BIOLOGICAL ASSESSMENT

(continued)

APPENDIX O

Mitigation

APPENDIX O.1

Compensatory Wetland Mitigation Plan

Compensatory Wetland Mitigation Plan

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Page No.	**Section**	**Change Description**
		Responded to JCEP comments on Rev G.
		Updated access channel habitat acreages based on September eelgrass data.
		Updated impact acreages in mitigation ratio acreages per expanded study areas (wetland K, rock apron).
		Updated figures O - 1 and E- 14, due to above changes.
		.

Jordan Cove Energy Project
and
Pacific Connector Gas Pipeline Project

Compensatory Wetland Mitigation Plan

Document Number:

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1. *COMPENSATORY WETLAND MITIGATION PLAN OVERVIEW*

1.1 INTRODUCTION

Jordan Cove Energy Project, LP (JCEP) is seeking authorization from the Federal Energy Regulatory Commission (FERC) under Section 3 of the Natural Gas Act (NGA) to site, construct, and operate a natural gas liquefaction and liquefied natural gas (LNG) export facility (LNG Terminal), located on the bay side of the North Spit of Coos Bay, Oregon. JCEP will design the LNG Terminal to receive a maximum of 1,200,000 dekatherms per day (Dth/d) of natural gas and produce a maximum of 7.8 million tonnes per annum (mtpa) of LNG for export. The LNG Terminal will turn natural gas into its liquid form via cooling to about -260^{o} Fahrenheit (F), and in doing so it will reduce in volume to approximately 1/600th of its original volume, making it easier and more efficient to transport.

In order to supply the LNG Terminal with natural gas, Pacific Connector Gas Pipeline, LP (PCGP) is proposing, under a separate Section 7c NGA authorization, to contemporaneously construct and operate a new, approximately 229-mile-long, 36-inch-diameter natural gas transmission pipeline from interconnections with the existing Ruby Pipeline LLC and Gas Transmission Northwest LLC (GTN) systems to the LNG Terminal (Pipeline, and collectively with the LNG Terminal, the Project).

This Compensatory Wetland Mitigation (CWM) Plan includes proposed mitigation at two sites within the Coos Bay Estuary, the Eelgrass Mitigation site and the Kentuck Project site. Each site provides for the minimum mitigation acreage/credits required to meet regulatory requirements plus additional acreage in which to conduct voluntary habitat improvements. Where appropriate, the distinction between required mitigation versus voluntary efforts is noted in this CWM Plan. The distinction is primarily with respect to the acreage of improvements to various habitat types and how much is required versus how much is voluntary.

The proposed LNG Terminal will result in unavoidable, permanent impacts to freshwater wetlands and estuarine habitats (collectively referred to as wetlands in this document except where there is a need to distinguish the difference) within the intertidal and shallow subtidal zone of Coos Bay, as provided below in Table 1. These resources provide important ecological functions to the greater Coos Bay ecosystem, and are regulated by state and federal agencies. Note that the Oregon Department of State Lands (ODSL) treats temporary impacts lasting more than two-years (long duration) as a permanent impact; whereas, the U.S. Army Corps of Engineers (USACE) does not. For consistency sake between the two agencies, this CWM Plan only covers actual permanent impacts. All temporary impacts, short and long duration, will be addressed in a separate site restoration plan.

The proposed Pipeline will result in permanent impacts to wetlands in the form of permanently converting forested and scrub-shrub wetlands to emergent wetlands as a result of temporary disturbance activities involved with pipe installation. Conversion from one Cowardin class to another Cowardin class is viewed as a permanent wetland impact by the USACE and ODSL due to an overall loss of wetland functions (Oregon Revised Statutes [ORS] 141-085-0680). The permanent wetland type conversion impacts from the Pipeline, which total less than one acre, would occur across eight fifth-field watersheds (HUC 10). Most of the conversion impacts within the affected watersheds would be less than 0.1 acre with only one watershed experiencing a permanent conversion impact exceeding 0.2 acre which would occur within the Olalla Creek –

Lookingglass Creek Watershed (HUC 1710030212). Previously, PCGP proposed to mitigate the conversion impacts at the Cow Hollow Mitigation Bank which is within the Olalla Creek – Lookingglass Creek Watershed, where the largest conversion impact (0.37 acre) would occur. However, ODSL had concerns that this mitigation bank was not a viable option due to the lack of available credits. PCGP and the Bank Owner prepared a mitigation plan as Phase II of the Cow Hollow Bank on lands adjacent to the existing Cow Hollow Mitigation Bank, but based on ODSL's reservations concerning the Phase II proposal and because there were no other mitigation bank service areas that overlapped the pipeline, PCGP dropped the use of mitigation banks from further consideration. Instead, PCGP chose to consolidate mitigation in a single location that would have a high likelihood of success and that would be co-located with the JCEP LNG Terminal's compensatory mitigation obligations at the Kentuck Project in Coos Bay, Oregon. Further, the Pipeline's permanent wetland impacts consist of small, individual impacts spread over a large geographic area, and, therefore, it is impractical to conduct wetland mitigation at multiple, small sites in various watersheds crossed by the Pipeline.

This CWM Plan specifically covers compensatory mitigation for permanent impacts to freshwater wetlands and estuarine resources proposed within the Project sites (Table 1 and Appendix A, Figures O-1A and O-1B; also see Appendix C for a detailed breakdown of Pipeline permanent impacts by watershed). As previously noted short and long duration temporary impacts are addressed in a separate site restoration plan. Development features that result in freshwater wetland and estuarine impacts and that are covered in this CWM Plan include:

LNG Terminal: Ingram Yard
LNG Terminal: Slip and access channel
LNG Terminal: Material Offloading Facility (MOF)
LNG Terminal: South Dunes site
LNG Terminal: Access and Utility Corridor
LNG Terminal: Trans Pacific Parkway/U.S. Highway 101 (US-101) Intersection Widening
LNG Terminal: Impacts associated with construction of the Kentuck Project mitigation site
Pipeline: Areas of forested and scrub-shrub wetland converted to emergent wetland

Table 1. Summary of Permanent Freshwater Wetland and Estuarine Impacts Being Mitigated

Habitat Category	Cowardin Code*	Project Habitat Description	Permanent Impact (Acres) ***
LNG Terminal			
Freshwater Wetland	PFO	Forested wetland	0.29
	PEM	Emergent wetland	1.15
	PAB	Emergent wetland and water	0.48
Estuarine	E2USN	Intertidal sand/mudflat	11.89
	E1UB	Shallow subtidal habitat (i.e., unvegetated areas from 0 feet to -15 feet Mean Lower Low Water ("MLLW") datum)	4.32
	E2EM	Saltmarsh	0.06
	E2AB	Eelgrass	2.26
	E2RS	Riprap road embankment below Highest Measured Tide ("HMT")	0.51
		Total all LNG Terminal	**20.89**
Pipeline**			
Freshwater Wetland	PFO, PSS	Forested and scrub-shrub wetland converted to emergent wetland	0.91
		Total all Pipeline	**0.91**
Impacts at Kentuck Site			
Freshwater Wetland	PFO	Forested wetland	0.85
	PEM	Emergent wetland	4.55
Estuarine	E2RS	Riprap road embankment below HMT	0.07
		Total all Kentuck Site	**5.47**
		Total all impacts being mitigated	**27.34**

* Cowardin classes: E2AB = estuarine, intertidal, aquatic bed; E2USN = estuarine, intertidal, unconsolidated shore, regularly flooded (i.e., mudflat); E1UB = estuarine, subtidal, uncosolidated bottom; E2EM = estuarine, intertidal, emergent; E2RS = estuarine, intertidal, rocky shore; PFO = palustrine forested; PSS = palustrine scrub-shrub; PEM = palustrine emergent; and PAB = palustrine aquatic bed.

** A detailed breakdown of permanent wetland impacts related to the Pipeline is provided in Appendices A (map) and B (table).

*** Impact values provided to the third decimal place for JLNG Terminal impacts, for consistency with joint permit application impact table. All other values provided to two decimal places.

As shown in Table 1, a total of 27.34 acres of permanent impacts will require mitigation. 26.36 acres of these impacts are attributable to the LNG Terminal, which includes the LNG Terminal development impacts (20.96 acres), the impacts associated with construction of the Kentuck Project mitigation site (5.47acres), and the impacts to 2.26 acres of existing eelgrass resources within the intertidal zone of the proposed LNG Access Channel. The remaining 0.91 acre of impacts are attributable to the Pipeline.

Mitigation of permanent impacts to wetlands from construction and operation of the LNG Terminal and related facilities will occur at two sites: the Eelgrass Mitigation site and the Kentuck Project site. Mitigation for the Pipeline will occur only at the Kentuck Project site.

The Eelgrass Mitigation site (9.34 acres) consists of a locally high area in the Coos Bay estuary, southwest of the Southwest Oregon Regional Airport (SORA), which is bordered by eelgrass. This locally high area was likely created by estuarine processes that have since been blocked by the airport runway extension constructed in the 1980s (Appendix D). Site elevations are currently too high to support eelgrass (+2.7 feet MLLW); mitigation activities will include lowering the elevations to match those of surrounding eelgrass beds and planting the site with eelgrass. Appendix D provides a historical geomorphic analysis that indicates that the Eelgrass Mitigation Site will remain stable after grading and planting. The most recent eelgrass surveys conducted in 2018 by DEA found that eelgrass is not present within the site boundaries, though adjacent eelgrass beds are present. The extent of grading of the final eelgrass mitigation site will be limited to avoid surrounding areas of existing eelgrass habitat. The site boundaries will be finalized after pre-construction eelgrass surveys have been completed.

The Kentuck Project includes two main components totaling approximately 100 acres adjacent to Kentuck Slough and Kentuck Creek. Kentuck Creek flows to Kentuck Slough. In this CWM Plan Kentuck Creek is used to refer to the portion of the drainage generally above the historic head of tide, while Kentuck Slough is used to refer to the portion of the drainage generally below the historic head of tide. The first Kentuck Project component (91.46 acres), which includes the majority of the former Kentuck Golf Course, consists of diked (i.e., levee construction) historical tide lands that will be reconnected to the estuary and result in a combination of tide channels, mudflats, salt marsh, and fringing freshwater wetland communities. The second component (9.14 acres) is located at the far northeast end of the former golf course and will feature a freshwater floodplain reconnection to Kentuck Creek. Construction of the Kentuck Project will entail roughly 5.47 acres of permanent impacts to wetlands, with mitigation for these impacts incorporated into this plan.

In Oregon, it is a longstanding and common practice for the USACE regulatory program to accept the State's wetland mitigation ratios when considering CWM Plans. Therefore, Oregon ODSL wetland mitigation ratios have been used to determine mitigation acreages presented in this plan. ODSL mitigation ratios are: 1 acre of restored wetland for each 1 acre of impacted wetland; 1.5 acres of created wetland for each 1 acre of impacted wetland; and 3 acres of enhanced wetland for each 1 acre of impacted wetland.

Mitigation at the Kentuck Project site will be achieved through enhancement activities (i.e., converting disturbed freshwater wetland back to historic estuarine habitats), and thus calculated using a 3:1 ratio. However, some activities may result in actual restoration; that is, some historical wetlands that are currently upland may be restored to wetland. For Kentuck Project site mitigation credit accounting purposes, all potential restoration will be considered contingency, because all of the mitigation needs can very likely be met through the proposed enhancement areas.

Eelgrass mitigation actions will be considered enhancement since they entail improving functions of existing estuarine habitat (i.e., sand/mudflat) to that of eelgrass habitat. Therefore, a 3:1 ratio will be used for initial eelgrass mitigation. Given a proposed impact to 2.26 acres of eelgrass (Table 1), a 3:1 impact to enhancement ratio will be 6.78 acres of initial eelgrass enhancement. This will be more than satisfied by the proposed grading of a 9.34 acre site at optimal elevations for eelgrass planting and colonization. However, for eelgrass, unlike wetlands, maintaining a 3 to 1 final ratio is not feasible and the USACE has recommended a final mitigation ratio of 1.2:1 after 5 years of post-construction monitoring (USACE 2018a). Therefore, the final mitigation requirement will be 2.71 acres of eelgrass (2.26 X 1.2) after a 5 year post-construction monitoring period. This final ratio is the objective for proposed eelgrass mitigation. The final eelgrass mitigation ratio, if justified, may also be reduced by the proposed salvage of existing eelgrass within the project area and transplantation to adjacent recipient sites prior to dredging actions (see Section 3.4.3). The final eelgrass mitigation requirement will be reduced by the amount of transplanted eelgrass that has successfully reestablished at the recipient sites. Successful reestablishment will be documented by annual quantitative monitoring.

This proposed CWM Plan has been prepared in accordance with the Oregon Administrative Rules (OAR) of the Oregon DSL for Compensatory Wetland and Tidal Waters Mitigation (OAR 141-085-0680). The plan also meets the requirements of the federal rule for Compensatory Mitigation for Losses of Aquatic Resources (33 CFR Part 332), commonly referred to as the "mitigation rule."

1.2 ECOLOGICAL GOALS AND OBJECTIVES

The goals and objectives of this CWM Plan seek to offset the loss of acreage and functions provided by the wetland resources that would be impacted by the Project. Specific goals and objectives for each proposed mitigation area are provided below, with additional detail provided in Section 7.1, Performance Standards. It should be noted that acreages proposed below are primarily the minimums based on the standard ODSL 3:1 enhancement ratios and USACE mitigation ratio of 1.2:1 for eelgrass, and that additional voluntary habitat improvement acreage is planned for beyond these minimums. In some instances voluntary efforts are included in the goals and objectives discussion to help clarify the distinction between required mitigation versus the voluntary efforts at each site.

1.2.1 Eelgrass Mitigation Site

The Eelgrass Mitigation site is intended to offset impacts to eelgrass habitat resulting from the LNG Terminal. The Pipeline does not impact eelgrass habitat.

Mitigation Goal 1: At the proposed Eelgrass Mitigation Site, establish a population of eelgrass equivalent to the impact site with the addition of the prescribed regulatory ratio (i.e., 2.71 acres). The stability of the population size and density shall be comparable to surrounding beds and reflect the overall natural fluctuation of eelgrass coverage and density within the bay (monitoring will include reference sites to enable tracking of natural fluctuations of eelgrass coverage and densities).

(Note that the eelgrass mitigation site will encompass 9.34 acres. As proposed, this intertidal area would be excavated to a similar elevation as the surrounding areas currently populated by eelgrass.)

To achieve this goal, the following objectives will be met:

Objective 1.1: Establish elevations suitable for eelgrass establishment over a minimum of 6.78 acres (i.e., 3 to 1 mitigation ratio for enhancement projects).

Objective 1.2: Establish a resultant 2.71 acres of eelgrass beds after 5-years of post-construction monitoring (i.e., a final mitigation ratio of 1.2 to 1 impact site to mitigation site, prescribed by the USACE). To maintain ecological functions, the densities of eelgrass at the Eelgrass Mitigation Site would be statistically no different than eelgrass densities within the adjacent reference site and within the proposed Access Channel prior to dredging. Quantitative density counts within both areas are similar and not statistically different from each other (53.5 shoots/m^2 at the Reference Area and 54.0 shoots/m^2at the Access Channel; details are available in the 2018 Eelgrass Summary Report [DEA 2018a]). The maturity and expansion of the planted eelgrass mitigation site over the 5-year post-construction monitoring period will also have to meet annual performance standards of areal coverage and density, as outlined in Section 7.1. In the case that eelgrass densities increase or decline within the Reference Site over the post-construction period, reference densities will be used to measure performance. This is consistent with maintaining the ecologically functional equivalent of current conditions within Coos Bay while following both ODSL and USACE guidelines.

It should also be noted that Objective 1.2 acreage may be reduced based on the amount of impact site acreage that can be salvaged and transplanted to other areas. Subject to agency consultation and approval, the project proposes to remove eelgrass from the Access Channel prior to dredging and transplant it to the Jordan Cove embayment a full two seasons before the eelgrass mitigation site will be planted. Jordan Cove was evaluated and found to be an acceptable recipient site for eelgrass transplants during eelgrass and bathymetric surveys conducted in 2018 (DEA 2018; see Section 3.4.3). Two seasons of monitoring the salvaged transplants will be conducted in Jordan Cove to verify what has established. Data would be used to recalculate (and potentially reduce) the total eelgrass mitigation requirement at the Eelgrass Mitigation Site based on the amount of eelgrass that has reestablished in Jordan Cove. Approval by the USACE and ODSL would be required before implementing this approach.

Objective 1.3: Reestablish eelgrass beds temporarily impacted from construction of the eelgrass mitigation site. The mitigation site shall be surveyed during the summer growing season prior to the proposed winter dredging activities to document potential incidental impacts that may occur. The functional acreage equivalent will be restored.

Objective 1.4: There will be no lasting depletion or harm to eelgrass donor beds, documented by annual monitoring requirements. This objective does not apply to eelgrass that would be salvaged from the impact site.

1.2.2 Kentuck Project Site – Tidal Reconnection Area (LNG Terminal)

The LNG Terminal's additional mitigation needs will be provided for in the Tidal Reconnection Area.

Mitigation Goal 2: Restore tidal connectivity to a minimum of 72.51 acres of historic tide lands within the former golf course site, which will result in a diverse array of habitat types including mudflat, tide channels, salt marsh, and fringing freshwater wetlands. This acreage is based on a 3:1 ratio of LNG Terminal impacts presented in Table 1, including permanent impacts at the Kentuck Site but not including eelgrass impacts.

Approximately 91 acres of construction will be undertaken to achieve this goal, including approximately 18 acres of voluntary habitat improvements above the minimum requirements. Additionally, JCEP anticipates providing substantially more vegetated habitat (e.g., salt marsh) than the minimum required because of salt marsh's higher productivity and historical loss within the watershed relative to mudflat. An estimated 28 percent of tidal wetland (e.g., salt marsh) has been lost within the bay compared to an estimated 18-percent loss of tidal flats (e.g., mudflat), and there is currently roughly four and a half times more tide flat than tidal wetland within the bay (Borde et. al. 2003). Proposed plant community elevations and species composition are based on a reference site immediately adjacent to the mitigation site in Kentuck Inlet.

To achieve this goal, the following objectives will be met:

Objective 2.1: Restore tidal reconnection to the site that allows for free exchange of tidal water from Kentuck Inlet. The reconnection will allow ecosystem processes to function similar to historic pre-settlement conditions to the greatest extent practicable given historic alterations at the site and within the watershed and also based on site constraints and adjacent property owner concerns. This objective will be achieved by installing a new bridge along East Bay Drive that meets Oregon Department of Fish and Wildlife (ODFW) fish passage criteria, National Marine Fisheries Service (NMFS) standards, and (based on hydrodynamic modeling) has been designed to allow for full tidal exchange within the site during a single tide cycle.

Objective 2.2: Allow for continuity of ecological processes to occur between Kentuck Inlet, the project site, and Kentuck Slough, including fish passage. This objective will be achieved by installing the bridge along East Bay Drive as noted in Objective 2.1 as well as a muted tidal regulator (MTR) (i.e., fish friendly tidegate) towards the upper end of the site to create a direct connection between the site and Kentuck Slough. An additional fish friendly culvert (i.e., box culvert with native substrate bottom) will be installed to reestablish tidal connection to a drainage now blocked by an earthen berm/irrigation pond. All structures will be designed to meet ODFW fish passage criteria and NMFS standards.

Objective 2.3: Provide a range of aquatic habitat regimes within the site to support native plant species. This objective will be achieved through site grading to provide a range of tidal regimes within the site, including areas of salt marsh (particularly lower marsh elevations), mudflats, grading of primary and secondary tide channels, and habitat pools.

Objective 2.4: Provide aquatic habitat features to further support native aquatic species, including rearing salmonids. This objective will be achieved through installation of wood habitat structures in habitat pools, channels, and other areas subject to periodic tidal inundation. At a minimum the following will be included:

- 4 five-log free standing habitat structures
- 13 three-log bank tied habitat structures
- 12 one-log root wads
- 2 habitat pools

Objective 2.5: Establish a diversity of vegetated estuarine and freshwater wetland habitat types dominated by native species (i.e., salt marsh, and palustrine forested, scrub-shrub, and emergent communities). At a minimum 22.35 acres of vegetated habitats shall be established to offset vegetated wetland impacts (i.e., Table 1 LNG Terminal impacts, including Kentuck impacts, to PFO, PSS, PEM, PAB, and E2EM habitats) at a 3:1 ratio. This objective will be achieved by grading site elevations that are supportive of salt marsh establishment (based on nearby reference salt marsh). Fringing freshwater wetlands are anticipated to form along the upper margins of the site that occur near sources of freshwater (i.e., tributary streams, and seeps and shallow subsurface flows from the hillside that runs along the south side of the site). There will be a natural interplay between salt water from the bay and freshwater inputs that ultimately dictates the boundary between freshwater wetland/salt marsh communities. Salt marsh elevations are anticipated to range between approximately 5.5 ft to 8.5 ft NAVD 88 and the majority of proposed vegetated areas have been designed to these elevations. Maximum site elevations (not including levee and roadways) extend up to an elevation of 10.0 ft NAVD 88, which is just below the highest measured tide elevation for Coos Bay (10.26 ft NAVD 88). Elevations have only been extended up to 10.0 ft where freshwater tributary and hillside inputs are anticipated and therefore freshwater wetland plant species are likely to grow.

1.2.3 Kentuck Project Site – Freshwater Floodplain Reconnection Area (Pipeline)

The Pipeline's mitigation needs will be provided for in the Freshwater Floodplain Reconnection Area.

Mitigation Goal 3: Improve wetland and aquatic habitat functions by restoring ecological processes along a reach of Kentuck Creek and its adjacent, diked and grazed wetland floodplain. This will entail reestablishing floodplain connection to a minimum of approximately 2.73 acres of historical floodplain adjacent to Kentuck Creek (i.e., 3:1 ratio of PCGP impacts noted in Table 1), and establishing a mix of forested and scrub-shrub wetland habitats. Approximately 9.14 acres of construction will be undertaken to achieve this goal, including approximately 6.41 acres of voluntary habitat improvements above the minimum requirements. Per recommendation from NMFS, realigning a portion of Kentuck Creek through the site will also occur in order to improve instream habitat.

To achieve this goal, the following objectives will be met:

Objective 3.1: Improve in-stream habitat channel complexity to support native aquatic species. This objective will be met by realigning the creek through the Freshwater Floodplain Reconnection Area instead of following its current course along the northeast property boundary. Channel sinuosity will be increased to approximate estimated historic conditions and the channel cross-section will simulate a natural channel as opposed to the current partially maintained ditch-like channel. The existing channel will be plugged at its upstream end where it enters the site to divert water to the new channel, while the remainder of the existing channel will be left in place as a backwater habitat feature and to allow flow inputs from Mettman Creek and an existing drain from an adjacent property.

Objective 3.2: Increase instream habitat structural complexity. This objective will be achieved through installation of large wood, including root wads. At a minimum the following will be included:

- 1 complex wood structure
- 5 three-log bank tied habitat structures
- 2 one-log root wads

Objective 3.3: Allow for floodplain connection between the creek and its historic floodplain. This objective will be achieved by realigning the creek as described in Objective 3.1 as well as removing the existing levee along the northeast boundary of the site.

Objective 3.4: Enhance wetland functions through the establishment of native forested and scrub-shrub wetland plant communities. This objective will be achieved by a combination of site grading that will add microtopographic relief and planting the site with native trees, shrubs, and emergent wetland species. The microtopography will result in varied hydrologic regimes to support a higher diversity of plant species. Trees and shrubs will border both sides of the creek providing shading as well as food sources (i.e., macroinvertebrates) to fish.

1.3 OVERVIEW OF CWM CONCEPT AND FUNCTIONS AND VALUES REPLACEMENT

CWM activities will occur at two separate sites—the Eelgrass Mitigation site and the Kentuck Project site—with each site addressing a different need (Figure O-1A in Appendix A). Location information is provided in Section 2, CWM Site Information. Lost functions and values at the existing wetland sites will be replaced by conducting mitigation in suitable locations within the Coos Bay estuary that will result in self-sustaining, complex habitats connected to adjacent ecosystems. Additional discussion of functional replacement is provided in Section 5, Functions and Values Assessment and in Appendices Appendix E and Appendix F, which provide the results of project functional assessments for the LNG Terminal and PCGP project components, respectively. Appendix E includes a summary table of proposed function and value losses and gains for wetlands associated with mitigation at the Kentuck Project site.

Currently there are no approved eelgrass functional assessments approved for use in Oregon and a search for other suitable rapid eelgrass functional assessments that could be applied to the project was unfruitful. The California Eelgrass Mitigation Policy and Implementing Guidelines (NOAA 2014) states that "In absence of a complete functional assessment, eelgrass distribution and density should serve as a proxy for eelgrass habitat function." Therefore, eelgrass density data were collected from existing eelgrass beds within the proposed Access Channel as well as the selected Reference Site. Eelgrass density and area coverage are integral to the performance criteria developed to measure acceptable progress at the eelgrass mitigation site over a 5-year post-construction monitoring program.

1.3.1 Eelgrass Mitigation Site

1.3.1.1 Site Description

To mitigate for permanent impacts to approximately 2.26 acres of eelgrass, JCEP proposes to initially enhance a minimum of approximately 6.78 acres of existing intertidal habitat to support a minimum of 2.71 acres of eelgrass beds due south of the SORA Airport (Figure O-1A). This effort is considered to be enhancement because it improves the functionality of existing estuarine habitat. As previously noted, enhancement projects in Oregon require a 3 to 1 ratio of mitigation to impact acreage. After 5-years of post-construction monitoring, the USACE requires a ratio of 1.2:1 mitigation site to impact site measured as an eelgrass area, hence a final mitigation total of 2.71 acres. As noted in Section 1.2.1, the total size of the site is designed to be 9.34 acres, which is substantially greater than the minimum 6.78 acres to meet a 3:1 initial eelgrass mitigation ratio. Conceptual design plans for the Eelgrass Mitigation site are provided in Figure E1. Based on documented evidence of eelgrass presence in Coos Bay, it is known that eelgrass tends to occur between approximately +2.31 ft and -4.77 ft (NAVD 88; +3.03 to -3.95 ft MLLW; Thom et al. 2003). These findings are further supported by hydrographic survey work conducted by DEA at the proposed Eelgrass Mitigation Site in 2018, 2014, 2010, and 2007, and the SSNERR in 2016. Based on these various surveys, eelgrass was found to be consistently most abundant adjacent to the proposed mitigation site between elevations 0.0 and -2.0 ft NAVD 88 (+0.72 to -1.28 ft MLLW, and in particular between -1.0 and -2.0 ft NAVD 88 (-0.28 to -1.28 ft MLLW).

The existing Eelgrass Mitigation Site is an unvegetated intertidal shoal comprised of medium to course sand. The top of the shoal is at an elevation of +2.7 ft MLLW (+2.0 ft NAVD88), with the outer boundaries at approximately +0.7 ft MLLW (0 ft NAVD88; Figure E2). In 2018, DEA conducted additional eelgrass investigations at the site and confirmed that no eelgrass is present within the grading boundaries (Figure E3). Large eelgrass patches were present east and south of the site. Areas west of the site become quite shallow approaching a remnant of a dredge spoil island created in the 1950s. Very small patches were observed in this area. Farther to the southwest, eelgrass becomes quite dense and continuous; this area was selected as the donor and reference site (see Section 1.3.1.3). An evaluation of both eelgrass distribution and bathymetry indicates that the principal limiting factor for eelgrass in the general vicinity of the Eelgrass Mitigation Site is elevation.

The proposed approach is to excavate the locally high area surrounded by eelgrass down to approximately -1.0 to -2.0 ft NAVD 88 (-0.28 to -1.28 ft MLLW; Figure E1). The site will be left to stabilize for at least one winter storm cycle. The area would then be planted with donor stock in subsequent years. Because excavation would need to occur within the ODFW recommended in-water work window (October 1 through February 15), it does not coincide with the preferred time for transplanting eelgrass (i.e., spring and summer). For this reason, eelgrass transplanting will not occur immediately following the completion of excavation. A similar work sequencing approach was used in the eelgrass mitigation efforts associated with the SORA runway extension project (McCollough pers. comm. 2006), which was considered successful (Rumrill pers. comm. 2006 and ODSL 1997).

Proposed grading has been designed to avoid and minimize impacts to nearby eelgrass beds. This area is proposed for grading in order to tie into desired elevations where more robust beds occur and to facilitate tidal circulation at the mitigation site. This could lead to temporary impacts to eelgrass that may occur in the grading footprint; however, preconstruction survey of eelgrass and bathymetry will take place during the main growing season (i.e., summer) before excavation is scheduled. Additionally, final excavation and grading limits will be established to avoid disturbance to eelgrass around the perimeter of the site. Temporary impacts that are unavoidable, based on the preconstruction survey, will be accounted for in the final planting plan that will be prepared prior to planting activities that would occur after the first storm season post-excavation. Areas of disturbance would be considered temporary, since excavation would result in elevations more conducive to promoting eelgrass growth.

1.3.1.2 Transplant Procedures

Guidance standards for planting eelgrass have not been established for eelgrass transplant projects. This allows the restoration biologist to be flexible based on site conditions. Best Available Science and successful methodologies currently in use include the following:

- Harvest eelgrass shoots from an identified and delineated donor bed by hand or by the use of small hand tools (e.g., garden trowel) to minimize damage to shoots. Each shoot will have intact portions of the rhizome mat.
- Harvested eelgrass shoots will be processed into discrete planting units (PUs) by tying the shoots loosely together at the base of the stem above the rhizome with a biodegradable line and tied to a degradable marine staple. The marine staple will anchor the PU to the bottom substrate and allow the rhizomes to reestablish within the substrate. Each PU would be composed of 3-10 shoots;
- Within the Eelgrass Mitigation site, establish ten, 100 ft by 100 ft planting parcels (10,000 square ft) that will be planted with PUs (Figure E1).
- Arrange the PUs in the planting parcels with each PU installed on 3-ft centers throughout the eelgrass mitigation site (Figure E1).

Upon transplanting the ten planting parcels, this would total approximately 33,000 eelgrass shoots (11,000 PUs of at least 3 shoots per PU) planted 3-foot on center within the Eelgrass Mitigation Site. This planting plan would provide approximately 2.3 acres of transplanted area at an initial density of 3 shoots per square meter.

1.3.1.3 Donor Stock

A suitable donor bed was identified during eelgrass surveys conducted in 2018 (DEA 2018a). The donor bed is located approximately 1,500 feet southwest of the eelgrass mitigation site and occupies approximately 18.6 acres of relatively continuous and dense eelgrass (Figure E4). The donor bed was mapped using underwater video georeferenced in realtime to a sub meter GPS; bed boundaries were established based on that portion of the eelgrass bed where shoot densities were highest. Eelgrass densities were obtained by divers who collected shoot count data along five, approximately 300 ft transects spaced throughout the bed, as shown in Figure E4.

In total, shoot counts were conducted at 144 quadrat (0.25m^2) locations randomly spaced within the 5 transects, as shown in Table 2; methodologies are presented below in Section 1.3.1.5.

Table 2. Eelgrass Density Data Collected Within the Selected Donor Bed

Donor Bed Transects	Number of Quadrats	Shoots/m^2
Northwest Transect	27	63.3
South Transect	29	67.7
Center Transect	28	50.0
East Transect	32	35.5
Southeast Transect	28	51.0
Total Number of Quadrats	**144**	
Mean Shoots/m^2		**53.5**

The mean density within the donor bed was calculated at 53.5 shoots/m^2. USACE guidelines state that no more than 10 percent of shoots from an existing eelgrass bed may be harvested for donor material, such that approximately 0.15 acre (617 m^2) of eelgrass could be harvested for the mitigation site (the higher the densities of the potential donor bed, the smaller the acreage that would need to be harvested). Therefore, donor shoots would need to be harvested from at least 1.5 acres (6,170 m^2) of intact eelgrass to meet the transplant needs of the eelgrass mitigation site. The selected eelgrass donor bed has been measured at 18.6 acres and is more than adequate to meet the needs of the mitigation site.

Eelgrass plants will be harvested in a manner to thin an existing location within the bed without denuding or leaving bare areas. The selected donor bed will have similar physical conditions as the Eelgrass Mitigation Site. In addition, the donor bed is close to the mitigation site, will have a similar bed elevation, and so will increase the likelihood that the planting stock will be adapted to local environmental conditions.

Eelgrass shoots from the donor site will be kept submerged in site water and handled carefully to avoid heat stress and desiccation. The amount of time between removal of eelgrass plants from the donor bed and their subsequent transplanting in the mitigation site will be minimized; eelgrass will typically be held for less than 72 hours after harvest and before transplanting. Until planted, the donor stock must be kept submerged and in a low light environment to prevent desiccation and thermal shock. Plants will remain wet during transport (e.g., stored in a tote or cooler filled with water that is exchanged on a regular basis) and if held overnight, will be stored in a submerged cage or mesh bag tied to a dock or mooring pile.

1.3.1.4 Reference Site

A suitable reference site, quantitatively delineated, will be needed to provide the basis for measuring mitigation success over time. Optimally, reference sites should be within the general vicinity of the eelgrass mitigation site and will have similar elevations, salinity regimes, current velocities, light penetration, sediment characteristics, and other water quality parameters that naturally affect eelgrass growth. The donor bed as described above in Section 1.3.1.3 will be the reference site for the Eelgrass Mitigation Site. At 18.6 acres, it is large enough and meets all of the requirements of both a donor bed and reference site. An area within this site will be defined as the reference area and not harvested for transplant material. Where eelgrass at the mitigation site declines coincident with and similarly to decline at the reference site, it is appropriate to scale the decline at the reference site to results from the mitigation site. However, if eelgrass expands within the reference site, the impact site will only be evaluated against the pre-construction condition of the reference site and not the expanded condition, as per USACE guidance (USACE 2018a).

1.3.1.5 Eelgrass Survey Methods

The USACE presents guidelines for conducting Tier 1 qualitative and Tier 2 quantitative eelgrass surveys (USACE 2016; 2018b). Surveys conducted by DEA in 2018 meet both of these requirements. Eelgrass surveys of potentially affected areas in Coos Bay were conducted under the USACE guidance using Method 3 (underwater video) and using the Eelgrass Delineation Detection Method A for defining boundaries (USACE 2018b), which meets Tier 1 requirements. This was followed by diver based quadrat counts within the delineated habitat to quantitatively determine eelgrass density. The number of quadrats needed for each transect were determined in realtime as quadrat shoot counts were communicated from the diver to the platform vessel and immediately entered into a spreadsheet that ran ongoing tests of statistical robustness. This approach meets and surpasses the requirements of the USACE Tier 2 quantitative surveys (USACE 2016). This approach also satisfies the Washington Department of Fish and Wildlife (WDFW) Eelgrass/Macroalgae Habitat Survey Guidelines (WDFW 2008).

As per the protocols, the eelgrass survey was initiated using a geo-referenced video system and on-board eelgrass biologist (Dr. Jason Stutes) to document the extent of subtidal eelgrass (*Zostera marina*) and macroalgae in the proposed project area. The video-based mapping system employed to map submerged vegetation uses a combination of underwater digital video, differential GPS, and allows for on-board audio annotation. It has a usable geo-referenced resolution of less than 1 meter.

