Endangered Species Act
Biological Assessment

For

Marbled Murrelet, Western Snowy Plover, Northern Spotted Owl, Short-Tailed Albatross, Columbian White-Tailed Deer, Bull Trout, Oregon Silverspot Butterfly, Nelson's Checker-mallow, and the Streaked Horned Lark

For the

Major Rehabilitation of the Jetty System at the Mouth of the Columbia River

In

Pacific County, Washington

And

Clatsop County, Oregon

Prepared by
U.S. Army Corps of Engineers
Portland District, Portland, Oregon

February 2011

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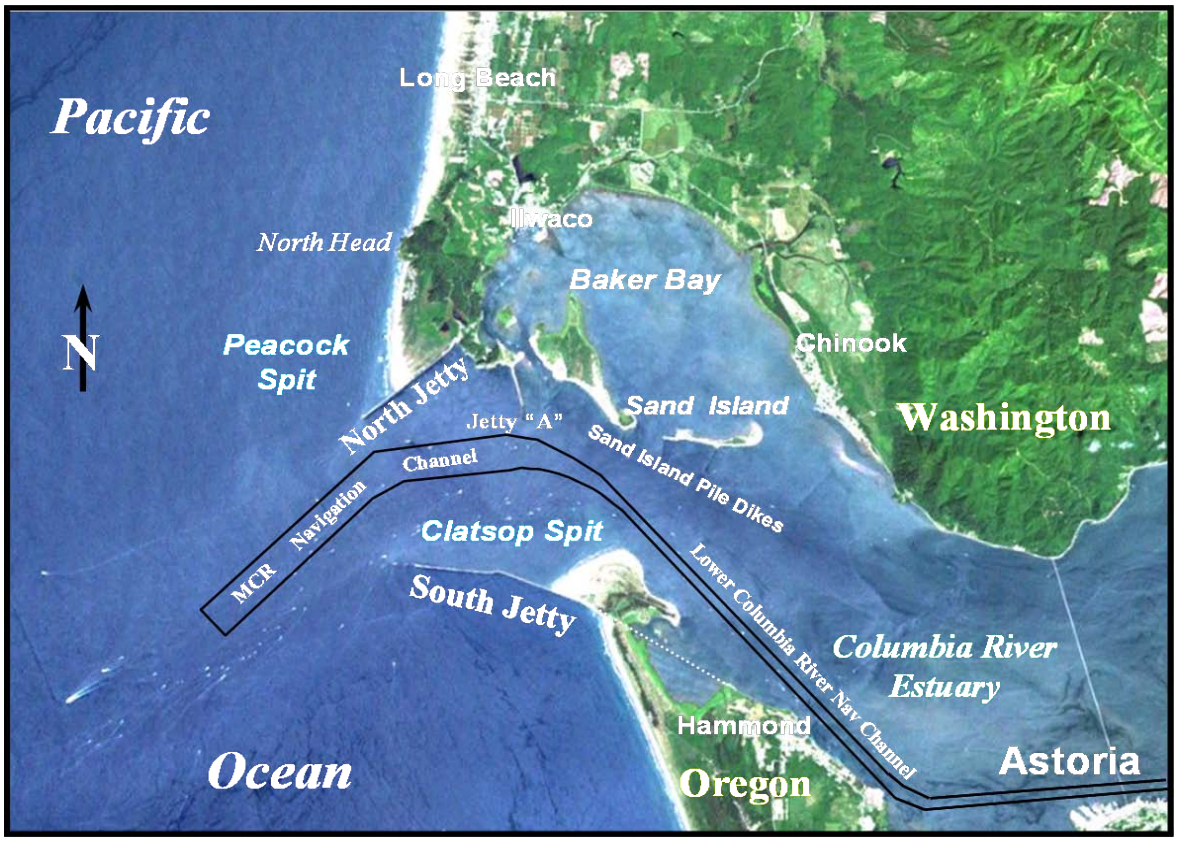
INTRODUCTION

The U.S. Army Corps of Engineers (Corps) prepared and is submitting this Biological Assessment (BA) to the U.S. Fish and Wildlife Service (USFWS) in compliance with the requirements of Section 7(c) of the Endangered Species Act of 1973, as amended. This BA evaluates effects to species listed on the Endangered Species Act (ESA) and their designated and proposed critical habitat for the Major Rehabilitation of the Jetty System at the mouth of the Columbia River (MCR). Federally listed fish, bird, mammal, invertebrate, and plant species and their Critical Habitat could be present in the vicinity of the proposed action. The Corps also requests a Conference Opinion regarding effects to streaked horned lark. The Corps did not request a species list from USFW. The Corps maintains this jetty system and navigational channels as appropriate based on necessity and appropriations. The Corps is currently proposing major repair and rehabilitation for the North Jetty, South Jetty, and Jetty A located at the MCR (Figure 1).

Figure 1. Location of the Jetty System at the MCR



PROJECT AUTHORITY

For the authorization for the actual construction of the MCR jetties, the present navigation channel and configuration of the inlet at the mouth of the Columbia River are the result of continuous improvement and maintenance efforts have been undertaken by the Corps Portland

District since 1885. Congress has authorized the improvement of the MCR for navigation through the following legislation. Senate Executive Document 13, 47th Congress, 2nd Session (5 July 1884) authorized the Corps to construct the South Jetty (first 4.5 miles) for the purpose of attaining a 30-foot channel across the bar at the MCR. House Document 94, 56th Congress, 1st Session (3 March 1905) authorized the Corps to extend the South Jetty (to 6.62 miles) and construct a North Jetty (2.35 miles long) for the purpose of attaining a 40-foot channel (0.5 mile wide) across the bar at the MCR. House Document 249, 83rd Congress, 2nd Session (3 September 1954) authorized a bar channel of 48 feet in depth and a spur jetty ("B") on the north shore of the inlet. Funds for Jetty "B" construction were not appropriated. Public Law 98-63 (30 July 1983) authorized the deepening of the northern most 2,000 feet of the MCR channel to a depth of 55 feet below mean lower low water (MLLW). The MCR federal navigation project was originally authorized (in 1884) before formulation of local sponsor cost sharing agreements; therefore, all navigation maintenance and improvements at MCR are borne by the Federal Government.

The authority for maintenance of the MCR jetties comes from the original authority for construction of the project and then with Corps' policies for the operations, maintenance, and management of a Corps' project (Chapter 11 of EP 1165-2-1). For navigation, completed projects like the MCR have established that operations and maintenance (O&M) is solely a federal responsibility to be accomplished at federal cost.

When maintaining a Corps' project, there is regular O&M, major maintenance, and major rehabilitation. Major rehabilitation consists of either one or both of two mutually exclusive categories, reliability or efficiency improvements.

- Reliability. Rehabilitation of a major project feature that consists of structural work on a Corps operated and maintained facility to improve reliability of an existing structure, the result of which will be a deferral of capital expenditures to replace the structure. Rehabilitation will be considered as an alternative when it can significantly extend the physical life of the feature (such as a jetty) and can be economically justified by a benefit/cost relationship. Each year the budget EC delineates the dollar limits and construction seasons (usually two construction seasons).
- Efficiency Improvements. This category will enhance operational efficiency of major project components. Operational efficiency will increase outputs beyond the original project design.

Thus, the authority for maintenance of the MCR jetties comes from the authorization documents for the project and/or the authority to operate and maintain the structures.

CONSULTATION HISTORY

As the project's preferred alternative has evolved, the Corps has been coordinating with USFW since 2005. Previously, the Corps submitted an earlier version of this Biological Assessment (BA) proposing a larger jetty rebuild. Subsequently, the BA was withdrawn later in January of 2008 due to significant changes in the project description.

Coordination with USFW and was reinstituted in the spring of 2010 after publication of the revised Draft Environmental Assessment in which a new proposed action with a smaller project footprint was determined to be the preferred alternative with which the Corps of Engineers would be moving forward. On May 20, 2010, the Corps and USFW Representatives conducted a Snowy Plover survey around the sandy beach portion of Clatsop Spit. Subsequently, though not specifically related to the MCR proposed action, the Corps has also signed a Memorandum of Agreement (MOA) which will affect implementation the Habitat Conservation Plan (HCP) developed by Oregon Parks and Recreation Department and proposed for portions of the Clatsop Spit.

The Corps has completed this Assessment and is requesting consultation based on current conditions, current listed species use, and currently designated critical habitat (as well as a Conference Opinion regarding the candidate species, streaked horned lark). However, given the duration of the project the Corps has proposed formation of an Adaptive Management Team (AMT) discussed further in the Proposed Action section. During the yearly check-in with the AMT – or more frequently if necessary – the Corps also proposes review of past and future project actions, species listings, and environmental conditions to determine if any re-initiation triggers arise. The Corps is also obligated at any time during implementation of the proposed action to re-initiate or supplement consultation in the event that new species are listed or that critical habitat is designated in the proposed action area.

The Corps has determined that the proposed action will have **no effect** on the following species: short-tailed albatross, northern spotted owls, Columbian white-tailed deer, Oregon silverspot butterfly, and Nelson's Checker-mallow. This Biological Analysis further demonstrates the Corps' determination that the proposed actions may affect but are **not likely to adversely affect** (NLAA) western snowy plovers, marbled murrelets, and bull trout.

BACKGROUND

The MCR project consists of a 0.5-mile wide navigation channel extending for about 6 miles (3 miles seaward and shoreward of the tip of the North Jetty) through a jettied entrance between the Columbia River and the Pacific Ocean on the border between Washington and Oregon. Figure 1 shows the navigation project and the three primary navigation structures, the North Jetty, South Jetty, and Jetty A. Those structures are shown in more detail in Figure 2. The North Jetty and Jetty A are located in Pacific County, Washington, near Ilwaco and Long Beach on the Long Beach Peninsula. The South Jetty is located in Clatsop County, Oregon near Warrenton/Hammond and Astoria.

Figure 2. Rubble-mound Jetties at the MCR

Top left photo shows the South Jetty looking east. The remnant feature shown disconnected from the primary structure is the concrete monolith that was constructed in 1941. The top right photo shows Jetty A. The bottom photo illustrates the North Jetty and the shoreline north of the MCR.

South Jetty

Jetty A

North Jetty

From 1885 to 1939, three rubble-mound jetties with a total length of 9.7 miles were constructed at the MCR on massive tidal shoals. The jetties were constructed to accelerate the flow of the river, which helps maintain the depth and orientation of the navigation channel, and to provide protection for ships of all sizes (both commercial and recreational) entering and leaving the Columbia River. The intention was to secure a consistent navigation channel through the coastal inlet, though morphology of the inlet currently remains in a dynamic, high-energy state. Under such conditions, the jetties have experienced significant deterioration since construction, mainly due to extreme wave attack and foundation instability associated with erosion of the tidal shoals on which the jetties were built.

The initial 4.5-mile section of the South Jetty was completed in 1895-1896. The Rivers and Harbor Act of 3 March 1905 authorized the extension of the South Jetty to 6.6 miles, with the 2.4-mile extension completed in 1913. Historical records show that six spur groins were constructed along the channel side of the South Jetty. Four of the groins were subsequently buried by accreted shoreline or sand shoal. Nine repairs to the South Jetty have been completed with the latest one in 2007. To date, jetty rock placement at the South Jetty totals approximately 8.8 million tons. In spite of these repairs and structural features, over 6,100 feet of head loss has occurred at the South Jetty.

The North Jetty was completed in 1917. Three repairs to the North Jetty have been made with the last one completed in 2005. To date, jetty rock placement totals approximately 3.4 million tons. Since initial construction, about 0.4 miles of the North Jetty head has eroded and is no longer functional.

Jetty A was constructed in 1939 to 1.1 miles in length in connection with rehabilitation of the North Jetty for the purpose of channel stabilization. Its purpose was to assist in controlling the location and direction of the ebb tidal flow through the navigation entrance. Improvements made from 1930 to 1942 (including addition of Jetty A and Sand Island pile dikes) produced the present entrance configuration.

The construction and repair history of the MCR jetties is summarized in Table 1.

The Corps' dredging and in-water disposal of dredged sediments to maintain the above referenced authorized navigation channel is conducted under the provisions of sections 102 and 103 of the Marine Protection Reserve and Sanctuaries Act of 1972, sections 401 and 404 of the Clean Water Act of 1977, and in accordance with Regulations 33 CFR parts 335-338.

Table 1. Construction and Repair History for the MCR Jetties

1881: Proposed project to build a strong pile-dike, 3 feet high about at low tide, 8,000 feet long and 20 feet wide along a line previously established on the south side. The structure to start near the northeast corner of Fort Stevens, following the 12-foot curve, dike will be directed a little westward of the outer part of headland of Cape Hancock. It was stated that work commence soon (during summer and autumn) because channel maintenance is dependent upon building up Clatsop Spit.

1883: A jetty plan approved by the Board of Engineers from the south cape of the entrance on the spit. A survey was conducted in October-November of the south cape, Point Adams, to extreme low water. The jetty extends from Point Adams and makes the distance between the outer end of the jetty and Cape Disappointment the same as the distance between Chinook Point and Point Adams. The Board stated that any structures placed in-river should not harm the river and should keep the channel open using the tide; therefore, the jetty should not obstruct the entry of the flood tide. The jetty design called for a crest elevation at low water level. Estimated depths of various jetty sections from the landward end are: 5,000 feet - less than +6 feet; 7,500 feet – +6 to +11 feet; 4,000 feet – +11 to +16 feet; and 7,500 feet – +16 to +21 feet. Jetty crest elevation was designed to be at low water level because of wave violence that could harm a higher jetty. The logic was that a higher jetty could be built, if needed later, by placing more stone on the existing jetty. A jetty height to mid-tide level was suggested but not recommended because the lower jetty would be quite effective in directing the ebb tide and would interfere less with the flood tide. A higher jetty would result in higher maintenance costs due to the jetty being more exposed to wave action.

1884: The improvement plan for MCR was approved by the Rivers and Harbors Act of July 5, 1884 to maintain a channel 30 feet deep at mean low tide by constructing a low-tide jetty, about 4.5 miles long, from near Fort Stevens on the South Cape to a point about 3 miles south of Cape Disappointment.

1886-1896: Original construction South Jetty from Fort Stevens (station 25+80) across Trestle Bay and Clatsop Spit to station 250+20. Rock placed with a natural slope to an elevation from 4 to 12 feet, crest width roughly 10 feet. "The jetty, of a brush-mattress and stone ballast, was built for 1,020 feet from ordinary highest tide-line, and minor constructions added." Material has filled along the jetty's south side, moving the shoreline seaward. Highest tide-line is located at tramway station 30+50. A 115 feet long spur was built landward of the jetty for shore protection. A 510 feet long sand-catch, consisting of heavy beach drift and loose brush, was built on the south side of landward end of the jetty to continue filling the old outlet of a lagoon at extreme end of Point Adams. Jetty stone was originally dumped in ridges, but waves flattened and compacted the rocks to a width of 50 feet. The report indicated urgency to extend the jetty to prevent further deterioration of the bar channel.

1889: The South Jetty now under construction for 1.5 miles. Clatsop Spit has more material visible at low water and the river channel has a tendency towards a straight course out to sea. Tillamook Chute being closed. Sand building up south of the jetty adjacent to and in front of the mattresses as they are constructed.

1890: South Jetty construction is 3.25 miles underway. Jetty elevation at MLLW for about 3 miles. 1.25 miles of tramway to be constructed. Clatsop Spit building up, the outflowing waters being concentrated over the channel bar. Station 25+80 considered the beginning of the jetty. The jetty mattress has advanced from stations 99+04 to 194+08. The jetty elevation is at MLLW to station 170+00. From Station 170+00 to the end of mattress work, there is about 9 feet of rock on top of the mattress. At station 65+00, there were signs of sinking and a large amount of rock was dumped in place.

1903-1913: Extension of South Jetty. Crest elevation of jetty raised to 10 feet MLLW from stations 210+35 to 250+20, and rock placed from stations 250+20 to 375+52, elevation increasing in steps to 24 feet MLLW. Crest width is 25 feet and side slopes are natural slope of rock. Seaward bend in the jetty is added and called the "knuckle."

1913-1917: Original construction of North Jetty from stations 0+00 to 122+00. Side slopes are 1 vertical by 1.5 horizontal (1:1.5) and crest width is 25 feet. Crest elevation varies from 15 to 32 feet.

1931-1932: Repair South Jetty from stations 175+00 to 257+68.7 (shoreline to knuckle), side slopes 1:1.5, crest elevation 24 feet MLLW, and crest width 24 feet. This is first maintenance for South Jetty. The jetty had been flattened to about low water level. 2.2 million tons of stone placed in super-structure. The work completed in 1936. The end of jetty would unravel 300 feet or more, so a solid concrete terminal was constructed above low water level. The terminal was located 3,900 feet shoreward of the original jetty end that was completed in 1913.

1933-1934: Repair of South Jetty from stations 257+68.7 to 305+05 (knuckle to middle of outer segment). Two level cross section with crest elevations of 17 and 26 feet. Crest width of each level is 24 feet. Side slopes are 1:1.5 on channel side and vary from 1:1 to 1:1.75 to 1:2 on ocean side.

1935-1936: Repair South Jetty from stations 305+05 to 353+05 (middle of outer segment to existing end). Similar design to 1933-1934 repair.

Table 1 (continued). Construction and Repair History for the MCR Jetties

1936: Stone/asphalt cone-shaped terminal constructed on South Jetty from stations 340+30 to 344+30. Crest width of approximately 50 feet and elevation varied from 23 to 26 feet. Side slopes are 1:2.

1937-1939: Repair of North Jetty from stations 68+35 to 110+35. Crest elevation 26 feet and crest width 30 feet. Side slope 1:1.25 on ocean side and 1:1.5 on channel side.

1939: Original construction of Jetty A from stations 40+93.89 to 96+83. Crest width is 10 feet from beginning to station 53+00, 30 feet in width, and elevation at 20 feet from this point on. Four pile dikes completed at Sand Island.

1940: Repair of South Jetty with replacement rock in locations as needed.

1940-1942: South Jetty repair from stations 332+00 to 343+30. Concrete terminal/stone foundation added. Crest elevation from 8-20 feet and crest width from 50-75 feet, 10 inches. Side slopes determined by concrete terminal shape.

1945-1947: Repair Jetty A from stations 78+00 to 96+00. Crest elevation to 20 feet with crest width of 40 feet.

1948-1949: Repair 300 feet of Jetty A from stations 92+35 to 95+35 with a crest elevation of 20 feet, a crest width of 30 feet, and side slopes of 1:1.25.

1951: Repair Jetty A from stations 91+50 to 93+00 with a crest elevation of 20 feet MLLW, a crest width of 30 feet, and side slopes of 1:1.5.

1952: Repair of Jetty A from stations 90+00 to 94+00 with a crest elevation of 20 feet, a crest width of 30 feet, and side slopes of 1:1.5.

1958: Repair of Jetty A from Stations 41+00 to 79+00. Crest elevation raised to 20 feet and a crest width of 20 feet from Stations 41+00 to 56+00. Crest width is 30 feet from Stations 61+00 to 79+00.

1961-1962: Repair Jetty A from stations 50+00 to 90+50, with no repairs from Stations 68+00 to 76+50. Crest elevation built with a 10% grade from 20 feet to 24 feet from stations 50+00 to 68+00. The crest elevation was raised to 24 feet from stations 76+50 to 90+50.

1961: South Jetty repair from stations 194+00 to 249+00 (before knuckle, current stationing). Crest elevation varies from 24 to 28 feet and crest width is 30 feet. Channel side slope 1:1.25 and ocean side slope 1:1.5. Repairs from stations 38+00 to 93+00 (old stationing). Elevation at station 38+00 is +24 feet and then increased with a 0.5% grade up to +28 feet for the remainder of repair section. The repair centerline is located 13 feet north of the centerline of the original jetty design. The design crest width is 30 feet. North slope is 1:1.25 and south slope is 1:1.5.

1962-1965: South Jetty repair from stations 249+00 to 314+05 (beyond knuckle). Crest elevation begins at 28 feet and transitions to 25 feet for most of section. Side slopes vary from 1:1.5 to 1:2 and crest width is 40 feet (this appears to be the furthest seaward intact portion of current jetty). Repairs made from stations 93+00 to 157+50 (old stationing). The crest elevation is +28 feet at station 93+00, then decreases to +25 feet at station 95+00, and then continues with this elevation to end of the repairs. The crest width is 40 feet and has a slope of 1:1.5 from stations 93+00 to 152+00. Slope then transitions to 1:2 from stations 152+00 to 154+00. The centerline of the repair is 15 feet south of the trestle centerline.

1965: Repair North Jetty from stations 89+47 to 109+67 with a crest elevation of 24 feet and crest width is 30 feet. Side slopes vary from 1:1.5 to 1:2.

1982: Repair South Jetty from stations 194+00 to 249+00 (segment before knuckle). Crest elevation varies from 22 to 25 feet MLLW. Crest width varies from 25-30 feet and side slopes 1:1.5. Crest elevation varies from +22 feet at station 38+00 to +25 feet at station 80+35 (old stationing). From stations 44+50 to 80+35, crest width is 30 feet and slope is 1:1.5. Centerline of repairs has 10 feet maximum variance to the north for the South Jetty control line. From stations 80+35 to 93+00, centerline of repairs is the same as South Jetty control. Crest elevation +25 feet, width varies from 25-30 feet, side slope is 1:1.5.

2005: Interim repair of North Jetty (stations 55+00 to 86+00). Crest elevation +25 feet with side slope of 1:1.5.

2006: Interim repair of South Jetty (stations 223+00 to 245+00). Crest elevation +25 feet with side slope of 1:2.

2007: Interim repair of South Jetty (stations 255+00 to 285+00). Crest elevation +25 feet with side slope of 1:2.

DESCRIPTION OF THE PROPOSED ACTION

OVERVIEW

The Corps proposes to perform modifications and repairs to the North and South Jetties and Jetty A at the MCR that would strengthen the jetty structures, extend their functional life, and maintain deep-draft navigation.

Proposed actions are generally comprised of four categories applicable to each jetty: (1) engineered designs elements and features of the physical structures; (2) construction measures and implementation activities; (3) proposed 7(a)(1) habitat improvement measures and wetland mitigation actions to improve habitat for the benefit of listed species and to offset wetland fill, and (4) proposed establishment of and coordination with an Adaptive Management Team (AMT) comprised of Corps' staff and representatives from appropriate Federal and State agencies.

It is notable that the duration of the construction schedules is 20 years, with a 50-year operational lifetime for the MCR jetty system. Therefore, an inherent level of uncertainty exists regarding dynamic environmental conditions and actual conditions of and at each of the jetties. For this reason, in all cases where areas, weights, and volumes (tons, acres, cubic yards, etc.) or other metrics are indicated, these are best professional estimates and may vary by greater or lesser amounts within a 20% range when final designs are completed. These amounts represent Corps' and staff's best professional judgments of what the range of variability could entail as the design is further developed and as on-the-ground conditions evolve over the 20-year construction schedule. The Corps maintains an active jetty monitoring and surveying program that will further inform the timing and design of the proposed action in order to facilitate efficient completion of the project and whenever possible to avoid emergency repair scenarios.

(1) Design elements and structural features specific to each jetty include the following:

- <u>North Jetty</u> – Scheduled repairs addressing the existing loss of cross section and the addition of engineering features designed to minimize future cross section instability are planned. The cross section repairs are primarily above MLLW, with a majority of stone placement not likely to extend beyond -5 ft below MLLW. In order to address the structural instability of the jetty cross-section, four spur groins will be added and the jetty head (western-most section) will be capped with large stone. Groins will be constructed primarily on existing relic stone and the head capping will be placed on relic as well as jetty stone that is above MLLW. The shore-side improvements that have been identified are culvert replacement and lagoon fill. These actions are designed to stop the current ongoing erosion of the jetty root.

- <u>South Jetty</u> – Scheduled repairs addressing the existing loss of cross section and the addition of engineering features designed to minimize future cross section

instability are planned. The cross section repairs are primarily above MLLW, with a majority of stone placement not likely to extend beyond -5 ft below MLLW. In order to address the structural instability of the jetty cross-section, five spur groins will be added and the jetty head (western-most section) will be capped with large stone. Groins will be constructed primarily on existing relic stone and the head capping will be placed on relic as well as jetty stone that is above MLLW. Augmentation of the dune at the western shoreline extending south from the jetty root has been included in the repair plan. This action is intended to prevent the degradation of the jetty root and prevent the potential breaching of the fore dune.

- Jetty A – Scheduled rehabilitation addressing the existing loss of cross section and the addition of engineering features designed to minimize future cross section instability are planned for Jetty A. The cross section repairs are primarily above MLLW, with a majority of stone placement not likely to extend beyond -5 ft below MLLW. In order to address the structural instability of the jetty cross-section, two spur groins will be added and the jetty head (southern most section) will be capped with large stone. The groins will be constructed primarily on existing relic stone and the head capping will be placed on relic as well as jetty stone that is above MLLW. Immediate rehabilitation with small cross section, two spur groins, and head capping.

(2.) Construction measures and implementation activities for all three jetties include the following:

- Storage and staging areas for rock stockpiles and all associated construction and placement activities such as: roadways, parking areas, turn-outs, haul roads, weigh stations, yard area for sorting and staging actions, etc.
- Stone delivery from identified quarries either by barge or by truck. Possible transit routes have been identified. This also includes the construction and use of permanent barge offloading facilities and causeways with installation and removal of associated piles and dolphins.
- Stone placement either from land or water, which includes the construction, repair, and maintenance of a haul road on the jetty itself, crane set-up pads, and turnouts on jetty road. Placement by water could occur via the use of a jack-up barge on South Jetty, but will not occur by other means or on North Jetty to avoid impacts to crab and juvenile salmon migration.
- Regular dredging and disposal of infill at offloading facilities with frequency dependent on a combination of the evolving conditions at the site and expected construction scheduling and delivery. Disposal will occur at existing approved in-water sites.

(3.) A suite of potential projects to provide 7(a) (1) habitat improvement and wetland mitigation actions have been identified as beneficial to listed species. Depending on further development of alternatives within this list, a specific project or combination of projects will be selected and constructed concurrently to provide environmental

benefits as portions of the proposed action are completed over time. Estimates for wetland impacts are preliminary and may be reduced when final delineations are completed; therefore wetland restoration may be less than approximations noted, but will be commensurate with impacts from construction activities. These restoration and habitat improvement measures will therefore require additional consultations, and it is anticipated that the proposed AMT will be of assistance in this process. It is anticipated that a programmatic opinion similar to SLOPES Restoration or Limit 8 may be useful to fulfill clearance requirements. Possible restoration measures could include an individual project or a combination of projects and actions such as:

- Excavation and creation of wetlands to restore and improve wetland functions including water quality, flood storage, and salmonid refugia.
- Culvert and tide gate replacements or retrofits to restore or improve fish passage and access to significant spawning, rearing, and resting habitat.
- Dike breaches to restore estuarine brackish intertidal shallow-water habitat for fish benefits.
- Beneficial uses of dredged material from MCR hopper dredge to replenish littoral cells.
- Invasive species removal and control and revegetation of native plants to restore ecological and food web functions that benefit fisheries.

(4.) Due to the long duration of the MCR Jetty Rehabilitation schedule, the Corps proposes formation of a modified Adaptive Management Team (AMT). The Corps suggests annual meetings to discuss relevant design and construction challenges and modifications, technical data, new species listings or critical habitat designations, evolving environmental conditions, and adaptive management practices as needed. The primary purpose of the proposed AMT and its implementation is to ensure construction, operation, and maintenance actions have no greater impacts than those described in the Biological Assessments, and that terms and conditions of the Biological Opinions are being met. This will also allow confirmation that any necessary construction or design refinements remain within the range and scope of effects described during Consultations. This forum will provide and opportunity for periodic evaluation as to whether or not the proposed actions, ESA listings, or environmental conditions result in any re-initiation triggers. It will also facilitate continued coordination and updating and allow the Corps to inform agency partners when unforeseen changes arise. Results regarding marine mammal and fish monitoring, wetland mitigation and habitat improvement monitoring, as well as water quality monitoring will also be made available to the AMT in order to fulfill reporting requirements and to address any unexpected field observations. Results of jetty monitoring surveys will also inform the AMT of the repair schedule and design refinements that become necessary as the system evolves over time. This venue will provide greater transparency and allow opportunities for additional agency input. Final selection and design of the habitat improvement and wetland mitigation proposal will be vetted through this forum to facilitate obtaining final environmental clearance documents for this component of the MCR proposed action. Potential principal partners include federal (National Marine Fisheries Service, U.S. Fish and Wildlife

Service) and State (Washington and Oregon) resource management agencies. The strategy is designed to be consistent with the guidance provided in 65 Federal Register (FR) 35242.

GENERAL TERMS AND FEATURES

Previously during earlier design phases of the proposed action, the U.S. Geological Survey (USGS) in Menlo Park, California assisted the Corps with evaluating potential improvements and impacts of rebuilding and repairing the lengths of the MCR jetties. The USGS efforts focused on using the Delft-3D model of the Columbia River estuary and adjacent coast (Delft3D 2006) to identify potential changes in circulation, salinity and sediment transport that could result from the offshore re-build of the three jetties. Increased jetty lengths were investigated to determine if they could provide a more sustainable jetty system over the long term. Although rebuild of the jetties is no longer proposed, Corps' engineering staff has also indicated modeling results remain relevant and valid for evaluating jetty performance in the current proposed action, which caps jetty lengths in their current locations (Moritz 2010).

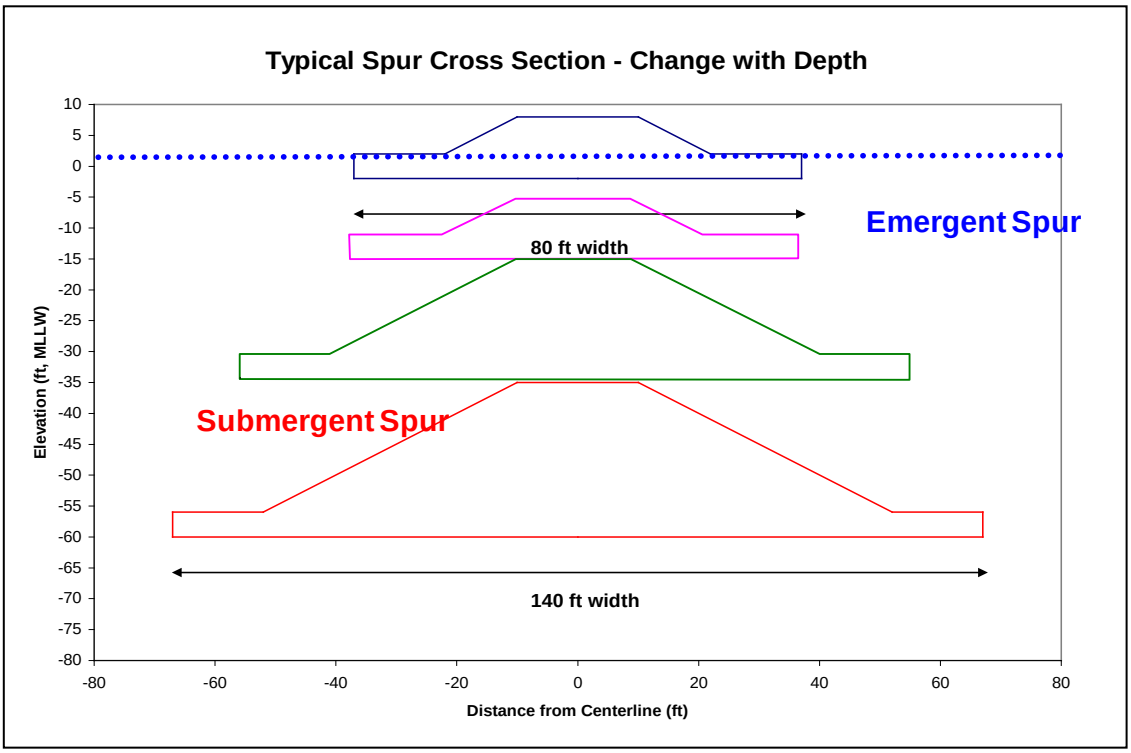
The Corps' Engineering Research and Development Center (ERDC) in Vicksburg, Mississippi was also contracted to conduct a physical model of the jetty cross-section design. The range of structural repair types addressed in the model included crest elevation and crest widths variations, side-slope variations, underwater berms, armor stone, and concrete armor unit options. Both the North Jetty and South Jetty were tested under low and high water conditions. Physical modeling results showed that the primary failure modes for the North and South jetties were high water wave attack and overtopping. These results were used to determine cross-section design options for the jetties that achieve varying levels of structure reliability. The following design components are a result of a combination of these models and other modeling and engineering staff efforts (Moritz and Moritz 2010).

Each MCR jetty consists of three parts. The <u>head</u> is the seaward terminus and is exposed to the most severe wave action. Jetty head design is much more substantial than a typical jetty trunk section due to its increased exposure to wave attack and its critical protective function for the rest of the structure. The <u>trunk</u> forms the connection from jetty head to shore, retains sub-tidal shoals, and confines circulation in the navigation inlet. The <u>root</u> forms the connection from the jetty trunk to shore and prevents accreted landforms from migrating into the navigation channel.

A spur groin is a relatively short structure (in comparison to jetty length) usually extending perpendicular from the main axis of a jetty. Spur groins are constructed: (1) on the ocean or beach side of a jetty to deflect the long-shore (rip) current and related littoral sediment away from the jetty and prevent littoral sediment from entering the navigation channel; and (2) on the channel side of a jetty to divert the tidal or river current away from the channel side toe of the jetty. Spur groins also act to reduce the scour affecting the foundation while increasing the current in the navigation channel, thus reducing the deposition in the channel. In areas where foundation scour threatens the overall stability of the MCR jetties, spur groins constructed perpendicular to the

structure facilitate stabilization by the accumulation of sediment along the jetty's foundation. Each spur groin will have a crest width of about 20 feet, and will be constructed using a bedding layer (mixture of gravel and rock) that will be covered with large stone sized for the location and exposure. Submergent spur groins that located at greater depths also typically have wider bases than shallower, emergent groins (Figure 3).

Figure 3. Typical Spur Cross Section - Change with Depth



The ERDC analyzed the hydrodynamics and circulation patterns in the MCR entrance, as well as the potential impacts and effectiveness of placing spur groins on the jetties. This analysis was conducted with the coastal modeling system and other models to select the type, depth, and length of spur groins necessary to protect the each jetty from the processes causing increased scour (e.g., rip currents, eddies). Although the models were also evaluating a potential restoration of the jetties' former lengths, proposed construction of spur groins at each jetty has not changed since modeling was completed. Therefore, Corps' engineering staff has indicated that modeling results remain relevant and valid in their assessment of spur groin performance.

Two potential construction methods could be used for spur groins, either land-based or marine-based depending on location. Barges or similar equipment could be used to dump the bedding layer rock into place and a clamshell would be used to place larger stone on top of the bedding rock layer in locations with sufficient water depth. This type of marine placement activity will not require installation of additional piles or dolphins. Material could also be placed using land-based equipment from on top of the

jetty. Land-based construction may require a wide turnout crane placement with over-excavation down to grade as the crane walks back onto the main jetty axis. In addition, the emergent spur groins may be used as turnouts for construction equipment. The land-based construction method could be used for all but the deepest spur groins.

Head capping involves placing much larger armor stone at the terminus of the jetty where the highest degree of enforcement is necessary to withstand conditions. Enforcement could also include the use of concrete armor units (CAU). These will be fabricated off-site and then transported to the head via truck or barge. The armor stone at the head helps avoid recession and loss of length and by protecting the rest of the jetty from unraveling back towards the root.

Repair and rehabilitation are two proposed approaches that specifically describe construction and stone placement actions for the cross-sections and engineered features along the trunks and roots of the jetties. The economics and design model used to select Schedule Repair as the proposed action at the North and South jetties predicts a certain number of repair actions that will be needed to avoid a breaching scenario during the 20-year construction schedule and 50-year operational lifetime of the jetties.

Along certain sections of each jetty, wave cast and erosional forces have in some cases flattened the jetty prism and left a bedding of relic stone with little or only a partially complete jetty prism remaining. The Scheduled Repair approach prioritizes work on specific portions of the jetty so that sections in a greater degree of deterioration will be repaired with rock according to a programmed sequence developed as a result of regular jetty monitoring and inspections. Proposed <u>repair</u> alternatives involve adding limited amounts of stone to trunk, head, and root features in order to restore the damaged cross-sections back to a standard repair template. A repair action is generally triggered when the upper cross-sectional area falls below 30%-40% of its standard jetty template profile (only 30% or 40% of the current jetty structure remains; 60%-70% of the previously existing prism is gone). Then a standard repair template is implemented. For each repair action, a majority of stone placement will occur above MLLW. However, depending on conditions at specific jetty cross-sections, stone could extend deeper than -5 ft below MLLW in order to restore the reach back to the standard repair template. Therefore, repair actions could be slightly greater or smaller depending on the condition of the cross-section being repaired. Stone placement will remain mostly within the prism of the existing jetty and relic stone structures; though it is possible that wave actions and slope angles could result in a small percentage of further rock slipping off the relic slope.

Proposed <u>rehabilitation</u> alternatives generally incorporate engineering components and rock placement along the cross-section of the entire root and trunk. The construction and placement sequence for Immediate Rehabilitation at Jetty A means stone placement activities are initiated at one end of the jetty and are completed continuously in succession without prioritization based on conditions at any particular jetty section. The proposed rehabilitation action on Jetty A is more robust than a repair action and includes a <u>small</u> cross section along the entire length of the jetty. Sections in a greater

state of deterioration may receive a relatively larger amount of rock compared to sections with less damage. The rehabilitation cross-section template is expanded slightly beyond the existing prism template. This generally involves stone placement that primarily fits within the existing footprint of the jetty structure or relic stone, but may extend slightly beyond the existing prism. It also generally involves the bulk of the rock placement above MLLW, though it could extend below in some sections, again depending conditions in each reach.

The following discussions also mention station numbers on each jetty. These stations indicate lineal distance along the jetty relative to a fixed reference point (0+00) located at the landward-most point on the jetty root. Numbering begins at the reference point (0+00) and increases seaward such that each station number represents that distance in feet, multiplied by 100, plus the additional number of feet indicated after the station number. For instance, station 100+17 would be 10,017 feet seaward from the reference point. A summary of design parameters for the preferred plan at each jetty is shown in Table 2.

Table 2. Preferred Plan Design Metrics Summary for MCR Jetties

Note: volumes, lengths and areas may vary by ± 20% upon final design.

North Jetty Scheduled Repair with Engineering Features

Jetty Crest Elevation	Estimated Stone Density	Total Repair Length	Jetty Crest Width	Jetty Sideslope		Jetty Head Station	Head Length	Spur Groin Sta.	Spur Groin Tons
				Channel	Ocean				
25' above MLLW	167 #/ft3	8,100'	30'	1v:1.5h	1v:1.5h	99+00 to 101+00	200'	Sta 50-C Sta 70-C Sta 80-O Sta 90-C	3,895 12,870 2,340 33,960

South Jetty Scheduled Repair with Engineering Features

Jetty Crest Elevation	Estimated Stone Density	Total Repair Length	Jetty Crest Width	Jetty Sideslope		Jetty Head Station	Head Length	Spur Groin Sta.	Spur Groin Tons
				Channel	Ocean				
25' above MLLW	167 #/ft3	15,800'	30'	1v:1.5h	1v:2h	311+00 to 313+00	200'	Sta 165-O Sta 210-C Sta 230-C Sta 265-C Sta 305-O	1,496 2,095 2,095 2,841 16,747

Jetty A Rehab with Engineering Features

Jetty Crest Elevation	Estimated Stone Density	Total Repair Length	Jetty Crest Width	Jetty Sideslope		Jetty Head Station	Head Length	Spur Groin Sta.	Spur Groin Tons
				Estuary	Ocean				
20' above MLLW	167 #/ft3	5,300'	40'	1v:2h	1v:2h	91+00 to 93+00	200'	Sta 84-O Sta 90-E	12,272 12,272

DESIGN ELEMENTS AND STRUCTURAL FEATURES OF PROPOSED ACTION

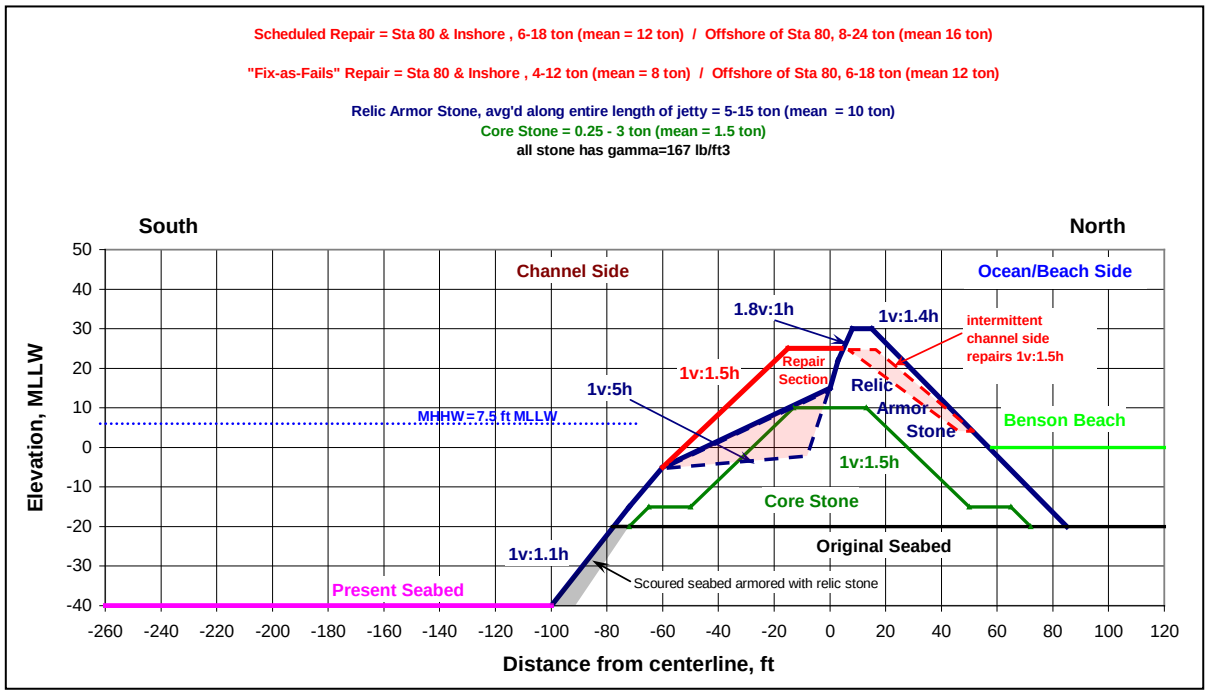
MCR North Jetty

The proposed action for the North Jetty is Scheduled Repair and construction of engineered features including four spur groins and head capping, culvert replacement, and lagoon fill to stop erosion of the jetty root (Figures 4 and 5). The jetty head and foundation at the most exposed portion of jetty will be stabilized.

North Jetty Trunk and Root

The cross-section design from stations 20+00 to 99+00 will have a crest width of approximately 30 feet and will lie essentially within the existing jetty footprint based on the configuration of the original cross section, previous repair cross sections, and redistribution of jetty rock by wave action. About 460,000 tons (~287,500 cy) of new rock will be placed on relic armor stone, with the majority of stone placement above MLLW. About four repair events were predicted over the next 20 years. Each repair action is expected to cover a length range of up to 1,700 feet and include stone volumes in the range of 45,000 to 100,000 tons (~28,125-62,500 cy) per season.

Figure 4. North Jetty Cross Section for Existing Condition and Scheduled Repair Template



At the time of repair, it is expected that 60%-70% of the standard jetty template cross-section has been displaced. Therefore, each repair event will increase the degraded cross-section from 30%-40% back to 100% of the desired standard cross-section template. This means the overall added rock will essentially triple what exists immediately prior to the time of repair. This could be described as a ~300% increase

in rock relative to the existing jetty rock volume. However, this will not increase the jetty prism or footprint beyond the scope and size of the historic structure, and does not include any modification that changes the character, scope, or size of the original structure design.

With placement divided into elevation zones per representative repair event, about 21,550 cy of rock will be placed above mean higher high water (MHHW). This represents 58% of the overall stone placement on these portions of the jetty and 376% change from the existing jetty prism. This means that currently only a small portion of the original profile remains in this zone and over three times as much stone must be placed compared to what presently remains. As described, above, this same concept applies characterizations about the rest of the zones. About 9,230 cy of rock will be placed between MHHW and MLLW. This represents 25% of the overall stone placement on these portions of the jetty and a 192% change from the existing jetty prism. About 6,675 cy of rock will be placed below MLLW. This represents 18% of the overall stone placement on these portions of the jetty and a 150% change from the existing jetty prism. The footprint of the trunk and root of the North Jetty will remain on relic stone and within its current jetty dimensions.

North Jetty Spur Groins

Three submergent spur groins will be placed on the channel side and one emergent spur groin will be placed on the ocean side of the North Jetty to stabilize the foundation (Figures 6 to 9). The approximate dimensions and other features of the spur groins are shown in Table 3. If possible, in order to avoid and minimize impacts to species and habitats, either one of the spur groins located around stations 50 or 70 may also serve a dual purpose as an offloading facility for stone delivery. This will occur at the contractor's discretion depending on channel current and wave conditions. Otherwise, a separate offloading facility will be constructed in the vicinity between these stations to take advantage of calmer waters. There is a dredge material disposal site along the North Jetty and adjacent disposal cells closest to the jetty and spur groins will be precluded from use to avoid interference with jetty construction and to ensure barge safety during disposal. Barge offloading structures and dredge activities are discussed in more detail later in this assessment.

Representing rock volume estimated totals divided into elevation zones for all newly constructed spurs on the North Jetty, about 25 cy of rock will be placed above MHHW. This represents 0.1% of the overall stone placement on these portions of the North Jetty spur groins and there is very little or no existing jetty stone expected to be present within this elevation range. About 1,146 cy of rock will be placed between MHHW and MLLW. This represents 4% of the overall stone placement on these portions of the North Jetty spur groins and there is very little or no existing jetty stone expected to be present within this elevation range. About 27,760 cy of rock will be placed below MLLW. This represents 95.9% of the overall stone placement on these portions of the North Jetty spur groins and there is very little or no existing jetty stone expected to be present within this elevation range. The footprint of the North Jetty spurs will increase

from 0 acres to 1.55 acres. In the relevant figures, note that the difference in the vertical and horizontal scales causes a slight representational distortion along the axes.

Figure 5. Proposed Action for the MCR North Jetty

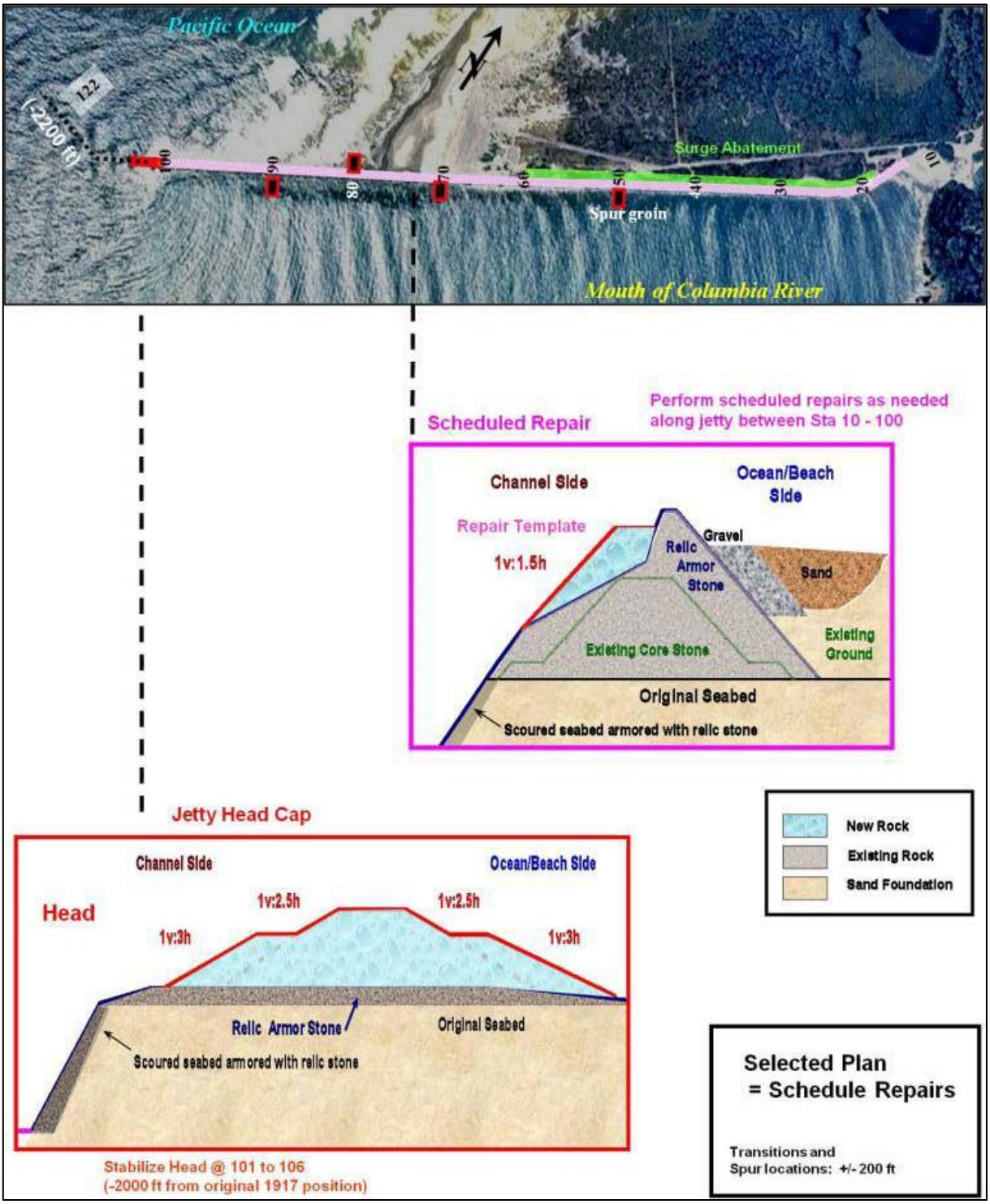
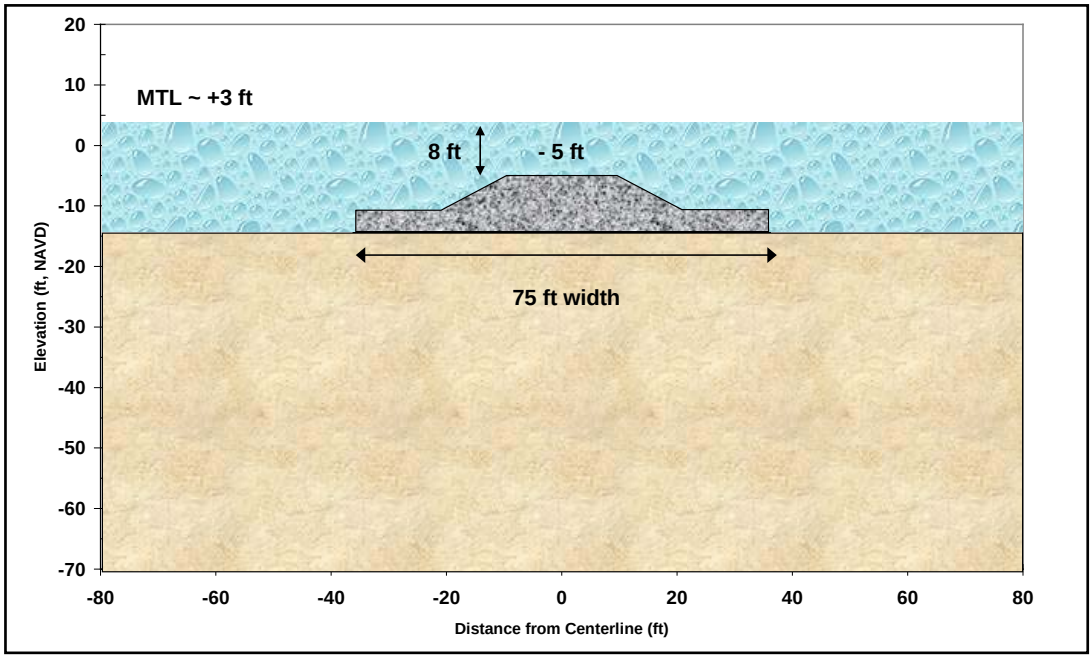


Table 3. North Jetty Spur Groin Features

Spur Groin Features	North Jetty
Number of spurs on channel side	3
Number of spurs on ocean side	1
Approximate total rock volume per spur (+/- 20%)	NJ1C: 3,350 tons (~2,094 cy) NJ2C: 11,090 tons (~6,931 cy) NJ3O: 2,010 tons (~1,256 cy) NJ4C: 29,250 tons (~18,281 cy)
Approximate total rock volume (all spurs) (+/- 20%)	53,000 tons (~33,125 cy)
Approximate area affected by each spur	NJ1C: 0.18 acres NJ2C: 0.45 acres NJ3O: 0.11 acres NJ4C: 0.80 acres
Approximate total area affected (all spurs)	1.55 acres
Approximate area of spurs above MLLW	NJ1C: 0% NJ2C: 0% NJ3O: 24% NJ4C: 0%
Approximate area of spurs below -20 MLLW	NJ1C: 0% NJ2C: 88% NJ3O: 0% NJ4C: 100%
Approximate dimension of spurs: length x width x height (feet)	NJ1C: 100 x 80 x 10 NJ2C: 170 x 115 x 19 NJ3O: 60 x 80 x 10 NJ4C: 170 x 115 x 19

Figure 6. North Jetty Spur Groin NJ1C

Note difference in scale between vertical and horizontal axes.



