BEAR RIVER ESTUARY RESTORATION DRAFT BIOLOGICAL EVALUATION

Report

Prepared for:

Willapa Bay Regional Fisheries Enhancement Group

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Bear River Estuary Restoration
Draft Biological Evaluation

REPORT

Prepared for:

Willapa Bay Regional Fisheries Enhancement Group
P.O. Box 46
South Bend, WA 98586

Attn: Mr. Ron Craig

Authored by:

Kerrie McArthur
Cherry Creek Environmental, Inc.

August 2, 2010

146 N Canal St, Suite 111 • Seattle, WA 98103 • www.cherrycrk.com

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BEAR RIVER ESTUARY RESTORATION DRAFT BIOLOGICAL EVALUATION

EXECUTIVE SUMMARY

The Willapa Bay Regional Fisheries Enhancement Group is applying for a permit from the U.S. Army Corps of Engineers (Corps) to restore 760 acres of intertidal area and obtaining the Corps permit will require compliance with the Endangered Species Act. The restoration will occur by removing about 5.74 miles of existing dike, 38 culverts, 2 fish ladders, 2 tide gates, and 2 foot bridges, and reconnect 18 estuary channels at the southern end of Willapa Bay, just west of the mouth of the Bear River. Increases in noise levels and increases in turbidity during construction have the potential to impact species listed under ESA, but best management practices would be used to reduce these impacts. Therefore, this biological evaluation reaches the following conclusions:

- may affect, not likely to adversely affect North American green sturgeon (*Acipenser medirostris*) or its designated critical habitat;
- may affect, not likely to adversely affect bull trout (*Salvelinus confluentus*) or its designated critical habitat;
- may affect, not likely to adversely affect marbled murrelets (*Brachyramphus marmoratus marmoratus*) or its designated critical habitat; and
- will have no effect on Western snowy plover (*Charadrius alexandrinus nivosus*).

1.0 INTRODUCTION

The Willapa Bay Regional Fisheries Enhancement Group (WBRFEG) is applying for a permit from the U.S. Army Corps of Engineers (Corps) to restore 760 acres of intertidal area. The restoration will occur by removing about 5.74 miles of existing dike, 38 culverts, 2 fish ladders, 2 tide gates, and 2 foot bridges, and reconnect 18 estuary channels at the southern end of Willapa Bay, just west of the mouth of the Bear River. Because this work requires a Section 10 permit from the Corps, it qualifies as an action by a federal agency, and must comply with Section 7 of the Endangered Species Act (ESA). Section 7 of the ESA requires that "actions" of federal agencies should be "not likely to jeopardize the continued existence of any [listed] species or result in the destruction or adverse modification of habitat of such species." Issuance of permits by federal agencies is considered an "action" and therefore falls under this requirement. Under ESA Section 7(c), the Corps is required to produce a biological evaluation (BE) of the potential influence of its action (issuing the permit) on listed species or their critical habitat. To help the Corps evaluate the potential effects of the proposed project on listed species, Cherry Creek Environmental (CCE), has prepared this BE on behave of WBRFEG.

To determine if listed species or their critical habitat are present in the vicinity of the proposed project, on June 28, 2010 CCE consulted the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS 2010); and the U.S. Fish and Wildlife Service (USFWS 2010). Based on information from NMFS and USFWS (Appendix A), the following listed species may occur in the vicinity of the proposed project and are therefore addressed in this BE:

- North American green sturgeon (*Acipenser medirostris*);
- Bull trout (*Salvelinus confluentus*);
- Marbled murrelet (*Brachyramphus marmoratus marmoratus*); and
- Western snowy plover (*Charadrius alexandrinus nivosus*).

Streaked horned lark (*Eremophila alpestris strigata*), a candidate species, will also be addressed. Should the lark become listed during the life of the proposed project, this BE could be used to aid the Corps during any subsequent Section 7 consultation with USFWS.

Based on information from NMFS and USFWS (Appendix A), the following listed species may occur in Pacific County. Because the following species are found on the outer coast or their habitat requirements do not exist in the vicinity of the proposed project, they are not addressed in the BE:

- Columbia River smelt (*Thaleichthys pacificus*);
- southern resident killer whale (*Orcinus orca*)
- humpback whale (*Megaptera novaeangliae*)
- blue whale (*Balaenoptera musculus*)
- fin whale (*Balaenoptera physalus*)
- sei whale (*Balaenoptera borealis*)
- sperm whale (*Physeter macrocephalus*)
- Steller sea lion (*Eumetopias jubatus*);
- leatherback sea turtle *(Dermochelys coriacea)*
- green sea turtle (*Chelonia mydas)*
- olive ridley sea turtle (*Lepidochelys olivacea)*
- loggerhead sea turtle *(Caretta caretta)*
- brown pelican (*Pelecanus occidentalis*)
- northern spotted owl (*Strix occidentalis caurina*);
- Oregon silverspot butterfly (*Speyeria zerene hippolyta*); and
- short-tailed albatross (*Phoebastria albatrus*)

2.0 PROJECT DESCRIPTION

This section provides a brief description of the proposed project area and proposed action.

2.1 Project and Action Areas

The "project area" is within the Willapa National Wildlife Refuge (Refuge) in Pacific County, Washington at Township 10 North, Range 11 West, Sections 1, 6, 7, 11, and 12 and Township 10N, Range 10W, Section 6. The project area is within the Lewis, Porter Point, and Riekkola Units in the Refuge at the southern end of Willapa Bay, just west of the mouth of Bear River. Aerial photographs of the project area and design sheets are in Appendix B.

The "action area" for fish resources is defined as extending from mean higher high water out to the minus 30 feet mean lower low water (MLLW) depth contour, which is the elevation where open water channel depths begin (WNWR 2010). The action area for avian species is defined as a 1-mile radius around the project area.

2.2 Proposed Action Description

Historically, the project site was tidally connected to Willapa Bay. During the late 1940's and early 1950's a large portion of area's salt marsh habitat was eliminated by diking to create pasture lands and freshwater wetlands, believed to enhance overall waterfowl use of the refuge and increase land available for agricultural production. The dike was constructed by excavating a borrow ditch along the shoreward side of the dike. The dike has substantially reduced the amount of historical shoreline habitat and serves as a barrier, reducing nutrient input to the estuary and interrupting the physical, chemical and biological processes of the estuarine system. The conversion of estuarine wetlands to freshwater wetlands and pasture by diking has removed important natural habitat for waterfowl, waterbirds, shorebirds, and salmon as well as many other estuarine-dependent species. Construction of the dike also eliminated fish access to 3 small streams; Lewis Stream, Porter Point Stream and Dolman Creek to the estuary. In 2001, fish ladders were installed into the dikes to restore some fish passage to these creeks.

The proposed project would remove 5.74 miles of existing dike, 38 culverts, 2 fish ladders, 2 tide gates, and 2 foot bridges, and reconnect 18 estuary channels; resulting in up to 760 acres of restored estuarine habitat. Construction details are depicted in Appendix B. The resorted habitat includes reconnection of stream channels to the estuarine environment, open water, intertidal flats, and saltmarsh. The proposed project would provide unrestricted tidal exchange and channels currently isolated landward of the dike will be reconnected to the estuary. The proposed project will assist in improving and maximizing the current estuarine system and contribute to the health of the bay and associated habitats. In addition, the proposed project would reduce or eliminate the extent of a highly invasive exotic plant, reed canarygrass, which currently infests the refuge's freshwater impoundments. Similarly, tussock infestation will also be reduced. Other exotic species, including nutria and bullfrogs, which currently use the freshwater ponds landward of the dike will be eliminated by restoration of estuarine habitat. Juvenile salmon habitat will be restored and other expected benefits include increased waterfowl, waterbird, and shorebird use. Finally, protection and restoration of native

estuarine and nearshore habitats is a major ecoregional and recovery goal in the Pacific Northwest Coast Ecoregional Assessment (TNC and WDFW 2006) and the Northern Pacific Coast Regional Shorebird Management Plan (Drut and Buchanan 2000).

2.2.1 Proposed Construction

The project would be accomplished by removal of dikes, culverts, fish ladders, and tide gates within the Lewis, Porter Point and Riekkola Units in the Refuge. Dikes will be removed completely to grade and material will be removed or used to fill in the associated borrow ditch. Approximately 114,812 cubic yards of fill from the dike will be placed back into the borrow ditch. Fish ladders and tide gates would be demolished and taken off-site for disposal and/or recycling. Heavy equipment utilized will include excavators, bulldozers, scrapers, and agricultural tractors. A detailed narrative of construction techniques and sequencing is in Appendix C. In summary, the first phase of construction would remove a portion of the dike fill, which will create a wider area for construction traffic than driving on the existing top of the dike. Construction would begin at the southern side of the project area, in the Lewis Unit and work northward/westward. In addition to removing the dike, the fish ladders and tide gates will be demolished. The demolished fish ladders and tide gates will be disposed of off-site at an approved location or recycled. Channels will be excavated as close as possible to their historic locations and have been sized so that tidal processes would accelerate the establishment of natural topography and vegetation.

Throughout the project, dewatering will need to occur. Dewatering techniques will be up to the contractor, but the recommended method (Appendix B) will be to create temporary culverts with tide gates. These would be placed in the constructed channels to allow construction traffic access during removal of the dikes and filling of the borrow ditch. This dewatering option would place the culvert and tide gate in the new channel location, Installation of riprap armoring may be necessary during construction, but would be removed when the temporary culvert and tide gate is removed.. As construction within weach unit is completed, these temporary culverts and tide gates would be removed and the channel enlarged to the required design. The advantage to this approach is that it is a passive and automatic approach that maintains the separation between the landward and waterward sides of the dike system.

2.2.2 Project Timeline

The proposed project would be constructed in phases, with each phase occurring during the in-water work window. Since there are three phase, the overall construction period is anticipated to last 3 years. Assuming all permits are received, the project would begin during the in-water work window of 2011. As stated above, work would begin at the southern end of the project area in the Lewis Unit. Removal of the dike and one of the fish ladders within the Lewis Unit would be finished by the end of the 2011 in-water work window. Construction would then stop until the beginning of the 2012 in-water work window. The cross-dike, located between the Lewis and Porter units would remain in place to serve as a sea dike until the 2012 in-water construction season. During 2012, work within the Porter Unit is

expected to occur. That is, dike removal work would begin where it was left off during the 2011 construction season and second fish ladder would be removed with construction continuing to work northward/westward. Removal of the dike and one of the fish ladders within the Porter Unit would be finished by the end of the 201in-water work window. Construction would then stop until the beginning of the 2012 in-water work window. During 2013, work within the Riekkola Unit is expected to occur. That is, dike removal work would begin where it was left off during the 2012 construction season and the proposed project would be completed by 2013.

Prior to leaving the site at the end of each in-water work window, the active construction area would be stabilized to reduce erosion.

2.2.3 Conservation Measures

To avoid impacts to aquatic species, construction would occur during the in-water work window and occur in the dry as much as possible. Although work would occur below the ordinary high water mark, material would not likely be placed when tidal waters have inundated the project area. Additionally, WBRFEG proposes to monitor water quality and dike erosion during and following the first construction season. This information would be used in adaptive management for subsequent phases of construction (AMEC 2010).

Vehicles used in the project area will be routinely inspected for petroleum product or hydraulic fluid leaks, and defective equipment will be serviced before being allowed back into the project area.

3.0 EXISTING ENVIRONMENTAL CONDITIONS AND EFFECTS OF THE ACTION

Presented below are discussions of existing environmental conditions and temporary, permanent, direct, indirect, and net effects of project activities. This section addresses only environmental attributes and habitat qualities important to listed species that may be present in the action area and likely to be affected by the project in some way.

3.1 General

This section describes existing general environmental conditions and effects of the proposed action on the general environmental conditions of the action area.

3.1.1 Existing Conditions

The Bear River Estuary, located in Willapa Bay, is part of the Willapa National Wildlife Refuge. Willapa Bay is the second largest estuary on the Pacific Coast and is one of the most pristine estuaries in the United States. The refuge is over 15,000 acres of tidelands, temperate rainforest, ocean beaches and

small streams. Within the project area the site can be divided into three areas; the Lewis Unit, the Porter's Point Unit, and the Riekkola Unit.

Freshwater impoundments were created behind the dike in the Lewis and Porter's Point units and their water levels are managed to provide freshwater foraging areas for migrating waterfowl, mostly ducks (USFWS 2010). Small seasonal freshwater wetlands are also maintained in the Riekkola Unit. Use of the freshwater impoundments by waterbirds other than waterfowl, include grebes, herons, bitterns, and rails. These shallow, vegetated wetlands provide breeding habitat for red-legged frogs, Pacific tree frogs, roughskin newts and northwestern salamanders. River otters and non-native nutria also use the freshwater impoundments.

Three small streams; Lewis Stream, Porter Point Stream and Dolman Creek flow from the foothills south of the project area to the estuary. However their historic connection was cut off and altered by the dike. To improve fish passage to these streams, fish ladders were installed in 2001. Although the fish ladders have improved fish passage, the conversion of estuarine wetlands to freshwater wetlands and pasture by diking has removed important natural transition habitat from freshwater streams and wetlands to estuaries.

The intertidal portion of the project area is dominated by mudflats and salt marsh. The mudflats consist of fine sediment combined with organic matter. Intertidal mudflats support an abundance of prey invertebrates including oysters, clams, mussels, amphipods, polychaete and oligochaete worms, insect larvae and nematodes. Foraging shorebirds follow the receding tide across the mudflats and fish and waterbirds frequent the mudflats when they are flooded to forage and find refuge (WNWR 2010).

The upper edges of the intertidal flats are ringed by salt tolerant plants which serve as sediment traps and add much organic matter to the estuarine system. Juvenile salmon and other fish find an abundance of food in the marshes, as well as shelter from strong currents and predators. Bald eagles, great blue herons, and other predators are attracted to the abundance of life. The productivity of the marshes is critical to the health of the estuary (WNWR 2010). It is estimated that Willapa Bay originally contained approximately 14,620 acres of saltwater wetlands, but only 5,277 acres remain, a 64% loss of estuarine wetlands (Coastal Resources Alliance 2007 as cited in (WNWR 2010).

No information on ambient noise levels in the Action Area was identified. A WSDOT noise assessment on the San Juan Islands identified a baseline of about 35 dBA, with regular noise intrusions from traffic and aircraft overflights ranging from 45 to 72 dBA (WSDOT 1994). Noise levels from breaking waves has been measured at levels ranging from 55 dBA to 80 dBA (Allan and Komar 2000; Bolin 2009; Tetra Tech 2005). For the purposes of evaluating ambient noise levels within the Project Area, it is assumed that background noise would likely be about 40 dBA.

3.1.2 Effects of the Action

Existing vegetation on the dikes will be permanently removed during the proposed action. Disturbed soils are expected to be colonized quickly by salt tolerant vegetation or converted to intertidal mudflats or stream channels. The streams will be directly reconnected to the estuary through reconstruction of stream channels where the dike was previously. The reconstructed stream channels are designed to provide efficient and unrestricted tidal exchange and effective low tide drainage. This will provide a vast improvement to fish passage in comparison to the existing conditions. Once the dike removal is complete, the proposed project would restore about 760 acres of land to estuarine open water, salt marsh, and intertidal flats.

A variety of construction equipment will likely be used in the project area, depending on the activity that is occurring. Based on average maximum noise levels of different construction equipment, noise levels associated with construction are likely to be around 80 dBA (WSDOT 2010). Based on existing site conditions, an estimated ambient noise level o f40 dBA, and a maximum construction noise level of 80 dBA, construction noise would attenuate to ambient levels at a distance of 15,811 feet. The increased noise level would be temporary and only occur during active construction). Terrestrial animals not used to the increased noise may avoid the immediate work area. Since the construction is occurring in the dry there will be no appreciable increases in underwater noise.

3.2 Water Quality

This section describes existing conditions and expected effects of the proposed action related to water quality in the action area.

3.2.1 Existing Conditions

No information on existing water quality in the action areas was identified. Dissolved oxygen and high temperatures have been determined to be limiting factors affecting the aquatic habitat and fish in the Willapa system (Ecology 2008a), although the action area is not on Ecology's 303d list for these or any other parameters (Ecology 2008b).

3.2.2 Effects of the Action

During active construction and shortly afterward, temporary increases in turbidity are likely to occur. Construction techniques (e.g. dewatering) would be implemented to reduce increases in turbidity. The increases in turbidity are not expected to persist long after construction. Construction activities are not expected to alter dissolved oxygen or temperature conditions in the Action Area. To ensure construction does not significantly impact water quality during construction, temperature, turbidity, and fecal coliform levels would likely be monitored as part of the Hydraulic Project Approval permit.

3.3 Sediment, Substrate, and Bathymetry

This section describes existing conditions and expected effects of the proposed action related to sediment, substrates, and bathymetry in the action area.

3.3.1 Existing Conditions

The dike was constructed mostly with site soils and some imported fill material. Landward of the dike, the substrate is likely fine grained with a high organic content because the area is cut off from tidal exchange and high flows, and is routinely planted with aquatic vegetation. Waterward of the dike, the area is tidal saltmarsh and mudflat. Since the project area was diked and drained, the surface has subsided by approximately 1-3 ft below the natural marsh elevation of mean higher high water (9 ft NAVD) (Vandever 2010).

3.3.1 Effects of the Action

The proposed project will remove the dike, changing surface elevations along the dike from upland to intertidal. Sediment transport will be restored to conditions similar to what existed prior to the construction of the dike. With the removal of the dike and reconnection of the stream channels, bathymetry will be restored to historic or near historic conditions. Removal of the dike will allow tidal exchange to be restored. It is anticipated that the removal of the dike and restoration of tidal exchange, over time, may return the salt marsh surface elevation to the natural elevations of the salt mash outside of the action area.

3.4 Access and Refugia

This section describes existing conditions and expected effects of the proposed action related to refugia and access in the action area.

3.4.1 Existing Conditions

The conversion of estuarine wetlands to freshwater wetlands and pasture following construction of the dikes has eliminated refuge habitat for waterfowl, waterbirds, shorebirds, and estuarine fish (e.g. juvenile salmon, juvenile flatfish, crabs). Three small streams, Lewis Stream, Porter Point Stream and Dolman Creek no longer had a direct connection to the estuary. In 2001, WBRFEG and the Refuge received grants funding to install the two fish ladders in the dikes. Installation of the fish ladders allowed salmonids to access and refuge habitat in the freshwater ponds landward of the dike, but their movements are still restricted from their historical spawning and rearing areas.

3.4.2 Effects of the Action

During construction the temporary culverts would allow access to the freshwater ponds and streams while the fish ladders are removed. Once the dike removal is complete, the proposed project would

restore about 760 acres of land to estuarine open water, salt marsh, and intertidal flats available for access and refuge for fish and wildlife.

3.5 Slope, Shoreline Condition, and Habitat Diversity

This section describes existing conditions and expected effects of the proposed action related to habitat diversity, slopes, and shoreline conditions in the action area.

3.5.1 Existing Conditions

Construction of the dikes converted about 760 acres of land from estuarine open water, salt marsh, and intertidal flats to freshwater ponds, freshwater wetlands, and pasture. The conversion from estuarine habitats to freshwater/upland habitats reduced habitat diversity. Landward of the dikes, the site is currently infested with invasive plant species such as reed canarygrass and tussock and animal species such as nutria and bullfrogs. Waterward of the dike, beyond the dike footprint, the action area is relatively flat and consists of salt marsh, mudflats, and open water.

3.5.2 Effects of the Action

Removal of the dike will restore about 760 acres of land to estuarine open water, salt marsh, and intertidal flats, restore the unrestricted tidal exchange to the three small creeks, and reduce or eliminate non-salt tolerant invasive plants, such as reed canarygrass and tussock and animals, like bullfrogs and nutria within the action area. The proposed project does not include planting the area with native salt marsh vegetation. The Refuge has an existing spartina elimination program and will monitor the site for spartina infestation and eradicate any infestation.

3.6 Flow, Current Patterns, Saltwater–Freshwater Mixing

This section describes existing conditions and expected effects of the proposed action related to flow, current patterns, saltwater–freshwater mixing in the action area.

3.6.1 Existing Conditions

Construction of the dikes and installation of the tide gates altered and reduced the saltwater-freshwater mixing zone and altered current patterns. Currently, saltwater-freshwater mixing s limited within the project area to the areas waterward of the dikes.

3.6.2 Effects of the Action

The proposed project will result in the unrestricted tidal exchange within the project area currently isolated behind the dikes. The proposed project would assist in restoring the estuarine system, including historic current patterns and saltwater-freshwater mixing zones.

3.7 Vegetation

This section describes existing conditions relevant to vegetation and expected effects of the proposed action.

3.7.1 Existing Conditions

Two vegetation communities are dominant in the action area; freshwater wetlands and salt marsh. Freshwater wetland plants include bulrush, cattail, sedges, spikerush, bur-reed, beggarticks, juncus, smartweed, mannagrass, water pennywort, several species of pondweed and duckweed. Native emergent and submerged aquatic plants are present as are non-native invasive species including reed canarygrass, tussock and bog loosestrife.

Salt marsh vegetation include pickleweed, seashore salt grass, jaumea, alkali grass, sea arrow grass, sand-spurry, seaside plantain, and salt marsh wort. Tufted hairgrass, Pacific silverweed, salt marsh bulrush and Lyngbye's sedge are found in higher elevations within the salt marsh, in areas that are occasionally covered by tidal water.

3.7.2 Effects of the Action

The proposed project will eliminate all of the vegetation on the dikes and effectively drain the freshwater impoundments. Areas dominated by non-salt tolerant plant communities will shift to salt tolerant plant communities. The distinction between freshwater wetland and salt mash will no longer be a discrete line (i.e. the dike), but become a natural gradient likely similar to historic conditions. Disturbed soils are expected to revegetate quickly because of the abundant native vegetation in the immediate vicinity will provide a seed source.

3.8 Benthic Epifauna

This section describes existing conditions relevant to benthic epifauna and expected effects of the proposed action in the action area.

3.8.1 Existing Conditions

Currently benthic epifauna are limited to the areas waterward of the dike. Although no studies of species abundance or richness were identified, epibenthic species present within the project area are likely typical of those found in estuarine mudflats.

3.8.2 Effects of the Action

During construction, benthic epifauna living on the dikes will be eliminated during the dike removal process. Benthic epifauna are expected to colonize quickly because of the large area of undisturbed habitat within the action area providing recruitment. Removal of the dike will restore about 760 acres of

land to estuarine area and restore the unrestricted tidal exchange to the three small creeks. Benthic epifauna will be able to colonize within areas where it was unable to prior to the dike removal.

3.9 Forage Fish

This section describes existing conditions relevant to forage fish and expected effects of the proposed action in the action area.

3.9.1 Existing Conditions

Forage fish are limited to estuarine areas of the action area (i.e. waterward of the dike) and are those typically found in estuaries.

3.9.2 Effects of the Action

During construction, forage fish would likely avoid the vicinity where active in-water construction is occurring. However, avoidance of the area is temporary and would not persist after construction. Removal of the dike will restore about 760 acres of land to estuarine area and restore the unrestricted tidal exchange to the three small creeks. Forage fish will be able to utilize newly restored estuarine areas within the action area where it was unable to prior to the dike removal.

4.0 EVALUATION OF EFFECTS ON LISTED SPECIES

This section discusses use by listed species of the action area, describes effects on listed species from project activities (Section 2.2), and provides an effect determination. This section discusses only attributes of listed species that are relevant to the project area and likely to be affected by the project. Life histories for the species discussed in this section are presented in Appendix D. Appendix E describes habitat for federally managed commercial fish species, potential project impacts, and proposed conservation measures.

4.1 North American Green Sturgeon

4.1.1 Stock Status and Critical Habitat

There are no good data on current stock sizes or population trends of the North American green sturgeon (NMFS 2009). NMFS has proposed designating critical habitat for the southern DPS green sturgeon in coastal U.S. marine waters within 110 meters (m) depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including certain coastal bays and estuaries in California, Oregon, and Washington, including Willapa Bay (73 FR 52084).

4.1.2 Use of the Action Area

The North American green sturgeon is present in Willapa Bay (Lindley, et al. 2010), but are not believed to spawn in any mainstem rivers in Willapa Bay (NMFS 2009). Since spawning is not expected to occur in the mainstem rivers of Willapa Bay, use of the bay by green sturgeon is likely limited to foraging and juvenile refuge.

4.1.1 Effects of the Action

During construction, the green sturgeon may avoid the vicinity where elevated turbidity occurs. However, avoidance of the area is temporary and would not persist after active construction. Removal of the dike would restore about 760 acres of land to estuarine area. Green sturgeon will be able to utilize newly restored estuarine areas within the action area.

4.1.2 Effect Determination

Because the proposed project would cause temporary increases in turbidity and restore about 760 acres of estuarine habitat that could be used by green sturgeon for foraging and refuge, this BE concludes that the proposed project may affect, not likely to adversely affect North American green sturgeon or its designated critical habitat.

4.2 Bull Trout

4.2.1 Stock Status and Critical Habitat

Willapa Bay does not have a breeding population of bull trout (WDFW 2000). Therefore, any bull trout in Willapa Bay are likely foraging. While bull trout critical habitat has been designated, no critical habitat for bull trout has been designated in Willapa Bay.

4.2.2 Use of the Action Area

Bull trout using Willapa Bay are believed to use the bay for occasional foraging. The nearest confirmed bull trout was caught in the Willapa River, the mouth of which is approximately 22 miles to the north of the action area. The single fish was caught by a Washington State Department of Fish and Wildlife technician near river mile 29, approximately one mile downstream of the Willapa/Forks Creek State Salmon Hatchery.

4.2.3 Effects of the Action

Bull trout are not expected to use the action area because bull trout are not frequent users of Willapa Bay. However, during construction, any bull trout in the area may avoid the vicinity where elevated turbidity occurs. However, avoidance of the area is temporary and would not persist after active construction. Removal of the dike would restore about 760 acres of land to estuarine area. Any bull trout in Willapa Bay would be able to utilize newly restored estuarine areas within the action area.

4.2.4 Effect Determination

Because the proposed project would cause temporary increases in turbidity and restore about 760 acres of estuarine habitat important that could be used by bull trout, this BE concludes that the proposed project may affect, not likely to adversely affect bull trout or its designated critical habitat.

4.3 Marbled Murrelet

4.3.1 Population Status and Critical Habitat

The estimated population size of marbled murrelets in North America is about 950,000 birds (Huff et al. 2006). Most of these birds occur in Alaska (about 860,000) and Canada (about 55,000 to 78,000). Huff et al (2006) conducted at sea surveys to estimate the marbled murrelet population in the Pacific Northwest (Washington, Oregon, and northern California). The population was estimated at about 22,000 birds, indicating only a small fraction of the total population (2 to 3%) uses the coast of the Pacific Northwest. The four year survey was not sufficient to detect population trends (declines or increases) (Huff et al 2006).

Critical habitat has been designated by USFWS, but there is no critical habitat within the action area (Appendix A). The closest WDFW Marbled Murrelet Detection Sections is about 0.5 mile to the south of the action area (WDFW 2010).

4.3.2 Use of the Action Area

No nesting habitat exists within the action area. Since marbled murrelets forage in nearshore waters, they may fly over the action area to reach foraging habitat near the action area

4.3.3 Effects of the Action

During active construction, increases in noise would occur. Behavioral effects from noise during marbled murrelet foraging occur at 70 dBA (WSDOT 2010). Construction noise would attenuate to the behavioral effects threshold of 70 dBA within 500 feet of the active construction area. However, since marbled murrelet use is likely limited to an occasional fly over, as the birds head out to open water to forage or return to their nests effects from construction noise are expected to be negligible.

4.3.4 Effect Determination

Although the proposed project would cause temporary increases in noise during active construction, marbled murrelet use of the action area is likely limited to occasional fly over's as they fly to and from their nesting sites to foraging sites. Thus, this BE concludes that the proposed project may affect, not likely to adversely affect marbled murrelets or its designated critical habitat.

4.4 *Western Snowy Plover*

4.4.1 Population Status and Critical Habitat

In Washington, snowy plovers formerly nested at five coastal locations but only three sites currently are known to be active (Pearson et al. 2009). The average number of breeding pairs over the four years reported in this study was approximately 25 pairs but the population is declining (Pearson et al. 2009). Critical habitat has been designated by USFWS, but there is no critical habitat within the action area (Appendix A).

4.4.2 Use of the Action Area

The Western snowy plover is found within the refuge in the Leadbetter Point Unit located approximately 15 miles away from the action area. The western snowy plover uses sparsely vegetated coastal dunes and beach, since this type of habitat does not exist within the action area, the Western snowy plover is not expected to be found within the action area.

4.4.3 Effects of the Action

During active construction, increases in noise would occur. However, the Western snowy plover is not expected to be within the action area because their preferred habitat (sparsely vegetated coastal dunes) does not exist in the action area.

4.4.4 Effect Determination

Because the Western snowy plover is not expected to be present in the action area, this BE concludes that the proposed project will have no effect on the Western snowy plover or its designated critical habitat.

4.5 *Streaked Horned Lark*

4.5.1 Population Status

Although no systematic range wide attempt has been made to estimate the total population of the streaked horned lark, results from winter and breeding surveys suggest that the entire population of this species is likely less than 1,000 birds (Pearson and Altman 2005).

4.5.2 Use of the Action Area

Results from these U.S. and Canadian surveys indicate that the streaked horned lark currently breeds on beaches and accreted lands near Grays Harbor and Willapa Bays (Pearson and Altman 2005). However, the streaked horned lark is not expected to be within the action area because their preferred habitat, sparsely vegetated coastal dunes, is not present there.

4.5.3 Effects of the Action

During active construction, increases in noise would occur. However, like the Western snowy plover, the streaked horned lark is not expected to be within the action area because their preferred habitat (sparsely vegetated coastal dunes) does not exist there.

4.5.4 Effect Determination

Because the streaked horned lark is not expected to be present in the action area, this BE concludes that the proposed project will not jeopardize the streaked horned lark or its habitat.

Should the streaked horned lark become listed as threatened or endangered under ESA during the construction of the proposed project, this BE would conclude that the proposed project would have no effect on the streaked horned lark or its designated critical habitat.

5.0 INTERRELATED AND INTERDEPENDENT ACTIONS AND CUMULATIVE EFFECTS

Cumulative effects are effects from state agency or private activities that are reasonably certain to occur within the area of the federal action subject to consultation (50 CFR 402.02 Definitions). The future construction of a trail and viewing platform on the 2,000 lineal feet of remaining dike in the Riekkola Unit would be considered a cumulative action. Federal actions unrelated to the proposed action are not considered in this section, because they require separate consultation pursuant to Section 7 of the Endangered Species Act. Interdependent actions are from actions with no independent utility apart from the proposed action. Interrelated actions include those that are part of a larger action and depend on the larger action for justification.

6.0 SUMMARY

The proposed project has the potential to adversely affect listed species or their habitat. Construction could temporarily increase noise and turbidity and possibly causes listed species to avoid the immediate work area, but best management practices would be used to reduce impacts. Therefore, this biological evaluation reaches the following conclusions:

- may affect, not likely to adversely affect North American green sturgeon or their designated critical habitat;
- may affect, not likely to adversely affect bull trout or their designated critical habitat;
- may affect, not likely to adversely affect marbled murrelets or their designated critical habitat; and

- will have no effect on Western snowy plover or their designated critical habitat.

Similarly, the proposed project will not jeopardize the streaked horned lark, a species proposed for listing. Should the streaked horned lark become listed during the proposed project, this BE reaches the conclusion that the proposed project may affect, not likely to adversely affect the streaked horned lark or their critical habitat.

