TILLAMOOK COUNTY PLANNING COMMISSION

LOCATION
Port of Tillamook Bay Conference Center
4000 Blimp Boulevard, Tillamook, OR 97141

HEARING DATE
October 13, 2022- Beginning at 7:00p.m.

VIRTUAL & TELECONFERENCE MEETING INFORMATION

For teleconference access the evening of the hearing, please call 971-254-3149. Conference ID: 887 242 77#. Virtual Meeting Access: https://www.co.tillamook.or.us/commdev. *Click on Virtual Teams Link. *Microsoft Teams Meeting Format.*

I. **CALL TO ORDER**

II. **ROLL CALL**

III. **OLD BUSINESS: NONE**

IV. **NEW BUSINESS:**

#851-22-000328-PLNG & #851-22-000329-PLNG: Consolidated review of a Estuary/Floodplain Development Permit and Conditional Use Request for a wetland restoration project. The subject property is zoned Estuary Natural (EN), Estuary Conservation 1 (EC1) and Farm (F-1), is partially located within the Shoreland Overlay zone and lies entirely within the Flood Hazard Overlay zone. The subject property is located to the west of Highway 101 and is designated as Tax Lots 901, 1700 and 1900 in Section 12 of Township 1 South, Range 10 West of the Willamette Meridian, Tillamook County, Oregon. The applicant and property owner are The Nature Conservancy.

V. **AUTHORIZATION FOR CHAIR TO SIGN APPROPRIATE ORDERS, IF NECESSARY**

VI. **ADMINISTRATIVE DECISIONS:** Administrative Decisions are available for public review on the Tillamook County Department of Community Development website: https://www.co.tillamook.or.us/commdev/landuseapps

VII. **HOUSING COMMISSION UPDATE**

VIII. **DEPARTMENT OF COMMUNITY DEVELOPMENT REPORT**

IX. **ADJOURNMENT**

The Port of Tillamook Bay Conference Center is accessible to citizens with disabilities. If special accommodations are needed for persons with hearing, visual, or manual impairments that wish to participate in the meeting, please contact 1-800-488-8280x3423 at least 24 hours prior to the meeting in order that appropriate communications assistance can be arranged.

Tillamook County

DEPARTMENT OF COMMUNITY DEVELOPMENT
BUILDING, PLANNING & ON-SITE SANITATION SECTIONS

1510 – B Third Street
Tillamook, Oregon 97141
www.tillamook.or.us

Building (503) 842-3407
Planning (503) 842-3408
On-Site Sanitation (503) 842-3409
FAX (503) 842-1819
Toll Free 1 (800) 488-8280

Land of Cheese, Trees and Ocean Breeze

CONSOLIDATED REVIEW OF CONDITIONAL USE REQUEST #851-22-000328-PLNG & ESTUARY/FLOODPLAIN DEVELOPMENT PERMIT REQUEST #851-22-000329-PLNG: THE NATURE CONSERVANCY

DATE OF PLANNING COMMISSION HEARINGS
OCTOBER 13, 2022 at 7:00pm
NOVEMBER 10, 2022 at 7:00pm

Report Prepared by: Sarah Absher, CFM, Director

I. GENERAL INFORMATION:

Request: Consolidated review for approval of a Conditional Use request and Estuary/Floodplain Development Permit for a 30-acre wetland restoration project (Exhibit B).

Location: The subject property is located north of the City of Tillamook and south of the Unincorporated Community of Idaville, west of Highway 101 and is designated as Tax Lots 901, 1700 and 1900 in Section 12 of Township 1 South, Range 10 West of the Willamette Meridian, Tillamook County, Oregon (Exhibit A).

Zone: Farm (F-1), Estuary Natural (EN), Estuary Conservation 1 (EC1), Flood Hazard Overlay (FH) Zone, Shoreland Overlay (SH) Zone (Exhibit A).

Applicant/ Property Owner: The Nature Conservancy, 821 SE 14th Avenue, Portland, OR 97214

Proposal Description: Located in the Kilchis valley west of Oregon State Highway 101, County records indicate the subject properties are primarily unimproved, encompass approximately 60 acres (total) and have been historically used for agricultural purposes (Exhibit A). The subject properties are irregular in shape and topography is fairly flat. The area primarily consists of tidal wetlands, estuarine areas and pasture lands (Exhibits A & B). The subject properties and project location are bordered by Highway 101 to the east, Stasek Slough to the south, Hathaway Slough to the north and

farmland to the east and west (Exhibit A). The lower Kilchis River also borders Tax Lot 901 to the west and the project site is within close proximity to Tillamook Bay (Exhibit A).

The subject properties are entirely located within an of Special Flood Hazard and the 'AE' Zone as depicted on the FEMA Flood Insurance Rate Map Panel No. 410570576F and No. 41057C0413F, both dated September 28, 2018 (Exhibit A). The subject properties are not mapped floodway due to their close proximity to Tillamook Bay where flooding is also subject to tidal influence.

The boundaries of the Estuary Natural (EN) and Estuary Conservation 1 (EC1) are determined by the Mean Higher High Water or the Line of Non-Aquatic Vegetation, whichever is most landward (Exhibit A). Lands zoned Farm (F-1) are actively utilized for commercial dairy operations with the exception of the "Dooher tract" which was restored to wetlands- a project that commenced in 2015 by The Nature Conservancy.

Areas to the north of the proposed project site are primarily estuarine areas with Estuary Natural (EN) and Estuary Conservation 1 (EC1) zoning designations. The project location is less than one mile south of the Unincorporated Community of Idaville where uses and zoning districts consist of residential and commercially developed properties.

The Applicant is proposing a 30-acre wetland restoration project within the eastern region of the subject properties identified as the Kilchis Porter wetland restoration project. The proposed project is designed to restore tidal wetlands and wetland functionality to the 60-acre tract known as the "Porter tract" now owned by The Nature Conservancy. Ground disturbance due to restoration activities is estimated to affect approximately 7 acres of the site and includes temporary road and pathways, construction staging areas, areas of dike lowering and connector channel realignment, and locations of vegetated mounds (Exhibit B).

The restored Porter tract wetlands will complement the Kilchis Preserve managed by The Nature Conservancy that is located immediately to the south and across Stasek Slough. Applicant states the restored Porter wetlands will provide critical habitat to juvenile salmon as well as waterbirds and other species that utilize these habitats. The wetland restoration activities are proposed on the eastern half the site previously used as seasonal pasture and hayfields. Applicant states the remaining 30 acres of the Porter tract on the west side of the site are already covered by native tidal wetland habitat and receive ongoing weed abatement stewardship actions (Exhibit B).

Applicant adds the restored habitats will also provide watershed benefits during high water events including flood conditions by providing additional off channel storage of flood waters, and suggest that benefits may extend beyond the project boundaries depending upon the severity of the flood conditions and combined effects of tidal waters and storm surge (Exhibit B).

A description of the restoration design is included in "Exhibit B". The Applicant has requested consolidated review of the required Conditional Use request and Estuary/Floodplain Development Permit applications that must be approved to allow the proposed development to occur. The criteria and standards for each of these reviews are addressed below in this report.

Background: In 2017, Tillamook County amended the Tillamook County Land Use Ordinance to reflect the County's participation in a 10-year Pilot Program allowed by Senate Bill 1517 to address community desire to achieve an appropriate balance between habitat restoration efforts – specifically wetlands restoration – and agricultural uses. The Pilot Program allowed by Senate Bill 1517 is specific to Tillamook County and established a conditional use review process for the creation, restoration or enhancement of wetlands in areas that are zoned Farm (F-1).

In the past, Tillamook County community members have come together to support restoration projects that benefit water quality, habitat and community needs like flood prevention. However, concerns have also been expressed by the community that these types of projects have the potential to result in

unintended impacts to surrounding agricultural lands. Some concerns put forth by the agricultural community related to restoration projects have been: loss and fragmentation of agricultural lands, raised water tables leading to increased ponding and flooding of agricultural lands, salinization of pasture lands and crop damage related to increases in ungulate populations. The conditional use review process for restoration project proposals on agricultural lands includes a mechanism for interested parties, prior to approval or denial of permit, to enter into a collaborative process to settle any disputes related to the application. The Conditional Use review process creates a space for consideration of the balance between wetlands restoration and agricultural uses in a procedural context reflected in TCLUO Section 6.060.

Conditional Use request #851-22-000328-PLNG is the first project to go through the SB1517 authorized Conditional Use review process. Because the proposed restoration project is also in the Estuary Natural zone (where restoration projects are allowed conditionally) and an Area of Special Flood Hazard, project approval is also subject to the standard Conditional Use Review Criteria outlined in TCLUO Section 6.040 and requires Floodplain/Estuary Development Permit approval reviewed in accordance with the applicable criteria outlined in TCLUO Section 3.510.

II. APPLICABLE ORDINANCE AND COMPREHENSIVE PLAN PROVISIONS:

The desired uses are governed through the following Sections of the Tillamook County Land Use Ordinance (TCLUO). The suitability of the proposed use, in light of these criteria, is discussed in Section III of this report:

A. TCLUO Section 3.002: Farm (F-1) Zone
B. TCLUO Section 3.102: Estuary Natural (EN) Zone
C. TCLUO Section 3.106: Estuary Conservation (EC1) Zone
D. TCLUO Section 3.120: Review of Regulated Activities
E. TCLUO Section 3.140: Estuary Development Standards
F. TCLUO Section 3.510: Flood Hazard Overlay (FH) Zone
G. TCLUO Section 3.545: Shoreland Overlay (SH) Zone
H. TCLUO Section 3.550: Freshwater Overlay (FW) Zone
I. TCLUO Section 4.140: Requirements for Protection of Water Quality and Streambank Stabilization
J. TCLUO Article VI: Conditional Use Procedures and Criteria
   - TCLUO Section 6.040: Conditional Use Review Criteria
   - TCLUO Section 6.060: Wetlands Restoration, Enhancement or Creation on Land Subject to Exclusive Farm Use Zoning Designation

III. ANALYSIS

A. TCLUO Section 3.002: Farm (F-1) Zone

PURPOSE: The purpose of the Farm Zone (F-1) is to protect and maintain agricultural lands for farm use, consistent with existing and future needs for agricultural products. The Farm Zone is also intended to allow other uses that are compatible with agricultural activities, to protect forests, scenic resources and fish and wildlife habitat, and to maintain and improve the quality of air, water and land resources of the county. It is also the purpose of the Farm Zone to qualify farms for farm use valuation under the provisions of ORS Chapter 308.

Findings: TCLUO Section 3.002(2)(ll) defines wetland restoration as, *the process of returning a disturbed or altered area or feature to a previously existing natural condition. Restoration activities reestablish the ecological structure, function, and/or diversity to that which occurred*

prior to impacts caused by human activity. Wetland restoration, enhancement or creation as defined in 3.002(2) is subject to conditional use review and is subject to the criteria outlined in TCLUO Section 3.002(5) and TCLUO Section 6.060.

The criteria listed in TCLUO Section 3.002(5) are duplicated in Section 6.060. For purposes of this report, the duplicative criteria outlined in these two sections are addressed in Section IV of this report.

B. TCLUO Section 3.102: Estuary Natural (EN) Zone

(1) PURPOSE AND AREAS INCLUDED: The purpose of the EN zone is to provide for preservation and protection of significant fish and wildlife habitats and other areas which make an essential contribution to estuarine productivity or fulfill scientific, research or educational needs.

Except where a goal exception has been taken in the Tillamook County Comprehensive Plan, the EN Zone includes the following areas:

(a) Development and Conservation Estuaries: Major tracts of tidal marsh, intertidal flats and seagrass and algae beds. The "major tract" determination is made through a consideration of all of the following four criteria: Size; habitat value; scarcity and degree of alteration.
(b) Natural Estuaries: The EN Zone includes all estuarine waters, intertidal areas, submerged or submersible lands and tidal wetland areas.

(2) USES PERMITTED WITH STANDARDS: The following uses are permitted subject to the procedure of Section 3.120 and the standards in Section 3.140:

...
(c) Vegetative shoreline stabilization.
(g) Bridge crossings and crossing support structures.

(3) USES PERMITTED CONDITIONALLY: The following uses may be permitted subject to the procedures of Section 3.120 and Article 6 and the standards in Section 3.140.

...
(e) Active restorations and estuarine enhancements

(4) REGULATED ACTIVITIES: The following Regulated Activities are permitted subject to the procedure of Section 3.120 and the standards of Section 3.140.

...
(f) Regulated activities in conjunction with an approved Active Restoration Estuarine Enhancement project.

Findings: The proposed restoration of the Porter project area includes tidal channel re-creation, lowering of dikes along portions of Stasek and Hathaway Sloughs, removal of dilapidated water control structures, installation of large wood structures, development of vegetation mounds and wetland revegetation (Exhibit B). Two, light-duty bridges that are not connected with public roadways are also proposed for the project site to facilitate restoration and site management. Applicant states the bridges will also provide emergency access to the lower Kilchis River and to Hathaway Slough (Exhibit B). Applicant states the restoration project will not permanently degrade or reduce estuarine natural values and will overall enhance estuarine natural values (Exhibit B).

In review of the Tillamook Bay Estuary Management Unit Designation map, those portions of the subject property zoned Estuary Natural (EN) are located within the 30EN Management Unit and are categorized as major tracts of saltmarsh (Exhibit A). Significant biological functions include bird resting, feeding and nesting.

Section 6.12(7) Restoration and Enhancement of the Goal 16 Estuarine Element of the Tillamook County Comprehensive Plan states active restoration and estuarine enhancement in Estuary Natural (EN) zoned areas shall be limited to restoration of fish and wildlife habitat or water quality, and that these activities shall be consistent with the resource capabilities of the area and the purposes of the management unit. Active restoration activities in major marshes, significant wildlife habitat, coastal headlands and exceptional aesthetic resources within coastal shorelands shall be consistent with the protection of shoreland natural values.

Policies for estuary activities outlined in Section 7.3, Goal 16 Estuarine Element for the placement of fill in EN zoned estuarine waters, intertidal areas and tidal wetlands shall only be allowed for an approved active restoration or estuarine enhancement project, subject to restoration and enhancement standards.

Policies for shoreline stabilization outlined in Section 7.5, Goal 16 Estuarine Element for shoreline stabilization activities in EN zoned estuarine waters, intertidal areas and tidal wetlands permits proper maintenance of existing riparian vegetation and planting of additional vegetation for purposes of shoreline stabilization within all estuary zones, and lists general priorities for shoreline stabilization for erosion control from highest to lowest as follows:

a. proper maintenance of existing riparian vegetation;
b. planting of riparian vegetation;
c. vegetated riprap;
d. non-vegetated riprap;
e. groins, bulkheads and other structural methods.

C. TCLUO Section 3.106: Estuary Conservation 1 (EC1) Zone

(1) PURPOSE AND AREAS INCLUDED: The purpose of the EC1 zone is to:
(a) Provide for long-term utilization of areas which support, or have the potential to support valuable biological resources.
(b) Provide for long-term maintenance and enhancement of biological productivity.
(c) Provide for the long-term maintenance of the aesthetic values of estuarine areas, in order to promote or enhance the low intensity recreational use of estuarine areas adjacent to rural or agricultural shorelands.

(2) USES PERMITTED WITH STANDARDS: The following uses are permitted subject to the procedure of Section 3.120 and the standards in Section 3.140:

...

(c) Vegetative shoreline stabilization.

(4) REGULATED ACTIVITIES: The following uses are permitted subject to the procedure of Section 3.120 and the standards in Section 3.140.

...

(f) Regulated Activities in conjunction with an approved active restoration or estuarine enhancement project.

Findings: In review of the Tillamook Bay Estuary Management Unit Designation map, those portions of the subject property zoned Estuary Conservation 1 (EC1) are located within the 29EC1 and 31EC1 Management Units, and are categorized as areas needed for maintenance or enhancement of biological productivity and areas needed for recreational use (Exhibits A & D). Significant biological functions include salmonid passage and fish feeding (Exhibit D).

Section 6.12(7) Restoration and Enhancement of the Goal 16 Estuarine Element of the Tillamook County Comprehensive Plan states a resource capability determination is required for active restoration in Estuary Conservation Zones (EC1) for purposes other than restoration of fish and wildlife habitat or water quality.

Policies for estuary activities outlined in Section 7, Goal 16 Estuarine Element for the placement of fill in EC1 zoned estuarine waters, intertidal areas and tidal wetlands shall only be allowed for an approved active restoration or estuarine enhancement project, subject to restoration and enhancement standards. Policy also states that only fills which do not constitute a major alteration to the estuary, and which are consistent with the resource capabilities of the area and the long-term use of renewable resources, shall be permitted. This determination shall be made by the Division of State Lands and the U.S. Army Corps of Engineers during review of fill permit applications.

D. TCLUO Section 3.120: Review of Regulated Activities

1) PURPOSE: The purpose of this Section is to provide an assessment process and criteria for local review and comment on State and Federal permit applications which could potentially alter the integrity of the estuarine ecosystem.
(2) REGULATED ACTIVITIES: Regulated activities are those actions which require State and/or Federal permits and include the following:
...
(e) Shoreline stabilization, bank line or streamline alteration involving fill or dredging in excess of 50 c.y.

Findings: Applicant's submittal included in "Exhibit B" contains a list of state and federal agency permits that have already been approved for the project or are in process of review and includes the following:

- Permit NWP 218-197: Army Corps of Engineers, included within the Nationwide Permit 27 for restoring aquatic vegetation under Section 10 of the Clean Harbors Act. Received June 13, 2018.

- Removal/Fill Permit, Joint Application Permit (JAP): Army Corps of Engineers and Oregon Department of State Lands for removal and fill activities associated with restoration. Section 404, Clean Water Act.
- Water Quality Certification Permit: Oregon Department of Environmental Quality, Nationwide 401Water Quality Certification Approval. June 19, 2018.
- Federal Compliance with ESA, NEPA and NHPA for cultural resources: the ACE is the lead agency for federal compliance for the project.
- SHPO compliance: A cultural resource inventory is being conducted on the site to determine in advance of restoration activities the potential for disturbance of cultural resources. Results of the inventory will be made available to SHPO and local Indian tribes. Recommendations for future actions will be detailed in the results.

With the assistance of affected State and Federal agencies, and in conjunction with review of state and federal permits required for this proposal, TCLUO 3.120(5) requires the following considerations to be addressed:

(a) The type and extent of alterations expected.
(b) The type of resource(s) affected including, but not limited to aquatic life and habitats, riparian vegetation, water quality and hydraulic characteristics.
(c) The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary.
(d) The methods which could be employed to avoid or minimize adverse impacts.

Applicant has provided a detailed description and drawings of the proposed project which are also found in "Exhibit B".

The Estuarine Resources Element of the Tillamook County Comprehensive Plan lists by management unit those resource areas of the Tillamook Bay Estuary. Copies of the management unit descriptions and the Management Unit Designation map are included as "Exhibit D". The estuarine portion of the subject property lies within Estuary Management Units 29EC1 and 30EN as described in the Goal 16 element of the Tillamook County Comprehensive Plan (Exhibit D). This Unit is described in Comprehensive Plan Goal element 16 as area suitable for recreational and aesthetic uses characterized by major tracts of salt marsh and areas needed for maintenance or enhancement of biological productivity.

The requirements for resource capability determinations are addressed in TCLUO Section 3.120(6) and 3.140. These ordinance sections require that the proposed activity be found to be consistent with the resource capabilities of a management unit and states that proposed activities may be considered consistent when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant; or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner that is consistent with the purposes of the zone.

TCLUO Section 3.120(6) states that for uses and activities for which a resource capability determination is required by Section 3.140, shall be allowed only if the uses and activities are found to be consistent of the management unit(s) and the purposes of the zone(s) in which they are to be located. An activity will be found to be consistent with the resource capabilities of a management unit (as described in Section 2 of the Estuarine Resources Element of the Tillamook County Comprehensive Plan) when either (1) the impacts of the use on estuarine species, habitats, biological

productivity and water quality are not significant or; (2) that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner consistent with the purposes of the zone. The resource capability determination shall be based on information generated by the impact assessment.

Applicant states in "Exhibit B" that the proposed project is anticipated to generate positive impacts summarized as:

- Project will result in enhanced tidal marsh and aquatic habitats at the site.
- Project will re-create tidal channels that will result in the excavation of natural materials including soil and rock.
- Excess excavation materials will be used to create vegetated mounds that may rise 1.5-2.5 feet above the wetland surface, providing slight topographic diversity to the site.
- Project will result in increased diversification of native riparian plant species.
- Fill materials will be beneficial to the overall restoration design for the project area as they will add habitat diversity by way of the created mounds.

Applicant states 'Exhibit B' that any potential negative impacts will be mitigated by the following actions:

- Water quality in nearby tidal sloughs will be protected by erosion controls including sediment fencing and straw waddles; see engineering plans (W2R 2019a) for details.
- All activities will be conducted during in-water work windows as established by ODFW.
- Mounds will be seeded with erosion control grasses immediately after construction is completed to prevent sediment and turbidity in nearby sloughs.

TCLUO Section 3.120(6) states for uses and activities for which a resource capability determination is required by Section 3.140, shall be allowed only if the uses and activities are found to be consistent of the management unit(s) and the purposes of the zone(s) in which they are to be located. An activity will be found to be consistent with the resource capabilities of a management unit (as described in Section 2 of the Estuarine Resources Element of the Tillamook County Comprehensive Plan) when either (1) the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or; (2) that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner consistent with the purposes of the zone. The resource capability determination shall be based on information generated by the impact assessment.

TCLUO Section 3.120(8) requires the Planning Department notify certain agencies when reviewing regulated activities. Staff provided notice as required by TCLUO Section 3.120(8) on September 20, 2022. No agency comments have been received to date. Included in the Applicant's submittal is a letter from the Oregon Department of Fish and Wildlife (ODFW) expressing their support for the project (Exhibit B).

E. TCLUO Section 3.140: Estuary Development Standards:

(7) FILL IN ESTUARINE WATERS, INTERTIDAL AREAS AND TIDAL WETLANDS: These standards shall apply only to fill in excess of 50 c.y. or fill of less than 50 c.y. which requires a Section 10 or 404 Permit from the U.S. Army Corps of Engineers.

(a) When fill in estuarine waters, intertidal areas or tidal wetlands is proposed, evidence shall be provided by the Applicant and findings made by the County that:

(1) The fill is necessary for navigation or other water dependent uses that require an estuarine location, or is specifically allowed by the management unit or zone; and

(2) A need (i.e. a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and,

(3) If no feasible alternative upland locations exist; and,

(4) If adverse impacts are minimized.

...

(15) RESTORATION AND ENHANCEMENT: Restoration and enhancement projects in estuary zones, Water-Dependent Development (WDD) shoreland zones or other areas within the Shoreland Overlay zone shall be subject to the following standards:

(a) Restoration and enhancement policy requirements in the Tillamook County Comprehensive Plan shall be met.

(b) Proposals for restoration projects shall present evidence that:

(1) The restored area is a shallow subtidal or an intertidal or tidal marsh area after alteration work is performed; and

(2) The restored area may not have been a functioning part of the estuarine system when alteration work begins; and

(3) The restored area is revitalizing, returning or replacing original attributes and amenities which have been diminished or lost by past alterations, activities or catastrophic events.

(c) Estuarine enhancement project proposals shall identify:

(1) The original conditions to be enhanced.

(2) The cause of the loss or degradation.

(3) The location and extent of actions necessary to achieve the enhancement objective

(d) Estuarine enhancement project proposals shall present evidence that the project will result in an overall improvement in the cultural, historic, economic or navigation features of an estuary, which will outweigh any adverse impacts.

(e) When active restoration and enhancement projects are proposed in Estuary Natural (EN) or Estuary Conservation Aquaculture (ECA) zones, evidence shall be provided by the applicant and findings made by the County that the project is consistent with the protection of significant fish and wildlife habitats, biological productivity, and scientific, research and educational needs.

(f) When active restoration or enhancement projects are proposed in Estuary Conservation 1 (EC1) or Estuary Conservation 2 (EC2) zones, evidence shall be provided by the applicant and findings made by the County that the proposed use is consistent with the resource capabilities of the area and the long-term use of renewable resources, and does not cause a major alteration of the estuary.

(g) When passive or active restoration or enhancement projects are proposed in Estuary Development (ED) zones, evidence shall be provided by the applicant and findings made by the County that the project will not interfere with the provision or maintenance of navigation and other needed public, commercial and industrial water-dependent uses, and will not interfere with the use of adjacent shorelands especially suited for water-dependent development.

(h) When active restoration projects are proposed in Water-Dependent Development (WDD) shoreland zones, evidence shall be provided by the applicant and findings made by the County that the proposed project does not preclude or conflict with existing or reasonable potential water-dependent use on the site or in the vicinity. Shoreland Development standards shall apply.

(i) Dredge, fill, shoreline stabilization, shoreland development, installation of energy facilities or utilities, dredged material disposal and other uses and activities proposed as part of (an active) a restoration or enhancement project shall be subject to the respective standards for these uses and activities.

(j) Restoration and enhancement projects in Water-Dependent Development (WDD) shoreland zones or other areas within the Shoreland Overlay zone shall be subject to Shoreland Development standards.

Findings: As noted above, the proposed restoration project is a use allowed in the Estuary Conservation 1 (EC1) zone, permitted conditionally in the Estuary Natural (EN) zone and is subject to the procedures of Section 3.120 and the standards in Section 3.140 which are addressed herein along with the conditional use criteria contained in Section 6.040 for restoration activities within the Estuary Natural (EN) zone as well as the Shoreland Overlay (SH) Zone.

In summary, the Applicant's submittal states:

- The project targets restoring spruce swamp as well as other tidal marsh habitats.
- The project will restore and improve functional aspects of the site by lowering dikes along sloughs and generally improving access of tidal waters to the former wetlands. The project site is only seasonally used for farming and was challenging due to high water levels and being largely undiked.
- The proposed restoration will increase the amount and the quality of rearing habitat for juvenile salmon and will also provide additional foraging and resting habitat for a variety of waterbirds as well as for juvenile marine fishes and nongame species.
- The loss of habitat is due to historic farming activities, primarily on the east half of the project area where restoration activities are concentrated. The project will improve the current condition of the former tidal marshes that are currently dominated by non-native species and no longer support tidal channels that deliver tidal waters on incoming tides and provide habitat for aquatic species.
- The proposed Kilchis Porter restoration project will improve the estuary habitat conditions at the site while not degrading other features present. The improved salmon numbers may result in increases for recreational and commercial angler opportunities in future years, will provide additional flood storage, and the restored tidal wetlands will be a positive benefit to visitors to Tillamook County who enjoy the scenic railroad route that passes along the restored site.
- Restoration of tidal marsh habitat has been shown to benefit salmon species that use these habitats for rearing before venturing out to sea.
- All fill and removal activities will be reviewed by the appropriate permitting agencies and will be conducted according to the standards.
- Agencies notified of the restoration project include the Oregon Department of Fish and Wildlife, Oregon Department of State Lands, Oregon Department of Land Conservation and Development, Environmental Protection Agency, US Fish and Wildlife Service and the US Army Corps of Engineers (Exhibit B).

....

(d) The fill shall be placed at a time that will minimize sedimentation and turbidity. The work periods specified in the Oregon Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (ODFW, 1976) shall be followed unless approval of alternative work periods has been obtained from the ODFW.

Findings: Applicant is proposing a construction window in accordance with those provisions set forth by the Oregon Department of Fish and Wildlife (Exhibit B).

(e) Only non-polluted materials may be used for fill. Materials which would create water quality problems are not permitted.

(f) The perimeters of the fill shall be provided with erosion prevention measures, consistent with Shoreline Stabilization standards.

(g) Fills shall be placed so that adjacent or nearby property is not adversely impacted by increased erosion, shoaling or flooding produced by changes in littoral drift or other changes in water circulation patterns. An affidavit from a professional registered engineer or hydrologist may impact assessment required in Section 3.120.

Findings: Applicant's submittal includes responses to the standards outlined above. Erosion control prevention measures are included in the project design. Technical memorandums for hydrodynamic studies are also included in the Applicant's submittal (Exhibit B).

(h) Fill proposals requiring mitigation shall include a mitigation plan consistent with Mitigation standards.

(i) Fill in estuarine waters, intertidal areas and tidal wetlands shall be subject to the requirements of the State Fill and Removal Law (ORS 541.605 - 541.665), The Rivers and Harbors Act of 1899, the Clean Water Act of 1977 (PL 95-217) and other applicable State and Federal laws. These requirements shall be enforced by State and Federal agencies with regulatory authority over fill projects.

(j) An impact assessment shall be conducted during the local, State, and Federal review of permit applications for fill in estuarine waters, intertidal areas, or tidal wetlands according to the provisions outlined in Section 3.120. Identified adverse impacts shall be minimized to be consistent with the resource capabilities and purposes of the area.

Findings: Applicant is proposing restoration activities that consist of fill in excess of 50 cubic yards and acknowledges this is a regulated activity requiring a Joint Permit Application from the Department of State Lands (DSL) and the Army Corps of Engineers (ACOE) as well as DEQ 401 Water Quality Certification (Exhibit B). Applicant's submittal contains a list of state and federal permits either already issued or currently under review (Exhibit B).

(17) SHORELINE STABILIZATION: Shoreline stabilization projects in estuary zones, Water-Dependent Development (WDD) shoreland zones or other areas within the Shoreland Overlay Zone shall be subject to the following standards:

(a) Within estuarine waters, intertidal areas and tidal wetlands, and along Water Dependent Development Zones and other shoreland areas, general priorities for shoreline stabilization for erosion control are, from highest to lowest:

(1) Proper maintenance of existing riparian vegetation.

(2) Planting of riparian vegetation.

(3) Vegetated riprap.

(4) Non-vegetated riprap.

(5) Groins, bulkheads or other structural methods. Shoreline protection proposals shall include justification for the use of a lower priority method over a higher priority method.

(b) Vegetative shoreline stabilization shall utilize native species, or non-native species approved by the Soil Conservation Service. Reference shall be made to the Inter-Agency Seeding Manual prepared by the Soil Conservation Service.

(c) When structural shoreline stabilization methods are proposed, evidence shall be presented by the Applicant and findings made by the County that:

(1) Flooding or erosion is threatening an established use on a subject property or a need (i.e. a substantial public benefit) is demonstrated in conjunction with navigation or a water dependent use, and
(2) Land use management practices or nonstructural solutions are inappropriate or will not meet the need, and
(3) The proposed structural stabilization method is the minimum size needed to accomplish the desired stabilization, and
(4) The proposed project will not restrict existing public access to publicly owned lands or interfere with navigation or the normal public use of fishery, recreation or water resources, and
(5) The proposed project will not adversely impact adjacent aquatic areas or nearby property through increased erosion, sedimentation, shoaling or flooding produced by changes in littoral drift or other changes in water circulation patterns. An affidavit from a professional registered engineer, hydrologist, or geologist may be required by the Planning Department as a result of the impact assessment required in Section 3.120.
(6) A brief statement from the local Soil and Water Conservation Service may serve as evidence that standards (c) (2) and (c) (3) have been met.

Findings: Applicant states the restoration project will not permanently degrade or reduce estuarine natural values and will enhance estuarine natural values (Exhibit B). All stabilization measures consist of maintenance of existing riparian vegetation, planning of riparian vegetation and no structural shoreline stabilization measures are proposed (Exhibit B). The project area is generally inaccessible by the public. Applicant is working with the Oregon State Preservation Office and local tribes in compliance with preservation of public and cultural resources present in the project area (Exhibit B).

(d) Shoreline stabilization projects shall be timed to minimize impacts on aquatic life.

Findings: Applicant is proposing a construction window coincident with the Oregon Department of Fish and Wildlife Guidelines for Timing of In-Water Work to Protect Fish and Wildlife Resources (Exhibit B). Applicant adds that the site has few improvements on it that would impede restoration actions and the site size, 30 acres, is manageable in terms of doing the major restoration construction work is a single season, reducing any temporary impacts to the area (Exhibit B).

Applicant states the restoration project has been designed to avoid any potential adverse impacts as feasible and that the project as designed will improve recreational, aesthetic and habitat values of the resource (Exhibit B). Applicant also states there are no significant degradations or reductions of estuarine natural values associated with the proposed restoration project (Exhibit B).

Issuance of permit approvals for the restoration project by the Oregon Department of State Lands, US Army Corps of Engineers and Oregon Department of Environmental Quality are generally considered to adequately demonstrate support the project is consistent with the resource capabilities of the area and the long-term use of renewable resources of the estuary.

TCLUO Section 3.120(8) requires the Planning Division notify certain agencies when reviewing regulated activities. Staff provided notice as required by TCLUO Section 3.120(8) on September 20, 2022. No comments were received however comments in the record from the 2019 public hearing notice for this project are included in "Exhibit C". Additionally, a letter of support for the project from the Oregon Department of Fish and Wildlife is included with the Applicant's submittal included as "Exhibit B" of this report.

...

(k) An impact assessment shall be conducted during local, state and federal review of permit applications for structural shoreline stabilization seaward of the line of non-aquatic vegetation or the Mean Higher High Water (MHHW) line. The impact assessment shall follow the procedure outlined in Section 3.120. Identified adverse impacts shall be avoided or minimized to be consistent with the resource capabilities and purposes of the area.

Findings: The requirements of TCLUO Section 3.120 are addressed in this report and in the Applicant's submittal (Exhibit B).

F. TCLUO Section 3.510: Flood Hazard Overlay (FH) Zone

(1) PURPOSE: It is the purpose of the FH zone to promote the public health, safety and general welfare and to minimize public and private losses or damages due to flood conditions in specific areas of unincorporated Tillamook County by provisions designed to:

(a) Protect human life and health;
(b) Minimize expenditure of public money for costly flood control projects;
(c) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the public;
(d) Minimize prolonged business interruptions;
(e) Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in areas of special flood hazards;
(f) Help maintain a stable tax base by providing for the sound use and development of areas of special flood hazard so as to minimize future flood blight areas;
(g) Ensure that potential buyers are notified that property is in an area of special flood hazard; and
(h) Ensure that those who occupy the areas of special flood hazard assume responsibility for their actions.
(i) Maintain the functions and values associated with Special Flood Hazard Areas which reduce the risk of flooding.

Findings: The proposed restoration project is designed to restore tidal marshes and tidal channels that support natural communities and native species (Exhibit B). Applicant states restored habitats will also provide watershed benefits during high water events including flood conditions by providing additional off channel storage of flood waters. Applicant asserts benefits may extend beyond the project boundaries depending upon the severity of the flood conditions and combined effects of tidal waters and storm surge (Exhibit B).

Project area is located within an Area of Special Flood Hazard, specifically the AE Zone as depicted on the FEMA Flood Insurance Rate Map (FIRM) Panel No. 41057C0413F and 41057C0576F (Exhibit A). The Flood Hazard Overlay Zone defines "restoration" as the process of returning a disturbed or altered area or feature to previously existing natural condition. Restoration activities reestablish the ecological structure, function, and/or diversity to that which occurred prior to impacts caused by human activity.