Macroalgae, eelgrass, benthic substrates, and habitats were viewed and recorded to map potential subtidal eelgrass/macroalgae habitat. Large invertebrate fauna and fish visible during the survey were also noted. The survey tracks were oriented perpendicular to shore to detect the presence of eelgrass while compensating for wind and current. Subsequent tracks meandered between the deep and shallow edge of the eelgrass bed to document the extent of the bed on a finer geographic scale. If *Zostera japonica* was suspected to occur in the area or potentially viewed on the survey transect. Divers were deployed to obtain a sample to verify the species of the macrovegetation.

For the quantitative, diver based portion of the survey, shoot density was surveyed for areas where eelgrass was detected and initiated immediately after the underwater video survey. Using randomly placed 0.25-square-meter (m^2) quadrats placed within the delineated eelgrass bed boundaries, counts at each location were taken until the requirements for statistical robustness for detecting differences among means ($\alpha = 0.10$ and power $[1 - \beta] = 0.90$) was met or variance around the computed mean remained static. Transects were approximately 300 feet on length. Differences in average density were tested using a one-way Analysis of Variance (ANOVA). Average densities were compared between transects and among sample sites.

This quantitative survey methodology was used to delineate eelgrass beds within the proposed Access Channel to accurately determine and update the acreage and density of the JCEP eelgrass mitigation requirement. These methods were also used at the donor/reference site bed to characterize both the acreage and density to determine appropriate harvest rates for the eelgrass mitigation site and to provide the basis for future performance monitoring.

1.3.2 Kentuck Project Site

Historically, the Kentuck Project site provided estuarine habitats (i.e., salt marsh, mudflats, tide channels, and fringing freshwater wetlands) that were hydrologically connected to the Kentuck Slough and Coos Bay estuary systems. However, circa the 1920's, the Kentuck Project site was diked and converted to agricultural uses. Eventually the site was converted into an 18-hole golf course before reverting back to agricultural use (i.e., pasture) in 2009.

The mitigation concept involves restoration activities to return the Kentuck Project site to its natural potential, given existing on-site and off-site constraints that include local transportation systems, access to and protection of adjacent private property, and Kentuck Drainage District requirements. Conceptual design plans for the Kentuck Project site are provided in Appendix A, Figures K-1 through K-8 and erosion and sediment control plans (ESCP) are provided in Appendix B. Figures are organized as follows:

- Figure K-1: existing conditions
- Figures K-2 through K-8: proposed finished conditions, including monitoring plan
- Appendix B (multiple sheets): 1200-C ESCP (Rev. B), including staged construction sequencing

Mitigation activities will establish a combination of native estuarine habitats (i.e., salt marsh, tidal sand/mudflats, and tide channels) and freshwater wetland habitat types (i.e., palustrine forested, scrub-shrub, and emergent) that will interact to provide a holistic coastal ecosystem. Mitigation activities will also result in an uplift in ecosystem functions and are expected to be particularly beneficial to coho salmon recovery and support of Chinook salmon. Socio-cultural benefits (e.g., public use trail and tribal ethnobotanical interests) will also be incorporated into the site to the extent feasible.

As shown in the draft ESCP (Appendix B), the Kentuck Project Site will be constructed in phases. The five phases are listed below, with additional description provided on Sheet C003:

- Phase 1: Stripping and temporary grading of site, construction of temporary stream diversion, construction of East Bay Road and Bridge.
- Phase 2: Dewatering of dredge sands
- Phase 3: Mass grading and levee widening
- Phase 4: Site stabilization, Golf Course Lane construction, trail and boardwalk construction, removal of temporary stream diversion.
- Phase 5: Permanent seeding and planting

Additional details of the Kentuck Project Site concept are provided below. The discussion is broken into the two main areas of the site, which are referred to as the Kentuck Tidal Reconnection Area and the Freshwater Floodplain Reconnection Area.

1.3.2.1 Kentuck Tidal Reconnection Area

The Kentuck Tidal Reconnection Area will restore tidal connectivity to historic tide lands within the former golf course site, which will result in a diverse array of habitat types including mudflat, tide channels, salt marsh, and fringing freshwater wetlands that support native plant communities and fish and wildlife species. A list of key project components is provided below, with further discussion provided thereafter. See Section 1.2.2 for a list of associated measurable ecologically based objectives and Section 7.2.1 for a list of associated performance standards (a.k.a. success criteria).

- Construct a new bridge in East Bay Drive to allow tidal exchange between Kentuck Inlet and the Kentuck Project site.
- Remove or plug the existing culverts and tidegate located near the intersection of East Bay Drive and Golf Course Lane.
- Augment approximately 6,000 linear feet of levee along the Kentuck Project site and Kentuck Slough.
- Install a MTR in the augmented levee to provide fish passage and hydraulic exchange between the former golf course and Kentuck Slough.
- Restore tidal connection to the former irrigation pond creek system by constructing a fish-passable culvert or structure through Golf Course Lane.
- Construct and/or enhance approximately 11,500 linear feet of tide channels.
- Install fish habitat features (e.g., simple and complex wood structures, habitat pools)
- Establish a combination of estuarine and fringing freshwater wetland habitats, (i.e., salt marsh, palustrine forested, scrub-shrub, and emergent wetland).
- Install a publicly accessible trail, to be located along the top of the augmented levee, and a boardwalk that will cross the northeast end of the site and follow near the toe of slope of the adjacent hillside.

Tidal reconnection will be achieved by constructing a new East Bay Drive bridge to allow tidal exchange between Kentuck Inlet and the mitigation site. A new tidegate array, including a MTR gate, will be placed towards the upstream end of the Kentuck Project site to allow for fish passage from the site to Kentuck Slough and to allow freshwater flows from the slough to enter the site, thus providing an important salinity mixing zone for outgoing smolts. Kentuck Slough would be substantially rerouted to flow through the new tidegate array and through the new bridge into Kentuck Inlet. The existing levee between the golf course area and Kentuck Slough will be repaired and/or augmented to protect upstream properties from tidal influence.

The proposed location of the MTR as well as the relocation of the portion of the levee that will separate the Kentuck Tidal Reconnection Area from the Kentuck Freshwater Floodplain Reconnection Area were based on two competing factors – the desire to restore as much of the site to its historic estuarine condition versus avoiding the potential for impacts of salinity intrusion to adjacent property owners. ODSL (1989) shows the historic head of tide occurring at the northeast corner of the overall Kentuck Site, near the confluence of Mettman Creek with Kentuck Creek. NMFS has expressed the desire to place the MTR structure as close to this historic head of tide location as possible. However, modeling efforts have shown that a plume of saline water could travel as much as 1,000 feet upstream of the MTR location, particularly during times of low stream flow. Therefore, as a precaution to the upstream property owner and to gain support with the Kentuck Drainage District, the MTR was shifted 1,000 feet lower than the historic head of tide location. Similarly, the proposed new levee was shifted southward on the property to provide a further buffer between the Kentuck Tidal Reconnection Area and the adjacent property owner. In addition to reducing property owner concerns, the shifting of the levee further to the southwest also has the benefit of providing important freshwater floodplain wetland habitat that ODFW and NMFS have expressed would have particular benefits to Coho salmon smolts that are not yet ready for the more saline conditions that would occur in the tidal reconnection portion of the Kentuck Site.

The existing ditched main channel through the Kentuck Project site runs for approximately 6,000 feet before draining via a tidegated culvert under a small levee on the east side of East Bay Drive. Water then flows under East Bay Drive via a roughly 10-foot-diameter fish-passable culvert owned by Coos County. The existing main channel through the site will be enhanced and rerouted to connect the tidegate array and bridge. Secondary tide channels will be constructed to connect with the main channel running through the site. Existing tributaries that drain into the Kentuck Project site will also connect with the enhanced main channel. The existing 10-foot-diameter culvert under East Bay Drive will be removed or plugged, and the small levee with the tidegated culvert just east of the road will be removed. A new culvert, which will be installed through the existing earthen dam associated with the former golf course irrigation pond, will restore tidal connection and fish access to the drainage upstream of the dam. Instream habitat features, such as large wood and habitat pools, will be included to support salmonids (Appendix A, Figures K-3A, 3B, and 7A-7C).

East Bay Drive and Golf Course Lane will also be improved as part of the mitigation project construction. East Bay Drive will be raised approximately 3 feet at its lowest point south of the existing Kentuck Slough Bridge. Approximately 1,900 total linear feet of the golf course access road will be raised approximately 3 to 8 feet, so that the road will be above projected high tide elevations, including storm surge and projected future sea level rise. Every effort will be made to minimize the roadway prism. The design is constrained by private property and highly compressible soils. While walls could be used to minimize the footprint, embankment is preferred in this setting to provide transitional shoreline habitat. Roadway needed for access during construction only will be removed and restored as appropriate to adjacent natural conditions.

Survey information confirms that elevations within the Kentuck Project site are appropriate for establishing mudflat habitat. The primary salt marsh surface at the nearby reference site (immediately downstream of East Bay Road) occurs between approximately elevations 5.5 feet and 8.5 feet North American Vertical Datum of 1988 (NAVD 88). However, typical elevations within the golf course range between 2.0 and 4.0 feet NAVD 88. These lower elevations in the former golf course preclude the establishment of vegetation, and therefore mudflat would be the predominant habitat type without intervention. As a result, grades will be increased where practicable to foster additional salt marsh establishment along the edges of the mitigation site. Current design includes increasing the elevations of parts of the site to better support establishment of salt marsh and fringe freshwater wetlands; however, conducting this work is dependent on having suitable material to import to raise grades. Because of this, mitigation goals and objectives are focused on providing the minimum amount of salt marsh and freshwater wetlands required to offset impacts to vegetated wetland and estuarine habitat types (excluding eelgrass), but with the understanding that the establishment of additional salt marsh and freshwater wetlands and a subsequent decrease in bare mudflat is a desirable outcome.

Proposed design elevations should be conducive to the establishment of salt marsh communities throughout much of the site (see Appendix A, Figures). Freshwater wetlands should form along the site margins, particularly where seeps and freshwater tributaries flow from the hillside into the site. Salt marsh vegetation is anticipated to establish by natural recruitment (i.e., self-seeding by seed brought in from adjacent marsh areas by the tides). Experience of the South Slough National Estuarine Research Reserve (SSNER) suggests that natural recruitment is an appropriate means of establishing salt marsh vegetation at mitigation and restoration sites, and that planting should not be needed (Cornu pers. comm. 2014). Craig Cornu of SSNER also noted that non-native annual salt marsh species, such as brass buttons (*Cotula coronopifolia*), often colonize a newly established salt marsh site during the first few years, but then typically begin to be outcompeted within the third year after establishment of the site. Natural recruitment may be utilized as the primary method for establishing salt marsh habitat, with supplemental plantings provided along the upper margins of salt marsh. However, more intensive seeding may be applied if it is determined to be of benefit to either salt marsh establishment or erosion control needs. Native freshwater wetland plant communities will be planted with species common to Oregon coastal palustrine forested and scrub-shrub wetlands. For example, fringing willow communities are highly beneficial in supporting food sources (e.g., macroinvertebrates) for rearing juvenile salmonids, and therefore native willows will be an important component of the plant palette. Areas anticipated to be in salt marsh-to-freshwater wetland transition zones/elevations will also be planted with a mix of species that are adapted to a variety of salinity conditions, such as meadow barley (*Hordeum brachyantherum*), tufted hair-grass (*Deschampsia caespitosa*), and Hooker's willow (*Salix hookeriana*).

To achieve the proposed design elevations, dredge material from the berm and Access Channel of the LNG Terminal will be beneficially utilized. Dredged materials will be transported by barge to the edge of the Federal Navigation Channel near Kentuck Inlet, where they will then be remobilized and pumped via pipeline into the Kentuck Project site. Materials will be allowed to dewater, and rough grading will occur. It will be desirable to allow rough-graded material to sit for a minimum of one year (subject to final geotechnical recommendations) before final grading to allow for material settling and compression of the underlying soils. This process will reduce the amount of settling that is otherwise anticipated to occur after the reintroduction of tidal influence. Prior to rough-grading, the upper 12 to 18 inches of top soil will be removed and stockpiled. This material will later be placed over the final graded material to improve the growing substrate. Some blending of the native soil with dredge material may occur to avoid a sharp transition between native and imported material.

A new Kentuck Slough levee will be built because of the poor condition of the existing levee (Appendix A, Figures K-2A, 2B, 6A, and 6B). The existing slough-side face of the levee will remain intact at the direction of the Kentuck Drainage District. A rocked or paved maintenance access road will run across the top of the levee and also serve as part of a proposed public use trail that would follow the perimeter of the Kentuck Project site. Every effort will be made to minimize the footprint of the proposed levee during final design.

In addition to the proposed levee trail section, the trail would consist of both boardwalk and soft path (i.e., surfaced with wood chips or gravel) sections. The trail has been sited to allow the public to experience the various habitats proposed for the Kentuck Project, while avoiding and minimizing impacts to the extent practicable. Previous iterations of the trail included spurs that extended into the body of the site; however, these were removed to avoid direct impacts (i.e., boardwalk construction) and potential indirect impacts (i.e., human disturbance to wildlife). The trail is only anticipated to cross wetlands at the eastern end, where the crossing is needed to complete the trail, and at several small crossing along the southern hillslope where site topography will make it difficult to push the trail further upslope away from the wetland edge.

In addition to levee and tidegate construction, the proposed mitigation will remove, to the greatest extent practicable, existing golf course improvements in the mitigation site, such as fencing, ditches, foot bridges, and culverts.

Mitigation construction activities (e.g., new levee construction, road improvements, septic drain field protection) will result in permanent wetland impacts within the mitigation site (Appendix A, Figures K-5A and 5B). These activities and associated impacts are needed to successfully construct the Kentuck Project, while protecting adjacent properties from the risk of salt water intrusion and to continue to provide access to properties post construction. For example, Golf Course Lane elevations will need to be raised above high tide plus storm surge and future projected sea level rise. This CWM Plan accounts for these impacts and provides the mitigation required to offset these unavoidable impacts. Bioengineering approaches will be reviewed during final design to assess opportunities to provide additional habitat benefits along the edges of the above-mentioned structural components of the project (concept example provided in Appendix A, Figure K-7D). Regarding construction activity impacts to forested wetlands, specifically Kentuck Wetland 4A located on the south side of Golf Course Lane, alternatives that would avoid or minimize impacts have been considered, but eliminated because they are not practicable, or not accepted by the landowners whose property would be affected. As previously described, raising the profile of Golf Course Lane is necessary to maintain the only access to adjacent and nearby private residences and properties. The property owners will not accept salt water intrusion on their property, so using culverts, bridges, or other elevated roadways are not viable; only embankment would preclude saltwater intrusion. However, the embankment would impound overland flows on to these properties. Given the surrounding grades and anticipated post-restoration water surface elevations, it is not feasible to drain the area above the road with culverts through the road prism because doing so would allow salt water intrusion and would flood the private land. NMFS has previously commented that tidegates are not desirable at these locations, either. But even if tidegates were allowed, the private land above the road would still be flooded during storm events occurring during high tides; the rising tide would close the gate forcing storm runoff to back onto the private land. It is also reasonable to assume that saltwater intrusion and/or repeated flooding would be detrimental to the existing forested wetland.

In all of these scenarios, the property owner's septic fields would be flooded, which is also a fatal flaw. The only practical solution remaining is to construct the roadway embankment and fill the adjacent land above the roadway to raise the septic fields and allow storm runoff to sheet flow over the road. Further, because the owners will not accept saltwater intrusion or freshwater impoundment on their properties, the area beyond that required for the septic fields must also be filled to allow sheet flow across the road.

Finally, a sump and pump scenario was considered that would reduce the amount of fill and forested wetland impact. In this scenario, runoff would be collected along the upper edge of roadway embankment via an open ditch and directed to a sump where it would be pumped through a pipe placed in the roadway embankment to discharge into the former golf course. The pipe's invert would be set above the anticipated high tide water surface to prevent salt water intrusion. However, this alternative was eliminated because it is not practicable. Specifically, the alternative relies in perpetuity on electrical and mechanical means to prevent damage to adjacent private property and flooding of the septic fields for these properties.

The proposed mitigation at the Kentuck Tidal Reconnection Area will offset permanently impacted estuarine and freshwater wetland acreage and functions and values. A discussion of functions and values replacement is provided in Section 1.5 and Section 5.

1.3.2.2 Kentuck Freshwater Floodplain Reconnection Area

The northeast end of the Kentuck Project site will be reconnected to Kentuck Creek, outside of the previously described tidal reconnection area, and therefore will provide restored freshwater wetland floodplain habitat. This Freshwater Floodplain Reconnection Area provides mitigation for Pipeline impacts, which consist of conversion of palustrine forested and scrub-shrub wetlands to emergent wetlands. Therefore, forested and scrub-shrub wetlands are the dominant habitat types proposed for this area. Per recommendation from NMFS (NMFS and JCEP October 26, 2017 meeting), realigning a portion of Kentuck Creek through the site will also occur in order to improve instream habitat. A list of key project components is provided below, with further discussion provided thereafter.

- Realign approximately 1,350 feet of the Kentuck Creek channel to provide increased in-channel complexity similar to historic natural conditions.
- Install large wood within the realigned stream channel in order to provide habitat structural components.
- Remove approximately 1,560 linear feet of existing levee between Kentuck Creek and the Kentuck Project site.
- Regrade the site to provide wetland hydrology and micro-topography to support a variety of plant species (forested and scrub-shrub wetland), and to the extent practical, provide access and refugia to fish during high flow events.

The existing levee that separates Kentuck Creek from the Kentuck Project site will be removed in this area, allowing flood flows to enter the floodplain bench. The improved levee, which is described above, will be relocated at this end of the Kentuck Project to provide the separation between the tidal reconnection and freshwater floodplain reconnection components of the Kentuck Project site. Minor grading within the freshwater floodplain reconnection area will occur in order to provide micro-topographic relief, which should allow for establishment of diverse plant communities and provide fish refugia habitat during periods of high water. Similar to the tidal portion of the Kentuck Project described above, because willows are highly supportive of rearing salmonids, they will be an important component of the plant communities.

The current alignment of Kentuck Creek, which runs along the northeast property line, will be shifted to the west and into the project site. The existing channel lacks habitat complexity and is confined by levees. Shifting the channel will allow for a more natural channel form to be established, allow for the placement of instream habitat structures (e.g., large wood), and allow plantings to occur on both sides of the channel. The upper portion of the existing channel will be plugged to force flows into the new channel. The lower portion of the existing channel will be left intact to function as a back water channel and also to receive inflows from Mettman Creek and an existing drain from an adjacent property.

The proposed mitigation at the Kentuck Freshwater Floodplain Reconnection Area will offset permanently impacted estuarine and freshwater wetland acreage and functions and values. A discussion of functions and values replacement is provided in Section 1.5 and Section 5.

1.4 SUMMARY OF IMPACTS AND CWM ACREAGE/CREDITS

A summary of freshwater wetland and estuarine resource impacts that will require mitigation is provided in Table 3. As previously noted short and long duration temporary impacts are addressed in a separate site restoration plan. Table 4 provides a summary of mitigation acreage and credits by the type of mitigation proposed (i.e., enhancement or restoration). Table 5 provides a summary of mitigation acreage by habitat type, Cowardin class, and hydrogeomorphic (HGM) class. The mitigation sites are larger than the actual area needed for mitigation. Therefore, work in the additional acreage at these sites is considered to be voluntary habitat improvements above and beyond mitigation requirements. Table 4 and Table 5 provide acreages for the entirety of the mitigation sites including areas of voluntary habitat improvements, whereas Section 1.2, Ecological Goals and Objectives, provides acreages specific to the mitigation requirements based on actual impacts. The habitat acreages in Table 5 should be considered rough estimates based on planting plan designs; however, final habitat acreage is likely to vary as the mitigation sites mature. This is particularly the case for vegetated communities at the Kentuck Tidal Reconnection Area, where the boundaries between communities are highly dependent on the interplay of high salinity water from the bay and freshwater inputs from inflowing creeks, seeps, and groundwater. The grading and planting plans for the Kentuck Tidal Reconnection Area have been designed so that proposed freshwater wetland habitat types would trend towards estuarine (i.e., salt marsh) habitats rather than upland habitats, should the interplay of fresh and saline waters not occur as anticipated. This will help assure that overall wetland mitigation objectives for vegetated wetland acreage is achieved, rather than some of the acreage potentially ending up as an upland community.

Table 3. Project Impacts Requiring Compensatory Mitigation

Wetland and Estuarine Resources	Cowardin Class Type*	Hydrogeomorphic (HGM) Class	Permanent Impacts (Acres)
Eelgrass at Slip and Access Channel	E1/E2AB	Estuarine	2.26
Intertidal Sand/Mudflat at Slip and Access Channel	E2US	Estuarine	10.25
Shallow Subtidal at Slip and Access Channel	E1UB	Estuarine	4.25
Salt Marsh at Slip and Access Channel	E2EM	Estuarine	0.06
Intertidal Sand/Mudflat at MOF	E2US	Estuarine	1.64
Shallow Subtidal at MOF	E1UB	Estuarine	0.07
2012-2	PEM	Slope/flats	0.02
2013-6	PEM	Depression	0.69
Wetland C	PFO	Depression	0.26
Wetland E	PAB	Depression	0.48
Wetland H (East)	PEM	Slope/flats	0.09
Wetland H (West)	PEM	Slope/flats	0.01
Wetland I (North)	PEM	Slope/flats	0.27
Wetland J	PEM	Slope/flats	0.07
Intertidal Riprap Embankment at Trans Pacific Parkway/US-101	E2RS	Estuarine	0.51
Wetland K	PFO	Depression	0.03
Kentuck-Wetland A1	PEM	Slope/flats	4.30
Kentuck-Wetland A2**	PEM	Slope/flats	0.07
Kentuck-Wetland A3	PEM	Slope/flats	0.14
Kentuck-Wetland A4	PFO	Slope/flats	0.85
Kentuck-Wetland A7	PEM	Slope/flats	0.04
Kentuck-Intertidal Riprap Embankment at East Bay Drive	E2RS	Estuarine	0.07
Pipeline Impacts (see Appendix B for breakdown)	PFO/PSS	various	0.91
		Total	**27.34**

* Cowardin classes: E1/E2AB = estuarine, subtidal/intertidal, aquatic bed; E2USN = estuarine, intertidal, unconsolidated shore, regularly flooded (i.e., mudflat); E1UB = estuarine, subtidal, uncosolidated bottom; E2EM = estuarine, intertidal, emergent; E2RS = estuarine, intertidal, rocky shore; PFO = palustrine forested; PSS = palustrine scrub-shrub; PEM = palustrine emergent; and PAB = palustrine aquatic bed.

** These are impacts associated with proposed boardwalks, a small portion of which extends into Wetland A1, but are included in the acreage calculation for Wetland A2 for ease of tracking.

Table 4. Mitigation and Voluntary Habitat Improvements Summary by Mitigation Type, Acres, Ratios, and Credits*

Mitigation Site	Mitigation Type	Total Mitigation Acres**, ***	Mitigation Ratio	Total Credits Available	Credits Needed (i.e., impacts)	Voluntary Habitat Improvement Credits
Eelgrass	Enhancement	**9.34**	3:1	**3.11**	**2.26**	**0.85**
Kentuck –Tidal Reconnection Area						
Kentuck Site – Tidal Reconnection Area	Enhancement	87.54	3:1	29.18	--	--
	Restoration	3.92	1:1	3.92	--	--
	Subtotal	**91.46**		**33.10**	**24.17**	**8.93**
Kentuck –Freshwater Floodplain Reconnection Area****						
Kentuck Site – Freshwater Floodplain Reconnection Area	Enhancement	7.50	3:1	2.50	--	--
	Restoration	1.64	1:1	1.64	--	--
	Subtotal	**9.14**		**4.14**	**0.91**	**3.23**
	Kentuck Subtotal	**100.60**		**37.24**	**25.08**	**12.16**
	Total All Sites	**109.94**		**40.35**	**27.34**	**13.01**

* Voluntary Habitat Improvement credits are based on the total mitigation credits for a given area minus proposed impacts. Pipeline impacts and associated mitigation have been asigned to the Kentuck – Freshwater Floodplain Reconnection Area, and non-eelgrass LNG Terminal impacts and associated mitigation have been assigned to the Kentuck –Tidal Reconnection Area.

** The mitigation sites are larger than the actual area needed for mitigation, which will result in additional habitat improvements referred to as "voluntary habitat improvements" in this CWM Plan. This table provides acreage and credits for the entirety of the proposed mitigation sites including the voluntary habitat improvements, whereas Section 1.2, Ecological Goals and Objectives, provides acreages specific to mitigation requirements based on permanent impacts.

*** Only includes area of potential mitigation credits (i.e., excludes impacts at mitigation sites.)

**** Area of proposed unvegetated realigned Kentuck Channel (area below 4 ft elevation contour [NAVD 88]) is not included in above acreages. This feature is viewed as proving positive ecological benefits, but is not a wetland habitat.

Table 5. Mitigation and Voluntary Habitat Improvements Summary by Habitat Type, Cowardin Class, and HGM Class

Mitigation Site	Habitat Type*	Cowardin Class**	HGM Class	Acres****
Eelgrass	Eelgrass	E1/2AB	Estuarine	9.34
Kentuck Project – Tidal Reconnection Area	Tidal mudflat	E2USN	Estuarine	34.75
	Salt marsh	E2EM	Estuarine	44.58
	Willow Scrub-Shrub Wetland ***	E2FO	Estuarine	8.71
	Forested Wetland ***	E2FO	Estuarine	3.42
			Subtotal	**100.8**
Kentuck Project – Freshwater Floodplain Reconnection Area	Willow Scrub-Shrub Wetland	PSS	Riverine	4.71
	Forested Wetland	PFO	Riverine	3.41
	Unvegetated Channel*****	R2	n/a	1.02
			Subtotal	**9.14**
Total All Sites				**109.94**

* Habitat type refers to the estimated plant communities shown on conceptual design sheets provided in Appendix A.

** Cowardin classes: E1/E2AB = estuarine, subtidal/intertidal, aquatic bed; E2USN = estuarine, intertidal, unconsolidated shore, regularly flooded (i.e., mudflat); E2EM = estuarine, intertidal, emergent; PFO = palustrine forested; PSS = palustrine scrub-shrub; and PEM = palustrine emergent; R2 = riverine lower perennial.

*** Cowardin and HGM classes for freshwater wetland communities at the Kentuck Project – Tidal Reconnection Area are considered to be estuarine, because they are located below Highest Measured Tide and are likely to experience some tidal influence at the groundwater/tidal prism interface. Acreage of these habitat types is based on proposed habitat communities; however, the actual areas occupied by these communities as the site matures are likely to vary based on the interplay between salt water from the bay and freshwater inputs from inflowing creeks, seeps, and groundwater.

**** Acreage is for entire area of mitigation site that could provide mitigation credits (i.e., required mitigation plus voluntary habitat improvements). See Section 1.2, Ecological Goals and Objectives for acreages specific to minimum requirements. Areas of impacts at mitigation sites not included.

***** The acreage of unvegetated channel has only been calculated for the proposed realigned channel section. Acreage of remaining existing channel has not been included. For eelgrass, this acreage assumes that the entire original site design will recolonize after initial transplantation.

1.5 SUMMARY OF NET GAINS AND LOSSES OF FUNCTIONS AND VALUES

A discussion of functional replacement is provided in Section 5, Functions and Values Assessment and in Appendix E and Appendix F, which provide the results of project functional assessments for the LNG Terminal and PCGP project components, respectively. Appendix E includes a summary table of proposed function and value losses and gains for wetlands associated with mitigation at the Kentuck Project site. Currently there are no approved eelgrass functional assessments approved for use in Oregon and a search for other suitable rapid eelgrass functional assessments that could be applied to the project was unfruitful. The California Eelgrass Mitigation Policy and Implementing Guidelines (NOAA 2014) states that "In absence of a complete functional assessment, eelgrass distribution and density should serve as a proxy for eelgrass habitat function." Therefore, data on eelgrass density at the proposed impact site has been provided and is intended to serve as a surrogate for eelgrass function (i.e., higher density equals higher function).

Proposed mitigation will result in a net increase in acreage of impacted habitats and, because mitigation habitats will function in a manner equivalent to or better than those habitats being impacted, it is anticipated that there would be a net gain in overall functions and values. Lost estuarine functions will be offset at the Kentuck Project site and the Eelgrass Mitigation site, both of which are situated in and/or will result in a considerably more complex and diverse array of habitats than at the slip impact site, thus resulting in an overall uplift in functions lost. For example, impacted shoreline habitats primarily consist of moderately productive unvegetated sand/mudflats. Impacts to these habitats will be offset at the Kentuck Project site through restoration of a substantially larger and more diverse assemblage of estuarine habitats, including salt marsh, sand/mudflats, and tide channels. This rich mosaic of estuarine habitats is expected to improve estuarine functions, including water quality, wildlife, and fish.

Impacted freshwater wetlands primarily consist of areas bordered by formerly developed industrial land. Mitigation will create freshwater fringe wetlands adjacent to the estuarine habitats to be restored at the Kentuck Project site. Habitat features will be incorporated that further support recovery of listed coho salmon. In addition, the Kentuck Project site will incorporate public access features, such as trails and tribal ethnobotanical elements (e.g., plant species of tribal importance and interpretative signage). Such community and cultural elements are currently absent at the impact locations, because the impact areas are in industrial lands.

Pipeline impacts consist of very small acreage impacts and only a partial reduction in function. These impacts will be offset at a consolidated site that will provide clear ecosystem benefits by restoring floodplain connection to Kentuck Creek, which will in turn benefit flood control, water quality, wildlife, and fish functions, including providing high flow refugia and food chain support that will directly benefit listed coho salmon.

2. CWM SITE INFORMATION

2.1 CWM SITE OWNER NAME AND CONTACT INFORMATION

The proposed Eelgrass Mitigation site is and will be owned by the State of Oregon.

The Kentuck Project site is owned by Fort Chicago LNG II U.S. LLC, a wholly-owned indirect subsidiary of Pembina Pipeline Corporation.

Project contact information is:

Attention: Derik Vowels, Lead Environmental Advisor
Jordan Cove LNG, LLC
111 SW 5th Ave., Suite 1100
Portland, OR 97204
Phone: (971) 940-7814

2.2 LEGAL AGREEMENT FOR PROPERTY USE AND LONG-TERM PROTECTION IF SITE IS NOT APPLICANT-OWNED

2.2.1 Eelgrass Mitigation Site

JCEP anticipates endowing a third-party conservation entity that will hold an easement from the State of Oregon for the mitigation site. Clauses necessary to protect the site will be written into the easement. A draft easement document with protection clauses and legal description will be provided prior to permit issuance, to be included as Appendix G. Information about riparian owners with potential proprietary rights is provided in the project Removal-Fill Application.

2.2.2 Kentuck Project

JCEP is an applicant; therefore, a legal agreement for the use and long-term protection of the site is not proposed. Although earthwork is proposed on properties south of Golf course Lane (tax lots 300, 400, and 500, see Figure K-2A), no mitigation credits are being sought on these properties and therefore they will not be included in conservation easements associated with the site. Proposed work on these properties is intended to preserve the viability of their septic fields. JCEP will enter into agreements with the property owners for work conducted on their properties.

2.3 LOCATION INFORMATION

2.3.1 Eelgrass Mitigation Site

Impacts to eelgrass resources will be mitigated at a shallow, unvegetated intertidal island located to the southwest of the SORA runway (Tax map #25-13-08, lot # not applicable, Township 25 South, Range 13 West, Section 8). The proposed mitigation site is owned by the State of Oregon, with management authority held by ODSL. Appendix G provides a draft easement for the mitigation site.

2.3.2 Kentuck Project

The Kentuck Project site is located east of North Bend, Oregon (Township 25 South, Range 12 West, Sections 6 and 7; Township 25 South, Range 13 West, Sections 1 and 12, Willamette Meridian). Tax maps and lots are: 25s12w06c lot 100, 25s13w12a lot 100, and 25s13w1d lot 400.

3. CWM SITE SELECTION AND DESIGN PRINCIPLES (ODSL PRINCIPAL OBJECTIVES)

3.1 REPLACEMENT

The proposed CWM will replace impacted functions and values through in-kind or like-kind mitigation, thereby enhancing the same or similar types of habitats that are being impacted. Net acreage of impacted habitats will be greater after the Project and CWM than under existing conditions as a result of the standard mitigation ratios required by Oregon law.

3.2 CWM PROVIDES LOCAL REPLACEMENT FOR LOCALLY IMPORTANT FUNCTIONS AND VALUES LOST, IF APPLICABLE

CWM for Terminal impacts will take place in proximity to the proposed impact sites, thereby providing local replacement of lost functions and values. Eelgrass mitigation will take place roughly opposite the Federal Navigation Channel from the impact site. Mudflat, salt marsh, and fringing freshwater mitigation will occur within the Coos Bay estuary system, 3 to 4 miles from the impact site.

As noted in Section 1, Introduction, the proposed Pipeline will result in permanent impacts to wetlands in the form of permanent conversion from one Cowardin class to another Cowardin class as a result of temporary disturbance activities involved with pipe installation. Conversion from a forested to an emergent wetland condition is viewed as a permanent wetland impact by the USACE and ODSL due to an overall loss of wetland functions (Oregon Revised Statutes [ORS] 141-085-0680). The permanent wetland type conversion impacts from the Pipeline, which total less than one acre, would occur across eight fifth-field watersheds (HUC 10). Most of the conversion impacts within the affected watersheds would be less than 0.1 acre with only one watershed experiencing a permanent conversion impact exceeding 0.2 acre which would occur within the Olalla Creek – Lookingglass Creek Watershed (HUC 1710030212). Previously, PCGP proposed to mitigate the conversion impacts at the Cow Hollow Mitigation Bank which is within the Olalla Creek – Lookingglass Creek Watershed, where the largest conversion impact (0.37 acre) would occur. However, ODSL had concerns that this mitigation bank was not a viable option due to the lack of available credits. PCGP and the Bank Owner prepared a mitigation plan as Phase II of the Cow Hollow Bank on lands adjacent to the existing Cow Hollow Mitigation Bank, but based on ODSL's reservations concerning the Phase II proposal and because there were no other mitigation bank service areas that overlapped the pipeline, PCGP dropped the use of mitigation banks from further consideration. Instead, PCGP chose to consolidate mitigation in a single location that would have a high likelihood of success and that would be co-located with the JCEP LNG Terminal's compensatory mitigation obligations at the Kentuck Project in Coos Bay, Oregon. Further, the Pipeline's permanent wetland impacts consist of small, individual impacts spread over a large geographic area, and, therefore, it is impractical to conduct wetland mitigation at multiple, small sites in various watersheds crossed by the Pipeline. It is also important to note that the Pipeline impacts will result only in a partial loss of wetland functions, as opposed to a loss of acreage and all functions, because these wetlands will still remain, but with what is considered to be a lower functioning habitat type than existed before the Pipeline.

3.3 CWM IS SELF-SUSTAINING AND MINIMIZES MAINTENANCE NEEDS

Each mitigation site has been designed to be self-sustaining to the greatest extent practicable. The Eelgrass Mitigation site will not rely on water control structures or other intensively managed structures to maintain wetland hydrology. The Kentuck Project requires a new tidegate structure to protect adjacent and upstream properties. Mitigation at the former golf course is not viable without this structure. However, the mitigation site will maintain a free and open connection to the Coos Bay estuary as a result of the installation of a bridge along East Bay Drive that will result in removal of the existing culvert (owned by Coos County) and tidegate that connect the golf course to the estuary.