7.0 CULTURAL RESOURCES ASSESSMENT

Section 106 of the National Historic Preservation Act requires any project receiving federal funds or a federal permit to undergo consultation with the "affected" Native American Tribe(s). To assist the WBRFEG with the Section 106 consultation, a cultural resources assessment was conducted. This assessment included a record search of the Washington State Department f Archaeology and Historic Preservation and a review of the ethnographic ad historical literature on Native American and early Euro-American use of the action area. The results of the review and record search are detailed in Appendix F. In summary, the cultural resources assessment identified two previously documented archaeological resources directly adjacent to the Project's Area of Potential Effects (APE). Sites 45PC125 and 45PC126 are pre-contact fish traps located within the mudflats adjacent to the Bear River channel. Radiocarbon (C-14) dates on the wooden stakes from 45PC126 dated the site to 1,000 Before Present (or approximately 1000 AD). It is anticipated other unknown fish weirs are located within the Bear River watershed due to the limited survey area covered during the original project which documented them.

There are no previously documented Traditional Cultural Properties (TCPs) identified within and/or directly adjacent to the APE. Ethnographic research does identify at least one place name associated with a former village (*nuʔxʷasʔnɬ* - "blackberry town") that was once located near the confluence of Bear River and Willapa Bay. The exact village location is unknown, but it may be closely associated with the previously documented fish traps in the area.

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Appendix A—
ESA listed Species

Endangered Species Act Status of West Coast Salmon & Steelhead

(Updated July 1, 2009)

Species[1]			*Current Endangered Species Act Listing Status*[2]	*ESA Listing Actions Under Review*
Sockeye Salmon (*Oncorhynchus nerka*)	1	Snake River	***Endangered***	
	2	Ozette Lake	***Threatened***	
	3	Baker River	*Not Warranted*	
	4	Okanogan River	*Not Warranted*	
	5	Lake Wenatchee	*Not Warranted*	
	6	Quinalt Lake	*Not Warranted*	
	7	Lake Pleasant	*Not Warranted*	
Chinook Salmon (*O. tshawytscha*)	8	Sacramento River Winter-run	***Endangered***	
	9	Upper Columbia River Spring-run	***Endangered***	
	10	Snake River Spring/Summer-run	***Threatened***	
	11	Snake River Fall-run	***Threatened***	
	12	Puget Sound	***Threatened***	
	13	Lower Columbia River	***Threatened***	
	14	Upper Willamette River	***Threatened***	
	15	Central Valley Spring-run	***Threatened***	
	16	California Coastal	***Threatened***	
	17	Central Valley Fall and Late Fall-run	***Species of Concern***	
	18	Upper Klamath-Trinity Rivers	*Not Warranted*	
	19	Oregon Coast	*Not Warranted*	
	20	Washington Coast	*Not Warranted*	
	21	Middle Columbia River spring-run	*Not Warranted*	
	22	Upper Columbia River summer/fall-run	*Not Warranted*	
	23	Southern Oregon and Northern California Coast	*Not Warranted*	
	24	Deschutes River summer/fall-run	*Not Warranted*	
Coho Salmon (*O. kisutch*)	25	Central California Coast	***Endangered***	
	26	Southern Oregon/Northern California	***Threatened***	
	27	Lower Columbia River	***Threatened***	• Critical habitat
	28	Oregon Coast	***Threatened***	
	29	Southwest Washington	*Undetermined*	
	30	Puget Sound/Strait of Georgia	***Species of Concern***	
	31	Olympic Peninsula	*Not Warranted*	
Chum Salmon (*O. keta*)	32	Hood Canal Summer-run	***Threatened***	
	33	Columbia River	***Threatened***	
	34	Puget Sound/Strait of Georgia	*Not Warranted*	
	35	Pacific Coast	*Not Warranted*	
Steelhead (*O. mykiss*)	36	Southern California	***Endangered***	
	37	Upper Columbia River	***Threatened***	
	38	Central California Coast	***Threatened***	
	39	South Central California Coast	***Threatened***	
	40	Snake River Basin	***Threatened***	
	41	Lower Columbia River	***Threatened***	
	42	California Central Valley	***Threatened***	
	43	Upper Willamette River	***Threatened***	
	44	Middle Columbia River	***Threatened***	
	45	Northern California	***Threatened***	
	46	Oregon Coast	***Species of Concern***	
	47	Southwest Washington	*Not Warranted*	
	48	Olympic Peninsula	*Not Warranted*	
	49	Puget Sound	***Threatened***	• Critical habitat
	50	Klamath Mountains Province	*Not Warranted*	
Pink Salmon (*O. gorbuscha*)	51	Even-year	*Not Warranted*	
	52	Odd-year	*Not Warranted*	

1 The ESA defines a "species" to include any distinct population segment of any species of vertebrate fish or wildlife. For Pacific salmon, NOAA Fisheries Service considers an evolutionarily significant unit, or "ESU," a "species" under the ESA. For Pacific steelhead, NOAA Fisheries Service has delineated distinct population segments (DPSs) for consideration as "species" under the ESA.

Page Title: ESA Other List
URL: http://www.nwr.noaa.gov/Other-Marine-Species/ESA-Other-List.cfm

Other ESA-Listed Species

Under the jurisdiction of NOAA Fisheries that may occur off Washington & Oregon:

- distinct population segment, or DPS, of bocaccio *(Sebastes paucispinis)* (E) in Puget Sound
- distinct population segment, or DPS, of canary rockfish *(Sebastes pinniger)* (T) in Puget Sound
- distinct population segment, or DPS, of yelloweye rockfish *(Sebastes ruberrimus)* (T) in Puget Sound
- southern distinct population segment, or DPS, of eulachon (Columbia River smelt) *(Thaleichthys pacificus)* (T)
- southern distinct population segment, or DPS, of north American green sturgeon (*Acipenser medirostris*) (T), listed in the NOAA Fisheries Southwest Region

(E) = Endangered
(T) = Threatened

Page last updated: 2010-06-15 10:22:36

Page Title: ESA MM List
URL: http://www.nwr.noaa.gov/Marine-Mammals/ESA-MM-List.cfm

ESA-Listed Marine Mammals

Under the jurisdiction of NOAA Fisheries that may occur:

off Washington & Oregon

- Southern Resident killer whale (*Orcinus orca*) (E); critical habitat
- humpback whale *(Megaptera novaeangliae)* (E)
- blue whale *(Balaenoptera musculus)* (E)
- fin whale (*Balaenoptera physalus)* (E)
- sei whale (*Balaenoptera borealis)* (E)
- sperm whale (*Physeter macrocephalus)* (E)
- Steller sea lion *(Eumetopias jubatus)* (T); critical habitat

in Puget Sound

- Southern Resident killer whale *(Orcinus orca*) (E); critical habitat
- humpback whale *(Megaptera novaeangliae)* (E)
- Steller sea lion *(Eumetopias jubatus)* (T); critical habitat

(E) = Endangered
(T) = Threatened

Page last updated: 2010-06-15 11:08:13

Page Title: ESA Turtle List
URL: http://www.nwr.noaa.gov/Other-Marine-Species/ESA-Turtle-List.cfm

ESA-Listed Marine Turtles

Under the jurisdiction of NOAA Fisheries that may occur off Washington & Oregon:

- leatherback sea turtle *(Dermochelys coriacea)* (E)
- green sea turtle (*Chelonia mydas)* (E)
- olive ridley sea turtle (*Lepidochelys olivacea)* (E)
- loggerhead sea turtle *(Caretta caretta)* (T)

Sightings and strandings of these animals are very rare, and there are no breeding beaches in the Northwest Region.

(E) = Endangered
(T) = Threatened

Feb. 19, 2010: NOAA Fisheries extended the comment period on the proposed revision to existing critical habitat for the leatherback turtle under the Endangered Species Act. See the *Federal Register* notice *(PDF 49KB)* for details.

Jan. 5, 2010: NOAA Fisheries proposed to revise and expand critical habitat for the leatherback turtle under the Endangered Species Act. Additional information about this proposal can be found in the links below and on NOAA Fisheries' Office of Protected Resources Website.

- News Release *(PDF 73KB -- links to NOAA Fisheries Website)*
- *Federal Register* notice *(PDF 711KB)*

Page last updated: 2010-06-17 23:03:52

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN IN **PACIFIC COUNTY**

AS PREPARED BY

THE U.S. FISH AND WILDLIFE SERVICE

WESTERN WASHINGTON FISH AND WILDLIFE OFFICE

(Revised November 1, 2007)

LISTED

Brown pelican (*Pelecanus occidentalis*) [outer coast]

Bull trout (*Salvelinus confluentus*)

Marbled murrelet (*Brachyramphus marmoratus*)

Northern spotted owl (*Strix occidentalis caurina*)

Oregon silverspot butterfly (*Speyeria zerene hippolyta*)

Short-tailed albatross (*Phoebastria albatrus*) [outer coast]

Western snowy plover (*Charadrius alexandrinus nivosus*)

Major concerns that should be addressed in your Biological Assessment of project impacts to listed species include:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

DESIGNATED

Critical habitat for the marbled murrelet

Critical habitat for the western snowy plover

PROPOSED

None

CANDIDATE

Streaked horned lark (*Eremophila alpestris strigata*)

SPECIES OF CONCERN

Bald eagle (*Haliaeetus leucocephalus*)
Coastal cutthroat trout (*Oncorhynchus clarki clarki*) [southwest Washington DPS]
Columbia torrent salamander (*Rhyacotriton kezeri*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Makah=s copper (butterfly) (*Lycaena mariposa charlottensis*) [historic]
Newcomb's littorine snail (*Algamorda newcombiana*)
Northern goshawk (*Accipiter gentilis*)
Northern sea otter (*Enhydra lutris kenyoni*)

Olive-sided flycatcher (*Contopus cooperi*)

Pacific lamprey (*Lampetra tridentata*)

Pacific Townsend=s big-eared bat (*Corynorhinus townsendii townsendii*)

Peregrine falcon (*Falco peregrinus*)

River lamprey (*Lampetra ayresi*)

Tailed frog (*Ascaphus truei*)

Van Dyke=s salamander (*Plethodon vandykei*)

Western toad (*Bufo boreas*)

Abronia umbellata ssp. *acutalata* (pink sandverbena)

Dodecatheon austrofrigidum (frigid shootingstar)

Filipendula occidentalis (queen of the forest)

Sanicula arctopoides (footsteps of spring; bear=s-foot sanicle)

Endangered Species Act Section 7 Consultation Form
for
Estuarine Restoration

File #: R1-13552-2010-NS-004

Refuge Name: Willapa National Wildlife Refuge
Address: 3888 State Route 101, Ilwaco, WA 98624
Phone: 360-484-3482

Refuge Action: Restoration of historical estuarine habitat (currently managed pasture and managed freshwater impoundments) is being considered through the CCP (Comprehensive Conservation Plan) process. Estuarine restoration is planned to occur on portions of the Lewis, Porter Point and Riekkola Units within the Willapa National Wildlife Refuge in Pacific County, WA.

Part 1

I. Project Overview

1. Project Location

The proposed project is located at the Willapa National Wildlife Refuge in Pacific County, Washington. The specific project sites are the Lewis, Porter Point and Riekkola Units at the southern end of Willapa Bay. The legal location of the sites is Township 10 North, Range 11 West and Sections 11,12,7,1and 6.

2. Description of the Proposed Action

Historically, the project site was tidally connected to Willapa Bay and the Bear River. Prior actions by the refuge in the late 1940's and early 1950's contributed to loss of this estuarine habitat. At that time, a large portion of refuge salt marsh habitat was eliminated by diking to create pasture lands and freshwater wetlands, believed to enhance overall waterfowl use of the refuge and increase land available for agricultural production. The dikes have substantially reduced the amount of historical shoreline habitat and serve as a barrier, reducing nutrient input to the estuary and interrupting the physical, chemical and biological processes of the estuarine system. Small streams including Lewis stream, Porter Point stream and Dolman creek do not connect directly with the estuary. Although fish ladders were incorporated into two water control structures in the dike system in 2001, anadromous fish species, including salmon, are restricted in their movements to and from spawning and rearing areas. The conversion of estuarine wetlands to freshwater wetlands and pasture by diking has removed important natural habitat for waterfowl, waterbirds, shorebirds, and salmon as well as many other estuarine-dependent species.

The property which consists of managed non-tidal pasture and freshwater impoundments is currently of low quality. During this project up to 2760.2 acres will be restored to

estuarine habitat (includes open water, intertidal flats and salt marsh). Unrestricted tidal exchange will be the goal and historic channels currently isolated within diked areas which are now removed from tidal influence will be reconnected to the Willapa Bay estuary. Such an action will assist in improving and maximizing the current estuarine system and contribute to the health of the bay and associated habitats. The project will be accomplished by removal of dikes and water control structures within the Lewis, Porter Point and Riekkola Units (In Alternative 3 of the CCP the Riekkola Unit will not be restored). Dikes will be removed completely to grade and material will be removed or used to fill in the associated borrow ditch. Partial removal or breaching of dikes will not be considered as problems may result, including restricted tidal penetration and circulation, ponding, and erosion (USFWS 2004). Heavy equipment utilized will include excavators, bulldozers, scrapers, and agricultural tractors. Concentration will be on restoration of functional processes including tidal influences, sediment delivery, native vegetative communities and channel networks. These processes will be instrumental to accomplish associated restoration of historical geomorphology and hydrodynamics. This action will also reduce or eliminate the extent of a highly invasive exotic plant, reed canarygrass, which currently infests the refuge's freshwater impoundments. Tussock infestation will also be reduced. Other exotic species, including nutria and bullfrogs, which currently use the freshwater impoundments will be eliminated by restoration of estuarine habitat. Juvenile salmon habitat will be restored and other expected benefits include increased waterfowl, waterbird, and shorebird use. Protection and restoration of native estuarine and nearshore habitats is a major ecoregional and recovery goal in the North Pacific Coast Ecoregion Plan (1995) and the Northern Pacific Coast Regional Shorebird Management Plan (Drut and Buchanan 2000).

3. Project Timeline

Work on the project will commence in 2011 after approval of the CCP for the Willapa National Wildlife Refuge. It is expected that work will occur in several stages and take several weeks per stage, depending on weather and tides.

4. Federally Listed Species and Critical Habitat

A. Listed species and/or their critical habitat:

Bull trout (*Salvelinus confluentus*) – Federally Threatened. Not found within the refuge or the action area.

Western Snowy Plover (*Charadrius alexandrinus nivosus*) – Federally Threatened. Found within the refuge but not within the action area. No officially designated critical habitat occurs on the refuge.

Marbled Murrelet (*Brachyramphus marmoratus*)– Federally Threatened. Found within the refuge but not within the action area. Occupied sites exist on the refuge but no officially designated critical habitat occurs on the refuge.

B. Proposed species and/or proposed critical habitat: None

C. Candidate species:

Streaked horned lark (*Eremophila alpestris strigata*) – Found within the refuge but not within the action area.

Part 2 – Informal Consultation

II. Effects Analysis

Species:

Bull trout (*Salvelinus confluentus*) – Federally Threatened. Not found within the refuge or the action area. NO EFFECT

Western Snowy Plover (*Charadrius alexandrinus nivosus*) – Federally Threatened. Found within the refuge but not within the action area. No officially designated critical habitat occurs on the refuge. NO EFFECT

Marbled Murrelet (*Brachyramphus marmoratus*)– Federally Threatened. Found within the refuge but not within the action area. Occupied sites exist but no officially designated critical habitat occurs on the refuge. NO EFFECT

Streaked Horned Lark (*Eremophila alpestris strigata*)- Found within the refuge but not within the action area. NO EFFECT

Bull Trout

The Bull Trout is a federally listed threatened species. Bull Trout have not been found in this portion of Willapa Bay. The nearest confirmed Bull Trout was caught in the Willapa River, the mouth of which is approximately 22 miles to the north of the project area. The single fish was caught by a Washington State Department of Fish and Wildlife technician near river mile 29, approximately one mile downstream of the Willapa/Forks Creek State Salmon Hatchery. There is not believed to be a breeding population in the Willapa River, or anywhere off Willapa Bay. Bull Trout are believed to use the Willapa River only for occasional foraging. Due to the distance from the sighting and the rarity of the sighting, we believe that this project will not have any impact on Bull Trout.

Western Snowy Plover

The Western Snowy Plover is a federally listed threatened species. Habitat consists of sparsely vegetated coastal dunes and beach. The Western Snowy Plover is found within the refuge in the Leadbetter Point Unit located approximately 15 miles away from the action area. It is not found within the action area. The project will have no effect on the Western Snowy Plover.

Marbled Murrelet

The Marbled Murrelet is a federally listed threatened species. Marbled Murrelets have been detected on the Long Beach Peninsula in low densities. The nearest terrestrial occupied habitat was documented by WDFW biologists about 2 miles southwest of the project site in T10N, R11W, Section 23. No potential Marbled Murrelet habitat exists at the project site. The project will have no effect on the Marbled Murrelet.

Streaked Horned Lark

The Streaked Horned Lark is a federal candidate species. Habitat consists of sparsely vegetated coastal dunes. The Streaked Horned Lark is found within the refuge in the Leadbetter Point Unit located approximately 15 miles away from the action area. It is not found within the action area. The project will have no effect on the Streaked Horned Lark.

III. Effects Determination and Response Requested:

Determination

A. no effect/no adverse modification

species:__Marbled Murrelet_____status:___Threatened
species:__Western Snowy Plover_____status:____Threatened
species: Streaked Horned Lark status: Threatened
species: Bull Trout status: Threatened
critical habitat:_____

B. may affect, but is not likely to adversely affect species/adversely modify critical habitat

species: status:
species status:

critical habitat:_____

C. may affect, and is likely to adversely affect species/adversely modify critical habitat

species: _____ **status:**_____ *
species:_____ **status:**_____ *
critical habitat:_____ *

D. may affect, and is likely to adversely affect species/adversely modify critical habitat

species: _____ **status: Proposed** **
species: _____ **status: Candidate** **
proposed critical habitat:_____ **

Marci Fernandez _____ __6-28-2010_____
Signature of Preparer **Date**

Evaluation by Project Leader:

1. ***For A & B above:*** **Concurrence __X___ Non-concurrence _____**
2. ***For C above:*** **Formal consultation required _____**
3. ***For D above:*** **Conference required _____**

_____ 6/30/10
Signature of Project Leader **Date**

References:

Drut, M.S. and J.B. Buchanan. 2000. U.S. Shorebird Conservation Plan. Northern Pacific Coast Regional Shorebird Management Plan. U.S. Fish and Wildlife Service, Office of Migratory Bird Management, Portland, Oregon.

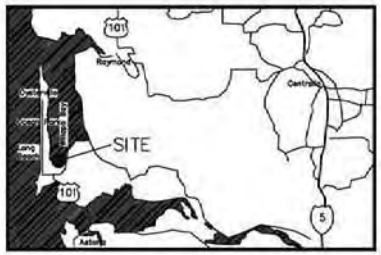
North Pacific Coast Ecoregion Plan (1995) Northern Pacific Coast Regional Shorebird Management Plan (Drut and Buchanan 2000).

U.S. Fish and Wildlife Service. 2004. Nisqually National Wildlife Refuge. Final Comprehensive Conservation Plan and Environmental Impact Statement.

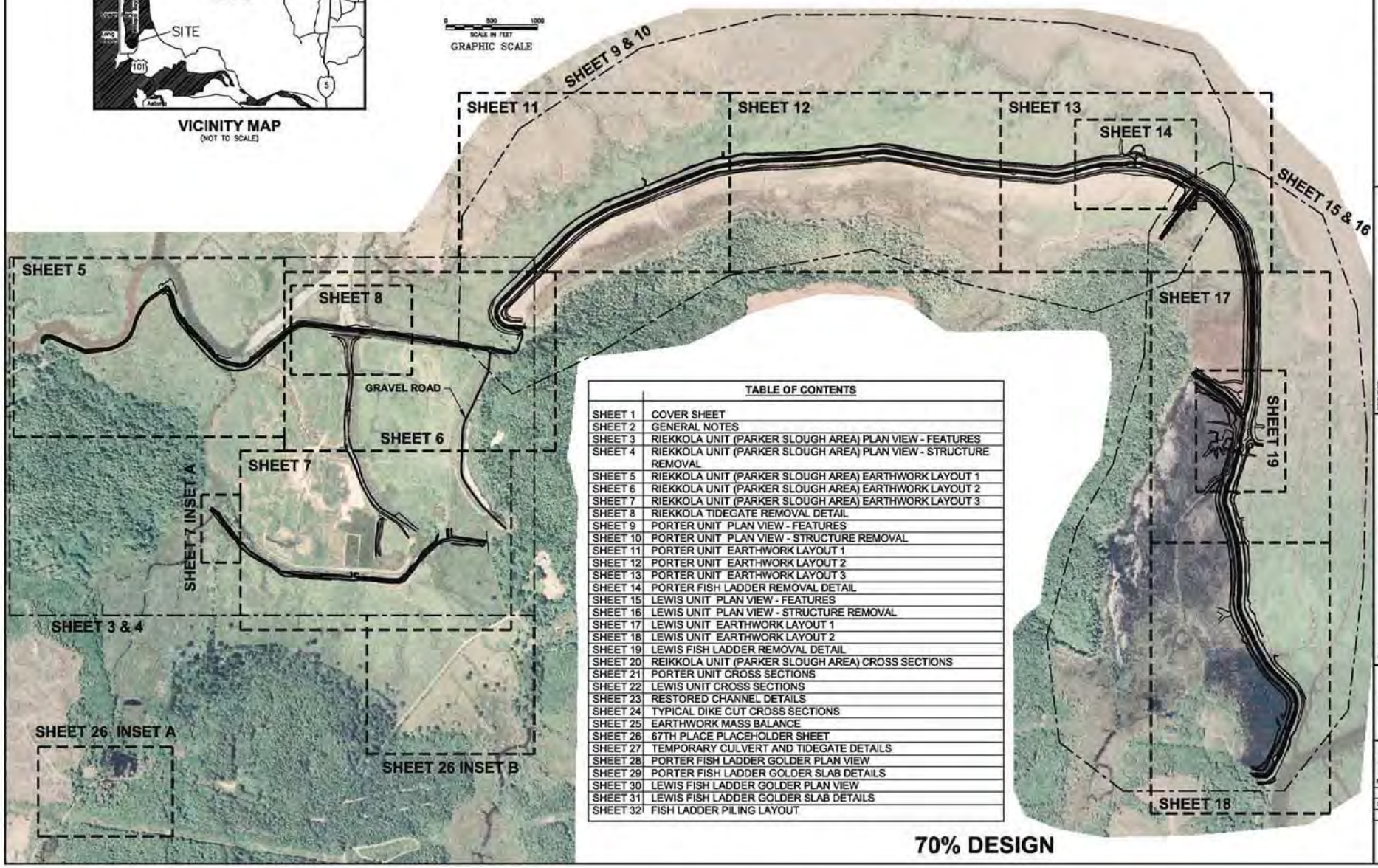
Appendix B—
Design Sheets (AMEC)

BEAR RIVER ESTUARY RESTORATION PROJECT

70% DESIGN
SOUTH WILLAPA BAY
PACIFIC COUNTY, WA



VICINITY MAP
(NOT TO SCALE)



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70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: COVER SHEET

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

Project No.

0-915-15903-0 REV No.

DR: JRS CHK: RB/PS

DATE: JULY 2010

1

SHEET NUMBER

GENERAL CONSTRUCTION NOTES

1. THE DRAWINGS INCLUDE LOCATION, PROFILES, SECTIONS, DETAILS AND NOTES NECESSARY TO DESCRIBE THE WORK AT THE LEVEL OF DETAIL DESIRED BY CLIENT.
2. ALL PERMITS, RIGHTS OF WAYS, AND/OR EASEMENTS THAT ARE APPLICABLE FOR THE CONSTRUCTION AND/OR OPERATION ARE THE RESPONSIBILITY OF THE LANDOWNER/OPERATOR AND SHALL BE AVAILABLE ON SITE DURING CONSTRUCTION.
3. THE CONTRACTOR IS RESPONSIBLE FOR COMPLIANCE WITH ALL LAWS, ORDINANCES, CODES, AND/OR REGULATIONS APPLICABLE FOR THE INSTALLATION.
4. DUE TO THE REMOTE NATURE OF THE PROJECT SITE, THE CONTRACTOR MUST HAVE ACTION PLANS IN PLACE FOR NORMAL OPERATIONS AND CONTINGENCY PLANS ACCOUNTING FOR SITUATIONS SUCH AS SPILLS, SOFT GROUND, STUCK EQUIPMENT, UNANTICIPATED FLOODING, AND OTHER SUCH EVENTS.
5. ALL PUBLIC ACCESS OR HAUL ROADS USED BY THE CONTRACTOR DURING CONSTRUCTION ACTIVITIES PROJECT SHALL BE SPRINKLED OR OTHERWISE TREATED TO FULLY SUPPRESS DUST.
6. ALL CONSTRUCTION EQUIPMENT SHALL BE STAGED IN A LOCATION AND MANNER TO MINIMIZE AIR, SOIL AND WATER POLLUTION.
7. ALL FUEL AND LUBRICANTS SHALL BE STORED IN CONTAINERS AND AREAS THAT ARE IN CONFORMANCE WITH APPLICABLE REGULATIONS.
8. ALL FUEL AND LUBRICANTS USED IN THE SERVICING OF CONSTRUCTION EQUIPMENT SHALL BE DONE IN A MANNER THAT AVOIDS SPILLS AND OVER FILLING.
9. ALL POLLUTION CONTROL MEASURES SHALL BE ADEQUATELY MAINTAINED IN A FUNCTIONAL CONDITION AS LONG AS NEEDED DURING THE CONSTRUCTION OPERATION. ALL TEMPORARY MEASURES SHALL BE REMOVED AND THE SITE RESTORED TO THE ORIGINAL CONDITIONS AS PRACTICABLE.

GENERAL DEMOLITION AND STRUCTURE REMOVAL NOTES

1. STRUCTURES SHALL BE REMOVED TO THE EXTENT AND DEPTH SHOWN ON THE DRAWINGS OR AS DESIGNATED BY THE TECHNICAL REPRESENTATIVE.
2. ALL HAZARDOUS MATERIALS SHALL BE IDENTIFIED PRIOR TO STRUCTURE REMOVAL BY A QUALIFIED INDIVIDUAL AND IDENTIFIED ACCORDINGLY IN A REPORT OR BY DRAWINGS.
3. ALL IDENTIFIED HAZARDOUS MATERIALS SHALL BE DISPOSED OF IN ACCORDANCE WITH APPLICABLE REGULATIONS.

GENERAL DEWATERING NOTES

1. PROTECTIVE MEASURES NEEDED TO DIVERT STREAMFLOW AND OTHER SURFACE WATER SHALL BE BUILT, MAINTAINED AND OPERATED DURING CONSTRUCTION.
2. THE CONSTRUCTION SITE SHALL BE DEWATERED AND KEPT FREE OF STANDING WATER OR EXCESSIVELY MUDDY CONDITIONS AS NEEDED FOR PROPER EXECUTION OF THE CONSTRUCTION WORK. DEWATERING SHALL INCLUDE FURNISHING, INSTALLING, OPERATING AND MAINTAINING ALL EQUIPMENT, SUCH AS PUMPS, AS NEEDED.
3. AFTER THE TEMPORARY WORKS HAVE SERVED THEIR PURPOSES, THEY SHALL BE REMOVED WITHOUT INTERFERING WITH PERMANENT DRAINAGE SYSTEMS OR STREAM FLOWS.
4. ALL TEMPORARY WORKS SHALL BE ACCOMPLISHED IN SUCH A MANNER THAT EROSION AND THE TRANSMISSION OF SEDIMENT AND OTHER POLLUTANTS ARE MINIMIZED.

GENERAL FILL NOTES

1. ALL EARTH CUT AND FILL QUANTITIES LISTED ARE BASED ON IN-PLACE VOLUMES.
2. ALL FILL MATERIAL SHALL BE OBTAINED FROM THE APPROVED EXCAVATION OR BORROW AREAS.
3. MINIMUM WEIGHT OF CONSTRUCTION EQUIPMENT USED FOR COMPACTION SHALL BE 40,000 POUNDS AND THE TRACKS OR WHEELS SHALL TRAVERSE THE ENTIRE SURFACE OF EACH FILL LAYER, OR IF THAT ISN'T POSSIBLE, USE OTHER MEANS TO TAMP OR OTHERWISE REASONABLY CONSOLIDATE AND COMPACT THE MATERIAL.
4. DITCH PLUGS SHALL BE A MINIMUM OF 100 FEET IN LENGTH EXCLUDING SLOPING ENDS OF 3H:1V GRADIENT. PLUG MATERIAL SHALL CONSIST OF THE HIGHEST-QUALITY FINE GRAINED FILL LOCALLY AVAILABLE AND SHALL BE APPROPRIATELY COMPACTED BY TRAVERSING CONSTRUCTION EQUIPMENT OVER THE ENTIRE SURFACE OF THE FILL. ARMOR EXPOSED DITCH PLUG ENDS WITH 1-2 FEET OF SUITABLE COARSE GRAINED MATERIAL, WHERE SUCH MATERIAL IS AVAILABLE.
5. DITCH PLUG DEPICTIONS ON CONSTRUCTION DRAWINGS ARE CONCEPTUAL IN NATURE AND DO NOT REFLECT ACTUAL LINEAL DIMENSIONS. DITCH PLUG FILL VOLUMES SHOWN ON CONSTRUCTION DRAWINGS HAVE BEEN CALCULATED TO MEET OR EXCEED MINIMUM PLUG DIMENSIONS. ACTUAL DIMENSIONS AND VOLUMES WILL VARY BASED UPON LOCAL CONDITIONS.

SITE SURVEY NOTES (CTS ENGINEERS)

BASIS OF BEARING

NAD 83 (1996), WASHINGTON SOUTH ZONE COORDINATES.

HORIZONTAL DATUM

HELD WSDOT HORIZONTAL STATIONS DESCRIBED BELOW:

1. MONUMENT ID 5509 (J 306), US ARMY CORPS OF ENGINEERS BRASS DISK SET INTO A 20CM DIAMETER ROUND CONCRETE MONUMENT THAT PROJECTS 16CM ABOVE THE GROUND. LOCATED ON THE EASTERLY SIDE OF SR 101 BEHIND A LONG RUN OF BEAM GUARDRAIL, 7.79 MILES NORTHEASTERLY FROM JUNCTION OF SR 100 AND SR 101.

   GRID NORTHING: 119736.624 METERS

   GRID EASTING: 234322.002 METERS

2. MONUMENT ID 6547 (TANGENT 1937), US ARMY CORPS OF ENGINEERS BRASS DISK SET IN THE TOP OF A ROUND CONCRETE MONUMENT, WHICH IS SET LEVEL WITH THE GROUND SURFACE. LOCATED ON FORMER SR 101 ALIGNMENT HEADING SOUTHERLY, 80 METERS PASS THROUGH A LOCKED GATE.

   GRID NORTHING: 118712.213 METERS

   GRID EASTING: 234096.237 METERS

VERTICAL DATUM

HELD WSDOT STATIONS DESCRIBED ABOVE:

1. MONUMENT ID 5509 (J 306)

   ELEVATION: 4.284 METERS (NAVD88)

2. MONUMENT ID 6547 (TANGENT 1937)

   ELEVATION: 4.463 METERS (NAVD88)

3. GRID COORDINATES AND ELEVATIONS WERE TRANSFORMED TO STATE PLANE COORDINATES (WA SOUTH) THROUGH CORPSCON VER. 6.0.1 (www.tec.army.mil)

SURVEY EQUIPMENT

1. CONVENTIONAL AND GPS SURVEY EQUIPMENTS WERE USED IN THE PERFORMANCE OF THIS SURVEY. ALL EQUIPMENT IS MAINTAINED IN CONFORMANCE WITH CURRENT STATE STATUTE.

SURVEY PROCEDURES

1. OREGON REAL-TIME GPS NETWORK (ORGN), PROVIDED BY OREGON DOT WAS UTILIZED TO PROVIDE RTK MEASUREMENTS IN THIS PROJECT.
2. FIELD TRAVERSE METHOD MEETS OR EXCEEDS MINIMUM REQUIREMENTS IN ACCORDANCE WITH WAC 332-130-090.