Staff finds the proposed project falls within the definition of "restoration" and is subject to the provisions of TCLUO Section 3.510. Development Permit approval is required for the proposed project. Estuary/Floodplain Development Permit #851-22-000329-PLNG has been submitted for this project proposal and is addressed later in this report.

G. TCLUO Section 3.545: Shoreland Overlay (SH) Zone

(1) PURPOSE: The purpose of the Shoreland Overlay zone is to:

(a) Provide for development, restoration, conservation of protection of coastal shorelands in a manner which is compatible with the resources and benefits of coastal shorelands and adjacent coastal water bodies.

(b) Protect identified priority dredged material disposal and mitigation sites from uses which would prevent their ultimate use for dredged material disposal or mitigation;

In the vicinity of the proposed project, the Goal 17 element of the Tillamook County Comprehensive Plan identifies all areas within 1,000 feet of estuaries and 500 feet of coastal lakes as within the Shorelands Boundary which may be subject to the provisions of TCLUO Section 3.545. TCLUO Section 3.545 defines those areas within the Shorelands Boundary included within the Shoreland Overlay Zone. Relevant to the proposed development, TCLUO 3.545(2) also identifies areas within 50 feet of estuaries as areas included in the Shorelands Overlay zone.

Findings: Staff finds the subject properties are located within the Shorelands Boundary as identified in the Goal 17 element of the Tillamook County Comprehensive Plan. Staff has reviewed the proposed development and determined that shoreland areas on the subject properties and project area are identified in the Estuarine Element and Coastal Shoreland Element of the Tillamook County Comprehensive Plan, are inventoried as major marshes and significant wildlife habitat, and are Significant Shoreland resources included within the second category of shorelands listed in TCLUO Section 3.545.

TCLUO Section 3.545(5)(c) lists estuarine restoration actions (as defined in Section 6.12 of the Estuarine Resources Element of the Comprehensive Plan) as a use permitted conditionally, stating these actions shall be allowed only at approved sites listed in the Comprehensive Plan, unless the restoration action is approved as part of a mitigation project. Restoration actions are subject to the standards of Section 3.140 (15).

Staff finds the scope of work for this active restoration and estuarine enhancement project is consistent with activities defined in Section 6.12 of the Estuarine Resources Element of the Comprehensive Plan. Staff also finds the standards of Section 3.140(15) are addressed through this process. The project is subject to Conditional Use review.

TCLUO Section 3.545(6) STANDARDS: Uses within the SHORELAND OVERLAY ZONE are subject to the provisions and standards of the underlying zone and of this section. Where the standards of the SHORELANDS OVERLAY ZONE and the underlying zone conflict, the more restrictive provisions shall apply.

(a) Riparian vegetation shall be protected and retained according to the provisions outlined in Section 4.140, REQUIREMENTS FOR PROTECTION OF WATER QUALITY AND STREAMBANK STABILIZATION.

(b) Development in flood hazard areas shall meet the requirements of Section 3.510, FLOOD HAZARD OVERLAY ZONE.

...

Findings: The requirements of TCLUO Section 4.140 and 3.510 are addressed in this report.

H. TCLUO Section 3.550: Freshwater Wetlands Overlay (FW) Zone

(1) PURPOSE AND AREAS INCLUDED: The purpose of this zone is to protect significant areas of freshwater wetlands, marshes and swamps from filling, drainage or other alteration which would destroy or reduce their biological value. Areas included in this zone are:

(a) Significant Goal 5 Wetlands: wetlands identified as "significant" in the Goal 5 Element of the Comprehensive Plan;
(b) Notification Wetlands: wetlands shown on the Statewide Wetland Inventory (discussed in the Goal 5 Element of the Comprehensive Plan).

Findings: In review of the wetland maps contained within the Tillamook Comprehensive Plan Goal 5 inventory, the wetlands are not identified as Significant Goal 5 Wetlands. The project is under review in accordance with the provisions outlined for notification wetlands. The Oregon Department of State Lands is in receipt of notice of this project proposal along with the Oregon Department of Fish and Wildlife and other interested state agencies.

I. TCLUO Section 4.140: Requirements for Protection of Water Quality and Streambank Stabilization

1) The following areas of riparian vegetation are defined:
(a) Fifty (50) feet from lakes and reservoirs of one acre or more, estuaries, and the main stems of the following rivers where the river channel is more than 15 feet in width; Nestucca, Little Nestucca, Three Rivers, Tillamook, Trask, Wilson, Kilchis, Miami, Nehalem and North and South Fork Nehalem River.

...

For estuaries, all measurements are horizontal and perpendicular from the mean high-water line or the line of non-aquatic vegetation, whichever is most landward. Setbacks for rivers, streams, and coastal lakes shall be measured horizontal and perpendicular from the ordinary high-water line.

(2) All development shall be located outside of areas listed in (1) above, unless:
(a) For a bridge crossing; or
(b) Direct water access is required in conjunction with a water dependent use; or
(c) Because of natural features such as topography, a narrower riparian area protects equivalent habitat values; or
(d) A minimal amount of riparian vegetation is present and dense development in the general vicinity significantly degrades riparian habitat values.

Setbacks may be reduced under the provisions of (c) and (d) above only if the threat of erosion will not increase and a minimum 20-foot setback is maintained. Determinations of habitat values will be made by the Oregon Department of Fish and Wildlife.

...

(4) All trees and at least 50 percent of the understory vegetation shall be retained within areas listed in (1) above, with the following exceptions:

...

(d) Structural shoreland stabilization subject to the shoreline stabilization standards in Section 3.140.

Findings: Applicant is proposing two bridge crossings and restoration activities within defined riparian boundaries (Exhibit B). Applicant states project is consistent with enhancement and protection of water quality. Stabilization (vegetation) measures are incorporated into project scope of work to limit sedimentation and erosion concerns that impact water quality (Exhibit B).

IV. CONDITIONAL USE REQUEST # 851-22-000328-PLNG ANALYSIS

TCLUO Article VI: Conditional Use Procedures and Criteria

TCLUO Section 6.040: Review Criteria requires that any Conditional Use authorized according to TCLUO Article VI shall be subject to the following criteria, where applicable:

(1) The use is listed as a CONDITIONAL USE in the underlying zone, or in an applicable overlying zone.

Findings: Applicant is proposing an active restoration project as described in "Exhibit B". Active restoration projects are listed as a use permitted Conditionally in the Estuary Natural (EN) Zone. Estuarine restoration actions as defined in Section 6.12 of the Estuarine Resources element of the Tillamook County Comprehensive Plan are also listed as a use permitted Conditionally in the Shoreland Overlay (SH) Zone.

The proposed restoration project is allowed in TCLUO 3.160: Estuary Conservation 1 (EC1) Zone subject to subject to satisfaction of the applicable requirements outlined in TCLUO Sections 3.120 and 3.140 which are outlined in this report, and the criteria contained in TCLUO Article 6 which are addressed below as these sections apply to development within the Estuary Natural (EN) Zone.

Wetland restoration projects in the Farm (F-1) zone are only subject to the criteria listed in Section 6.060. These criteria are addressed later in this report.

(2) The use is consistent with the applicable goals and policies of the Comprehensive Plan.

Findings: The Tillamook County Land Use Ordinance is an implementing document of the Comprehensive Plan. In the absence of evidence to the contrary, uses allowed conditionally in the Land Use Ordinance are presumed to be consistent with the Comprehensive Plan. Staff finds that the proposed restoration project should be reviewed specifically for consistency with the policies of the Tillamook County Comprehensive Plan contained in Goals 6, 7, 16 and 17.

- Tillamook County Comprehensive Plan Goal 6 Element: AIR, WATER AND LAND RESOURCES QUALITY

Summary: This goal requires local comprehensive plans and implementing measures to be consistent with state and federal regulations on matters such as groundwater pollution.

Findings: Applicant asserts the proposed development will not reduce protections for resources and natural features addressed in the Goal 6 Element or waive requirements for satisfaction of development standards intended to address resource quality such as those contained in TCLUO 4.140: Requirements for Protection of Water Quality and Streambank Stabilization. Compliance with TCLUO Section 4.140 is discussed above in this Staff Report. Compliance and permitting requirements through the U.S. Army Corps of Engineers and 401 Water Quality Certification approval from DEQ are required for restoration projects (Exhibit B). Should the Planning Commission choose to approve this request, typical Conditions of Approval on development requiring Applicants obtain all required Federal, State, and Local permits and/or licenses and comply with applicable rules and regulations are incorporated into permitting requirements.

- Tillamook County Comprehensive Plan Goal 7 Element: HAZARDS

Summary: Goal 7 deals with development in places subject to natural hazards such as floods or landslides. It requires that jurisdictions apply "appropriate safeguards" (floodplain zoning, for example) when planning for development there.

Findings: The Tillamook County Land Use Ordinance is an implementing document of the Comprehensive Plan and contains ordinance provisions addressing the identification of hazard areas and requirements for development in identified hazard areas. The proposed development is located in a

Special Flood Hazard Area (Exhibits A and B). Applicant has submitted an Estuary/Floodplain Development Permit with hydraulic modeling to address flood concerns (Exhibit B).

- Tillamook County Comprehensive Plan Goal 16 Element: ESTUARINE RESOURCES

Summary: This goal requires local governments to classify Oregon's 22 major estuaries in four categories: natural, conservation, shallow-draft development, and deep-draft development. It then describes types of land uses and activities that are permissible in those "management units."

Findings: The Tillamook County Land Use Ordinance (TCLUO) is an implementing document of the Comprehensive Plan, and the use and development of estuarine areas is addressed under the ordinances of the relevant estuary zone as well as the general estuary development standards contain in TCLUO 3.140. Conformance of the proposed development with the requirements of the Estuarine standards are outlined in this report.

The Goal 16 Element defines three types of Estuary Management Units, specifying purposes and permissible uses within each management unit. These unit types are Natural, Conservation and Development.

Natural Units: In all estuaries, areas shall be designated to assure the protection of significant fish and wildlife habitats, of continued biological productivity within the estuary, and of scientific, research, and education needs. These shall be managed to preserve the natural resources in recognition of dynamic, natural, geological and evolutionary processes. Such areas shall include, at a minimum, all major tracts of salt marsh, tideflats, and seagrass and algae beds. Permissible uses in natural areas include protection of habitat, nutrient, fish, wildlife and aesthetic resources; passive restoration measures; and bridge crossings. A use or activity is consistent with the resource capabilities of the area when either the impacts of the use on estuarine species, habitats, biological productivity and water quality are not significant or that the resources of the area are able to assimilate the use and activity and their effects and continue to function in a manner to protect significant wildlife habitats, Estuarine Resources Goal 16 11 natural biological productivity, and values for scientific research and education.

Conservation Units: Conservation units are generally classed for preservation. Areas shall be designated for long-term uses of renewable resources that do not require major alteration of the estuary, *except* for the purposes of restoration. These areas are managed to conserve the natural resources and benefits, and include areas needed for maintenance and enhancement of biological productivity, recreational and aesthetic uses, and aquaculture. Conservation units include tracts of significant habitat smaller or of less biological importance than those in Estuary Natural units. Areas that are partially altered and adjacent to existing development of moderate intensity which do not possess the resource characteristics of natural or development units are also included in this classification.

Goal 16 also establishes eight implementation requirements, six of which are implemented through the Tillamook County estuary management plans. Most notably, Implementation Requirement 1 requires an impact assessment for actions which would potentially alter the estuarine ecosystem. The impact assessment need not be lengthy or complex, but it should enable reviewers to gain a clear understanding of the impacts to be expected, and shall include the following:

> *(a) The type and extent of alterations expected;*
> *(b) The type of resource(s) affected;*
> *(c) The expected extent of impacts of the proposed alteration on water quality and other physical characteristics of the estuary, living resources, recreation and aesthetic use, navigation and other existing and potential uses of the estuary; and*
> *(d) The methods which could be employed to avoid or minimize adverse impacts.*

Implementation Requirement 2 requires that dredging or fill only be allowed under the following circumstances. Other uses and activities which could alter the estuary shall be allowed if the requirements in (b), (c) and (d) are met:

> *(a) If required for navigation or other water-dependent uses that require an estuarine location or if specifically allowed by the applicable management unit requirements of this goal; and*
> *(b) If a need (i.e., a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and*
> *(c) If no feasible alternative upland locations exist; and*
> *(d) If adverse impacts are minimized.*

Implementation Requirement 3 requires the local government to maintain water quality and minimize man-induced sedimentation in estuaries by recognizing the management techniques or controls of existing programs or authorities. Implementation Requirement 5 requires mitigation for the effects of dredging or fill in intertidal or tidal marsh areas.

Implementation Requirement 8 requires local governments, with the assistance of state and federal agencies, to identify areas suitable for estuarine restoration.

Policies for new land transportation facilities (bridge crossings) within estuarine waters, intertidal marshes or tidal wetlands shall be permitted only if no feasible alternative upland route exists; a need (i.e. a substantial public benefit) is demonstrated and the use or alteration does not unreasonably interfere with public trust rights; and adverse impacts are avoided or minimized. New land transportation facilities in Estuary Natural (EN) zones shall be limited to low-water bridges, bridge crossings and bridge crossing support structures. Bridge crossing support structures are allowed only if consistent with the resource capabilities of the area and the purposes of the management unit.

New land transportation facilities shall be limited to bridge crossing support structures and temporary low-water bridges in the Estuary Conservation (EC1) zone. New land transportation facilities in any Estuary Management Unit shall be sited and designed to be consistent with the protection of the natural values of identified major marshes, significant wildlife habitat, coastal headlands, and exceptional aesthetic resources within the shorelands planning boundary identified in the Tillamook County comprehensive Plan.

Policies for active restoration and estuary enhancement activities are permitted in all estuary zones, and are subject to the following requirements:

In Estuary Natural (EN) zones, active restoration shall be limited to restoration of fish and wildlife habitat or water quality. Active restoration and estuarine enhancement shall be consistent with the resource capabilities of the area and the purposes of the management unit. In Estuary Conservation (EC1) zones, a resource capability determination shall be required for active restoration for purposes other than restoration of fish and wildlife habitat or water quality.

In major marshes, significant wildlife habitat, coastal headlands and exceptional aesthetic resources within coastal shorelands, active restoration shall be consistent with the protection of shoreland natural values.

- Tillamook County Comprehensive Plan Goal 17 Element: COASTAL SHORELANDS

Summary: The goal defines a planning area bounded by the ocean beaches on the west and the coast highway (State Route 101) on the east. It specifies how certain types of land and resources there are to be

managed: major marshes, for example, are to be protected. Sites best suited for unique coastal land uses (port facilities, for example) are reserved for "water-dependent" or "water related" uses.

Findings: As discussed above the proposed development is located within the Shorelands Boundary as identified in the Goal 17 element of the Tillamook County Comprehensive Plan. Review of the proposed restoration development must demonstrate consistency with applicable policies including allowance of only low-intensity uses that do not disrupt wildlife (including the prohibition of "facilities") as well as demonstration of protection of estuarine resources and values. Applicant asserts the proposed development does not impact significant shorelands (Exhibit B).

(3) The parcel is suitable for the proposed use considering its size, shape, location, topography, existence of improvements and natural features.

Findings: Applicant's submittal included as "Exhibit B" contains a detailed description of the proposed development on the subject properties. Applicant states the project area is an ideal candidate for restoration as it occupies former tidal marsh habitat that has good connectivity to tidal waters of Tillamook Bay via Hathaway and Stasek Sloughs that that border the property on two sides. The site is also ideal as it is relatively isolated from active farmlands being located all but adjacent to Tillamook Bay. The Kilchis Preserve owned by The Nature Conservancy borders the project area to the south, across Stasek Slough, and is dominated by restored tidal marsh habitat that is complementary to the intended restored marsh habitat on the project area. The project site also borders Highway 101 and the Tillamook Bay railroad line on its eastern border, both of which are located on elevated berms that are far above tidal and flood elevations and not affected by restoration. The project area will restore 30 acres of spruce swamp habitat, a habitat that has suffered 90% loss countywide and is very important for salmon rearing in associated tidal channels as well as providing habitat for other wildlife species (Exhibit B).

Applicant also states the site has few improvements on it that would impede restoration actions and the site size, 30 acres, is manageable in terms of doing the major restoration construction work is a single season which reduces any temporary impacts to the area (Exhibit B).

(4) The proposed use will not alter the character of the surrounding area in a manner which substantially limits, impairs or prevents the use of surrounding properties for the permitted uses listed in the underlying zone.

Findings: Predominant use in the surrounding area is agricultural, specifically commercial dairy operations. Applicant states the restored site will not interfere with adjacent land uses focused on farming as the project area is separated from farmlands by two existing tidal sloughs, Stasek and Hathaway, and by native wetlands that occur on the western border of the site (Exhibit B). Applicant also explains why the restored site will not interfere with any transportation uses along the Highway 101 corridor or the Tillamook Bay Railroad line, both of which occur along the eastern edge of the site (Exhibit B).

Impacts to agricultural lands are examined through the criteria contained in TCLUO Section 6.060, addressed at the end of this report in accordance with the process and procedures developed under SB1517.

Estuarine Uses: The purpose of the Estuary Conservation 1 (EC1) Zone as described in TCLUO 3.106 is to provide for long-term utilization of areas which support, or have the potential to support valuable biological resources, provide for long-term maintenance and enhancement of biological productivity and provide for the long-term maintenance of the aesthetic values of estuarine areas, in order to promote or enhance the low intensity recreational use of estuarine areas adjacent to rural or agricultural shorelands.

Applicant has provided responses addressing the requirements for review of regulated activities contained in TCLUO Section 3.120 and the applicable standards for development of the restoration project contained in TCLUO Section 3.140: Estuary Development Standards (Exhibit B).

Applicant states there are no significant degradations or reductions of estuarine natural values associated with the proposed restoration project which is and will be supported by issuance of required state and federal permits for the proposed project. Applicant's submittal argues that the proposed project would not negatively impact aesthetic values, recreational opportunities or impact public access to estuarine resources- reasons of which are also summarized throughout this report (Exhibit B).

(5) The proposed use will not have detrimental effect on existing solar energy systems, wind energy conversion systems or wind mills.

Findings: Applicant's response indicates there are no such systems in this area (Exhibit B). Staff finds no County records that indicate the presence of solar energy systems, wind energy conversion systems, or windmills within the vicinity of the proposed project.

(6) The proposed use is timely, considering the adequacy of public facilities and services existing or planned for the area affected by the use.

Findings: Applicant states the proposed use is timely with regards to any potential impacts to public facilities and services as no existing facilities will be affected by the restoration or by the continued conservation actions at the site (Exhibit B).

The subject area is served by several public facilities and services that have been in existence for decades. These include law enforcement, transportation, and utility services. Applicant is not proposing utilization of existing utility facilities or a modification in access to the project area that would result in review of the state and county transportation system. As a precautionary measure, the Oregon Department of Transportation and the Tillamook County Public Works Department received notification of this project. No comments have been received to date.

TCLUO Section 6.060: Wetlands Restoration, Enhancement or Creation on Land Subject to Exclusive Farm Use Zoning Designation

(1) Notwithstanding 6.040 or ORS 215.296(10), a CONDITIONAL USE for a WETLAND RESTORATION, ENHANCEMENT OR CREATION located on land zoned Farm (F-1) and authorized according to this Article shall only be subject to the following criteria:

a. The use will not force a significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest use; and

b. The use will not significantly increase the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use.

Findings: Per the Applicant, the Porter Kilchis restoration project is proposed for a parcel of land in the lower Kilchis River watershed that is largely isolated from active farmlands. The 60-acre Porter tract is zoned approximately 35% estuary zoning (EN, EC1) and 65% farmland zoning (Figure 3). The 30-acre restoration project area is approximately 25% estuary zoning and 75% farmland zoning (Exhibit B). Applicant states that there are no active forestry programs on neighboring lands and that

the project area, which is mostly to the east of Porter Slough and the connector channel, has shared property boundaries with farmlands that are either separated by natural waterways, native wetlands or Highway 101. Applicant refers to Figure 5 of the submittal for site depiction (Exhibit B).

Applicant's submittal includes discussion of type and frequency of agricultural activities on adjacent farmlands. Applicant states, *The Kilchis Preserve—Dooher Tract which has been managed by The Nature Conservancy since 2010 has coexisted with neighboring farms for nine years. The Preserve had undergone tidal wetland restoration actions in 2015 and there have been no impacts to neighboring farmlands attributed to the restoration. Management of the Kilchis Preserve which includes the restored Dooher tract as well as the Porter tract, is directed by the Kilchis Preserve Management Plan* (Exhibit B).

Applicant also states, *The restored Porter project area within the Porter tract will also not interfere with adjacent farmland management as it is separated from neighboring farmlands by Stasek and Hathaway Sloughs and by native wetlands that occur on the western portion of the Porter tract. The native wetlands will not be subject to major restoration activities. The Porter tract is separated from farmlands on its eastern border by Highway 101. Restoration activities on the Porter tract will primarily take place within the interior of the tract. Only a minor amount of low dike along Hathaway Slough will be lowered so there will be little increase in overland flow of high waters onto the Porter tract from the sloughs at peak tides* (Exhibit B).

Applicant acknowledges that changing water levels in the sloughs adjacent to the project area are a primary concern for farmers who have lands that also border these natural sloughs. To assess the effects of the restoration on water levels in the project area, on the sloughs and the Kilchis River in the surrounding area, Applicant contracted with Wolf Water Resources to develop a hydrodynamic model (Hydrodynamic Model memo from NHC 2019) based on waterway bathymetry and elevations of the surrounding area with inputs of water levels from water level loggers, tidal heights and projected river flows determined from nearby gauged rivers (Exhibit B). Applicant adds that the hydrodynamic model was initially developed for the Dooher tract restoration project and has been updated to reflect potential effects of the 2015 flood that occurred in the region. Further refinement of the model has occurred to reflect the proposed hydrologic changes associated with the planned restoration at the Porter project area (Exhibit B). Applicant asserts the restored wetlands in fact will function as overflow and storage zones for floodwaters in the sloughs, thus offering some minor relief to adjacent lands in the Kilchis drainage during high flow conditions (Exhibit B).

Applicant's submittal also addresses concerns related to the spread of noxious weeds and native plant species to adjoining lands. Applicant states a management plan has been developed for weed control management and that restoration will not result in a spread of noxious species to adjacent farmlands as TNC will be aggressively managing detections of weeds through manual and chemical control (Exhibit B). Applicant adds native species used in the revegetation activities at the project are not prone to spreading and are mostly wetland obligate species that will not spread or become established in managed farm or pasture lands (Exhibit B).

Applicant also addresses concerns raised related to enhanced wildlife damage and increased public use on private lands resulting from the wetland restoration project. Applicant states, *Wildlife use may increase on the restored project area as natural habitats are improved but as there won't be any increases in food that attract geese, for instance, it is not expected to result in more geese being attracted to the site or surrounding farmlands. It has been suggested that deer could become more numerous on the restored site but wetlands don't offer the best habitat for deer so use will be limited. Public use is not expected to increase in the project area as there is no defined public access to the site. Therefore, public use is not expected to increase on neighboring farmlands* (Exhibit B).

Applicant also states, *TNC believes that the proposed restoration meets the conditional use criteria of (a)*

not forcing significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest use; and (b) not significantly increasing the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use. Adjacent farmlands will not experience rising water levels, increased wildlife depredation, or more public use because of the restoration on the Porter project area. Therefore, the adjacent farms should not be forced to make significant changes to accepted farm practices due to restored wetlands on the Porter project area. The relatively isolated nature of the restoration site that lies west of Highway 101 should not pose a conflict to neighboring farms that do not share roads, access, fences or even close boundaries for the most part. Because of this, there should be no significant increase in costs of accepted farm practices due to the presence of the restored project area (Exhibit B).

Initial review of this project proposal commenced in 2019, and was identified as Conditional Use request #851-19-000510-PLNG with accompanying Estuary/Floodplain Development Permit #851-19-000511-PLNG. Public comments received during the initial review process are included in "Exhibit C" at the request of those who submitted testimony early on in the review process. Objections raised to the project proposal largely focused on impacts to surrounding agricultural lands resulting in a loss of protected farmland due to increased flooding of farmland, increased sedimentation issues, accumulation of tidewater and salinization, increased wildlife presence and concerns related to effective vegetation management. Impacts realized from the restoration project on the "Dooher tract" are also described in the letters from adjoining landowners, expressing concerns that without acknowledging and addressing the problems resulting from restoration of the "Dooher tract", the restoration project on the "Porter tract" should not be permitted to move forward (Exhibit C).

Comments received also argue that the combined project areas for wetland restoration doubles impacts to farms and other bordering properties. Impacts in loss of farmland impacts effective drainage of active farmland and limits opportunities for expansion and reinvestment of multi-generational farm operations. Comments also state that the economic costs and consequences of saturation of soils that result in loss of farmland have also not been fully explored (Exhibit C).

Upon receipt of these public comments, the Applicant agreed to enter a collaborative process to try to settle disputes related to the proposed wetland restoration project. The procedures for a project-specific collaborative process outlined in TCLUO Section 6.060(2) were followed. Mediation services were provided by 6 Rivers Agricultural Mediation Program. While no formal resolution was reached, the Applicant agreed to continue conversations outside of the land use process with the Tillamook County Creamery Association and the Tillamook Bay Flood Improvement District- both of whom represented adjacent landowners who own and operate farmlands and other stakeholders who share concerns about impacts resulting from the proposed restoration project.

It was agreed upon by all parties that Northwest Hydraulic Consultants (NHC) would be hired to complete an independent assessment of the Kilchis restoration projects that included the restoration work on the "Dooher tract". The assessment was funded by The Nature Conservancy and the Tillamook County Creamery Association. A copy of the assessment is included in "Exhibit B".

Upon completion of the NHC assessment, Wolf Water Resources completed additional hydrodynamic modeling, completing revised models described in the updated technical memorandum dated July 16, 2022. Copies of the updated memorandum is also included in "Exhibit B".

V. ESTUARY/FLOODPLAIN DEVELOPMENT PERMIT 851-22-000329-PLNG ANALYSIS

As stated previously in this report, the subject properties and project area are located entirely in an 'AE' Flood Zone and Area of Special Flood Hazard (Exhibit A). Applicant is proposing a 30-acre wetland restoration project in the eastern portion of the subject properties (Exhibit B). Staff finds that the proposed restoration project is subject to the standards and criteria of TCLUO Section 3.510: Flood Hazard Overlay (FH) Zone which are addressed below.

A. TCLUO Section 3.510: Flood Hazard Overlay (FH) Zone

(13) DEVELOPMENT PERMIT PROCEDURES: A development permit shall be obtained before construction or development begins within any area of special flood hazard zone. The permit shall be for all structures including manufactured dwellings, and for all development including fill and other development activities, as set forth in the Definitions contained in this Section of the Land Use Ordinance.

(a) Application for a development permit shall be made on forms furnished by the Community Development Director and shall include but not necessarily be limited to: plans in duplicate drawn to scale showing the nature, location, dimensions, and elevations of the area in question, existing or proposed structures, fill, storage of materials, drainage facilities, and the location of the foregoing. Specifically, the following information in 3.510(13)(a)(1)–(4) is required and Development Permits required under this Section are subject to the Review Criteria put forth in Section 3.510(13)(b):

...

(4) Description of the extent to which any watercourse will be altered or relocated as a result of proposed development.

Findings: Applicant's are proposing to alter and relocate watercourses as outlined in the project site. The restoration design overview and states the proposed restoration project is designed to restore tidal marshes and tidal channels that support natural communities and native species (Exhibit B).

(b) Development Permit Review Criteria

(1) The fill is not within a floodway, Coastal High Hazard Area, wetland, riparian area or other sensitive area regulated by the Tillamook County Land Use Ordinance.

(2) The fill is necessary for an approved use on the property.

(3) The fill is the minimum amount necessary to achieve the approved use.

(4) No feasible alternative upland locations exist on the property.

(5) The fill does not impede or alter drainage or the flow of floodwaters.

Findings: Applicant submitted the required information on forms provided by the Community Development Department and as attachments thereto (Exhibit B). As described in detail in Applicant's submittal, the fill is necessary for the requested activities (Exhibit B). Applicant has provided hydrodynamic technical memorandums from Wolf Water Resources (Exhibit B).

Following mediation and to address flooding concerns raised by adjacent landowners, an independent hydrodynamic review was conducted by Northwest Hydraulic Consultants, Inc. The scope of work was developed in concert with the Tillamook County Creamery Association and Tillamook Bay Flood Improvement District. Scope of work included review of observed water levels and the hydrodynamic model developed for the Kilchis/Porter tracts, review of the "Dooher tract" impacts, and review of the "Porter tract" impacts (Exhibit B).

The subject properties are not located within a Coastal High Hazard area (Exhibit A). Applicant describes type of materials to be brought to the project site- gravel and/or cobble to be used in substructures for the bridges to be constructed or for stabilizing construction staging areas or temporary roadways, the above-mentioned bridges located over Porter Slough, and large logs that will be used as wood habitat structures in the tidal channels. Applicant adds that material generated on the site from excavation activities will be used on the site to fill drainage ditches according to the restoration plans. Any excess materials will be

placed in vegetated mounds that are designed to provide topographic diversity at the site and elevated planting habitats (Exhibit B).

Section 3.510 of the Tillamook County Land Use Ordinance defines "Fill" as, "*any material such as, but not limited to, sand, gravel, soil, rock or gravel that is placed on land including existing and natural floodplains, or in waterways, for the purposes of development or redevelopment.*" The same section of the Ordinance further defines "Restoration" as "*The process of returning a disturbed or altered area or feature to a previously existing natural condition. Restoration activities reestablish the ecological structure, function, and/or diversity to that which occurred prior to impacts caused by human activity.*" It should also be noted that an overly stringent interpretation and application of criterion #1 would prohibit any development whatsoever from occurring in wetland, riparian or other sensitive areas regulated by the TLCUO, including any opportunities for restoration. Moreover, restoration activities are expressly allowed in the Flood Hazard Overlay Zone as well as several other underlying and overlay zones, provided all applicable supplemental regulations of the TCLUO are met.

Applicant states the project utilizes the minimum amount of grading possible to achieve restoration results. Applicant states the mounds will not impede drainage or the flow of floodwaters on the site. Materials amounts generated by the excavations equal 9790CY; material from dike lowering equals 2150CY. Materials brought onto the site total 569CY: 400CY gravel, 129CY logs, 40CY bridge works (Exhibit B).

By the very nature of a wetland or estuary restoration project, upland locations for the project would not be feasible. The purpose of this project is to restore a previously-diked area to its natural state by removing and restoring previous man-made development that has altered the natural flow and drainage of floodwaters (Exhibit B).

Applicant states the hydrodynamic model developed for the project shows that under base flood conditions (12.5 feet elevation for the site and project area), there will be no rise in water level elevations in the project area after restoration actions have been completed (Exhibit B). The project area is not located within a mapped floodway, however provisions outlined in Section 3.510(9)(3) state, *In areas where a regulatory floodway has not been designated, no new construction, substantial improvements or other development (including fill) shall occur within an AE Zone designated on the community's Flood Insurance Rate Map, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.*

In review of the modeling completed by Wolf Water Resources and Northwest Hydraulic Consultants Inc., Staff has approached FEMA Region X for guidance on whether or not this project should be required to submit a Letter of Map Revision (LOMR) based on as-built conditions when the project is completed. Staff will be able to provide comments from FEMA Region X at the November hearing.

