SUPPLEMENT

To the

Revised Final Environmental Assessment

Columbia River at the Mouth, Oregon and Washington

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

Clatsop County, Oregon, and Pacific County, Washington

May, 2013

Table of Contents:

1. Introduction 1
2. Brief Description of Project History and Need 2
3. Revised Preferred Alternative 5
3.1. Updated Details for South Jetty Foredune Augmentation 6
3.2. Updated Construction Access, Storage and Staging Areas 11
4. Affected Environment 14
4.1. Aquatic Resources 14
4.1.1. Surrounding Water Resources 14
4.1.2. Wetlands 18
4.2. Vegetation 19
4.3. Endangered Species Act (ESA) Listed Species 19
4.3.1. Streaked Horned Lark 19
4.4. Social and Economic Environment 20
4.5. Cultural and Historical Resources 21
5. Environmental Impacts 22
5.1. General Discussion 22
5.2. Aquatic Resources 23
5.2.1. Surrounding Water Resources 23
5.2.2. Wetlands 24
5.3. Vegetation 25
5.4. Endangered Species Act (ESA) Listed Species 26
5.4.1. Streaked Horned Lark 26
5.5. Social and Economic Environment 26
5.6. Cultural and Historical Resources 27
5.7. Cumulative Effects 27
6. Agency and Public Coordination 28
6.1. NEPA 28
6.2. Endangered Species Act (ESA) 29
6.3. National Historic Preservation Act 29
6.4. Other Agency Coordination 29
7. Compliance with Environmental Laws and Regulations 30

7.1. National Environmental Policy Act (NEPA) 30
7.2. Clean Water Act (CWA) 30
7.3. Coastal Zone Management Act (CZMA) 31
7.4. National Historic Preservation Act (NHPA) 32
7.5. Endangered Species Act 33
7.6. Marine Mammal Protection Act 34
7.7. Migratory Bird Treaty Act (MBTA) and Migratory Bird Conservation Act 34
7.8. Executive Order 11990, Protection of Wetlands 34
7.9. Additional State and County Permitting and Compliance 35
8. References 36
Appendix 39
A. Additional Details Related to Design Options 39
1. Conventional Rip-Rap Revetment 40
2. Geotextile Sand-filled Tubes 41
3. Sand Beach Fill 41
4. Implement a Spur Groin on the South Jetty 42
5. Provide Beach Nourishment 42
6. Re-use Haul Road Material for Maintenance 42
B. NEPA Background 42

Table of Figures

Figure 1: Mouth of the Columbia River (MCR) South Jetty foredune project area. 2
Figure 2: Active erosion at the dune face south of the South Jetty (2010 December). 3
Figure 3: Vulnerability of present dune and backshore separating the Pacific Ocean from Trestle Bay. ... 4
Figure 4: Time varying reduction of the foredune 1,200 ft south of the South Jetty at Clatsop Spit..... 5
Figure 5: As-constructed vs. equilibrium profile for the dynamic revetment/cobble berm. 7
Figure 6: Example of existing cobble beaches 8
Figure 7: Cross-section for dynamic revetment featuring a 65 ft wide cobble berm. 9
Figure 8: Construction plan layout for dynamic revetment to stabilize the MCR South Jetty foredune. . 13
Figure 9: Mouth of the Columbia River historical shoreline evolution as defined by MHHW. 16

1. Introduction

This document incorporates by reference and supplements the *Revised Final Environmental Assessment for Columbia River at the Mouth, Oregon and Washington, Rehabilitation of the Jetty System at the Mouth of the Columbia River*, by the U.S. Army Corps of Engineers, Portland District (Corps), July 19, 2012 (EA). The EA disclosed environmental impacts and provided a comprehensive analysis for all repairs and rehabilitation actions proposed for the jetty system at the Mouth of the Columbia River (MCR), including the following: (1) lagoon fill and critical repairs at the North Jetty; (2) scheduled repair and stabilization of the jetty length at the North Jetty; (3) scheduled repairs and stabilization of the jetty length at Jetty A; (4) interim repairs and intense monitoring at the South Jetty; and (5) foredune augmentation at the Clatsop Spit (Spit) adjacent to the South Jetty root. The Corps also proposed the formation of an Adaptive Management Team (AMT) comprised of the state and federal resource management agencies, along with compensatory mitigation for actions related to work on each of the jetties. Pending receipt of final clearance documents, the Corps issued a Finding of No Significant Impact (FONSI) on July 26, 2012.

Features of the MCR navigation project were authorized by the River and Harbor Acts of 1884, 1905, and 1954. Congress authorized the improvement of the MCR for navigation through various pieces of legislation and public laws. The authority for maintenance of the MCR jetties comes from its 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 Engineering Policy 1165-2-1).

The scope of this Supplemental Environmental Assessment (SEA) clarifies the work of the preferred alternative as it relates to the foredune augmentation at Clatsop Spit adjacent to the South Jetty root. Since the EA and FONSI, further design has been done related to the foredune augmentation (item 5 above in first paragraph). This SEA clarifies the particulars of that work and further describes the impacts that were not entirely covered in the EA before the design evolved. The reason for protecting and stabilizing the foredune at the MCR South Jetty is to prevent further foredune erosion, and to minimize the risk of a breach of the foredune, Clatsop Spit, and the South Jetty root. The foredune augmentation is one component of the preferred and selected alternative as described in the EA and FONSI for the larger suite of repair and rehabilitation actions of the MCR jetty system.

Since completion of the EA, the Corps' proposed design to augment the existing foredune adjacent to the South Jetty has evolved to reflect the following updates: (1) additional design options and material sources were considered as part of a value engineering (VE) study; (2) the locations of the proposed associated construction access and staging areas were altered to avoid cultural resource, shore pine forest, and additional dune impacts, but would have unanticipated minor wetland impacts (a wetland determination was completed in the area south of the previously delineated project area); (3) an adjustment in the project design elevation would result

in previously unforeseen fill in 404 waters of the U.S.; and (4) newly proposed compensatory mitigation would offset fill in wetlands and waters of the U.S.

The preferred alternative is a cobble berm, dynamic revetment feature, which was described as cobble fill in the EA. The VE study explored design options in more detail, and findings reinforced the decision to select the preferred alternative. The location of the construction staging and access areas in the EA were immediately north of the jetty root. The staging areas proposed in the SEA are now south of the jetty root along an existing roadway. The cobble fill design in the EA was not expected to extend below the Clean Water Act (CWA) Section 404 jurisdictional ordinary high water (OHW) elevation. Whereas, in this SEA, the proposed cobble fill design would fill below OHW into waters of the U.S. The EA did not anticipate fill in wetland or waters of the U.S. for a staging and access area south of the jetty root, nor did it account for fill as a result of the cobble placement. Therefore, new compensatory mitigation has been proposed for unavoidable fill impacts.

2. Brief Description of Project History and Need

At the MCR, three rubble-mound jetties with a total authorized length of 10.2 miles were constructed by the Corps to secure consistent navigation through the coastal inlet. The MCR South Jetty, with an authorized length of 6.62 miles, is located on Clatsop Spit (Spit) on the north end of Fort (Ft.) Stevens State Park (Park), in Clatsop County, Oregon, near Hammond. Figure 1 shows the project South Jetty foredune project area indicated by red "circle" at root[1] of South Jetty.

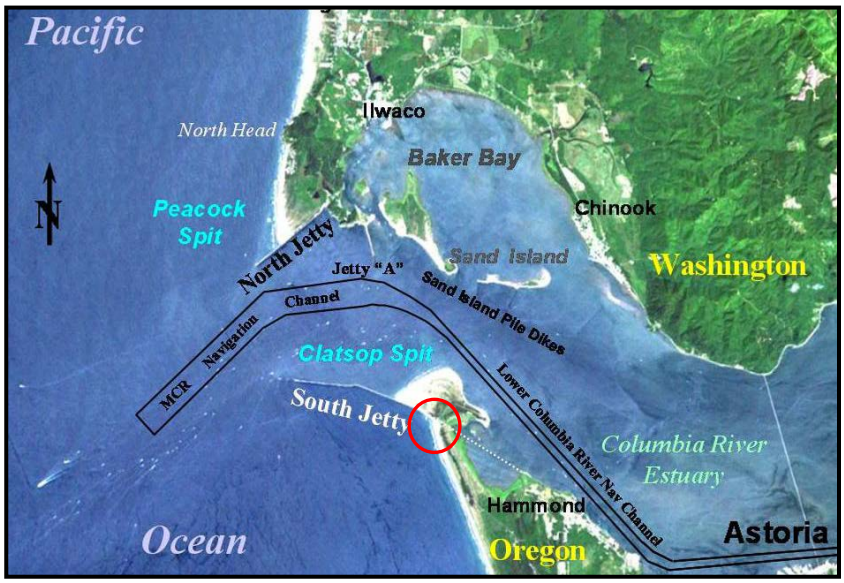

Figure 1: Mouth of the Columbia River (MCR) South Jetty foredune project area.

[1] The root forms the connection from the jetty trunk to the shore and prevents accreted landforms from migrating into the MCR inlet.

The Corps described and evaluated the proposed foredune augmentation in the EA and the 2012 *Major Rehabilitation Evaluation Report, Columbia River at the Mouth, Oregon and Washington, Major Rehabilitation of the Jetty System at the Mouth of the Columbia River* (Corps, 2012) (MRR). In the MRR, dune stabilization immediately south of the South Jetty was identified as an action that would need to be implemented independent of any jetty repair activity. This was based on the assessment that consequences of a breach through the Spit on the south side of the jetty would warrant immediate preventative measures.

The foredune south of the jetty root is presently in a condition of advanced deterioration (see Figure 2). During the 1970's, the South Jetty foredune had a crest elevation of 30 and 40 ft North American Vertical Datum 88 (NAVD 88) and 50-100 ft crest width. The high-crested foredune prevents storm-induced overtopping from reaching the backshore, and it protects the narrow strip of low-lying land that separates the ocean from the jetty lagoon called Trestle Bay (Figure 3). The foredune is now a relatively narrow feature on an otherwise flat, low-elevation area adjacent to a tidal marsh. Between 2003 and 2007, the concave shoreline area receded more than 40 feet, further reducing the protective ability of the foredune. Presently, the foredune crest has been reduced to less than 25 ft NAVD 88, along much of the project's 1,100 ft reach (Figure 4).

Figure 2: Active erosion at the dune face south of the South Jetty (2010 December).

In summary, the present foredune adjacent to the South Jetty is being eroded primarily by locally-enhanced cross-shore sediment transport (net offshore direction), and the net long-shore sediment transport is not sufficient to replace the eroded sediment. The proposed foredune augmentation needs sufficient resilience so that it does not excessively erode or become

displaced by either long-shore or cross-shore transport processes affecting the project area (now or future). It is advantageous to stabilize the foredune now, before it is completely eroded, so that the stabilizing treatment can utilize the foredune as a buttress. Stabilization of the South Jetty foredune is required to maintain the jetty's functional purpose of providing deep-draft navigation at the Mouth of the Columbia River (MCR).

Under the present condition of wave and surge exposure, the affected South Jetty foredune is vulnerable to short-term risk of being completed overtopped and eroded by wave surge action within the next 1-3 years. Without stabilization, the foredune along the root of the South Jetty would continue to erode and recede, resulting in a possible breach through the Spit along the South Jetty Root and into Trestle Bay. The Major Rehabilitation Report (MRR) (Corp, June 2012) estimated this breach could occur in 8-16 years. Such a breach would cause a secondary flow pathway to develop from the Columbia River estuary to the ocean, re-directing hydraulic flow from the existing inlet, threatening inlet stability, and disrupting navigation at the MCR. In the 1920's such a breach did occur in this vicinity. A similar breach also occurred at Grays Harbor, WA in December 1993. Rapid post-breach intervention was required to prevent loss of navigation function at the inlet and protect the town of Westport, WA.

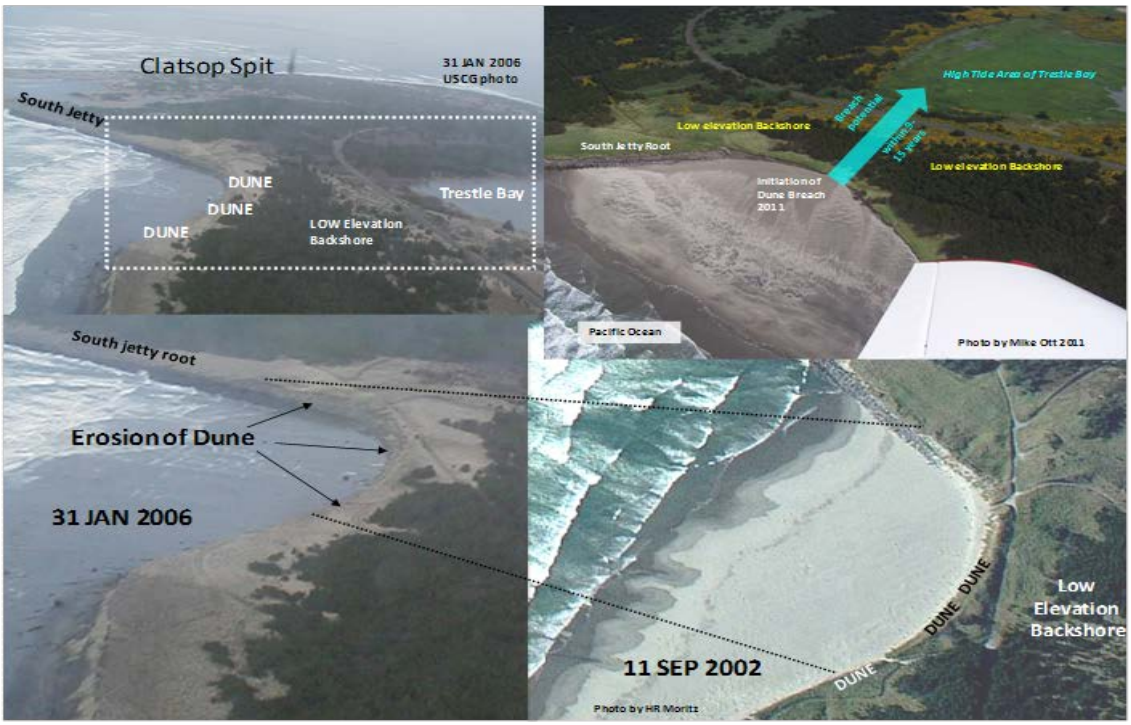

Figure 3: Vulnerability of present dune and backshore separating the Pacific Ocean from Trestle Bay.