ADDITIONAL NOTES

1. ELEVATIONS SHOWN IN THIS SURVEY ARE IN US SURVEY FEET.

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: GENERAL NOTES

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
1100 Dexter Avenue North, Seattle, WA 98109-5001
Phone: (425) 395-1000 Fax: (425) 395-001

BEAR RIVER ESTUARY RESTORATION

Project No. 0-915-16933-0 | REV No. 3

DR: JRS | CHK: RB/PS

DATE: JULY 2010

2

SHEET NUMBER

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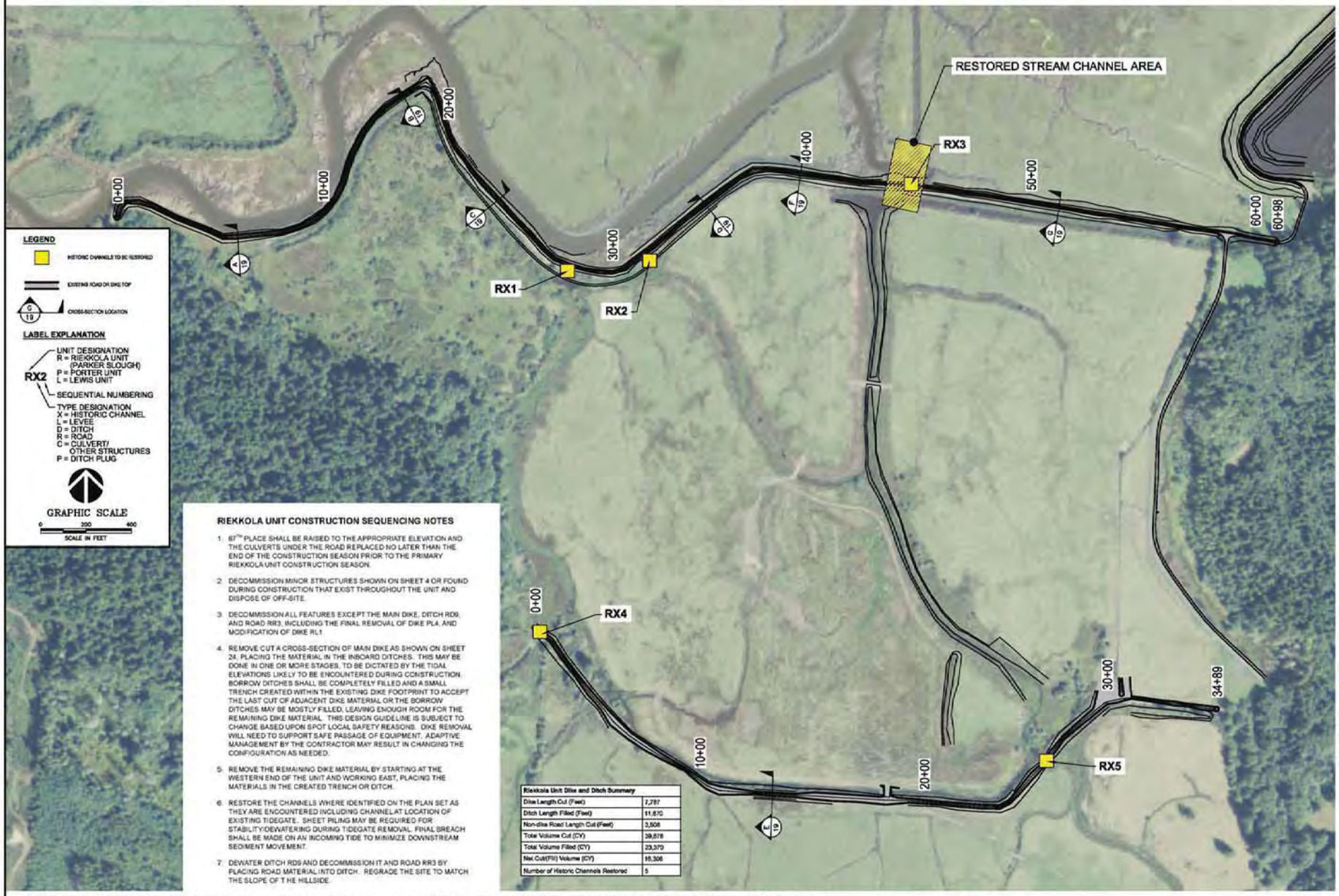


RIEKKOLA UNIT CONSTRUCTION SEQUENCING NOTES

1. 67TH PLACE SHALL BE RAISED TO THE APPROPRIATE ELEVATION AND THE CULVERTS UNDER THE ROAD REPLACED NO LATER THAN THE END OF THE CONSTRUCTION SEASON PRIOR TO THE PRIMARY RIEKKOLA UNIT CONSTRUCTION SEASON.
2. DECOMMISSION MINOR STRUCTURES SHOWN ON SHEET 4 OR FOUND DURING CONSTRUCTION THAT EXIST THROUGHOUT THE UNIT AND DISPOSE OF OFF-SITE.
3. DECOMMISSION ALL FEATURES EXCEPT THE MAIN DIKE, DITCH RD9, AND ROAD RR3, INCLUDING THE FINAL REMOVAL OF DIKE PL4, AND MODIFICATION OF DIKE RL1.
4. REMOVE CUT A CROSS-SECTION OF MAIN DIKE AS SHOWN ON SHEET 24, PLACING THE MATERIAL IN THE INBOARD DITCHES. THIS MAY BE DONE IN ONE OR MORE STAGES, TO BE DICTATED BY THE TIDAL ELEVATIONS LIKELY TO BE ENCOUNTERED DURING CONSTRUCTION. BORROW DITCHES SHALL BE COMPLETELY FILLED AND A SMALL TRENCH CREATED WITHIN THE EXISTING DIKE FOOTPRINT TO ACCEPT THE LAST CUT OF ADJACENT DIKE MATERIAL OR THE BORROW DITCHES MAY BE MOSTLY FILLED, LEAVING ENOUGH ROOM FOR THE REMAINING DIKE MATERIAL. THIS DESIGN GUIDELINE IS SUBJECT TO CHANGE BASED UPON SPOT LOCAL SAFETY REASONS. DIKE REMOVAL WILL NEED TO SUPPORT SAFE PASSAGE OF EQUIPMENT. ADAPTIVE MANAGEMENT BY THE CONTRACTOR MAY RESULT IN CHANGING THE CONFIGURATION AS NEEDED.
5. REMOVE THE REMAINING DIKE MATERIAL BY STARTING AT THE WESTERN END OF THE UNIT AND WORKING EAST, PLACING THE MATERIALS IN THE CREATED TRENCH OR DITCH.
6. RESTORE THE CHANNELS WHERE IDENTIFIED ON THE PLAN SET AS THEY ARE ENCOUNTERED INCLUDING CHANNEL AT LOCATION OF EXISTING TIDEGATE. SHEET PILING MAY BE REQUIRED FOR STABILITY/DEWATERING DURING TIDEGATE REMOVAL. FINAL BREACH SHALL BE MADE ON AN INCOMING TIDE TO MINIMIZE DOWNSTREAM SEDIMENT MOVEMENT.
7. DEWATER DITCH RD9 AND DECOMMISSION IT AND ROAD RR3 BY PLACING ROAD MATERIAL INTO DITCH. REGRADE THE SITE TO MATCH THE SLOPE OF THE HILLSIDE.

Riekkola Unit Dike and Ditch Summary	
Dike Length Cut (Feet)	7,787
Ditch Length Filled (Feet)	11,670
Non-dike Road Length Cut (Feet)	3,508
Total Volume Cut (CY)	39,878
Total Volume Filled (CY)	23,370
Net Cut(Fill) Volume (CY)	16,306
Number of Historic Channels Restored	5

NOTE: USFWS REFERS TO THIS AREA AS THE RIEKKOLA UNIT (PARKER SLOUGH AREA), AND THIS CONVENTION IS FOLLOWED THROUGHOUT THIS PLAN SET. TARLATT SLOUGH IS LOCATED ALONG THE OUTBOARD DIKE, AND PARKER SLOUGH IS WITHIN THIS AREA.

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: RIEKKOLA UNIT (PARKER SLOUGH AREA) PLAN VIEW - FEATURES

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental
11512 North Creek Parkway North, Suite 110, Bothell, WA, U.S.A. 98011-8201
Phone: (425) 369-1000 Fax: (425) 369-1001

BEAR RIVER ESTUARY RESTORATION

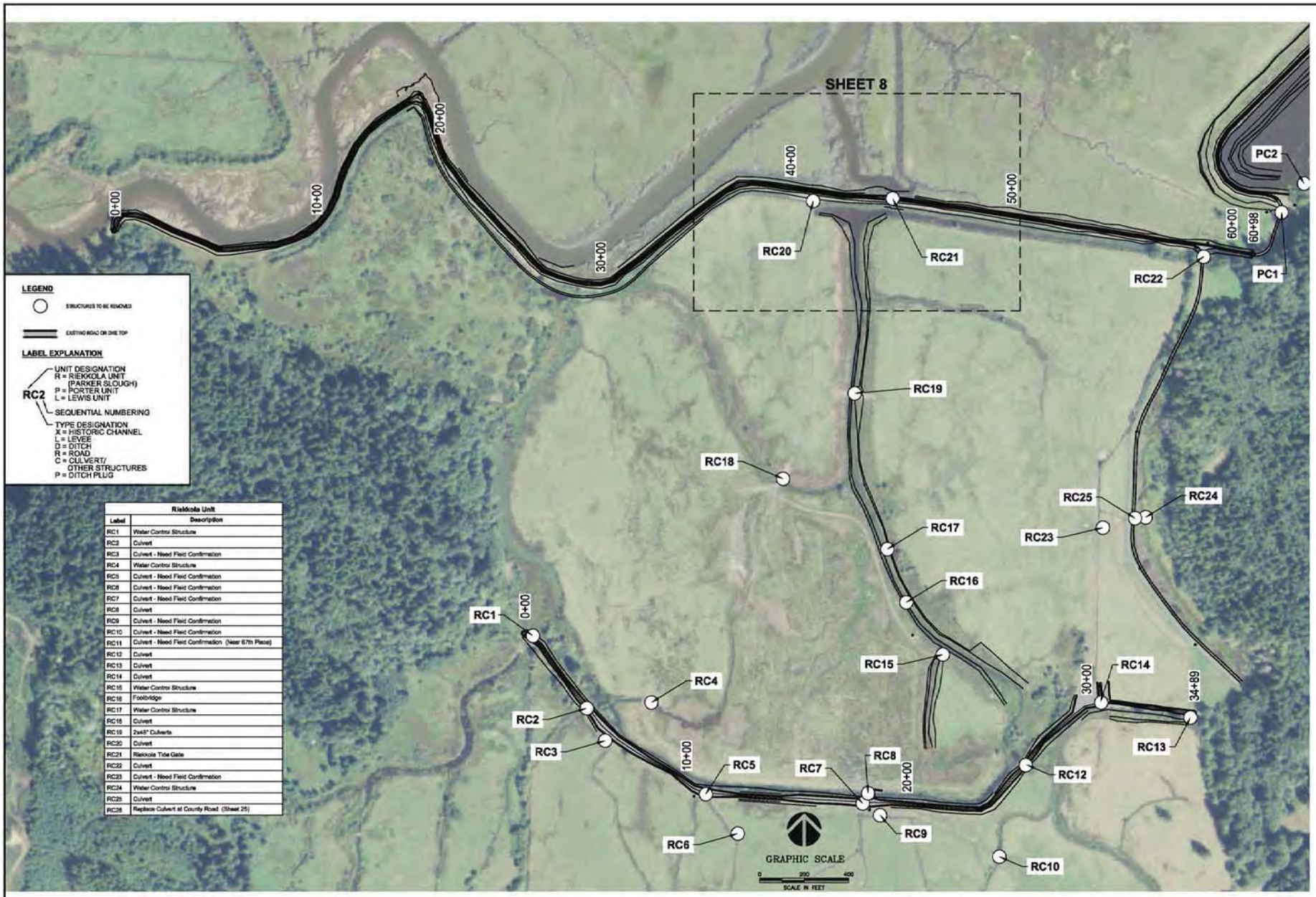
Project No. 0-915-15933-0 | REV No.

DR: JRS | CHK: RB/PS

DATE: JULY 2010

3

SHEET NUMBER



Riekkola Unit	
Label	Description
RC1	Water Control Structure
RC2	Culvert
RC3	Culvert - Need Field Confirmation
RC4	Water Control Structure
RC5	Culvert - Need Field Confirmation
RC6	Culvert - Need Field Confirmation
RC7	Culvert - Need Field Confirmation
RC8	Culvert
RC9	Culvert - Need Field Confirmation
RC10	Culvert - Need Field Confirmation
RC11	Culvert - Need Field Confirmation (Near 67th Place)
RC12	Culvert
RC13	Culvert
RC14	Culvert
RC15	Water Control Structure
RC16	Footbridge
RC17	Water Control Structure
RC18	Culvert
RC19	2x48" Culverts
RC20	Culvert
RC21	Riekkola Tide Gate
RC22	Culvert
RC23	Culvert - Need Field Confirmation
RC24	Water Control Structure
RC25	Culvert
RC26	Replace Culvert at County Road (Sheet 25)

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: RIEKKOLA UNIT (PARKER SLOUGH AREA) PLAN VIEW - STRUCTURE REMOVAL

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

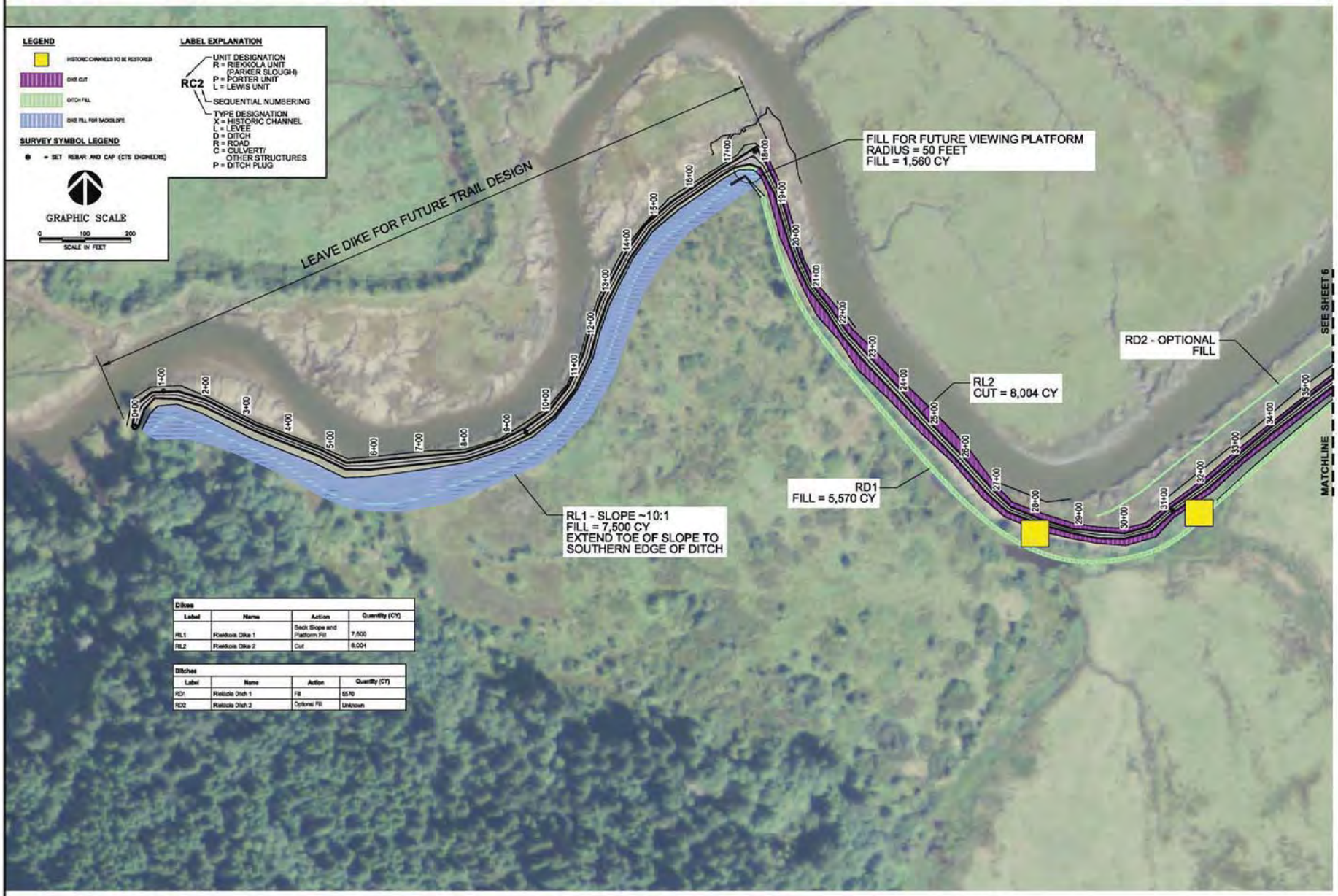
Project No.

DR: JRS CHK: RB/FS

DATE: JULY 2010

4

SHEET NUMBER



Dikes

Label	Name	Action	Quantity (CY)
RL1	Riekkola Dike 1	Back Slope and Platform Fill	7,500
RL2	Riekkola Dike 2	Cut	8,004

Ditches

Label	Name	Action	Quantity (CY)
RD1	Riekkola Ditch 1	Fill	5570
RD2	Riekkola Ditch 2	Optional Fill	Unknown

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: RIEKKOLA UNIT (PARKER SLOUGH AREA) EARTHWORK LAYOUT 1

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA U.S.A. 98011-8201
Phone: (425) 368-1000 Fax: (425) 368-1001

BEAR RIVER ESTUARY RESTORATION

Project No.

04915-15930-0	REV No.
DR: JRS	CHK: RB/PS

DATE: JULY 2010

5

SHEET NUMBER

Dikes

Label	Name	Action	Quantity (CY)
RL3	Riekkola Dike 3	Cut	11758
PL1	Porter Dike 1	Cut	3881

Ditches

Label	Name	Action	Quantity (CY)
RD3	Riekkola Ditch 3	Fill	1481
RD4	Riekkola Ditch 4	Optional Fill	Unknown
RD5	Riekkola Ditch 5	Fill	5333
RD6	Riekkola Ditch 6	Fill	From adjacent road
RD7	Riekkola Ditch 7	Fill	107
PD1	Porter Ditch 1	Fill	5095

Plugs

Label	Name	Quantity (CY)
PP1	Porter Plug 1	65

Roads

Label	Name	Action	Quantity (CY)
RR1	Riekkola Road 1	Cut	Unknown

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: RIEKKOLA UNIT (PARKER SLOUGH AREA) EARTHWORK LAYOUT 2

CLIENT: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

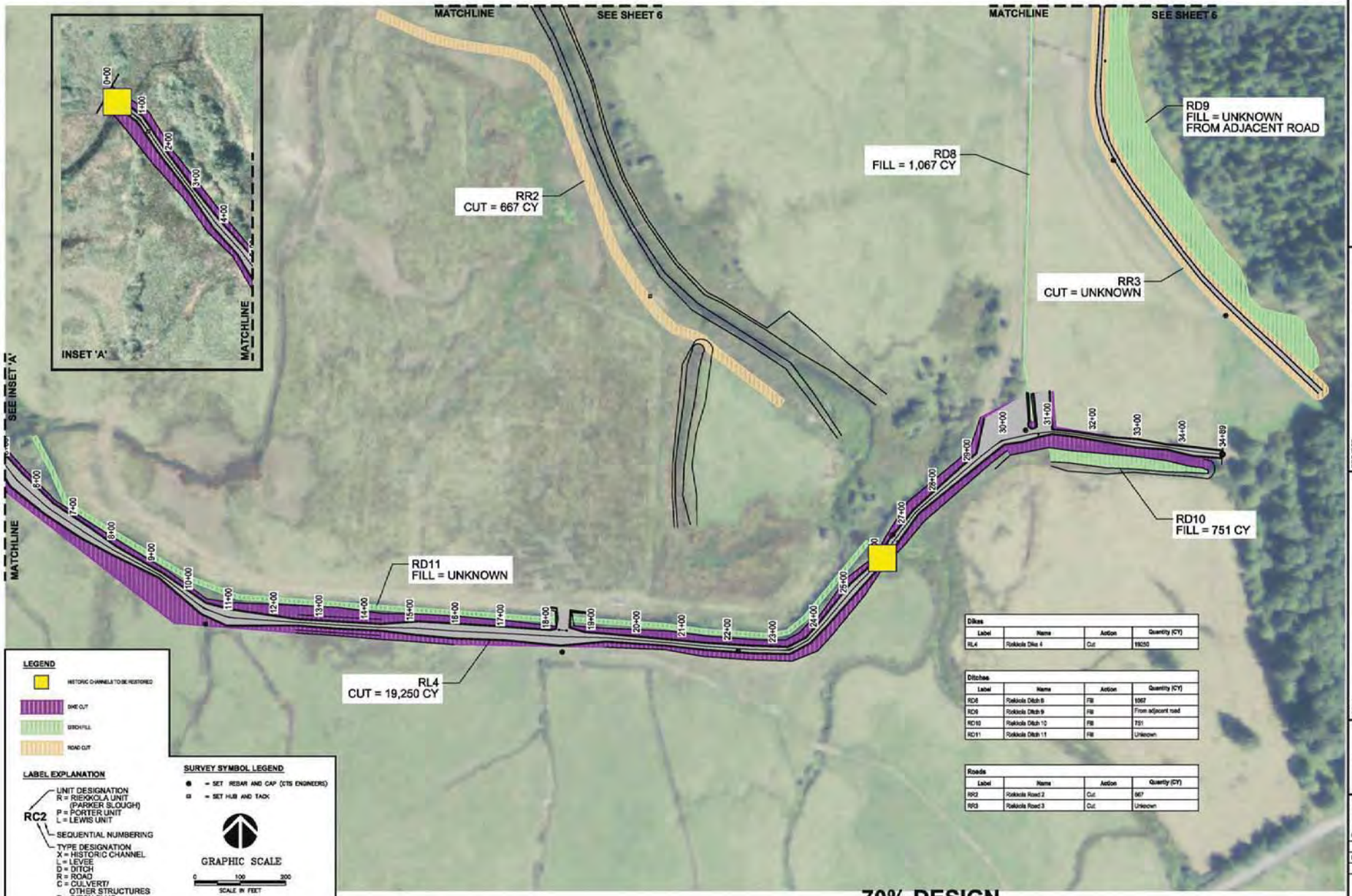
Project No: 0-615-16533-0 REV No.

DR: JRB CHK: RBJPB

DATE: JULY 2010

6

SHEET NUMBER



Dikes

Label	Name	Action	Quantity (CY)
RL4	Riekkola Dike 4	Cut	19250

Ditches

Label	Name	Action	Quantity (CY)
RD8	Riekkola Ditch 8	Fill	1067
RD9	Riekkola Ditch 9	Fill	From adjacent road
RD10	Riekkola Ditch 10	Fill	751
RD11	Riekkola Ditch 11	Fill	Unknown

Roads

Label	Name	Action	Quantity (CY)
RR2	Riekkola Road 2	Cut	667
RR3	Riekkola Road 3	Cut	Unknown

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: RIEKKOLA UNIT (PARKER SLOUGH AREA) EARTHWORK LAYOUT 3

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

Project No.

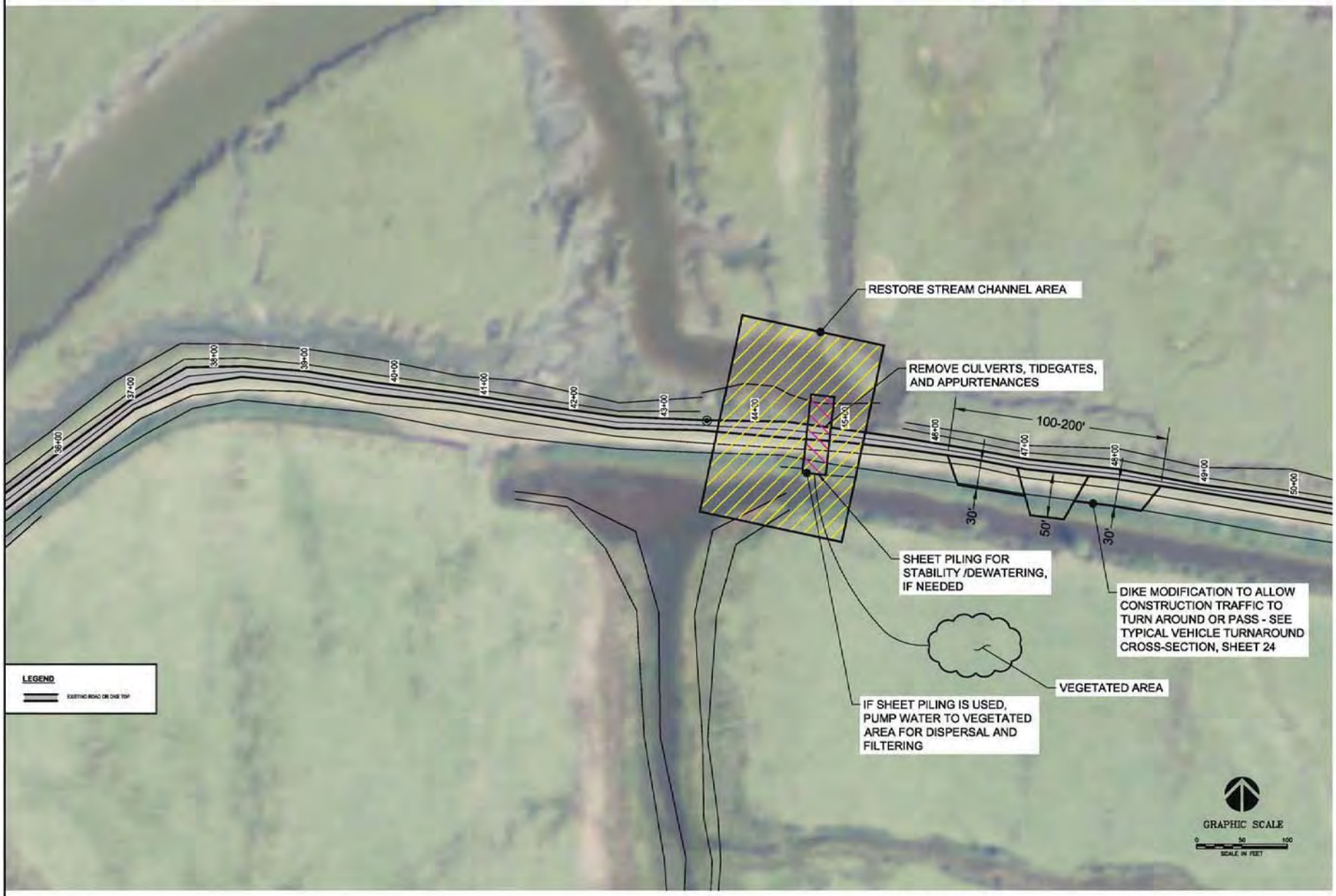
0-915-10930-0 | REV No.

DR. JRB | CHK RB/PB

DATE: JULY 2010

7

SHEET NUMBER



70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: RIEKKOLA (PARKER SLOUGH AREA) TIDEGATE REMOVAL DETAIL

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

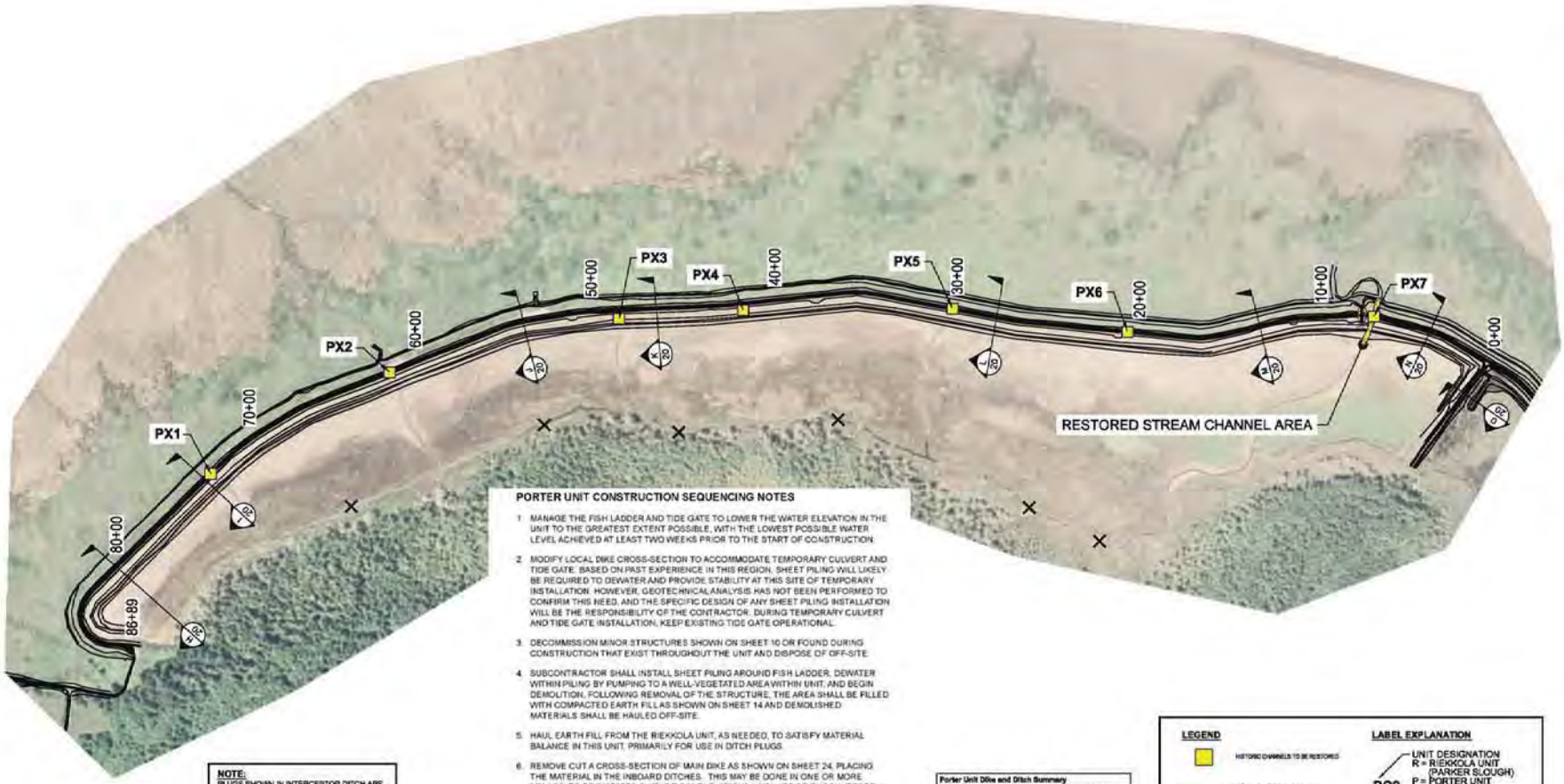
Project No.

5-915-19930-0	REV No.
DR: JRS	CHK: RB/PS

DATE: JULY 2010

8

SHEET NUMBER



NOTE:
PLUGS SHOWN IN INTERCEPTOR DITCH ARE REPRESENTATIONS OF THE INTENT TO REDIRECT FLOWS THROUGH RESTORED STREAM CROSSINGS AFTER THEY HAVE BEEN OPENED UP. NO SURVEYS OR QUANTITY CALCULATIONS HAVE BEEN COMPLETED FOR THESE PLUGS. MATERIAL CUTS AND FILLS WILL BE LOCALIZED.