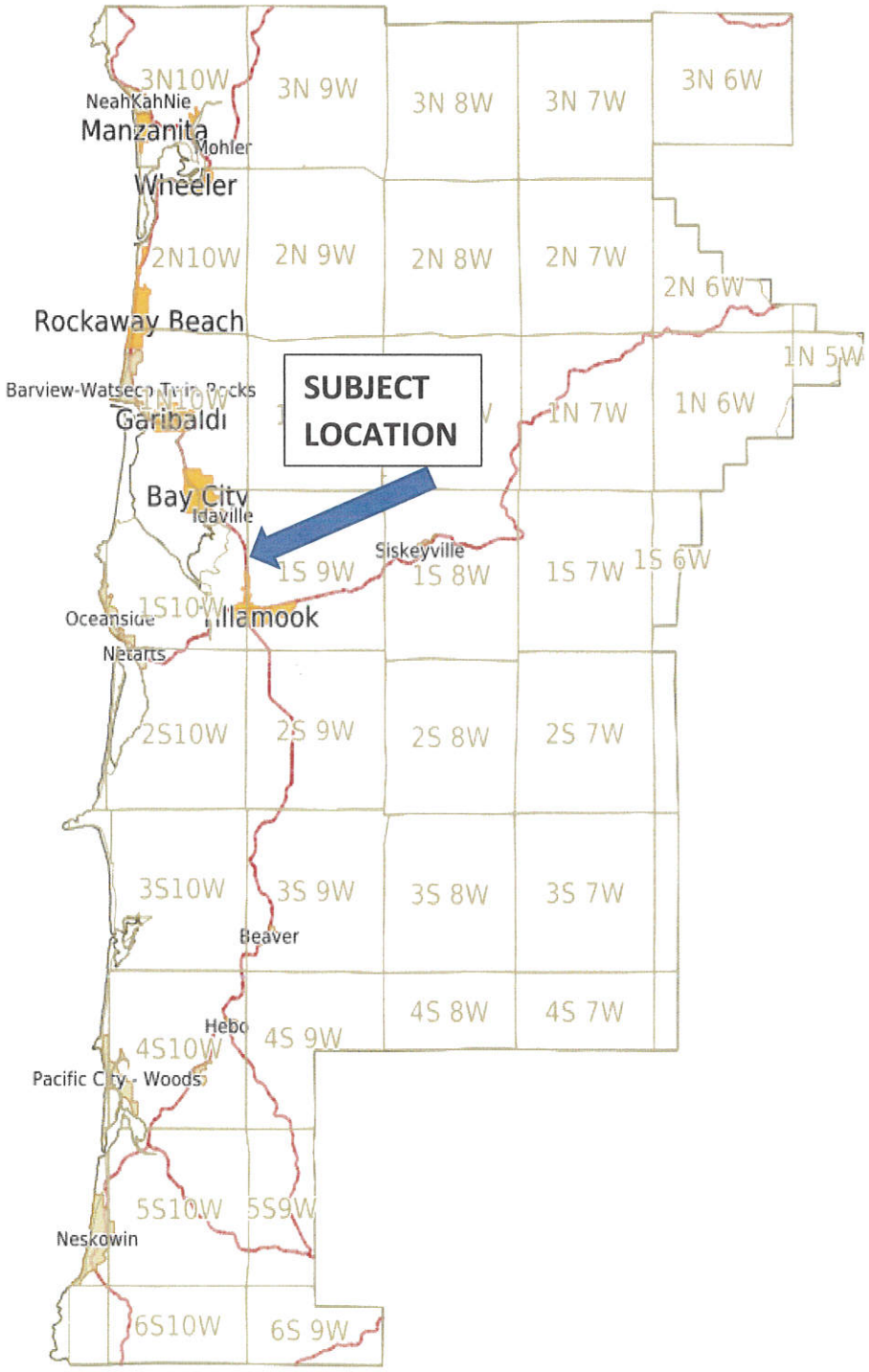
VII. EXHIBITS

All Exhibits referred to herein are, by this reference, made a part hereof:

A. Location map, Assessor map, Zoning map, FEMA FIRMs, NWI Wetlands map, Estuary Management Unit Map
B. Applicant's submittal
C. Public Comments (2019 Submittal)
D. Tillamook County Comprehensive Plan Goal 16 Estuary Management Unit Map and Descriptions for Units 29EC1, 30EN and 31EC1
E. Mediation Summary

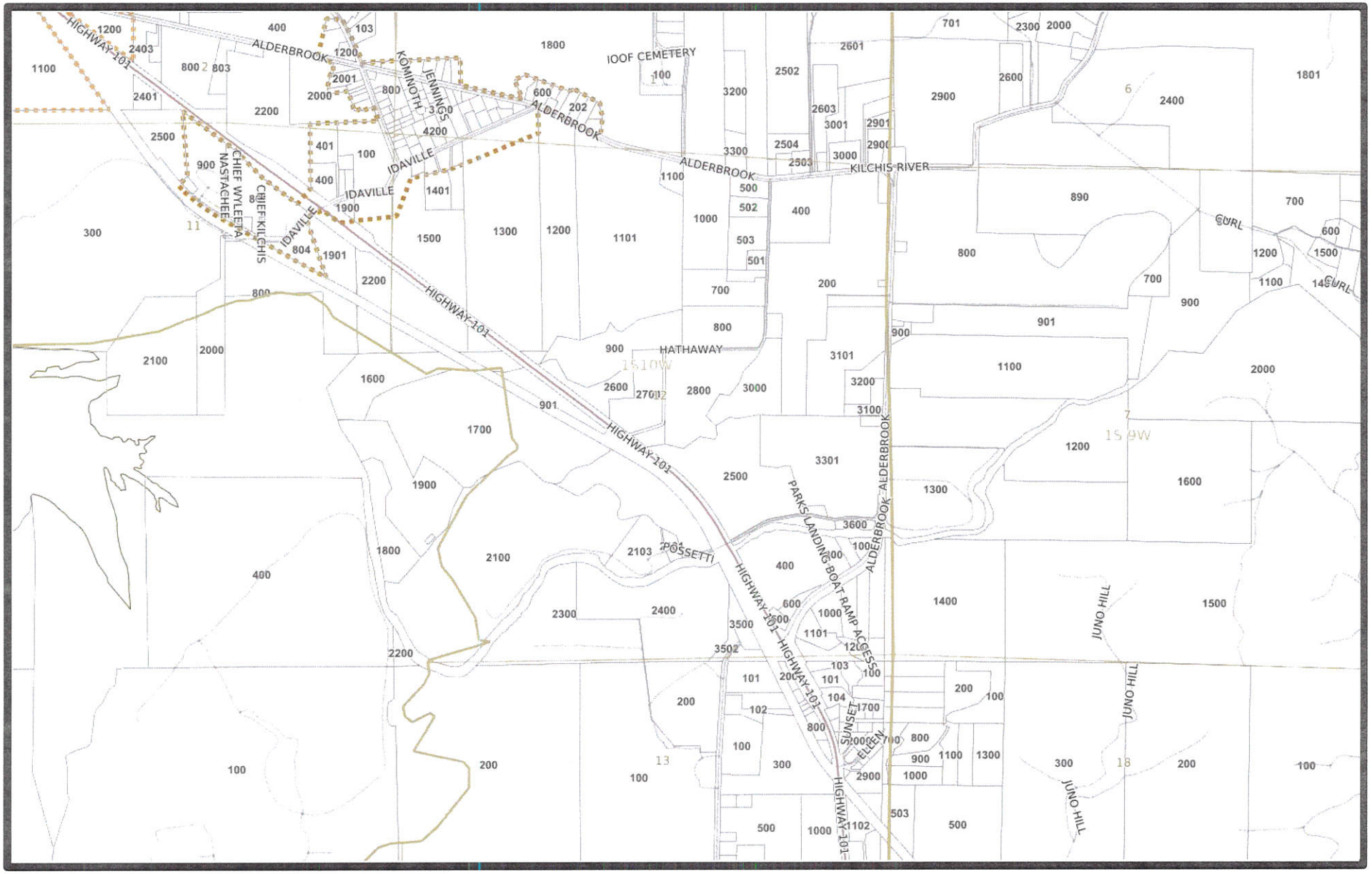
EXHIBIT A

VICINITY MAP



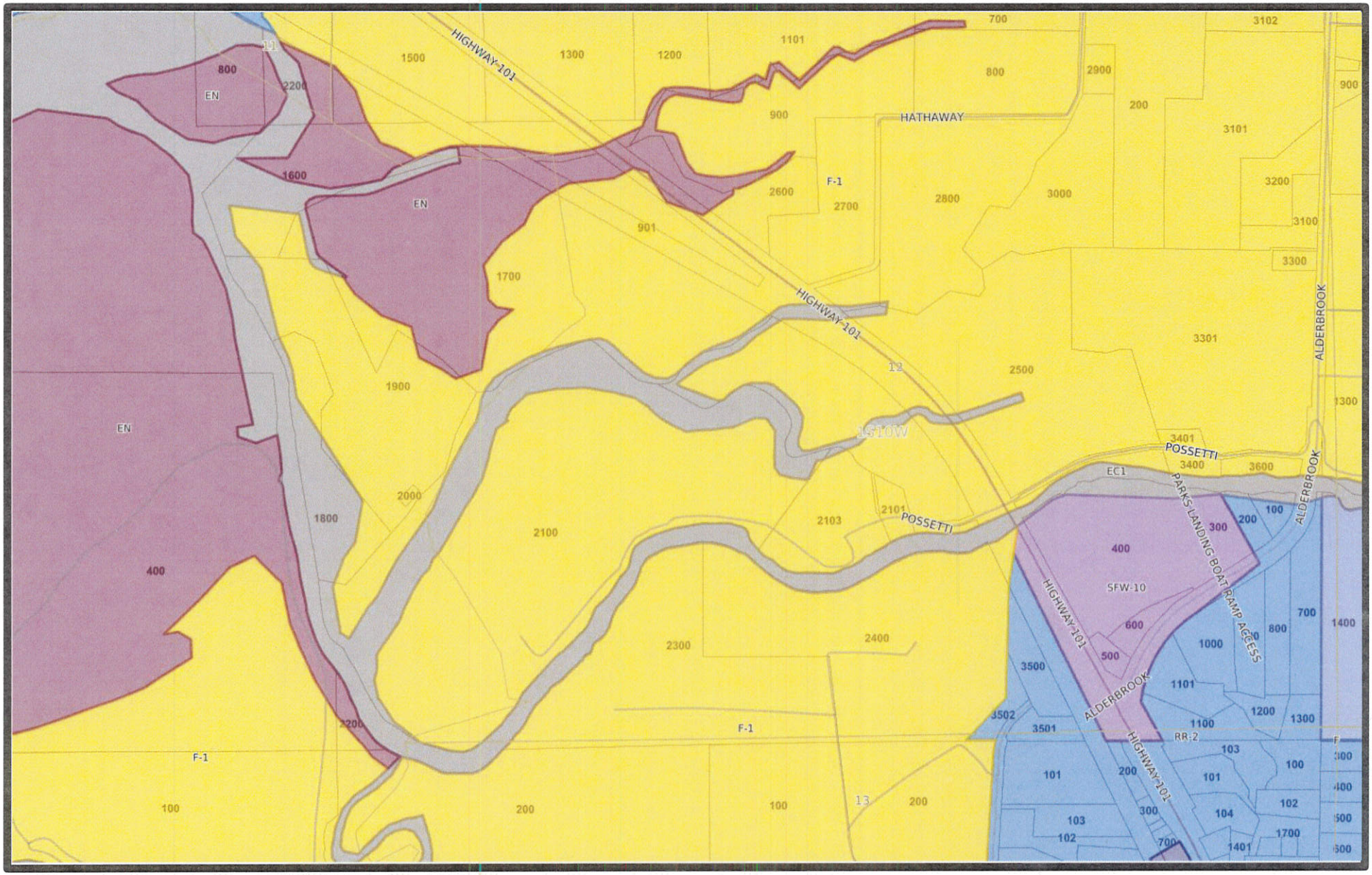
#851-22-000328-PLNG & #851-22-000329-PLNG:
The Nature Conservancy

Map



Generated with the GeoMOOSE Printing Utilities

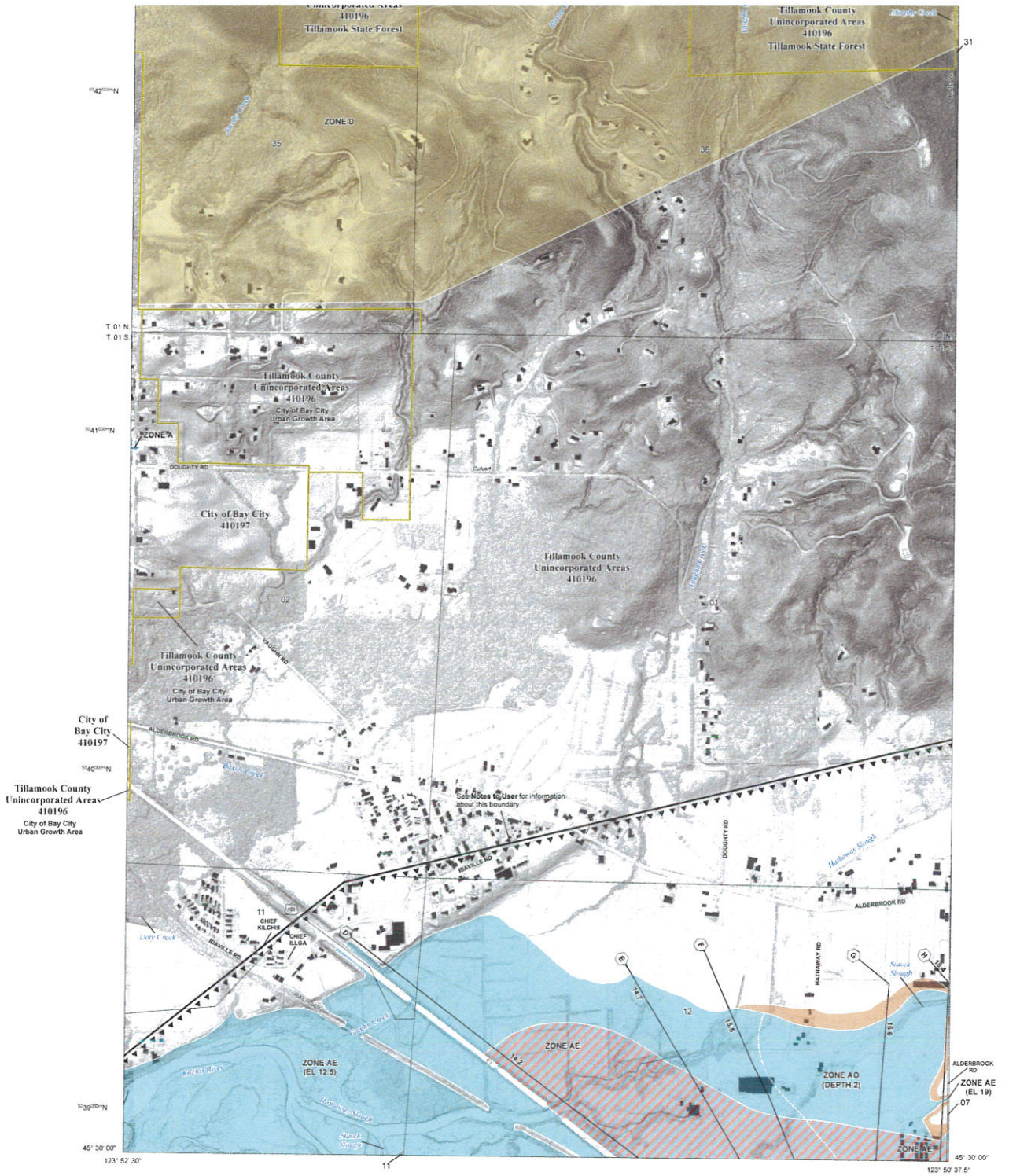
Map



Generated with the GeoMOOSE Printing Utilities

Figure 1. Kilchis Porter Project Area, Tillamook County Oregon. Project Area

Figure 2. FEMA FIRM Map of Project Area, Kilchis Porter Restoration, Map #41057C0576F, eff. 9/28/2018. Base flood elevation 12.5 feet.



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A,V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*

OTHER AREAS OF FLOOD HAZARD

- Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall
- E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect

NOTES TO USERS

For information and questions about this map, available products associated with the FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

The topographic base map for this FIRM revision is derived from aerial lidar surveys conducted between 2007 and 2011. Orthophotography acquired in 2009 was used where lidar coverage was unavailable for portions of Tillamook County.

ATTENTION: The levee, dike, or other structure that impacts flood hazards inside this boundary has not been shown to comply with Section 65.10 of the NFIP Regulations. As such, this FIRM panel will be revised at a later date to update the flood hazard information associated with this structure.

The flood hazard data inside this boundary on the FIRM panel has been republished from the previous effective (historic) FIRM for this area, after being converted from NGVD 29 to NAVD 88.

SCALE

N

Map Projection:
Universal Transverse Mercator Zone 10N. North American Datum 1983
Western Hemisphere, Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR

FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

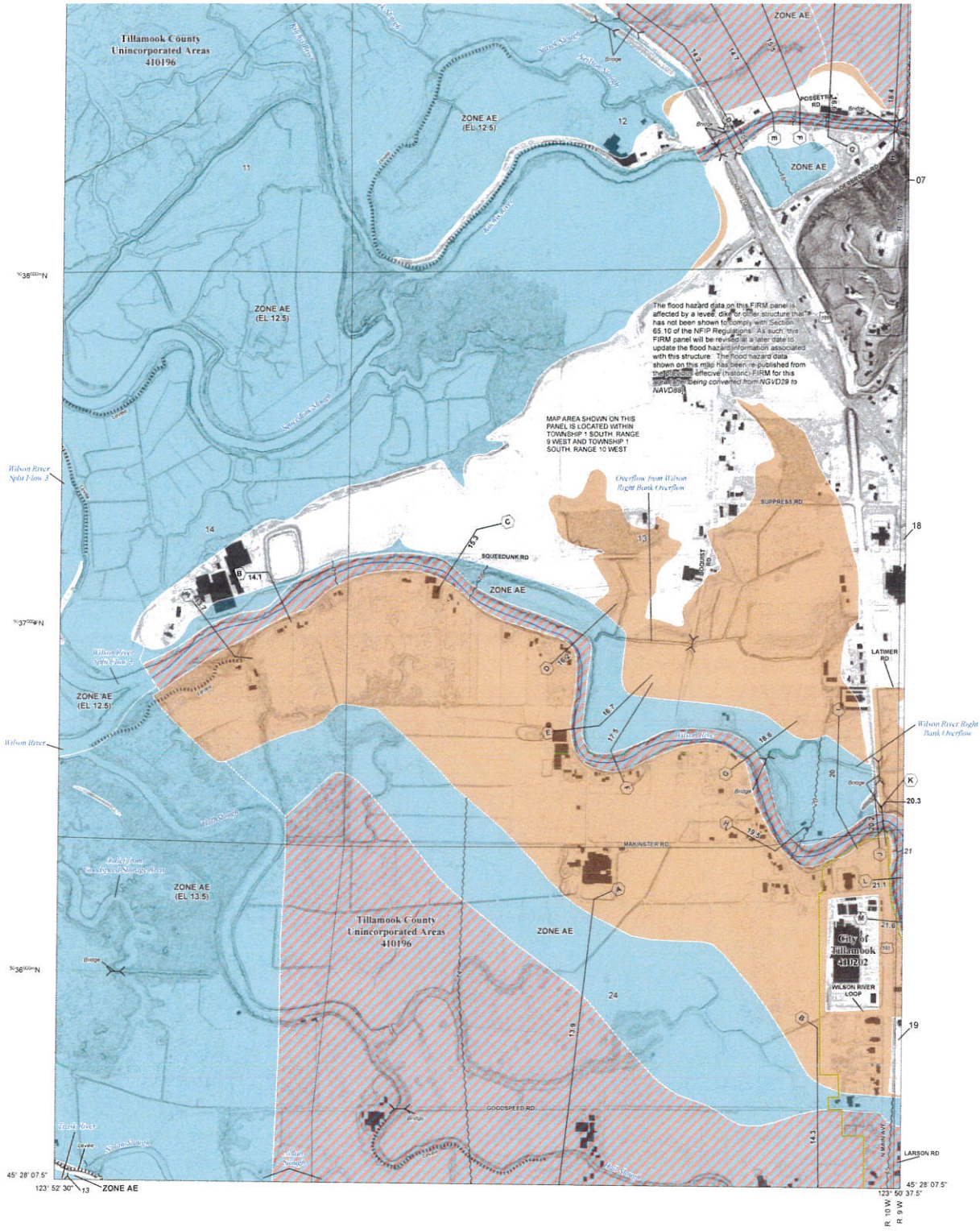
FLOOD INSURANCE RATE MAP

TILLAMOOK COUNTY, OREGON

And Incorporated Areas

PANEL 413 OF 1075

COMMUNITY	NUMBER	PANEL	SUFFIX
BAY CITY, CITY OF	410197	0413	F
TILLAMOOK COUNTY	410196	0413	F



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) Zone A,V, A99
- With BFE or Depth Zone AE, AO, AH, VE, AR
- Regulatory Floodway
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
- Future Conditions 1% Annual Chance Flood Hazard Zone X
- Area with Reduced Flood Risk due to Levee See Notes. Zone X

OTHER AREAS OF FLOOD HAZARD

- Area with Flood Risk due to Levee Zone D

OTHER AREAS

- NO SCREEN Area of Minimal Flood Hazard Zone X
- Area of Undetermined Flood Hazard Zone D

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall
- E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

The topographic base map for this FIRM revision is derived from aerial lidar surveys conducted between 2007 and 2011. Orthophotography acquired in 2009 was used where lidar coverage was unavailable for portions of Tillamook County.

ATTENTION: The levee, dike, or other structure that impacts flood hazards inside this boundary has not been shown to comply with Section 65.10 of the NFIP Regulations. As such, this FIRM panel will be revised at a later date to update the flood hazard information associated with this structure.

The flood hazard data inside this boundary on the FIRM panel has been republished from the previous effective (historic) FIRM for this area, after being converted from NGVD 29 to NAVD 88.

SCALE

N

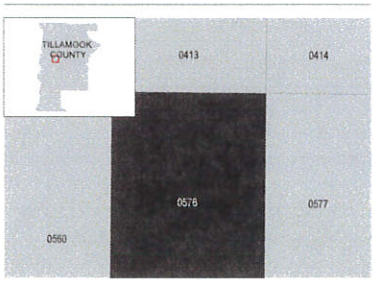
Map Projection:
Universal Transverse Mercator Zone 10N, North American Datum 1983
Western Hemisphere, Vertical Datum: NAVD 88

1 inch = 500 feet 1:6,000

0 500 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

TILLAMOOK COUNTY, OREGON
And Incorporated Areas

PANEL 576 OF 1075

COMMUNITY	NUMBER	PANEL	SUFFIX
TILLAMOOK, CITY OF	410202	0576	F
TILLAMOOK COUNTY	410196	0576	F


R. 10 W.W.M.
T. 1 N.
Tillamook County Park
Barview
GARIBALDI
Miami Cove
MIAMI RIVER
Kincheloe Point
Hobsonville Point
PACIFIC OCEAN
BAYOCEAN PENINSULA
Bayocean Rds.
Larson Cove
Sandstone Point
BAY CITY
Willamette Base Line
TILLAMOOK BAY
Middle Control Dike
Kilchis River Dike
Goose Point
Idaville
Kilchis Point
Cape Meares Lake
Pitcher Point
Cape Meares
U.S. Hwy. No. 101
Hathaway Slough
KILCHIS


R. 10 W.W.M.
T. 1 N.
Tillamook County Park
Barview
GARIBALDI
MIAMI RIVER
Miami Cove
Kinchefoe Point
Hobsonville Point
PACIFIC OCEAN
BAYOCEAN PENINSULA
Larson Cove
Sandstone Point
BAY CITY
TILLAMOOK BAY
Willamette Base Line
Bayocean Rds.
Cape Meares Lake
Pitcher Point
Cape Meares
Goose Point
Idaville
Kilchis River Dike
Kilchis Point
U.S. Hwy. No. 101
Hathaway Slough
KILCHIS
2 EC2
1 EN
3 ED
4 EN
5 EN
6 ECI
7 EC2
8 ECI
9 ECI
10 ECI
11 EC2
12 EN
13 ECI
14 EC2
15 EN
17 EN
18 EN
19 EN
20 ECI
21 EN
22 EN
23 ED
24 EN
25 ECA
28 EN
29 ECI
30 EN
31 ECI

TILLAMOOK County Assessor's Summary Report

Real Property Assessment Report

FOR ASSESSMENT YEAR 2021

October 6, 2022 4:31:23 pm

Account #	152417	**Tax Status**	ASSESSABLE
Map #	1S10120001700	**Acct Status**	ACTIVE
Code - Tax #	0905-152417	**Subtype**	NORMAL
Legal Descr	See Record		
Mailing Name	THE NATURE CONSERVANCY	**Deed Reference #**	2016-1318
Agent		**Sales Date/Price**	03-11-2016 / $250,000.00
In Care Of		**Appraiser**	ELIZABETH LOFTIS
Mailing Address	821 SE 14TH AVE PORTLAND, OR 97214		

Prop Class	500	**MA**	**SA**	**NH**	**Unit**
RMV Class	500	01	01	500	10560-1

Situs Address(s)	Situs City

Value Summary

Code Area		RMV	MAV	AV	RMV Exception		CPR %
0905	Land	183,380			Land	0	
	Impr.	0			Impr.	0	
Code Area Total		183,380	119,430	119,430		0	
Grand Total		183,380	119,430	119,430		0	

Land Breakdown

Code Area	ID#	RFPD	Ex	Plan Zone	Value Source	TD%	LS	Size	Land Class	Trended RMV
0905	0	☑		F-1	Market	100	A	20.45	MKT	88,340
0905	0	☑		EN	Market	100	A	22.00	MKT	95,040
					Grand Total			42.45		183,380

Improvement Breakdown

Code Area	ID#	Yr Built	Stat Class	Description	TD%	Total Sq. Ft.	Ex%	MS Acct #	Trended RMV
				Grand Total		0			0

Exemptions / Special Assessments / Potential Liability

NOTATIONS:

■ FARMLAND - POTENTIAL ADDITIONAL TAX LIABILITY 308A.083 ADDED 2017 **Tax** 7,200.92 **Years** 10
Per ORS 308A.706(c) - this disqualification is a PAT. Land has been approved in the registry of Oregon State Natural Areas.
2016-17 - $639.45
2015-16 - $805.76
2014-15 - $793.66
2013-14 - $785.40
2012-13 - $736.77
2011-12 - $716.70
2010-11 - $695.79
2009-10 - $693.50
2008-09 - $675.59
2007-08 - $658.30

Comments: 6/28/16 Size change per GIS, updated soil classes.LM
6/16/17 - Disqualified from EFU for change of use (due to conservation easement). Brought land to market and applied exception for disqualified land. Owner provided documentation showing that this parcel has been approved in the Oregon State Natural Areas (Porter Tract) - posted PAT due to ORS 308A.706(c). EJ.

TILLAMOOK County Assessor's Summary Report

Real Property Assessment Report

FOR ASSESSMENT YEAR 2021

October 6, 2022 4:28:33 pm

Account #	152417	**Tax Status**	ASSESSABLE
Map #	1S10120001700	**Acct Status**	ACTIVE
Code - Tax #	0905-152417	**Subtype**	NORMAL
Legal Descr	See Record		
Mailing Name	THE NATURE CONSERVANCY	**Deed Reference #**	2016-1318
Agent		**Sales Date/Price**	03-11-2016 / $250,000.00
In Care Of		**Appraiser**	ELIZABETH LOFTIS
Mailing Address	821 SE 14TH AVE PORTLAND, OR 97214		

Prop Class	500	**MA**	**SA**	**NH**	**Unit**
RMV Class	500	01	01	500	10560-1

Situs Address(s)	Situs City

Value Summary

Code Area		RMV	MAV	AV	RMV Exception		CPR %
0905	Land	183,380			Land	0	
	Impr.	0			Impr.	0	
Code Area Total		183,380	119,430	119,430		0	
Grand Total		183,380	119,430	119,430		0	

Land Breakdown

Code Area	ID#	RFPD	Ex	Plan Zone	Value Source	TD%	LS	Size	Land Class	Trended RMV
0905	0	☑		F-1	Market	100	A	20.45	MKT	88,340
0905	0	☑		EN	Market	100	A	22.00	MKT	95,040
					Grand Total			42.45		183,380

Improvement Breakdown

Code Area	ID#	Yr Built	Stat Class	Description	TD%	Total Sq. Ft.	Ex%	MS Acct #	Trended RMV
				Grand Total		0			0

Exemptions / Special Assessments / Potential Liability

NOTATIONS:

■ FARMLAND - POTENTIAL ADDITIONAL TAX LIABILITY 308A.083 ADDED 2017 **Tax** 7,200.92 **Years** 10
Per ORS 308A.706(c) - this disqualification is a PAT. Land has been approved in the registry of Oregon State Natural Areas.
2016-17 - $639.45
2015-16 - $805.76
2014-15 - $793.66
2013-14 - $785.40
2012-13 - $736.77
2011-12 - $716.70
2010-11 - $695.79
2009-10 - $693.50
2008-09 - $675.59
2007-08 - $658.30

Comments: 6/28/16 Size change per GIS, updated soil classes.LM
6/16/17 - Disqualified from EFU for change of use (due to conservation easement). Brought land to market and applied exception for disqualified land. Owner provided documentation showing that this parcel has been approved in the Oregon State Natural Areas (Porter Tract) - posted PAT due to ORS 308A.706(c). EJ.

TILLAMOOK County Assessor's Summary Report

Real Property Assessment Report

FOR ASSESSMENT YEAR 2021

October 6, 2022 4:29:02 pm

Account #	152417	**Tax Status**	ASSESSABLE
Map #	1S10120001700	**Acct Status**	ACTIVE
Code - Tax #	0905-152417	**Subtype**	NORMAL
Legal Descr	See Record		
Mailing Name	THE NATURE CONSERVANCY	**Deed Reference #**	2016-1318
Agent		**Sales Date/Price**	03-11-2016 / $250,000.00
In Care Of		**Appraiser**	ELIZABETH LOFTIS
Mailing Address	821 SE 14TH AVE PORTLAND, OR 97214		

Prop Class	500	**MA**	**SA**	**NH**	**Unit**
RMV Class	500	01	01	500	10560-1

Situs Address(s)	Situs City

Value Summary

Code Area		RMV	MAV	AV	RMV Exception		CPR %
0905	Land	183,380			Land	0	
	Impr.	0			Impr.	0	
Code Area Total		183,380	119,430	119,430		0	
Grand Total		183,380	119,430	119,430		0	

Land Breakdown

Code Area	ID#	RFPD	Ex	Plan Zone	Value Source	TD%	LS	Size	Land Class	Trended RMV
0905	0	☑		F-1	Market	100	A	20.45	MKT	88,340
0905	0	☑		EN	Market	100	A	22.00	MKT	95,040
					Grand Total			42.45		183,380

Improvement Breakdown

Code Area	ID#	Yr Built	Stat Class	Description	TD%	Total Sq. Ft.	Ex%	MS Acct #	Trended RMV
				Grand Total		0			0

Exemptions / Special Assessments / Potential Liability

NOTATIONS:

■ FARMLAND - POTENTIAL ADDITIONAL TAX LIABILITY 308A.083 ADDED 2017 **Tax** 7,200.92 **Years** 10
Per ORS 308A.706(c) - this disqualification is a PAT. Land has been approved in the registry of Oregon State Natural Areas.
2016-17 - $639.45
2015-16 - $805.76
2014-15 - $793.66
2013-14 - $785.40
2012-13 - $736.77
2011-12 - $716.70
2010-11 - $695.79
2009-10 - $693.50
2008-09 - $675.59
2007-08 - $658.30

Comments: 6/28/16 Size change per GIS, updated soil classes.LM
6/16/17 - Disqualified from EFU for change of use (due to conservation easement). Brought land to market and applied exception for disqualified land. Owner provided documentation showing that this parcel has been approved in the Oregon State Natural Areas (Porter Tract) - posted PAT due to ORS 308A.706(c). EJ.

TILLAMOOK County Assessor's Summary Report

Real Property Assessment Report

FOR ASSESSMENT YEAR 2021

October 6, 2022 4:29:26 pm

Account #	152462	**Tax Status**	ASSESSABLE
Map #	1S10120001900	**Acct Status**	ACTIVE
Code - Tax #	0905-152462	**Subtype**	NORMAL
Legal Descr	See Record		
Mailing Name	THE NATURE CONSERVANCY	**Deed Reference #**	2016-1318
Agent		**Sales Date/Price**	03-11-2016 / $250,000.00
In Care Of		**Appraiser**	ELIZABETH LOFTIS
Mailing Address	821 SE 14TH AVE PORTLAND, OR 97214		

		MA	SA	NH	Unit
Prop Class	500				
RMV Class	500	01	01	500	10562-1

Situs Address(s)	Situs City

Value Summary

Code Area		RMV	MAV	AV	RMV Exception	CPR %
0905	Land	89,110			Land 0	
	Impr.	0			Impr. 0	
Code Area Total		89,110	58,010	58,010	0	
Grand Total		89,110	58,010	58,010	0	

Land Breakdown

Code Area	ID#	RFPD	Ex	Plan Zone	Value Source	TD%	LS	Size	Land Class	Trended RMV
0905	0	☑		EN	Market	100	A	0.31	MKT	1,560
0905	0	☑		EC-1	Market	100	A	1.40	MKT	7,060
0905	0	☑		F-1	Market	100	A	15.97	MKT	80,490
					Grand Total			17.68		89,110

Improvement Breakdown

Code Area	ID#	Yr Built	Stat Class	Description	TD%	Total Sq. Ft.	Ex%	MS Acct #	Trended RMV
				Grand Total		0			0

Exemptions / Special Assessments / Potential Liability

NOTATIONS:

■ FARMLAND - POTENTIAL ADDITIONAL TAX LIABILITY 308A.083 ADDED 2017 **Tax** 3,846.72 **Years** 10
Per ORS 308A.706(c) - this disqualification is a PAT. Land has been approved in the registry of Oregon State Natural Areas.
2016-17 - $285.31
2015-16 - $435.74
2014-15 - $429.23
2013-14 - $426.81
2012-13 - $400.38
2011-12 - $389.45
2010-11 - $378.10
2009-10 - $376.86
2008-09 - $367.12
2007-08 - $357.72

Comments: 8/20/16 - Due to a series of Lot Line Adjustments, a portion of taxlot 1S10 12 1800 is now carried in taxlot 1900, and a portion of taxlot 1S10 12 1900 is now carried in taxlot 1800. Added MAV to farm land and updated soil classes. Brought land to market and apportioned MAV. EJ.
6/16/17 - Disqualified from EFU for change of use (due to conservation easement). Brought land to market and applied exception for disqualified land. Owner provided documentation showing that this parcel has been approved in the Oregon State Natural Areas (Porter Tract) - posted PAT due to ORS 308A.706(c). EJ.

EXHIBIT B

NOTICE OF PUBLIC HEARING

Tillamook County

DEPARTMENT OF COMMUNITY DEVELOPMENT
BUILDING, PLANNING & ON-SITE SANITATION SECTIONS

1510 – B Third Street
Tillamook, Oregon 97141
www.tillamook.or.us
Building (503) 842-3407
Planning (503) 842-3408
Sanitation (503) 842-3409
FAX (503) 842-1819
Toll Free 1(800) 488-8280

Land of Cheese, Trees and Ocean Breeze

NOTICE TO MORTGAGEE, LIENHOLDER, VENDOR OR SELLER:
ORS 215 REQUIRES THAT IF YOU RECEIVE THIS NOTICE,
IT MUST BE PROMPTLY FORWARDED TO THE PURCHASER

NOTICE OF PUBLIC HEARING
TILLAMOOK COUNTY PLANNING COMMISSION

Date of Notice: September 20, 2022

Public hearings will be held by the Tillamook County Planning Commission at 7:00p.m. on Thursday, October 13, 2022, and at 7:00p.m. on Thursday, November 10, 2022, in the Port of Tillamook Bay Conference Center, 4000 Blimp Boulevard, Tillamook, OR 97141 to consider the following:

#851-22-000328-PLNG & #851-22-000329-PLNG: Consolidated review of a Floodway/Estuary/Floodplain Development Permit and Conditional Use Request for a wetland restoration project. The subject property is zoned Estuary Natural (EN), Estuary Conservation 1 (EC1) and Farm (F-1), is partially located within the Shoreland Overlay zone and lies entirely within the Flood Hazard Overlay zone. The subject property is located to the west of Highway 101 and is designated as Tax Lots 901, 1700 and 1900 in Section 12 of Township 1 South, Range 10 West of the Willamette Meridian, Tillamook County, Oregon. The applicant and property owner are The Nature Conservancy.

The criteria applicable to review of the Conditional Use request are Tillamook County Land Use Ordinance Article 6: Conditional Use Procedures and Article 10: Administrative Provisions. The criteria applicable to review of the Floodway/Estuary/Floodplain Development Permit request are Tillamook County Land Use Ordinance Section 3.510: Flood Hazard Overlay and Article 10: Administrative Provisions. Only comments relevant to the approval criteria are considered evidence.

The hearing will take place at the Port of Tillamook Bay Conference Center with an option for virtual participation. For instructions on how to provide oral testimony at the October 13, 2022 hearing, please visit the Tillamook County Community Development homepage at https://www.co.tillamook.or.us/commdev for instructions and protocol or email Lynn Tone, Office Specialist 2, at ltone@co.tillamook.or.us. The virtual meeting link will be provided at the DCD homepage address as well as a dial in number for those who wish to participate via teleconference but are unable to participate virtually prior to the evening of the hearing.