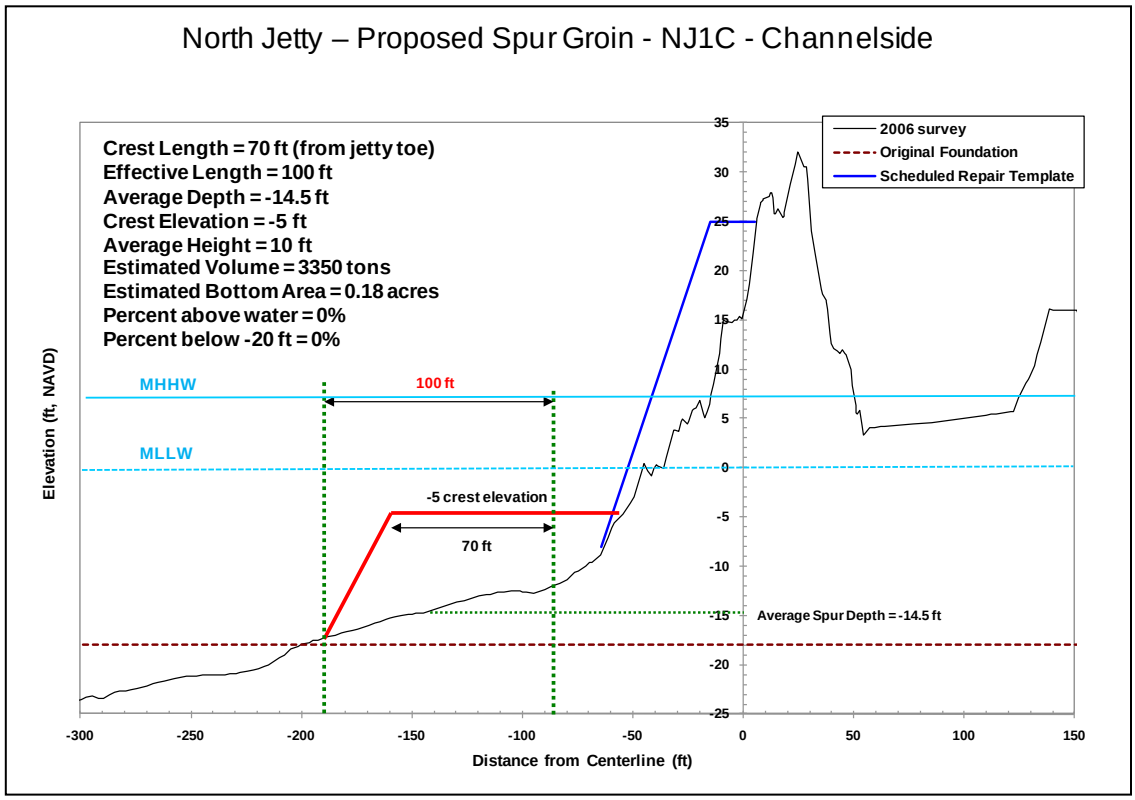
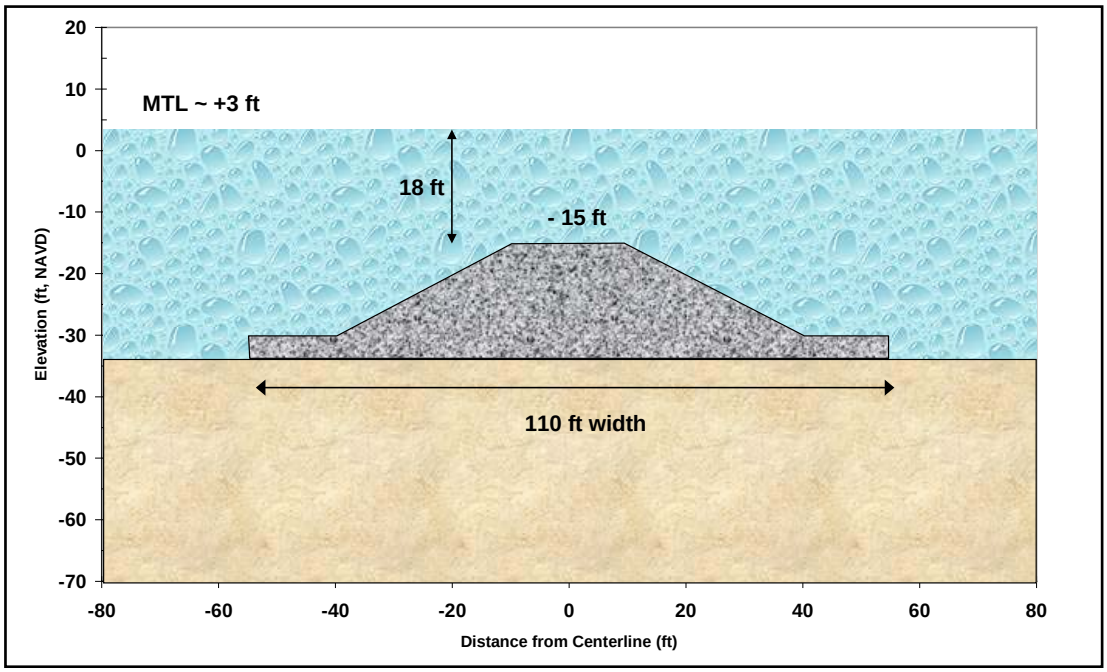


Figure 7. North Jetty Spur Groin NJ2C

Note difference in scale between vertical and horizontal axes.



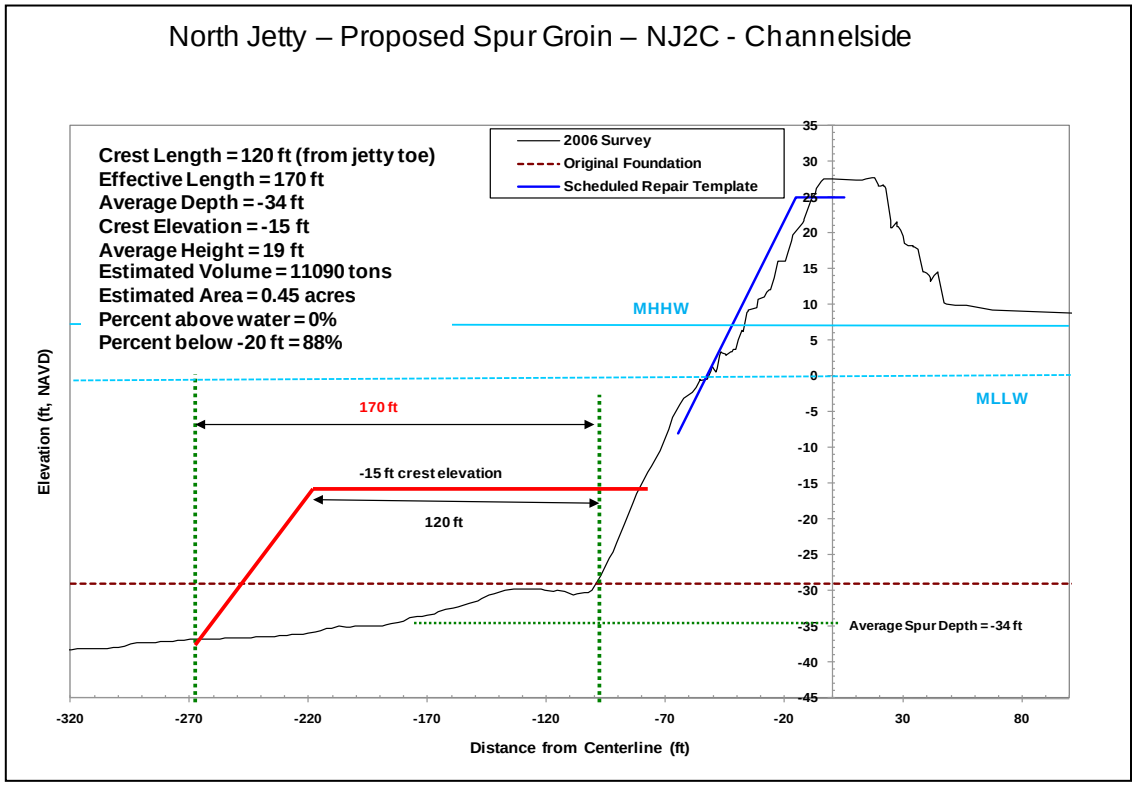
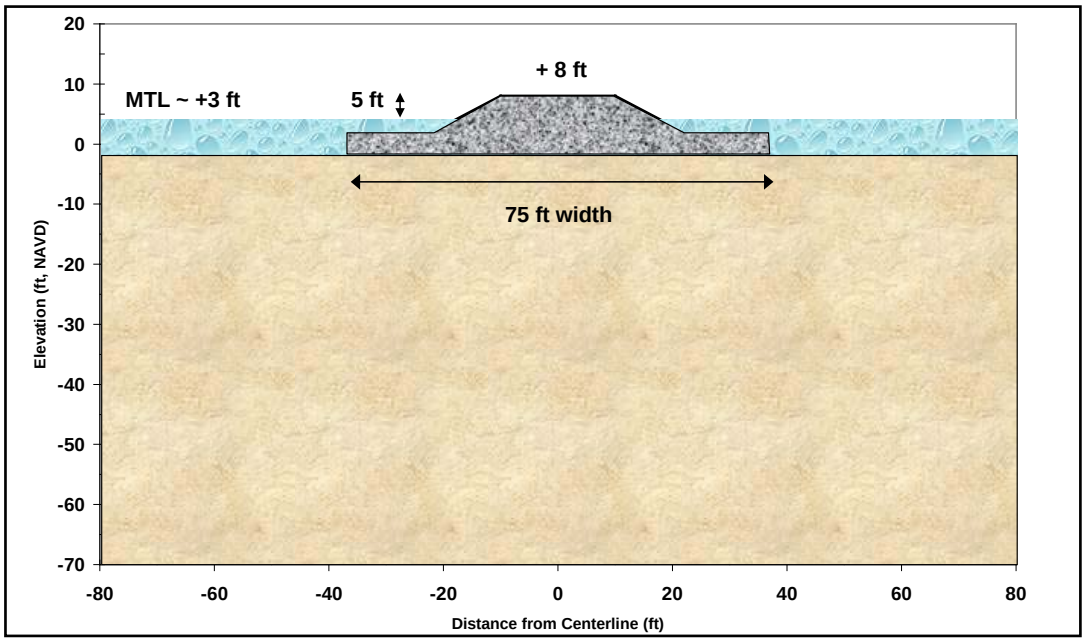


Figure 8. North Jetty Spur Groin NJ3O

Note difference in scale between vertical and horizontal axes.



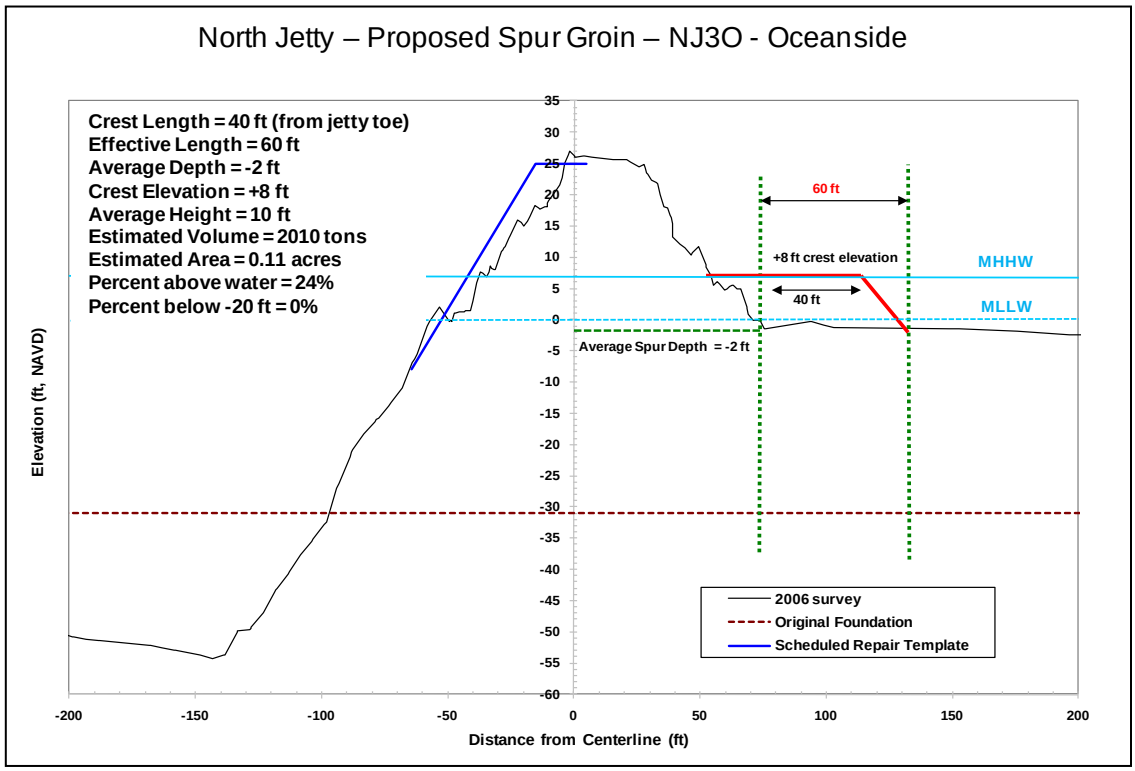
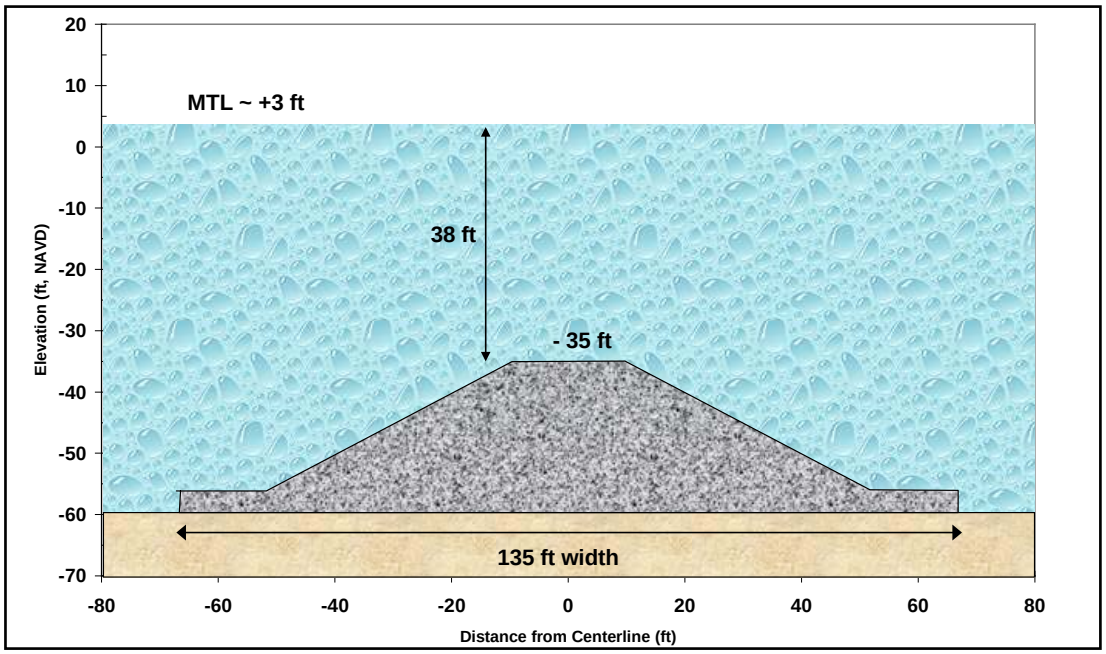
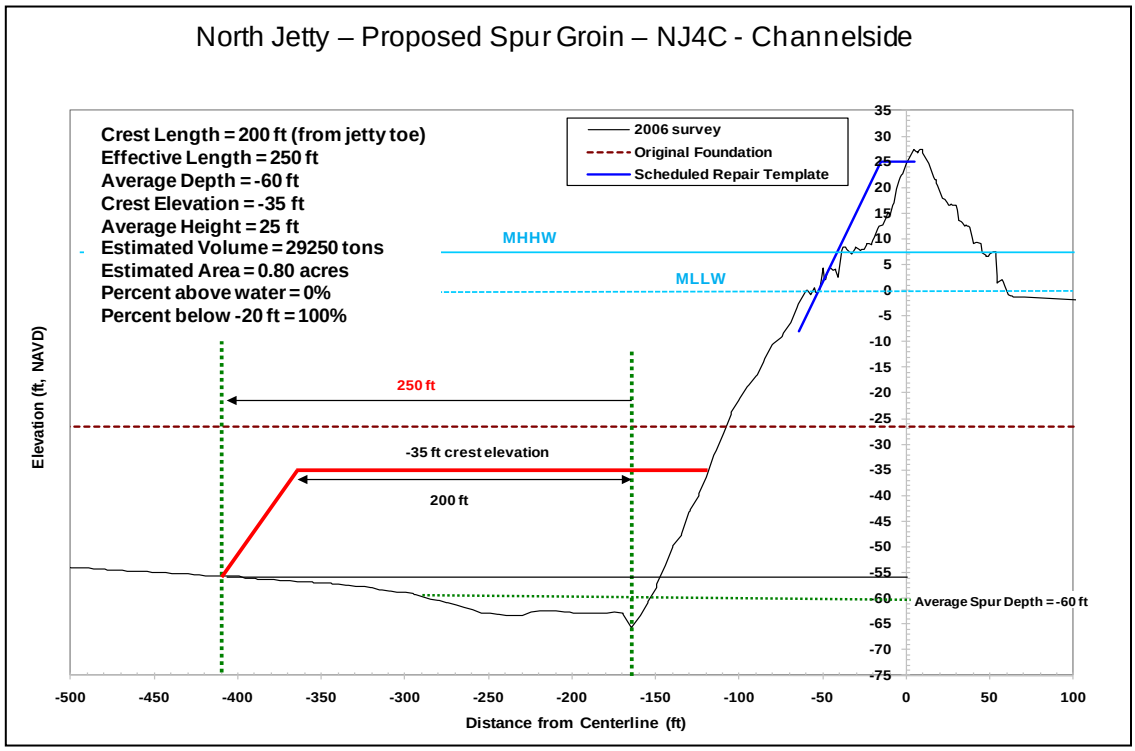


Figure 9. North Jetty Spur Groin NJ4C

Note difference in scale between vertical and horizontal axes.





North Jetty Head Capping

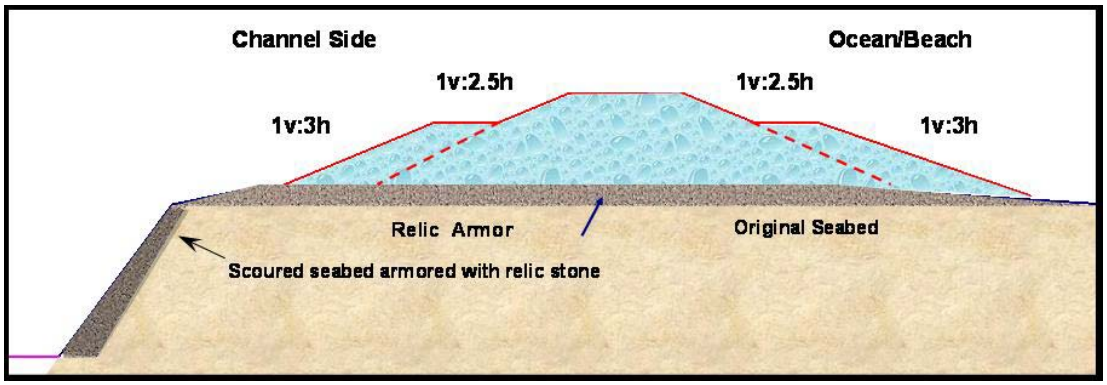
An armor stone cap or concrete armor units (CAU) will be placed on the head of the North Jetty to stop its deterioration (Table 4 and Figure 10). Approximately 38,000 tons (~23,750 cy) of stone or functionally equivalent CAUs will be placed on the relic stone to cap the jetty head. Future physical modeling will refine head capping features.

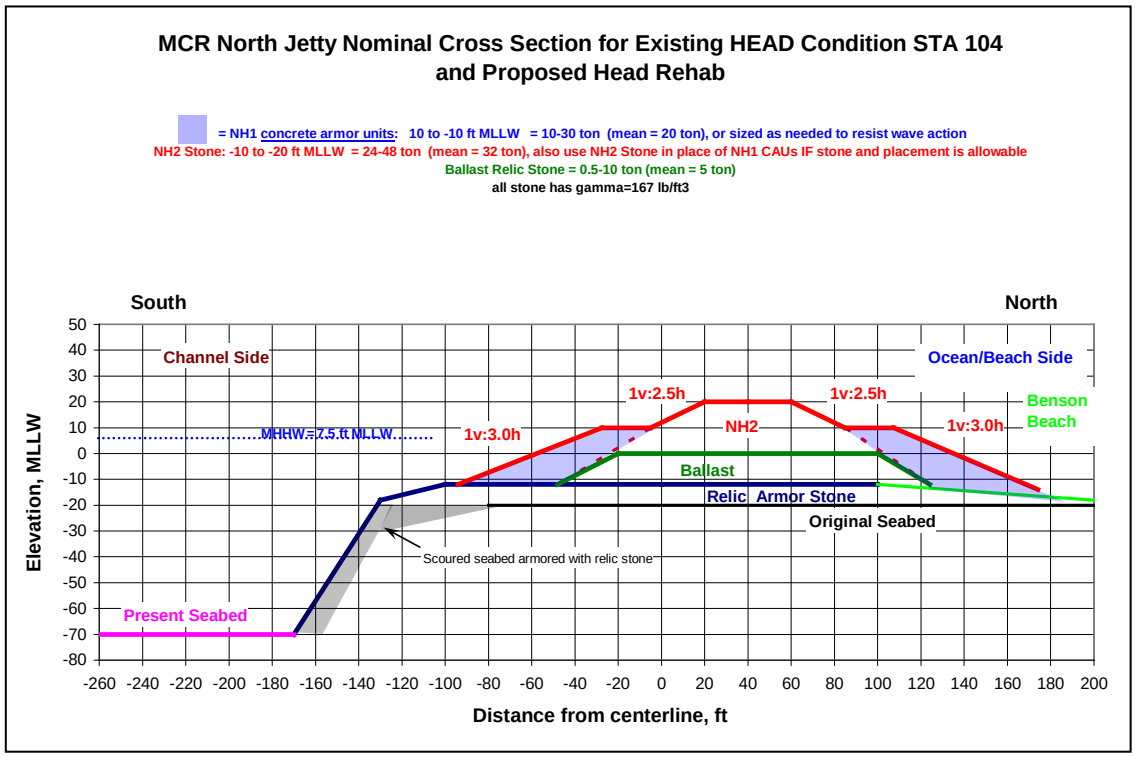
Table 4. North Jetty Head Cap Features

Head Cap Features	North Jetty
Location of cap	stations 99 to 101
Timing of construction	2015
Approximate dimensions of cap: length x width x height (feet)	350 x 270 x 45 (2.17 acres)
Stone size	30 to 50 tons
Area affected (outside relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Cranes set on the jetty

For capping of the head, when stone placement is divided into elevation zones about 13,425 cy of rock will be placed above MHHW. This represents 49% of the overall stone placement on this portion of the jetty, and there is very little or no existing mounded jetty stone expected to be present within this elevation range. About 6,490 cy of rock will be placed between MHHW and MLLW. This represents 24% of the overall stone placement on this portion of the North Jetty, and there is very little or no existing jetty stone expected to be present within this elevation range. About 7,280 cy of rock will be placed below MLLW. This represents 27% of the overall stone placement on this portion of the North Jetty head, and a 2684% change from the existing jetty prism on this portion, as there is very little or no existing mounded jetty stone expected to be present within this elevation range. In all zones, all proposed stone placement will occur on existing base relic stone that formed the original jetty cross-section and was displaced and flattened by wave action, and does not include any modification that changes the character or increases the scope, or size of the original structure design. The terminus of the head is simply closer to shore on a shorter jetty structure. The footprint of the existing jetty mound on the flattened relic stone is approximately 1.37 acres, and the additional capping on the relic stone increases the width of the prism approximately 0.80 acres, for a total footprint of 2.17 acres, all of which will remain on the existing relic stone.

Figure 10. North Jetty Head Cap





North Jetty Lagoon and Wetland Fill and Culvert Replacement

Approximately 109,000 tons (~68,125 cy) of gravel and sand will be added to the jetty's beach side as lagoon fill to eliminate the tidal flow through the jetty that is destabilizing the foundation. A recent berm repair action now precludes lagoon inundation by tidal waters. Scouring has taken place on the north side of the North Jetty resulting in formation of a backwater area (lagoon) that was previously inundated both by tidal waters that come through the jetty and by freshwater that drains from the O'Neil Lake-McKenzie Head Lagoon and wetland complex area through the accreted land to the north of the jetty and North Jetty Road. This area drains through a culvert under the road and provides some of the freshwater flow to the lagoon. The surrounding lagoon resembles a scoured-out tidal channel and is a non-vegetated (and

non-wetland) area of bare sand comprising approximately 4.71 acres. These wetland and waters will be filled to protect and stabilize the foundation of the North Jetty and to serve as a location for rock stockpiles and construction staging activities. The features of this work are shown in Table 5.

Table 5. North Jetty Lagoon and Wetland Fill Features

Features	North Jetty
Timing of construction	2014
Material used for fill	Sand, gravel, quarry stone
Short-term and long-term use	Stockpile area, long-term stabilization of root
De-watering	Culvert feeding into area will be re-placed
Impact on wetlands	1.78 acres
Impact on Section 404 waters	4.71 acres

After further hydraulic and hydrologic design, the aging culvert draining south from the wetland complex north of the roadway will be replaced, as it provides required drainage under the roadway. The design of the inlet, elevation, and culvert size will be determined so that hydrologic function in the adjacent wetland system is not negatively impacted. The outlet channel downstream of the culvert will not be filled. This area may provide an opportunity for minor stream and bank enhancement which will be evaluated when the culvert design is finalized, but this is uncertain until possible benefits can be further assessed. Under the proposed action, the existing channel will outlet to an engineered sump area comprised of newly placed lagoon fill material. In addition to infiltration through the jetty structure, this small portion of the creek currently connects the wetland to the lagoon and likely also receives some backwater flow from jetty infiltration. The current culvert is perched, and the regularly disconnected nature of the lagoon system does not appear to support anadromous fish use. Fish surveys were not completed for the stream inlet leading into this wetland complex and creek. The Corps proposes to conduct an initial sampling survey during peak juvenile salmon outmigration to determine whether or not fish salvage and fish exclusion efforts for listed species is warranted. The Corps will coordinate with NMFS if listed species are identified. Redesign of this system may provide an opportunity to accommodate improved hydrology to newly created wetlands excavated adjacent to the existing wetland complex. This will be further investigated during the hydraulic/hydrologic design analysis.

MCR South Jetty

The proposed action for the South Jetty includes scheduled repairs addressing mostly above MLLW water structural instability, five spur groins, head capping, and improving the jetty shoreline near the root (Figure 11). Seven Scheduled Repair events over the next 20 years were predicted at the South Jetty.

South Jetty Trunk and Root

The cross-section design from stations 155+00 to 311+00 will have a crest width of approximately 30 feet and will lie essentially within the existing jetty footprint based on the configuration of the original cross section, previous repair cross sections, and redistribution of jetty rock by wave action (Figure 12). The majority of the stone placement will be conducted above the MLLW. Each repair action is expected to cover a length up to 2,100 feet and include stone volumes in the range of 30,000 to 118,000 tons per season (18,750 - 73,750 cy).

As with the North Jetty repair action, it is expected that 60%-70% of the South Jetty's overall standard jetty template cross section has been displaced. Therefore, each repair event will increase the existing degraded cross section from 30%-40% back to 100% of the desired standard cross-section template. This means overall, the added rock will essentially triple what exists immediately prior to the time of repair. This could be described as a ~300% increase in rock relative to the existing jetty rock volume. However, this will not result in an increase the jetty prism or footprint beyond the scope and size of the historic structure, and does not include any modification that changes the character, scope, or size of the original structure design.

Per repair event, when divided into elevation zones, about 37,640 cy of rock will be placed above MHHW. This represents 68% of the overall stone placement on these portions of the South Jetty and a 1023% change from the existing jetty prism, as very little stone currently remains in the zone and a larger amount of stone must be placed compared to what presently remains. As described, above, this same concept applies characterizations about the rest of the zones. About 10,420 cy of rock will be placed between MHHW and MLLW. This represents 19% of the overall stone placement on these portions of the South Jetty and a 225% change from the existing jetty prism. About 6,940 cy of rock will be placed below MLLW. This represents 13% of the overall stone placement on these portions of the South Jetty and a 150% change from the existing jetty cross section. However, in all zones, all proposed stone placement will occur on existing base relic stone that formed the original jetty cross section. The footprint of the trunk and root of the South Jetty will remain within its current jetty dimensions and on relic stone.

Figure 11. Proposed Action for the MCR South Jetty

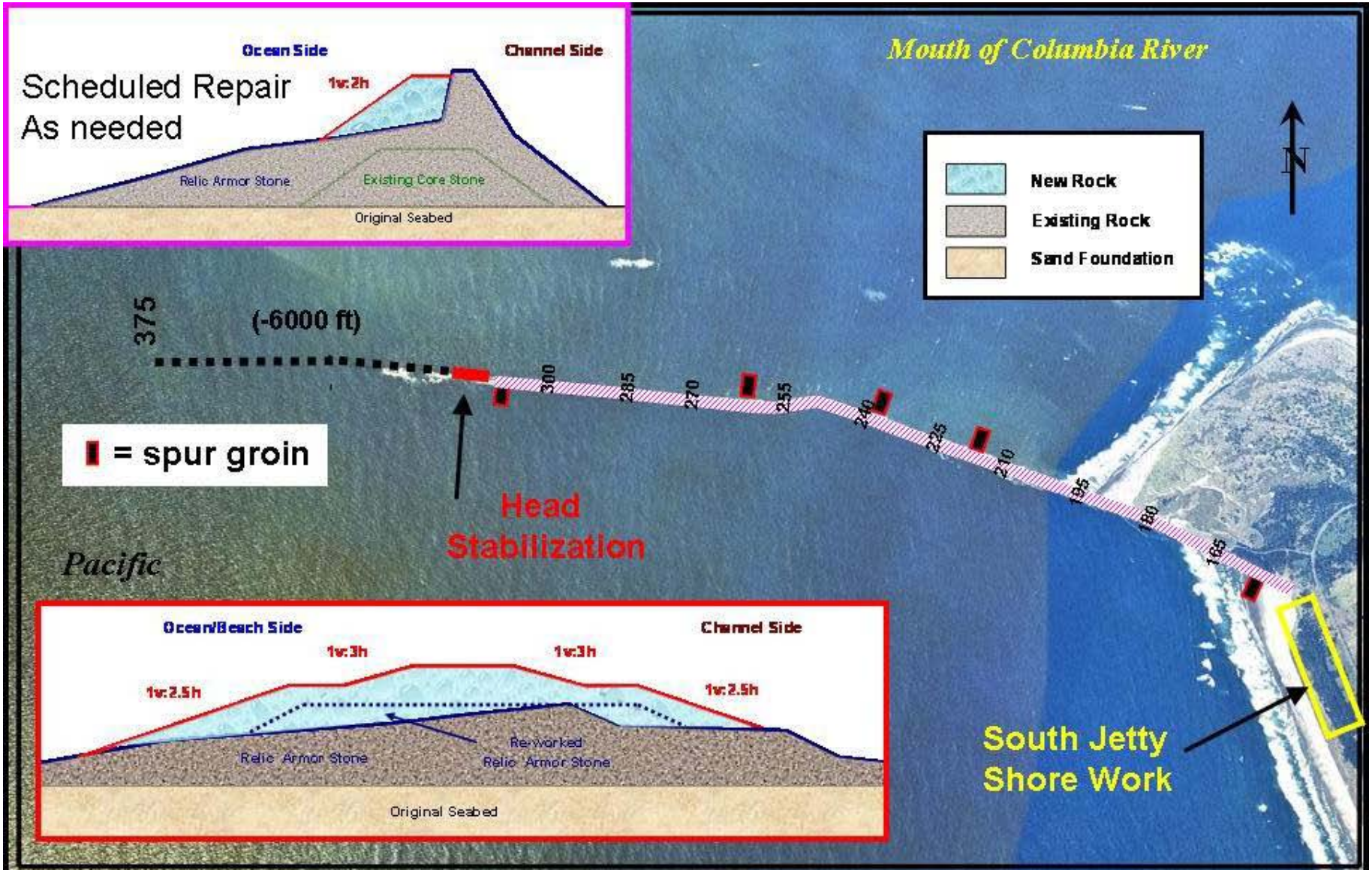
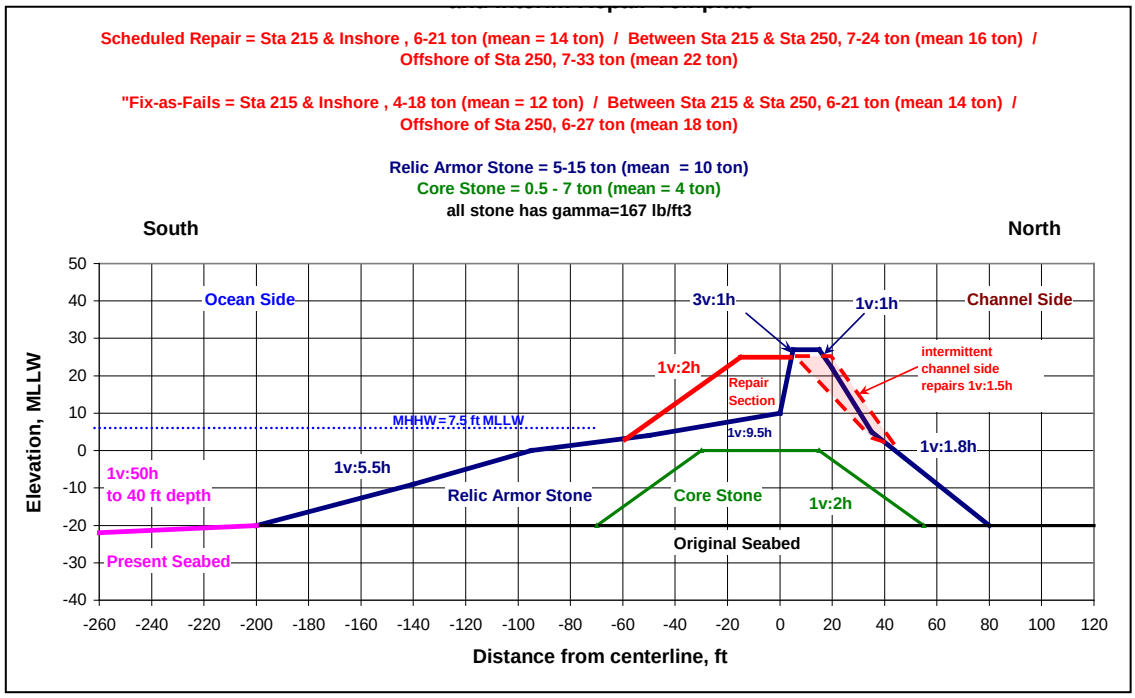


Figure 12. South Jetty Cross Section for Existing Condition and Scheduled Repair



South Jetty Spur Groins

Three emergent and two submergent spur groins will be constructed to stabilize the jetty's foundation (Figures 13 to 17). The dimensions and other features of the spur groins are shown in Table 6.

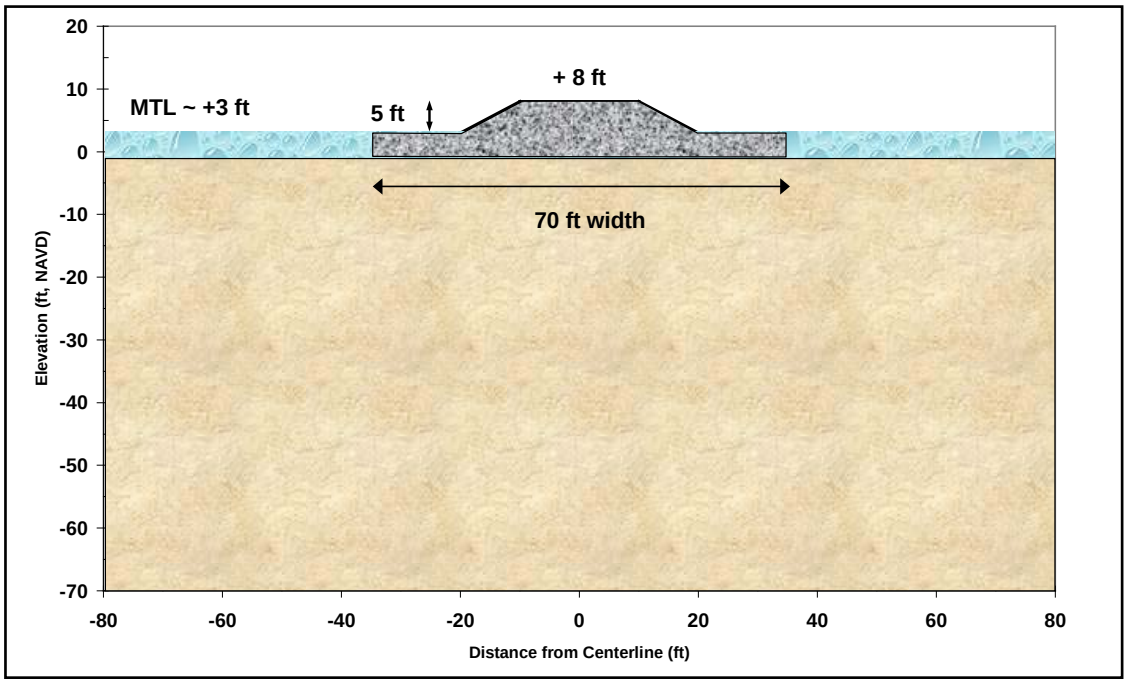
Representing estimated rock volume totals divided into elevation zones for all spurs on the South Jetty, about 21 cy of rock will be placed above MHHW. This represents 0.1% % of the overall stone placement on these portions of the South Jetty, and there is very little or no existing jetty stone expected to be present within this elevation range. About 2,190 cy of rock will be placed between MHHW and MLLW. This represents 12.3% of the overall stone placement on these portions of the South Jetty, and there is very little or no existing jetty stone expected to be present within this elevation range. About 15,700 cy of rock will be placed below MLLW. This represents 87.6% of the overall stone placement on these portions of the South Jetty, and there is very little or no existing jetty stone expected to be present within this elevation range. The footprint of the spurs on the South Jetty will increase from 0 acres to 1.10 acres. In the relevant figures, note that the difference in the vertical and horizontal scales causes a slight representational distortion.

Table 6. South Jetty Spur Groin Features

Spur Groin Feature	South Jetty
Number of spurs on channel side or downstream	3
Number of spurs on ocean side or upstream	2
Approximate total rock volume per spur (+/- 20%)	SJ1O: 1,680 tons (~1,050 cy) SJ2C: 2,350 tons (~1,469 cy) SJ3C: 2,350 tons (~1,469 cy) SJ4C: 3,180 tons (~1,988 cy) SJ5O: 18,750 tons (~11,719 cy)
Approximate total rock volume (all spurs) (+/- 20%)	25,000 tons (~15,625 cy)
Approximate area affected by each spur	SJ1O: 0.11 acres SJ2C: 0.13 acres SJ3C: 0.13 acres SJ4C: 0.19 acres SJ5O: 0.55 acres
Approximate total area affected (all spurs)	1.10 acres
Approximate area of spurs above water	SJ1O: 29% SJ2C: 7% SJ3C: 7% SJ4C: 0% SJ5O: 0%
Approximate area of spurs below -20 MLLW	SJ1O: 0% SJ2C: 0% SJ3C: 0% SJ4C: 0% SJ5O: 92%
Approximate dimension of spurs: length x width x height (feet)	SJ1O: 60 x 80 x 9 SJ2C: 70 x 80 x 10 SJ3C: 70 x 80 x 10 SJ4C: 90 x 90 x 12 SJ5O: 190 x 125 x 22

Figure 13. South Jetty Spur Groin SJ1O

Note difference in scale between vertical and horizontal axes.



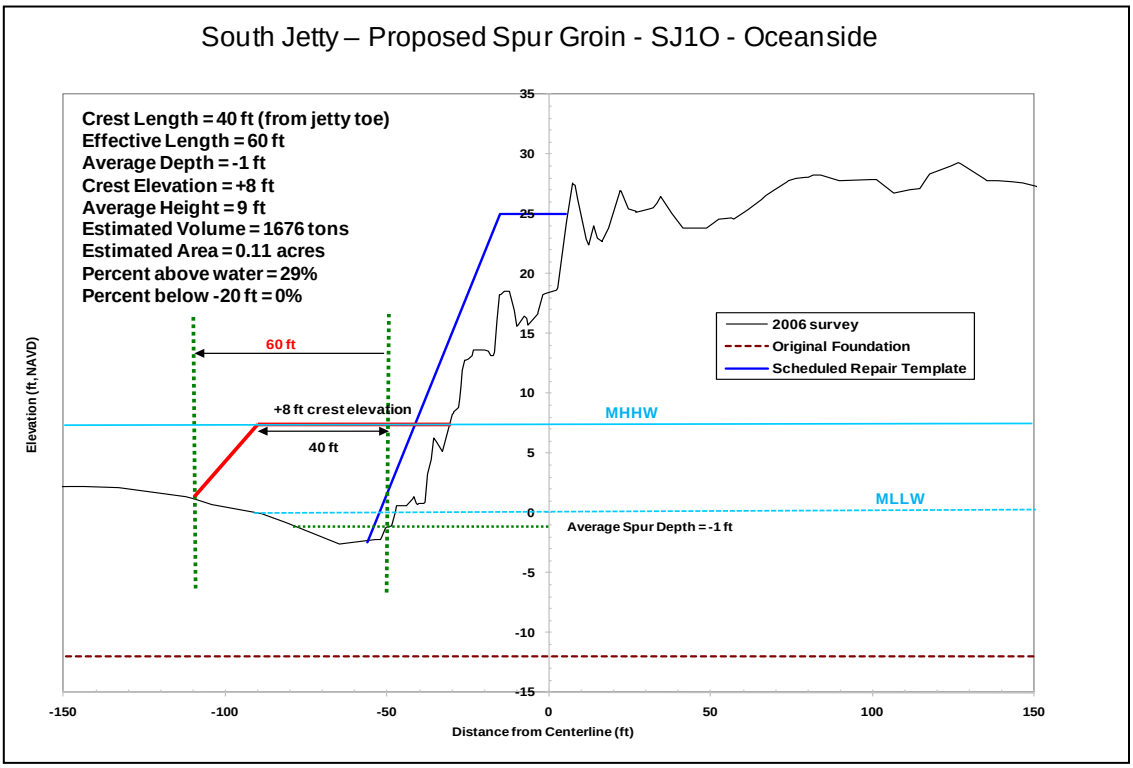
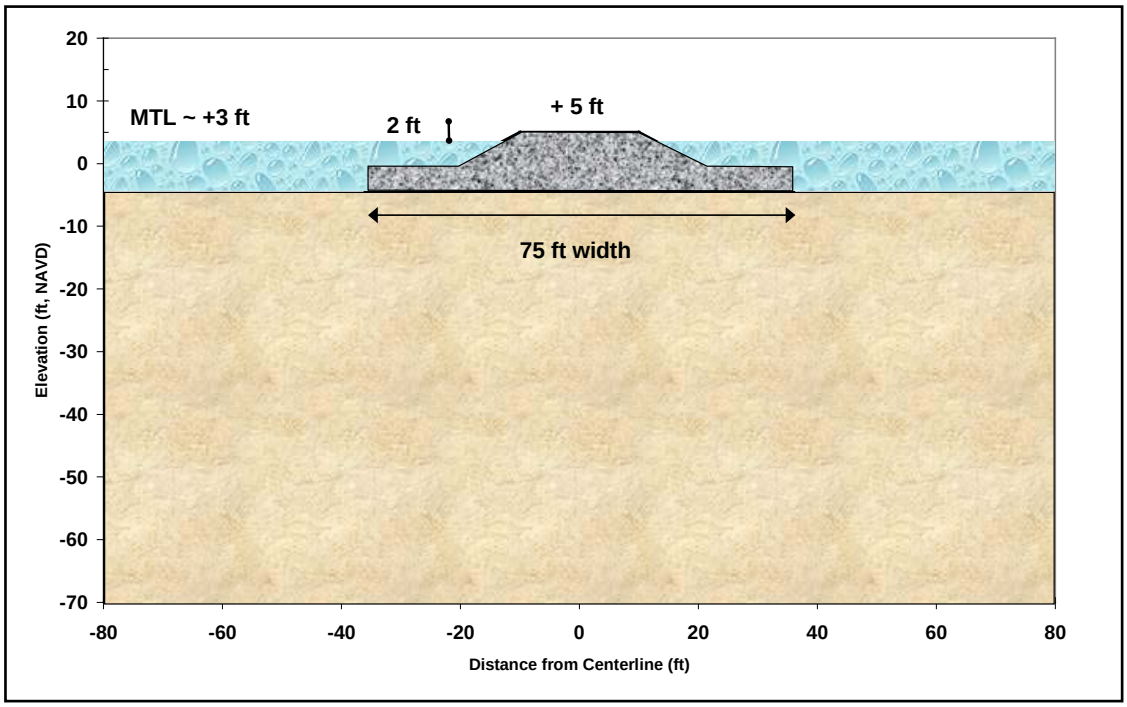


Figure 14. South Jetty Spur Groin SJ2C

Note difference in scale between vertical and horizontal axes.