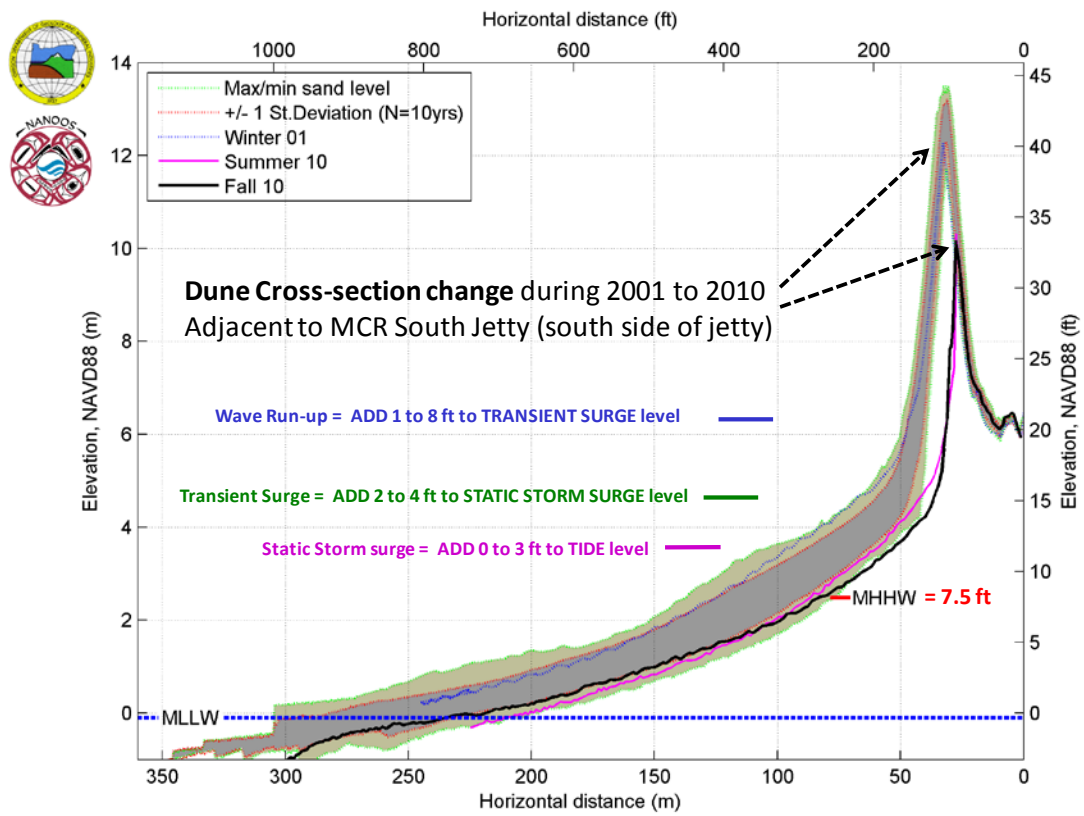

Figure 4: Time varying reduction of the foredune 1,200 ft south of the South Jetty at Clatsop Spit. The foredune has lost 13 ft of elevation and 100 ft of width during 2001 to 2010. The Standard Deviation in elevation change along this shore profile is 3-4 ft. Also shown is a range in water surface elevations for cumulative components of water level. Cross-shore change analysis provide by Department of Geology and Mineral Industries (DOGAMI).

3. Revised Preferred Alternative

The following describes the updates of the preferred alternative described in the EA and FONSI in regards to the design of the foredune. This SEA updates the description of the alternatives considered (pp. 72-73, EA) and why the cobble berm (dynamic revetment) design remains the preferred design option. This SEA provides additional design details about the preferred alternative that, until now, were formerly unavailable. This section supplements the design descriptions on pages 111-112, and the staging areas described on pages 141, 151-152 of the EA.

The EA described the dune augmentation at the root of the South Jetty as cobble fill and as cobble berm foredune augmentation. The cobble berm is part of what forms the dynamic revetment, and for the purposes of the SEA, these terms are synonymous. As indicated in the EA and FONSI, the Corps proposes to construct a cobble berm/ dynamic revetment as the dune augmentation and has further refined its design composition. Additional details are also available in the Appendix.

3.1. Updated Details for South Jetty Foredune Augmentation

A dynamic revetment is composed of cobble-sized rock placed along the vulnerable reach of shore. Its purpose is to protect the back shore from wave-surge induced erosion and to reduce the level of wave run-up (and overtopping) along the protected shore face. The thickness of the berm cross-section must be sufficient to provide an increased porosity during wave attack, which reduces the degree of wave run-up on the berm cross-section. Simply paving a beach face with 1-4 ft armoring treatment of cobble material likely would not provide the effective porosity for reducing wave run-up.

The cross-section is intended to be dynamic, in that its slope aspect would be re-shaped by the incident wave action. As the berm is reformed by wave action, its cross-section equilibrates into a stable configuration and blends in with the adjacent shore area. The required gradation of the cobble can vary depending upon the exposure to wave action. Cobble gradation may also vary along the cross-shore aspect of the dynamic revetment, with smaller material being located along the lower part of the berm cross-section and larger material being located along the upper slope area and on the berm crest. Gradation range for cobble material generally would be within a range of 1-inch to 8-inches.

The slope aspect for dynamic revetments can vary between 1vertical (V):4 horizontal (H) to 1V:15H, depending upon the wave action that is acting on the berm. Increased wave action tends to flatten the slope aspect (Figure 5). The volume of cobble material to be placed within the berm template needs to be sufficient to allow re-working of the cross-section (by wave action) to an equilibrium cross-section shape, while still providing ample cobble thickness and shore-face coverage to protect the back shore from wave-surge run-up. A revetment composed of rounded cobble tends to achieve greater porosity than angular quarry-produced cobble. Rounded cobble tends to provide better beach function and improved transition with adjacent sand beach areas, as rounded cobble is present on many beaches within the Pacific Northwest (PAC-NW). It also provides better pedestrian function and is more endemic to more natural materials that have been reworked in coastal and fluvial environments. Cobble berm beaches are also a natural occurrence at the base of bluffs along the Oregon Coast.

The advantages in using a dynamic revetment for shore protection rather than a hard armoring approach include lower cost, simpler construction, ability to accommodate shore-face recession (profile lowering), and reduction in adverse impacts to adjacent shoreline. In addition, the dynamic revetment approach does not require beach and dune restoration, as it can be constructed to protect the shoreline in its existing condition. For all of the above reasons, a dynamic revetment is the preferred alternative for design of the stabilization feature.

The composite beach at Ecola State Park (Indian Beach) most closely resembles the scale of the project feature proposed for the MCR South Jetty dune stabilization, based on the berm geometry and size of the cobble material (Figure 6).

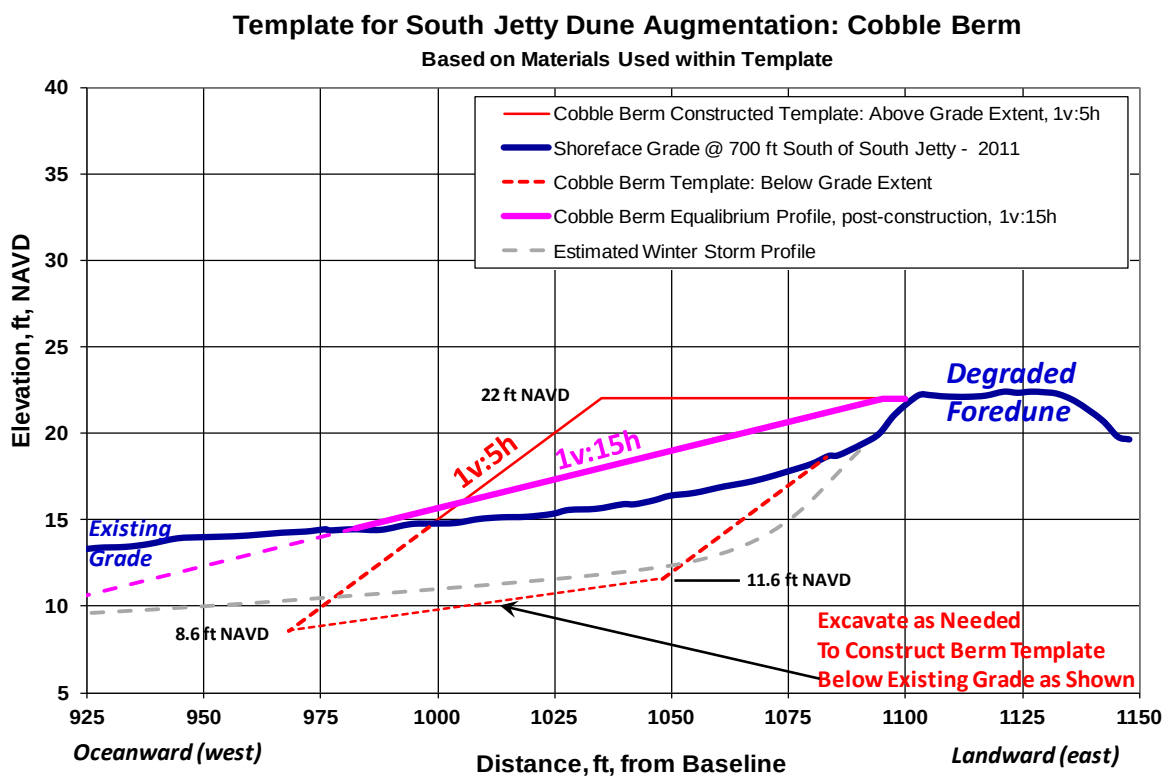

Figure 5: As-constructed vs. equilibrium profile for the dynamic revetment/cobble berm.

The Corps' goal is to construct a gravel or cobble berm that can deform in response to severe wave action. The material composing the dynamic revetment would be sized so the structure can deform, but not be dispersed by wave action. The top elevation of the berm (crest) would be high enough to prevent wave run-up from completely overtopping the berm, for the lading conditions of interest. The crest width of the cobble berm would serve as ballast material to accommodate deformation without reducing the crest elevation of the berm. The berm crest width also would serve to provide a cross-section with sufficient porosity. These types of porous structures are very effective in dissipating incident wave action and run-up. In the Great Lakes where fluctuating water levels are problematic for conventional shore protection methods, Johnson (1987) found dynamic revetments to be an effective alternative: not vulnerable to toe scour, overtopping, or flanking. Design attributes for a dynamic revetment include: material sizing, expected deformed side-slope, crest (berm) elevation, crest (berm) width, and toe elevation (embedment below grade).

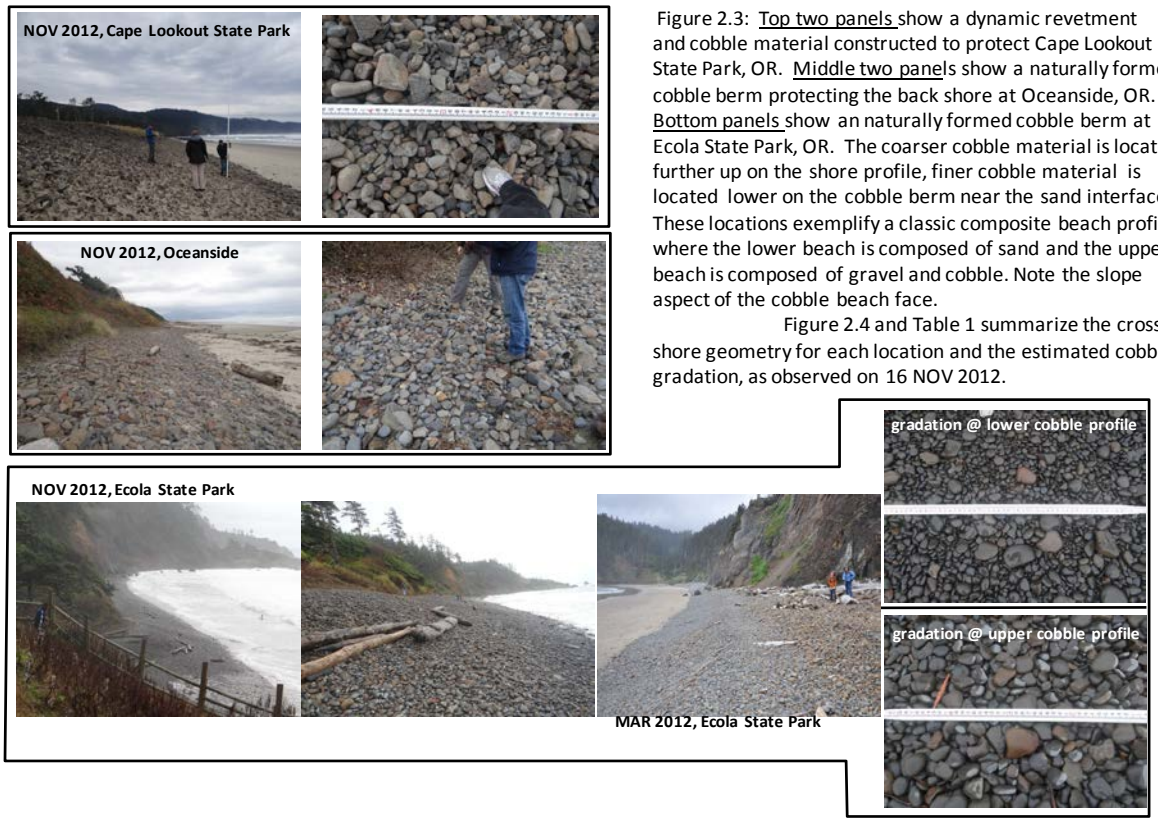

Figure 2.3: Top two panels show a dynamic revetment and cobble material constructed to protect Cape Lookout State Park, OR. Middle two panels show a naturally formed cobble berm protecting the back shore at Oceanside, OR. Bottom panels show an naturally formed cobble berm at Ecola State Park, OR. The coarser cobble material is located further up on the shore profile, finer cobble material is located lower on the cobble berm near the sand interface. These locations exemplify a classic composite beach profile, where the lower beach is composed of sand and the upper beach is composed of gravel and cobble. Note the slope aspect of the cobble beach face.