PORTER UNIT CONSTRUCTION SEQUENCING NOTES

1. MANAGE THE FISH LADDER AND TIDE GATE TO LOWER THE WATER ELEVATION IN THE UNIT TO THE GREATEST EXTENT POSSIBLE, WITH THE LOWEST POSSIBLE WATER LEVEL ACHIEVED AT LEAST TWO WEEKS PRIOR TO THE START OF CONSTRUCTION.
2. MODIFY LOCAL DIKE CROSS-SECTION TO ACCOMMODATE TEMPORARY CULVERT AND TIDE GATE. BASED ON PAST EXPERIENCE IN THIS REGION, SHEET PILING WILL LIKELY BE REQUIRED TO DEWATER AND PROVIDE STABILITY AT THIS SITE OF TEMPORARY INSTALLATION. HOWEVER, GEOTECHNICAL ANALYSIS HAS NOT BEEN PERFORMED TO CONFIRM THIS NEED, AND THE SPECIFIC DESIGN OF ANY SHEET PILING INSTALLATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. DURING TEMPORARY CULVERT AND TIDE GATE INSTALLATION, KEEP EXISTING TIDE GATE OPERATIONAL.
3. DECOMMISSION MINOR STRUCTURES SHOWN ON SHEET 10 OR FOUND DURING CONSTRUCTION THAT EXIST THROUGHOUT THE UNIT AND DISPOSE OF OFF-SITE.
4. SUBCONTRACTOR SHALL INSTALL SHEET PILING AROUND FISH LADDER, DEWATER WITHIN PILING BY PUMPING TO A WELL-VEGETATED AREA WITHIN UNIT, AND BEGIN DEMOLITION. FOLLOWING REMOVAL OF THE STRUCTURE, THE AREA SHALL BE FILLED WITH COMPACTED EARTH FILL AS SHOWN ON SHEET 14 AND DEMOLISHED MATERIALS SHALL BE HAULED OFF-SITE.
5. HAUL EARTH FILL FROM THE RIEKKOLA UNIT, AS NEEDED, TO SATISFY MATERIAL BALANCE IN THIS UNIT, PRIMARILY FOR USE IN DITCH PLUGS.
6. REMOVE CUT A CROSS-SECTION OF MAIN DIKE AS SHOWN ON SHEET 24, PLACING THE MATERIAL IN THE INBOARD DITCHES. THIS MAY BE DONE IN ONE OR MORE STAGES, TO BE DICTATED BY THE TIDAL ELEVATIONS LIKELY TO BE ENCOUNTERED DURING CONSTRUCTION. BORROW DITCHES SHALL BE COMPLETELY FILLED AND A SMALL TRENCH CREATED WITHIN THE EXISTING DIKE FOOTPRINT TO ACCEPT THE LAST CUT OF ADJACENT DIKE MATERIAL OR THE BORROW DITCHES MAY BE MOSTLY FILLED, LEAVING ENOUGH ROOM FOR THE REMAINING DIKE MATERIAL. THIS DESIGN GUIDELINE IS SUBJECT TO CHANGE BASED UPON SPOT LOCAL SAFETY REASONS. DIKE REMOVAL WILL NEED TO SUPPORT SAFE PASSAGE OF EQUIPMENT. ADAPTIVE MANAGEMENT BY THE CONTRACTOR MAY RESULT IN CHANGING THE CONFIGURATION AS NEEDED.
7. REMOVE THE REMAINING DIKE MATERIAL BY STARTING AT THE EASTERN END OF THE UNIT AND WORKING WEST, PLACING THE MATERIALS IN THE CREATED TRENCH OR DITCH.
8. RESTORE THE CHANNELS WHERE IDENTIFIED ON THE PLAN SET AS THEY ARE ENCOUNTERED. FINAL BREACH SHALL BE MADE ON AN INCOMING TIDE TO MINIMIZE DOWNSTREAM SEDIMENT MOVEMENT.
9. REMOVE TEMPORARY CULVERT AND TIDE GATE WHEN LOCAL CHANNEL IS RESTORED.
10. CREATE MINOR PLUGS IN INTERCEPTOR DITCH AND RESTORE CHANNEL CONNECTIONS BETWEEN THE UPSLOPE PART OF THE UNIT AND THE RESTORED CHANNELS.

Porter Unit Dike and Ditch Summary	
Dike Length Cut (Feet)	9,278
Ditch Length Filled (Feet)	8,893
Total Volume Cut (CY)	44,832
Total Volume Filled (CY)	47,843
Net Cut(Fill) Volume (CY)	(3,011)
Number of Historic Channels Restored	7

LEGEND

- HISTORIC CHANNELS TO BE RESTORED
- EXISTING ROAD OR DIKE TOP
- 0 / 20 CROSS-SECTION LOCATION
- × INTERCEPTOR DITCH PLUGS

LABEL EXPLANATION

PC2
- UNIT DESIGNATION
  - R = RIEKKOLA UNIT (PARKER SLOUGH)
  - P = PORTER UNIT
  - L = LEWIS UNIT
- SEQUENTIAL NUMBERING
- TYPE DESIGNATION
  - X = HISTORIC CHANNEL
  - L = LEVEE
  - D = DITCH
  - R = ROAD
  - C = CULVERT/ OTHER STRUCTURES
  - P = DITCH PLUG

GRAPHIC SCALE
0 300 600
SCALE IN FEET

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

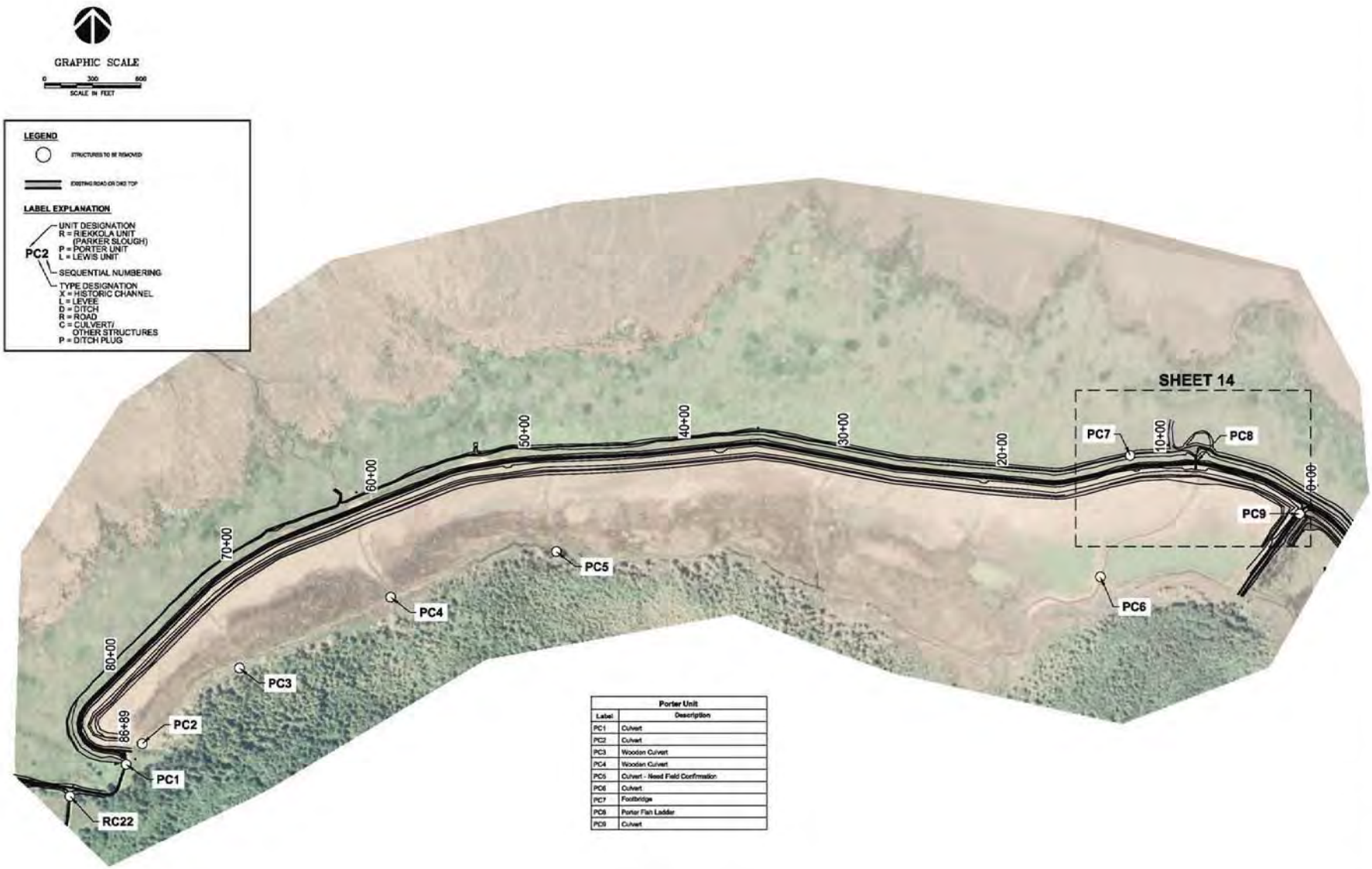
TITLE: PORTER UNIT PLAN VIEW - FEATURES

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11820 North Creek Parkway N, Suite 100, Bothell, WA 98011-8201
Phone (425) 820-5000 Fax (425) 820-5001

BEAR RIVER ESTUARY RESTORATION
Project No. 0-915-10603-0 REV No.
DR. JRS CHK. RSP/TG
DATE: JULY 2010

9
SHEET NUMBER



Porter Unit	
Label	Description
PC1	Culvert
PC2	Culvert
PC3	Wooden Culvert
PC4	Wooden Culvert
PC5	Culvert - Need Field Confirmation
PC6	Culvert
PC7	Footbridge
PC8	Porter Fish Ladder
PC9	Culvert

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER UNIT PLAN VIEW - STRUCTURE REMOVAL

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

Project No.

5-915-19930-0 REV No.

DR: JRS CHK: RS/FS

DATE: JULY 2010

10

SHEET NUMBER

LEGEND

- HISTORIC CHANNEL TO BE RESTORED
- DIKE CUT
- DITCH FILL

LABEL EXPLANATION

PC2
- UNIT DESIGNATION
  - R = RIEKKOLA UNIT (PARKER SLOUGH)
  - P = PORTER UNIT
  - L = LEWIS UNIT
- SEQUENTIAL NUMBERING
- TYPE DESIGNATION
  - X = HISTORIC CHANNEL
  - L = LEVEE
  - D = DITCH
  - R = ROAD
  - C = CULVERT/ OTHER STRUCTURES
  - P = DITCH PLUG

SURVEY SYMBOL LEGEND

● = SET REBAR AND CAP (CTS ENGINEERS)

GRAPHIC SCALE

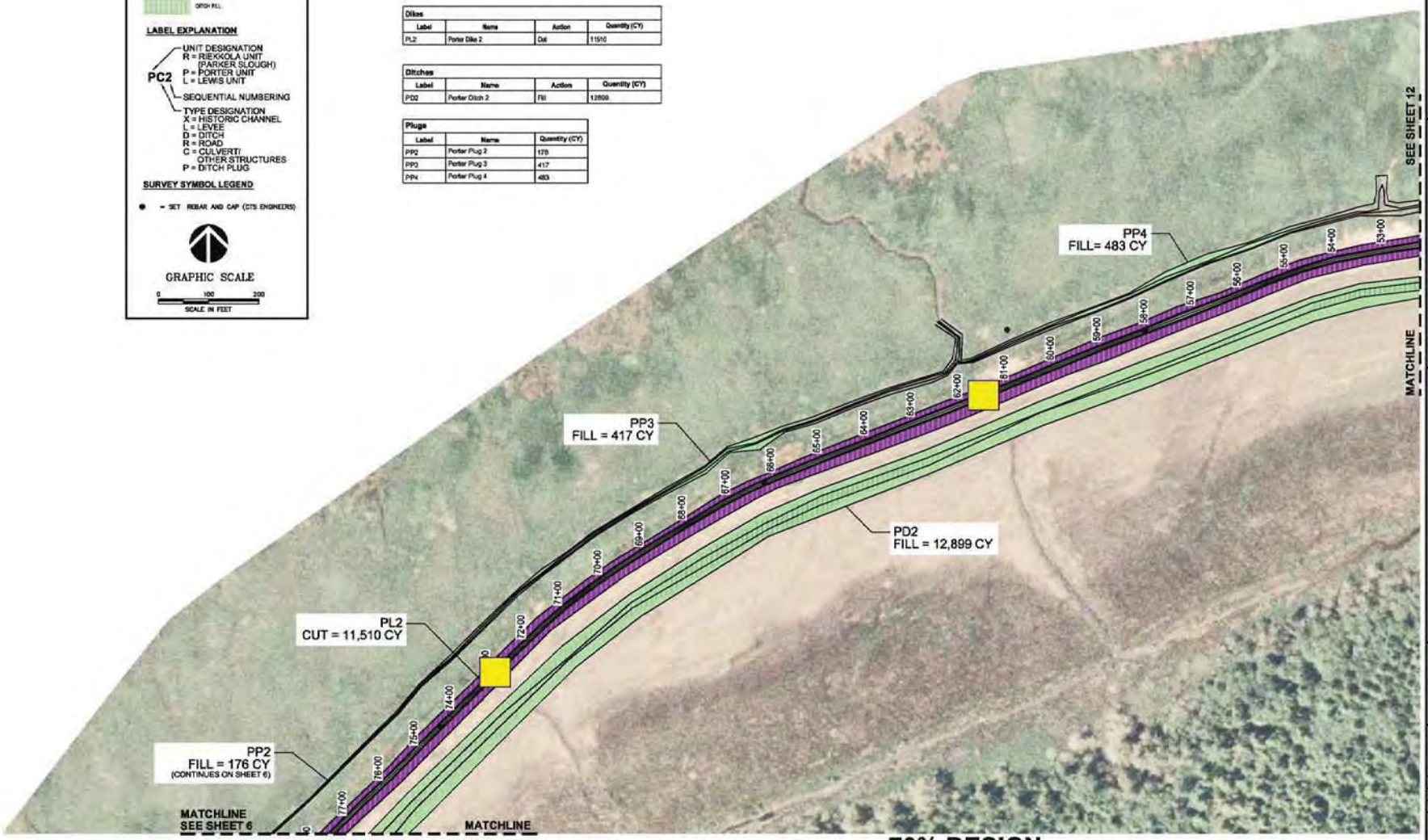
0 100 200

SCALE IN FEET

Dikes			
Label	Name	Action	Quantity (CY)
PL2	Porter Dike 2	Cut	11510

Ditches			
Label	Name	Action	Quantity (CY)
PD2	Porter Ditch 2	Fill	12899

Plugs		
Label	Name	Quantity (CY)
PP2	Porter Plug 2	176
PP3	Porter Plug 3	417
PP4	Porter Plug 4	483



70% DESIGN

REVISIONS			
NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER UNIT EARTHWORK LAYOUT 1

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway N, Suite B, Bothell, WA 98011
Phone: (425) 806-5000 Fax: (425) 806-1820

BEAR RIVER ESTUARY RESTORATION

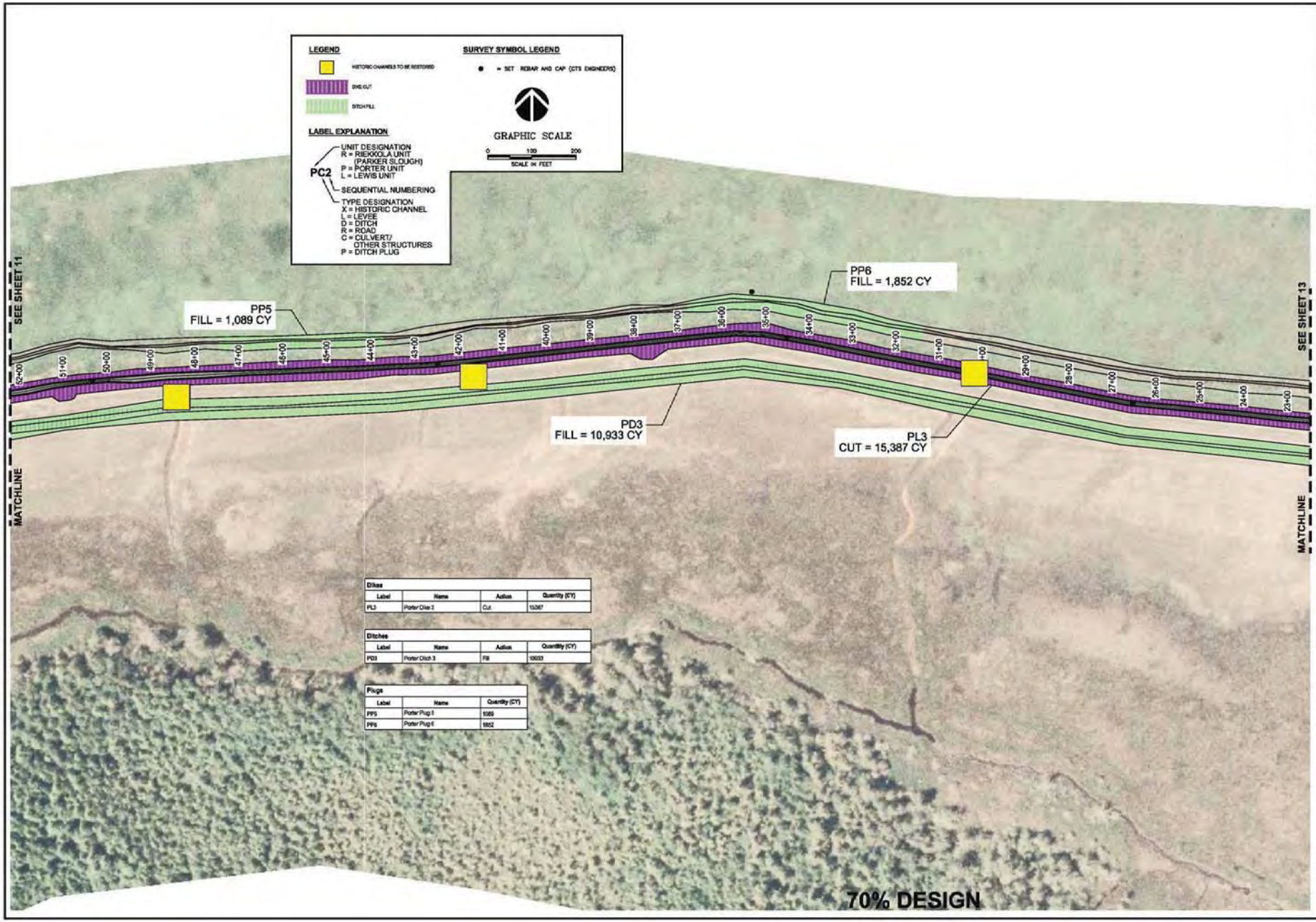
Project No. 5-F-5-1-1803-0 REV No.

DR: JRB CHK: RB/PS

DATE: JULY 2010

11

SHEET NUMBER



Dikes

Label	Name	Action	Quantity (CY)
PL3	Porter Dike 3	Cut	15387

Ditches

Label	Name	Action	Quantity (CY)
PD3	Porter Ditch 3	Fill	10933

Plugs

Label	Name	Quantity (CY)
PP5	Porter Plug 5	1089
PP6	Porter Plug 6	1852

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER UNIT EARTHWORK LAYOUT 2

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

Project No.

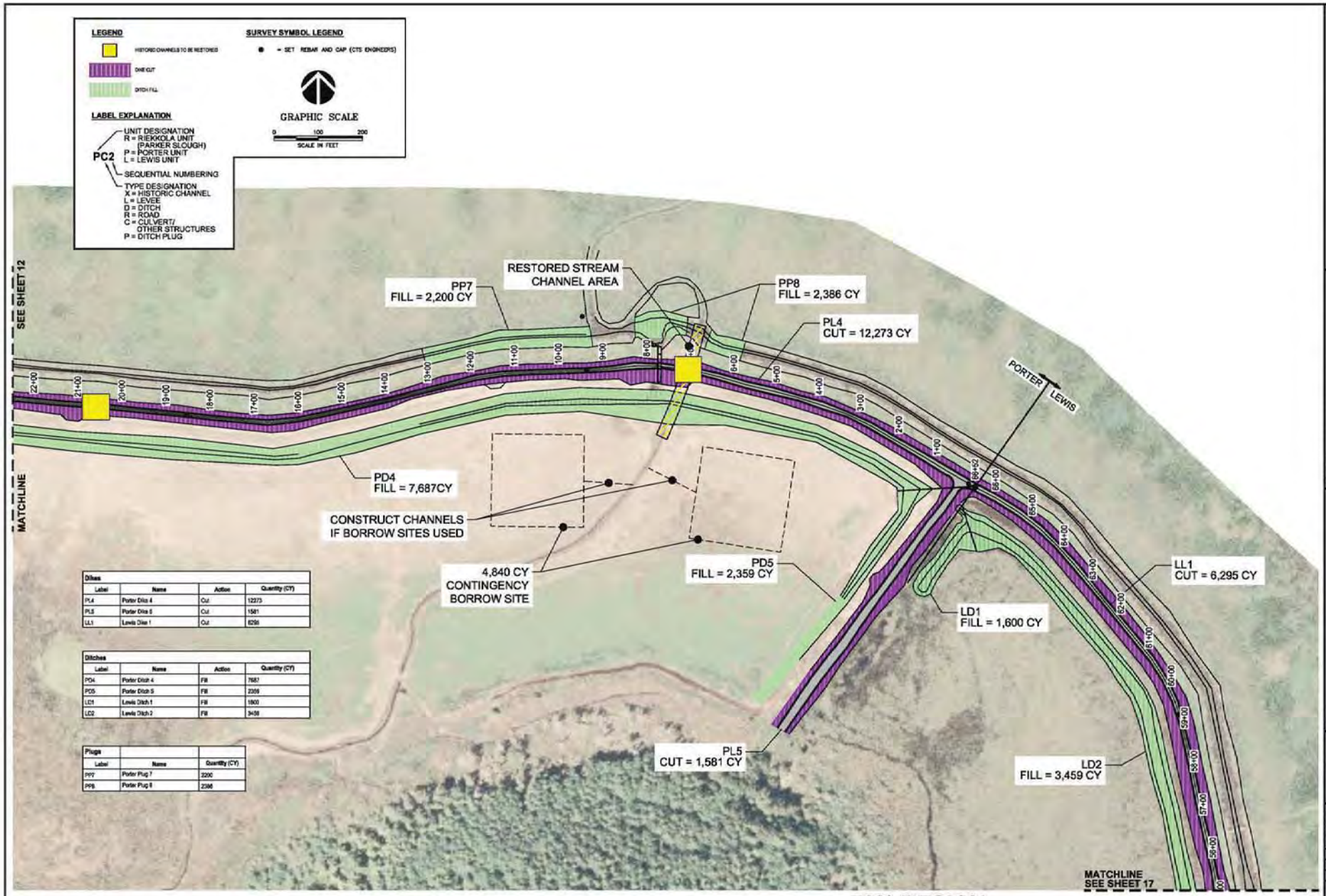
0-915-10933-0 | REV No.

DR: JRS | CHK: RB/PS

DATE: JULY 2010

12

SHEET NUMBER



Dikes

Label	Name	Action	Quantity (CY)
PL4	Porter Dike 4	Cut	12273
PL5	Porter Dike 5	Cut	1581
LL1	Lewis Dike 1	Cut	6295

Ditches

Label	Name	Action	Quantity (CY)
PD4	Porter Ditch 4	Fill	7687
PD5	Porter Ditch 5	Fill	2359
LD1	Lewis Ditch 1	Fill	1600
LD2	Lewis Ditch 2	Fill	3459

Plugs

Label	Name	Quantity (CY)
PP7	Porter Plug 7	2200
PP8	Porter Plug 8	2386

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER UNIT EARTHWORK LAYOUT 3

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

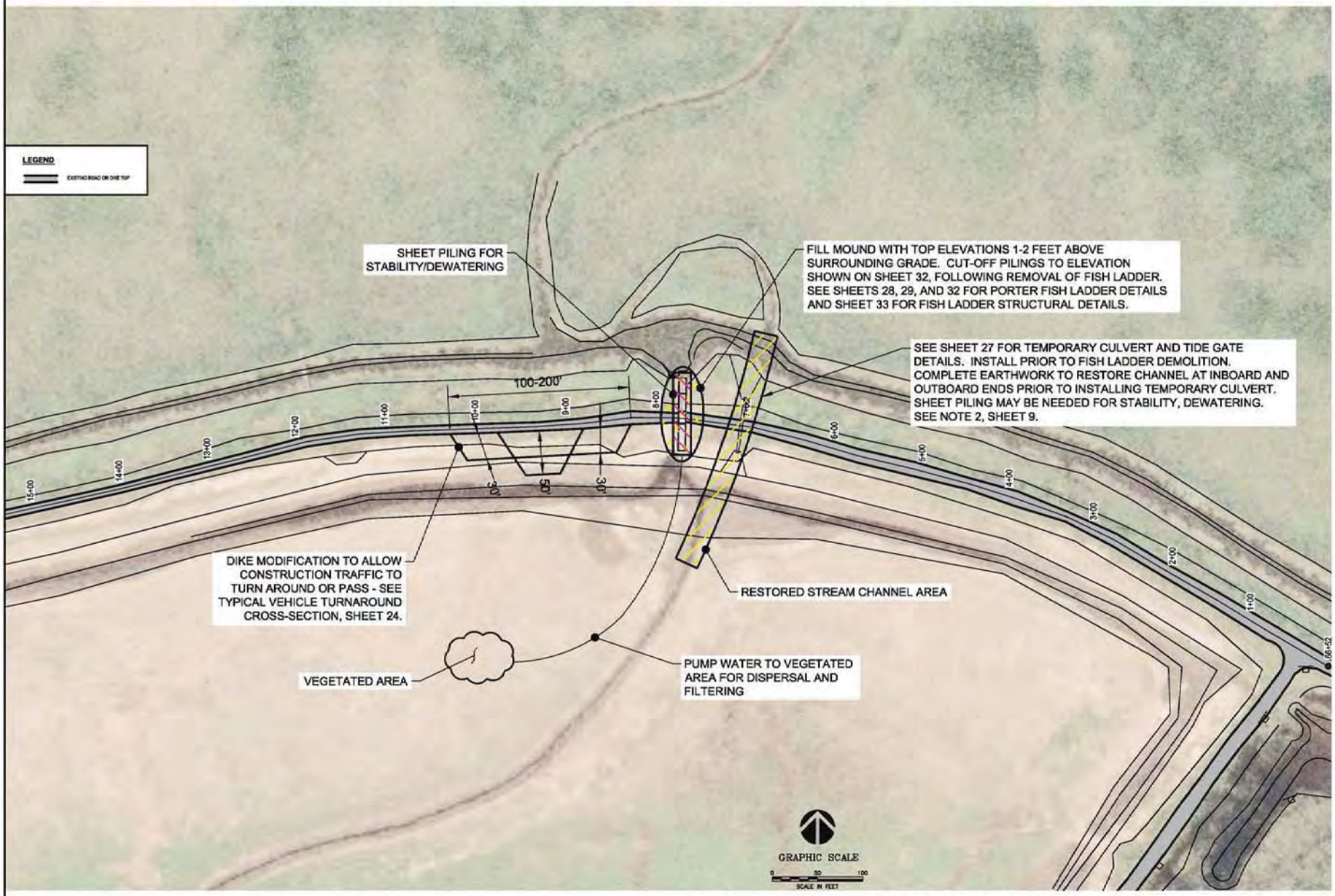
Project No.

DR: JRB CHK: RB/PS

DATE: JULY 2010

13

SHEET NUMBER



70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER FISH LADDER REMOVAL DETAIL

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

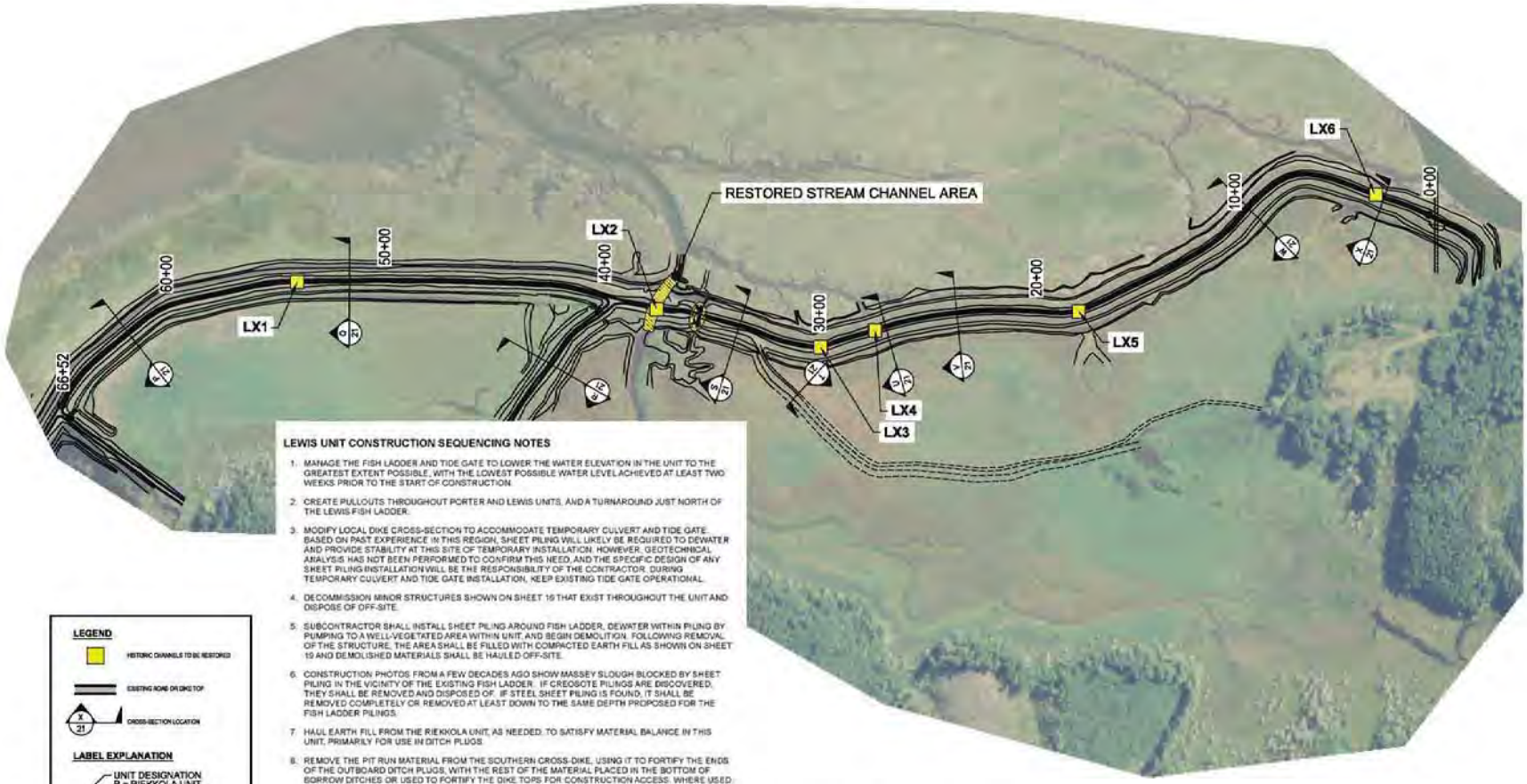
Project No.