Written testimony may be submitted to the Tillamook County Department of Community Development, 1510-B Third Street, Tillamook, Oregon, 97141 prior to 4:00 p.m. on the date of the October 13, 2022, Planning Commission hearing. If submitted by 4:00 p.m. on October 5, 2022, the testimony will be included in the packet mailed to the Planning Commission the week prior to the October 13, 2022, hearing. Failure of an issue to be raised in a hearing, in person or by letter, or failure to provide sufficient specificity to afford the decision-maker an opportunity to respond to the issue precludes appeal to the Land Use Board of Appeals on that issue. Please contact Lynn Tone, Office Specialist 2, Tillamook County Department of

Community Development, ltone@co.tillamook.or.us as soon as possible if you wish to have your comments included in the staff report that will be presented to the Planning Commission.

The documents and submitted application are also available on the Tillamook County Department of Community Development website (https://www.co.tillamook.or.us/commdev/landuseapps) or at the Department of Community Development office located at 1510-B Third Street, Tillamook, Oregon 97141. A copy of the application and related materials may be purchased from the Department of Community Development at a cost of 25 cents per page. The staff report will be available for public inspection on October 6, 2022. Please contact Lynn Tone for additional information ltone@co.tillamook.or.us or call 1-800-488-8280 x3423.

Notice of public hearing, a map of the subject area, applicable specific request review criteria and a general explanation of the requirements for submission of testimony and the procedures for conduct of hearing are being mailed to all property owners within 750 feet of the exterior boundary of the subject property for which application has been made at least 10 days prior to the date of the hearing.

The Port of Tillamook Bay Conference Center is handicapped accessible. If special accommodations are needed for persons with hearing, visual, or manual impairments who wish to participate in the hearing, please contact 1-800-488-8280 ext. 3423, at least 24 hours prior to the hearing in order that appropriate communications assistance can be arranged.

If you need additional information, please contact Lynn Tone, DCD Office Specialist, at 1-800-488-8280 ext. 3423 or email ltone@co.tillamook.or.us.

Sincerely,

Sarah Absher

Tillamook County Department of Community Development
Sarah Absher, CFM, Director

Enc. Maps

TCLUO SECTION 6.040: CONDITIONAL USE REVIEW CRITERIA (continues to next page):

Any CONDITIONAL USE authorized according to this Article shall be subject to the following criteria, where applicable:

(1) The use is listed as a CONDITIONAL USE in the underlying zone, or in an applicable overlying zone.

(2) The use is consistent with the applicable goals and policies of the Comprehensive Plan.

(3) The parcel is suitable for the proposed use considering its size, shape, location, topography, existence of improvements and natural features.

(4) The proposed use will not alter the character of the surrounding area in a manner which substantially limits, impairs or prevents the use of surrounding properties for the permitted uses listed in the underlying zone.

(5) The proposed use will not have detrimental effect on existing solar energy systems, wind energy conversion systems or wind mills.

(6) The proposed use is timely, considering the adequacy of public facilities and services existing or planned for the area affected by the use.

TCLUO SECTION 3.510: FLOOD HAZARD OVERLAY ZONE CRITERIA:

(1) The fill is not within a Coastal High Hazard Area.

(2) Fill placed within the Regulatory Floodway shall not result in any increase in flood levels during the occurrence of the base flood discharge.

(3) The fill is necessary for an approved use on the property.

(4) The fill is the minimum amount necessary to achieve the approved use.

(5) No feasible alternative upland locations exist on the property.

(6) The fill does not impede or alter drainage or the flow of floodwaters.

(7) If the proposal is for a new critical facility, no feasible alternative site is available.

(8) For creation of new, and modification of, Flood Refuge Platforms, the following apply, in addition to (14)(a)(1-4) and (b)(1-5):

i. The fill is not within a floodway, wetland, riparian area or other sensitive area regulated by the Tillamook County Land Use Ordinance.

ii. The property is actively used for livestock and/or farm purposes,

iii. Maximum platform size = 10 sq ft of platform surface per acre of pasture in use, or 30 sq ft per animal, with a 10-ft wide buffer around the outside of the platform,

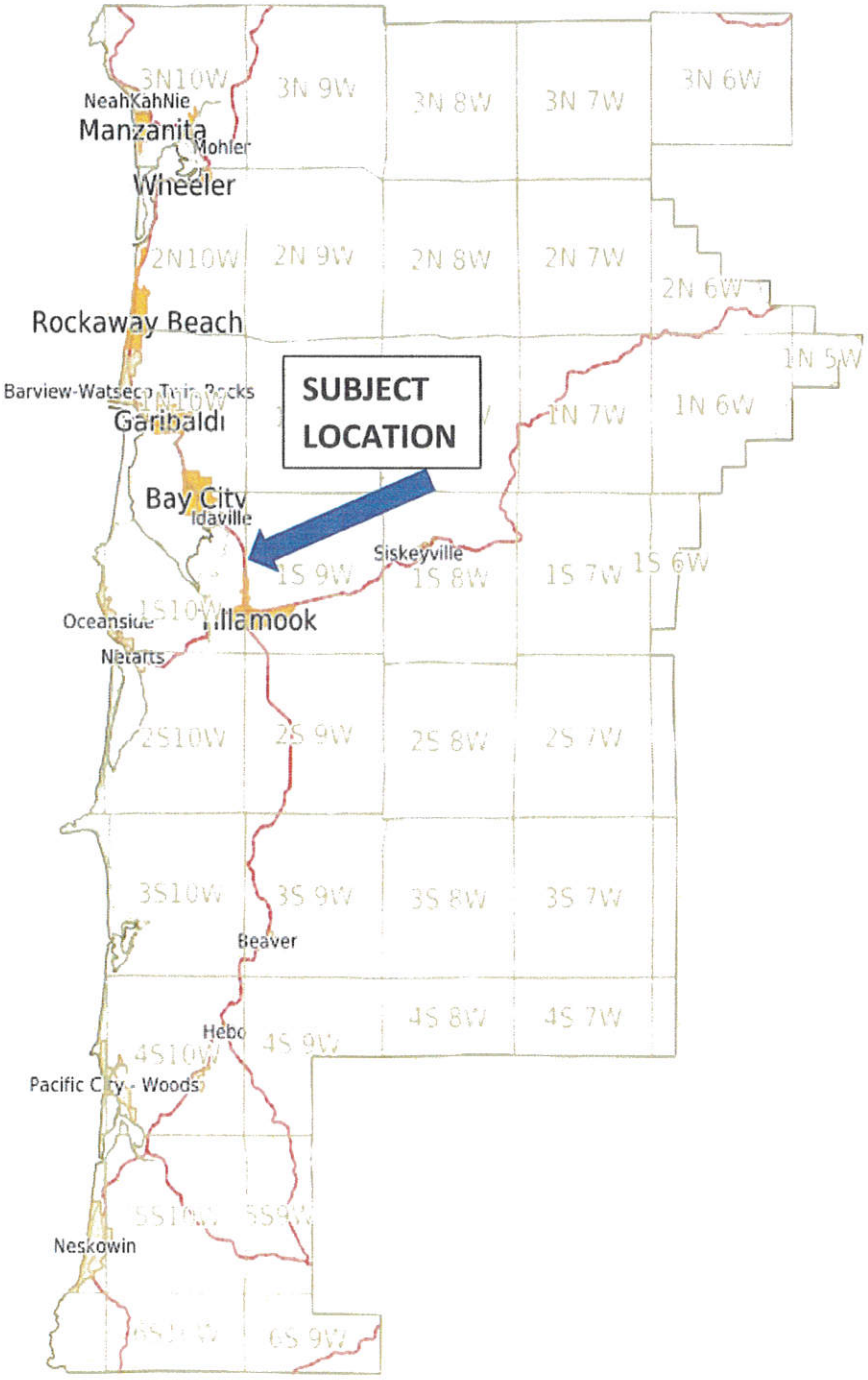
iv. Platform surface shall be at least 1 ft above base flood elevation,

v. Slope of fill shall be no steeper than 1.5 horizontal to 1 vertical,

vi. Slope shall be constructed and/or fenced in a manner so as to prevent and avoid erosion.

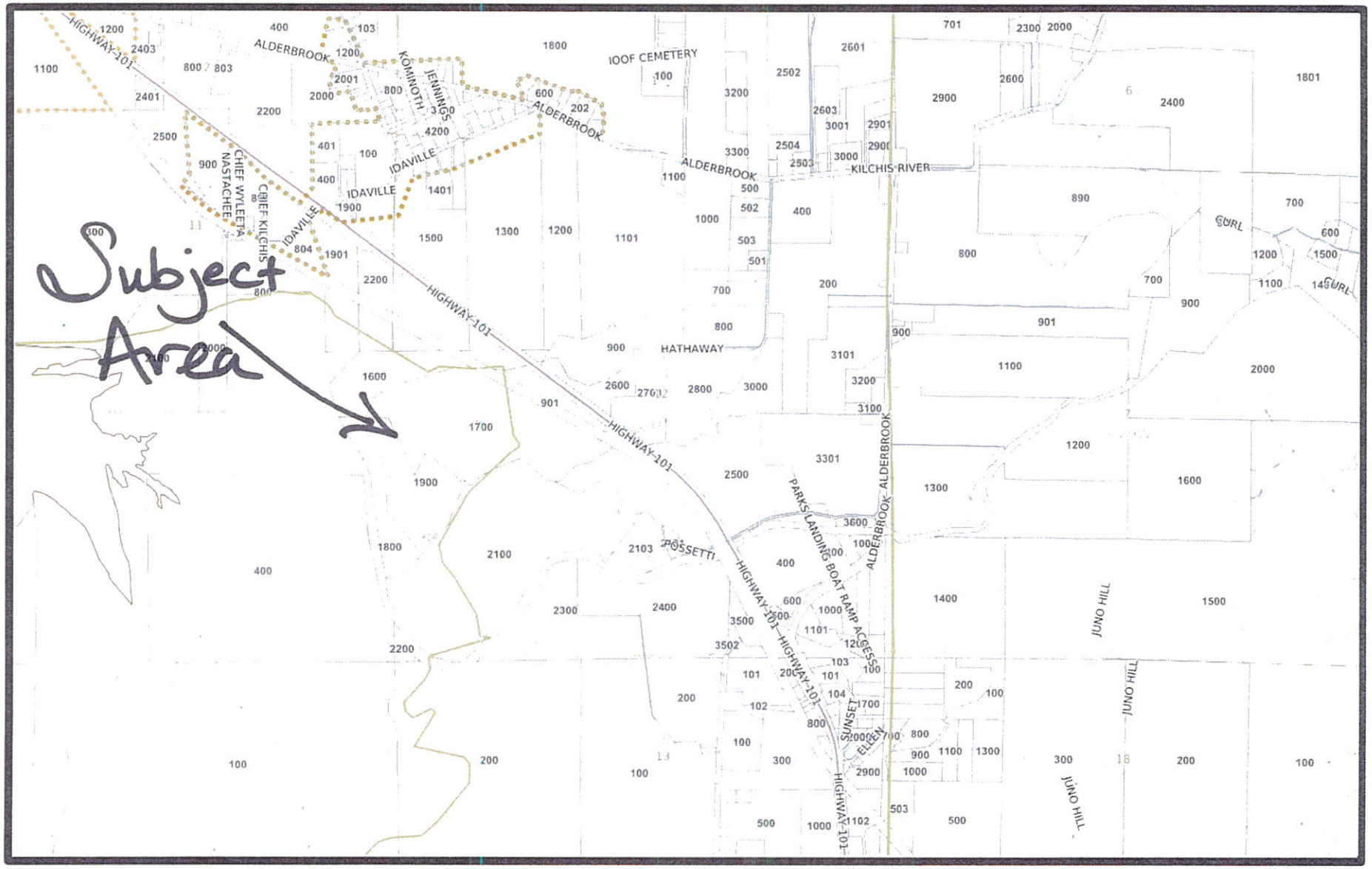
Conditions of approval may require that if the fill is found to not meet criterion (5), the fill shall be removed or, where reasonable and practical, appropriate mitigation measures shall be required of the property owner. Such measures shall be verified by a certified engineer or hydrologist that the mitigation measures will not result in a net rise in floodwaters and be in coordination with applicable state, federal and local agencies, including the Oregon Department of Fish and Wildlife.

VICINITY MAP



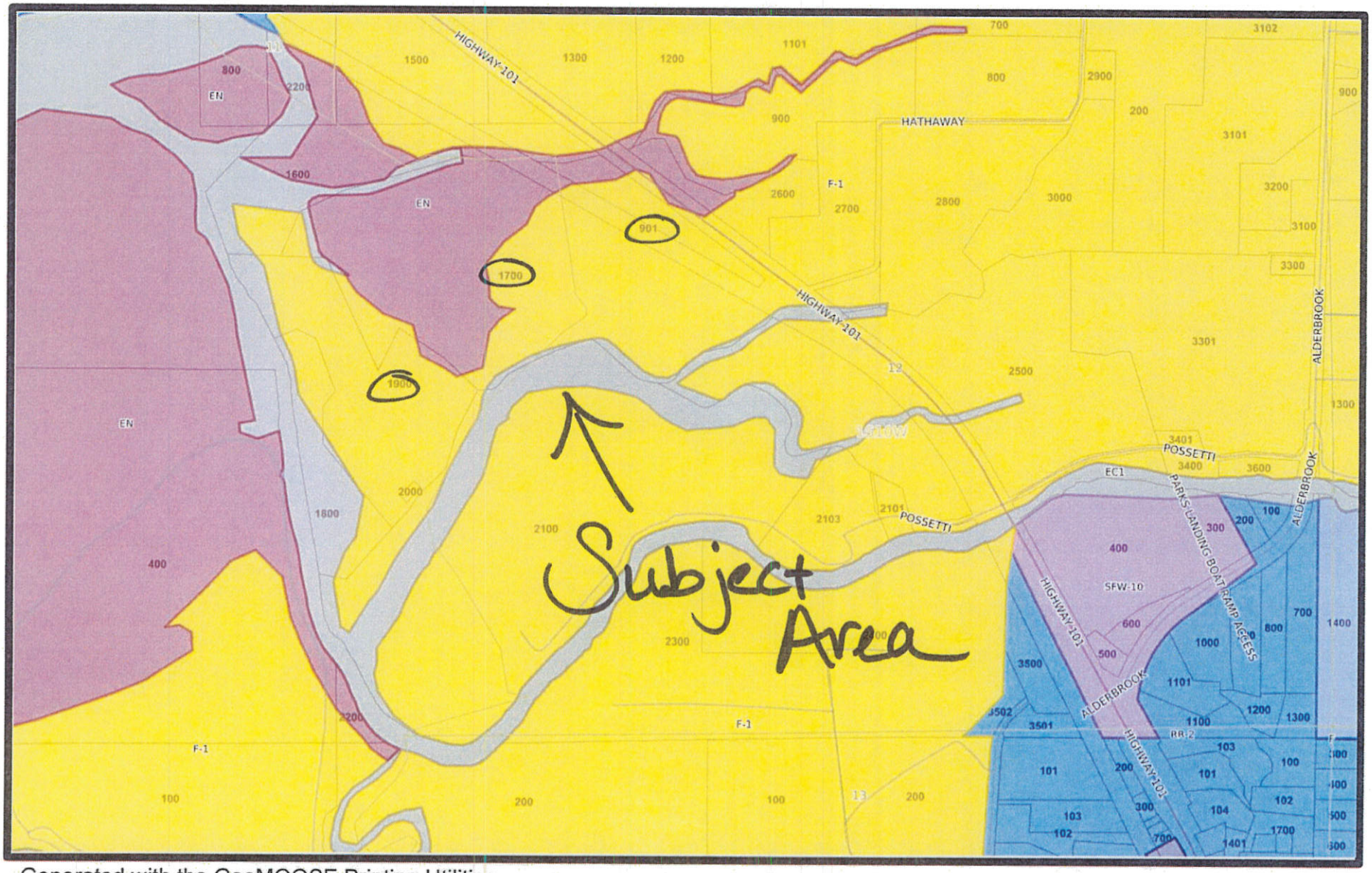
#851-22-000328-PLNG & #851-22-000329-PLNG:
The Nature Conservancy

Map



Generated with the GeoMOOSE Printing Utilities

Map



Generated with the GeoMOOSE Printing Utilities

TILLAMOOK COUNTY TYPE II APPLICATION

(AUGUST 2, 2022)

Tillamook County Department of Community Development
1510-B Third Street. Tillamook, OR 97141 | Tel: 503-842-3408 Fax: 503-842-1819
www.co.tillamook.or.us

PLANNING APPLICATION

OFFICE USE ONLY
Date Stamp
☐Approved ☐Denied
Received by:
Receipt #:
Fees:
Permit No: 851-22-000328PLNG

Applicant ☒ *(Check Box if Same as Property Owner)*

Name: The Nature Conservancy Phone: 503-802-8100 503-490-6907 (c)
Address: 821 SE 14th Avenue
City: Portland State: OR Zip: 97214
Email: dvanderschaaf@tnc.org

Property Owner

Name: Phone:
Address:
City: State: Zip:
Email:

Request: Request permit for tidal marsh restoration in lower Kilchis watershed.

Type II	Type III	Type IV
☐ Farm/Forest Review	☐ Appeal of Director's Decision	
☒ Conditional Use Review	☐ Extension of Time	☐ Appeal of Planning Commission Decision
☐ Variance	☐ Detailed Hazard Report	☐ Ordinance Amendment
☐ Exception to Resource or Riparian Setback	☐ Conditional Use (As deemed by Director)	☐ Large-Scale Zoning Map Amendment
☐ Nonconforming Review (Major or Minor)	☐ Ordinance Amendment	☐ Plan and/or Code Text Amendment
☒ Development Permit Review for Estuary Development	☐ Map Amendment	
☐ Non-farm dwelling in Farm Zone	☐ Goal Exception	
☐ Foredune Grading Permit Review		
☐ Neskowin Coastal Hazards Area		

Location:

Site Address: Hwy 101 N of Tillamook, between Stasek and Hathaway Sloughs.
Map Number: 1S (Township) 10W (Range) 12 (Section) 1700, 901, 1900 (Tax Lot(s))

Clerk's Instrument #:

Authorization

This permit application does not assure permit approval. The applicant and/or property owner shall be responsible for obtaining any other necessary federal, state, and local permits. The applicant verifies that the information submitted is complete, accurate, and consistent with other information submitted with this application.

Property Owner Signature (Required) — Date: 8-2-22

Applicant Signature: Dicki VanderSchaaf — Date: 8-2-22

NHC RESTORATION REVIEW - HYRDAULIC REVIEW

(JULY 7, 2022)

Kilchis Porter Restoration Review

Prepared by:

Northwest Hydraulic Consultants Inc.
12787 Gateway Drive S.
Seattle, WA 98168
Tel: (206) 241-6000
www.nhcweb.com

NHC Project Contact:
Vaughn Collins, PE
Principal

Prepared for:

The Nature Conservancy
821 SE 14th
Portland, OR 97214

October 1, 2021
Final Report, Rev. 2

NHC Reference 02006629.0

nhc

Report prepared by:

EXPIRES 12/31/2021

Vaughn Collins, PE
Principal

DISCLAIMER

This document has been prepared by **Northwest Hydraulic Consultants Inc.** in accordance with generally accepted engineering practices and is intended for the exclusive use and benefit of The Nature Conservancy and their authorized representatives for specific application to the Kilchis Porter Restoration Review. The contents of this document are not to be relied upon or used, in whole or in part, by or for the benefit of others without specific written authorization from **Northwest Hydraulic Consultants Inc.** No other warranty, expressed or implied, is made.

Northwest Hydraulic Consultants Inc. and its officers, directors, employees, and agents assume no responsibility for the reliance upon this document or any of its contents by any parties other than The Nature Conservancy.

CREDITS AND ACKNOWLEDGEMENTS

The following persons provided review and support for the study:

Dick Vanderschaaf	The Nature Conservancy, TNC Project Manager
Jena Carter	The Nature Conservancy
Casey Storey	Tillamook County Creamery Association
Paul Snyder	Tillamook County Creamery Association
Tilda Jones	Tillamook Bay Flood Improvement District

The following persons provided information used in the study:

Leo Kuntz	Nehalem Marine	Tidegate location and history, site observations
Curtis Loeb	Wolfe Water Resources	Modeling and Design Questions

The following NHC personnel participated in the study:

Vaughn Collins	Lead Technical Reviewer
Edwin Wang	Delft3D Modeling
Patty Dillon	Report Review

EXECUTIVE SUMMARY

The Nature Conservancy (TNC) contracted with Northwest Hydraulic Consultants (NHC) to perform a technical hydraulic review of one completed (Dooher) and one planned (Porter Tract) restoration project on the TNC-owned Kilchis Estuary Preserve. The scope of work was developed in concert with the Tillamook County Creamery Association (TCCA) and Tillamook Bay Flood Improvement District and consisted of twelve items to be addressed. TNC provided all relevant reports, data, and hydraulic models to be reviewed. In the report body the twelve items are addressed individually even though there is some overlap and common elements between them. This executive summary describes the key findings of the review, which in some cases are synthesized from the analysis of several scope items.

Reports, Hydraulic Modeling, and Observed Water Level Data

- The hydraulic analyses completed to date have evaluated Dooher and Porter individual project flood impacts adequately. The analyses have not addressed or only partially addressed normal flow impacts more relevant to agricultural practices on adjacent lands and the combined effects of the Dooher and Porter projects.
- The Dooher model appears to have been calibrated to an incorrect flow. The more recent models used for the Porter project have been updated and are well calibrated for flood analysis. The model will likely need some additional updates to fully evaluate off site water level impacts under normal flow conditions. A set of model refinements and development of a pre-Dooher project model based on the latest existing conditions model is recommended.
- Observed water level data from the gage network is extremely valuable for system analysis. Data collected to date has been of variable quality. A set of recommendations are made on gage rebuilding, relocation, and new gages to improve data quality and future analysis.

Hydraulic Effects of Dooher Project

- The Dooher project initially reduced flood levels in the Kilchis River below Highway 101 by several feet. As the channel has adjusted to the project and filled in these reductions have lessened but reductions of about half a foot persist. The flood level reductions do not extend above Highway 101. The removal of the river levee by the Dooher project allowed more water to flow west, resulting in increases of a few tenths of a foot in flood levels on lands adjacent to Stasek and Neilson Sloughs.
- The largest water level increases from the Dooher project occur in Stasek Slough under normal flow conditions. At very low flow water levels increases are about half a foot. When Kilchis River flows are above 400 cfs (in typical winter flow ranges) low tide and average water levels in Stasek Slough have increased 2-3 feet, and high tides 1-2 feet. This increase persists up to a 2-year flood event. The increase is due to the re-connection of Stasek Slough to the Kilchis River: at higher flows the river at this point runs 2-3 feet higher than where it connects to Hathaway Slough, where Stasek Slough used to drain through. These changes also will have propagated into Neilson Slough.
- Changes in Hathaway Slough water levels are less certain but are believed to be at most a tenth of a foot or so based on very limited gage data, modeling, and anecdotal information. Changes

elsewhere in the surrounding rivers and sloughs due to the Dooher project are similarly on the order of a tenth of a foot or less.

Hydraulic Effects of Porter Project

- The Porter project will have much smaller effects on flood levels than the Dooher project. Up to a tenth of a foot rise is forecast for Hathaway Slough due to increased flow transfer from Stasek Slough. Changes in peak flood levels are generally less than a tenth of foot elsewhere.
- During winter flows the Porter project will lower water levels by 0.4-0.8 feet in Stasek and Neilson Sloughs. This will partially counteract the 2-3 foot increases in water levels the Dooher project created. With increased flow from Stasek Slough, Hathaway Slough will see increases in water level of one to two tenths of a foot on average. Changes elsewhere are typically less than a tenth of a foot.

TABLE OF CONTENTS

LIST OF TABLES IN TEXT

LIST OF FIGURES IN TEXT

APPENDICES

1 INTRODUCTION

The Nature Conservancy (TNC) has contracted with Northwest Hydraulic Consultants (NHC) to perform a technical hydraulic review of one completed (Dooher) and one planned (Porter Tract) restoration project on the TNC-owned Kilchis Estuary Preserve. The scope of work has been developed by consensus with the Tillamook County Creamery Association (TCCA) and Tillamook Bay Flood Improvement District, and TCCA will pay one-half of the review costs.

1.1 Scope of Work and Organization of Document

The scope of work consists of 12 items to be reviewed. All items are related to project effects on site and area hydrology, or related sediment issues. Prior to addressing the 12 items we provide a reference map and geographic naming convention and an evaluation of three key parts of the analyses relevant to all the items. These are observed water level data, estimation of Kilchis River and tributary flows, and the hydraulic model used for analysis.

Several of the items refer to 'impacts', and we use the same term throughout this document. Our use of this term is limited to changes in water level. We do consider land elevations in our review to provide some additional context. For instance, an increase in water level elevation from 8 to 9 feet is unlikely to have an impact on land use if the land surface is 16 feet but may if the land surface is at 10 feet. However, this review does not judge whether a change in water level may lead to positive or negative outcomes on field productivity, ability to operate machinery in the spring, or other common agricultural concerns, nor do we provide any opinion on the ecological impacts of changes to area hydrology.

1.1.1 Project Partner Review Timeline

A draft version of this review was provided to the project partners on June 2, 2021. A comment review letter was provided to NHC dated August 5, 2021. NHC responded to the letter in writing on August 19, 2021, with a set of clarifying questions and responses. This was followed up with a call between all parties on September 2, 2021, where all questions were resolved and direction for the final report was agreed to.

1.2 Information Reviewed

TNC provided a suite of documents for review, a bibliography for which is included at the end of this report. In addition, the following information was provided to or acquired by NHC:

- Observed water level data in spreadsheet format for various sites, with data from 2014 to 2020. Data from 2012-2014 were collected by PC Trask & Associates under contract to TNC, post-2014 data were collected by TNC directly.
- Delft3D hydraulic model files for the Porter Tract analysis consisting of existing and proposed condition simulations for the large December 2015 flood and a small event in January 2017.
- USGS flow data for the Wilson River near Tillamook Gage.
- USGS StreamStats flow estimates for local tributaries and the Kilchis River.

- NOAA Garibaldi tide gage data.
- LiDAR data used as the basis for the hydraulic model geometry.
- Verbal and email communications with Dick Vander Schaaf, Curtis Loeb, and Leo Kuntz for specific questions, mostly regarding site conditions, that arose during the review.

In addition, NHC developed a rough two-dimensional HEC-RAS hydraulic model of the area shown in Figure 1. The purpose was to provide some validation of the Delft3D model (especially for the connector culvert, where HEC-RAS has much better modeling capabilities), but primarily because it is much easier to extract and display information from HEC-RAS. The HEC-RAS model used a terrain file based on the Delft3D model grid bathymetry with a nominal resolution of 15 feet. We calibrated the model to the January 2017 flood using identical boundary conditions to the Delft3D model. The HEC-RAS model produces similar results to the Delft3D model at high tides and during flood flows but does not do as well at low tides. The model is only valid up to about a 2-year event, as substantial additional effort would be required to enforce accurate levee elevations. Nevertheless, the HEC-RAS model provided useful information and visualization of flow patterns and volumes that are difficult to extract from Delft3D. All model data and discussion presented herein refers to the Delft3D model unless otherwise noted.

1.3 Reference Map and Agricultural Units

The scope of work requests analysis of hydrologic impacts to the project site, adjacent channels, and neighboring agricultural lands. NHC delineated neighboring private agricultural lands into hydrologic units defined by levees, embankments, and channels for reference in this document. For agricultural areas upstream (north) of Highway 101, we only delineated areas where land elevations were below 15 feet. In our opinion, this is a conservative upper limit to the potential area of project impacts. Figure 1 and Figure 2 show these areas. The Hathaway, Stasek, Neilson, and Vaughn Creek units include significant areas at elevations above 15 feet that drain into the project area; Figure 18 shows the entire watersheds for each. Vaughn Creek is unique among these units in that it drains through a series of tidegates from an interconnected ditch network into Hathaway Slough, while as far as is known the Stasek, Hathaway, and Neilson units have no tidegates.

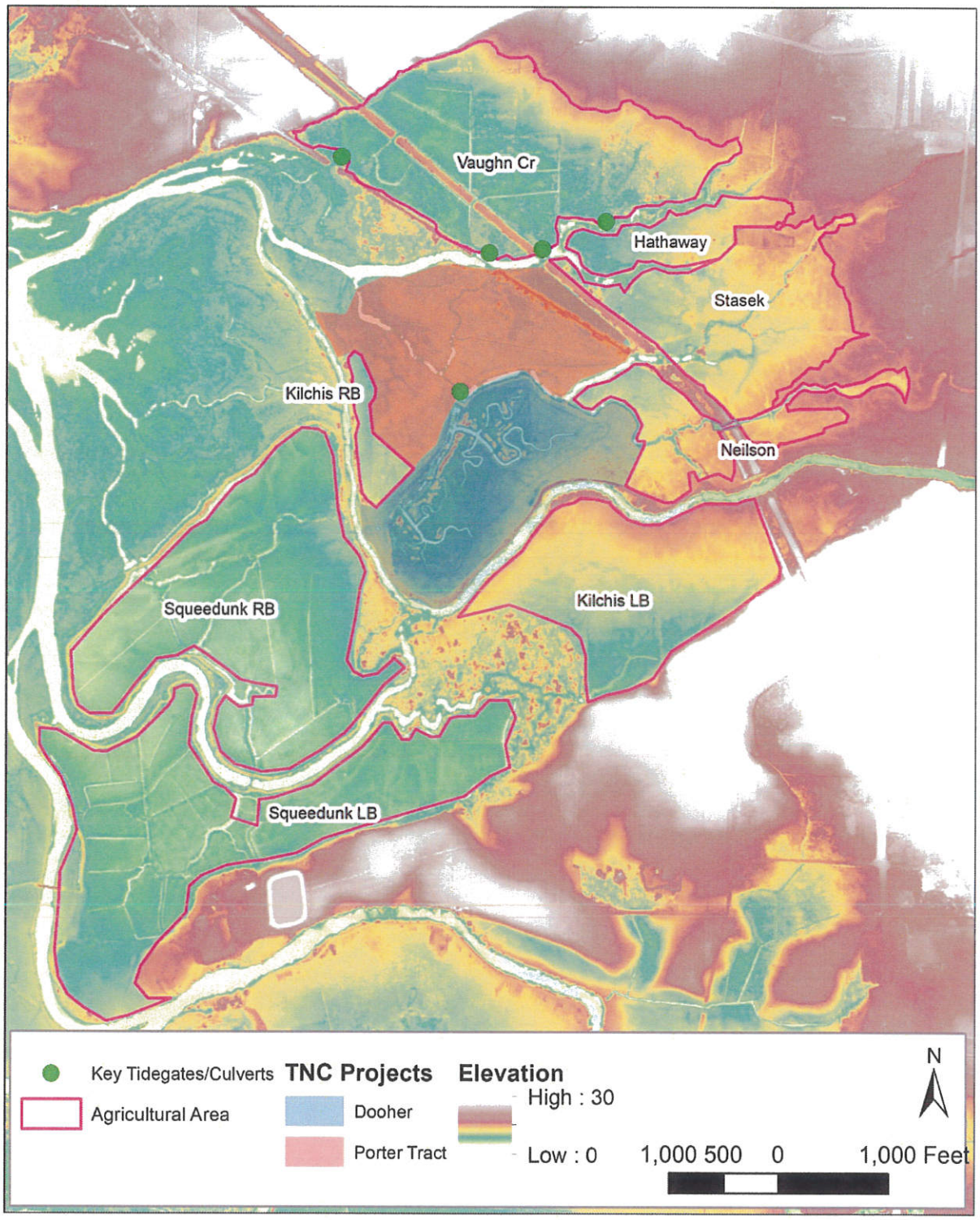


Figure 1: Site map with LiDAR showing agricultural areas potentially affected by TNC projects

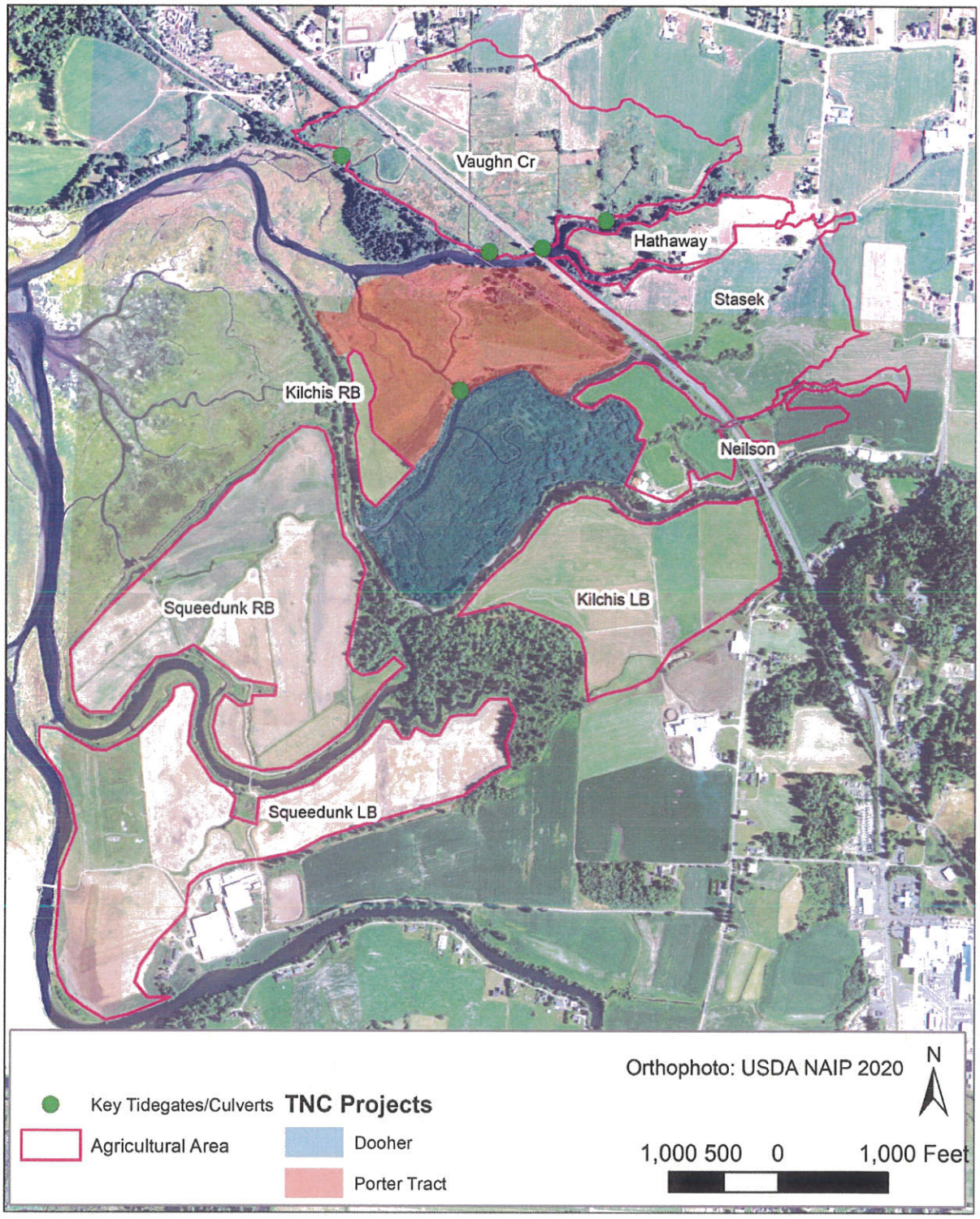


Figure 2: Site map with orthophoto showing agricultural areas potentially affected by TNC projects

1.4 Datums

All elevations in this report, for both water levels and land, are referenced to the NAVD88 datum. Use of this datum allows direct comparison between tides at Garibaldi and at the project site, as well as comparison to land elevations. To correct tides at Garibaldi to the NAVD88 datum, subtract 0.3 feet[1] from published tidal elevations. Tides as given in tide books at other stations in the Bay, particularly upper Bay stations, have much larger but undetermined differences from the NAVD88 datum and cannot be directly compared with elevations given in this report.