Figure 2.4 and Table 1 summarize the cross-shore geometry for each location and the estimated cobble gradation, as observed on 16 NOV 2012.

Figure 6: Example of existing cobble beaches

The Corps would install a dynamic revetment to be "dynamically stable", so that it can adapt to a project site over time-varying topographic change (erosion). The structure's cross-section would be compliant with wave and water level forcing and would subsequently be re-shaped to an equilibrium profile to match evolving site conditions (Figure 5). The slope aspect of dynamic revetments would be about 2-3 times flatter than standard rip-rap revetments, due to the relatively small and dynamic material used (cobbles 1 to 10 inches verses rip-rap 3 to 5 ft diameter).

Rounded cobble material proposed to be used within the dynamic revetment cross-section is more porous than conventional rip-rap and would absorb wave action, reducing turbulence and reflective dissipation. Incorporating these properties, a dynamic revetment would induce less erosion (scour) at the structure's toe and adjacent beach areas as compared to a conventional rip-rap revetment. Dynamic revetments are also more similar to naturally-formed cobble beaches that occur along the OR Coast (Figure 6). They reduce the potential for indirect hydraulic effects adjacent to the structure, and they are more aesthetically appealing and accessible for beach recreationalists.

The existing EA indicated that the foredune augmentation feature would be constructed from clean, upland sources (p. 112, EA). This was prior to additional evaluations regarding the benefits of using rounded cobble. Any selected material source would have and comply with all appropriate environmental compliance documentation.

The design attributes of a dynamic revetment are such that the feature's cross-section would be compliant with wave and water level forcing and would subsequently be re-shaped to an equilibrium profile to match evolving site conditions. The South Jetty Dune stabilization focused on stabilizing the critical area at the eroded face of the foredune along the concave area extending approximately 1,100 feet. The project location provides a unique opportunity to implement a design-with-nature approach utilizing a cobble/gravel berm (i.e., dynamic revetment) that would be naturally backed by an erosional escarpment (the existing high-crested foredune). The dynamic revetment would be bounded along its northern extent by the South Jetty. A 100-foot overlapping transition between South Jetty root and dynamic revetment would provide a littoral barrier to eliminate losses due to littoral transport of the cobble material to the north. The dynamic revetment would also taper at the south end to minimize flanking of the structure and to minimize other adverse impacts to the adjacent shoreline to the south.

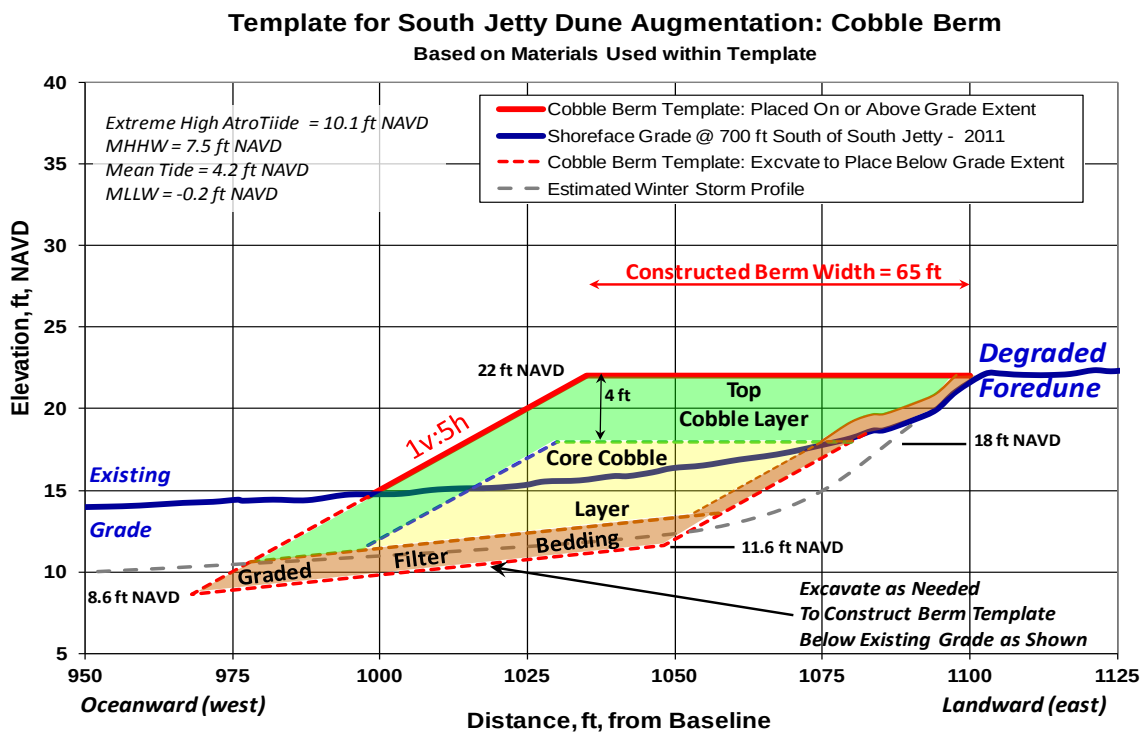

Figure 7: Cross-section for dynamic revetment featuring a 65 ft wide cobble berm.

The dune augmentation feature would key-into the existing foredune and would be comprised of a gravel bedding layer, a core of angular or rounded cobble, and a 4-ft deep rounded cobble

overlay (see Figure 7). A dynamic revetment (cobble/gravel berm) would be constructed along the ocean side of the foredune. The feature's dimensions would be approximately: 1,100 linear feet of cobble-sized stone (1"- 8" dia., but could go a small as 6"); crest width 65-ft wide; crest height 22-ft NAVD 88; and slope5 height (H):1 vertical (V) (resulting in about 150-ft total structure width ocean-ward from the edge of the existing dune). The total cobble fill volume would be about 43,000 cy of material (not including the excavated and replaced sand), and associated excavation for keying-in the base of the structure would be about 18,000 cy of sand. The average cobble fill volume per ft of shoreline for the proposed structure is 40 cy/ft. Approximately one-half of the quantity would feature rounded cobble, similar to material that is commonly found on many composite beaches within the Pacific NW. Also, a 50-ft wide portion near the middle of the revetment would be somewhat "hardened" by not including rounded rock in this portion. . This would allow emergency vehicles access to the beach. However, at the Park's request, this access would be gated so that it is only available to Park and Corps staff and emergency vehicles.

The minimum life-cycle of this dynamic revetment is intended to be 30 years, with maintenance intervals of 10-15 years featuring 10-25% cobble replacement per maintenance. If the dynamic revetment is adequately maintained, the project feature may realize a 50-year life-cycle. Construction of a dynamic revetment would remediate the MCR project's vulnerabilities at the south jetty foredune, within the context of minimizing life-cycle costs for maintaining reliable deep-draft navigation at MCR.

Additionally, the bedding layer for the preferred alternative uses gravel rather than geotextile due to concerns about exposure of the geotextile material and its incompatibility within a natural beach environment.

The dynamic revetment would be constructed by first excavating sands from the toe of the existing foredune in order to key-in the feature (which could entail a depth of sand between 5 – 8-ft depending on summer or winter profiles) and then placing cobble materials in layers. Excavation and material placement would be staged in sections and according to low-tides, in order to accommodate the challenges of periodic potential structure exposure to wave and tidal forces during storm surges. Otherwise, much of the construction would occur in the dry sands area. After construction is complete, the excavated sand would be placed at the toe of the structure to preserve the existing grade at the time of construction; any remaining sand would be used to supplement low spots in the foredune crest.

Construction is proposed to occur in late summer to early fall 2013. Work would be sequenced to account for tide action. It is anticipated that construction would be completed before onset of the fall-winter storm season (October-November), when wave-surge action may affect construction operations. Construction would take up to 4 months and likely would occur between June and October 31.

A monitoring plan would be enacted, as a formal element to this project, to document the post-construction performance of the dynamic revetment and to verify that the project feature causes no adverse impact to adjacent shore areas. The monitoring plan scope would be developed and executed in cooperation with the State of Oregon Department of Geology and Mineral Industries (DOGAMI).

3.2. Updated Construction Access, Storage and Staging Areas

Design features generally affect project implementation and construction methods. Environmental considerations and design criteria were applied equally to implementation strategies for the preferred alternative, as the process of constructing features can have as much or more environmental and biological impacts as the feature itself. Proposed construction storage, staging, stockpiling, and access areas avoided and minimized cultural and environmental impacts, including effects to wetland, dune, riparian areas, shore pine forests, and cultural resource sites. As much as possible, proposed project site locations took advantage of already developed and disturbed areas such as existing roads and parking lots. Construction access to the site via travel along the beach would be prohibited, and equipment access to and activity on the beach would be restricted to only that which is required to place and construct the stabilization structure. This would balance the need for efficient construction execution, maintenance of some level of public access, safety, and avoidance of additional environmental disturbance.

The EA identified construction and staging areas north of the jetty root and the currently preferred staging alternative (pp. 141, 151-154, EA). However, subsequent to finalization of the EA, areas immediately north of the jetty root near the foredune were deemed unsuitable for staging and access due to: (a) the topography of the existing dune, (b) the existence of previously unidentified historic/potentially historic resources (bunkers and trestle),and (c) the desire to protect the existing vegetation in this dune location. The previous staging and access locations would have: (a) been on top of the bunkers and trestle, (b) would have disturbed vegetation critical for dune stabilization immediately behind the existing root, (c) and would have required drastic grading that would have further destabilized the existing dune. For these reasons, this SEA updates the newly preferred staging and access locations.

This SEA considered multiple access and staging alternatives in the context of minimizing impacts to cultural resources, dune vegetation, and interdunal wetlands. Though Parking Area B is proposed for some of the staging and storage activities (thus reducing impacts by using previously disturbed areas), additional staging and access area would be required immediately adjacent to the foredune itself. Beach access and a proximal/adjacent location for rock and equipment staging and movement would be required. Driving would be limited along the beach to protect razor clam beds and reduce vehicular impacts on beaches.

The VE study recommended using a conveyer belt to transport material from the Jetty Access Road to the foredune area on the beach. The intent was to avoid impacts to cultural and wetland resources. However, this was deemed unfeasible given the required equipment configuration and

the additional impacts that would have been caused by implementing such a temporary conveyance structure.

Two unimproved sand roads currently allow access to the placement site (see Figure 8). The northern route (Haul Road B) is free of wetlands on its south side, and could be widened to provide some staging. However, access to the dynamic revetment placement site is limited by the historic jetty trestle structure which transects Haul Road B near the dune. Also, this route would have increased impacts to the shore pine forest relative to the proposed southern route (Haul Road A). For this reason, the Haul Road B would be limited to use only as a potential staging area.

The southern alternative route (Haul Road A) has wetlands along both sides of the road at the eastern-most portion of the road where it meets the paved Jetty Access Road (see Figure 8). Because of the slope of the entrance, the required turning radius, and the need for some amount of fill that would be difficult to remove in its entirety, this area of wetlands would be considered permanently impacted. Otherwise, the roadway width would be limited to a maximum of 30-ft in non-wetland areas, and sediment fencing would be installed to buffer adjacent wetlands in the vicinity. There also would be impacts to a section of the shore pine forest, but impacts would be contained and the site would be restored. Impacts to the foredune itself also would be avoided to the maximum extent practicable in order to maintain the stability and cohesiveness of the existing feature.

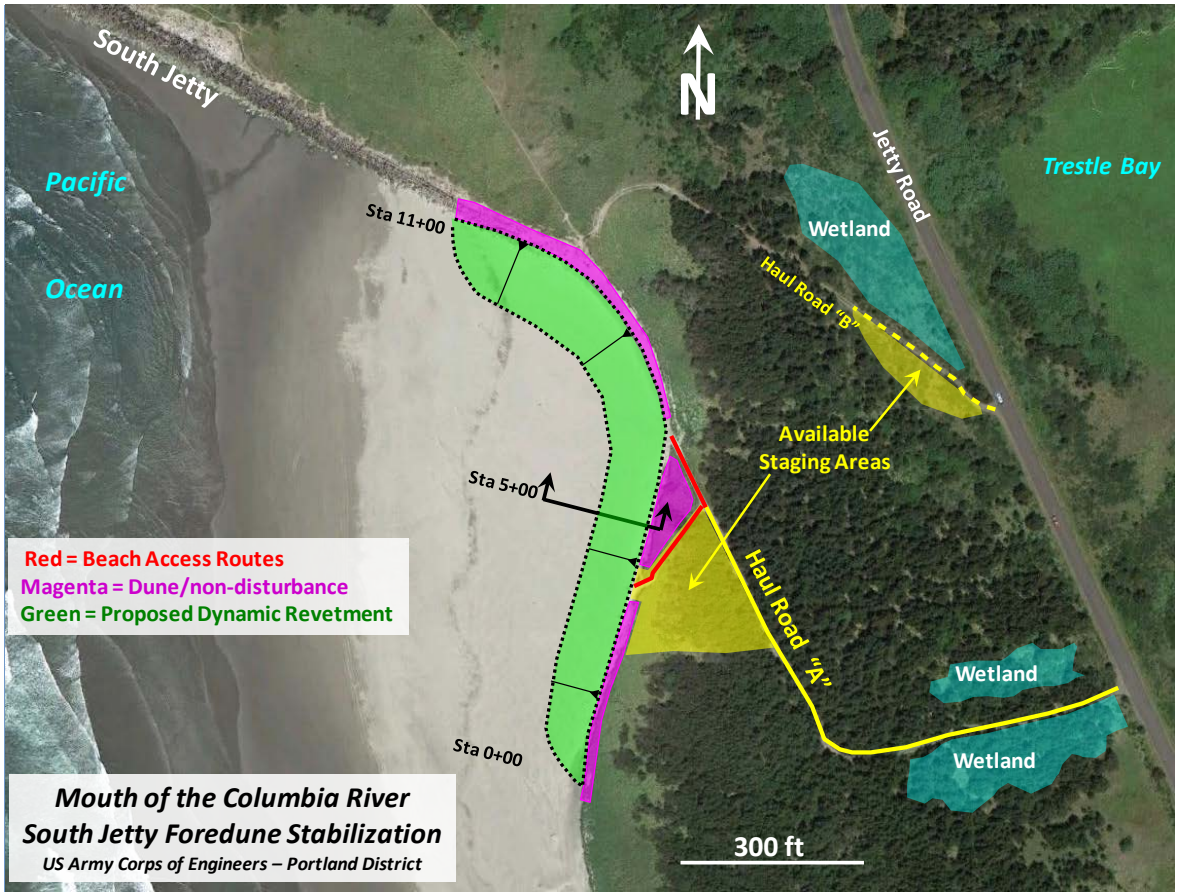

Figure 8: Construction plan layout for dynamic revetment to stabilize the MCR South Jetty foredune.