DR: JRS CHK: RB/PS

DATE: JULY 2010

14

SHEET NUMBER



LEWIS UNIT CONSTRUCTION SEQUENCING NOTES

1. MANAGE THE FISH LADDER AND TIDE GATE TO LOWER THE WATER ELEVATION IN THE UNIT TO THE GREATEST EXTENT POSSIBLE, WITH THE LOWEST POSSIBLE WATER LEVEL ACHIEVED AT LEAST TWO WEEKS PRIOR TO THE START OF CONSTRUCTION.
2. CREATE PULLOUTS THROUGHOUT PORTER AND LEWIS UNITS, AND A TURNAROUND JUST NORTH OF THE LEWIS FISH LADDER.
3. MODIFY LOCAL DIKE CROSS-SECTION TO ACCOMMODATE TEMPORARY CULVERT AND TIDE GATE. BASED ON PAST EXPERIENCE IN THIS REGION, SHEET PILING WILL LIKELY BE REQUIRED TO DEWATER AND PROVIDE STABILITY AT THIS SITE OF TEMPORARY INSTALLATION. HOWEVER, GEOTECHNICAL ANALYSIS HAS NOT BEEN PERFORMED TO CONFIRM THIS NEED, AND THE SPECIFIC DESIGN OF ANY SHEET PILING INSTALLATION WILL BE THE RESPONSIBILITY OF THE CONTRACTOR. DURING TEMPORARY CULVERT AND TIDE GATE INSTALLATION, KEEP EXISTING TIDE GATE OPERATIONAL.
4. DECOMMISSION MINOR STRUCTURES SHOWN ON SHEET 16 THAT EXIST THROUGHOUT THE UNIT AND DISPOSE OF OFF-SITE.
5. SUBCONTRACTOR SHALL INSTALL SHEET PILING AROUND FISH LADDER, DEWATER WITHIN PILING BY PUMPING TO A WELL-VEGETATED AREA WITHIN UNIT, AND BEGIN DEMOLITION. FOLLOWING REMOVAL OF THE STRUCTURE, THE AREA SHALL BE FILLED WITH COMPACTED EARTH FILL AS SHOWN ON SHEET 19 AND DEMOLISHED MATERIALS SHALL BE HAULED OFF-SITE.
6. CONSTRUCTION PHOTOS FROM A FEW DECADES AGO SHOW MASSEY SLOUGH BLOCKED BY SHEET PILING IN THE VICINITY OF THE EXISTING FISH LADDER. IF CREOSOTE PILINGS ARE DISCOVERED, THEY SHALL BE REMOVED AND DISPOSED OF. IF STEEL SHEET PILING IS FOUND, IT SHALL BE REMOVED COMPLETELY OR REMOVED AT LEAST DOWN TO THE SAME DEPTH PROPOSED FOR THE FISH LADDER PILINGS.
7. HAUL EARTH FILL FROM THE RIEKKOLA UNIT, AS NEEDED, TO SATISFY MATERIAL BALANCE IN THIS UNIT, PRIMARILY FOR USE IN DITCH PLUGS.
8. REMOVE THE PIT RUN MATERIAL FROM THE SOUTHERN CROSS-DIKE, USING IT TO FORTIFY THE ENDS OF THE OUTBOARD DITCH PLUGS, WITH THE REST OF THE MATERIAL PLACED IN THE BOTTOM OF BORROW DITCHES OR USED TO FORTIFY THE DIKE TOPS FOR CONSTRUCTION ACCESS. WHERE USED IN BORROW DITCHES, IT SHALL BE BURIED BY AT LEAST TWO FEET OF FINE-GRAINED MATERIAL. ALTERNATELY, IF THIS MATERIAL COULD BE SUITABLE AS CHANNEL BOTTOM MATERIAL, STOCKPILE IT FOR LATER PLACEMENT.
9. REMOVE CUT A CROSS-SECTION OF MAIN DIKE AS SHOWN ON SHEET 24, PLACING THE MATERIAL IN THE INBOARD DITCHES. THIS MAY BE DONE IN ONE OR MORE STAGES, TO BE DICTATED BY THE TIDAL ELEVATIONS LIKELY TO BE ENCOUNTERED DURING CONSTRUCTION. BORROW DITCHES SHALL BE COMPLETELY FILLED AND A SMALL TRENCH CREATED WITHIN THE EXISTING DIKE FOOTPRINT TO ACCEPT THE LAST CUT OF ADJACENT DIKE MATERIAL OR THE BORROW DITCHES MAY BE MOSTLY FILLED, LEAVING ENOUGH ROOM FOR THE REMAINING DIKE MATERIAL. THIS DESIGN GUIDELINE IS SUBJECT TO CHANGE BASED UPON SPOT LOCAL SAFETY REASONS. DIKE REMOVAL WILL NEED TO SUPPORT SAFE PASSAGE OF EQUIPMENT. ADAPTIVE MANAGEMENT BY THE CONTRACTOR MAY RESULT IN CHANGING THE CONFIGURATION AS NEEDED.
10. REMOVE THE CROSS-DIKE JUST NORTH OF THE LEWIS FISH LADDER.
11. REMOVE THE REMAINING DIKE MATERIAL BY STARTING AT THE SOUTHERN END OF THE UNIT AND WORKING NORTH, PLACING THE MATERIALS IN THE CREATED TRENCH WITHIN THE CURRENT DIKE FOOTPRINT OR THE DITCH.
12. RESTORE THE CHANNELS WHERE IDENTIFIED ON THE PLAN SET AS THEY ARE ENCOUNTERED. FINAL BREACH SHALL BE MADE ON AN INCOMING TIDE TO MINIMIZE DOWNSTREAM SEDIMENT MOVEMENT.
13. REMOVE TEMPORARY CULVERT AND TIDE GATE WHEN LOCAL CHANNEL IS RESTORED.

Lewis Unit Dike and Ditch Summary	
Dike Length Cut (Feet)	9,896
Ditch Length Filled (Feet)	7,424
Total Volume Cut (CY)	43,226
Total Volume Filled (CY)	46,185
Net Cut/(Fill) Volume (CY)	(2,959)
Number of Historic Channels Restored	6

LEGEND

- HISTORIC CHANNELS TO BE RESTORED
- EXISTING NONE OR DIKE TOP
- X/21 CROSS-SECTION LOCATION

LABEL EXPLANATION

LC2
- UNIT DESIGNATION
  - R = RIEKKOLA UNIT (PARKER SLOUGH)
  - P = PORTER UNIT
  - L = LEWIS UNIT
- SEQUENTIAL NUMBERING
- TYPE DESIGNATION
  - X = HISTORIC CHANNEL
  - L = LEVEE
  - D = DITCH
  - R = ROAD
  - C = CULVERT/ OTHER STRUCTURES
  - P = DITCH PLUG

GRAPHIC SCALE

0 250 500

SCALE IN FEET

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS UNIT PLAN VIEW - FEATURES

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

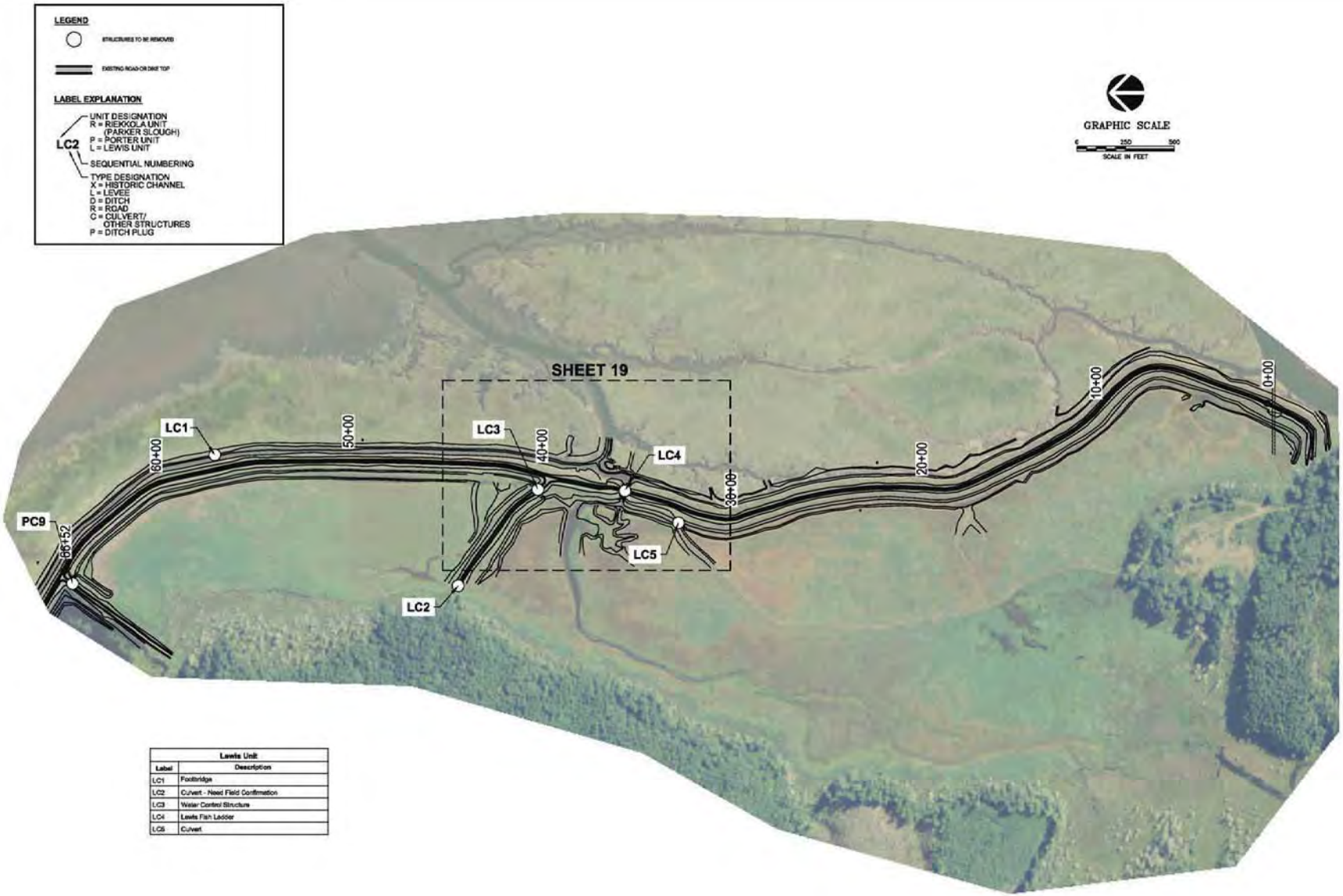
Project No. 0-915-15933-0 REV No.

DR. JRS CHK. RSPG

DATE: JULY 2010

15

SHEET NUMBER



Lewis Unit	
Label	Description
LC1	Footbridge
LC2	Culvert - Need Field Confirmation
LC3	Water Control Structure
LC4	Lewis Fish Ladder
LC5	Culvert

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS UNIT PLAN VIEW - STRUCTURE REMOVAL

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

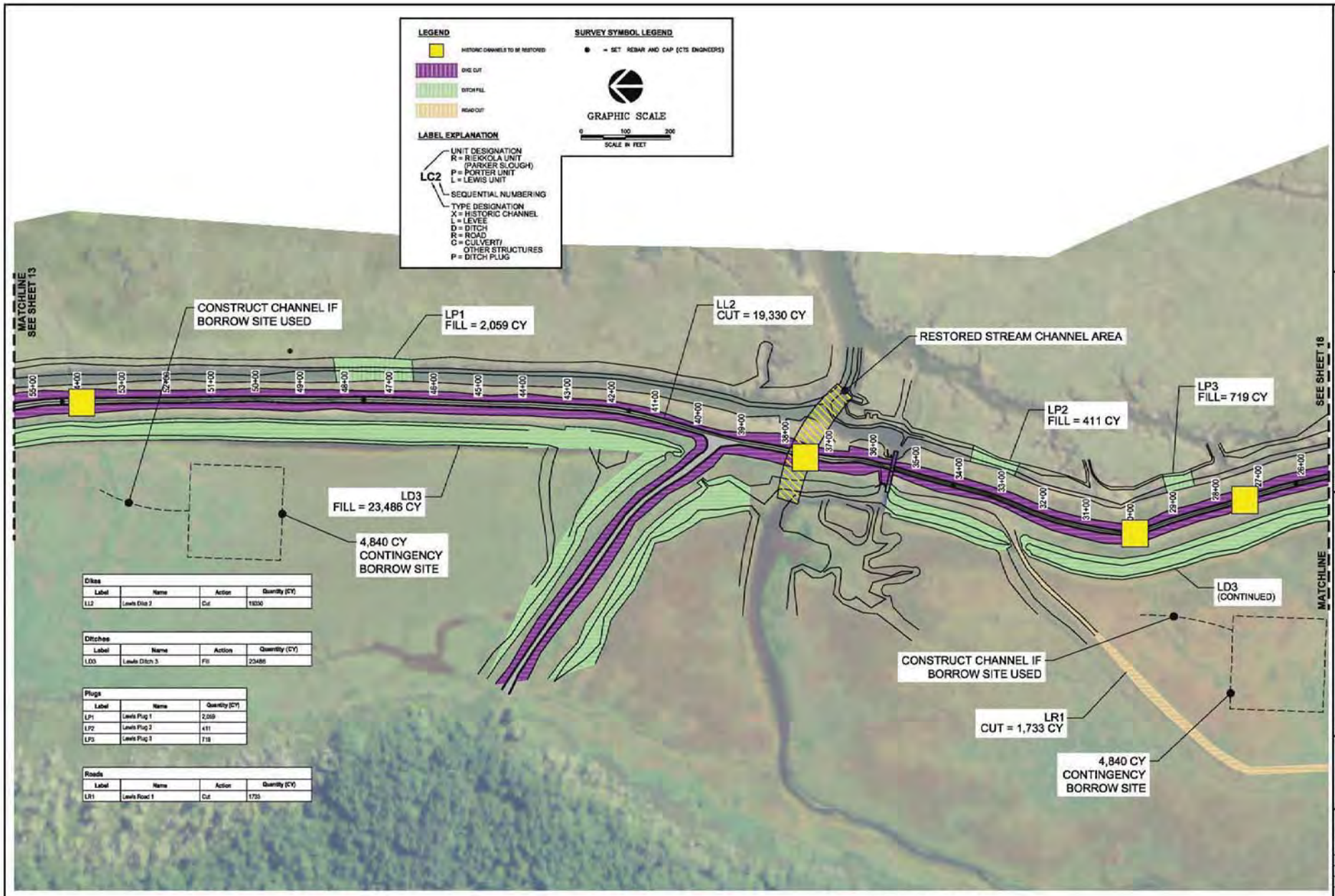
Project No.

5-915-18930-0	REV No.
DR: JRS	CHK: RB/FS

DATE: JULY 2010

16

SHEET NUMBER



Dikes

Label	Name	Action	Quantity (CY)
LL2	Lewis Dike 2	Cut	19330

Ditches

Label	Name	Action	Quantity (CY)
LD3	Lewis Ditch 3	Fill	23486

Plugs

Label	Name	Quantity (CY)
LP1	Lewis Plug 1	2,059
LP2	Lewis Plug 2	411
LP3	Lewis Plug 3	719

Roads

Label	Name	Action	Quantity (CY)
LR1	Lewis Road 1	Cut	1733

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS UNIT EARTHWORK LAYOUT 1

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

Project No.

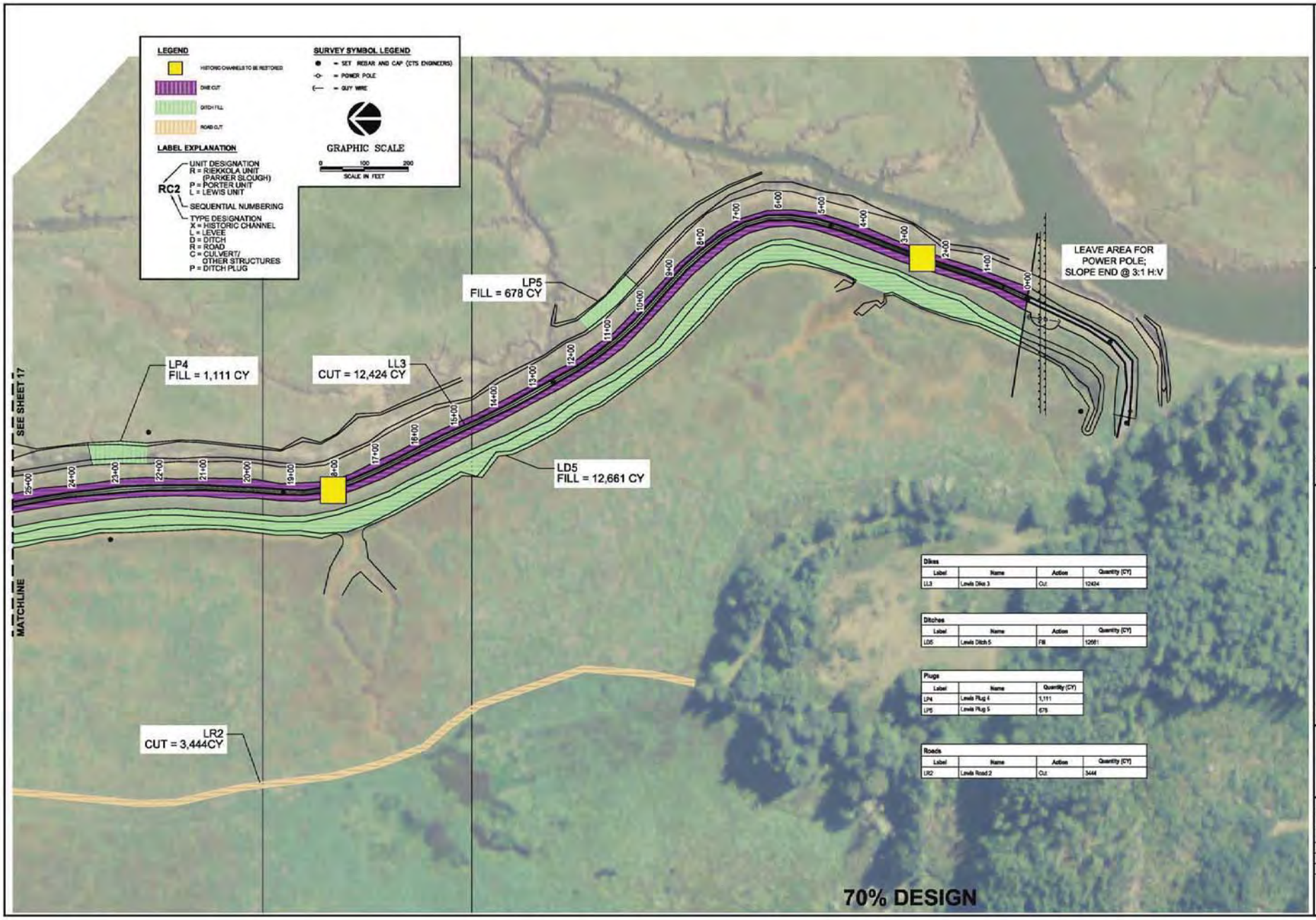
0-615-16933-0 | REV No.

DR: JRB | CHK: RBPS

DATE: JULY 2010

17

SHEET NUMBER



Dikes

Label	Name	Action	Quantity (CY)
LL3	Lewis Dike 3	Cut	12424

Ditches

Label	Name	Action	Quantity (CY)
LD5	Lewis Ditch 5	Fill	12661

Plugs

Label	Name	Quantity (CY)
LP4	Lewis Plug 4	1,111
LP5	Lewis Plug 5	678

Roads

Label	Name	Action	Quantity (CY)
LR2	Lewis Road 2	Cut	3444

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS UNIT EARTHWORK LAYOUT 2

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, U.S.A. 98011-8201
Phone: (425) 366-1000 Fax: (425) 366-1001

BEAR RIVER ESTUARY RESTORATION

Project No.

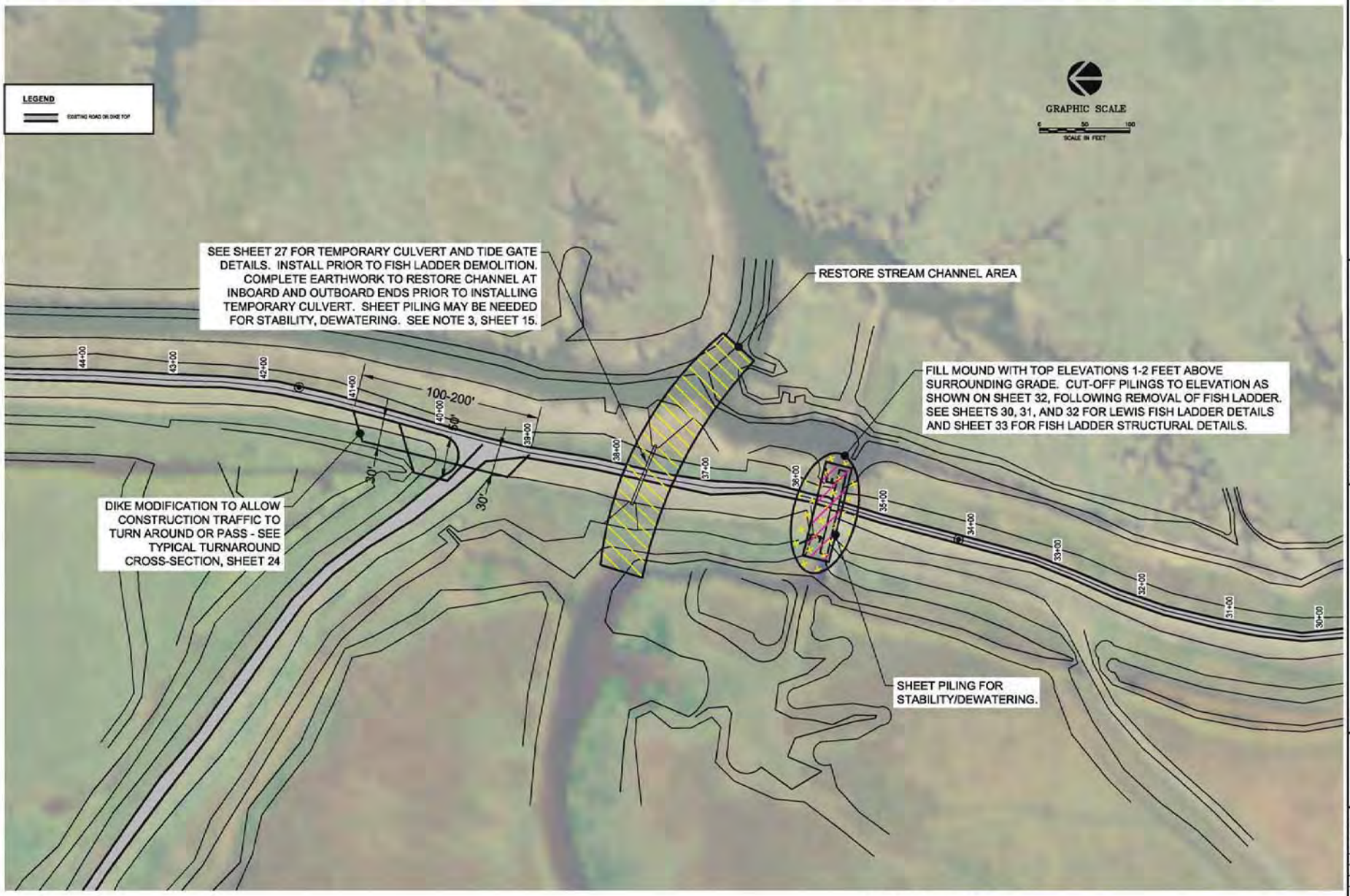
5-915-18930-0 | REV No.

DR: JRS | CHK: RB/PS

DATE: JULY 2010

18

SHEET NUMBER



70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS FISH LADDER REMOVAL DETAIL

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

amec

AMEC Earth & Environmental

BEAR RIVER ESTUARY RESTORATION

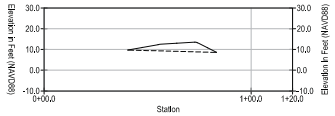
Project No.

5-915-19930-0	REV No.
DR: JRS	CHK: RB/PS

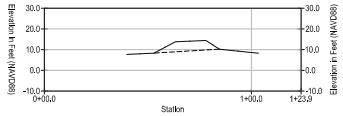
DATE: JULY 2010

19

SHEET NUMBER



A 2 SECTION A-A'
30" SCALE



D 2 SECTION D-D'
30" SCALE

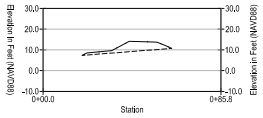
LEGEND

EXISTING

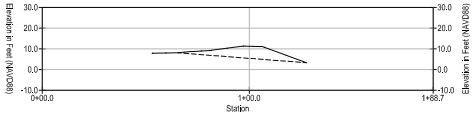
PROPOSED

0 30 60

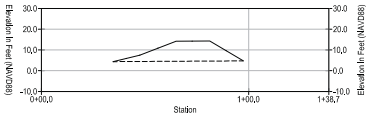
SCALE IN FEET



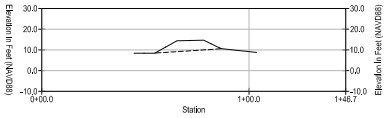
B 2 SECTION B-B'
30" SCALE



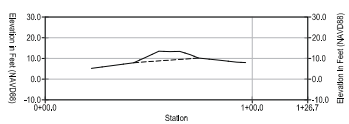
E 2 SECTION E-E'
30" SCALE



C 2 SECTION C-C'
30" SCALE



F 2 SECTION F-F'
30" SCALE



G 2 SECTION G-G'
30" SCALE

RIEKKOLA UNIT (PARKER SLOUGH AREA) EXISTING CROSS SECTIONS

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: REIKKOLA UNIT (PARKER SLOUGH AREA) CROSS SECTIONS

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION

Project No.

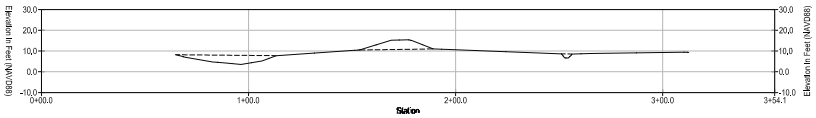
0-915-16933-0 | REV No.

DR: JRS | CHK: RB/PS

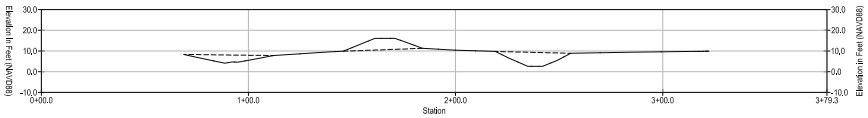
DATE: JULY 2010

20

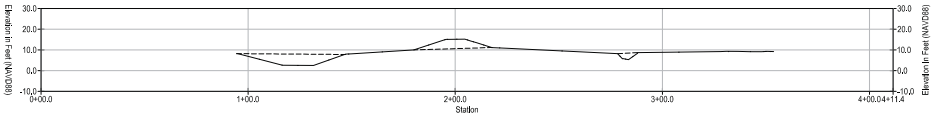
SHEET NUMBER



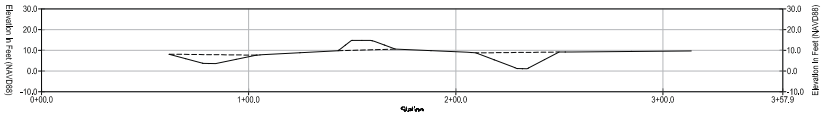
H/8 SECTION H-H'
30' SCALE



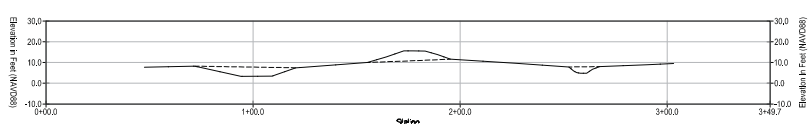
L/8 SECTION L-L'
30' SCALE



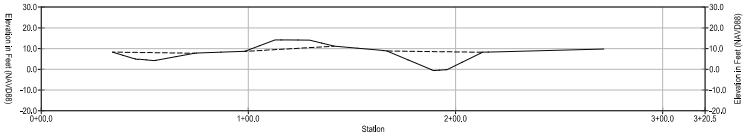
I/8 SECTION I-I'
30' SCALE



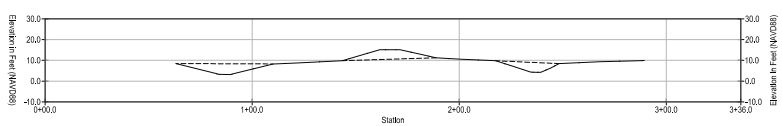
M/8 SECTION M-M'
30' SCALE



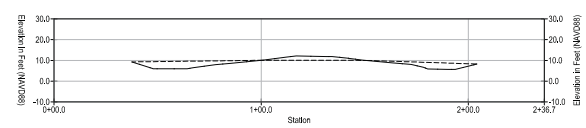
J/8 SECTION J-J'
30' SCALE



N/8 SECTION N-N'
30' SCALE



K/8 SECTION K-K'
30' SCALE



O/8 SECTION O-O'
30' SCALE

PORTER UNIT EXISTING CROSS SECTIONS

LEGEND

EXISTING

PROPOSED

0 30 60
SCALE IN FEET

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER UNIT CROSS SECTIONS

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION

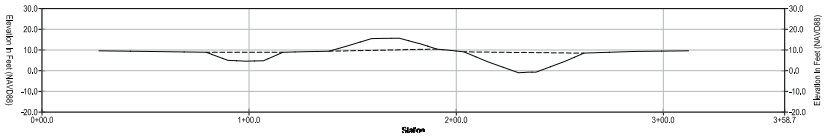
Project No. 0-915-16933-0 | REV No.

DR: JRS | CHK: RB/PS

DATE: JULY 2010

21

SHEET NUMBER



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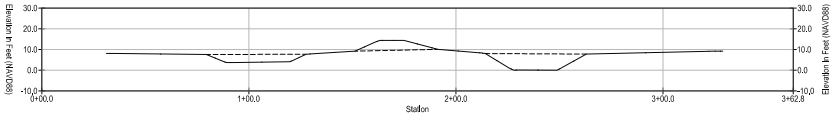
30" SCALE



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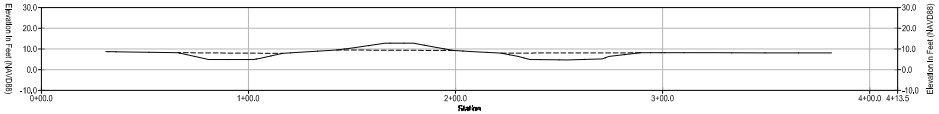

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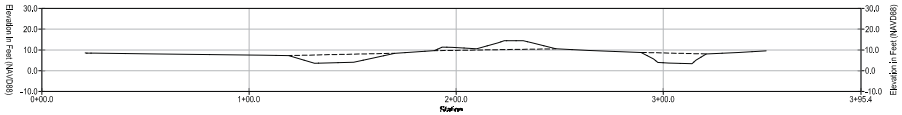

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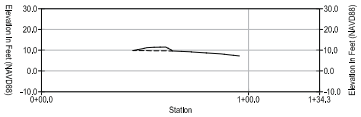
30" SCALE



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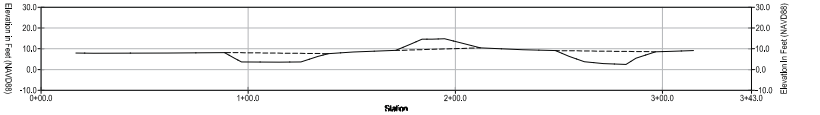
30" SCALE



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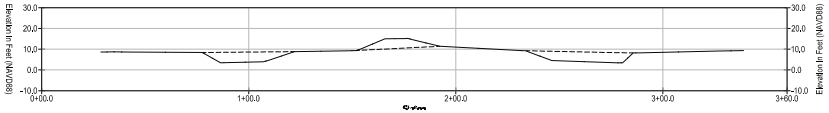
30" SCALE



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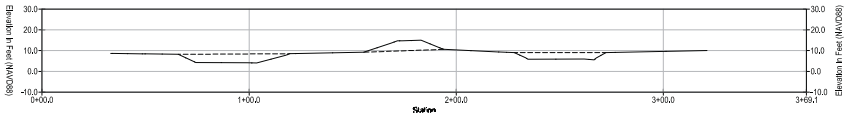
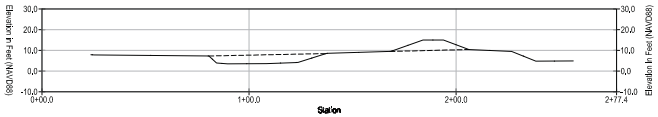
30" SCALE



W 14 SECTION W-W'
30" SCALE



X 14 SECTION X-X'
30" SCALE

LEGEND

EXISTING

PROPOSED

0 30 60
SCALE IN FEET

LEWIS UNIT EXISTING CROSS SECTIONS

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS UNIT CROSS SECTIONS

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION

Project No.

