US Army Corps Of Engineers (Portland District)

Joint Permit Application Form

DATE STAMP

AGENCIES WILL ASSIGN NUMBERS

Corps Action ID Number | Oregon Department of State Lands No.

SEND ONE SIGNED COPY OF YOUR APPLICATION TO EACH AGENCY

US Army Corps of Engineers:		DSL - West of the Cascades:		DSL - East of the Cascades:		Send DSL Application Fees to:
District Engineer ATTN: CENWP-OD-GPPO Box 2946 Portland, OR 97208-2946 503-808-4373	**AND**	State of Oregon Department of State Lands 775 Summer Street, Suite 100 Salem, OR 97301-1279 503-986-5200	**OR**	State of Oregon Department of State Lands 1645 NE Forbes Road, Suite 112 Bend, Oregon 97701 541-388-6112	**AND**	State of Oregon Department of State Lands PO Box 4395, Unit 18 Portland, OR 97208-4395 **(Attach a copy of the first page of the application)**

(1) APPLICANT INFORMATION

Applicant Name and Address	Oregon State University - Hatfield Marine Science Center 2030 SE Marine Science Drive Newport, OR 97365	Business Phone # Home Phone # Fax # Email	541-867-0212 541-867-0138 george.boehlert@oregonstate.edu
Authorized Agent Name and Address Check one Consultant ☐ Contractor ☐		Business Phone # Home Phone # Fax # Email	
Property Owner Name and Address If different from above[1]	Port of Newport 600 SE Bay Blvd. Newport, OR 97365	Business Phone # Home Phone # Fax # Email	541-265-7758 541 265 4235 portman@portofnewport.com

(2) PROJECT LOCATION

Street, Road or Other Descriptive Location		Legal Description (attach *tax lot map**)			
2030 SE Marine Science Dr.		Township	Range	Section	Quarter/Quarter
		NE	17	11 South	11 West
In or near (City or Town)	County	Tax Map #		Tax Lot #[2]	
Newport	Lincoln	11-11-17		104	
Wetland/Waterway (pick one)	River Mile (if known)	Latitude (in DD.DDDD format)		Longitude (in DD.DDDD format)	
Yaquina Bay		N 44.6227		W-124.0421	
Directions to the site	The site is on the Hatfield Marine Science Center campus in Newport OR, approximately 200 meters east of the main building at 2030 SE Marine Science Dr.				

[1] If applicant is not the property owner, permission to conduct the work must be attached.
[2] Attach a copy of all tax maps with the project area highlighted.

- ***Italicized areas are not required by the Corps for a complete application, but may be necessary prior to final permit decision by the Corps.***

(3) PROPOSED PROJECT INFORMATION

Type: Fill ☒ Excavation (removal) ☐ In-Water Structure ☐ Maintain/Repair an Existing Structure ☐

Brief Description: Stabilize portion of Yaquina Bay shoreline at Hatfield Marine Science Center (area of erosion along eastern edge of HMSC property).

Fill

Riprap ☐ Rock ☒ Gravel ☒ Organics ☐ Sand ☐ Silt ☐ Clay ☐ Other: ☐

Wetlands	Permanent (cy)	Temporary (cy)							Total cubic yards for project (including outside OHW/wetlands)		
	Impact Area in Acres	Dimensions (feet)									
		L'		W'		H'					
Waters below OHW	Permanent (cy)	Temporary (cy)							Total cubic yards for project (including outside OHW/wetlands)	550	
	550 cu. yds rock/gravel										
	Impact Area in Acres	Dimensions (feet)									
	0.25	L'	500	W'	10-50	H'	0.5-3				

Removal

Wetlands	Permanent (cy)	Temporary (cy)							Total cubic yards for project (including outside OHW/wetlands)		
	Impact Area in Acres	Dimensions (feet)									
		L'		W'		H'					
Waters below OHW	Permanent (cy)	Temporary (cy)							Total cubic yards for project (including outside OHW/wetlands)		
	Impact Area in Acres	Dimensions (feet)									
		L'		W'		H'					

Total acres of construction related ground disturbance (If 1 acre or more a 1200-C permit may be required from DEQ)

Is the disposal area upland? Yes ☐ No ☐ Impervious surface created? 0<1 acre ☐ 0>1 acre? ☐

	Yes	No	If yes, please explain in the project description (in block 4)
Are you aware of any state or federally listed species on the project site?		X	
Are you aware of any Cultural/Historic Resources on the project site?		X	
Is the project site within a national Wild & Scenic River?		X	
*Is the project site within a State Scenic State Scenic Waterway?**		X	

(4) PROPOSED PROJECT PURPOSE AND DESCRIPTION

Purpose and Need:

*Provide a description of the public, social, economic, or environmental benefits of the project along with any supporting formal actions of a public body (e.g. city or county government), as appropriate.**

Stabilization of the Yaquina Bay shoreline along the eastern edge of the Hatfield Marine Science Center campus is necessary to halt erosion that is undermining critical infrastructure at HMSC. During late 2006, erosion forced closure of the HMSC public estuary trail, and in March 2007 with the assistance of the Oregon Army National Guard IRT program, an erosion control project using a gravel beach or "dynamic revetment" resulted in the stabilization of approximately 200 linear feet of shoreline. That shoreline has remained stable since project implementation. Erosion had been occurring at a slower rate to the south of the project area, but in the winter of 2009-2010, weather conditions resulted in rapid erosion of up to 13 ft along approximately 500 linear ft of shoreline. This erosion has moved the shoreline to the edge of the nature trail in one location, and to within only 25 ft of portions of the 800,000 gallon seawater system infrastructure for HMSC which supports the research of Oregon State University and the six federal and state agency programs co-located on site. A significant portion of the HMSC's $48 million annual budget is dependent on the seawater reservoir and delivery system that supports research and educational activities at the center, and the estuary trail, one of the few public access points to the estuary, serves the community as an educational and recreational resource. HMSC has designed this environmentally-friendly 'soft' solution in a effort to proactively prevent a crisis that would require stabilization requiring the use of riprap to protect infrastructure, and as an opportunity to engage in mission-related outreach efforts on the adjacent estuary trail on appropriate alternatives to armoring the shoreline.

- ***Italicized areas are not required by the Corps for a complete application, but may be necessary prior to final permit decision by the Corps.***

Project Description:

Please describe in detail the proposed removal and fill activities, including the following information:

- Volumes and acreages of all fill and removal activities in waterway or wetland separately
- Permanent and temporary impacts
- Types of materials (e.g., gravel, silt, clay, etc.)
- How the project will be accomplished (i.e., describe construction methods, equipment, site access)
- *Describe any changes that the project may make to the hydraulic and hydrologic characteristics (e.g., general direction of stream and surface water flow, estimated winter and summer flow volumes.) of the waters of the state, and an explanation of measures taken to avoid or minimize any adverse effects of those changes.*
- Is any of the work already complete? Yes ☐ No ☒ If yes, please describe the completed work.

In addition, for fish habitat or wetland restoration or enhancement activities, complete the information requested in supplemental Fish Habitat or Wetland Restoration and Enhancement form.

Project Drawings

State the number of project drawing sheets included with this application: 10 pages; see Fig 2-4

A complete application must include a location map, site plan, cross-section drawings and recent aerial photo as follows and as applicable to the project:

- **Location map** (must be legible with street names)
  - Site plan including;
  - Entire project site and activity areas
  - Existing and proposed contours
  - Location of ordinary high water, wetland boundaries or other jurisdictional boundaries
  - Identification of temporary and permanent impact areas within waterways or wetlands
  - Map scale or dimensions and north arrow
  - Location of staging areas
  - Location of construction access
  - Location of cross section(s), as applicable
  - Location of mitigation area, if applicable
- **Cross section drawing**(s) including;
  - Existing and proposed elevations
  - Identification of temporary and permanent impact areas within waterways or wetlands
  - Ordinary high water and/or wetland boundary or other jurisdictional boundaries
  - Map scale or dimensions
- **Recent Aerial photo** (1:200, or if not available for your site, the highest resolution available)

Will any construction debris, runoff, etc., enter a wetland or waterway? Yes ☒ No ☐

If yes, describe the type of discharge and show the discharge location on the site plan.

Although rock will be washed prior to placement, residual silt may be washed into the estuary by tidal acton.

Estimated project start date:	11/15/2010	Estimated project completion date:	11/22/2010

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(5) PROJECT IMPACTS AND ALTERNATIVES

Alternatives Analysis:

Describe alternative sites and project designs that were considered to avoid or minimize impacts to the waterway or wetland. (Include alternative design(s) with less impact and reasons why the alternative(s) were not chosen. Reference OAR 141-085-0565 (1) through (6) for more information).*

Please see attachment 2. During planning for the similar 2007 erosion control project implemented on an adjacent strech of shoreline, several other project designs were considered, ranging from basic sand replenishment to more highly engineered approaches, such as construction of a vegetated revetment using interlocking precast concrete blocks ("Tri-Lock" erosion control system) at the base. Renourishing the shoreline with sand alone, arguably the least impacting approach, was ruled out based on previous experience showing how quickly the sand can wash away with storm-driven high tides and high frequency wave action. A vegetated revetment using the Tri-Lock design system, although proven successful in other applications , was deemed not the best solution for this situation.

Measures to Minimize Impacts

Describe what measures you will use (before and after construction) to minimize impacts to the waterway or wetland. These may include but are not limited to the following:

- *For projects with ground disturbance include an erosion control plan or description of other best management practices (BMP's) as appropriate. (For more information on erosion control practices see DEQ's Oregon Sediment and Erosion Control Manual)*
- *For work in waterways where fish or flowing water are likely to be present, discuss how the work area will be isolated from the flowing water.*
- *If native migratory fish are present (or were historically present) and you are installing, replacing or abandoning a culvert or other potential obstruction to fish passage, complete and attach a statement of how the Fish Passage Requirements, set by the Oregon Department of Fish and Wildlife will be met.*

The project proposal incorporates several measures to avoid possible impacts on Yaquina Bay's biological resources and water quality. The size and composition of the fill material (small rounded river gravel with average grain size diameter of 64 mm) was selected based on its similarity to the type of rocks commonly found on other nearby beaches. The fill material, purchased locally from Devil's Lake Rock Co. in Lincoln City, OR provides ecological value as a substrate capable of supporting the settlement and growth of barnacles, rockweed, and other typical compenents of the upper intertidal community on hard substrates in the region. Such settlement has been observed on the cobble at the toe of the previous cobble beach project. The surface cover of benthic algae may provide a food source for migrating juvenile fish. The fill material will be washed prior to project implementation to limit the amount of associated silt entering the estuary. The timing of the project itself is scheduled to be implemented within the Oregon Department of Fish and Wildlife's designated in-water work period for the Yaquina Bay estuary, even though there will actually be no "in-water" work done, as the gravel placement is scheduled to occur during low or ebb tides.

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Description of resources in project area

Ocean ☐ Estuary ☒ River ☐ Lake ☐ Stream ☐ Freshwater Wetland ☐

Describe the existing **physical and biological characteristics** of the wetland/waterway site by area and type of resource (Use separate sheets and photos, if necessary).

For wetlands, include, as applicable:

- *Cowardin and Hydrogeomorphic(HGM) wetland class(s)**
- *Dominant plant species by layer (herb, shrub, tree)**
- Whether the wetland is freshwater or tidal
- *Assessment of the functional attributes of the wetland to be impacted**
- Identify any vernal pools, bogs, fens, mature forested wetland, seasonal mudflats, or native wet prairies in or near the project area.)

For waterways, include a description of, as applicable:

- *Channel and bank conditions**
- *Type and condition of riparian vegetation**
- *Channel morphology (i.e., structure and shape)**
- *Stream substrate**
- Fish and wildlife (type, abundance, period of use, significance of site)
- *General hydrological conditions (e.g. stream flow, seasonal fluctuations)**

Please see the attached document on functions and values for the site (attachment 3). The project site is located on the shoreline of the Hatfield Marine Science Center campus of Oregon State University in Yaquina Bay. Yaquina Bay is a 4300 acre, drowned river mouth estuary located on Oregon's central coast. The "land" on which the HMSC campus stands today was created from dredge spoil deposited to the site over a period of years during the mid 20th century. The area of the proposed shoreline stabilization treatment is classified under the Cowardin system as Estuarine - Intertidal - Unconsolidated Shore (Sand). The area below the high water line is Regularly Flooded and designated in the National Wetlands Inventory as type E2USN. The project shoreline in large part consists of sedimentary material eroded from the dredge spoil deposits. Due to recently accelerated erosion, chunks of peat like material formed of root mats and sediment from the dune plant community has been deposited on the shore face. The composition of intertidal sediments in the project area is >91% sand. There is no marsh vegetation below the high water line within the project area. A dune type vegetational community is present above the erosional scarp bordering the shoreline, occuring at an elevation >9.5 ft above MLLW. There are no seagrass or green macroalgal beds within the proposed project area, nor are such beds present in the immediately adjacent sand flat area. Dominated by wave-washed and windblown sand, the site has a low density population of estuarine talitrid amphipods along the supra-littoral fringe of the beach. The adjacent sand flat habitat is predominantly beds of the burrowing shrimp Neotrypaea californiensis.

*Describe the existing **navigation, fishing and recreational** use of the waterway or wetland.**

This project seeks to restore one of the principal uses of the site, which has served as a conduit for estuarine study, discovery and recreation for the general public for many years. The Hatfield Marine Science Center is a federally designated Coastal Ecosystem Learning Center; the estuary trail has provided access for a wide variety of users, including K-12 school groups, college students, birdwatchers, and until recently the physically challenged, who were able to take wheelchairs onto the paved trail. People also use this area to access mudflats further offshore (exposed during low tides) for research, educational and recreational activities. In keeping with our mission of research, education and outreach through collaborative partnerships, we will highlight the environmentally friendly "dynamic revetment" as an alternative to riprap and other armoring approaches to erosion control in our outreach activities through the HMSC Visitor Center, including on our established "Estuary Walk" tours and through signage as approriate.

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Site Restoration/Rehabilitation

- *For temporary disturbance of soils and/or vegetation in waterways, wetlands or riparian areas, please discuss how you will restore the site after construction including any monitoring, if necessary**

The project as proposed will result in restoration of the beach to a profile similar to that prior to erosion, and the area will be monitored for changes. Once deposited on the beach, a certain amount of movement of the smaller rounded gravel can be expected, as seasonal fluctuations in the natural morphology of the estuary shape the beachface over time. However, the density and weight of the rocks will provide much greater resistance to wave action than the unconsolidated sediments and sand that would otherwise continue to erode away from the shoreline.

Mitigation

*Describe the reasonably expected adverse effects of the development of this project and how the effects will be mitigated.**

- *For permanent impact to wetlands, complete and attach a Compensatory Wetland Mitigation (CWM) Plan. (See OAR 141-085-0705 for plan requirements)**
- *For permanent impact to waters other than wetlands, complete and attach a Compensatory Mitigation (CM) plan (See OAR 141-085-0765 for plan requirements)**
- *For permanent impact to estuarine wetlands, you must submit a CWM plan.**

Please see attachment 3.