The Corps would site construction, storage, and staging areas to avoid and minimize impacts to wetlands and cultural resources in the vicinity. Access to the site through Ft Stevens State Park (Park) would be along the Jetty Access Road. Dune access would occur via unpaved improvement to an existing, primitive sand road (Haul Road A) that traverses the shore pine forest between the Jetty Access Road and shoreline. A small loop road enclosing an additional staging area is also proposed immediately adjacent to the dune/beach access site. These impacts would involve ground disturbance, including removal of some of the shore pine trees. There would also be limited staging and stockpile opportunity at a second, more northern existing unimproved roadway, as well as in Parking Area B. This northern unimproved road (Haul Road B) and staging area is mostly free of trees and consists of a dominance of scotch broom and European beach grass. Traffic would be restricted extending west on the roadway to avoid effects to the potentially historic trestle and further disturbance to the dune (see Figure 8).

A survey of the existing vegetation to be removed including stem counts for affected shore pine would be conducted to inform the replanting plan for site restoration. The Corps would minimize the removal of vegetation and trees. Shore pine replanting ratios would be no less than 5:1, (planting 5 seedlings for each tree removed). Removed trees would be disposed of off-site

at an approved location (unless the Park has identified an alternate approved use). The Corps would minimize clearing vegetation at the dune crest as much as possible, and would limit any required clearing to leeward side of the dune in order to maintain dune stability. Post-construction restoration plans would be reviewed by the Oregon Parks and Recreation Department (OPRD) forester to ensure the replanting plan meets Park needs.

Disturbance areas would: be re-vegetated with native, in-kind plant species; follow standard re-planting practices; and be planted during the recommended planting season for each particular species. The Corps would guarantee a minimum of one year survival rate for re-vegetated sites, and the Corps would replant areas that do not meet this rate. The Corps would not apply herbicide, although mechanical or other methods may be used to control weeds and unwanted vegetation. No surface application of fertilizer would occur within 50 feet of any wetland or ocean waters. The Corps would use restoration criteria that would include a high volume of native plantings in order to achieve a target native species coverage amount.

Post construction restoration would also entail minor roadway patching for damages caused by haul trucks and site restoration compliant with the Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit. Haul roads would be graded and narrowed to meet pre-site conditions.

The Corps is proposing compensatory mitigation for unavoidable impacts to wetlands and waters of the U.S.

4. Affected Environment

4.1. Aquatic Resources

The following discussion supplements the discussions regarding the purpose and need (p. 7, EA) and descriptions of the Affected Environment and the South Jetty No-Action alternative sections of the EA (pp. 9 & 56 EA, respectively). It also updates the discussions and descriptions on pp. 19-32, and 33-34 of the EA regarding wetlands and waters within the affected area. The following only includes updates for the foredune augmentation actions, and is not a complete description, which the EA contains.

4.1.1. Surrounding Water Resources

The area along the South Jetty has experienced profound changes since the time of jetty construction (1885-1913) (Figure 9). Before construction, the nearshore area was dominated by a broad ebb tidal shoal with relatively shallow water depths. During the construction period for the South Jetty, Clatsop Spit accreted (accumulated) seaward following the South Jetty alignment.

By 1918, accretion along the South Jetty changed to erosion. The broad ebb tidal shoal dissipated; and, as water depths increased, wave action along the south side of the jetty and

adjacent shore area increased. The higher energy wave environment impacting this area motivated rapid deterioration of the entire South Jetty and culminated with a notable jetty breaching event in the late 1920s that also breached Clatsop Spit. During the 1930s, extensive efforts were undertaken to rebuild the South Jetty and to re-establish the coastal dune morphology along Clatsop Spit and the south side of the South Jetty. Enhancement of the coastal dune morphology was successful. However, by the late 1970s the continual erosion that has affected this area since 1920s had initiated a large erosional escarpment into the face of the foredune (Figure 2). The locally enhanced shore recession of 10-14 ft/yr has created a concave shore alignment (erosive embayment) that extends approximately 1,100 feet south of the South Jetty (Figure 3). This affected area continues to be impacted by increasingly harsh wave and storm surge environment; driven in part by localized wave reflection induced by the South Jetty and a deficit of littoral sediment within the nearshore area (from -20 to -50 ft NAVD 88) extending several miles south of the South Jetty.

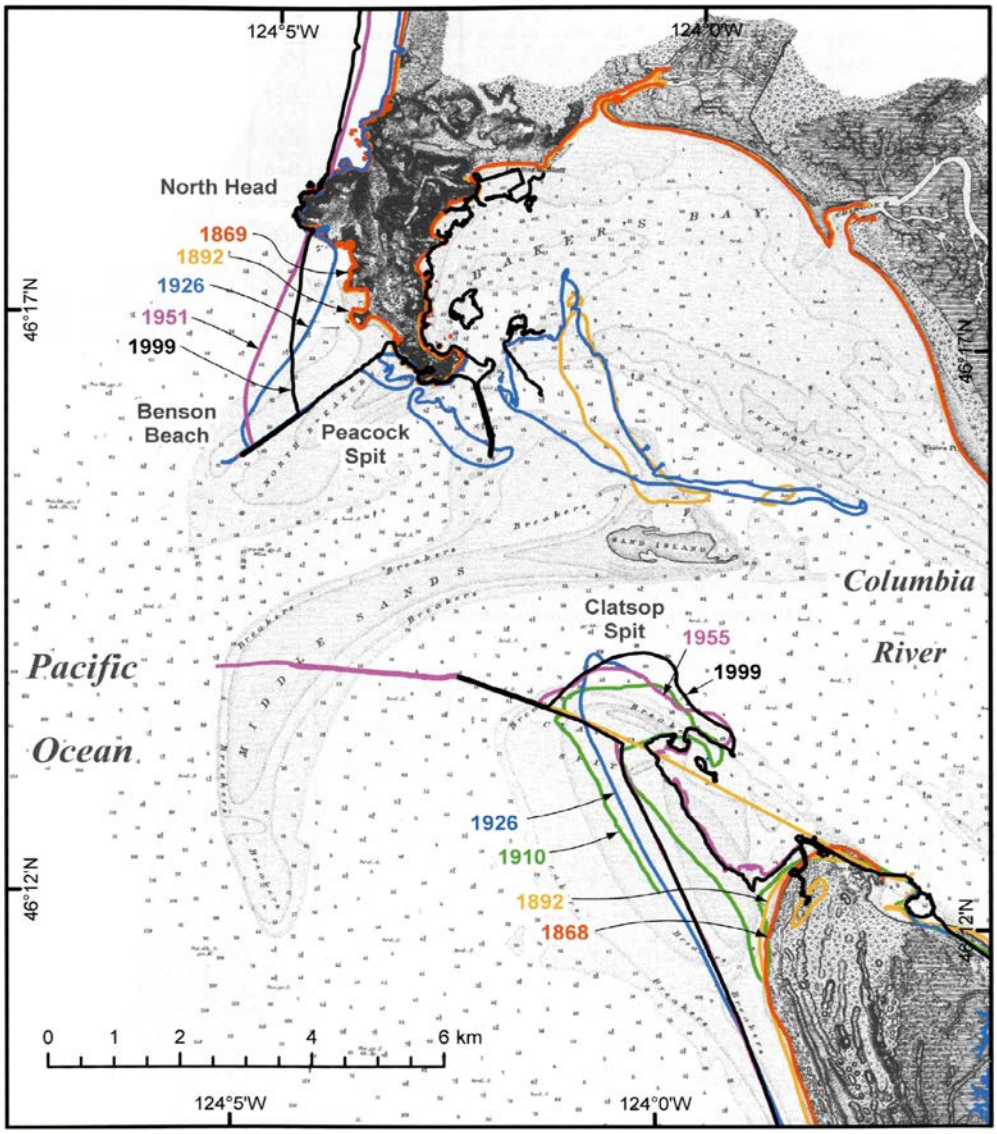

Figure 9: Mouth of the Columbia River historical shoreline evolution as defined by MHHW.
Base map is 1870 US Coast and Geodetic Survey (Kaminsky et al 2010). South Jetty constructed 1885-1910, North Jetty constructed 1913-1917, and Jetty A constructed 1938-1939. Note transient evolution of Clatsop Spit in vicinity of the present South Jetty foredune (where the SJ root connects to the Clatsop Spit).

The coastal margin at the MCR is subjected to vigorous environmental loading associated with seasonal variation of waves and winds, tidal action and estuarine circulation, and morphological change. The primary environmental loading factors that affect coastal navigation infrastructure and shoreline stability are incident wave action and variation of water level.

The ocean entrance at MCR is characterized by large waves and strong currents and has been considered one of the world's most dangerous coastal inlets. The transition from coastal regime to oceanic is abrupt at MCR. The sea state at MCR during storm conditions is characterized by high swell approaching from the northwest to southwest combined with locally generated wind

waves approaching from the south to southwest. Between October and April, the seasonal average wave height and period is 9 ft (2.7 m) and 12 seconds, respectively. During intense winter storms, waves can exceed 30 ft (9 m). Individual waves having a height of 45-55 ft (trough to crest) were recorded 5 miles south of MCR in water depth of 135 ft (Moritz 2001). During May-September, average wave height and period is 5 ft (1.5 m) and 9 seconds, respectively.

As offshore waves propagate shoreward toward the MCR, the waves are modified (waves begin to shoal and refract) by the asymmetry of the MCR's underwater morphology. Nearshore currents and tidal currents are also modified by the jetties and the MCR's morphology. These modified currents interact with the shoaling waves to produce a complex and agitated wave environment within the MCR. The asymmetric configuration of the MCR and its morphology is characterized by the 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 MCR.

The asymmetry of the MCR causes incoming waves to be focused onto areas which would not otherwise be exposed to direct wave action. Large waves approaching the MCR from the northwest can be refracted/diffracted (changed in direction) around the South Jetty and directed onto Clatsop Spit, including the project area. The wave environment affecting the South Jetty foredune is defined entirely by the water levels induced by tides and storms. Waves only affect the South Jetty foredune when the water level is elevated by tide and storm wave action. The present frequency of the foredune toe (13-17 ft NAVD 88) being affected by wave-surge action varies from 1 to 20 times per year. The South Jetty locally modifies wave action, directly affecting the project area, by inducing wave reflection off of the jetty. Additionally, a mach-stem effect can develop when waves ride along (are guided by) the South Jetty as they propagate toward shore. The cul-de-sac shape of the project's recessed shoreline and eroded foredune indicate that cross-shore transport dominates long-shore transport within the project site, and that the net direction of cross-shore transport is offshore.

Summary tidal information for the project site is provided below based on data for the MCR North Jetty, near Cape Disappointment, WA from the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service (NOS). This tidal station emulates the open coast conditions of MCR, and minimizes estuary/riverine effects of the Columbia River. For this project, relevant elevations are listed below:

MEAN LOWER LOW WATER, MLLW = -0.25 ft NAVD 88
MEAN HIGHER HIGH WATER, MHHW = 7.5 ft NAVD 88
MEAN HIGH WATER, MHW = 6.9 ft NAVD 88
MEAN TIDE LEVEL, MTL = 4.0 ft NAVD 88
MEAN SEA LEVEL, MSL = 3.8 ft NAVD 88
MEAN LOW WATER, MLW = 1.0 ft NAVD 88

[2]Extreme Astronomical High Tide (at Astoria, OR) = 10.14 ft (3.09m) NAVD88
Extreme Astronomical Low Tide (at Astoria, OR) = -1.08 ft (0.33m) NAVD88
Augmentation Feature, Keyed-in Depth = 8.6 NAVD 88

4.1.2. Wetlands

A Wetland Delineation Report and an Oregon Rapid Wetland Assessment Protocol (ORWAP) functional evaluation were previously completed by Tetra Tech, Inc. (dated May, 2011) (p. 19-32, EA). These reports covered all anticipated project actions on the Spit related to the full suite of jetty Major Repair and Major Rehabilitation actions, of which foredune augmentation was a component. However, new cultural resources information in the project vicinity became available, and because of this, construction limits related to the foredune augmentation changed after completion of the EA. Therefore, the existing wetland delineation needed supplemented. Site visits to conduct the wetland determination were conducted by Corps a Regulatory Jurisdictional Specialist and a Wetland Mitigation Banking Specialist on October 3, October 23, and November 21, 2012.

Surveys were conducted under the assumption that expanded roadway widths would be no greater than 30-ft in total. Staff took data points at multiple locations identified as potential staging, access, and road widening areas. Obligate wetland vegetation was observed on both sides along the Haul Road A in the understory of the eastern portion of the roadway (see Figure 8). Wetland vegetation was also located on and at the base of the road fill prism of the Jetty Access Road. The Corps did not specifically delineate these wetlands boundaries. Due to the mosaic, interspersed nature of the wetlands in this setting, the Corps has assumed the entire 5-ft buffer area on either side of the eastern portion of Haul Road A is wetlands, along with the entire proposed entrance area. However, this is a conservative estimate to assume a maximum impact, as there are several upland breaks between wetlands. Though additional wetlands may be present beyond the surveyed boundary, a determination was not conducted beyond the estimated buffer because further wetland impacts would be avoided and minimized since the project staging and road widening would be limited through this area.

