FINAL
ENVIRONMENTAL ASSESSMENT
REPAIR OF NORTH AND SOUTH JETTIES
MOUTH OF THE COLUMBIA RIVER
CLATSOP COUNTY, OREGON and PACIFIC COUNTY, WASHINGTON

1. Introduction

This EA is being written to evaluate the affects of a major rehabilitation of both the North and South Jetties at the Mouth of the Columbia River (MCR). Due to funding constraints, only the most severe areas will be repaired in the immediate future with the remaining components of the major rehabilitation to follow when funding becomes available. The immediate proposed work will be referred to in this EA as "repair" and the long term proposed work will be referred to as "rehabilitation". Emergency action may also become necessary if either jetty breaches prior to the proposed repairs.

The MCR deep-draft navigation project consists of a 1/2-mile wide navigation channel extending for about six miles through a jettied entrance (three miles seaward and shoreward of the tip of the North Jetty) between the Columbia River and the Pacific Ocean (Figure 1; figures are located at the end of this document). The channel was deepened to its present depths in 1984 and has been maintained at those depths to date. The northerly 2,000 feet of the channel is maintained at 55 feet and the southerly 640 feet is maintained at 48 feet, with an additional five feet of depth allowed for advanced maintenance.

The Columbia River estuary is a tidal estuary approximately five miles wide, north to south, at the mouth and about one mile wide above rivermile (RM) 30. The estuarine environment extends about 38 miles upriver. The ocean entrance to the river is protected by two jetties (Figure 1), whose tips are about two miles apart.

The jetties were constructed at the entrance to the Columbia River to confine tidal currents to obtain scouring velocities in the bar and entrance channels, to help maintain the authorized channel dimensions, and to help protect vessels entering and exiting the river. The South Jetty is about 6.6 miles long. The first 4.5 miles of the South Jetty were constructed between 1885 and 1895. It was extended to its current authorized length in 1913 (Figure 2); however, about 4,000 feet (head loss) has deteriorated. Portions of the South Jetty were repaired in 1982. The North Jetty is about 2.5 miles long and was constructed in 1914-1917. About 1,700 feet of head loss has occurred on the North Jetty (Figure 3). These existing project features were authorized by the River and Harbor Acts of 5 July 1884, 3 March 1905, and 3 September 1954. The oceanward portion of the North Jetty was the last repaired and completed in 1965 with the placement of 136,935 tons of stone. Both the North and South Jetties at MCR have experienced damage to both jetty heads and along the jetties at several locations.

A discussion of the MCR jetties and the surrounding environment can be found in the following U.S. Army Corps of Engineers documents:

a. Dredging of the MCR navigation channel was addressed in the 1983 EIS for deepening and subsequent maintenance (Columbia River at the Mouth, Oregon and Washington: Navigation Channel Improvement.) U.S. Army Corps of Engineers, 1983).
b. MCR, South Jetty, Major Rehabilitation. Environmental Assessment, March 1982.
c. Dredged Material Management Plan & Final Supplemental EIS, Columbia and Lower Willamette River Federal Navigation Channel. U.S. Army Corps of Engineers, 1998.
d. Integrated Feasibility Report for Channel Improvements and Final EIS, Columbia and Lower Willamette River Federal Navigation Channel. U.S. Army Corps of Engineers, 1999.
e. EA/Finding of No Significant Impact for Repair of South Jetty, Mouth of the Columbia. U.S. Army Corps of Engineers, 1982.

A summary of the information contained in these documents is included in this assessment.

2. Purpose and Need

The purpose of the action is to repair critical trunk portions of the North and South Jetties and when future funding becomes available, to rehabilitate the remaining critical sections of both jetties. This action is necessary to prevent further deterioration and subsequent breaching of the jetties.

Both North and South MCR Jetties contain badly deteriorated areas where degradation has accelerated in recent years due to increased storm activity and loss of sand, upon which the jetties are constructed. Breaching is a likely possibility and would mostly likely occur near the shoreline (especially at the North Jetty). This would allow sand to migrate into the Columbia River navigation channel, thereby disrupting deep draft navigation and increasing dredging requirements. Within the next five years there is a high likelihood that a significant breach will occur on either jetty. The likelihood of a jetty breach will continue to increase with time.

Emergency repairs required for either or both jetties within the next few years appears highly probable; however repairs could not necessarily be made during the winter, especially at the South Jetty. Costs to repair following a breach are estimated at two to five times higher than if completed prior to the failure.

Along the reach of the North Jetty proposed for rehabilitation and repair, 70 percent of the area has not been repaired since its original construction in 1917. The remaining 30 percent was last repaired in 1965. Along the South Jetty reach proposed for rehabilitation and repair, the jetty was last repaired in 1934 and 1962 and 1982; or at approximately 25-year increments from the 1913 original construction. The landward 35 percent of the reach was last repaired in 1982. At the South Jetty, 65 percent of the proposed repair area has not been repaired since 1962.

Scour of the seabed along the channelside of the North Jetty has resulted in increased depths of 10 to 40 ft, impacting not only the stability of the jetty foundation but also wave impact on the already vulnerable jetty cross section. Increased depths along both the oceanside and

channelside of the South Jetty repair area have also resulted in increased wave impact on the jetty.

3. Proposed Action and Alternatives

Proposed Action

With funding available for Fiscal Year 05 (Oct 1, 2004 to Sept 30, 2005), the Portland District plans to begin construction and repairs of the critical portions of the North Jetty and will prioritize critical repair work to the South Jetty subject to future availability of funding. Completion of the proposed repairs on the North Jetty would be approximately eight to nine months and at the South Jetty from one to three years.

The premise of the jetty repair is to repair the most vulnerable areas of the North and South Jetties, where the consequences of jetty failure (a breach through either jetty) is high and would rapidly and significantly degrade navigation through the Mouth of the Columbia River (MCR). The intent of the proposed design will be three-fold: 1) Improve the stability of the foundation (toe) of each jetty as affected by scour, 2) Improve the side slope (above and below water) stability, 3) Improve the dynamic stability of each jetty as affected by wave forces impinging the jetties.

The proposed future rehabilitation would occur along an 8,000 foot-long reach of the South Jetty (stations 220+00 to 300+00) and a 4,000 foot-long reach of the North Jetty (stations 40+00 to 90+00), shown in Figures 4a, b, c and Figure 5. The rehabilitation work would require placement of approximately 200,000 to 300,000 tons of stone along the North Jetty and 300,000 to 500,000 tons along the South Jetty.

The proposed current repair would occur along the South Jetty at approximate stations: 225+00 to 232+99; 235+00 to 243+00; 260+00 to 265+00; 269+00 to 275+00 and 285+00 to 290+00 (Figure 4c). The proposed repairs at the North Jetty would be several critical locations within stations 40+00 to 90+00. All of these repair locations are critical areas that need immediate attention. Due to a recent survey of the jetties that was conducted by the Corps in 2004, the quantity of jetty stone to be placed has increased from 40,000 tons on the South Jetty to approximately 111,000 tons and on the North Jetty from 30,000 tons to approximately 57,000 tons.

Armor stone sizes for the proposed repair will range from 10 to 25 tons for the North Jetty and 10 to 40 tons for the South Jetty. Proposed repair cross sections are shown in Figures 6 and 7 for the North and South jetties, respectively.

The North and South Jetties lie essentially within the existing jetty footprint, based on the configuration of the original cross section, previous repair cross sections, and redistribution of jetty stone by wave action. There may be a minor deviation of the proposed design from the existing jetty configuration at the repair areas where jetty damage has been extensive or scour along the toe has been severe. Crest elevation for the repair template for both the North and the

South Jetties is expected to be +25 ft mean lower low water (MLLW). The crest width is set at 30 feet.

Repair Work Generic to Both the North and South Jetties

The proposed jetty repair work would be conducted by marine and/or land access activities. For marine-based delivery and placement of stone, the contractor will be provided with three options: marine-based using a tow boat and barge, a barge off-loading platform and land based operations bringing in material via existing park roads. Material will be trucked through the State park or County Park via the county road. The county road will be used to bring in the trucks for movement of the jetty stone, transportation of construction material and employee use during the construction timeframe. Prior to construction, the contractor will document the condition of the road and will be responsible for repairing the road to its pre-construction condition upon completion of the work.

Tow Boat and Barge

A tow boat and barge would deliver the stone to either jetty, where water depth, wave, and current conditions permit. During stone off-loading, the barge may be secured to four to eight dolphins situated within 200 feet of the jetty. The dolphins would be composed of multiple untreated timber piles driven to a depth of 15-25 feet below grade, by a vibratory pile hammer. An impact hammer may be used at the final driving to ensure pilings are seated properly. The dolphins will be relocated as work advances along the jetty and would be removed at the conclusion of the work. The maximum number of dolphins present along the North or South Jetty during any one time during the work is estimated to be 10 to 20. Stone would be off-loaded from the "stone barge" by a crane (either land or marine based) and either placed directly within the jetty work or stock piled on the jetty crest for placement at a later time.

For marine-based stone placement, a lattice boom crane or large track hoe excavator would be fixed to a moored barge. The crane barge would be moored using either a series of anchors or the barge would be lashed to four to eight dolphins paralleling the jetty work area (same concept for a marine-based stone delivery). The marine-based crane would pick stones either directly from the stone barge or from stones stock-piled on the jetty crest and place the stones into the work area. The crane would advance along the jetty as work is completed.

Barge Off-loading Platform

The barge off-loading platform for either the South or North Jetty would be an enclosed cell structure constructed of sheet piles with the placement of clean quarry waste (crushed gravel) within the structure (Figures 8 and 9). Three inches of compacted material will be placed on top of the crushed gravel to form a road that will provide a stable surface for vehicles to load jetty stones. For the South Jetty only, the area riverward of the sheet pile retaining wall will need to be dredged to accommodate the 12-16 foot draft of the off-loading barges. Approximately 2000 to 4000 cubic yards (cy) of material will need to be dredged for the South Jetty platform. The material will be tested prior to dredging. If found suitable, the contractor will have the option of reusing the material to back fill the area after removal of the sheetpile or to find a suitable

location for the material upon removal. The North and South Jetties would require about 12,000 and 25,000 tons of rip rap and gravel, respectively for the access ramps. Access ramps would be removed following construction.

Land-based Placement

For land-based stone placement, a lattice boom crane or large track hoe excavator would be situated on top of the jetty. A land based placement operation would require the construction of a jetty "haul road" along the jetty crest within the proposed work area limits for each jetty, and possibly an access road that would ramp up to the jetty crest. Jetty haul and access roads associated with this phase of the rehabilitation and repair would be located above Mean Higher High Water (MHHW) and located to avoid wetlands. The crane or excavator would use the haul road to move along the top of jetty. Construction of these haul roads for the repairs along the North and South Jetty would require about 12,000 and 25,000 tons of rip rap and gravel, respectively. Access ramps would be removed following construction.

The North Jetty has the highest funding priority; however, once the activities are fully underway, repair work may also occur simultaneously on the South Jetty. Unless otherwise directed by the Corps, the work along the North and South Jetties will be left to the contractor's discretion. Where weather and other conditions allow, the work could occur throughout the year (winter, summer, fall, spring). Conditions that could shut down work on the jetties include wave direction and wave height. For the South Jetty, 10 foot offshore waves at high tide and 14 foot offshore waves at low tide would shut down construction. For the North Jetty, 14 foot waves at high tide and 18 foot waves at low tide would halt construction. Winds gusting to about 35 knots would cause boom crane operation to stop. The duration of stone placement activities for completing jetty repairs is estimated to be eight to nine months for the North Jetty and one to three years for the South Jetty. The length of time to repair the jetties is largely dependent on quarry production rates.

Repairs are not expected to interfere with the dredging and disposal activities associated with the annual maintenance of the MCR navigation channel, including use of the North Jetty dredged material disposal site. Use of the North Jetty disposal site would be coordinated with the marine delivery of stone such that the use of the North Jetty site during jetty construction would not be impacted (see Figure 5).

<u>The South Jetty</u>

For the South Jetty, marine-based activities likely would be used to deliver armor and fill stone from the barge off-loading platform to the project site by use of the existing haul road from previous repairs (Figures 4a and b). Since the old haul road used a portion of the existing park road and would cut off use of the road and viewing platform at the end of the road, the contractor will be directed to construct a small, new section of the road from the off-loading platform to the existing haul road. The width of both the new and old road will be 20 feet wide. The new road will be bladed and gravel will be placed atop both the new and existing portions of the haul road.