Mitigation Location Information (Fill out only when mitigation is proposed or required)

Proposed mitigation (Check all that apply):

- ☐ *Onsite Mitigation*
- ☐ *Offsite Mitigation*
- ☐ *Mitigation Bank*
- ☐ *Payment to Provide*

Type of mitigation:

- ☐ *Wetland Mitigation*
- ☐ *Mitigation for impacts to other waters*
- ☐ *Mitigation for impacts to navigation, fishing, or recreation*

Street, Road or Other Descriptive Location	*Legal Description (attach tax lot map*)*			
	Quarter/Quarter	*Section*	*Township*	*Range*

In or near (City or Town)	*County*	*Tax Map #*	*Tax Lot #*[3]
Wetland/Waterway (pick one)	*River Mile (if known)*	*Latitude (in DD.DDDD format)*	*Longitude (in DD.DDDD format)*
Name of waterway/watershed/HUC		*Name of mitigation bank (if applicable)*	

[3] Attach a copy of all tax maps with the project area highlighted.

- ***Italicized areas are not required by the Corps for a complete application, but may be necessary prior to final permit decision by the Corps.***

(6) ADDITIONAL INFORMATION

Adjoining Property Owners and Their Address and Phone Numbers *(if more than 5, attach printed labels*)*

Port of Newport
600 SE Bay Blvd.
Newport, OR 97365
541-265-7758

Has the proposed activity or any related activity received the attention of the Corps of Engineers or the Department of State Lands in the past, e.g., wetland delineation, violation, permit, lease request, etc.?

Yes ☒ No ☐

If yes, what identification number(s) were assigned by the respective agencies:

Corps #		State of Oregon #	

Has a wetland delineation been completed for this site? *Yes* ☐ *No* ☒

*If yes by whom?**	

Has the wetland delineation been approved by DSL or the COE? *Yes* ☐ *No* ☐
*If yes, attach a concurrence letter. **

- ***Italicized areas are not required by the Corps for a complete application, but may be necessary prior to final permit decision by the Corps.***

(7) CITY/COUNTY PLANNING DEPARTMENT AFFIDAVIT
*(TO BE COMPLETED BY LOCAL PLANNING OFFICIAL) **

I have reviewed the project outlined in this application and have determined that:

- ☐ This project is not regulated by the comprehensive plan and land use regulations.
- ☑ This project is consistent with the comprehensive plan and land use regulations.
- ☐ This project will be consistent with the comprehensive plan and land use regulations when the following local approval(s) are obtained.
  - ☐ Conditional Use Approval
  - ☐ Development Permit
  - ☐ Other

This project is not consistent with the comprehensive plan. Consistency requires a

- ☐ Plan Amendment
- ☐ Zone Change
- ☐ Other

An application has ☐ has not ☐ been filed for local approvals checked above.

Local planning official name (print)	Signature	Title	City / County	Date
DERRICK TOKOS		COMMUNITY DEVELOPMENT DIRECTOR	NEWPORT	9/29/10

Comments:

SUBJECT TO CONDITIONS OF CITY CONDITIONAL USE PERMIT (SEE ATTACHED)

(8) COASTAL ZONE CERTIFICATION *

If the proposed activity described in your permit application is within the Oregon coastal zone, the following certification is required before your application can be processed. A public notice will be issued with the certification statement, which will be forwarded to the Oregon Department of Land Conservation and Development for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program, contact the department at 635 Capitol Street NE, Suite 150, Salem, Oregon 97301 or call 503-373-0050.

CERTIFICATION STATEMENT

I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

Print /Type Name	Title
Applicant Signature	Date 9/24/10

- ***Italicized areas are not required by the Corps for a complete application, but may be necessary prior to final permit decision by the Corps.***

(9) SIGNATURES FOR JOINT APPLICATION

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and, to the best of my knowledge and belief, this information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities. By signing this application I consent to allow Corps or Dept. of State Lands staff to enter into the above-described property to inspect the project location and to determine compliance with an authorization, if granted. I hereby authorize the person identified in the authorized agent block below to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirement of obtaining the permits requested before commencing the project. *I understand that payment of the required state processing fee does not guarantee permit issuance. The fee for the state application must accompany the application for completeness.*

Amount enclosed	*$*

Print /Type Name	Title	Print /Type Name	Title
George Boehlert	Director, Hatfield Marine Science Center		
Applicant Signature	Date	**Authorized Agent Signature**	Date
George Boehlert	9/28/10		

Landowner signatures: *For projects and /or mitigation work proposed on land not owned by the applicant, including state-owned submerged and submersible lands, please provide signatures below. A signature by the Department of State Lands for activities proposed on state-owned submerged/submersible lands only grants the applicant consent to apply for authorization to conduct removal/fill activities on such lands. This signature for activities on state-owned submerged and submersible lands grants no other authority, express or implied.*

Print /Type Name	Title	Print /Type Name	Title
Don Mann	General Manager, Port of Newport		
Property Owner Signature	Date	***Mitigation Property Owner Signature***	Date
Don Mann	9.28.10		

- ***Italicized areas are not required by the Corps for a complete application, but may be necessary prior to final permit decision by the Corps.***

Attachments and Figures for JPA 45455-FP/NWP-2010-401

Attachment 1: Project Summary
Attachment 2: Alternatives Analysis
Attachment 3: Functions and Values Assessment (Mitigation Issues)
Attachment 4: City of Newport Conditional Use Permit
Figure 1a and 1b: Lincoln County Tax maps
Figure 2a and 2b: Aerial site maps with plan drawing
Figure 3: Transect location
Figure 4a-g: Cross-sectional beach profiles

HMSC Erosion Control Project (2010)
Project Summary

Overview

The Hatfield Marine Science Center (HMSC) in Newport, Oregon, a Coastal America designated Coastal Ecosystem Learning Center, proposes to implement an erosion control project in winter 2010-2011 with the assistance of the Oregon Army National Guard Innovative Readiness Training (IRT) program. Stabilization of the Yaquina Bay shoreline along the northeastern edge of the Hatfield Marine Science Center (HMSC) campus is necessary to halt erosion that threatens both HMSC critical infrastructure and public access to the HMSC estuary trail. An environmentally-friendly 'soft' solution is proposed to proactively halt advancing erosion that may later require stabilization with riprap to protect infrastructure, and as an opportunity to engage in mission-related outreach efforts on the adjacent estuary trail on appropriate alternatives to armoring the shoreline.

Background

During late 2006, erosion forced closure of the HMSC public estuary trail. Consultation with a coastal geomorphologist from the Oregon Department of Geology and Mineral Industries led to implementation of an erosion control project using a gravel beach or "dynamic revetment" as a solution that would best maintain the natural and aesthetic values of the shoreline area (attachment 2). The project was completed in March 2007 with the assistance of the Oregon Army National Guard IRT program and resulted in the stabilization of approximately 200 linear feet of shoreline. That shoreline has remained stable since project implementation. Erosion had been occurring at a lower rate to the south of the project area, but in the winter of 2009-2010, weather conditions resulted in rapid erosion of up to 13 ft along approximately 500 linear ft of shoreline. This erosion has moved the shoreline to the edge of the nature trail in one location, and to within only 25 ft of portions of the seawater system infrastructure for HMSC. The seawater system supports the research of Oregon State University and the six federal and state agency programs co-located on site. The threat to critical public infrastructure requires an additional erosion control effort that will again utilize the gravel shoreline technique.

Project Implementation

The proposed project will involve placement of approximately 550 yds^3 of river rock, consisting of 400 yds^3 of small rounded gravel and 150 yds^3 of cobble, along the eroding shoreline. Following the design of the 2007 stabilization effort, the project will move the current, eroded shore profile seaward by approximately 8 ft. Local river rock will be delivered to the HMSC from Devil's Lake Rock Co. in Lincoln City, OR. Rock will be held in a staging area, washed and then placed on the shoreline using small bulldozers. Gravel will be placed on the exposed shore face at low tide during approximately a one-week period during November 2010 - February 2011. Although the work is solely intertidal, this period is the in-water work window as defined by the Oregon Department of Natural Resources.

Maintenance

A dynamic revetment is specifically designed to be dynamic, and gravel is expected to absorb wave energy by being lifted and moved short distances, while remaining in the

general area of the beach. Some loss of material is expected, and this loss can be accelerated during winter storms. It will therefore be necessary to maintain the revetment by replenishing rock as needed. We request, as part of this permit, permission to maintain the site by replenishing up to 40 cubic yards of gravel per year. The dynamic revetment is expected to need maintenance when exposed to winter storms that are the most erosive, yet unlike a static solution like riprap, it should prevent the accelerated erosion in currently stable adjacent areas that is often caused by riprap.

Permits

The current comprehensive management plan allows the use of the gravel beach for erosion control along this shoreline. A conditional use permit from the City of Newport has been obtained. Other than this joint permit from Oregon Department of State Lands and the US Army Corps of Engineers, no other permits are required.

Attachment 2

Oregon
Theodore Kulongoski, Governor

Department of Geology and Mineral Industries
Coastal Field Office
P.O. Box 1033
Newport, OR 97365
(541) 574-6658
FAX (541) 265-5241

Mr. Ken Hall,
Program Manager
Hatfield Marine Science Center
2030 SE Marine Science Drive
Newport, OR 97365-5296

28 August 2006

Dear Ken,

Re: HMSC erosion and options for mitigations

On 26 February 2006 I attended a meeting at the Hatfield Marine Science Center to discuss an erosion issue occurring along its northeastern shore, east of the HMSC wharf and groin and adjacent to the HMSC Estuary trail (Figure 1). The HMSC Estuary trail was constructed in 1988 and is unique to Newport since it provides the only trail for exploring the Yaquina Bay estuary from its banks, as well as being one of the longer accessible trails in the area for those with disabilities (Parametrix, 2005). Since the late 1990s/early 2000 the trail has experienced erosion from a combination of oceanographic processes including high frequency wind waves coupled with high tides and tidal currents associated with both the ebb and flood tide. The erosion eventually led to the closure of part of the trail in 2005. The general purpose of this scoping meeting was to introduce and discuss the erosion problem, discuss the processes that may be contributing to the erosion, examine various engineered solutions suitable for erosion remediation, and discuss the various information needs for addressing any permitting requirement. During the meeting, staff from HMSC observed that besides their concern over losing the Estuary trail, there are also concerns that the erosion may in time begin to impact a saltwater storage tank (Figure 1) located adjacent to the trail and eroding shore. This storage tank contains seawater that is used to maintain the aquarium tanks and research labs located throughout the HMSC complex.

This letter provides background follow-up material that supports the decision by HMSC staff to adopt a "dynamic revetment" or "cobble berm" as the preferred solution for erosion remediation at HMSC. The author undertook several site visits to the site in an effort to understand the processes affecting the beach under a range of conditions. Furthermore, one of these field visits involved the use of a Trimble 5700/5800 Real-Time Kinematic Differential Global Positioning System (RTK-DGPS) to measure the overall topography of the beach and backshore adjacent to the Estuary trail, the cross-shore profile morphology and the existing sediment volume.

Documented Historical Changes:

HMSC was established in 1965 as a major research center operated by Oregon State University. The complex is built on reclaimed land constructed using fine-grained dredge spoil derived from within Yaquina Bay. The complex includes a private wharf, which extends from a groin constructed on the north side of the property (Figure 1). Immediately adjacent to the HMSC groin, is approximately 160 ft of riprap (designated as a black dashed line in Figure 1).

The area of immediate concern extends an additional 160 ft southeast of the riprap towards an inflexion in the shore, beyond which the shore is orientated north/south. While it is apparent that this latter area of the bay is also undergoing retreat of its shoreline, the problem is not as critical as the beach erosion adjacent to the riprap revetment. There, the erosion has been sufficiently significant that it caused part of the nature trail to be undermined, resulting in its eventual closure in 2005.

According to a study by Parametrix (2005), an analysis of infrared aerial photographs revealed that the area did experience some erosion between 1997 and 2000. Unfortunately, the Parametrix study did not undertake any analysis of shoreline change prior to 1997 so there is no long-term information concerning the response of the bayshore since the construction of HMSC complex in 1965. Such information is useful since it may have shed some light on the factors driving the erosion of the shore.

Figure 1: Location map of the HMSC complex, wharf and eroding shore

In 2001, staff from HMSC placed approximately 50 cubic yards of relatively small to moderately-sized riprap along an approximately 50 – 60 ft length of the eroding trail at the end of the groin-related riprap (Parametrix, 2005). The riprap was subsequently backfilled with sand and planted with American dune grass to further stabilize the backshore. Within 1 to 2 years following placement, the stacked riprap had fallen apart and toppled over, and the vegetation was washed away. Currently the rock is scattered along the shoreline area adjacent to where it was originally stacked, however, none of the riprap has been moved any substantial distance offshore. This is not surprising since the riprap is effectively comprised

of small angular boulders and require high velocity thresholds to mobilize them. As a result, these particles will preferentially remain on the subaerial portion of the beach (i.e. they will not be transported offshore). Unfortunately there is no information on how the riprap was constructed that may shed some light on why it failed. It is likely that the structure was never constructed properly in the first place so that it was undermined at its toe, a response that is fairly common with poorly constructed revetements.

During September 2004, approximately 35 cubic yards of sand was placed along the eroding trail area directly southeast of the 2001 riprapped area in an attempt to nourish the eroding beach (Parametrix, 2005). The sand was brought by dump truck into a nearby parking area, and subsequently moved and placed along the shoreline using a tractor. According to HMSC staff, the sand was gone within one week following the first high tide cycle subsequent to placement.

Processes Driving Beach Erosion at HMSC:

There are a variety of processes that may directly have a bearing on the response of the beach at HMSC. These include the development of high-frequency wind waves that develop across the bay, boat wakes, high tides, and currents generated both by the flood and ebb tide.

Having visited the site under a variety of prevailing wind conditions it is apparent that the shore is particularly susceptible to wind waves that arrive from the northwest, north, and from the east (I have not examined wind conditions at the site that may develop during the winter (e.g. from the south)). Under these conditions, waves on the order of 0.5 – 2 ft in height may form. While the heights of the waves may seem small, these waves are typically characterized by high-frequencies (typical periods range from ~1-3 seconds). The significance of this is that the waves have short wavelengths and are steep natured (ratio of height to wave length), which makes them highly erosional at the shore (Allan and Kirk, 2000). Furthermore, under these prevailing wind conditions the waves are typically arriving oblique to the shore, which results in the development of alongshore currents that are capable of transporting sand away from the site. Thus waves are probably the main process eroding and entraining the sediment at the beach, while the alongshore currents in conjunction with tidal currents generated by both the flood and ebb tide are contributing to the direct removal of the sediment from the shore and its placement elsewhere. It is also worth mentioning the importance of the rise and fall of the tide as another factor contributing to the erosion of the shore, since the elevation of the tide determines where the waves are able to reach on the beach profile.