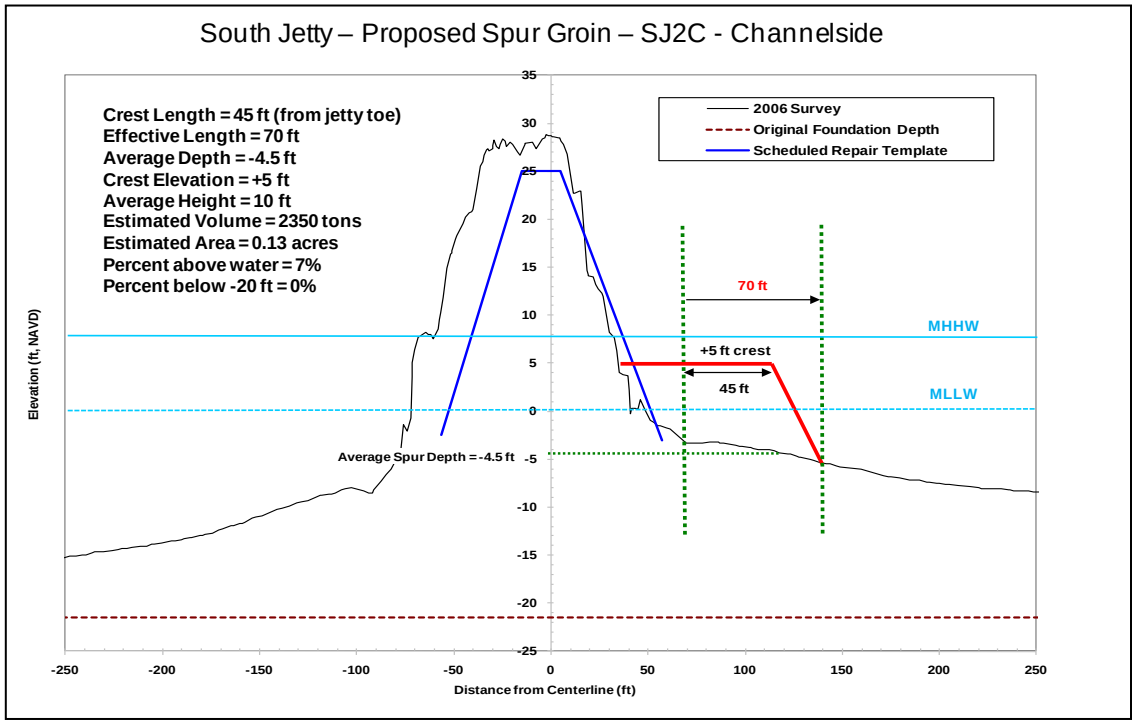
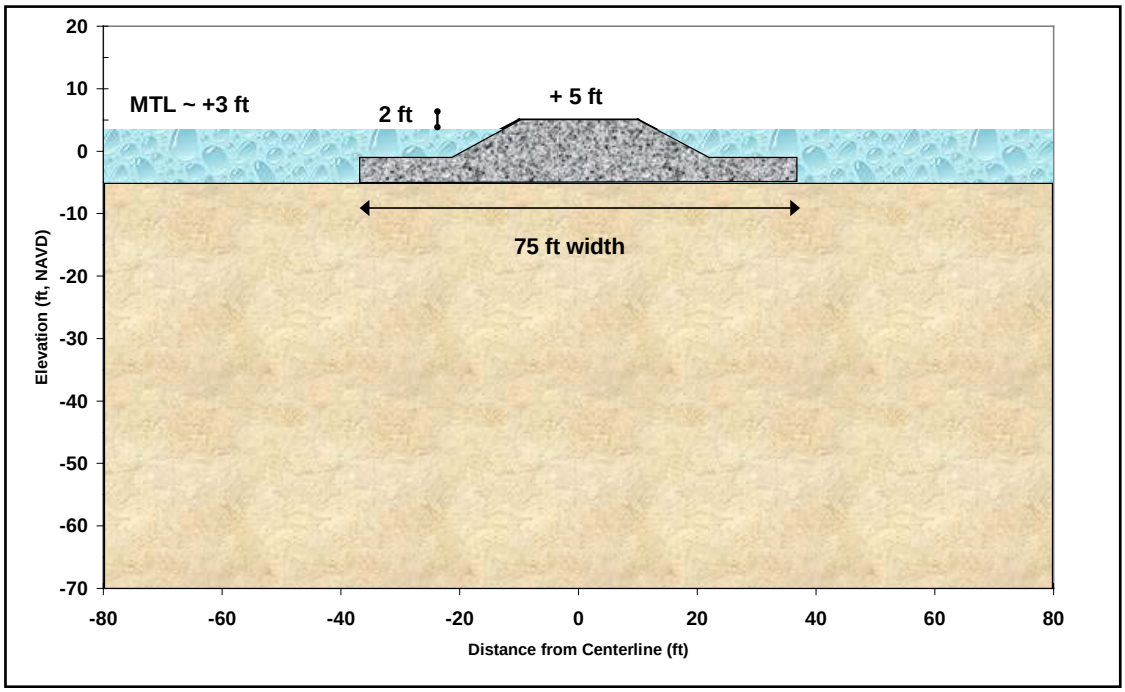


Figure 15. South Jetty Spur Groin SJ3C

Note difference in scale between vertical and horizontal axes.



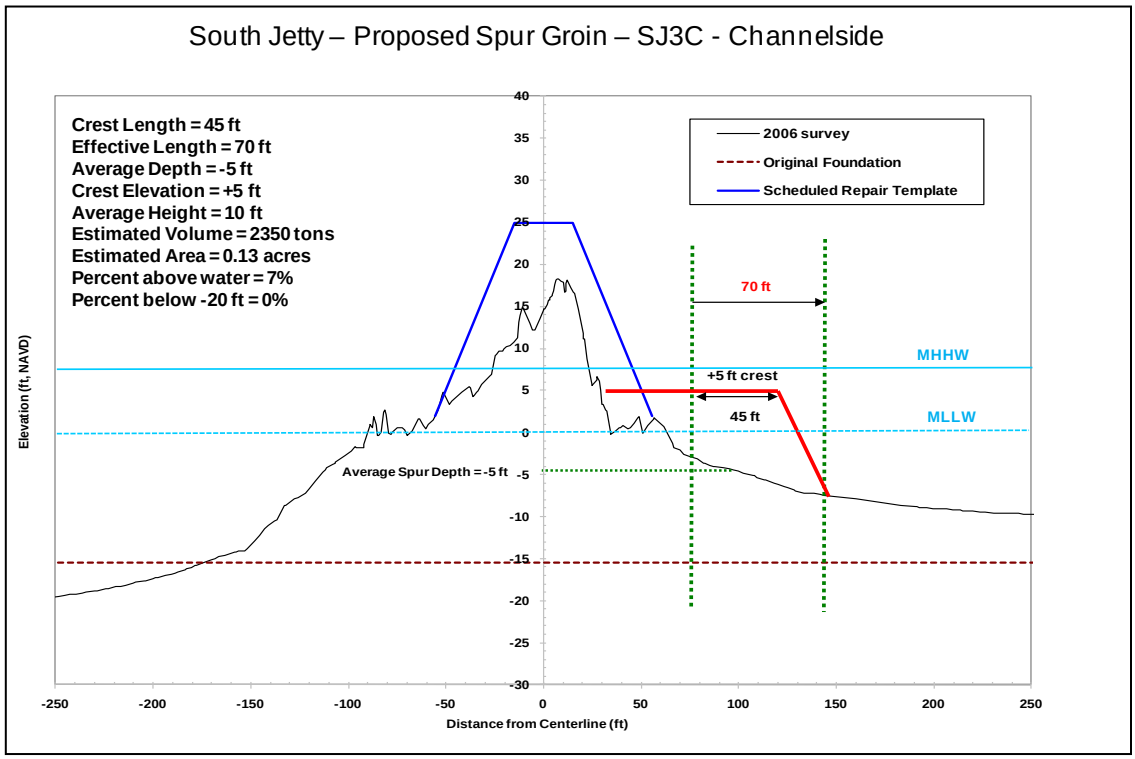
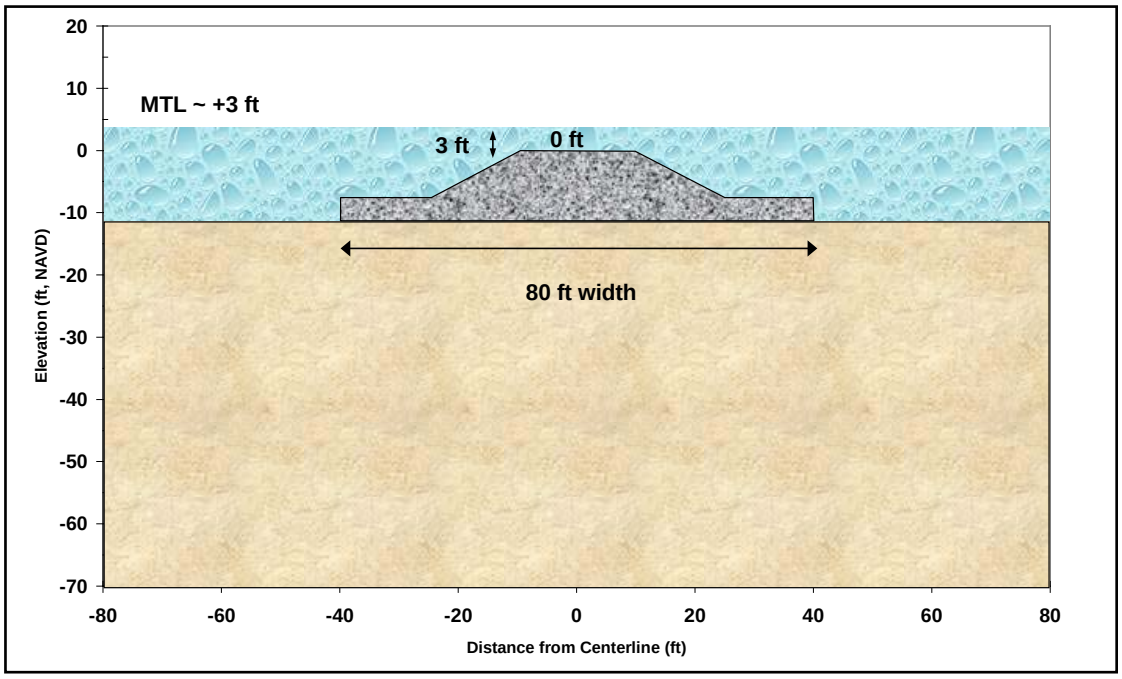


Figure 16. South Jetty Spur Groin SJ4C

Note difference in scale between vertical and horizontal axes.



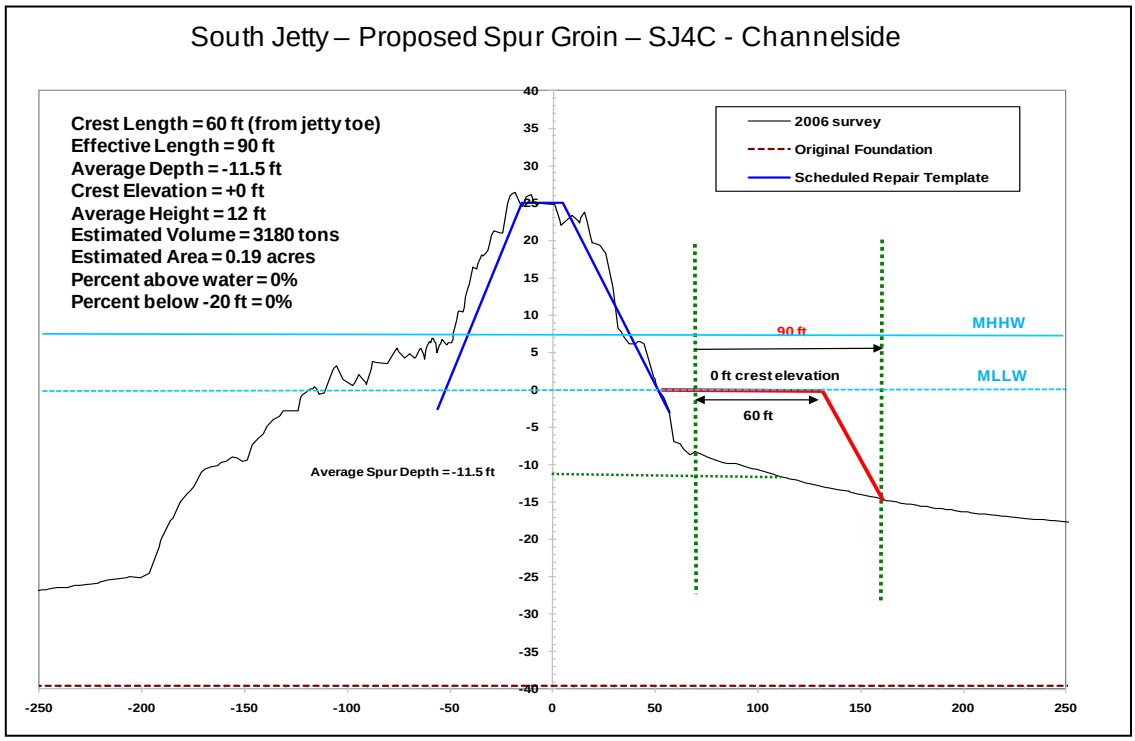
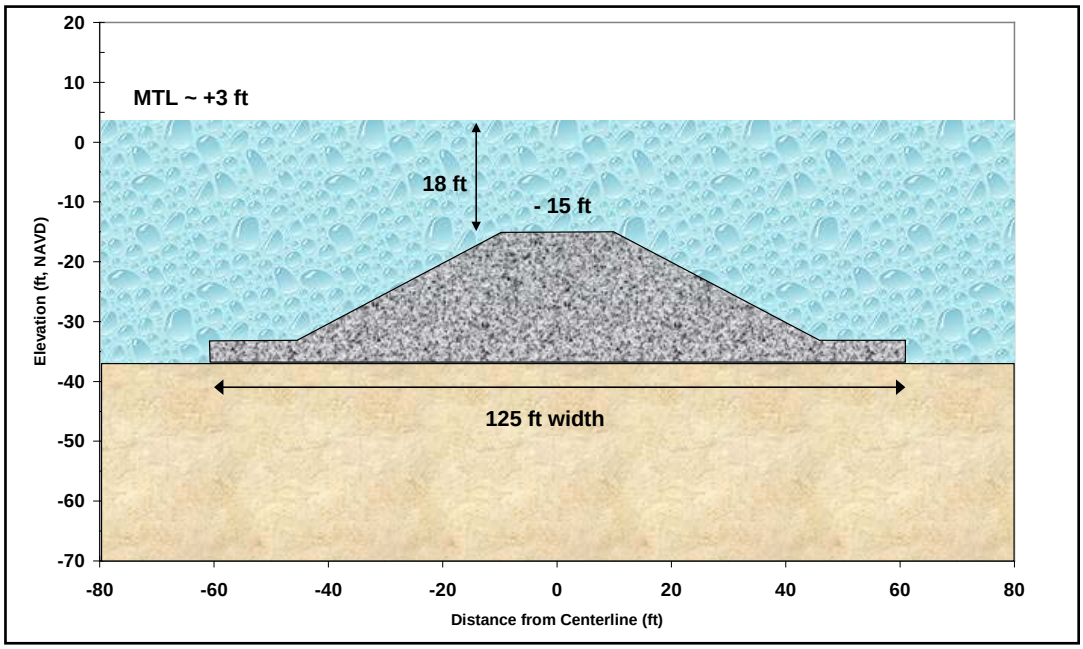
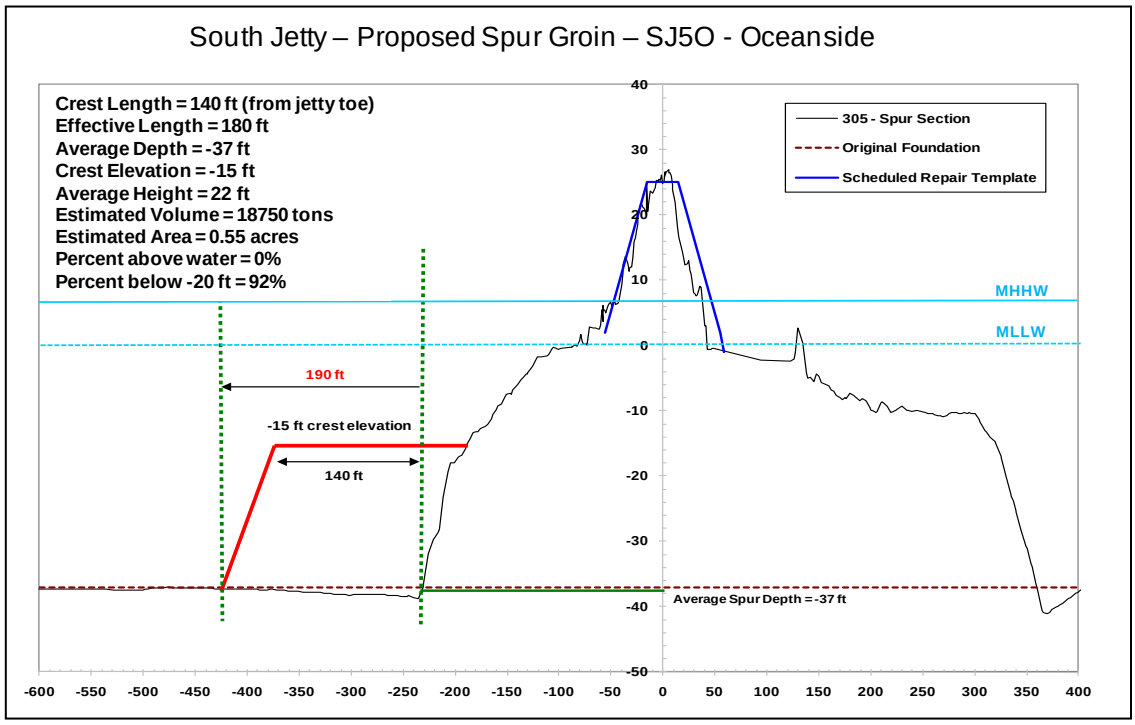


Figure 17. South Jetty Spur Groin SJ5O

Note difference in scale between vertical and horizontal axes.





South Jetty Head Capping

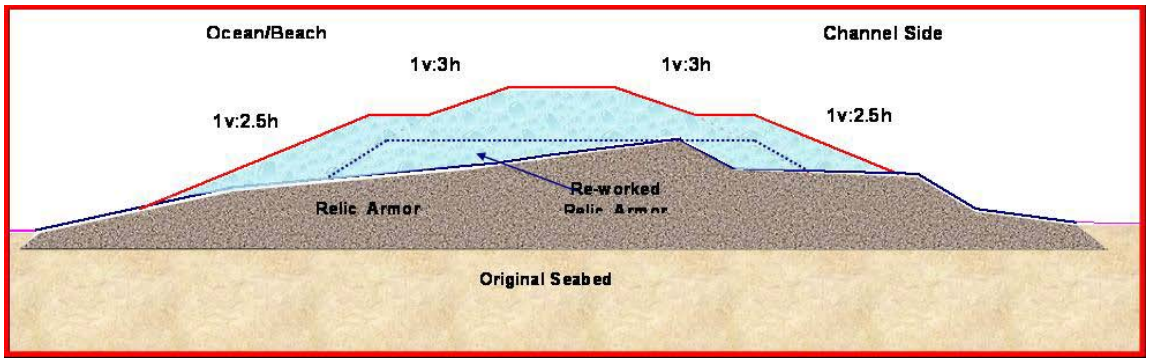
An armor stone cap with approximately 40,000 to 74,000 tons (~25,000 - 46,250 cy) of stone or equivalent concrete armor units will be placed on the head of the South Jetty to stop its deterioration (Figure 18). The features of this work are shown in Table 7.

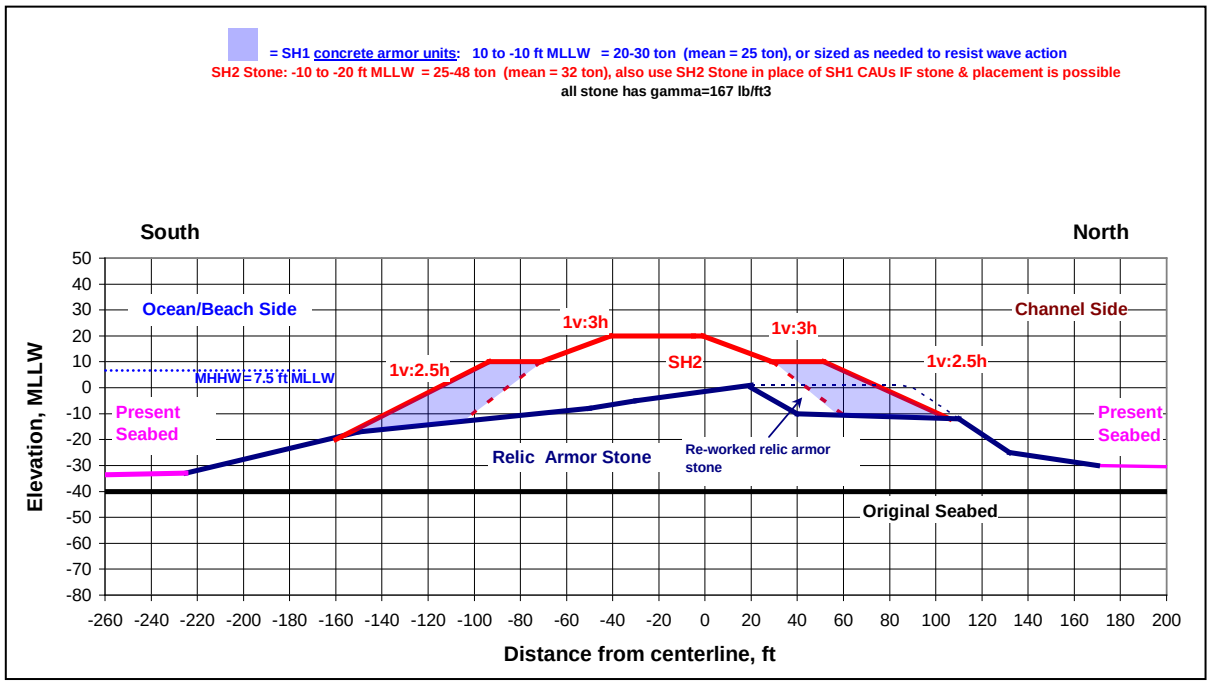
For capping of the head, divided into elevation zones about 13,425 cy of rock will be placed above MHHW. This represents 52% of the overall stone placement on this portion of the South Jetty and there is very little or no existing jetty stone expected to be present within this elevation range. About 6,490 cy of rock will be placed between MHHW and MLLW. This represents 25% of the overall stone placement on this portion of the South Jetty and there is very little or no existing jetty stone expected to be present within this elevation range. About 6,050 cy of rock will be placed below MLLW. This represents 23% of the overall stone placement on this portion of the South Jetty and 1150% change from the existing base condition as there is very little or no existing mounded jetty stone expected to be present within this elevation range. In all zones, all proposed stone placement will occur on existing base relic stone that formed the original jetty cross section and was displaced and flattened by wave action, and does not include any modification that changes the character or increases the scope or size of the original structure design. The terminus of the head is simply closer to shore on a shorter jetty structure. The footprint of the existing jetty mound on the flattened relic stone is approximately 1.69 acres, and the additional capping on the relic stone increases the width of the prism approximately 0.64 acres, for a total footprint of 2.33 acres, all of which will occur on existing relic stone.

Table 7. South Jetty Head Capping Features

Capping Feature	South Jetty
Location of cap	stations 311 to 313
Timing of construction	2019-2020
Dimensions of cap: length x width x height (feet)	350 x 290 x 45 (2.33 acres)
Stone size	30 to 50 tons
Area affected (outside relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Land-based cranes or jack-up barge

Figure 18. South Jetty Head Cap





South Jetty Root Erosion and Dune Augmentation

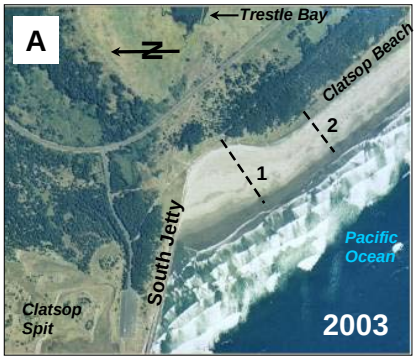
Currently, the coastal shore interface along the South Jetty is in a condition of advanced deterioration (Figure 19). The foredune separating the ocean from the backshore is almost breached. The backshore is a narrow strip of a low-elevation, accretion area that separates Trestle Bay from the ocean by hundreds of yards. The offshore area along the South Jetty (and to the south) continues to erode, promoting larger wave action to affect the shoreline along the South Jetty root. The back dune of Trestle Bay has continued to advance westward due to increased circulation in the bay, seasonal wave chop, and hydraulic surcharging. Under existing conditions, the shoreline at the root of the South Jetty will continue to erode and recede, resulting in a possible shoreline breach into Trestle Bay in about 8-16 years. If this sand spit breach occurs, the result would be catastrophic. The MCR inlet would establish a secondary flow way from the estuary to the ocean along this area (south of South Jetty). This condition would profoundly disrupt navigation at the MCR and bring lasting changes to the physical nature of the inlet.

Figure 19. Clatsop Spit and South Jetty Root Erosion

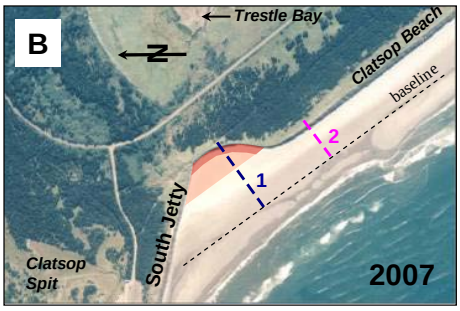
About 40,000 to 70,000 cy of cobble in the shape of angular or rounded graded stone is proposed at the South Jetty root in order to fortify the toe of the foredune and to improve the foreshore fronting to resist wave-induced erosion/recession (Figure 20). Maximum crest width of the template is estimated to extend 70 feet seaward from the seaward base of the present foredune. Construction of the berm augmentation would require 2 to 6 weeks. To adequately protect the foredune during storm conditions, this requires that the top of the stone berm (crest) extend vertically to approximately 25 feet NAVD and have an alongshore application length of approximately 1,100 feet, extending southward from the South Jetty root. This is equivalent to about 3 acres. The constructed template crest would be 10 to 15 feet above the current beach grade and have a 1 vertical to 10 horizontal slope aspects from crest to existing grade. Cobble is not expected to extend below MHHW. An additional layer of sand may be placed over this berm, or natural accretion may facilitate sand recruitment after construction of the adjacent spur groin.

Cobble material would be procured from upland sources and placed using haul trucks and dozers. The material would be transported on existing surface roads and through Fort Stevens State Park to a beach access point at the project site. There is an existing relic access road along the jetty root that will be refurbished and used to transport stone to the dune augmentation area. Though there is an existing razor clam bed adjacent to the vicinity of the proposed dune augmentation, species impacts are not expected because all of the stone placement will occur above MHHW, and haul traffic will be precluded using Parking Lot B and from driving on the beach during material delivery. Excavator and bulldozer work will be mostly confined to the dry sand areas to further avoid negative species effects.

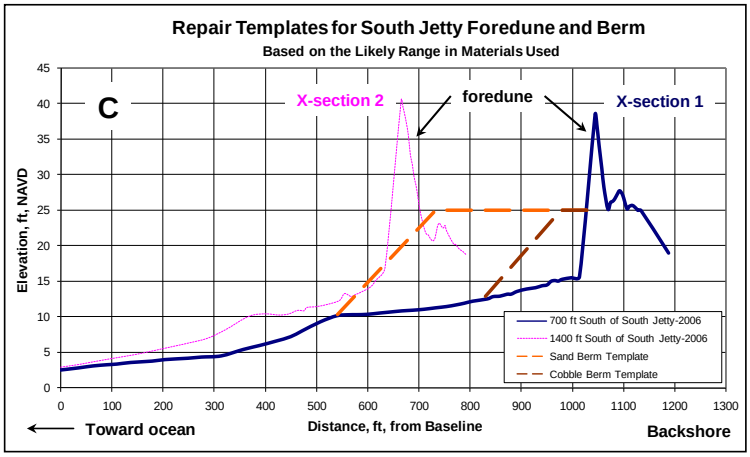
Figure 20. South Jetty Root Shoreline Area



MCR South Jetty root, south side where Clatsop Spit joins with Clatsop Plains/Beach. Panels A and B show the erosion embayment along the south jetty root for 2003 (hIgh tide) and 2007 (low tide). The embayment & adjacent shore have receded 40 ft landward during 2003-2007, reducing the protective foredune along the embayment.



Panel C shows cross-sections 1 and 2 for 2007(shown in panels A & B). Severe erosion in this area had threatened the inlet stability during early 1930s, when jetty rehabilitation and sand augmentation measures were implemented. Erosion has again become chronic since the late 1970s. The foredune protects the backshore (elevation 15-18 ft NAVD) from wave surge action during storms. If the foredune is breached, the backshore will be rapidly eroded. Without erosion abatement, it is estimated that that the Pacific Ocean will establish hydraulic connectivity with Trestle Bay in 10-15 years from 2009, and again threaten inlet stability. Panel C shows two options for protecting the foredune within the erosion embayment: A SAND berm template requires ~225,000 cy of sand placement, and a COBBLE berm template requires ~60,000 cy of cobble placement.



The dune augmentation may require maintenance every 4-10 years (assume 40% replacement volume). Consideration will be given to development of revegetation plans which incorporate native dune grasses to supplement foredune stabilization in the augmentation area. This bioengineering component could help restore habitat and take advantage of natural plant rooting functions that provide greater protection from erosive forces.

MCR Jetty A

The proposed action for Jetty A includes Immediate Rehabilitation with a small cross section, two spur groins, and head capping (Figure 21).

Jetty A Trunk and Root

The cross-section design from stations 40+00 to 91+00 will have a crest width of approximately 40 feet and will lie mostly within the existing jetty footprint based on the configuration of the original cross section, previous repair cross sections, and redistribution of jetty rock by wave action (Figure 22). About 55,000 tons (~34,375 cy) of new rock will be placed on the existing jetty cross section and relic armor stone on the estuary/channel side of the jetty and 75,000 tons (~46,875 cy) of new rock on the ocean side of the jetty. Though most of the work will occur above MLLW, there will also be some stone placement below this elevation. The small cross-section also has a higher likelihood of expanding beyond the relic base compared to repair actions.

About 63,700 cy of rock will be placed above MHHW. This represents 63% of the overall stone placement on these portions of Jetty A and a 2020% change from the existing jetty prism, as very little stone currently remains in the zone and a larger amount of stone must be placed compared to what presently remains. As described previously for North and South jetties, this same concept applies to characterizations about the rest of the zones. About 28,940 cy of rock will be placed between MHHW and MLLW. This represents 29% of the overall stone placement on these portions of Jetty A and a 280% change from the jetty prism. About 8,030 cy of rock will be placed below MLLW. This represents 8% of the overall rock on these portions of Jetty A and a 233% change from the existing jetty prism. In all zones, most of the proposed stone placement will occur on existing base relic stone that formed the original jetty cross-section. However, the footprint of the proposed prism could increase in width compared to the existing prism by up to 10 feet along the length of the jetty (though it would still be on the relic stone). This equals about 1.2 acres, but it is not expected to result in additional habitat conversion because it will be in a bottom location already comprised of jetty stone, and does not include any modification that changes the character, scope, or size of the original structure design.

Figure 21. Proposed Action for MCR Jetty A

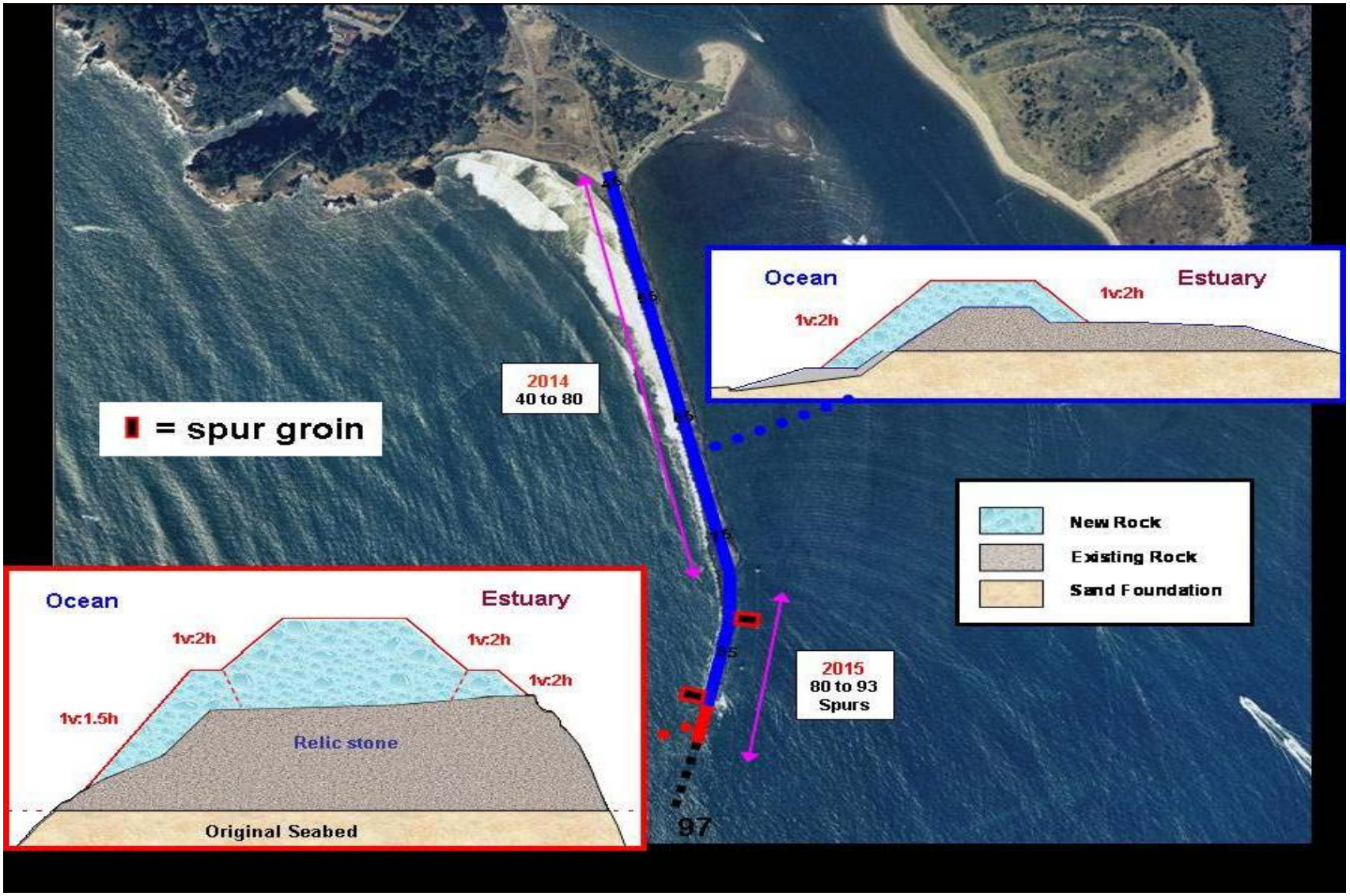
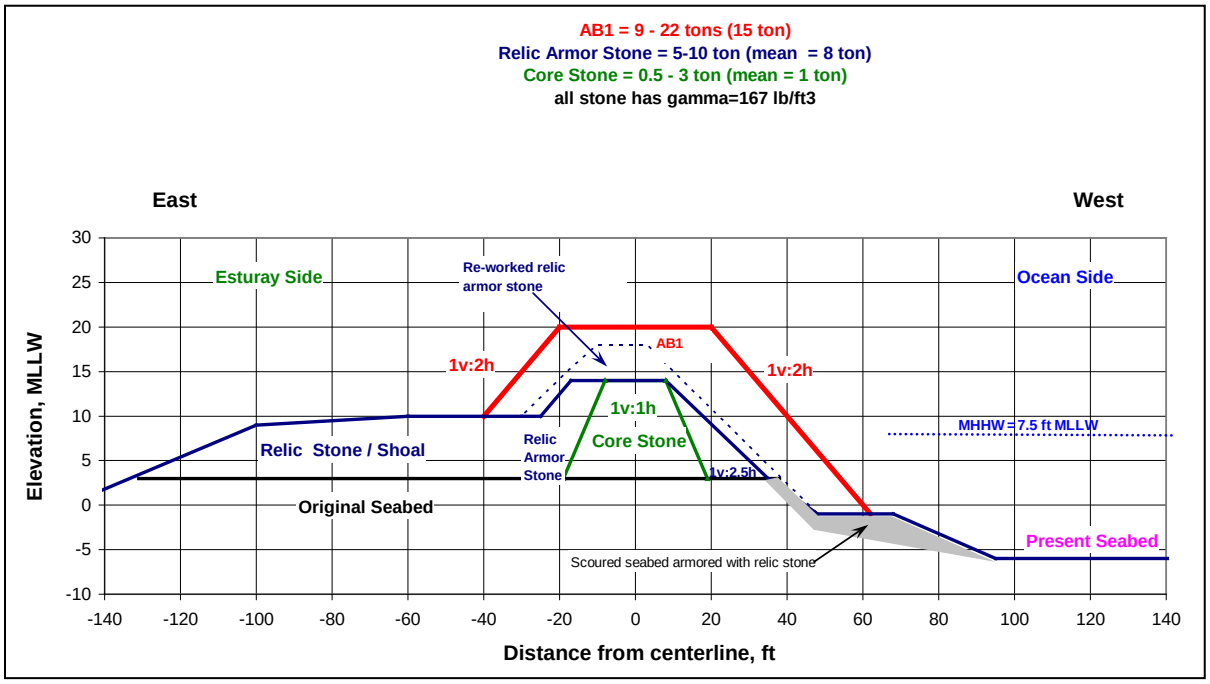


Figure 22. Jetty A Cross Section for Proposed Action



Jetty A Spur Groins

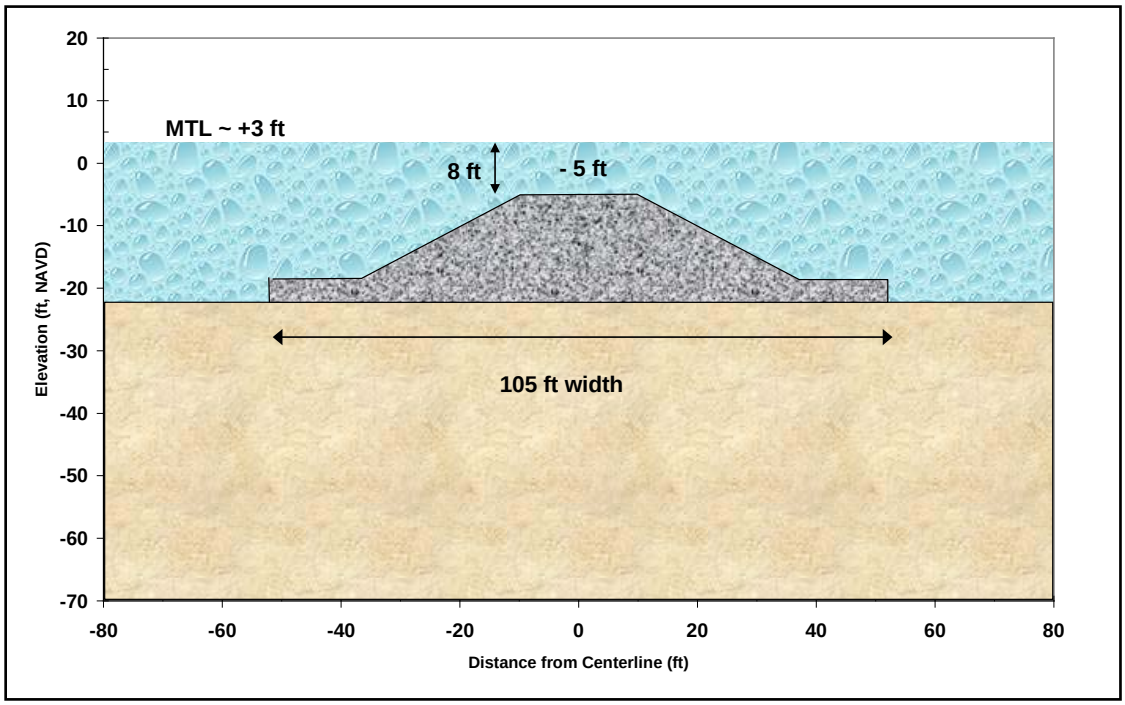
One submergent spur groin will be placed on the downstream (referred to as JA1C) side and one submergent spur groin will be placed on the upstream (referred to as JA2O) side to stabilize the jetty's foundation (Figures 23-24). The dimensions and other features of the spur groins are shown in Table 8. Representing estimated rock volume totals divided into elevation zones for all spurs on Jetty A, no stone will be placed above MLLW, and there is very little to no existing jetty stone expected to be present within either of these elevation ranges. About 10,800 cy of rock will be placed below MLLW and represents 100% of the overall stone placement on these portions of Jetty A. The footprint of the Jetty A spurs will increase from 0 acres to ~ 0.61 acres beyond existing relic stone. In the relevant figures, note that the difference in the vertical and horizontal scales causes a slight representational distortion.

Table 8. Jetty A Spur Groin Feature

Spur Groin Feature	Jetty A
Number of spurs on channel side or downstream for Jetty A	1
Number of spurs on ocean side or upstream for Jetty A	1
Approximate total rock volume per spur (+/- 20%)	JA1C: 9,650 tons (~ 6,031 cy) JA2O: 7,330 tons (~ 4,581 cy)
Approximate total rock volume (all spurs) (+/- 20%)	25,000 tons (~ 15,625 cy)
Approximate area affected by each spur	JA1C: 0.33 acres; JA2O: 0.29 acres
Approximate total area affected (all spurs)	0.61 acres
Approximate area of spurs above water	JA1C: 0%; JA2O: 0%
Approximate area of spurs below -20 MLLW	JA1C: 1%; JA2O: 0%
Approximate dimension of spurs: length x width x height (ft)	JA1C: 135 x 105 x 18 JA2O: 125 x 100 x 15

Figure 23. Jetty A Spur Groin JA1C

Note difference in scale between vertical and horizontal axes.



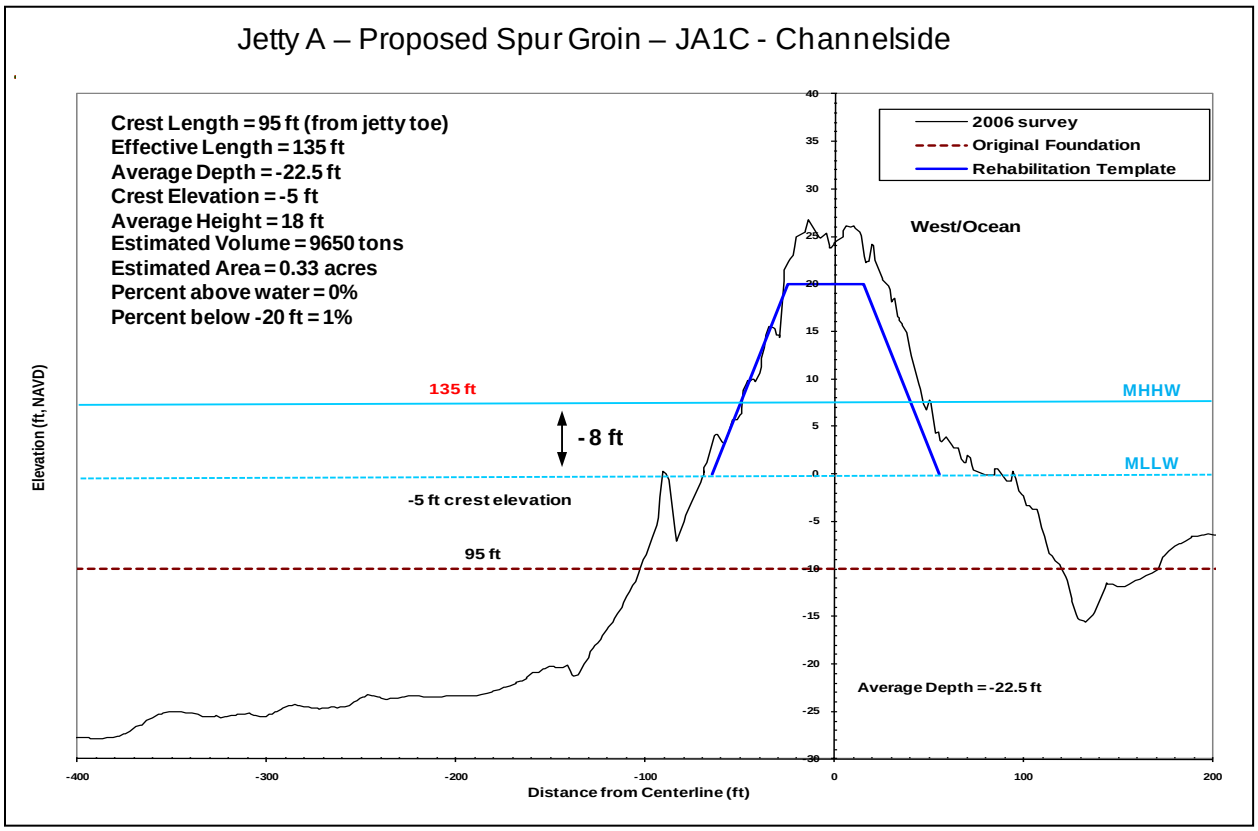
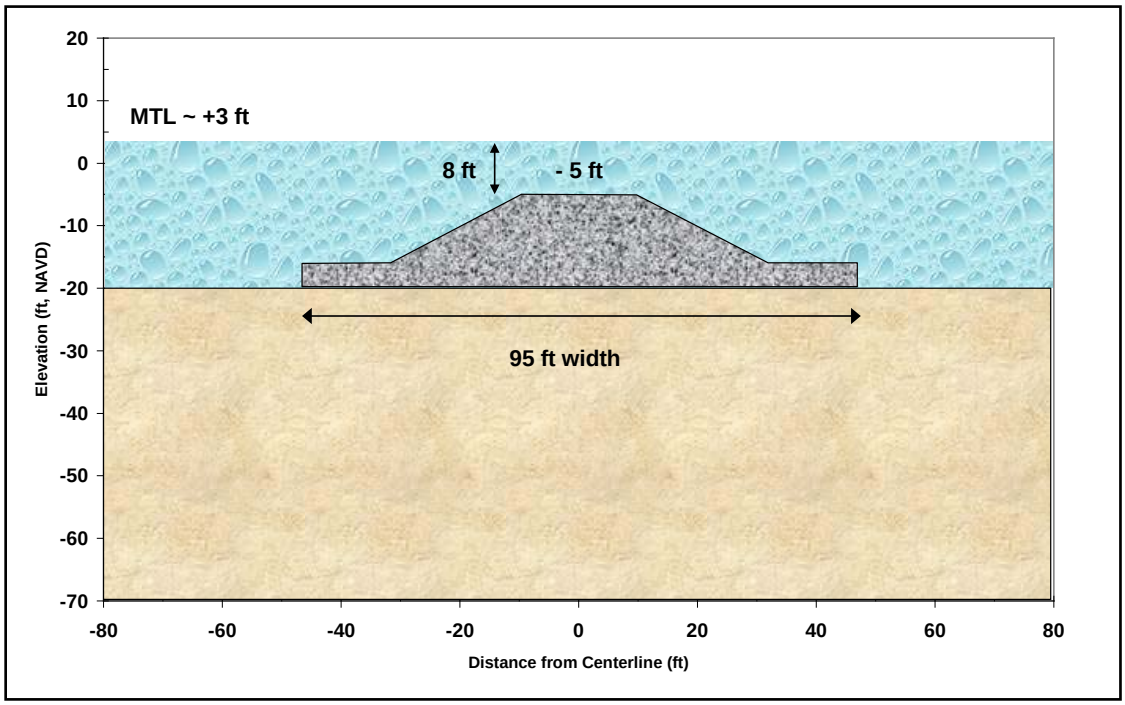
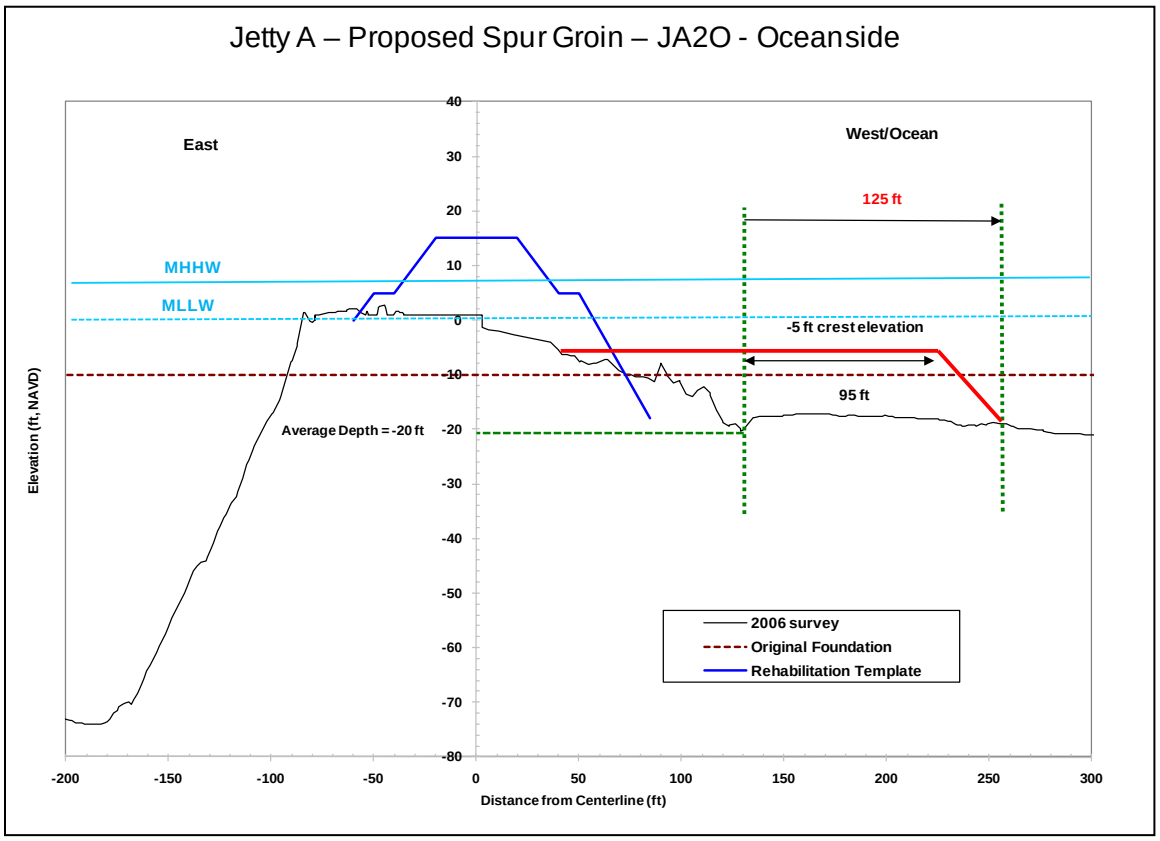


Figure 24. Jetty A Spur Groin JA2O

Note difference in scale between vertical and horizontal axes.