A 200-foot barge off-loading structure will be built at the end of the haul road on the South Jetty (Figures 4a and b). Approximately fifty feet of sheet pile will be placed to form a cell structure that would be filled with clean quarry waste material. Approximately 4000 cy of material will need to be dredged riverward of the platform to ensure that the barges have sufficient depth to off-load at the site. The material will be tested and may be used as fill material for the haul road or may be placed on the beach. The new and old areas will be replanted upon completion of the project. Any damage to the existing asphalt roads will be restored to pre-project condition.

For land based jetty access, transportation of jetty stone would be via the existing asphalt surfaced road through Fort Stevens State Park to the work area located at the end of the east parking lot.

Two five-acre work areas would be needed, to maneuver trucks/stone handling equipment and/or stockpile stone near the jetty. A stone weighing facility could be erected in this area. One five-acre site would be located adjacent to the barge off-loading platform. The second five-acre site would be located near the jetty and would use approximately half of the east parking lot and some adjacent land (see Figures 4a and b). Some grading of sand would be conducted and crushed gravel would be used to improve the work area. A temporary gravel access road would be placed to facilitate equipment access from the work area to the jetty crest. The work area and access road area would be restored to pre-project conditions after jetty work is completed. The 400 foot-long access road (25 feet wide) and ramp would be situated above MHHW and would be constructed of 4,000 cy of sand, gravel and small rip-rap. The access road and ramp would be removed at the completion of work. The access road would require a 3-foot-diameter galvanized culvert to facilitate tidal exchange and surface water run off to/from the wetland within Clatsop Spit. (The temporary fill of waters of the U.S. related to construction is accommodated within Nationwide Permit number 33.)

<u>The North Jetty</u>

As a result of comments received in response to the public notice, the Corps will construct a less then one acre gravel parking lot along the existing fire road. Two options for the parking lot site are shown in figure 12. The northern area is approximately 90' x 368' which provides up to 0.76 acre of parking. At its closest point, it is approximately 925 feet from the jetty axis (or about 975 feet from the river, depending on tide), and about 705 feet from the present paved access road. It is approx 2,050 feet from the wet line on the beach. The Southern area is at the intersection of the paved and gravel public access road. It is about 73’ across at the narrowest point, and about 212 feet across at its widest. It will provide up to approximately 0.96 acre of potential parking development. At the closest point, the site is approximately 290 feet from the jetty axis, or 340 feet from the river, and about 2,500 feet from the beach wet line. Both location options were provided to Washington Department of Ecology (WDOE) in the water quality document to assess which option would be less impactive to wetlands. In cooperation with WDOE, the Corps will select the less impactive option.

The Corps plans to improve the gravel road by adding gravel to the road. The road may also need to be widened up to the point of where the road meets the new parking lot. This parking lot will be built to ensure the safety of visitors to the park by providing them a place to park since

the road to the Benson Beach parking area and the parking area itself will be closed during construction. The attached figure shows the two areas proposed for the parking area. No wetlands will be impacted by construction of either of the two gravel parking lots (see Figure 12).

For the North Jetty, marine or land based activities could be used to delivery armor stone and fill stone to the project site. The method of delivery will be at the discretion of the contractor. For marine based construction, a barge off-loading platform could be constructed at approximate station 40+00 requiring approximately 12,000 cubic yards (cys) of quarry waste material to be placed within sheet piles on the ocean side of the North jetty and 500 cys of material placed on the land side of the jetty (Figure 5). The sheet piles will be driven by a vibratory hammer. All material placed within the sheet piles will be removed before removal of the sheet piles. The wetland area is defined as estuarine and marine wetland. The total wetland area that may be impacted within the footprint of the jetty would be approximately 0.10 acres and outside the jetty footprint would be approximately 0.15 to 0.25 acres. The type of wetlands that may be impacted are estuarine, intertidal, emergent, non-persistent and estuarine, intertidal, unconsolidated shoreline, mud (Figure 5a). The fill material that may be used to fill the wetland will be quarry waste and it will be removed upon completion of construction. The area will be restored to its preexisting condition by removal of the barge off-loading platform after the projects completed. Since the impact area to the wetlands outside the footprint of the jetty is minimal and will be restored to its pre-construction condition, no wetland mitigation is proposed.

For land based construction, heavy equipment would access the site via an existing asphalt surfaced road to the Benson Beach Parking lot at Cape Disappointment State Park (Figure 5). A five acre work area for equipment and possible rock storage would be located near the parking lot. A second five acre work area will be constructed across from the potential barge off-loading site where a stone weighing facility may be erected. Two rock access roads and ramps would be constructed adjacent to the jetty located approximately at between 60+00 and 70+00 stations. The access roads, about 400 feet in length and 25 feet wide, would each be constructed of approximately 4,000 cy of sand, gravel and small rip rap and located above MHHW on beach sand. Both access roads will be removed once the jetty is repaired.

The Benson Beach parking lot will be closed to the public during construction. To facilitate public access to Benson Beach, the existing fire road (Figure 5) will be used as a public access road. The road will have a small amount of new gravel placed on top of the existing layer to make the road accessable to foot traffic.

Alternatives

Various design alternatives were considered. These alternatives dealt with type and size of stone, slope, and which areas to repair first. The footprint of these designs would not exceed that of the proposed action.

The “no action” alternative was considered in the alternatives analysis and was determined to be unacceptable due to the danger and risk of jeopardizing the integrity of both jetties. To allow the jetties to continue to deteriorate will eventually lead to breaching and sediment transport into the

estuary, which will increase inside and outside of the channel entrance (Figures 10 and 11). As the jetties continue to deteriorate, waves will move into the inner harbor adding to the difficulty of maintaining a reliable year round channel, and increase boating hazards.

Should the condition of the jetties worsen to the point an emergency is declared, repair would commence as soon as funding could be obtained. Environmental documentation would follow, if not completed prior to emergency construction.

4. Affected Environment

The Columbia River estuary is a drowned river mouth. The estuarine environment extends from the mouth to RM 38. The river varies from one to five miles wide throughout the estuary and is about one mile wide at RM 30. Tidal effect extends almost 150 miles upstream. (USACE 1983), but the saltwater wedge is limited to RM 20 (USACE 1999). Three jetties (North, South, and Jetty A) have been constructed at the mouth to help stabilize the channel and reduce the need for dredging. The entrance channel is currently maintained at authorized dimensions of 48-55 feet deep below MLLW and ½ mile wide from mile -3 to RM 3. River flows are controlled by upstream storage dams. A dredged material disposal site near the North Jetty was established in 1999 to protect the North Jetty from erosion and to disperse sand into the littoral zone. This site closely matches an historic disposal site. About 100,000 to 500,000 cubic yards of sand are placed here annually. All construction activities will be coordinated such that the rehabilitation and repair of the North Jetty and the associated construction activities will not impact the use of the North Jetty disposal location (Figure 5).

The MCR is a high energy area. Horizontal circulation in the estuary is generally clockwise, with incoming ocean waters moving upstream in the northern portion of the estuary and river waters moving downstream in the southern portion. Vertical circulation is variable, reflecting the complex interaction of tides with river flows and bottom topography and roughness (USACE 1983).

Both jetties are located in fairly high-energy areas subject to strong tidal and river currents and wave action. These high-energy conditions contribute to continual movement of sediments with both deposition and erosion occurring. This high energy environment is only suitable for species adapted to these conditions. These species normally have some method of attaching themselves to the rocks during the high wave and currents and are similar to those found in the rocky intertidal areas of the coast. Productivity on the jetties, however, is generally much less than the natural rock areas, due primarily to the fact that the rocks on the jetty move around during high wave and current events which makes the habitat less stable and less suitable for these type of organisms.

The lower Columbia River estuary, in the vicinity of the jetties is predominantly a marine environment. Dominant aquatic habitats near the jetties include mobile sand flats and rocky intertidal and subtidal habitat. The estuary is also a migratory route for anadromous fish species. Juvenile marine and estuarine fish species and macroinvertebrates such as Dungeness crabs also use the estuary as a rearing area.

The mobile sand community at the MCR provides habitat for such invertebrate species as polychaetes, clams (*Macoma sp*.), amphipods and crabs. This is a high energy zone and generally less productive than other areas of the estuary. The jetties provide rocky intertidal and subtidal habitat. Dominant species on the jetties include macro-algae such as *Fucus*, *Ulva* and *Enteromorpha* that are attached to the rocks. Invertebrate species present include sponges, hydroids, sea anemones, crabs, tubeworms, limpets and mussels that live on the rocks or in crevices. Fish species associated with the jetties include rockfish, sculpins, greenlings, ling cod, sea perch and blennies.

Near the MCR, the Oregon shore of the estuary is a coastal plain; the Clatsop Spit. On the Washington shore the dominant features is Cape Disappointment, a narrow rocky headland. Behind this headland is beach dune and swale. Land adjacent to the jetties consists primarily of beach sands with European beach grass and some conifer saplings. Some estuarine and palustrine wetlands also occur. Impacts to the wetlands adjacent to the North Jetty will be minimal and will occur only if the barge off-loading platform is constructed. The impact area will be approximately .25 acres.

Pacific herring, starry flounder, and juvenile English sole prefer the sandy habitat. Cobble beaches are inhabited by rockfish, chinook salmon, and surf smelt. Shiner perch and white sturgeon are found in deeper water habitat.

Federally listed threatened and endangered species which may occur in the MCR area include 15 wildlife species and 12 listed stocks of salmon, steelhead and trout. In-water work for the construction of the offloading sites will be done after the peak out migration of juvenile salmon to minimize impacts to there out-migration. Pile driving for the offloading sites will be done to the extent possible with a vibratory hammer. In the event that conditions warrant the use of an impact pile driver a bubble curtain will be used to minimize noise impacts to migrating fish. The placement of the culvert in the South Jetty will be done during low tide to minimize turbidity impacts and will be designed and constructed to allow fish passage at all water levels. A pollution control plan will also be developed by the contractor to minimize impacts from construction activities and the operation of the construction equipment. This plan will be reviewed by the regulatory agencies for acceptability.

Pursuant to the Magnuson-Stevens Fishery Conservation and Management Act an Essential Fish Habitat (EFH) consultation is necessary for the above described actions. EFH is defined by the Act in Section 3 (104-297) as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". The estuary and the Pacific Ocean off the mouth of the Columbia River are designated as EFH for various ground fish and coastal pelagic and salmon species (PFMC 1998a and 1998b).

A detailed discussion of EFH for the ground fish species is provided in the Final Environmental Assessment/Regulatory Impact Review for Amendment 11 to the Pacific Coast Groundfish Fishery Management Plan [(PFMC) 1998a] and the NMFS (1998), Essential Fish Habitat for West Coast Groundfish Appendix. A detailed discussion of EFH for Coastal Pelagic species is provided in Amendment 8 to the Coastal Pelagic Species Fishery Management Plan (PFMC

1998b). Salmon EFH is discussed in Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC, 1999).

Marine mammals known to occur in the Columbia River estuary and nearby offshore areas include but are not limited to: gray whale, harbor porpoises, northern and California sea lions, and harbor seals. Most cetacean species observed by Green et al. (1991) occurred in slope (600 to 6,000-foot depths) or offshore waters. Harbor porpoises and gray whales were prevalent in shelf waters less than 600 feet deep. Pinniped species likely to occur in the vicinity of the proposed jetty repair sites are harbor seal and California and northern sea lion. No rookeries occur within the area (Bonnell et al., 1989). The South Jetty is used as a seasonal haulout area by northern (Steller) sea lions.

Two species of listed marine turtles, loggerhead, and Pacific leatherback, have been recorded from strandings along the Oregon and Washington coastline. They are typically associated with warmer waters that occur over the Pacific slope waters during summer (Green et al., 1991). Their occurrence inshore is incidental in nature.

Pelagic birds are numerous off the Columbia River, including gulls, shearwaters, auklets, common murres, fulmars, phalaropes and kittiwakes. Briggs et al. (1992) found that seabird populations were most densely concentrated over the continental shelf. Brown pelicans typically occur from late spring to mid-fall along the Oregon and Washington coast. Large concentrations (10,000 plus birds) of this species occur at the mouth of the Columbia River at the South Jetty and at East Sand Island near Baker Bay. This species forages in nearshore waters of the Pacific Ocean and estuarine waters of the Columbia River.

Three species of cormorants occur in the Columbia River estuary and forage in nearshore Pacific Ocean waters, the estuary or upriver. Pelagic and Brandt's cormorants nest on the cliffs of Cape Disappointment (USACE, 1999). Double-crested cormorants are very abundant with a colony exceeding 12,000 pairs present on East Sand Island. This population represents the largest Double-crested cormorant colony on the U.S. west coast. Three species of terns occur in the Columbia River or over nearshore waters. Caspian terns are present from April to September and have established a large colony (approximately 9,000 pairs) on East Sand Island within the estuary. Common and Arctic terns occur off the Oregon and Washington coasts from April to September principally during migration. Shorebirds found on coastal beaches at MCR and estuarine flats include western sandpipers, sanderlings, dunlins, least sandpipers and semi-palmated plovers.