The other major process that may also be contributing to the beach erosion is the arrival of boat wakes that form due to the passage of vessels close to the shore. Given the proximity of the site relative to the main channel in Yaquina Bay and the high recreational use of the area, the role of boat wakes is likely to be significant. This is particularly the case if the vessel passing the shore is large and is therefore capable of generating bigger waves. Depending on the size and shape of the vessels hull and the speed of boat travel, waves generated by larger vessels are generally characterized by longer frequencies. As a result, these latter waves can therefore contain significant energy and have been shown elsewhere in the world (e.g. in the Marlborough Sounds of New Zealand, Puget Sound) as having the capacity to cause significant erosion to beaches and the backshore.

For the purposes of this work, no attempt has been made to quantify the waves or even to model their characteristics. Furthermore, no effort has been taken to quantify currents that may be produced by the waves or the tide.

Options for Erosion Mitigation:

There are several options for dealing with the erosion of beaches and shorelines. These range from the do-nothing approach to relocation and retreat and ultimately an engineered solution.

The simplest solution is to do nothing and allow nature to take its course. However, it was recognized early on that this approach was simply not viable since the existing erosion problem has already destroyed a portion of the Estuary trail, while future beach erosion will probably begin to affect the viability of the HMSC saltwater storage tank and its saltwater return drainage ditch. As a result, there was consensus among those attending the meeting that this was not a feasible option. Another erosion remediation approach is to relocate the affected infrastructure. While this is feasible to some extent with the Estuary trail, it is not a viable option for the Saltwater storage tank. Consequently, the most practical solution is to undertake some form of engineered approach.

Engineered solutions typically involve either a "soft" approach, primarily beach renourishment to "hard" engineering that include the construction of groins, sea walls, or riprap revetments. In discussing these various options with HMSC staff, the decision was made at an early stage to avoid "hard" engineering due to concerns over the potential physical and aesthetic impact such a structure would have on the surrounding area. Consequently, existing efforts have been directed at examining the potential of some form beach nourishment at HMSC. Nevertheless, it is important to stress that all forms of beach nourishment involve some form of ongoing monitoring to document the effectiveness of the placed material, the overall response of the beach over time, and in particular to identify subsequent maintenance "top-ups" that may be necessary to maintain or supplement the design beach volume. Thus, it is important to appreciate that beach renourishment will typically involve some form of periodic maintenance top-up in order to sustain the integrity of the designed beach.

From an engineering standpoint, the most common approach used to nourish a beach is to place sediment that is typically coarser than the existing sediment present on the beach. The logic here is that particles that are coarser than the existing sediment population are more likely to remain on the beach, compared with particles that are comparable in size to the existing grain-size, which are already being eroded. Since the sediment at HMSC is essentially fine to medium sand, this would mean that any 'effective' nourishment should involve the use of particles in the coarse sand to gravel size range (note: the term gravel is generic and includes those particles that range in size from pebbles to cobbles). Previous attempts to nourish the beach at HMSC involved a small amount of sand. However, as described above ongoing erosion of the shore following its placement resulted in the loss of the entire volume of sand placed on the beach. While the amount of sand placed there was extremely small (i.e. ~35 cubic yards), the response shown by the beach indicate that under the right conditions (i.e. high frequency wind waves coupled with high tides) the sand is capable of being removed relatively quickly. Thus, even utilizing much larger volumes of sand would inevitably result in its removal and redistribution elsewhere and the need for periodic top-ups of the sand beach volume. To avoid having to regularly repeat this process, it is recommended that nourishment of the beach at HMSC involve the use of gravels.

Dynamic Revetments and Gravel Beaches:

Gravel beaches have long been recognized as an effective form of natural coastal protection, minimizing the potential for inundation from wave overtopping as well as exhibiting a remarkable degree of stability in the face of sustained wave attack (Allan et al., in press; Nicholls and Webber, 1988; van Hijum, 1974). The reason for this is due to their high threshold of motion and because of the asymmetry (shape) of shoaling waves and swash velocities on the beach face, which results in a greater propensity for onshore particle movement compared with sand-size particles, forming a steeply sloping beach face. Once formed, the porous gravel beach is able to disrupt and dissipate the incident-wave energy, even during intense storms. As a result of these characteristics, artificially constructed gravel beaches have been suggested as a viable approach for protection from coastal erosion, variously termed "cobble berms" or

"dynamic revetments" when used in such applications (Ahrens, 1990). Once formed, the gravel beach is considered to be dynamic in that the gravels may be moved about by waves and currents, adopting a morphology that will reflect those assailing forces.

There are numerous examples in the coastal literature that involve the nourishment of beaches with gravels (most of these reflect studies undertaken in the United Kingdom). In contrast, there are fewer examples of actual dynamic revetments. The main difference between gravel beach renourishment and a dynamic revetment is that the latter involves some form of design aspect. This typically reflects identifying various morphological characteristics such as the design beach slope, crest elevation, grain-size, and volume. In reality, the difference between a beach renourishment project and a dynamic revetment is minor. The construction of the dynamic revetment is relatively simply in that once the general design characteristics of the structure has been established, the gravel particles can be simply dumped en masse on the beach and graded to an appropriate height and slope. Beyond that, it is simply up to nature to modify the shape of the gravel beach.

On the Oregon coast, there is only one example of an actual dynamic revetment, which was constructed at Cape Lookout State Park in December 2000 to provide protection to the park from coastal erosion and inundation. To date, this structure has survived numerous storms including several major events in which the structure was overtopped. So far it has withstood all of these with only minimal damage (confined mainly to the artificial dune that backs the dynamic revetment).

Design Characteristics for a Dynamic Revetment at HMSC:
Determination of the design characteristics for a dynamic revetment at HMSC has been based primarily on an analysis of the GPS survey of the beach, analysis of the tides in the bay, and an understanding of the grain-size characteristics observed on natural gravel beaches present on the Oregon coast.

Analysis of the monthly extreme tidal elevations for the period 1967 to 2006 reveal that the highest tide measured at the South Beach (#9435380) tide gauge reached 3.734 m relative to the Mean Low Low Water (MLLW) datum. An extreme value analysis of all available monthly extremes reveals that the 1-year extreme water level is 3.3 m, the 2-year extreme water level is 3.38 m, the 5-year event is 3.48 m, the 10-year event is 3.55 m, the 25-year is 3.64 m, while the 100-year elevation is 3.76 m. To determine the elevation of the shore, I undertook a GPS survey of the beach and backshore. This was accomplished on 18 May, 2006. Survey control was provided by several high accuracy GPS survey monuments. Errors associated with the static portion of the survey was ~1-2 centimeters. Based on the survey, two additional monuments were installed and their location is provided in Figure 1; pk-shore located on the footpath at the western end of the erosion hotspot has an elevation of 3.09 m, while pk-river located on the footpath near the main parking lot has an elevation of 3.49 m. In general, the elevation of the backshore adjacent to the footpath was ~3.0 m decreasing to ~2.8 m at the eastern end of the zone of erosion hotspot (Figure 2); the yellow line shown in Figure 2 identifies the boundary between the beach and backshore and has an elevation of 2.8 m. Based on the above extreme tide analysis, it therefore comes as no surprise that the backshore is frequently being flooded by high tides (essentially every year), which is likely contributing to the erosion of the beach. Field evidence for this inundation, characterized by the accumulation of flotsam debris landward of the beach, provides physical support for the extreme tide modeling provided above.

Based on the above analysis, it is recommended that a design crest elevation of 3.6 m be adopted at HMSC. Accordingly, if feasible the crest of the gravel berm should be constructed to an elevation of 3.6 m above MLLW along the full length of the problem area. This would effectively eliminate flooding in this area for almost all major events up through the 10-20 year recurrence interval. Nevertheless, it is also important to be aware that this elevation reflects only the tidal elevation and does not include the height of any wind waves that may be superimposed on top of the tide. Such analysis is beyond the scope of this

initial effort. Having said this, it is anticipated that adopting the above design crest elevation should provide significant protection to the backshore. If this elevation is deemed to be too high, then an alternative approach involving the construction of an artificial dune landward of the gravel berm would provide the same level of protection during high tides. Such an effort could be accomplished at a later date as a phase 2. This would be my recommendation.

In terms of an appropriate grain-size, I would recommend adopting a grain-size on the order of 64 mm in size across the particles intermediate (middle) axis. This equates to approximately a 1 to 2 inch size river gravel. This recommendation is based on my previous work that examined the predominant grain-size present on Oregon's beaches (Allan et al., 2005). Furthermore, use of river gravel (as opposed to angular crushed gravel) will be aesthetically pleasing and will eventually provide a suitable environment for future recreational activities. I would also recommend placing a much coarser layer of cobble size material lower down on the profile as toe protection. These latter gravels would be much harder to mobilize and would provide significant protection and support to the gravel beach.

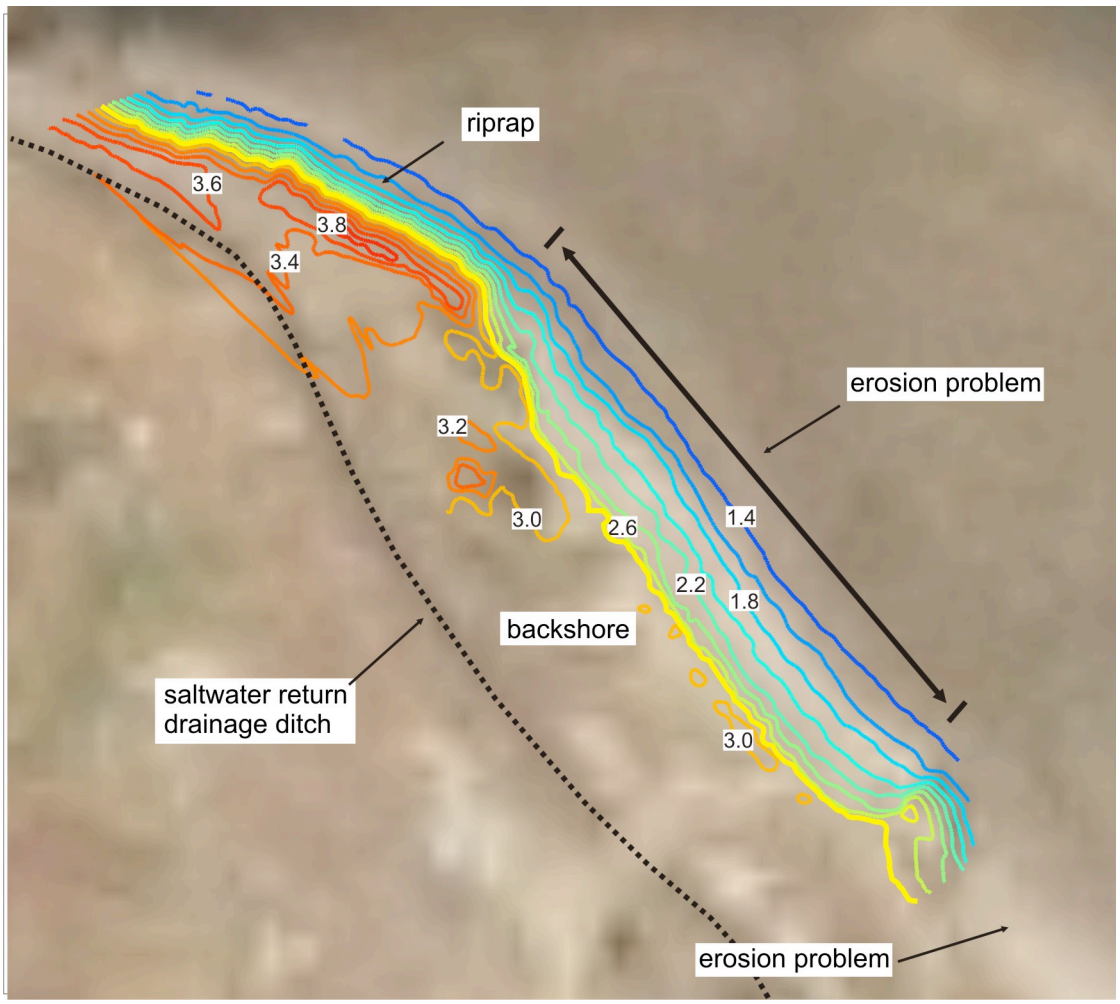

Figure 2: Contour map of eroding shore and riprap revetment. Note: the yellow line identifies the boundary between the beach crest and the backshore and is located at an elevation of 2.8 m above MLLW.

In order to identify the volume of gravel required to nourish the beach in the most critical area (i.e. east of the riprap), cross-sections were derived of the existing beach profiles (Figure 3). As indicated in Figure 3, the crest of the beach is located at an elevation of ~3.0 m, 0.3 m below the annual extreme tidal elevation of 3.3 m. The existing beach volume was assessed at approximately 11.3 m^3 per linear meter of beach. The design profile reflects pushing the existing beach profile approximately 2.5 m towards the bay, increasing the overall beach volume by approximately 4.8 m^3 per linear meter of beach. The total volume of new material would therefore be 240 m^3 (~300 $yards^3$), and is based on a total shore length of 50 m. As noted earlier, I would also recommend using cobble size gravel to provide additional toe protection to the beach (Figure 3). Based on the above gravel volume, the amount of cobble size material could be about 1/3 of the total volume or 100 $yards^3$. Ideally, these gravels should be placed low down on the beach profile, below the 1.0 m elevation on the profile as shown in Figure 3.