Jetty A Head Capping

An armor stone cap of approximately 24,000 tons (~ 15,000 cy) or equivalent concrete armor units will be placed on the head of the Jetty A to stop its deterioration (Figure 21). The features of this work are shown in Table 9.

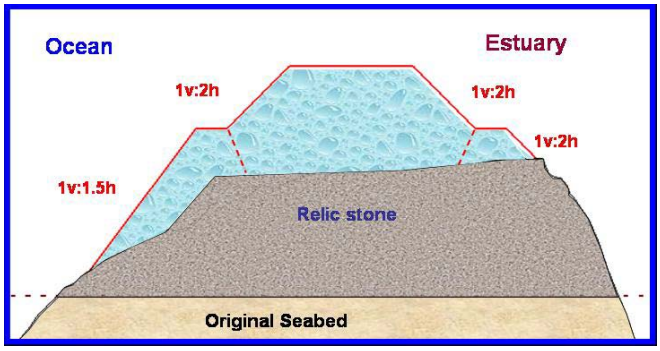
For capping of the head, divided into elevation zones about 7,920 cy of rock will be placed above MHHW. This represents 44% of the overall stone placement on this portion of Jetty A and there is very little or no existing jetty stone expected to be present within this elevation range. About 4,740 cy of rock will be placed between MHHW and MLLW. This represents a 26% of the overall stone placement on this portion of Jetty A and there is very little or no existing jetty stone expected to be present within this elevation range. About 5,420 cy of rock will be placed below MLLW. This represents 30% of the overall stone placement on this portion of Jetty A and a 1783% change from the existing jetty prism, as there is very little or no existing mounded jetty stone expected to be present within this elevation range.

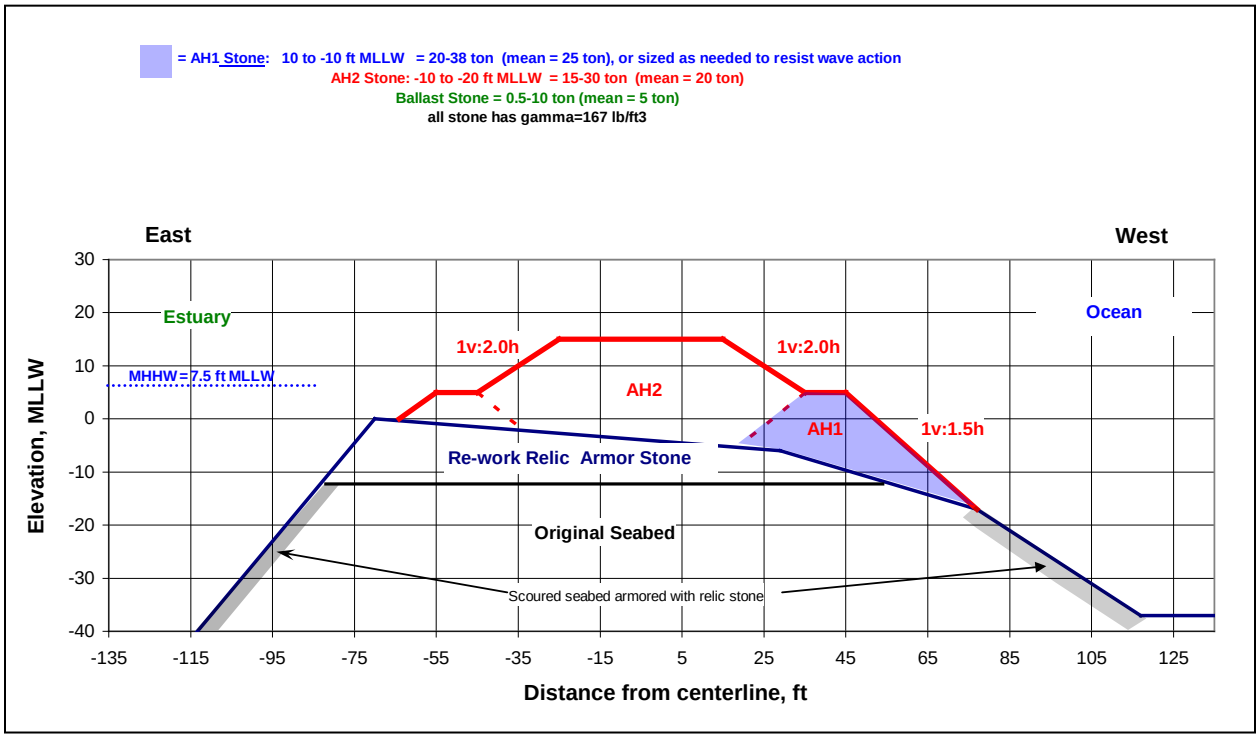
In all zones, all proposed stone placement will occur on existing base relic stone that formed the original jetty cross-section and was displaced and flattened by wave action, and does not include any modification that changes the character or increases the scope or size of the original structure design. The terminus of the head is simply closer to shore on a shorter jetty structure. . The footprint of the existing jetty mound on the flattened relic stone is approximately 0.64 acres, and the additional capping on the relic stone increases the width of the prism approximately 0.09 acres, for a total footprint of 0.73 acres on the existing relic stone.

Table 9. Jetty A Head Cap Feature

Features	Jetty A
Location of cap	stations 91 to 93
Timing of construction	2015
Dimensions of cap: length x width x height (feet)	200 x 160 x 40 (0.73 acres)
Stone size	30 to 40 tons
Area affected (outside relic stone)	None
% of cap constructed on relic stone	100%
Construction method	Land-based crane

Figure 25. Jetty A Head Cap





CONSTRUCTION MEASURES AND IMPLEMENTATION ACTIVITIES

Construction Schedule and Timing

The preferred in-water work window for the Columbia River estuary at the mouth is 1 November to 28 February. However, seasonal inclement weather and sea conditions preclude safe, in-water working conditions during this timeframe. Therefore, it is likely that most of in-water work for constructing spur groins, head capping, cross-section repairs, constructing off-loading facilities, etc. will occur outside this period during calmer seas, mostly between April and October.

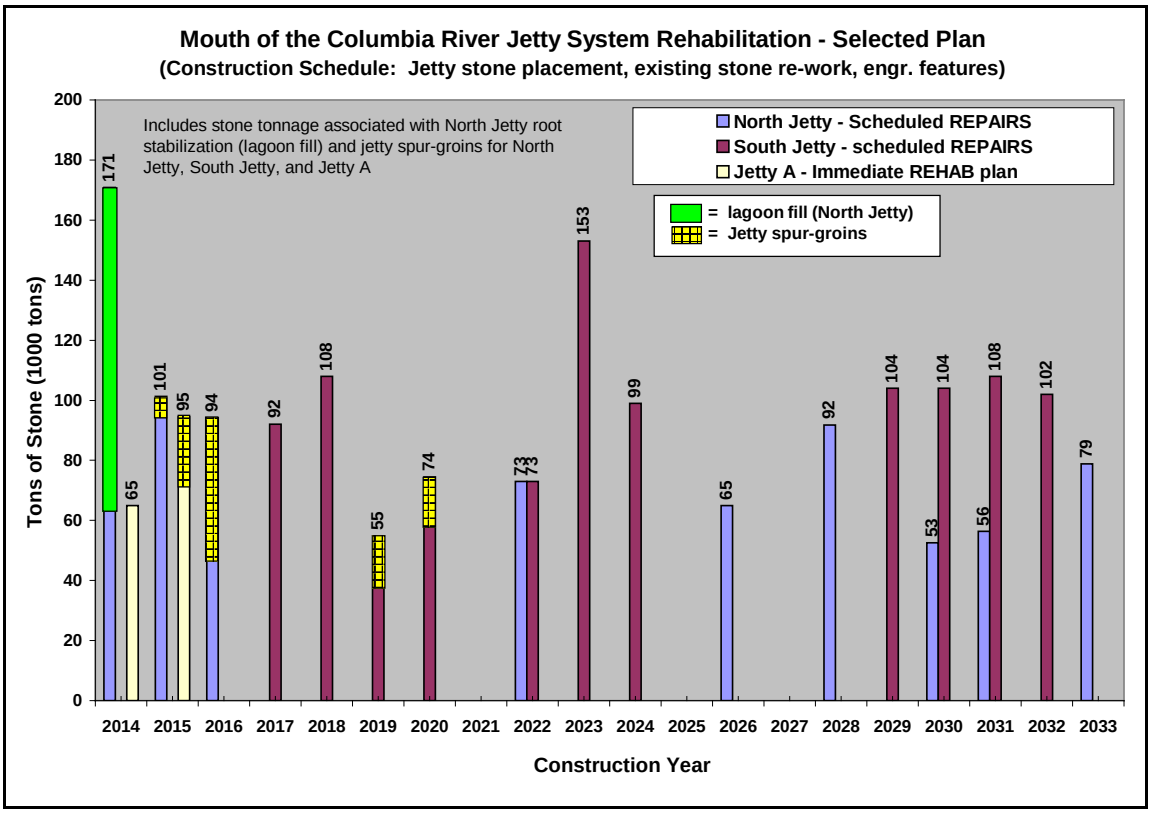
Most landward work on the jetties will be occurring from 1 April to 15 October. Work is assumed to occur 1 June to 15 October on the more exposed sections of the jetties. Placement work may extend beyond these windows if weather and wave conditions are conducive to safe construction and delivery. Stone delivery by land or water could occur year-round, depending on delivery location and weather breaks. Barge delivery would most likely occur during the months of April through October or at other times of the year depending on breaks in the weather and which jetty is being used. Quarrying of the rock may be limited to the months of April through October depending on the regulations pertinent to each quarry.

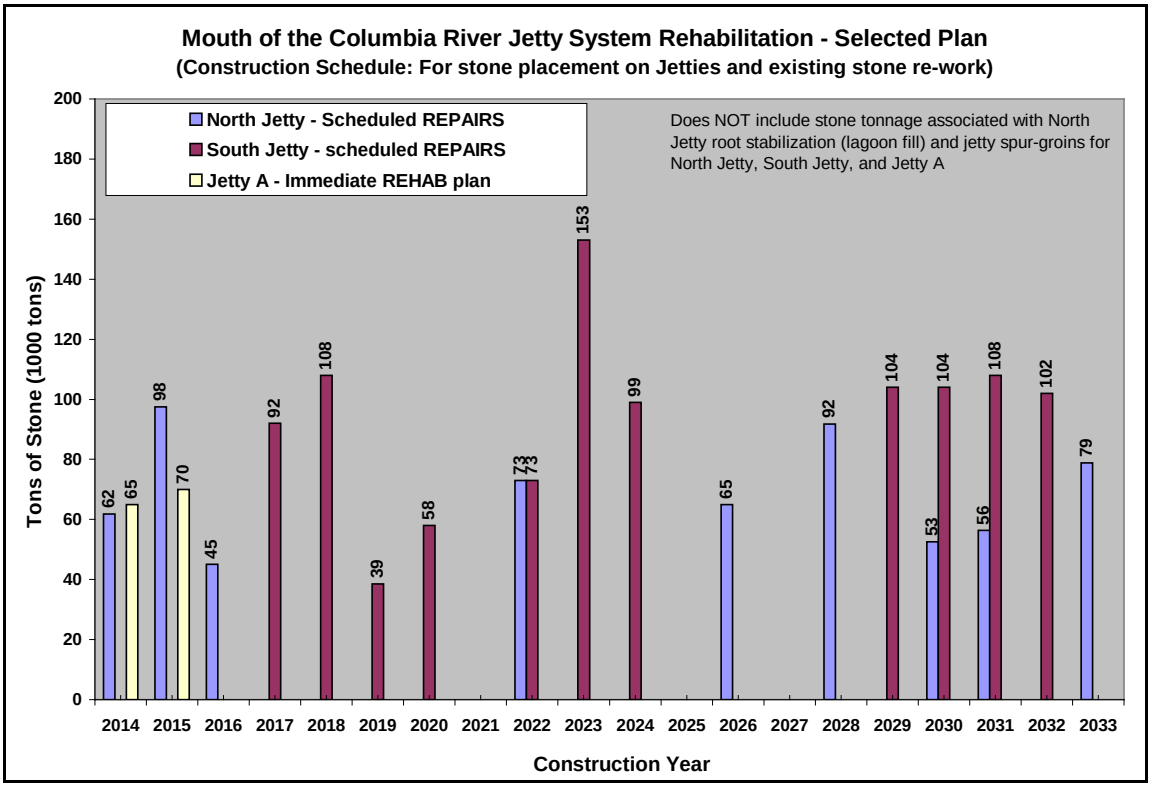
Work elements fall into four general categories for scheduling: (1) rock procurement, quarrying, and delivery transport, (2) construction site preparation, (3) lagoon fill and dune augmentations, and (4) jetty repair and rehabilitation work with construction of the design features including head capping and spur groins. Site preparation would consist of the preparation of the rock stockpile storage and staging areas, as well as the construction of any barge-offloading facilities that may be required. Approximate transport quantities by method are 30 tons per truck and 6,500 tons per barge. The majority of the jetty rehabilitation work is expected to be conducted from the top of the jetty downward using an excavator or a crane. Areas which may require marine plant work include construction at the jetty heads and some of the deeper spur groins.

For design and cost-benefit estimates, the project was modeled and designed for a 50-year operational lifespan. The schedule shown in Figure 26 illustrates construction actions related to building engineered features anticipated to occur at any one or some combination of all three of the jetties for the duration of 20 years. It also includes a predicted schedule of repair actions that the Corps' model estimates will be necessary within that same time period. Additional repairs have also been predicted to occur after the initial 20-year construction schedule and within the 50-year lifespan of the project. Additional repairs beyond the 20-year schedule will be similar in scale and nature to those described above in the standard repair template. Repair actions are generally triggered when a cross-section of the jetty falls below about 30%-40% of the standard repair template profile. The schedule described further in the narrative is a combined reflection of constructing specific engineered features and forecasting needed repairs. Real-time implementation of repair actions will likely vary based on evolving conditions at the jetties and could be shifted within and beyond this 20-year construction schedule.

In the construction schedule, rock production and stockpiling material begins in 2013. The first jetty installation is scheduled for late spring 2014 and continues through 2033. The estimate assumes the work will be accomplished with multi-year contracts.

Figure 26. Construction Schedule





Due to pinniped use at the South Jetty, the Corps proposes to conduct monitoring per conditions in the expected IHA permit. The Corps anticipates that the new IHA permit will entail requirements similar to those in the previous permit. These previous requirements included monitoring and reporting the number of sea lions and seals (by species if possible) present on the South Jetty for 1 week before (re)starting work on this jetty. During construction, the Corps provided weekly reports to the NMFS, which included a summary of the previous week's numbers of sea lions and seals that may have been disturbed as a result of the jetty repair construction activities. These reports included dates, time, tidal height, maximum number of sea lions and seals on the jetty and any observed disturbances. The Corps also included a description of construction activities at the time of observation. Post-construction monitoring occurred with one count every 4 weeks for 8 weeks, to determine recolonization of the south jetty. The Corp anticipates future monitoring and reporting requirements will be similar and will designate a biologically trained on-site marine mammal observer(s) to carry out this monitoring and reporting. The Corps will submit the required reports to the NMFS and the AMT. The Oregon Department of Fish and Wildlife, who monitors sea lion use of the South Jetty, will also be apprised of the Corps work and results of the monitoring efforts.

Conservation Measures the Corps will implement in order to minimize disturbance to Stellar sea lions includes the following; during land-based rock placement, the contractor vehicles and personnel will avoid as much as possible direct approach towards pinnipeds that are hauled out. If it is absolutely necessary for the contractor to make movements towards pinnipeds, the contractor shall approach in a slow and steady manner to reduce the behavioral harassment to the animals as much as possible. Monitoring and reporting will occur as required.

Construction Sequence and General Schedule

Rock procurement activities will be initiated for the North Jetty repair in 2013. In 2014, the on-site work will begin with filling the lagoon area behind the North Jetty root (stations 20 to 60) and installing a culvert to divert overland flow to another area that will not impact the North Jetty root stability. The lagoon area will be filled with rock, gravel, and sand. Once the lagoon is filled, the filled portion will serve as a staging and stockpile area for the rock delivered to the North Jetty site. To control further head recession of the North Jetty, in 2014 construction will focus on reconstructing the jetty head (station 88 to 99). This work will require haul road construction on top of the jetty from station 70 out to the head requiring approximately 31,000 tons of rock. The North Jetty will require installing a barge offloading facility on the channel side of the jetty at approximately station 45+00. Dredging of 30,000 cy is anticipated to provide the minimum 25-ft working clearance. Concurrently, work will begin on Jetty A beginning with constructing the off-loading facility, 60,000 cy of dredging to accommodate the rock delivery by barge, and constructing the jetty crest haul road from station 40+00 to 80+00. Total new stone consists of approximately 50,000 tons of imported rock, equivalent to 1,700 trucks or 8 barges.

In 2015 construction will continue on the North Jetty head from station 99 to 101 and installation of one spur groin at station 50 on the channel side. The haul road will need to be reworked with approximately 26,000 tons of new topping material. Work will occur concurrently with Jetty A beginning with 60,000 cy of dredging, completion of the jetty crest haul road from station 80 to 93, and installation of two spur groins. Total new stone for 2015 would consist of approximately

160,000 tons of imported rock, equivalent to 5,400 trucks or 25 barges. Work on Jetty A shall be completed this year.

In 2016, work continues on the North Jetty with placement of 36,000 tons of large armor near the head at station 80 to 88. This requires refurbishing the haul road and building vehicle turnouts. In addition, three spur groins will be installed at station 70-C, 80-O, and 90-C with a total of 50,000 tons of new stone. Total new stone would consist of approximately 86,000 tons of imported rock, equivalent to 2,900 trucks or 13 barges. Site preparation work and stockpiling stone at the South Jetty will occur to prepare staging and stockpile areas for 2017 construction.

In 2017, construction on the South Jetty is projected to begin, starting with construction work near the head from stations 173 to 176 and 180 to 195. South Jetty construction will require either a haul road be constructed on top of the jetty or constructed from a marine plant in order to get out to the head. Total work effort in 2017 is projected to consist of approximately 74,000 tons of rock; equivalent to 2,500 trucks or 12 barges.

Work continues on the South Jetty for the next 3 years working towards the head in 2018 with a total of 86,000 tons of new armor at station 290 to 311. Head construction begins in 2019 with 30,000 tons of new head armor and installation of 4 spur groins at stations 165–O, 210-C, 230-C, and 265-C for a total of 9,000 tons of spur groin rock. The South Jetty head completes in 2020 with 44,000 tons of new stone.

In 2022, construction is projected to occur concurrently on the North and South jetties: (1) continuation of North Jetty stone placement station 40 to 45 and station 65 to 73; and (2) continuation of stone placement on the South Jetty station 160 to 163, station 170 to 173, station 176 to 180, and station 195 to 200. Total rock tonnage for 2022 is estimated at 115,000 tons, equivalent to 3,850 trucks or 18 barges.

In 2023, construction continues on the South Jetty with the placement of approximately 118,000 tons of rock between stations 205 to 250. The haul road will need to be reworked with approximately 62,000 tons of quarry stone road base and topping material. Total jetty stone rock tonnage to be placed would require 4,000 trucks or 18 barge loads.

In 2024, construction continues on the South Jetty with the placement of approximately 76,000 tons of rock between stations 270 to 290. Total rock tonnage to be placed would require 2,600 trucks or 12 barge loads.

In 2026, construction resumes on the North Jetty with the placement of approximately 52,000 tons of rock between stations 20 to 30. The long time frame from the previous construction on the North Jetty will also require rebuilding the jetty haul road from station 20 to 30. Total rock tonnage to be placed would require 1,800 trucks or 8 barge loads.

In 2030, construction is projected to occur on the North and South jetties: (1) continuation of North Jetty stone placement station 30 to 40; and (2) continuation of stone placement on the South Jetty station 223 to 237, and station 250 to 253. Total rock tonnage to be placed is estimated at 129,000 tons, equivalent to 4,300 trucks or 20 barges.

In 2031, construction is projected to occur on the North and South jetties: (1) continuation of North Jetty stone placement station 88 to 99; and (2) continuation of stone placement on the South Jetty station 253 to 270. The North Jetty haul road will need to be re-built from station 65 to 99 and will require 30,000 tons of quarry waste material. Total armor stone rock tonnage to be placed is estimated at 135,000 tons, equivalent to 4,500 trucks or 21 barges.

In 2032, construction continues on the South Jetty with the placement of approximately 85,000 tons of rock between stations 295 to 311. Total rock tonnage to be placed would require 2,850 trucks or 13 barge loads. The offloading facility will be removed and scheduled construction will be complete for the South Jetty.

The final anticipated year of North Jetty rehabilitation is projected for 2033 with construction from stations 80 to 88. Total rock tonnage estimated is 63,000 tons, equivalent to 2,100 trucks or 10 barge loads. The offloading facility will be removed and scheduled construction will be complete for the North Jetty.

Because construction at the North and South jetties is spaced out from 2014 through 2033 with intermittent work, dredging at the barge offloading sites will only be required prior to a year of actual rock delivery in preparation for upcoming construction work. The Jetty A barge offloading site will only require dredging to make that site accessible for 2 years. Dredging will only be needed if the clearance depth at the barge offloading site is not found to be adequate prior to rock delivery activities.

Sources and Transportation of Rock

Rock Quarries and Transport

Currently, it is not exactly known where jetty rock will come from and how it will be transported to the jetty sites. However, one or more of the options discussed below would be employed (Figures 27 to 32 and Table 10). Stone sources located within 150 miles of a jetty are likely to be transported by truck directly to the jetty. Stone sources located at further distances, especially if they are located near waterways, are likely to be transported by truck to a barge onloading facility, then transported by tug and barge to either a Government-provided or commercial barge offloading site located nearby. Railway may also be an option for transporting stone, provided that an onloading site is convenient to the quarry. Most railroads follow main highway arterials, such as Interstate 5. The closest railroad terminal to the MCR South Jetty is at Tongue Point, east of Astoria, Oregon, which is about 15 miles from the jetty. The nearest railroad terminal to the MCR on the north side of the Columbia River is at Longview, Washington.

The Corps intends to use operating quarries rather than opening any new quarries. The Contractor and quarry owner/operator will be responsible for ensuring that quarries selected for use are appropriately permitted and in environmental compliance with all State and Federal laws.

Canadian Quarries. Quarries in British Columbia are typically located adjacent to waterways and rock produced from these quarries will likely have a limited truck haul. Due to the long distance to the MCR, plus the immediate availability to deep water, rock would likely be loaded onto barges and shipped down the Washington Coast to barge offloading sites.

Washington Quarries. Quarries located in northern Washington are typically not on the water, but are generally located within 50 miles of a potential barge on-loading site. As a result, rock would need to be hauled, at least initially, by truck. Rock would be transported by trucks most likely to a barge on-loading facility or possibly all the way to the staging site at the jetty. In the event of a combination of trucking and barging, trucks would be loaded at the quarry, and then traverse public roads to existing facilities. Once the rock is loaded on barges, it would be transported down the coast to barge offloading sites.

It also is possible that railway systems may be used to transport rock much of the way to the jetties. Burlington Northern Railroad operates a rail system that parallels Interstate 5 throughout Washington which would be the most likely route rock would be transported. Rock from the quarry would be taken by truck to a nearby railway station where they would be loaded onto railway cars and transported to an intermediate staging area. Trucks would then again take the rock the remainder of the way to the jetty staging areas.

Truck hauling of rock from northern Washington sources to the North Jetty or Jetty A most likely would be transported by public road to Interstate 5 or any of the main roads over to Highway 101. Trucks using Interstate 5 would either turn at Longview on Highway 4 to Highway 101, or cross over the Longview Bridge to Highway 30 near Rainier, Oregon. From this point they would proceed west to Astoria to Highway 101, crossing the Astoria-Megler Bridge through Ilwaco to the jetty staging areas. Delivery to the South Jetty most likely would use main roads to Interstate 5 or any of the main roads over to Highway 101.

Trucks using Highway 101 south through Washington would likely cross the Astoria-Megler Bridge, go through Warrenton using local roads into Fort Stevens State Park and the staging area. Trucks utilizing Interstate 5 would either turn at Longview on Highway 4 to Highway 101, or on Highway 30 near Rainier, proceeding through Astoria to Highway 101, going through Warrenton through local roads into Fort Stevens State Park and the jetty staging area.

Rock located within southern Washington would likely be trucked to the jetty staging areas. An exception to this would be a quarry that occurs within just a few miles of a port on the Washington Coast or a quarry that is near the Columbia River. In either of these two barge possibilities, rock would be delivered by truck to a barge on-loading facility, loaded on oceangoing or riverine barges, and delivered to one of the barge offloading facilities (see section on barge offloading facilities below). Truck hauling of rock from this area to the jetties would be as described above.

Oregon Quarries. Rock located in northern Oregon within 50 miles of the North Jetty and Jetty A would likely utilize any of the main roads over to Highway 101 or Highway 30. From this point they would cross the Astoria-Megler Bridge and proceed west through Ilwaco to the jetty staging areas. Quarries exceeding 50 miles from the jetties would likely utilize main roads at a farther distance from the jetty sites. This would involve longer haul distances on Highways 101, 30, 26, and others before crossing the Astoria-Megler Bridge and proceeding to the staging areas.

Truck hauling of rock from quarries within 50 miles of the South Jetty will most likely utilize any of the main roads over to Highway 101 or Highway 30. From this point they would proceed through Astoria and Warrenton, or Seaside and Gearhart to local roads leading to Fort Stevens State Park and the jetty staging areas. Quarries exceeding 50 miles from the jetty would likely utilize main roads at a farther distance from the jetty site. This would involve longer haul distances on Highways 101, 30, 26, and others before going through Astoria and Warrenton, or Seaside and Gearhart to local roads leading into Fort Stevens State Park and the staging areas.

The likely mode of transportation from southern Oregon quarries is trucking, or a combination of trucking and barging. Many of the quarries may be near the Oregon Coast; however, they may not be near a port facility that has barge on-loading capability. Providing that barge facilities are available, rock located south of Waldport would be loaded at the quarry onto trucks and traverse main public roads to the barge on-loading site, loaded on ocean-going barges, and shipped up the Oregon Coast to one of the barge offloading facilities (see section on barge offloading facilities below). Quarries north of Waldport would most likely be hauled by truck the entire distance.

Southern Oregon rock sources requiring trucking would be loaded onto lowboy trucks one to three at a time and would traverse main roads to more main arterials such as Highway 101 or, to a lesser degree, Interstate 5. An effort would be made to use the least distance possible to transport the rock without sacrificing transport time.

California Quarries. For northern California quarries, there would be a very long haul distance required to get rock to the jetty repair areas. Barging of rock would be the only economically feasible option. Rock would be transferred by truck from the quarries along main roads leading to Highway 101 to a barge offloading facility.

Figure 27. Potential Quarry Locations (red dots) for Repairs to MCR Jetties

See corresponding quarry information located in Table 10.

Table 10. Quarry Information

See Figure 27 for site map.

No.	Quarry	County and State	Nearest City	Road Miles from MCR	Unit Weight (pcf)	Reserves Available (tons)	Likely Transportation Method	Nearest Barge Facility
1	Columbia Granite Quarry	Thurston, WA	Vail, WA	129	168.5	28 M	Truck	N/A
2	Beaver Lake Quarry	Skagit, WA	Clear Lake, WA	251	181.1	1.86 M	Truck, then Barge	Anacortes, WA
3	Texada Quarry	BC, CANADA	Texada Island, BC	363	173.5+	275 M	Barge	Onsite
4	Stave Lake Quarry	BC, CANADA	Mission, BC	311	169.1	74 M	Truck, then Barge	Mission, BC, Canada
5	192nd Street Quarry	Clark, WA	Camas, WA	109	168.5	0.5 M	Truck/Barge	Camas, WA
6	Iron Mountain Quarry	Snohomish, WA	Granite Falls, WA	225	174	Unknown	Truck	N/A
7	Marble Mount Quarry	Skagit, WA	Concrete, WA	276	189.7	2 M	Truck, then Barge	Anacortes, WA
8	Youngs River Falls Quarry	Clatsop, OR	Astoria, OR	20	181.8	0.5 M+	Truck	N/A
9	Liscomb Hill Quarry	Humboldt, CA	Willow Creek, CA	515	179.1	0.5 M	Truck, then Barge	Eureka, CA
10	Baker Creek Quarry	Coos, OR	Powers, OR	275	200	Unknown	Truck, then Barge	Coos Bay, OR
11	Phipps Quarry	Cowlitz, WA	Castle Rock, WA	69	167.4	0.5 M	Truck	N/A
12	Cox Station Quarry	BC, CANADA	Abbotsford, BC	313	167.9	150 M	Barge	Onsite
13	Ekset Quarry	BC, CANADA	Mission, BC	309	172.2	10 M	Truck, then Barge	Mission, BC, Canada
14	Fisher Quarry	Clark, WA	Camas, WA	108	168.5	2 M	Barge	Camas, WA
15	Bankus Quarry	Curry, OR	Brookings, OR	347	183 & 195	0.7M	Truck, then Barge	Crescent City, CA

Figure 28. Potential Canadian Rock Source Transportation Routes

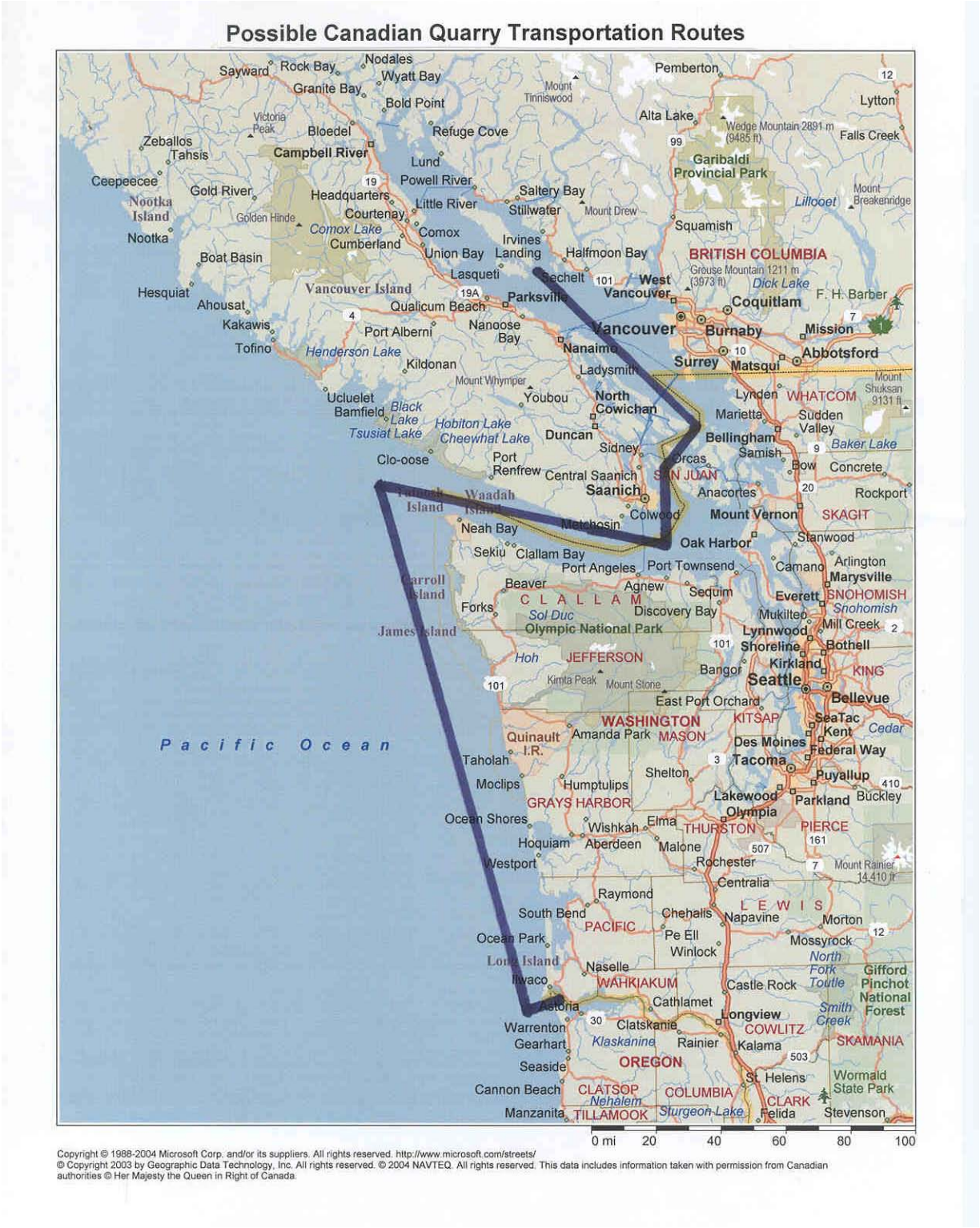


Figure 29. Potential Washington Rock Source Transportation Routes

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Figure 30. Potential Oregon Rock Source Transportation Routes

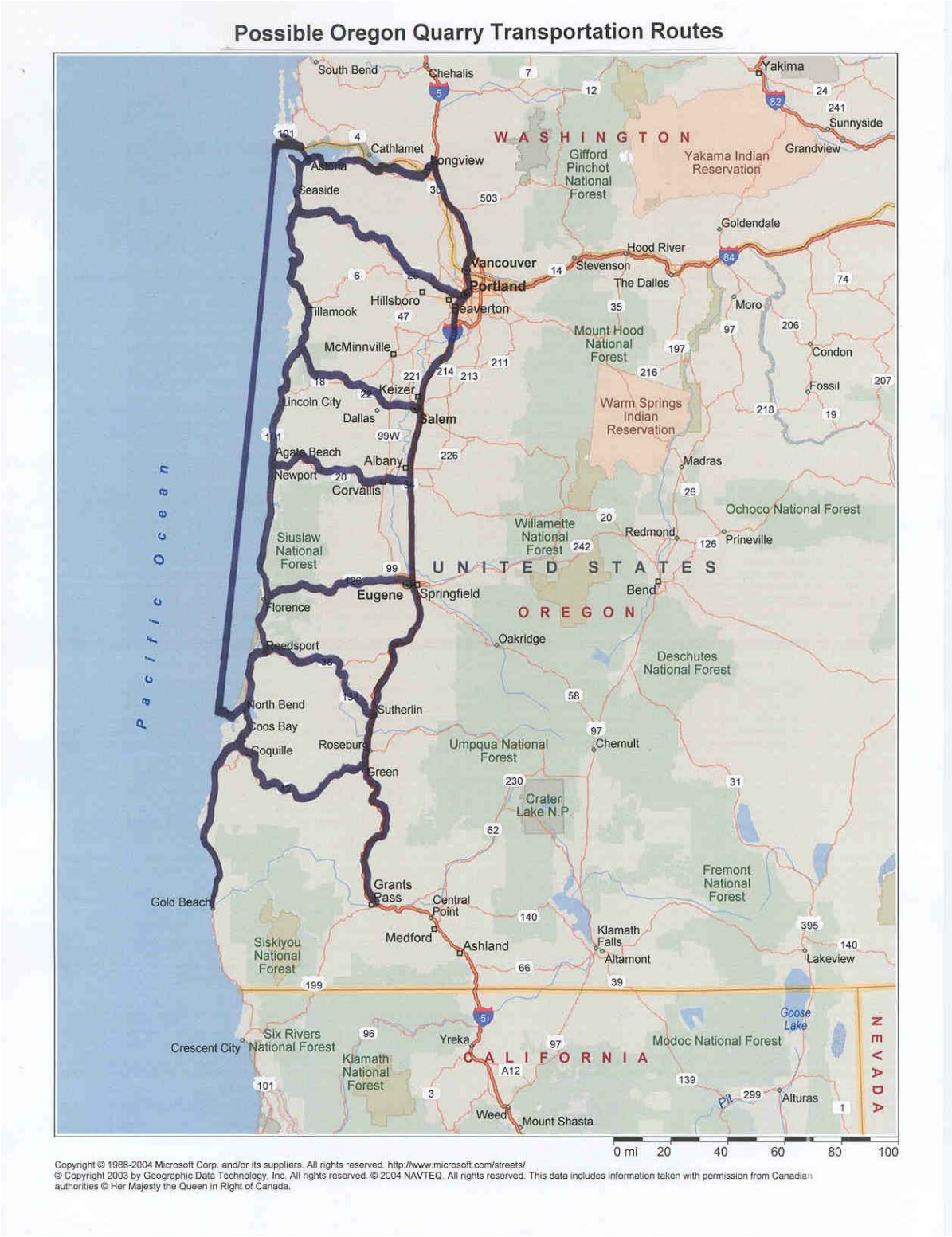


Figure 31. Potential Northern California Rock Source Transportation Routes

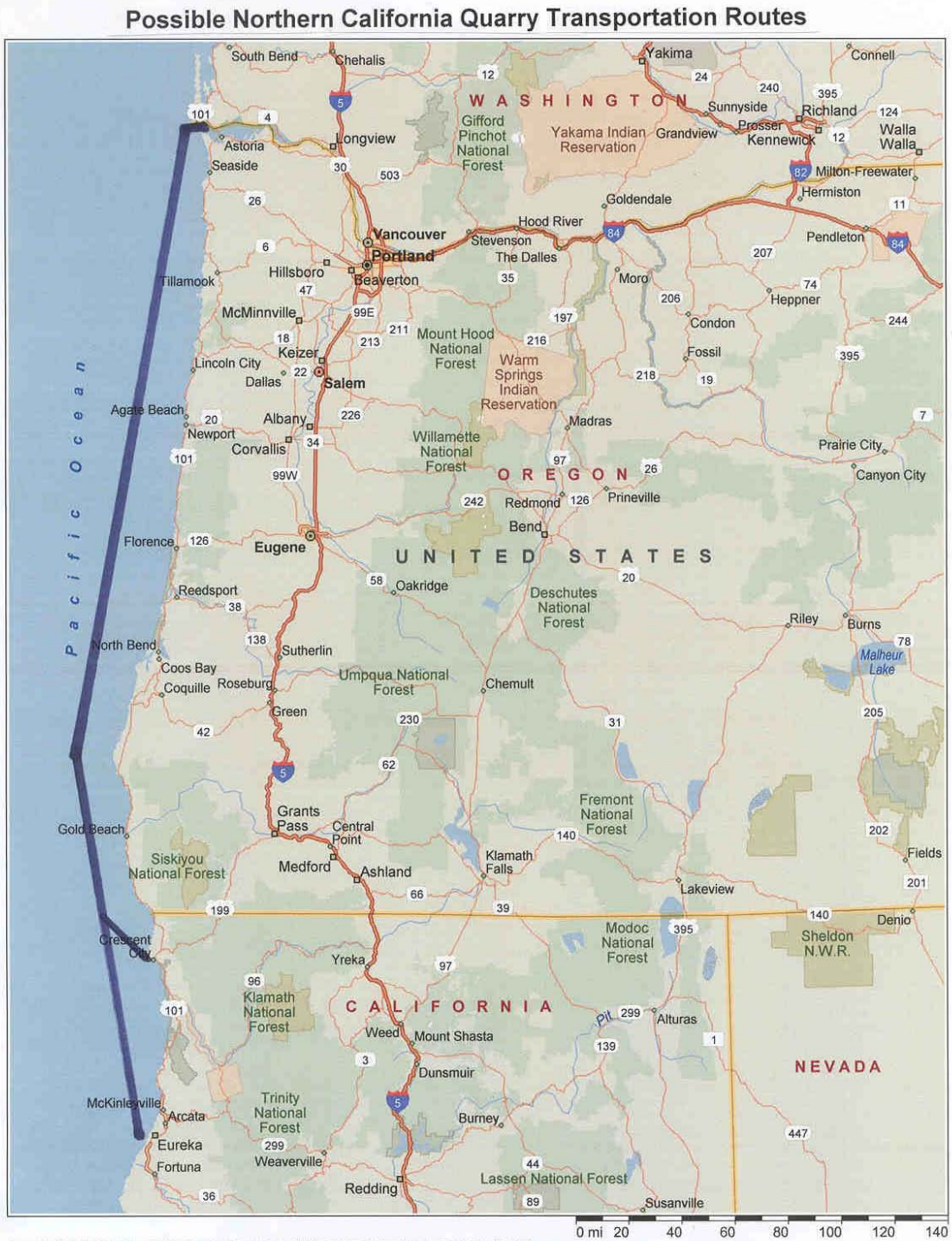


Figure 32. Potential Railway Transportation Routes

For water-based delivery of rock, a tow boat and barge would deliver the rock to the channel side of the jetties where water depth, waves, and current conditions permit. During rock offloading, the barge may be secured to approximately 4 to 8 temporary dolphins/H-piles to be constructed within 200 feet of the jetty. Rock would be off-loaded from the barge by a land- or water-based crane and either placed directly within the jetty work area or stock piled on the jetty crest for subsequent placement at a later time.

For land-based delivery of rock, jetty access for rock hauling trucks would be via an existing paved road to the Benson Beach parking lot at Cape Disappointment State Park (North Jetty) and via an existing paved road to the Parking Lots C and D at the South Jetty. An existing overland route between Jetty A and North Jetty may also be used for land-based hauling. Work areas for delivery of rock, maneuvering of equipment, and stockpiling of rock near the jetties have been identified and are shown in Figures 33-35.

Barge Offloading Facilities

Stone delivery by water could require up to four barge offloading facilities that allow ships to unload cargo onto the jetty so that it can then be placed or stockpiled for later sorting and placement. The range of locations for these facilities is shown in Figures 33-35. Depending on site-specific circumstances, offloading facilities may be converted to spur groins, may be partially removed and rebuilt, may be permanently removed, or may remain as permanent facilities upon project completion. Facility removal will depend on access needs and evolving hydraulic, wave, and jetty cross-section conditions at each offloading locations.

Facilities will range from approximately 200- to 500-ft long and 20- to 50-ft wide, which ranges from about 0.48 to 2.41 acres in total area. For initial construction of all four facilities combined, approximately up to 96 Z- or H-piles could be installed as dolphins, and up to 373 sections of Z- or H-piles to retain rock fill. Figure 36 shows a cross section diagram for stone access ramp at potential barge offloading facilities and photos illustrating typical barge offloading facilities. Facilities will have a 15-ft NGVD crest elevation and will be installed at channel depths between -20 and -30 NGVD. A vibratory hammer will be used for pile installation and only untreated wood will be used, where applicable. Removal and replacement of the facilities could occur within the duration of the construction schedule. Volume and acreage of fill for these facilities are shown in Table 11.