0-915-16933-0	REV No.
DR: JRS	CHK: RB/PS

DATE: JULY 2010

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SHEET NUMBER

THE MOST IMPORTANT PARAMETERS FOR THE CHANNELS ARE THE ELEVATION, WIDTH, AND SIDE SLOPES. THE RECOMMENDED DEPTHS AND WIDTHS FOR THE CHANNELS HAVE BEEN COMPUTED CONSERVATIVELY. THESE RECOMMENDED CONFIGURATIONS REPRESENT PREDICTED CHANNEL SIZES AND DEPTHS, USING EMPIRICAL RELATIONSHIPS FROM OTHER LOCATIONS, EXTRAPOLATED TO THE TIDE RANGE AT THIS PROJECT SITE. THERE ARE A NUMBER OF UNCERTAINTIES IN THE RELATIONSHIPS, LOCAL FACTORS, AND DATA. THEREFORE, THE HISTORIC CHANNEL DEPTHS SHOULD BE CONSTRUCTED AT AN ELEVATION NO HIGHER THAN EXISTING, AND AS CLOSE AS POSSIBLE TO THE RECOMMENDED ELEVATION. SIMILARLY, THE BOTTOM WIDTH SHOULD BE CONSTRUCTED AT LEAST AS WIDE AS THE EXISTING CHANNELS ON BOTH SIDES OF THE RESTORED CROSSING, AND AS CLOSE AS POSSIBLE TO THE RECOMMENDED WIDTH. AMEC RECOMMENDS THAT SIDE SLOPES SHOULD BE MADE AT LEAST AS FLAT AS THE EXISTING OUTBOARD CHANNEL, WITH AS CLOSE TO 3:1 AS POSSIBLE. IF THE EXISTING CHANNEL ON THE BAY SIDE OF A HISTORIC CHANNEL CROSSING IS AT A LOWER ELEVATION OR IS WIDER THAN WHAT IS LISTED IN THE TABLE, THE CHANNEL SHALL BE CONSTRUCTED TO THE LOWER ELEVATION AND/OR WIDER WIDTH OF THE EXISTING CHANNEL. SEE DESIGN NARRATIVE FOR ADDITIONAL INFORMATION.

Historic Channel To Be Restored	Bottom Elevation (NAVD ft)	Bottom Width (feet)
RX1	-4.8	31.0
RX2	-0.2	10.0
RX3	-5.8	42.0
RX4	-3.3	16.0
RX5	-3.2	16.0
PX1	1.8	3.0
PX2	1.3	6.0
PX3	2.0	3.0
PX4	1.9	3.0
PX5	1.6	6.0
PX6	1.1	4.0
PX7	0.0	12.0
LX1	0.2	3.0
LX2	-1.5	8.0
LX3	3.6	8.0
LX4	3.1	12.0
LX5	0.4	4.0
LX6	1.9	6.0

Side slopes shall be constructed at 3 horizontal : 1 vertical

NOTE: IF THE EXISTING CHANNEL ON THE BAY SIDE OF A HISTORIC CHANNEL IS AT A LOWER ELEVATION OR IS WIDER THAN WHAT IS LISTED IN THE TABLE, THE CHANNEL SHALL BE CONSTRUCTED TO THE LOWER ELEVATION AND/OR WIDER WIDTH OF THE EXISTING CHANNEL.

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

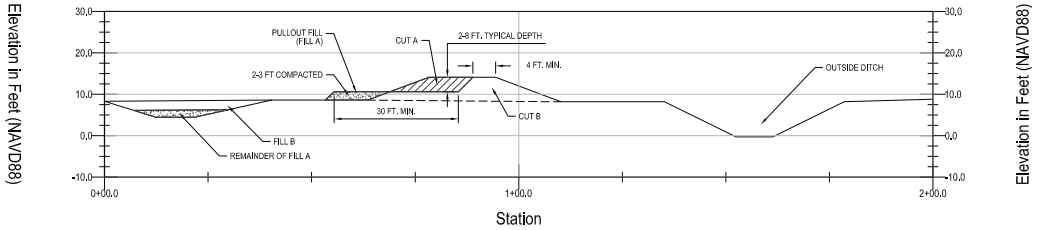
PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: RESTORED CHANNEL DETAILS

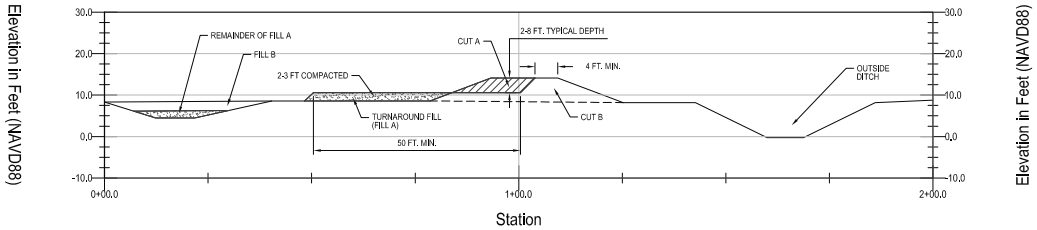
Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell WA US 98011-8201
Phone: (425) 398-0100 Fax: (425) 398-0101

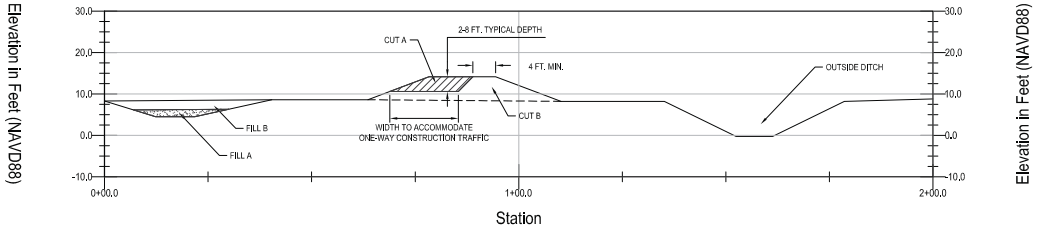
BEAR RIVER ESTUARY RESTORATION
Project No. 0-915-16933-0 | REV No.
DR: JRS | CHK: RB/PS
DATE: JULY 2010



TYPICAL VEHICLE PULLOUT AREA CROSS-SECTION
CONCEPTUAL SCALE



TYPICAL VEHICLE TURNAROUND CROSS-SECTION
CONCEPTUAL SCALE



TYPICAL DIKE CUT CROSS-SECTION
CONCEPTUAL SCALE

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: TYPICAL DIKE CUT CROSS SECTIONS

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION
Project No.
0-915-16933-0 | REV No.
DR: JRS | CHK: RB/PS
DATE: JULY 2010

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SHEET NUMBER

Earthwork quantities calculated for this project were based on survey data by CTS Engineers, where available. For those features not surveyed, their volumes are a best professional estimate based on interpretation of aerial photography and comparison with similar surveyed features on-site. All volumes are based on in-place yardage. The overall balance of materials depends significantly on the conditions experienced in the field. To anticipate potential material shortages resulting from varying conditions, contingency borrow areas have been identified in both the Porter and Lewis Units.

Cut and fill actions are organized in an approximately sequential order in this table. Cut features are listed on the left-hand column of the table, with the proposed destinations for that material shown as fill features across each row of the table. Although organized in the table by unit, certain earthwork actions in different units can be completed concurrently without breaching external dikes. Variations in soil material, quality, and moisture content, along with compaction conditions will result in volumes different from those calculated. The construction sequence reflected in this table is hypothetical in nature and suggests minor differences in earthwork actions not reflected in the raw cut/fill balance summaries on Sheets 3, 9, and 15. It is recommended that those sheets be consulted for overall project cut/fill balance information.

Earthwork Mass Balance

Earth Fill In Lewis Unit (In-place cubic yards)

Earth Cut	LP5	LP4	LP3	LP2	LP1	LD5	LC4 Fill	LD3	LD2	LD1	PD5					Earth Cut Total
RL4	678	1,111	719	411	2,059	237		115								5,330
LR2	18	30	29	17	42		1,000	2,308								3,444
LR1								1,733								1,733
LL3						12,424										12,424
LL2								19,330								19,330
LL1									3,459	1,600	1,236					6,295
Earth Fill Total	696	1,141	748	428	2,101	12,661	1,000	23,486	3,459	1,600	1,236					

Earth Fill In Porter Unit (In-place cubic yards)

Earth Cut	PD5	PC8	PD4	PP8	PP7	PD3	PP6	PP5	PD2	PP4	PP3	PP2	PD1	PP1		Earth Cut Total
RL4		542								483	417	176	1,090	65		2,773
PL5	1,123	458														1,581
PL4			7,687	2,386	2,200											12,273
PL3						10,933	1,852	1,089	1,513							15,387
PL2									11,386				124			11,510
PL1													3,881			3,881
Earth Fill Total	1,123	1,000	7,687	2,386	2,200	10,933	1,852	1,089	12,899	483	417	176	5,095	65		

Earth Fill in Riekkola Unit (Parker Slough area) (In-place cubic yards)

Earth Cut	RD11	RD10	RD8	RD7	Backslope	Platform Fill	County Road	RD5	RD3	RD4	RD2	RD1	RD6	RD9	Spread	Earth Cut Total
RL4	Unknown	751	1,067	107	1,682		7,540									11,147
RL3								5,333	1,481	Optional	Optional	4,944				11,758
RL2					5,818	1,560						626				8,004
RR1													Unknown	Unknown		
RR3													Unknown	Unknown		
RR2															667	667
Earth Fill Total	0	751	1,067	107	7,500	1,560	7,540	5,333	1,481	0	0	5,570	0	0	667	

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION ELEMENT

TITLE: EARTHWORK MASS BALANCE

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell WA US 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION

Project No. 0-915-16933-0 | REV No.

DR: JRS | CHK: RB/PS

DATE: JULY 2010

INSET A
SCALE: AS NOTED

INSET B
SCALE: AS NOTED

NOTE: GRAPHICS HERE WERE PROVIDED BY CTS ENGINEERS AND ARE SHOWN "AS-IS".

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION ELEMENT

TITLE: 67TH PLACE PLACEHOLDER SHEET

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell WA, USA, 98011-8201
Phone: (425) 366-1000 Fax: (425) 366-1001

BEAR RIVER ESTUARY RESTORATION
Project No.
0-915-16933-0 | REV No.
DR: JRS | CHK: RB/PS
DATE: JULY 2010

26
SHEET NUMBER

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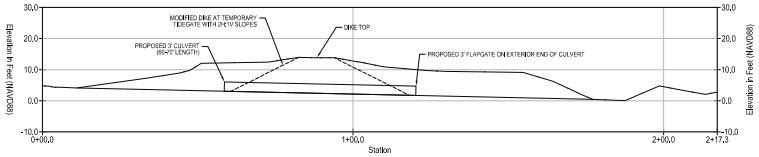
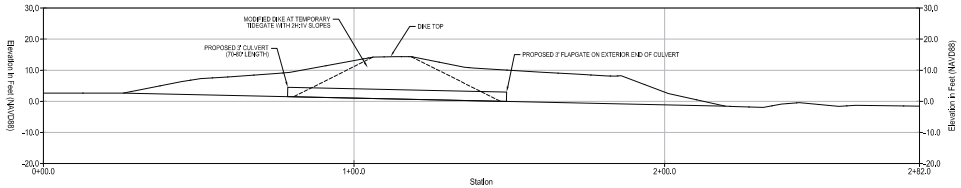


PORTER UNIT TEMPORARY TIDEGATE DETAIL PROFILE
20' SCALE



LEWIS UNIT TEMPORARY TIDEGATE DETAIL PROFILE
20' SCALE

LEGEND

EXISTING
PROPOSED

0 20 40
SCALE IN FEET

NOTE: TEMPORARY CULVERTS AND TIDEGATES SHALL BE INSTALLED AT AS LOW OF AN ELEVATION AS PRACTICAL AND POSSIBLE, AND IN NO CASE SHALL THEIR INVERT ELEVATIONS BE HIGHER THAN THOSE OF THE EXISTING DRAINAGE STRUCTURES. TARGET INVERT ELEVATION IN LEWIS UNIT IS -1.5 (LX2), AND 0.0 IN PORTER UNIT (PX7), TO MATCH ELEVATION PROPOSED FOR RESTORED CHANNEL ELEVATION.

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: TEMPORARY CULVERT AND TIDEGATE DETAILS

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION
Project No.
0-915-16933-0 REV No.
DR: JRS CHK:
DATE: JULY 2010

27
SHEET NUMBER

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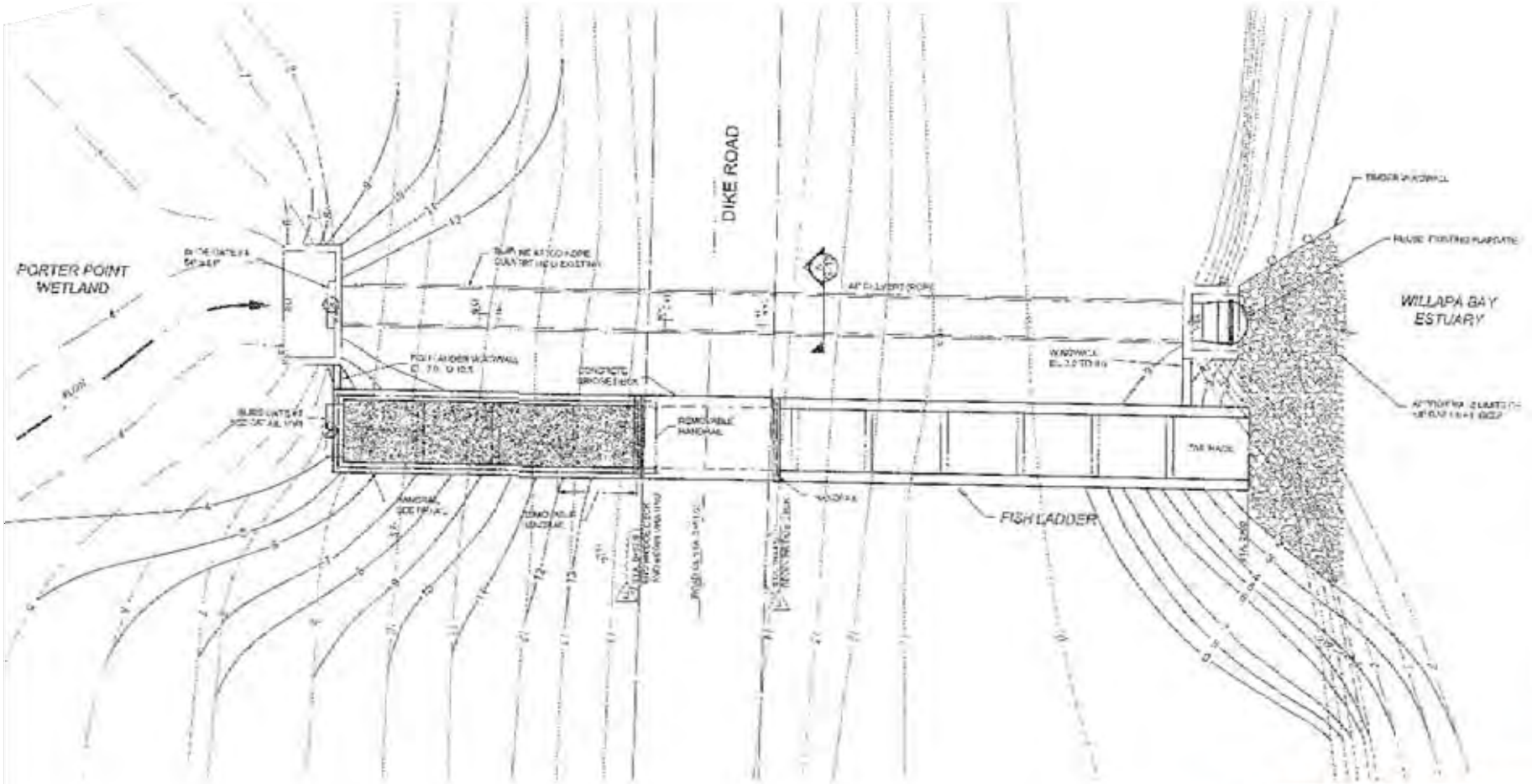


LEGEND

STEEL GRATING OVER FISH WAY AND OVERFLOW CHANNEL

NOTES:

1. ADAPTED FROM GOLDER ASSOCIATES, LEWIS AND PORTER FISH LADDER DESIGN, FEBRUARY 7, 2001.

GRAPHIC SCALE

0 5 10

SCALE IN FEET

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER FISH LADDER GOLDER PLAN VIEW

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell WA U.S.A. 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION

Project No. 0-915-16933-0

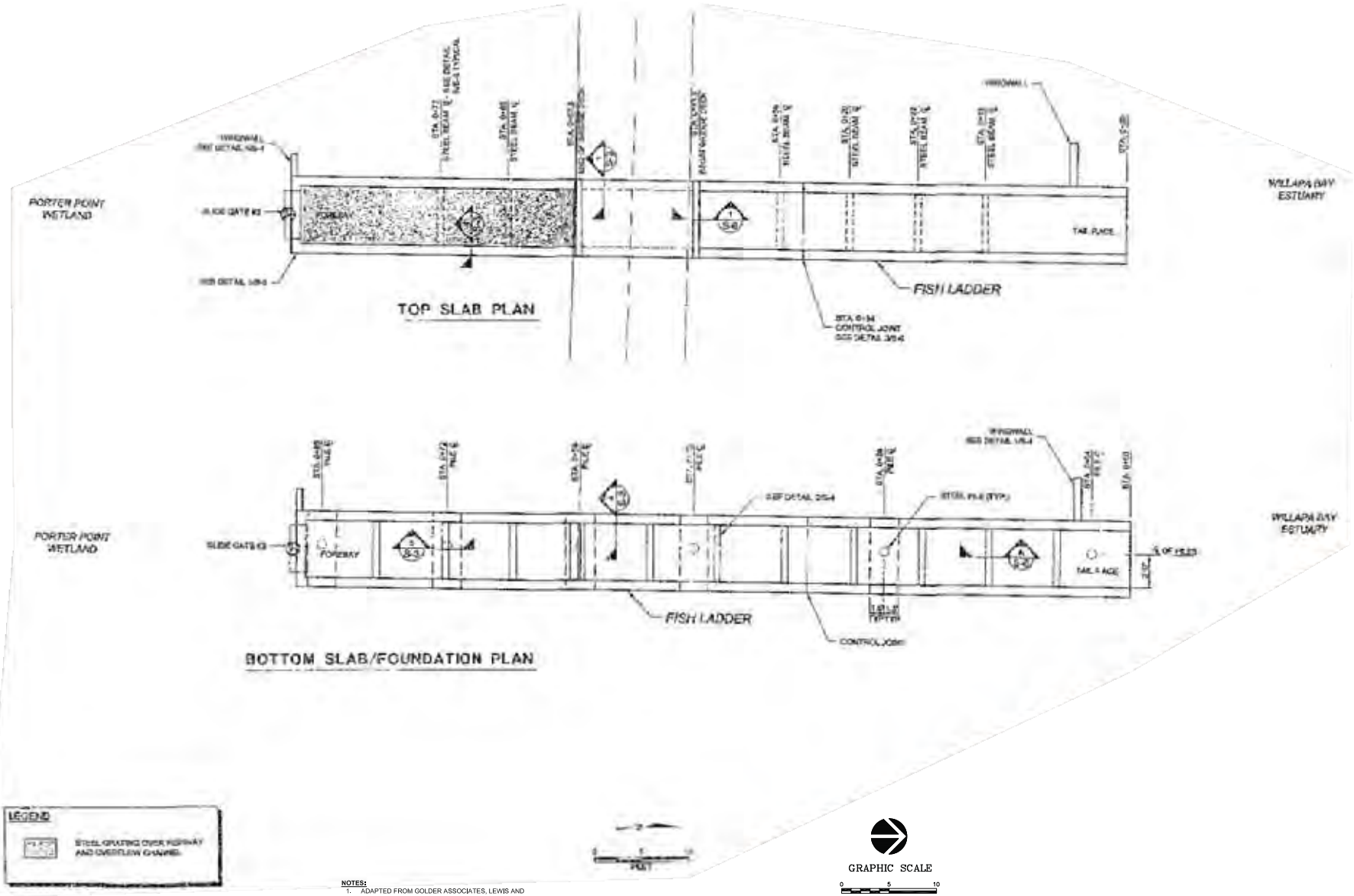
REV No.

DR: JRS CHK: RB/PS

DATE: JULY 2010

28

SHEET NUMBER



NOTES:
1. ADAPTED FROM GOLDER ASSOCIATES, LEWIS AND PORTER FISH LADDER DESIGN, FEBRUARY 7, 2001.

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: PORTER FISH LADDER GOLDER SLAB DETAILS

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION
Project No.

0-915-16933-0	REV No.
DR: JRS	CHK: RB/PS

DATE: JULY 2010

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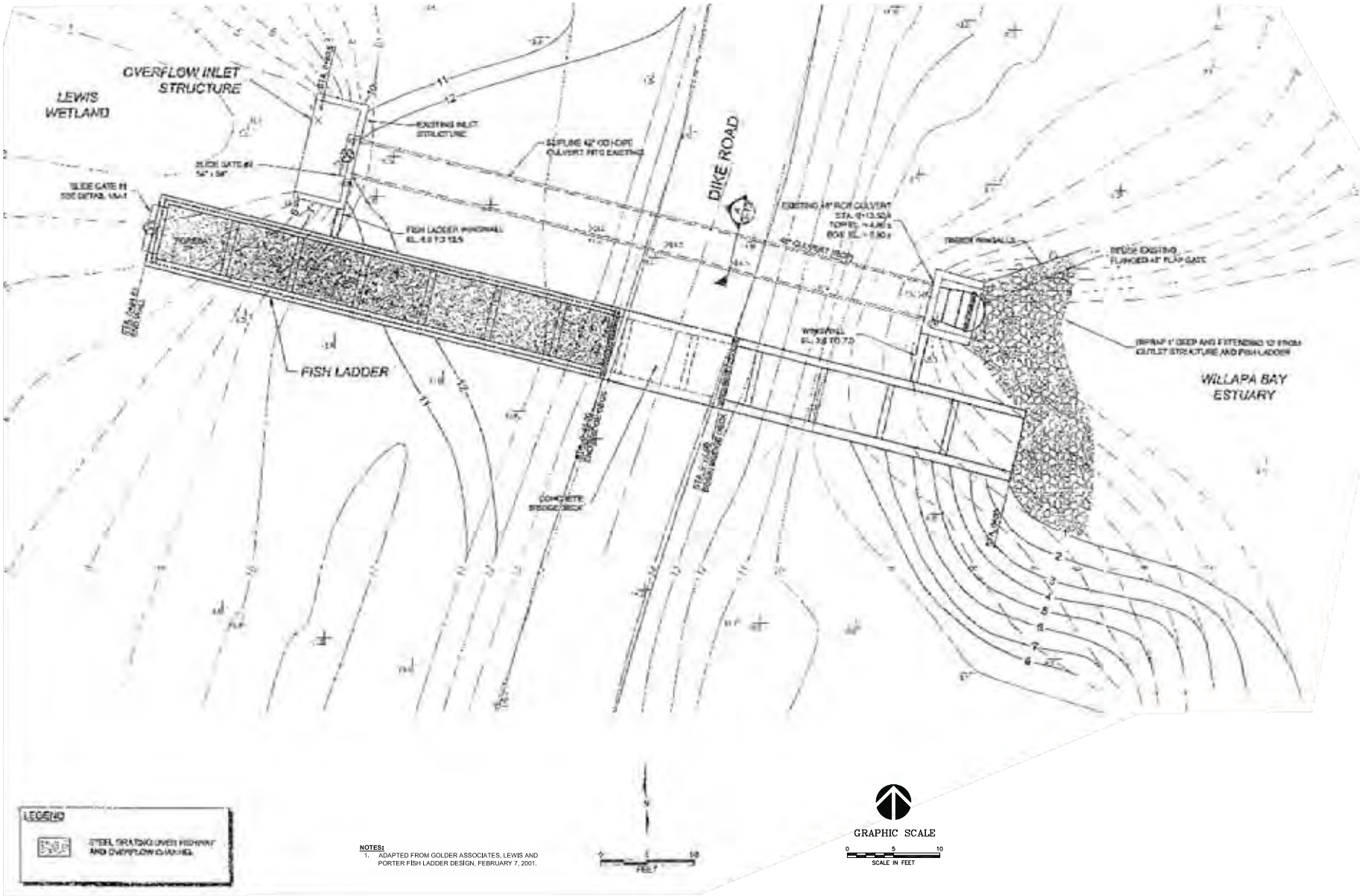
SHEET NUMBER



NOTES:
1. ADAPTED FROM GOLDER ASSOCIATES, LEWIS AND PORTER FISH LADDER DESIGN, FEBRUARY 7, 2001.

70% DESIGN

REVISIONS

NO.	DESCRIPTION	BY	DATE

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS FISH LADDER GOLDER PLAN VIEW

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 368-1000 Fax: (425) 368-1001

BEAR RIVER ESTUARY RESTORATION

Project No. 0-915-16933-0 | REV No. 0

DR: JRS | CHK: RB/PS

DATE: JULY 2010

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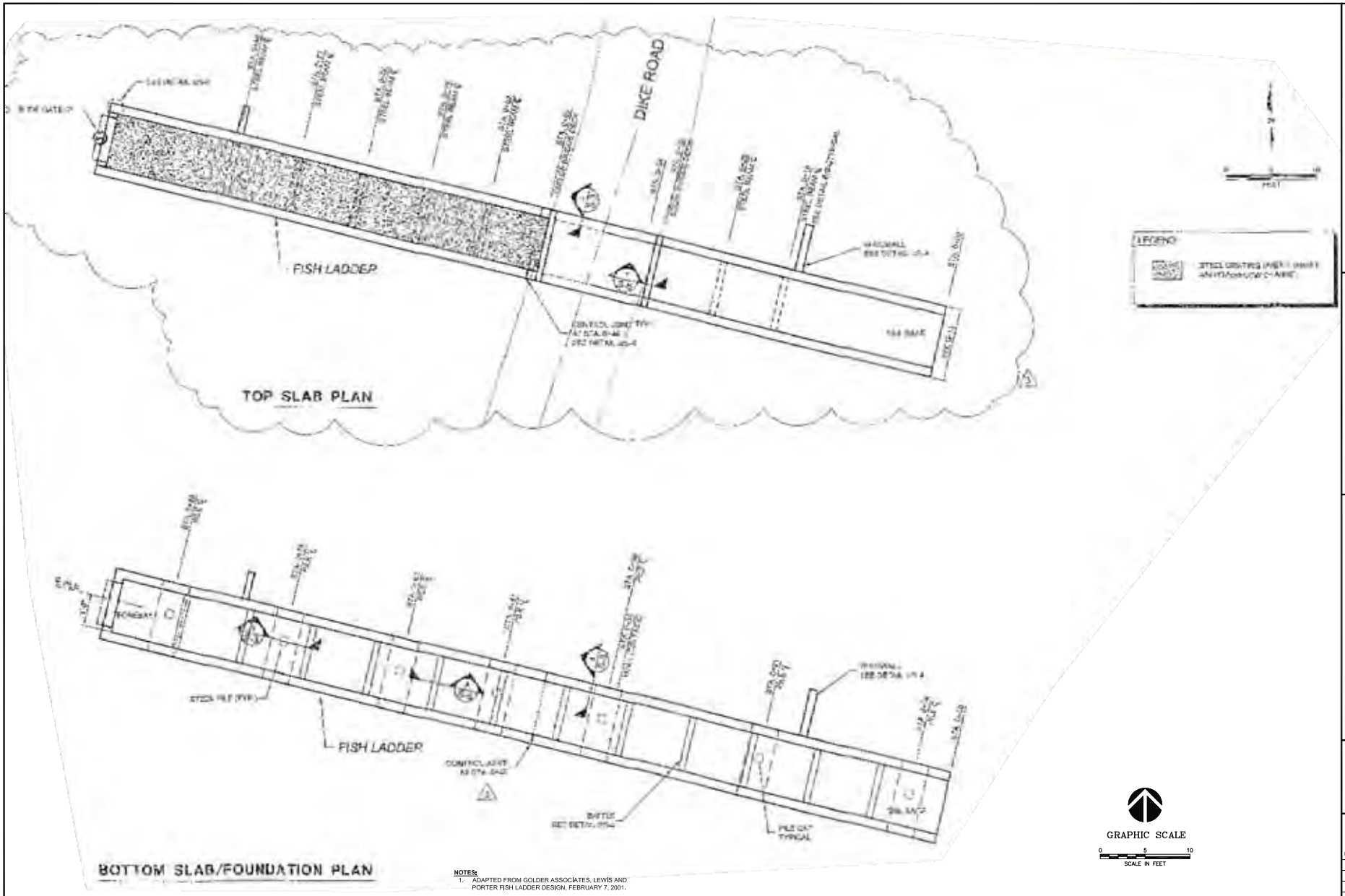
SHEET NUMBER



NOTES:
1. ADAPTED FROM GOLDER ASSOCIATES, LEWIS AND PORTER FISH LADDER DESIGN, FEBRUARY 7, 2001.

70% DESIGN

NO.	DESCRIPTION	BY	DATE

REVISIONS

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: LEWIS FISH LADDER GOLDER SLAB DETAILS

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

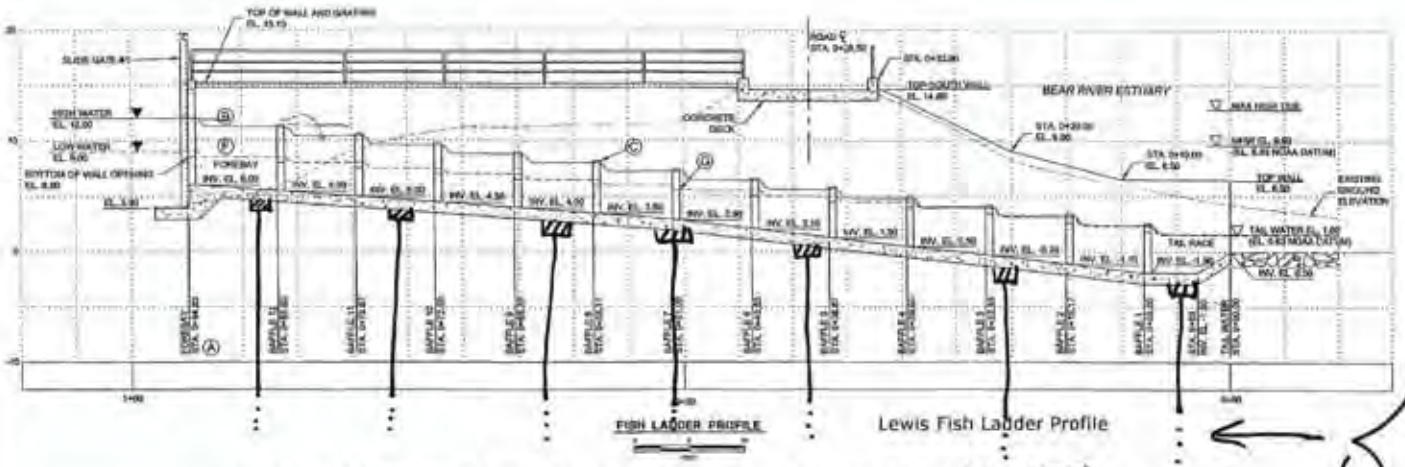
AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA, 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION
Project No.