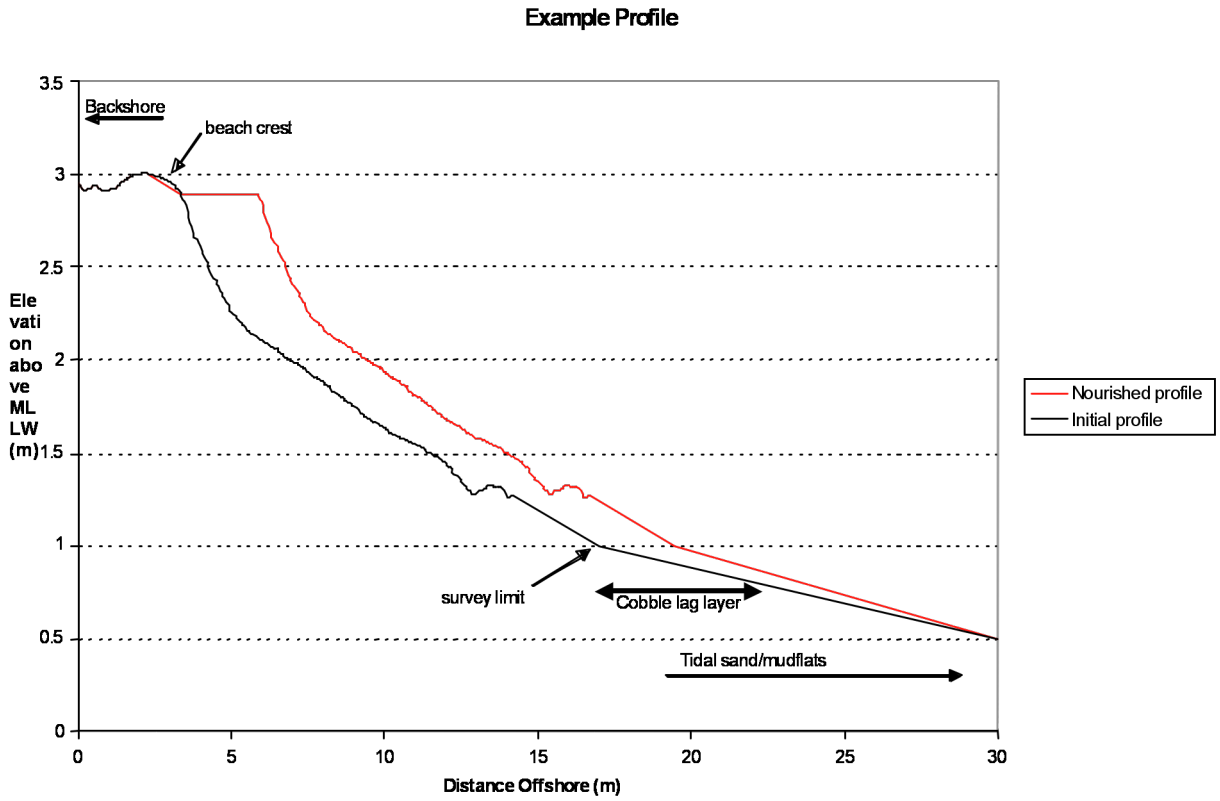

Figure 3: A comparison plot of the existing beach profile at HMSC versus the design profile. Note: due to the coarse nature of the gravel proposed for beach nourishment at HMSC, the actual profile shape will probably be steeper than what is shown in the figure.

The volume estimates provided above does not account for the added need to raise the beach crest elevation by 0.6 m. As noted earlier, this can be accomplished in a several ways. First, it could be undertaken at a later date as phase 2 and would involve the construction of an artificial dune perched on top of the backshore. Second, additional gravels could be obtained during the gravel beach construction phase (i.e. increase the gravel volume required in phase 1) and poured near the backshore/beach junction to create a perched gravel berm. Third, some portion of the gravel obtained for phase 1, be placed on the backshore in an effort to raise the crest of the beach. Fourth, the height limitation could be accepted as it is and the issue of periodic flooding

being simply accepted as a nuisance factor. This last option is a decision that needs to be made by HMSC staff.

In terms of the two gravel options, I would avoid using gravel planned for the beach building phase to beef up the backshore as this reduces the overall volume of the beach thereby increasing the potential for the beach to be eroded. The second option is a possibility. However, with this option some effort would be required to figure out the volume and size of gravel necessary. Furthermore, because the gravel is porous it is possible that during high tides, seawater could seep through the gravel flooding the backshore area in behind. As a result, the preferred option is the design and construction of an artificial dune placed immediately behind the gravel beach and planted with native grasses and plants capable of tolerating a saline environment. Such a structure would provide significantly better protection to the backshore and if designed properly would effectively eliminate inundation through percolation. My advice would be to undertake the gravel beach nourishment phase first, monitor its response, and in year 2 begin phase 2, which would be the construction of an artificial dune.

Finally, given the somewhat experimental nature of this entire approach, I would advocate that some effort be directed towards monitoring the response of the gravel beach. This is important in order to understand the overall response of the nourished beach over time, to identify any problems that may occur, and to identify any future maintenance top-ups that may be necessary to simply maintain the gravel beach volume based on the existing design. Such an effort could be kept to a relatively simple level by undertaking a follow-up survey of the beach on at least a biannual basis (e.g. end of winter/end of summer) and/or after major events (e.g. storm and/or extreme high tide).

Should you have any questions, please don't hesitate to contact me.

Yours sincerely,

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Mitigation Issues
HMSC Shoreline Stabilization Project
Submitted by:
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U.S. Environmental Protection Agency
September 10, 2010

Site description

The project site is located on the shoreline of the Hatfield Marine Science Center campus of Oregon State University in Yaquina Bay. The project shoreline consists of land that was created from dredge spoil deposited to the site over a period of years during the mid 20th century. The area of the proposed shoreline stabilization treatment is classified under the Cowardin system as Estuarine - Intertidal - Unconsolidated Shore (Sand). The area below the high water line is Regularly Flooded and designated in the National Wetlands Inventory as type E2USN. The project shoreline in large part consists of sedimentary material eroded from the dredge spoil deposits. Due to recently accelerated erosion, chunks of peat like material formed of root mats and sediment from the dune plant community has been deposited on the shore face. The composition of intertidal sediments in the project area is >91% sand. There is no marsh vegetation below the high water line within the project area. A mixed high salt marsh and dune type vegetational community (Appendix 1) is present above the erosional scarp bordering the shoreline, occuring at an elevation >9.5 ft above MLLW. There are no seagrass or green macroalgal beds within the proposed project area, nor are such beds present in the immediately adjacent sand flat area. Dominated by wave-washed and windblown sand, the site has a low density population of estuarine talitrid amphipods along the supra-littoral fringe of the beach. The adjacent sand flat habitat, which occurs at a lower tidal elevation, is composed predominantly of beds of the burrowing shrimp *Neotrypaea californiensis* and associated benthic infauna.

Potential Impacts

Profile changes
The proposed project will not change the current elevational profile of the project area, rather it attempts to reproduce the existing elevational profile while moving the shoreline seaward by a design distance of approximately 6 ft (refer to project design profiles). Based on implementation experience from the previous dynamic revetment project, the actual layer of material deposited is significantly less than the theoretical design. Whether the design width is obtained or not, the vertical elevations are not modified. Thus, there should be no change in the frequency of inundation at any elevation in the project area, including the high marsh habitat.

Shoreline type
The specific shoreline type (steep slope, intertidal sand) is not common within the Yaquina estuary, and its presence in the current project location is the result of artificial deposition of dredge spoil. In an unaltered system, this shoreline type would tend to be present near the mouth of the estuary, where the outer coast sand beaches and dunes abut the estuary entrance. The entire area where HMSC and the South Beach M arina are located would have originally been

intertidal sand/mud flats with fringing marsh vegetation. There is some similar sand beach shoreline located opposite the parking lot of the HMSC Visitor Center, but it is also an artifact of spoil deposition, and persists only because it is protected on both sides by artificial, rip rap protected causeways.

Substrate Change

The proposed project will change the shoreline type from Estuarine - Intertidal - Unconsolidated Shore (Sand) to Estuarine - Intertidal - Unconsolidated Shore (Cobble). This change is within a Cowardin class, but does alter one of the characteristics of the system. A principle alteration is increased shoreline stability, which will have beneficial effects in terms of maintaining the remaining dune vegetation seaward of the HMSC nature trail (Figures 1,2) that is currently being rapidly eroded away. Following cobble installation on the previous project, sand has been trapped behind the cobble toe of the project, reestablishing the original substrate on top of the gravel base layer (Figure 3) . Approximately 20% of the cobble has been at least seasonally covered by sand, potentially allowing colonization by shallow dwelling, soft sediment organisms.

Figure 1. Dune shore interface of existing gravel/cobble beach (dynamic revetment) on HMSC Nature Trail. Note the absence of scarping at the interface, and the presence of sand amid the pebbles. Photo 9/9/10.

Impacts to Vegetation

The proposed project will not deposit any material within the salt marsh/dune vegetation zone. There are no nearby seagrass or algal beds to be affected by the gravel/cobble placement. Based on the previously permitted dynamic revetment project located adjacent to the current project area, there will likely be an increase in algae on the cobble toe of the project area as algae attach to the rocks.

There may be some mechanical impact to dune vegetation at the two ends of the project due to heavy equipment access to the intertidal slope where material will be placed. This impact should

be limited, and any tracks will be raked out and replanted, if necessary, with American dune grass obtained from a native plant nursery.

Figure 2. Beach dune interface in the proposed project area. Note severe scarping and erosion of salt marsh/dune vegetation and the presence of root mats on the shore. Photo 9/9/10.

Figure 3. Sand accumulation on top of gravel area behind the cobble toe of the previously installed dynamic revetment along HMSC Nature Trail. Photo 9/9/10.

Fish and Wildlife Habitat

Salmonids found in Yaquina Bay include coho (*Oncorhynchus kisutch*), chinook (*O. tshawytscha*), chum (*O. keta*), steelhead (*O. mykiss*), and cutthroat trout (*O. clarkii*). Of these, the coho is presently listed as "threatened" under the Endangered Species Act by the National Marine Fisheries Service. The adults of all of these species may be present in the estuary during their upstream spawning migration, but because the affected area is only intermittently available and is quite shallow it is highly improbable that the project will have any effect on adult salmonids. The intermittent availability of the habitat due to tidal exposure also minimizes that effect on juvenile salmon and migrating smolts. The area has no vegetation that would provide refuge from predators for these smaller fish, and so is likely to be avoided by them. The substrate at the very lowest margin of the project does provide potential food resources for small salmon in the form of amphipods like *Corophium* spp. and other small invertebrates, but the loss of food from the affected area is inconsequential when compared with that produced by the remainder of the estuary. The cobble substrate and attached algae will also provide habitat for epifaunal invertebrates, which may also provide replacement for any lost food value from the sand beach. (Section contributed by Dr. James Power, Fish Ecologist, U.S. EPA).

Because of the tidally exposed nature of the project area, potential food resources for birds are also very limited. Based on extensive quantitative observations (J. Lamberson, U.S. EPA, unpublished data, report in progress), shorebirds and gulls forage on the adjacent tidal sand flats, but do not typically use the intertidal shoreline in the project area (Figure 4). Gulls typically simply float on the water as the tide comes in. Bird use of the intertidal shore in the proposed project area is probably also limited due to the close proximity of the Nature Trail and associated human activity. Upland birds such as sparrows do forage in the dune vegetation, but should not be impacted in any way by the project since it will not affect their foraging habitat.

Figure 4. View of proposed project area shoreline showing gulls utilizing adjacent sand flat area. As the tide came in, the gulls remained in the same area, floating on the water rather than moving up slope to the beach. Photo 9/9/10.

The current sandy intertidal shore has a population of talitrid amphipods (beach hoppers), which are highly mobile and can move considerable distances to forage on vegetation brought in by the tides. The amphipods tend to be highly patchy, and qualitative observations have observed the amphipods in some but not in other large portions of the project area. Insects are commonly observed utilizing the wrack vegetation brought in by the tide, both along the sand and the current cobble beach areas. Inspection of the wrack line on 9/9/10 within the existing gravel/cobble beach area found numerous talitrid amphipods within the wrack. Sand does accumulate at the upper edge of the gravel/cobble beach, (Figure 1) and inspection of sand between pebbles immediately above the wrack line showed the presence of talitrid burrow holes. Thus the gravel/cobble beach is able to maintain this same ecological function found on the adjacent sand beach.

Habitat Species Diversity

Upper elevation levels of sand beaches typically have a low faunal diversity limited to semi-terrestrial marine invertebrates and terrestrial insects utilizing wrack vegetation as a food source (McLachlan and Erasmus, 1983). This is due to the extended periods of tidal exposure. Specialized species typical of the swash zone of open ocean sand beaches (e.g. mole crabs, *Emerita* spp.) do not occur on the estuarine sand beach because of the varying salinity conditions of the estuary. Species diversity on both sand and cobble beaches typically increases at lower tidal levels (McLachlan and Erasmus, 1983; Osman, 1977). Qualitative observation of the cobble toe in the existing project area indicates that the rock substrate becomes colonized by barnacles and numerous littorine snails (Figure 5), mussels (Figure 6), and *Fucus* (rockweed) and various green algae (Figure 7).

Figure 5. Barnacles and littorine snails using cobble as habitat in existing dynamic revetment area along HMSC Nature Trail. Photo 9/9/10.

Figure 6. Mussel attached to gravel within the cobble toe region of existing dynamic revetment area along HMSC Nature Trail. Photo 9/9/10.

Figure 7. Fucus and green algae on cobble in existing dynamic revetment area along HMSC Nature Trail. Photo 9/9/10.

Water Quality and Quantity

There should be no effects of the project on water quantity. Although washed rock will be purchased from a supplier, there is likely to be a short term (1 week) increase in turbidity in the immediate project area as remnant fine sediments are washed from the gravel fill material by tidal action. The project shoreline and adjacent sand flat area are highly dynamic sedimentary environments, and the duration of increased turbidty is spatially and temporally limited. Marine animals in the adjacent flats are adapted to a dynamic sediment habitat, and no signficant biological effects are anticipated from the small amount of additional sediments that may be deposited..

Recreation and Education

There are no anticipated negative impacts of the proposed project on recreation or educational opportunities. Instead, the project should help prevent the loss of such opportunities by helping

to preserve the exisiting HMSC Nature Trail, which is used extensively by the HMSC Visitor Center and USFWS for educational and outreach activities, as well as by the public. Recreational clamming or bait shrimping activities will not be impacted since these do not take place in the project area. Visitors to HMSC have been observed conducting bird watching, sun bathing and other recreational activities on the existing cobble beach area of the shoreline, so no impact is anticipated.

Mitigation Considerations

The proposed project will result in replacement of unconsolidated intertidal sand beach with an unconsolidated intertidal gravel/cobble beach, which is likely to accumulate some sand over time. Inspection of the shoreline of the Idaho Flat region of Yaquina Bay suggests that the intertidal, steep slope, sand beach does not appear to be a natural habitat within the portion of the Yaquina estuary in which it presently occurs, and is a result of previous conversion of sand flat to upland via deposition of dredge spoil. Local replacement of the sand beach habitat as mitigation would not appear to be a feasible option. Any habitat replacement option within the boundary of the HMSC campus would either bury emergent fringing marsh, or would necessitate removal of rip rap where the sand would be unlikely to persist due to strong erosional forces that led to rip rap placement in the first place. Similar limitations would be encountered within the larger estuary. The only other option is repeated beach nourishment with sand. This is never a long term solution since it may last only as long as the first storm, and comes with environmental issues of its own. The letter report by Jonathan Allan of DOGAMI (Allan, 2006) notes that beach nourishment is not a recommended option. In the present case, the logic of replacement with like sand beach habitat seems somewhat questionable given the fact that the habitat derives from a previous anthropogenic alteration of the environment.

We suggest that an acceptance of the substitution of the ecological functions of a gravel/cobble beach for those of the sand beach may be an acceptable option in the case of the current proposed project. The two beach types fall within the same Cowardin class. Biologically, there do not appear to be significant biological functions being lost from the substitution, given the limited biological diversity of the sand beach and its limited utilization by species of particular concern, i.e. birds or salmonids. The substitution of a beach with larger grain size is likely to result in stablization of the shoreline and preservation of the existing salt marsh/dune vegetation which is being rapidly lost to erosion, and this benefit should be considered. The dune - beach interface within the current gravel/cobble beach area is compared to that within the proposed project area in Figures 8.9. The images show that the gravel/cobble beach interface is stable and shows some accretion of sand, whereas the interface is the project area is highly unstable, with salt marsh/dune habitat being rapidly lost.