1.5 Flow Nomenclature

This report describes Kilchis River flows under 'normal' and 'flood' conditions. Based on NHC's hydrologic analysis (described in section 2.2), a 1.01-year ("annual") flood is around 4,400 cfs. Flows above this threshold are described as flood flows, and below as normal flows. Note that normal flows cover a wide range of conditions from extreme low summer flows through uncommon higher flows that do not quite reach the flood flow criteria. The river is in normal flow condition over 99 percent of the time (Figure 8).

2 DATA AND MODEL REVIEW

NHC first performed a review of the observed water level data, flow estimates and Delft3D hydraulic model inputs and outputs to identify any issues or concerns that might affect our use of these data in our review.

2.1 Observed Water Level Data

TNC (2020) noted that several gages had indications of movement, inaccurate survey control, and instrument failure. Where possible, erroneous data had been corrected or removed by TNC in the spreadsheets provided. NHC's review identified additional data issues on multiple gages. Due to the importance of observed data in answering the scope questions, NHC made a series of corrections to the TNC data for use in our analysis. We believe these corrections result in observed water levels within a few tenths of true values, but in most cases have no way to definitively be certain.

Our primary data quality check method was to compare summer high tide levels to adjacent gages and the NOAA Garibaldi tide gage. During the summer, effects of river flow on water levels are minimal at high tide. Our expectation—based on the relatively small project area, short distance to Garibaldi, and experience with gages operated at the adjacent Southern Flow Corridor project--is that high tides between all gages should be very similar, within a few tenths of a foot. ESA-PWA (2013) reports using a -0.21-foot corrector for tides between Garibaldi and the mouth of the Kilchis River (see also Appendix A). Differences of half a foot or more were investigated further. Low tide comparisons were not as useful

[1] Datum corrector provided by Tillamook County Surveyor for Southern Flow Corridor project.

because low tides vary much more between sites, and most of the gages go dry on low tide. Based on this comparison, NHC made the following changes to the observed water level datasets:

- Pre-2016 Gages (PC Trask operated, pre-Dooher project)
    - Raw 2014 data for Squeedunk and Stasek gages was provided with no datum correction. We estimated correctors for both gages. For the Squeedunk gage, we used Garibaldi tide gage barometric data for pressure compensation, then manually adjusted the datum corrector to achieve a good match between Garibaldi and gage high tides in July 2014. Adjustment to the Stasek Slough data was more involved and is described in detail in Appendix A.
- Post-2016 Gages (TNC operated, post-Dooher project completion)
    - Stasek@Highway, Channel Connector, Neilson, and Ditch gages were determined to be in metric units. These were converted to feet and the TNC-supplied datum corrector applied to generate a time series in feet.
    - Hathaway Slough. This gage was consistently 0.9 feet higher at high tide compared to all the other gages and the Garibaldi gage. The same pattern existed at low tide. This suggests an error in the datum conversion elevation for this gage. We applied a -0.9-foot correction to the time series to match the other gages at summer high tides.

Based on logged depth readings near zero and characteristic flat hydrograph shape, we determined that all post-2016 gages except Hathaway and the Kilchis River downstream of Highway 101 go dry on low tides. Since we expect the Hathaway gage to have the lowest low tide readings of all the gages, and this gage does not go dry, this gage serves as a lower limit on low tide levels at the other gages. None of the pre-2016 gages (Hathaway, Squeedunk, Stasek) appeared to go dry on low tide, although the Stasek gage was very close. We did not remove the 'dry' gage data but mention it as something to keep in mind when looking at figures in this report.

We used the post-project Stasek near Culvert gage as a key dataset for evaluating project impacts. This gage goes dry at an elevation of 5.0-5.1 feet. Using a comparison with the Hathaway Slough gage and projecting out approximate expected water levels had the gage not gone dry, we estimate that the true minimum low tide at this gage is about 4.8 feet. We checked this across multiple summer periods and have high confidence in this conclusion, within a tenth of a foot or so. We consider this 0.2 to 0.3 feet of 'missing data' to be minor. The following discussion uses statistics from this gage with minimum elevations of 5.0 feet, but we have called out our estimate that the true low tides should be about 4.8 feet on the relevant figures and narrative. Figure 3 shows a typical example of how the hydrograph from a dry gage looks compared to one that remains wetted and how we estimated the true minimum low tide elevation for the Stasek Slough gage.

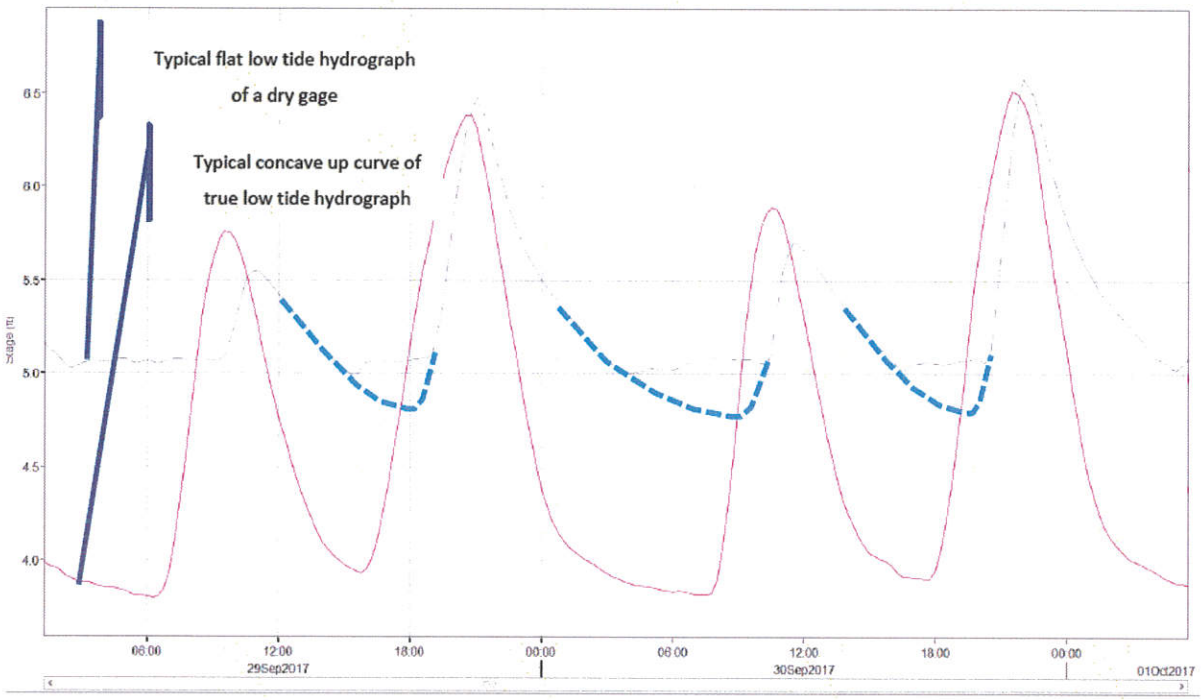


Figure 3: Observed Stasek near Culvert (Gray) and Hathaway (Pink) gage data and estimated true Stasek low tide hydrograph (Blue)

2.2 Kilchis River Flow Estimates and Probabilities

There is no record of long-term stream gage installation on the Kilchis River (we believe there was a short-term Oregon Department of Water Resources gage installed around the 2000s but no online records were found). Therefore, river flows and associated probabilities must be estimated using indirect means, as opposed to flood frequency analysis of an extended gage record. Several different methods and sources have been used for determining Kilchis River flows. These varied by study but were all based on applying a scaling factor to observed Wilson River USGS gage data. Table 1 summarizes the range of flow estimates and scaling factors from the various studies. The following paragraphs review the hydrologic methods and flows used as documented in the reports that were reviewed. We also discuss independent estimates of Kilchis River normal and flood flows developed by NHC.

Table 1: Kilchis River flood flows and scaling factors

Flood Return Interval (yrs)	PWA-ESA 2013 @ Mapes Cr	FEMA FIS 2002/2018 @ Mapes Cr	Behrens (2017) @ Mapes Cr	Kilchis River Direct Application of Cooper (2005) @ Hwy 101	NHC @ Highway 101 scaled from Miami R. (this report)	NHC @ Highway 101 scaled from Wilson R. (this report)
2	4,100	--	--	7,000	7,933	9,625
5	5,000	--	--	9,730	11,530	13,794
10	5,600	11,180	--	11,500	14,007	16,437
20	6,200	--	--	13,800	17,394	19,841
50	6,900	15,190	--	15,500	20,007	22,322
100	--	16,795	--	17,200	22,759	24,744
Wilson River Flood Scaling Factor	22.3%	--	45%	--	--	59%
Wilson River Low Flow Scaling Factor	22.3%?	--	37%	--	--	45%

PWA-ESA (2013) states that "a scaling method based on watershed parameters (area, climate, and soil properties) was used" and refers to Cooper (2005). The equations referenced in Cooper (2005) are incorporated in the USGS StreamStats online streamflow estimation tool (https://streamstats.usgs.gov/ss/). NHC applied StreamStats to the Kilchis River above Mapes Creek, where the Delft3D model has its inflow location, but was unable to replicate the results shown in Table 1 of the PWA-ESA report. The report notes the PWA-ESA numbers had large differences compared to prior hydrologic study flow estimates but attribute the differences to limitations of the USGS regression equations. Given that our use of the Cooper (2005) equations gives results very much in line with those older studies, we believe that an error was made in the application of the regression equations during the Dooher hydraulic analysis. As a result, we believe the flood frequency numbers reported in column 1, Table 1 of PWA-ESA (2013) are about one-half of what they should be. (We also note that the table reports the values for the 2002 FEMA Flood Insurance Study (FIS) 50- and 100-year flows as the 25- and 50-year flows, respectively, but as these flows were not modeled this error did not affect the analysis.)

The main concern with this apparently erroneous flow is that it was used in calibration of the model. PWA-ESA (2013) describes a low-flow and high-flow calibration period. The method to estimate low flows is not stated explicitly; we assume the same scaling factor that was described to estimate high flows was used. If this is the case, the low-flow Kilchis River discharges would have the same magnitude of error as the high flows, but as noted in the report, during low flows the site is tidally dominated so

there is less concern with the apparent errors here. The report notes that the model was calibrated to the November 2012 flood, which had a peak of 21,000 cfs at the Wilson River USGS gage (between a 2- and 5-year event based on the observed Wilson River gage record). The Kilchis inflow was then scaled to 4,700 cfs from the Wilson River observed record. This is 22.3 percent of the Wilson peak, whereas correct scaling should use about 58 percent of Wilson River values. Later modeling documented by Behrens (2017) notes "a 10 to 20 percent change in flow rate led to as much as 0.5-1 feet of change in water level", so a 60 percent lower flow would be expected to have a significant impact on water levels. The model calibration of the November 2012 event undersimulated both low tides and the flood peak by one-half to one foot: both issues can be explained by inputting too low a river flow.

Loeb (2014) documents model upgrades and analysis of the regulatory 100-year flood event. The report states a base flood (100-year) flow of 15,600 cfs was used, referencing the 2002 FEMA FIS for Tillamook County. This is slightly greater than the 15,360 cfs reported in the FIS, which may be due to adding in local tributary inflows but is consistent with the expected value for this flood. We do note that NHC's analysis indicates higher estimates for flood flows may be warranted for future modeling work.

Behrens (2017) documents extensive model upgrades and used a different method of scaling Wilson River flows to create Kilchis River flows using only drainage area, referencing Oregon State University and USGS Texas studies. This method results in a scaling ratio of 37 percent for flows lower than 1,000 cfs and 45 percent for larger flows. Using the NHC approaches described below, the scaling ratio for low flows would be 45 percent and 59 percent for flood flows, resulting in the estimated NHC flows 8 percent and 14 percent higher than those used in Behrens (2017) for low and high flows, respectively. These differences are small and well within the uncertainties of estimating flows in ungaged basins. We conclude the methods used in Behrens (2017) give reasonable (though perhaps somewhat underestimated) estimates of Kilchis River flows from low flow through large floods.

NHC also developed scaling ratios independently as part of this review. In our opinion, generating the basin scaling ratios using the USGS coastal Oregon-specific equations developed by Cooper (2005) for flood flows and Risley et.al. (2009) for low flows, as implemented in StreamStats, is the most appropriate method, as this approach accounts for more variables found to be important in estimating flows, not just basin area. These scaling ratios are then applied to the Wilson River observed flow record to generate a simulated Kilchis River flow record that can be used for statistical analysis. This appears to be the method that was incorrectly applied in PWA-ESA (2013).

For low flows, NHC generated monthly 50 percent exceedance interval flow estimates for the Wilson River and Kilchis River using the equations of Risley et.al. (2009), then took the mean of the monthly scaling ratios, to produce a scaling factor of 45 percent. For flood flows, we calculated the ratio of the estimated Kilchis and Wilson River peak flows for each of the 2- through 100-year events. The ratio ranges from 55 percent for the 2-year flood to 61 percent for the 100-year flood; we used an average of 59 percent to scale flood flows. We cross checked this information by applying the same procedures to scale flows from the Miami River watershed, which had a USGS gage operating in it for several decades.

Comparing Kilchis River flood quantiles from the observed gage records of both the Miami and Wilson Rivers versus those calculated directly using Cooper (2005) shows both rivers produce higher flood flows than the Cooper equations predict. This implies that the Kilchis River, located between these two basins both geographically and in drainage area, also may produce higher flood flows than those predicted by the Cooper equation. Using the Cooper equation to generate the scaling factor but using observed

Wilson River flows for the base dataset addresses the potential underestimation using Cooper directly for the Kilchis could create. One other difference between this NHC analysis and those reviewed is that we calculated scaled flows for the Kilchis River at the Highway 101 bridge. While the model extends up to Mapes Creek, there is an additional 10 percent increase in drainage area by Highway 101 that should be accounted for in the modeling (this does not include estimated inflow from Stasek, Hathaway, or Vaughn Creek drainages).

In summary, the initial modeling conducted for the Dooher project appears to have a substantial error in flow estimates that affected the calibration and therefore the confidence in the ability of that model to simulate accurately across a range of flows. Subsequent generations of the model used better flow estimates. Comparison with flows produced by adjacent basins, using region-specific scaling factors, and accounting for basin area between Mapes Creek and Highway 101, indicate that both low and flood flows may be larger than those used in all the analyses to date. Regardless, there will always be substantial uncertainty in estimating flows in ungaged basins. Given these uncertainties, use of flow sensitivity testing in future modeling, rather than investing substantial effort in additional hydrologic analysis, is recommended.

2.3 Delft3D Hydraulic Model

NHC reviewed all hydraulic modeling reports supplied for the project and the model input and output files used for the Porter Tract analysis. There have been several generations of the hydraulic model, with increases in model domain, updates to topographic data, and updates to the design incorporated over time. Additional modeling work was done after the significant changes to bed and floodplain topography caused by the large December 2015 flood interacting with the newly completed Dooher project. The analysis was done in Delft3D using its two-dimensional formulation. Topography for most of the model domain was derived from LiDAR, with supplemental ground- and boat-based survey points added in channels, within and adjacent to the Dooher and Porter sites. The computational grid resolution is 15 feet.

The more recent Delft3D models have demonstrated good calibration to both low-flow/tidally-dominated conditions and floods. The observed data used for the calibration is limited to TNC lands and the Kilchis River channel immediately adjacent. The 15-foot cell resolution can accurately simulate the Kilchis River, floodplain areas, and primary sloughs in the project area—Stasek, Hathaway, Neilson, and Porter—but is too coarse to capture smaller channels and drainage ditches.

Virtually all the reports reviewed focus on flood impact evaluation of the Dooher or Porter projects. The few short sections that discuss low-flow/tidally-dominated conditions focus mostly on high-tide peaks with no discussion of low-tide or average water level impacts that are generally more important for agricultural drainage impacts analysis. We have been able to glean model results for partial low flow analysis because the simulations generally included a few days prior to and after the flood.

Overall, we found the models well suited for flood analysis and normal flow analysis for the Kilchis River and primary sloughs in the area. The models were not set up to allow a detailed agricultural drainage impacts analysis, particularly in the Vaughn Creek unit. In our answer to Item 4, we recommend a series of model improvements to address this.

3 SCOPE OF WORK QUESTIONS

3.1 Dooher Project Impacts Analysis

1) How did the Dooher project impact water levels in Hathaway Slough, Stasek Slough, and the Kilchis River (adjacent to the project site)?

We discuss flood and normal flow impacts separately. By 'normal' flow we mean all non-flood flows, including both summer low flows and higher but frequent winter flows.

3.1.1 Flood Impacts

Flood impacts are described in two reports (Loeb, 2014; PWA ESA, 2013). The model scenarios used were a steady flow 100-year flood of 15,600 cfs and a 5-year flood of 4,700 cfs[2]. Downstream tidal boundaries were between 10 and 11.6 feet. For the 4,700 cfs simulation no change in peak stages is noted.

For the 100-year flood the Dooher project had significant impacts on Kilchis River flood levels: by removing the levee along the river and the one that bordered Stasek Slough, significant flow now spills out of the river to the north. For the 100-year flood run, reductions in Kilchis River flood stages of up to two feet at the levee removal location were predicted, and around one foot closer to Highway 101. The reduction tapered off at the Squeedunk Slough entrance. Downstream of Squeedunk Slough, increases in peak flood levels of about a tenth of a foot were predicted, due to more flow being diverted into this reach by the project. Peak water levels on TNC lands and adjacent sloughs were not reported, but based on the Kilchis River data, we expect that increases on the order of 0.1 foot likely occurred in Stasek, Neilson, and Hathaway Sloughs.

The 100-year flood was also run with an 'evolved bed condition' accounting for expected change in the Kilchis River due to the project. This condition added several feet of sediment to the main channel in the area of levee removal and assumed some scour upstream from there to the Highway 101 Bridge. Post-December 2015 flood surveys show that the riverbed has evolved fairly closely to these predictions. The reduction in flood levels in the Kilchis River between Highway 101 and Squeedunk Slough is reduced to less than half a foot, but the small rise downstream of Squeedunk Slough is also removed. No results for adjacent sloughs or floodplains were reported.

In summary, the modeling indicates that the project has reduced large flood levels in the Kilchis River between Highway 101 and Squeedunk Slough, possibly by half a foot or more. Sedimentation in the channel induced by the project has led to smaller flood level reductions over time. Flood levels in Stasek, Neilson, and Hathaway Sloughs and surrounding floodplain have perhaps seen rises of 0.1 foot or so.

[2] See prior discussion on Kilchis River flows. Our estimates of a 5-year flood based on USGS StreamStats and basin scaling from the Wilson and Miami River gages is 11,500 cfs. Using our estimates this flow is significantly less than a 2-year event.

3.1.2 Normal Flow Impacts

The Dooher project reports reviewed focused on flood impacts, with the associated model simulation run for short time spans covering only the flood modeled and a few days on either side. Therefore, we have relied almost entirely on the observed gage data provided to evaluate impacts to normal flows. Fortunately, we have data from both Hathaway and Stasek Slough gages for pre- and post-project periods, although the pre-project Stasek Slough data has a higher level of uncertainty than the other observed data (see Appendix A).

3.1.2.1 Stasek Slough

Water level changes in Stasek Slough due to the Dooher project are significant and vary by season. We present the differences in a variety of different figures in this section, but perhaps the simplest way to visualize the difference for wet season conditions is to plot Stasek Slough stage from a pre- and post-project time when river flows and high tides were very similar (Figure 4). This figure shows that while high tides in Stasek Slough closely match those in Garibaldi, minimum low tide levels were increased by around two feet, reducing the tidal amplitude from over three feet to one foot.

We applied some averaging to the timeseries data to better evaluate seasonal changes in water level due to the Dooher project. Figure 6 shows averaged Hathaway and Stasek Slough water levels. The stage was developed by first creating daily maximum, minimum, and average water level records (the daily maximum and minimum are a close surrogate for higher high and lower low tides). We then averaged these data over a semi-monthly (i.e., approximately bi-weekly) period, which provides better estimates of longer duration water level trends and makes for clearer figures.

Referring to Figure 6, summer maximum average levels have increased from 7.3 to 7.9 feet. Minimum levels have increased from 4.2 to 4.8 feet, and mean levels increased from 5.1 to 5.6 feet. Prior to the Dooher project, maximum water levels were a few tenths lower than Hathaway Slough, average water levels similar, and minimum water levels about 0.2 feet higher. The smaller amplitude (difference between highs and lows) is attributed to the muting effect of the connector culvert on flow exchange between Hathaway and Stasek Slough prior to Dooher project construction. Post-construction, the connector culvert still limits flow out to Hathaway, but Stasek Slough sees much more inflow from the Kilchis River connection. This creates the increases in water levels over the summer months.

The greatest change to Stasek Slough is seen in the winter months. Minimum and mean water levels rose on the order of 1.5 to two feet during the wet season once the project was constructed. Maximum winter water levels are generally about one foot above Hathaway maximum water levels, whereas minimum and average water elevations are two to three feet higher. The greater difference in the minimum and average levels between Stasek and Hathaway sloughs, and the fact they occur in the winter, is an indication that these changes are related to Kilchis River flows. In Figure 7, Kilchis River mean daily flows are plotted versus stage in Stasek Slough for pre- and post-project conditions. Post-project water levels are much more sensitive to increasing Kilchis River flows. At very low flows post project water levels are about 0.6 feet higher than pre-project water levels, but at 1000 cfs post project water levels are over 2.5 feet higher than pre-project conditions.

We interpret this to indicate that at very low flows, bay tides (which were not changed by the project) dominate hydraulic behavior, while even relatively small increases in river flow lead to sharp increases in

slough water levels. This finding was indirectly described in Behrens (2017), who noted high sensitivity in the hydraulic model to Kilchis River scaling assumptions – a 1 to 1.5 foot change in stage for a 10-20 percent change in river flow.

The greatest project effects are seen between flows of about 400 and 5,000 cfs. On an annual basis, flows are within this range about 36 percent of the time (Figure 8). On a mean monthly basis, flows exceed 400 cfs from November through April (Figure 9), which corresponds with the increases in winter season stage shown in Figure 7. Pre-project data is limited at higher flows, but it can be seen the two curves are converging, which falls in line with the flood modeling predictions that there is little difference in pre- and post-project water levels during floods greater than about a 2-year event.

The increases in winter water levels in Stasek Slough are most likely caused by the connection of Stasek Slough to the Kilchis River as part of the Dooher project, implying that stages in the Kilchis River at the Stasek Slough breach are much more strongly influenced by Kilchis River flows than at the river's confluence with Hathaway Slough.

The increases in water levels in Stasek Slough on TNC lands propagate upstream under Highway 101, where both Stasek and Neilson Sloughs flow through private lands. The relatively small low-lying areas of the Stasek and Neilson units may see increased frequency of inundation in the winter months. When water levels in Stasek Slough exceed about 11 feet, water spills over the north bank upstream of Highway 101 and flows into Hathaway Slough.

3.1.2.2 Hathaway Slough

Hathaway Slough water levels are shown in purple in Figure 6. There is minimal pre-project data, covering a few late summer months in 2012. Comparing minimum, maximum, and average curves with the post-project data, no significant change has occurred for summer months. For instance, the averaged low tides have remained around an elevation of five feet in all years shown.

However, we believe it likely that there have been some increases in winter water levels due to the Dooher project, driven by the significant increases observed in Stasek Slough. Figure 10 plots Stasek and Hathaway Slough observed water levels, as well as the difference between them, and estimated Kilchis River flows. At the beginning of the period with very low river flows, the differences vary between +1 and -1 feet, indicating bi-directional flow in the connector culvert between the two sloughs. Once flows begin to rise, the difference increases to two to three feet on average and is always positive, indicating continuous one-way flow from Stasek Slough to Hathaway Slough through the connector culvert. Once flows exceed about 3,000 cfs, Stasek Slough water levels exceed 11 feet (Figure 5). At this elevation, water begins to spill from Stasek Slough to Hathaway Slough over the floodplain on TNC property and also over a low point just upstream of Highway 101 (mentioned as an observation by Leo Kuntz in his 'staircase' memorandum (Kuntz, 2017)). This evidence indicates that flows into Hathaway Slough have been increased by the Dooher project during winter months. Increasing flows in tidal sloughs almost always result in reduced (higher) low tides. In contrast, it typically takes far larger flow increases to affect high tide levels, so we believe it unlikely that the probability of overtopping of the west side Hathaway Slough dikes into the Vaughn Creek unit has been increased. We do not know the magnitude of the increase from available model data, observed data, or reports. We therefore do not know if they are significant or not, although Leo Kuntz's observations in his letter imply that Hathaway Slough was not affected nearly to the degree that Stasek Slough was by the project.

3.1.2.3 Kilchis River

The focus of the Dooher project reports on floods and the lack of Kilchis River gages spanning project implementation mean that there was not enough information to quantitatively evaluate changes to normal water levels in the Kilchis River between Highway 101 and Squeedunk Slough. With the two to four feet of aggradation measured in the reach where the levee was removed after the December 2015 flood, we expect water levels during summer low flows to be similarly increased. The increase in water level is reduced as Kilchis River flows increase, and once flows begin to spill over the removed levee section, post-project water levels are lower than pre-project water levels (based on the flood modeling described previously). We can infer that Hathaway Slough water levels are in large part driven by Kilchis River levels at their confluence, so the relatively small change we see in Hathaway Slough water levels between pre- and post-project conditions likely reflects similarly small changes in the Kilchis River here. We believe it likely there is some increase in low tide levels in the river around where Stasek Slough was connected and extending both up- and downstream some distance due to significant tidal exchange into Stasek Slough induced by the project. However, there is no modeling or observed data to validate this.

2) What were the hydrological impacts of the Dooher Project regarding both drainage and flooding on farm properties adjacent the Dooher property and Stasek Slough?

The analysis discussed in the previous section provides the information needed to answer this question, which we address on an agricultural unit (Figure 1) basis in Table 2.

Table 2: Dooher project water level impacts on agricultural units

Agricultural Unit	Flood Impacts	Normal Flow Impacts
Vaughn Creek	A rise of 0.09 feet is predicted at the mouth of Hathaway Slough for the base flood run (Loeb, 2014), which would lead to flood level increases of this magnitude or less in Vaughn Creek. The area is diked so flood levels must exceed the dike height to inundate the area.	This unit is most sensitive to increases in Hathaway Slough water levels, due to its low ground elevations and tributary inflow. Flows into Hathaway Slough from Stasek Slough have increased to an unknown degree, which may have affected winter drainage function, but whether the increases are significant is unknown. The two upper tidegates that drain the area would be the most likely to have reduced function if Hathaway Slough water levels have indeed increased during winter months. The west tidegates drain almost directly to Tillamook Bay and are less likely to be affected. Summer hydrology appears to be unaffected.
Hathaway	See above.	The western portion of this unit has lower ground elevations (about eight feet on the LiDAR), and would be affected similarly to Vaughn Creek if Hathaway Slough winter water levels have risen to a significant degree. Summer hydrology appears to be unaffected.

Agricultural Unit	Flood Impacts	Normal Flow Impacts
Stasek	A small decrease in base flood water levels is predicted at Stasek Slough under Highway 101. Upstream the decrease is expected to be no greater than this and is most likely less due to overland flood flows from up valley. Extrapolation of the water level increases seen during normal winter flows indicates there may be some increase in flood levels during smaller, more frequent floods.	Winter water levels have risen several feet in Stasek Slough due to the project, and these rises are expected to have propagated upstream of Highway 101. The lower elevation areas of the unit close to the highway now see overtopping flow during higher winter river flows and likely a generally higher water table in the wet season. Summer minimum and mean water levels have increased about one-half foot.
Neilson	Same as Stasek unit.	Neilson Slough water levels are driven by Stasek Slough levels, which have increased up to 3 feet in the winter. The area downstream of the highway between Neilson and Stasek Sloughs has land elevations around 10 feet and is the most likely area to be affected. The rest of this unit is mostly three to four feet higher and less likely to be impacted. Summer minimum and mean water levels have increased about one-half foot.
Kilchis LB	The project reduced flood levels in the Kilchis River by one-half foot, leading to decreased frequency, duration, and volume of overtopping flows into this unit.	Elevations in this unit are highest near the river and slope to the south. Drainage is out into Squeedunk Slough, which is unaffected by the project. No impacts to either winter or summer hydrology in the unit are anticipated.
Kilchis RB	This unit is undiked high tideland (elevation 9-10 feet). Increases of 0.2 feet are expected in the base flood scenario (note this is well below the expected 100-year tide). Increases of about a foot during a 2-year flood event are indicated.	Winter water levels have likely increased several feet here based on Stasek Slough water level data. Summer hydrology appears to be unchanged.
Squeedunk RB	Minor decreases in flood levels possible due to more flow diverting to the Kilchis River and less into Squeedunk Slough. Along the Kilchis River portion of the levee see the Kilchis RB above.	No change expected as the unit drains west to Squeedunk Slough, which appears to be unaffected by the project.
Squeedunk LB	Minor decreases in flood levels possible due to more flow diverting to the Kilchis River and less into Squeedunk Slough. Highest risk is likely from Wilson River and coastal flooding, not the Kilchis River.	No change expected as the unit drains to Squeedunk Slough, which appears to be unaffected by the project.

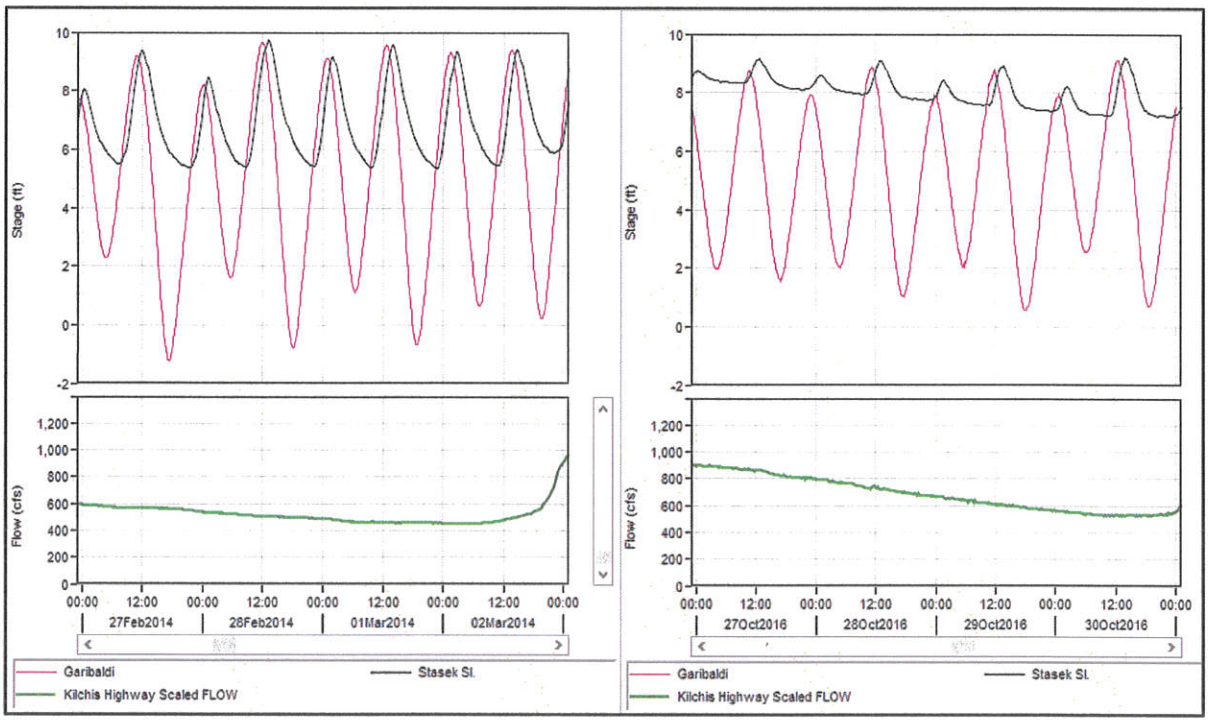


Figure 4: Comparison of Stasek Slough water levels pre- (left) and post- (right) Dooher project under similar river flow and high tide conditions. Note that high tides remain closely matched with Garibaldi high tides but low tides increase by around two feet.