To assure proper functioning of the MTR structure it will be monitored at least once annually with an on-site visit, but with additional visits as necessary post heavy storm events. The condition of structural components will be recorded and recommendations provided to implement maintenance, repair, or replacement, if applicable. An MTR Operation and Maintenance Plan will be developed during final design of the project and will include a plan for long-term endowment for responsibility of MTR inspection, maintenance and repairs, and replacements as warranted.

3.4 SITING CONSIDERATIONS FOR ECOLOGICAL SUITABILITY

3.4.1 Alternatives Analysis – Eelgrass Mitigation Site

The proposed Eelgrass Mitigation site was selected after an updated rigorous evaluation of potential sites by DEA. The review assessed 10 sites throughout the bay and evaluated each based on ecological conditions suitable for eelgrass growth. These conditions included appropriate salinity concentrations, moderate flow/circulation, appropriate depths relative to MLLW, distance from potential pollution sources, stability and longevity of the bed, and the presence of other nearby eelgrass beds. The review also assessed land availability and constructability issues.

Site selection of mitigation sites is an important factor in determining the ultimate success of an eelgrass mitigation project. Through review of existing eelgrass mapping surveys, habitat surveys, and site assessments, 10 sites were initially investigated as presented below and in Figure E5:

1. Old Hatchery Site
2. Airport Site (selected site)
3. Pony Slough
4. APCO Sites
5. Dredge Islands –Area A
6. Dredge Islands –Area B
7. Dredge Islands –Area C
8. West Shoreline

9. Jordan Cove
10. Haynes Inlet-Clausen Property

Sites were reviewed against a list of criteria in order to evaluate the potential for a successful eelgrass mitigation project. These criteria included land availability, ecological conditions, presence of other nearby eelgrass beds, and whether a viable design was available and constructible. Evaluation criteria are listed in Table 6 along with the processes used to rank them. Table 7 provides a resultant matrix of the 10 potential mitigation sites evaluated using these criteria.

Table 6. Eelgrass Mitigation Sites Evaluation Matrix Criteria

Land Availability	• Do current zoning and/or development plans preclude use of the site for mitigation? Are the landowners willing to provide easements for access and use of the site for mitigation? • An assumption has been made that intertidal areas, which are under ownership by the State, would generally be available for mitigation purposes so long as there are no existing easements on those lands (i.e. oyster beds, utility easements, etc.).
Ecological Conditions	• Physical: mild current, low wave impact (Coos Bay-North Bend Airport prevailing high winds in summer are from the north and west-northwest, prevailing high winds in winter are from the south-southwest and the southwest [Oregon Climate Service 2002]), sediment stability (low erosion and low sediment deposition), low to moderate turbidity • Chemical: moderate to high salinity, away from source of nutrient overloading (i.e. storm water and sewage treatment outfalls) • Biological conditions suitable for eelgrass (i.e. limited bioturbation, etc.) were indirectly evaluated based on presence of eelgrass at or nearby the potential mitigation site, as described below.
Presence of Nearby Eelgrass of Medium to High Density	• Eelgrass Surveys: Did review of existing eelgrass surveys from 2005 to 2017 show eelgrass mapped adjacent to the potential mitigation site? • Field Verified: Did subsequent field surveys identify existing eelgrass beds of medium to high density (i.e. percent cover) in or near the prospective mitigation site?
Viable Design/Constructability	• Viable Design: Is there a design strategy available with a high likelihood of successfully establishing eelgrass and other intertidal habitats? Can this be done without having a significant adverse effect on surrounding resources? • Constructability: If there is a viable design strategy, can it be readily constructed in an environmentally sensitive manner? (i.e., Would costs be in-line with overall project costs? Can appropriate equipment reach the site? Would construction result in significant adverse effects to surrounding resources?

Table 7. Potential Eelgrass Mitigation Site Evaluation Matrix*

	Land Availability	Ecological Conditions (Physical and Chemical)	*Presence of Nearby Eelgrass, Medium to High Density*		Viable Design / Constructability
			Eelgrass Abundance Mapped in Previous Surveys	Field Verified	
Old Hatchery Site	**Yes**	**Good to Moderate**	**Yes Abundant**	**Yes**	**Potential / Potential**
Airport Site	**Yes**	**Good to Moderate**	**Yes Abundant**	**Yes**	**Potential / Potential**
Pony Slough	Yes	Poor to moderate	Yes Abundant in limited areas	Yes	Unlikely / not applicable
APCO Sites	Yes	Poor to moderate	Yes Abundant in limited areas	Yes	Unlikely / not applicable
Dredge Islands –Area A	Yes	Poor to Moderate	Minor abundance	Minor	Unlikely/ not applicable
Dredge Islands –Area B	Yes	Poor to Moderate	Minor abundance	Minor	Unlikely/ not applicable
Dredge Islands –Area C	Yes	Poor	None to minor abundance	No	Unlikely/ not applicable
West Shoreline	No	Poor to Moderate	None to minor abundance	None to Minor	Potential / Potential
Jordan Cove	**Yes**	**Good to Moderate**	**Yes Abundant**	**Yes**	**Potential / Potential**
Haynes Inlet-Clausen Property	**Yes**	**Moderate**	**Minor abundance**	**No**	**Potential / Potential**

* Bolded Sites proceeded to further evaluation

Using the criteria developed in Table 6, six of the sites were eliminated from consideration (Table 7). These six sites either had poor to moderate ecological conditions for eelgrass; had no or minor amounts of existing eelgrass or eelgrass habitat, or were not available for mitigation because of institutional reasons. Sites such as Pony Slough contain existing eelgrass resources, but only at the mouth; this site was eliminated because only a small area of suitable habitat was available for mitigation (Figure E5). Similarly, relatively dense, but narrow eelgrass beds are located adjacent to the APCO Sites, but existing bathymetries suggest that eelgrass already occupies optimal elevations with little room for expansion. The West Shoreline Site, southwest of JCEP is an area that may be developed in the future; using this site for eelgrass mitigation would preclude any alteration of the existing intertidal zone. The three dredge island sites were eliminated from consideration because of poor to moderate site conditions and the fact that eelgrass was only observed at appreciable densities during the earliest EPA (2005) survey. These early surveys were conducted using remote-sensing technologies (aerial photography) from a fixed-wing aircraft with no ground-truthing and likely overestimated eelgrass coverage. Subsequent studies that ground-truthed aerial surveys, such as the SSNERR work conducted in 2016, did not find substantial eelgrass resources (Figure E5).

After this evaluative process, the 10 initial sites were narrowed down to four sites in which additional analyses were conducted. The four sites are situated throughout lower and middle portions of Coos Bay, from Haynes Inlet to the lower bay (Figure E5). The four sites further evaluated include:

1. Haynes Inlet Clausen Property
2. Old Hatchery Site
3. Jordan Cove
4. Eelgrass Mitigation Site near the Airport

3.4.1.1 Haynes Inlet (Clausen Property)

The Haynes Inlet site is located in upper portions of the inlet at the edge of eelgrass beds documented by US EPA in 2005 (EPA 2005; Figure E5). This site was considered a mitigation alternative as a means to expand the northern reach of native eelgrass in Coos Bay. The property is privately held by the Clausen Oyster Company, but the parcel cannot be used for site operations because of regulatory restrictions within the upper bay. The site was considered available to JCEP as a potential mitigation area.

Existing conditions at the site consist of a broad, shallow grade mudflat composed of fine-grained, highly organic mud from an elevation of +4 feet MLLW to the lowest reaches of the intertidal zone. Sediments were relatively firm within the middle intertidal zone, but gradually became unconsolidated with distance from the shoreline. At the north end of the property, Larson Slough discharges to the Haynes Inlet's intertidal zone. The mudflat is widest adjacent to the slough and extends from the shore for as much as 700 feet offshore. Brackish conditions resulting from bay inputs and freshwater flowing from the slough have created optimal conditions for the formation of an expansive Lyngby's sedge marsh (*Carex lyngbyei*), which extends from the northern edge of the property for approximately 700 feet south (Figure E6; DEA 2018b). The marsh is at an approximate elevation of +5.0 to +6.0 feet MLLW. Small areas of pickleweed (*Salicornia virginica*) and salt grass (*Distichlas spicata*) were observed within the sedge marsh, but not at dominant densities.

Native eelgrass (*Z. marina*) was not observed during eelgrass surveys conducted in mid-May 2018. An eelgrass survey following Tier 1 guidelines developed by the USACE was conducted over the length of the property (USACE 2018b; DEA 2018b). A near continuous band of non-native *Z. japonica* was observed at approximate elevations of between +3.5 feet and +4.0 feet MLLW (Photo 1); mapped eelgrass on the site is presented in Figure E6.

Photo 1 - Continuous, dense* Z. japonica *in the middle intertidal zone

This site was eliminated from further considerations for the following reasons:

- No native eelgrass was observed during eelgrass surveys conducted in 2018.
- The widespread presence of fine-grained, high organic content sediments found in this portion of Haynes Inlet and the soft, unconsolidated nature of sediments at optimal elevations for *Z. marina* may preclude native eelgrass growth at appreciable densities.
- Native eelgrass within Coos Bay has generally been observed within lower intertidal zones composed of fine to medium sands. A habitat shift from sandy sediments in the main portions of Coos Bay to a fine-grained mudflat within upper Haynes Inlet may be the reason for a lack of native eelgrass on the site. Transplants within this area may have a high probability of failure.

3.4.1.2 Old Hatchery Site

The Old Hatchery site is situated due south of an abandoned fish hatchery facility located on the west shoreline of lower Coos Bay, approximately 2.6 miles southwest of JCEP (Figure E7). The area where potential mitigation opportunities exist are situated on State owned land within the intertidal zone adjacent to a Port of Coos Bay property. A small island is located in this area, which NOAA navigation charts note as a dredge spoil island. The site appears to be relatively protected from wind waves and excessive current velocities. Sediments are composed of fine to medium grained sands. Water clarity is good compared to upper reaches of the bay. Large patches of eelgrass were noted in the general area, and in particular surrounding portions of the island (Figure E7). The patches occur within a distinct elevation zone (DEA 2007).

At the north end of the island, where it extends into the intertidal zone, water depths remain too shallow to support eelgrass. This area is a sandy reach of intertidal zone extending to the northeast, beyond the island, forming a partially submerged spit for approximately 1,200 feet. The spit has eelgrass on all sides (Figure E7). An opportunity exists to excavate and grade this area to the elevation of the surrounding eelgrass to significantly expand this bed by approximately 1.5 acres.

DEA has eliminated this site from further consideration for the following reasons:

- Early agency input by the Oregon Department of Fish and Wildlife has determined that the area currently provides important ecological functions in its existing condition as a vegetated island and intertidal spit. Although removal of a portion of the dredge disposal island at this site could improve aquatic resource function, a concern was expressed that performing mitigation at this site could potentially degrade the existing high quality resources.
- Existing habitat processes that formed the shallow intertidal spit would remain after the area is regraded and planted with eelgrass, indicating that the longevity of the eelgrass mitigation site may not be sufficient to meet the mitigation needs of JCEP. The existing dredge spoil island and nearshore drift processes likely provide a continuous source of sediment for the shallow spit. Reburial is the likely long-term outcome.

3.4.1.3 Jordan Cove Embayment

The Jordan Cove embayment, located approximately 0.5 miles east of JCEP is a shallow, very low gradient embayment with continuous to patchy eelgrass beds along much of the outer bay (Figure E8). Much of the embayment consists of a broad intertidal or shallow subtidal sand flat composed of fine sands. Existing eelgrass coverage within the bay appears to be substantial suggesting that conditions for eelgrass colonization are good (DEA 2018a). An assessment of eelgrass surveys over the years has found that a limited degree of overlap has occurred in the areal distribution of the resource between 2005 and 2016. Based on this and the low gradient of the embayment, it is anticipated that sediment may shift from year to year affecting the optimal conditions that eelgrass would require in order to effectively colonize or expand.

DEA has eliminated this site from further consideration as a primary means of eelgrass mitigation for the following reasons:

- The shifting nature of eelgrass colonies within Jordan Cove may make it difficult for a mitigation site to comply with annual performance monitoring criteria or successfully meet eelgrass mitigation requirements.
- The amount of area available for eelgrass mitigation may not be sufficient to satisfy the eelgrass requirements of JCEP (e.g., an area that will allow an initial mitigation area of 3:1 mitigation area to impact site or a final mitigation requirement of 1.2:1[(2.3 acres]).

However, based on the substantial amount of existing eelgrass resource within Jordan Cove, the shallow water habitat that exists, and due to its close proximity to JCEP, this site may be a suitable site for receiving eelgrass transplants removed from the proposed Access Channel before it is dredged (DEA 2018a). As a result, JCEP plans to remove eelgrass from the Access Channel prior to dredging so it can be transplanted at Jordan Cove. Further details of eelgrass salvage from the Access Channel and transplantation to Jordan Cove is presented in Section 3.4.3.

3.4.1.4 Airport Site (JCEP Proposed Eelgrass Mitigation Site)

3.4.1.4.1 Overview

Based on the before-mentioned screening criteria, the Airport Site has been identified as JCEP's preferred Eelgrass Mitigation Site. It is located due south of the proposed Access Channel on the eastern shoreline of the bay as described in Section 1.3.1 (Figures E1, E2, and E3). The existing site is an elevated shoal associated with runway expansion at SORA. The shoal was likely created by estuarine processes that have since been blocked by the airport runway extension constructed in 1988 (Appendix D).

The site consists of an unvegetated intertidal shoal comprised of medium to course-textured sand. The top of the shoal is at an elevation of +2.7 feet MLLW (+2.0 feet NAVD88), with the outer boundaries at approximately +0.7 feet MLLW (0 feet NAVD88; Figure E2). Eelgrass surveys conducted in 2018 found no fringing eelgrass within the existing grading boundary. Patchy eelgrass beds have been found to the east and south (Figure E3), and substantial continuous eelgrass beds have been found to the southwest (donor and reference site; Figure E4). To the north, waters shallow approaching the airport runway, and to the west, remnants of a dredge spoil island are present.

The proposed approach is to excavate the locally high area surrounded by eelgrass down to approximately -1.0 to -2.0 ft NAVD 88 (-0.28 to -1.28 ft MLLW). The site will be left to stabilize for at least one winter storm cycle. The area would then be planted with donor stock in subsequent years. Because excavation would need to occur within the ODFW recommended in-water work window (October 1 through February 15), it does not coincide with the preferred time for transplanting eelgrass (i.e., spring and summer). The area is proposed for grading in order to tie into desired elevations where more robust beds occur and to facilitate tidal circulation at the mitigation site.

3.4.1.4.2 Site Stability

Hydrodynamic and sediment transport modeling was conducted at the site to determine if the proposed grade reduction would likely remain over time or whether sediment accretion would occur (Moffatt & Nichol 2018; CHE 2014; Appendix I). One study evaluated substrate stability after sediment removal and the other evaluated sediment transport to determine the potential for future sediment redeposition at the site. Study results indicate that the eelgrass mitigation site will remain at stable elevations once the site has been excavated and graded and eelgrass transplantation has been completed. Studies by CHE (2014) also indicate that local currents at the site reflect velocities that should allow transplanted eelgrass to remain stable and that substrate erosion is not expected. Studies by Moffatt & Nichol (2018) indicate that proposed bathymetric changes at the eelgrass mitigation site will not become altered to a significant extent over time. This confirms that estuarine processes that may have created the shoal are no longer present. These studies are appended to this Compensatory Wetland Mitigation Plan in Appendix I.

Modeling results are consistent with a historical geomorphic analysis conducted, as presented in Appendix D. Historical aerial photos show that the shoal appeared to be first formed as a result of secondary tidal channels running through the area, depositing sediments onto the shoal as the channels widened and lost velocity. These tidal channels were defined in part, by one of two dredge spoil islands placed northwest and west of the site when the federal navigation channel was deepened between 1948 and 1951. These processes appear to have created the shoal over time between the 1950s and 1980s (Figures E9 and E10). The larger of the dredge spoil islands was subsequently removed and used as fill material for a 2,000 foot airport runway extension constructed in 1988 (Figure E11). Remnants of the smaller dredge spoil island remains due west of the shoal, defining the edge of the proposed eelgrass donor bed and reference site (Figure E4). After the extended runway was completed in 1988, it has completely blocked the tidal channel responsible for creating the shoal (Figure E12). As indicated by the modeling results, there no longer are estuarine tidal processes that can re-form the shoal after grading and planting it with eelgrass. Additional details of the historical geomorphic analysis is presented in Appendix D.

3.4.1.4.3 Increase in Ecological Function

From a regulatory perspective, the proposed mitigation site previously received ODSL approval as part of ODSL authorization (ODSL # 37712-RF), which has since been withdrawn by the applicant to better align the USACE and ODSL permits for the overall project. Though the site will convert one intertidal habitat with existing ecological functions into another, the area was likely created by in-water work activities (placement of dredge spoil islands) before the airport runway extension was constructed in 1988. The area is also of insufficient elevations to have developed a vegetated upland and remains largely unvegetated. Proposed mitigation will increase ecological functions to a high degree over approximately 5.7 acres of isolated unvegetated sand flat. It will also restore the area where historical in-water construction (airport runway extension) changed estuarine processes resulting in substantially lowered ecological functions.

In addition, ODSL considers compensatory mitigation for eelgrass restoration as removing existing material near existing eelgrass beds to establish elevations and a hydrologic regime suitable for supporting eelgrass beds (ODSL 2016).

3.4.2 Summary Conclusions – Site Suitability and Alternatives Analysis

The site suitability evaluation and Alternatives Analysis has developed the criteria necessary to carefully evaluate and select a number of potential mitigation sites within Coos Bay to serve the mitigation needs of JCEP. The Alternatives Analysis leads to the conclusion that the proposed site southwest of the airport is the preferred eelgrass mitigation site to compensate for anticipated losses of existing eelgrass and habitat from the proposed dredging of the Access Channel. This conclusion was reached because of the following site and design attributes: Of the 10 sites evaluated, the preferred mitigation site meets all of the selection criteria necessary to maximize the success of eelgrass mitigation (Table 6).

- Physical, water quality, and ecological conditions are optimal for eelgrass transplantation after site preparation.
- The existing elevated shoal has adjacent eelgrass beds, documented over multiple years and field verified.
- The site meets engineering design requirements and is readily constructible.
- The site is a state owned aquatic land available to conduct long-term compensatory mitigation.
- Long-term mitigation at this site will not interfere with future economic development within Coos Bay.
- The area can be protected by the state from future development to preserve the mitigation site to serve the compensatory mitigation requirements of JCEP.
- Based on historical aerial photo analysis, it has been determined that the existing shoal is the result of estuarine processes that were enhanced by the placement of a dredge spoil island in the area and has been subsequently blocked by the construction of the airport runway extension. This has been further confirmed by sediment modeling conducted by JCEP.

- The site is of sufficient size to more than meet the eelgrass mitigation requirements to compensate for proposed losses of eelgrass habitat at the Access Channel.
- Eelgrass mitigation at the preferred site in conjunction with proposed removal of existing eelgrass within the Access Channel prior to dredging and transplantation to recipient areas meets the USACE requirement of avoiding and minimization of impacts.
- The preferred eelgrass mitigation site can be readily monitored over time to determine the short and long-term success of proposed mitigation.

3.4.3 Eelgrass Salvage and Transplantation from the Access Channel

The existing eelgrass resource within the proposed Access Channel of the LNG Facility has been consistently present since 2005. The most recent eelgrass survey conducted by DEA in September 2018 (DEA 2018a), as well as observations during a site visit in May 2018 (DEA 2018b) show a near continuous *Z. marina* bed running the length of the Access Channel (Figure E10; Photo 2).

Photo 2 - Existing* Z. marina *eelgrass within the proposed Access Channel – May 2018

The latest acreage of the Access Channel eelgrass bed is the same as that found in 2017 (1.90 acres; Figure E13). The 2018 survey also conducted a Tier 2 eelgrass survey where quantitative densities were collected. Divers collected eelgrass shoot counts from 85 quadrats from three, approximately 300 foot transects within the Access Channel. Mean shoot counts from the three transects were remarkably similar, indicating that the eelgrass bed is uniformly dense. Mean shoot counts were 54.0 shoots per square meter (Table 8).

Table 8. Eelgrass Density Data Collected within the Proposed Access Channel.

Access Channel Transects	Number of quads	Shoots/m^2
Access channel south	29	53.8
Access channel middle	29	52.6
Access channel east	27	55.6
Total Number of Quadrats	**85**	**--**
Mean Shoots/m^2	**--**	**54.0**

As reported in Section 3.4.1.3 above, eelgrass available to be salvaged within the Access Channel prior to dredging will be transplanted to a suitable recipient site. The selected recipient site is the Jordan Cove embayment located 0.5 miles east of the Access Channel (Figure E8). A Tier 1 eelgrass survey was also conducted in Jordan Cove in 2018 to carefully delineate the existing eelgrass boundaries so that these areas can be avoided during transplantation, and so that monitoring events will only delineate transplants rather than from existing eelgrass. In addition, a bathymetric survey of Jordan Cove was conducted to identify optimal areas away from existing eelgrass beds to transplant (DEA 2018a). As a result of these two surveys, two areas within Jordan Cove were identified as potential recipients for eelgrass transplantation, as shown in Figure E14. The two areas are along the outer bay, and combined, encompass approximately 2.1 acres at elevations between approximately +1.3 feet and -2.0 feet MLLW. The two areas are free of eelgrass and run along the same elevation as existing eelgrass, situated between an existing shallow shoal to the east and the Jordan Cove shoreline to the north. The two areas are also of sufficient size to receive all of the eelgrass from the proposed Access Channel.

The eelgrass salvage and transplantation project proposes to remove eelgrass from the Access Channel two seasons before planting at the eelgrass mitigation site begins. Eelgrass removal will follow procedures outlined for donor beds (Section 1.3.1.3) to remove eelgrass and ready it for transplantation, except that the entire bed will be removed. It is anticipated that removal will occur using both on-foot field biologists at lower tidal elevations and divers at higher tidal elevations. Post-removal processing will involve preparing and storing PUs as outlined in Section 1.3.1.2, though it is anticipated that planting will occur at densities approaching those of the original bed within the Access Channel. The transplant of larger sods of eelgrass with staples to hold them in place may also be conducted. This methodology was successfully used recently for large scale transplants in Puget Sound, Washington for the Washington Department of Natural Resources (Gaekle J., WA Dept. of Natural Resources, pers. comm. 2018).

Seasonal post-transplant monitoring would be conducted to verify the level of transplant success. These data would be used to determine if reduction in JCEPs total eelgrass requirement at the Eelgrass Mitigation Site is justified. Data would be used to recalculate (and potentially reduce) the total eelgrass mitigation requirement at the Eelgrass Mitigation Site based on the amount of eelgrass that has reestablished in Jordan Cove over the 5-year monitoring period.

Approval by the USACE and ODSL would be required before implementing this approach. However, the USACE would consider this a conservation measure built into the design of the project. In this way, it would be considered a recommended action to both avoid and minimize impacts to existing eelgrass, as well as minimize the temporal loss of the resource. ODSL would likely consider this action a contingency mitigation to supplement the preferred mitigation site.

Two other sites were considered for transplantation in areas adjacent and immediately west of the Access channel located between existing pile dikes. After discussions with JCEP's environmental and permitting group, it was determined that areas adjacent to shorelines potentially used for industrial purposes should be avoided to avoid limiting future development. An eelgrass transplantation site in this area may preclude shoreline alterations that may be necessary for waterfront development.

3.4.4 Kentuck Project

The proposed Kentuck Project site was selected partly through the same investigation of eelgrass sites (DEA 2007). This site historically provided mudflat, salt marsh, tide channel, and fringing freshwater habitats. The site historically also was an important transitional rearing habitat for coho salmon, because it would have provided an important brackish water mixing zone between the inflowing freshwater of Kentuck Creek and the more saline waters of the bay. Because of subsidence related to diking and draining activities, the site can now support primarily mudflat habitats.

Proposed design would raise grades throughout much of the site in order to provide a diverse and complex suite of habitats. Grades would be raised through the beneficial reuse of dredge material associated with other aspects of the Project. Dredge material is anticipated to be predominantly sand. The proposed approach for grading the site will be to strip the upper 12 to 18 inches of top soil before applying dewatered dredge material. The stockpiled top soil, which is predominantly silt loam (Coquille silt loam and Nestucca silt loam) will then be reapplied. Some blending of the dredge material with top soil may occur to aid soil cohesiveness and avoid having a sharp contrast of soil types within the soil profile. Use of the existing top soil will provide nutrients for plant establishment and also aid with soil cohesiveness. That said, salt marsh and freshwater wetland vegetation appears to grow quite well in sandy soils as evidenced by the communities that grow from this substrate along the Coos Bay North Spit. Wetland delineation work by DEA has observed the soils here often have very little fine material or organics. Site construction methods including timing and approaches to material import and dewatering, top soil salvage, mass grading, channel construction, erosion control measures, etc. will be prepared as part of final design with documentation provided to ODSL and other agencies either prior to permit issuance or as a condition of permits.

Design has been based on modeling from WEST Consultants as well as input from NMFS and ODFW over the years. A final hydrology and hydraulics report will be completed around mid-fall of 2018 that will include hydrodynamic modeling of the slough system based on proposed site conditions. Modeling will include an analysis of salinity fluctuations and sediment transport. The final report will be made available to ODSL, USACE and other reviewing agencies. ODFW and NMFS will also review and provide input on the MTR design, including how best to time the gate function to best support salmonids. The proposed MTR, new bridge, and box culvert at the irrigation pond will all be designed to meet ODFW fish passage criteria and coordination with ODFW is taking place to assure compliance with their requirements.

3.4.5 Minimizes Temporal Loss

3.4.5.1 Eelgrass Mitigation

As reported in Section 3.4.3, JCEP proposes to remove eelgrass from the proposed Access Channel prior to dredging and transplanting it to suitable habitats within adjacent Jordan Cove (Figure E14). Rather than a primary mitigation site, this action would be a conservation measure built into the design of the project, or contingency mitigation to lower JCEPs total eelgrass mitigation requirement by the amount of eelgrass that successfully establishes in the embayment. Removal and transplantation prior to dredging would also constitute an advanced action conducted prior to impacts, hence lowering the potential temporal losses of ecological functions. In addition, this would satisfy USACE comments (USACE 2018a) to consider options that would further avoid/minimize impacts to eelgrass.

3.4.5.2 Kentuck Mitigation Site

Mitigation work will be conducted concurrently with Project construction, a period of approximately 60 months. Mitigation work will begin at the front end of the construction schedule, where feasible, in an effort to minimize temporal loss of ecological functions. However, the construction schedule will also emphasize measures that are likely to lead to the long-term success of the Project-related mitigation work. For example, allowing imported dredge material to be rough graded and then to sit for a minimum of six months will allow for settling to occur before final grading, which will improve the ability to achieve the target elevations.

To assure proper functioning of the MTR structure it will be monitored at least once annually with an on-site visit, but with additional visits as necessary post heavy storm events. The condition of structural components will be recorded and recommendations provided to implement maintenance, repair, or replacement, if applicable. An MTR Operation and Maintenance Plan will be developed during final design of the project and will include a plan for long-term endowment for responsibility of MTR inspection, maintenance and repairs, and replacements as warranted.

4. CWM EXISTING SITE CONDITIONS (BASELINE INFORMATION)

4.1 WETLAND DELINEATION OR DETERMINATION

4.1.1 Eelgrass Mitigation Site

A wetland delineation report has not been prepared for the proposed Eelgrass Mitigation site, though several recent eelgrass surveys have been conducted since 2005 with the most recent in 2018. The site is an unvegetated elevated intertidal shoal of medium to course sand, historically surrounded by eelgrass. The top of the shoal is at an elevation of +2.7 feet MLLW (+2.0 feet NAVD88), with the outer boundaries at approximately +0.7 feet MLLW (0 feet NAVD88; Figure E2). Earlier eelgrass surveys conducted in 2005 (EPA 2005) and 2010 (DEA 2010) mapped areas of eelgrass along the southwest perimeter (fringe) of the proposed grading limits (Appendix A Figure E2; Figure E9). However, the latest eelgrass surveys conducted in 2016 (SSNERR 2016) and 2018 (DEA 2018a) showed no eelgrass within the proposed grading limits. The site is clearly an estuarine resource feature that is subject to ODSL and USACE jurisdiction.

Moffatt & Nichol (2017) prepared a Sediment Transport Analysis technical memorandum that evaluated the potential for scour and/or shoaling at the proposed eelgrass mitigation site. The analysis concludes that changes in bathymetry post construction are not likely. This is consistent with a historical geomorphic analysis of the area that found it likely that placement of a dredge spoil island to the north in the 1950s contributed to the formation of the existing shoal at the Eelgrass Mitigation Site. Subsequent construction of the airport runway extension altered local hydrodynamic patterns and estuarine processes. With the current extended runway configuration, the processes that created the shoal are no longer present. (Moffatt & Nichol 2018).

4.1.2 Kentuck Project

Wetland delineation reports have been prepared for the Kentuck Project site (DEA 2009 [updated via DEA 2016, ODSL WD #2010-0337R, concurrence received August 18, 2016], DEA 2014 [ODSL WD #2014-0350, concurrence received February 23, 2016]). The wetland delineation reports provide the following site description:

The approximately 133-acre former golf course is located adjacent to the south bank of Kentuck Slough, between River Mile 0.0 and River Mile 0.9. Prior to diking, the area consisted of mudflats, and low and high salt marsh plant communities located along a broad intertidal terrace. The property has been diked from Coos Bay and the slough, and (until 2009 has been operated as a golf course. Near the northwest corner of the property, the Kentuck Slough channel flows under East Bay Road through a bridge with a tidegate structure, where flows then enter Kentuck Inlet, an arm of the Coos Bay Estuary. The site is also hydraulically connected to Kentuck Inlet by way of a 10-foot-diameter culvert and tidegate near the southeast corner of the property under East Bay Drive.

Portions of the original channel and smaller tributary channels remain on the golf course; however, they have been notably altered, and additional drainage ditches have been added. The presence of the levee and East Bay Drive section have resulted in the conversion of the property from an estuarine (i.e., saltwater and brackish water) system to a freshwater system. Historically the site had a bi-directional hydrologic connection (i.e., tidal flow in and out) with the slough channel and Coos Bay. Currently, the site is protected from tidal inundation, and drainage only occurs in one direction.

The approximately 100-acre historical flood terrace has been delineated as an emergent wetland (palustrine emergent Cowardin class) plant community dominated by lawn grasses, with scattered native and ornamental tree plantings. Since golf course operations ceased, circa 2009, the flood terrace has reverted to wet pasture and is grazed by cattle. The areas outside of the former maintained golf course grounds consist of forested wetlands (palustrine forested Cowardin class) and upland forest. Historically, the flood terrace would have been classified as an estuarine wetland.

4.2 HYDROGEOMORPHIC ("HGM") AND COWARDIN CLASSES/SUBCLASSES AT CWM SITE

4.2.1 Eelgrass Mitigation Site

Based on the *Guidebook for HGM-based Assessment of Oregon Wetland and Riparian Sites: Statewide Classification and Profiles* (Adamus 2001), the proposed Eelgrass Mitigation site can be classified as Estuarine Fringe, Embayment (EFE). Estuarine Fringe sites include areas whose hydrodynamics are influenced mainly by the daily bi-directional movement of tides and where the deep water edge is defined by the 2-meter depth contour, as measured from mean daily low tide (Adamus 2001). The Estuarine Fringe, Embayment (EFE) subclass typically receives more of its hydrologic inputs from the ocean than from rivers and is less influenced by seasonal runoff events.

The Cowardin class of the proposed Eelgrass Mitigation site is estuarine, intertidal, unconsolidated shore, regularly flooded (E2USN).

4.2.2 Kentuck Project

The former golf course wetlands would be classified as a slope wetland under the HGM classification system, because groundwater provides the dominant source of hydrology; however, these wetlands could also be placed in the "flats" class due to the notable effect that direct precipitation can have on water levels there. Prior to diking, the golf course wetlands would have been classified as an estuarine wetland. Under the Cowardin classification system, this wetland would now be classified as a palustrine emergent wetland (PEM). The small amount of forested area within the site would be classified as palustrine forested wetlands (PFO).

The narrow fringe wetlands within the Kentuck Slough channel would be classified as estuarine, intertidal, emergent wetlands (Cowardin class) closer to the tidegate, and as PEM wetlands (Cowardin class) farther from the tidegate. The western portions of these wetlands, which experience brackish water conditions, would be classified as an estuarine fringe, marine-sourced, high tidal wetland under the HGM classification system. The eastern portions, which experience freshwater conditions, would be classified as an estuarine fringe, river-sourced wetland under the HGM classification system.

4.3 EXISTING AND PROPOSED HYDROLOGY

4.3.1 Eelgrass Mitigation Site – Existing Hydrology

Coos Bay is the water source for the Eelgrass Mitigation site. The site consists of an unvegetated sandflat below the average high tide elevation of Coos Bay and is surrounded by deeper water areas. The sandflat is exposed during lower tides.

4.3.2 Eelgrass Mitigation Site – Proposed Hydrology

Coos Bay is the water source at the Eelgrass Mitigation site. The site will be situated near the MLLW elevation (-0.7 feet MLLW; 0 feet NAVD88; Figure E2), which will allow nearly permanent inundation of the site, except during very low tides. This is the natural hydrologic condition at which eelgrass flourishes within the bay, including areas adjacent to the Eelgrass Mitigation site.

4.3.3 Kentuck Project – Existing Hydrology

Hydrology within the Kentuck Project site is driven primarily by groundwater elevations and secondarily by direct precipitation. During wetland delineation efforts, groundwater was typically observed in soil pits from 10 inches depth to within an inch or two of the surface. Saturation typically occurred 2 inches above this depth. These conditions are typical of wintertime conditions. In summer, groundwater elevations are typically a foot or two deeper (Culp pers. comm. 2009). These observations are consistent with hydrology conditions described in the Coos County soils survey (USDA 1989). Hydrology is also provided by seeps near the base of hill slopes, where shallow subsurface flows come to the surface.

During site investigations shallow ponding has been observed in many locations throughout the golf course, but it was most pronounced in the western half. Ground topography throughout the golf course varies slightly, with roughly 2 to 3 feet of difference in topographic relief from location to location. Some flooding occurs from the surface drainages, particularly during high and incoming tides, when the tidegate on the culvert at the southwest corner of the golf course is closed. This effect is exacerbated during heavy or prolonged steady precipitation events.

Hydrology for the narrow fringe wetlands adjacent to the Kentuck Slough channel is primarily a function of flooding by tidal inundation and high flows within the Kentuck Slough channel. A high water table and saturation were observed in the soil pits. Shallow inundation (i.e., approximately 6 inches) occurred during high tide. The existing MTR tide gate at the Kentuck Slough bridge limits salt water intrusion into the slough; however, a tidal backwater affect is still experienced in the slough when the gate closes and freshwater backs up behind the gate during incoming tides.

4.3.4 Kentuck Project – Proposed Hydrology

As previously noted, in this CWM Plan Kentuck Creek is used to refer to the portion of the drainage generally above the historic head of tide, while Kentuck Slough is used to refer to the portion of the drainage generally below the historic head of tide.