Cultural Environment

The primary area affected by the MCR is the lower Columbia River region, from the river’s entrance to Portland harbor. While the immediate area affected by the jetties is predominantly rural, the area affected by jetty failure extends to Portland and beyond. The nearest communities are Ilwaco in Washington and Astoria in Oregon.

Both jetties border State parks. In Oregon, Fort Stevens State Park is located on Clatsop Spit. Cape Disappointment State Park is located on Cape Disappointment in Washington. Lands adjacent to the jetties are administered by the Corps of Engineers and leased to the respective States. Recreational use includes sightseeing, bicycling, hiking, beachcombing, nature observation, and jetty and beach angling.

The jetties themselves are more than 50 years old and therefore "historic". They are not presently listed on the National Historic Register, but may be eligible for listing under National Register Criteria (a) "associated with events that have made a significant contribution to the broad patterns of our history."

5. Environmental Affects

The environmental impacts associated with the proposed action would be minor because the rehabilitation work is to an existing structure within a limited area within the original footprint and will not impact any significant benthic habitat. Some short-term loss of habitat will occur during the construction period but will be replaced by the completion of the proposed action.

The proposed activities are expected to have minimal affects or no affects on wildlife species of the area but may affect listed fish species. An increase in suspended sediments in the water column is expected during the construction period; however, this impact is expected to stay within acceptable levels for fish species of concern. Disturbed material would primarily be sand, which would settle quickly. Avoidance of the area by the listed species may occur throughout the construction period as a result of the increased activities and noise, but all species would be expected to return following project completion. No significant adverse effects on any listed/candidate threatened or endangered species are anticipated.

Construction may occur year-round on the South Jetty. Some work would occur during appropriate in-water work periods determined by fishery agencies to minimize impacts to fish, wildlife and habitat; however, most of the work would occur outside these periods. Based on the analysis of the effects and consideration of environmental impact reduction measures that would be implemented to avoid and reduce effects, the Corps determined that the proposed project actions either would not effect, or "may affect, but are not likely to adversely affect" with regard to listed wildlife species. It was determined that the proposed action is likely to adversely affect listed salmonids, however these impacts are expected to be minimal since they will be intermittent and of short duration.

Public access to the North and South Jetties and adjacent beach will be closed or restricted during the construction period. Placement of the staging area near the base of the jetties, using State Park parking lots and adjacent upland beaches for work areas and rock storage areas, will likely cause some inconvenience to park visitors during the construction period.

Off-loading rock from barges alongside the jetties would involve temporary disturbance of the benthos due to placement of pilings or dolphins and barge traffic. Anadromous fish will be impacted by the offloading sites principally by causing them to alter their migration pattern,

which will cause them to migrate further off shore and potentially be more susceptible to predation. The offloading structures may also provide additional habitat for predators which may increase the predation rate on juvenile salmonids as they migrate out of the estuary. The pilings however, would be removed once construction is complete and this will reduce the potential predator habitat. Both placement and removal could cause minor temporary increases in turbidity.

The rock source will be determined by the contractor and as a result all the impacts resulting from the quarry activities cannot be predicted. It is expected that quarry activities would result in increased noise, dust, and traffic congestion in the vicinity of the quarry. Also, given the size of the jetty stone, repeated trips along the haul route could damage local roads.

Impacts to the construction staging areas should be minimal. Construction of the off-loading areas will result in the loss of benthic habitat in the area of the fill. This habitat will be restored following project construction and it is likely that the benthic organisms will quickly recolonize the area. Species of the fish and macro-invertebrates that occur in the vicinity of the fill will also be displaced by the offloading sites. Once these areas are restored it is likely that these organisms will return to these areas. The areas are beach with European beach grass, and as a result would not require much preparation for replanting. The sites will be restored to original contours and all re-vegetation will be done prior to April 15 to allow for the plants to establish prior to the growing season. No pesticides will be used for weed control nor will fertilizers be used within 50 feet of any water body. Temporary access roads, to haul equipment and rock up to the jetties would also be placed on beach sands. For the North Jetty, the access road would be located to avoid nearby swales. The South Jetty access road likely would be for equipment only (rock would be barged in) and would cross a tidal drainage route. A temporary culvert would be placed to accommodate tidal flow. The access road and culvert would be removed and the area restored to its pre-project condition after construction.

The intertidal wetland located adjacent to the North Jetty, is affected by the jetty which delays water getting in and out of the area. The wetland area that may be filled consists of scattered conifers and a few deciduous trees. Other vegetation in the area consists of scotch broom and European beach grass. There is a narrow fringe of emergent marsh vegetation between subtidal and upland zones. There are a few scattered conifers and pockets of deciduous scrubs that have established a foothold atop the jetty stones.

Aquatic Life Forms

Various aquatic life forms utilize the jetties and surrounding area as habitat or migratory routes. These organisms, such as crabs, would temporarily be disturbed by construction activities. New rock would displace existing habitat but would, in time, provide new and additional habitat. Mobile organisms would avoid the area during construction. Non-mobile life forms such as algae, barnacles and benthic invertebrates would be lost as they are covered by new rock. These organisms however would recolonize the area quickly.

Listed Marine and Terrestrial Wildlife

It has been determined that there would be no effect on humpbacked, blue, finback, Sei, right and sperm whales, leatherback and loggerhead sea turtle, western snowy plover, Columbian white-tailed deer, and Oregon silverspot butterfly. A determination of "may affect, but is not likely to adversely affect" has been made for Steller sea lion, bald eagle, brown pelican and marbled murrelet.

Listed Anadromous Fish

Both juveniles and adults of the listed salmonids species will be in the vicinity of the project area during the rehabilitation work. Though it is unlikely that they will occur close enough to the work area to be directly impacted by the construction activities it is likely that they will be disturbed during migration by the construction noise and turbidity generated during rock placement. The extent of this potential impact cannot be quantified; however, it is expected to be small since the area impacted is small compared to the width of the MCR area. In addition, the impacts are intermittent, only occurring for short periods of time followed by longer periods of no vibration or noise while the piles or rocks are being prepared for the next activity. Consequently, it is likely that salmon can easily avoid the impacts from these activities and the short- and long-term effects would be minimal.

Temporary increases in suspended sediment and resultant turbidity from driving piles during the construction of the barge off-loading platform, the placement of the platform itself and the placement of jetty stones and larger rocks may also impact salmon. These increases in suspended sediment will generally be limited to the construction area and will be low and of short duration, as compared to baseline levels. Alteration of bottom habitat by pile driving or the placement of stone in the jetty areas will not impact salmon since these areas do not provide much of any valuable resting or feeding areas. The MCR is an active migration corridor and it is not likely that juvenile salmon are feeding to any extent in this area. Based on the above, it is anticipated that MCR jetty rehabilitation will only have a minor impact on salmon. Consequently, the impact to the listed species is expected to be small and of short duration. A determination of "may affect, likely to adversely affect" has been made and a Biological Assessment submitted to NOAA.

Essential Fish Habitat

Based on the EFH requirements for the managed species of salmon, ground fish and coastal pelagics species, the potential direct, indirect, and cumulative effects of the proposed jetty maintenance project are not likely to adversely affect the total EFH for the managed species because the jetties do not provide valuable EFH habitat. Various species of rock fish could utilize the jetties, either as juveniles or adults, depending on the species. However, due to the abundance of rocky habitat and the short duration of construction activities in any one location, any impact would be temporary, and be primarily one of avoidance of the immediate area. Rehabilitation would increase the amount of rocky habitat available after construction.

Recreation

Recreation at both State parks could be slightly affected. Heavy equipment using park roads and parking lots could delay or inconvenience visitors. Jetties would be closed or restricted to sightseers and anglers during construction. Construction activities themselves may attract some sightseers.

Cultural Resources

The only cultural resources that potentially could be affected by the proposed actions are shipwrecks. Jetty site evaluations have concluded that shipwrecks or remnants do not occur at these locations (U.S. Army Corps of Engineers, 1998). The jetties themselves are historic; however, they are typical rock jetties and currently not listed in the National Register. Rehabilitation of the jetties would preserve their historic function.

6. Coordination

This Environmental Assessment was issued for a 30-day public review. Comments were requested from the following:

Department of Land Conservation Division
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
National Marine Fisheries Service (NOAA Fisheries)
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Parks and Recreation
Oregon Division of State Lands
Oregon State Historic Preservation Office
Washington Department of Ecology
Washington Department of Natural Resources
Washington State Historic Preservation Office
Washington State Parks and Recreation Commission
Lower Columbia River Port Districts
CREST
Clatsop County, Oregon
Pacific County, Washington
Columbia River Crab Fishermen's Association
Tribes

7. Consultation Requirements

a. **Clean Water Act of 1977 (33 U.S.C.)**: A Section 404 (b)(1) Evaluation has been prepared to address the proposed discharge of dredged material into a water of the United States and is attached to the public notice. State Water Quality certification will also be obtained as required under Section 401 of the Act from both the States of Oregon and Washington. Temporary placement of a culvert in waters of the U.S. at the South Jetty is addressed by Nationwide Permit

(NWP) number 33, Temporary Construction, Access and Dewatering. This NWP has received certification by the State of Oregon. Under Section 402, National Pollution Discharge Elimination System permits for construction runoff will be required from both the states of Oregon and Washington since the ground disturbance at both the North and South Jetties work sites exceeds one acre. The Corps will be acquiring the NPDES permit from both the states of Washington and Oregon prior to construction.

b. **Coastal Zone Management Act of 1972, as amended**: The proposed project is located within coastal zone of both Oregon and Washington. Consistency determinations that have addressed applicable enforceable policies of the approved programs have been submitted to both States in accordance with Section 307 of the CZMA.

c. **Endangered Species Act of 1973, as amended**: In a letter dated June 5, 2002, the U.S. Fish and Wildlife Service (USFWS) listed the marbled murrelet, bald eagle, western snowy plover, and brown pelican as threatened and endangered species which may occur in the project area. The Oregon silverspot butterfly and Columbian white-tailed deer were also listed. Under jurisdiction of the National Marine Fisheries Service, now referred to as National Oceanographic Atmospheric Administration Fisheries (NOAA Fisheries), now include gray, humpback, blue, finback, sei, right, and sperm whales; leatherback sea turtles; northern (Steller) sea lion; and 12 ESUs of salmonids. Biological Assessments (BA) have been prepared and a determination made that the proposed action either does not affect, or may affect, but is not likely to adversely affect, or may affect, is likely to adversely affect but will not jeopardize any listed or candidate species. BAs have been submitted to the appropriate agencies with these determinations.

d. **Fish and Wildlife Coordination Act**: In compliance with this act, the proposed action is being coordinated with USFWS, NOAA Fisheries, the Oregon Department of Fish and Wildlife, and the Washington Department of Fish and Wildlife. A Fish and Wildlife Coordination Act Report is not required for operations and maintenance work.

e. **Magnuson-Stevens Fishery Conservation and Management Act.** An EFH evaluation has been prepared and submitted to NOAA Fisheries.

f. **Marine Protection, Research, and Sanctuaries Act of 1972, as amended**: The proposed action does not involve the transportation of dredged material for the purpose of ocean disposal; therefore, this act does not apply.

g. **The National Historic Preservation Act of 1966, as amended through 2000:** North and South Jetties at the MCR in Oregon and Washington are older than 50 years. No known prehistoric sites have been documented within the rehabilitation areas (these areas are most likely accreted ground). Coordination with Oregon and Washington State Historic Preservation Offices (SHPO), per Section 106 and 110 of the National Historic Preservation Act, will be undertaken. Any required coordination with tribes will also be conducted.

h. **Executive Order 11988, Flood Plain Management, 24 May 1977**: The proposed project would not encourage development in or alter any flood plain areas.

i. **Executive Order 11990, Protection of Wetlands, 24 May 1977**: Minimal impacts to a wetland area will be affected by this project and will be restored after project completion. Tidal flow on the Clatsop Spit would be maintained through a temporary culvert under the construction access route.

j. **Analysis of Impacts on Prime and Unique Farmlands**: Not applicable.

k. **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA).** No hazardous, toxic and radioactive waste (HTRW) is known to occur in the proposed project vicinity. Presence of HTRW will be responded to within the requirements of the law and USACE regulations and guidance.

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U.S. Army Corps of Engineers, Portland District. 2002b. Biological Assessment for Humpbacked, Blue, Finback, Sei, Right, and Sperm Whales; Leatherback and Loggerhead Sea Turtles; and Steller Sea Lions for the Maintenance Dredging and Use of Ocean and Shoreline Dredged Material Disposal Sites at Mouth of the Columbia River Federal Navigational Channel (MCR) Clatsop County, Oregon and Pacific County, Washington.