Table 11. Approximate Rock Volume and Area of Barge Offloading Facilities and Causeways

Location	Approximate Length (ft)	Approximate Rock Volume (cy) Below 0 MLLW	Total Approximate Rock Volume (cy)	Approximate Square Feet	Acres
North Jetty	200	7,778	29,640 cy	21,000	0.48
Jetty A – near head	200	7,778	29,640 cy	21,000	0.48
Jetty A – mid-section causeway	5000	38,888	38,888	105,000	2.41
South Jetty – Parking Area D	450	17,417	33,688 cy	47,250	1.08
South Jetty – Along Jetty Turn-out	200		18,640 cy	21,000	0.48

Figure 33. North Jetty Offloading, Staging, Storage and Causeway Facilities

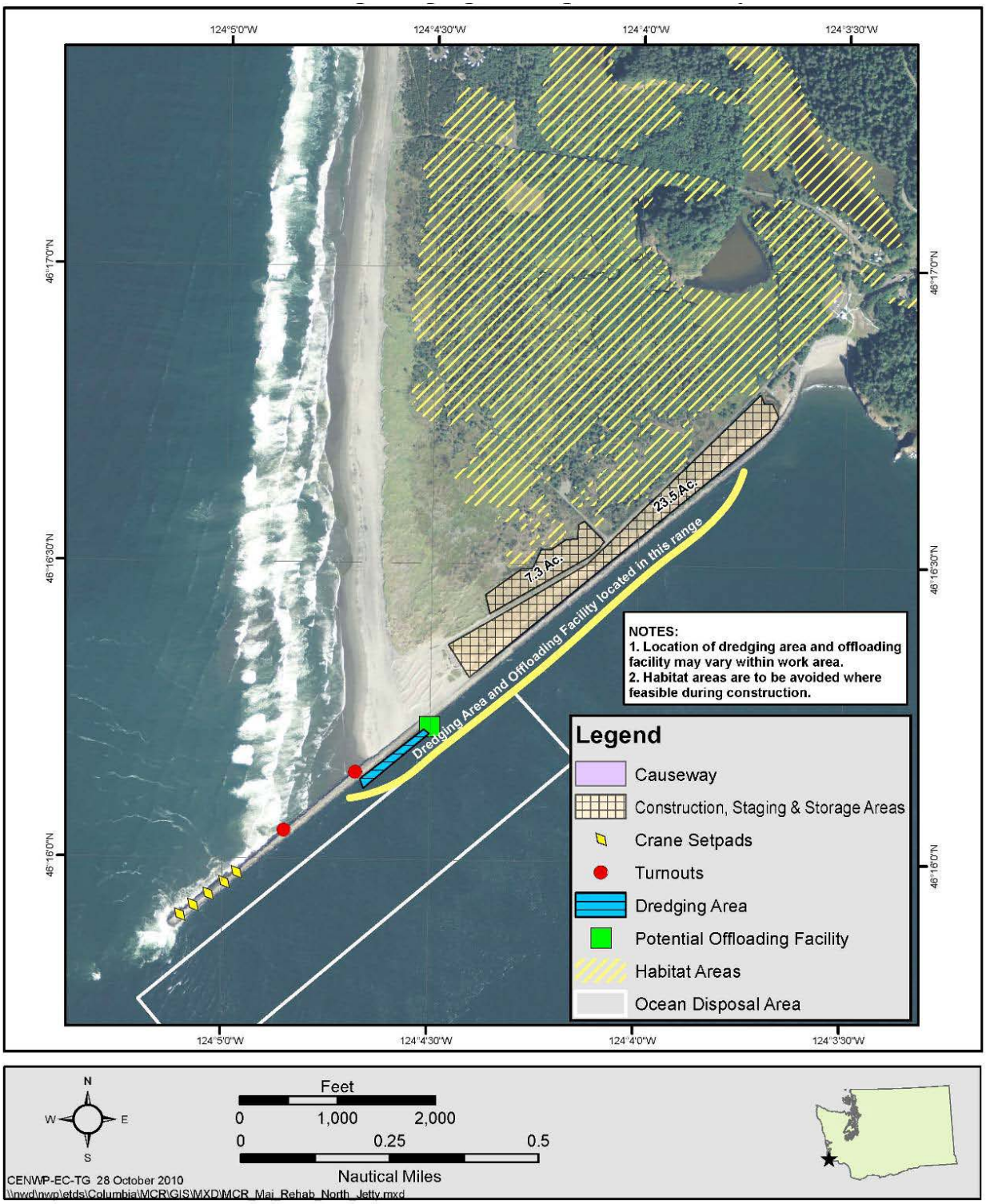


Figure 34. South Jetty Offloading, Staging, Storage and Causeway Facilities

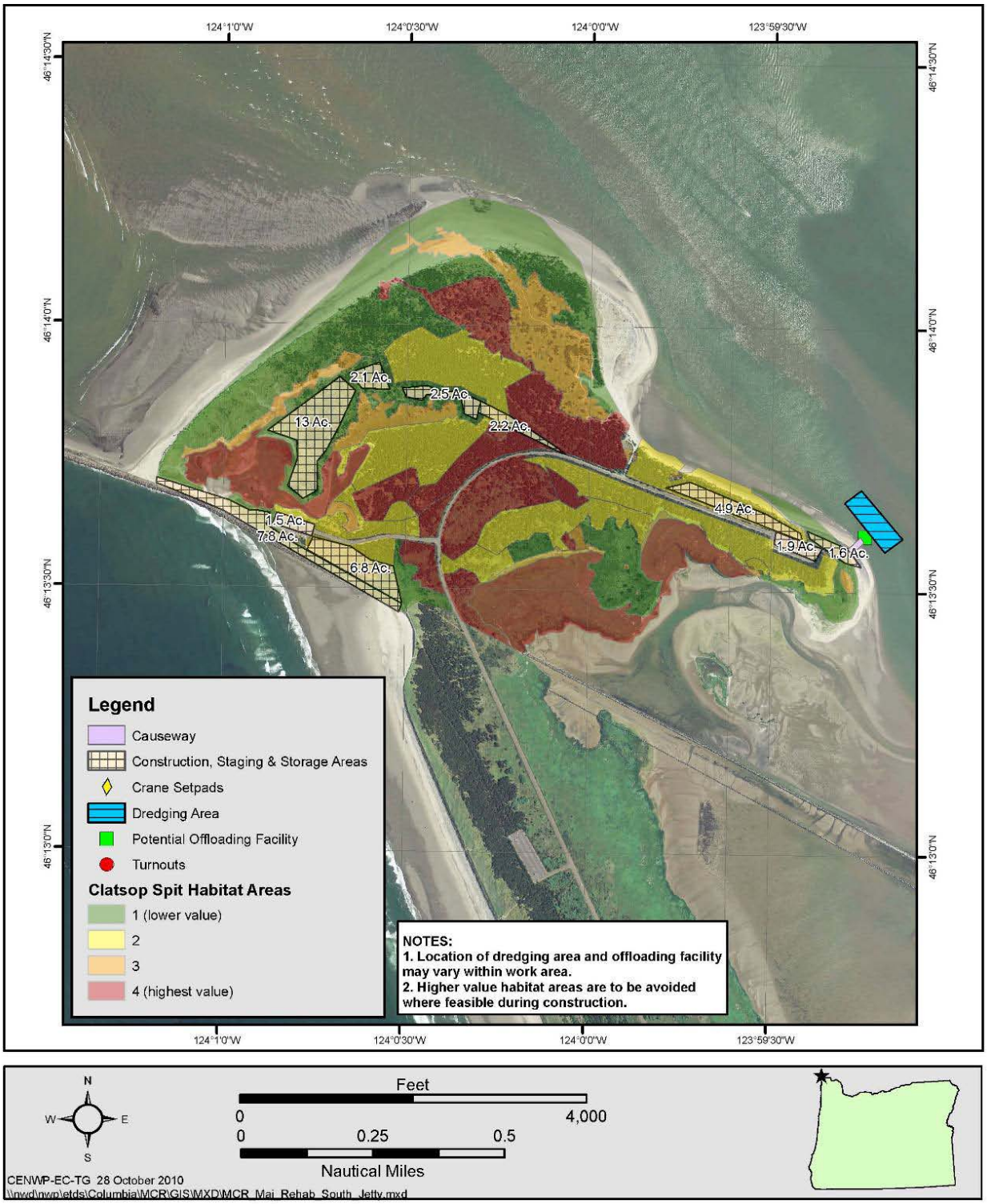


Figure 34 (continued). South Jetty Offloading, Staging, Storage and Causeway Facilities

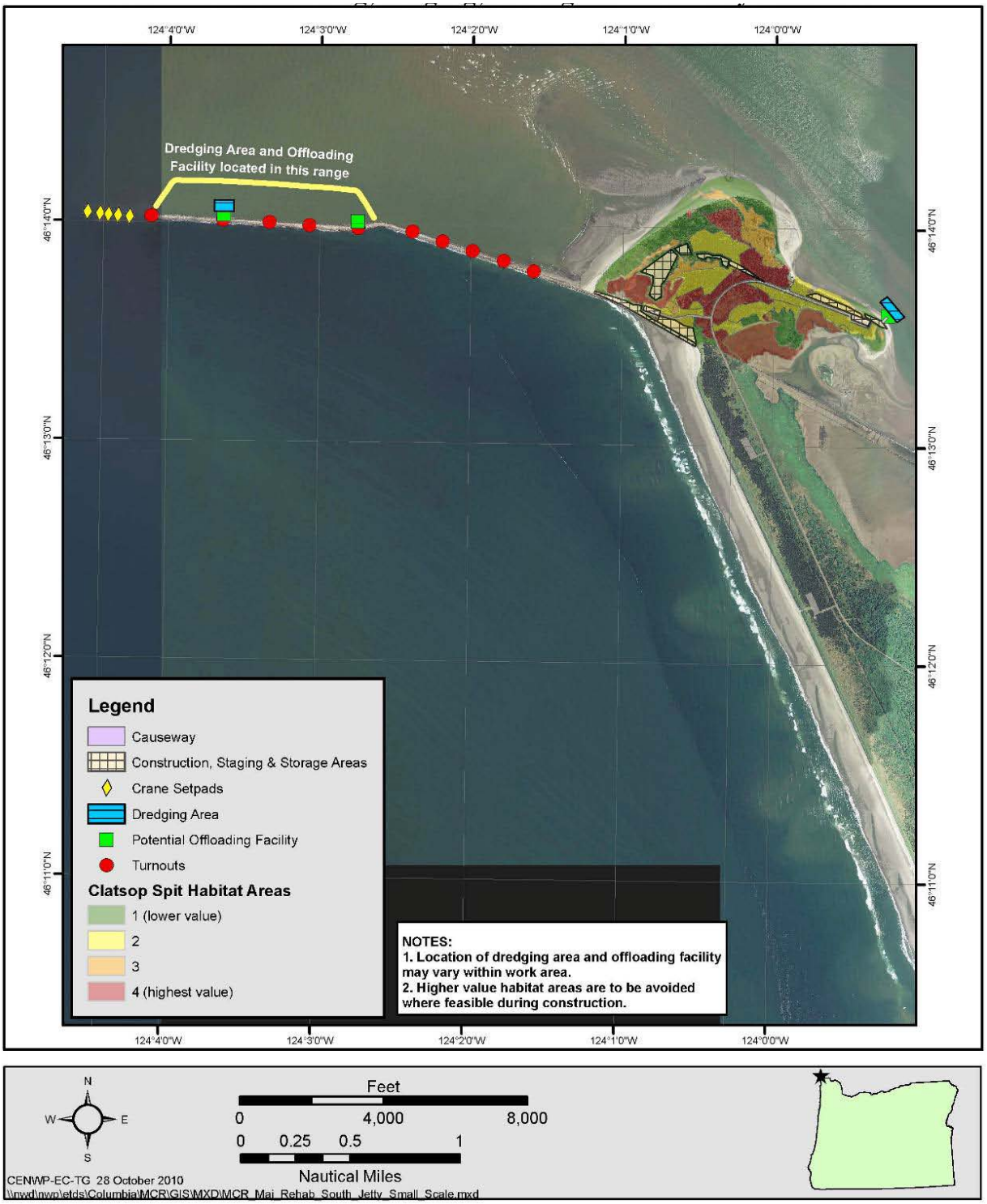


Figure 35. Jetty A Offloading, Staging, Storage and Causeway Facilities

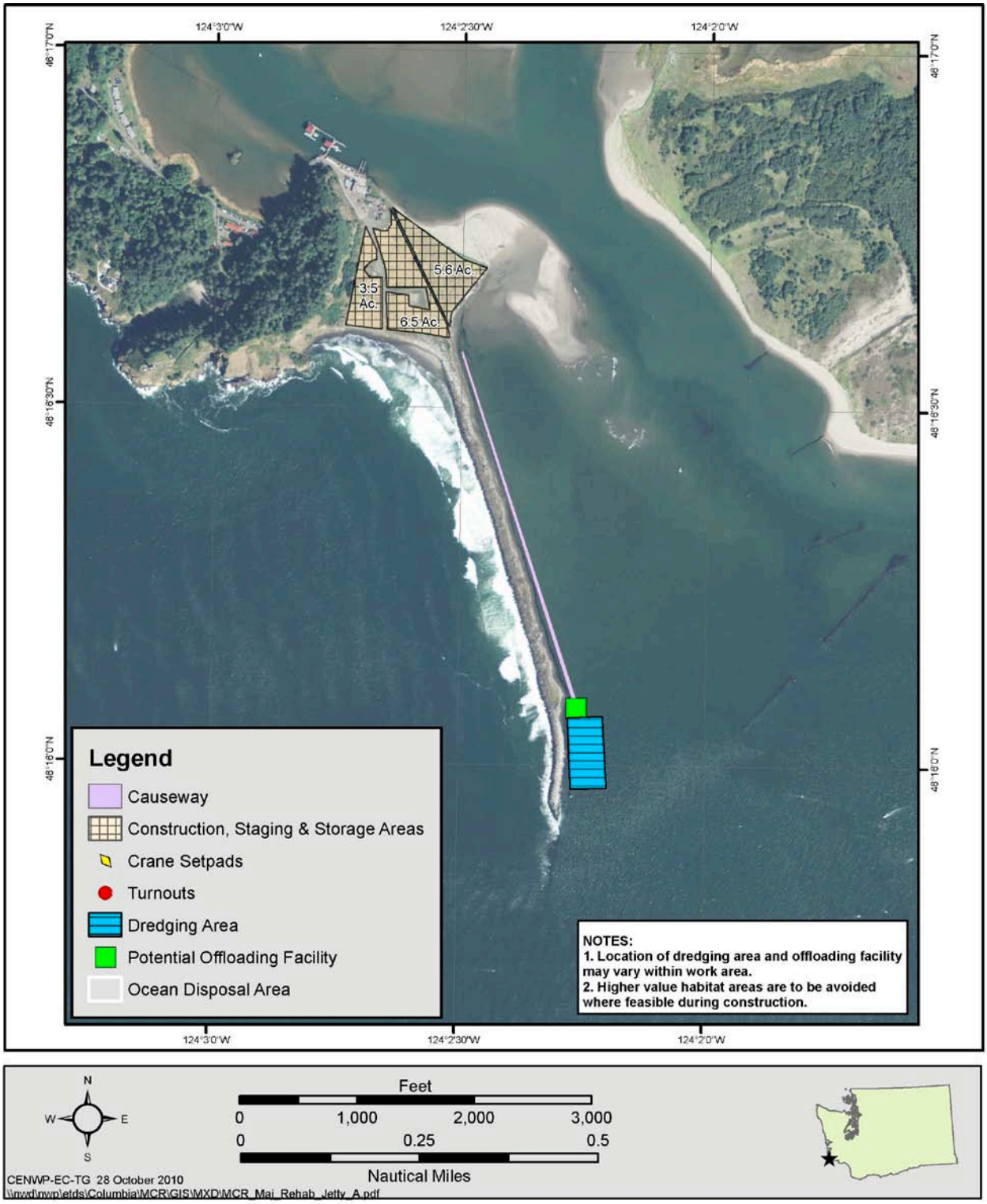


Figure 36. Cross Section of Stone Access Ramp at Barge Offloading Facilities at East End of Clatsop Spit near Parking Area D and Photos of Typical Barge Offloading Facilities

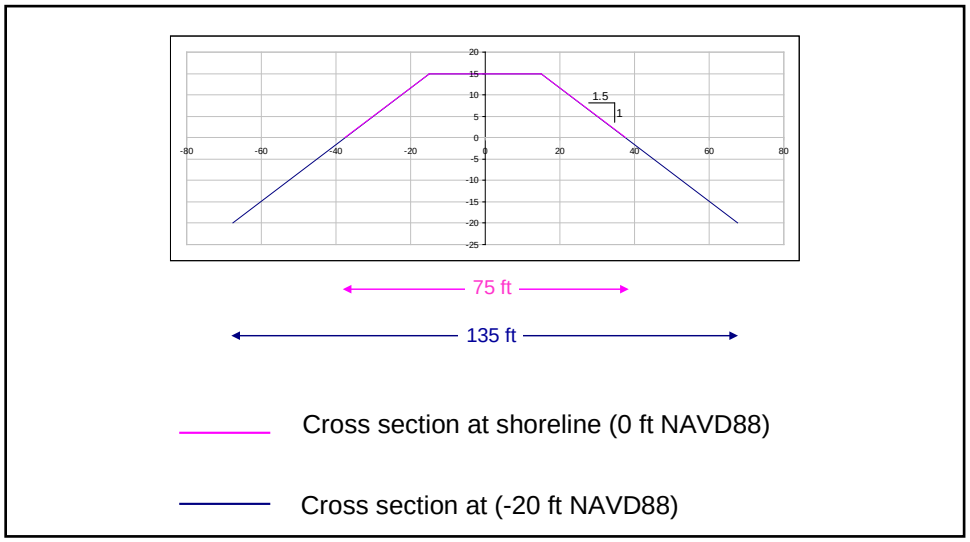


Figure 36 (continued)

The following existing private facilities may serve as potential offloading sites depending on availability for Corps' use:

- Commercial Site in Ilwaco. For the North Jetty, barges would pull up to a dock at Ilwaco where rock would be transferred by crane onto trucks that would proceed by public road to Cape Disappointment State Park. Trucks would then pass through the park grounds to the staging area adjacent to the jetty. For Jetty A, trucks would proceed through the Coast Guard facility to the staging area near the root of the jetty.

- Commercial Site in Warrenton. Nygaard Logging has a deep-water offloading site that could be used to offload rock. For the North Jetty/Jetty A, rock would be transferred to trucks that would likely use Highway 101 into Astoria, cross the Astoria-Megler Bridge, and head west through Ilwaco to Cape Disappointment State Park. Trucks would then pass through the park grounds to the staging area adjacent to the jetty. For the South Jetty, rock would be transferred to trucks which would then proceed west through Hammond to Fort Stevens State Park and use the existing park road to staging area adjacent to the jetty. This site needs no improvement to accommodate deep-draft vessels.

If existing facilities are not available or do not have adequate capacity to provide access, barge offloading facilities could be constructed at each jetty.

- North Jetty: Between or on the spur groin at/between Station 50 or 70, a barge offloading facility will be constructed. If wave conditions make it feasible, the spur groin designed for this area will first function as an offloading facility prior to conversion and stone removal to reach the spur's design depth. Otherwise, a separate facility will be installed in the reach between these two stations such that wave conditions allow safe offloading. This offloading facility will require 4-8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at the offloading point.

- Jetty A: An offloading facility will be sited near the location of the proposed spur groin around Station 81, at the upstream portion of the jetty near the head. The proposed spur groin could not be used for dual purposes, because it would have required additional, unnecessary rock in order to connect the offloading facility with the causeway. A 15-ft causeway will also be constructed along the entire length of the jetty on existing relic stone that runs adjacent to and abutting the upstream eastern portion of the jetty. This facility will likely remain a permanent facility, but may deteriorate due to wave and tidal action. This offloading facility will require 4-8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at offloading point.

- South Jetty: The South Jetty could have up to two associated offloading sites. One will be located at Parking Lot Area D near the northeastern-most corner of the Spit. The second facility will be located along the jetty and will resemble an extra-large turn-out facility. It is likely to be located somewhere on the northern, channel-side of the jetty and west of Station 270 in order to take advantage of deeper bathymetry and subsequently less need for dredging. The facility at Parking Lot Area D may be removed after 5 or more years depending on hydraulic impacts of the structure and spit. The facility along the jetty will likely be partially removed and rebuilt after each repair to avoid the

potential for wave-focusing on the jetty. Otherwise, it will remain in place until around 2033. Each offloading facility will require 4-8 dolphins of 3 piles each for vessel tie-up, and sheet-pile installation will be required to shore-up and retain rock at offloading point.

Dredging for Barge Offloading Facilities

Transport of rock would most likely be done by ocean-going barges that require deeper draft (20-22 feet) and bottom clearance than river-going barges when fully loaded. Therefore, dredging will be required to develop each of the barge offloading facilities. Under-keel clearance should be no less than 2 feet. The elevation at barge offloading sites should have access to navigable waters and a dredge prism with a finish depth no higher than -25 feet MLLW, with advance maintenance and disturbance zone depths not to extend below -32 feet MLLW. These facilities should also provide for a maneuvering footprint of approximately 400 feet x 400 feet. The depth along the barge unloading sites would be maintained during the active period for which the rock barges will be unloaded.

A clamshell dredge would likely be used for all dredging, though there is a small chance that a pipeline dredge could be feasible but is unlikely to be used. The material to be dredged is medium to fine-grained sand, typical of MCR marine sands. Disposal of material would occur in-water at an existing approved disposal site. The volume of material to be dredged is shown in Table 12; these estimates are based on current bed morphology and may change. Also, maintenance dredging to a finish depth of -25 feet MLLW will be needed before offloading during each year of construction. Dredging is likely to occur on a nearly annual basis for the duration of the project construction period, but this will be intermittent per jetty, depending on which one is scheduled for construction in a particular year.

Table 12. Estimated Dredging Volumes for Barge Offloading Facilities

Location*	Estimated Dredging Volume (cy)		Approximate Acres
	Initial	Est. Maintenance**	
North Jetty	30,000	30,000	3.73
Jetty A	60,000	80,000	3.73
South Jetty	20,000	20,000	4.19
South Jetty - Parking Area D	20,000	20,000	4.19

* Some of the locations will not be used on an annual basis; it depends on the construction schedule for each jetty.
**All dredging will be based on surveys that indicate depths shallower than -25 feet MLLW.

Clamshell dredging is done using a bucket operated from a crane or derrick that is mounted on a barge or operated from shore. Sediment removed from the bucket is generally placed on a barge before disposal. This type of dredge is typically used in shallow water areas.

The following overall impact minimization practices and best management practices (BMPs) will be used for all maintenance dredging for offloading facilities.

1. To reduce the potential for entrainment of juvenile salmon or green sturgeon, the cutter-heads will remain on the bottom to the greatest extent possible and only be raised 3 feet off the bottom when necessary for dredge operations.

2. To reduce turbidity, if a clamshell bucket is used, all digging passes shall be completed without any material, once in the bucket, being returned to the wetted area. Not dumping of partial or half-full buckets of material back into the project area will be allowed. No dredging of holes or sumps below minimum depth and subsequent redistribution of sediment by dredging dragging or other means will be allowed. All turbidity monitoring will comply with Sate 401 Water Quality Certification Conditions.
3. If the Captain or crew operating the dredges observes any kind of sheen or other indication of contaminants, he/she will immediately stop dredging and notify the Corps' environmental staff to determine appropriate action.
4. If routine or other sediment sampling determines that dredged material is not acceptable for unconfined, in-water placement, then a suitable alternative disposal plan will be developed in cooperation with the NMFS, EPA, Oregon Department of Environmental Quality (ODEQ), Washington Department of Ecology (WDOE), and other agencies.

Dredged Material Disposal Sites

Two dredged material disposal sites, the Shallow Water Site (SWS) and the North Jetty site, are located near the North Jetty. These are the most likely sites to be used. Modeling has showed that the potential changes to the two disposal sites from the proposed action would not inhibit their use as disposal sites. Spur groin construction at the North Jetty would avoid the North Jetty disposal site. The northern-most cells of this site immediately adjacent to the jetty will be avoided to reduce the possibility of vessel impact with the spur groins.

Pile Installation and Removal

As mentioned earlier, inclement weather and sea conditions during the preferred in-water work window (IWWW) preclude safe working conditions during this time period. Therefore, installation of piles is most likely to occur outside the IWWW. For initial construction of all four facilities combined, approximately up to 96 Z- or H-piles could be installed as dolphins, and up to 373 sections of sheet pile to retain rock fill. They will be located within 200-ft of the jetty structure. Because the sediments in the region are soft (sand), use of a vibratory driver to install piles is feasible and will be used when necessary. The presence of relic stone may require locating the piling further from the jetty so that use of this method is not precluded by the existing stone. The dolphins/Z- and H-piles would be composed of either untreated timber or steel piles installed to a depth of approximately 15 to 25 feet below grade in order to withstand the needs of off-loading barges and heavy construction equipment. Because vibratory hammers will be implemented in areas with velocities greater than 1.6 ft/s, the need for hydroacoustic attenuation is not an anticipated issue. Piling will be fitted with pointed caps to prevent perching by piscivorous birds to minimize opportunities for avian predation on listed species. Some of the pilings and offloading facilities will be removed at the end of the construction period.

Rock Placement

Placement of armor stone and jetty rock on the MCR jetties would be accomplished by land or limited water-based equipment. Only clean stone will be used for rock placement, where appropriate and feasible. Where appropriate, there may also be some re-working and reuse of the existing relic and jetty prism stone. Fill for the jetty haul roads will not be cleaned prior to

installation. Dropping armor stone from a height greater than 2 feet will be prohibited. During placement there is a very small chance of stone slippage down the slope of the jetty. However, this is unlikely to occur due to the size and cost of materials and placement.

Another approach to water-based rock placement would be via a jack-up barge. This would only be applicable at the South Jetty. For armor stone and rock placement at the head, a jack-up barge with crane could be used to serve as a stable work platform (Figure 37). Once into place, the jack-up barge would be jacked up on six legs so that the deck is at the same elevation as the jetty. The legs are designed to use high-pressure water spray from the end of the legs to agitate the sand and sink the legs under their own weight. The jacking process does not use any lubricants that contain oils, grease, and/or other hydrocarbons. The stone and rock will be barged to the jack-up barge and offloaded onto the jetty head. The jack-up barge will keep moving around the head of the jetty to complete the work. A jack-up barge would not be used on the North Jetty or Jetty A to avoid interference with navigation of fishing boats and crab and fish migrations.

Figure 37. Illustration of a Jack-up Barge

For land-based rock placement, a crane or a large track-hoe excavator could be situated on top of the jetty. The placement operation would require construction of a haul road along the jetty crest within the proposed work area limits. The crane or excavator would use the haul road to move along the top of jetty. Rock would be supplied to the land-based placement operation by land and/or marine-based rock delivery. For marine-based rock, the land-based crane or excavator would pick up rock directly from the barge or from a site on the jetty where rock was previously offloaded and stockpiled, and then place the rock within the work area. For land-based rock, the crane or excavator would supply rock via a truck that transports rock from the stockpile area. The crane or excavator would advance along the top of the jetty via the haul road as the work is completed.

In order to place stones, a haul road will be constructed on the 30-ft crest width of each jetty to allow crane and construction vehicle access. Roads will consist of an additional 3-ft of top fill material, which could also entail an additional 2-ft of width spill-over. These roads will remain in place for the duration of construction. Due to ocean conditions and the wave environment, these roads will likely need yearly repair and replacement. They will not be removed upon completion. Ramps from the beach up to the jetty road will also be constructed to provide access at each jetty.

At approximately 1000-ft intervals, turnouts to allow equipment access and passage will be constructed on the North and South jetties. These will consist of 50-ft long sections that are an additional 20-ft wide. Some of this stone for these facilities may encroach below MLLW. On the North Jetty, there will be approximately 2 turnouts. South Jetty will have approximately 8 turnouts with two additional larger-sized turnouts. These larger turnouts will be in the range of 300-ft long with an additional 20-ft width. One of these larger turnouts will function as an offloading facility on South Jetty. At Jetty A, the causeway will function as the turnout facility.

Towards the head of each jetty, additional crane set up pads will be constructed at approximately 40-ft increment to allow crane operation during the placement of the larger capping stones. Set-up pads will roughly entail the addition of 8 extra feet on each side of the crest for a length of about 50-ft. Some of this stone for these facilities may encroach below MLLW. Approximately 5 set-up pads will be required to construct each jetty head.

Construction Staging, Storage, and Rock Stock Piles

Jetty repairs and associated construction elements entail additional footprints for activities involving equipment and supply staging and storage, parking areas, access roads, scales, general yard requirements, and rock stock pile areas. It was determined that for most efficient work flow and placement, a 2-year rock supply would be maintained on site and would be continuously replenished as placement occurred on each jetty. In order to estimate the area needed, a surrogate area was determined for a reference volume of 8,000 cy, which was then used to extrapolate the area needed at each jetty. These results are shown in Table 13.

Table 13. Acreages Needed for Construction Staging, Storage, and Rock Stock Piles

Location	Approximate Acres
North Jetty	31
Jetty A	23
South Jetty	44

Several actions will be taken to avoid and minimize impacts from these activities. Staging and stockpiles will remain above MHHW and where feasible have also been sited to avoid impacts to wetlands and habitats identified as having higher ecological value. In order to maintain erosive resilience along the shoreline, a vegetative buffer will be preserved. When available and possible, partial use will be made of existing parking lots. Additional measures specific to each jetty have also been considered. Besides access roads in the areas identified in Figures 33-35, no

additional roadways or significant roadway improvements are anticipated. Some roadway repair and maintenance will likely be required on existing roads experiencing heavy use by the Corps.

At the North Jetty, the lagoon and wetland fill necessary for root stabilization will also serve a dual purpose as for the bulk of staging and storage activities.

At the South Jetty, a small spur road will be required to connect the existing road with the proposed staging area and is indicated in Figures 33-35. The existing road along the neck of the South Jetty that will be used for dune augmentation work may require minor repair/improvements for equipment access. Construction access to the area receiving dune augmentation will be limited to an existing access road along the relic jetty structures at the neck of the spit. Equipment will be precluded from delivery using the access point from Parking Lot B in order to avoid impacts to water quality and razor clam beds in the vicinity of the proposed dune fill area. Grading equipment may have to access the area by driving along the shore, but this route will be used as a last resort and equipment will be limited to dry sand where feasible. Additionally, the proposed actions will avoid the more sensitive habitat areas south of Parking Lot D.

If possible, the project will avoid and minimize impacts to the adjacent marshland by allowing crossing between the construction area and jetty via a Bailey bridge, which may require small removable abutments on either end of the marsh crossing. Otherwise a series of culverts and associated fill will be installed, or equipment will be required to enter and exit from the same access road on the northeast end of the main staging area indicated in Figures 33-35.

Additionally, at the outlet of the marsh complex a culvert will be installed under the construction access road, which will allow continuous hydrologic connectivity between affected portions of the marsh and ocean exchange through the jetty. This will also avoid equipment passage through marsh waters. To connect the staging area to the jetty haul road, a temporary gravel access road would be constructed from the staging area nearest the jetty to the jetty crest. The access road would measure approximately 400 ft in length by 25 ft in width, would be above MHHW, would require approximately 4,000 cy of sand, gravel and rip rap, and would require the installation and removal of a temporary culvert near station 178+00 to maintain tidal exchange into and out of the intertidal wetland and through the jetty. The staging areas and haul roads, except for the jetty haul road, would be removed and restored to pre-construction conditions once repairs to the jetty are completed.

Prior to in-water work for installing the construction access road and culverts across the southern portion of the marsh wetland outlet at the South Jetty, the Corps will conduct fish salvage and implement fish exclusion to and from the wetland complex upstream of the proposed culvert. Also, post-installation of the culvert, the Corps will develop and implement fish monitoring as necessary to ensure that no listed fish species are stranded. If listed fish species are found, NMFS will be contacted immediately to determine the appropriate course of action.

At Jetty A, adequate area may not be available for the estimated storage and staging needs. Therefore, construction sequencing will accommodate the supply that can be fit into the acreage

available. Land-based delivery options may be precluded due to road access constraints, though some existing access may prove available and feasible depending on load and truck sizes.

The following measures will also be required at each location to further avoid and minimize impacts to species. Before significant alteration of the project area, the project boundaries will be flagged. Sensitive resource areas, including areas below ordinary high water, wetlands and trees to be protected will be flagged. Chain link fencing or something functionally equivalent will likely encircle much of the construction areas.

Temporary Erosion Controls

Temporary erosion controls will be in place before any significant alteration of the site. If necessary, all disturbed areas will be seeded and / or covered with coir fabric at completion of ground disturbance to provide immediate erosion control. Erosion control materials (and spill response kits) will remain on-site at all times during active construction and disturbance activities (e.g., silt fence, straw bales). If needed these measures will be maintained on the site until permanent ground cover or site landscaping is established and reasonable likelihood of erosion has passed. When permanent ground cover and landscaping is established, temporary erosion prevention and sediment control measures, pollution control measures and turbidity monitoring will be removed from the site, unless otherwise directed.

An Erosion Sediment and Pollution Control Plan (ESPCP) or Stormwater Pollution Prevention Plan (SWPPP), as applicable to each State, will outline facilities and Best Management Practices (BMPs) that will be implemented and installed prior to any ground disturbing activities on the project site, including mobilization. These erosion controls will prevent pollution caused by surveying or construction operations and ensure sediment-laden water or hazardous or toxic materials do not leave the project site, enter the Columbia River, or impact aquatic and terrestrial wildlife. The Corps retains a general 1200-CA permit from Oregon Department of Environmental Quality (DEQ), and will also work with EPA to obtain use of the NPDES General Permit for Stormwater Discharge from Construction Activities. At a minimum, these ESCP and SWPPP plans will include the following elements and considerations. Construction discharge water generated on-site (debris, nutrients, sediment and other pollutants) will be treated using the best available technology. Water quality treatments will be designed, installed, and maintained in accordance with manufacturer's recommendation and localized conditions. In addition, the straw wattles, sediment fences, graveled access points, and concrete washouts may be used to control sedimentation and construction discharge water. Construction waste material used or stored on-site will be confined, removed, and disposed of properly. No green concrete, cement grout silt, or sandblasting abrasive will be generated at the site.

Emergency Response

To avoid the need for emergency response a Corps' Government Quality Assurance Representative (GQAR) will be on-site or available by phone at all times throughout construction. Emergency erosion/pollution control equipment and best management practices will be on site at all times; Corps' staff will conduct inspections and ensure that a supply of sediment control materials (e.g., silt fence, straw bales), hazardous material containment booms

and spill containment booms are available and accessible to facilitate the cleanup of hazardous material spills, if necessary.

Hazardous Materials

A description of any regulated or hazardous products or materials to be used for the project, including procedures for inventory, storage, handling and monitoring, will be kept on-site. Fuels or toxic materials associated with equipment will not be stored or transferred near the water, except in a confined barge. Equipment will be fueled and lubricated only in designated refueling areas at least 150 feet away from the MHHW, except in a confined barge.

Spill Containment and Control

A description of spill containment and control procedures will be on-site, including: notification to proper authorities, specific cleanup and disposal instructions for different products, quick response containment and cleanup measures that will be available on the site including a supply of sediment control materials, proposed methods for disposal of spilled materials, and employee training for spill containment. Generators, cranes, and any other stationary power equipment operated within 150-feet MHHW will be maintained as necessary to prevent leaks and spills from entering the water. Vehicles / equipment will be inspected daily for fluid leaks and cleaned as needed before leaving staging and storage area for operation within 150 feet of MHHW. Any leaks discovered will be repaired before the vehicle / equipment resumes service. Equipment used below MHHW will be cleaned before leaving the staging area, as often as necessary to remain grease-free. Additionally, the Corps proposes to use a Wiggins fast fuel system or equivalent to reduce leaks during fueling of cranes and other equipment in-place on the jetties (Figure 38). Also, spill pans will be mounted under the crane and monitored daily for leaks.

Water Quality Monitoring

In-water work will require turbidity monitoring that will be conducted in accordance with 401 Water Quality Certifications Conditions to ensure the project maintains compliance with State water quality standards. Turbidity exceedences are expected to be minimal due to the large size of stone being placed. Dynamic conditions at the jetties in the immediate action area preclude the effective use of floating turbidity curtains (or approved equal). Sedimentation and migration of turbid water into the Columbia is not expected to be a significant issue. Best management practices will be used to minimize turbidity during in-water work. Turbidity monitoring will be conducted and recorded each day during daylight hours when in-water work is conducted. Representative background samples will be taken according to the schedule set by the resource agencies at an undisturbed area up-current from in-water work. Compliance samples will be taken on the same schedule, coincident with timing of background sampling, down-current from in-water work. Compliance sample will be compared to background levels during each monitoring interval. Additional 401 Water Quality Certification conditions and protocols may be required.

Figure 38. Fast Fuel System

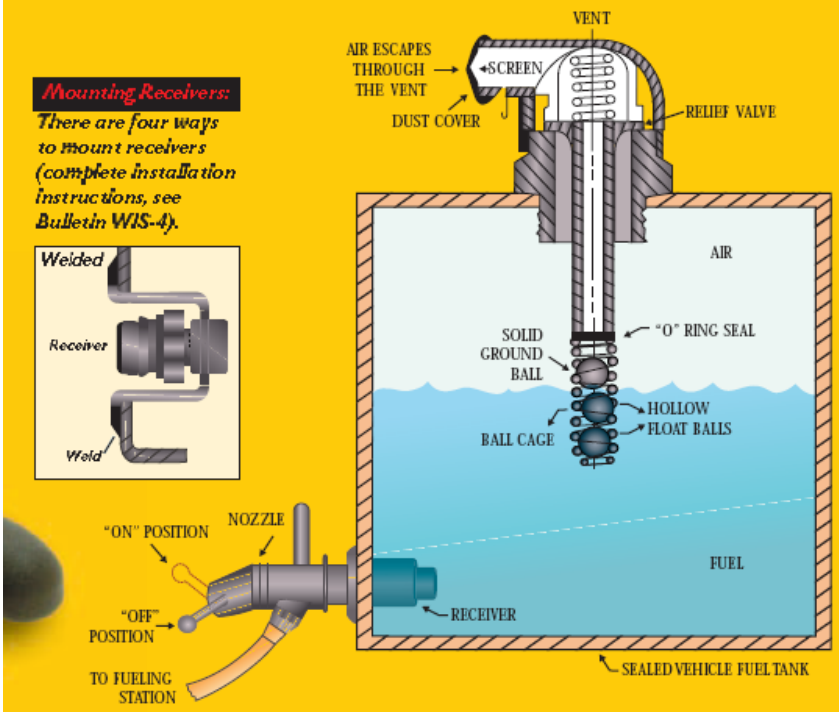
WIGGINS Service Systems

How It Works

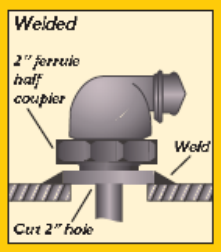
The Wiggins "fast fuel" System is based on the simple concept of using a sealed vehicle tank to allow a small amount of back pressure to build up and automatically shut off the nozzle. A receiver is mounted on the tank, located near the bottom. Bottom filling helps eliminate foaming which can occur during top fueling "splash fill".

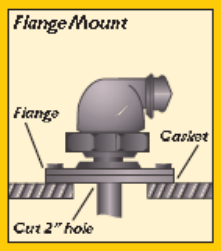
The Wiggins ZZ9A1 nozzle is attached to the receiver, the handle is turned to the "ON" position, and fuel begins to fill the fuel tank at a rate up to 150 gallons per minute. As fuel enters the tank, it forces the air inside the tank to exit through the Wiggins vent. When the fuel level nears the top of the tank, the "hollow floating balls" force the third "solid ball" to seal against the vent "stem", sealing the tank and stopping the air flow out of the tank. As fuel continues to flow, pressure inside the tank builds until it reaches 8 to 10 PSIG. At 8 to 10 PSIG, the nozzle automatically shuts off. The nozzle shut off is gradual, preventing a hammer effect which could damage the fuel line. The nozzle can then be removed, and is ready to fuel the next vehicle!

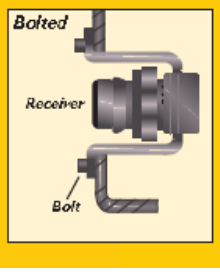
Mounting Receivers:
There are four ways to mount receivers (complete installation instructions, see Bulletin WIS-4).

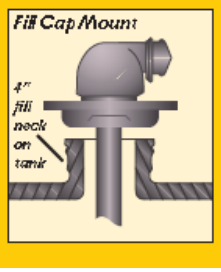


Mounting Vents:
There are three ways to mount vents (for complete installation instructions, see Bulletin WIS-4).









WETLAND MITIGATION AND HABITAT IMPROVEMENTS

The selected plan design and construction methods for repair and rehabilitation of the MCR jetties have been developed and refined to take advantage of opportunities to avoid and minimize the project's ecological impacts to habitats and species. As required under the Clean Water Act, the Corps will mitigate for impacts to wetlands which could not be otherwise avoided or minimized. The Corps has also incorporated habitat improvements into the proposed action to assist with the recovery of ESA-listed salmonid habitats and ecosystem functions and processes. These actions are not proposed to directly mitigate or compensate for any Project-related impacts to ESA-listed salmonids. The habitat improvement components of the overall ecosystem restoration action are proposed as Conservation Measures under Section 7(a) (1) of the ESA and have been included into the proposed action by the Corps. These actions are the Corps' affirmative commitment to fulfill responsibility to assist with conservation and recovery of ESA-listed salmonids.

Habitat improvement features will be designed to create or improve salmonid habitat, specifically tidal marsh, swamp, and shallow water and flats habitat, and to improve fish access to these habitat features. In addition, one of the features would create habitat for snowy plover. Habitat improvement and wetland mitigation plans currently address three general categories: actions that create, improve, and restore wetlands, actions that improve in-water habitats, and actions that restore upland habitats. From the list of possible wetland mitigation and habitat improvement features shown in Table 14, one or a combination of projects will be selected for further development and implementation. Selection will occur with input from the AMT and work is anticipated to be completed concurrent with jetty repair actions.

Table 14. Possible Wetland Mitigation and Habitat Improvement Features

Feature/Site	Area Affected	Type and Function
Trestle Bay	5-8 acres with potential of additional acres	Estuarine Saltwater Marsh Wetland and Intertidal Mudflat Creation and Restoration • Create and expand estuarine intertidal brackish saltwater marsh wetland habitat. • Expand and restore Lyngby sedge plant community. • Expand/increase intertidal shallow water habitat, including dendritic mud flats and off-channel habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat complexity for fisheries benefit. • Potentially expand floodplain terrace and improve riparian function. • (Re)introduce natural tidal disturbance regime to area currently upland dunes.
Walooskee to Youngs Bay	~151 acres	Levee Breach for Estuarine Emergent Wetland and Brackish Intertidal Shallow-water Habitat Restoration • Restore connection between Walooskee and Youngs River via levee breach. • Restore and expand estuarine intertidal brackish marsh wetland habitat. • Expand and restore Lyngby sedge and native estuarine vegetation community to improve trophic foodweb functions. • Restore and expand brackish intertidal shallow water habitat including dendritic mud flats and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • (Re)introduce natural tidal disturbance regime to area currently diked pasture land. • Restore hydrologic regime and restore/improve water quality function. • Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Walooskee to Youngs Bay	~39 acres	Levee Breach and/or Tide Gate Retrofits for Emergent Wetland and Intertidal Shallow-water Habitat Restoration • Restore connection with Walooskee River via levee breach and/or tide gate retrofits. • Restore and expand intertidal marsh wetland habitat. • Expand and restore native vegetation community to improve trophic foodweb functions. • Restore and expand intertidal shallow water habitat including dendritic and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • Restore hydrologic and natural tidal disturbance regime and restore/improve water quality function to area currently functioning as diked pasture land. • Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Slough to Youngs River	~250-500 acres	Levee Breach for Estuarine Wetland and Intertidal Restoration • Restore connection between Slough and Youngs River via levee breach. • Restore and expand estuarine intertidal brackish marsh wetland habitat. • Expand and restore Lyngby sedge and native estuarine vegetation community to improve trophic foodweb functions. • Restore and expand brackish intertidal shallow water habitat including dendritic mud flats and off-channel edge habitat.

Feature/Site	Area Affected	Type and Function
		• Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • Restore hydrologic and natural tidal disturbance regimes to an area currently functioning as diked pasture land. • Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Youngs River - Diked Farmland, Freshwater Intertidal Restoration	45-50 acres With potential up to 80 acres	Levee Breach for Wetland and Intertidal Restoration • Restore connection with Youngs River via levee breach. • Restore and expand freshwater intertidal wetland habitat. • Expand and restore native vegetation community to improve trophic foodweb functions. • Restore and expand intertidal shallow water habitat including dendritic mud flats and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • (Re)introduce natural tidal disturbance regime to area currently diked pasture land. • Restore hydrologic regime and restore/improve water quality function. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia.
Tributary Cr. to Youngs River	~5 or more acres	Estuarine Wetland and Intertidal Restoration; Tributary Reconnection to Youngs Bay • Convert diked pasture land to brackish estuarine wetland and shallow water intertidal habitat. • Improve and restore hydrologic regime and increase regular hydrologic connectivity between Crosel Cr. And Youngs Bay estuary. • Improve and restore fish passage and provide access throughout greater range of flows to off-channel juvenile rearing, refuge and foraging habitats. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat complexity for fisheries benefit. • Improve adult salmonid access to headwaters and potential spawning habitat. • Potentially expand floodplain terrace and improve riparian function. • (Re)introduce natural flow regime and tidal disturbance regime to area currently functioning as pasture land.
Tributary Cr. and Slough to the Columbia River - near Clatskanie	Up to ~43 acres	Levee Breach and/or Tide Gate Retrofits for Emergent Wetland and Intertidal Shallow-water Habitat Restoration and Tributary Reconnection • Restore connection between Tandy and Graham creeks and Westport Slough and Columbia River via levee breach and/or tide gate retrofits. • Restore and expand intertidal wetland habitat. • Expand and restore native vegetation community to improve trophic foodweb functions. • Restore and expand intertidal shallow water habitat including dendritic and off-channel edge habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages. • Increase habitat access and complexity for fisheries benefit including expanded foraging, rearing, and refugia habitat types. • Improve riparian function. • Potentially restore floodplain terrace and increase flood storage capacity. • Restore hydrologic and natural tidal disturbance regime and restore/improve water quality function to area currently functioning as diked pasture hayfields.

Feature/Site	Area Affected	Type and Function
		• Improve capacity for additional carbon sequestration via native root masses. • Increase and restore hyporheic functions for improved water quality and potential creation of cold water refugia. • Improve adult salmonid access to headwaters and potential spawning habitat.
Knappa - Warren Slough	~100 or more acres	Preservation and Expansion of Estuarine Intertidal Restoration; Improve Tributary Reconnection for Fish Passage • Maintain and enhance evolving restoration that has occurred since inundation of previously diked pasture land to estuarine wetland and shallow intertidal habitat. Maintain restored ecosystem function and intertidal shallow water habitat established post-breach. • Maintain and enhance restored hydrologic regime and increase regular hydrologic connectivity between Hall Cr. and Warren Slough. • Maintain and improve existing fish passage and provide access throughout greater range of flows to off-channel juvenile rearing, refuge and foraging habitat types. • Maintain and increase habitat complexity for fisheries benefit. • Improve adult salmonid access to headwaters and potential spawning habitat. • Remove and control invasive species and improve/restore diversity and density of native plant assemblages; Improve riparian function as appropriate. • Potentially expand floodplain terrace. • Maintain restored natural tidal disturbance regime, dendritic channels, and connection between Hall Cr. and Warren Slough.
Snowy Plover Work on Clatsop Spit	Up to ~22 acres	Forego Revegetation and Convert Upland Areas to Snowy Plover Habitat • Convert upland scrub-shrub habitat with invasive species to snowy plover habitat via periodic tilling and application of shell hash.
Wetland Creation at Cape Disappointment	Up to ~10 acres	Creation and Expansion of Interdunal Wetland Complex • Excavation of new interdunal wetlands adjacent to existing wetlands. • Establishment of native wetland plant communities and removal of invasive species around a buffer zone. • Restoration or provision of hydrology to newly excavated wetlands via appropriate elevation design. • Restoration of wetland connectivity between existing fragmented wetlands via culvert retrofits, if feasible.
Tide Gate Retrofits for Salmonid Passage	Variable	Select Tributaries from ODFW Priority Culvert Repair List - Tributary Reconnection • Restore and improve existing fish passage and provide access throughout greater range of flows to off-channel juvenile rearing, refuge and foraging habitat types. • Restore and increase habitat complexity for fisheries benefit. • Restore and improve adult salmonid access to headwaters and potential spawning habitat.

Wetlands and shallow-water habitat will be filled and converted as a result of the project. Official wetland delineations have not yet been completed for all three of the jetties. However, available preliminary information has allowed the Project Delivery Team (PDT) to site construction activities and features to reduce anticipated impact to wetlands. This information has also been used to calculate initial estimates regarding the possible acreage of impacts. The approximated acreages identified as potentially impacted are North Jetty ~4.78, South Jetty up to ~22 and Jetty A up to ~11. This comes to an estimated total of ~38.28 acres of potential wetlands impacts. To reiterate, official delineations must be completed, and these numbers will be revised accordingly after report results and project design details are further developed and available. These estimates are on the conservatively high end of what final wetland impacts will likely be.

In-water habitats, both shallow intertidal and deeper subtidal areas will also be affected by the project. Habitat conversions will occur from maintenance dredging and placement of the spur groins, jetty cross-sections, turnouts, barge offloading facilities, and causeways. There will also be permanent lagoon fill at the North Jetty root. Without drawing a distinction between depths, initial acreage estimates for all in-water impacts include North Jetty ~11.75, South Jetty ~21.2, and Jetty A ~7.23. This comes to an approximated total of ~40.18 acres of potential in-water conversions. Shallow-water habitat is especially important to several species in the estuary; therefore, specific initial estimates were also calculated regarding shallow-water habitat (shallow here defined as -20-ft or -23-ft below MLLW). About 30 acres (out of the ~40 mentioned above) of area at these depths will be affected by groins, maintenance dredging, and construction of the causeways and barge offloading facilities. However, this estimate does NOT including any expansion of the jetty's existing footprint or overwater structures from barge offloading facilities. The approximate acreage breakdowns entail: spur groin fill = 1.56 (shallow defined as -20-ft or less below MLLW; ~3.26 total area including all depths); dredge for barges ~20, likely all shallow (less than -23-ft deep below MLLW); and causeway fill~ 7, likely all shallow (less than -23 ft deep below MLLW). For this analysis, there was no distinction drawn between periodically exposed intertidal habitat and shallow-water sandflat habitat. As with wetland estimates, these approximations will be updated as project designs are refined and as additional analyses and surveys are completed to quantify changes in jetty and dune cross sections.

Ultimately the project seeks to achieve no net loss in wetland habitat, to protect, improve and restore overall ecosystem functions, and to provide actions that are anticipated to benefit listed species in the vicinity of the project. Towards that end, specific project footprints and activities described above have been identified, categorized, and quantified with conservative estimates where appropriate. The calculated extents were strictly based on the area of habitat that was converted. They did not include value or functional assignments regarding the significance of the conversion, whether it was a beneficial, neutral, or detrimental effect, nor if conversions created unforeseen, indirect far-field effects. For example, acreage of conversion for shallow sandy sub-tidal habitat to rocky sub-tidal habitat was calculated in the same manner as conversion from shallow intertidal habitat to shallow sub-tidal habitat. Per initial consultation with resource agencies, a preliminary suggested ratio of 2:1 for wetland mitigation will likely be required. This is described in Table 15. These estimated footprints will likely change slightly during final design and after updated wetland delineations are completed.

Table 15. Maximum Estimated Acreages for Habitat Improvement and Wetland Mitigation

Jetty	Wetland	In-water	Upland Replanting
North Jetty Total	9.56	--	--
South Jetty Total	44.00	--	--
Jetty A Total	23.00	--	--
TOTAL Wetland and Habitat Improvements	76.56	60.00	55.00

Specific opportunities have been identified in the Columbia River estuary and Youngs Bay (see Table 14) and are under consideration to improve and restore functions affected in each of the generalized habitat categories (wetland, in-water, and upland). Depending on further development of wetland mitigation and habitat improvement alternatives, a specific project or combination of projects will be designed and constructed concurrently as the proposed repair and rehabilitation options are completed over time. Mitigation actions and extents will be commensurate with wetland impacts and ratios identified. Proposed projects are subject to further analysis, and unforeseen circumstances may preclude further development of any specific project. In all cases, final selection, design, and completion of specific improvement features is contingent on evolving factors and further analyses including hydraulic and hydrologic conditions, real estate actions, cultural resource issues, etc. For this reason a suite of potential proposals has been identified, and subsequent selection of one or some combination of projects and designs will occur during continued discussion with resource agencies participating on the Adaptive Management Team. These wetland mitigation and habitat improvement measures will therefore require additional Consultations, and it is anticipated that the AMT will facilitate in this process. It is also anticipated that a programmatic Opinion similar to SLOPES or Limit 8 may be useful to fulfill clearance requirements.

Actions adjacent to or onsite in the vicinity of the North and South Jetties that could potentially mitigate wetland impacts include: excavation of low and high saltwater marsh wetlands and new interdunal wetlands adjacent to existing wetlands; establishment of native wetland plant communities and removal of invasive species around a buffer zone for wetlands; restoration or provision of hydrology to newly excavated wetlands via appropriate elevation design; and/or restoration of wetland connectivity between existing fragmented wetlands. Offsite opportunities for wetland mitigation in the estuary that warrant further investigation are associated with: levee breaches, inlet improvements, or tide gate retrofits, as appropriate. Purchasing mitigation bank credits may be a possibility, though this is currently constrained by limitations of service area and availability of appropriate wetland types. However, private farmlands behind existing levees may provide wetland mitigation opportunities to pursue further. Hydrology and vegetative communities are heavily influenced by elevation; therefore providing improved hydrology combined with strategic excavation and appropriate plantings should result in a simple and self-sustaining design and outcome.

Actions to provide benefits and improvements to in-water habitat include the following opportunities: levee breaches, inlet improvements, or tide gate retrofits, as appropriate. Additional associated actions include: excavation in sand dunes and uplands to specified design elevations in order to create additional intertidal shallow water habitat with dendritic channels

and mud flats, and excavation for potential expansion of the floodplain terraces. Though conceptually considered, specific opportunities for additional projects such as the following were not identified but could warrant further investigation if none of the projects in the list is determined to be feasible: removal of overwater structures and fill in the estuary; removal of relic pile-dike fields; removal of fill from Trestle Bay or elsewhere; removal of shoreline erosion control structures and replacement with bioengineering features; beneficial use of dredge material to create ecosystem restoration features (Lois Island Embayment is an example from Columbia River Channel Improvement that may be applicable here); and restoration of eelgrass beds. Certain pile fields and engineering features may be providing current habitat benefits that could be lost with removal, and such actions would require appropriate hydraulic analysis coordination with engineers and resource agencies.

For potential habitat improvement projects located in Trestle Bay, there is additional monitoring and assessment opportunity. A separate hydraulic/engineering study should investigate whether or not an expansion of low-energy, intertidal habitat near Swash Lake could effectively provide additional storage capacity and affect circulation in the Bay such that erosive pressure at neck of Clatsop Spit could be reduced. The previous 1135 action which breached a section of the relic jetty structure is speculated to have been the cause of increased circulation and erosion. It would be worth evaluating whether or not projects that expand floodplain and intertidal areas in the Bay provide significant energy dissipation and additional low-energy storage capacity to offset or redirect erosive pressures. Alternatively, if other habitat improvement concepts are pursued that include removal of additional piles or creation of additional inlets; it would be worth investigating whether these actions could have indirect positive impacts that further reduce concern with erosion at the neck. Evaluating actions in this light would provide valuable information and insight regarding possible solutions and concerns for erosion and breaching at the neck area of Clatsop Spit on Trestle Bay.

Post-construction upland restoration would include the following actions: re-establishing native grasses, shrubs, and trees where appropriate; controlling and removing invasive species like scotch broom and European beach grass in the project vicinity; and re-grading/tilling the area to restore natural contours. Oregon Parks and Recreation Department has requested that the Corps utilize the State Forester as one resource for determining optimal revegetation plans.

On the Clatsop Spit there is also a unique opportunity to partner with U.S. Fish and Wildlife and Oregon Parks and Recreation Department (OPRD) regarding creation and management of snowy plover habitat on the Spit. This would be an alternative to re-vegetative restoration of the uplands. The OPRD is currently developing a Habitat Conservation Plan in the area to address snowy plover habitat management prior to an anticipated designation of Critical Habitat by US Fish and Wildlife. There may be locations in the vicinity and away from projected construction and staging areas to convert upland habitat to snowy plover habitat via invasive species removal, tilling, and application of shell hash. Ongoing operation and maintenance during the project via regular tilling and shell hash distribution could possibly be coordinated between the agencies through a vehicle such as a Memorandum of Agreement or similar avenue.

Refinement and implementation of this wetland mitigation and habitat improvement plan will help protect species and habitats while restoring wetland functions affected by the MCR project.

