and thermal variations in the surrounding water, and the topography and composition of the surrounding seafloor. It has been hypothesized that dredging-induced sound may block or delay the migration of anadromous fishes, interrupt or impair communication, or impact foraging behavior, and dredging is known to elicit an avoidance response by marine fishes.

The proposed project at Elim will involve sources of underwater noise beyond that typically associated with dredging. Removal of bedrock through hydraulic ripping generates non-impulsive noise similar to that caused by mechanical dredging, though potentially at a higher amplitude. The underwater noise caused by the installation of sheet pile (Alternatives 3 through 5) may be either impulsive or non-impulsive, depending on whether an impact or vibratory hammer is used to drive the piles.

Because of the expected shallow bedrock in the area, the proposed sheet pile dock will be designed to require minimal driving into the seabed (i.e., perhaps 2 to 3 feet). The location of the sheet pile dock within the rubble mound breakwaters will also greatly limit the propagation of underwater noise.

The potential noise impacts of subsurface blasting are difficult to evaluate at this phase of project planning. Subsurface blasting would be conducted only if hydraulic ripping is not sufficient to remove a particular bedrock outcropping or other rocky mass. The impact from any subsurface blasting would be dependent upon the number and size of the explosive charges necessary, the depth of charge placement, and the opportunities to suppress blast effects through stemming or other mitigatory steps.

Dredging also has the potential for modifying current patterns and water circulation via alterations to substrate morphology. These alterations can cause changes in the direction or velocity of water flow, water circulation, or dimensions of the water body traditionally used by fish for food, shelter, or reproductive purposes (Limpinsel et al. 2017, Kelly and Ames 2018).

4.2 Dredged Material Placement

Disposal or placement of the dredged material can have disruptive effects similar to that of dredging, particularly through altering existing habitat by changing water depth or substrate, smothering benthic organisms, increasing turbidity, and releasing contaminants (Limpinsel et al. 2017).

The USACE expects that the dredged material will consist of sand, gravel, and crushed rock that will contain a low percentage of fines, and therefore create little turbidity. The coarse marine sediments offshore of this unimproved shoreline are unlikely to contain chemical contamination. The USACE has not yet selected a dredged material disposal site, but it would likely be in relatively deep (30 feet or more) waters found roughly a mile to the southeast of Elim, but east of the Territorial Sea baseline (i.e., “inland waters”; Figure 2). The benthic environment at this location is expected to be flat and sandy, and the substrate consists of material similar to the dredged material. Observations by Elim residents suggest that sandy benthic sediments in Norton Bay are highly mobile and frequently displaced by storm surge; dredged material discharged in the disposal area would probably be redistributed fairly quickly by natural forces.

4.3 Placement of Rubble Mound Structures

Activities associated with the construction of small boat harbors may include:

- loss and conversion of habitat;

- altered light regimes and loss of submerged aquatic vegetation;
- altered temperature regimes;
- siltation, sedimentation, and turbidity;
- contaminant releases; and
- altered tidal, current, and hydrologic regimes (Limpinsel et al. 2017).

At Elim, the placement of rock and fill materials to create the breakwaters will directly convert flat, sandy habitat into high-relief rocky substrate that should recruit a new community of marine algae and other organisms. The in-water construction work will cause disturbances within the water column, but should not generate significant turbidity due to the lack of fines in the existing substrate.

4.4 Construction of the Sheet Pile Tender Dock

The tender dock is expected to be an open cell sheet pile system. The sheer faces of a sheet pile dock may eliminate sheltered areas of shallow, slower-moving water where juvenile fish preferentially gather (Limpinsel et al. 2017). However, the sheet pile dock at Elim would be constructed within the shelter of the rubble mound breakwater, which would minimize its effects on water movement and habitat.

The pile driving necessary to create the tender dock has the potential to create injurious or disturbing noise. Pile driving can generate intense underwater sound pressure waves that may adversely affect EFH. Fish may leave an area for more suitable spawning grounds or may avoid a natural migration path because of noise disturbances, and can be injured and killed by more intense pressure waves. Short-term exposure to peak sound pressure levels (SPLs) above 180 to 190 dB is believed to cause physical harm to fish, while SPLs around 155 dB may be sufficient to stun small fish (Limpinsel et al. 2017). Adverse behavioral effects are expected above a root mean square (RMS) value of 150 dB (CALTRANS 2015).

The type and intensity of the sounds produced during pile driving depend on a variety of factors, including the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile-driving hammer:

- Sound pressure levels are positively correlated with the size of the pile, as more energy is required to drive larger piles.
- Firmer substrates require more energy to drive piles and produce more intense sound pressures.
- Sound attenuates more rapidly with distance from the source in shallow water than it does in deep water.

- Studies have shown that fish display an avoidance response to the sound from vibratory hammers, and do not habituate to such sound, whereas fish may become habituated to impact hammer sounds after an initial startle response, and may remain within range of potentially harmful sound (Limpinsel et al. 2017).

4.5 Long-term Effects

The USACE expects no significant long-term adverse effects on EFH. The project location is within the general distribution of marine-phase Pacific salmon but otherwise does not appear to provide important habitat for feeding, spawning, or rearing salmon. The rubble mound structures will create a minor diversion for migrating salmon away from the shoreline, but into waters only a few feet deeper than the salmon traverse at present. The USACE expects the new high-relief rocky habitat created by the rubble mound structures to rapidly recruit a diverse community of marine algae and invertebrates similar to that observed on natural boulders and pinnacles in the area.

The beach material at the project site is very mobile and constantly reworked by wave action. No fish passage gap is proposed for this project; any fish passage gap incorporated into the breakwater design would likely be quickly filled in with sand, and be difficult to keep clear of obstruction. The breakwater enclosure is intended to alter currents and wave action but should have no significant effect on temperature regimens. There is no significant submerged aquatic vegetation at the project site.

4.6 Relative Effects on EFH of the Four Alternatives

The long-term effects of the four alternatives would be very similar, as the alternatives occupy the same location, share most construction features, and differ primarily in scale. The construction of the sheet pile dock included in alternatives 3, 4, and 5, would add to the short-term impacts from noise and disturbance, as would the potential for subsurface blasting in alternative 5.

4.7 Proposed mitigation measures

1. The selected contractor shall include an Oil Spill Prevention and Control Plan, and a plan for minimizing the spread of invasive species, in its Environmental Protection Plan, which is submitted to the Corps for review and approval.

2. Rock for rubble mound construction will be free of contaminants and invasive species.

3. Adverse effects of in-water pile driving on fish will be minimized to the extent practicable by following standard NMFS conservation recommendations (Limpinsel et al. 2017) for pile driving.

5.0 DETERMINATION OF EFFECT ON EFH

The USACE determines that the proposed project will not adversely affect EFH. The construction activities will create temporary disturbances that may modify fish behaviors and movements, but the project will not have a significant impact on the waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. The rubble mound structures will create a minor diversion for migrating salmon away from the shoreline, but into waters only a few feet deeper than the salmon traverse at present. The USACE expects the new high-relief rocky habitat created by the rubble mound structures to rapidly recruit a diverse community of marine algae and invertebrates similar to that observed on natural boulders and pinnacles in the area.

The USACE welcomes any further EFH conservation recommendations the NMFS may have to offer.

6.0 REFERENCES

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