U.S. Army Corps of Engineers, Portland District. 2002c. Biological Assessment for Bald Eagles, Western Snowy Plovers, Brown Pelicans, Marbled Murrelets, Columbian White-tailed Deer and

Oregon Silverspot Butterfly for the Maintenance Dredging and Use of Ocean and Shoreline Dredged Material Disposal Sites at Mouth of the Columbia River Federal Navigational Channel (MCR) Clatsop County, Oregon and Pacific County, Washington.

U.S. Army Corps of Engineers, Portland District. 1998. Dredged Material Management Plan & Supplemental Environmental Impact Statement. Final. Portland, Oregon. 1998.

U.S. Army Corps of Engineers, Portland District. 1983. Columbia River at the Mouth Navigation Channel Improvement, Final Environmental Impact Statement, Oregon-Washington.

Figures

Figure 1 – Columbia River Jetty System

Figure 2 – South Jetty

Figure 3 – North Jetty

Figure 4a, 4b and 4c – Plan View of South Jetty

Figure 5 – Plan View of North Jetty

Figure 5a – Map of North Jetty Wetlands

Figure 6 – North Jetty Cross-Section

Figure 7 – South Jetty Cross-Section

Figure 8 – South Jetty Profile View of Barge Off-Loading Platform

Figure 9 – North Jetty Profile View of Barge Off-Loading Platform

Figure 10 – South Jetty Breach Shoaling Scenario

Figure 11 – North Jetty Breach Shoaling Scenario

Figure 12 – New North Jetty Parking Area

Response to Comments

U.S Fish and Wildlife Service

Comment: "We would prefer and do recommend, that if at all possible, jetty repair and rehabilitation be accomplished from land-based work sites. If marine-based operations are necessary, then we recommend the tow boat and barge option over the barge off-loading platform. In addition, any restoration of work sites and/or haul and access roads should consider methods to eliminate European beach grass and re-create coastal beach habitat."

Response: Recommendations are noted. As for eliminating or covering European beach grass, the Corps plans to replant any disturbed area that was previously planted with European beach grass with American beach grass.

The construction of the repairs to the South Jetty will not take place for one to two years. At a meeting on October 5, 2004 between Clatsop County, DLCD, Oregon State parks, USFWS and the Corps, habitat creation was discussed. It was decided that since construction is one to two years into the future and the Snowy Plover Environmental Impact Statement has yet to be coordinated with the Clatsop county and the state park, it was agreed upon by the group, that at this time the Corps would not create habitat for Snowy Plovers. The Corps agreed to readdress this option as the Corps approaches the actual construction of the repairs.

Comment: USFWS had several corrections that they thought should be made to the EA.

Response: All recommended changes were made to the EA except for the comments suggested on pages 1, 2 and 6. The comments they referenced on page 6 were addressed above.

Oregon Department of Land Conservation and Development

Comment: "Information regarding the sediments to be dredged and their beneficial use and disposal requires further review."

Response: In discussions with DLCD, the Corps stated that any dredging required as a result of construction of the barge off-loading facility would be coordinated with their agency. The material will also be tested and the results of those tests will be sent to DLCD. The Corps and DLCD agreed that any dredged material would be used as fill material for the haul road or taken to an approved upland site.

Comment: "Resource agencies and Clatsop County have raised apparently contradictory issues relative to the potential creation of habitat for the Western Snowy Plover."

Response: The Corps and DLCD met with the resource agencies on October 5, 2004 to resolve the outstanding issue of the creation of Snowy Plover habitat. The group resolved the issues by the Corps agreeing to revisit the issue once the Plover EIS was complete and the Corps awarded the contract and knew the method of construction.

Oregon Department of Fish and Wildlife

Comment: "If the barge off-loading option is selected for jetty repair, consideration should be given to enhancement opportunities for the state and federally listed western snowy plover….We would like to suggest that not replanting would provide a cost-effective opportunity to partially restore a portion of the snowy plover breeding/wintering habitat."

Response: See comment responses to CREST and Clatsop County below.

13th Coast Guard District

Comment: "If the contractor needs to mark any structures or work areas….please have them contact me (Timothy L. Westcott) so I may ensure they meet all Coast Guard requirements."

Response: The Corps will notify the contractor of this condition.

Oregon Parks and Recreation Department

Comment: "…request that this agency be invited to participate in pre-construction and planning meetings for the South Jetty work."

Response: The Corps will ensure that Oregon Parks is invited to the pre-construction meeting.

Clatsop County and CREST

Comment: The following is a list of both Clatsop County's and CRESTs conditions of consistency:

1. Bottom sediments in the dredging area shall be characterized prior to dredging.

Response: If dredging is required for placement of the barge off-loading platform, the material will be tested prior to dredging and the results provided to DLCD, Clatsop County and CREST for review.

2. Dredging will be coordinated with local fishing groups, specifically the Columbia River Crab Fisherman's Association to minimize impacts to those fisheries.

Response: The following discussion took place at the October 5, 2004 meeting between the resource agencies and the Corps:
The EA had been sent to the Columbia River Crab Fisherman's Association (CRCFA) and the comment received back from them was positive and expressed the need for the project. This letter was read to the group and the Corps asked what more CREST and Clatsop County would like to see done to help keep CRCFA informed. They asked that CRCFA be notified when and if the Corps' would be dredging in the area and when the Corps plan on constructing the project. The Corps stated that they would send out notices prior to construction. In the Coast Guard comment letter, they offered to send out a notice to mariners when we begin work in the area and the Corps has agreed to coordinate with the Coast Guard on the construction activities. The group agreed that these measures were sufficient to address their concerns.

3. Any disturbed riparian vegetation shall be replanted.

Response: The following discussion took place at the October 5, 2004 meeting between the resource agencies and the Corps: with regards to replanting, NOAA's Biological Opinion (BO) also states that the Corps replant the disturbed area with native woody species. The group had concerns that the species listed in the BO would not grow in the coastal area. The group requested that NOAA be contacted to change replanting from woody species to American beach grass. It was agreed that the Corps would contact NOAA and ask if they would make that change. An e-mail message was sent to NOAA and copies furnished to the group, on October 8, 2004 requesting the change.

4. EITHER demonstrate that it is not feasible to construct the barge off-loading platform on pilings, OR include a mitigation plan for the estuarine aquatic area fill.

Response: The following discussion took place at the October 5, 2004 meeting between the resource agencies and the Corps: The Corps explained that placing material between sheetpiles would be the least environmentally impactive way to construct the barge off-loading platform. In NOAA's Biological Opinion (BO), they conditioned the Corps that when using the platform to install measures to ensure that any fluids that could potentially leak from the use of equipment be contained using containment booms and other erosion control measures.

5. In-water construction activity in aquatic areas shall follow the recommendation of state and federal fisheries agencies with respect to project timing to avoid unnecessary impacts on migratory fish.

Response: The following discussion took place at the October 5, 2004 meeting between the resource agencies and the Corps: The Corps informed the group that in NOAA's BO, they have provided an in-water work timing restriction between July 1 and February 28. The Corps requested from NOAA that in the event the Corps needed to begin work earlier than the July 1 date, that the Corps could seek reconsultation via letter and NOAA would be willing to look at a new date and adjust the Take statement as necessary. The group agreed with this approach.

6. Any additional mitigation requirements required by other state or federal agencies made a part of this project would be subject to further review by the County for consistency to County goals, policies and regulations.

Response: See first response to USFWS.

<u>Oregon Invasive Species Council</u>

Comment: "…the Council recommends not replanting beach grass following construction of the North and South Jetties."

Response: If the Corps replants beach grass, they will replant American beach grass and not European beach grass.

<u>Washington State Parks</u>

Comment: Mr. Farber asked that the Corps modify the repair plans to include: the construction of a 22 foot paved roadway for approximately 500 feet; construct a ¾ acre paved parking lot on

the eastern side of the public beach access above where the roadway ends; continue with the crushed surface 10-feet wide beyond the new day use parking area and to remove asphalt from the existing day use parking lot. The letter also suggested correction to a number of technical corrections.

Response: The Corps met with Mr. Farber on August 25, 2004 to discuss the parks' comments. The Corps agreed to construct a less than one acre gravel parking lot along the fire access road. This new feature has been added to the EA (see figure 12 of the EA). The Corps however, does not have the authority under the jetty project to construct the paved road or to give state parks $450,000 to construct the roadway. We assured Mr. Farber that any damage done to the park roads as a result of construction activities would be fixed to the roadways pre-construction condition.

The technical corrections were made.

Department of Fish and Wildlife

Comment: "…Placement of rock be conducted from upland"…"and recommend that as much rock placement as possible be done on the ocean sides of the jetties."

Response: The placement of jetty stone will be at the discretion of the contractor. It is neither feasible from an engineering perspective nor safe to place the rock from the ocean side of jetties. The Corps has proposed three feasible and structurally safe options to store and place the jetty stone. The contractor can choose one or a combination of these options.

Comment: "…construction and delivery of rock would be by far more practical to do in the winter."

Response: Due to severe storms and intense wave action, it would be impractical and unsafe to place jetty stone on the jetty in the winter.

Comment: Page 2, second paragraph.

Response: Fish migration will not be impacted as a result of the barge off-loading platform or the construction activities on the jetty. Studies conducted at Lower Granite Dam on the lower Snake River of a Behavioral Guidance Device have shown migrating juvenile salmon likely guide some distance off a structure similar to the jetty and/or off-loading platform. Further, given the physical environment near the jetty and off-loading platform it is unlikely emigrant salmonids are within the near jetty area. Additionally, multiple predator habitat studies conducted within the Columbia River basin have shown most predators inhabit areas near rock structures like jetties and the off-loading platform, and not more main channel habitats. The marine environment along the jetties provides suitable habitat for predators, therefore construction activities and sheet pile placement will likely cause disturbance in the area. This disturbance may provide less area for predators to feed in.

Washington State Department of Transportation

Comment: If the work the Corps is proposing will impact SR 100, WSDOT would like more information and coordination with the Corps.

Response: The Corps will be meeting with both the States of Oregon and Washington transportation agencies, local counties and cities and park officials to discuss road impacts during construction prior to the construction of the project. WSDOT will be invited to this meeting.

City of Ilwaco

Comment: The city expressed concerns about the city roads and traffic volume and impacts the streets will be receiving for not only the jetty repair project but the Lewis & Clark Commemoration.

Response: As stated in the above comment, the Corps will be meeting with the city of Ilwaco to address their concerns prior to construction of the project.

Pacific Northwest Waterways Association

Comment: PNWA requested that the Corps involve the local transportation authorities as we develop the project.

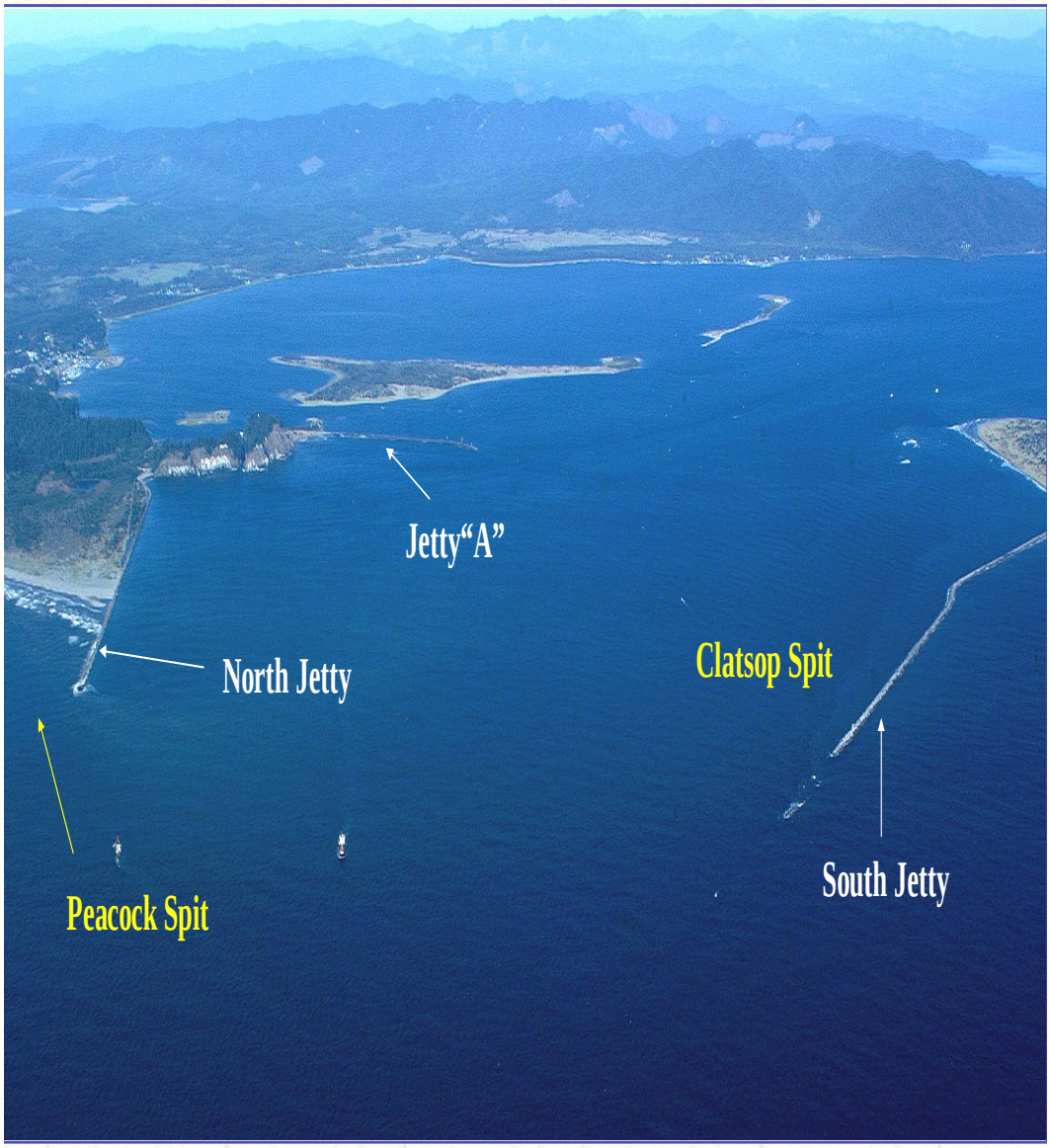
Response: See response to comment for WSDOT and the City of Ilwaco.