Hydrology to the Kentuck Project –Tidal Reconnection Area will be provided by tidal inundation from Coos Bay/Kentuck Inlet. Normal tidal cycles will substantially flood the property twice daily. The proposed new bridge opening will be designed, based on hydrodynamic modeling, to allow the entire site to be fully exposed to tidal influence with only limited tidal muting anticipated. Salt marsh occurs up to approximately 8.5 ft elevation (NAVD 88) at the salt marsh reference site located in Kentuck Inlet. This suggests that typical tidal affects within the Kentuck Project --Tidal Reconnection Area will provide wetland hydrology at least up to this elevation. Most of the proposed site grading has been designed to be no higher than elevation 8.5 ft, not including infrastructure such as the new levee or roadway improvements. However, elevations have been designed to extend up to 10.0 ft elevation where freshwater inputs from hillside seepage, shallow subsurface flow, and where the eastern tributary stream enters the site. It is anticipated that the combination of these freshwater inputs interplaying with tidal influence will provide wetland hydrology to these slightly higher areas of the site which are intended to support fringing freshwater wetland communities. No portion of the site, aside from infrastructure features, have been designed to occur above highest measured tide (elevation 10.26 ft NAVD 88). Flows from Kentuck Slough will be partially routed through the site. The current irrigation pond, formed by an earthen berm across a small drainage, drains to the former golf course through a standpipe/culvert water control structure. Golf Course Lane currently runs along the bottom of the berm. The proposed project will raise the elevation of the road above tidal influence and replace the current irrigation pond setup by installing a box culvert with native stream bed to allow tidal influence into the irrigation pond area. This will change the freshwater pond to estuarine habitat that is fish accessible. Some of the fringing emergent marsh habitat will convert to salt marsh; however, areas above elevation 8.5 ft are likely to remain as freshwater marsh since fresh surface and groundwater inputs will continue to provide hydrology to the wetland post tidal connection. A final hydrology and hydraulics report will be completed around early summer of 2018 that will include hydrodynamic modeling of the slough system based on proposed site conditions. Modeling will include an analysis of the extent of tidal influence across the site, including salinity regimes that can then be used to assess where reed canarygrass establishment could be prevented.

Hydrology to the Kentuck Project – Freshwater Floodplain Reconnection Area will be provided by direct precipitation and a seasonally high groundwater table, as is currently the case. Kentuck Creek overbank flows will also provide a source of wetland hydrology.

4.4 EXISTING PLANT COMMUNITY DISTRIBUTIONS AND ABUNDANCE OF EXOTIC SPECIES

4.4.1 Eelgrass Mitigation Site

The proposed Eelgrass Mitigation site is primarily devoid of vegetation; however, some drift macroalgae may pass through the site. Some of the deeper areas adjacent to the proposed site contain eelgrass beds (*Z. marina*) and associated epiphytic algae.

4.4.2 Kentuck Project

The approximately 100-acre historical flood terrace has been delineated as an emergent wetland (palustrine emergent Cowardin class) plant community dominated by lawn/pasture grasses, with scattered native and ornamental tree plantings. Since golf course operations ceased, circa 2009, the flood terrace has reverted to wet pasture and is grazed by cattle. The areas outside of the formerly maintained golf course grounds consist of forested wetlands (palustrine forested Cowardin class) and upland forest. A small and narrow fringe of high salt marsh community occurs along the lower portion of the Kentuck Slough channel. Six plant communities were identified during the wetland delineation and are described below.

4.4.2.1 Pasture Community

The Pasture community was is dominated by Kentucky bluegrass (*Poa pratensis*, FAC). This community occurs in the flats portion of the former golf course. Reed canarygrass (*Phalaris arundinacea*, FACW) and soft rush (*Juncus effusus*, FACW) are also prominent in places, having established since golf course maintenance activities ceased. This plant community is considered to be hydrophytic, because greater than 50 percent of the dominant plants with known indicator status are hydrophytic.

A second type of this community was found in upland locations, and it contains Kentucky bluegrass and hairy cat's ear (*Hypochaeris radicata*, FACU). This second community type occurs on maintained hill slopes. This type of the Pasture plant community is considered to be non-hydrophytic, because no greater than 50 percent of the dominant plants with known indicator status are hydrophytic.

Tree plantings occur in localized groupings throughout the former golf course, but they are not considered dominant. Tree species included Sitka spruce (*Picea sitchensis*, FAC), shore pine (*Pinus contorta*, FAC), and various ornamental species.

4.4.2.2 Weedy Upland

The Weedy Upland community is located primarily along the levee protecting the golf course from the Kentuck Slough channel. It is also occasionally found along semi-maintained areas along the toe of slopes along the south side of the site. The Weedy Upland community is dominated by Himalayan blackberry (*Rubus armeniacus*, FACU), trailing blackberry (*Rubus ursinus*, FACU), Scotch broom (*Cytisus scoparius*, UPL), tall fescue (*Schedonorus phoenix*, FAC), reed canarygrass, Kentucky bluegrass, and orchard grass (*Dactylis glomerata*, FACU). Hooker willow (*Salix hookeriana*, FACW) is also occasionally found in this community. This plant community is considered to be non-hydrophytic, because no greater than 50 percent of the dominant plants with known indicator status are hydrophytic.

4.4.2.3 Forested Wetland Community

The Forested Wetland community occurs at the base of hillside ravines along the south side of the golf course, where maintenance activities do not occur. Dominant vegetation consists of red alder (*Alnus rubra*, FAC), Oregon crab apple (*Malus fusca*, FACW), salmon berry (*Rubus spectabilis*, FAC), twin berry (*Lonicera involucrata*, FAC), trailing blackberry, small-fruited bulrush (*Scirpus microcarpus*, OBL), stinging nettle (*Urtica dioica*, FAC), slough sedge (*Carex obnupta*, OBL), skunk cabbage (*Lysichiton americanum*, OBL), deer fern (*Blechnum spicant*, FAC), creeping buttercup (*Ranunculus repens*, FACW), water parsley (*Oenanthe sarmentosa*, OBL), and youth on age (*Tolmiea menziesii*, FAC). This plant community is considered to be hydrophytic, because greater than 50 percent of the dominant plants with known indicator status are hydrophytic.

4.4.2.4 Forested Upland Community

The Forested Upland community occurs on the hillsides adjacent to the Forested Wetland community and maintained portions of the golf course. Dominant vegetation consists of Douglas fir (*Pseudotsuga menziesii*, FACU), red alder, cascara (*Rhamnus pershiana*, FAC), red elderberry (*Sambucus racemosa*, FACU), salmon berry, evergreen huckleberry (*Vaccinium ovatum*, UPL), salal (*Gaultheria shallon*, FACU), trailing blackberry, sword fern (*Polystichum munitum*, FACU), and deer fern. This plant community is considered to be non-hydrophytic, because no greater than 50 percent of the dominant plants with known indicator status are hydrophytic.

4.4.2.5 High Salt Marsh Community

The High Salt Marsh community is located towards the western end of Kentuck Slough, where some tidal influence occurs and results in saltwater/brackish water conditions. Dominant species include Lyngby sedge (*Carex lyngbyei*, OBL), with salt grass (*Distichlis spicata*, FACW) and tufted hairgrass (*Deschampsia caespitosa*, FACW) as common subdominants. This plant community is considered to be hydrophytic, because greater than 50 percent of the dominant plants with known indicator status are hydrophytic.

4.4.2.6 Reed Canarygrass Community

The Reed Canarygrass community is located towards the eastern end of Kentuck Slough. Tidal influence occurs; however, freshwater conditions predominate. Reed canarygrass is the sole dominant in this community. This community transitions into the High Salt Marsh community to the west, where water conditions grade from predominantly fresh to predominantly brackish. The Reed Canarygrass community is considered to be hydrophytic, because greater than 50 percent of the dominant plants with known indicator status are hydrophytic.

4.5 SITE CONSTRAINTS OR LIMITATIONS

4.5.1 Eelgrass Mitigation Site

Potential site constraints include the following:

- Site access for construction and monitoring is limited to barge and other watercraft.
- Dynamic site conditions are susceptible to force majeure (i.e., catastrophic events such as severe storm surge, tsunami, etc.). Note, hydrodynamic-sediment transport modeling has shown that the project will not result in noticeable changes to sedimentation at the site (Moffatt & Nichol 2018).
- Construction activities will need to be adjusted to assure minimization of impacts to adjacent eelgrass beds.
- Coordination and clearances from the nearby airport may be needed.

4.5.2 Kentuck Project

Potential site constraints include the following:

- Opening the golf course to tidal influence creates the risk of increased flooding potential and saltwater intrusion to adjacent and upstream landowners. New levee construction and repair and/or enhancement of the existing levee are therefore required to reduce this risk. Levee construction and/or repair will result in additional wetland impacts that are accounted for in this plan.
- Portions of East Bay Drive and the golf course access road need to be elevated above tidal elevations to allow continued access to private residences and/or to comply with Coos County requirements. Road improvements will result in additional wetland impacts that are accounted for in this plan.
- Two overhead power lines traverse the mitigation site. Accommodations will need to be made to provide access to power poles.
- The site has encountered substantial subsidence that has required the import of fill to raise grades in order to provide desired habitat types. Importing this fill will entail transshipment of a large volume of JCEP dredge material to the site (this process is covered in detail in JCEP's Dredge Material Management Plan).
- PCGP proposes to install a new gas pipeline under the Kentuck Project site.

4.6 ENHANCEMENT PROJECTS

4.6.1 Eelgrass Site

Transplantation of eelgrass at the Eelgrass Mitigation Site will enhance habitat conditions degraded by historical anthropogenic activities. Dredge spoil disposal in the 1950s when the Federal Navigation Channel was deepened created a dredge spoil island that likely contributed to the creation of the existing shoal at the Eelgrass Mitigation Site. Subsequent removal of the dredge spoil island in 1988 and construction of the airport runway extension blocked the tidal channels responsible for shoal formation. Prior to these events, historical aerial photography showed an enlargement of the shoal between the 1950s and 1970s (Appendix D). Since the current configuration of the runway now prevents additional shoaling, proposed removal of these sediments to optimal elevations for eelgrass growth and expansion presents a unique opportunity to restore eelgrass habitats modified by historic in-water work.

4.6.2 Kentuck Site

4.6.2.1 Factors Leading to Degraded Condition

Enhancement will occur at the Kentuck Project site. Before alteration, the area consisted of mudflats, and low and high salt marsh plant communities located along a broad intertidal terrace. The property has been diked from Coos Bay and managed for various uses over the decades, including use as pasture for grazing and use as a golf course. The factors leading to the degraded condition at the Kentuck Project site include the construction of levees and resulting isolation from Kentuck Inlet and Coos Bay; the construction of Kentuck Golf Course and appurtenances (e.g., cart paths, bridges, culverts); significant changes in vegetative communities resulting from altered site hydrology; and pumping and maintenance activities associated with golf course operations.

4.6.2.2 How CWM Plan Will Reverse Degradation

The CWM Plan will reverse degradation by breaching the levee and restoring tidal hydrology to the historical estuarine wetland, removing golf course appurtenances, and providing for the re-establishment of mudflat, salt marsh, and fringing freshwater wetland plant communities. Similarly, floodplain reconnection will occur at the far northeast end of the site, which will allow for establishment of freshwater wetland dominated by native species.

5. *FUNCTIONS AND VALUES ASSESSMENT*

5.1 ASSESSMENT METHODS USED

Wetland functions and values were evaluated for impacted wetlands and the mitigation sites pre- and post-mitigation. Table 9 lists the assessment methods used for various aspects of this CWM Plan.

Table 9. Functional Assessment Methods Used to Support this CWM Plan

Project and Components	Method: Rationale
LNG Terminal	
Freshwater wetland impacts	Oregon Rapid Wetland Assessment Protocol ("ORWAP"): This is the approved method for assessing functions and values in Oregon, particularly for projects that entail multiple wetland types.
Existing tidal habitats and Eelgrass Mitigation site (intertidal sand/mudflats, shallow subtidal, eelgrass, salt marsh, riprap embankment below HMT)	Best Professional Judgement and Eelgrass Densities: These habitats occur at the proposed slip and access channel, the Trans Pacific Parkway/US-101 intersection, along the west side of East Bay Drive at the Kentuck Project, and at the Eelgrass Mitigation site. ORWAP is not intended to assess these types of estuarine resources, with the exception of salt marsh. Other methods for assessing these habitats in Oregon are not available. Salt marsh impacts are extremely small (0.06 acre) and are located adjacent to the other habitats noted above, and therefore have been included in this category. Based on literature review it is presumed that high density eelgrass provides a higher level of function than low density eelgrass (NOAA 2014). This concept informs the collection of quantitative data on eelgrass densities at reference sites and the establishment of performance criteria to meet those densities by the end of the prescribed post-construction monitoring period.
Kentuck Project, pre- and post-mitigation	ORWAP: This method is appropriate for evaluating all wetland types at the site in its existing condition. This method also covers the many wetland types that will result post-mitigation. ORWAP does consider the presence of mudflats within the greater vegetated portion of a site. Therefore, mudflats that will form at the site have been included as a part of the overall site assessment.
Pipeline	
Forested and scrub-shrub wetlands converted to emergent wetlands	Best Professional Judgement: PCGP has not had site access to a number of the wetlands that will be impacted by the Pipeline. For purposes of this mitigation plan, PCGP conducted a functional assessment based on best professional judgement. Once access is allowed and site visits conducted, PCGP will follow up with an ORWAP-based assessment.

5.2 FUNCTIONS AND VALUES ASSESSMENT

Lost functions and values at the existing wetland sites will be replaced by conducting mitigation in suitable locations within the Coos Bay estuary that will result in self-sustaining, complex habitats connected to adjacent ecosystems. Appendix E and Appendix F provide the results of project functional assessments for the LNG Terminal and PCGP project components, respectively. Appendix E includes a summary table of proposed function and value losses and gains for wetlands associated with mitigation at the Kentuck Project site.

Currently there are no approved eelgrass functional assessments approved for use in Oregon and a search for other suitable rapid eelgrass functional assessments that could be applied to the project was unfruitful. The California Eelgrass Mitigation Policy and Implementing Guidelines (NOAA 2014) states that "In absence of a complete functional assessment, eelgrass distribution and density should serve as a proxy for eelgrass habitat function." Therefore, data on eelgrass density at the proposed impact site has been provided and is intended to serve as a surrogate for eelgrass function (i.e., higher density equals higher function).

5.2.1 Conclusions of LNG Terminal and PCGP Functions and Values Assessments

5.2.1.1 LNG Terminal Function and Values Assessment Summary

Based on ORWAP, freshwater wetland group functions and values likely to be most affected by the LNG Terminal and that rated higher for values are Aquatic Habitat and Ecosystem Support functions. No functions at the proposed Kentuck Project site, under existing conditions, rated as higher. Meanwhile, post-mitigation scores for both the Kentuck Project site Tidal Reconnection Area and Freshwater Floodplain Reconnection Area rated as higher for Water Quality Support, Fish Habitat, Aquatic Habitat, and Ecosystem Support functions, all which received higher value ratings as well. These ratings suggest: (1) proposed mitigation at the Kentuck Project site results in functional uplift of important wetland values, and (2) the uplift at the Kentuck Project site will occur, at a minimum, to the same higher functioning and valued group functions that will be lost at the freshwater impact sites.

Estuarine habitat functions will be lost at the proposed LNG Terminal. Functions such as shellfish habitat, waterbird habitat, primary production, cover for juvenile fish, and egg-laying attachment areas for herring and other aquatic organisms may be provided at this impact site; however, due to site conditions, the impact site likely does not provide these functions at as high a level as some of the more diverse and ecologically complex locations found elsewhere in the bay. Lost estuarine functions will be offset at the Kentuck Project site and the Eelgrass Mitigation site, both of which are situated in and/or will result in a considerably more complex and diverse array of habitats than at the slip impact site, thus resulting in an overall uplift in functions lost.

5.2.1.2 Pipeline Function and Values Assessment Summary

For the Pipeline, functional impacts are likely to result in reduced functioning at a given impacted wetland rather than wholesale loss of function, because permanent wetland impacts entail a conversion of wetlands from forested or scrub-shrub wetland habitat to emergent wetland habitat, with emergent habitats often providing lower levels of function. Furthermore, Pipeline acreage impacts are all quite small. The largest single impact is 0.29 acre, with almost all other impacts being less than 0.10 acre. Estimated higher rating functions and values at the ORWAP group level likely to be reduced by the Pipeline impacts to forested and scrub-shrub wetlands include: Water Quality, Aquatic Support, and Ecosystem Support. The Pipeline's wetland functions and values impacts will be offset at the Kentuck Project site – Freshwater Reconnection Area. As described above for LNG Terminal freshwater impacts, ORWAP shows that the Kentuck Project site will result in notable uplift of functions that are of high value. The functional uplift also aligns with the higher functions and values estimated to be impacted by the Pipeline.

6. *MAPS, DRAWINGS, AND CONSTRUCTION SPECIFICATIONS*

6.1 SCALED SITE PLAN AND CROSS SECTIONS

Scaled site plans and cross sections for both mitigation sites are provided in Appendix A.

6.2 CONSTRUCTION SCHEDULE

Construction of the Project is anticipated to begin in the first half of 2020 and last approximately 60 months.

6.2.1 Eelgrass Mitigation Site

A proposed sequencing schedule for the Eelgrass Mitigation site is provided in Table 10. Excavation at the site, to provide suitable bed elevation for subsequent eelgrass transplanting, is anticipated to begin in the fourth quarter of 2020, assuming permit issuance by the fourth quarter of 2019. Dredging of the access channel, where permanent eelgrass impacts will occur, is also anticipated to start the fourth quarter 2020. Prior to dredging, eelgrass salvage will take place and be transplanted to the recipient site in Jordan Cove during the 2nd quarter of 2020. The Eelgrass Mitigation site takes into account the following two key time periods that will affect mitigation activities:

- Dredging during ODFW-approved in-water work window for the estuary: October 1 through February 15.
- Transplanting during optimal eelgrass transplanting period: late spring and summer.

Table 10. Proposed Mitigation Project Sequencing Schedule – Eelgrass Mitigation Site

Time Period	Mitigation Activities
3Q2020 to 1Q2021	• Conduct salvage of exiting eelgrass within Access Channel and transplant to Jordan Cove during the spring and summer of 2020. • Install site dredge pipeline and infrastructure (pumping stations and loading dock) during in-water work window • During the fall months of the in-water work window, dredge mitigation site to appropriate elevations for eelgrass establishment • Remove dredge pipeline and infrastructure prior to end of in-water work window • Post-excavation bathymetric survey or cross sections to be used in monitoring site stability
2Q2021 to 2Q2022	• Allow site to remain idle through the 2020-2021 winter storm season • Monitor Jordan Cove transplants summer 2021
2Q2022 to 4Q2022	• Late spring 2022, conduct bathymetric survey to monitor site stability after second (2021-2022) winter storm season. If results indicate site is relatively stable, then further site-stability monitoring in subsequent years would only occur if other monitoring efforts discover a notable change in site elevations that could prevent the mitigation from meeting the performance standard for Objective 1.2. • Summer, monitor reference and donor sites for baseline conditions. Monitor Jordan Cove transplants summer of 2022. If justified, reduce total eelgrass mitigation site requirement • Summer, conduct first eelgrass collection and transplanting to planting beds at the Eelgrass Mitigation Site (Figure E1) • Summer, post-transplanting monitoring of mitigation site to determine compliance with agreed-upon planting plan • Fall/winter, evaluate mitigation work to date and determine whether any corrective measures are needed for next season.
2Q2023 to 4Q2023	• Late spring 2023, conduct third bathymetric survey to monitor site stability • Summer, conduct second and final eelgrass collection and transplanting efforts to remaining planting beds at the Eelgrass Mitigation Site (Figure E1) • Summer, monitor mitigation, reference, and donor sites • Fall/winter, evaluate mitigation work to date and determine whether any corrective measures are needed for next season.
2Q2024 to 4Q2024	• Summer, monitor mitigation, reference, and donor sites (first year in which percent cover at mitigation site can apply to meeting performance standard, assuming additional planting is not proposed for this year). • Fall/winter, evaluate mitigation work to date and determine whether any corrective measures are needed for next season.
2Q2025 to 4Q2025	• Summer, monitor mitigation, reference, and donor sites (second year in which percent cover at mitigation site can apply to meeting performance standard, assuming additional planting is not proposed for this year). • Fall/winter, evaluate mitigation work to date and determine whether any corrective measures are needed for next season. • If performance standards for Objective 1.2 have been met, then the mitigation project is considered compliant with permitting requirements and future monitoring is no longer required. If performance standards for Objective 1.2 have not been met, then additional monitoring would be required.

Time Period	Mitigation Activities
2026 to 2028	• Continue to monitor until performance standards for Objective 2 are met. If by the end of year 8 performance standards have still not been met, then JCEP will consult with the agencies to determine future actions.

* Schedule presumes all required permits have been obtained by the fourth quarter of 2019.

** Timing nomenclature: 3Q2020 = 3rd quarter of 2020 based on a standard calendar year (not fiscal year)

6.2.2 Kentuck Project

Mitigation construction for the Kentuck Project is anticipated to begin in earnest after installation of the PCGP pipeline at the Kentuck Project site. The construction schedule of the Kentuck Project site takes into account the following constraints:

- In-water work window for the estuary: October 1 through February 15.
- In-water work window for Kentuck Slough (i.e., above the existing tidegate): July 1 through September 15.

See Table 11 for the sequencing schedule for the Kentuck Project site.

Table 11. Proposed Mitigation Project Sequencing Schedule – Kentuck Project Site

Time Period *	Mitigation Activities

2Q2020 to 2Q2021	• Construct Kentuck site dredge material delivery pipeline/offloading facility.
	• Site prep for delivery of dredge material (continues through 3Q2021)
	  o Install erosion and sediment control measures
	  o Remove remnant golf course infrastructure
	  o Top soil stripping and stockpiling

3Q2021 to 4Q2022	• Delivery of dredge material begins 3Q2021.
	• Removal of dredge material pipeline/offload facility end of 2Q2022
	• Staged material dewatering and rough grading occurs through 3Q2022.
	• Begin construction of permanent and temporary infrastructure improvements:
	  o Temporary East Bay Drive detour.
	  o Permanent East Bay Drive roadway improvements
	  o East Bay Drive bridge, including cofferdams to prevent tidal exchange into golf course.
	  o Golf Course Lane improvements.
	• Potential grading and planting of Freshwater Floodplain Reconnection area to accelerate mitigation efforts at this part of the site. Reconnection would likely not take place until final site completion.

1Q2023 to 1Q2024	• Rough graded material allowed to sit for six months to surcharge site and accelerate consolidation/settling.
	• Continue constuction of infrastructure improvements, in addition to above:
	  o New Kentuck Slough levee
	  o New tidegate structure with MTR gate in Kentuck Slough, including cofferdams

2Q2024 to 4Q2024	• Final site grading and habitat structures (e.g., large wood installation) • Plant installation • Connect new channel at Freshwater Floodplain Reconnection area to upstream and downstream portions of existing Kentuck Creek/Slough. • Remove cofferdams at MTR and bridge to connect Tidal Reconnection area to tidal influence

* Schedule presumes all required permits have been obtained by the fourth quarter of 2019.

** Timing nomenclature: 3Q2020 = 3rd quarter of 2020 based on a standard calendar year (not fiscal year)

6.3 SCHEMATIC OF WATER CONTROL STRUCTURES

Water control structures are not anticipated for the Eelgrass Mitigation site. The Eelgrass Mitigation site will interact freely with Coos Bay. The Kentuck Project site will feature new tidegates. A schematic of the MTR gate array is included in Appendix A, Figure K-8B.

6.4 PLANTING LISTS

A planting list for the Kentuck Project is provided in Appendix A, Figure 7. As noted in Section 1.3.2.1, Kentuck Tidal Reconnection Area, salt marsh vegetation is anticipated to establish by natural recruitment, particularly within lower salt marsh areas. Planting at the Eelgrass Mitigation site will consist solely of eelgrass (*Z. marina*). Non-native eelgrass (e.g., *Z. japonica*) will not be planted. No more than 10 percent of eelgrass donor beds will be harvested, except as follows. Complete harvest of eelgrass plant stock from the proposed impact site or extensive use of eelgrass from oyster culture beds will be allowed where it is common practice to conduct extensive removal of eelgrass that interferes with oyster culture operations. An eelgrass collection and transplanting plan will be prepared as part of final design efforts and will be made available to the regulatory agencies for comment. It is assumed that preparation of this plan will be included as a condition of appropriate permits and that agency approval will be required before eelgrass disturbance can occur on the project. The plan will identify specific locations for potential harvest, known conditions at those locations, and an estimate of available eelgrass harvest material. Due to annual fluctuations in eelgrass presence and density, these locations will need to be reviewed prior to actual harvest time to determine the final locations for harvest. All sites that are used for harvest will be documented as part of as-built requirements and monitored as part of overall eelgrass monitoring efforts.

7. *PERFORMANCE STANDARDS AND MONITORING PLAN*

7.1 PERFORMANCE STANDARDS

Performance standards for each objective are presented below. Project objectives have been partially restated for the sake of convenience. The performance standards set the minimum requirements that need to be met to consider mitigation efforts successful. A monitoring plan has been developed to determine whether the mitigation sites are on track and will eventually meet the performance standards.

7.1.1 Eelgrass Mitigation Site

Mitigation Goal: At the proposed Eelgrass Mitigation Site, establish a stable population of eelgrass beds at an area of 1.2 times or greater the area and equivalent densities as the impact site (i.e., 2.71 acres or greater). The stability of the population size and density shall be comparable to surrounding beds and overall natural fluctuation of eelgrass populations within the bay (monitoring will include reference sites to enable tracking of natural fluctuations of eelgrass).

To achieve this goal, the following objectives will be met:

Objective 1.1: Establish elevations suitable for eelgrass establishment over a minimum of 6.78 acres (i.e., 3 to 1 mitigation ratio for enhancement projects).

A minimum of 6.78 acres within the mitigation site will be at elevations suitable for eelgrass establishment. Wave and current action may cause elevations to shift over time. This is acceptable as long as performance standards for Objective 1.2 are still likely to be met.

Objective 1.2: Establish a minimum of 2.71 acres of eelgrass beds at densities that reflect those found at a selected reference site. Increases in eelgrass density as the mitigation site matures must meet a prescribed annual performance criteria of density, which is based on a percentage of reference site density each year over a total 5-year post-construction monitoring period. By the end of the post-construction monitoring period, eelgrass density must be within 10 percent of the reference site.

It should be noted that eelgrass that is salvaged from the proposed impact site and successfully transplanted to a recipient site will be subtracted from the total eelgrass mitigation requirement. Successful transplant reestablishment shall be documented by multiple year monitoring.

Objective 1.3: Reestablish eelgrass beds temporarily impacted from eelgrass mitigation site construction. This includes any eelgrass that may be within site boundaries a season before excavation/grading activities begin

Objective 1.3 is essentially the same as Objective 1.2; however, the eelgrass areal coverage and densities shall be based on the pre-construction estimate of likely incidental impacts.

Objective 1.4: There will be no lasting depletion or harm to eelgrass donor beds.
Recovery of donor beds shall be assessed the year after harvest and subsequent years after that until it is documented that beds have returned to pre-harvest conditions relative to adjacent unharvested areas. This shall occur for up to three years. If after 3 years the performance standard is not met, then permitting agencies shall be consulted to discuss potential remedial actions**.** Conditions of adjacent beds will be assessed during each monitoring event to assess natural variation in eelgrass presence in the immediate vicinity and this information will be used to calibrate whether donor beds have returned to pre-harvest condition.

To achieve these objectives, performance standards have been developed, based on recommendations by the USACE. DEA proposes to use the performance metrics outlined in USACE comments, as follows:

- Percent survival of the transplanted shoots after 1 year**.**
- Measurements of the areal coverage (total areas occupied by eelgrass within the transplanted site, [e.g., square feet, meters, acres]) at each monitoring interval.
- Measurements of the shoot density (expressed as mean # shoots per square meter) within the vegetated areas of the transplant site, donor bed(s), and reference site(s) at each monitoring interval.

Performance standards and milestones would be developed in consultation with the USACE in advance of construction. DEA proposes the following, based on USACE standards:

Year 1 – 40% coverage of eelgrass and 50% of the density of reference sites over not less than 1.2 times the area of the impact site (2.71 acres).

Year 2 – 85% areal coverage of eelgrass and 60% of the density of initial transplant density over original transplanted area.

Year 3 – 100% areal coverage of eelgrass and 75% of the density of reference sites over not less than 1.2 times the area of the impact site (2.71 acres).

Year 4 – 100% areal coverage of eelgrass and 85% of the density of reference sites over not less than 1.2 times the area of the impact site (2.71 acres).

Year 5 – 100% areal coverage of eelgrass and similar density of reference sites (not statistically different) over not less than 1.2 times the area of the impact site (2.71 acres).

Conducting monitoring at the 6-month mark after transplantation may not provide useful data or information if transplants occur during the optimal periods of mid-summer. Six months subsequent to transplantation would be mid-winter, during which transplants may not have a substantial showing above the sediments. These intervals will provide annual updates on the establishment and persistence of eelgrass during the growing season and detect potential early failures in eelgrass growth at the mitigation site that may suggest the need for additional actions (e.g., additional transplants).

7.2 KENTUCK PROJECT

7.2.1 Kentuck Project – Tidal Reconnection Area

Mitigation Goal 2: Restore tidal connectivity to a minimum of approximately 72.51 acres of historic tide lands within the former golf course site, which will result in a diverse array of habitat types including mudflat, tide channels, salt marsh, and fringing freshwater wetlands. This acreage is based on a 3:1 ratio of LNG Terminal impacts presented in Table 1, including permanent impacts at the Kentuck Site but not including eelgrass impacts.

Approximately 91 acres of construction will be undertaken to achieve this goal, including approximately 18 acres of voluntary habitat improvements above the minimum requirements. Additionally, JCEP anticipates providing substantially more vegetated habitat (e.g., salt marsh) than the minimum required because of salt marsh's higher productivity and historical loss within the watershed relative to mudflat. An estimated 28 percent of tidal wetland (e.g., salt marsh) has been lost within the bay compared to an estimated 18 percent loss of tidal flats (e.g., mudflat), and there is currently roughly four and a half times more tide flat than tidal wetland within the bay (Borde et. al. 2003), Proposed plant community elevations and species composition are informed by a reference site immediately adjacent to the mitigation site in Kentuck Inlet.

To achieve this goal, the following objectives will be met:

Objective 2.1: Restore tidal reconnection to the site that allows for free exchange of tidal water from Kentuck Inlet. The reconnection will allow ecosystem processes to function similar to historic pre-settlement conditions to the greatest extent practicable given historic alterations at the site and within the watershed and also based on site constraints and adjacent property owner concerns. This objective will be achieved by installing a new bridge along East Bay Drive that meets ODFW fish passage criteria, NMFS standards, and (based on hydrodynamic modeling) has been designed to allow for full tidal exchange within the site during a single tide cycle.

Performance Standard: *An as-built survey will show that the new bridge was built to specifications included in ODFW Fish Passage permit. Follow up visual inspection will occur as a part of annual vegetation monitoring, which will occur for five years.*

Objective 2.2: Allow for continuity of ecological processes to occur between Kentuck Inlet, the project site, and Kentuck Slough, including fish passage. This objective will be achieved by installing the bridge along East Bay Drive as noted in Objective 2.1 as well as a MTR (i.e., fish friendly tidegate) towards the upper end of the site to create a direct connection between the site and Kentuck Slough. An additional fish friendly culvert (i.e., box culvert with native substrate bottom) will be installed to reestablish tidal connection to a drainage now blocked by an earthen berm/irrigation pond. All structures will be designed to meet ODFW fish passage criteria and NMFS standards.

Performance Standard: *An as-built survey will show that the new bridge and MTR structure were built to specifications included in ODFW Fish Passage permit. Follow up visual inspection will occur as a part of annual vegetation monitoring, which will occur for 5 years.*

Objective 2.3: Provide a range of aquatic habitat regimes within the site to support native plant species. This objective will be achieved through site grading to provide a range of tidal regimes within the site, including areas of salt marsh (particularly lower marsh elevations), mudflats, grading of primary and secondary tide channels, and habitat pools.

Performance Standard: *An as-built survey will show that proposed grading was constructed as designed. Follow up visual inspection will occur as a part of annual vegetation monitoring.*

Objective 2.4: Provide aquatic habitat features to further support native aquatic species. This objective will be achieved through installation of complex wood structures (i.e., many pieces of large wood per structure) in habitat pools and simple wood structures (i.e., 1 to 3 pieces of large wood per structure) within channels. At a minimum the following will be included:

- 4 complex wood structures
- 11 simple wood structures
- 2 habitat pools

Performance Standard for Objectives 2.4: *An as-built survey will show that the proposed habitat features were properly constructed. Follow up visual inspection will occur as a part of annual vegetation monitoring.*

Objective 2.5: Establish a diversity of vegetated estuarine and freshwater wetland habitat types dominated by native species (i.e., salt marsh, and palustrine forested, scrub-shrub, and emergent communities). At a minimum 22.35 acres of vegetated habitats shall be established to offset vegetated wetland impacts (i.e. Table 1 LNG Terminal impacts, including Kentuck impacts, to PFO, PSS, PEM, PAB, and E2EM habitats) at a 3:1 ratio. This objective will be achieved by grading site elevations that are supportive of salt marsh establishment (based on nearby reference salt marsh). Fringing freshwater wetlands are anticipated to form along the upper margins of the site that occur near sources of freshwater (i.e., tributary streams, and seeps and shallow subsurface flows from the hillside that runs along the south side of the site). There will be a natural interplay between salt water from the bay and freshwater inputs that ultimately dictates the boundary between freshwater wetland/salt marsh communities. Salt marsh elevations are anticipated to range between approximately 5.5 ft to 8.5 ft NAVD 88 and the majority of proposed vegetated areas have been designed to these elevations. Maximum site elevations (not including levee and roadways) extend up to an elevation of 10.0 ft NAVD 88, which is just below the highest measured tide elevation for Coos Bay (10.26 ft NAVD 88). Elevations have only been extended up to 10.0 ft where freshwater tributary and hillside inputs are anticipated and therefore freshwater wetland plant species are likely to grow.