Wetlands at the entrance and eastern portion of Haul Road A (see Figure 8) were classified as palustrine emergent (PEM) depressional freshwater wetlands that are part of an interdunal mosaic of wetlands formed on deflation plains throughout the Spit. Wetlands are similar to others in the vicinity, which were scored in the EA per Oregon Rapid Wetland Assessment Protocol (ORWAP). Wetlands along the roadway were classified as palustrine forested (PFO) depressional freshwater wetlands.

The Corps identified the area south of Haul Road B as uplands from (a) the roadway to the tree line indicated by the mature shore pine canopy, and (b) from the entrance with the Jetty Access Road to the beginning of the bend in and canopy closure over the road. The area north of Haul Road B had PEM wetlands and was therefore avoided as part of the staging area (see Figure 8).

[2] This elevation defines the Clean Water Act Section 404 Waters of the U.S. elevation for this project.

No wetlands were identified within 30-ft buffer adjacent to the western portion of Haul Road A. The backshore staging area and loop proposed immediately adjacent to and east of the dune connecting to Haul Road A was determined to include only upland characteristics. Discrete portions of the leeward side of the dune in the vicinity of the Haul Road B were also investigated and were confirmed to have upland characteristics. However, in these areas there were cultural resources and dense stands of shore pine forest.

4.2. Vegetation

Generally, project implementation would affect the coastal foredune and shore pine forested areas. As described, the foredune is receding at an accelerated pace, and it is primarily comprised of sand and vegetative root structures. In this location and the accreted area of the Spit, the over-story is dominated by shore pine, which was likely planted sometime during or after World War I, anecdotally by the Civilian Conservation Corps. The primary understory is comprised on European beach grass and scotch broom.

4.3. Endangered Species Act (ESA) Listed Species

Since the EA, snowy plover were spotted north of the root in 2012. No nests were found, and none are expected in the vicinity of the dune augmentation. Further, the area of construction would not be within the Habitat Conservation Plan identified by OPRD and U.S. Fish and Wildlife Service (USFWS). Plover would not be expected to be in the vicinity during project construction period since it is outside of breeding season.

Proposed critical habitat has also been designated since the EA for leatherback sea turtle, eulachon, and Lower Columbia River coho. These species and their proposed critical habitat were covered in the *Endangered Species Act Biological Opinion and Conference Report and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River* received from National Oceanic Atmospheric Administration (NMFS) on March 18, 2011.

4.3.1. Streaked Horned Lark

Since the EA was completed, the streaked horned lark (*Eremophila alpestris strigata*) has been proposed as Threatened under the ESA, and critical habitat has been proposed. Streaked horned lark is known to or is believed to occur in Clatsop County (10/11/2012; 77 Federal Register (FR) 61937-62058).

According to USFWS (http://www.fws.gov/oregonfwo/Species/Data/StreakedHornedLark/, accessed 4/10/13), horned larks are birds of wide open spaces with no trees and few or no shrubs. The streaked horned lark nests on the ground in sparsely vegetated sites dominated by grasses and forbs. The nesting season for streaked horned larks begins in mid-April and ends in the early part of August. Historically this type of habitat was in dune habitats along the coast of Washington and on the sandy beaches and spits along the Columbia Rivers. Wintering streaked horned larks use habitats that are very similar to breeding habitats.

A key attribute of habitat used by larks is open landscape context. USFWS data indicate that sites used by larks are generally found in open (i.e., flat, treeless) landscapes of 120 hectares (ha) (300 acres) or more. Some patches with the appropriate characteristics (i.e., bare ground, low stature vegetation) may be smaller in size if the adjacent fields provide the required open landscape context. This situation is common in agricultural habitats and on sites next to water. For example, many of the sites used by larks on the islands in the Columbia River are small, but are adjacent to open water, which provides the landscape context needed.

Primary Constituent Elements (PCE's) for streaked horned lark identify the elements of physical or biological features that provide for a species' life-history processes and are essential to the conservation of the species. In the proposed listing and critical habitat designation, USFWS determined that the PCE's specific to the streaked horned lark are:

> Areas having a minimum of 16 percent bare ground that have sparse, low stature vegetation composed primarily of grasses and forbs less than 13 inches (33 cm) in height found in:
>
> a. Large (300-ac (120-ha)), flat (0–5 percent slope) areas within a landscape context that provides visual access to open areas such as open water or fields, or;
>
> b. Areas smaller than described in (a), but that provide visual access to open areas such as open water or fields.

Though streaked horned lark is known to or is believed to occur in Clatsop County, there are no recent occurrence records from the Oregon Coast (77 FR 61937-62058). A few non-breeding season records exist for Clatsop County (Gabrielson and Jewett 1940, p. 403 in 77 FR 61937-62058). Small numbers of larks were known to breed at the South Jetty of the Columbia River in Clatsop County, but the site was abandoned in the 1980s (Gilligan et al.1994, p. 205; in 77 FR 61937-62058). According to the Federal Register, the streaked horned lark, while occasionally present, was described as an uncommon and local summer resident all along the coast on sand spits (Gilligan et al. 1994, p. 205; in 77 FR 61937-62058). Clatsop Spit is not included as part of the proposed Designated Critical Habitat (77 FR 61937-62058).

4.4. Social and Economic Environment

The Corps owns the project area on the Clatsop Spit where the dynamic revetment is proposed and leases it to Fort Stevens State Park under OPRD. As such, the State Park is on federal lands, and the Corps has been in coordination with OPRD during project development.

This area of beach is used by clammers, dog-walkers, surfers, ultimate Frisbee players, bird watchers, and other beach recreationalists. Public access on the primitive sand roads and across the dune is already restricted in the area, as indicated by posted signs. Though discouraged and not endorsed by the Corps, the jetty is also used for fishing. The jetty itself along with its root and stable foredune are also structures critical to maintaining a navigation channel that supports up to $20-billion of commerce annually. Designated Beneficial Uses in Estuaries and Adjacent

Marine Waters in the North Coast - Lower Columbia Basin (OR Basin # 11\21) Necanicum River - Frontal Pacific Ocean Watershed include: Industrial Water Supply; Fish & Aquatic Life; Wildlife & Hunting; Fishing; Boating; Water Contact Recreation; Aesthetic Quality; Commercial Navigation & Transportation

4.5. Cultural and Historical Resources

In accordance with the mandates of Section 106 of the National Historic Preservation Act and its implementing regulations 35 Code of Federal Regulations (CFR) 800, the Corps has conducted a review of the proposed undertaking and its potential effects on historic properties.

Record searches of previous cultural resource assessment reports on file at the Corps-Portland District and in Oregon State Historic Preservation Office (SHPO) databases indicate that one archeological survey has been conducted on Clatsop Spit. The survey was carried out by the Oregon State Museum of Anthropology in 2002-2003. Numerous archeological sites were recorded during this survey, which covered areas outside of Clatsop Spit, but no specific sites were recorded within or near the project area. A few historic features were located and recorded, but no formal archeological sites were documented. The portion of the Spit where this project is proposed has been created in modern times, and thus, there should be no archeological sites in this area that predate 1892. The Corps is also currently unaware of any areas of traditional or significant cultural interest to the Native American Tribes that could be affected by this undertaking.

There are no known archeological sites within the project area, and there is only one site in the vicinity; 35CLT85. Site 35CLT85 was originally recorded in 1989 by Le Gilson and documents the Fort Stevens State Park. The northern boundary of this site is within the proximity of the project area. In communicating with Dr. Dennis Griffin, he stated that the boundaries of this site are incorrect and should be reduced. That said even based on the current, larger boundaries, this project will have No Effect on this site.

In addition to this survey, the Portland District archeologist also made a site visit to the project area in order to determine if any of the trestle remnants, or historic military features would be affected by this undertaking. Based on maps provided by State Parks, there are historic features related to the military history of the Spit near the project. On 21 November 2012, the Corps archaeologist made a site visit to the project area and did a visual inspection, which included the staging areas, access roads, and the rock berm location. The goal was to identify any impacts to the historic military features, the trestle remnants, or any other historic features. The only historic feature in close proximity to one of the staging areas was identified as a “Height Finder”. The Corps archaeologist did a visual inspection of this location and surroundings and did not identify any structural elements. No other historic features associated with the military history of the Spit were identified within or near the Area of Potential Effect (APE).

Remnants of the trestle used to construct the jetty does still cross the Spit. The North and South Jetties and their structural elements, including the trestles remnants, have been determined eligible for listing on the National Register of Historic Places by the Corps Center of Expertise for the Preservation of Historic Structures and Buildings. One of the alternatives for accessing the project area would have included using Haul Road B and then cutting over to the project location. This alternative was eliminated because it would have impacted the trestle remnants that were documented during the site visit. The current alternative as described will use existing roads and will have No Effect on any trestle remnants. No other historic features were identified within or near the project area.

One other historic aspect to note is shipwrecks within the vicinity of the Spit. There are a number of shipwrecks recorded at the MCR, but there are no recorded shipwrecks in the area where the rock berm will be placed. In addition, the heavy wave action and constant fluctuation of sand levels would have adversely impacted any resources in this location if they were to exist, and thus this project should have No Effect on any historic shipwrecks.

5. Environmental Impacts

This chapter of the SEA evaluates effects not analyzed for the update of the preferred alternative in regards to the design and construction of the foredune augmentation. These updates were identified since the completion of the EA and signed FONSI. The following discussion only includes sections updated for the foredune augmentation actions, and is not a complete description, which the EA contains.

5.1. General Discussion

There are advantages to using a dynamic revetment for shore protection rather than a hard armoring approach. These include lower cost, simpler construction, ability to accommodate shore face recession (profile lowering), and reduction in adverse impacts to the adjacent shoreline. The Corps balanced the following considerations: the size and footprint of the dune stabilization feature, the feature's indirect impacts, and the expected return period or frequency of maintenance/replenishment requirements. In addition, the proposed dynamic revetment approach would not require beach and dune restoration, as it can be constructed to protect the shoreline in its existing condition. It also would be more reflective of coastal beach materials, and more aesthetically appealing and recreationally accessible for beach users. These characteristics avoid and minimize negative effects on the human environment.

Further, proposed construction storage, staging, stockpiling, and access areas were identified to most optimally avoid and minimize historical and environmental impacts, including effects to wetland, dune, riparian areas, shore pine forests, and cultural resource sites. As much as possible, project site locations have taken advantage of already developed and disturbed areas such as existing roads and parking lots.

5.2. Aquatic Resources

The updated design of the proposed foredune augmentation would result in effects related to Clean Water Act Section 404 wetlands and waters of the U.S. As such, the Corps updated its 404 (b) (1) evaluation.

5.2.1. Surrounding Water Resources

In the EA, the Corps indicated that the foredune augmentation feature would not extend below Mean Higher High Water (MHHW) (p. 73, EA). However, it has subsequently been determined that the malleable nature of the cobble dune could eventually flatten out and extend below this elevation. Furthermore, in order to key-in the toe of the feature to accommodate design requirements, the updated bottom elevation of the dynamic revetment would now be below the jurisdictional elevation for Clean Water Act Section 404 Waters of the U.S.(8.6 versus 10.14 feet NAVD 88, respectively) Depending on the sand lens that develops prior to construction, there could be material above the 404 elevation so that the project excavation site is separated/isolated from the ocean.

The dynamic revetment would entail temporary removal and permanent fill (about 3.79 acres) below waters of the U.S. The functional hydraulic and hydrologic effects of this fill have been somewhat avoided and minimized based on the structure's ability to better accommodate natural erosional and depositional coastal processes while maintaining the shoreline protection required for the navigational jetty structure. The augmentation feature would also better blend in with the beach aesthetic and recreational uses that occur in the vicinity.

Materials that are being removed and placed are expected to be clean fill, and are almost 100% sand or cobble. The Corps received a memo concurring with this clean-fill determination through compliance with the sediment evaluation framework process.

Most of the stabilization feature would be behind/above the 404 jurisdictional elevation and in the dry sands, but depending on the sand profiles, the structure also would be inundated during astronomical high tides and wave surges. Therefore, about 3.79 acres of sandy shoreline habitat in waters of the U.S. inundated during more extreme events would be converted with the placement of cobble materials. As compensatory mitigation, the Corps is proposing to participate in marine debris removal. This would be commensurate with the project's habitat conversion impacts because it would help protect the beach ecosystem by removing artificial debris (much of which is currently as a result of the Japanese tsunami) that could have severe biological, chemical, and physical effects on water quality. This also would improve recreational and aesthetic conditions along the ocean shores, which supports both the CWA beneficial use designations and the coastal communities. The Corps coordinated with OPRD and Oregon Department of Fish and Wildlife (ODFW) to determine the best way to implement marine debris removal actions in the vicinity of the project area and has incorporated guidance from the Oregon Marine Debris Partnership listed on the OPRD website.

5.2.2. Wetlands

Based on the potential alternative impacts to the mature shore pine forest and cultural resources, the access option through the wetlands along the southern access road was considered to have fewer overall impacts compared to access across/along the dune from the north or along the beach. Wetland impacts were avoided and minimized by using existing roads. The Corps balanced the following resource impact considerations: wetland impacts from the roadway; avoidance of cultural resources like the historic jetty trestle and old WWII bunkers; impacts to the eroding dune; and impacts to the mature shore pine forest. However, constructability and the difficulty/impossibility of complete removal of temporary fill led the Corps to determine 0.08 acre of wetland impacts would be permanent. However, these wetland areas would be stabilized and reseeded with a wetland mix when the rest of the site restoration plantings are implemented.

Ultimately, the proposed project design and implementation plan would avoid all wetland impacts except at wetlands located near the entrance from the paved Jetty Access Road to the southern, unimproved sand access road (Haul Road A). Wetlands are present immediately adjacent to the hillslope/road fill prism and on either side of the unimproved road linearly for about 240-ft, starting from the paved roadway. In order to accommodate a sufficient turning radius, the entrance turn-out would need to be widened, and fill would be required to construct a matching grade for heavy equipment. Deployment of a removable bridge and removable matting in this location were considered in order to avoid permanent fill in wetlands. However, the nature of the topography, the potential for future access needs, the mosaic nature of the wetlands, and the constraints of construction material alternatives capable of achieving the required road surface and radius precluded the use of more temporary access methods.