0-915-16933-0	REV No.
DR: JRS	CHK: RB/PS

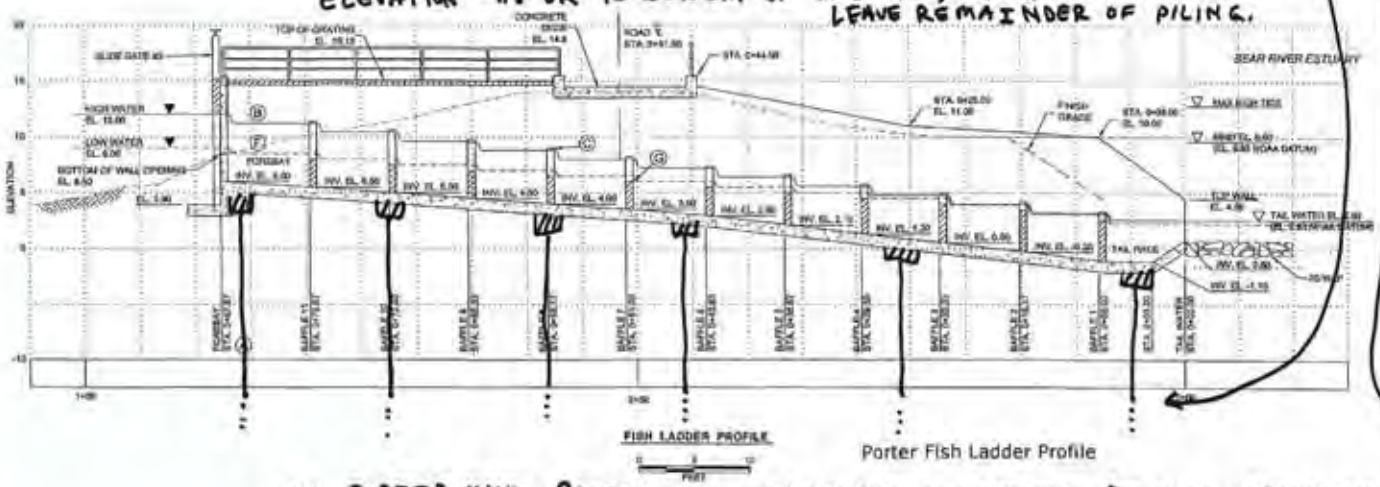
DATE: JULY 2010

31
SHEET NUMBER



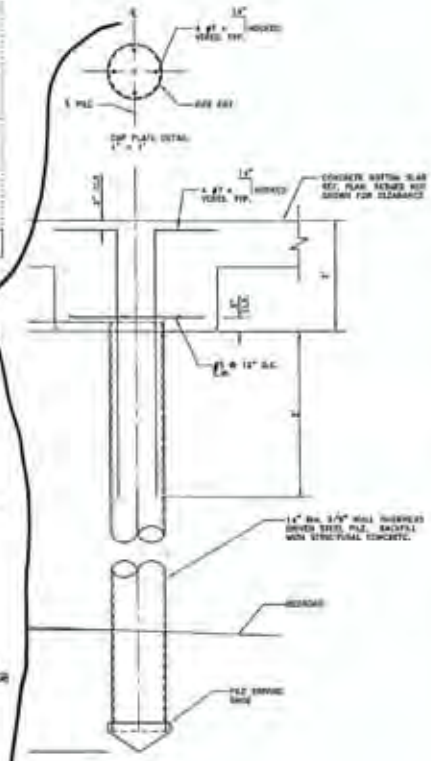
Lewis Fish Ladder Profile

SINGLE ROW OF PILINGS, LOCATION APPROXIMATE, DERIVED FROM GOLDER DRAWINGS (LEWIS & PORTER UNITS).
IN LEWIS UNIT, REMOVE ALL FISH LADDER COMPONENTS DOWN TO ELEVATION -1.5 OR TO BOTTOM OF PILE CAP, WHICHEVER IS LOWER. LEAVE REMAINDER OF PILING.



Porter Fish Ladder Profile

IN PORTER UNIT, REMOVE ALL FISH LADDER COMPONENTS DOWN TO ELEVATION 0.0 OR BOTTOM OF PILE CAP, WHICHEVER IS LOWER. LEAVE REMAINDER OF PILING.



TYPICAL DRIVEN STEEL PILE DETAIL

Not to scale

GRAPHIC SCALE

NOT TO SCALE

NOTES:

1. ADAPTED FROM GOLDER ASSOCIATES, LEWIS AND PORTER FISH LADDER DESIGN, FEBRUARY 7, 2001.

70% DESIGN

NO.	DESCRIPTION	BY	DATE

REVISIONS

PROJECT: BEAR RIVER ESTUARY RESTORATION

TITLE: FISH LADDER PILING LAYOUT

Client: WILLAPA BAY REGIONAL FISHERIES ENHANCEMENT GROUP

AMEC Earth & Environmental
11810 North Creek Parkway North, Bothell, WA, USA 98011-8201
Phone: (425) 398-1000 Fax: (425) 398-1001

BEAR RIVER ESTUARY RESTORATION

Project No. 0-915-16933-0 | REV No.

DR: JRS | CHK: RB/PS

DATE: JULY 2010

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SHEET NUMBER

Appendix C—
Construction Narrative (AMEC)

BEAR RIVER ESTUARY RESTORATION PROJECT: 70 PERCENT DESIGN NARRATIVE

Submitted to:
Ron Craig
Willapa Bay Regional Fisheries Enhancement Group
PO Box 46
South Bend, WA 98586

Submitted by:
AMEC Earth & Environmental, Inc.
11810 North Creek Parkway North
Bothell, Washington 98011

July 16, 2010

AMEC Project No. 0-915-16933-0

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5.0 DIKE MODIFICATIONS AND BREACHING 5
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7.0 CHANNEL DIMENSIONS AT DIKE CROSSINGS 6
8.0 EARTHWORK QUANTITY CONSIDERATIONS 7

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APPENDICES

APPENDIX A. Breach sizing recommendations for Bear River Restoration Project.
Memorandum from PWA to Ryan Bartelheimer dated June 23, 2010.

1.0 INTRODUCTION

The Willapa Bay Regional Fish Enhancement Group (WBRFEG) hired AMEC Earth & Environmental, Inc. (AMEC) and its subconsultant, Philip Williams & Associates (PWA), to complete a 70 percent design for the removal of approximately 5 miles of dikes and associated roads and drainage features in south Willapa Bay in the vicinity of the Bear River estuary, Washington. WBRFEG also directed AMEC to develop and implement a monitoring plan to document the environmental changes that will occur on the project site.

The "Bear River Estuary Restoration Project Basis of Design" (Basis of Design; AMEC, May 3, 2010) gives details about the specific objectives, design considerations, and activities associated with the design and the monitoring plan. AMEC developed the Basis of Design in consultation with a design team comprising representatives of WBRFEG, the Willapa National Wildlife Refuge (WNWR), the Washington Department of Fish and Wildlife, Friends of WNWR, University of Washington, Pacific County, and a trusted construction contractor.

The 70 percent design consists of the design drawings and this report, which together depict and describe the approach used to fulfill the objectives identified in the Basis of Design. The purpose of this report is to supplement information presented in the design drawings, focusing on important elements of the design and its implementation.

The Bear River Estuary Restoration Project Monitoring Plan is on a different schedule and will be addressed in a separate report.

2.0 DEWATERING

Water levels should be kept low in the construction area behind the dikes in each management unit to facilitate construction and minimize water quality impacts.

2.1 Lewis and Porter Units

AMEC recommends installing temporary culverts and tide gates in the Lewis and Porter Units before starting work on the existing fish ladders or tide gates. This approach will keep tidal waters out of the area behind the dikes, while still allowing freshwater to drain to the bay during low tide.

Before construction starts, operate the existing fish ladders and tide gates in the Lewis and Porter Units to give the area behind the dikes as much time as possible to dry out. The temporary culverts and tide gates will facilitate drainage of these units during construction, up until the time the dikes are breached.

In each unit, after the area behind the dike has been dewatered, the contractor should modify the cross-section where the temporary culvert and tide gate are to be installed so that a shorter culvert can be used. Sheet piling and pumping may be required to stabilize and dewater the area where the temporary culvert and tide gate will be installed. Install the culvert and tide gate, place and compact backfill to rebuild the dike, and remove the sheet piling. Once the temporary tide gate is functioning, the contractor should surround the existing tide gate and fish ladder with sheet piling and dewater the area as described in section 2.3, “Pump System Discharge.”

Temporary culverts can be smaller in diameter (minimum 24 inches) if they are to be removed in the same year they are installed. If they are to remain in place for a second year, the culverts should be larger in diameter (minimum 36 inches).

2.2 Riekkola Unit

In the Riekkola Unit (also referred to as the Parker Slough area), the existing tide gates will provide for unit-wide water level control. These tide gates will be removed late in the construction sequence when the historic stream crossing is restored at this location.

2.3 Pump System Discharge

The contractor should use pumps for any localized dewatering needed in the Riekkola Unit or in the vicinity of the fish ladders and tide gates in the Porter and Lewis units. The pump system should discharge to a well-vegetated location so that the water is filtered before leaving the project area. If the receiving area is not well-vegetated or is not adequately treating the water, the contractor should implement other best management practices (BMPs) to meet water quality criteria.

2.4 Ditch Fill

Additional dewatering measures may be necessary to avoid problems associated with placing fill in ditches with water present. Slurry that forms while working in the ditches can be dealt with in one of three ways:

1. a peristaltic pump system can be used to pump the material to a nearby containment area,
2. the slurry can be bailed out with an excavator and allowed to dry on the ground surface, or
3. the slurry can be contained in an isolated portion of the ditch by placing fill on either side.

3.0 CONSTRUCTION ACCESS

All construction access will be from Sandridge Road to 67th Place[1]. The construction staging will occur at the eastern end of 67th Place in the Riekkola Unit. Construction access to all units will originate from this location, following the existing roads and dikes on the project site.

To facilitate two-way vehicle traffic on top of the dikes, AMEC recommends constructing pullouts at regular intervals in the Porter and Lewis Units and turnarounds near each fish ladder and tide gate. The plan set shows the typical details of the pullouts and turnarounds. The contractor should construct pullouts and turnarounds from material available locally in the dike, not brought in from other parts of the site. If needed, the pit-run gravelly materials in the southernmost cross-dike in the Lewis Unit, or other durable surfacing materials, should be used to top the construction travel corridors to maintain the viability of construction traffic on the dikes, pullouts, and turnarounds.

The contractor should haul fill from the inner Riekkola Unit dike or create local borrow sites to meet the import requirements in the Lewis and Porter Units, using the top of the main dikes as the corridor for moving equipment and materials. The contractor should remove the pullouts and turnarounds during the initial stage of dike modifications. The contractor shall place the material from the pullouts and turnarounds into the ditches when the initial modification to the dike cross section is made in each unit. Typical cross-sections for these areas of the dike are shown within the construction drawings.

4.0 CROSS-DIKES

Construction will begin first in the Lewis Unit, which contains three cross-dikes. The cross-dike just north of the fish ladder can be removed at any time prior to breaching the main dike. The cross-dike south of the fish ladder can also be removed at any time prior to breaching the main dike, but unlike the other dikes in this unit, it is composed of imported pit-run material. AMEC recommends using some of this material at the ends of the ditch plugs to resist erosion. The ditch plug material should be at a moisture content that allows it to be placed and compacted to be resistant to erosion. The ditch plugs are designed to be constructed in locations that break up artificial outboard drainage features but that maintain channel connections downstream to minimize the risk of fish stranding. The cross-dike between the Lewis and Porter units will not be removed until later, as part of the work in the Porter Unit.

The cross-dike between the Lewis and Porter Units will serve as a temporary sea dike after the Lewis Unit is deconstructed. The cross-dike could be augmented to have a similar top elevation and cross section as the outer dike (increasing its strength and reducing the risk of being overtopped), or the water level in the Porter Unit could be kept high in the winter, minimizing the amount of dike exposed to flowing water and the time it would take for the water levels on either side of the dike to equalize. The risk of a premature breach would be very low in either case.

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[1] The eastern end of 67th Place is identified on some maps as Honeyman Road.

The design team has discussed the possibility of demolishing the Porter Unit fish ladder and tide gate and installing a temporary tide gate at the same time that similar work would be done in the Lewis Unit, which would be a year before construction in the Porter Unit. In this scenario, AMEC recommends raising the cross-dike between the Porter and Lewis Units, because there would not be water impounded within the Porter Unit to reduce the risk of a premature breach in an overtopping event.

The inner dike in the Riekkola Unit may be removed at any time before breaching the main dike. This unit has a large surplus of fill; some of this surplus should be hauled to the Lewis and Porter Units, or used as fill to raise 67th Place, to help meet the material needs in those locations. About 2,000 lineal feet of dike is proposed to remain in the northwestern part of the Riekkola Unit. The top of this dike is proposed to serve as the location of a future trail and observation platform. AMEC recommends filling the borrow ditch along this dike and creating a flatter dike backslope that stays within the ditch footprint. The flattened slope will improve the dike's stability, resistance to erosion during storms, aesthetics from the trail, and will provide a habitat face that allows wider bands or zones of different vegetation types.

5.0 DIKE MODIFICATIONS AND BREACHING

The Basis of Design identified the goal of completing as much work as possible before creating the initial dike breach in each unit. This approach relies on maintaining dry work conditions, excavating drainage channels, removing as much dike material as possible, and filling borrow ditches before breaching. Material can be removed from the top and inboard side of each dike, and then hauled away or placed into nearby borrow ditches. This material will be drier than earth fill located on the outside and lower parts of the dike. It will be easier to place and compact and should therefore be more resistant to erosion than wetter materials. AMEC recommends hauling the minimum materials needed to address fill deficits in each area, primarily for the outboard ditch plugs. As mentioned previously, fill should be moved between and within units to meet the import needs before the initial modification to the dike cross section, in order to make use of the existing road surface atop the dike.

After the dike in each unit is modified as described above, the contractor should remove the remaining material during a neap tide cycle (minimal tidal range) in order to avoid or minimize the amount of water flowing into and over the construction areas. The contractor should make the initial breach as large as possible during an incoming tide, which will keep the outbound water velocities low as the first high tide recedes, minimizing sediment movement and water quality issues outside the project area. The contractor should finish the remaining dike deconstruction and ditch filling work during the same neap tide cycle, when the high tide levels are low enough to minimize water contacting the construction area.

6.0 RIPRAP AND GRAVEL

Some sections of dike or cross-dike contain riprap armoring, pit-run, or other rocky materials. These materials should either be buried under a minimum of 2 feet of fine-grained material to

leave exposed soils that are most suitable to recreate mudflat habitat or incorporated in the exposed ends of the ditch plugs to minimize the potential for erosion there.

7.0 CHANNEL DIMENSIONS AT DIKE CROSSINGS

AMEC designed channels to be located as close as possible to where they historically existed and sized them so that tidal processes would accelerate the re-establishment of natural topography and vegetation conditions. AMEC used regression equations that correlate measured tidal channel characteristics to the size of tidal marsh areas that drain through these channels, and compared the results to measurements obtained from recent and historic aerial photographs. The stormwater flow rates were calculated using USGS regression equations. The drainage basin and the tidal basin areas used in the calculations were derived by delineating these basins from available elevation data. The channel sizes on this project are dictated by tidal processes rather than precipitation processes, which will be clarified later in this section.

The plans depict the channels as trapezoidal in cross section. The most important parameters are the elevation and width of channel bottoms and the slope of the channel sides. In all cases, AMEC calculated that much larger channels are needed to convey tidal waters than runoff from precipitation. Table 1 lists the recommended depths and bottom widths for channels to be reconnected at dike crossings in the restored units. The recommended depths and widths for the channels have been computed conservatively. These recommended configurations represent predicted channel sizes and depths, using empirical relationships from other locations, extrapolated to the tide range at this project site. There are a number of uncertainties in the relationships, local factors, and data. Therefore, the historic channel depths should be constructed at an elevation no higher than existing, and as close as possible to the recommended elevation. Similarly, the bottom width should be constructed at least as wide as the existing channels on both sides of the restored crossing, and as close as possible to the recommended width. AMEC recommends that side slopes should be made at least as flat as the existing outboard channel, with as close to 3:1 as possible. Because of the shallow side slopes needed for stability, the resulting channel top widths are greater than those calculated by the regression equations. The cross-sectional areas of the reconnected channels should therefore be adequate to convey tidal flows under conditions that will exist following construction. If the existing channel on the bay side of a historic channel crossing is at a lower elevation or is wider than what is listed in the table, the channel should be constructed to the lower elevation and/or wider width of the existing channel. AMEC also recommends removing vegetation and root mass along the top and edges of the existing inboard and outboard channels, and excavating a transition area between the restored channels and the existing channels.

Table 2. Historic channel crossing details

Historic Crossing To Be Restored	Bottom Elevation (NAVD ft)	Bottom Width (feet)
RX1	-4.8	31.0
RX2	-0.2	10.0
RX3	-5.8	42.0
RX4	-3.3	16.0
RX5	-3.2	16.0
PX1	1.8	3.0
PX2	1.3	6.0
PX3	2.0	3.0
PX4	1.9	3.0
PX5	1.6	6.0
PX6	1.1	4.0
PX7	0.0	12.0
LX1	0.2	3.0
LX2	-1.5	8.0
LX3	3.6	8.0
LX4	3.1	12.0
LX5	0.4	4.0
LX6	1.9	6.0

The ground on the landward side of the dikes has subsided by approximately 1-3 feet since the dikes were built, so the quantity and rate of water flowing through the reconnected channels will be greater than in a salt marsh without subsidence. However, the beds of historical channels outside the dikes have since aggraded due to a reduction in tidal flows through them since the dikes were built. Following construction, outboard channels are expected to eventually revert to their historical sizes and depths. Channels on the inside of the dikes can be expected initially to deepen and widen but then gradually to aggrade and become more narrow as sediment is deposited over the larger subsided area. Channels will reach equilibrium when ground elevations on the inside of the dike approximately equal those on the outboard side. As this happens, AMEC predicts that the channels will evolve to sizes and depths closer to those predicted by the tidal drainage area relationships than what currently exists.

8.0 EARTHWORK QUANTITY CONSIDERATIONS

AMEC calculated earthwork quantities for this project using survey data from CTS Engineers, where available. For those features not surveyed, volumes are best professional estimates based on interpretation of aerial photography and comparison with similar surveyed features on site. All volumes were calculated as in-place yardage. The overall balance of material to be imported or exported depends significantly on the conditions experienced in the field. To address potential material shortages resulting from varying conditions, AMEC has identified contingency borrow areas in both the Porter and Lewis Units.

Cut and fill actions are organized in an approximately sequential order in the table on Sheet 25 of the design set. Cut features are listed on the left-hand column of the table, with the proposed destinations for that material shown as fill features across each row of the table. Although organized in the table by unit, certain earthwork actions, most notably the removal of the inboard Riekkola Unit dike, in different units can be completed concurrently without breaching external dikes. Variations in soil material, quality, and moisture content, along with compaction conditions, will result in volumes different from those calculated.

Appendix D—
Species Life Histories

APPENDIX D
LIFE HISTORIES

INTRODUCTION

This appendix provides brief descriptions of the life histories of species listed under the Endangered Species Act (ESA) that may occur in the action area of the proposed project. The species discussed herein include:

- North American green sturgeon (*Acipenser medirostris*);
- Marbled murrelet (*Brachyramphus marmoratus marmoratus*);
- Western snowy plover (*Charadrius alexandrinus nivosus*); and
- Streaked horned lark (*Eremophila alpestris strigata*).

NORTH AMERICAN GREEN STURGEON

This section presents descriptions of the biology, distribution, and population trends of the North American green sturgeon.

Life History

The North American green sturgeon (green sturgeon) is a long-lived, slow-growing fish and the most marine-oriented of the sturgeon species. Mature males range from 4.5 to 6.5 feet in fork length and do not mature until they are at least 15 years old, while mature females range from 5 to 7 feet in fork length and do not mature until they are at least 17 years old. Maximum ages of adult green sturgeon are likely to range from 60 to 70 years.

Green sturgeon lack scales; however, they have five rows of characteristic bony plates on their body called scuutes. The backbone of the green sturgeon curves upward into the caudal fin, forming their shark-like tail. On the underside of their flattened snouts are sensory barbels and a siphon-shaped, protrusible, toothless mouth. Recent genetic information suggests that green sturgeon in North America is taxonomically distinct from morphologically similar forms in Asia (NMFS 2009b).

Green sturgeon are believed to spend the majority of their lives in nearshore oceanic waters, bays, and estuaries. Early life-history stages reside in fresh water, with adults returning to freshwater to spawn when they are more than 15 years of age and over 4 feet in size. Spawning is believed to occur every 2 to 5 years. Adults typically migrate into fresh water beginning in late February; spawning occurs from March to July, with peak activity from April to June. Females produce 60,000 to 140,000 eggs. Juvenile green sturgeon spend 1 to 4 years in fresh and estuarine waters before dispersal to saltwater. They disperse widely in the ocean after their out-migration from freshwater (NMFS 2009b).

The only feeding data available for adult green sturgeon shows that they eat benthic invertebrates, including shrimp, mollusks, amphipods, and even small fish (NMFS 2009b).

Distribution and Habitat

The green sturgeon is the most broadly distributed, wide-ranging, and marine-oriented species of the sturgeon family, ranging from Mexico to at least Alaska in marine waters, and is observed in bays and estuaries up and down the west coast of North America (NMFS 2009b).

The historical and current spawning distribution of this species is unclear, as green sturgeon make non-spawning movements into coastal lagoons and bays in the late summer to fall, and because their original spawning distribution may have been reduced due to harvest and other anthropogenic effects. Today, green sturgeon are believed to spawn in the Rogue River, Klamath River Basin, and the Sacramento River. Spawning appears to occur rarely in the Umpqua River. Green sturgeon in the South Fork of the Trinity River were thought extirpated, but juveniles have been captured at Willow Creek on the Trinity River, and it is suspected that the fish could be coming from either the South Fork or the Trinity River. Green sturgeon appear to occasionally occupy the Eel River (NMFS 2009b).

Green sturgeon utilize both freshwater and saltwater habitat, spawning in deep pools or "holes" in large, turbulent, freshwater river mainstems. Eggs are likely broadcast over large cobble substrates, and may be deposited in clean sand to bedrock substrates as well. Regardless, it is likely that cold, clean water is important for proper embryonic development (NMFS 2009b).

Adults live in oceanic waters, bays, and estuaries when not spawning. Green sturgeon are known to forage in estuaries and bays ranging from San Francisco Bay to British Columbia (NMFS 2009b).

Population Trend

Good data on current population sizes does not exist and data on population trends are lacking (NMFS 2009b).

BULL TROUT

This section presents descriptions of the biology, distribution, and population trends of bull trout.

Life History

Bull trout typically use pristine headwater areas to spawn (WDFW 1998). Spawning begins in late August, peaks in September and October, and ends in November. Fish in a given stream spawn over a period of two weeks or fewer. Almost immediately after spawning, adults begin to work their way back to the mainstem rivers, lakes, or reservoirs to overwinter. Some of these fish stay in these areas while others move into salt water in the spring. Bull trout will spawn a second or even third time. Kelts (adults that have spawned) feed aggressively to recover from the stress of spawning (WDFW 1998).

Newly hatched bull trout emerge from the gravel in the spring (WDFW 1998). Adfluvial, fluvial, and anadromous bull trout typically spend two years in fresh water before they migrate to lakes, reservoirs, the mainstems of rivers, or salt water. Nonmigratory populations spend their entire lives in the same stretch of headwater stream. Fish that exhibit this behavior may not mature until they are 7 to 8 years old, and rarely reach sizes greater than 14 inches in length (WDFW 1998).

Bull trout are opportunistic feeders, eating aquatic insects, shrimp, snails, leeches, fish eggs, and fish. Contrary to earlier beliefs, these fish are generally no longer considered serious predators of salmon and steelhead (WDFW 1998).

Distribution and Habitat

The historical range of bull trout includes major river basins in the Pacific Northwest at about 41 to 60 degrees North latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in the Northwest Territories, Canada. To the west, bull trout range includes Puget Sound, various coastal rivers of British Columbia, Canada, and southeast Alaska. Bull trout occur in portions of the Columbia River and tributaries within the basin, including its headwaters in Montana and Canada. Bull trout also occur in the Klamath River basin of south-central Oregon. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta and Montana and in the MacKenzie River system in Alberta and British Columbia, Canada (USFWS 2002).

Population Trend

Although bull trout are presently widespread within their historical range in the coterminous United States, they have declined in overall distribution and abundance during the last century. Retaining migratory forms of bull trout in a population is important because these forms allow fish access to more resources (i.e., food and habitat), opportunities for genetic exchange, and the ability to recolonize habitats after local extirpations (e.g., by a watershed-wide disturbance affecting all bull trout in a resident population) (USFWS 2002). In Washington, WDFW has identified 80 bull trout populations, of which 14 were considered in healthy condition, two were in poor condition, six were in critical condition, and 58 were in unknown condition (WDFW 1998).

MARBLED MURRELET

This section presents descriptions of the biology, distribution, and population trends of the marbled murrelet.

Life History

The marbled murrelet is a small seabird that nests in the coastal, old-growth forests of the Pacific Northwest. In contrast to other seabirds, murrelets do not form dense colonies and may fly about 43 miles or more inland to nest, generally in older coniferous forests. They are more commonly found inland during the summer breeding season, but make daily trips to the ocean to gather food and have

been detected in forests throughout the year. When not nesting, the birds live at sea, spending their days feeding and then moving several kilometers offshore at night (SEI 2006).

The breeding season of the marbled murrelet generally begins in April, with most egg-laying occurring in late May and early June. Peak hatching occurs in July after a 27- to 30-day incubation. Chicks remain in the nest and are fed by both parents. By the end of August, chicks have fledged and dispersed from nesting areas (Marks and Bishop 1997). The marbled murrelet differs from other seabirds in that its primary nesting habitat is old-growth coniferous forest within 50 to 75 miles of the coast. The nest typically consists of a depression on a moss-covered branch where a single egg is laid. Marbled murrelets appear to exhibit high fidelity to their nesting areas and have been observed in forest stands for up to 20 years (Marks and Bishop 1997).

Marbled murrelets are presumably a long-lived species but are characterized by low fecundity (one egg per nest) and low nesting and fledging success. Fledging success has been estimated at 45 percent. Nest predation on both eggs and chicks appears to be higher for marbled murrelets than for other alcids and may be cause for concern. Principal predators are birds, primarily corvids (jays, ravens, and crows) (Marks and Bishop 1997).

At sea, foraging murrelets are usually found as widely spaced pairs. In some instances murrelets form or join flocks that are often associated with river plumes and currents. These flocks may contain sizable portions of local populations (Ralph and Miller 1994).

Distribution and Habitat

The marbled murrelet inhabits the Pacific Coast of North America from the Bering Sea to central California (SEI 2006).

Marbled murrelets are more commonly found inland during the summer breeding season, but make daily trips to the ocean to gather food, primarily fish and invertebrates, and have been detected in forests throughout the year. When not nesting, the birds live at sea, spending their days feeding and then moving several kilometers offshore at night (SEI 2006). Marbled murrelets feed in nearshore marine waters, mainly within 1 to 2 km from shore, consuming small fish such as Pacific herring, Pacific sand lance, sardines, and juvenile salmonids, as well as invertebrates such as euphasids and shrimp (USFWS 1997).

Throughout the forested portion of the species' range, marbled murrelets used forest stands with old-growth forest characteristics, generally within 80 km of the coast for nesting. The farthest known nesting site from the marine environment in Washington is 63 km. In Washington, marbled murrelet detections increased when old-growth/mature forests comprised more than 30 percent of the landscape, but decreased when the percentage of clear-cut/meadow in the landscape increased above 25 percent (USFWS 1997).

Population Trend

With declines documented separately for Conservation Zones 1 through 5 (coastal area from California to Washington) and Conservation Zone 6 (Strait of Juan de Fuca/Puget Sound), the U.S. Fish and Wildlife Service (USFWS) concluded that the listed population has declined significantly since 2002, the year of the estimate in the USFWS' previous 5-year review. For Conservation Zones 1 through 5 combined, population estimates from monitoring for 2000 to 2008 indicate an annual rate of decline in the range of 2.4 to 4.3 percent. For Conservation Zone 6, new data indicate an annual decline of about 15 percent between 2003 and 2008. Based on the tri-state estimate of about 24,400 birds used in the analysis for the 2004 5-year review, the 2008 population estimate of about 18,000 birds represents a decline of about 26 percent across the listed range from that estimate (USFWS 2009a).

WESTERN SNOWY PLOVER

This section presents descriptions of the biology, habitat, distribution, population trend, threats, and conservation efforts for the western snowy plover.

Life History

The western snowy plover is a small shorebird distinguished from other plovers (family Charadriidae) by its small size, pale brown upper parts, dark patches on either side of the upper breast, and dark gray to blackish legs. Snowy plovers weigh between 1.2 and 2 ounces. They are about 5.9 to 6.6 inches long (USFWS 2010a).

The nesting season extends from early March through late September. The breeding season generally begins earlier in more southerly latitudes, and may be 2 to 4 weeks earlier in southern California than in Oregon and Washington. Fledging of late-season broods may extend into the third week of September throughout the breeding range. Nests typically occur in flat, open areas with sandy or saline substrates. Vegetation and driftwood are usually sparse or absent. The typical clutch size is three eggs but can range from two, and in rare cases, up to six eggs (USFWS 2010a).

Snowy plover chicks leave the nest within hours after hatching to search for food. They are not able to fly for approximately 4 weeks after hatching, during which time they are especially vulnerable to predation. Adult plovers do not feed their chicks, but lead them to suitable feeding areas. Adults use distraction displays to lure predators and people away from chicks. Adult plovers signal the chicks to crouch, with calls, as another way to protect them. They may also lead chicks, especially larger ones, away from predators. Most chick mortality occurs within 6 days after hatching (USFWS 2010a).

Snowy plovers are primarily visual foragers. They forage on invertebrates in the wet sand and among surf-cast kelp within the intertidal zone; in dry, sandy areas above the high tide; on salt pans; and along the edges of salt marshes, salt ponds, and lagoons. They nest in open, flat, sparsely vegetated beaches and sand spits above the high tide. Plovers often return to the same breeding sites year after year (USFWS 2010a).

Distribution and Habitat

The Pacific Coast population of the western snowy plover is defined as those individuals that nest beside or near tidal waters, and includes all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays, and estuaries from southern Washington to southern Baja California, Mexico. Historic records indicate that western snowy plovers nested in at least 29 locations on the Oregon coast. Currently, only eight locations in Oregon support nesting western snowy plovers, a 72-percent reduction in active breeding locations.

The Pacific Coast population of western snowy plovers breeds on coastal beaches from southern Washington to southern Baja California, Mexico. Plovers lay their eggs in shallow depressions in sandy or salty areas that generally do not have much vegetation. Because the sites they choose are in loose sand or soil, nesting habitat is constantly changing under the influence of wind, waves, storms, and encroaching plants (USFWS 2010a).

Population Trend

The current Pacific Coast breeding population of snowy plover extends from Damon Point, Washington, to Bahia Magdalena, Baja California, Mexico (ICF 2009). There are approximately 2,230 breeding birds along the Pacific coast of California, 162 resident adults in Oregon, and 70 adult birds in Washington (ICF 2009). In 2008, the Oregon Natural Heritage Information Center observed 187 to 199 adult snowy plovers; a minimum of 129 individuals were known to have nested. The adult plover population was the highest estimate recorded since monitoring began in 1990 (USFWS 2009b). A survey of breeding snowy plovers along the Pacific coast of Baja California, Mexico, in 1991 and 1992 found 1,344 adults. A current population estimate for Baja Mexico is 2,470 (ICF 2009).

The Pacific Coast population of snowy plover in Oregon was once found along the entire coast but is currently located among eight breeding areas from Florence south (ICF, 2009). Oregon breeding sites in 2006 included Sutton Beach, the Siltcoos River Estuary, beachgrass removal sites at Dunes Overlook, the Tahkenitch Creek Estuary, the Tenmile Creek Estuary, Coos Bay North Spit, Bandon State Nature Area, and the New River spit area. Other Oregon sites where snowy plovers have nested in the recent past (since 1980) include the beach between Clatsop Spit and Gearhart, mouth of the Necanicum River, Bayocean Spit, Sand Lake Spits, South Beach (Newport), mouth of the Siuslaw River, Threemile Creek/Umpqua River, Menasha Spoils (Coos Bay North Spit), and the Floras Lake area (ICF 2009).