Monitoring and maintenance of wetland mitigation and habitat improvement actions will likely be required to ensure successful establishment of goals and satisfactory return on investment. Regular coordination with the AMT will further facilitate selection and implementation of wetland mitigation and habitat improvement actions that appropriately meet the framework for successful restoration, protection, and preservation of ESA listed species and high-value habitat.

ADDITIONAL CONSERVATION MEASURES

In addition to standard environmental protection measures to be included in the contract specifications, measures 1, 2, and 3 will be employed during the marbled murrelet nesting season (April 1 – September 15) to reduce impacts from noise to nesting marbled murrelets on the Washington side, and measure 4 will be considered to create western snowy plover nesting habitat:

1. Trucks will only be allowed to use the roads through Cape Disappointment State Park during daylight hours.

2. Trucks will not unnecessarily stop along the roads through Cape Disappointment State Park.

3. Trucks will be prohibited from using compression brakes (also known as jake brakes) on the roads through Cape Disappointment State Park.

4. The Corps is currently investigating opportunities to create western snowy plover nesting habitat on Clatsop Spit, Oregon within Fort Stevens State Park. Since rock could be stored on Clatsop Spit for years, the Corps will consider creation of habitat after use of the spit for rock storage is complete to avoid potential limitations to rock storage and transport on the spit if plovers begin to nest. The Corps will also consider options to create plover habitat concurrently with rock storage if it is certain that plover use of the created habitats and beaches would not interfere with the Corps' ability to use Clatsop Spit throughout the life of the project. Habitat maintenance each year after creation would be required to provide functional habitat, but maintenance would not be the responsibility of the Corps. Habitat creation work would be conducted under 7(a) (1) authority of the ESA. The Corps has had initial discussions with the Oregon Department of Parks and Recreation regarding plover habitat creation.

ACTION AREA

"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this consultation, the action area includes (see Figure 1): (1) an area extending 10 miles offshore from Columbia River mile -1; (2) extending 5 miles north and 5 miles south of river mile -1, including all terrestrial habitats; (3) extending upstream as far as the Astoria-Megler Bridge, river mile 13.5; and (4) all areas where quarried stone will be transported, including offshore and inland navigation channels, existing roadways and/or rail routes in the Pacific ocean or along inland transportation routes extending as far north as Vancouver B.C. in the Puget Sound, and as far south as Eureka, and Humbolt Bay, California. See Figures 28-32 for possible route illustrations.

The sixth field HUCs in the vicinity of the MCR include: Baker Bay-Columbia River – 1708000605; Necanicum River-Frontal Pacific Ocean – 1710020101; Youngs River-Frontal Columbia River – 1708000602; Long Beach-Frontal Pacific Ocean – 1710010607 and Wallacut River-Frontal Columbia River – 1708000604.

Federally listed fish, bird, plant, invertebrate, mammal, and turtle species and their critical habitat may be present in the action area (Table 16).

Transportation of rock from Canada, California, the Puget Sound and in-between sources will occur in navigation channels and along existing truck or rail routes through or adjacent to areas where additional listed inland terrestrial species and their critical habitat may occur. However, barge traffic is not expected to encounter these species and therefore will not affect their behaviors or habitats. Truck traffic in the vicinity of the MCR jetties, rather than along existing haul routes, has a higher likelihood of encountering such species and possible effects are discussed further. Therefore, it is anticipated that the rock transport outside the vicinity of the MCR jetty system as described above will have no effect on listed species or their critical habitat; therefore, only the species described below have been included further in this effects analysis.

Table 16. Federal Register Notices for Final Rules that List Threatened and Endangered Species, Designate Critical Habitats, or Apply Protective Regulations to Species under Consideration

Listing status: 'T' means listed as threatened under the ESA; 'E' means listed as endangered; 'P' means proposed.

Species	Listing Status	Critical Habitat
Birds		
Marbled Murrelet *(Brachyramphus marmoratus)* **T**		
Oregon, Washington, and California Populations	10/01/92; 57:FR 45328; 2/11/09 74 FR 6852	05/24/96; 61 FR 26255; 02/11/09; 74 FR 6852
Western Snowy Plover *(Charadrius alexandrinus nivosus)* **T**	3/05/93; 58 FR 12864	09/29/05; 70 FR 56969
Short-tailed Albatross *(Phoebastria albatrus)* **E**	7/31/00; 65 FR 46643	Not applicable
Northern Spotted Owl *(Strix occidentalis caurina)* **T**	6/26/90; 55 FR 26114	1/15/92; 57 FR 1796; 08/13/08 73 FR 47325
Mammals		
Columbian White-tailed Deer *(Odocoileus virginianus leucurus)* **E**		
Columbia River Population	03/11/67; 68 FR 43647	Not applicable
Fish		
Bull Trout *(Salvelinus confluentus)* **T**		
Columbia DPS	06/10/98; 63 FR 31647	10/18/10 75 FR 63897
Invertebrates		
Oregon Silverspot Butterfly *(Speyeria zerene hippolyta)* **T**	07/02/80; 45 FR 44935	07/02/80; 45 FR 44935
Plants		
Nelson's Checker-mallow *(Sidalcea nelsoniana)* **T**	02/12/93; 58 FR 8235	Not applicable
Reptiles and Amphibians		
Green turtle (*Chelonia mydas*) **E, T**		
Excludes Pacific Coast of Mexico & FL	7/28/78; 43 FR 32800	9/02/98; 63 FR 46693
Leatherback turtle (*Dermochelys coriacea*) **E**	6/02/70 ; 39 FR 19320	1/5/10; 75FR319;
Loggerhead turtle (*Caretta caretta*) **T**	7/28/78; 43 FR 32800	Not applicable
Olive ridley turtle (*Lepidochelys olivacea*) **E, T**	7/28/78; 43 FR 32800	Not applicable

ENDANGERED SPECIES ACT ENVIRONMENTAL ASSESSMENT

INTRODUCTION

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this Assessment. More detailed information on the status and trends of these listed resources, and their biology and ecology can be found in the listing regulations and critical habitat designations published in the Federal Register (see Table 16) and in many publications available from the USFW Washington and Oregon Offices and the NMFS Northwest Region, Protected Resources Division in Portland, Oregon.

It is likely that climate change will play an increasingly important role in determining the abundance of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. During the last century, average regional air temperatures increased by 1.5°F, and increased up to 4°F in some areas (USGCRP 2009). Warming is likely to continue during the next century as average temperatures increase another 3° to 10°F (USGCRP 2009). Overall, about one-third of the current cold-water fish habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (USGCRP 2009).

Precipitation trends during the next century are less certain than for temperature, but more precipitation is likely to occur during October through March, and less during the summer; and more of the winter precipitation is likely to fall as rain rather than snow (ISAB 2007, USGCRP 2009). Where snow occurs, a warmer climate will cause earlier runoff so stream flows in late spring, summer, and fall will be lower and water temperatures warmer (ISAB 2007, USGCRP 2009).

The earth's oceans are also warming, with considerable inter-annual and inter-decadal variability superimposed on the longer-term trend (Bindoff et al. 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances (Scheuerell and Williams 2005, Zabel et al. 2006, USGCRP 2009). Ocean conditions adverse to salmon and steelhead may be more likely under a warming climate (Zabel et al. 2006).

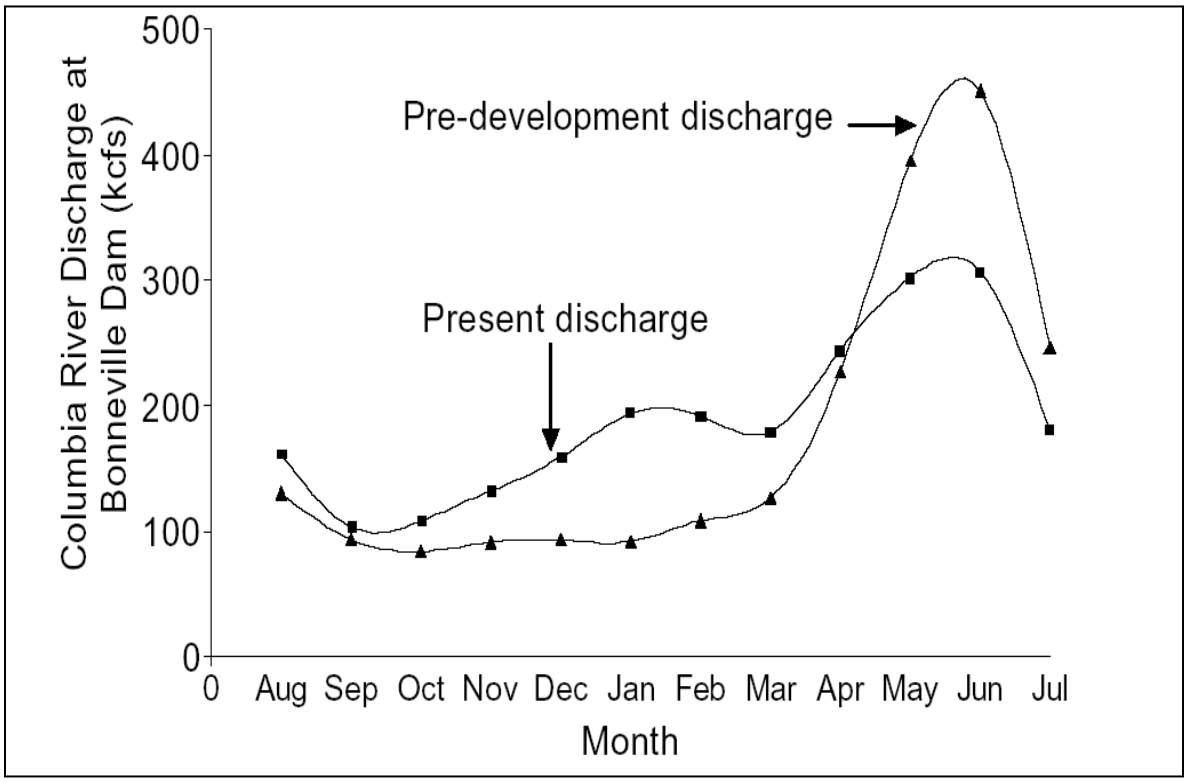
ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Overview

The Columbia River drains an area of 259,000 square miles and flows 1,243 miles from its headwaters in the Canadian Rockies of British Columbia, across the state of Washington, and along the border of Washington and Oregon to its mouth on the Pacific Ocean near Astoria, Oregon. The lower Columbia River extends from Bonneville Dam (RM 146) to the mouth of the Columbia River. Historically, unregulated discharges at the mouth ranged from 79,000 cubic feet per second (cfs) to over 1 million cfs, with average discharges of 273,000 cfs (Figure 39). Currently, discharge at the mouth of the river ranges from 100,000 to 500,000 cfs, with an average of about 260,000 cfs.

Figure 39. Annual Monthly River Discharge at Bonneville Dam under Current Operations as Compared to Historical River Discharge with No Mainstem Dams



Source: Corps Portland District

Highest discharges occur between December and March. Stream discharge in the lower Columbia River is influenced by snowmelt, winter rainstorms, and dam regulation. Stream discharge peaks generally occur during April through June. Local flooding in the lower Columbia River now begins when stream discharge reaches about 450,000 cfs, while the unregulated peak discharge would have been 602,000 cfs. Low stream flow generally occurs between August and October.

Discharge and sediment load have been altered by construction of 31 irrigation and hydropower dams, and 162 smaller dams, in the basin since 1890. Before 1890, the Columbia River estuary

had extensive sand beds and variable river discharges. However, the construction of upriver hydroelectric dams has dramatically changed the nature of the estuary, as these dams have translated into different discharge rates and sediment discharges. Moreover, channel deepening, use of jetties and dredging to stabilize channels, development of perennial wetland areas, and isolation of remaining wetlands from the mainstem river have altered the physical character of the estuary; these changes have affected the biological systems supported by the estuary.

Physical Characteristics

The Columbia River estuarine environment extends from the mouth to approximately RM 38. The river varies from 2 to 5 miles wide throughout the estuary and is about 1 mile wide at RM 30. Tidal effect extends almost 150 miles upstream (Corps 1983), but the saltwater wedge is limited to approximately RM 20 (Corps 1999). The North and South jetties and Jetty A were constructed at the mouth to help stabilize the channel, reduce the need for dredging, and provide protection for ships. A series of pile dikes were also historically constructed for similar reasons. The navigation channel is currently maintained at authorized depths of 48-55 feet deep below MLLW and 0.5-mile wide from RM -3 to RM 3. River flows are controlled by upstream storage dams. A dredged material disposal site near the North Jetty was established in 1999 to protect the North Jetty from erosion. About 100,000 to 500,000 cubic yards of sand are placed there annually. The MCR Shallow Water Site (SWS), Deep Water Site (DWS), and Chinook Channel Area D Sites are also active disposal locations within the action area but offshore and upstream of MCR, respectively. Historic disposal sites no longer active within vicinity of the jetties include Site E located within the expanded SWS and sites A, B, and F, which are in deeper water but still shoreward of the active DWS.

The Corps regularly conducts operations and maintenance activities to maintain the jetty system and the authorized navigation channels and facilities. In the action area, there are several turning and mooring basins and federally authorized periodically dredged channels extending to various ports from the navigation channel. The Columbia River Channel Improvements Project was recently completed and deepened the navigation channel 3 feet from approximately RM 3-104.

Waves, Currents, and Morphology

The MCR is a high energy environment. The ocean entrance at the MCR is characterized by large waves and strong currents interacting with spatially variable bathymetry. The MCR is considered one of the world's most dangerous coastal inlets for navigation. Approximately 70% of all waves approaching the MCR are from the west-northwest. During winter storm conditions, the ocean offshore of the jettied river entrance is characterized by high swells approaching from the northwest to southwest combined with locally generated wind waves from the south to southwest. From October to April, average offshore wave height and period is 9 feet and 12 seconds, respectively. From May to September, average offshore wave height and period is 5 feet and 9 seconds, respectively, and waves approach mostly from the west-northwest. Occasional summer storms produce waves approaching MCR from the south-southwest with wave heights of 6.5 to 13 feet and wave periods of 7 to 12 seconds. Astronomical tides at MCR are mixed semi-diurnal with a diurnal range of 7.5 feet. The instantaneous flow rate of estuarine water through the MCR inlet during ebb tide can reach 1.8 million cfs. Tidally dominated currents within the MCR can exceed 8.2 feet per second. A large, clockwise-rotating eddy

current has been observed to form between the North Jetty, the navigation channel, and Jetty A during ebb tide. A less pronounced counter-clockwise eddy forms in response to flood tide. Horizontal circulation in the estuary is generally clockwise (when viewed from above), with incoming ocean waters moving upstream in the northern portion of the estuary and river waters moving downstream in the southern portion. Vertical circulation is variable, reflecting the complex interaction of tides with river flows and bottom topography and roughness (Corps 1983). The North Jetty eddy has varying strength and direction (based on location and timing of tide) ranging from 0.3 to 3.3 feet per second.

As waves propagate shoreward toward the mouth of the Columbia River, the waves are modified (waves begin to shoal and refract) by the asymmetry of the mouth of the Columbia River underwater morphology. Nearshore currents and tidal currents are also modified by the jetties and the mouth of the Columbia River morphology. These modified currents interact with the shoaling waves to produce a complex and agitated wave environment within the mouth of the Columbia River. The asymmetric configuration of the mouth of the Columbia River and its morphology is characterized by the significant offshore extent of Peacock Spit on the north side of the North Jetty, southwesterly alignment of the North/South jetties and channel, and the absence of a large shoal on the south side of the mouth of the Columbia River. The asymmetry of the mouth of the Columbia River causes incoming waves to be focused onto areas which would not otherwise be exposed to direct wave action. An example of this wave-focusing effect is the area along the south side of the North Jetty. Upon initial inspection, it would appear that this area is most susceptible to wave action approaching the mouth of the Columbia River from the southwest. However, this is not the case; the opposite is what occurs. The area located between the North Jetty, the navigation channel, and Jetty A is affected by wave action during conditions when the offshore wave direction is from the west-northwest, because of the refractive nature of Peacock Spit. Waves passing over Peacock Spit (approaching from the northwest) are focused to enter the mouth of the Columbia River along the south side of the North Jetty. Conversely, large waves approaching the mouth of the Columbia River from the southwest are refracted/diffracted around the South Jetty and over Clatsop Spit, protecting the south side of the North Jetty from large southerly waves.

Channel stability at the mouth of the Columbia River is related to the jetties and the morphology of Peacock and Clatsop spits (Moritz et al. 2003). Because of phased jetty construction from 1885 to 1939 and the associated response of morphology, mouth of the Columbia River project features and the resultant morphology are now mutually dependent both in terms of structural integrity and project feature functional performance.

The Columbia River plume is the zone of freshwater/saltwater interface where the freshwater exiting the Columbia River meets and rises above the denser saltwater of the Pacific Ocean, just seaward of the MCR. The plume is formed as thin, buoyant lenses of fresher water flowing over denser, oceanic water and is more pronounced when flow from the river is large in comparison to tidal volume. The Columbia River plume is ephemeral and may persist for several hours and is controlled by fluctuating tide. A frontal boundary (front) is formed between the river plume and adjacent marine waters. The front is richer in zooplankton than adjacent marine waters and plume waters, being attributed to increased abundance of surface-oriented organisms (Morgan et

al. 2005). The plume front is easily identified by well defined horizontal gradients in salinity and water clarity and by the accumulations of foam and flotsam (De Robertis et al., 2005).

Nutrients were not found to be more abundant in the fronts than adjacent plume and ocean waters and, therefore, it is unlikely that plume fronts are regions of greater production. Greater zooplankton biomass in the plume front was largely due to the concentration of surface-oriented species along the front, particularly Dungeness crab (*Cancer magister*) megalopae and the concentration of the eggs of northern anchovy (*Engraulis mordax*) and sanddab (*Citharichthys* spp.). This increased concentration of surface-oriented zooplankton is caused by convergent water flows at the frontal boundary. Although biomass was greater, density of all zooplankton combined (including non-surface-oriented zooplankton) was not found to be greater at the plume compared to adjacent plume and ocean waters. More bird feeding activity was noted at the front compared to the adjacent plume and ocean waters (Morgan et al. 2005). Increased bird foraging could contribute to limiting salmon use of fronts.

In the study by Morgan and others (2005), there was no significant difference in the mean temperature among the three habitats in 2001 but the plume was significantly warmer than the ocean and front habitats in 2002. The mean salinity of the front was more similar to that of the plume in 2001 and to the ocean habitat in 2002.

This multi-layered mixing zone plays an important role as habitat for juvenile salmonids and other fish species. The first few weeks of their ocean life, some of which is spent in the plume, are critical for recruitment success of salmonids (Pearcy 1992). The Columbia River plume provides a high turbidity refuge from predation, provides fronts and eddies where prey become concentrated, and provides a stable habitat for northern anchovy spawning (Richardson 1981, Bakun 1996). A strong, quickly moving plume also helps juvenile salmonids and other species move rapidly offshore.

Foundation Conditions

The project has two main shoaling areas. The outer shoal extends from approximately RM -1.6 to RM -1.0. The inner shoal, Clatsop Shoal, extends from approximately RM 0.0 to RM 2.6, beginning on the south side and crossing the channel near RM 1.0. To maintain the channel's depth, dredging is conducted and materials dredged from the project are placed in one of two EPA Section 102 of the Marine Protection, Research, and Sanctuaries Act (MPRSA) Ocean Dredged Material Disposal Sites (ODMDS) -- the Deep Water Site (DWS) or the Shallow Water Site (SWS), or alternately in a Clean Water Act Section 404 North Jetty site (Corps 2008).

The MCR jetties were constructed on these underwater sand shoals which are considered to be crucial project elements. These shoals are currently receding, which could affect the sediment budget supplying the adjacent littoral zones north and south of the MCR. As morphology near the jetties experiences significant erosion, the jetties will be undermined by waves and currents.

Landforms

Near the Oregon shore of the estuary, Clatsop Spit is a coastal plain. On the Washington shore, Cape Disappointment is a narrow, rocky headland. Extensive accretion of land has occurred

north of the North Jetty since its construction. This accreted land, however, is now in the process of recession as is evident by erosion at Benson Beach. The Corps is in the process of placing Columbia River sand back into the littoral drift cell north of the North Jetty at Benson Beach. Behind the headland is beach dune and swale. Wetlands occur on accreted land north of the North Jetty and on Clatsop Spit.

Wetlands near the North Jetty

Scouring has occurred on the north side of the North Jetty resulting in the formation of wetlands and a backwater lagoon within the approximately 16-acre wedge of land between the North Jetty and Jetty Road. Lagoons are characterized by shallow water and intermittent ocean connectivity and are often oriented parallel to the shoreline. Because of their interface location between land and sea, their exposure to rapidly changing physical and chemical influences, their short and varied water residence time, and their wind and weather dependent vertical and horizontal stratification, these lagoon features can be very dynamic and productive based on these natural constraints (Troussellier 2007). A recently repaired sand berm separates the western entrance of the North Jetty lagoon from tidal flows along the south end of Benson Beach. Thus, the North Jetty lagoon and wetlands are separated from direct ocean connectivity by the berm and the jetty itself. Fish access to and use of the lagoon is not likely. However, the lagoon is often inundated both by tidal waters that come through the jetty and by freshwater from wetlands that have formed in accreted lands north of Jetty Road and which drain through a culvert into the lagoon and its adjacent wetlands. The lagoon area and three wetland areas were delineated in this wedge of land and total approximately 6.5 acres of wetlands and waters of the United States.

Wetlands within and fringing the lagoon that are proposed to be filled are located between the North Jetty and the beach access road to the north and comprise a total of 1.78 acres. These wetlands were delineated by Tetra Tech (2007a, b) in accordance with the Corps' Wetlands Delineation Manual (Corps 1987). Three distinct wetlands were identified.

Wetland 1 (0.61 acre). These disjunct wetlands are classified as estuarine emergent, persistently regularly flooded. These patches of wetlands fringe the scoured-out tidal channel and are characterized by bighead sedge, American dune grass, Baltic rush, and tufted hairgrass. These fringe wetlands are ephemeral in nature in that they can be affected by moving sand. This was evident during a field visit in fall 2007 when a storm during the previous winter washed sand eastward covering nearly all of a patch of wetland that occurred near Benson Beach.

Wetland 2 (0.97 acre). This wetland is classified as palustrine emergent, persistently seasonally flooded and as palustrine scrub-shrub broad-leaved deciduous seasonally flooded. It occurs adjacent to the beach access road in drainage ditches. Three plant communities characterize this wetland: baltic rush-velvet grass emergent, slough sedge emergent, and willow shrub.

Wetland 3 (0.20 acre). This wetland is classified as palustrine scrub-shrub, broad-leaved deciduous, seasonally flooded. This bowl-shaped wetland occurs toward the west end of the area projected for filling and is characterized by a thick understory of slough sedge and an overstory mainly of alder. Pacific crabapple and Sitka spruce are also present.

Two of the three wetlands described above were rated by the Washington Department of Ecology and the Corps on November 16, 2007 in accordance with the Washington State Wetland Rating System (Hruby 2004). Wetland 1, the tidal fringe wetlands, was not rated by this system because they are considered estuarine wetlands. Because of lack of hydrologic connection, Wetland 2 (consisting of two ditches) was broken out into discrete wetlands for rating purposes (referred to here as Wetland 2a and Wetland 2b). Wetland 2a is between the east parking lot and beach access road and Wetland 2b is just west of Wetland 2a. Categories assigned by the rating system are: Category I (score ≥ 70), Category II (score 51-69), Category III (score 30-50), and Category IV (score < 30). All three wetlands rated are considered depressional wetlands and qualify as Category III wetlands. Scores for the wetlands are shown in Table 34.

Table 17. North Jetty Wetland Scores

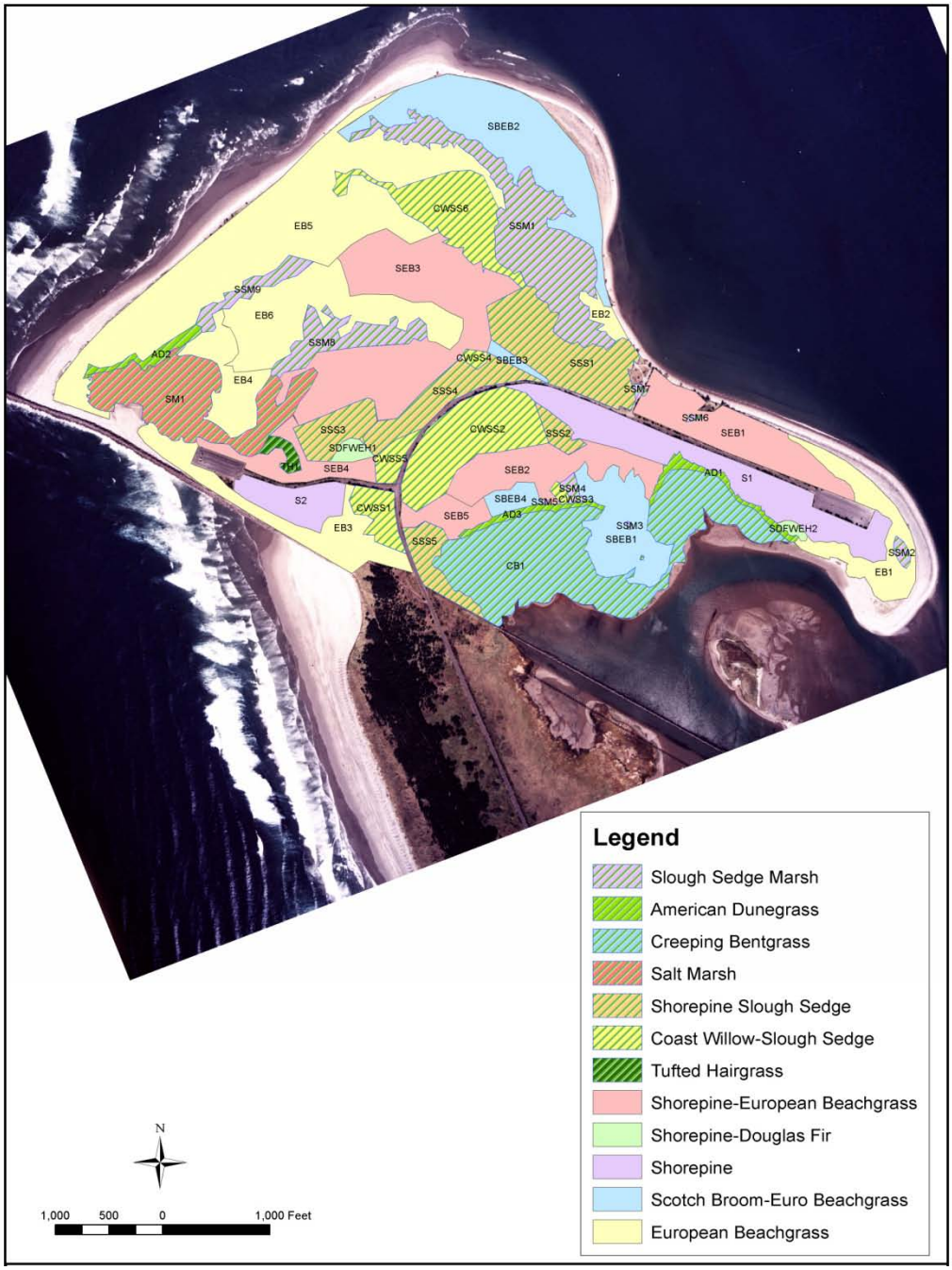
Function	Wetland		
	2a	**2b**	**3**
Water Quality Functions	12	20	12
Hydrologic Functions	5	10	12
Habitat Functions	13	13	15
Total Score	30	43	39

Note: Rating by Washington State Wetland Rating System.

Wetlands near the South Jetty (on Clatsop Spit)

Though official delineations have not yet been completed near the South Jetty, habitat surveys (Tetra Tech, 2007b) suggest that of the 600-acres of Clatsop Spit surveyed, there are likely 193-acres of wetlands. The topography of the area is complex with dunes and intertidal swales forming a mosaic of various vegetation communities, including: shorepine-slough sedge, slough sedge marsh, American dune grass, creeping bent grass, salt marsh, coast willow-slough sedge, tufted hair grass, shorepine-European beach grass, shorepine-Douglas fir, shorepine, Scotch broom-European beach grass, and European beach grass (Figure 40). At least three of these communities (shorepine-slough sedge, shorepine-Douglas fir, and coast willow-slough sedge) have been ranked globally and by the state for their rarity and vulnerability to extinction.

Figure 40. Clatsop Spit Vegetative Communities (Tetra Tech 2007b)



It is anticipated that the proposed actions will avoid most impacts to wetlands and waters of the United States in this area to the maximum degree feasible. The marsh wetlands at the South Jetty are also mostly isolated and separated from active direct ocean access by an existing dune that precludes regular connectivity, therefore regular anadromous fish use is not expected. However, fish monitoring surveys from the 2007 repairs did observe some stranding of

threespine stickleback (*Gasterosteus aculeatus*), which was reported to NMFS. As mentioned, at the South Jetty fish salvage and exclusion have been proposed to avoid stranding listed species.

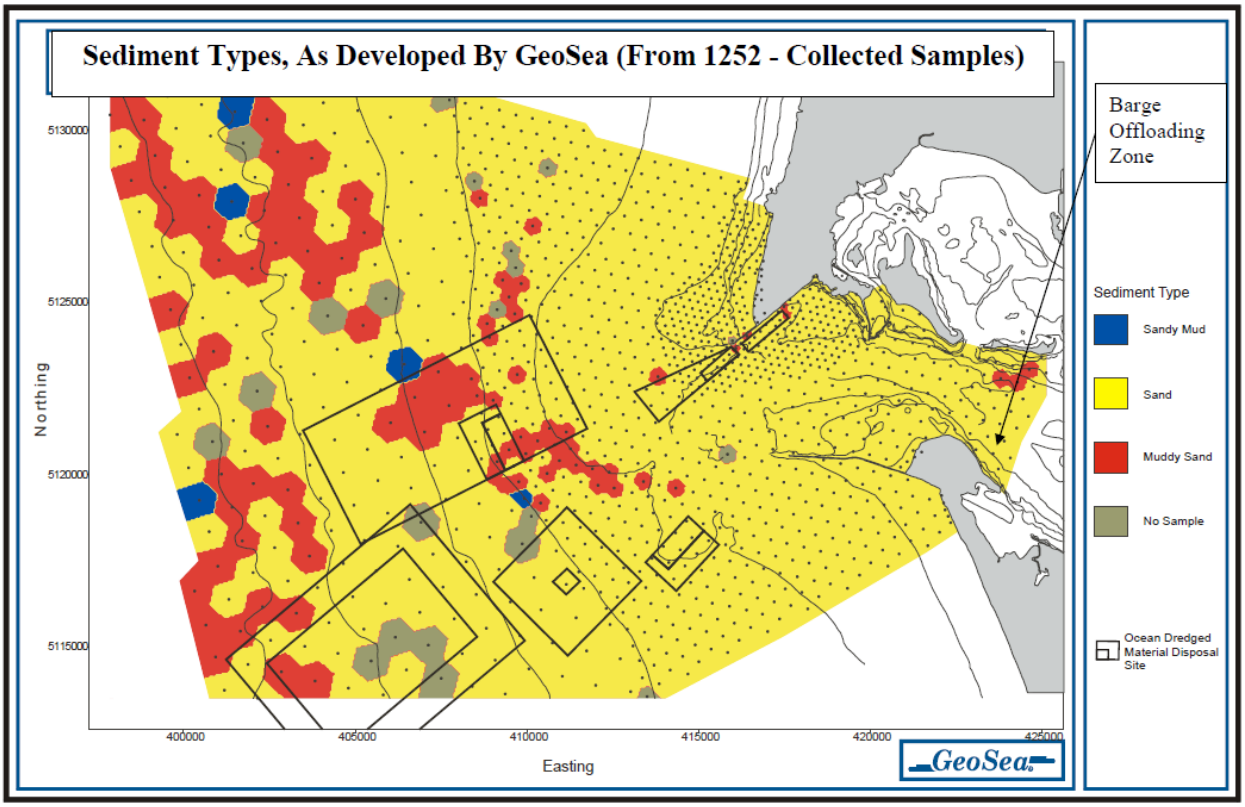
Wetlands near Jetty A

Land around the base of Jetty A received a cursory inspection on January 22, 2007 and on September 13, 2010. It is possible that sparse, perched wetlands composed of sedge and grassy fringe estuarine wetlands were present; no official wetland delineation was completed.

Sediment Quality

In 2000 a Sediment Trend Analysis (STA) was conducted by GeoSea Consulting, under contract to the Corps. Over twelve hundred (1,252) samples were collected in the MCR and surrounding off-shore locations (Figure 41). Physical analyses, of the samples surrounding the study area (6 samples selected), indicate the project area consists of >99 % sand. Select samples (10) from the GeoSea study in the MCR project were analyzed for physical and chemical contamination. These samples indicated no contaminates were detected at or near the DMEF screening levels. See http://www.nwp.usace.army.mil/ec/h/hr/Reports/Mcr/mouth00.pdf for the complete report on chemical results (Corps 2008).

Figure 41. Sediment Trend Analysis in MCR Area



In 2005 a Tier I evaluation was conducted near the proposed the South Jetty barge offloading site following procedures set forth in the Inland Testing Manual (ITM) and the Upland Testing

Manual (UTM). The methodologies used were those adopted for use in the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area, November 1998, and its updated draft 2005 version, the Sediment Evaluation Framework (SEF). This Tier I evaluation of the proposed dredge material indicated that the material was acceptable for both unconfined in-water and upland placement. No significant, adverse ecological impacts in terms of sediment toxicity were expected from disposal (Corps 2005a).

In 2008 using USEPA's OSV Bold, ten Van Veen surface grab samples were collected from sites previously sampled during the September 2000 sediment evaluation study. Percent sand averaged 98.45% with a range of 99.3% to 97.0%. Percent silt and clay averaged 1.59% ranging from 3.0% to 0.7%. Per the Project Review Group approved SAP, no chemical analyses were conducted. Physical results for the 2000 and 2008 sampling events were compared. The mean percent sand for all samples in September 2000 was 98.11% for June 2008 it was 98.45%. Within both data sets, sediment towards the outer portion of the mouth is finer than sediments towards the center of the mouth (Corps 2008).

Other Activities and Conditions

Commercial and recreational fishing activities also have some influence on listed species and their prey items in the action area. The major fisheries are for bottom fish, salmon, crab, and other species of shellfish. Crab fishing occurs from December to September with the majority of the catch occurring early in the season. Most crab fishing occurs north of the Columbia River mouth at depths ranging from 25 to 250 feet mean sea level (MSL). Dungeness crab population numbers are subject to large cyclic fluctuations in abundance. Catch records for fishery are generally believed to represent actual population fluctuations. Modeling studies by Higgins and others (1997) show that small scale environmental changes, such as a short delay in the onshore currents in spring, can dramatically impact survival of young-of-the-year crab but have no effect on adults and older juveniles inshore. Bottom fishing by trawl for flatfish, rockfish, and pink shrimp occurs year-round throughout the entire offshore area, primarily at depths offshore from the jetties. Many of these species interact with listed species in a predator-prey relationship that, in some cases, can change over the course of each species' life history. Fisheries could have some effect on prey availability and species numbers in the action area.

EFFECTS OF THE ACTION

Effects of the action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. The Corps has determined that the effects of the proposed action could occur from:

- Rock Transport
- Construction Access, Staging, Storage, And Rock Stockpiling
- Rock Placement
- Dredging
- Disposal
- Barge Offloading Facilities
- Pile Installation and Removal
- Lagoon And Wetland Fill And Culvert Replacement
- Dune Augmentation
- Water Quality
    - Suspended sediment
        - Dredging
        - Disposal
        - Pile Installation and Removal
    - Spills Leaks
    - Contamination
- Hydraulic and Hydrological Processes
    - Water Velocity
    - Salinity and Plume Dynamics
    - Bed Morphology
- Wetland Mitigation and Habitat Improvements

Rock Transport

As discussed, barge transport of stone from quarry sites is likely and would occur mostly during daylight hours along major navigation routes in existing harbors and navigation channels. The number of additional barge trips per year attributable to the proposed action is expected to be somewhere between 8 and 22 ships. This is small annual percentage increase relative to the current number of other commercial and recreational vessels already using any of these potential routes. MCR is the gateway to the Columbia-Snake River system, accommodating commercial traffic with an approximate annual value of $16 billion dollars a year. Loaded water-borne

container traffic identified as foreign in- and outbound to/from Portland that would likely have crossed the MCR in 2008 totaled approximately 195,489 ships (Corps 2010). Traffic from the proposed action will also be limited mostly to summer months when fair weather allows safe passage. Though transport will occur on an annual basis, stone may or may not be delivered to one or more jetties seasonally. Due to the infrequency of these vessel trips, their geographic limitations to existing navigation channels, and their minimal duration in any particular area, the disturbance effects are expected to be discountable. The proposed action will not cause any meaningful increase (less than 1%) in annual vessel traffic along the routes or around the MCR jetty system. Any increase in acoustic levels from barge traffic during delivery will be transient. Sound levels are expected to return to background near the source, and are not expected reach harmful levels. Therefore, these effects are negligible and discountable.

Construction Access, Staging, Storage, and Rock Stockpiling

Construction activities will occur on an annual basis, could happen through-out the year, and may occur at one or more jetties simultaneously. Upland effects could include: repetitive disturbance; de-vegetation; residual rock side-cast; and soil compaction. Changes in soil structure and composition could also result in localized habitat conversion of the vegetative and biological communities. Invasive species are located in the vicinity of all three jetties, and chronic disturbance can increase the spread and establishment of such species. Changes in the plant communities can also cause trophic effects on the faunal communities that rely on these ecosystems for forage and habitat. However, the Corps expects effects to listed species from associated construction activities for staging, roadways, and stockpiles to be localized at all jetties, as the majority of these construction features have been sited in upland areas above mean high tide elevation in locations that were identified as of lower habitat value, and were in some cases previously used as staging areas. Avoidance and minimization measures have reduced the construction footprint where possible, and higher value habits like marsh wetlands and slough sedge communities have been preserved such that activities are limited to areas where previous disturbance and development have already occurred. Wetland fill effects from these activities are discussed in the wetland fill section.

Whenever feasible, stabilizing dune vegetation is being preserved and little if any riparian or vegetative cover will be removed or disturbed. Furthermore, protective fencing, set-backs, and an Erosion and Sediment Control Plan or Stormwater Protection Plan will be implemented so that best management practices (BMPs) avoid stormwater erosion and run-off from disturbed areas. The topography in this area is flat, and proposed impact minimization measures for construction will reduce the likelihood for sediment to enter the Columbia River. When construction activities are suspended for the season, appropriate demobilization and site stabilization plans will limit the distribution and duration of any effects. No pollutants are expected to enter waterways.

Any increase in acoustic levels from truck traffic during delivery will be transient and intermittent. Conservation measures limit the hours for stone delivery as well as the use of compression brakes, which will reduce species exposure to acoustic effects. Trucks will only be allowed to use the roads through Cape Disappointment State Park during daylight hours. Sound levels are expected to return to background near the source, and are not expected reach harmful levels. Therefore, these effects are negligible and discountable. There may be some disturbance

from equipment sounds and human presence, but these will be indirect and of low intensity, mostly during daylight hours and summer months. The geographic area will be limited, and species will be able to avoid work areas. Therefore, disturbance effects from these activities are expected to be minimal and discountable.

Rock Placement

Rock placement will occur on an annual basis starting in the late spring through the late to early fall seasons. Placement may occur at more than one jetty per season and will occur regularly throughout the duration of the construction schedule. Some permanent habitat conversion and modification will occur as a result of stone placement for repair and rehabilitation of jetty features. Along specific portions of North and South jetties and along the entire length of Jetty A, substrate will be converted to rocky sub and intertidal habitat, and associated benthic communities will be covered. In addition, crane set-up pads and turnouts will require placement of rock that could extend slightly off the current centerline of the jetty trunk. However, this total area is a relatively small percentage of the existing jetty structures, and conversion is mostly limited to the spur groin locations. Generally, effects to in-water habitat could include the following sub-tidal and intertidal habitat conversion from sandy to rocky substrate and potential unforeseen indirect far-field effects from hydraulic influence (slight, localized changes to accretion, currents, velocities, etc). However, relatively little habitat conversion and footprint expansion will occur because a majority of the stone placement for construction of the jetty head, trunk, and root features will occur on existing relic jetty stone and within the existing structural prism. Moreover, aquatic species will experience limited exposure, since stone placement for cross-section repair and rehabilitation actions occurs mostly above the MHHW elevation. This is summarized below.

North Jetty

- About 58% of the overall stone placement on these portions of the jetty will be placed above mean higher high water (MHHW); about 25% of the volume will be placed between MHHW and MLLW; and about 18% of the volume placed will be below MLLW. Therefore, approximately 83% of the volume placed for trunk and root cross section repairs is above MLLW. There is no expected expansion of the footprint beyond the relic jetty stone or structure.
- A small percentage (about 0.1%) of the overall stone placement for spur groins will be above MHHW; about 4% will be placed between MHHW and MLLW; and about 95.9% will be placed below MLLW. Therefore, approximately 96% of the spur groin construction will be below MLLW, and this will cause 1.55 acres of habitat conversion from sandy to rocky substrate. Bottom topography and shallow water habitat will be altered in a limited geographical area, and benthic organisms will be covered. This is a small percentage relative to the existing acreage of the jetty structure and the available adjacent remaining shallow-water sand habitat in the vicinity of the action area. These structures are also relatively short, remaining close to the jetty trunk and root. Channel-side groins are submerged a minimum of 5 to 35 ft below MLLW.
- About 49% of the overall stone placement on the capping portions of the jetty will be placed above MHHW; about 24% of the volume will be placed between MHHW and

MLLW; and about 27% of the volume placed will be below MLLW. Therefore, approximately 73% of the volume placed for head capping will remain above MLLW. This feature is not expected to expand beyond the footprint of the relic jetty stone.

- Stone placement for barge offloading facilities (additional effects discussed further elsewhere), turn-outs, and set-up pad facilities will cover and convert about 0.63 acres and will be confined within the same location as the stone placed for repairs. This is a small percentage relative to the existing acreage of the jetty structure and the available adjacent remaining shallow-water sand habitat in the vicinity of the action.

South Jetty

- About 68% of the overall stone placement on these portions of the jetty will be placed above mean higher high water (MHHW); about 19% of the volume will be placed between MHHW and MLLW; and about 13% of the volume placed will be below MLLW. Therefore, approximately 87% of the volume placed for trunk and root cross section repairs is above MLLW. There is no expected expansion of the footprint beyond the relic jetty stone or structure.
- A small percentage (about 0.1%) of the overall stone placement for spur groins will be above MHHW; about 12.3% will be placed between MHHW and MLLW; and about 87.6% will be placed below MLLW. Therefore, approximately 88% of the spur groin construction will be below MLLW, and this will cause 1.10 acres of habitat conversion from sandy to rocky substrate. This is a small percentage relative to the existing acreage of the jetty structure and the available adjacent remaining shallow-water sand habitat in the vicinity of the action area. These structures are also relatively short, remaining close to the jetty trunk and root.
- About 52% of the overall stone placement on the capping portions of the jetty will be placed above MHHW; about 25% of the volume will be placed between MHHW and MLLW; and about 23% of the volume placed will be below MLLW. Therefore, approximately 77% of the volume placed for head capping will remain above MLLW. This feature is not expected to expand beyond the footprint of the relic jetty stone or structure.
- Stone placement for barge offloading facilities, causeways, turn-out, and set-up pad facilities will cover and convert about 1.96 acres. This is a small percentage relative to the existing acreage of the jetty structure and the available adjacent remaining shallow-water sand habitat in the vicinity of the action.

Jetty A

- About 63% of the overall stone placement on these portions of the jetty will be placed above mean higher high water (MHHW); about 29% of the volume will be placed between MHHW and MLLW; and about 8% of the volume placed will be below MLLW. Therefore, approximately 92% of the volume placed for trunk and root cross section rehabilitation will remain above MLLW. There may be some expansion of the footprint beyond the relic jetty stone or structure. This is not expected to extend beyond 10-ft off the existing prism, which is a possible conversion of 1.2 acres from sandy to rocky substrate. This is a small percentage relative to the existing acreage of the jetty structure

and the available adjacent remaining shallow-water sand habitat in the vicinity of the action.

- 100% of the spur groin construction will be below MLLW, and this will cause 0.61 acres of habitat conversion from sandy to rocky substrate. This is a small percentage relative to the existing acreage of the jetty structure and the available adjacent remaining shallow-water sand habitat in the vicinity of the action area. These structures are also relatively short, remaining close to the jetty trunk and root. Both groins are submerged a minimum of 5 below MLLW.
- About 44% of the overall stone placement on the capping portions of the jetty will be placed above MHHW; about 26% of the volume will be placed between MHHW and MLLW; and about 30% of the volume placed will be below MLLW. Therefore, approximately 70% of the volume placed for head capping will remain above MLLW. This feature is not expected to expand beyond the footprint of the relic jetty stone or structure.
- Stone placement for barge offloading facilities, causeways, turn-out, and set-up pad facilities will cover and convert about 2.89 acres. This is a small percentage relative to the existing acreage of the jetty structure and the available adjacent remaining shallow-water sand habitat in the vicinity of the action.

Indirect disturbance effects due to placement activities will be localized and occur mostly during daylight hours in the summer months. Disturbance effects are expected to be of limited duration and minimal, since a majority of the placement is above MHHW and on existing relic stone. Acoustic effects of construction on the jetties similar to those mentioned in the Construction and Staging section are less likely to reach the land at levels much above background. There may be temporary disturbance to species using the jetty structure in the vicinity of placement activities. However, the Corps does not expect long-term negative effects from these actions.

Dredging

As previously described, dredging will for construction and maintenance of barge offloading facilities and is likely during early summer prior to rock delivery, but may not occur at all facilities annually. If all facilities were dredged, this would total about 16 acres near the jetties. However, it is likely only one or two facilities would be used seasonally for short durations and would be dredged on a periodic basis as needed.

The effects of dredging on physical habitat features include modification of bottom topography, which in the vicinity of the jetties is by nature extremely dynamic. Dredging may convert intertidal habitats to subtidal, or shallow subtidal habitats to deeper subtidal. Such conversions may affect plant and animal assemblages uniquely adapted to the particular site conditions these habitats offer. However, the dredged prisms are very small as a relative percentage of the ~19,575 acres of shallow-water habitat available within a 3-mile proximity to the MCR. The proposed dredging of the offloading facilities will affect bottom topography, but is unlikely to cause large-scale or long-term effects to habitat features. Dredging activities will also have some contribution to increased acoustic disturbance that could occur for a limited duration while dredging is underway. These effects are expected to attenuate rapidly such that they return to background levels within a short distance from the source.

The effects on water quality and suspended sediment are discussed further under the Water Quality section.

Disposal

Disposal is likely to occur on an annual basis originating from one or more of the offloading facilities. The duration of disposal will be limited and will likely occur earlier in the construction season prior to use of offloading facilities. As mentioned previously, all disposal of dredged material will be placed at previously evaluated and EPA-approved in-water ODMDS or Clean Water Act disposal sites. No new or different impacts to species or habitats than those previously evaluated by EPA for disposal approval are expected from these actions. Per EPA guidelines, all ocean dumping sites are required to have a site management and monitoring plan (SMMP) which is aimed at assuring that disposal activities will not unreasonably degrade or endanger the marine environment. This involves regulating the times, the quantity, and the physical/chemical characteristics of dredged material that is dumped at the site, establishing disposal controls, and monitoring the site environs to verify that unanticipated or significant adverse effects are not occurring from past or continued use of the disposal site and that permit terms are met. The relative quantities, characteristics, and effects of the proposed action area not expected to have different or significant negative impacts to these sites.

The effects of disposal on physical habitat features include modification of bottom topography. In some cases, disposal may result in the mounding of sediments on the bed of the disposal site. Such conversions may affect plant and animal assemblages uniquely adapted to the particular site conditions these habitats offer. However, the area impacted by disposal is relatively small and will likely occur in deeper habitat offshore, in the littoral cell or near the North Jetty vicinity. The proposed disposal is unlikely to cause large-scale or long-term effects to habitat features. The effects on suspended sediment are discussed further under the Water Quality section.

Barge Offloading Facilities

Installation of offloading facilities is likely to occur once, likely in the late spring or early summer prior to or during the first season of construction on the associated jetty. Subsequently, periodic maintenance may be required as facilities weather wave and current conditions at the MCR. Facilities may also occasionally be partially removed and reconstructed, which could slightly increase the frequency of disturbance. Depending on the specific facility and contemporary conditions at the time, removal would then occur at the end of the scheduled construction duration. Temporally, this limits the repetition of disturbance activities associated with the construction of these facilities. Use of the facilities may be annual with periodic breaks in between, depending on the construction schedule and conditions at the jetties. Annual use is likely on at least one of the facilities and will be seasonally concentrated in the spring, summer, and fall. Though unlikely, occasional breaks in weather could allow offloading at other times of the year.

Stone placement for barge offloading facilities could have the same minimal effects and were described previously under rock placement. However, - with the exception of the facility at Parking Lot D on the Clatsop Spit - construction and maintenance of the facility and associated

and piles would be equivalent to actions already occurring from jetty repair and stone placement, and would not cause a separate or cumulative increase in disturbance. Also as mentioned previously, chemically treated wood will not be used for decking material, as treated decking could leach toxic substances into the water. Therefore water quality is not expected to be negatively impacted by these facilities. Possible effects of the action to water quality are discussed under Water Quality. Offloading facilities will be areas of slightly increased activity and vessel traffic, but the intensity of use is expected to be low and seasonal in nature. Additional noise from vessel activities may increase disturbance, but acoustic effects are not expected to reach harmful levels and will be geographically and temporally limited. A return to background noise levels is likely near the source.

The effects from dredging and pile installation and removal for these facilities are discussed under their respective sections.

Pile Installation and Removal

Pile Installation and subsequent removal is likely to occur once, likely in the late spring or early summer prior to or during the first season of construction on the associated jetty. Subsequently, periodic maintenance may be required as piles weather barge use and wave and current conditions at the MCR. Pile may also occasionally be partially removed and installed, which could slightly increase the frequency of disturbance. Depending on the specific associated offloading facility and contemporary conditions at the time, removal would then occur at the end of the scheduled construction duration. Temporally, this limits the repetition of disturbance activities associated with the installation and removal of these structures.