Road widening would be restricted in this area, but a 5-ft buffer of wetland impacts was indicated to accommodate the likely migration of some roadway gravels during vehicle passage. The turnout from Haul Road A onto the Jetty Access Road was also identified as an area of wetland impact. West of the boundary of the wetland area, road widening will be limited to a maximum width of 30-ft in order to avoid any further potential wetland impacts.

The area previously identified as a potential wetland mitigation site (pp. 28 and 154-155, EA) for impacts from work at the South Jetty proper has subsequently been identified as on OPRD property and unavailable as a mitigation site. The potential mitigation sites for wetlands on the Spit and within Corps existing property boundary are extremely limited. At this time, only one additional potential area has been preliminarily identified as potential mitigation for future wetland impacts that could occur during construction elements related to repairs under the Major Rehabilitation scenario. The potential mitigation area is of limited acreage, and no wetland surveys have been conducted. It also may be identified in OPRD documentation as being of “high probability” for cultural resources, but this has not been confirmed or evaluated by Corps archaeological staff, and cultural resource clearances have not been obtained.

In-kind mitigation for these interdunal depressional wetlands typically would occur in-basin. However, the South Jetty dune stabilization is not within the service area of an in-basin mitigation banks. Therefore, having exhausted all avoidance and minimization measures, mitigation credits would be sought from an out-of-basin source. Given the limitations of this particular project, this approach should not be considered as precedent for future mitigation determinations.

Approximately 0.08 acres of interdunal depressional palustrine wetlands would be permanently impacted due to unavoidable construction activities and cultural constraints. At this time, the Corps has coordinated with its Seattle Regulatory Mitigation Bank Coordinator and expects that compensatory mitigation bank credits would be purchased from a mitigation bank coming on-line in April near Long Beach WA. Though it is out-of-basin, (Columbia rather than Pacific Ocean), it has appropriate, in-kind wetland credits. This mitigation is considered appropriate because: there are no mitigation banks or in lieu fee locations with service areas applicable to the project location; the affected wetland type limits the potential pool of banks with similar wetland types; and there are current limitations for on-site wetland restoration or creation.

5.3. Vegetation

Placement of the staging and access areas considered impacts to mature shore pine vegetation and dune stability. The number of trees and vegetation removed would be minimized. The southern staging areas surveyed adjacent to the dune would not have wetland impacts but would require clearing and restoration of mature shore pine vegetation. The Corps would minimize clearing vegetation at the dune crest, and as much as possible would limit any required clearing to the leeward side of the dune in order to maintain dune stability.

Shore pine replanting ratios are high (5:1, 5 seedlings planted for every tree removed) to take into account the harsher coastal environment and greater difficulty in successful establishment. Post-construction restoration plans would take into consideration the extent of non-native, aggressive European beach grass that is present onsite. With surrounding existing conditions, achievable native plant coverage is expected to be at about 15% native species, post-construction. Disturbance from staging activities could increase the spread of European beach grass and scotch broom, which already dominate the understory and dunal project areas. Disturbance areas would be re-vegetated with native, in-kind plant species, follow standard practices and be planted during the recommended planting season for each particular species. The replanting plan prepared by the Contractor would require a reasonable survivability rate after 1 year. Areas that do not meet this rate would be replanted. No herbicide application would be allowed, although mechanical or other methods may be used to control weeds and unwanted vegetation. No surface application of fertilizer would occur within 50 feet of any wetland or ocean waters.

5.4. Endangered Species Act (ESA) Listed Species

Changes to the preferred alternative do not introduce new effects to Threatened and Endangered listed species that were previously analyzed under the Biological Opinion from NMFS (March 18, 2011) and informal consultation with USFWS (February 23, 2011). Therefore, the effects analyzed in the EA and FONSI are still current.

The Corps has requested adoption of the NMFS Conference Report as a Letter of Concurrence confirming the "not likely to adversely affect" determination with regards to recently designated critical habitat for leatherback sea turtle, eulachon, and Lower Columbia River coho

Though snowy plover have been spotted north of the root in 2012, no nests were found, and none are expected in the vicinity of the dune augmentation. Birds are also not expected to be in the vicinity during project construction period since it is outside of breeding season.

5.4.1. Streaked Horned Lark

Based on the information about proposed designated critical habitat and absence of streaked horned lark at the proposed action area, the Corps has determined its preferred alternative will have no-effect on streaked horned lark or its proposed critical habitat. The Corps has come to this determination because: (a) the nesting season for streaked horned larks begins in mid-April and ends in the early part of August, which is outside of the proposed action window; (b) there are no recent lark occurrence records from the Oregon Coast; (c) though the action area is located on a sandy beach, the dune itself is heavily vegetated in areas that are not part of the eroding dune scarp; and (d) the Clatsop Spit is not included as part of the proposed Designated Critical Habitat (77 FR 61937-62058).

The foredune stabilization and associated actions remain within the scope of effects previously evaluated in the 2011 Biological Opinion and Concurrence Letter.

5.5. Social and Economic Environment

The location of the proposed project feature is exclusively on federal property, and as designed the foredune feature does not extend below the Mean High Water (MHW) line (8.6 ft vs. 6.9 ft, respectively). The dynamic nature of the structure would shift over time, such that future slopes could flatten from a 1:5 to a 1:15 profile and may extend beyond the design elevation. However, in the future the foredune augmentation feature is not expected to extend beyond 6.9 ft NAVD 88. Mean High Water demarcates the landward extent of State ownership of the Territorial Sea, and State-owned Recreation Area and Submersible lands. On other non-federal lands, this zone from the jurisdictional vegetation line is typically under the jurisdiction of OR Parks and Recreation Department (OPRD) as part of the area indicated "Dry Sands, Public Recreation Easement" within the Oregon Shore Boundary (which extends landward to the Beach Zone vegetation line). Additionally, the landward jurisdictional elevation for the Shoreline State Planning Goals is Mean Higher High Water (MHHW) (7.5 NAVD 88). However, the foredune augmentation feature as constructed would be exclusively on federal lands.

There would be seasonal temporary delays along the Jetty Access road due to truck traffic along Park roads. The current estimate is about 30 trucks per day. Parking Area B would be closed in its entirety to ensure public safety. However, the rest of the parking lots on the Spit would remain open in their entirety as would a majority of the beaches in the vicinity.

Construction access to the site via travel along the beach would be prohibited, and equipment access to and activity on the beach would be restricted as much as possible to only that which is required to place and construct the stabilization structure. This would entail balancing the need for efficient construction execution, maintenance of some level of public access and safety, and avoidance of additional environmental disturbance. Most of the activities would occur in the dry sands. The Corps, with the help of ODFW, has identified clam beds so they will be avoided.

Depending on the sand lens profile, there is some beach access during various times of the year as unauthorized vehicles drive over a portion of the dune. However, vehicle entry is restricted in the area, as indicated by existing Park signs. At Park's request, the proposed emergency access would be gated. Without the "hardened" section of the dune, emergency vehicles could not pass over the berm.

5.6. Cultural and Historical Resources

Based on the APE, and the activities associated with this undertaking (revised preferred alternative) the Corps has determined that this project will have *no effect* on properties on or eligible to the National Register of Historic Places. The Corps submitted its determination and request for concurrence to SHPO on May 3, 2013 The SHPO concurred with determination of effect in its letter to the Corps dated May 6, 2013. Further, the Corps prepared an inadvertent discovery plan, which would be part of the construction contract. The Cops would coordinate with SHPO should there be any proposed changes to the project. The Corps also coordinated with the tribes interested in the area. The Corps received one comment from the Siletz giving concurrence contingent upon the included inadvertent discovery clause. No other responses were received.

More specifically this project should have No Effect on the following potential historic resources:
(a) There are no known archeological sites within the project area;
(b) There are no known structural remnants associated with the military history of the Spit;
(c) This project will have no impact on any trestle remnants near the project area;
(d) Given that most of the Spit has been created in modern times, there should be No Effect to pre-contact Native American resources.

5.7. Cumulative Effects

The majority of the effects described in this SEA relate to unforeseen fill in wetlands and waters of the U.S. However, through avoidance, minimization, and planned restoration measures, the Corps has limited the potential impacts from the proposed action. The fill is considered, clean

and is geographically limited. It will not cause degradation of water quality parameters. Effects to interdunal depressional wetlands are being offset by purchase of in-kind compensatory wetland mitigation bank credits. The dynamic, deformable characteristic of the cobble berm revetment maintains some of the coastal processes while remaining compatible with the surrounding recreational and beach aesthetic. Habitat conversion from sandy to cobble substrate is being offset by marine debris removal, which is commensurate with the effects because it removes artificial, potentially harmful materials that could cause chemical, physical, or biological degradation to waters of the U.S.

6. Agency and Public Coordination

This chapter of the SEA describes agency and public coordination efforts not covered in the EA (206-212) and past compliance efforts for this project.

6.1. NEPA

A public meeting was held for construction contractors on January 31, 2013, at the Portland District Corps offices.

A public notice was issued informing agencies and the interested public of a 15-day comment period regarding the Draft SEA. Six responses were received.

1) The Pacific Northwest Waterways Association commented in strong support of the foredune augmentation project and rehabilitation of the jetty system as a whole.
    - Response: The Corps appreciates the public's support in this endeavor.
2) The Confederated Tribes of Siletz Indians commented that they were fine with the project proceeding if there was an indirect discovery protocol in the construction contract.
    - Response: The Corps would incorporate an inadvertent discover plan in its contracting package.
3) The State Historic Preservation Office (SHPO) responded requesting a hardcopy of the draft SEA.
    - Response: The Corps sent SHPO a paper and electronic version of the draft SEA. In sending the SEA, the Corps advised SHPO that the undertaking described in the draft SEA is part of SHPO case #13-0171, under which the Corps has been completing the coordination required of Section 106 of the National Historic Preservation Act.
4) One commenter requested the Corps construct passage upon and across the jetties in order to accommodate deep-water fishing access.
    - Response: Jetty structures are strictly navigation aids and are not meant to be used for public access or recreation, and the Corps strongly cautions against such use. Jetties are subject to extremely hazardous ocean and riverine conditions and are situated in an exposed and dangerous setting. Therefore no passage structure has been added for further consideration.

5) One commenter left a voicemail requesting more information about park and beach closures at the North Jetty and South Jetty.
    - Response: The draft SEA was strictly limited to actions relating to foredune augmentation at the South Jetty. The Corps responded to the commenter and explained more about the project, as described in the EA and draft SEA.
6) One commenter remarked that the Corps should consider the use of a jack-up barge for these types of projects and requested more information.
    - Response: South Jetty foredune augmentation would not require the use of a barge, nor would it require placement or delivery from the water. The EA describes the potential use of jack-up barges at the South Jetty for work on the jetty proper. A jack-up barge is precluded from use at the North Jetty. The Corps responded to the commenter and explained more about the project, as described in the EA and draft SEA.

6.2. Endangered Species Act (ESA)

On October 18, 2012, the Corps confirmed the disturbance as a result of revisions to the preferred alternative would remain within the scope of the existing consultation with NMFS and that no marine mammals Incidental Harassment Authorization Permit would be required for this dune augmentation work at MCR.

On May 20, 2010, the Corps and U.S. Fish and Wildlife Service (USFWS) representatives conducted a snowy plover survey around the sandy beach portion of Clatsop Spit. No birds were sighted. On February 1, 2013, the Corps confirmed with USFWS that the proposed actions would remain within the scope of the informal consultation previously conducted and that no snowy plover monitoring would be required at this time.

6.3. National Historic Preservation Act

Letters were sent to SHPO in January and in May of 2013. Under Section 106, the Corps coordinated with SHPO regarding the new staging area and the potential for monitoring requirements during construction. The Corps received concurrence with its no-effects call on May 6, 2013.

6.4. Other Agency Coordination

The Corps met onsite with Oregon Parks and Recreation Department (OPRD) on September 19, 2012, and again on March 18, 2013, conducted regular email and phone correspondence with the agency prior to and since these site visits.

The Corps corresponded with other Oregon state agencies; the SHPO, Department of Land Conservation and Development (DLCD), and the Oregon Department of Environmental Quality (DEQ). The Corps Consistency Determination and Water Quality Finding have been posted for comment by DLCD and DEQ, respectively.

The Corps has also committed to the formation of a modified interagency Adaptive Management Team (AMT) to keep resource agency partners apprised of any potential project changes or challenges during implementation. In addition, the Corps Portland District established a web site to keep the public informed about the repair/rehabilitation of the MCR jetties located at http://www.nwp.usace.army.mil/Missions/Currentprojects/MouthoftheColumbiaRiverJettyRehabilitation.aspx.

7. Compliance with Environmental Laws and Regulations

The following discussion updates the same sections found in the EA (pp.214-219) regarding the new information about the preferred alternative related to the dune augmentation. The following list only includes sections which were updated for the foredune augmentation actions and is not a complete list of applicable laws and regulations. This SEA supplements the full description of environmental commitments, compliance conditions, constraints, and assumptions which can be found in the original clearance documents (EA, Biological Assessments, Biological Opinion, Letter of Concurrence, etc.). This section is not a substitute for the original documents and should not be construed as an all-inclusive list of environmental law and regulation compliance obligations.

7.1. National Environmental Policy Act (NEPA)

Opportunities for public input and agency involvement required under NEPA were summarized in the EA Sections 7 and 8, Coordination and Compliance with Laws and Regulations, respectively.

Based on changes subsequent to the EA for the updates of the dune augmentation including impacts not previously anticipated, the Corps prepared a draft SEA. The Corp issued the draft SEA and a draft finding of no significant impact (FONSI) (for dune augmentation only) for a 15-day public comment period on April 19, 2013.

7.2. Clean Water Act (CWA)

There are various sections of the CWA (404, 402, 401, etc) with which the Corps must comply. Further explanation is described in the EA. Pertinent CWA Sections include:

Section 404. A 404 (b) (1) Evaluation was prepared for the preferred alternative identified in the EA and selected in the FONSI, and this foredune stabilization project was also included in the evaluation. The Corps supplemented the existing 2012 404 (b) (1) evaluation document based on:

- Expanded project fill footprint of approximately 3.79 acres and up to 43,000 cy below the Clean Water Act Section 404 jurisdictional waters of the U.S. elevation. (This jurisdictional elevation is the highest measured tide, not including storm surges, and has been interpreted as the highest astronomical tide at elevation 10.14 ft NAVD 88). The

Corps proposed compensatory mitigation in the form of marine debris removal for fill in waters other than wetlands. The District Environmental Section has determined that the project does not fit within existing Nationwide Permits.