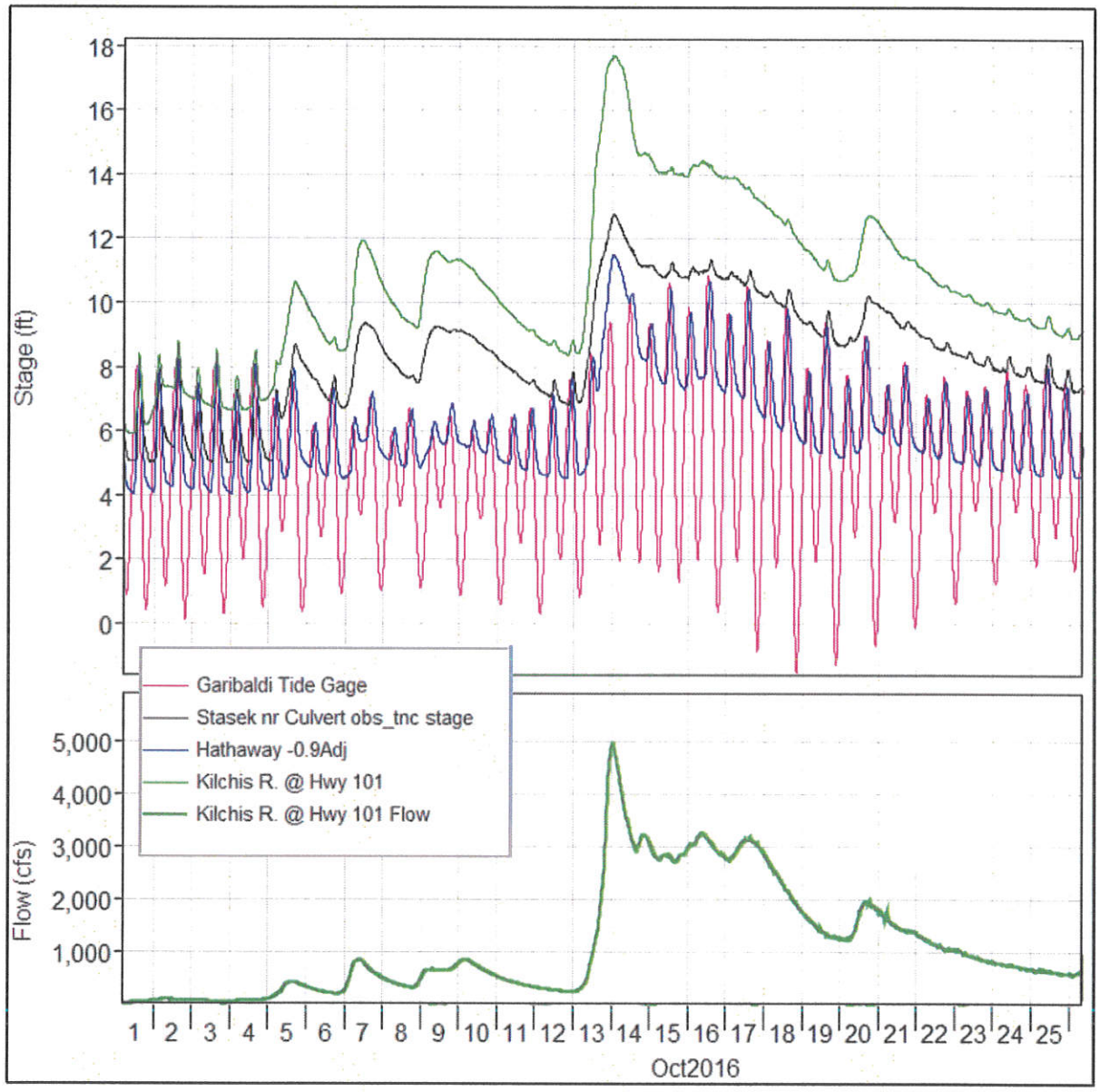


Figure 5: Observed stage and flow data for October 2016

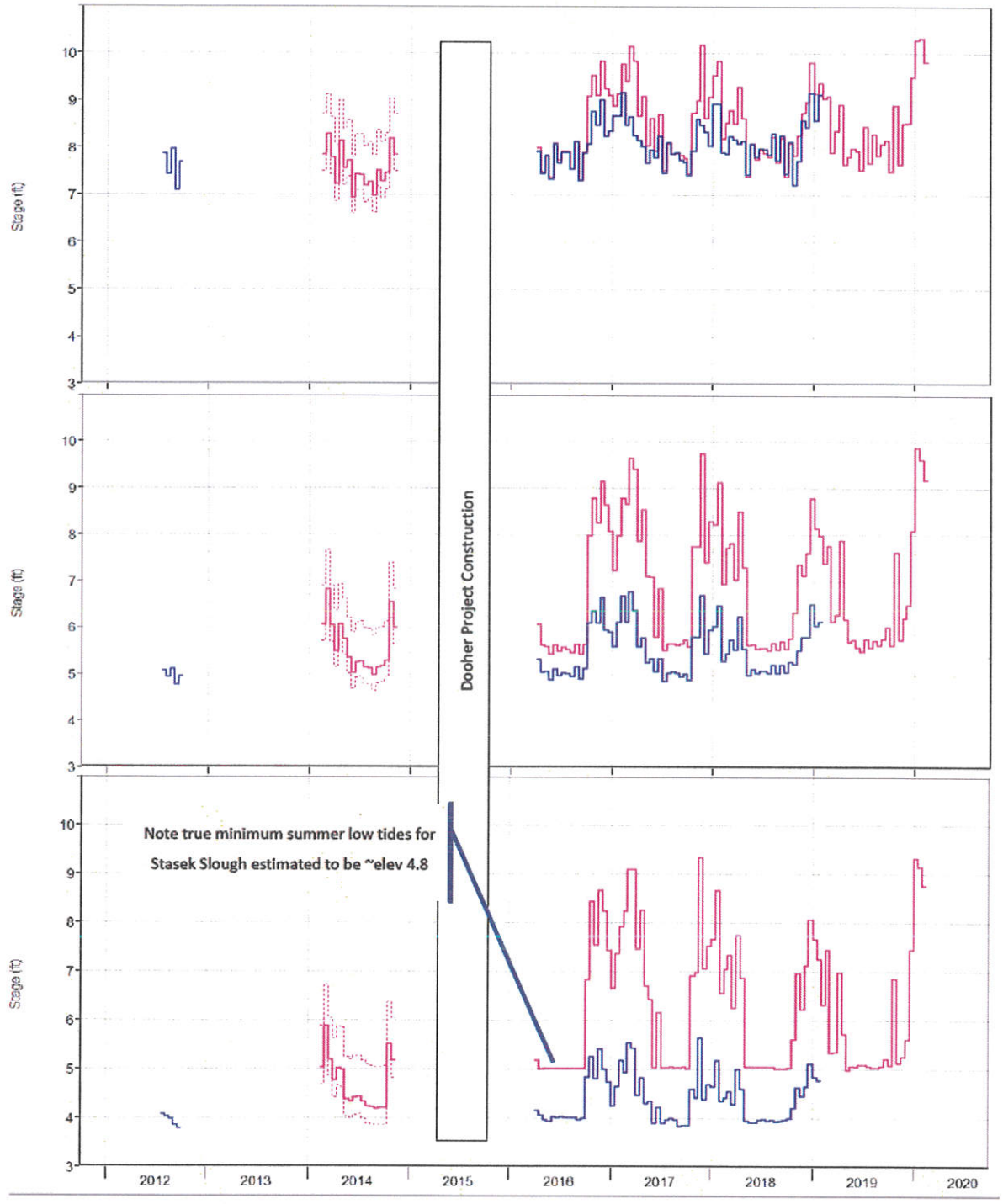


Figure 6: Observed semi-monthly averaged maximum (top), mean (middle), and minimum (bottom) of daily water levels for Hathaway Slough (blue) and Stasek Slough (pink). Dashed lines for 2014 Stasek Slough data indicate upper and lower uncertainty bounds.

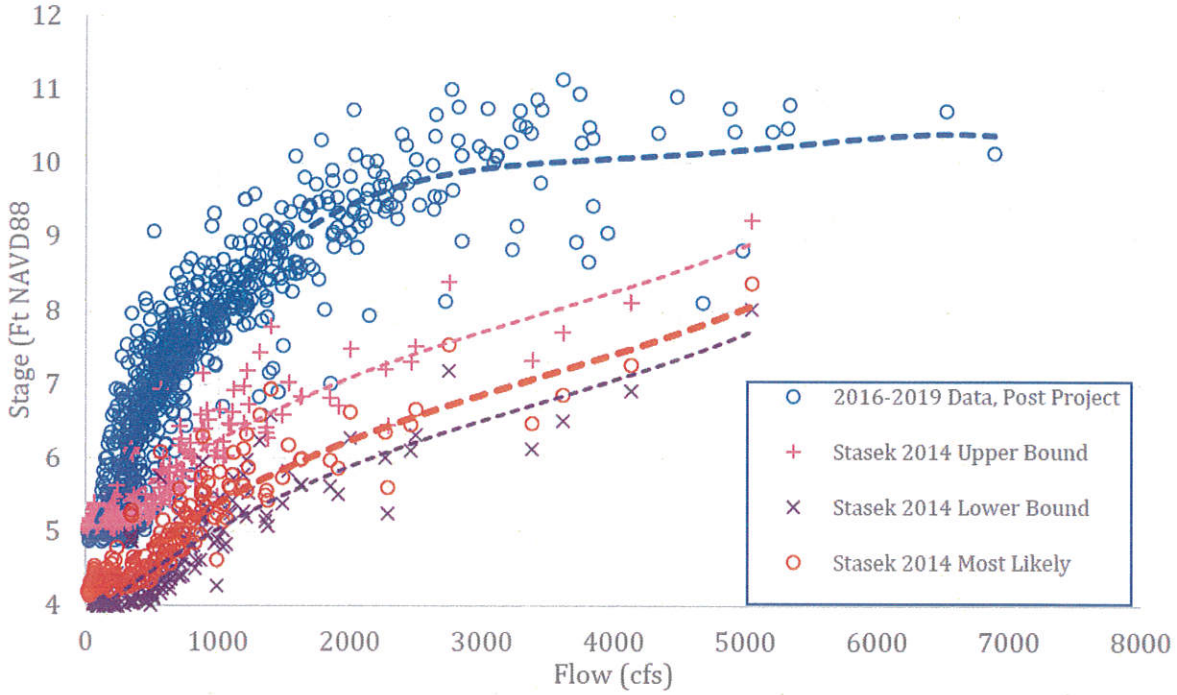


Figure 7: Stasek Slough stage vs estimated Kilchis River flow pre- and post-Dooher project

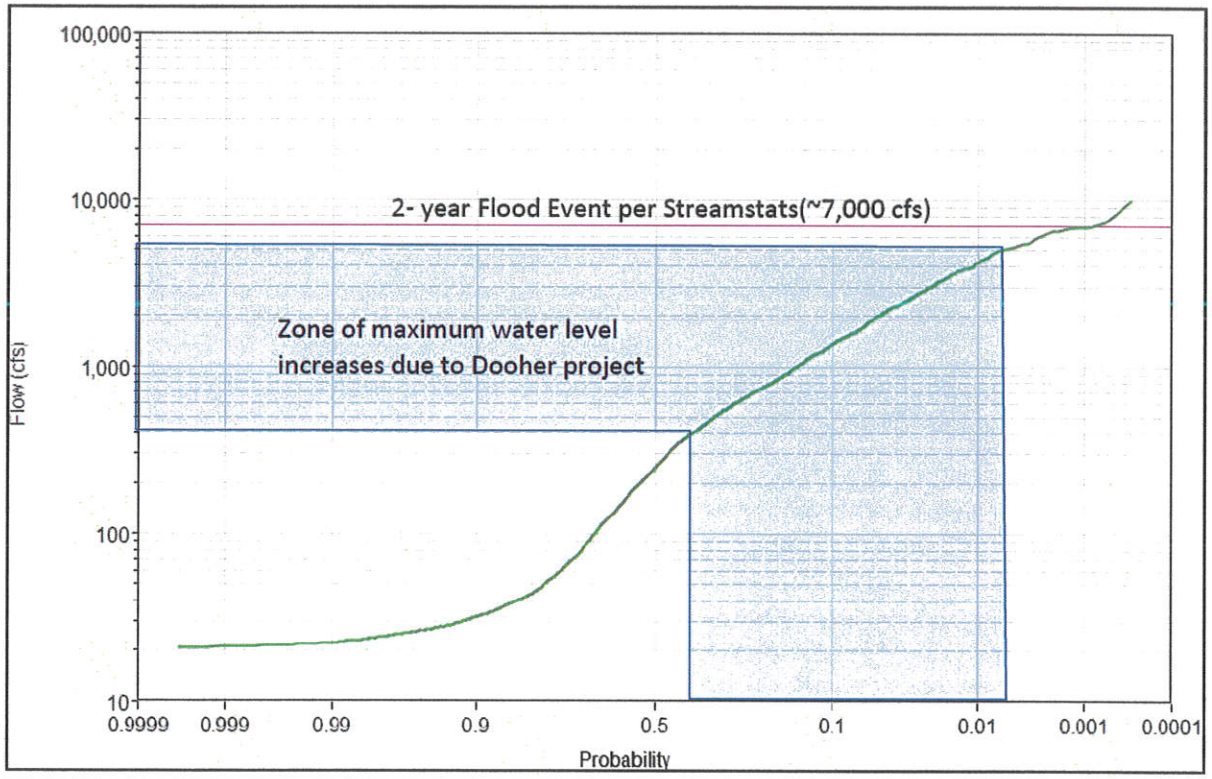


Figure 8: Estimated Kilchis River annual flow duration curve WY2012-2020

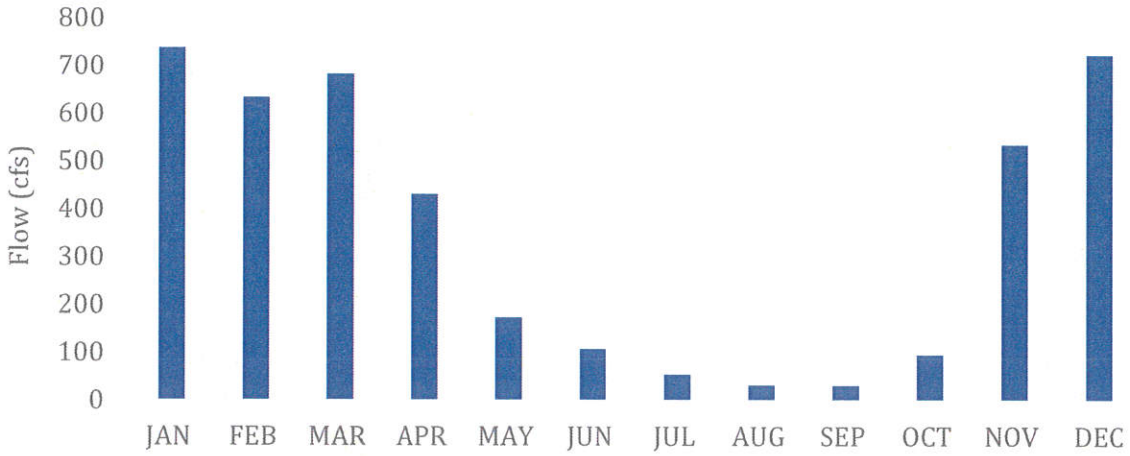


Figure 9: Median monthly estimated Kilchis flows

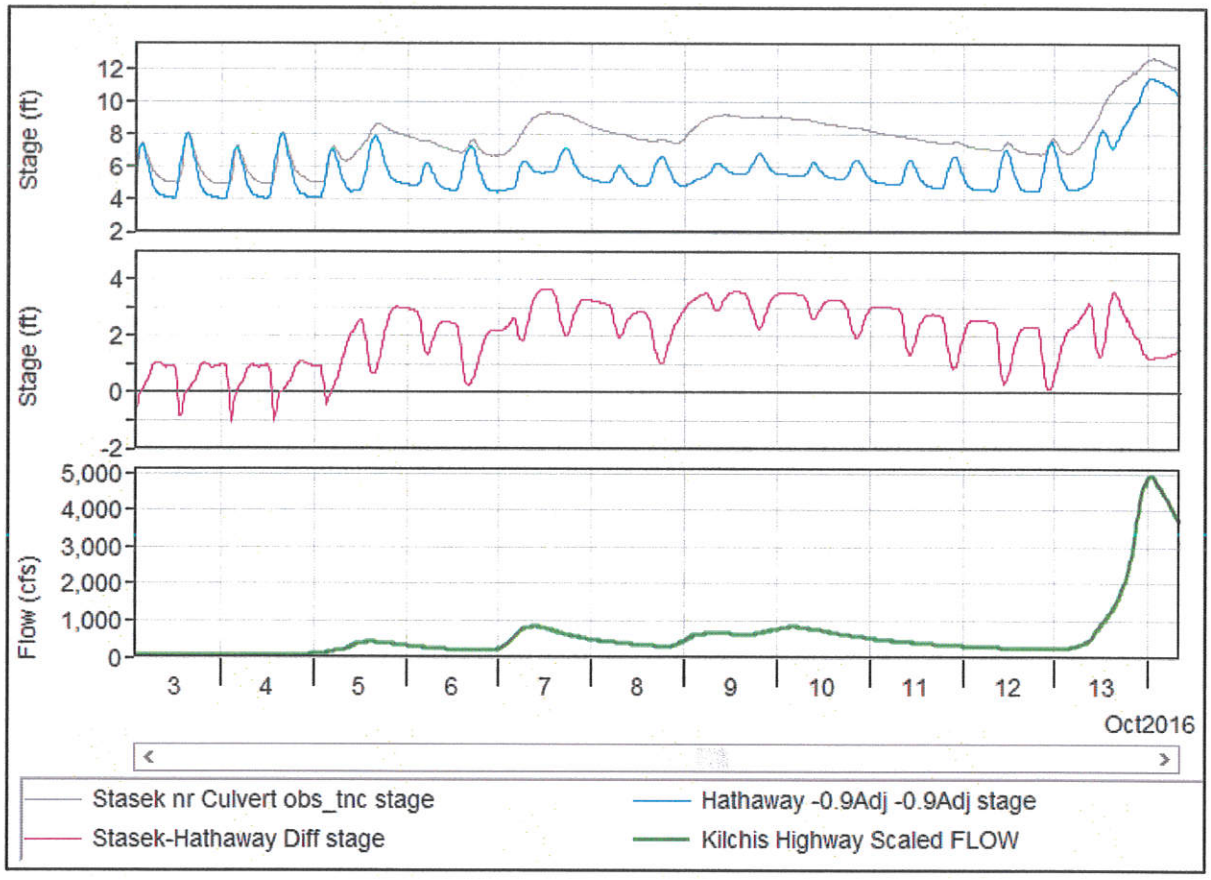


Figure 10: Stasek and Hathaway Slough observed water surface elevation (top), difference in stage (middle), and Kilchis River flows for reference (bottom).

3.2 Kilchis Porter Project Impacts Analysis

3) 3a. What are the anticipated impacts of the Kilchis Porter Project to neighboring farm properties regarding both drainage and flooding? 3b. How do the impacts of the initial Dooher and proposed Porter projects combine?

The Dooher project had a greater impact on area hydrology than the proposed Porter project will. By removing large portions of the Kilchis River levee and the berm along Stasek Slough, and connecting Stasek Slough directly to the river, the Dooher project has provided much greater connectivity between the river, Stasek Slough, and Hathaway Slough at all flows. The main impact of the Porter project will be to further increase the flow and connectivity between Stasek and Hathaway Slough by removing the existing four-foot box culvert and widening the connector channel to 35 feet.

We evaluated the expected impacts by analyzing model results for the large December 2015 flood and a small event in January 2017 (NHC, 2019). This modeling effort used the latest updated model, which included updated post-2015 flood channel survey, various other improvements, and recalibration as documented in Behrens (2017). The with-project simulations used the latest design plans. Both simulation periods contain times of low to moderate flows that allowed evaluation of drainage impacts as well as flood impacts.

3.2.1 Drainage Impacts

For drainage impacts, we analyzed normal flow conditions, represented by the first four days of the December 2015 simulation (Figure 11) and the first day and a half and last four days of the January 2017 simulation (Figure 12). This period includes flows up to about 4,000 cfs, which is exceeded only about one percent of the time (Figure 8).

Figure 13 presents the stage differences for both simulations as stage difference versus flow plots. This figure shows that, below about 500 cfs, differences in water levels between existing and post-project conditions are less than 0.2 feet and oscillate about zero (Figure 12, first day and a half). The largest differences occur between around 1,000 cfs and 2,500 cfs, with Stasek Slough water levels up to 0.8 feet lower than under existing conditions and Hathaway Slough water levels up to 0.5 feet higher. As flows increase further, the differences diminish. Stasek Slough stage differences tend towards zero, but Hathaway Slough shows a persistent small rise of about 0.1 feet through the flood peak. This change is attributed to greater connectivity between the sloughs due to the culvert removal, allowing more effective drainage of Stasek Slough but routing this water into Hathaway Slough. The Porter project is essentially reducing the head difference between the two sloughs. The effects of these changes in the sloughs propagate upstream of Highway 101; Figure 14 illustrates a representative time period with water surface differences plotted.

Based on the modeling, we expect very little change in hydrology in the area during summer low flow months when flows are below 500 cfs. During the winter, Hathaway Slough will see water level increases up to 0.5 feet at times, with average increases of perhaps 0.2 feet; this could affect drainage from the Vaughn Creek and Hathaway units. The increases will mostly occur on the low tide. Water levels in the Stasek and Neilson units will go down, up to 0.8 feet at certain flows and averaging perhaps 0.4 feet. The largest decrease in water level occurs on the low tide for these units. The changes on all units are at their maximum when river flows are between 1,000 and 2,000 cfs. Water levels on the Kilchis RB unit

will be reduced by a lesser amount. Water levels in Squeedunk Slough are expected to be reduced by less than a tenth of a foot, but no measurable impact on either of the Squeedunk units or the Kilchis LB unit is expected.

The net effects of the combined Dooher and Porter projects vary by area. In the Stasek-Neilson units, the Dooher project raised average and low-tide water levels by several feet during winter months. The Porter project will tend to reduce average and low-tide water levels, but on the order of a few tenths of a foot to half a foot, so the net result will still be increases of several feet in water levels in these units. For Hathaway Slough, the Dooher project effects have not been quantified but are believed to be increases on the order of one or two tenths of a foot at average and low-tide water levels. The Porter project will add a further increase in average and low tide water levels of another one or two tenths of a foot.

3.2.2 Flooding Impacts

Changes in flood water levels due to the Porter project are less than the changes predicted under normal flow conditions. Project induced increases in water surface elevations tend towards zero as flows exceed 6,000 cfs on the Kilchis River for both Stasek and Hathaway Sloughs, although the latter sees a small persistent increase of about 0.1 feet through all but the very peak of the floods (Figure 11, Figure 12, Figure 13). This increase will be seen in the Vaughn Creek, Hathaway, and Stasek units for floods large enough to overtop the banks and dikes (Figure 15).

Reductions to mainstem Kilchis River stages due to the Porter project are less than 0.05 feet near the railroad and about 0.1 feet at Squeedunk Slough. The other agricultural units are expected to not see any measurable difference (we caution against giving much weight to the apparent flood reduction in the Squeedunk LB unit shown in Figure 15 due to the lack of attention and calibration data that section of the model has seen).

3.2.3 Impacts Due to Combined Projects (Question 3b)

Question 3b is difficult to answer with the available information because no modeling has been performed directly comparing pre-Dooher project conditions with proposed post-Porter+Dooher conditions. Synthesizing the various reports, model outputs, and observed data we have discussed in the prior sections, we can summarize what we know in the following tables.

Table 3: Summary of inferred flood impacts of combined Dooher-Porter projects on agricultural units

Agricultural Unit	Flood Impacts Dooher Project	Porter and Combined Project Impacts
Vaughn Creek	A rise of about 0.1 feet in Hathaway Slough is estimated. This will slightly increase the frequency and depth of overtopping into this unit from river floods. Note a separate risk not affected by the project is overtopping from extreme tidal events.	An additional rise of about 0.1 feet for a total increase of 0.2 feet in Hathaway Slough, leading to corresponding increases in Vaughn Creek.
Hathaway	See above.	See above.
Stasek	Negligible decrease in large flood water levels is predicted in Stasek Slough under Highway 101. There may be an increase of a few tenths of a foot around the 2-year flood.	No change in large flood levels. Porter may result in decreases of a tenth of a foot or less in small flood levels, but not enough to make up for the increase caused by the Dooher project.
Neilson	Same as Stasek unit	Same as Stasek unit
Kilchis LB	The project significantly reduced flood levels in the Kilchis River, leading to decreased frequency, duration, and volume of overtopping flows into this unit.	A small additional decrease in river levels from Porter (less than 0.1 feet) would provide minor additional flooding reductions.
Kilchis RB	This unit is undiked high tideland (elevation 9-10 feet). Increases of 0.2 feet are expected in the base flood scenario (note this is well below the expected 100-year tide). Increases of about a foot during a 2-year flood.	No change to a decrease of 0.1 feet from Porter. Net result is very little difference from existing (post-Dooher) conditions.
Squeedunk RB	During large floods, Squeedunk Slough water level may have decreased by 0.1 feet, but Kilchis River water levels are predicted to increase by 0.2 feet. Net change to flood risk in the unit depends on relative dike heights on the river and slough, but changes due to project are expected to be at most a few tenths of a foot.	Possibly another minor decrease in flood levels for net decreases of 0.1-0.2 feet in Squeedunk Slough. Due to levees and tidal dominant location, impacts to diked agricultural lands are likely negligible.
Squeedunk LB	Minor decreases in flood levels possible due to more flow diverting to the Kilchis River and less into Squeedunk Slough. Highest risk is likely from Wilson River and coastal flooding, not the Kilchis River.	No additional impacts.

Table 4: Summary of inferred drainage (normal flow) impacts of combined Dooher-Porter projects on agricultural units

Agricultural Unit	Drainage Impacts of Dooher Project	Porter and Combined Project Impacts
Vaughn Creek	An increase in water levels in Hathaway Slough of unknown magnitude (but likely on the order of a tenth of a foot) is likely to have occurred. This may have slightly reduced drainage capacity.	An additional rise from Porter averaging about 0.2 feet, added to whatever increase occurred due to the Dooher project. This may slightly reduce drainage capacity.
Hathaway	See above.	See above.
Stasek	Significant increases in winter water levels of several feet. Much of this unit is at higher ground elevations that may not be impacted by this rise.	Porter will decrease winter water levels 0.4-0.8 feet. Net result is still expected to be 1.5 to 2 feet higher than pre-Dooher project water levels.
Neilson	Same as Stasek unit	Same as Stasek unit
Kilchis LB	None	None
Kilchis RB	Winter water levels have likely increased several feet here based on Stasek Slough water level data.	No change to a small decrease of 0.1 feet from Porter. Net result is several feet of increase from pre-Dooher project conditions.
Squeedunk RB	No change	No change
Squeedunk LB	No change	No change

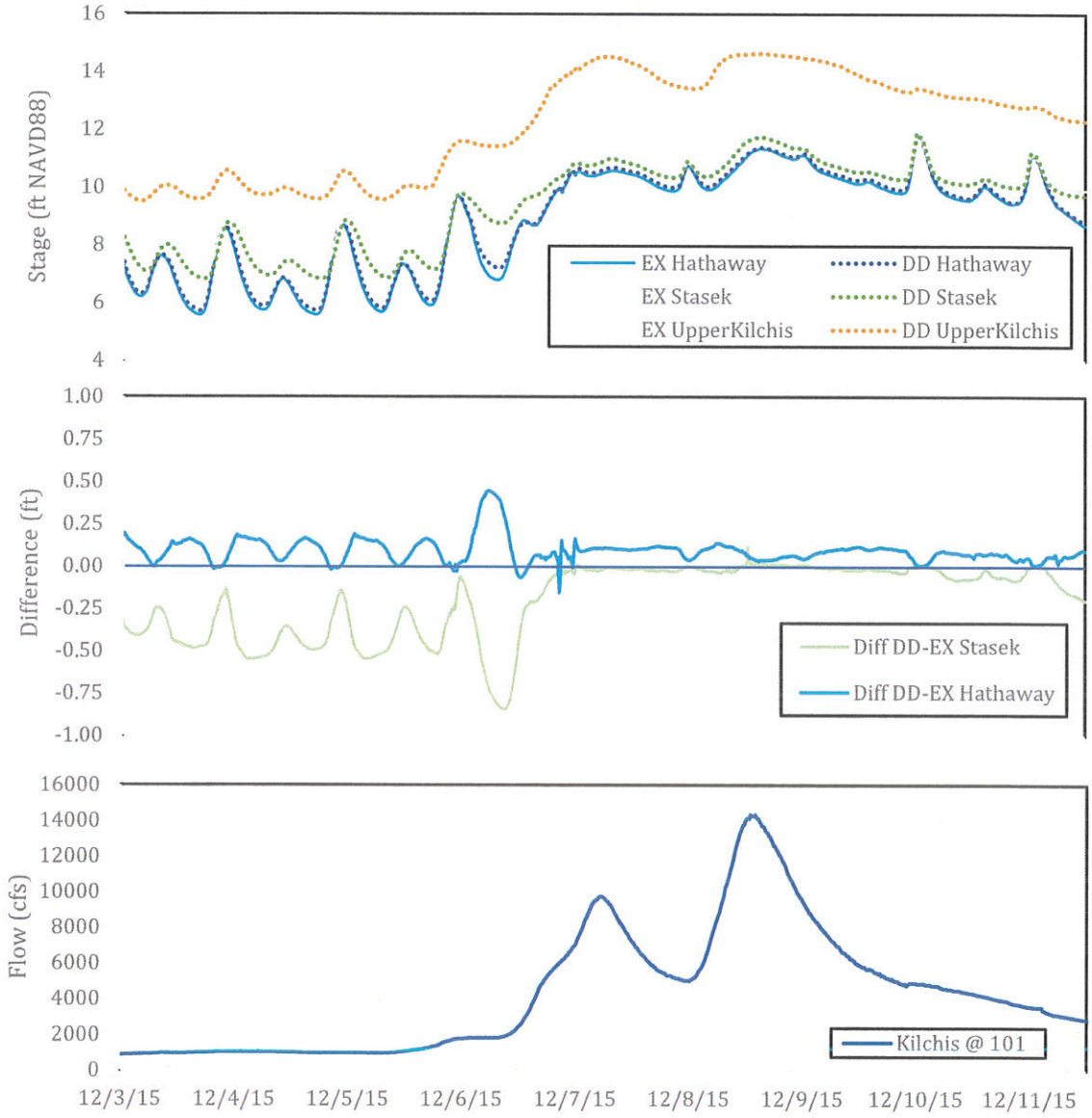


Figure 11: Comparison of existing conditions (EX) and proposed Porter project (DD) - simulated stage (top), difference in stage (middle), and Kilchis River flow (bottom) for the December 2015 flood

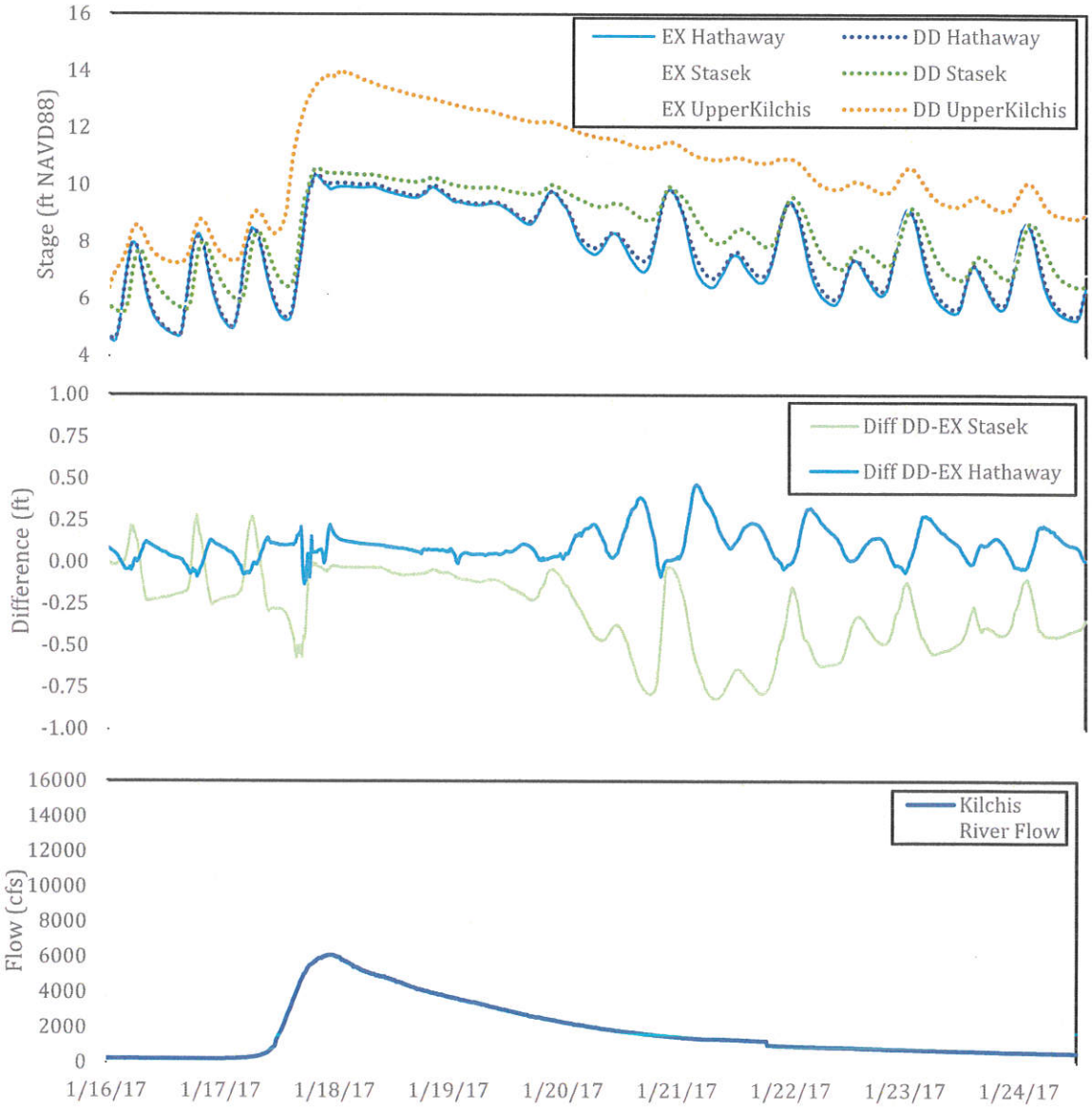


Figure 12: Comparison of existing conditions (EX) and proposed Porter project (DD) - simulated stage (top), difference in stage (middle), and Kilchis River flow (bottom) for the January 2017 flood

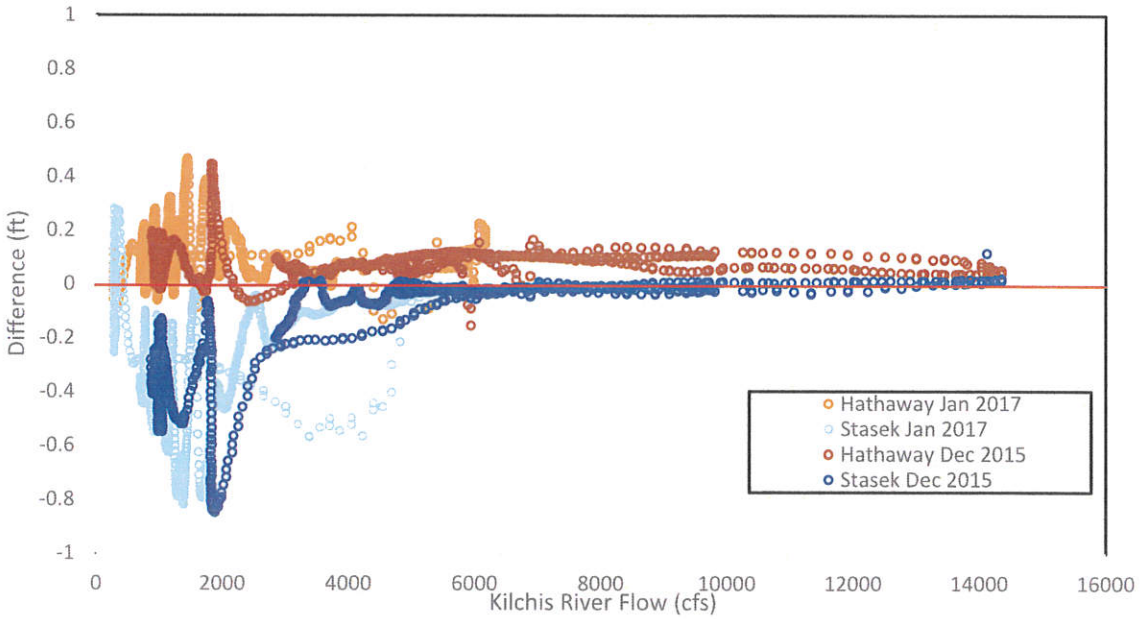


Figure 13: Difference in stage between existing and proposed Porter project conditions versus Kilchis River Flow