Performance Standard: *Annual monitoring will show that a minimum of 5.88 acres of vegetated wetland habitats have become established at the site. (Note, the entirety of the site, excluding bare mudflats, will be monitored for vegetation to assess overall conditions and to aid with invasive species control). Detailed vegetation performance standards are provided below.*

Performance Standard (based on standard ODSL vegetation performance criteria): *At the end of Year 5 (vegetation monitoring), the percent cover objectives enumerated below will be met, as determined through vegetation sample plots. These objectives are specific to the vegetation communities and minimum acreages noted above, and do not include mudflat areas. However, the entire Kentuck Project will be monitored, and plant communities will be managed to the same standards. Noxious weeds include those species designated as "A" or "B" by the Oregon Department of Agriculture Noxious Weed Control Program, as well as non-native cordgrass (Spartina sp.) species.*

1. *The cover of native herbaceous species is at least 60 percent.*
2. *The cover of invasive herbaceous species is no more than 20 percent.*
3. *The cover of invasive shrub or tree species is no more than 10 percent.*
4. *Bare substrate, in areas that clearly should have vegetation, represents no more than 20 percent cover.*
5. *By Year 3 and thereafter, there are at least three different native species. To qualify, a species must have at least 5 percent average cover in the habitat class, and occur in at least 10 percent of the plots sampled. (This time period may be extended in the salt marsh habitat to account for natural recruitment processes.)*

6. *Prevalence Index total for all strata is less than 3.0.*
7. *Woody vegetation: Woody vegetation will be established in fringing freshwater forested and willow scrub-shrub wetland areas. The precise extent of these areas is subject to the interaction of fresh water coming into the site and salt water coming in from the bay. This success criterion should be focused on areas that actually support freshwater communities, as observed post-mitigation, rather than the extent of these communities as shown on design plans. Where this is the case, the density of woody vegetation performance standard will be: At least 1,600 native plants (shrubs) and/or stems (trees) per acre, or the cover of native woody vegetation on the site is at least 50 percent in the scrub-shrub and forested communities. Native species volunteering on the site may be included; dead plants do not count. Woody vegetation standards should be met for two successive years without irrigation. The woody vegetation success criterion is specific to scrub-shrub and forested communities in which freshwater conditions predominate.*

7.2.1.1 Kentuck Project – Freshwater Floodplain Reconnection Area (Pipeline)

Mitigation Goal 3: Improve wetland and aquatic habitat functions by restoring ecological processes along a reach of Kentuck Creek and its adjacent, diked and grazed wetland floodplain. This will entail reestablishing floodplain connection to a minimum of approximately 2.73 acres of historical floodplain adjacent to Kentuck Creek (i.e., 3:1 ratio of PCGP impacts noted in Table 1), and establishing a mix of forested and scrub-shrub wetland habitats. Approximately 9.14 acres of construction will be undertaken to achieve this goal, including approximately 6.41 acres of voluntary habitat improvements above the minimum requirements. Per recommendation from NMFS, realigning a portion of Kentuck Creek through the site will also occur in order to improve instream habitat.

To achieve this goal, the following objectives will be met:

Objective 3.1: Improve in-stream habitat channel complexity to support native aquatic species. This objective will be met by realigning the creek through the Freshwater Floodplain Reconnection Area instead of following its current course along the northeast property boundary. Channel sinuosity will be increased to approximate estimated historic conditions and the channel cross-section will simulate a natural channel as opposed to the current partially maintained ditch-like channel. The existing channel will be plugged at its upstream end where it enters the site to divert water to the new channel, while the remainder of the existing channel will be left in place as a backwater habitat feature and to allow flow inputs from Mettman Creek and an existing drain from an adjacent property.

Performance Standard: *An as-built survey will show that the proposed creek realignment was constructed in accordance with the approved design. Follow up visual inspection will occur as a part of annual vegetation monitoring.*

Objective 3.2: Increase instream habitat structural complexity. This objective will be achieved through installation of large wood, including root wads. At a minimum the following will be included:

- 18 simple wood structures (or equivalent number of complex wood structures [i.e., 2 simple structures = 1 complex structure])
- 1 complex wood structure

Performance Standard: *An as-built survey will show that the proposed habitat features were properly constructed. Follow up visual inspection will occur as a part of annual vegetation monitoring.*

Objective 3.3: Allow for floodplain connection between the creek and its historic floodplain. This objective will be achieved by realigning the creek as described in Objective 3.1 as well as removing the existing levee along the northeast boundary of the site.

Performance Standard: *An as-built survey will show that the existing levee was removed in accordance with approved plans. Follow up visual inspection will occur as a part of annual vegetation monitoring.*

Objective 3.4: Enhance wetland functions through the establishment of native forested and scrub-shrub wetland plant communities. This objective will be achieved by a combination of site grading that will add microtopographic relief and planting the site with native trees, shrubs, and emergent wetland species. The microtopography will result in varied hydrologic regimes to support a higher diversity of plant species. Trees and shrubs will border both sides of the creek providing shading as well as food sources (i.e., macroinvertebrates) to fish.

Performance Standard (based on standard ODSL vegetation performance criteria): *At the end of Year 5 (vegetation monitoring), the percent cover objectives enumerated below will be met, as determined through vegetation sample plots. Noxious weeds include those species designated as "A" or "B" by the Oregon Department of Agriculture Noxious Weed Control Program.*

8. *The cover of native herbaceous species is at least 60 percent.*
9. *The cover of invasive herbaceous species is no more than 20 percent.*
10. *The cover of invasive shrub or tree species is no more than 10 percent.*
11. *Bare substrate, in areas that clearly should have vegetation, represents no more than 20 percent cover.*
12. *By Year 3 and thereafter, there are at least three different native species. To qualify, a species must have at least 5 percent average cover in the habitat class, and occur in at least 10 percent of the plots sampled. (This time period may be extended in the salt marsh habitat to account for natural recruitment processes.)*
13. *Prevalence Index total for all strata is less than 3.0.*
14. *Woody vegetation: Woody vegetation will be established in fringing freshwater forested and willow scrub-shrub wetland areas. The precise extent of these areas is subject to the interaction of fresh water coming into the site and salt water coming in from the bay. This success criterion should be focused on areas that actually support freshwater*

communities, as observed post-mitigation, rather than the extent of these communities as shown on design plans. Where this is the case, the density of woody vegetation performance standard will be: At least 1,600 native plants (shrubs) and/or stems (trees) per acre, or the cover of native woody vegetation on the site is at least 50 percent in the scrub-shrub and forested communities. Native species volunteering on the site may be included; dead plants do not count. Woody vegetation standards should be met for two successive years without irrigation. The woody vegetation success criterion is specific to scrub-shrub and forested communities in which freshwater conditions predominate.

7.3 MONITORING PLAN

The purpose of the mitigation monitoring requirement is to provide information for the agencies to:
(a) determine whether the mitigation project complies with the conditions of the authorization;
(b) evaluate whether the mitigation project meets the goals, objectives, and performance standards of the mitigation plan; and (c) provide information for removal-fill program monitoring.

JCEP will monitor the mitigation sites and provide a post-construction report and annual written monitoring report or reports to USACE and ODSL. Monitoring reports will include all data necessary to document compliance with goals, objectives, and performance standards associated with the CWM Plan. This data may include photographs, topographic surveys, plant survival data, hydrologic data, and other information as required to demonstrate compliance.

The reports will include the following sections:

1. Introduction
2. Goals, objectives, and performance standards
3. Methods
4. Results
5. Summary and recommendations
6. Figures
7. Appendices with data and photographs

7.3.1 Monitoring Schedule

7.3.1.1 Eelgrass Mitigation Site

Pre-construction monitoring will occur at the proposed Access Channel, eelgrass mitigation site, and at the reference and donor site. Post-construction monitoring will be conducted for a minimum of five years but may extend up to eight years if Objective 2 is not met within the first five years, as described in Table 10.

7.3.1.2 Kentuck Project Site

Monitoring will be conducted for at least five years unless otherwise specified by USACE or ODSL.

7.3.2 Monitoring Methods

7.3.2.1 Eelgrass Mitigation Site

To assess the likelihood of meeting the goals, objectives, and performance standards for the Eelgrass Mitigation site, the following monitoring efforts will be conducted. Pre-construction and post-construction monitoring will occur meeting the guideline requirements developed by the USACE (2016), either a Tier 1 Qualitative or Tier 2 Quantitative eelgrass surveys. *In-situ* monitoring using divers or waders, depending on the water depth, will be conducted in order to assess percent survival of transplanted shoots, and shoot density of eelgrass in the transplanted beds, both of which are essential components of any eelgrass mitigation monitoring plan. Shoot density is the most commonly used metric to assess mitigation performance (Thom et al. 2008).

Monitoring will determine the area of eelgrass (e.g., square feet, meters, acres) and shoot density of plants (mean number of shoots per square meter) at Year 0, 1, 2, 3 ,4 ,and 5 after completing the eelgrass mitigation.

Tier 1 surveys are proposed for the following:

- Tier 1 surveys will be used to determine areas where temporary construction impacts will occur (e.g., where a hydraulic dredge line crosses an existing eelgrass bed).
- Tier 1 surveys will be used as a tool to avoid/minimize impacts to existing eelgrass beds.
- Tier 1 surveys will be used to identify locations of potential donor beds, with additional detail captured using Tier 2 surveys.
- Tier 1 surveys will be used to identify recipient sites within Jordan Cove to transplant eelgrass from the Access Channel prior to dredging.

Tier 2 quantitative surveys are proposed at the following locations:

- During pre-construction periods within the proposed dredge prism of the Access Channel adjacent to the Federal Navigation Channel (FNC), data will be collected to quantify the area and density of eelgrass offshore from the proposed LNG Terminal slip.
- During pre-construction periods, Tier 2 surveys will be conducted to quantify the density of eelgrass donor beds identified during Tier 1 surveys. In this way, only 10 percent or less of existing eelgrass within the donor bed will be harvested for transplantation.
- During post-construction periods, Tier 2 surveys will be conducted to quantify the density of eelgrass donor beds to assess healthy recovery of these beds post-harvest.

- During both pre- and post-construction periods, Tier 2 surveys will be conducted within a nearby reference area or areas likely within existing eelgrass beds adjacent to the mitigation site, to measure natural expansion and contraction of eelgrass colonies over time. Reference sites may also be established near donor beds. The location of reference areas will be confirmed during final engineering design.
- During both pre- and post-construction periods, Tier 2 surveys will be conducted within the Jordan Cove transplant areas to determine eelgrass transplant success and the potential reduction of eelgrass mitigation requirements
- Post-construction Tier 2 surveys will be conducted at the eelgrass mitigation site and compared to the reference site(s) and performance standards included in Project permits (e.g. USACE and DSL permits). Proposed performance standards are described in Section 6.

The analyses of monitoring data will be statistically rigorous, and include the following statistical considerations:

- Low probability of a Type I error - concluding there is loss of eelgrass when, in fact, there is not. This issue is addressed by selecting a small value for α in statistical analyses, usually 0.10.
- Low probability of a Type II error - failing to detect a loss of eelgrass when, in fact, there is one. Selecting a small value for β (applying high statistical power, $(1-\beta)$ ensures this. Power set at 0.90 provides low probability of a Type II error.

The duration of monitoring activities will be determined based on whether the Eelgrass Mitigation site has met the performance standards. Specifically, monitoring would continue until performance standards for Objective 1.2 are met, which would require a minimum monitoring period of five years. If, by the end of Year 5, performance standards have not been met, then JCEP will consult with the regulatory agencies (USACE and ODSL) to determine future actions.

7.3.2.2 Kentuck Project Site

To assess the likelihood of meeting the goals and objectives for the Kentuck Project site, the following monitoring efforts will be conducted. Although only a portion of the site is needed to meet performance criteria, monitoring will take place across the entire site in order to assess overall site conditions and potential management needs.

Monitoring at the Kentuck Project site will consist of a post-construction site review to verify construction/removal of the specified bridge, levees, tidegates, channel reconstruction/enhancement, and other earthwork. This site review will occur shortly after completion of the proposed construction work. Site conditions will be documented with photographs and summarized in a report or technical memorandum (i.e., an as-built report). After construction, additional monitoring will occur for a period of five years.

Details of the monitoring plan are provided below and cover the Tidal Reconnection Area and Freshwater Floodplain Reconnection Area:

1. **Structures and habitat features (Objectives/performance standards 2.1, 2.2, 2.3, 2.4, 3.1, and 3.2)**

   - As-built report to document constructed per approved design
   - Visual inspection winter high flow/storm period (Year 1 and 2): inspect for stability and signs of scour risks
   - Visual inspection summer low flow period (Years 1 – 5, can be timed with annual vegetation monitoring): inspect for stability, evidence of excessive scour or deposition.

2. **Vegetation monitoring (Objectives/performance standards 2.5 and 3.4) (See Appendix A, Figures K-3A and 3B for proposed monitoring plots layout)**

   Purpose: Assess establishment of plant communities.

   - Vegetation monitoring will follow methods outlined in "Routine Monitoring Guidance for Vegetation" (ODSL 2009). Which generally includes the following:
     - Vegetation plots in areas with proposed plant communities (not needed in mudflats) (Years 1 - 5) (see Section 7.1, Performance Standards, for additional details).
     - Map approximate extent of vegetated wetland/estuarine communities, including the edge of bare mudflat which is anticipated to adjust over time.

3. **Photo documentation (See Appendix A, Figures K-3A and 3B for proposed photo point layout)**

   Purpose: Visually document site changes over time.

   - Permanent photo points will be established around the site. Photo documentation will occur in conjunction with other monitoring efforts (Years 1 - 5).
   - Supplemental photos will be taken as appropriate to document site functionality as well as potential problem areas.

7.4 CONTINGENCY PLAN/ADAPTIVE MANAGEMENT PLAN

7.4.1 Eelgrass Mitigation Site

Contingency measures are based on principles of adaptive management. If monitoring shows that the performance standards are not being met or are not on a path to being met by the end of the monitoring period, then contingency measures will be needed. The following contingency measures are proposed to address potential foreseeable problems. Actual contingency measures would be based on monitoring data and site circumstances during the monitoring period:

1. If eelgrass transplants are surviving and appear healthy, but colonization of open areas is occurring too slowly or not at all, then additional transplanting may take place from identified donor beds. A review of reference site conditions would take place to determine if lack of colonization may be due to eelgrass trends in the area as opposed to mitigation site performance.
2. If eelgrass transplants are not surviving or appear unhealthy, then the following contingency measure would occur:
    - Mitigation site monitoring data will be compared with monitoring of the donor site and a reference site to determine whether poor eelgrass survivorship/health is occurring in adjacent areas, with the following potential courses of action:
        - If survivorship/health is poor in nearby areas, then the mitigation site could potentially be re-transplanted. However, this re-transplantation should only occur once nearby eelgrass populations are healthy again.
        - If survivorship/health is good in nearby areas, then a review of transplanting technique and site elevations will occur to determine whether inappropriate installation methods were used, and/or whether elevations have changed and may be the root cause of poor success.
            - If inappropriate installation methods are found to have been used, then the site may be retransplanted once the installation method issue has been rectified.
            - If installation methods are deemed adequate, but elevations have changed so that they do not support eelgrass, then an assessment of site stability will be performed. If it is deemed possible to regrade the site, with acceptable adjustment so that elevations will be maintained naturally, then the site could be retransplanted. Replanting would occur at least one year after regrading occurs.
            - If installation methods are deemed adequate, elevations have not changed or have changed but cannot be appropriately rectified, and no other rectifiable source of plant failure can be identified, then no further actions would be proposed for this site. JCEP and the agencies would then discuss alternative mitigation strategies.

3. Replanting Schedule:

   - After the completion of initial planting, if performance standards are not met during Year 2, and/or Year 3 monitoring, and site conditions are favorable for transplantation and growth at the eelgrass mitigation site, additional transplantation will be conducted each year to bolster bed densities subject to consultation with agencies.
   - Annual monitoring will also occur in Jordan Cove, the recipient site for eelgrass salvaged from the proposed Access Channel before dredging. The amount of eelgrass that has reestablished will be used to adjust performance standards. If the relative success of eelgrass transplants in Jordan Cove is greater than at the eelgrass mitigation site, and performance standards are still not met, then additional transplants can occur in Jordan Cove.
   - If Year 4 monitoring results are not within 20 percent of performance standards, other potential eelgrass mitigation sites will be investigated with agency consultation.

7.4.2 Kentuck Project

If the site does not meet the performance standards, including the identification of potential concerns to surrounding infrastructure, the potential cause or causes of the deficiencies or concerns will be evaluated as they arise, and solutions offered to the agencies.

8. LONG-TERM PROTECTION AND FINANCIAL SECURITY INSTRUMENTS

8.1 PROTECTION INSTRUMENT

8.1.1 Eelgrass Mitigation Site

The proposed Eelgrass Mitigation site is and will be owned by the State of Oregon.

JCEP anticipates endowing or otherwise funding a local non-profit organization that meets the requirements of Oregon Revised Statute (ORS) 271.715(3)(b) to provide near-term (i.e., permit monitoring period) and long-term management and maintenance of all mitigation sites associated with the Project. JCEP anticipates this entity would hold the conservation easement from the State of Oregon for the Eelgrass Mitigation site. Clauses necessary to protect the site will be written into the easement(s). A draft easement document including protection clauses will be provided in Appendix F prior to permit issuance.

During the construction and monitoring periods, floating signage and/or buoy markers will be used that identify the site as a mitigation site and that prohibit anchoring.

8.1.2 Kentuck Project

JCEP anticipates preparing and recording a deed restriction for the Kentuck Project site before commencing the work. A draft protection instrument will be provided in Appendix H.

8.2 PROPOSED FINANCIAL SECURITY INSTRUMENT

JCEP will provide a surety bond specifically for the purpose of guaranteeing CWM site performance. In addition, JCEP will provide personal guarantees or other appropriate sureties (e.g., a letter of credit from the managing partner of the Limited Partnership or its parent company) that secures compliance with mitigation obligations and promises to make all reasonable efforts to maintain the business entity in an active status until all mitigation obligations have been satisfied. A financial security instrument will be provided prior to permit issuance. A draft letter of credit is provided in Appendix J.

8.3 LONG-TERM MAINTENANCE PLAN (POST-MONITORING PERIOD)

8.3.1 Anticipated Ownership

The Eelgrass Mitigation site will be owned by the State of Oregon, with an easement held by an appropriate third party. JCEP, or a sister company, will own the Kentuck Project site.

8.3.2 Anticipated Long-term Maintenance Actions

Long-term maintenance actions at the mitigation sites will take effect after the permit monitoring period has ended, which assumes that performance criteria have been met. Long-term maintenance actions could include the following, on an as-needed basis:

- At a minimum, conduct an annual site visit at each mitigation site to document potential management and maintenance needs
- Tidegate and bridge maintenance
- Levee maintenance
- Invasive/noxious weed control
- Garbage/debris removal
- Installation of protective signage and/or other deterrents if vandalism or inappropriate activities occur
- Maintenance of "no anchor" signage/buoys at the Eelgrass Mitigation site
- Installation of new native plantings and/or habitat features

A long-term management plan that incorporates the principles of adaptive management will be prepared as a condition of approval of the permit. The plan will discuss long-term management goals, general monitoring and maintenance guidance, reporting requirements, and roles and responsibilities. In line with the principles of adaptive management, the long-term management plan will be considered a living document that may be revised over time in an effort to best serve conservation needs and on-the-ground realities.

8.3.3 Entity Responsible for Maintenance

JCEP anticipates endowing or otherwise funding a local non-profit organization that meets the requirements of ORS 271.715(3)(b) to provide near-term (i.e., permit monitoring period) and long-term management and maintenance of all mitigation sites associated with the Project. JCLNG is actively discussing long-term easement and maintenance responsibilities with conservation organizations. The site conservation easement holder and long-term management entity and contractual mechanism will be provided to ODSL prior to issuance of the Removal-Fill permit.

8.3.4 Anticipated Funding Source

JCEP will create an endowment to fund long-term maintenance of the mitigation sites.

9. *PREPARERS AND CONTRIBUTORS*

Ethan Rosenthal, DEA Ecologist, and Jim Starkes, DEA Senior Biologist authored this report. Sean Sullivan, DEA Senior Project Manager, provided the quality review. Jason Stutes, GeoEngineers Senior Marine Ecologist, provided technical expertise and quality review regarding eelgrass mitigation. Shay Witten, DEA Project Assistant, prepared the report drafts. Sara Gilbert, GIS Manager and Jim Culpepper, Senior Design Technician/CAD Manager, provided graphics.

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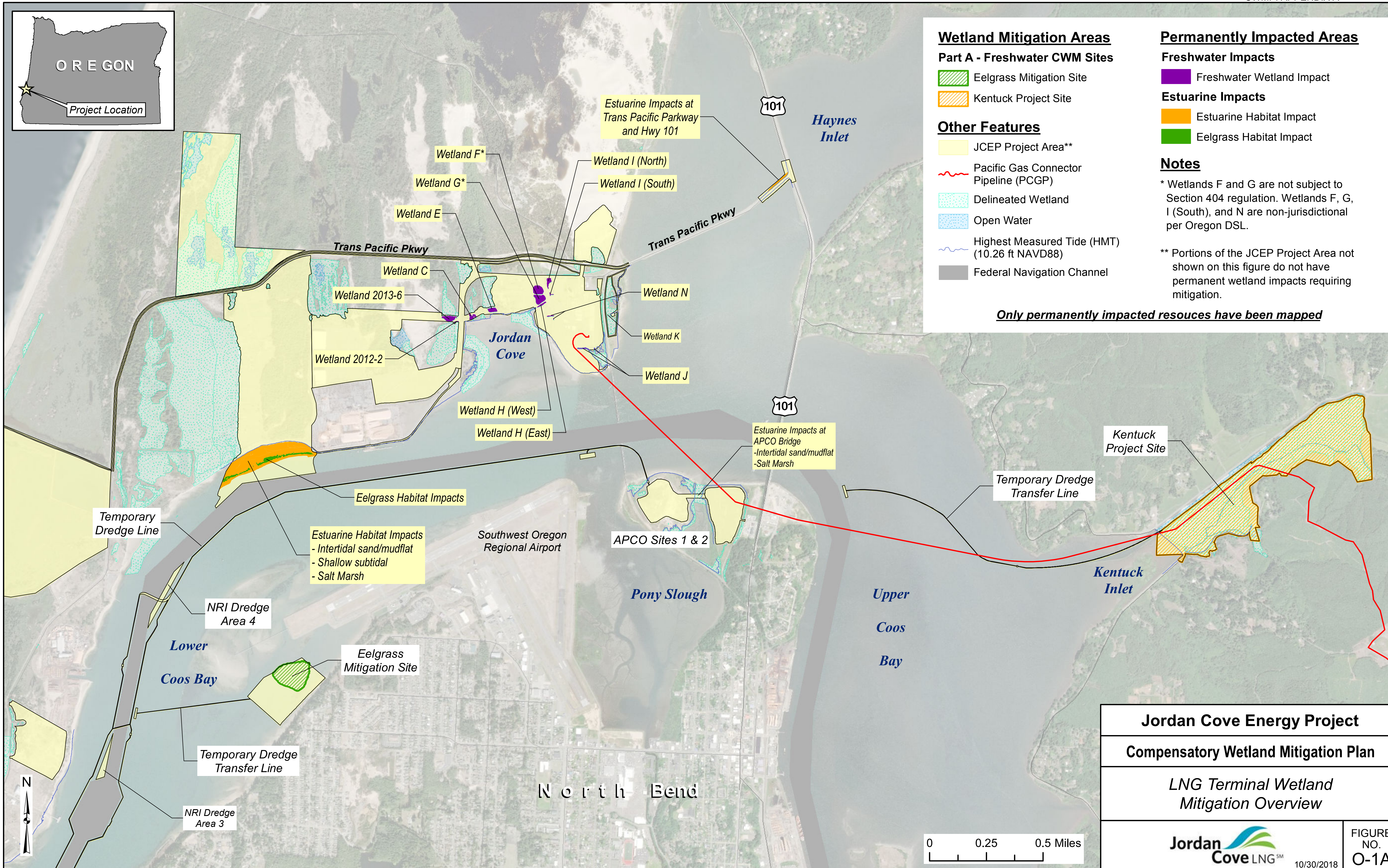
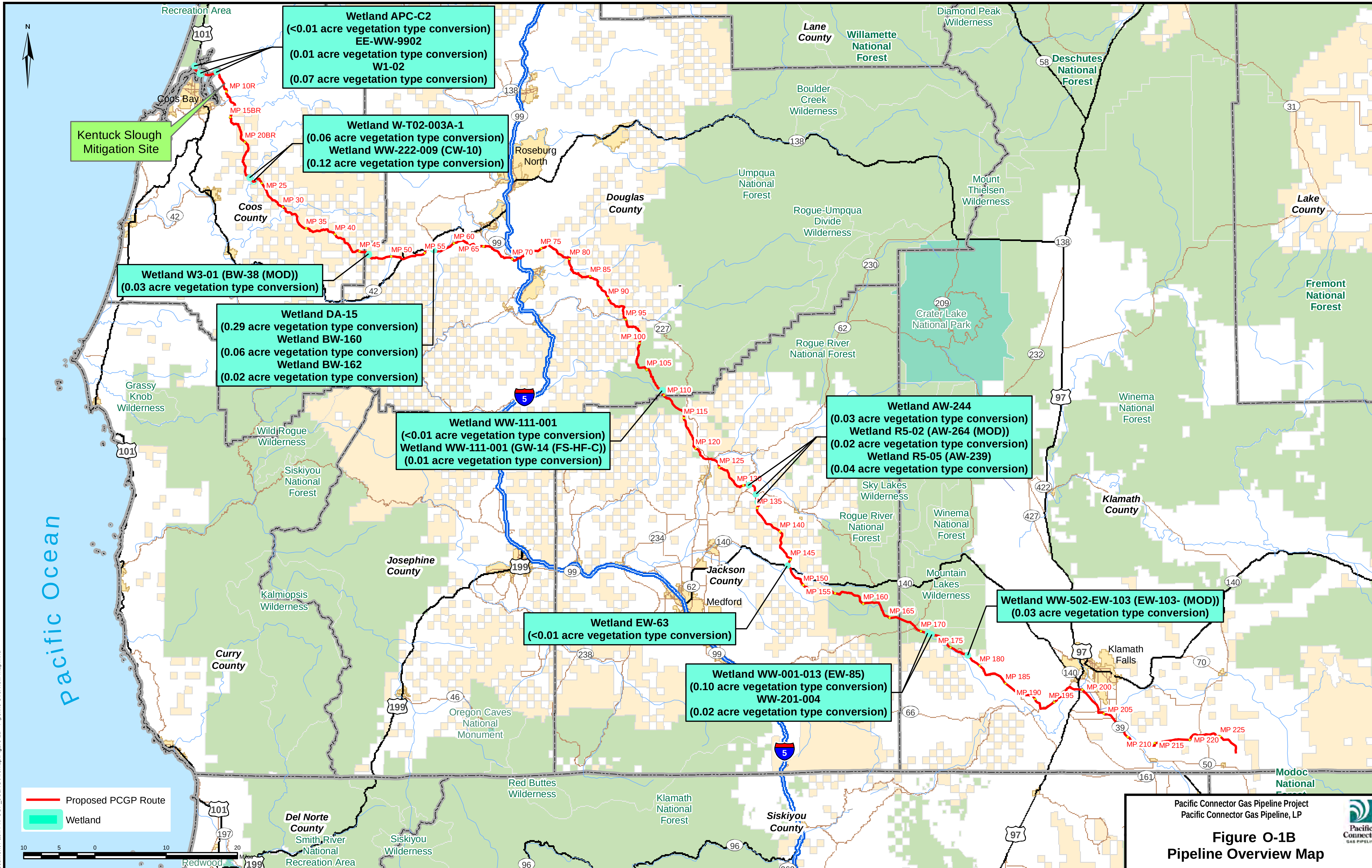
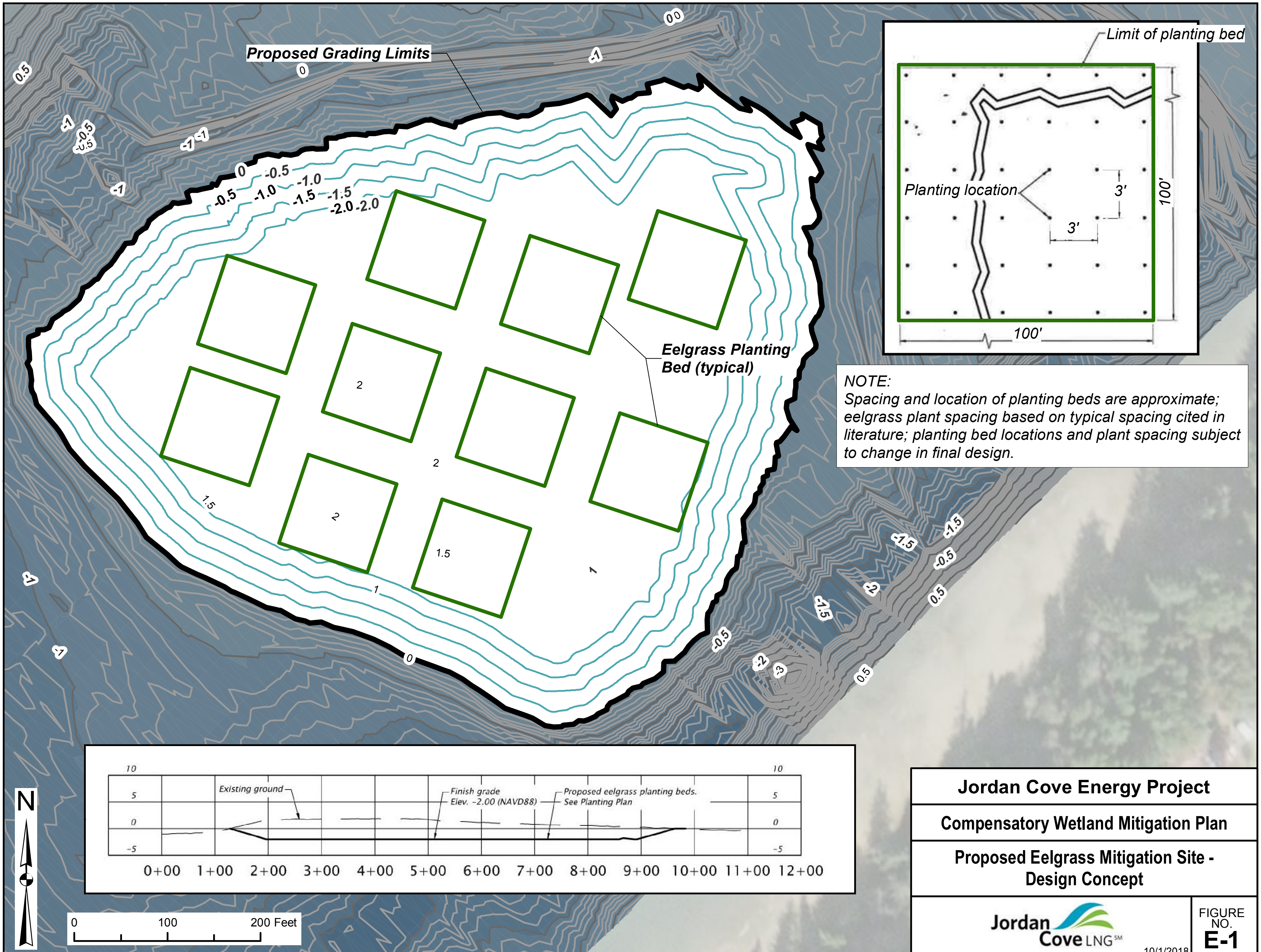
11. *APPENDICES*

APPENDIX A: FIGURES


OREGON
Project Location
Wetland Mitigation Areas
Part A - Freshwater CWM Sites
Eelgrass Mitigation Site
Kentuck Project Site
Other Features
JCEP Project Area**
Pacific Gas Connector Pipeline (PCGP)
Delineated Wetland
Open Water
Highest Measured Tide (HMT) (10.26 ft NAVD88)
Federal Navigation Channel
Permanently Impacted Areas
Freshwater Impacts
Freshwater Wetland Impact
Estuarine Impacts
Estuarine Habitat Impact
Eelgrass Habitat Impact
Notes
* Wetlands F and G are not subject to Section 404 regulation. Wetlands F, G, I (South), and N are non-jurisdictional per Oregon DSL.
** Portions of the JCEP Project Area not shown on this figure do not have permanent wetland impacts requiring mitigation.
Only permanently impacted resouces have been mapped
Estuarine Impacts at Trans Pacific Parkway and Hwy 101
101
Haynes Inlet
Wetland F*
Wetland G*
Wetland E
Wetland I (North)
Wetland I (South)
Trans Pacific Pkwy
Trans Pacific Pkwy
Wetland C
Wetland 2013-6
Wetland N
Wetland K
Wetland J
Jordan Cove
Wetland 2012-2
Wetland H (West)
Wetland H (East)
101
Estuarine Impacts at APCO Bridge -Intertidal sand/mudflat -Salt Marsh
Kentuck Project Site
Temporary Dredge Transfer Line
Eelgrass Habitat Impacts
Temporary Dredge Line
Estuarine Habitat Impacts - Intertidal sand/mudflat - Shallow subtidal - Salt Marsh
Southwest Oregon Regional Airport
APCO Sites 1 & 2
Kentuck Inlet
Pony Slough
Upper Coos Bay
NRI Dredge Area 4
Lower Coos Bay
Eelgrass Mitigation Site
Temporary Dredge Transfer Line
NRI Dredge Area 3
North Bend
N
0 0.25 0.5 Miles
Jordan Cove Energy Project
Compensatory Wetland Mitigation Plan
LNG Terminal Wetland Mitigation Overview
Jordan Cove LNG SM
10/30/2018
FIGURE NO. O-1A


Wetland APC-C2
(<0.01 acre vegetation type conversion)
EE-WW-9902
(0.01 acre vegetation type conversion)
W1-02
(0.07 acre vegetation type conversion)
Kentuck Slough Mitigation Site
Wetland W-T02-003A-1
(0.06 acre vegetation type conversion)
Wetland WW-222-009 (CW-10)
(0.12 acre vegetation type conversion)
Wetland W3-01 (BW-38 (MOD))
(0.03 acre vegetation type conversion)
Wetland DA-15
(0.29 acre vegetation type conversion)
Wetland BW-160
(0.06 acre vegetation type conversion)
Wetland BW-162
(0.02 acre vegetation type conversion)
Wetland WW-111-001
(<0.01 acre vegetation type conversion)
Wetland WW-111-001 (GW-14 (FS-HF-C))
(0.01 acre vegetation type conversion)
Wetland AW-244
(0.03 acre vegetation type conversion)
Wetland R5-02 (AW-264 (MOD))
(0.02 acre vegetation type conversion)
Wetland R5-05 (AW-239)
(0.04 acre vegetation type conversion)
Wetland EW-63
(<0.01 acre vegetation type conversion)
Wetland WW-502-EW-103 (EW-103- (MOD))
(0.03 acre vegetation type conversion)
Wetland WW-001-013 (EW-85)
(0.10 acre vegetation type conversion)
WW-201-004
(0.02 acre vegetation type conversion)
Pacific Ocean
Coos Bay
Coos County
Douglas County
Lane County
Josephine County
Jackson County
Curry County
Klamath County
Lake County
Del Norte County
Siskiyou County
Roseburg North
Medford
Klamath Falls
Willamette National Forest
Deschutes National Forest
Umpqua National Forest
Rogue-Umpqua Divide Wilderness
Rogue River National Forest
Crater Lake National Park
Fremont National Forest
Winema National Forest
Siskiyou National Forest
Klamath National Forest
Modoc National Forest
Boulder Creek Wilderness
Mount Thielsen Wilderness
Diamond Peak Wilderness
Grassy Knob Wilderness
Wild Rogue Wilderness
Kalmiopsis Wilderness
Sky Lakes Wilderness
Mountain Lakes Wilderness
Red Buttes Wilderness
Siskiyou Wilderness
Oregon Caves National Monument
Smith River National Recreation Area
Recreation Area
Redwood National Park
MP 10R
MP 15BR
MP 20BR
MP 25
MP 30
MP 35
MP 40
MP 45
MP 50
MP 55
MP 60
MP 65
MP 70
MP 75
MP 80
MP 85
MP 90
MP 95
MP 100
MP 105
MP 110
MP 115
MP 120
MP 125
MP 130
MP 135
MP 140
MP 145
MP 150
MP 155
MP 160
MP 165
MP 170
MP 175
MP 180
MP 185
MP 190
MP 195
MP 200
MP 205
MP 210
MP 215
MP 220
MP 225
Proposed PCGP Route
Wetland
Miles
Pacific Connector Gas Pipeline Project
Pacific Connector Gas Pipeline, LP
Figure O-1B
Pipeline Overview Map
Document Path: P:\PCGP_JCLNG\ArcMap\Figure 1B - Pipeline Overview Map.mxd



NOTE:
Spacing and location of planting beds are approximate; eelgrass plant spacing based on typical spacing cited in literature; planting bed locations and plant spacing subject to change in final design.