As early as the 1970s, observers suspected a decline in plover numbers. The primary cause of decline is loss and degradation of habitat. The introduced European beachgrass (*Ammophila arenaria*) contributes to habitat loss by reducing the amount of open, sandy habitat and contributing to steepened beaches and increased habitat for predators. Urban development has reduced the available habitat for western snowy plovers while increasing the intensity of human use, resulting in increased disturbance to nesting plovers.

STREAKED HORNED LARK

This section presents descriptions of the biology, distribution, and population trends of the streaked horn lark.

Life History

The streaked horned lark is small, ground-dwelling songbird with conspicuous feather tufts, or "horns," on its head. Its back is heavily streaked with black, contrasting sharply with its deeply ruddy nape and yellow underparts.

Nesting begins in late March and continues into June. The nest consists of a shallow depression built in the open or near a grass clump and lined with fine dead grasses. The female lays a clutch of three to five heavily streaked white eggs. Incubation is only 11 days and the young are able to fly within 9 to 12 days after hatching. Horned larks are mainly insect eaters but may eat seeds in winter (USFWS 2010b).

Distribution and Habitat

The streaked horned lark once occurred from British Columbia, Canada, south to northern California. In Oregon, the streaked horned lark was a common summer resident in the Rogue River, Umpqua, and Willamette Valleys, as well as many other smaller valleys on the west side of the Cascade Mountain range. Streaked horned larks winter in eastern Washington, Oregon, and Northern California (USFWS 2010b).

The streaked horned lark nests and breeds in short herbaceous vegetation (<30 centimeters [cm] tall [about 12 inches]) where woody plants are absent and a relatively high percentage of bare ground and patches of sparsely vegetated areas are interspersed with more densely vegetated patches (Altman 1999). Canadian and U.S. surveys indicate that the streaked horned lark currently breeds on prairie remnants and airports in the southern Puget lowlands, on beaches and accreted lands near Grays Harbor and Willapa Bays, on dredge spoil islands in the Columbia River, on an industrial site along the lower Columbia River in Oregon, and on a number of agricultural, pasture, grass, and mudflat habitats in the Willamette Valley from Portland to Eugene, Oregon. Streaked horned larks winter along the Washington Coast on dunes and beaches adjacent to open water with few or no trees and shrubs (Pearson and Altman 2005).

Population Trend

Although population estimates are not exact, the Washington Department of Fish and Wildlife (WDFW) estimates that there are approximately 774 streaked horned larks with 29 percent breeding in the Puget lowlands, 11 percent breeding on the Washington Coast, 9 percent breeding on the lower Columbia River, and 51 percent breeding in the Willamette Valley (Pearson and Altman 2005).

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Appendix E—
EFH Assessment

APPENDIX E
ESSENTIAL FISH HABITAT

ACTION AGENCY

U.S. Army Corps of Engineers, Seattle District

LOCATION

The project is located within the Willapa National Wildlife Refuge (Refuge) in Pacific County, Washington at Township 10 North, Range 11 West, Sections 1, 6, 7, 11, and 12 and Township 10 North, Range 10 West, Section 6. The project area is within the Lewis, Porter Point, and Riekkola Units in the Refuge at the southern end of Willapa Bay, just west of the mouth of Bear River.

PROJECT NAME

Bear River Estuary Restoration, Pacific County, Washington

ESSENTIAL FISH HABITAT BACKGROUND

The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), requires federal agencies to consult with the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) on activities that may adversely affect Essential Fish Habitat (EFH). EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (NMFS, 1999).

This assessment evaluates the impacts of the proposed project to determine whether it "may adversely affect" designated EFH for federally managed fisheries species in the proposed action area. The assessment also describes conservation measures to avoid, minimize, or otherwise offset potential adverse effects of the proposed action on designated EFH.

IDENTIFICATION OF EFH

Groundfish, coastal pelagic, and salmonid fish species that could have designated EFH in the action area are listed in the table below. Several of these species are not typically found in the high-energy regime of the action area. Assessment of the impacts on species that may occur in the action area is based on life-history stages described in Casillas et al. (1998) and PFMC (1998a, 1998b, and 1999).

Species of Fish with Designated Essential Fish Habitat in the Project Area

Common Name	Scientific Name	Common Name	Scientific Name
Groundfish		**Groundfish (cont.)**	
arrowtooth flounder	*Atheresthes stomias*	Pacific sanddab	*Citharichthys sordidus*
big skate	*Raja binoculata*	petrale sole	*Eopsetta jordani*
black rockfish	*Sebastes melanops*	quillback rockfish	*Sebastes maliger*
bocaccio	*Sebastes paucispinis*	ratfish	*Hydrolagus colliei*
brown rockfish	*Sebastes auriculatus*	redbanded rockfish	*Sebastes babcocki*
butter sole	*Isopsetta isolepis*	redstripe rockfish	*Sebastes proriger*
cabezon	*Scorpaenichthys marmoratus*	rex sole	*Glyptocephalus zachirus*
California skate	*Raja inornata*	rock sole	*Lepidopsetta bilineata*
canary rockfish	*Sebastes pinniger*	rosethorn rockfish	*Sebastes helvomaculatus*
China rockfish	*Sebastes nebulosus*	rosy rockfish	*Sebastes rosaceus*
copper rockfish	*Sebastes caurinus*	rougheye rockfish	*Sebastes aleutianus*
curlfin sole	*Pleuronichthys decurrens*	sablefish	*Anoplopoma fimbria*
darkblotch rockfish	*Sebastes crameri*	sand sole	*Psettichthys melanostictus*
Dover sole	*Microstomus pacificus*	sharpchin rockfish	*Sebastes zacentrus*
English sole	*Parophrys vetulus*	shortspine thornyhead	*Sebastolobus alascanus*
flathead sole	*Hippoglossoides elassodon*	spiny dogfish	*Squalus acanthias*
greenstriped rockfish	*Sebastes elongatus*	splitnose rockfish	*Sebastes diploproa*
hake	*Merluccius productus*	starry flounder	*Platichthys stellatus*
jack mackeral	*Trachurus symmetricus*	striptail rockfish	*Sebastes saxicola*
kelp greenling	*Hexagrammos decagrammus*	tiger rockfish	*Sebastes nigrocinctus*
lingcod	*Ophiodon elongatus*	vermilion rockfish	*Sebastes miniatus*
longnose skate	*Raja rhina*	yelloweye rockfish	*Sebastes ruberrimus*
Pacific cod	*Gadus macrocephalus*	yellowtail rockfish	*Sebastes flavidus*
Pacific ocean perch	*Sebastes alutus*		
Coastal Pelagic		**Salmonid Species**	
anchovy	*Engraulis mordax*	Chinook salmon	*Oncorhynchus tshawytscha*
market squid	*Loligo opalescens*	coho salmon	*Oncorhynchus kisutch*
Pacific mackerel	*Scomber japonicus*	pink salmon	*Oncorhynchus gorbuscha*
Pacific sardine	*Sardinops sagax*		

DETAILED DESCRIPTION OF THE PROPOSED PROJECT

The proposed project would remove about 5.74 miles of existing dike, 38 culverts, 2 fish ladders, 2 tide gates, and 2 foot bridges, and reconnect 18 estuary channels; resulting in up to 760 acres of restored estuarine habitat. The resorted habitat includes reconnection of stream channels to the estuarine environment, open water, intertidal flats, and salt marsh. Unrestricted tidal exchange is the goal and historic channels currently isolated within diked areas which are now removed from tidal influence will be reconnected to the Willapa Bay estuary. The proposed project will assist in improving and maximizing the current estuarine system and contribute to the health of the bay and associated habitats. In addition, the proposed project would reduce or eliminate the extent of a highly invasive exotic plant, reed canarygrass, which currently infests the refuge's freshwater impoundments. Tussock infestation will also be reduced. Other exotic species, including nutria and bullfrogs, which currently use the freshwater ponds behind the dike will be eliminated by restoration of estuarine habitat. Juvenile salmon habitat will be restored and other expected benefits include increased waterfowl, waterbird, and shorebird use. Protection and restoration of native estuarine and nearshore habitats is a major ecoregional and recovery goal in the Pacific Northwest Coast Ecoregional Assessment (TNC and WDFW 2006) and the Northern Pacific Coast Regional Shorebird Management Plan (Drut and Buchanan 2000).

For a more detailed project description, see Section 2.2 of the Draft Biological Evaluation.

POTENTIAL ADVERSE EFFECTS OF PROPOSED PROJECT

Groundfish Species

The proposed project could affect EFH beneficially for a limited number of groundfish species by creating 750 acres of intertidal saltmarsh and mudflats. Construction could affect EFH adversely by creating temporary and localized increases in turbidity and could eliminate nonmobile benthic and epibenthic food sources within the footprint of the base of the dike area.

Coastal Pelagic Species

The proposed project is not expected to adversely affect EFH for coastal pelagic species because the project area is limited to intertidal and subtidal zones, where coastal pelagic species are unlikely.

Salmonid Species

Chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch)*, particularly juveniles of these species, may occur in the project area or immediately offshore at any time of the year. Because of project timing, few, if any, juvenile or adult Chinook are expected to be in the action area during construction. The proposed project would increase turbidity briefly in the project area, possibly causing salmonids to avoid certain areas in the vicinity. This possible impact would be temporary and not persist beyond the construction period. The proposed project would affect salmonids beneficially by creating 750 acres of intertidal saltmarsh and mudflats.

CONSERVATION MEASURES

Implementing the conservation measures specified in Section 2.2.3 of the Draft Biological Evaluation would avoid and minimize potential adverse effects of the proposed project.

CONCLUSION

As described above, the proposed activities may cause temporary, localized adverse impacts on certain EFH parameters but should not reduce the overall value of the EFH of managed species. After completion of the proposed project, the disturbed areas would be recolonized and the benthic and epibenthic communities should return to conditions similar to those before project construction. The project would create 760 acres of intertidal saltmarsh and mudflats. Although the proposed project may have localized and temporary adverse effects on designated EFH for groundfish and salmonids, the conservation measures described above would avoid, minimize, or otherwise offset such adverse effects.

REFERENCES

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Appendix F—
Cultural Resources Assessment (AMEC)

CULTURAL RESOURCES REPORT COVER SHEET

Author: Cooper, Jason B., M.A., R.P.A

Title of Report: Cultural Resources Existing Conditions Report for the Bear River Estuary Restoration Project, Pacific County, Washington

Date of Report: July 30, 2010

County: Pacific Section: 1, 11, and 12 Township: 10 North Range: 11 W and Section: 6, 7, and 18 Township: 10 North Range: 10 W

Quads: Chinook, Long Beach, Ocean Park, and Cape Disappointment Acres: 760

PDF of report submitted (REQUIRED) ☒ Yes

Historic Property Export Files submitted? ☐ Yes ☒ No

Archaeological Site(s)/Isolate(s) Found or Amended? ☐ Yes ☒ No

TCP(s) found? ☐ Yes ☒ No

Replace a draft? ☐ Yes ☒ No

Satisfy a DAHP Archaeological Excavation Permit requirement? ☐ Yes # ☒ No

DAHP Archaeological Site #:

_____
_____
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- Submission of paper copy is required.
- Please submit paper copies of reports ***unbound.***
- Submission of PDFs is required.
- Please be sure that any PDF submitted to DAHP has its cover sheet, figures, graphics, appendices, attachments, correspondence, etc., compiled into one single PDF file.
- Please check that the PDF displays correctly when opened.

PROJECT REVIEW SHEET – EZ1

HISTORIC & CULTURAL RESOURCES REVIEW

PROPERTY / CLIENT NAME: Bear River Estuary Restoration Project **FUNDING AGENCY:** Recreation and Conservation Office

Project Applicant:	Willapa Bay RFEG		
Contact Person:	Ron Craig		
Address:	P.O. Box 46		
City, State:	South Bend	**Zip:** 98586	**County:** Pacific
Phone/ FAX:	360 875 6402/360 875 5802		
E-Mail:	rcraig@willapabay.org		

Funding Agency:

Organization:	Recreation and Conservation Office	
Address:	PO Box 40917	
City, State:	Olympia, WA	**Zip:** 98504-0917
Phone:	(360) 902-	
	RCO #	
Date prepared:	July 30, 2010	

PLEASE DESCRIBE THE TYPE OF WORK TO BE COMPLETED

(Be as detailed as possible to avoid having to provide additional information)

☒ **Provide a detailed description of the proposed project:**

See attached existing conditions report.

☒ **Describe the existing project site conditions:**

See attached existing conditions report.

☒ **Describe the proposed ground disturbing activities:**

See attached existing conditions report.

☐ **Check if building(s) will be altered or demolished. If so please complete a DAHP Determination of Eligibility "EZ2" form for each building effected by the proposed project.**

PLEASE ATTACH A COPY OF THE RELEVANT PORTION OF A 7.5 SERIES USGS QUAD MAP AND OUTLINE THE PROJECT INPACT AREA.
(USGS Quad maps are available on-line at http: www.topozone.com)

Project Location

Township: 10 and 11 North **Range:** 10 and 11 West **Section:** multiple
Address: _____ **City:** _____ **County:** Pacific

Place Map Here

See Figures within the attached existing condition report

Please be aware that this form may only initiate consultation. For some projects, DAHP may require additional information to complete our review such as plans, specifications, and photographs. An historic property inventory form may need to be completed by a qualified preservation professional.

July 30, 2010
9-915-17055-0

Cherry Creek Environmental
146 North Canal Street, Suite 111
Seattle, Washington 98103-8652

Attention: Kerrie McArthur

Subject: Cultural Resources Existing Conditions Report for the Bear River Estuary Restoration Project, Pacific County, Washington

Dear Kerrie:

A record search and literature review was conducted on July 26, 2010 on the Washington State Department of Archaeology and Historic Preservation (DAHP) electronic database by a qualified AMEC cultural resources specialist for the Bear River Estuary Restoration Project (Project). A one-mile study area was investigated surrounding the project's Area of Potential Effect (APE), which is situated in Pacific County, Washington. The proposed Project is located partially within Sections 1, 11, and 12 of Township 10 North, Range 11 West and Sections 6, 7, and 18 of Township 10 North, Range 10 West, Willamette Meridian (USGS Chinook, Long Beach, Ocean Park, and Camp Disappointment, WA-OR 7.5 minute topographic quadrangles [1949; photorevised 1984]) (Figure 1).

In 2009, the Willapa Bay Regional Fish Enhancement Group obtained funding from the Washington State Salmon Recovery Funding Board 1 to develop design plans for removing approximately 5 miles of levees, thereby restoring tidal exchange and high quality estuarine habitat to 760 acres on its landward side (Figure 1-1). The levees and associated water management features were constructed over the last 50 years. Since the Project will be receiving either federal funds and/or federal permit to complete this work, it must comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended), its implementing regulations in 36 C.F.R. 800.

To assist Cherry Creek Environmental in submitting a Biological Evaluation for the Project, AMEC conducted a background literature review and record search of the DAHP electronic database and provided an existing conditions report that documents our results of the record search. The level of effort and information provided in this document is geared toward initiating the Section 106 of the NHPA process. Formal consultation, known as government-to-government consultation, is required between the lead federal agency and affected Native

AMEC Earth & Environmental, Inc.
11810 North Creek Parkway N
Bothell, Washington 98011
(425) 368-1000 Phone
(425) 368-1001 Facsimile
www.amec.com

American tribes under Section 106. AMEC was scoped to assemble cultural resources information that is known about the APE and identify areas that may contain unknown and significant cultural resources. There was no fieldwork associated with this phase of cultural resources work. If fieldwork is determined necessary at a later date, this effort will be conducted under a separate task order.

RECORD SEARCH RESULTS

The record search and literature review indicated that there are two previously documented archaeological sites within and/or adjacent to the Project's Area of Potential Effects (APE). Sites 45PC125 and 45PC126 are fish traps and located approximately 500 feet east of the APE near the point where Bear River reaches Willapa Bay. They were recorded during a surveying effort to map archaeological resources of the Willapa Bay area (Losey 2006a).

Site 45PC125, termed Big Bear River Fish Trap, consists of three closely spaced lines of densely packed vertical wood stakes that parallel the river channel for much of their length. Stakes in the features were a mix of branch wood and split stakes. Many protruded far above the mudflat surface. All wood stakes were vertical, and no horizontal elements were noted (Losey 2006b).

Site 45PC126, termed Otter Fish Trap, consists of four lines of densely arranged stakes and two lines of widely spaced single larger posts/stakes. The features are being eroded at their north end by the outer edge of the river channel as it turns northward. Stakes in the features were a mix of branch wood and split stakes. Radiocarbon tests on the portions of two wood stakes resulted in dating the age of the fish trap to approximately 1000 B.P. (Losey 2006c).

The first systematic attempt to identify archaeological resources near the Project area was conducted by Dr. Richard Daugherty in the 1940s. Dr. Daugherty (1947) surveyed large coastal sections of Washington, including the Willapa Bay area.

Abramowitz (1980) reported on a cultural resource survey of portions of the Willapa National Wildlife Refuge in Pacific County for the Office of Public Archaeology. No evidence of cultural resources were recorded during their survey, but the author did indicate that archaeological deposits may be present further upstream on Bear River associated with potential Chinook winter village locations or for travel camps (Abramowitz 1980).

Cooper (2009) conducted a cultural resources survey and evaluation of the Oman Berm-Tarlatt Slough Set-Back Project for WSDOT. A pedestrian survey coupled with an extensive sub-surface exploration program (i.e., shovel test probes and mechanical trenching) failed to identify any archaeological resources. AMEC documented a primary ditch, east/west lateral ditches, a dike and several footbridges as a historic-era structure. AMEC recommended the water management feature as not being eligible for listing in the NRHP because it lacked association with an historic event and/or persons.

GEOLOGICAL CONTEXT

The APE is predominately covered by Ocosta silty clay loam, a clayey alluvial soil deposited in coastal bays (Pringle 1986). Upland areas within the project area are generally covered by Willapa silt loam soils, which typically develop in marine sediment on coastal terraces. The APE is categorized as Agriculture (AG) by the Pacific County Comprehensive Plan. Agricultural land in the County is classified as: (1) “agricultural land of long-term significance,” including all land devoted to the production of aquaculture, cranberries, or other bog related crops; and (2) “agricultural land of local importance,” including diked tideland involved in existing and ongoing activities.

RECOMMENDATIONS

There are two previously documented archaeological resources directly adjacent to the Project’s Area of Potential Effects (APE). Sites 45PC125 and 45PC126 are pre-contact fish traps located within the mudflats adjacent to the Bear River channel. Radiocarbon (C-14) dates on the wooden stakes from 45PC126 dated the site to 1,000 Before Present (or approximately 1000 AD). It is anticipated other unknown fish traps are located within the Bear River watershed due to the limited survey area covered during the original project which documented them.

Based on the evaluation of historic aerial photographs of the APE, the dike and ditch drainage system that extends from Tarlatt Slough around Porter Point to the Bear River channel was built / improved upon between 1942 and 1959. This would make the water management feature at least 50 years old.

There are no previously documented Traditional Cultural Properties (TCPs) identified within the APE. Ethnographic research does identify one place name associated with a former Chinook village (*nu?x^{w}as?nł* - “blackberry town”) that was once located near the confluence of Bear River and Willapa Bay, immediately outside the Project’s APE. The exact village location is unknown, but it may be closely associated with the previously documented fish traps in the area.

Government-to-government consultation with all affected Native American tribes, as directed by Section 106 of the National Historic Preservation Act of 1966, as amended, is required for this project. Consultation with the affected Native American tribes may identify culturally sensitive areas within the watershed that would require further evaluation.

Please feel free to call (425.368.0953) or email (jason.cooper@amec.com) if you have any questions about this existing conditions report.

Sincerely,

AMEC Earth & Environmental, Inc.

Jason B. Cooper, M.A., RPA
Senior Archaeologist

Attachments-Figures 1, 1-1, and 1-2

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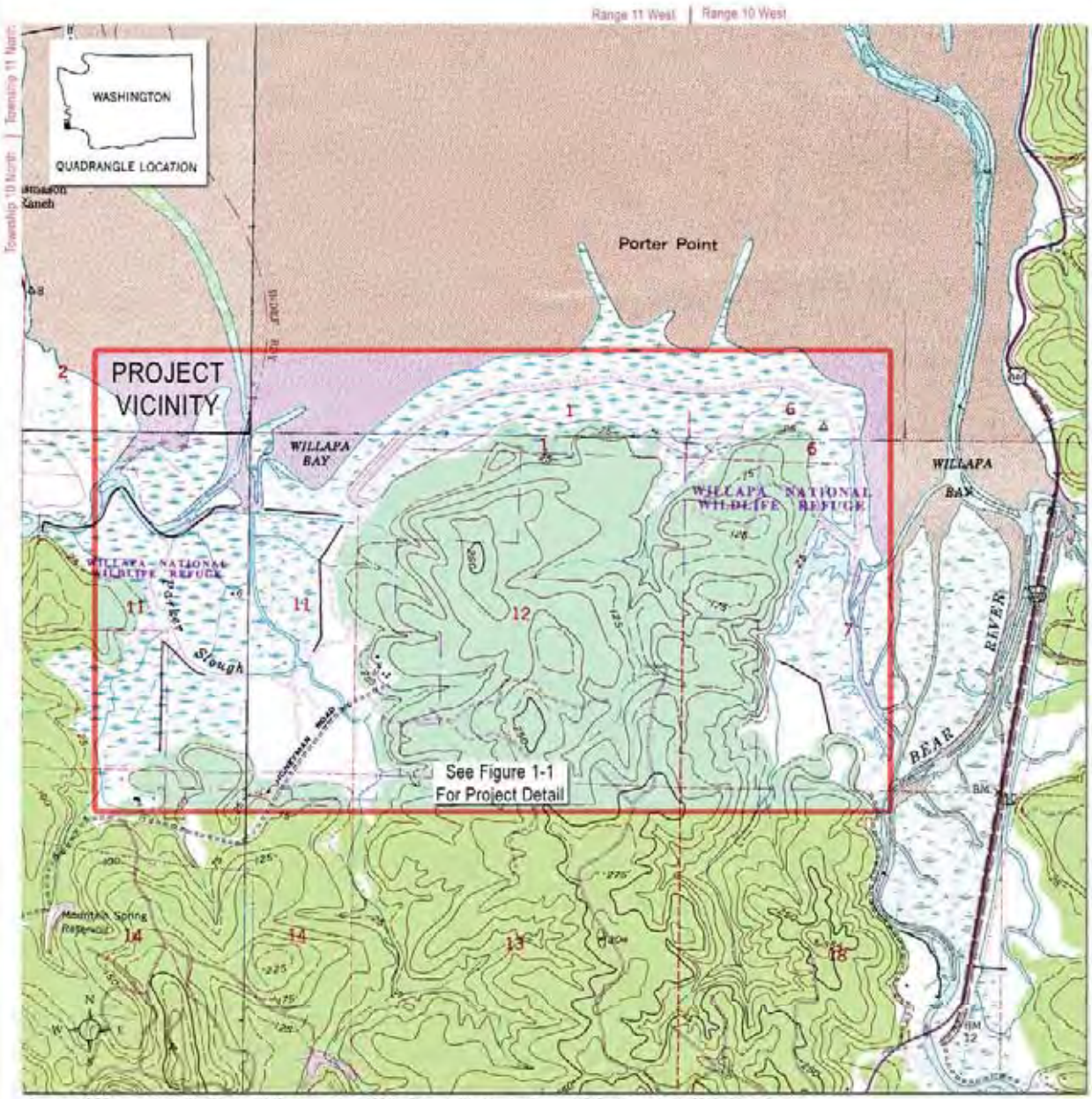


Source: USGS Long Island, Washington (1949; photorevised 1964); Chinook, Washington-Oregon (1949; photorevised 19840; Ocean Park, Washington (1949; photorevised 1984); and Cape Disappointment, Washington-Oregon (1949; photorevised 1964) 7.5 minute topographic quads.

Scale

0 Mile 0.5

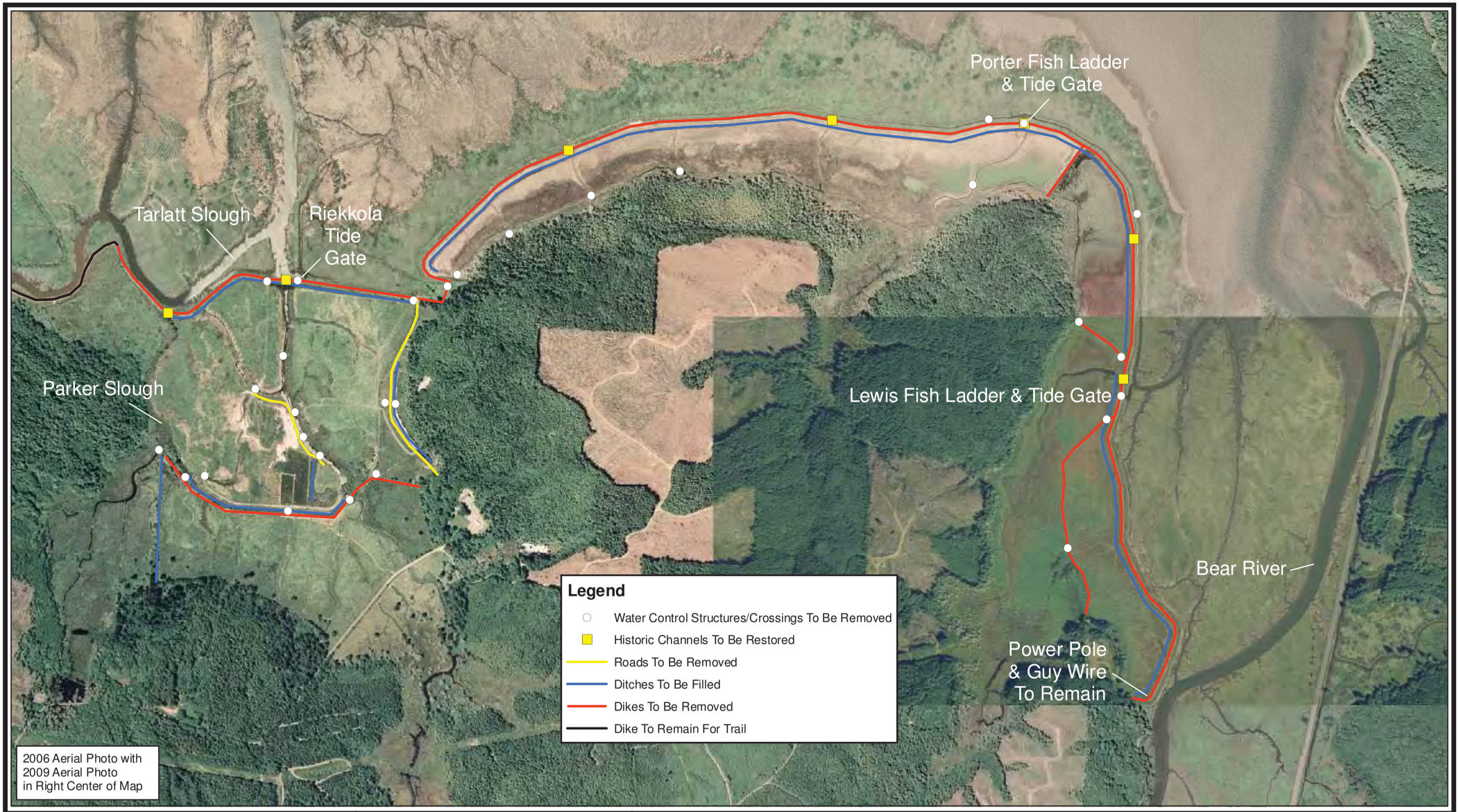
FIGURE 1

Project Vicinity Map

BEAR RIVER ESTUARY RESTORATION PROJECT

amec

0-915170XX-0



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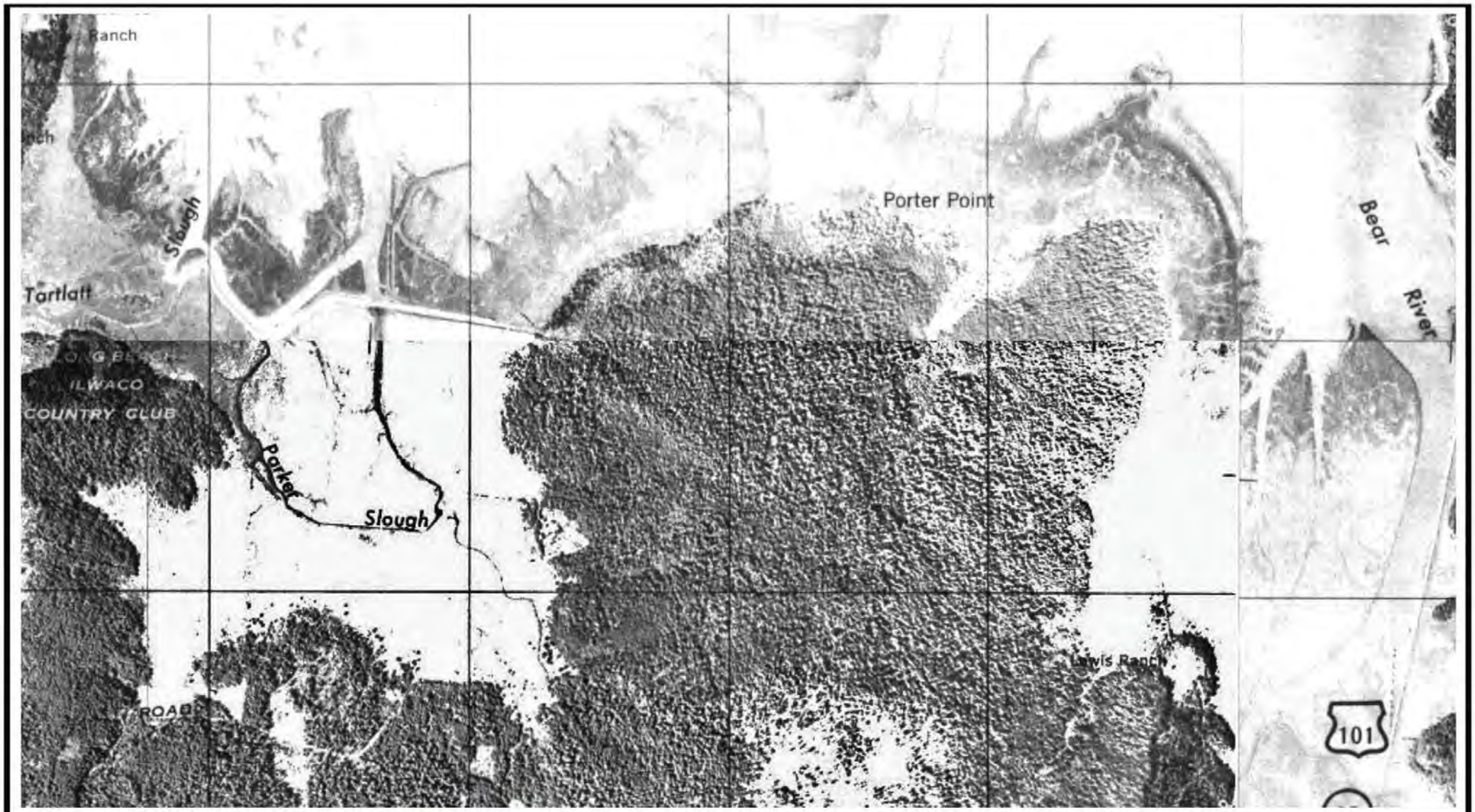
Project Map
Bear River Estuary Restoration
Willapa Bay Regional Fisheries Enhancement Group
Willapa National Wildlife Refuge

Figure 1-1



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1000 0 1000 Feet

Approximate Scale & Orientation

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1943 Aerial Photo
Bear River Estuary Restoration
Willapa Bay Regional Fisheries Enhancement Group
Willapa National Wildlife Refuge

Figure 1-2