Figure 8. Salt marsh/dune interface and beach slope within existing dynamic revetment area along HMSC Nature Trail. Note the absence of scarping at the interface, and the presence of sand amid the pebbles at the top of the beach. Photo 9/9/10.

Figure 9. View of the shoreline in the proposed project area, showing loss of salt marsh/dune habitat, and illustrating alteration of the sand beach face due to large sod root mats being deposited on the shore face. Photo 9/9/10.

The gravel beach seasonally develops some sand cover, which partially reproduces the habitat type being lost, although the relative functionality of the habitat in the lower intertidal beach zone has not been assessed. Talitrid ampipod populations appear to have established at the upper margin of the gravel/cobble beach within sand trapped between the pebbles. The cobble and gravel substrate in the lower portion of the intertidal develops an epifaunal biological community which provides signficicant habitat functions. The existing gravel/cobble beach area has only

been in place for three years and presumably has not yet reached an equilibrium biological community. Typically, complex habitat such as cobble can provide shelter to a wide variety of hard substrate organisms. We suggest that the substitution results in preservation of generally equivalent ecological functions, while preserving additional ecological functions (salt marsh/dune) presently being lost.

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Appendix 1 – Vegetation composition of upland area adjacent to the project.

Vegetation Survey at the HMSC eastern shoreline

20 August 2010, Dr. C.N. Janousek, Pacific Coastal Ecology Branch, US EPA

Region surveyed: All shoreline habitat east of the paved trail from the NE corner of the water tank building southward to the middle of the main EPA facility.

SALT MARSH/WETLAND SPECIES

1. *Atriplex patula* – relatively common
2. *Rumex* sp(p.) – common
3. *Salix* sp. (willow) – one individual, ~8 ft tall
4. *Grindelia stricta* – common
5. *Juncus arcticus* var *balticus*
6. *Angelica lucida*
7. *Achillea millefolium*
8. *Symphyotrichum subspicatum* - rare
9. *Spergularia* sp(p)
10. *Carex obnupta* – a species typically found in fresher wetlands or high elevation estuarine habitat.

DUNE SPECIES

1. *Juncus lesueurii* – common in the southerly portion of the surveyed area
2. *Cakile* sp. - (sea rocket)
3. *Carex pansa* – common in two large patches, with the more southerly patch being larger in extent
4. *Elymus mollis* (American dune grass) – very common

UPLAND SPECIES/SPP of UNKNOWN HABITAT AFFINITY

1. Apiaceae, unknown species, present, but not common
2. *Lupinus* sp. (lupine) – rare
3. ? Coyote bush – 5 individuals noted
4. *Salix* sp. (willow) – 1 individual
5. *Rubus procerus* (Himalayan blackberry) – invasive; present, but not common; second species of *Rubus* may be present
6. Several species of unknown grasses
7. *Alnus rubra* (red alder) – 1 individual young tree, a few ft tall
8. Apiaceae, unknown species – present, but not common
9. *Picea sitchensis* (Sitka spruce) – 3 trees present (2 large)
10. *Trifolium* sp. (clover)
11. Scotch broom – invasive, nuisance species; 1 small plant observed
12. ? *Rumex acetosella* - invasive
13. Fabaceae, unknown species, (?*Menyanthes*) - common
14. shrub (?*Vaccinum*) – about 2 individuals observed

169 SW COAST HWY
NEWPORT, OREGON 97365

COAST GUARD CITY, USA

NEWPORT
OREGON

www.thecityofnewport.net

MOMBETSU, JAPAN, SISTER CITY

COMMUNITY DEVELOPMENT DEPARTMENT
(541) 574-0629
FAX: (541) 574-0644

NOTICE OF DECISION

August 10, 2010

The Newport Planning Commission, by final order signed August 9, 2010, has approved a request for a Conditional Use Permit as described herein:

FILE NO: # 6-CUP-10

APPLICANT: Oregon State University Hatfield Marine Science Center (Port of Newport, property owner)

REQUEST: Per Section 2-2-1.040 ("Water-Dependent and Water-Related Uses") of the Newport Zoning Ordinance (NZO) (No. 1308, as amended) in order to construct a cobble/pebble dynamic revetment along 500 lineal feet of the Yaquina Bay shoreline at the northeast edge of the Hatfield Marine Science Center located in a W-2/"Water-Related" zone.

PROPERTY LOCATION: Along the Yaquina Bay shoreline at the northeast edge of the HMSC campus, 2030 SE Marine Science Dr (Lincoln County Assessor's Tax Map 11-11-17, Tax Lot 104).

CONDITION(S):

1. Approval of this land use permit is based on the submitted written narrative and plans listed as Attachments to this report. No work shall occur under this permit other than that which is specified within these documents. It shall be the responsibility of the property owner to comply with these documents and the limitations of approval described herein.

2. The applicant shall obtain any required permits from the US Army Corps of Engineers and Department of State Lands prior to initiating construction activities.

THIS DECISION MAY BE APPEALED TO THE NEWPORT CITY COUNCIL WITHIN 15 CALENDAR DAYS (August 24, 2010) OF THE DATE THE FINAL ORDER WAS SIGNED. Contact the Community Development (Planning) Department, Newport City Hall, 169 SW Coast Hwy, Newport, Oregon 97365 (541/574-0629) for information on appeal procedures. A person may

EST. 1882

appeal a decision of the Planning Commission to the City Council if the person appeared before the Planning Commission either orally or in writing.

Sincerely,

Wanda Haney

Wanda Haney
Senior Administrative Assistant

Enclosures

cc: OSU HMSC (applicant)
Port of Newport (property owner)
Elwin Hargis, Building Official *(letter only via email)*
Victor Mettle, Planner/Code Administrator *(letter only via email)*
Meredith Savage, Senior Planner *(letter only via email)*

Figure 1a. Lincoln County Tax Lot Maps.

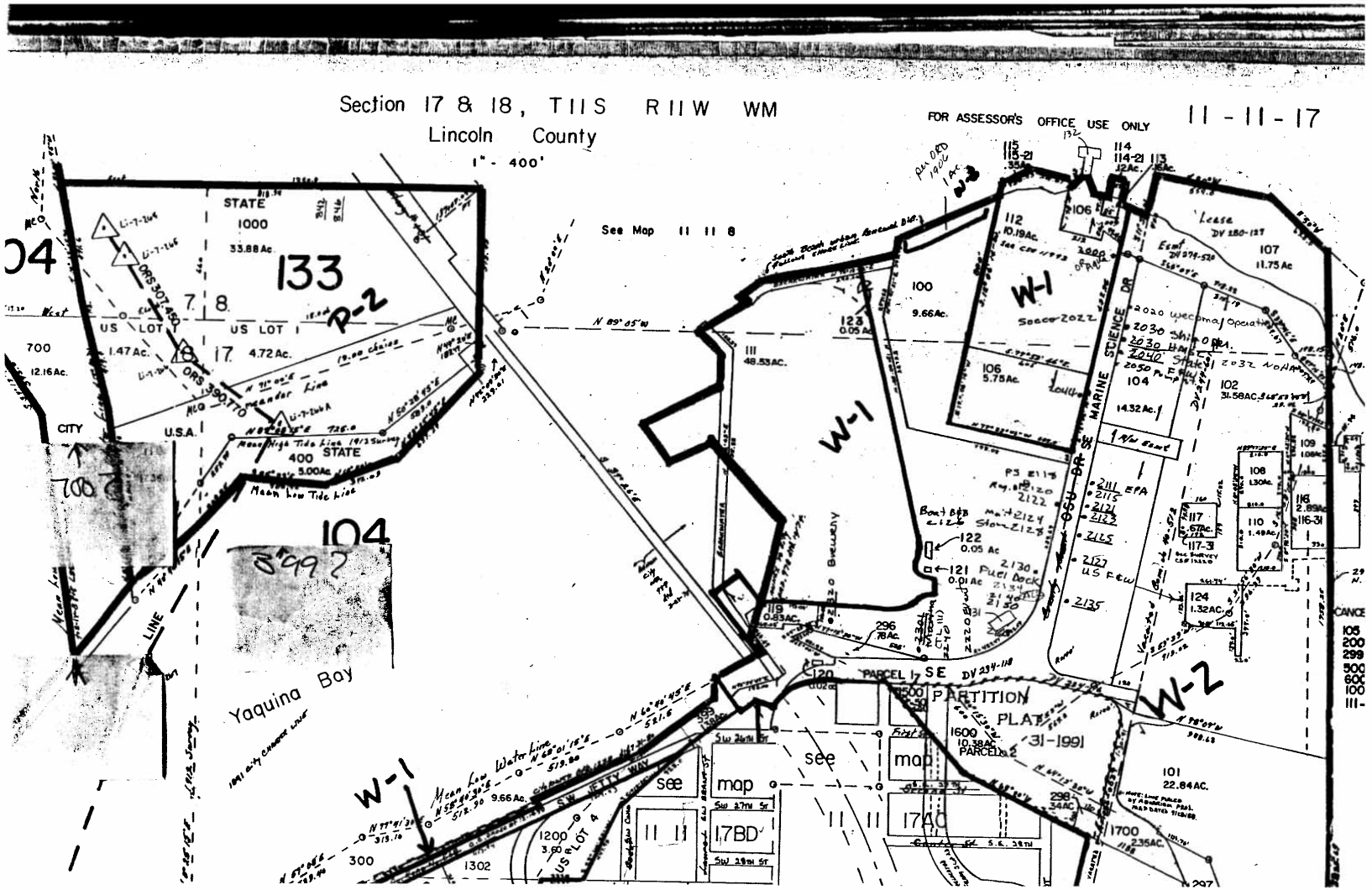

Figure 1b. Lincoln County Tax Lot Maps.

Figure 2a. Aerial view of Hatfield Marine Science Center campus.

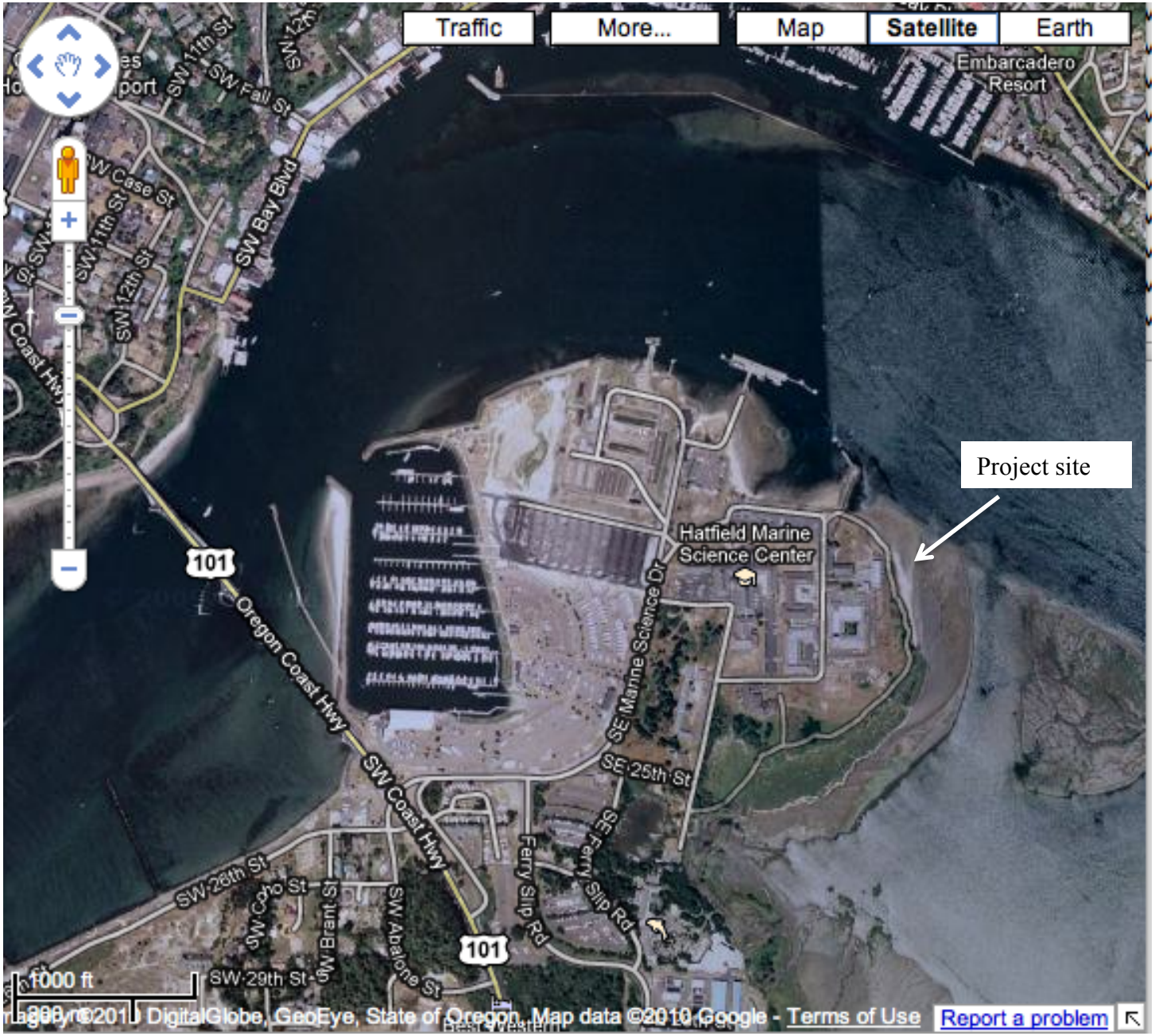

Figure 2b. Aerial view of project site.