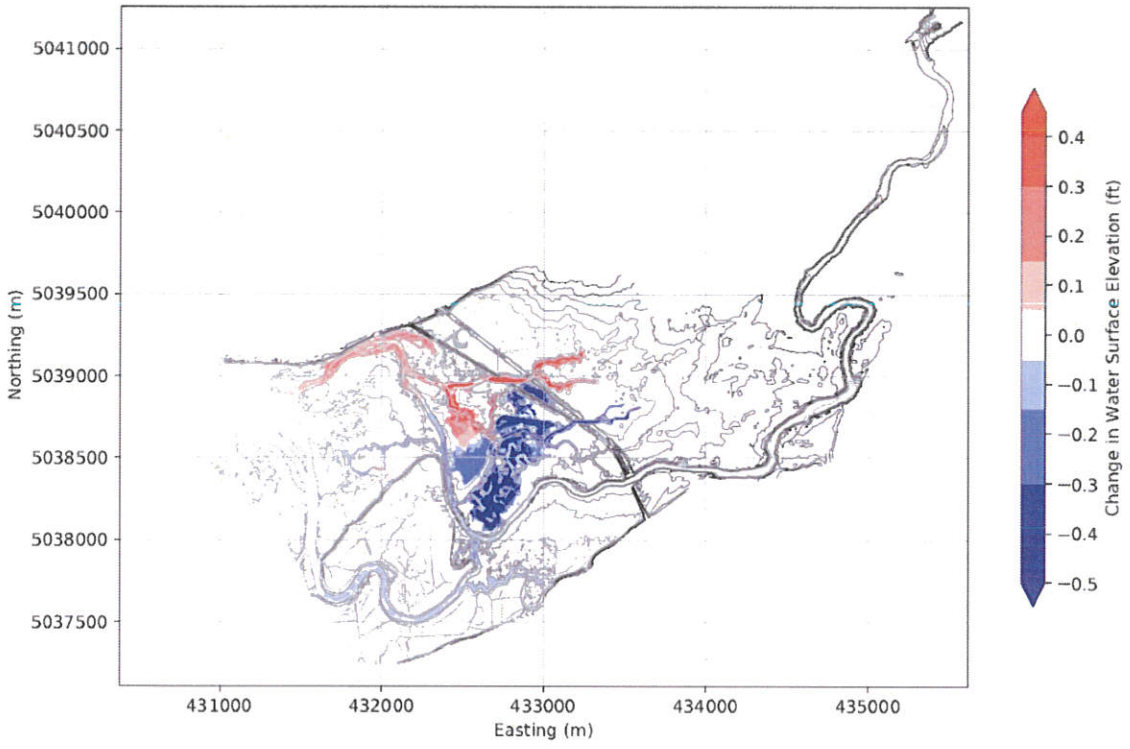


Figure 14: Change in water surface elevation due to Porter project on December 6, 2015 18:00 (Ebb tide) from (NHC, 2019)

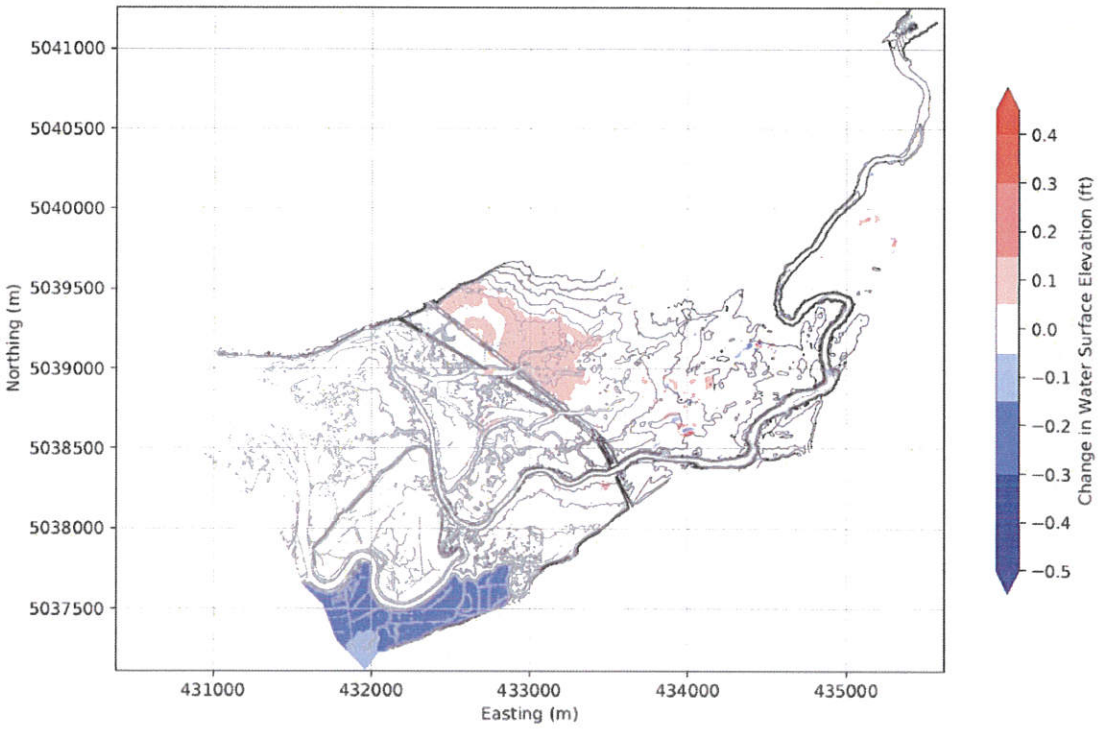


Figure 15: Change in water surface elevation due to Porter project on December 9, 2015, 11:00 (flood peak) from (NHC, 2019)

4) Review and, if needed, propose updates to the model, report and findings associated with Kilchis Porter permit.

The modeling and reporting to date have addressed flood impacts well but have not considered impacts to agricultural drainage during normal flow conditions, which is clearly an area of concern to stakeholders. We recommend consideration of a series of model updates, modeling of new scenarios, and upgrading the existing gage network to better evaluate agricultural drainage. We assume that updated findings and reporting would flow out of this new work.

3.2.3.1 Model Inputs

Geometry and Grid Size

For the Porter model(s), the representation was generally good except for three issues in the Vaughn Creek unit. To the north of the Porter Tract (off TNC lands), there is a dike built across an unnamed slough that conveys at least part of the flow of Vaughn Creek (Figure 16). The dike is not large, and in fact neither LiDAR dataset examined captured it, and since no ground survey was conducted in this area it was not represented in the model (Figure 17). From a hydrologic standpoint, it makes logical sense to build a dike here; otherwise, high tides would routinely flood under Highway 101 and inundate the low-lying areas to the north. Leo Kuntz confirmed the existence of this dike, noting there were two tidegates in it, and he had repaired it several times over the years.

Due to the small opening under the railroad tracks and the 15-foot grid resolution, the model does not capture the true low point of the opening. The LiDAR elevations are around five feet, and the true bottom of channel is probably at least three feet lower, but the model mesh resolution imposes an artificial barrier with an elevation around nine feet in the opening. This is probably two to three feet lower than the true dike elevation at a minimum but does keep out most normal tides from the area to the north.

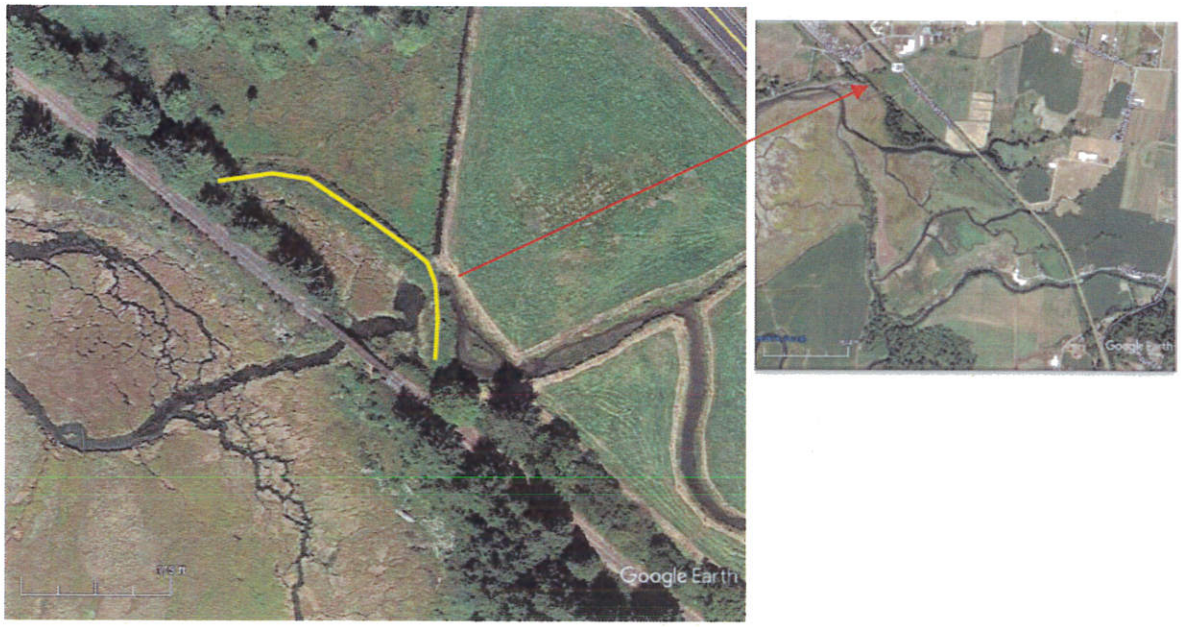


Figure 16: Left - Vaughn Creek Levee - centerline shown in yellow. Right - location on floodplain (August 2016 Google Earth Image)

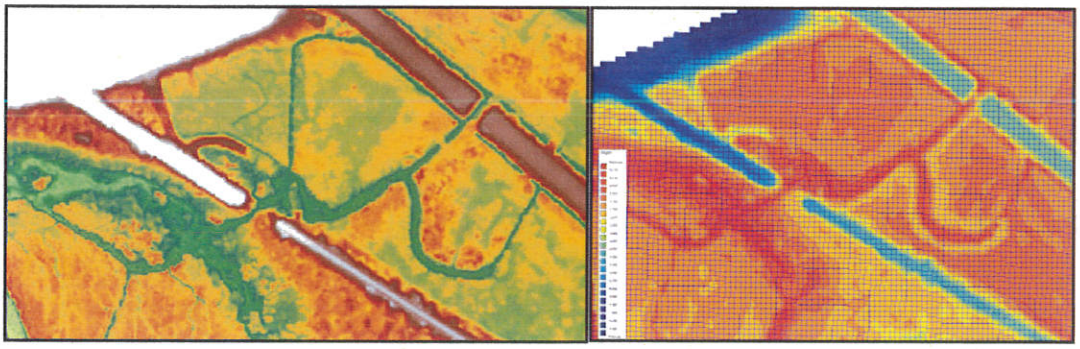


Figure 17: Left - LiDAR image showing apparent gap in levee, Right – model mesh showing same gap

There are two other small openings in Highway 101 in this area that the model probably does not represent well due to their small size and mesh resolution, thereby artificially restricting flow through them during large floods. Accurate accounting for floodplain storage volume in diked ditch networks is an important component for drainage analysis. In the Vaughn Creek unit, most of the volume is contained in a network of small ditches. The current 15-foot grid size of the model is likely too coarse to

capture the available storage volume of this ditch network. Either reducing the model grid size or developing an alternate method to accurately capture ditch storage volume should be implemented.

Local Tributary Inflows

The Dooher model report (PWA ESA, 2013) notes a local tributary inflow was included for Hathaway Slough. The report has a flood frequency table that includes 50 cfs as the Hathaway Slough inflow for a 2-year flood event. However, the rest of the report, including sections on calibration, low-flow, and flood simulations, does not document how flows were estimated or used for Hathaway Slough in the model. It is unclear what was included in the assumed tributary area for the Hathaway Slough model input. We applied the USGS StreamStats model (https://streamstats.usgs.gov/ss/) for the total watershed above the railroad including the Vaughn Creek, Hathaway, and Stasek sub basins (Figure 18). The 2.2-square mile watershed generates a 2-year flood flow estimate of 146 cfs; the same source reports for a 17-year gage record on adjacent Patterson Creek (1.9 square miles) the 2-year flood was estimated at 107 cfs. This suggests that total local inflows for the Dooher model may be underestimated. No tributary inflows appear to have been used in any of the Porter Tract models.

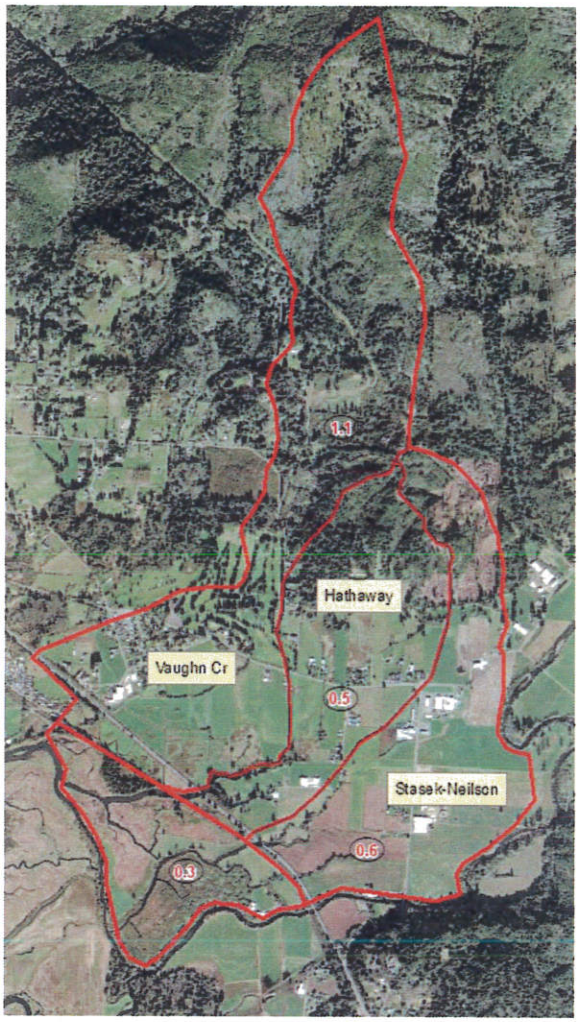


Figure 18: Approximate tributary watersheds

Estimation of local tributary inflows is a key component for a robust drainage analysis. We recommend that flow estimates be developed or measured in the field for the sub-watersheds shown in Figure 18 and applied at appropriate model locations. Summary results from the StreamStats analysis are shown in Table 5. One caution is that subsided areas with significant lengths of dike along tidal channels may have much more inflow from seepage through and under the dike than from hillside tributaries. Vaughn Creek is the hydrologic unit in this area where this might be an issue.

Table 5: Combined tributary flood and median monthly flow estimates

	Flood Flow Estimates											
Return Interval	2	5	10	20	50	100						
Flow (cfs)	147	211	254	311	354	397						
	Median (50% Exceedance) Monthly Flow Estimates											
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flow (cfs)	19.7	17.1	13.2	8.4	5.0	3.3	1.9	1.2	1.1	4.5	10.7	19.5

Culverts and Levees

The only culvert represented in the model is the connector culvert that transfers flow between Stasek and Hathaway Sloughs. For large flood modeling, not including small tidegated culverts is a reasonable assumption: they will be closed during the rising limb and through the peak of the flood, and their conveyance capacity is small compared to overall flood flows when open. However, for hydraulic analysis of normal flows, especially if evaluating potential impacts to adjacent agricultural lands is important, these culverts should be represented in the model. There are believed to be at least four additional tidegated culverts that discharge into Hathaway Slough from the Vaughn Creek unit that should be included. We also recommend checks to the Delft3D culvert flow calculations against some models with better culvert simulation routines such as HEC-RAS or HY-8.

Most of the key levees in the area, both on and off TNC lands, have been surveyed and incorporated into the model. There may be a few additional small levees that need survey and incorporation into the model in the upper Hathaway and Vaughn Creek units.

Roughness

Delft3D models use the Chezy coefficient to represent the frictional resistance to flow caused by the ground. It is intuitive that water can flow with less resistance across smooth surfaces, such as a sand-bedded channel, than rough surfaces, such as a densely vegetated tidal marsh. Most two-dimensional models with both floodplain and channel components use multiple roughness values to classify the land surface, for instance into channel, low grass pasture, tidal marsh, and forest. The Kilchis models all use a single roughness value for the entire model domain. The roughness value used – 53 for the newer models – is appropriate for sand-bedded channels such as the very lower end of the Kilchis, the surrounding sloughs, and Tillamook Bay. It is a very low roughness value to use for a gravel-bed river such as the Kilchis and especially for any floodplain with tall grass, brush, or trees.

Projects can also change surface roughness over time. For the Dooher project, as the site vegetates, floodplain roughness is clearly increasing (Figure 19). None of the reports reviewed mentioned any consideration of modeling changes to site roughness over time.

While the model has reproduced water levels well using a single roughness, we recommend mapping spatially varying roughness parameters onto the model, with consideration of evolved roughness

parameters based on planting zones. This will increase confidence in use of them model across a full range of hydrologic conditions.

Figure 19: Dooher project vegetation changes from 2015 (top, Google Earth) to 2020 (bottom, USDA NAIP)

3.2.3.2 Model Simulations

First, we recommend developing a set of new normal flow model simulations. These simulations should include one or more typical steady-state summer and winter river flows with matching local tributary inflows. They should be run for a minimum of two weeks to cover one complete spring-neap tide cycle. Analysis of the model outputs should focus on water levels in the agricultural units. Ideally this new modeling would be calibrated to gage data, including new gages recommended in the next section.

Second, we recommend developing a pre-Dooher project geometry and running all flood and normal flow simulations with this geometry. Developing this geometry should not be too difficult if the pre-project survey data are still available. One of the key uncertainties identified to date is the impact, if any, that the Dooher project had on Hathaway Slough water levels. How important the projected impact from the Porter project is (on the order of tenths of a foot) depends in part on how much this impact builds on the impacts from the Dooher project.

Gaging Network Upgrades

We recommend a series of gage upgrades to remedy some of the issues that limited the usefulness of the data in our analysis. Upgrades and new gages would also increase confidence in model outputs. Specific recommendations include:

- Rebuild all gages that go dry during summer low tides so they no longer do so.
- Strengthen gage installations as needed to minimize potential for shifts or sensor movement.
- Install staff gages and crest stage gages, or other means of independent datum checks, to be performed at each gage download.
- Consider installing new gages on the Kilchis River at Squeedunk Slough, on Squeedunk Slough just downstream of the inlet, at the Stasek Slough outlet to the Kilchis River, and in the Vaughn Creek unit near one of the tidegates.
- Unless needed for ecological purposes, two of the gages in the Stasek Slough network could be removed and used elsewhere.

Note that we discuss some further field data collection options in our response to question 12.

5) If anticipated impacts are identified, what proposed actions could be considered to mediate or mitigate impacts to neighboring farm properties?

We believe it premature to propose actions to mitigate impacts. Repeating what we stated at the beginning: a water level impact does not necessarily equate to a land use impact such as reduced field productivity. This report is focused strictly on water level impacts. Our recommendation is to first complete the proposed updates described in answering Question 4. At the same time, documentation of impacts to agricultural land use could be undertaken. Once both are completed, the stakeholders will have a clear understanding of what and where land use impacts have occurred and have the technical tools needed to develop and evaluate alternatives to mitigate them. Development of mitigation alternatives will need to consider factors beyond technical feasibility; proposing alternatives at this stage based strictly on hydrologic considerations runs the risk of developing solutions that may be unrealistic for multiple reasons.

We do note that the proposed Porter project appears to provide partial mitigation for the water level rises in Stasek Slough caused by the Dooher project. The balancing rise in Hathaway Slough caused by the proposed project is much smaller and presumed less likely to cause land use impacts.

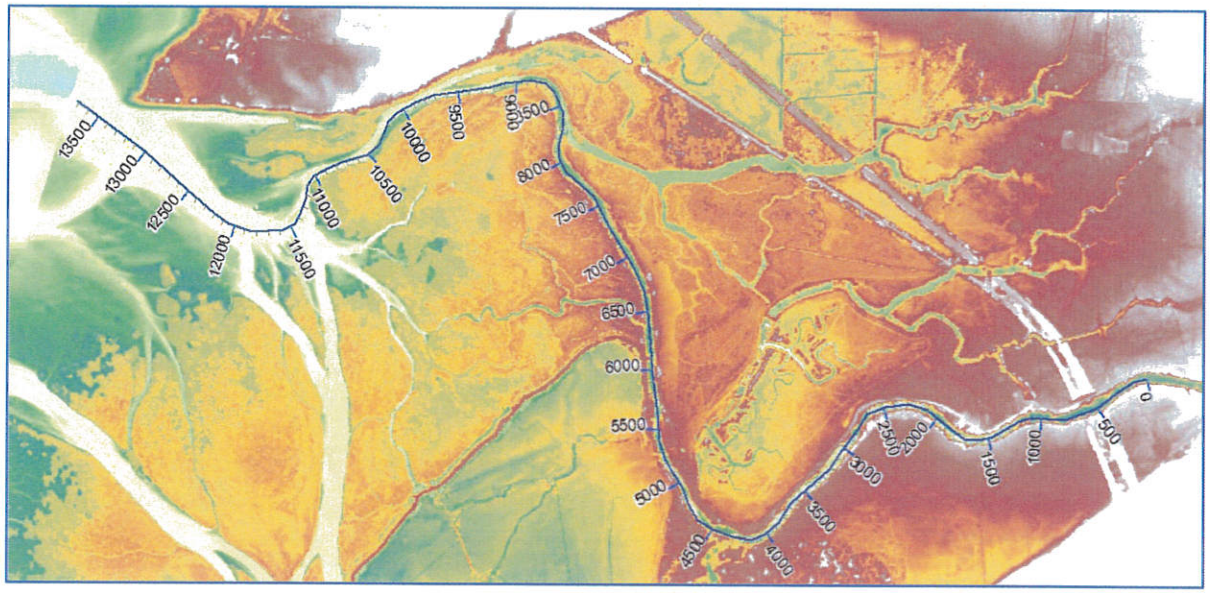
3.3 Additional Review Items

6) Review the "staircase" theory per L. Kuntz 2017 NM memo, and the Kilchis River gradient from Highway 101.

Leo Kuntz's hydraulic analysis of the effects of the Dooher project on area hydrology (Kuntz, 2017) is in agreement with our analysis of observed gage data and model outputs that we presented in answering questions 1 and 2. The 'staircase' theory is a convenient and easily visualized representation of typical tidally influenced river behavior.

In tidally influenced rivers, gradient is always changing even if river flow is constant. The lower the river flow, the greater the tidal influence. As flows increase, they 'fill in' the low tide without affecting high tides very much – these tend to match those in the Bay. Eventually at higher flows and floods, low tides are completely filled in, and water levels begin to push above high tide levels.

Simulated water surface profiles from high, mid, and low tides for different flows are shown in Figure 20. The figure shows high tides in the Kilchis River at Stasek and Hathaway Sloughs are very similar, but Hathaway Slough is one to three feet lower during mid and low tides. This agrees with the observed gage data already discussed (Figure 10). The point made in the Kuntz letter is that better drainage is obtained from connecting to the river at Hathaway Slough, as was the case for Stasek Slough prior to the Dooher project. This is somewhat of a simplification: the connector culvert restricted flow from Stasek to Hathaway prior to the Dooher project, and even without the culvert we would expect some head loss between the two sloughs. Squeedunk Slough also complicates things to some degree. In keeping with the staircase analogy, Squeedunk is another staircase that offers an alternate route to Tillamook Bay. Nevertheless, the basic point made in the letter is borne out by both the observed and modeled data.



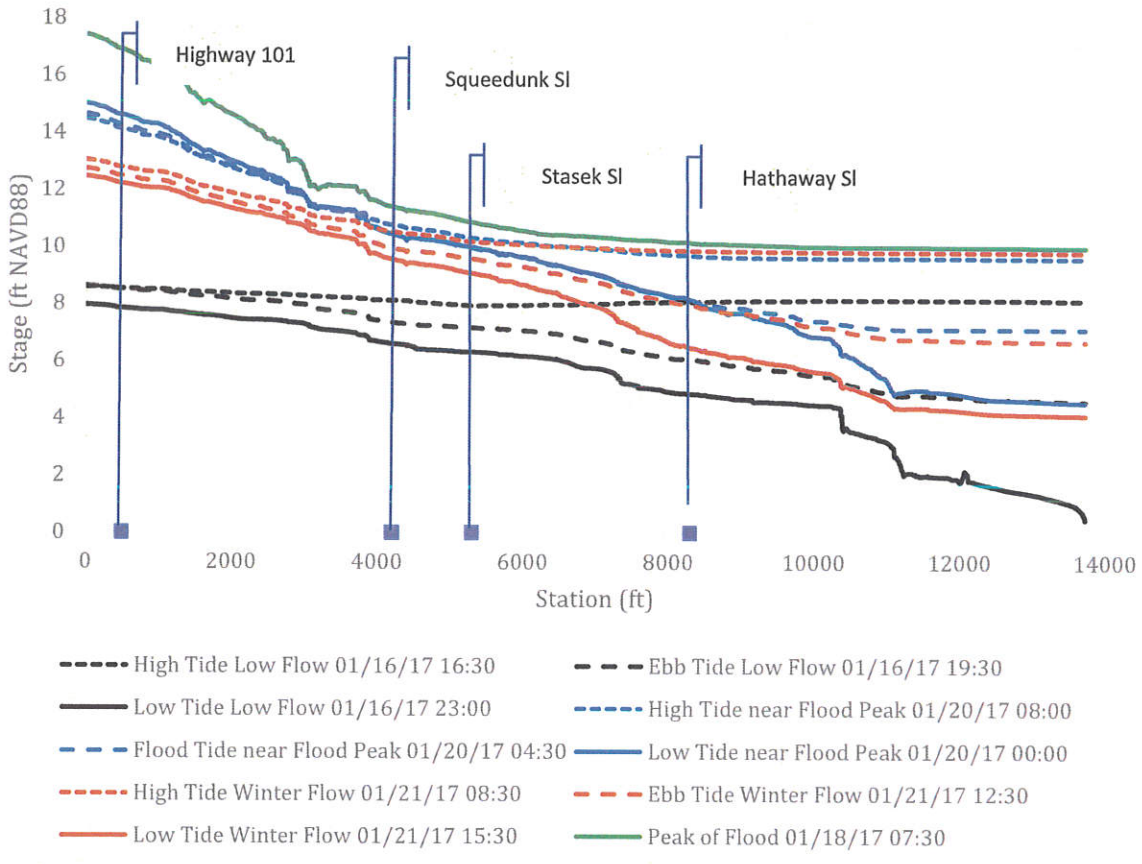


Figure 20: Simulated Kilchis River profiles at various flows and tides

7) Review the flow control function of the existing box culvert on the Porter property and potential effects on drainage and flooding on farm properties adjacent to Hathaway Slough.

The existing box culvert exerts a strong control on water levels in Stasek Slough and regulates flow from Stasek into Hathaway Slough during normal winter flows. In the summer, water levels are more equalized throughout the area and the box culvert appears to have a much smaller effect on water level regulation. The degree of regulation is most evident in the water surface elevation difference between Hathaway and Stasek Sloughs that has already been discussed. Comparison of the Hathaway and Connector Channel (located just downstream of the culvert) gages shows close matches, especially at normal winter flows (i.e., October 19-20, Figure 21), indicating that most of the water surface differential between the Stasek and Hathaway Sloughs occurs at the culvert, rather than being distributed downstream along Porter Slough. This is a strong indication that the culvert is restricting flow.

Under normal flow conditions, the HEC-RAS model predicts flow through the culvert to be about 70 to 100 cfs towards Hathaway Slough. Under low flow conditions, flow reversals of 50 cfs occur on the flood tide (bottom, Figure 22). With higher river flows, reversals are minimal or missing, meaning the culvert is always flowing towards Hathaway Slough regardless of the tide. This flow is drawn in from the Kilchis River via Stasek Slough. The culvert has minimal effect during floods compared to the total flow over the floodplain between the Kilchis River and Highway 101 (top, Figure 22). Another indication of the regulation provided by the culvert is shown by the effects of removing it, as is proposed for the Porter project. We have discussed previously the reduction in stage in Stasek Slough and increase in stages in Hathaway Slough; Figure 22 (bottom) shows how removing the culvert and widening the channel doubles the flow through the cut between Stasek and Hathaway Sloughs during non-flood periods, explaining this effect.

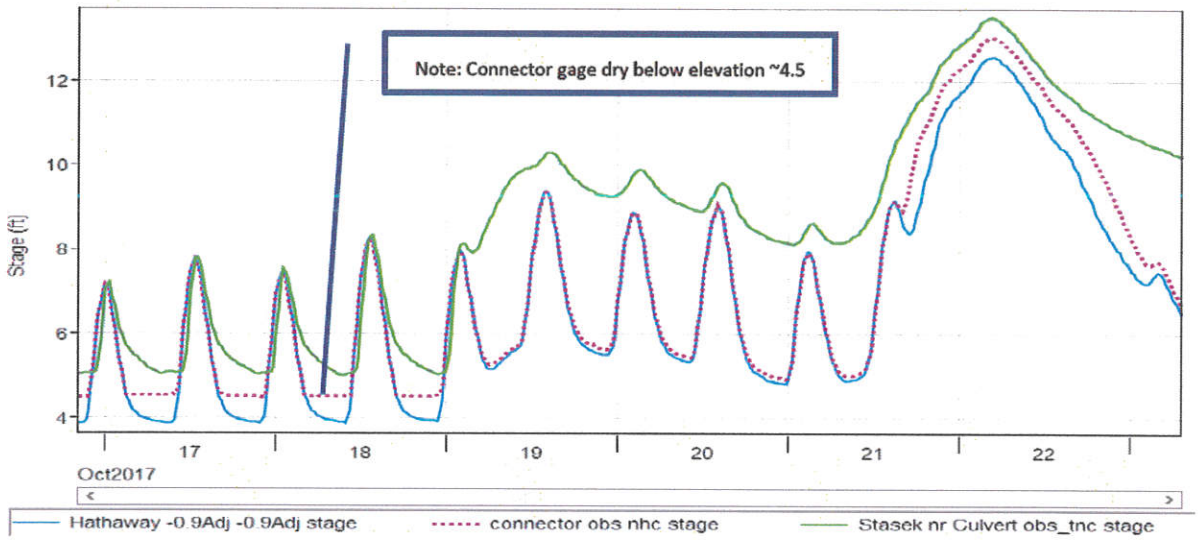


Figure 21: Observed water levels at the Stasek, Connector, and Hathaway Slough gages October 2017

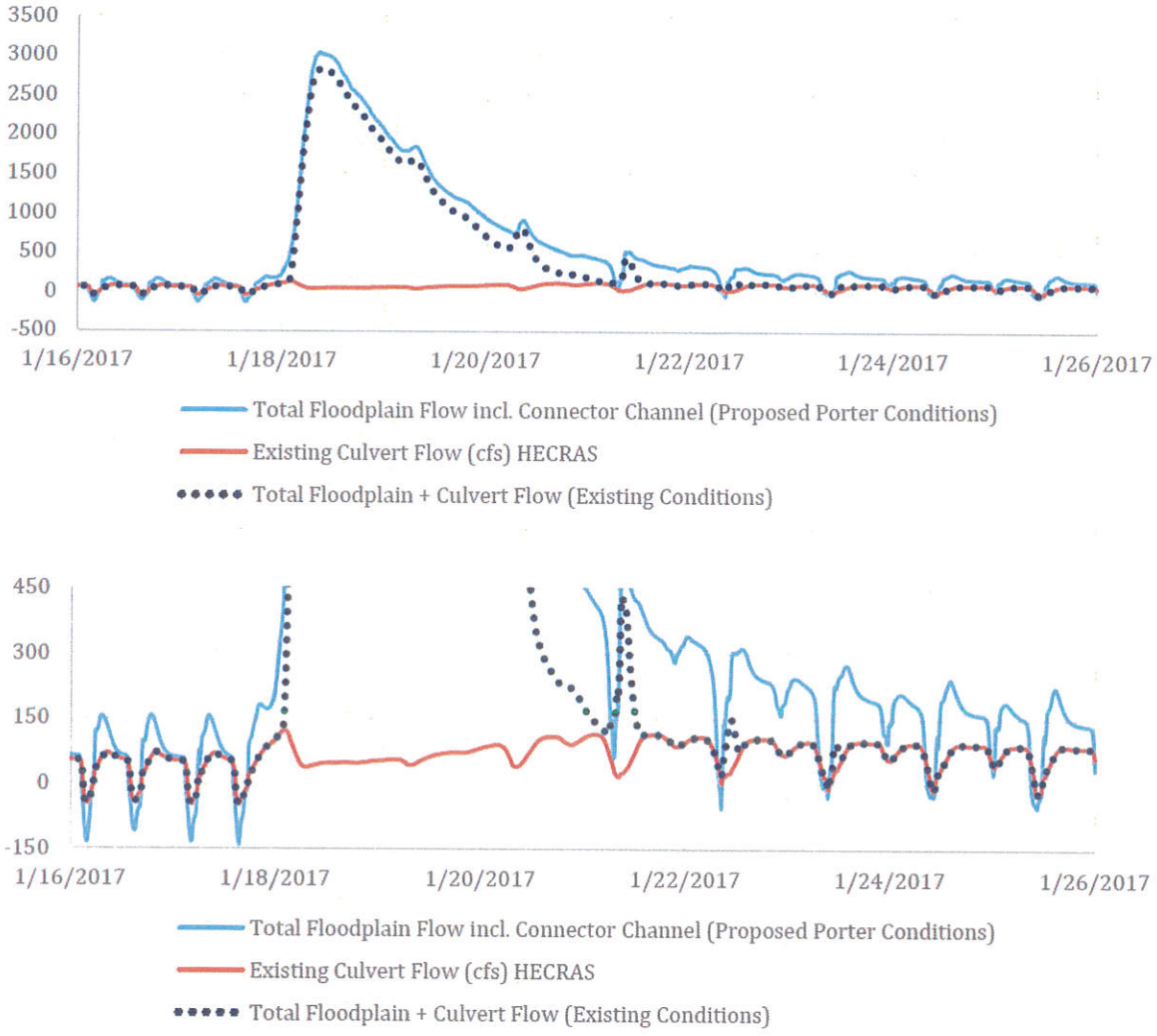


Figure 22: Simulated HEC-RAS flow in connector culvert/channel and total floodplain flow under existing and proposed Porter project conditions. Bottom figure is close-up to show non-flood (contained in channel/culvert) flows.