As mentioned previously, for initial construction of all four facilities combined, up to approximately up to 96 Z- or H-piles could be installed as dolphins, and up to approximately 373 sections of sheet piles installed to retain rock fill. However, it is unlikely that all facilities would be installed at the same time. Installation is likely to happen early in the construction season sometime between April and June, and is weather dependent. Piles will be located within 200-ft of the jetty and offloading structures. Vibratory drivers will be used and will dampen any acoustic effects to fish and other species. Because of the soft substrates in the lower Columbia River, vibratory drivers can be used effectively to install and remove piles. Sound wave form and intensity is not expected to reach harmful levels and are expected to return to background levels within a short distance from the source. Any acoustic impacts would be short duration and intermittent in frequency. Therefore, this action is not expected to have any significant direct effects, though it may cause temporary displacement during installation.

The presence of piles at the offloading facilities could increase perching opportunities for piscivorous birds, especially cormorants and brown pelicans. However, piling caps will avoid any significant increase in new perch sites so that the effects are expected to be minimal and discountable. Furthermore, perching opportunities for these birds are abundant in the lower Columbia River and are not expected to increase cormorant and pelican use of this area.

Wetland and Lagoon Fill and Culvert Replacement

Wetland fills and culvert installations at all jetties will occur once, and could happen during anytime in the construction season depending on weather. Sequentially, these actions will be required prior to several of the other proposed action. Subsequent removal of construction related culverts is likely to occur once, and could also happen during anytime in the construction season depending on weather and construction need. Periodic culvert maintenance may be required during construction. Temporally, this limits the repetition of disturbance activities to single event and season on separate jetties.

Where possible, the Corps has planned the construction, access, and staging areas at all jetties so that the footprint minimizes impacts to wetlands and higher value habitat features. Protections will be implemented for the identified rare and ranked vegetative communities within this area. Strategic use of uplands and lower quality wetlands for rock storage will be done to the most practical extent in order to avoid and minimize these impacts. However, permanent and temporary wetland fill will occur as a result of construction staging, storage, and rock stockpiles at all three jetties. Fill to protect the North Jetty root will also affect wetlands. Long-term direct and indirect impacts to wetlands could include: permanent wetland fill; potential fragmentation of and between existing wetlands; soil compaction; loss of vegetation; altered hydrology; conversion to upland; and loss of ecosystem functions (water quality, flood storage, nitrogen cycling, habitat, etc.). However, the Corps further expects effects from wetland impacts and lagoon fill to be insignificant on river functions, as the wetlands are not within the channel prism of the Columbia River. Although these wetlands are connected hydrologically to the Columbia River, wetland fill impacts are not likely to negatively alter groundwater-stream exchange or hyporheic flow because wetlands are on accreted land that has formed on stabilized sand shoals behind the jetties. Wetland hydrology is mostly elevation and rainfall dependent, and fill impacts will be relatively insignificant to the Columbia channel. Culverts will be installed to maintain wetland hydrology and connectivity with permanent replacement at the North Jetty and when temporary construction roadways cross wetlands. See the Wetland Mitigation and Habitat Improvements sections for further information about actions that will offset any habitat and functional losses from wetland fill.

Dune Augmentation

Dune augmentation will occur once during a single season, and could happen likely in the late spring or early summer depending on weather. Sequentially, this action will be required prior to several of the other proposed action. Periodic maintenance may be required, likely on a decadal scale. This is only proposed at the South Jetty. Therefore, temporally and geographically this limits the repetition of disturbance activities to single event and season on a single jetty.

Dune augmentation at the South Jetty will occur above mean high tide; therefore, actions will cause limited exposure to aquatic species. Though substrate modification will occur along the shoreline, the Corps does not expect any measurable changes from in-water habitat conversion below MHHW. This action is likely to be completed in a single season, and cobble replenishment would likely be on a decadal scale. Clean cobble material will be placed from an existing roadway, and delivery via beach access will be prohibited. Some equipment will be required to move materials around on the dry sand. There is little likelihood of having any direct

or indirect negative impacts to water quality or intertidal species, and the amount of dry sand conversion is relatively small compared to the amount of similar adjacent habitat that is available. The effects of this conversion are discountable and species exposure is unlikely.

Water Quality

Effects of the proposed action to water quality could occur by: increasing suspended sediments; increasing the potential occurrence of spills and leaks, and; increasing the potential for contamination. However, the Corps does not expect these effects to be significant.

Placement of rock by heavy equipment, jetty access road construction, dredging, disposal, and pile installation and removal could all cause temporary and local increases in suspended sediment. This is expected to have minimal and limited effects on the environment. Previous tests have confirmed that material to be dredged will be primarily sand with little or no fines, which does not stay suspended in the water column for a significant length of time. During infrequent and limited duration dredging and disposal, suspended sediments may increase locally for a short time. However, light attenuation and water quality effects from increased suspended sediments are expected to be minimal and fleeting. Pile driving is also expected to occur in sand and therefore have similar transient and minimal effects to water quality. Jetty roads could also contribute suspended sediments that would create turbidity, but since they are above MHHW this will likely be an infrequent occurrence. Increases in turbidity from construction activities on the jetties will likely occur on a nearly daily basis but will be of limited extent and duration, as rock placement will involve clean fill. Wave and current conditions in the action area naturally contribute to higher background turbidity levels; and such conditions also preclude the effective use of isolating measures to minimize turbidity. However, other BMPs described in the proposed action will further reduce effects of turbidity from the proposed action. Effects from potential stormwater runoff were addressed in the Construction Staging and Stockpile section. Therefore, impact from suspended sediments should be insignificant.

The Corps will require the contractor to provide a spill prevention and management plan that will include measures to avoid and minimize the potential for spills and leaks and to respond quickly to minimize damages should spills occur. Good construction practices, proper equipment maintenance, appropriate staging set-backs, and use of a Wiggins fueling system would further reduce the likelihood of leak and spill potential and exposure extent and its associated effects.

Test results on dredge material described earlier further indicated that materials in the area are approved for unconfined in-water disposal and do not contain contaminants in concentrations harmful to organisms occupying the action area. The prohibition of treated wood will also avoid contamination from the migration of creosote and its components [e.g., copper and polynuclear aromatic hydrocarbons (PAHs)] from treated wood in the lotic environments.

Temporally, effects to water quality from suspended sediment and turbidity could occur on a daily basis, but are not expected to be continuous throughout the day. Turbidity levels and durations will be limited to conditions required in the State Water Quality Certifications which include exceedence windows that are protective of beneficial uses like salmonids and other aquatic life. Contamination, spill, or leaks are expected to be infrequent and unlikely. Though, temporally the repetition of disturbance could be greater, this is still expected to remain within

safe ranges that do not have long-term or significant effects. Furthermore, effects are expected to be geographically limited, short term and minor.

Hydraulic and Hydrological Processes

As mentioned previously, over the years of project development, USGS and ERDC have conducted numerical modeling to evaluate changes in circulation and velocity, salinity, and sediment transport at the MCR for various rehabilitation design scenarios of the MCR jetty system. The purpose of the 2007 USGS evaluation was to assess the functional performance of the extended jetty system and to aid in the assessment of potential impacts to fish from the rebuilt lengths and spur groins. Except for the spur groins, modeling components including rebuilding jetty lengths is not proposed in this action. However, results under the larger build-out scenario are still relevant for comparing and evaluating previously estimated potential changes to the MCR system as a whole. Previous modeling work also remains somewhat valid for consideration because the current proposed action caps the jetties at their present location, which is essentially the same length as the original base conditions used for the previous models.

In 2007, modeling by USGS was done for two time periods, August-September and October-November. The model period of August-September was in existence from the 2005 Mega-Transect experiment (see below). The October-November run was established for engineering purposes as this time period represents extreme conditions at the MCR. A series of plots was produced to show existing and post-rehabilitation conditions for the following parameters: residual (average for all tides) velocity and current direction for bed and near surface, residual bed load transport, residual total load transport (bed load + suspended load), and mean salinity for bed and near surface. Rehabilitation components for USGS modeling included restoring the lengths of the North Jetty and Jetty A, and installing spur groins (Moritz and Moritz 2010; USGS 2007).

Existing conditions were established using August-September 2005 data collected from the Mega-Transect, a data collection system at the MCR. The Mega-Transect experiment was a 6-week field data collection effort to observe currents, suspended sediment, and salinity-temperature across the MCR. Data was collected concurrently at five fixed locations spanning 2 miles across the MCR during August-September of 2005. Instrumented tripods were placed at these five critical hydraulic-morphologic locations. Acquisition of prototype data describing the three-dimensional circulation within the MCR was intended to improve the hydrodynamic understanding and improve the ability to manage the sediment resources within the inlet/estuary (Moritz et al., undated).

The ERDC analyzed the impacts of the presence of spur groins at the MCR. This analysis was done independently of the modeling conducted by USGS and was conducted with the coastal modeling system (CMS) and other models that operate within the surface water modeling system (SMS). A regional circulation model (ADCIRC) provided the tidal and wind forcing for the boundaries of project-and local-scale wave, current, sediment transport, and morphology change calculated by the CMS. The half-plane version of the wave transformation model, STWAVE, was coupled with two-dimensional and three-dimensional versions of the CMS, which calculates current, sediment transport, and morphology change. These models were coupled to provide

wave forcing and update calculated bathymetry used in both models at regular intervals (Connell and Rosati 2007).

Water Circulation and Velocity

The Columbia River estuary has a greater range between high and low tides and receives a larger river discharge than most other estuaries in the U.S. resulting in rapid and turbulent currents. The primary factors controlling circulation in the Columbia River estuary are river flow, tides, and currents resulting from the pressure gradient force. The variability in the above mentioned parameters result in large variability in velocity (see charts presented in Fox et al. 1984). Quinn (2005) notes that there is great spatial variation in estuaries and that and that physiochemical attributes of the water such as depth, salinity, temperature, turbidity, and velocity vary over complex temporal scales including seasonal, lunar, and tidal periods. The USGS modeling results, for example, showed that in near surface waters near the landward portions of the North Jetty, velocity naturally varies with tides to over 1 meter/second during August-September. Under the rebuild scenario, changes to bed and surface velocities and current directions predicted by the models were negligible, particularly with respect to fluctuations that already occur. Though spur groins remain a component, no length rebuild is proposed under the current action. Therefore, any previously predicted effects to water circulation and velocity are even less likely under the current proposed action.

To further illustrate for the sake of comparison, previous model results quantified changes for the length rebuilds, which were negligible despite the larger scale action than what is currently proposed. When viewing the figures below, it is important to keep in mind they represent a previous action of a larger scope and scale. The representative original condition along with the spur groins is now more reflective of what the likely post-project conditions could entail.

For the August-September timeframe, an increase to residual bed layer velocity was predicted on the west side of the south portion of Jetty A to currents oriented in a south-southeast direction (Figure 42) but mean differences (existing to predicted) were less than 0.1 meter/second in this area. Smaller changes in residual velocities were predicted for near surface waters in the vicinity of Jetty A (Figure 43) (Moritz 2010, USGS 2007). These changes are small (10% or less) relative to the natural variation in this high energy environment. In these velocity charts, length of arrows indicates magnitude of velocity; red arrows indicate existing conditions and black arrows indicate predicted conditions resulting from implementation of the proposed project.

Under the length rebuild scenario, surface current direction for the August-September timeframe was predicted to change slightly toward the north as water flowed around Jetty A forming a more pronounced clockwise eddying effect west of Jetty A and tending to force water more directly toward the North Jetty. Residual velocities toward the North Jetty were predicted to decrease, however, and this effect would have protected the North Jetty. Predicted changes to current direction in the bed layer are less pronounced than in the surface layer (Figures 44 and 45). Changes to current direction and velocities are negligible in the vicinity of the South Jetty (Figure 45) (Moritz 2010, USGS 2007).

Figure 42. Residual Velocity Bed Layer for August/September Time Window

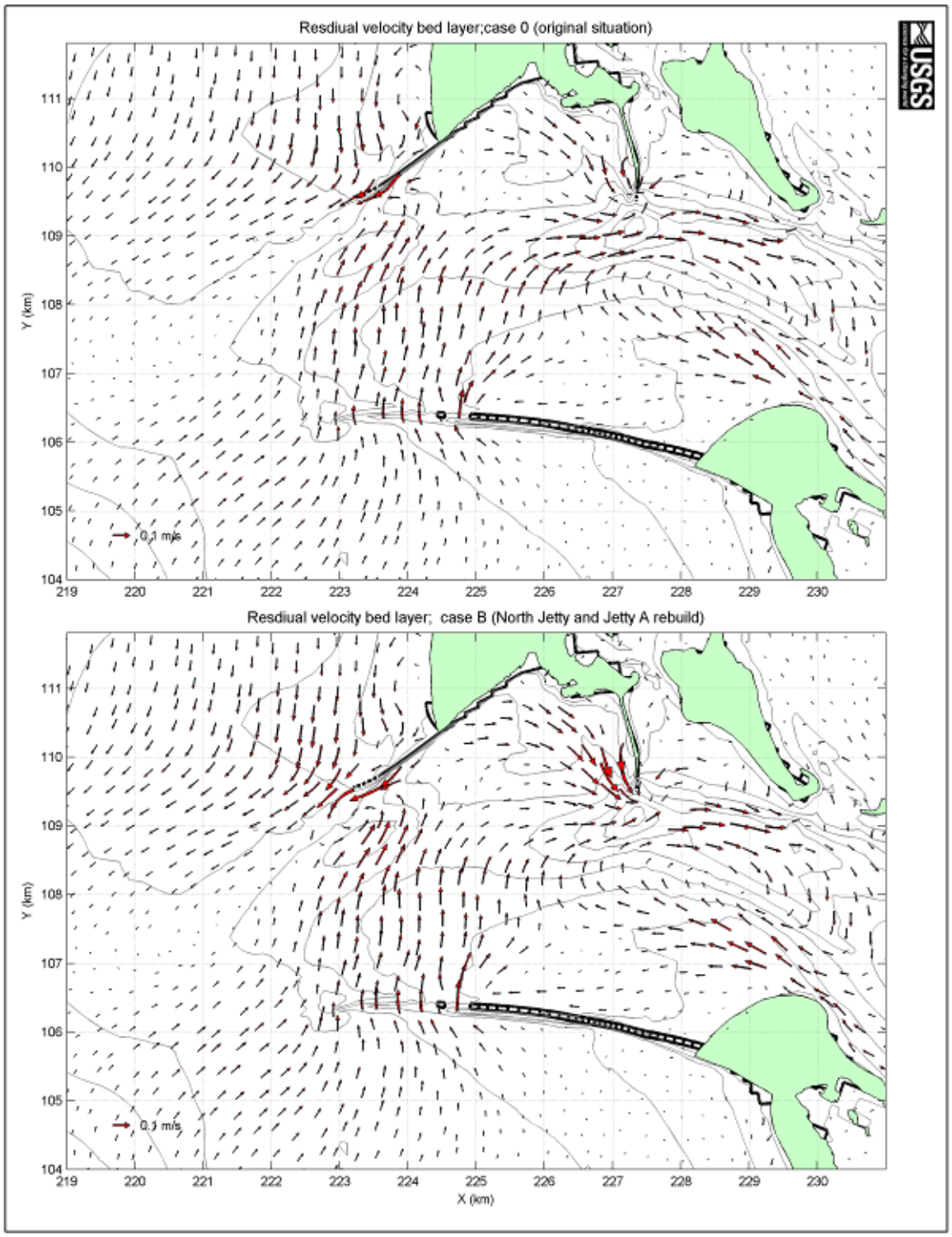


Figure 43. Residual Velocity Surface Layer for August/September Time Window

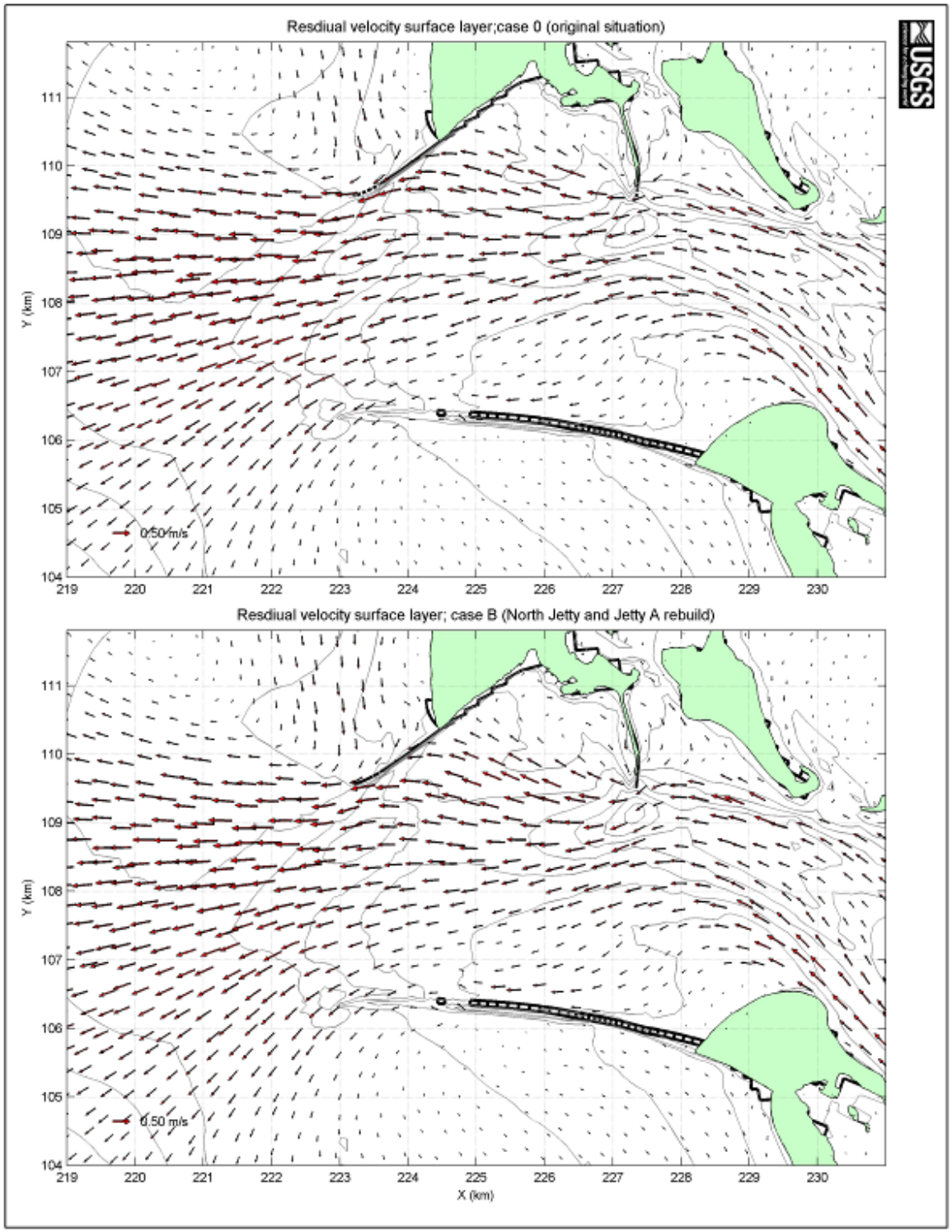


Figure 44. Residual Velocity near North Jetty and Jetty A for August/September Time Window

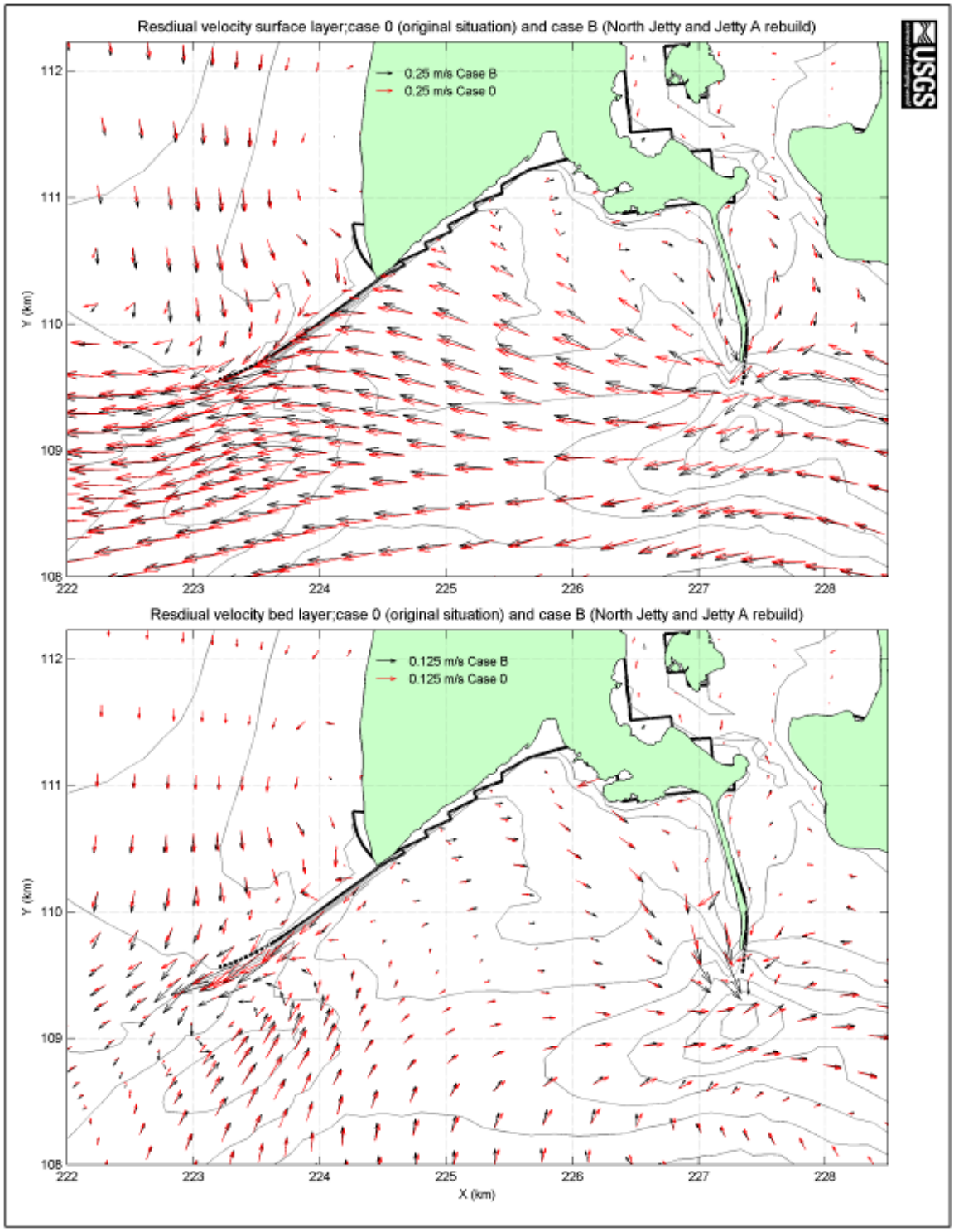
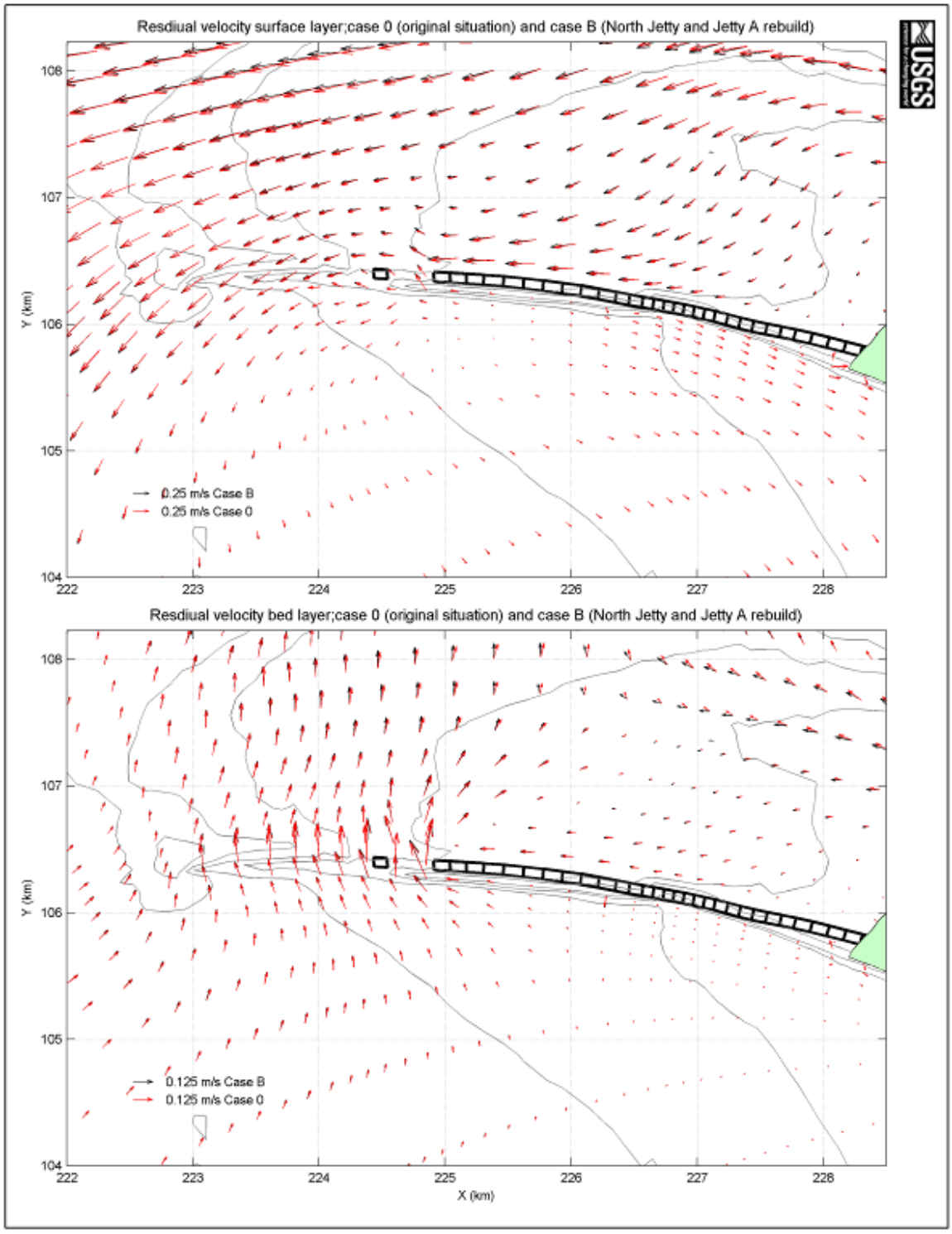


Figure 45. Residual Velocity near South Jetty for August/September Time Window



For the October-November timeframe, the situation was similar to the August-September timeframe in that a relatively large increase to residual bed layer velocity, compared to other areas in the MCR, was predicted on the west side of the south portion of Jetty A to currents oriented in a south-southeast direction (Figure 46) (Moritz 2010, USGS 2007). These changes, however, as with the August-September timeframe, were small as compared to natural variability.

For the October-November timeframe, current direction was predicted to change slightly toward the north as water flows around Jetty A forming a more pronounced clockwise eddying effect west of Jetty A and tending to force water more directly toward the North Jetty (Figure 47). Residual velocities toward the North Jetty are predicted to decrease, however, and this effect would act to protect the North Jetty, as is the case with the August-September timeframe (Moritz 2010, and USGS 2007). Such changes to velocities and currents are even less likely now since the current proposed action does not involve a length rebuild.

For the October-November timeframe, there also were predicted increases in bed layer velocity near the terminus of the North Jetty (Figure 47). Only small changes in residual velocities were predicted for near surface waters near the North Jetty terminus. Changes in surface current direction are similar to those described above for the August-September timeframe. Changes to velocities and current directions were predicted to be minimal for areas near the South Jetty (Figure 48), because these parameters at the South Jetty are essentially unaffected by alterations on the north side of the river (Moritz 2010, USGS 2007). As mentioned above, such changes are unlikely now since the current proposed action does not involve any length rebuild.

Figure 46. Residual Velocity Bed Layer for October/November Time Window

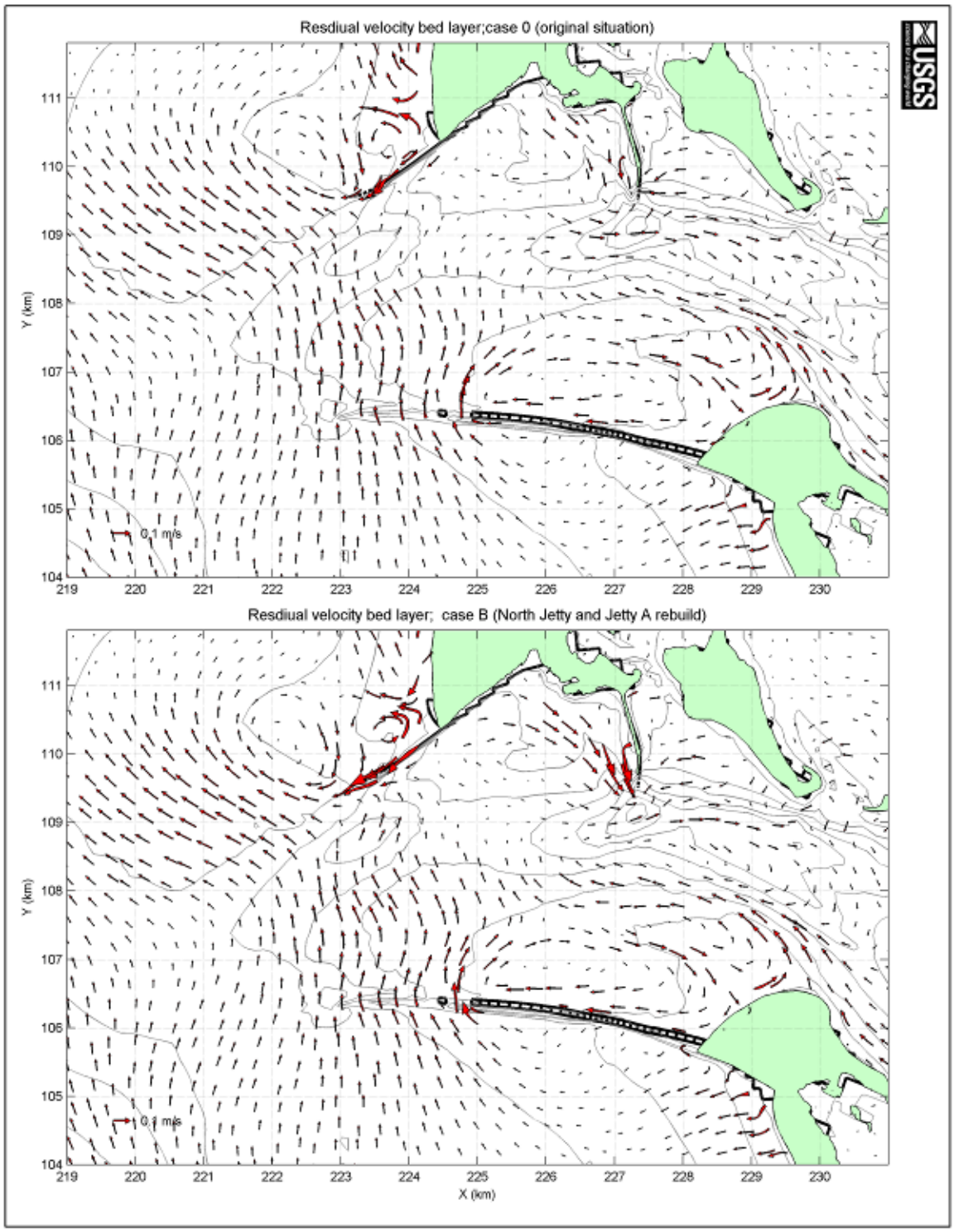


Figure 47. Residual Velocity near North Jetty and Jetty A for October/November Time Window

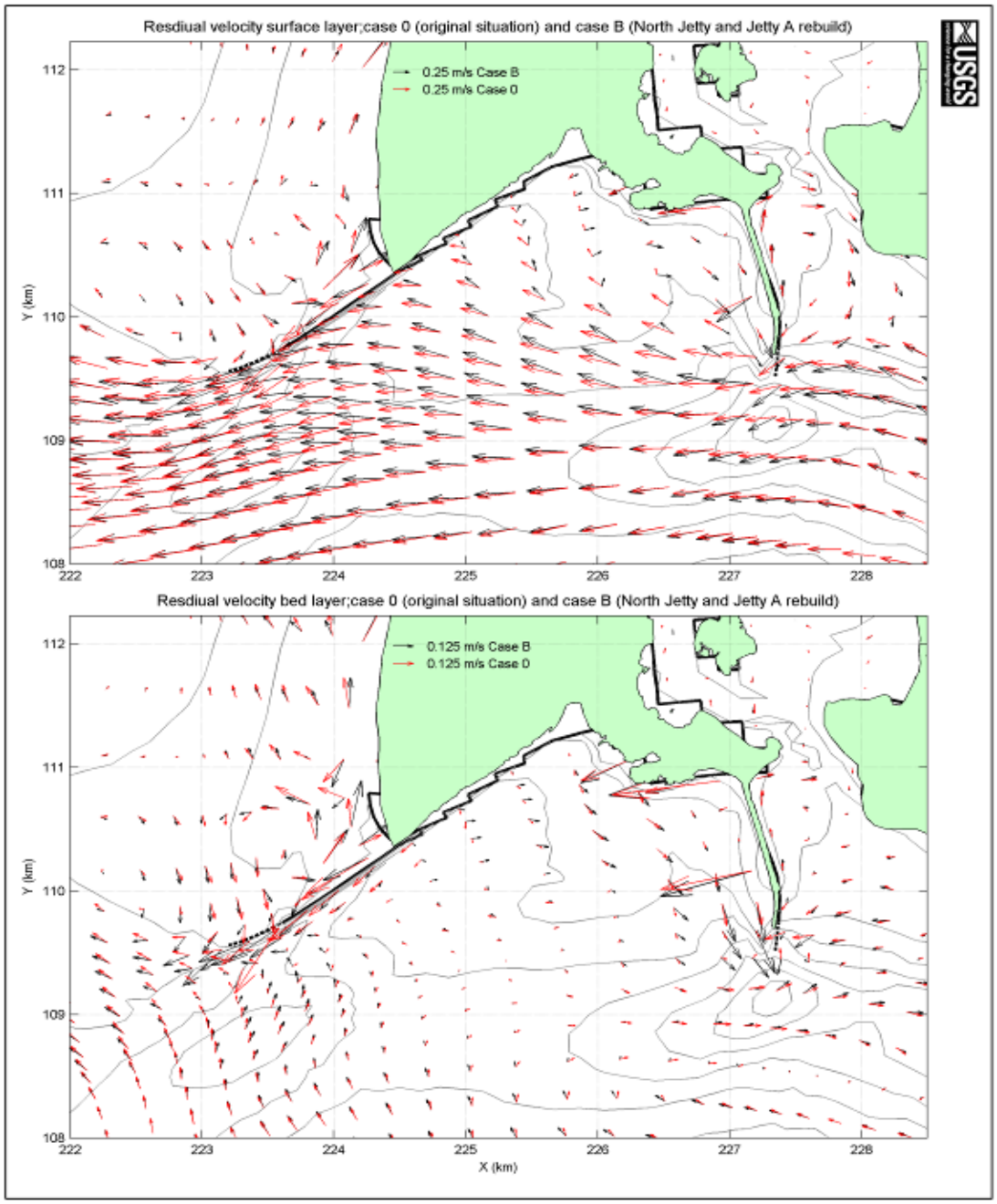
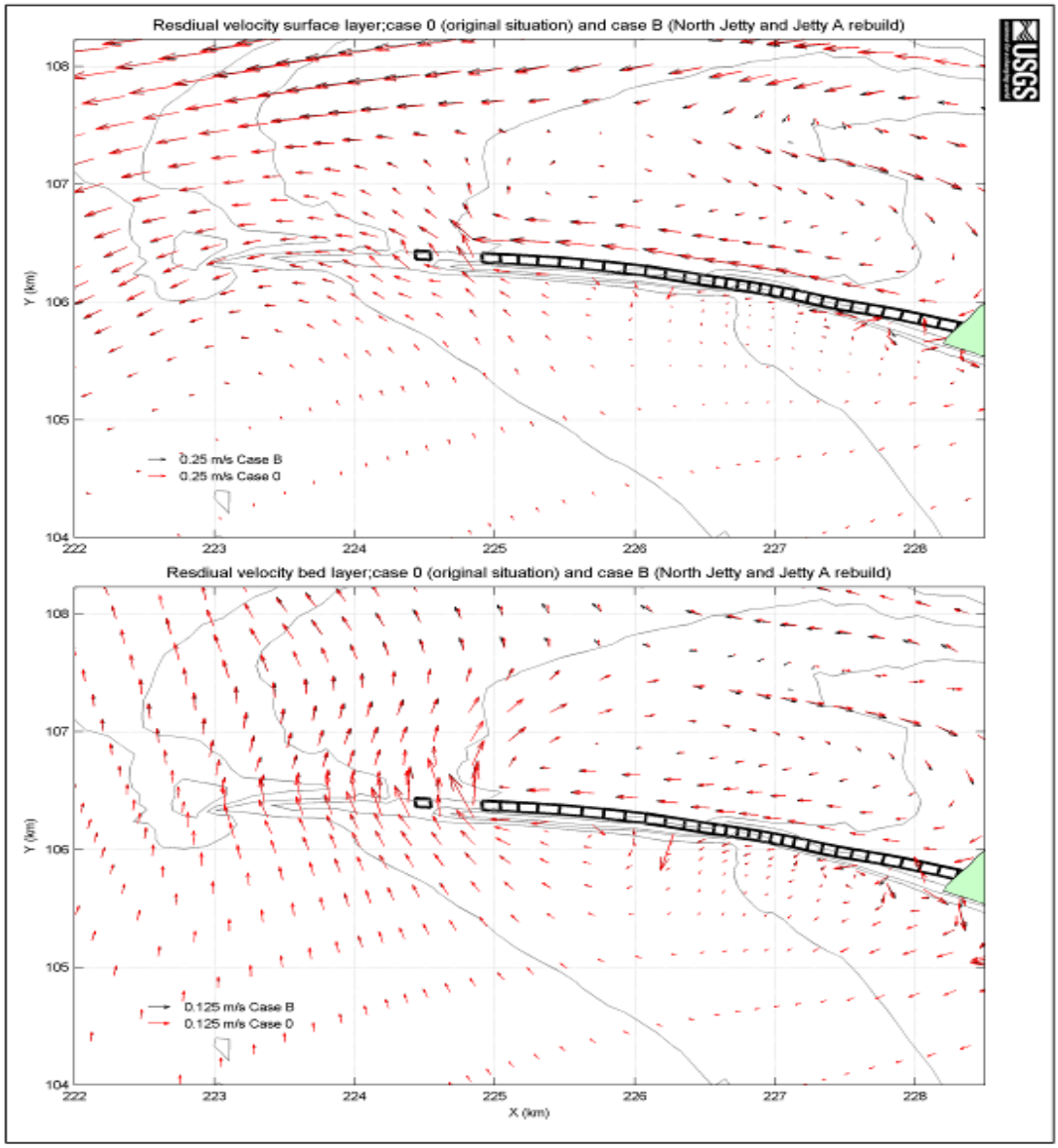


Figure 48. Residual Velocity near South Jetty for October/November Time Window



Salinity

As noted above, the primary factors controlling circulation in the Columbia River estuary are river flow, tides, and currents resulting from the pressure gradient force. Salinity distribution is, in turn, determined by the circulation patterns and the mixing process driven by tidal currents. The variability in the above mentioned parameters also result in large variability in salinity. The USGS modeling results, for example, showed that in near surface waters near the landward portions of the North Jetty, salinity naturally varies with tides to 20 parts per thousand (ppt) during October-November (Moritz 2010, USGS 2007).

As illustrated previously, earlier model results quantified changes to salinity for the length rebuild scenarios. Changes were again negligible despite the larger scale action than what is currently proposed. As before, figures represent changes predicted for action of a larger scope and scale. The representative original condition along with the spur groins is now more reflective of what the likely post-project conditions could entail.

Minor local changes to mean salinity was predicted as a result of implementation of the length rebuild proposed action. For the August-September timeframe, changes to bed layer salinity were predicted in waters between Jetty A and the North Jetty (Figure 49). An increase in mean salinity of 0-4 ppt from 26-28 ppt to 28-30 ppt was predicted to occur over some of this area (Moritz 2010, and USGS 2007) This could be calculated as up to ~ 15% change, but was still well under the 20 ppt (or up to 67%) change range of natural variability. A similar but less extensive salinity pattern was predicted for the near surface layer in waters between Jetty A and the North Jetty, where mean salinity was also predicted to increase 0-4 ppt from 18-20 ppt to 20-22 ppt (Figure 50). For the near surface layer, note that this increase in mean salinity included the area in close proximity to much of the landward portion of the North Jetty. For the near surface layer, a decrease in mean salinity of 0-4 ppt from 12-14 ppt to 14-16 ppt was predicted to occur over a relatively small area south of West Sand Island, which is located just east of Jetty A (Moritz 2010, USGS 2007).

For the October-November timeframe, small patterns of salinity change were also predicted. For the bed layer, a small-scale extrusion of higher salinity water was predicted for the main channel and along the South Jetty as a result of implementation of the proposed action (Figure 51). For example, for the existing condition, salinity in the range of 28-30 ppt occurs just upstream of Jetty A; whereas for the post-project condition, this zone of salinity ended directly south of Jetty A. Only small changes were predicted in the bed layer near the North Jetty. For the surface layer, extrusion of higher salinity water in the main channel was not predicted but was predicted for waters near the South Jetty (Figure 52). For the existing condition, salinity in the range of 24-26 ppt was predicted along the seaward 1/3 of the South Jetty, whereas for the post-project condition this area was predicted to support salinity in the range of 22-24 ppt. A minor reduction of lower salinity waters in the range of 18-20 ppt is predicted for along the landward half of the North Jetty (Moritz 2010, USGS 2007).

In summary, under the rebuild scenario minor local changes to mean salinity were predicted as a result of implementation of jetty build-outs. Even under a larger rebuild, the resulting changes to salinity were also negligible with respect to fluctuations that already occur. No rebuild is proposed under the current action, so any effects to water salinity and plume conditions are even more unlikely.

Figure 49. Mean Salinity for Bed Layer for August/September Time Window

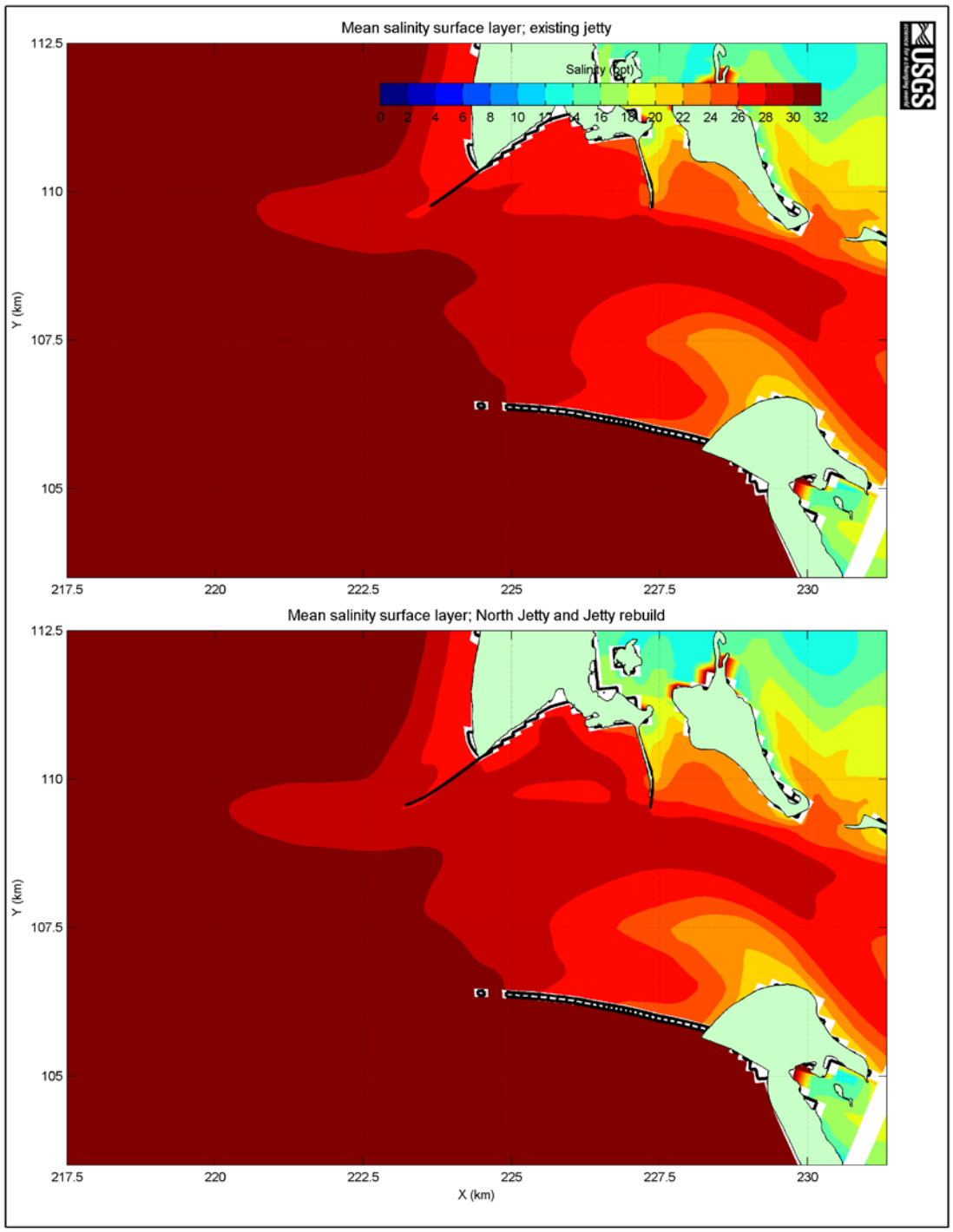


Figure 50. Mean Salinity for Surface Layer for August/September Time Window

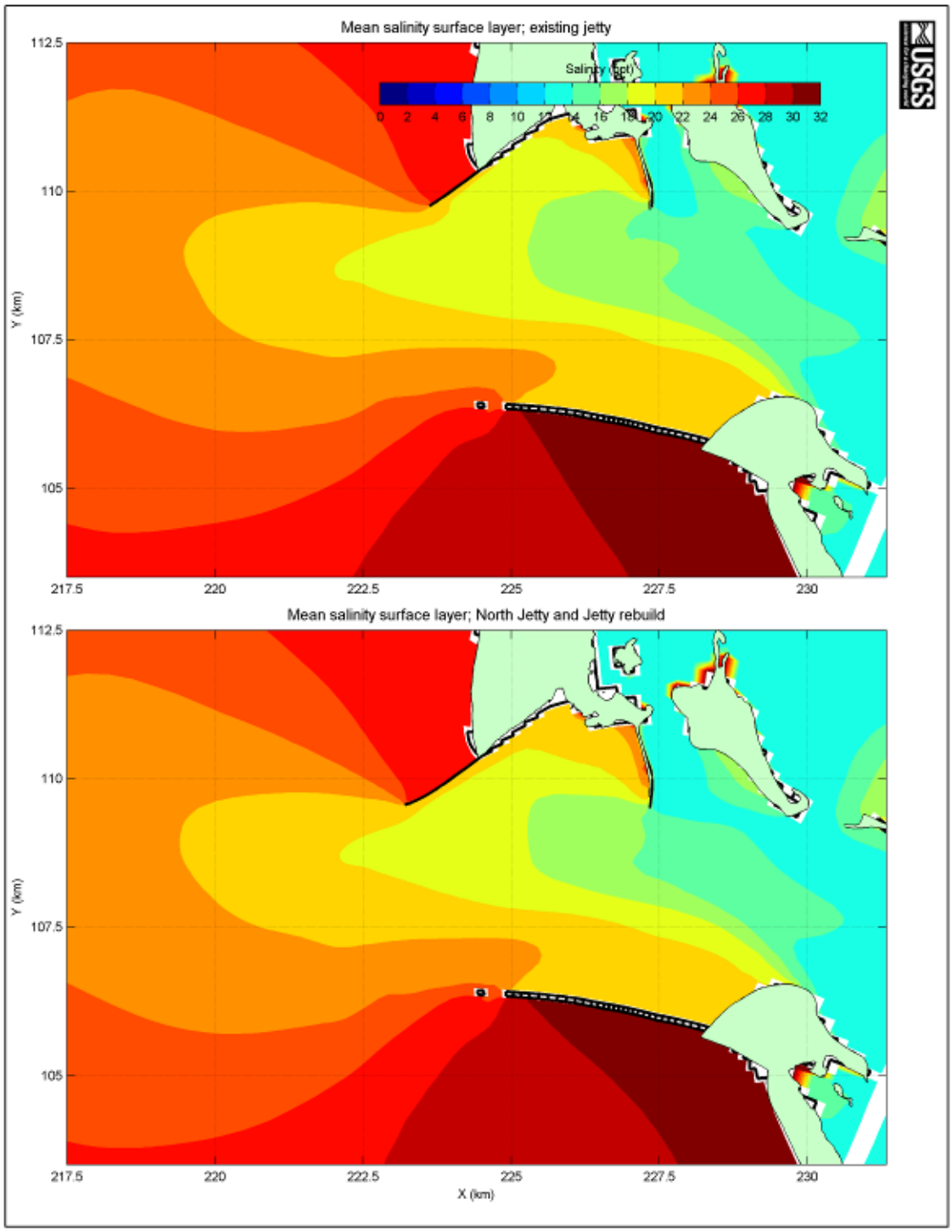


Figure 51. Mean Salinity for Surface Layer for October/November Time Window

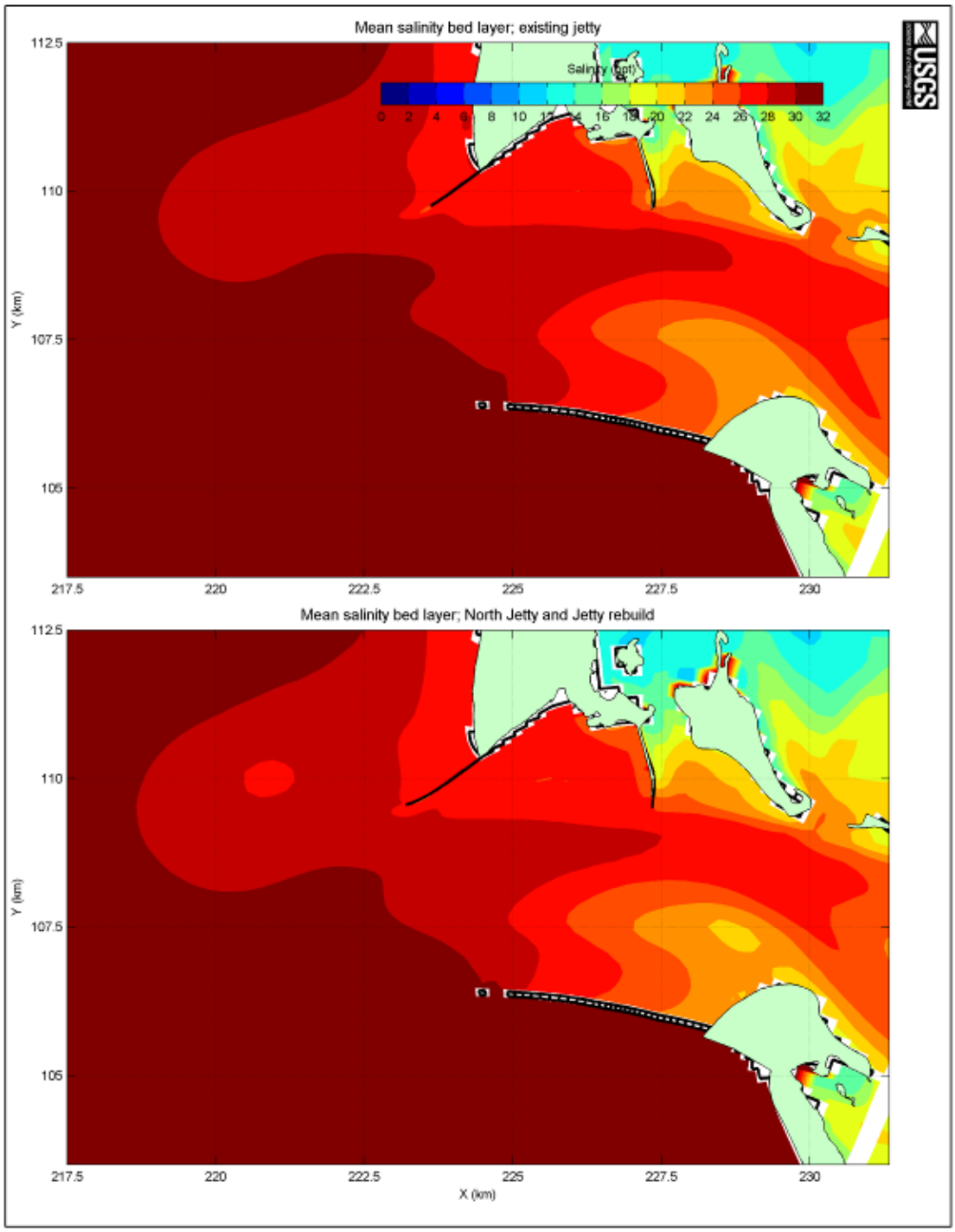
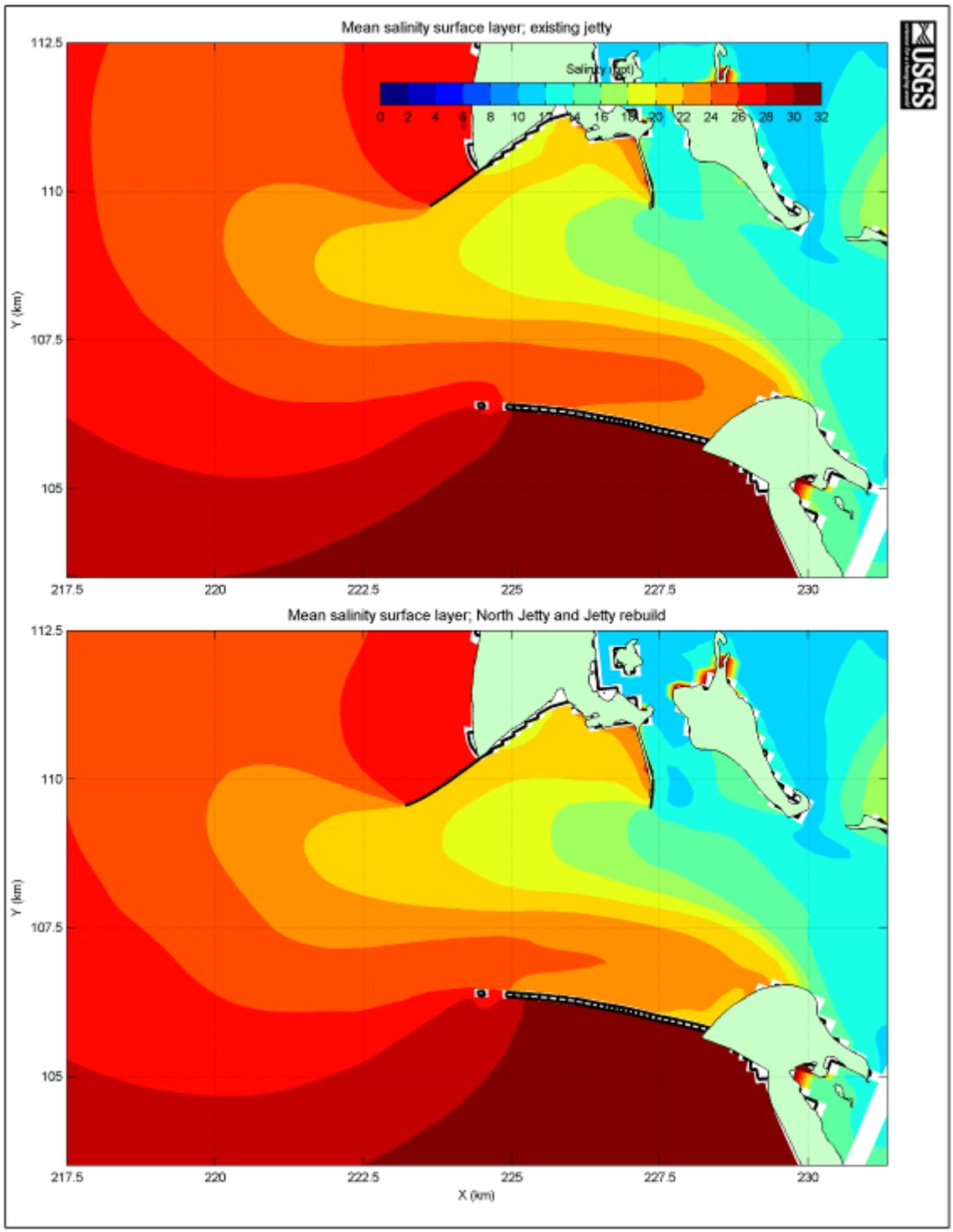