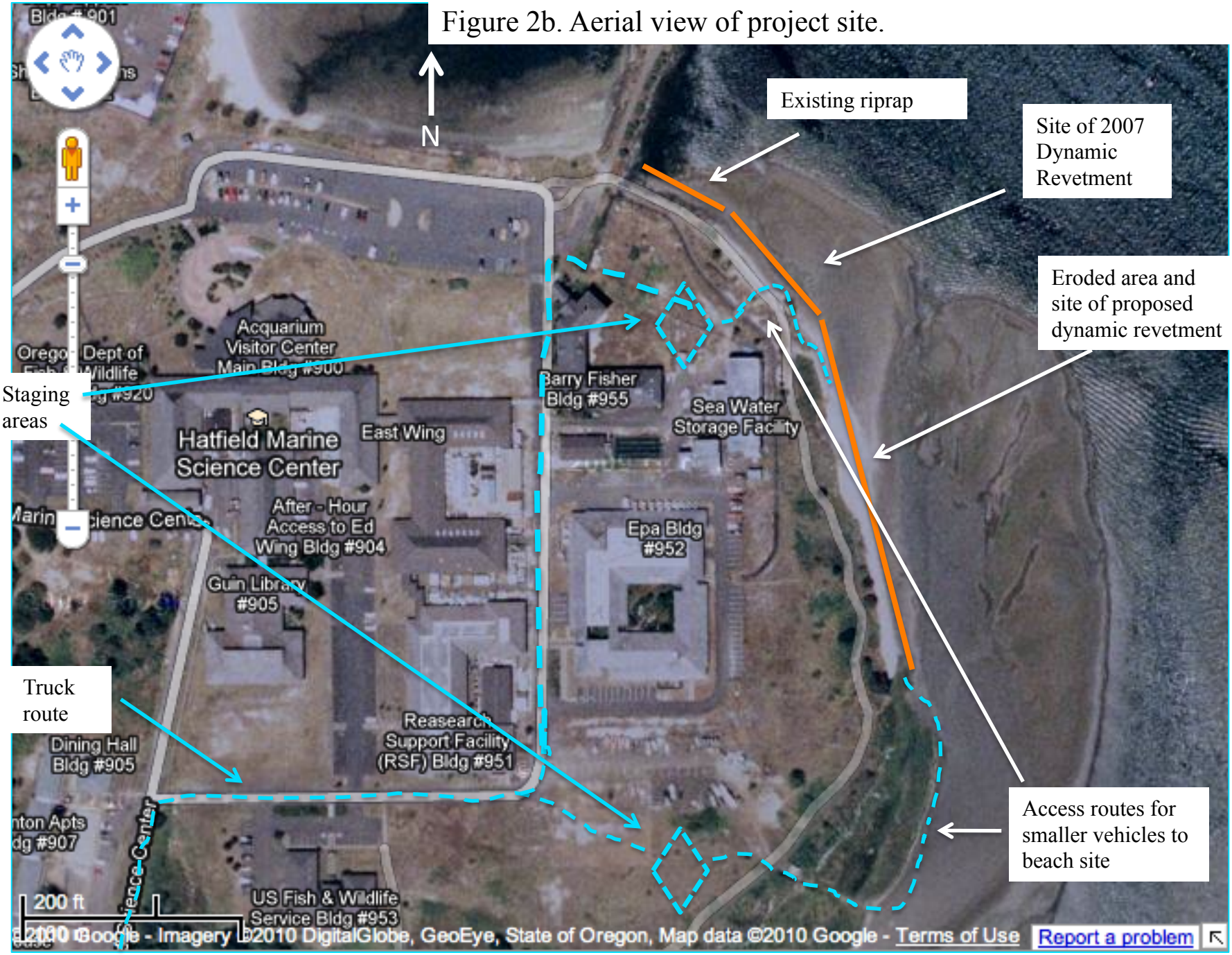

Figure 3. Transect locations.

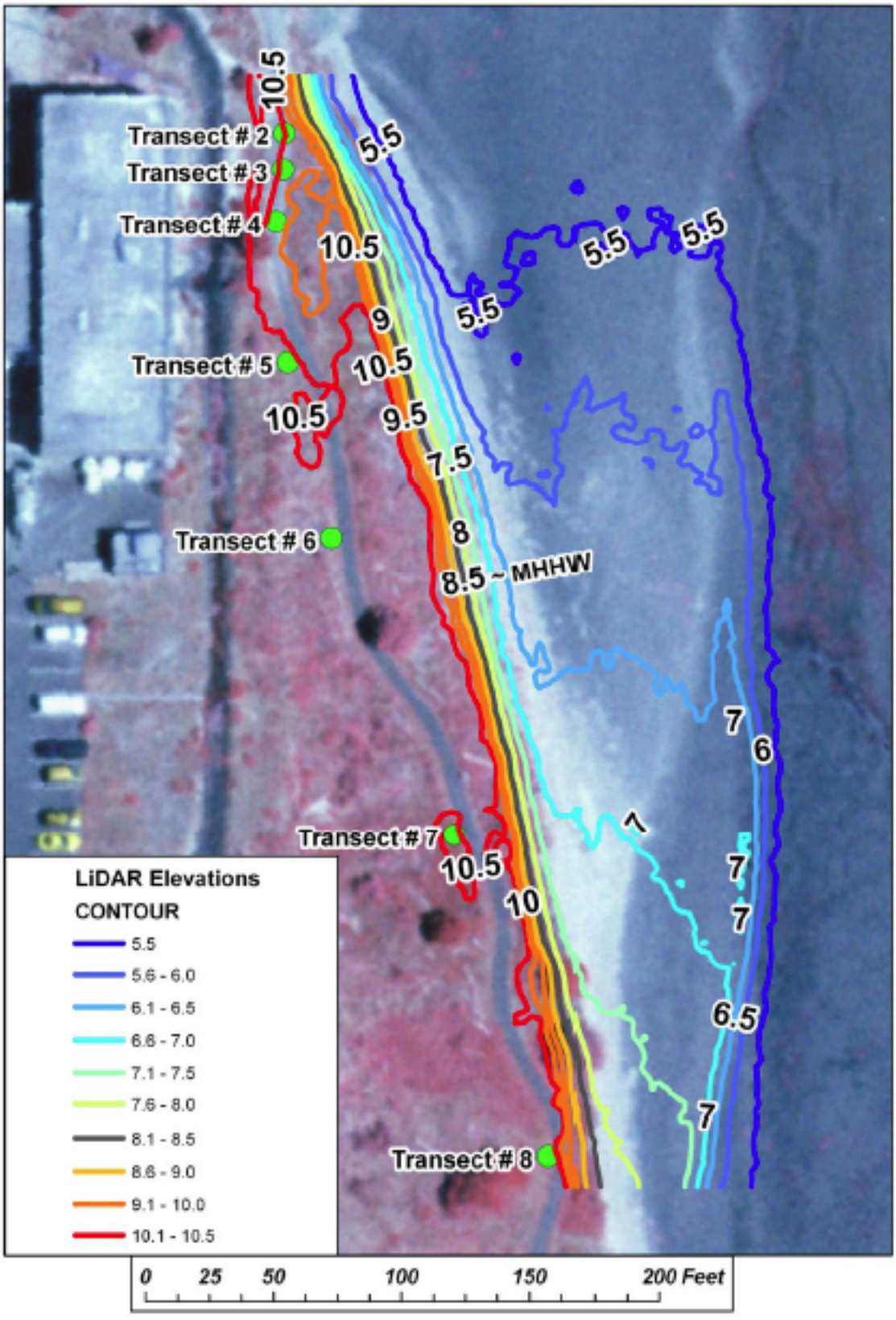

Figure 4a-g. Cross-sectional comparisons of the existing beach profiles at the project site, versus the design profiles at 7 transect locations across the project area. See Figure 3 for transect locations.

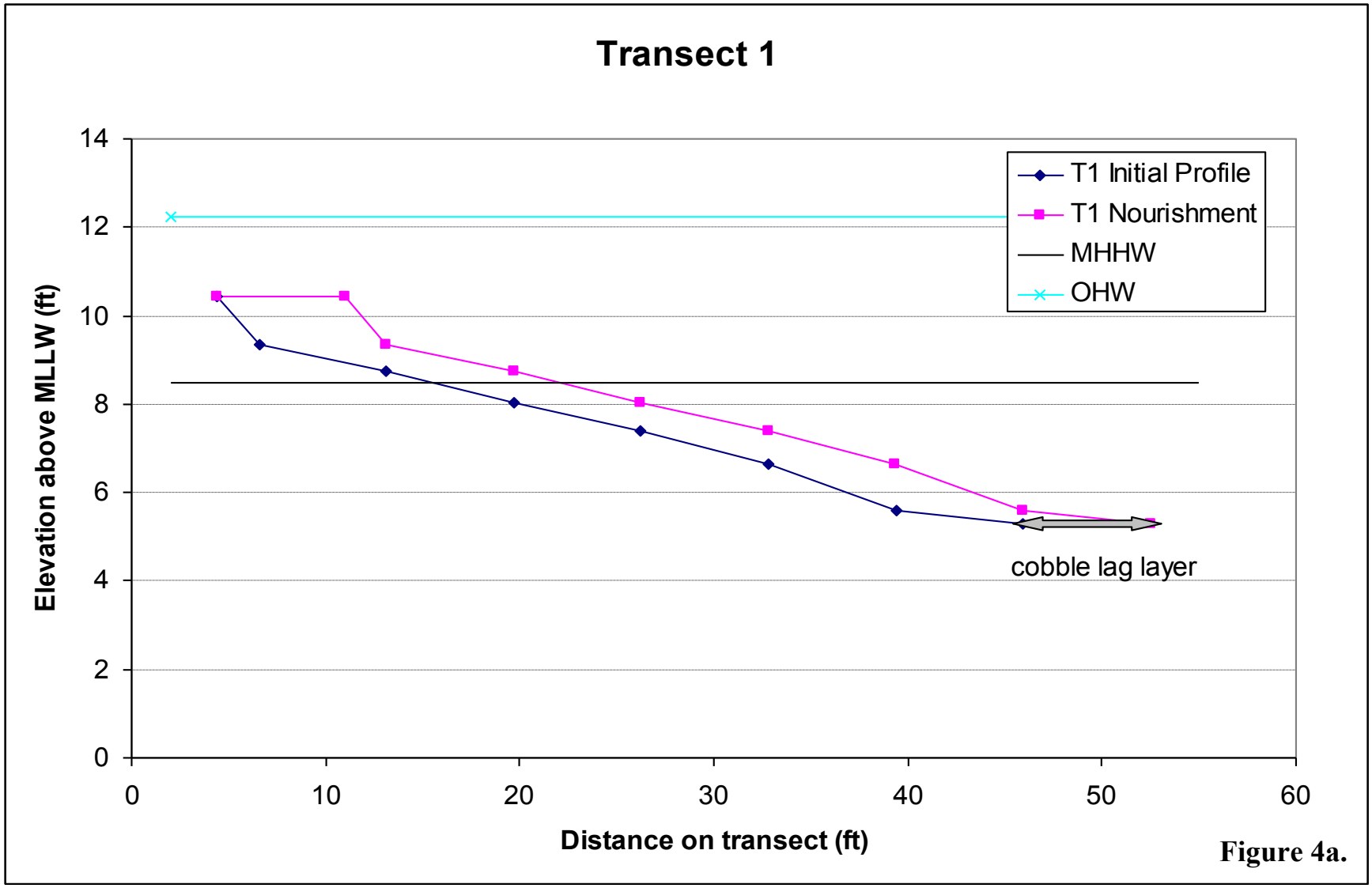

Figure 4a.

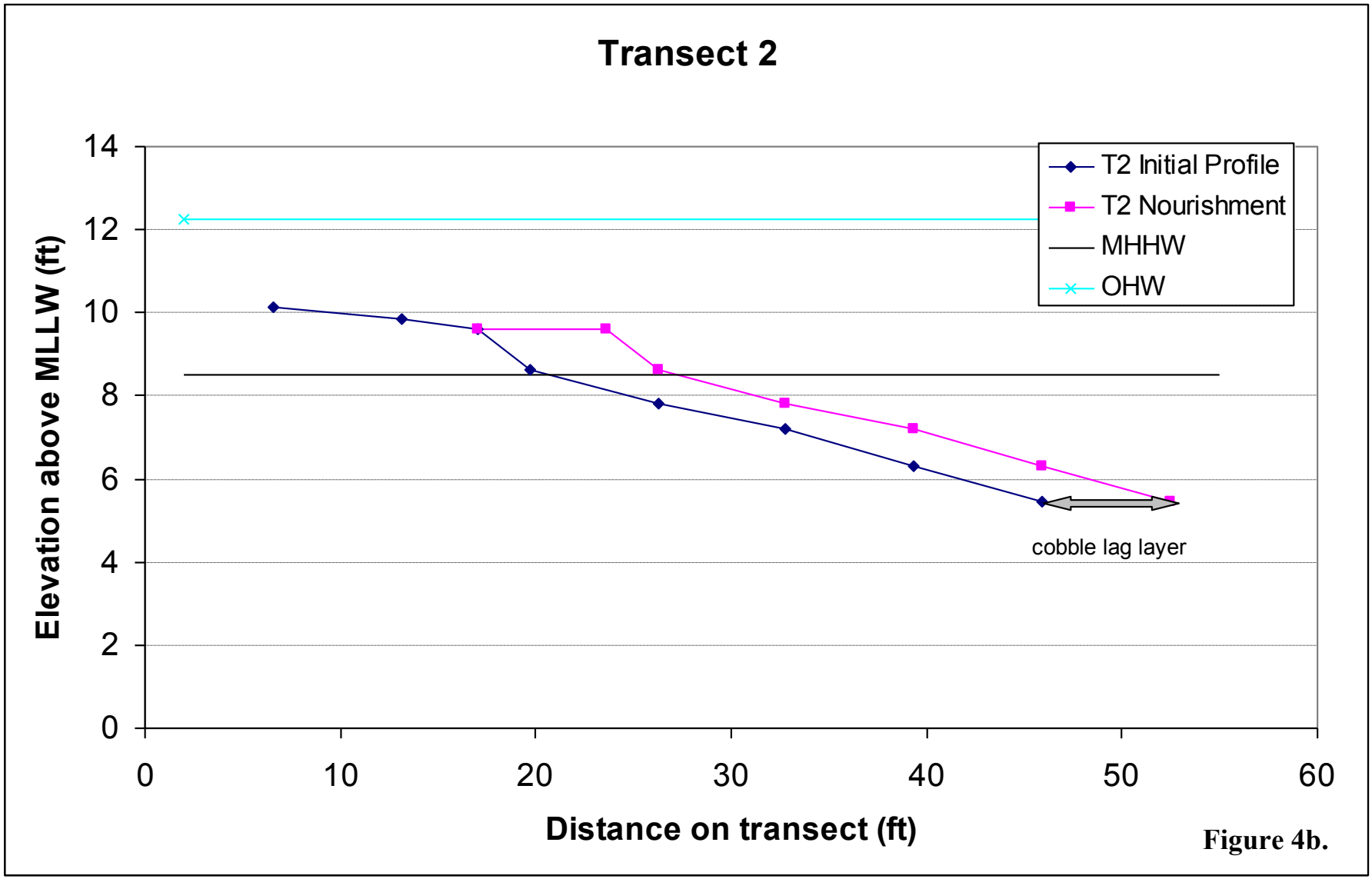
Transect 2
Elevation above MLLW (ft)
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
Distance on transect (ft)
T2 Initial Profile
T2 Nourishment
MHHW
OHW
cobble lag layer

Figure 4b.