Shirley M. Burt, Ilwaco City Council

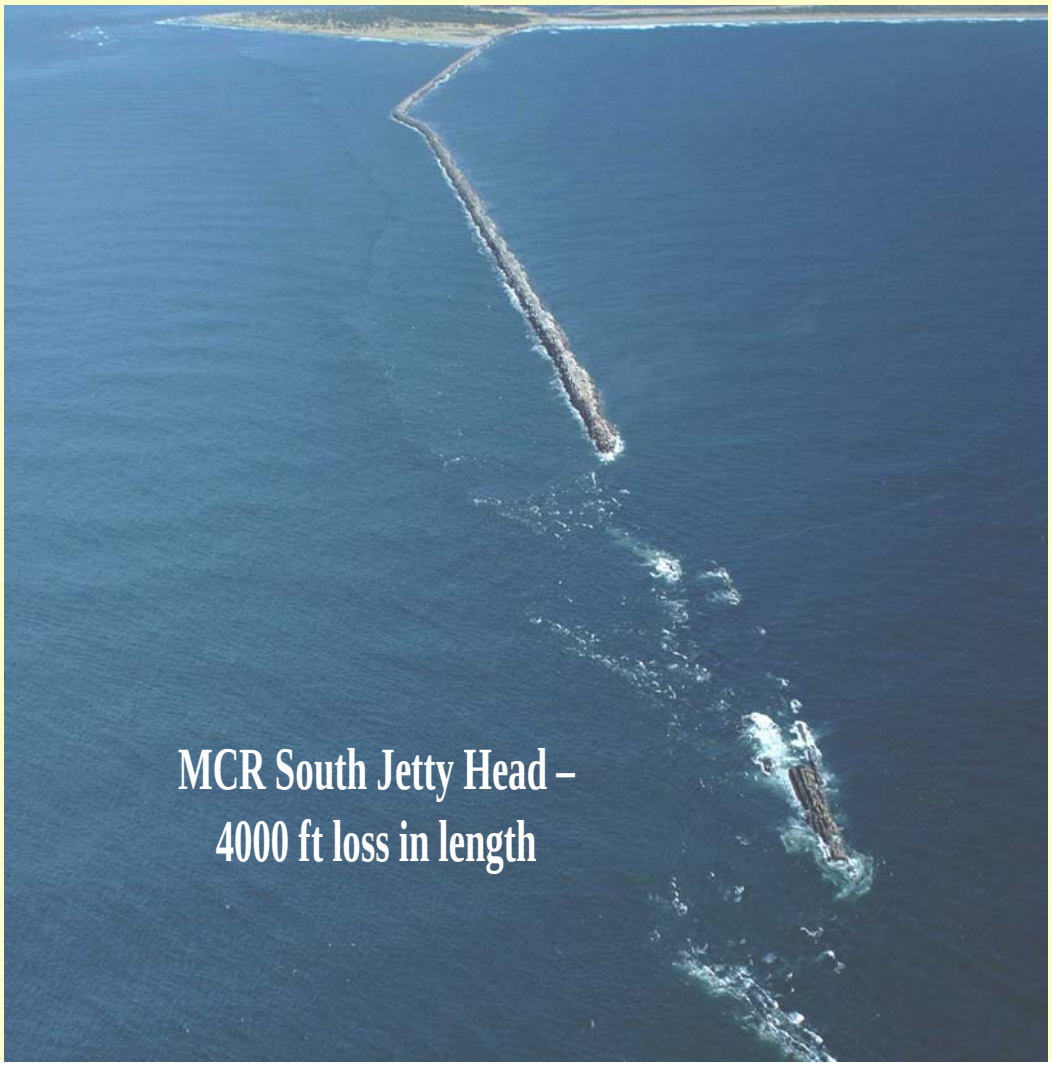
Comment: Ms. Shirley expressed concern for the local roads in the City of Ilwaco.

Response: See response to comments for WSDOT and the City of Ilwaco.

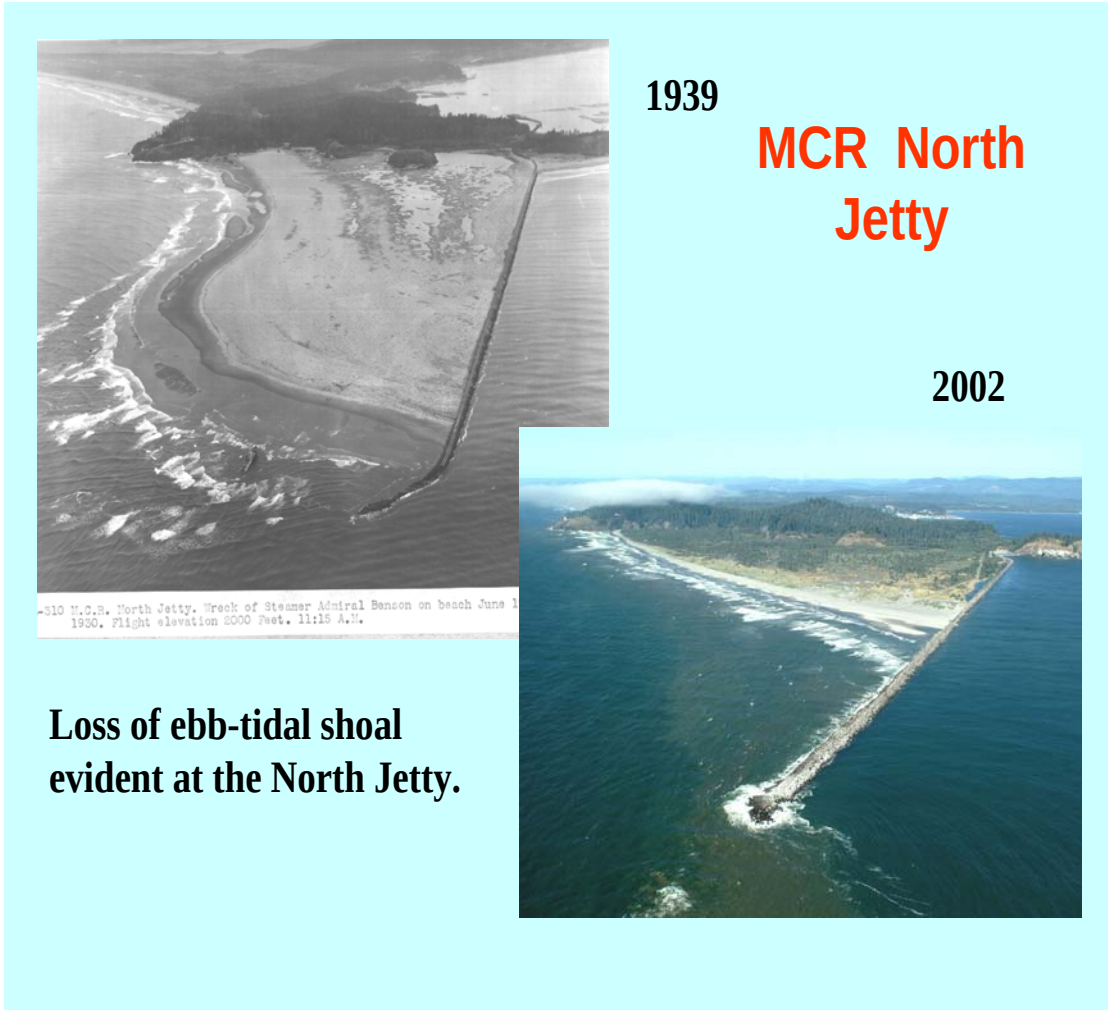
Columbia River Jetty System



MCR Jetty Repair – Figure 1



MCR Jetty Repair – Figure 2



MCR Jetty Repair – Figure 3

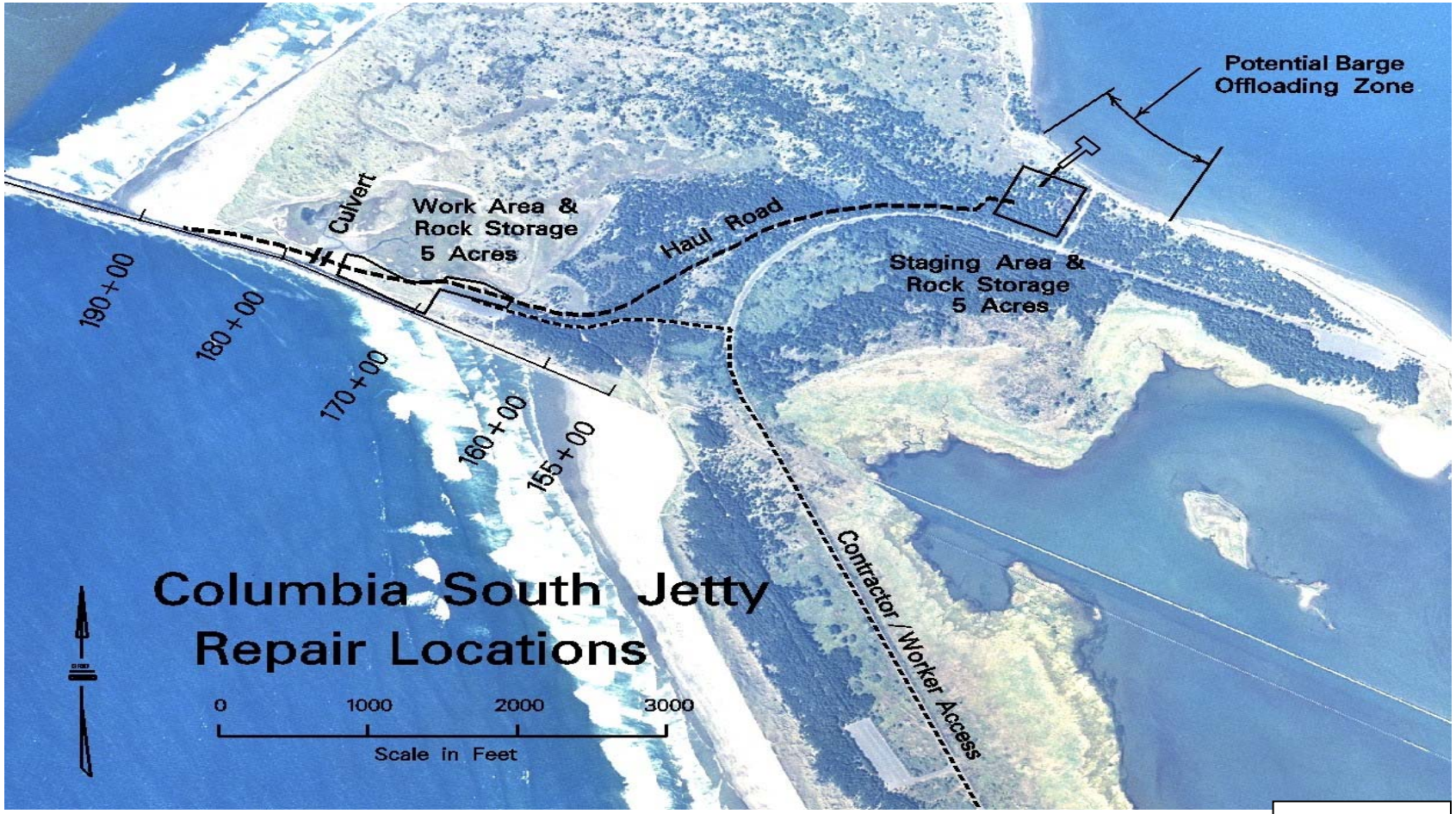

Potential Barge
Offloading Zone
Culvert
Work Area &
Rock Storage
5 Acres
Haul Road
Staging Area &
Rock Storage
5 Acres
190+00
180+00
170+00
160+00
155+00
Contractor / Worker Access
Columbia South Jetty
Repair Locations
0
1000
2000
3000
Scale in Feet