Figure 52. Mean Salinity for Surface Layer for October/November Time Window



Plume Dynamics

The parameters of study in the USGS modeling were predicted to be less affected in the plume than in the entrance itself from construction of the larger rebuild project. It was evident from the above figures that there would be only small predicted changes to residual velocity and current directions for both bed layer and near surface layer for the August-September and October-November timeframes in the plume. A decrease in bed layer salinity of 0-4 ppt (from 28-30 ppt to 26-28 ppt) was predicted in the plume over an oval area west of the terminus of the North Jetty. Only small changes were predicted to residual bed load transport and residual total load transport within the plume for the August-September and October-November timeframes (Moritz 2010, USGS 2007). Under the current proposed action, no length rebuild is included. Because of this smaller scale of action, any minimal changes that were previously predicted under the model comparison would be less likely. The existing conditions of the previous model are somewhat representative of the current proposed action with the addition of spur groins.

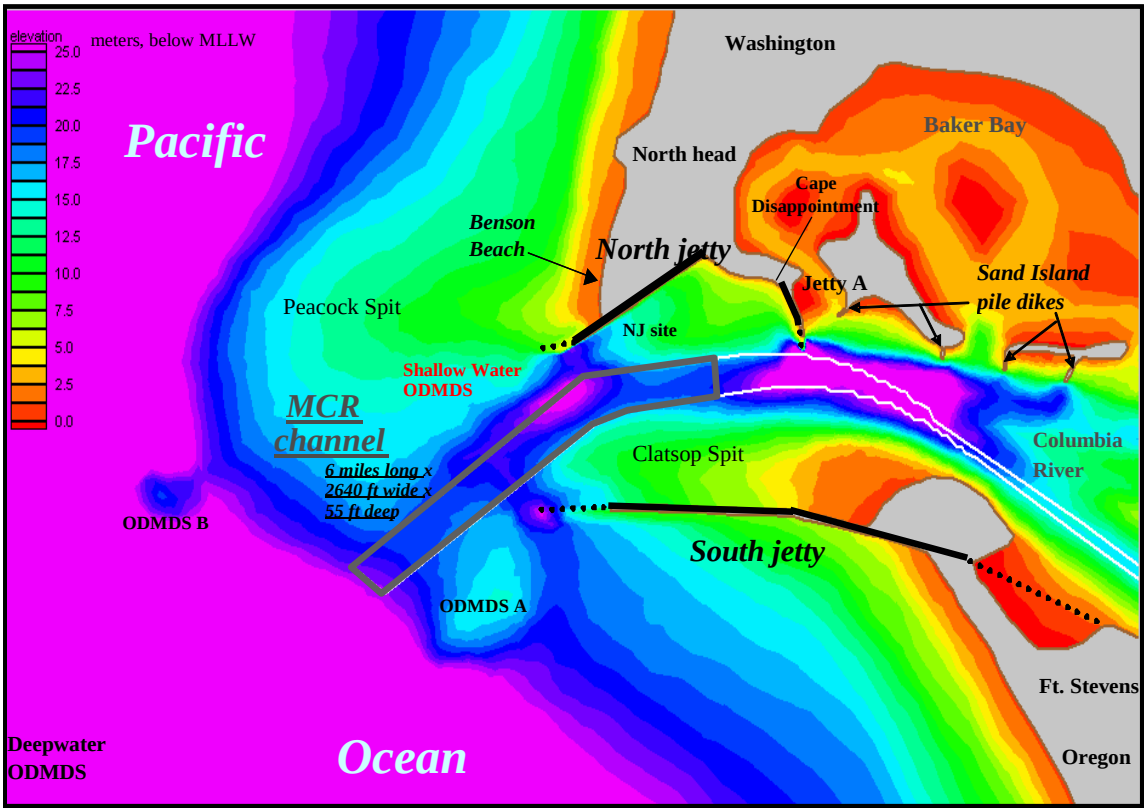
Bed Morphology

Modeling predicted some bed level changes along the seaward channel- side of the North Jetty due to the rebuilt lengths and implementation of spur groins. With longer jetties, change were predicted for both modeled timeframes, but was more pronounced in the winter, with an approximately 8.3% differences in bed elevation of 1.25 to 1.50 meters change from the existing 12 to 24 meters depth. This change is relatively small, however, considering the dynamic environment at the MCR (bathymetry at the MCR is shown in Figure 53). From the ERDC modeling results of the groin structures, it was predicted that a temporary increase in bed level due to sedimentation would occur upstream of the spurs, but that a temporary decrease in bed level due to erosion would occur immediately downstream of the spurs.

There were predicted changes that would occur to bed levels with implementation of the proposed length rebuild project. The most obvious change to bed level would have resulted in deeper water habitat than currently exists along the channel side of the seaward half of the North Jetty. This change was predicted to exist for both the August-September (Figure 54) and October-November (Figure 55) timeframes, but was more pronounced for the latter, with differences in bed elevation of 1.25 to 1.50 meters. This change is relatively small, however, considering that water here is 12 to 24 meters deep (Moritz 2010, Connell and Rosati 2007).

Bed morphology changes were predicted to occur in similar areas during the August-September and October-November timeframes but more scouring and deposition is predicted to occur during the latter. In addition to the result described above for the channel side of the seaward portion of the North Jetty, decreases to bed level with implementation of the proposed action were predicted for a broad area in deep waters of the navigation channel off of Jetty A and deep waters around the seaward portion of Jetty A and for locations north of the North Jetty, which includes shallow nearshore waters. Areas predicted to have an increase in bed level occurred upstream and downstream of Jetty A, downstream of the above-mentioned broad area in the navigation channel, on the ocean side of the North Jetty, and downstream of Clatsop Spit (Moritz 2010, Connell and Rosati 2007). As mentioned before, the scale of the current proposed action is much smaller and precludes a length rebuild. Therefore, any changes previously predicted would be even smaller or unlikely.

Figure 53. Bathymetry at the MCR



From the ERDC modeling results of the groin structures, it is predicted that a temporary increase in bed level due to sedimentation would occur upstream of the spurs, but that a temporary decrease in bed level due to erosion would occur immediately downstream of the spurs (Moritz 2010, Connell and Rosati 2007).

Temporally, effects from hydraulics and hydrologic process would occur as a single event with construction as described under Rock Placement. Any minor subsequent effects would be long-term, but are discountable within the range of natural dynamic conditions and are of limited geographical extent.

In summary, previous modeling results indicated the changes to velocities, currents, salinity, plume dynamics, and bed morphology were minimal under the much larger jetty length rebuild scenario. Also, the existing or "original" conditions of the previous model represented lengths that are retained under the current proposed action. Because of previous results, no significant overall changes to the hydraulics or hydrology of the MCR system are anticipated under the new, smaller proposed action.

Figure 54. Difference in Bed Level (meters) for August/September Time Window

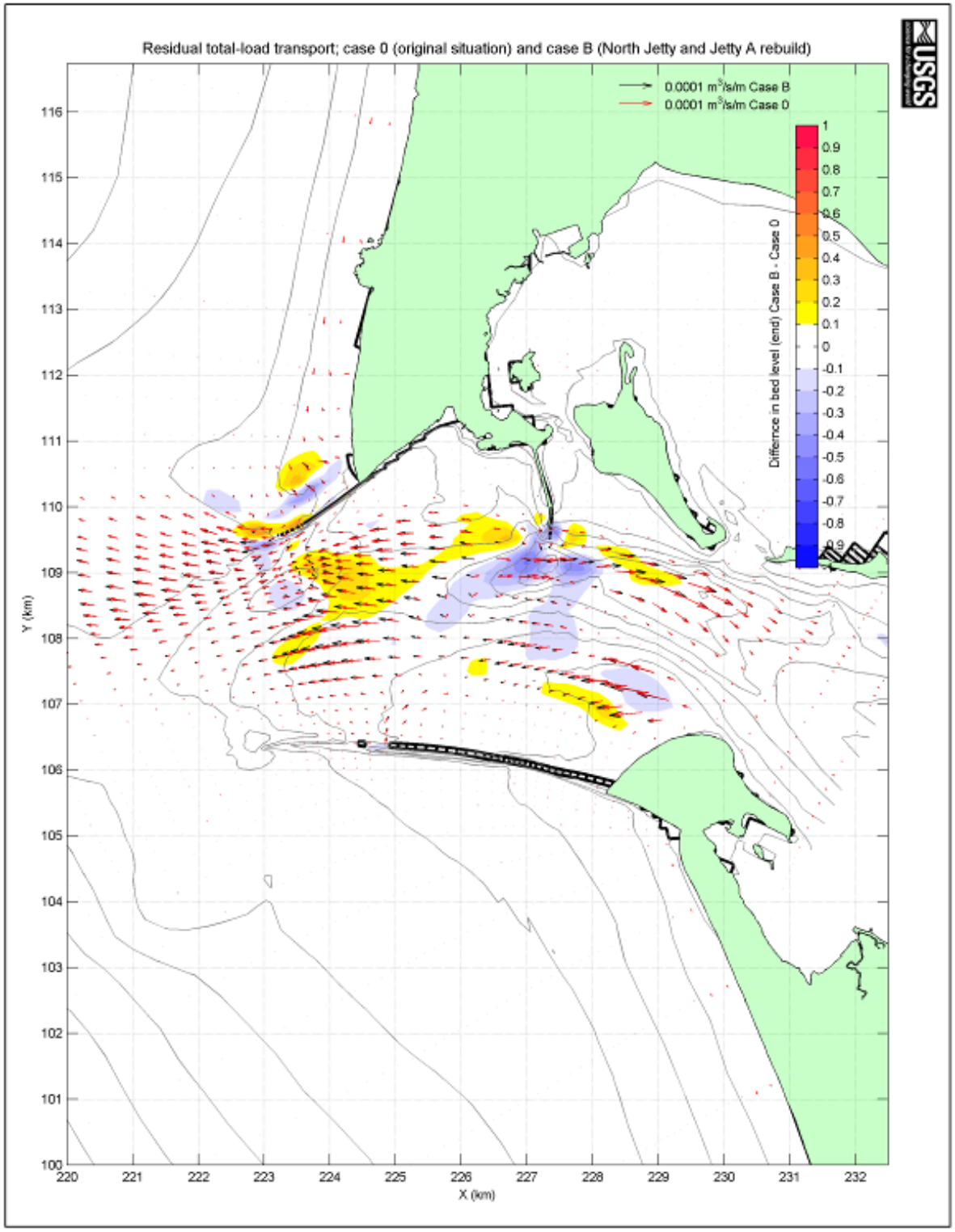
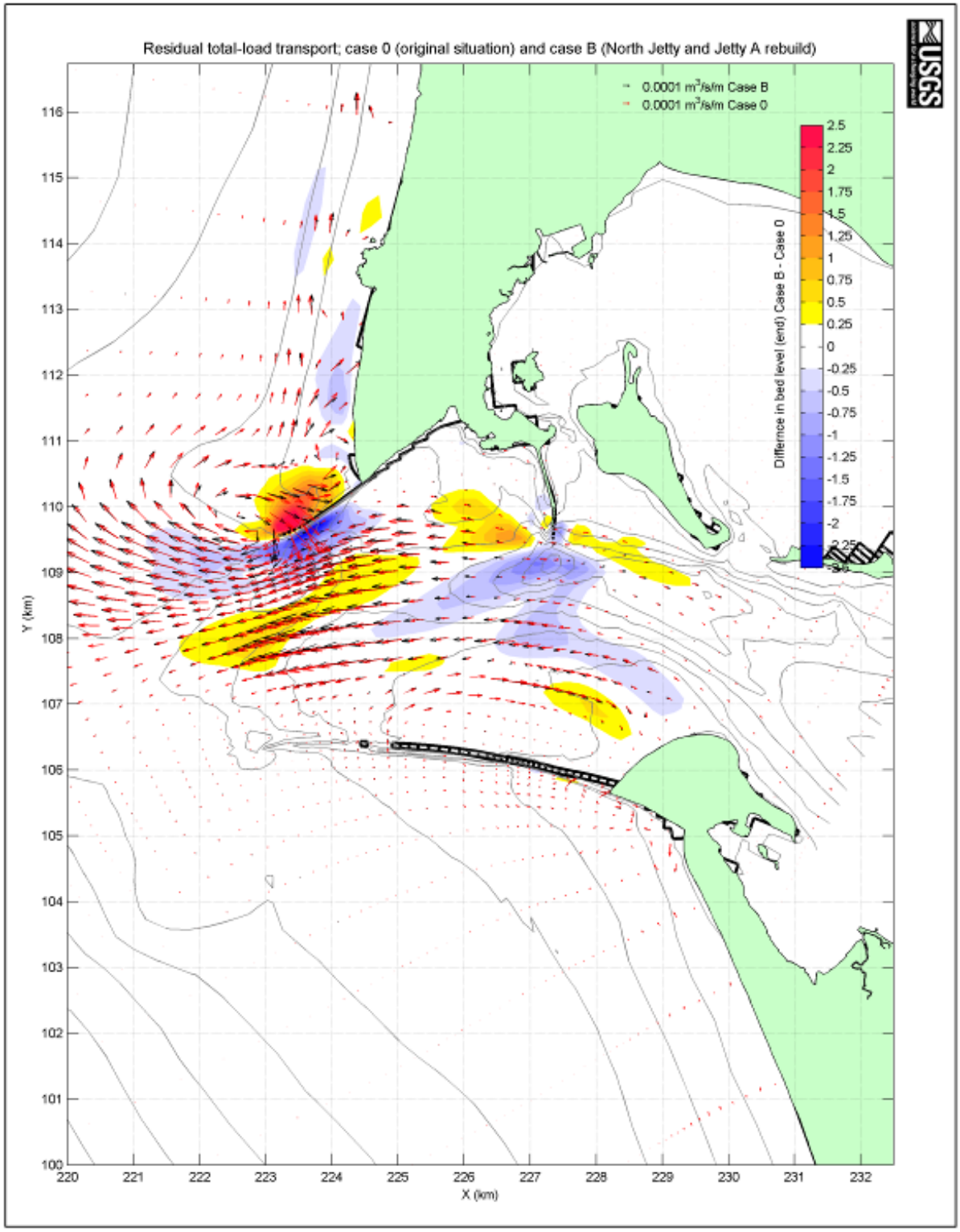


Figure 55. Difference in Bed Level (meters) for October/November Time Window



Wetland Mitigation and Habitat Improvements

In this BA, the Corps has proposed ecosystem restoration at its discretion under Section 7(a) (1) of the ESA. These actions will restore and improve the habitat for the benefit of listed and candidate salmonid species as well as other native species found in the lower Columbia River ecosystem. Under the Clean Water Act, the Corps is also required to provide mitigation for wetland impacts. The Corps will develop detailed proposals, which will be coordinated with the Services and State partners, and then work to implement them using the AMT.

As described in the proposed action, the Corps has developed a wetland mitigation and habitat improvement package with a suite of potential actions to offset wetland impacts and to improve shallow-water habitats. In the long term, implementation of wetland mitigation and habitat improvement actions along with upland plantings will increase the overall square footage of wetlands and improve uplands, potentially also improving wetland-stream hydrologic functions in the Columbia River estuary. Restoration of low saltwater marsh habitat will improve resting and rearing habitat access for juvenile fish, as well as improved and increased instream and riparian and estuarine functions; for example, creation of brackish intertidal and mudflat habitat, restoration of hydrologic regimes, and improvement of riparian and canopy cover. These actions will be focused on higher value habitats and functions than those which are being affected in the immediate vicinity of the jetties. Possible restoration of snowy plover habitat at the Clatsop Spit would be coordinated with OPRD and USFW to ensure that actions fit within the HCP and provided the necessary ecological elements.

Actions could also increase estuarine productivity lower in the Columbia River system for a wide range of species. Re-establishment of native plant communities and improvement of riparian functions would improve water quality function, habitat complexity, and trophic inputs. Reintroduction of a greater range of flows and more natural tidal regimes to uplands and diked pasturelands would also improve the likelihood of re-establishing native intertidal species. Re-establishing hydrologic and tidal regimes increases the opportunity to develop edge networks, dendritic channels, and mud flat habitats for use by listed species. Increased benthic habitat could also improve food web productivity. Dike breaches and tide and culvert retrofits would also increase adult fish passage and restore access to expanded spawning and rearing areas.

In relationship to the recovery plan in the estuary module (NMFS 2007c), the 7 (a) (1) actions being proposed by the Corps address threats identified in the recovery plan, and specifically relate to Columbia River Estuary (CRE) management actions. Depending on final plan selection, habitat improvements may specifically address the following CRE actions: 1 (riparian protection and restoration); 4 (restoring flow regimes via improved/restored tributary hydrologic connectivity); 5 (replenishment of littoral cell via beneficial use of dredged materials); 8 (removal of pile dikes); 9 (protection of remaining high-quality off-channel habitat from degradation), and; 10 (improvement of off-channel habitat via levee and dike breaches). Several of these CREs were also in the higher rankings for benefits with implementation, and higher percentages for Survival Improvement Targets (NMFS 2007c).

Therefore, the Corps expects these actions to have either direct or indirect long-term beneficial rather than adverse effects to most of the listed species and their designated critical habitat in the action area. In the short-term, temporary disturbance and increased suspended sediment may

result in higher turbidity during in-water construction at restoration sites. This is not likely to occur during upland planting. However, these actions will be limited in duration and intensity, as BMPs to reduce and avoid pollutant runoff described in the proposed action would also be applicable to actions at restoration sites. Suspended sediments from in-water work will be monitored per State Certification conditions, and appropriate BMPs to minimize turbidity will also be implemented to ensure levels do not reach a duration or intensity that will harm species.

For invasive species removal, the Corps proposes to use no herbicides within 100 feet of the Columbia River or associated water bodies, and therefore, does not expect increased pollutant loads or effects on instream or riparian function. Short-term noise disturbances are likely to attenuate near the source and project locations are likely to be much further away from habitat used by marine mammals. These acoustic effects will likely be minimal and discountable.

Temporally, implementation of different components of wetland mitigation and habitat improvement projects could occur throughout the year. It would likely be possible to complete associate in-water work during the appropriate in-water work windows that protect listed species. Concurrent with initial impacts to wetlands, construction would likely occur in one or two seasons with subsequent monitoring. Temporally, this limits the repetition of disturbance activities associated with the construction of these projects. Short-term effects to water quality may occur on a daily basis, but would be limited and similar to those describe in the Water Quality effects discussion.

EFFECTS OF THE ACTION ON LISTED SPECIES

Harassment applies to actions that create the potential for injury by significantly disrupting normal behavioral patterns including breeding, spawning, rearing, migrating, feeding or sheltering. To be significant, harassment must be capable of resulting in the death or injury of fish or wildlife. Harm applies to actions that result in actual injury or death, including actions that cause environmental damage leading to injury or death.

Based on habitat needs, migratory patterns, and residence time, listed birds including marbled murrelets, snowy plover, and northern spotted owls may be present in the action area during the proposed period of jetty repair, rehabilitation, and maintenance operations. Similarly, listed mammals, fish, invertebrates, or plants, including Columbia white tailed deer may have potential or designated critical habitat in the vicinity of MCR.

Marbled Murrelet *(Brachyramphus marmoratus)* – Threatened

Occurrence and Discussion: The marbled murrelet is a small, robin-sized, diving, near-shore marine bird that is most frequently observed within 1.5 miles of shore (Marshall 1988). Marbled murrelets forage just beyond the breaker-line and along the sides of river mouths where greater upwelling and less turbulence occurs. Sealy (1975) cited in Marshall (1988) reported that murrelets foraged within 500 meters of shore. Murrelets forage within the water column; prey items include invertebrates and small fish such as anchovy, herring, and Pacific sandlance (Marshall 1988). Sandlance are known to occur in estuaries (NOAA Fisheries 1991). Murrelets spends the majority of time on the ocean, roosting and feeding, but come inland up to 80 kilometers (50 miles) to nest in forest stands with old growth forest characteristics (USFW 2010). Marbled murrelets nest from mid-April to late September, and adults feed the chick at least once per day, flying in (primarily at dawn and dusk) from feeding on the ocean, carrying one fish at a time (USFW 2010).

Currently, the largest concentrations of marbled murrelets in Oregon are thought to occur off the central coast (Marshall 1988) between Depoe Bay and Coos Bay. Lincoln and Lane Counties, which comprise a large block of the central Oregon coast, were historic centers of abundance for marbled murrelets in Oregon (FR 1991). Initial results from Strong (1992) indicate that abundance of murrelets is relatively higher on the central Oregon coast than the northern Oregon coast. Strong (1992) also found that murrelet occurrence was patchy and that use of specific locations was not consistent. Strong et al. (1995) recorded less than 10 marbled murrelets on average for boat and shore-based surveys of marbled murrelets off the MCR. They reported that murrelets were concentrated within 1 km of shore in 1992 but broadly scattered within 5 km of shore in 1993. Strong (1997; field notes on presence of marbled murrelets in the Umpqua River estuary and other Oregon coastal river mouths) noted that “Marbled murrelets in general are uncommon to absent in the river mouth/estuarine environment during summer in Oregon” (Bayer 1988).

Marbled murrelets nest in old growth/mature coniferous forests. The low incidence of marbled murrelets at coastal locations is probably related to the loss of old growth coniferous forest from

harvest and/or fire on near-coastal lands (FR 1991). Marbled murrelets are expected to occur in the general vicinity of the MCR. The Cape Disappointment area contains suitable habitat for marbled murrelet nesting. While nesting has not been documented in the Cape Disappointment area, birds have frequently been noted in flight during the nesting season and doubtlessly nest in the area. This potential nesting area is located about 1.6 miles northeast of the South Jetty at Benson Beach.

Marbled murrelets are expected to occur in the general vicinity of the MCR, specifically on the Columbia River bar and nearshore (<5 km) waters. Their numbers are anticipated to be low throughout the general project area but activities within the MCR Navigation Channel may result in occasional disturbance of marbled murrelets on the water.

Previous modeling results predicted from a larger-scale, length-rebuild scenario indicated only minimal changes to hydrology and hydraulics in the larger MCR system. Results remain informative because the relatively small changes anticipated from a larger action were still not expected to have significant negative on sediment transport, plume dynamics, bed morphology, or velocities in the system. The smaller currently proposed action, which only includes spur groins and not additional lengths from the original model, would be expected to have even fewer effects. The most significant scouring effects that were predicted at the seaward half of the North Jetty and near the tip of Jetty A are no longer as likely under the current scenario, as no changes in lengths are proposed. Maximum change to bed level was predicted to be 1.25 to 1.50 meters in these areas, which was a small percentage (8%) of the existing 12-24m depth. This scouring was also predicted to occur in deep areas. Bed load effects from accretion on the leeward side of spur groins may be more relevant, but were not expected to be significant enough to alter habitat use or foraging opportunities. Presentation of predicted changes and an analysis of effects of changes to the MCR on anadromous fish and sea lions are presented in Corps (2007 and 2010) and available upon request. Changes in these parameters seaward of the tips of the jetties is predicted to be negligible and should have no adverse impact on feeding of marbled murrelets. Minor changes to salinities, current velocities and directions, and bed morphology are unlikely and discountable, especially relative to natural variation and should also have no adverse impact on feeding of murrelets that may occasionally occur in the Columbia River.

Murrelets are susceptible to noise disturbance. Adult murrelets typically switch incubation duties on the nest about 1 hour before sunrise, and this is the most critical time for impacts from noise (personal communication with Greg Smith, U.S. Fish and Wildlife Service on May 28, 2004). Though within the navigation channels, rock transport could increase the possible disturbance of murrelets, this is unlikely to occur. Adult species are likely already attuned to vessel traffic, and the proposed action will also not cause a significant increase in the intensity of barge traffic levels. Any encounters with barge traffic will be transitory and discountable. Vehicle traffic may cause some acoustic disturbance during the work day as trucks haul rock into the North Jetty site. However, sound levels are expected to return to near back-ground conditions a short distance from the source. Conservation measures limiting traffic timing and use of jake brakes will further reduce any possible exposure to acoustic effects. Therefore, exposure to acoustic effects would be geographically and temporally limited. Proposed actions are not expected to have significant long-term impacts to nesting or foraging behaviors.

Marbled Murrelet Critical Habitat:
According to USFW, nesting locations generally include dense shady forests characterized by large trees with large branches or deformities for use as nest platforms (2010). Murrelets nest in stands varying in size, however, larger, unfragmented stands of old growth Douglas fir appear to be the highest quality habitat for marbled murrelet nesting (USFW 2010). Benson Beach and the Clatsop Spit have large areas of land that have accreted since the construction of the jetty system and are not old enough to have evolved these forest characteristics. These nesting conditions do not exist in the immediate vicinity where a majority of the proposed construction activities will occur. Neither Benson Beach nor Clatsop Spit are designated Critical Habitat.

Actions are not expected to remove or kill trees with suitable platforms, and large diameter trees with well-developed canopies will not be impacted by construction activities. Therefore, actions will not reduce the suitability or development of the stand as nesting habitat. The Corps has determined the proposed actions will have ***No Effect*** on marbled murrelet critical habitat.

In addition to standard environmental protection measures to be included in the contract specifications, measures 1, 2, and 3 will be employed during the marbled murrelet nesting season (April 1 – September 15) to reduce impacts from noise to nesting marbled murrelets on the Washington side, and measure 4 will be considered to create western snowy plover nesting habitat:

1. Trucks will only be allowed to use the roads through Cape Disappointment State Park during daylight hours.

2. Trucks will not unnecessarily stop along the roads through Cape Disappointment State Park.

3. Trucks will be prohibited from using compression brakes (also known as jake brakes) on the roads through Cape Disappointment State Park.

Conclusion: The proposed work is located approximately 1.6 miles from potential nesting areas. Marbled murrelets likely will occur and nest in the project vicinity during construction, and periodic minor disturbance may occur due to noise generated from trucks on the haul roads through Washington State Parks property adjacent to probable nesting habitat. However, truck traffic will occur only during daylight hours (Conservation Measure 1 under the Proposed Action – Additional Conservation Measures section) and noise and disturbance-reducing measures will be implemented (Conservation Measures 2 and 3 also under the Proposed Action – Additional Conservation Measures section). Abundant foraging habitat is available adjacent to the activity and any disturbance on the water would be minor and temporary. Additionally, disturbance on the water by transitory ships will be intermittent and temporary, and is not expected to cause adverse impacts to feeding behaviors. Therefore, the Corps has determined that the proposed action ***May Affect but is Not Likely to Adversely Affect*** marbled murrelets.

Western Snowy Plover *(Charadrius alexandrinus nivosus)* – Threatened

Occurrence and Discussion: The western snowy plover is a small shorebird that nests above the high tide beside or near tidal waters and on the mainland coast, peninsulas, offshore islands,

adjacent bays and estuaries from southern Washington to southern Baja California, Mexico, often returning to the same breeding site yearly (USFW 2010b). Snowy plovers are primarily visual foragers feeding on invertebrates in the wet sand and among surf-cast kelp within the intertidal zone, in dry, sandy areas above the high tide, on salt pans, and along the edges of salt marshes, salt ponds, and lagoons (USFW 2010b).

Plover nesting season extends from early March through late September when they lay their eggs in shallow depressions of loose soil or in sandy or salty areas with generally little vegetation or driftwood (USFW 2010b). Chicks are especially vulnerable to predation, as adult plovers do not feed them, but lead them to suitable feeding areas (USFW 2010b). Most chick mortality occurs within six days after hatching (USFW 2010b).

Western snowy plovers historically occurred in the vicinity of Clatsop Spit, Oregon. Mean averages from 1902-1985 estimated breeding and winter populations of about 9 and 1 respectively (ODFW 2005). No breeding or wintering populations have been reported from these beaches in recent years (U.S. Fish and Wildlife Service, 2001 and 2007). Prior surveys completed indicated that the last breeding population (late May/early June, (USFW 2010j)) was observed on the Clatsop Spit in 1984, and the last winter population (winter window- December 1 and January 31, (USFW 2010j)) in 1985 (ODFW 2005). In the more recent past, incidental observations occurred on January 13, 2008 – at river beach at South Jetty; in 2007 on September 5, - one plover, Clatsop Beach (a few miles s. of Peter Iredale), and November 29 – one plover Del Ray Beach; and on October 2003 - 8-10 unconfirmed plovers on a mud flat furthermost north from the jetty (Columbia River, S jetty). Evidence for the current lack of winter or breeding populations was supported by a survey completed by USFW and Corps representatives on May 20, 2010, when no plovers were observed. A small population of western snowy plovers occurs on beaches at Leadbetter Point, Washington, which is greater than 20 miles north of the general project vicinity. Other Washington locations where western snowy plovers are known to occur (e.g., Dammon Point, Conner Creek, and Midway Beach) are farther north. The nearest Oregon location is far south of the project site at Bayocean Spit in Tillamook County. Neither Benson Beach nor Clatsop Spit are designated Critical Habitat, though a Habitat Conservation Plan (HCP) has been developed for Clatsop Spit. This is illustrated in the following figure from the Final OPRD/USFW HCP (2010), and can be visually compared with the planned staging and storage areas illustrated in the Proposed Action.

Figure 56. Boundary of Habitat Conservation Plan at the Clatsop Spit

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Figure 2-2
Boundary of Snowy Plover Management Area within Fort Stevens State Park

Most of the land-based construction activities will occur above the MHHW levels in the near and immediate vicinity of the jetties. The area proposed for construction, storage, and staging is mostly or completely outside of the area on Clatsop Spit identified in the HCP. If the northwestern most portions of the staging area are needed, a small portion of the southern-most border of the HCP may be affected. However, because habitat creation areas could occur anywhere within the polygon, there is unlikely to be overlap with adjacent construction activities. Additionally, Corps habitat improvement actions may improve nesting areas for snowy plover in the Clatsop Spit.

Except for areas near the offloading facility near Parking Area D and at the South Jetty and root foredune, the bulk of the construction, stockpile, and staging areas will be concentrated more towards the inland of the Spit. If snowy plover nesting were to occur, it is more likely that snowy plovers would use the river-side on the northern portion of the Spit in the area identified under the HCP and illustrated in the previous figure. Furthermore, in areas cleared for construction use, the presence of large machinery, human activity, and large stone likely reduces the suitability for immediate habitat usage, as these elements would create a higher density of activities, structure, and vertical complexity than seems to be preferred for nesting habitat. Therefore, this limits the geographical extent of the disturbance effects from construction clearing, and reduces the likelihood that actions would occur in areas preferred by snowy plover. According to USFW, introduced European beachgrass (*Ammophila arenaria*) reduces the amount of open, sandy habitat and contributes to steepened beaches, and increases habitat for predators (USFWb). These conditions are problematic at the Spit, and may actually be improved by the proposed clearing for stockpiling and construction staging and eventual replanting of native dune plants.

Recreation activities at the Spit have also increased the intensity of human use in the vicinity. Recreation will likely be somewhat impacted by periodic construction closures, when human activities would then be more concentrated in the areas previously identified for construction rather than recreational activities occurring on the beaches.

Furthermore, as described under the proposed actions, the Corps is currently investigating 7 (a) 1 opportunities to create plover nesting habitat on Clatsop Spit (Conservation Measure 4 under the Proposed Action – Additional Conservation Measures section and re-copied above). Details of this action including location and appropriate timing will be further developed and refined by the Corps and coordinated with the resources agencies through the use of the annual AMT. The Site Management Plan under development with Oregon Parks and Recreation will further inform this action. Additionally on December 17, 2010, the Corps joined the U.S. Fish and Wildlife Service, along with other federal agencies and the State of Oregon for sign-off on a Memorandum of Understanding regarding the statewide HCP for Snowy Plover.

Conclusion: Though construction activities are proposed in the vicinity of areas of historical winter and breeding snowy plover populations, there is no current plover use. The Spit has not been designated as Critical Habitat. Because activities are not proposed for below MHHW and are expected to be concentrated in the interior behind a protective vegetative buffer, there is little

likelihood of impacting nesting habitat. Staging areas will contain associated construction elements and likely year-round human activity that will reduce the likelihood of nesting in the newly cleared areas. Proposed staging areas are excluded from the north end of the Spit, where the HCP boundary has been identified. Therefore, the likelihood of species presence and exposure to effects is very low. However, it is conceivable that throughout the lifetime of the project, species could be observed during implementation of the proposed action. If species nested within areas identified for activities under the proposed action, then they could experience disturbance effects. Should species be observed or should this occur, the Corps would immediately inform resource agencies and the AMT to discuss and determine next steps. Therefore, the Corps has concluded that because no plovers have been reported in the vicinity of the project in recent years but because the proposed action is within the range of historic use, the proposed project may affect, but is ***not likely to adversely affect*** western snowy plovers.

Short-tailed Albatross *(Phoebastria albatrus)* – Endangered

Occurrence and Discussion: The short-tailed albatross was listed as endangered in the U.S. in 2001. It has been listed since 1970 outside the U.S. and nests on islands south of Japan. The short-tailed albatross is a large pelagic bird with long narrow wings adapted for soaring just above the water surface, and its diet includes squid, fish, eggs of flying fish, shrimp, and other crustaceans (USFW 2010c). This species may occur off the Oregon and Washington coasts, though there is no critical habitat designation.

There have been three confirmed records of short-tailed albatross off the coast of Oregon. The closest was 20 miles southwest of the MCR (Marshall et al. 2003).

Conclusion: Since the short-tailed albatross is not expected in the vicinity of the MCR and there is no designated critical habitat at MCR, the proposed action would have ***No Effect*** on this species.

Northern Spotted Owl *(Strix occidentalis caurina)* – Threatened

The northern spotted owl was federally listed as threatened under the Endangered Species Act in 1990, with critical habitat designated in 1992 and revised in 2008 (USFWd). They are believed to have historically inhabited most forests throughout southwestern British Columbia, western Washington and Oregon, and northwestern California as far south as the San Francisco Bay, though today they are particularly rare in the Coast ranges of southwest Washington and northwest Oregon (USFWd).

Northern spotted owls are nocturnal "perch-and-pounce" predators that generally prey primarily on small forest mammals and nest from February to June, with parental care of the juveniles lasting into September (USFWd). Spotted owls live in forests characterized by dense canopy closure of mature and old-growth trees, abundant logs, standing snags, and live trees with broken tops and prefer older forest stands with variety: multi-layered canopies of several tree species of varying size and age, both standing and fallen dead trees, and open space among the lower branches to allow flight under the canopy (USFWd). Benson Beach and the Clatsop Spit have

large areas of land that have accreted since the construction of the jetty system and are not old enough to have evolved these forest characteristics. These habitat conditions do not exist in the immediate vicinity where a majority of the proposed construction activities will occur. Neither Benson Beach nor Clatsop Spit are designated Critical Habitat

Conclusion: Since the northern spotted owls are not expected in the vicinity of the MCR and there is no designated or potential critical habitat at MCR, the proposed action would have ***No Effect*** on this species.

Columbian White-tailed Deer *(Odocoileus virginianus leucurus)* – Endangered

Occurrence and Discussion: Columbian white-tailed deer occur on the Oregon and Washington mainland and instream islands primarily from Skamokawa, Washington (CRM 34) upstream to Port Westward (CRM 54). Columbian white-tailed deer are closely associated with riparian habitats and use "tidal spruce" habitats characterized by densely forested swamps covered with tall shrubs and scattered spruce, alder, cottonwood and willows (USFWe). Though critical habitat has not been designated for this species, accreted land at both the north and the south jetties could provide suitable habitat. However, the proposed action is situated 34 miles downstream of the Julia Butler Hansen National Wildlife Refuge for Columbian White-tailed deer and would occur in an area that is not known to be inhabited by the species.

Conclusion: Since the Columbian white-tailed deer is not expected in the vicinity of the MCR, the proposed action would have ***No Effect*** on this species.

Oregon Silverspot Butterfly *(Speyeria zerene hippolyta)* – Threatened

Occurrence and Discussion: The Oregon silverspot butterfly occupies coastal headlands or Oregon Coast Range peaks that provide specific habitat features, primarily the presence of *Viola adunca*, the obligate plant species of this butterfly. The nearest populations of butterflies are the Camp Riles, Clatsop County, Oregon population to the south and the Long Beach, Washington population to the north.

The historical range of this subspecies extends from the Long Beach Peninsula, Pacific County, Washington, south to Del Norte County, California, and all of these populations were restricted to the immediate coast, centered around salt-spray meadows, or within a few miles of the coastline in similar meadow-type habitat (USFWf). The Oregon silverspot occurs in three types of grassland habitat including: marine terrace and coastal headland salt-spray meadows; stabilized dunes (with both of the former strongly influenced by proximity to the ocean, mild temperatures, high rainfall, and persist fog); and montane grasslands (USFWf). Though the proposed action does not occur in areas designated as critical habitat, portions of the action are may provide suitable habitat conditions for the species.

Conclusion: No Oregon silverspot butterfly populations are known from the project area, and actions will not affect areas of designated critical habitat. Therefore, the proposed project will have ***No Effect*** on the Oregon silverspot butterfly.

Bull Trout (*Salvelinus confluentus*) – Threatened

Occurrence and Discussion: Bull trout are endemic to western North America and were more widely distributed historically. The Columbia River may have provided important historical rearing habitat for migratory bull trout and overwintering habitat (Buchanan et al. 1997; U.S. Fish and Wildlife Service 2004). In the Columbia River, occurrence of bull trout now in the lower Columbia River below Bonneville Dam appears to be incidental and occurrence above Bonneville Dam appears to be limited. Bull trout are dependent on cool water and their movements are limited by the availability of cool water. Historic records have documented bull trout (or Dolly Varden as this species was previously known) passing the fish ladder at Bonneville Dam in 1941, 1947, 1982, 1986, and 1994 and in the lower Columbia River near Jones Beach. Historic records also indicate that Dolly Varden were caught in fishwheels operated on the mainstem Columbia River in the late 1800s (U.S. Fish and Wildlife Service 2004). Fossil fragments of trout identified as bull trout have been found in the "Bonneville Basin" (Tomelleri 2002).

High quality bull trout habitat is typically characterized by cold temperatures; abundant cover in the form of large wood, undercut banks, boulders, etc.; clean substrate for spawning; interstitial spaces large enough to conceal juvenile bull trout; and stable channels (U.S. Fish and Wildlife Service 2000). The Columbia River downstream of Bonneville Dam does not typically achieve water temperatures that would be suitable for bull trout. Bull trout exhibit patchy distribution even in pristine habitats (Rieman and McIntyre 1993). Bull trout are piscivorous and frequent areas with overhead cover and coarse substrate and have been observed overwintering in deep beaver ponds or pools containing large woody debris (U.S. Fish and Wildlife Service 2000; Federal Register 2002).

Critical Habitat: The proposed action will occur in areas designated as critical habitat for bull trout. The proposed action will not have any effects on the following Primary Constituent Elements (PCE): water temperature, channel complexity, spawning substrate, natural hydrograph, and water quantity. PCE's that may be affected include:

1. Food Resources – Minor and temporary impacts to benthic invertebrates are expected at localized dredging, disposal, and rock placement sites. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days only annually. However, this is not anticipated to limit productivity or to have any long-term effects on food availability or foraging behavior.
2. Migratory Corridors free of obstruction – Spur groins are small components of the jetty that will protrude slightly into the channel but are expected to accrete sand on their leeward sides, which may provide some resting area for out-migrating juveniles. Their depths and limited geographical effects are not expected to alter migration patterns of juveniles or adults. Pile structures will also be localized and of low density and are not expected to measurably interfere with migration patterns or behaviors.

3. Water quality – Minor, localized, and temporary effects from increased suspended sediment due to dredging, disposal, rock placement, and piling installation and removal are likely. Placement could occur during a limited time window on a seasonal daily basis, and the other actions are temporally limited to a few days only annually or a single event basis. There is also an increased potential for spills or leaks, but BMPs reduce the likelihood of this occurrence. Monitoring will limit the levels and durations of turbidity; therefore long-term or significant effects to water quality are not likely.
4. Springs, seeps, and ground water sources – Proposed fill will have effects on some of the wetlands and lagoon in the vicinity of the MCR. Although these wetlands are connected hydrologically to the Columbia River, fill impacts are expected to be insignificant on river functions. Wetland fill impacts are not likely to negatively alter groundwater-stream exchange or hyporheic flow because wetlands are on accreted land that has formed on stabilized sand shoals behind the jetties. Wetland hydrology is mostly elevation and rainfall dependent, and fill impacts will be relatively insignificant to the Columbia channel. Culverts will be installed to maintain wetland hydrology and connectivity with permanent replacement at the North Jetty and when temporary construction roadways cross wetlands. Any effects will be minimal and discountable.

Conclusion: Bull trout are known to have occurred in the Columbia River itself historically but now appear to occur only incidentally in the lower Columbia River. Water temperature and lack of spawning substrate likely limits their use at the MCR to migratory passage. Only sporadic records of bull trout in the Columbia River downstream of Bonneville Dam or passing through the dam have been documented dating to 1941. Proposed actions will occur within area designated as critical habitat for bull trout. The proposed action ***May Affect but is Not Likely to Adversely Affect*** bull trout and designated critical habitat for the following reasons: 1) it is unlikely bull trout will be within the action area; and 2) the primary constituent elements of critical habitat are not likely to be degraded to an extent that is measureable or permanent.

Nelson's Checker-mallow *(Sidalcea nelsoniana)* – Threatened

Nelson's checker-mallow was federally listed as threatened in 1993. It is a perennial herb in the mallow family (Malvaceae) with tall, lavender to deep pink flowers with flowering occurring as early as mid-May and extend into September, though Coast Range populations generally flower later and produce seed earlier (USFWg). Nelson's checker-mallow most frequently occurs in Oregon ash swales and meadows with wet depressions, or along streams, and species also grow in wetlands within remnant prairie grasslands or along roadsides at stream crossings where non-native plants, such as reed canary grass, blackberry, and Queen Anne's lace, are also present (USFWg). Nelson's checker-mallow primarily occurs in open areas with little or no shade and will not tolerate encroachment of woody species (USFWg). Though some potential habitat may exist in the proposed action area, Nelson's Checker-mallow is not known to occur in the vicinity of the MCR. Critical Habitat has not been designated for Nelson's checker-mallow.

Conclusion: No Nelson's Checker-mallow populations are known from the project area. Therefore, the proposed project will have ***No Effect*** on the Nelson's Checker-mallow.

CUMULATIVE EFFECTS

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). For the proposed action, the action area previously defined, there are no foreseeable non-federal actions subject to their own ESA consultation that have the potential to increase the impacts of actions described in this BA on federally listed species.

CONCLUSION

Due to the minimal likelihood that species would be present or encounter any elements of the proposed action, or that actions would occur in or significantly affect any portion of their critical habitat, the Corps has determined that the proposed action will have **no effect** on the following species: short-tailed albatross, northern spotted owls, Columbian white-tailed deer, Oregon silverspot butterfly, Nelson's Checker-mallow, and the streaked horned lark. This Biological Analysis further demonstrates the Corps' determination that the proposed action is **not likely to adversely affect** (NLAA) western snowy plovers, marbled murrelets, and bull trout.

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