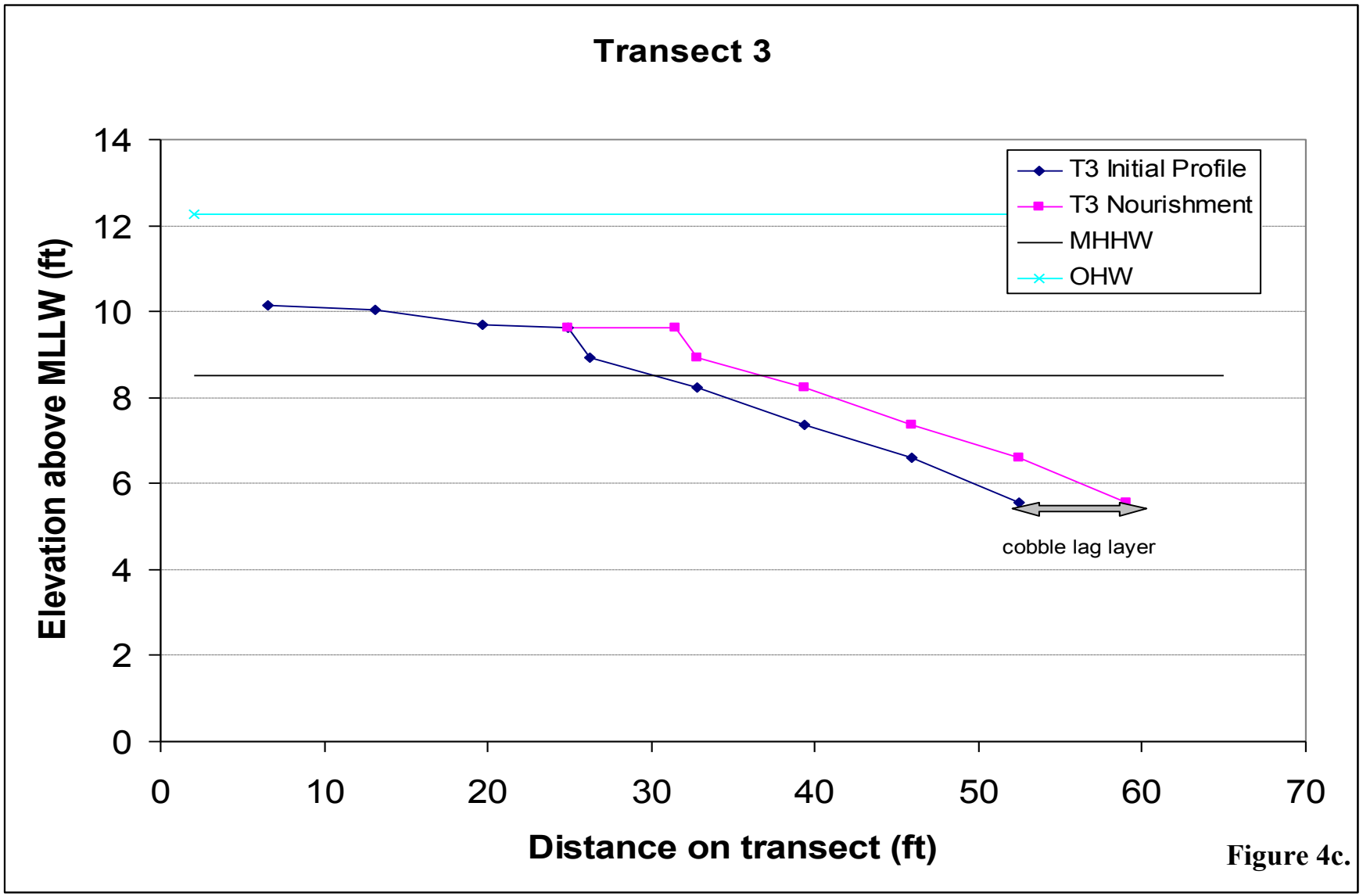
Transect 3
Elevation above MLLW (ft)
Distance on transect (ft)
T3 Initial Profile
T3 Nourishment
MHHW
OHW
cobble lag layer
0
2
4
6
8
10
12
14
0
10
20
30
40
50
60
70

Figure 4c.

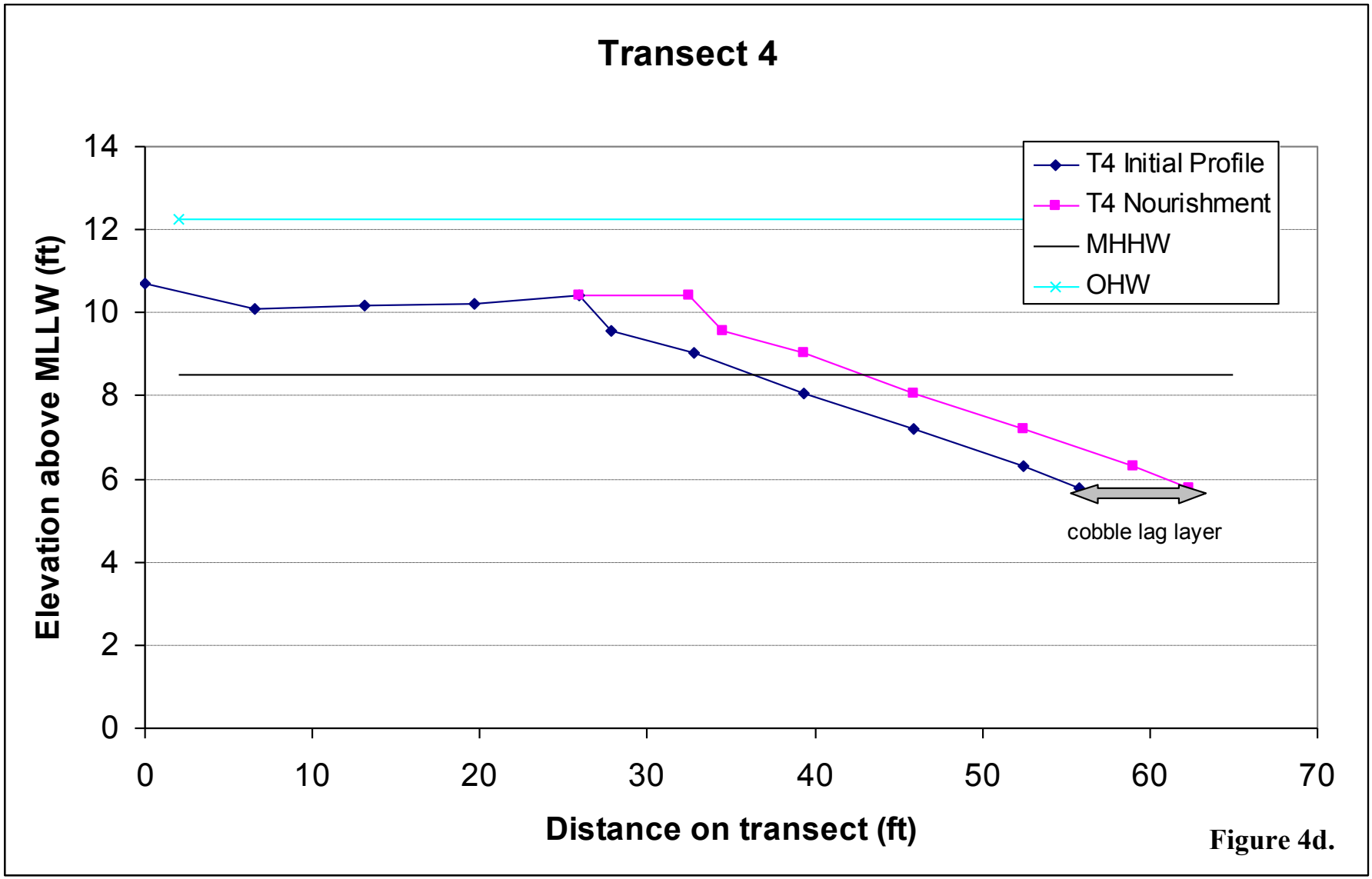
Transect 4
Elevation above MLLW (ft)
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
Distance on transect (ft)
T4 Initial Profile
T4 Nourishment
MHHW
OHW
cobble lag layer

Figure 4d.

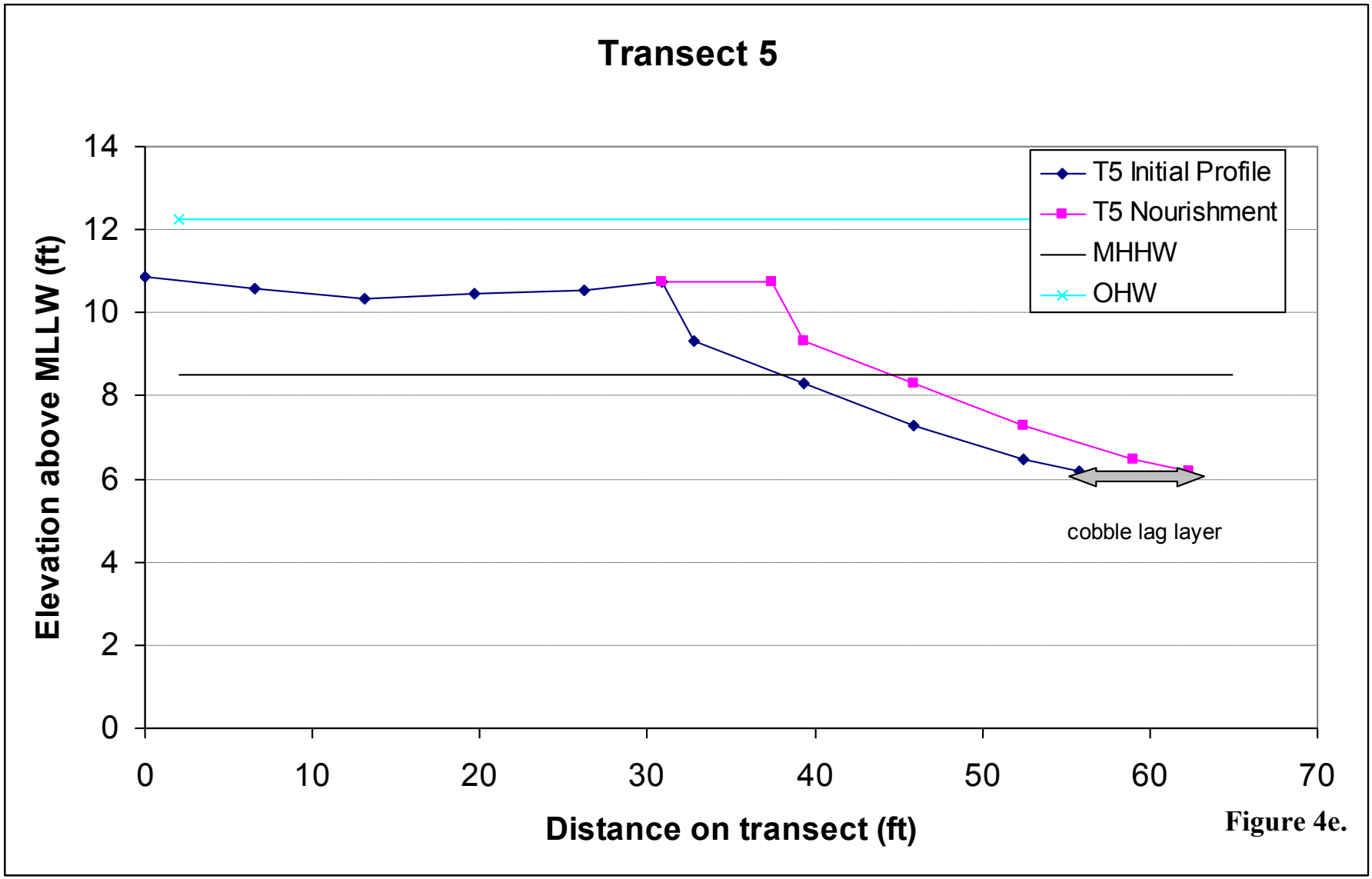
Transect 5
Elevation above MLLW (ft)
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
Distance on transect (ft)
T5 Initial Profile
T5 Nourishment
MHHW
OHW
cobble lag layer

Figure 4e.

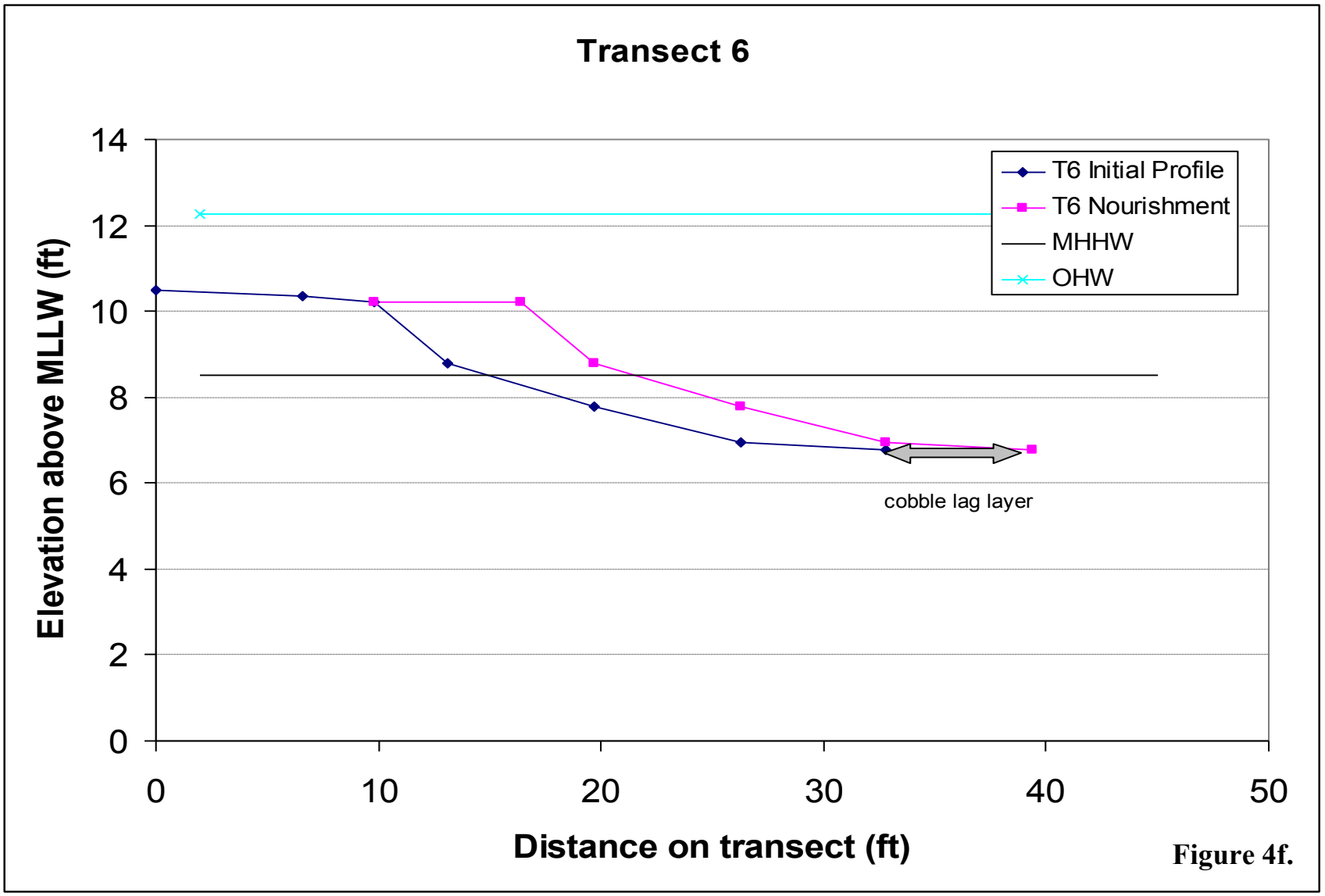
Transect 6
Elevation above MLLW (ft)
14
12
10
8
6
4
2
0
0
10
20
30
40
50
Distance on transect (ft)
T6 Initial Profile
T6 Nourishment
MHHW
OHW
cobble lag layer

Figure 4f.