Jordan Cove Energy Project

Compensatory Wetland Mitigation Plan

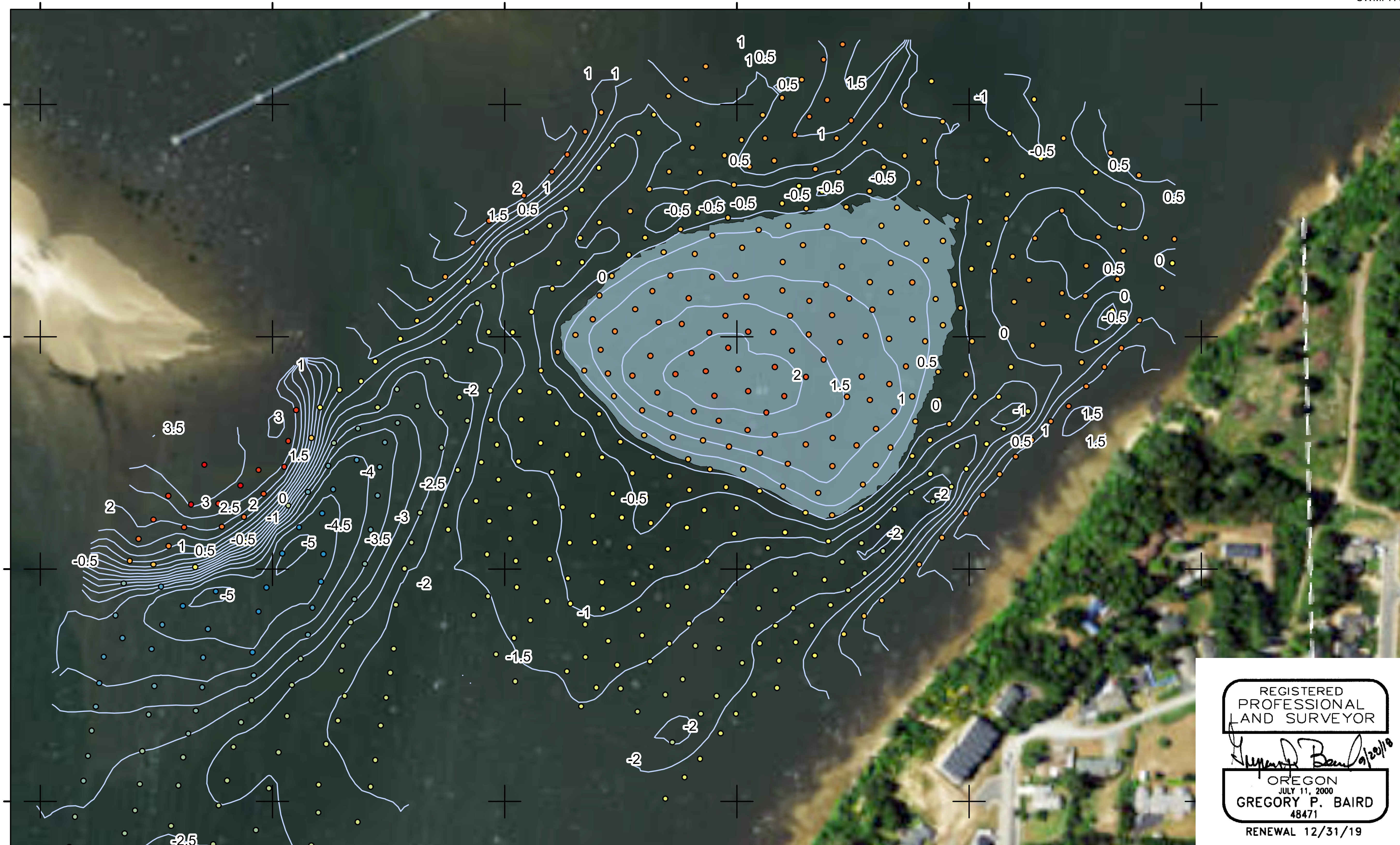
Proposed Eelgrass Mitigation Site - Design Concept

Jordan Cove LNG℠

10/1/2018

FIGURE NO. **E-1**

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-1 CWMP_Proposed Eelgrass Mitigation Site - Design Concept.mxd 10/3/2018



Elevation (feet)

-5.0 - -4.5	-3.0 - -2.5	-1.0 - 0	1.0 - 1.5	3.0 - 3.5
-4.5 - -4.0	-2.5 - -2.0	-0.5 - 0	1.5 - 2.0	
-4.0 - -3.5	-2.0 - -1.5	0 - 0.5	2.0 - 2.5	
-3.5 - -3.0	-1.5 - -1.0	0.5 - 1.0	2.5 - 3.0	

0.5 ft Contour
Oregon South Graticule
Mitigation Site Boundary

N W E S

0 60 120 180 240
UNITS IN FEET

0 20 40 80 120
UNITS IN METERS

J1-000-TEC-PLN-DEA-00002-00 Rev. H

Volume limited to that within the constraining boundary - Object 8270
Datum Elevation: -2.00 Ft NAVD88
Area within boundary: 406,858.57 Sq. Ft. (9.3402 Acres)
Total triangulated area: 406,858.57 Sq. Ft. (9.3402 Acres)

Excavation Volume Beneath Datum (Cu. Yd.)	Fill Volume Above Datum (Cu. Yd.)
0.0	46,535.1

Net Difference: 46,535.1 Cu. Yd. excess volume above datum

Jordan Cove Eelgrass Mitigation Site Elevation Contour Map (NAVD88)

COOS BAY, OREGON

DAVID EVANS AND ASSOCIATES INC. MARINE SERVICES

SURVEY BY:
David Evans and Associates, Inc

DATE OF SURVEY:
August 2018

HORIZONTAL DATUM:
North American Datum of 1983 (NAD83), State Plane Coordinate System, OregonSouth Zone, Intl. Feet

VERTICAL DATUM:
North American Vertical Datum of 1988 (NAVD88)

THIS HYDROGRAPHIC SURVEY WAS COMPLETED UNDER THE DIRECTION OF A NATIONAL SOCIETY OF PROFESSIONAL SURVEYORS/THE HYDROGRAPHIC SOCIETY OF AMERICA, CERTIFIED HYDROGRAPHER

NICHOLAS LESNIKOWSKI
NSPS/THSOA CERTIFIED HYDROGRAPHER (206)

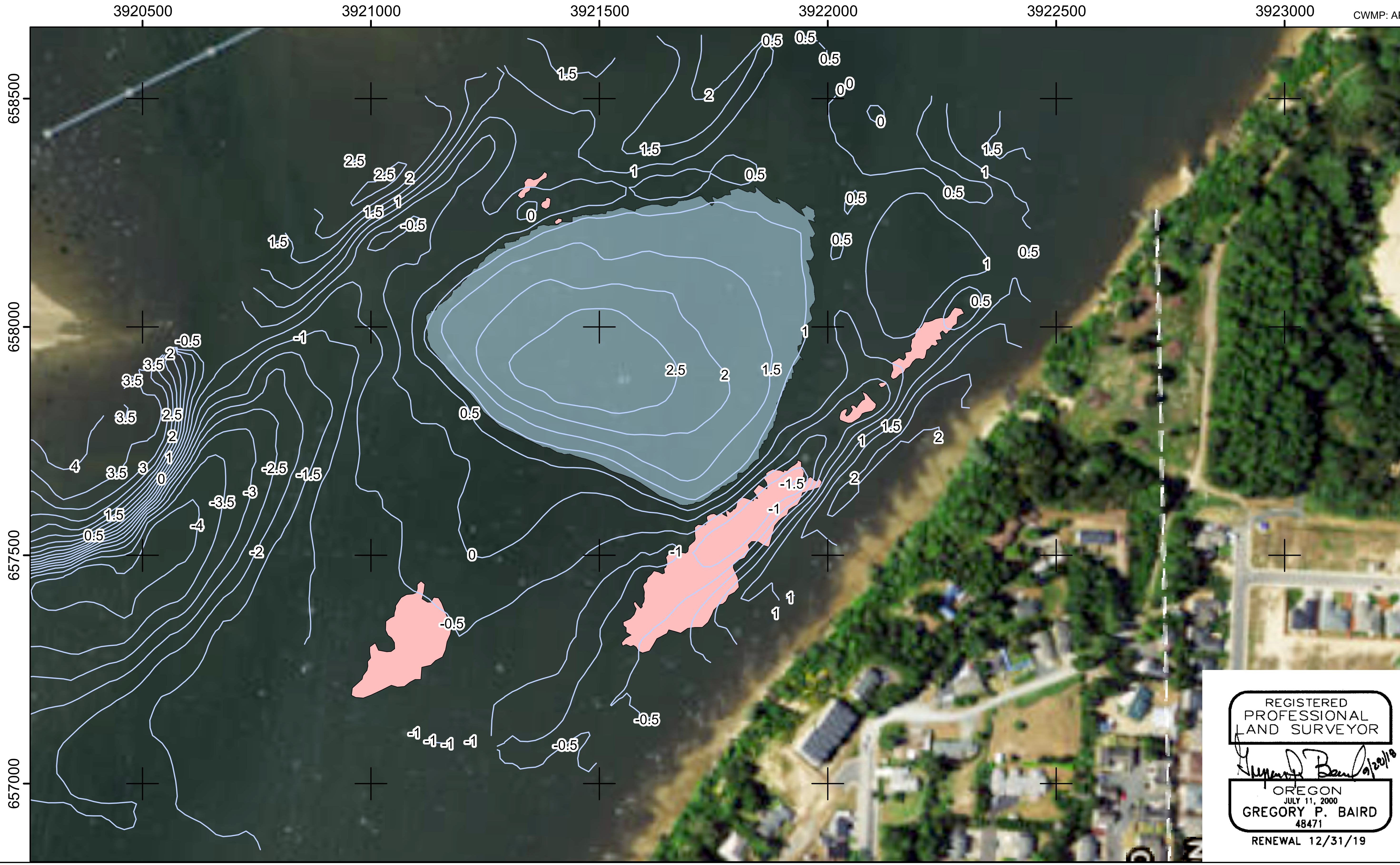
DATE: 9/28/2018
DESIGN: VEP
DRAWN: VEP
CHECKED:
REVISION NUMBER: 0

SCALE: 1" = 200'

CONTRACT NUMBER:

FILE:

FIGURE NO.
E-2



0.5 ft Contour

Oregon South Graticule

High Density Eelgrass

Mitigation Site Boundary

N E S W

0 60 120 180 240
UNITS IN FEET

0 20 40 80 120
UNITS IN METERS

Jordan Cove Eelgrass Mitigation Site Eelgrass Coverage (MLLW)

COOS BAY, OREGON

DAVID EVANS AND ASSOCIATES INC.
MARINE SERVICES

SURVEY BY:
David Evans and Associates, Inc.

DATE OF SURVEY:
August 2018

HORIZONTAL DATUM:
North American Datum of 1983 (NAD83), State Plane Coordinate System, OregonSouth Zone, Intl. Feet

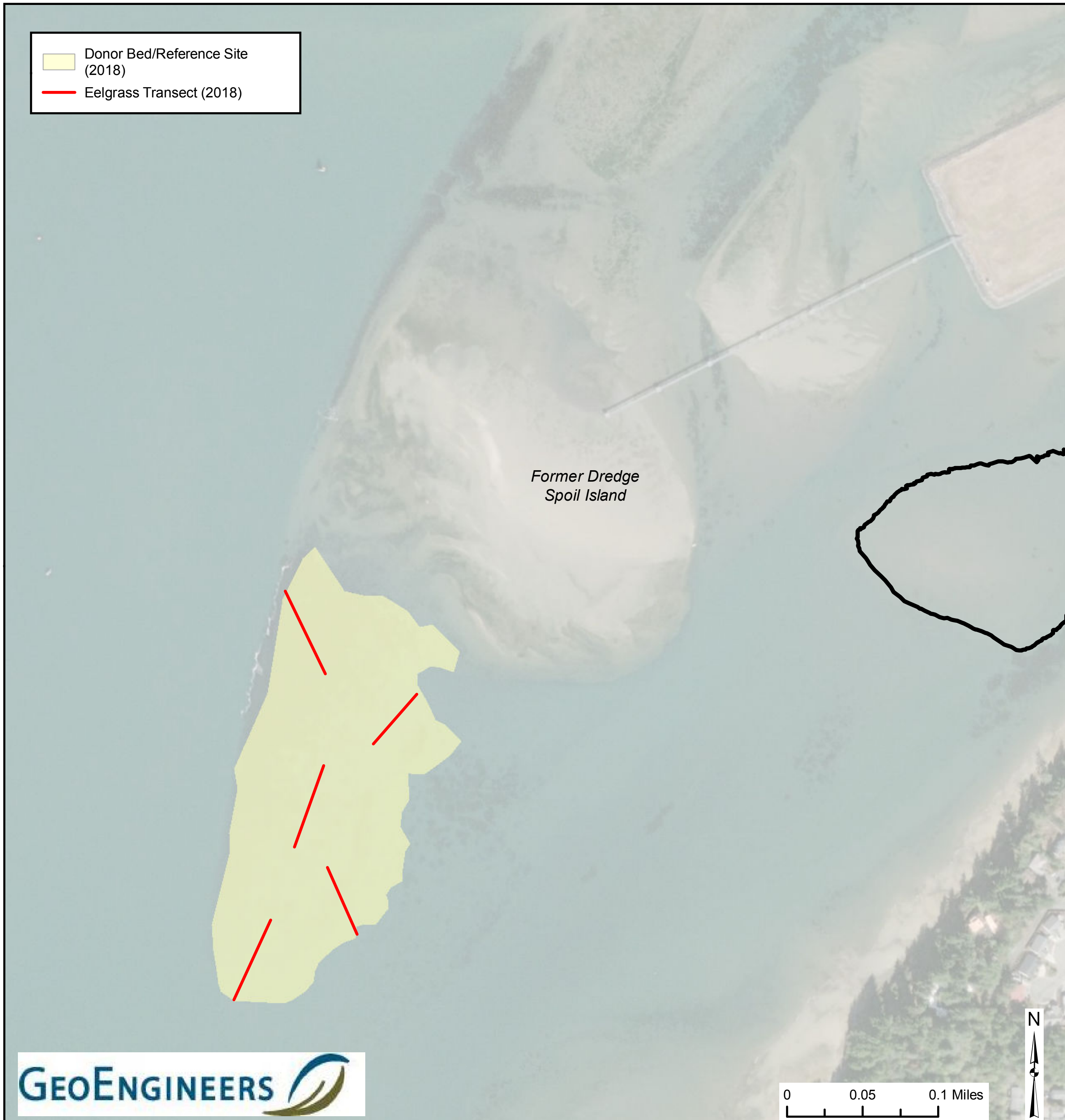
VERTICAL DATUM:
Mean Lower Low Water (MLLW)

THIS HYDROGRAPHIC SURVEY WAS COMPLETED UNDER THE DIRECTION OF A NATIONAL SOCIETY OF PROFESSIONAL SURVEYORS/THE HYDROGRAPHIC SOCIETY OF AMERICA, CERTIFIED HYDROGRAPHER

NICHOLAS LESNIKOWSKI
NSPS/THSOA CERTIFIED HYDROGRAPHER (206)

DATE:	9/28/2018
DESIGN:	VEP
DRAWN:	VEP
CHECKED:	
REVISION NUMBER:	0
SCALE:	1" = 200'
CONTRACT NUMBER:	
FILE:	

FIGURE NO.
E-3



Jordan Cove Energy Project

Compensatory Wetland Mitigation Plan

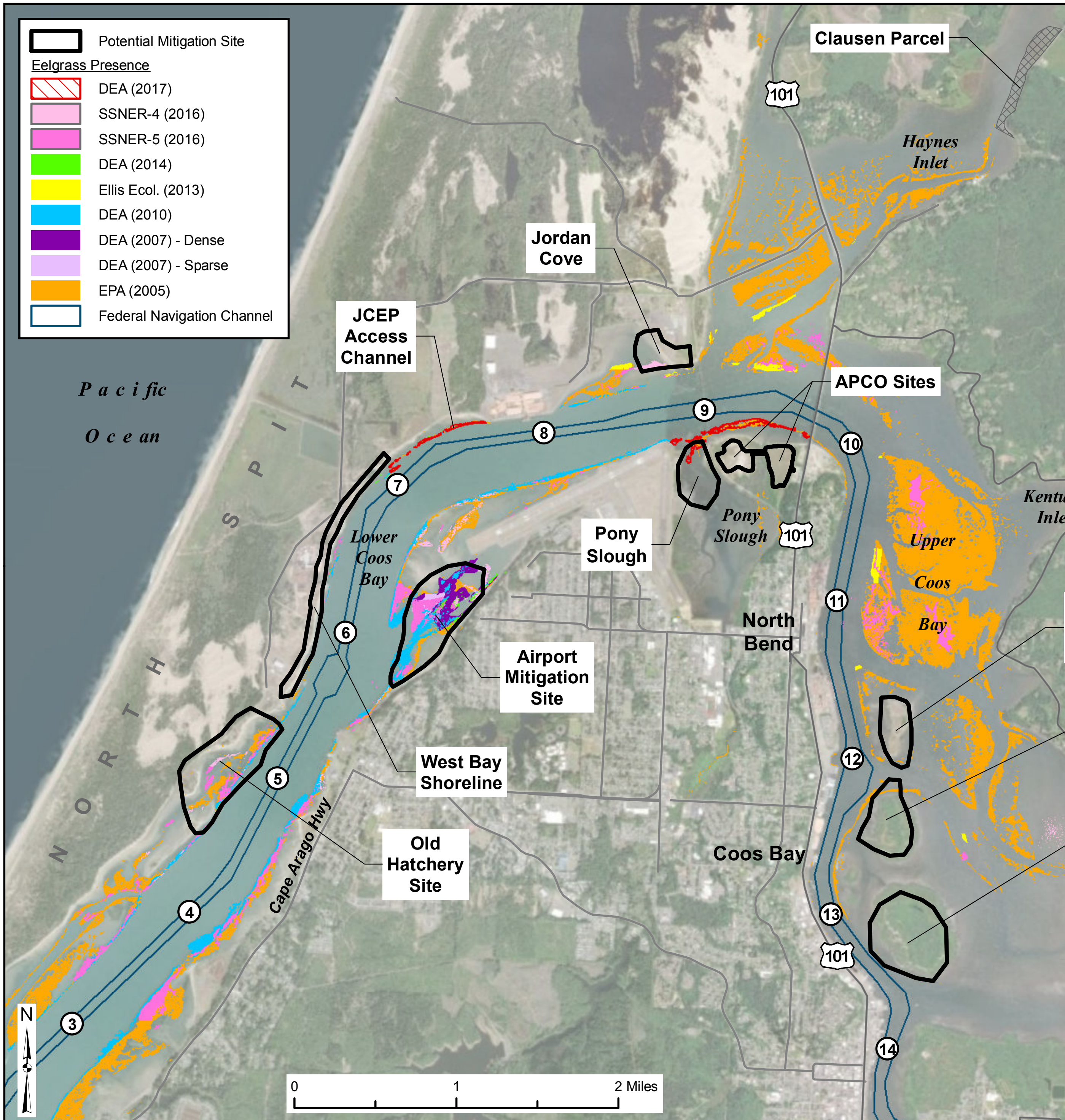
Donor Bed/Reference Site

Jordan Cove LNG℠

10/2/2018

FIGURE NO. E-4

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-4 GeoEngineers Eelgrass Mitigation Site.mxd 10/3/2018



Jordan Cove Energy Project

Compensatory Wetland Mitigation Plan

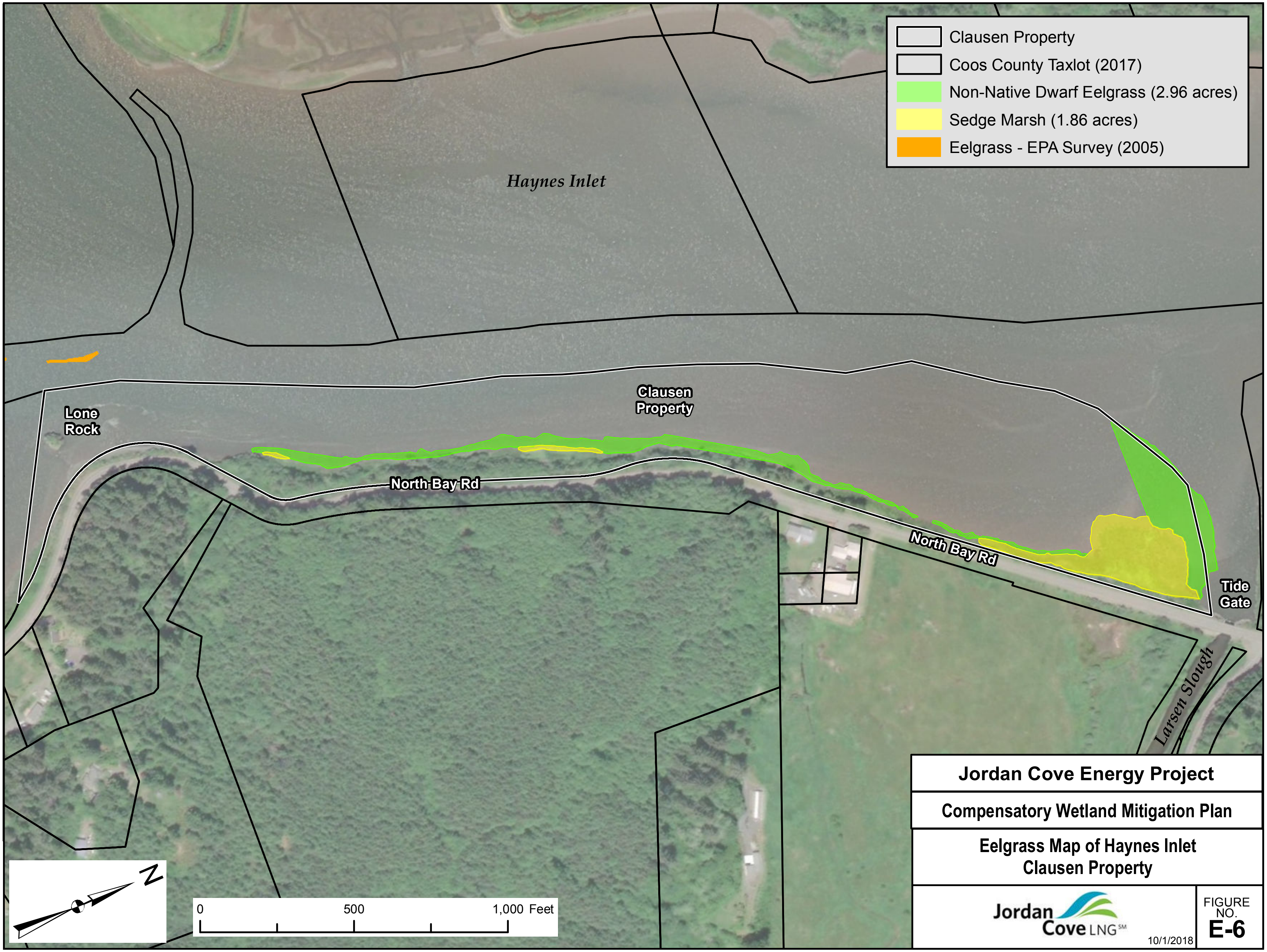
Alternative Eelgrass Mitigation Site Locations

Jordan Cove LNG℠

10/1/2018

FIGURE NO. **E-5**

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-5 Alternative Eelgrass Mitigation Site Locations.mxd 10/3/2018



Jordan Cove Energy Project

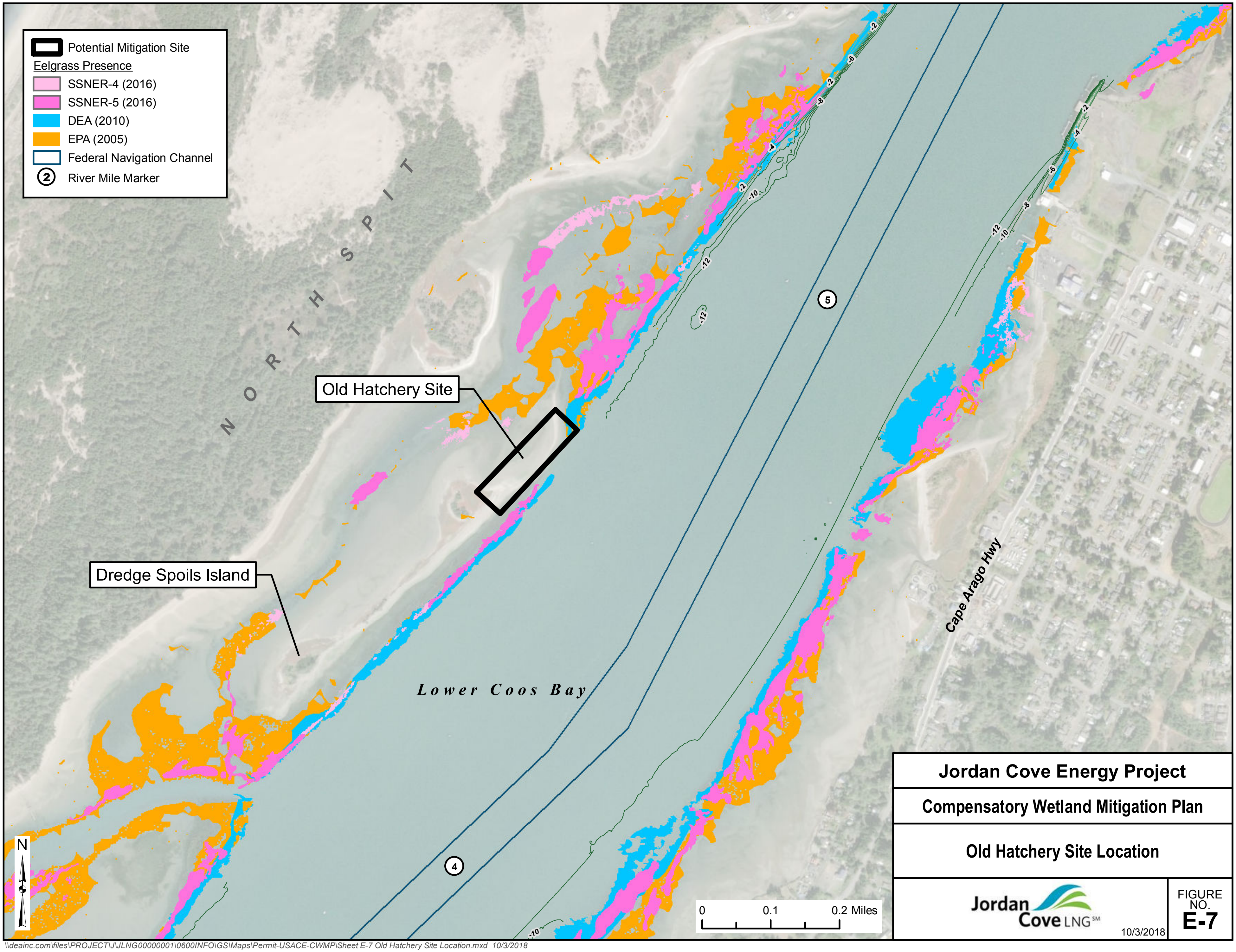
Compensatory Wetland Mitigation Plan

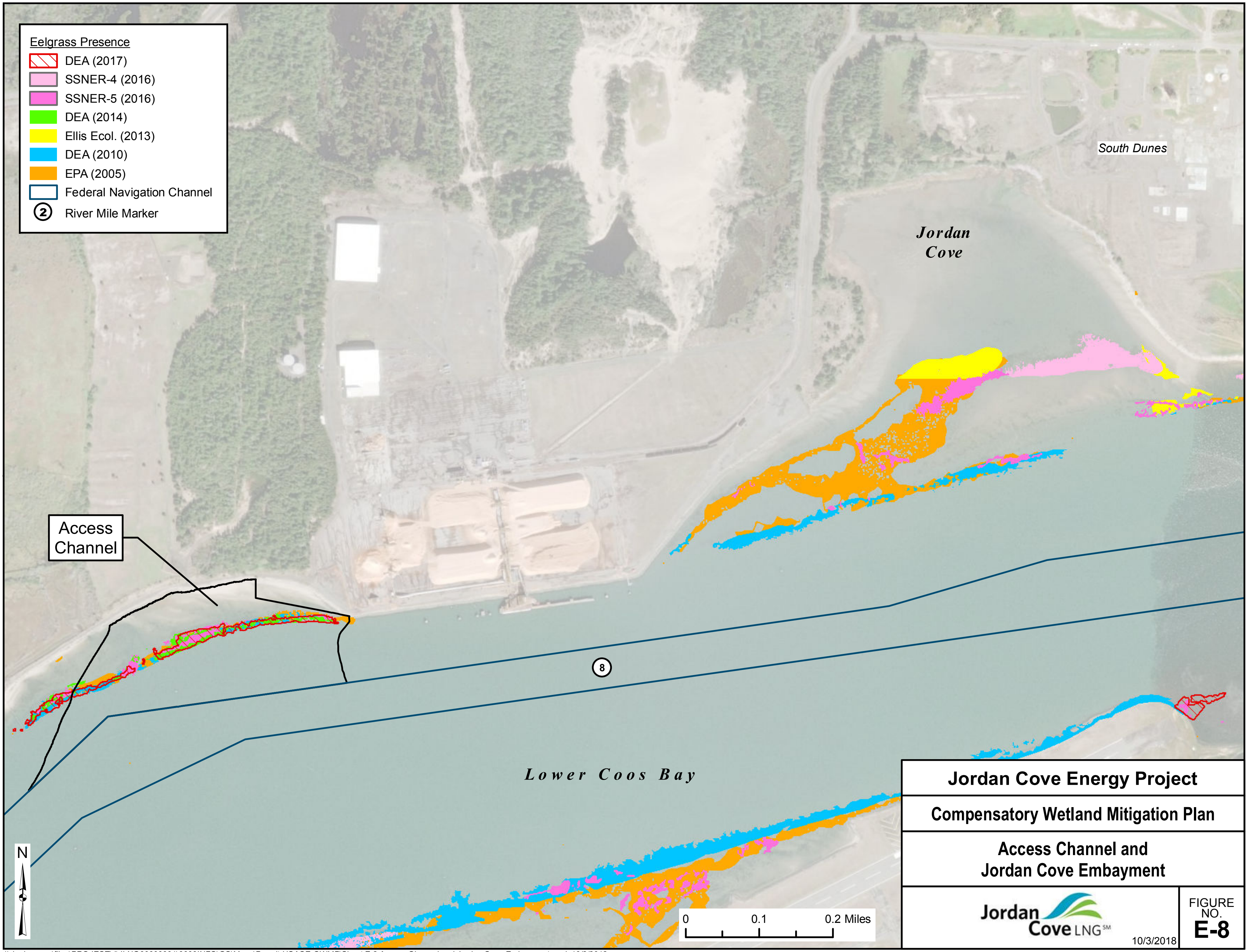
Eelgrass Map of Haynes Inlet Clausen Property

Jordan Cove LNG℠

10/1/2018

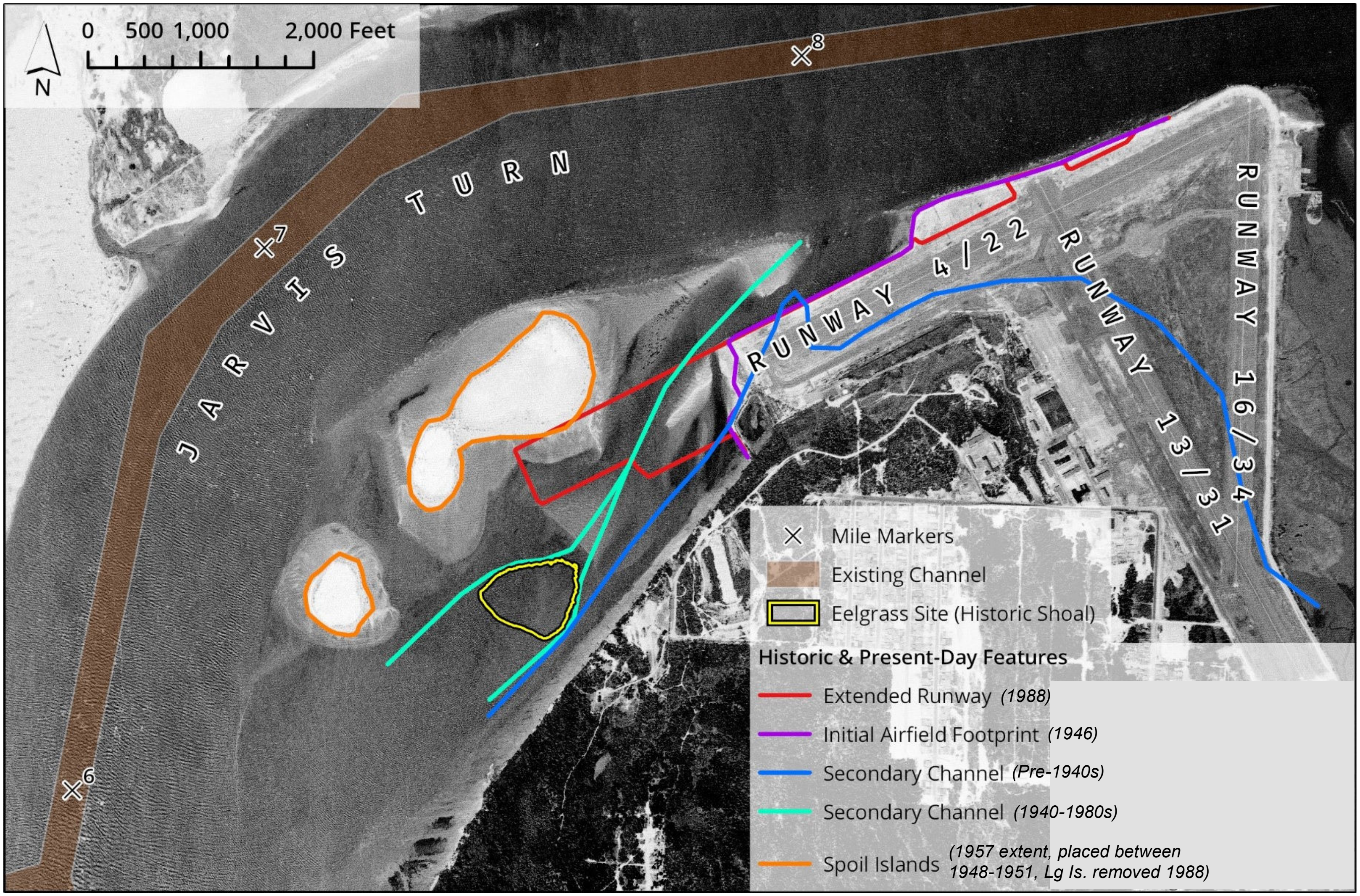
FIGURE NO. **E-6**


Potential Mitigation Site
Eelgrass Presence
SSNER-4 (2016)
SSNER-5 (2016)
DEA (2010)
EPA (2005)
Federal Navigation Channel
River Mile Marker
NORTH SPIT
Old Hatchery Site
Dredge Spoils Island
Lower Coos Bay
Cape Arago Hwy
5
4
N
0 0.1 0.2 Miles
Jordan Cove Energy Project
Compensatory Wetland Mitigation Plan
Old Hatchery Site Location
Jordan Cove LNG
10/3/2018
FIGURE NO. E-7
\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-7 Old Hatchery Site Location.mxd 10/3/2018