- New project disturbance areas not identified in the EA or FONSI;
- Change in impacts to 0.08-acre PEM interdunal wetlands and newly proposed mitigation area. The Corps has proposed compensatory wetland mitigation via purchase of mitigation bank credits.

Section 5.2 Environmental Impacts to Aquatic Resources summarized avoidance and minimization measures and compensatory mitigation for impacts to wetlands and waters of the U.S. The Corps concluded that these actions will not have unacceptable adverse impacts affecting ecosystems of concern. The Corps is proposing compensatory mitigation to offset unavoidable fill in wetlands and waters.

Section 401. Based on fill below the jurisdictional 404 waters of the U.S. elevation, a 401 Water Quality Certification (WQC) is required. The Corps submitted to DEQ pertinent information in a Joint Permit Application and Water Quality Findings document, which went out for public comment on April 4, 2013. The Corps received a WQC with conditions protective of water quality on May 15, 2013

Section 402. The Corps has a general 1200-CA permit (#14926) through the DEQ that, though expired, has been administratively extended indefinitely by ODEQ and remains in effect. The Corps would comply with its terms and conditions, including development of an Erosion and Sediment Control Plan (ESCP) prior to disturbance. Once the Corps determined the project is complete and stabilize according to general permit 1200-CA, the Corps would complete a notice of termination.

7.3. Coastal Zone Management Act (CZMA)

Under 15Code of Federal Regulations (CFR) 923.33 (a), the constructed project is considered on Federal excluded lands, which are excluded from the boundaries of the State's coastal zone. Additionally, federal lands are not subject to local zoning regulations. However, 15 CFR 923.33 (b) indicates the Federal actions must comply with consistency provisions of section 307 of the CZMA when there are spillover impacts. The Corps has determined that in this particular case there could be minor "spillover" effects due to the following implementation related activities: the proposed Clean Water Act 404 waters compensatory mitigation of tsunami debris removal would occur on state-owned lands; temporary access restrictions would be required during construction on the beach and the Jetty Access Road outside of federal lands; permits are required for passage of trucks along non-federal roads in the park; and there is very minimal possibility that through the flattening of the structure over time, there is limited potential for migration of some of the cobble material. Therefore, in a letter dated April 5, 2013, the Corps requested state concurrence with the Corps' Coastal Zone Management Act (CZMA)

Consistency Determination (CD) from the Department of Land Conservation and Development (DLCD) per CZMA Section 307 (c) and 15 CFR 923.33 (a) & (b). The public comment period for the CD was initiated by DLCD on April 8, 2013

The CZMA per 15 CFR 930.30 states "…provisions of this subpart are intended to assure that all Federal agency activities including development projects affecting any coastal use or resource will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of approved management programs." Therefore, CZMA requires that federal actions be consistent, to the maximum extent practicable with the enforceable policies of the Oregon Coastal Management Program (OCMP). According to DLCD, the enforceable policies of the OCMP include: (1) the statewide planning goals, (2) the applicable acknowledged city or county comprehensive plans and land use regulations (those approved by the Land Conservation and Development Commission as being in compliance with the statewide planning goals), and (3) selected state authorities (e.g. those governing removal-fill, water quality, actions in the ocean shore, and fish and wildlife protection). The Corps prepared its determination consistent with content requirements described in 15 CFR 930.39, and has based its determination " upon an evaluation of the relevant enforceable policies of the management program " and has included or incorporated by reference commensurate supporting information. The Corps has evaluated its determination of effects in compliance with 15 CFR 930.33-39, as applicable. The Corps has also considered 15 CFR 930.32 when evaluating consistency to the "maximum extent practicable".

Based on the CD evaluation in conjunction with evaluations to meet ESA, NEPA, and CWA compliance requirements, the Corps determined that the foredune augmentation, including its associated construction areas and activities, is consistent with the Clatsop County Comprehensive Plan, applicable provisions of State Goals 2 (Land Use Planning) for goal exceptions, Goal 6 (Air, Water and Land Resources Quality), Goal 17 (Coastal Shorelands), Goal 18 (Beaches and Dunes), and OPRD requirements. The action is, therefore, consistent to the maximum extent practicable with the enforceable policies of the OCMP.

7.4. National Historic Preservation Act (NHPA)

This Act is designed to protect and preserve cultural resources and ensure that development does not cause harm or degradation to historic integrity and significance. Section 106 of the NHPA requires all Federal agencies to consider the potential effects of their undertakings on historic properties eligible for or currently listed on the National Register of Historic Places (National Register) (http://www.cr.nps.gov/nr/). Historic properties include archaeological sites, historic structures or the remnants of sites or structures, and areas of historic, cultural or traditional significance.

Per Section 106 of the National Historic Preservation Act, the Corps consulted with SHPO. Letters were sent to Oregon State Historic Preservation Office in January and May, 2013. and on May 9, 2013 obtained concurrence with the Corps' *no effect* determination to properties on or

eligible to the National Register of Historic Places. Marine Protection, Research, and Sanctuaries Act

This Act will not apply to this particular foredune stabilization stage, as no placement of fill is occurring in Ocean Dredged Material Disposal Sites.

7.5. Endangered Species Act

Changes to the preferred alternative do not introduce new effects to threatened and endangered listed species that were previously analyzed under the Biological Opinion with NMFS (March 18, 2011) and informal consultation with USFWS, (February 23, 2011). Therefore, the effects analyzed in the EA and FONSI are still current, and ESA consultation is complete.

The Corps also requested a conference report from NMFS for critical habitat that NMFS proposed for leatherback turtles, eulachon, and Lower Columbia River coho salmon. On May 3, 2013 the Corps requested NMFS adopts its Conference Report as a Letter of Concurrence for its not likely to adversely affect determination now that habitat has become designated.

For this particular project component, many of the identified effects to NMFS species are not applicable, as there is minimal in-the-wet work anticipated, there is no pile installation, and there is no large stone placement or work on the jetty proper. The Corps confirmed with NMFS on a conference call October 18, 2012 that: the new disturbance area was within the scope of the existing consultation, and that no marine mammals Incidental Harassment Authorization permit would be required for this portion of work because stone placement and pile installation will not occur on the jetty.

The Corps has continued coordination with USFWS regarding the new disturbance area for staging south of the root, and on February 1, 2013, confirmed with USFWS that no snowy plover monitoring would be required at this time. Though birds have been spotted north of the root in 2012, the area of construction is not within the Habitat Conservation Plan identified by OPRD and USFWS.

The Corps has determined its preferred alternative/proposed action will have no-effect on proposed threatened streaked horned lark or its proposed critical habitat. The Corps has come to this determination because: (a) the nesting season for streaked horned larks begins in mid-April and ends in the early part of August, which is outside of the proposed action window; (b) there are no recent lark occurrence records from the Oregon Coast; (c) though the action area is located on a sandy beach, the dune itself is heavily vegetated in areas that are not part of the eroding dune scarp; and (d) the Clatsop Spit is not included as part of the proposed Designated Critical Habitat (77 FR 61937-62058).

The foredune stabilization and associated actions remain within the scope of effects previously evaluated in the 2011 Biological Opinion and Concurrence Letter.

7.6. Marine Mammal Protection Act

Impacts to this species were evaluated and are described in the EA. Impacts were further evaluated as part of the Biological Assessment submitted to the NMFS for the proposed action. The Biological Opinion from NMFS indicated Corps actions would not jeopardize the survival of the species if certain conservation measures were implemented. Because the foredune stabilization work would occur on land, and no placement of piles or stones would occur in the water, an Incidental Harassment Authorization (IHA) for impacts to Stellar sea lions, humpback whales, California sea lions, and harbor seals is not required. On October 18, 2012, the Corps confirmed the new proposed disturbance area was within the scope of the existing consultation with NMFS and that no marine mammals Incidental Harassment Permit would be required for this portion of work at MCR.

7.7. Migratory Bird Treaty Act (MBTA) and Migratory Bird Conservation Act

This Act makes it unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not.

Impacts of construction could displace birds by causing flushing, altering flight patterns, removing nesting or perching habitat, or causing other behavioral changes, but it is not expected that effects would rise to the level of take as defined under the MBTA. Most migratory birds are expected to be out of the area by late August. No construction activities would occur during nesting season, and there is ample habitat of similar nature immediately adjacent to the disturbance areas. Raptors are not expected to nest in the area, as the tree size and density are not optimal relative to other options in the vicinity. The removal of shore pines would be in a geographically limited area that is immediately adjacent to and surrounded by dense stands of similar shore pine habitat type. The disturbance area would be replanted with shore pine. USFWS has consulted on the greater repair and rehab project components with a greater disturbance area and did not raise any concerns. Therefore, the proposed action is *in compliance* with this Act because the action would not result in the taking of any migratory birds.

7.8. Executive Order 11990, Protection of Wetlands

The purpose of this executive order is to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. In planning their actions, Federal agencies are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

Wetlands (0.08 acre) along Haul Road A would be impacted. Even after avoidance and minimization efforts, some impacts would be unavoidable based on balancing other resource concerns and project constraints. Avoidance and minimization measures implemented prior to the determination of permanent wetland fill along with associated compensatory mitigation have

been documented in the Clean Water Act section of this SEA and in the CWA 404 (b) (1) Evaluation and its supplement. In-kind compensatory mitigation credits would be purchased from an out-of-basin bank. Therefore the proposed action is in compliance with this executive order (EO).

7.9. Additional State and County Permitting and Compliance

The Corps' CD was submitted to Clatsop County with a request for a Land Use Compatibility Statement (LUCS), which was required by the State in order to issue the 401 WQC and the CZMA concurrence.

A Shoreline Use Permit from OPRD is not required of Federal agencies. Under principles of federal supremacy and sovereign immunity, the Federal government is not subject to state or local regulation. For the reasons outlined in the CD and in compliance with 15 CFR 930.39(e) and OAR 660-035-0030(4), the Corps will not obtain a shoreline permit from OPRD. The Corps would, however, carry out its activities "…in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs…" per 15 CFR 930.32 and 15 CFR 930.39. In its CD, the Corps has evaluated its determination of effects in compliance with 15 CFR 930.33-39, as applicable.

The Corps discussed removal fill permitting with the Department of State Lands (DSL). In response, they sent an email indicating they would not be involved in the project…"According to Oregon Administrative Rule, OAR141-085-0530, 'Activities conducted by or on the behalf of any agency of the federal government acting in the capacity of navigational servitude in connection with a federally authorized navigational channel are exempt.'" (DSL, 2010). Furthermore, the project does not extend into state-owned shorelands.

8. References

Allan, Jonathan C., Geitgey, Ron, and Hart, Roger. 2005. Dynamic Revetments for Coastal Erosion in Oregon. Final Report SPR 620. Oregon Department of Geology and Mineral Industries, Coastal Field Office, 313 SW 2nd St, Suite D, Newport, OR 97365. for Oregon Department of Transportation Research Unit, 200 Hawthorne Avenue SE, Suite B-240, Salem, OR 97301-5192, and Federal Highway Administration, 400 Seventh Street SW, Washington, DC 20590, August 2005.

Department of Environmental Quality (DEQ). 2005. Corps NPDES 1200-CA General Permit (#14926). December 23, 2005.

Johnson, C. N. 1987. Rubble Beaches Versus Rubble Revetments. Proceedings ASCE Conference on Coastal Sediments. 1987. New Orleans, Louisiana, May 1987.

Kaminsky, G.M., Ruggerio, P., Buijsman, M.C., McCandless, D., Gelfenbaum G.R. (2010). Historical Evolution of the Columbia River Littoral Cell. Marine Geology 273, pages 96-126.

National Marine Fisheries Service (NMFS). 2011. Endangered Species Act Biological Opinion and Conference Report and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River. NMFS No:2010/06104. Portland, OR. March 18, 2011.

Moritz, H. 2001. Observing Large Waves Using Bottom-Mounted Pressure and Current Meters, Waves 2001 Conference, ASCE, San Francisco, California.

State Historic Preservation Office. 2013. Concurrence Letter with SHPO Case #13-0171.Dennis Griffin. Salem OR. May 6, 2013.

U.S. Army Corps of Engineers (Corps). 2010. Revised Draft Environmental Assessment Columbia River at the Mouth, Oregon and Washington Rehabilitation of the Jetty System at the Mouth of the Columbia River. Portland District, Civil Works. Portland OR. January 2010.

Corps. 2010. Endangered Species Act Biological Assessment For Anadromous Salmonids, Green Sturgeon, Pacific Eulachon, Marine Mammals, & Marine Turtles And Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Assessment for the Major Rehabilitation of the Jetty System at the Mouth of the Columbia River In Pacific County, Washington And Clatsop County, Oregon. Portland District, Civil Works. Portland OR. December 2010.

Corps. 2011. 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. Portland District, Civil Works. Portland OR. February 4, 2011.

Corps. 2011. Final Environmental Assessment Columbia River at the Mouth, Oregon and Washington Rehabilitation of the Jetty System at the Mouth of the Columbia River. Portland District, Civil Works. Portland OR. May 2011.

Corps. 2011. Finding of No Significant Impact (FONSI), for Final Environmental Assessment (EA), Major Rehabilitation of the Jetty System at the Mouth of the Columbia River. Portland District, Civil Works. Portland OR. May 31, 2011. [Limited to critical repairs and lagoon fill at North Jetty, and South Jetty foredune augmentation.]

Corps. 2011. North Jetty Major Maintenance Report (MMR). Portland District, Civil Works. Portland OR. May 2011.

Corps. 2012. Draft EA for Proposed Nearshore Disposal Locations at the Mouth of the Columbia River Federal Navigation Project, Oregon and Washington. Portland District, Civil Works. Portland OR. April 2012.

Corps. 2012. Revised Clean Water Act Section 404(B) (1) Evaluation for Major Rehabilitation of the Jetty System at the Mouth of the Columbia River in Pacific County, Washington and Clatsop County, Oregon. Portland District, Civil Works. Portland OR. June 19 (20th), 2012.