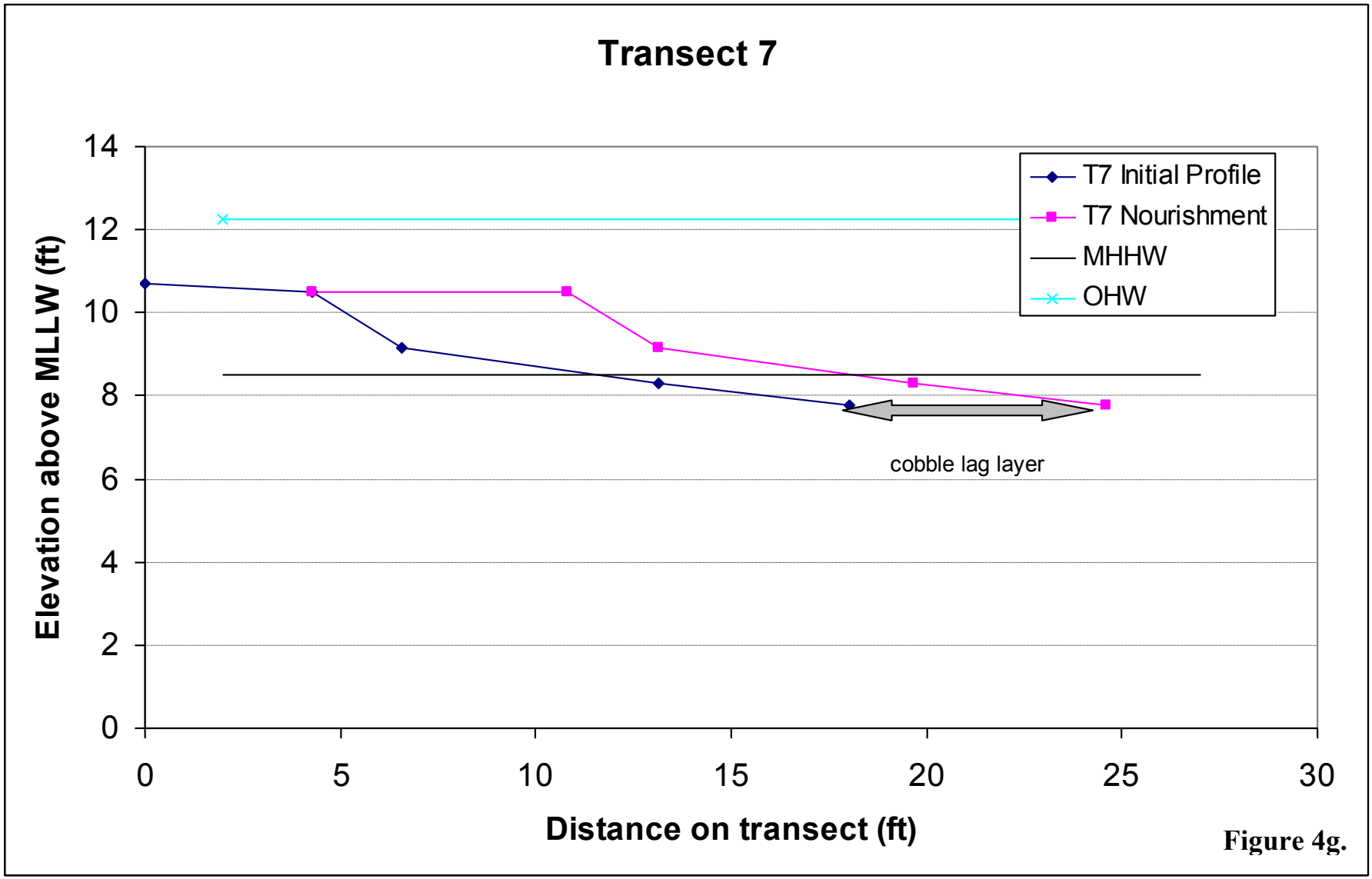
Transect 7
Elevation above MLLW (ft)
14
12
10
8
6
4
2
0
0
5
10
15
20
25
30
Distance on transect (ft)
T7 Initial Profile
T7 Nourishment
MHHW
OHW
cobble lag layer

Figure 4g.

Hatfield Marine Science Center
Director's Office
2030 S.E. Marine Science Dr., Newport, Oregon 97365-5296
T 541-867-0212 | F 541-867-0444 | http://hmsc.oregonstate.edu
Email: hmsc@oregonstate.edu

September 29, 2010

Carrie Landrum
DSL Resource Coordinator
State of Oregon
775 Summer St. NE
Salem, OR 97301

Dear Ms. Landrum:

This letter accompanies the Oregon State University Hatfield Marine Science Center's (HMSC) amended Joint Permit Application (JPA) 45455-FP regarding erosion along the HMSC Estuary Trail, as per your completeness review of July 27, 2010. Please find enclosed the JPA and a set of attachments, including the alternatives analysis, which you have previously seen, and the functional analysis, which you requested. Two changes from the original application are noted. First, the HMSC campus sits on land owned by the Port of Newport, and requires a City of Newport Conditional Use Permit, which has since been approved and is attached. Second, we have removed the sand from our project design. Although addition of sand was meant to further stabilize the revetment by encouraging vegetation on the uplands and strongly recommended by ODFW, is still below "highest high water" and therefore subject to mitigation. It was found to be a complicating factor that is not integral to the design of the revetment, so has been removed, further decreasing the footprint of this project to 0.25 acre.

As outlined in the application, HMSC in Newport, Oregon, a federally designated Coastal Ecosystem Learning Center, proposes to implement an erosion control project in winter 2010-2011 with the assistance of the Oregon National Guard Innovative Readiness Training (IRT) program. Stabilization of the Yaquina Bay shoreline along the northeastern edge of the HMSC campus is necessary to halt erosion that threatens HMSC critical infrastructure and the popular HMSC Estuary Trail, which serves as one of the few public access points to the Yaquina Bay estuary for the Newport community. We hope to reestablish wheelchair accessibility of the estuary trail, damaged due to erosion in 2005, once the shoreline is stabilized.

The critical infrastructure this project will protect is an 800,000-gallon seawater storage facility that provides seawater to research labs of OSU and six federal and state agencies. In keeping with the HMSC's mission of research, education and outreach through collaborative partnerships, we propose to control erosion proactively with an environmentally-friendly "soft" solution called a dynamic revetment, which will absorb rather than deflect wave energy. This innovative design is meant to prevent the need for armoring, such as riprap, although it is imperative that the dynamic revetment be implemented before the beach is lost. In the absence of a beach, the only mechanism for halting further erosion will be a sea wall or riprap.

It is my understanding that the Department of State Lands has requested much of the new information provided in this packet to aid in the determination of whether mitigation is necessary for this project. I feel strongly that mitigation should not be a requirement for the following reasons:

1. The addition of gravel and cobble to the beach will result in a change from sand only that is within a Cowardin class, as outlined in the attached document prepared by the US EPA. The project site analysis suggests that this substitution results in preservation of generally equivalent ecological functions.

2. By using a "soft" solution, we assume considerable risk, as it is possible that the dynamic revetment could be damaged by wave action and need to be replaced, or ultimately replaced with riprap. If the sole purpose of the project were to prevent erosion and protect infrastructure, HMSC would be better served in the long run by riprap. Instead, we have incorporated our mission-related activities of outreach, education and community partnerships into the project design to maximize the opportunity to educate the Oregon Coast community about the effects of over-armoring the estuary's shoreline.
3. Mitigation was not required in a previous, identical, adjacent project that was implemented in March 2007, which has been successful at preventing erosion. DSL has not provided any reason for this discrepancy, including potential differences that would warrant such a dramatically different outcome.

For these reasons, I believe it is unreasonable to expect HMSC to incur similar responsibility and expense for mitigation as would be required for riprap. In fact, it is financially and logistically not feasible for HMSC to both implement this project as well as simultaneously implement a mitigation project. I therefore suggest that, instead of mitigation, HMSC be required as a condition of our permit to garner the expertise inherent in our extensive federal, state, university and community partnerships to implement effective outreach including:

1. Interpretation of the dynamic revetment design in estuary and campus tours
2. Interpretive signs to inform and educate the public on alternative solutions to erosion control
3. Use of news media during implementation and afterward to enhance community outreach

Numerous publications by Jonathan Allan, DOGAMI staff who assisted with the HMSC revetment design, and enthusiasm by USACE personnel who used the revetment recently as an outreach and teaching tool for a meeting of regulators, have underscored the significant interest in the professional community. Interest by local government was evident when HMSC applied recently for a City of Newport permit; the Newport Planning Commission took great interest in the project and requested updates and photos at appropriate intervals after implementation to further educate the commission. All of these efforts take staff time and expertise, yet in spite of the added cost, I welcome them as a way to further our mission.

Alternatively, we can proceed directly to a permanent solution. This is not my preference; in fact, I have actively opposed riprap for any shoreline within our 49-acre campus since becoming Director in 2002. However, I have now instructed my staff to begin preparing an emergency request for riprap, in the event that the inevitable storms between now and implementation bring us to a crisis situation. Our seawater storage facility is arguably our most important infrastructure, as it supports the bulk of our $48 million research program, and we cannot risk a lengthy period of inaction.

We trust that this project, as designed, can help advance the goals and mission for public service and education of your state agency as well as ours, and we look forward to working with you to achieve this.

Sincerely,

George Boehlert
Director

cc: Corps of Engineers District Engineer
HMSC Seawater Committee

Hatfield Marine Science Center
Director's Office
2030 S.E. Marine Science Dr., Newport, Oregon 97365-5296
T 541-867-0212 | F 541-867-0444 | http://hmsc.oregonstate.edu
Email: hmsc@oregonstate.edu

September 28, 2010

Thomas J. Taylor
Department of the Army
Corps of Engineers, Portland District
PO Box 2946
Portland, OR 97208-2946

Dear Mr. Taylor:

This letter accompanies the Oregon State University Hatfield Marine Science Center's (HMSC) amended Joint Permit Application (JPA) NWP-2010-401 regarding erosion along the HMSC Estuary Trail, as per your completeness review of September 22, 2010. Please find enclosed the JPA and a set of attachments, including the alternatives analysis, which you have previously seen, the functional analysis, which was requested by DSL, and the required City of Newport Conditional Use Permit, which has since been approved and is attached.

As outlined in the application, HMSC in Newport, Oregon, a federally designated Coastal Ecosystem Learning Center, proposes to implement an erosion control project in winter 2010-2011 with the assistance of the Oregon National Guard Innovative Readiness Training (IRT) program. Stabilization of the Yaquina Bay shoreline along the northeastern edge of the HMSC campus is necessary to halt erosion that threatens HMSC critical infrastructure and the popular HMSC Estuary Trail, which serves as one of the few public access points to the Yaquina Bay estuary for the Newport community. We hope to reestablish wheelchair accessibility of the estuary trail, damaged due to erosion in 2005, once the shoreline is stabilized.

The critical infrastructure this project will protect is an 800,000-gallon seawater storage facility that provides seawater to research labs of OSU and six federal and state agencies. In keeping with the HMSC's mission of research, education and outreach through collaborative partnerships, we propose to control erosion proactively with an environmentally-friendly "soft" solution called a dynamic revetment, which will absorb rather than deflect wave energy. This innovative design is meant to prevent the need for armoring, such as riprap, although it is imperative that the dynamic revetment be implemented before the beach is lost. In the absence of a beach, the only mechanism for halting further erosion will be a sea wall or riprap.

Several components of the completeness review are noted here:

1. Concerning the use of rock to stabilize the beach, please see the Alternatives Analysis presented in attachment 3. In our original application, sand and eventual plantings were included as a way to further stabilize the bank after the eroding beach is stabilized. Due to the State's view that placement of sand to stabilize the bank requires mitigation and is not considered restoration, we have decided to focus our initial efforts on stabilizing the intertidal beach, and will address the possibility of restoration and planting at a later time.
2. This project does not include in-water work, as all work will be done on exposed beach during low tide. Heavy equipment will not be used; instead, smaller "skidsters" will be used during low tide to place rock and are not expected to affect water quality. Equipment used will be in good repair and personnel trained in hazardous spill response will be on hand in case of emergency.
3. The JD was signed and mailed on September 28, 2010.

Thank you for your accelerated review of our application, and for your visit and interest in our project design. I look forward to working with you.

Sincerely,

George Boehlert
Director

cc: Carrie Landrum, Oregon Department of State Lands
HMSC Seawater Committee

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

A. REPORT COMPLETION DATE: SEPTEMBER 17, 2010

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD: George Boehlert Oregon State University, Hatfield Marine Science Center, 2030 SE Marine Science Drive, Newport, OR 97365

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Portland District, Oregon State University, Hatfield Marine Science Center, NWP-2010-401

D. PROJECT LOCATION(S), BACKGROUND INFORMATION, AND WATERS:

State: Oregon
City: Newport
County: Lincoln
Name of nearest waterbody: Pacific Ocean

Identify amount of waters in the review area: 260 acres

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal: Yaquina Bay
Non-Tidal: NA

Waters of the U.S.

Waterbody	Latitude (dd.ddd °N)	Longitude (dd.ddd °W)	Cowardin Class	Area (Acres)	Length (Feet)	Width (Feet)
Yaquina Bay	44.6227	- 124.0421	E2US	0.36	500	50

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☒ Office (Desk) Determination. Date: 9/17/10 (Site visited 9/13/10)
☒ Field Determination. Date(s): 9/13/10

F. SUPPORTING DATA:

Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

- ☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant:
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps: .
- ☒ Corps navigable waters' study: Navigable Riverways Within The State of Oregon 1993
- ☐ U.S. Geological Survey Hydrologic Atlas: .
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☒ U.S. Geological Survey map(s). Cite quad name: digital map from Corps eGIS Information Portal.
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation:
- ☒ National wetlands inventory map(s). Cite name: digital map from Corps eGIS Information Portal.
- ☐ State/Local wetland inventory map(s): .
- ☐ FEMA/FIRM maps: .
- ☐ 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- ☐ Photographs: ☐ Aerial (Name & Date):.
  or ☐ Other (Name & Date): .
- ☐ Previous determination(s). File no. and date of response letter: .
- ☐ Other information (please specify): .

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Thomas J. Taylor 9/17/10
Signature and date of
Regulatory Project Manager
(REQUIRED)

9/28/10
Signature and date of
person requesting preliminary JD
(REQUIRED, unless obtaining the signature is impracticable)