Jordan Cove Energy Project	
Compensatory Wetland Mitigation Plan	
Access Channel and Jordan Cove Embayment	
Jordan Cove LNG℠ 10/3/2018	FIGURE NO. E-8

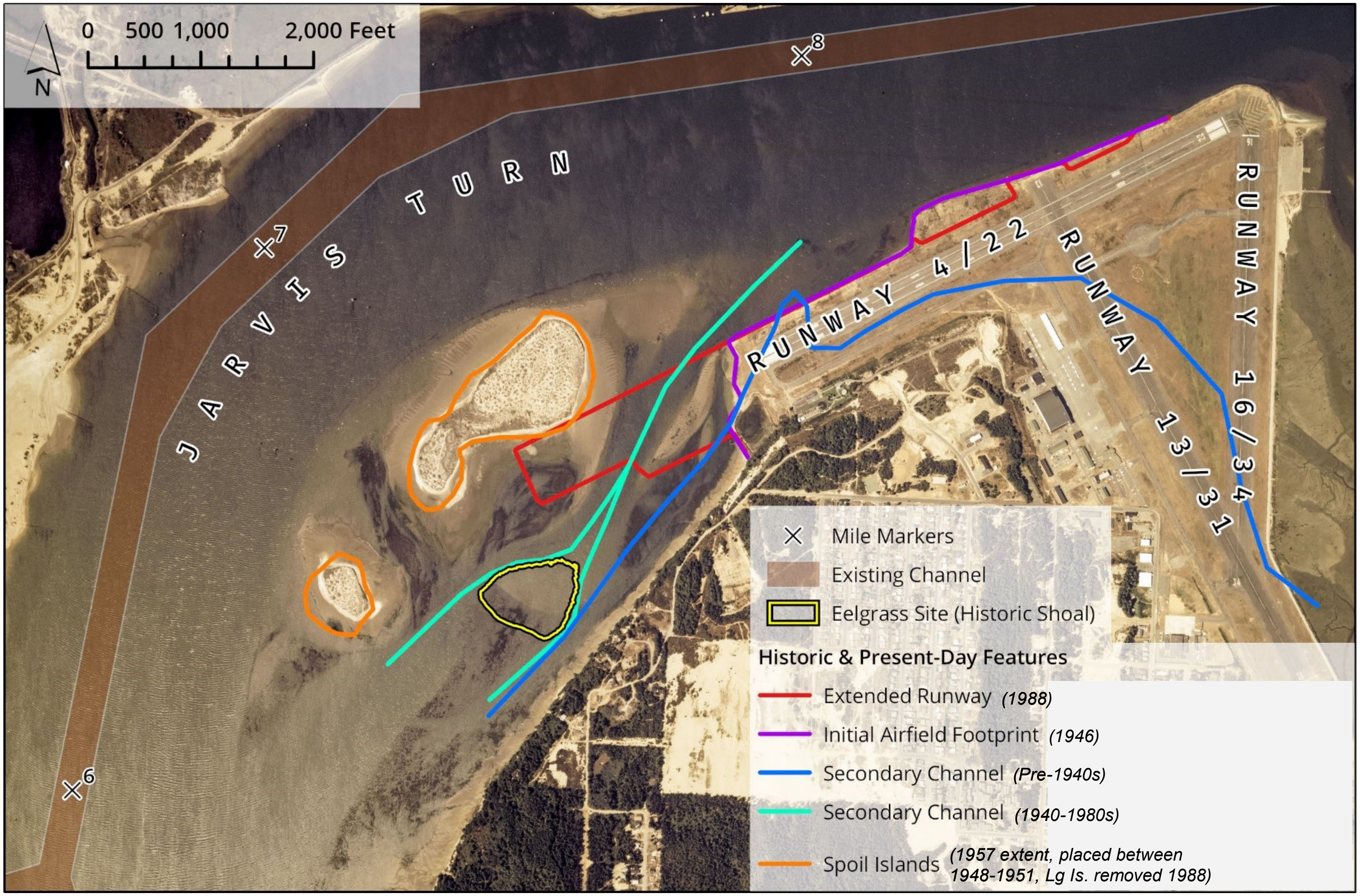
\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-8 Access Channel and Jordan Cove Embayment.mxd 10/3/2018



moffatt & nichol

Jordan Cove Energy Project
Compensatory Wetland Mitigation Plan
1957 USGS Aerial
Jordan Cove LNG℠ 9/27/2018 — FIGURE NO. **E-9**

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-9 Moffatt Nichol.mxd 10/3/2018



moffatt & nichol

Jordan Cove Energy Project

Compensatory Wetland Mitigation Plan

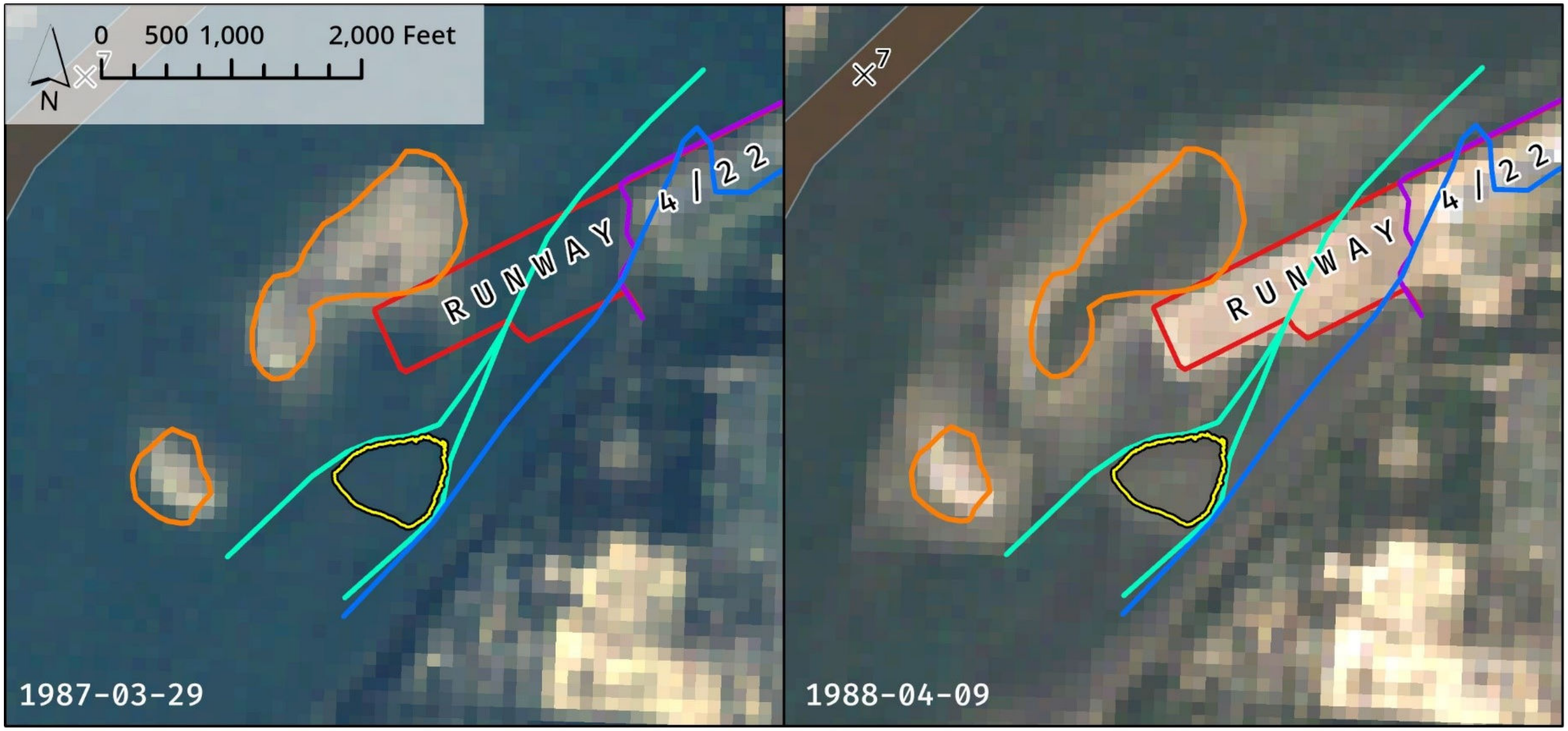
1977 USGS Aerial

Jordan Cove LNG℠

9/27/2018

FIGURE NO. **E-10**

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-10 Moffatt Nichol.mxd 10/3/2018



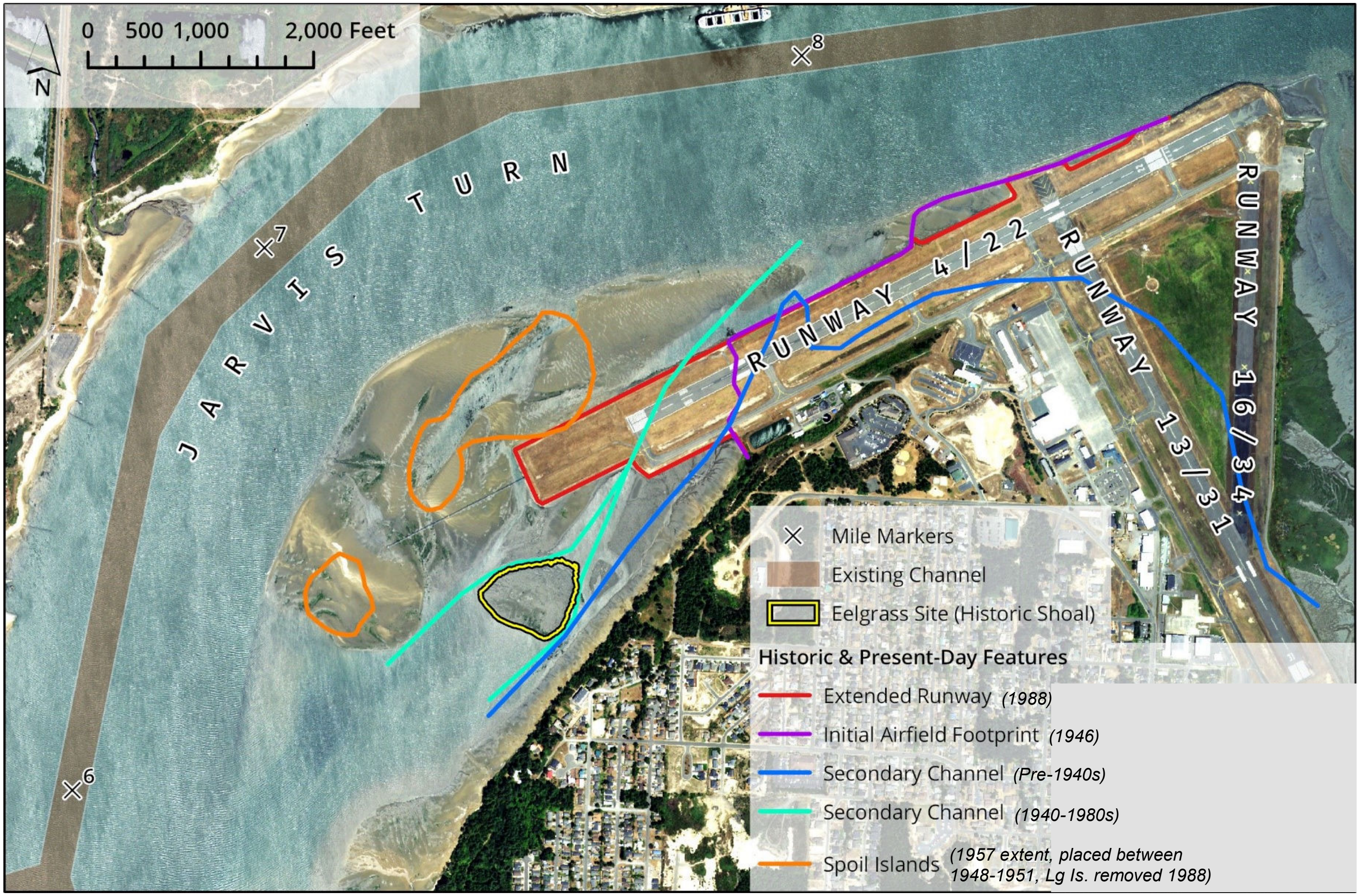
Mile Markers
Existing Channel
Eelgrass Site (Historic Shoal)

Historic & Present-Day Features

Extended Runway *(1988)*
Initial Airfield Footprint *(1946)*
Secondary Channel *(Pre-1940s)*
Secondary Channel *(1940-1980s)*
Spoil Islands *(1957 extent, placed between 1948-1951, Lg Is. removed 1988)*

moffatt & nichol

Jordan Cove Energy Project
Compensatory Wetland Mitigation Plan
1987-1988 Aerials
Jordan Cove LNG℠ 9/27/2018 — FIGURE NO. **E-11**



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Jordan Cove Energy Project	
Compensatory Wetland Mitigation Plan	
2016 USDA Aerial	
Jordan Cove LNG℠ 9/27/2018	FIGURE NO. E-12

\\deainc.com\files\PROJECT\J\JLNG000000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-12 Moffatt Nichol.mxd 9/27/2018

Jordan Cove Energy Project

Compensatory Wetland Mitigation Plan

Access Channel

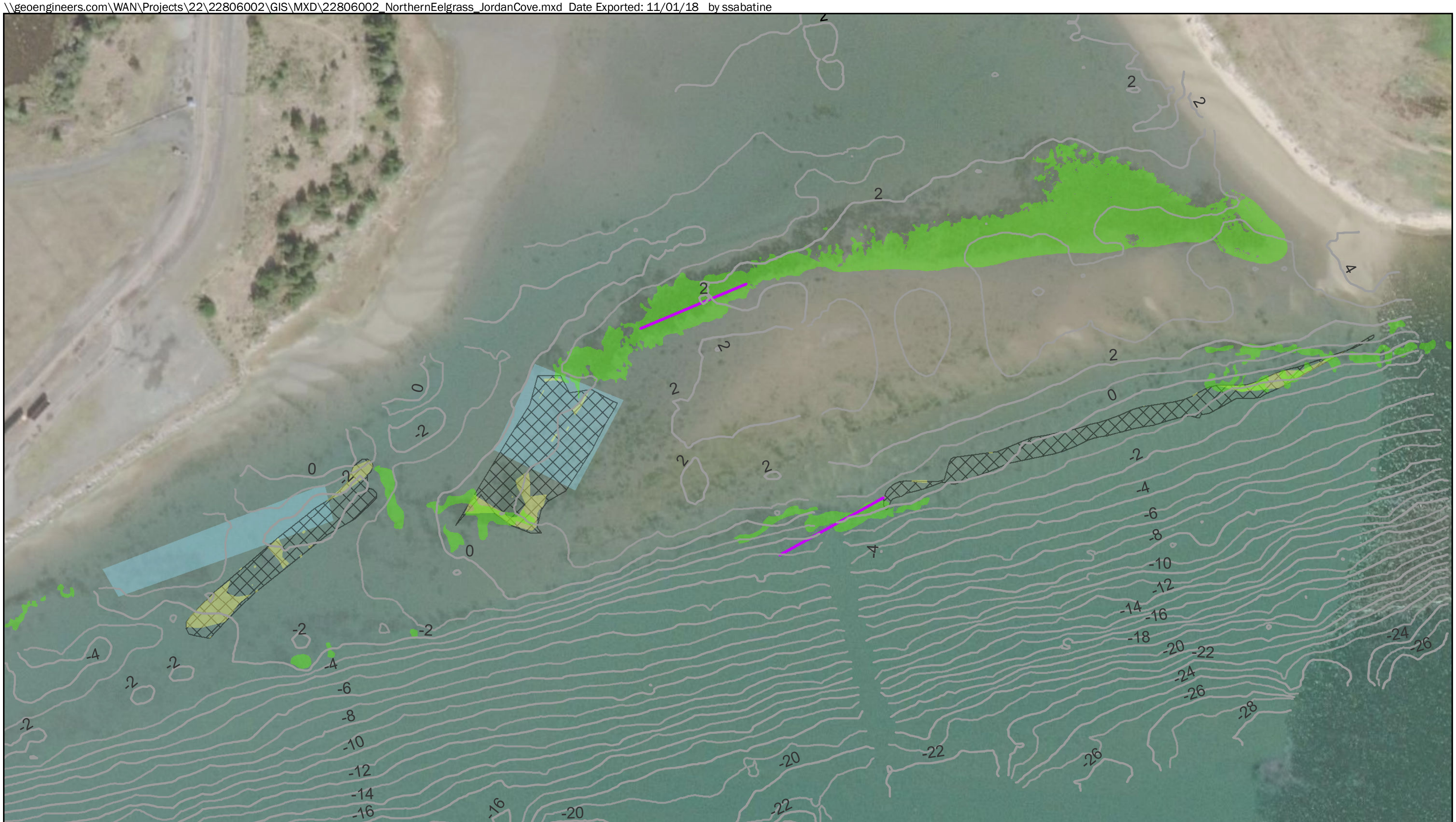
Jordan Cove LNG℠

10/2/2018

FIGURE NO. **E-13**

\\deainc.com\files\PROJECT\J\JLNG00000001\0600INFO\GS\Maps\Permit-USACE-CWMP\Sheet E-13 Access Channel.mxd 10/3/2018

\\geoengineers.com\WAN\Projects\22\22806002\GIS\MXD\22806002_NorthernEelgrass_JordanCove.mxd Date Exported: 11/01/18 by ssabatine



Notes:
1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. cannot guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

Data Source: Aerial image from ESRI Data Online.

Projection: NAD 1983 StatePlane Oregon North FIPS 3601 Feet

Legend

- Bathymetric Contour (Int Ft, MLLW)
- Transect
- SSNERR Eelgrass Survey (2016)
- DEA Eelgrass Survey (2018)
- DEA Survey Boundary
- Transplant Area

N W E S

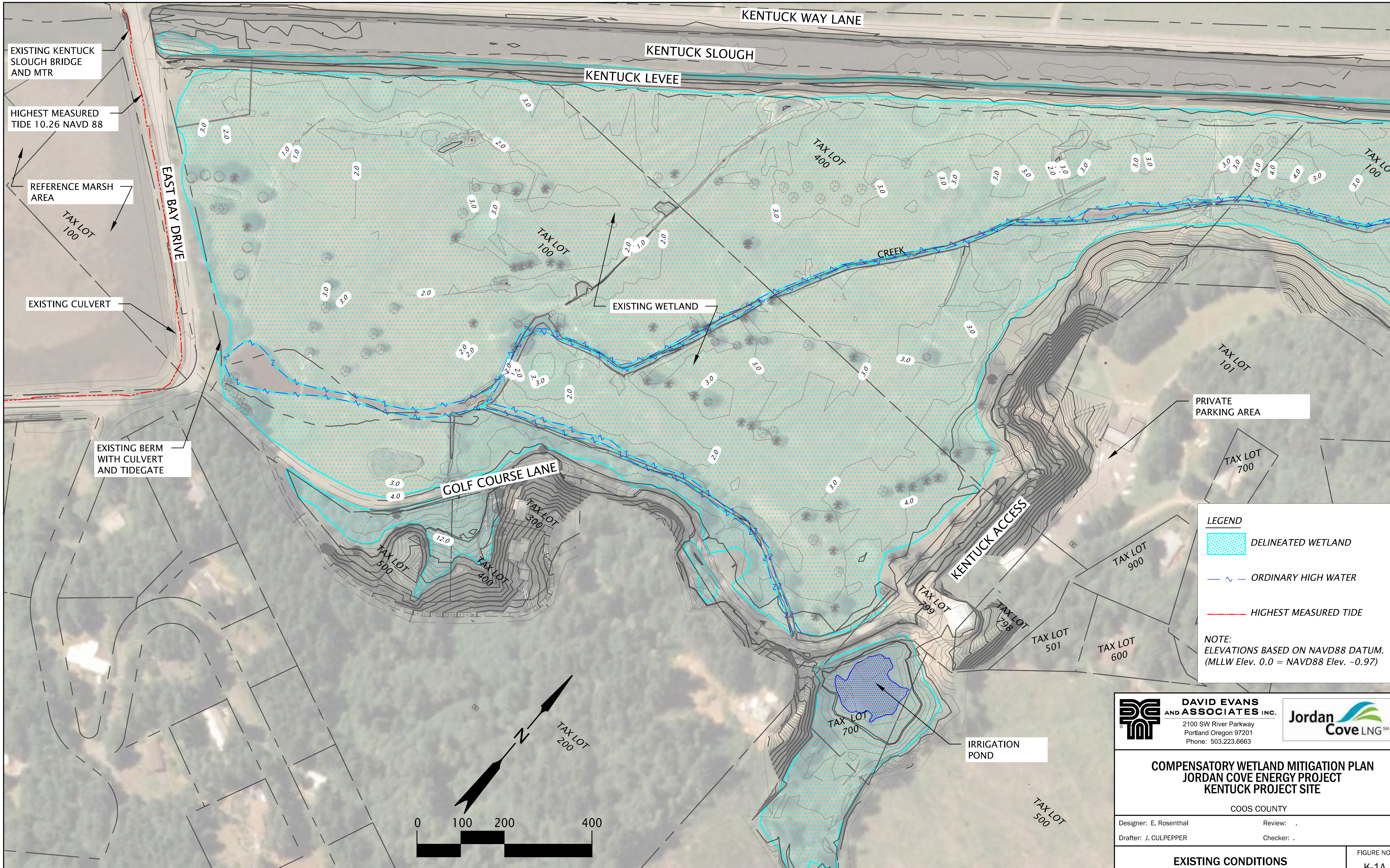
100 0 100
Feet

Eelgrass Distribution in Jordan Cove and Proposed Eelgrass Transplant Recipient Sites

Jordan Cove LNG
Coos Bay, Oregon

GEOENGINEERS

Figure E-14



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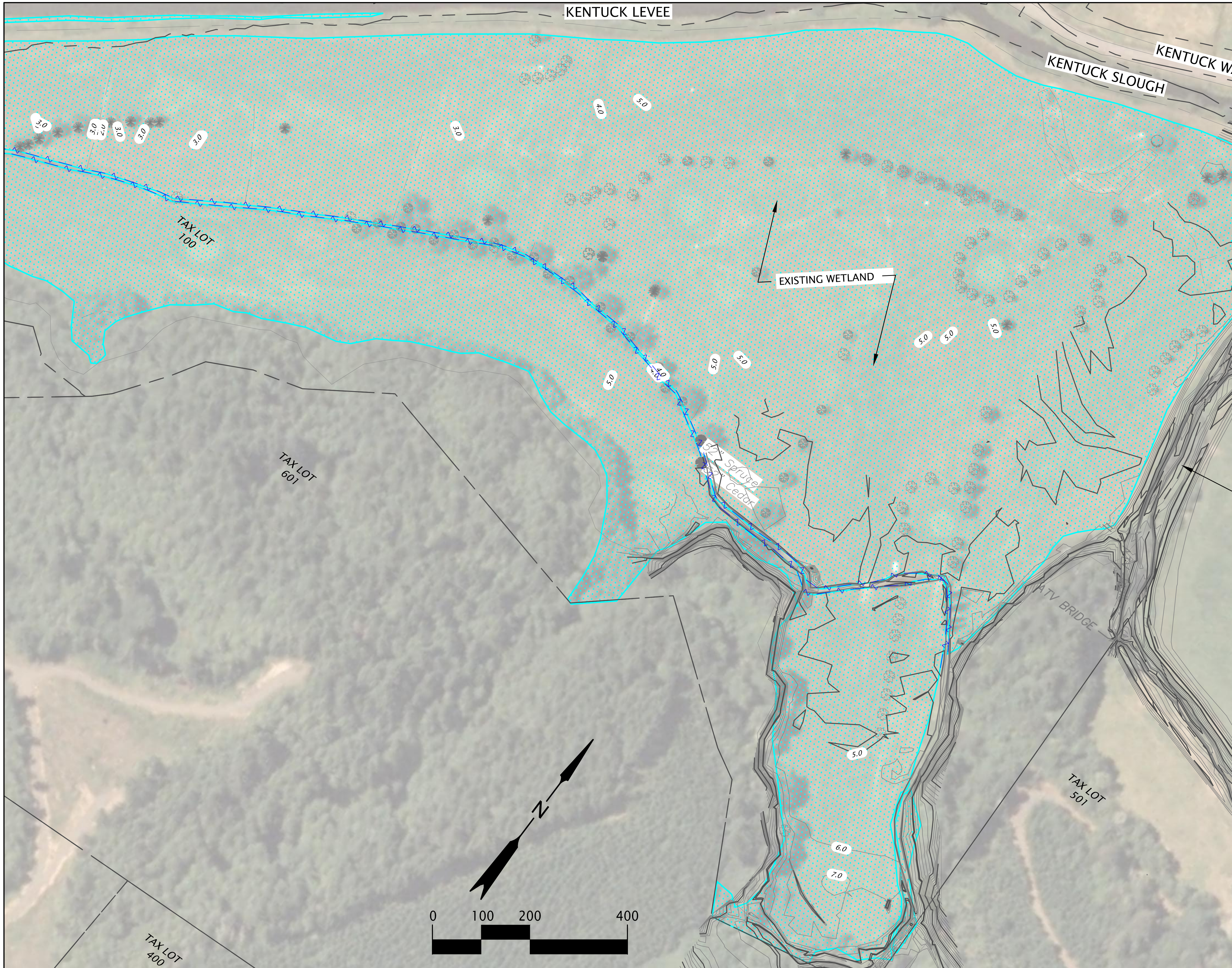
Jordan Cove LNG℠

COMPENSATORY WETLAND MITIGATION PLAN
JORDAN COVE ENERGY PROJECT
KENTUCK PROJECT SITE

COOS COUNTY

Designer: E. Rosenthal	Review: .
Drafter: J. CULPEPPER	Checker: .

EXISTING CONDITIONS — FIGURE NO. K-1A



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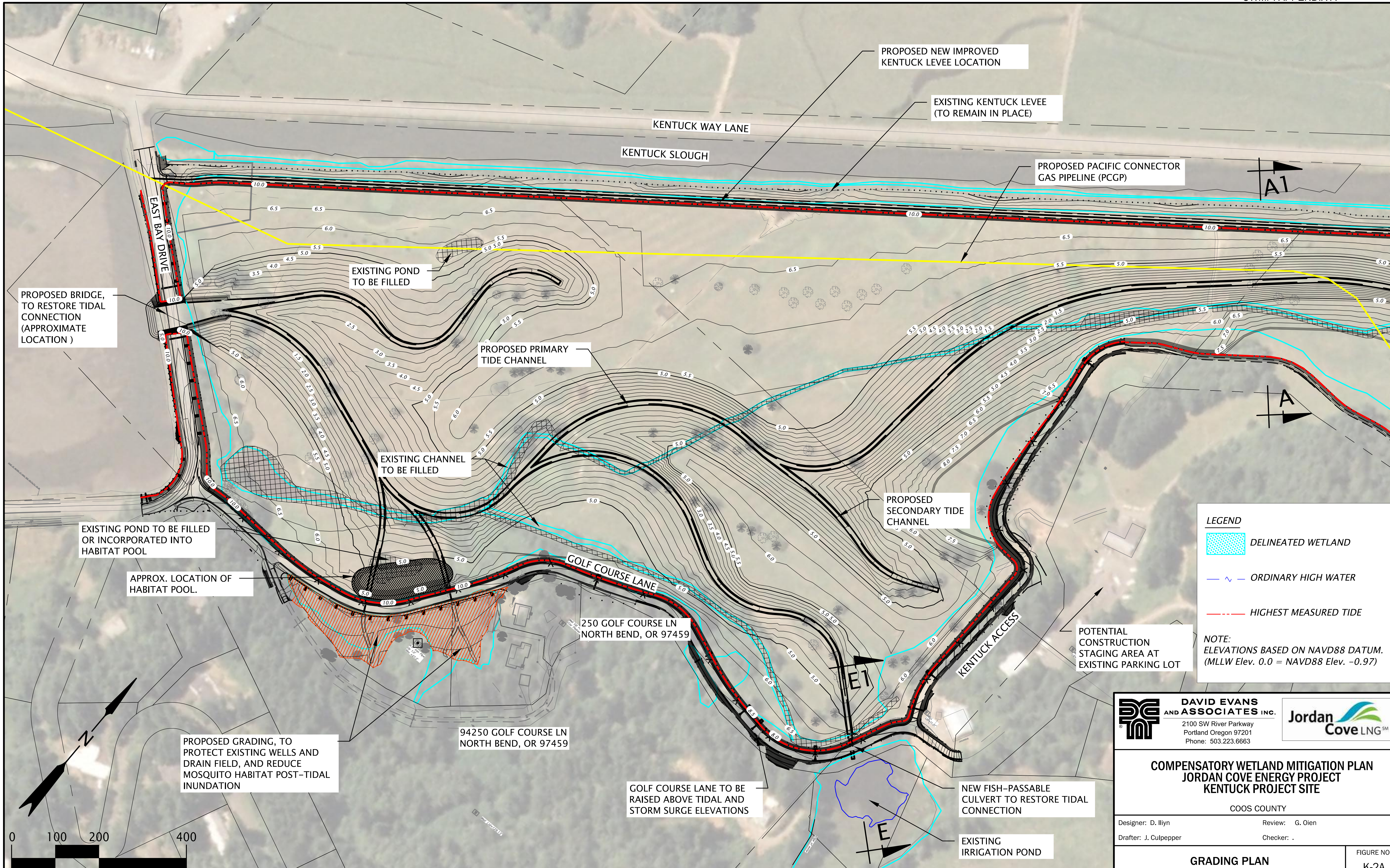
COOS COUNTY

Designer: E. Rosenthal | Review: G. Oien
Drafter: J. Culpepper | Checker: .

EXISTING CONDITIONS

FIGURE NO. K-1B


PROPOSED NEW IMPROVED KENTUCK LEVEE LOCATION
EXISTING KENTUCK LEVEE (TO REMAIN IN PLACE)
KENTUCK WAY LANE
KENTUCK SLOUGH
PROPOSED PACIFIC CONNECTOR GAS PIPELINE (PCGP)
A1
EAST BAY DRIVE
PROPOSED BRIDGE, TO RESTORE TIDAL CONNECTION (APPROXIMATE LOCATION)
EXISTING POND TO BE FILLED
PROPOSED PRIMARY TIDE CHANNEL
A
EXISTING CHANNEL TO BE FILLED
PROPOSED SECONDARY TIDE CHANNEL
EXISTING POND TO BE FILLED OR INCORPORATED INTO HABITAT POOL
APPROX. LOCATION OF HABITAT POOL.
GOLF COURSE LANE
250 GOLF COURSE LN NORTH BEND, OR 97459
KENTUCK ACCESS
POTENTIAL CONSTRUCTION STAGING AREA AT EXISTING PARKING LOT
LEGEND
DELINEATED WETLAND
ORDINARY HIGH WATER
HIGHEST MEASURED TIDE
NOTE:
ELEVATIONS BASED ON NAVD88 DATUM.
(MLLW Elev. 0.0 = NAVD88 Elev. −0.97)
E1
94250 GOLF COURSE LN NORTH BEND, OR 97459
PROPOSED GRADING, TO PROTECT EXISTING WELLS AND DRAIN FIELD, AND REDUCE MOSQUITO HABITAT POST-TIDAL INUNDATION
GOLF COURSE LANE TO BE RAISED ABOVE TIDAL AND STORM SURGE ELEVATIONS
NEW FISH-PASSABLE CULVERT TO RESTORE TIDAL CONNECTION
EXISTING IRRIGATION POND
E
N
0 100 200 400
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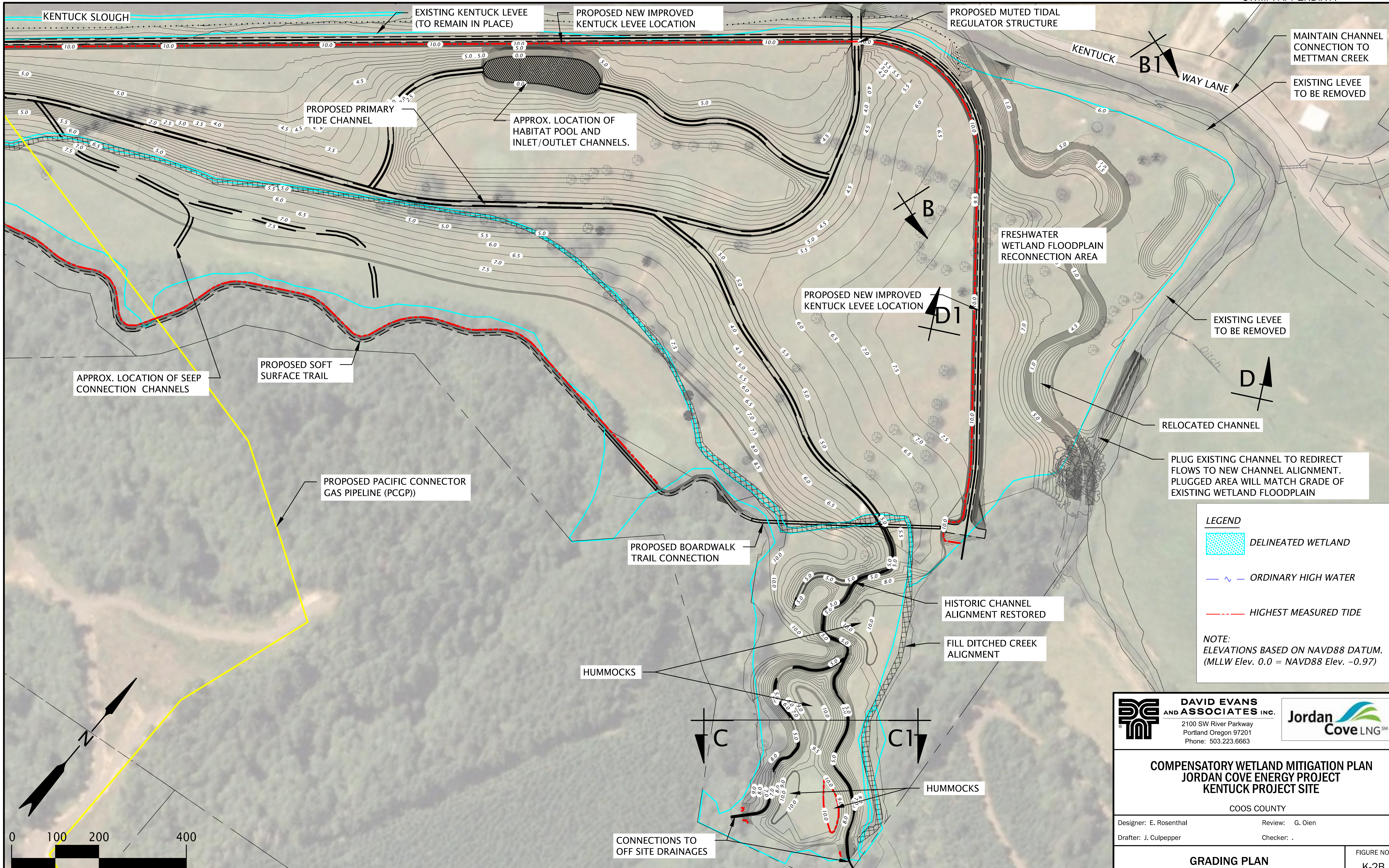
Jordan Cove LNG
COMPENSATORY WETLAND MITIGATION PLAN
JORDAN COVE ENERGY PROJECT
KENTUCK PROJECT SITE
COOS COUNTY
Designer: D. Iliyn
Review: G. Oien
Drafter: J. Culpepper
Checker: .
GRADING PLAN
FIGURE NO.
K-2A



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KENTUCK PROJECT SITE

COOS COUNTY

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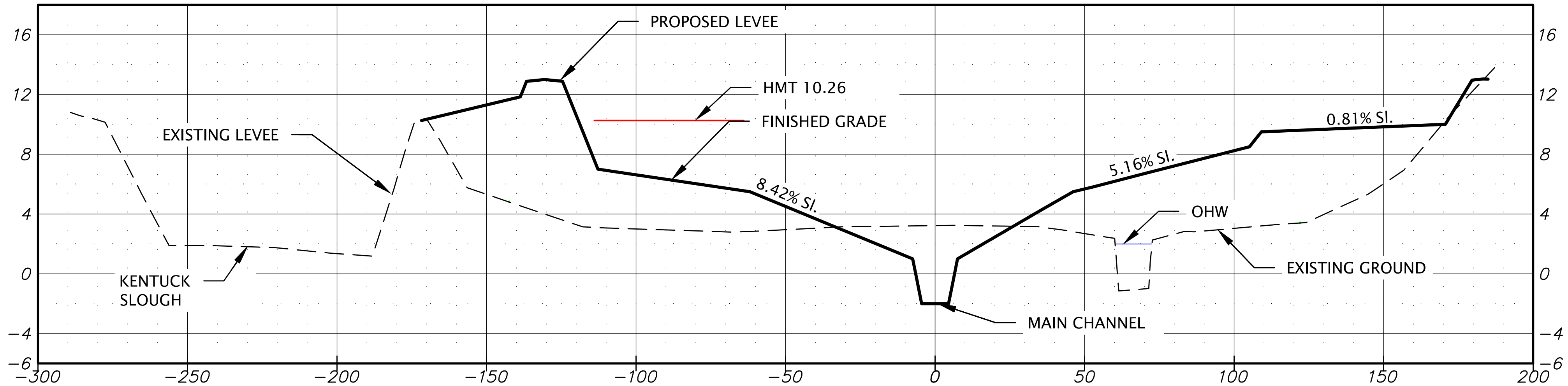
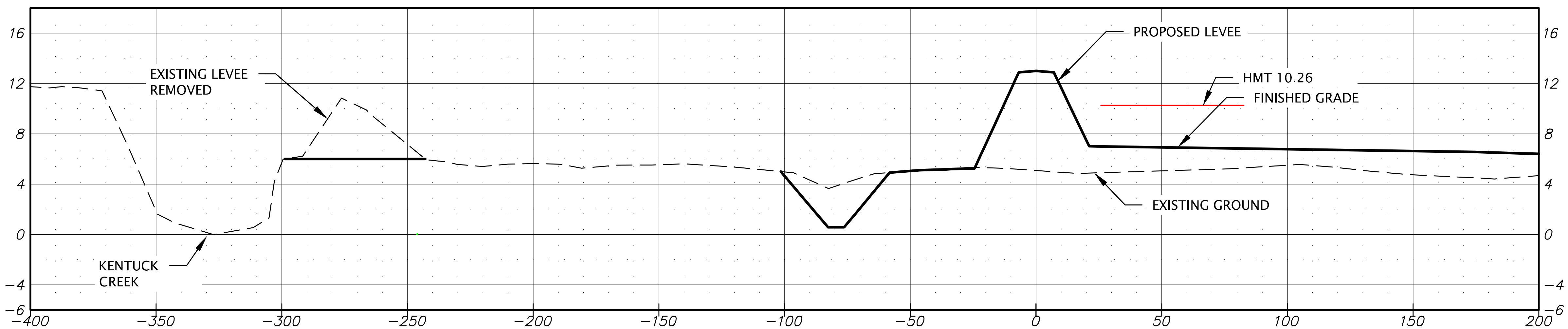
Drafter: J. Culpepper | Checker: .