Figure 4a

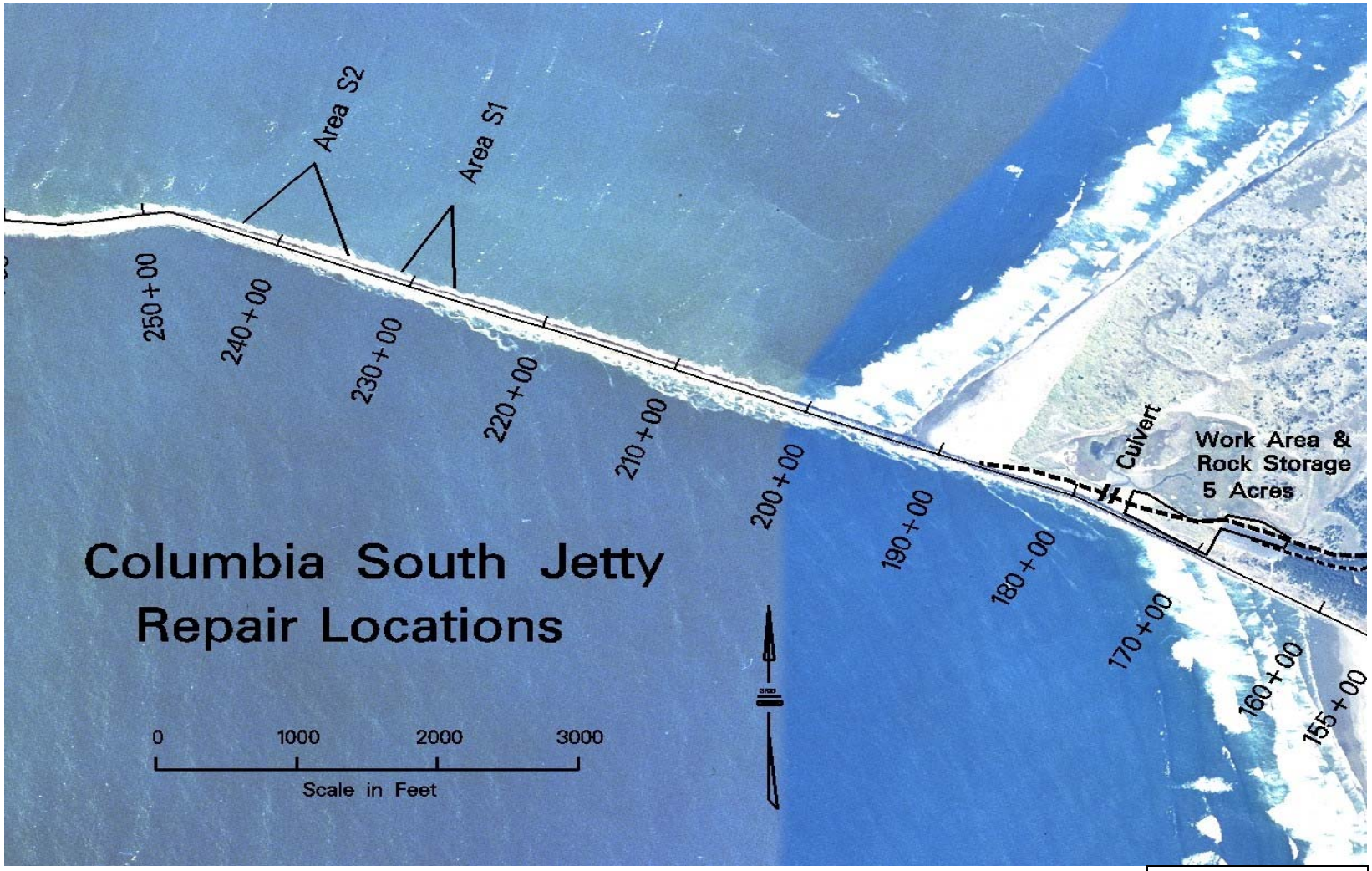

Columbia South Jetty
Repair Locations
Area S2
Area S1
250+00
240+00
230+00
220+00
210+00
200+00
190+00
180+00
170+00
160+00
155+00
Culvert
Work Area &
Rock Storage
5 Acres
0
1000
2000
3000
Scale in Feet

Figure 4b

330+00
320+00
310+00
300+00
290+00
280+00
270+00
260+00
250+00
AREA S5
AREA S4
AREA S3
Columbia South Jetty
Repair Locations