Corps. 2012. Major Rehabilitation Evaluation Report, Columbia River at the Mouth, Oregon and Washington, Major Rehabilitation of the Jetty System at the Mouth of the Columbia River (MRR). Portland District, Civil Works. Portland OR. (June) July 2012.

Corps. 2012. Revised Final Environmental Assessment, Columbia River at the Mouth, Oregon and Washington; Rehabilitation of the Jetty System at the Mouth of the Columbia River, Clatsop County, Oregon, and Pacific County, Washington. Appendix D, of the MMR. Portland District, Civil Works. Portland OR. (June) July 19, 2012.

Corps. 2012. Revised Finding of No Significant Impact (FONSI) for Revised Final Environmental Assessment (EA), Major Rehabilitation of the Jetty System at the Mouth of the Columbia River. Portland District, Civil Works. Portland OR. July 26, 2012. [Full suite of repair and rehabilitation actions.]

Corps. 2013. Evaluation Report and Water Quality Findings: In Conjunction with the Corps' Request for Water Quality Certification Pursuant to Section 401 of the Federal Clean Water Act for Activities Resulting in Discharge to Waters of the U.S. related to the South Jetty

Foredune Augmentation Project Near the Mouth of the Columbia River - on the Clatsop Spit, in Clatsop County, Oregon. Portland District, Civil Works. Portland OR. February 26, 2013.

Corps. 2013. Coastal Zone Management Act Consistency Determination for Actions Related to the South Jetty Foredune Augmentation Near the Mouth of the Columbia River, Clatsop County, Oregon. Portland District, Civil Works. Portland OR. April 5, 2013.

Corps. 2013. Draft Supplement to the Revised Final Environmental Assessment, Columbia River at the Mouth, Oregon and Washington; Rehabilitation of the Jetty System at the Mouth of the Columbia River, Clatsop County, Oregon, and Pacific County, Washington. Portland District, Civil Works. Portland OR. April 19, 2013.

Corps. 2013. Mouth of the Columbia River South Jetty Dune Stabilization Design Documentation Report (DDR). Portland District, Civil Works. Portland OR. May 2013.

Corps. 2013. Supplement to The Revised Clean Water Act Section 404(B) (1) Evaluation for Major Rehabilitation of the Jetty System at the Mouth of the Columbia River in Pacific County, Washington and Clatsop County, Oregon. Portland District, Civil Works. Portland OR. May 2013.

Department of State Lands. 2010. Personnel communication via email from Dan Carey. April 13, 2013.

U.S. Fish and Wildlife Service (USFWS). 2011. Letter of Concurrence. Major Rehabilitation of the Jetty System at the Mouth of the Columbia River Navigation Channel, Clatsop County, Oregon, and Pacific County Washington. USFWS #13420-2011-I-0082. TS # Reply to:11-491. 833010082(11). Portland OR. February 23, 2011.

Appendix

A. Additional Details Related to Design Options

Several dune stabilization design options were considered in addition to a dynamic revetment. The intended primary function for each option was the same: to stabilize the foredune by protecting it from continued erosion induced by storm wave and surge action, and to eliminate wave-induced overtopping of the foredune dune and backshore areas. A secondary function was for each alternative to remain stable within the project environment (with minimum or no maintenance), without negatively affecting adjacent shore areas. The best candidate alternative would function within a forcing environment that is increasing over time and a nearshore morphology that is receding, due to the evolving nature of the inlet. In summary, the selected option would be compliant and adaptable with the changing physical project condition.

None of the options considered in greater detail within the draft SEA would function in a free-standing configuration; they all would require some sort of backshore grade (dune face or shore scarp) along their lee side to retain the feature in place. A flood wall or levee are examples of free-standing structures and were considered to be impractical for application along an exposed open coast, such as Clatsop Spit, characterized by tides with a diurnal range of 7.7 ft. The details of the designs considered are listed, from most rigid to most compliant. Additionally, the bedding layer for the preferred alternative uses gravel rather than geotextile due to concerns about exposure and compatibility within a natural beach environment.

The following considerations were taken into account when developing and recommending the updates to the foredune augmentation design. The Corps goals of a shore protection structures applied to this foredune were to:

a) Avoid translating coastal erosion processes to adjacent areas – the risk of which is often greater at down-drift locations.
b) Blend the feature with the natural environment and its associated coastal processes.
c) Accommodate, to the highest degree feasible, beach (re)formation and littoral sediment (re)distribution functions. Dynamic conditions of the MCR estuary/coastal interface, and the importance of the inlet's Federal Navigation Channel, increase the challenge of balancing maintenance needs of a static structure with ecosystems that evolve and depend on more dynamic conditions.
d) Accommodate the habitat and recreational uses that would naturally occur in the area under contemporary conditions.

A dynamic-revetment (also referred to as cobble berm) type of structure would be preferable because it allows wave energy to be absorbed and dissipated, rather than reflected and translated to adjacent shoreline areas. By having a compliant geometry that can adapt in response to the prevailing wave conditions, dynamic revetments are also more similar to natural cobble or

composite cobble-sand beaches found at shore-side sites like Ecola State Park and Seaside, OR, especially at the toe of coastal bluffs (Allen et.al. 2005).

As with sandy beaches, dynamic revetments constructed using rounded cobbles are also more aesthetically pleasing and recreationally accessible for pedestrians compared with "hard" engineered solutions like large angular stone (rip-rap) revetments. This is why a dynamic revetment structure was implemented by the State of Oregon in 2003 at Cape Lookout State Park, OR, (Figure 6) to mitigate acute erosion occurring there. Construction measures using sand or rounded cobble material are also preferable compared to selection of angular stone. For beach placement, sand or rounded cobble is more representative of weathered, coastal or fluvial materials that would naturally be re-worked and redistributed throughout the system and along coastal shorelines. Sand that is to be excavated during project construction would be set-aside for placement over the top of the completed structure. This action may facilitate more immediate use by visitors and wildlife, and would avoid the potential impacts of placing sand in some other environmentally-sensitive location.

When evaluating the source of materials for this project, consideration was given to the potential effects caused by mining of any fluvial or coastal cobble supply. Beneficial use of previously-dredged materials, whether sands or cobble, was preferred over new gravel mining. This would avoid causing or encouraging project-specific new or additional removal of materials from fluvial or coastal systems elsewhere, which could affect different, unrelated systems and associated organisms. Re-use of previously produced sediment, for application within this project represents an initiative of "engineering with nature".

Design considerations also balanced the size and footprint of the dune stabilization feature, the feature's indirect impacts, and the expected return period or frequency of maintenance/replenishment requirements, as any replenishment activities would entail some level of (re)disturbance. Maintenance actions, including the source and type of materials used for replenishment would require the same level of environmental protections, considerations, and compliance documentation included in this proposed project design and implementation.

1. Conventional Rip-Rap Revetment

Large armor (2 to 5 ft diameter) stone and an appropriate foundation treatment would be placed to resist movement due to wave action and scour. The armor layer would be designed to maintain the slope aspect at which it was initially placed. None of the materials placed within a standard revetment cross-section would be disturbed by wave action of scour, for the structure to remain functional. A relatively steep slope (1:vertical to 1.5horizonal, to 1v:2h) and low porosity induce reflective interaction with waves, resulting in increased scour along the armor layer interface with existing beach grade (toe scour) and adjacent beach areas (end flanking-erosion). The high slope aspect and high porosity also could increase wave run-up along a conventional revetment, motivating the need to increase the structure's design crest elevation. The large size and angular shape of the rip-rap (armor stone) is not endemic with the project

morphology and sediments, and as such, may be incompatible with a dune-beach environment. A conventional revetment would require relatively less stone materials to be placed and have a relatively small areal extent due to the feature's steep side slope aspect.

2. Geotextile Sand-filled Tubes

Geotextile-tube (geotube) shore protection consists of sediment-filled sleeves of geotextile fabric. The geotubes are elliptical in cross-section (3 feet (ft.) x 4 ft) and are typically 20-40 ft in length. Insitu sediment is used to fill each tube, after which the end of the tube is securely closed. Geotubes are typically placed in a trench dug parallel to shore along the foredune. Geotubes can be stacked as needed (up 3 courses high) to attain an aggregate crest elevation needed to resist wave overtopping during storm conditions. Because geotubes are impermeable and rigid (after being filled with sediment), they require a foundation treatment to prevent settlement of the geotube into the ambient sediment on which they rest. In most geotube applications, the geotubes are covered with sand and natural beach vegetation in order to protect the geotubes from exposure-wear and to attain compatibility with the adjacent surroundings. Geotubes are intended to serve as temporary storm-surge protection and erosion-control structures. They will fail when exposed to direct wave attack due to scour and differential settling. To prevent failure, it is critical to: (1) keep the geotubes covered with sand, (2) maintain a beach in front of them through beach nourishment, and (3) repair holes in the fabric as soon as possible. If left exposed to wave action, geotubes can cause erosion to adjacent beach areas (end flanking-erosion). These features require constant upkeep if exposed to wave surge action. Based on the above, geotubes were not deemed suitable for this project.

3. Sand Beach Fill

A relatively large volume of sand would be placed oceanward from the foredune to partially restore the volume of sand previously lost from the degraded foredune and the beach profile. The cross-shore width of the sand fill template would extend several hundred feet oceanward from the present foredune to approximately the high tide line (10 ft NAVD). The initial slope aspect of the sand beach fill would be constructed to be 1v:10h. Wave action would eventually reform the slope aspect of the sand beach fill to 1v:50h to 1v:100h. The initially constructed crest (top) elevation of the sand beach fill would need to be high enough to protect the present foredune (and backshore) from wave erosion and overtopping, after the sand fill template has been reformed by wave action and attained an equilibrium profile. Using mobile beach-sand as form of shore protection in an area that is already experiencing continual recession was not deemed to be a sustainable solution. There were also limitations for pumping ashore enough sand to the specific location, without causing additional environmental effects. Dredged material is already being placed at the nearshore South Jetty site to restore the littoral cell and potentially resupply sand to the South Jetty dune location (Corps' April 2012 *Draft EA for Proposed Nearshore Disposal Locations at the Mouth of the Columbia River Federal Navigation Project, Oregon and Washington*). However, action is required before enough nearshore placement material would accrete.

4. Implement a Spur Groin on the South Jetty

The Value Engineering (VE) study recommended consideration of a spur groin at the South Jetty. This was already considered in the Major Rehabilitation Report and the EA. This alternative was not the preferred alternative in the EA, and was therefore not proposed as a solution for foredune stabilization.

5. Provide Beach Nourishment

The VE study recommended consideration of beach nourishment at the South Jetty. This was already described under the cumulative impacts section of the EA, as the Corps is already conducting nearshore placement in the vicinity. However, as described under sand fill, beach nourishment was not considered sufficient to address the erosion issues in time, and was not considered a preferred design option.

Approximately 300,000 cubic yards/year (cy/yr) of MCR sand would be placed in the nearshore area south of South Jetty (South Jetty Site-SJS) beginning 2013. The SJS is located within 2 miles offshore from the project site, in 45 ft of water depth. Wave and currents would disperse much of the dredged sand placed at the SJS toward shore, where the sand would augment the littoral sediment budget. This SJS initiative is intended to address a littoral sediment budget deficit south of the South Jetty which would require 5-20 years to fully realize full benefits of reducing shore face erosion. SJS use is expected to reduce risk to South Jetty root/dune after 20 years.

6. Re-use Haul Road Material for Maintenance

The VE team recommended that haul road material from future South Jetty repair activities be used to re-nourish/maintain the dynamic revetment. This alternative appears to have merit, provided that: (a) the jetty repair contract can re-claim haul road material at reduced cost as compared to normal operations and maintenance (O&M); (b) that the reclaimed haul road material is suitable for use on the cobble berm; and (c) that the contactor has capability and environmental clearance to place reclaimed haul road material.

B. NEPA Background

Components of the South Jetty foredune stabilization have been included in broader discussions involving major repair and rehabilitation of the MCR jetty system since 2010. The major repair and rehabilitation actions were also put out for public notice in January, 2006.

Within this context under the National Environmental Policy Act (NEPA), the foredune stabilization measure has been vetted for public and resource agency comment since 2010 (30-day comment period beginning January 13, 2010). It was introduced in a revised Draft Environmental Assessment (EA) prepared to describe the greater MCR jetties rehabilitation and repair efforts (*Revised Draft Environmental Assessment Columbia River at the Mouth, Oregon and Washington Rehabilitation of the Jetty System at the Mouth of the Columbia River*, Portland District Corps, January 2010).

The revised Draft EA was issued for a 30-day public review and comment period and was provided to federal and state agencies, organizations and groups, and various property owners and interested publics. In addition, a public information meeting was held in Astoria, Oregon on February 3, 2010. Another public information meeting to describe likely construction techniques was also held on June, 4, 2010, at Fort Vancouver, WA. A third meeting was held for construction contractors on January 31, 2013, at the Portland District Corps offices.

The 2010 Draft EA was finalized (*Final Environmental Assessment Columbia River at the Mouth, Oregon and Washington Rehabilitation of the Jetty System at the Mouth of the Columbia River*, Portland District Corps, May 2011) and posted along with an associated decision document to the Corps' internet site in May 2011. The Corps signed a Finding of No Significant Impact (FONSI), May 31, 2011 for a subset of the proposed action described in the 2011 final EA, which included dune stabilization at Clatsop spit.

Subsequently, a 2012 Revised Final EA updated the 2011 Final EA. The July 2012 EA provided a comprehensive analysis for all actions proposed at the MCR, including actions for the South Jetty dune stabilization, actions at the North Jetty described in the *North Jetty Major Maintenance Report* (MMR), (Portland District Corps, May 2011) and actions described in the Major Rehabilitation Report (MRR) (*MCR Jetty System Major Rehabilitation Evaluation Report*, June 2012). The 2012 EA described and evaluated all of these actions, and their associated cumulative effects are detailed therein. On 26, July 2012, a revised provisional FONSI was signed covering the entirety of the project elements at the South Jetty, including foredune stabilization. This document has been available to the public on the Corps' website.

Due to project changes described herein, the draft SEA was issued for a 15-day public comment period. Public input was generally in support, and the SEA was followed by a FONSI that only covers the actions associated with the South Jetty foredune augmentation work.