GRADING PLAN

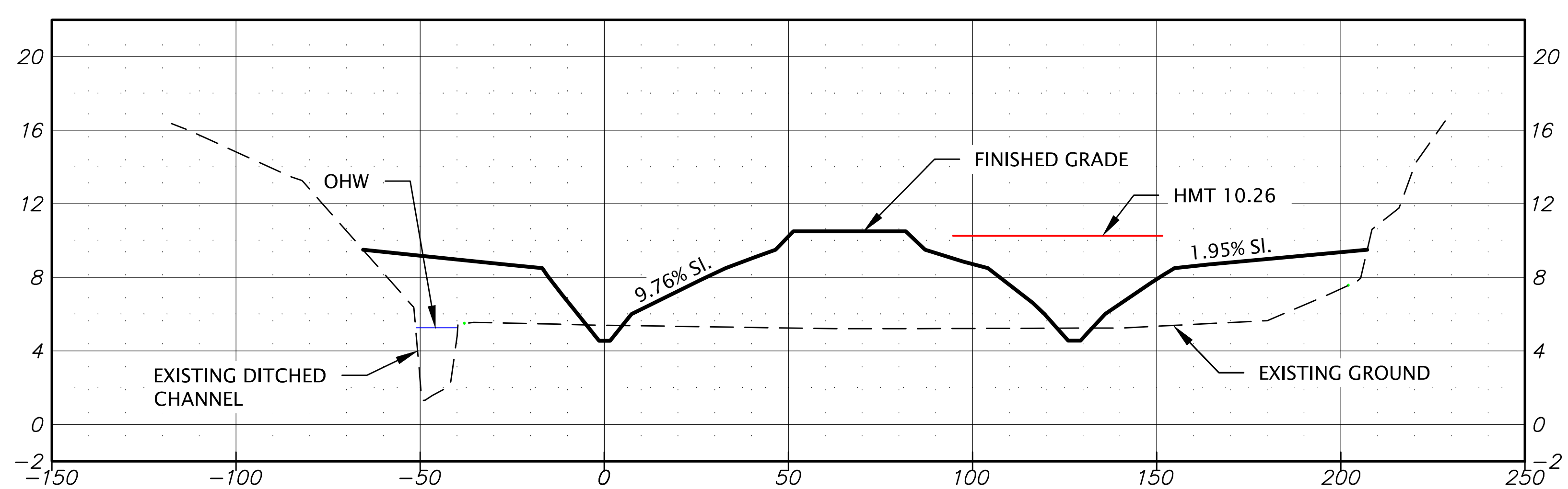
FIGURE NO. K-2B



SECTION A1–A



SECTION B1–B



SECTION C1–C

NOTE:
ORDINARY HIGH WATER (OHW) BASED ON EXISTING CONDITIONS. HIGHEST MEASURED TIDE (HMT) BASED ON POST-TIDAL RECONNECTION CONDITION

ELEVATIONS BASED ON NAVD88 DATUM.
(MLLW Elev. 0.0 = NAVD88 Elev. −0.97)

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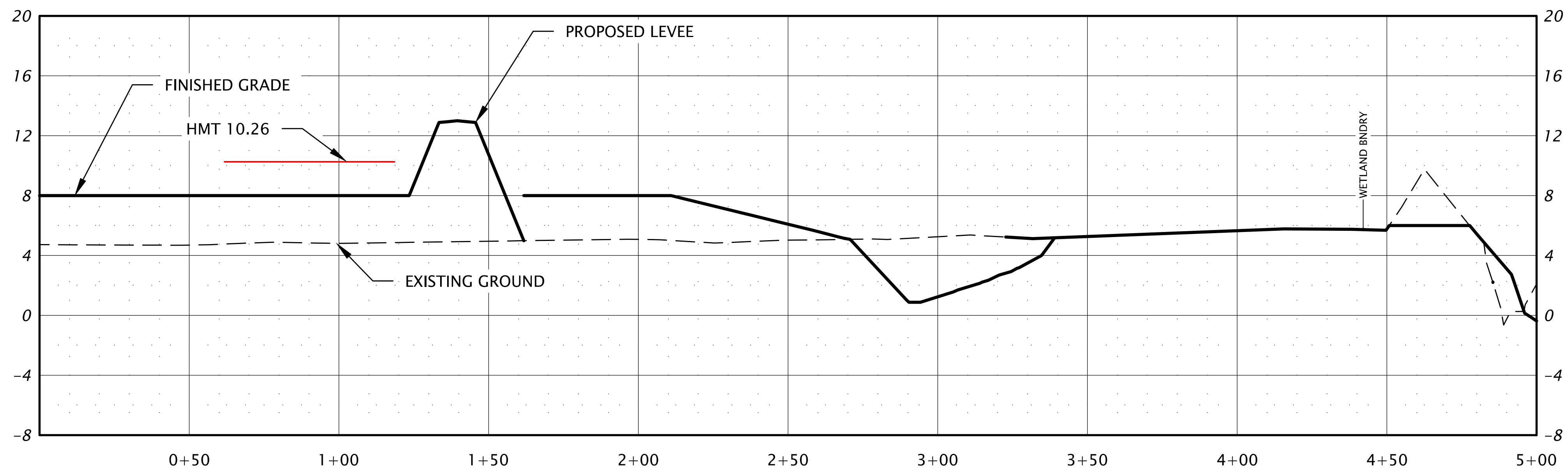
KENTUCK PROJECT SITE

COOS COUNTY

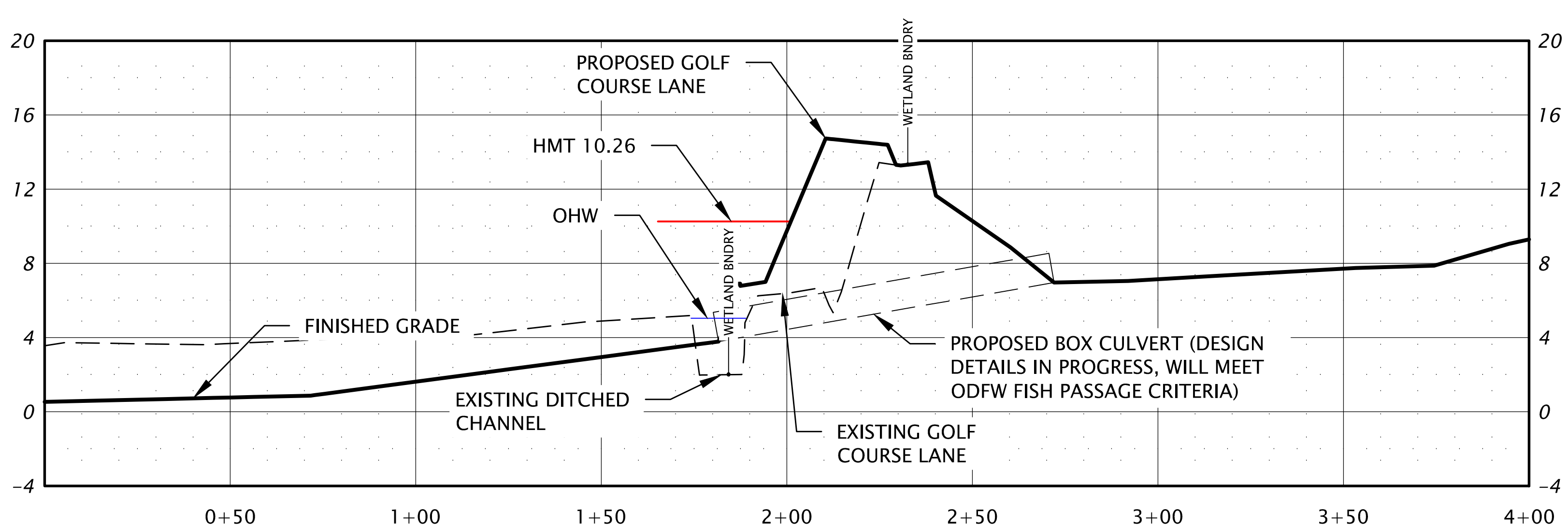
Designer: E. Rosenthal	Review: G. Oien
Drafter: J. Culpepper	Checker:

GRADING PLAN

FIGURE NO. K-2C



SECTION D1-D



SECTION E1-E

NOTE:
ORDINARY HIGH WATER (OHW) BASED ON EXISTING CONDITIONS. HIGHEST MEASURED TIDE (HMT) BASED ON POST-TIDAL RECONNECTION CONDITION

ELEVATIONS BASED ON NAVD88 DATUM.
(MLLW Elev. 0.0 = NAVD88 Elev. -0.97)

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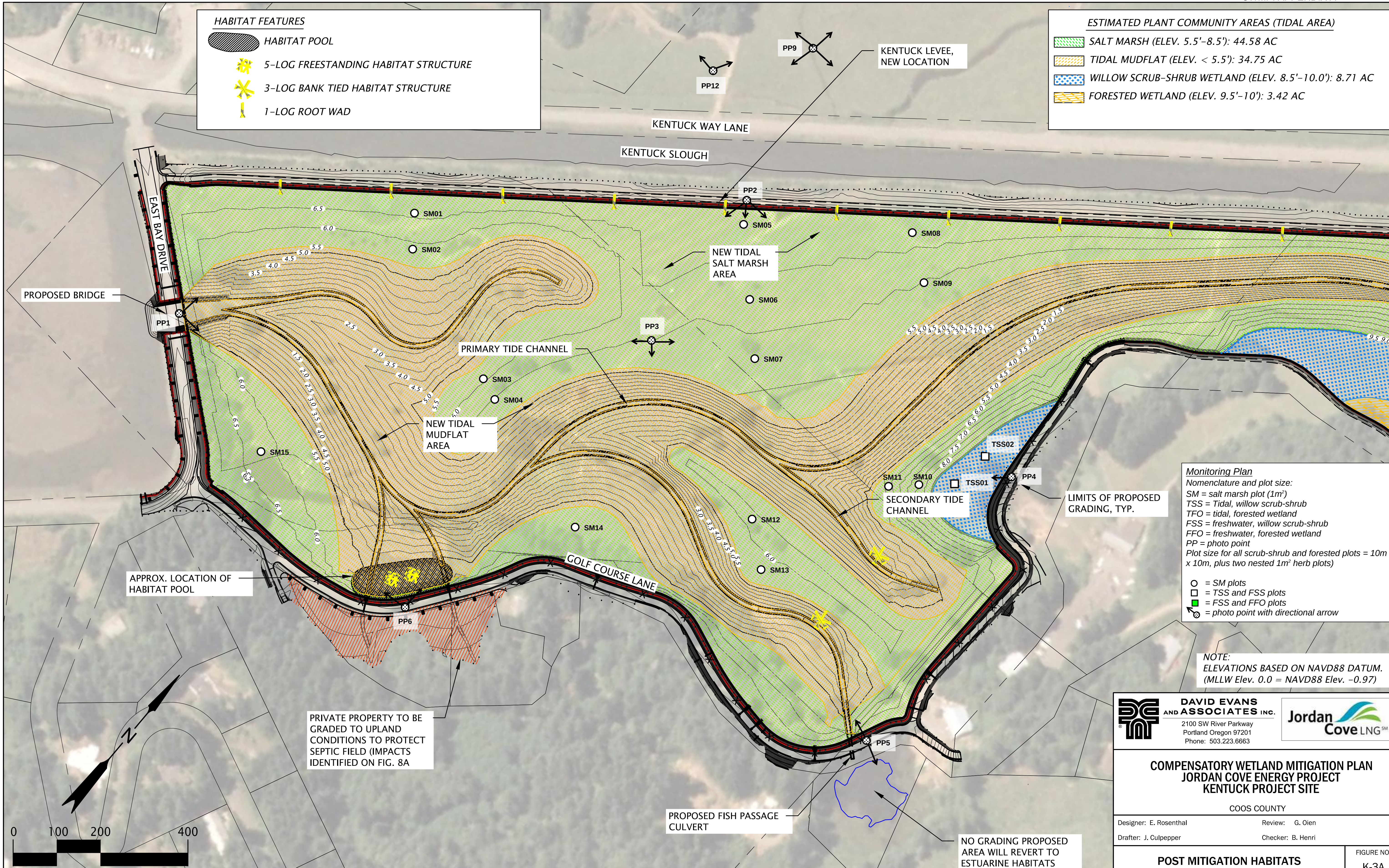
KENTUCK PROJECT SITE

COOS COUNTY

Designer: E. Rosenthal | Review: G. Olen
Drafter: J. Culpepper | Checker: .

GRADING PLAN

FIGURE NO. K-2D



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COMPENSATORY WETLAND MITIGATION PLAN
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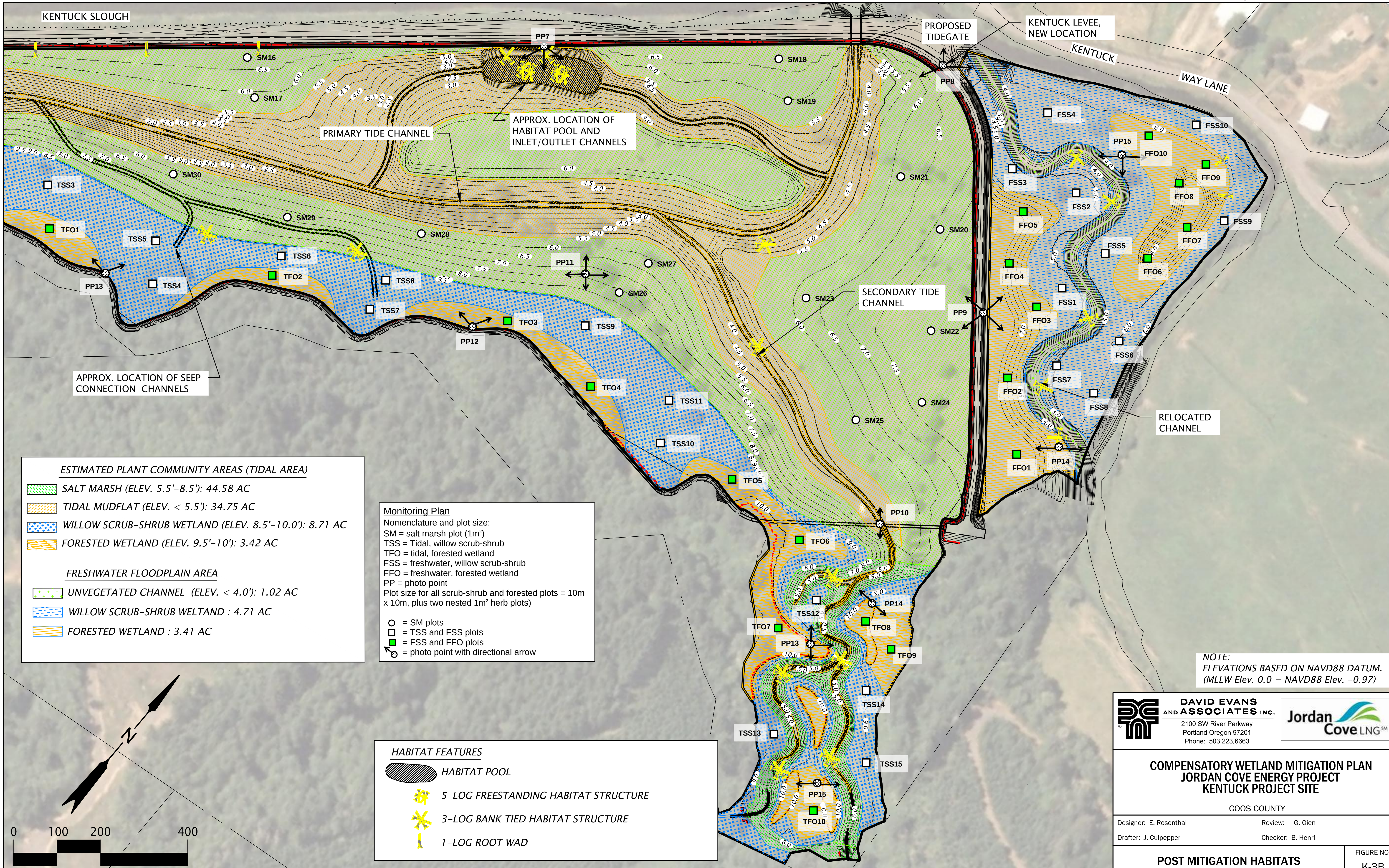
KENTUCK PROJECT SITE

COOS COUNTY

Designer: E. Rosenthal	Review: G. Oien
Drafter: J. Culpepper	Checker: B. Henri

POST MITIGATION HABITATS

FIGURE NO. K-3A


KENTUCK SLOUGH
PROPOSED TIDEGATE
KENTUCK LEVEE, NEW LOCATION
KENTUCK WAY LANE
APPROX. LOCATION OF HABITAT POOL AND INLET/OUTLET CHANNELS
PRIMARY TIDE CHANNEL
SECONDARY TIDE CHANNEL
APPROX. LOCATION OF SEEP CONNECTION CHANNELS
RELOCATED CHANNEL
ESTIMATED PLANT COMMUNITY AREAS (TIDAL AREA)
SALT MARSH (ELEV. 5.5'-8.5'): 44.58 AC
TIDAL MUDFLAT (ELEV. < 5.5'): 34.75 AC
WILLOW SCRUB-SHRUB WETLAND (ELEV. 8.5'-10.0'): 8.71 AC
FORESTED WETLAND (ELEV. 9.5'-10'): 3.42 AC
FRESHWATER FLOODPLAIN AREA
UNVEGETATED CHANNEL (ELEV. < 4.0'): 1.02 AC
WILLOW SCRUB-SHRUB WELTAND : 4.71 AC
FORESTED WETLAND : 3.41 AC
Monitoring Plan
Nomenclature and plot size:
SM = salt marsh plot (1m²)
TSS = Tidal, willow scrub-shrub
TFO = tidal, forested wetland
FSS = freshwater, willow scrub-shrub
FFO = freshwater, forested wetland
PP = photo point
Plot size for all scrub-shrub and forested plots = 10m x 10m, plus two nested 1m² herb plots)
= SM plots
= TSS and FSS plots
= FSS and FFO plots
= photo point with directional arrow
HABITAT FEATURES
HABITAT POOL
5-LOG FREESTANDING HABITAT STRUCTURE
3-LOG BANK TIED HABITAT STRUCTURE
1-LOG ROOT WAD
N
0 100 200 400
NOTE:
ELEVATIONS BASED ON NAVD88 DATUM.
(MLLW Elev. 0.0 = NAVD88 Elev. -0.97)
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Jordan Cove LNG
COMPENSATORY WETLAND MITIGATION PLAN
JORDAN COVE ENERGY PROJECT
KENTUCK PROJECT SITE
COOS COUNTY
Designer: E. Rosenthal
Review: G. Oien
Drafter: J. Culpepper
Checker: B. Henri
POST MITIGATION HABITATS
FIGURE NO.
K-3B

Kentuck Site Proposed Planting List

-species subject to change per design refinements and availability

Kentuck Site (Salt Marsh- Plantings and Estimated Volunteer Recruitment)				
Deschampsia cespitosa	*Tufted hairgrass*	*FACW*		
Hordeum brachyantherum	*Meadow barley*	*FACW*		
Carex lyngbei	*Lyngby's sedge*	*OBL*		
Grindelia integrifolia	*Gumweed*	*FACW*		
Argentina egedii	*Pacific silverweed*	*OBL*		
Distichlis spicata	*Saltgrass*	*FACW*		
Scirpus americanus	*American threesquare*	*OBL*		
Salicornia virginica	*Pickleweed*	*OBL*		
Schoenoplectus pungens	*Common threesquare*	*OBL*		
Kentuck Site (Freshwater Wetland Plantings)			**Forest Community**	**Willow Scrub-Shrub**
Alnus rubra	*Red alder*	*FAC*	*X*	
Picea sitchensis	*Sitka spruce*	*FAC*	*X*	*X (low density)*
Myrica californica	*California wax myrtle*	*FACW*	*X*	*X*
Malus fusca	*Oregon crab apple*	*FACW*	*X*	
Salix hookeriana	*Hooker's willow*	*FACW*	*X*	*X (high density)*
Lonicera involucrata	*twinberry*	*FAC*	*X*	*X*
Spiraea douglasii	*Douglas spirea*	*FACW*	*X*	*X*
Rubus spectabilis	*salmon berry*	*FAC*	*X*	
Carex obnupta	*slough sedge*	*OBL*	*X*	*X*
Juncus ensifolius	*daggerleaf rush*	*FACW*	*X*	*X*
Scirpus microcarpus	*small-fruited bulrush*	*OBL*	*X*	
Argentina egedii	*Pacific silverweed*	*OBL*	*X*	*X*
Distichlis spicata	*Salt grass*	*FACW*	*X*	*X*
Hordeum brachyantherum	*Meadow barley*	*FACW*	*X*	*X*
Deschampsia caespitosa	*tufted hairgrass*	*FACW*	*X*	*X*

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COMPENSATORY WETLAND MITIGATION PLAN
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KENTUCK PROJECT SITE

COOS COUNTY

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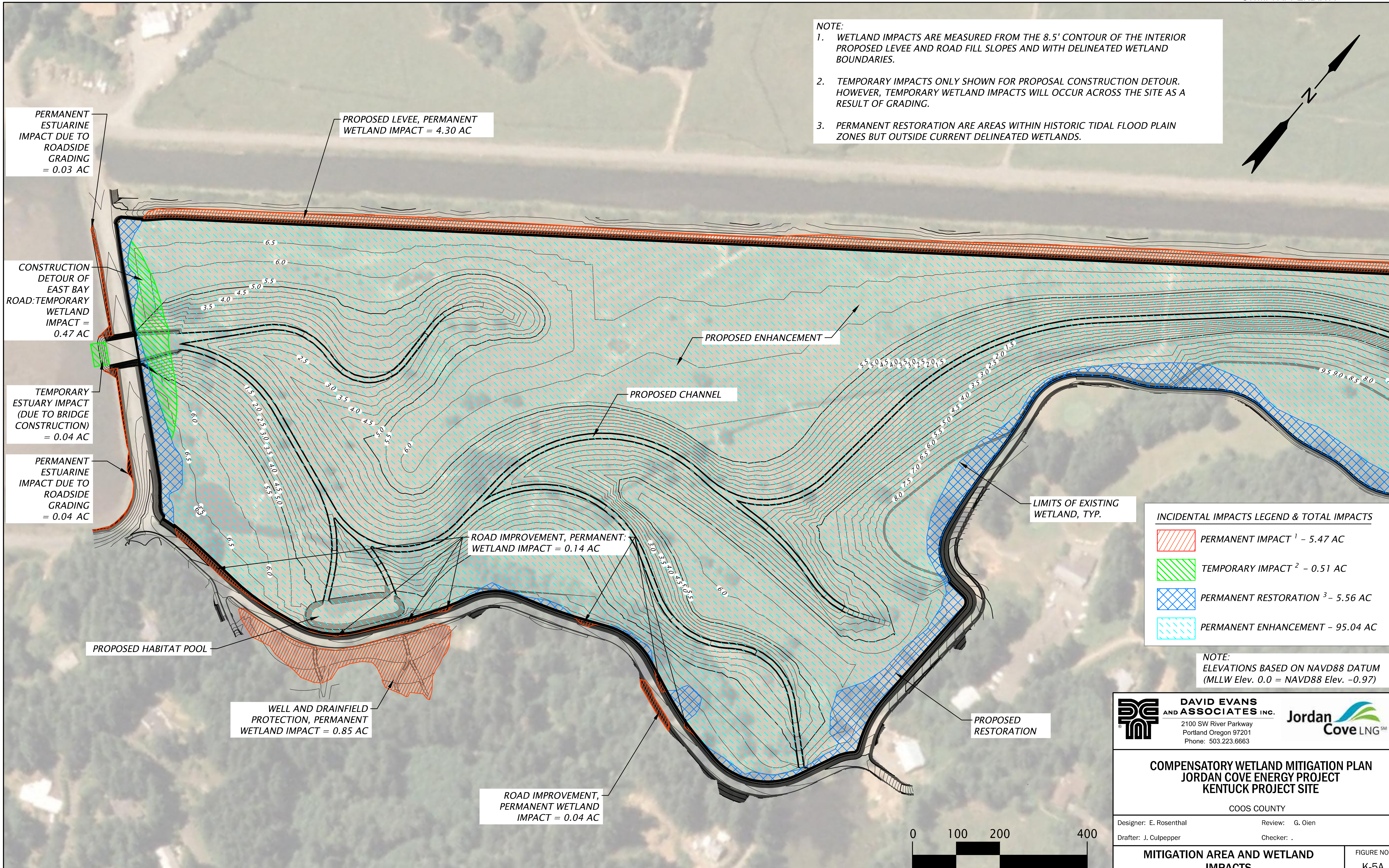
Drafter: J. Culpepper Checker: .

PROPOSED PLANTING PLAN FIGURE NO. K-4


NOTE:
1. WETLAND IMPACTS ARE MEASURED FROM THE 8.5' CONTOUR OF THE INTERIOR PROPOSED LEVEE AND ROAD FILL SLOPES AND WITH DELINEATED WETLAND BOUNDARIES.
2. TEMPORARY IMPACTS ONLY SHOWN FOR PROPOSAL CONSTRUCTION DETOUR. HOWEVER, TEMPORARY WETLAND IMPACTS WILL OCCUR ACROSS THE SITE AS A RESULT OF GRADING.
3. PERMANENT RESTORATION ARE AREAS WITHIN HISTORIC TIDAL FLOOD PLAIN ZONES BUT OUTSIDE CURRENT DELINEATED WETLANDS.
N
PERMANENT ESTUARINE IMPACT DUE TO ROADSIDE GRADING = 0.03 AC
PROPOSED LEVEE, PERMANENT WETLAND IMPACT = 4.30 AC
CONSTRUCTION DETOUR OF EAST BAY ROAD:TEMPORARY WETLAND IMPACT = 0.47 AC
PROPOSED ENHANCEMENT
TEMPORARY IMPACT ESTUARY IMPACT (DUE TO BRIDGE CONSTRUCTION) = 0.04 AC
PROPOSED CHANNEL
PERMANENT ESTUARINE IMPACT DUE TO ROADSIDE GRADING = 0.04 AC
LIMITS OF EXISTING WETLAND, TYP.
ROAD IMPROVEMENT, PERMANENT: WETLAND IMPACT = 0.14 AC
INCIDENTAL IMPACTS LEGEND & TOTAL IMPACTS
PERMANENT IMPACT 1 - 5.47 AC
TEMPORARY IMPACT 2 - 0.51 AC
PERMANENT RESTORATION 3 - 5.56 AC
PERMANENT ENHANCEMENT - 95.04 AC
PROPOSED HABITAT POOL
NOTE:
ELEVATIONS BASED ON NAVD88 DATUM (MLLW Elev. 0.0 = NAVD88 Elev. -0.97)
WELL AND DRAINFIELD PROTECTION, PERMANENT WETLAND IMPACT = 0.85 AC
PROPOSED RESTORATION
ROAD IMPROVEMENT, PERMANENT WETLAND IMPACT = 0.04 AC
0 100 200 400
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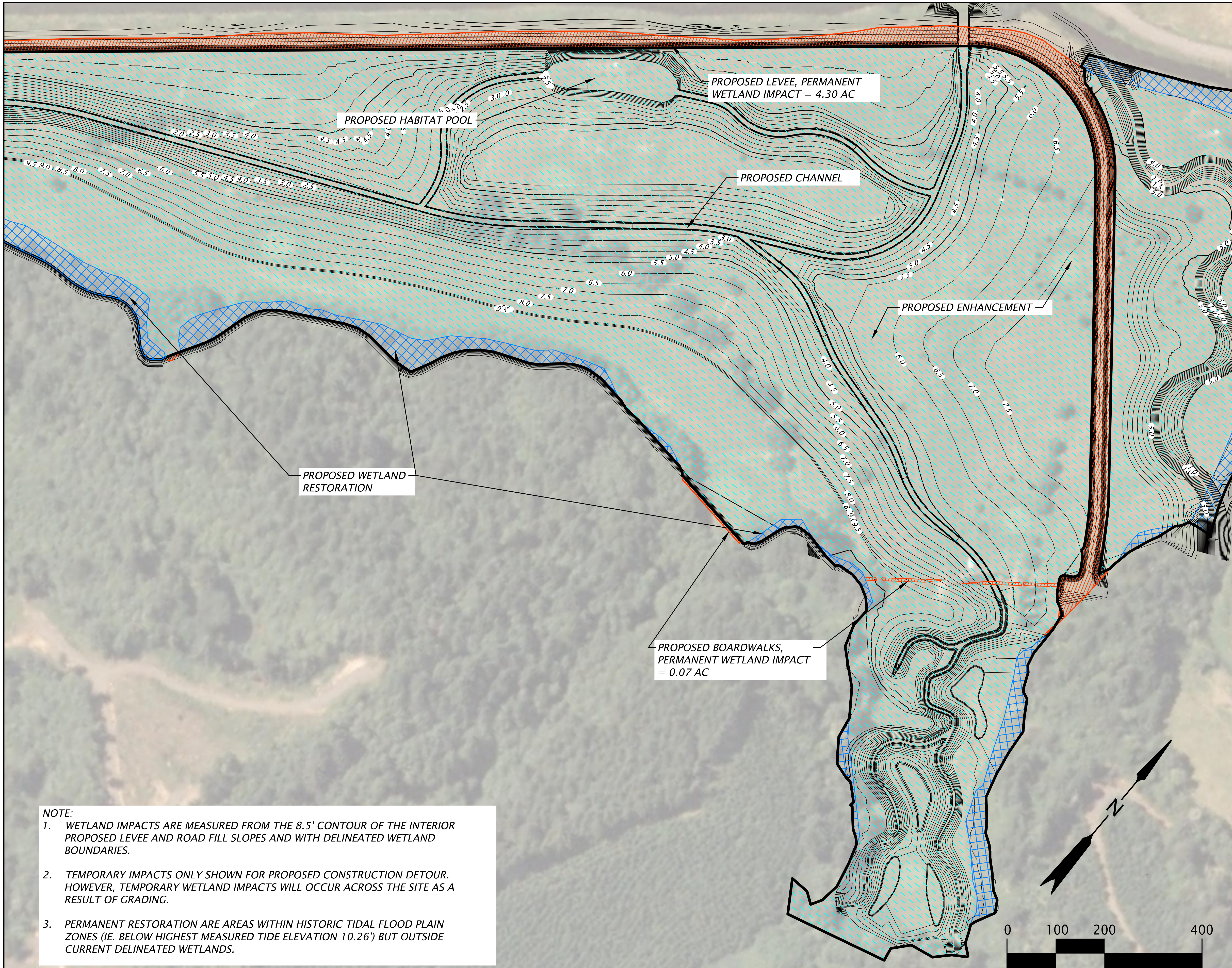
KENTUCK PROJECT SITE
COOS COUNTY
Designer: E. Rosenthal
Review: G. Oien
Drafter: J. Culpepper
Checker: .
MITIGATION AREA AND WETLAND IMPACTS
FIGURE NO.
K-5A



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KENTUCK PROJECT SITE

COOS COUNTY

Designer: E. Rosenthal	Review: G. Oien
Drafter: J. Culpepper	Checker:

MITIGATION AREA AND WETLAND IMPACTS	FIGURE NO. K-5B