Figure 4c

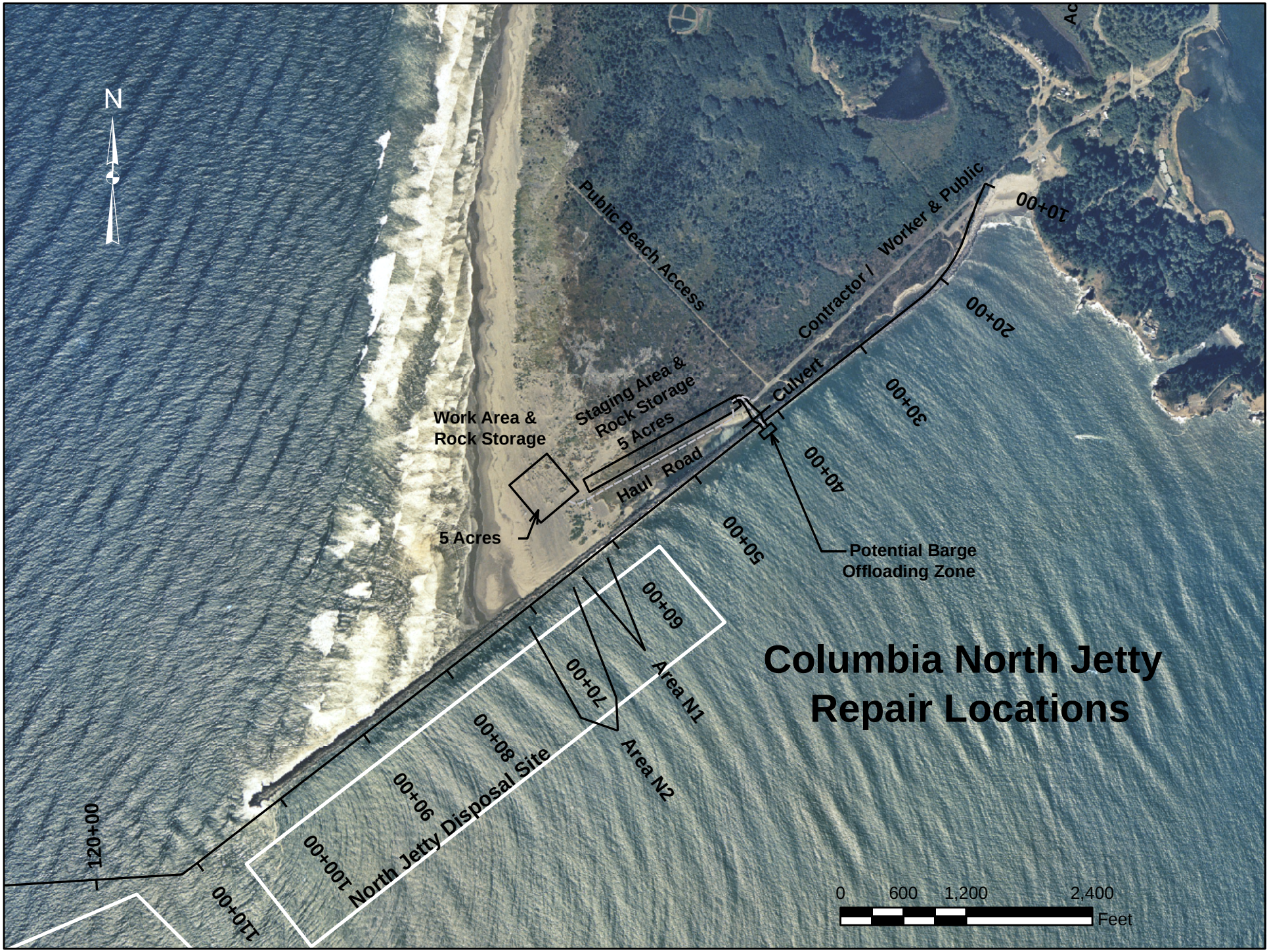


Figure 5 - North Jetty

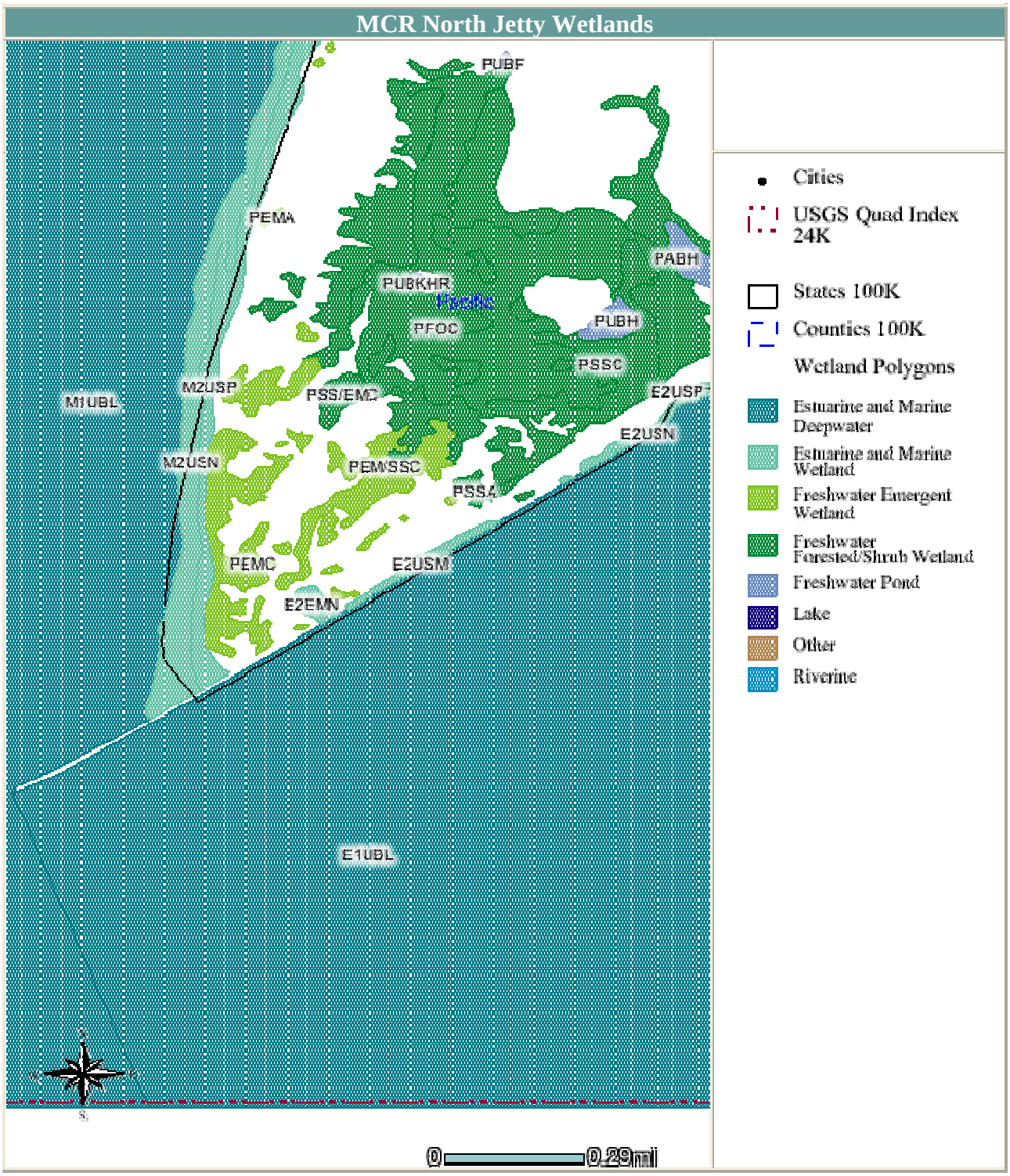
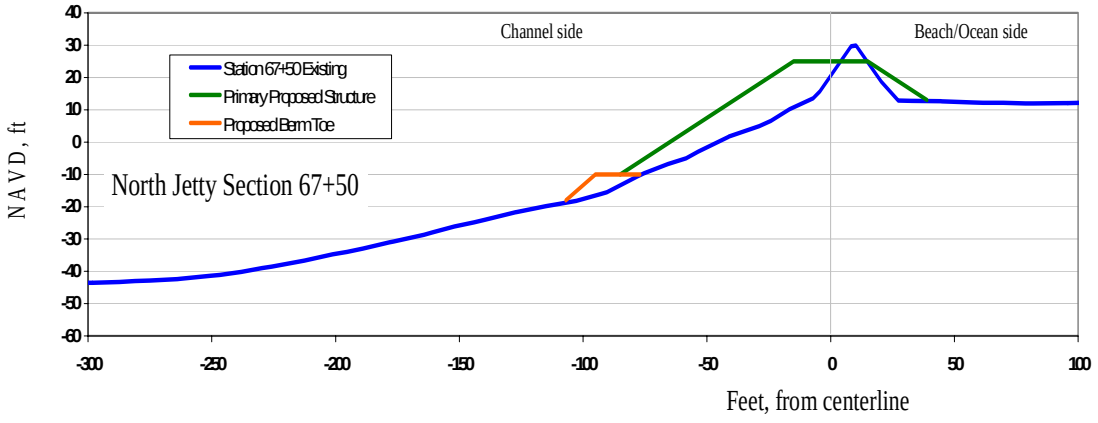
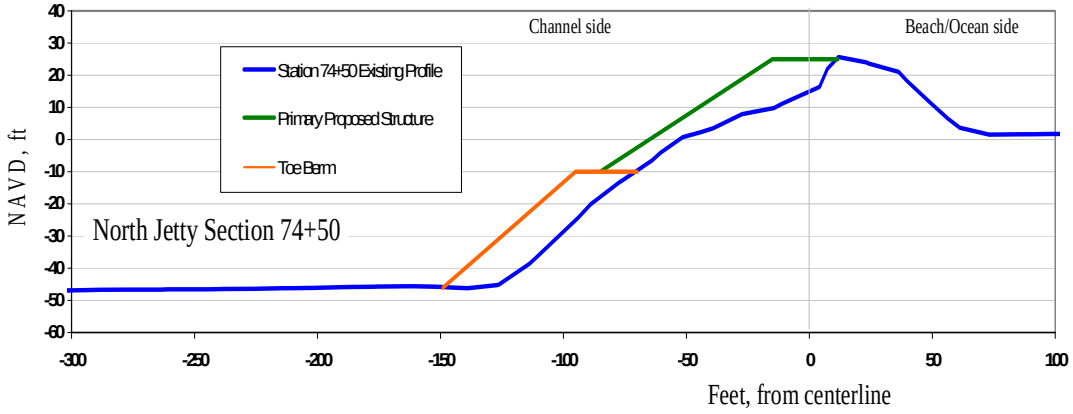

MCR North Jetty Wetlands
PUBF
PEMA
PABH
PUBKHR
Pacific
PFOC
PUBH
PSSC
M1UBL
M2USP
PSS/EMC
E2USP
E2USN
M2USN
PEM/SSC
PSSA
PEMC
E2USM
E2EMN
E1UBL
0
0.29mi
Cities
USGS Quad Index 24K
States 100K
Counties 100K
Wetland Polygons
Estuarine and Marine Deepwater
Estuarine and Marine Wetland
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Other
Riverine

Figure 5a

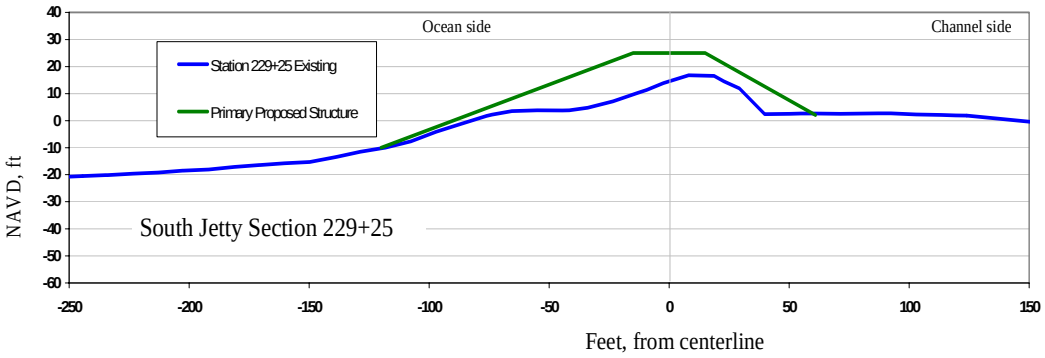
NORTH JETTY CROSS-SECTIONS view to offshore

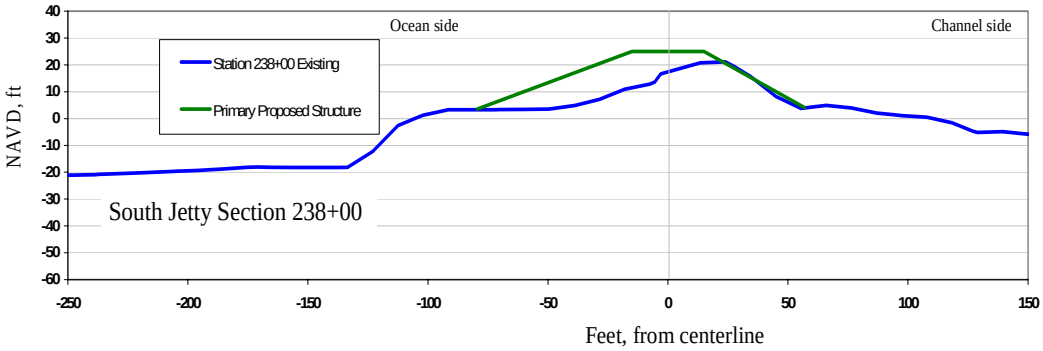




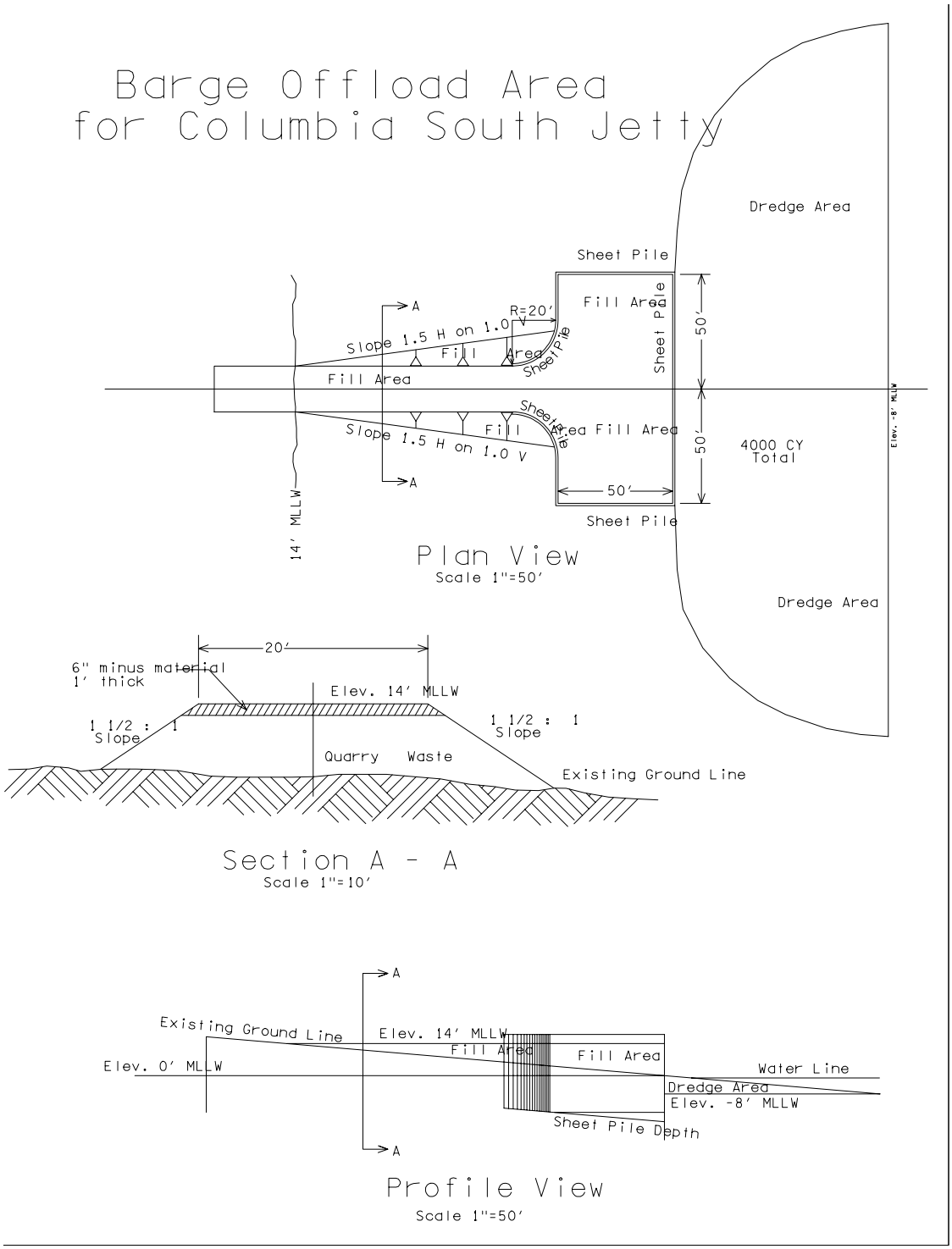
MCR Jetty Repair – Figure 6

SOUTH JETTY CROSS-SECTIONS view to offshore

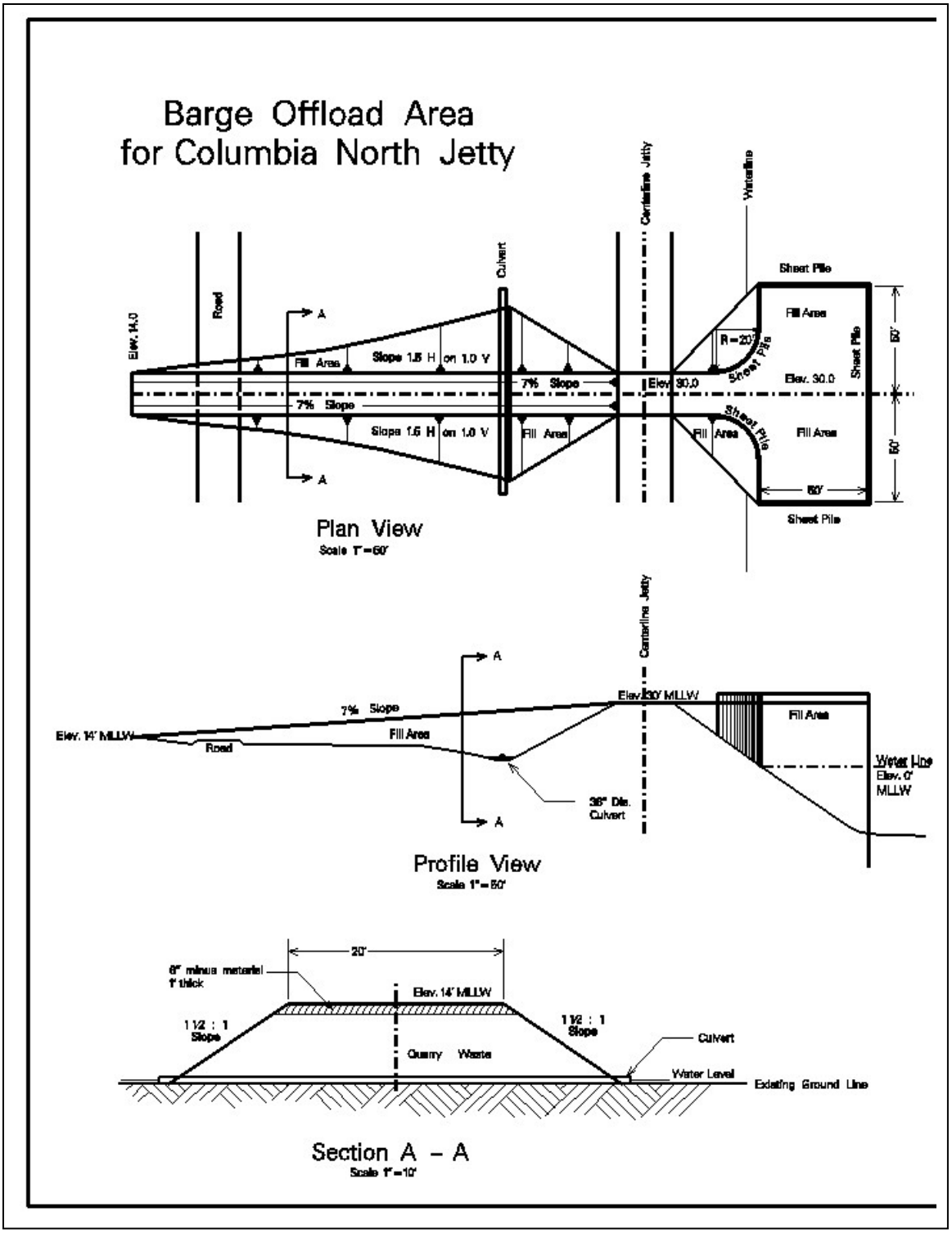




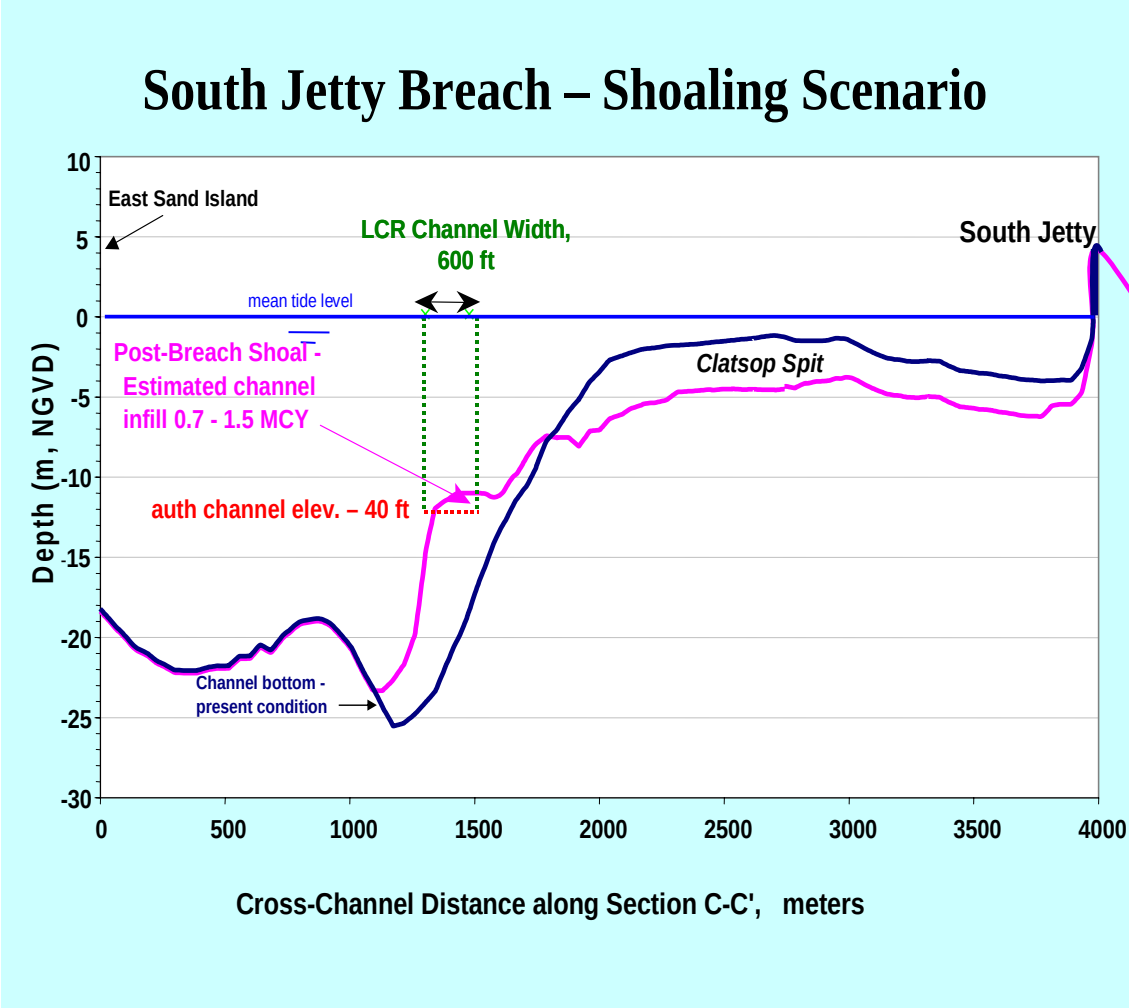
MCR Jetty Repair – Figure 7



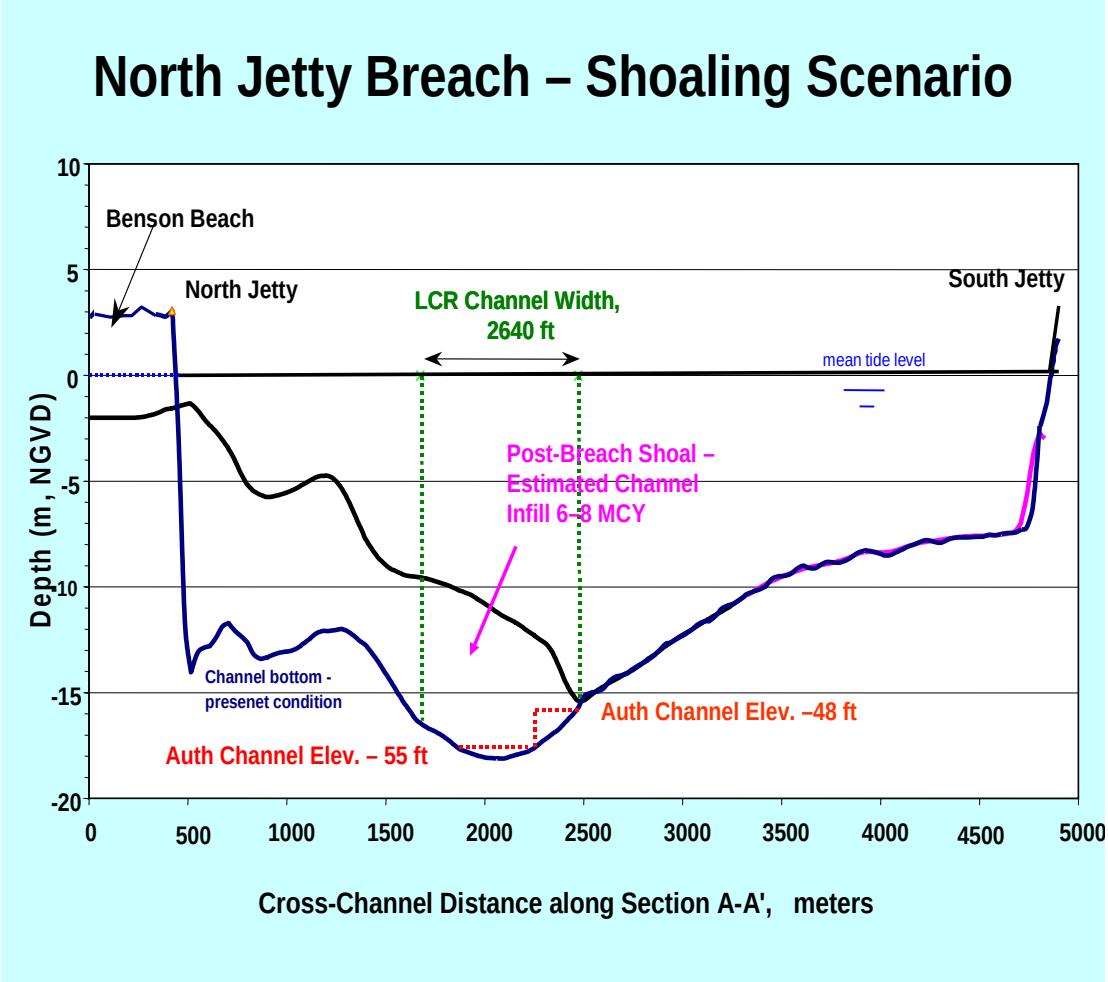
MCR Jetty Repair - Figure 8



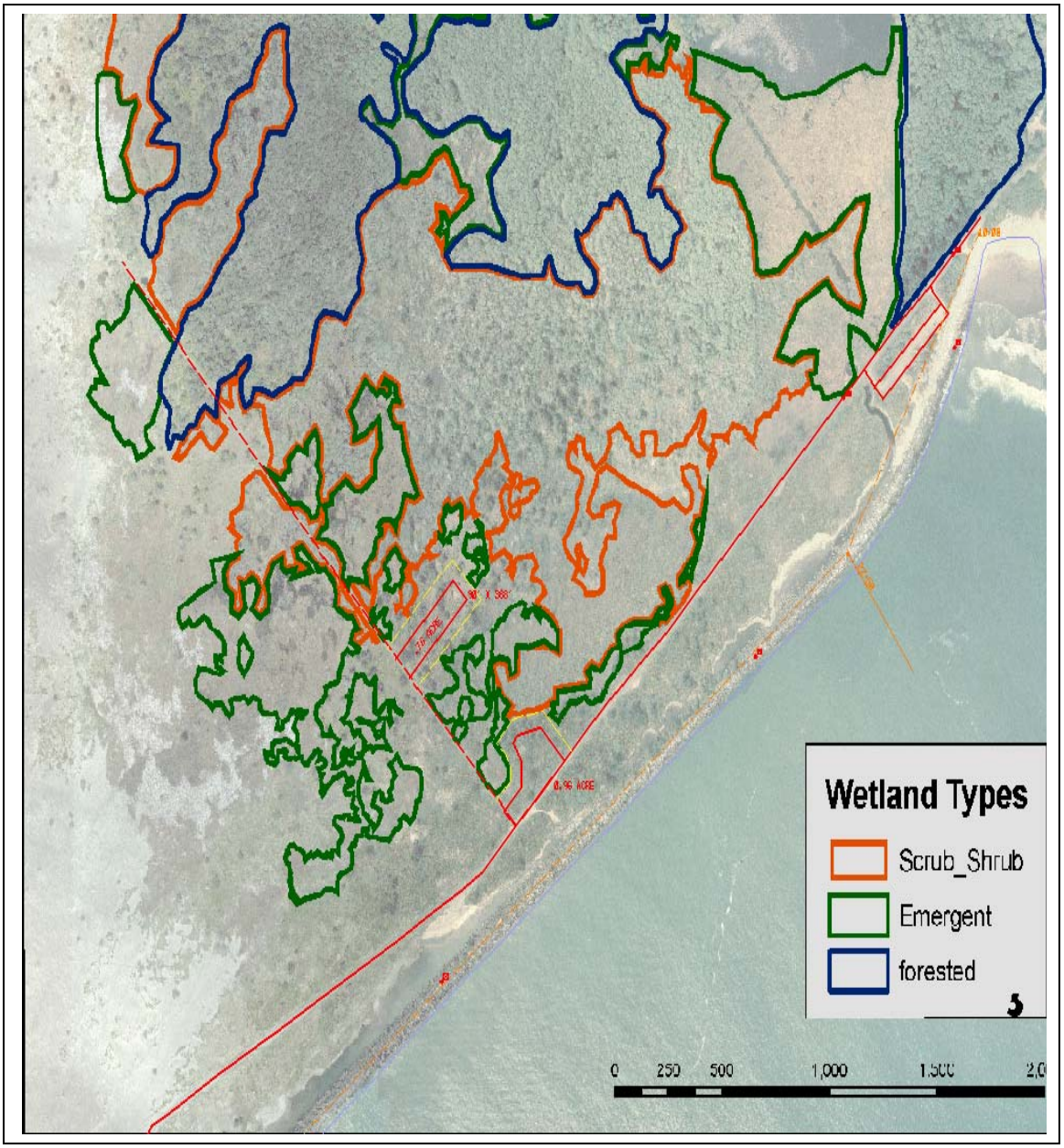
MCR Jetty Repair – Figure 9



MCR Jetty Repair – Figure 10



MCR Jetty Repair – Figure 11



MCR Jetty Repair – Figure 12