8) Review Stasek Slough water levels versus Hathaway Slough levels and timing with tides.

Detailed water level comparisons have been discussed in answering Question 1. Timing of tides between all lower Kilchis areas is very close (Figure 5).

9) Analyze effects of proposed Hathaway Slough levee removal.

Analyzing the effects of this element of the proposed Porter project in isolation from the other elements would require additional modeling effort. Our examination of LiDAR, the Dooher design plans, and Porter plans leads us to believe that the Dooher project removed most of the levees that were impediments to flow in the area. Our opinion is that removal of the existing culvert and widening of the

Stasek-Porter Slough connector channel is the most consequential action of the proposed Porter project, and removal of levees probably only has small secondary effects on flood hydraulics. The reasons why the levees proposed for removal as part of the Porter project will not have a significant effect can be seen in Figure 23. The north bank Stasek Slough levee blocks flow, but there are wide expanses of floodplain on either side that the flow already uses. Flow is parallel to the two Hathaway Slough levee removals and both sides are flooded, so these structures do not block the flow in any meaningful way.

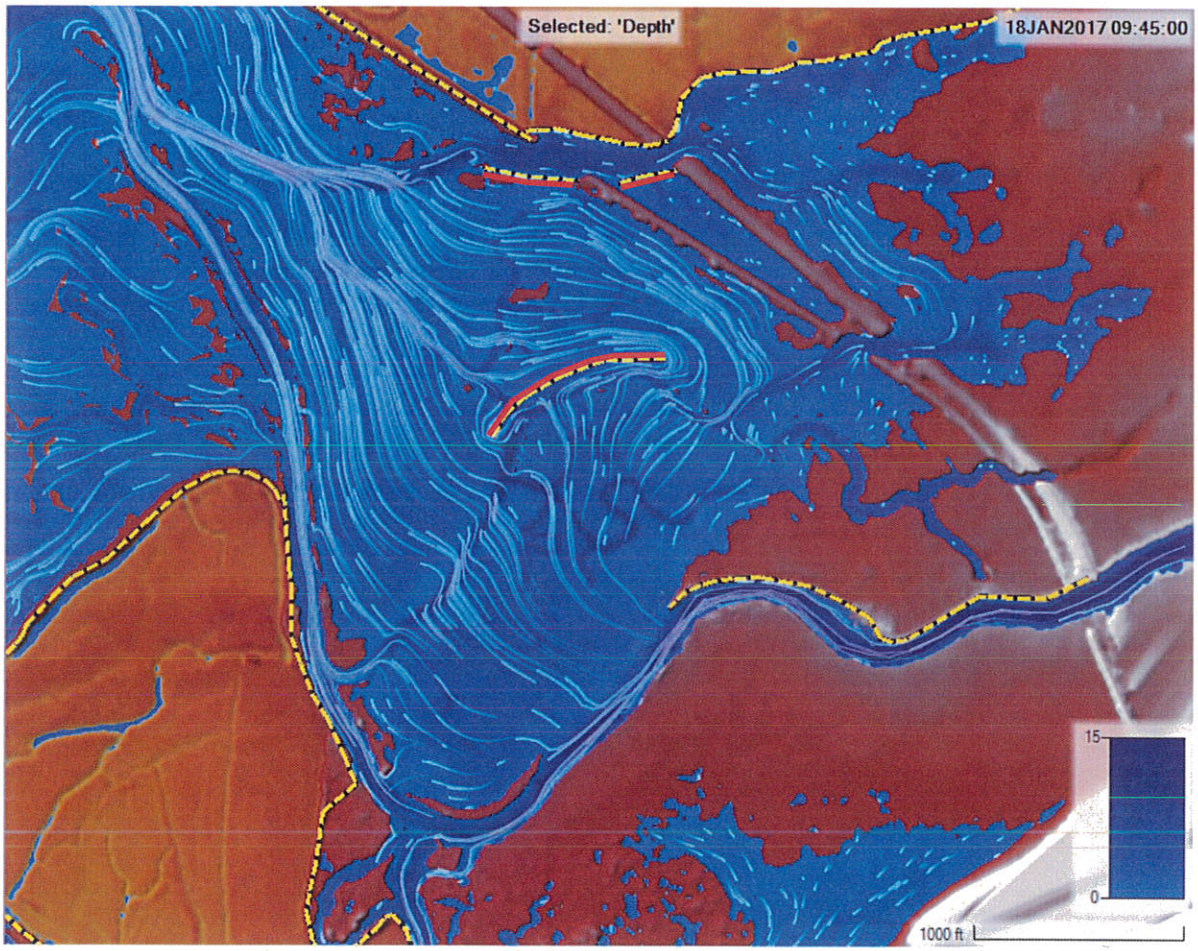


Figure 23: Flowpaths and depths during peak of January 2017 flood from NHC HEC-RAS model. Levees to be removed as part of Porter Project outlined in red.

10) Analyze Dooher levee removal effects on the Kilchis River east of Highway 101.

Our opinion is that the hydraulic models developed for this project are well suited for use in evaluating changes to flood levels throughout the lower Kilchis River valley. These models show decreases (about one to two-tenths of a foot) in flood levels at Highway 101, tapering off to no change by the Alderbrook Road bridge. Upstream of here, the Dooher project has no effect on flood levels. Because even in large floods there is no overtopping of the right bank of the Kilchis between Highway 101 and Alderbrook Road (Figure 24), there is probably no effect from this small reduction on overbank flooding to the

north, including the Vaughn Creek, Hathaway, Stasek, and Neilson units. There may be reductions on the order of a tenth of a foot or so in overbank flooding on the south bank between the highway and Alderbrook Road.

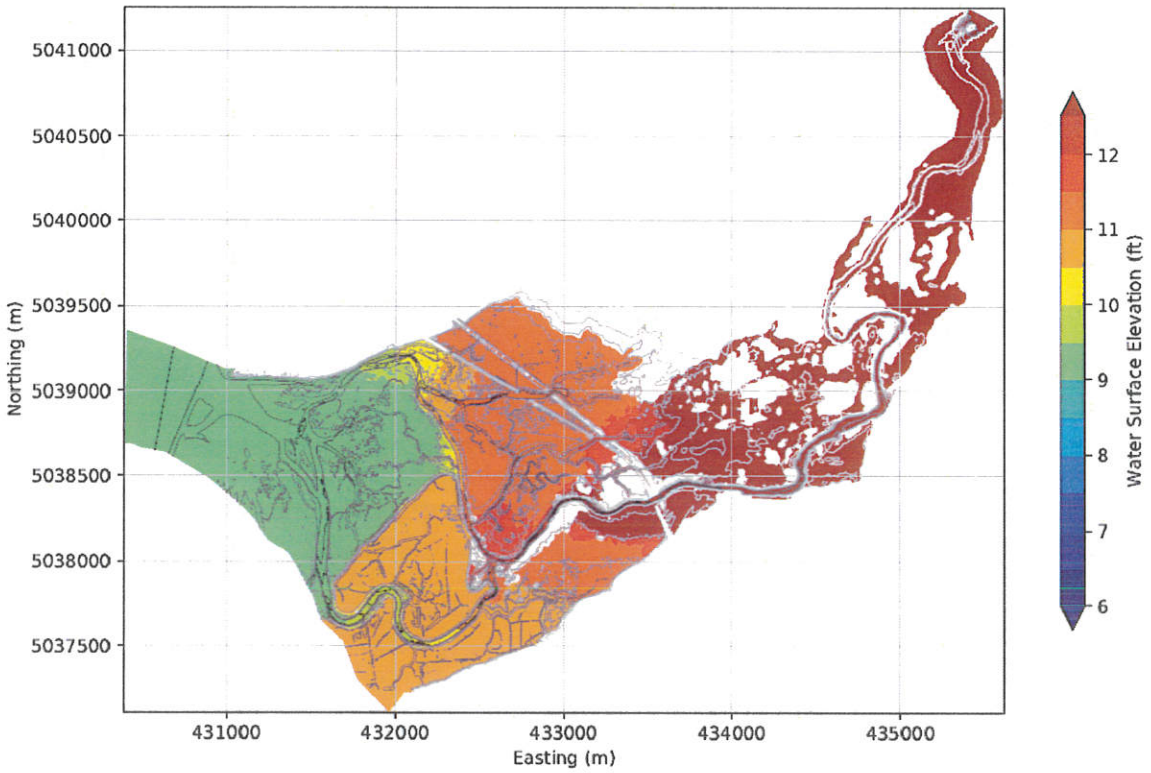


Figure 24: Simulated water surface elevation on December 9, 2015 01:00 - Existing Conditions (from NHC (2019))

11) Review land accretion on former Dooher lands post-2015 TNC project and potential changes.

Land accretion (sedimentation) on the Dooher project site is documented in Behrens (2017). Sedimentation was quantified by comparing a 2015 as-built survey with a re-survey completed in 2017. The Kilchis River thalweg was also re-surveyed. It is important to note that a large flood occurred in December 2015 shortly after project completion. Even without the project, a flood of that size would be expected to mobilize significant amounts of sediment, although the Dooher project clearly affected the distribution of sediment deposition. The following is an edited version from section 2.1 of Behrens (2017) discussing changes on the Dooher site:

> Most of the channel network received at least 1-2 feet of deposition, with Channel 1 receiving up to seven feet of deposition in some areas. Deposition was largest (4-7 feet) at the channel edges...closest to the sections where the Kilchis River levee was lowered....Field observations after the 2015 flood event indicated that two large mounds of gravel up to two-feet thick accumulated at the upstream end of Channel 1, as well as a large mound of fine sediment and organic materials in and near Channel 1b. Changes in the adjacent marsh plain... were smaller, ranging from zero to one feet of deposition in

> most areas.... Sediment also accumulated in Stasek Slough, between its connection with Channel 1 and the confluence with the Kilchis River.... Aerial images available after 2015 indicate that a deltaic structure formed at the breach... the available points suggest deposition of 1-4 feet in Stasek Slough in the vicinity of the inlet to Channel 1 and the breach, and less deposition farther upstream.

This report also documents channel changes in the Kilchis River. Upstream of Squeedunk Slough, where the levee was lowered, changes generally matched predictions given in (Loeb, 2014), with two to four feet of deposition and some scour upstream of that (Figure 6 in Behrens (2017)). Deposition is evident in aerial photos taken before and after the December 2015 flood (Figure 25).

Multiple model simulations have been completed to evaluate the effects of changes to in-channel bed elevations. It is unclear if the updated modeling included observed floodplain accretion, but we consider that to be of minor importance compared to in-channel changes. The observed channel sedimentation patterns have been consistent with those predicted in Loeb (2014). Given the good calibration of the various hydraulic models to floods, we believe the overall impacts on flood levels caused by the observed changes to the riverbed to date have been accurately characterized. With the observed bed sedimentation in the area of the Dooher levee removal, the reduction in peak water levels in the Kilchis River is less but still lower than pre-project conditions. Effects of channel sedimentation and scour on water levels in the Dooher and Porter Tract properties and agricultural lands to the north are generally a tenth of a foot or less. In summary, the hydraulic effects of the Dooher project and proposed Porter Tract project are fairly insensitive to changes in Kilchis River bed levels, at least to the magnitudes that have been observed since 2012.

Figure 25: Kilchis River in October 2015 and August 2016 (photo Google Earth)

1. Photos taken during low tide, estimated 25 cfs river flow both periods.
2. Red arrows indicate areas of deposition due to December 2015 flood and Dooher Project
3. Note channel spanning bars downstream of both Squeedunk Slough and Stasek Slough

12) Analyze flooding and changes to subsurface water levels in adjacent farming properties, as well as the attributions of identified changes. Specifically, does the information currently available allow site specific subsurface water analysis? If yes, how was this analysis conducted? If no, what data is needed to conduct such an analysis?

Please refer to the previous discussion on agricultural drainage analysis. We believe the data and models developed to date are not sufficient to answer this question. All the work to date has also been strictly related to surface water. However, in this setting, subsurface water levels in adjacent farming properties should generally correlate with water levels in surrounding ditches, channels, and sloughs.

For higher elevation undiked lands (such as those around the eastern portion of the Stasek unit), average water levels would be expected to correlate best with groundwater levels. In lower diked areas, low tide levels are the most critical in determining drainage functionality – in many cases drainage only occurs during a few hours over the low tide.

One option to help evaluate this question would be to augment the existing surface water gage network with additional shallow groundwater piezometers. This would allow mapping of groundwater gradients, identification of areas with significant groundwater-surface water exchange, and estimation of soil permeability based on attenuation of tidal signature compared to nearby surface water gages. A key component of this would be rebuilding most of the existing surface water gages to ensure they do not go dry on low tides (see Question 4). Knowing whether any drain tile has been installed within the area would also be important. The most complete evaluation would involve numerical modeling of the coupled surface water-groundwater system. MODFLOW is the most common model in use for this application. Acquisition of observed shallow groundwater data would still be critical to allow calibration and validation of the model. The advantage of having a validated numerical groundwater model is that, in the same way as the surface water hydraulic models, proposed actions can be evaluated for potential impacts prior to implementation. Should further analysis of subsurface water levels be desired, we recommend engaging a hydrogeologist.

4 REFERENCES

Behrens, D. (2017). DRAFT Technical memorandum – Kilchis River Wetland Restoration Project: Resurvey and Hydrodynamic Modeling Update.

Cooper, R. M. (2005). Estimation of peak discharges for rural, unregulated streams in Western Oregon: U.S. Geological Survey Scientific Investigations Report 2005–5116 (Scientific Investigations Report) [Scientific Investigations Report]. U.S. Geological Survey.

Kuntz, L. (2017). Memo to TBFID Re: Modified hydrology Lower Kilchis (Dooher, Porter, Prince, Vermiyea properties etc.).

Loeb, C. (2014). Kilchis River Tidal Wetland Restoration Design Supplemental Hydrodynamic Modeling Assessment of Flooding and Evolved Bed Conditions. ESA.

NHC. (2019). DRAFT Kilchis River Estuary Porter Tract Restoration Hydrodynamic Model Results.

PWA ESA. (2013). Hydrodynamic Modeling To Support Feasibility Analysis Kilchis River Tidal Wetland Restoration Project (p. 26).

Risley, J., Stonewall, A., & Haluska, T. (2009). Estimating Flow-Duration and Low-Flow Frequency Statistics for Unregulated Streams in Oregon: U.S. Geological Survey Scientific Investigations Report 2008-5126, 22p. Version 1.1 (Scientific Investigations Report No. 2008–5126; Scientific Investigations Report).

Additional references reviewed but not cited

ESA. (2014). KIlchis River Tidal Wetland Restoration Engineering and Design—Basis of Design Report.

NHC. (2017). DRAFT Kilchis River Estuary Porter Tract Restoration Hydrodynamic Model Results.

PC Trask & Assoc. (2013, April). Kilchis Data Summary.

TNC. (2020). Kilchis Hydrologic Monitoring and Data Report.

Wolf Water Resources. (2017). Porter Tract Restoration Kilchis Estuary Preserve Feasibility Analysis and Conceptual Restoration Plan, Revised.

Wolf Water Resources. (2019a). Porter Tract Restoration Kilchis Estuary Preserve Basis of Design Report Final Design.

Wolf Water Resources. (2019b). Flood Analysis Memo—Porter Tract Restoration, Kilchis Estuary Preserve.

APPENDIX A

2014 STASEK SLOUGH WATER LEVEL DATA PROCESSING

TNC provided raw water level logger data for the Stasek Slough gage from February 18 to November 22, 2014, before the Dooher project was completed. At this time, Stasek Slough was connected to Hathaway Slough through the connector culvert but was otherwise diked off from tidal influence. The logger data was recorded as absolute pressure. No datum conversion was available. The following describes NHC's processing of the data to convert it to NAVD88 water levels.

The first step was to convert the data to water depth. This was accomplished by subtracting barometric pressure obtained from the NOAA Garibaldi gage for the period of record, creating a water depth data set. Minimum depths recorded were about 0.15 feet, and no indication of the gage going dry is evident in the low tide data. Standard practice would then be to apply a datum corrector to adjust the water depths to water levels on NAVD88 vertical datum. Because no datum corrector was available for this dataset, we were required to estimate the corrector using indirect methods. With these methods, we were able to put bounds on the possible ranges and estimate the most likely datum corrector.

The upper bound datum corrector relies on the fact that under normal river flows, all bayside gages in upper Tillamook Bay have very similar high tides to those at Garibaldi when using a consistent NAVD88 datum. This has held true when comparing gage data collected by the Corps of Engineers, Institute for Applied Ecology, NHC, Tillamook Estuaries Partnership, and TNC since the late 1990s. There is no physically plausible reason why Stasek Slough would have higher high tides than gages outside the dike system under normal river flows. Therefore, the upper bound for Stasek Slough data is that it should not exceed the matching high tides observed at Garibaldi.

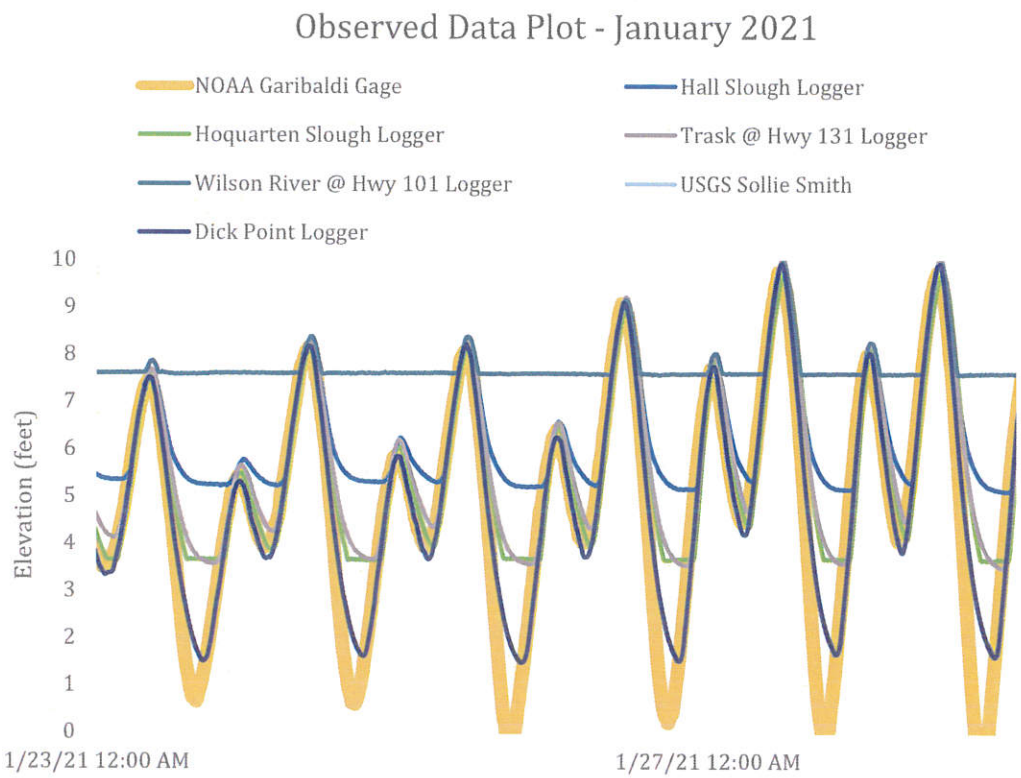


Figure A-1: Upper Tillamook Bay water levels from TEP gages showing all high tides matching Garibaldi high tides. The same holds true for TNC gages on the Kilchis River outside the dikes.

The lower bound on the dataset relies on the fact that Stasek Slough drains to Hathaway Slough, where TNC has operated a gage both pre- and post-Dooher project. Across the years of data available, low tides at this gage have consistently bottomed out at around elevation 4 during low river flows. Stasek Slough should never get lower than Hathaway Slough; therefore, the lower bound on Stasek Slough water levels is that low tides should not fall below elevation 4.

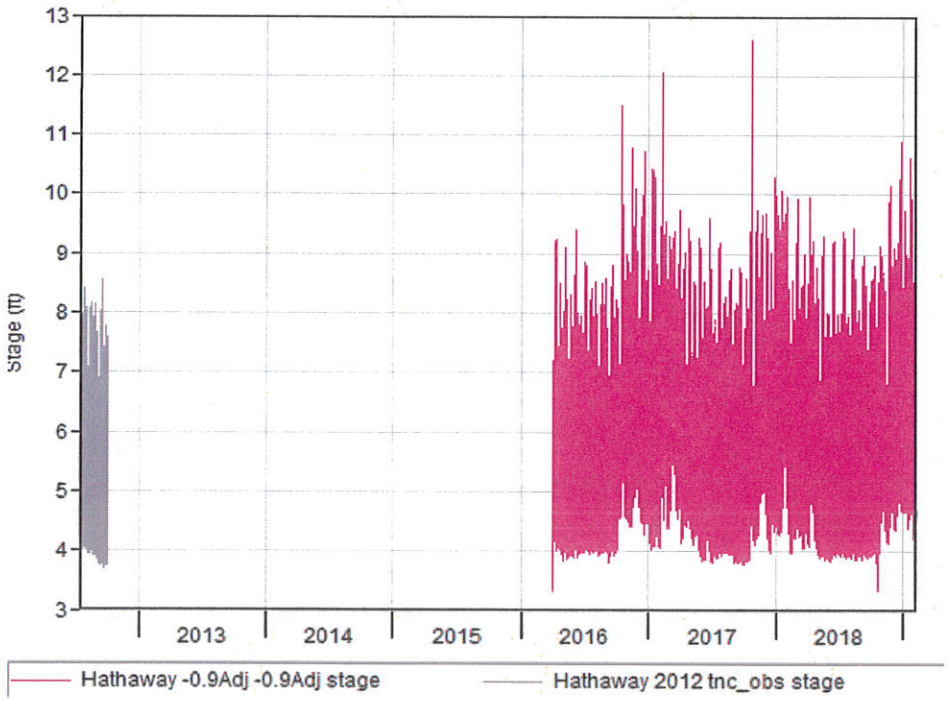


Figure A-2: TNC Hathaway Slough observed data showing lower limits are around elevation 4 for both pre- and post-Dooher project datasets.

The 'most likely' water levels were determined using hydraulic modeling. A coarse HEC-RAS model of pre-Dooher project conditions was created with the dikes in place and the connector culvert between Stasek and Hathaway Sloughs. Two periods were run: the first two weeks of March 2014 and July 2014. The March simulation had a small flood event and higher baseflows. Kilchis River inflows for the model were scaled directly from Wilson River USGS gage records using a 0.45 factor. The July simulation used a constant 100 cfs inflow for the river representing summer low flows. Downstream boundary conditions for both simulations were observed Garibaldi tides. The optimal datum corrector was determined by adjusting the corrector until it best matched the high and low tides and amplitude of the simulated water levels at the gage site. Priority was given to matching the July simulations when there is much less uncertainty introduced by effects of river and tributary flows. A constraint on this corrector was that it had to fall in between the upper and lower bound correctors.

The end result was datum correctors ranging from 3.7 feet on the low end to 4.9 feet on the high end, a range of 1.2 feet. The most likely value was determined to be 4.05 feet. Due to the uncertainties inherent with this methodology, all three datasets (upper bound, lower bound, and most likely) are shown on report plots whenever Stasek Slough 2014 data is utilized. An example of the results for July 2014 is shown below.

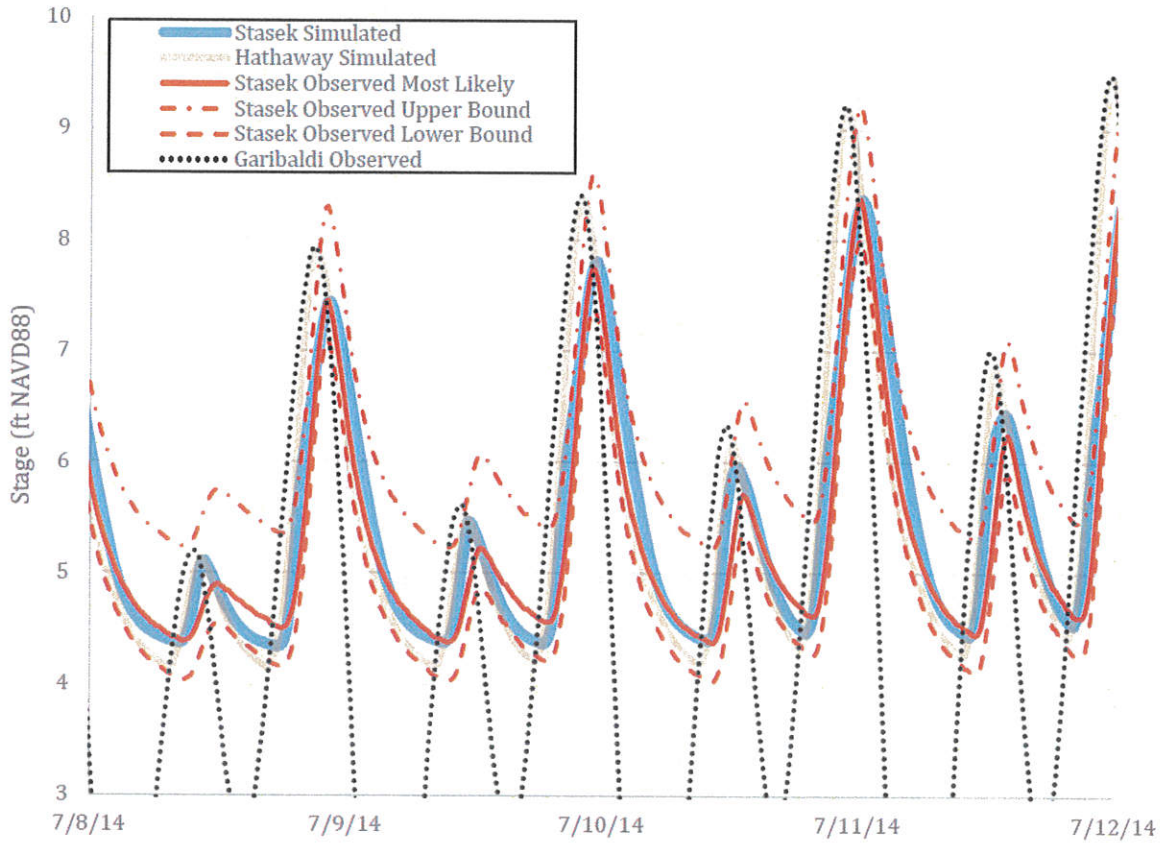


Figure A-3: Sample of observed and simulated data used to develop Stasek Slough 2014 datum correctors.

Figure Notes:

1. Most likely corrector selected by adjusting most likely observed line to match Stasek simulated data.
2. Note tidal muting caused by connector culvert evident in the higher highs and lower highs and earlier high tide for Hathaway Slough versus Stasek Slough (simulated data).

MEDIATION & ADDITIONAL ANALYSIS

(JULY 7, 2022)

SB1517 Mediation and Additional Analysis

Kilchis Porter Restoration Project

The Nature Conservancy

July 7, 2022

Application materials for the Kilchis Porter Restoration Project were submitted to Tillamook County by The Nature Conservancy (TNC) in October 2019. In January 2020, TNC was notified that the application would be remanded to the Planning Commission due to receipt of several letters in opposition to the project. The Planning Commission was delayed in reviewing the project in early 2020 due to a hacking attack on County computer services and the COVID 19 pandemic. This necessitated TNC withdrawing the application as there was insufficient time for the County to meet its review deadlines.

The Kilchis Porter Restoration Project is subject to SB1517 provisions as it takes place, in part, on F-1 farmland in Tillamook County and was initiated after the bill was enacted. Section 4(3) of SB 1517 provides for the applicant (TNC) to request a project-specific collaborative process for settling disputes among the applicant, neighbors and stakeholders, government agencies and others with technical expertise. TNC requested the collaborative process to provide a forum to foster better understanding of the proposed project.

The mediation process was initiated by Tillamook County and began with a meeting of participants in October 2020 that was facilitated by Six Rivers Agricultural Mediation Program. Over a dozen participants were present at the meeting with many providing verbal comments. Additional smaller group meetings and one-on-one meetings with the facilitator occurred over the next four months seeking solutions to issues raised. No formal resolution was reached through the mediation. A summary of the mediation proceedings drafted by Six Rivers is included with the County permit application materials.

In April 2021 following the facilitated mediation process, a path forward was agreed upon by the primary participants including TNC, Tillamook County Creamery Association (TCCA) and the Tillamook Bay Flood Improvement District (TBFID). A dialogue between the TCCA, representing Association farmers, and The Nature Conservancy was begun to investigate ideas and seek solutions to issues that were raised. Others involved included Leo Kunz, a consultant with experience in riparian and wetland projects and neighboring landowners participated several meetings as well.

In April 2021, Northwest Hydraulic Consultants (NHC) was hired to do an independent assessment of the Kilchis restoration projects beginning with the initial restoration project of 2015 on the Dooher tract, and the proposed Kilchis Porter project. All relevant engineering plans, hydrologic modeling data, and water level data collected by TNC were made available to NHC. An assessment report was completed by NHC in October 2021; the assessment was jointly

funded by TNC and TCCA. The assessment report is included with the County permit application materials. Findings of the assessment included:

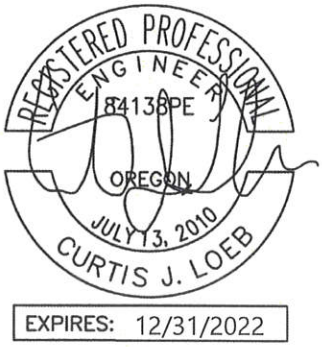
- The hydraulic analyses conducted to date have assessed flood impacts adequately but have not fully assessed normal flow impacts.
- Hydrologic modeling for both projects has accurately portrayed expected impacts with model improvements made over time.
- The Dooher restoration project lowered Kilchis flood water levels upwards to 1 foot upstream of the project area, as predicted by project engineering modeling.
- Reconnection of Stasek Slough to the Kilchis River has resulted in normal winter flow increases in the Slough to approximate tidal levels. This has occurred when river flows are above 400 cfs.
- Water levels changes in Hathaway Slough are less clearly attributed to the existing project but may have increased 0.1 foot during normal winter flows.
- The Porter restoration project will lower winter water levels in Stasek Slough by 0.4-0.8 feet; effects in Hathaway Slough will be minimal with possible 0.1foot increases.
- The Porter restoration will not affect Kilchis River water levels.
- The assessment made recommendations for a few modifications to the hydrologic modeling.

The recommended modeling work was completed by Wolf Water Resources, and results were presented to TNC, TCCA and other participants in May 2022 (video meeting) and during a Kilchis field tour in June 2022TNC's engineering consultants, Wolf Water Resources, also drafted a Technical Memorandum to the Hydraulic Review by NHC (7-5-2022). Additionally, Wolf Water Resources drafted a memo dated 7-16-22 addressing the requested scenarios and modifications to the hydrologic modeling. The revised models showed relatively minor effects from these suggestions. Both memos are included with the County planning submittals.

WOLF WATER RESOURCES TECHNICAL MEMORANDUM HYDRODYNAMIC MODEL REFINEMENTS

(JULY 16, 2022)

1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688



Technical Memorandum

Date:	07/16/2022
To:	Dick Vander Schaaf, Project Manager Associate Coast and Marine Conservation Director The Nature Conservancy of Oregon
From:	Curtis Loeb, PE, Principal Engineer Rowyn Cooper-Caroselli, PE, Lead Modeler Wolf Water Resources Portland, OR
Project:	Porter Tract Restoration - Kilchis Estuary Preserve
Subject:	Hydrodynamic Model Refinements in Response to Hydraulic Review

Introduction

The Nature Conservancy of Oregon (TNC) seeks to continue restoration of tidal wetland habitats along the margins of Tillamook Bay with restoration of the Porter Tract, an approximately 60-acre parcel in the floodplain of the Kilchis River in Tillamook County west of Highway 101 and north of the town of Tillamook. The Porter Tract is located in the lower Kilchis River watershed, one of the five large river tributaries to Tillamook Bay. The restoration site is situated approximately one mile from the mouth of the Kilchis River and is influenced by both river flow and ocean tides. The Porter Tract is north of and adjacent to the recently restored Kilchis Estuary Preserve (former Dooher Property) that

was constructed in 2015 by the TNC. The cumulative area of these restoration efforts would result in 127 acres of high functioning estuarine habitat.

The overall goal of the Kilchis Estuary Preserve project is to restore freshwater and tidal hydrologic connections to the Porter Tract wetlands, providing off-channel rearing habitat for salmonids and re-establishing spruce swamp habitat. Specific objectives and constraints of the project are described in the Basis of Design Report (W2r 2019).

Restoration measures proposed for the Porter Tract Restoration include:

- Tidal channel creation,
- Restoration / expansion of the connector channel between the Hathaway Slough tributary channel and Stasek Slough,
- Filling linear drainage ditches,
- Removing man-made dikes and berms along sloughs,
- Removal of water control structures (tidegates, culverts, and berms),
- Two new pedestrian bridges for vegetation maintenance,
- Wood habitat structures in the tidal channels as cover habitat and organic substrate for rearing habitat for juvenile salmonids,
- Site revegetation with native grasses, shrubs, and woody plants

The scope and purpose of this memo is to update and improve the hydrodynamic model based on technical review comments by a third-party (NHC 2021; referred to herein as Hydraulic Review, see Attachment A). This Hydraulic Review was conducted as part of the Tillamook County project review process for the Porter Tract. The Hydraulic Review included review of (1) observed water levels and the hydrodynamic model developed for Kilchis/Porter Tracts, (2) Dooher Tract impacts, and (3) Porter Tract impacts. The scope of this technical response memo considers comments on item (1), potential refinements or limitations of the restoration and hydrodynamic model. This response memo also considers item (2) potential refinements of the Porter Tract Restoration design that would benefit habitat or reduce inundation frequencies or extents. These improvements and investigation of changes were considered in a series of test scenarios using the hydrodynamic model originally developed to support Porter Tract and Kilchis Wetland designs (W2r 2019a; W2r 2019b; W2r 2017).

In the evaluations presented in this memo, model scenarios were compared against the current (original) Porter Tract Restoration design scenario (documented in W2r 2019a), which is referred to as the base case or baseline scenario. The current or existing conditions (pre-Porter Tract restoration) were not used as the basis for evaluation, as the primary purpose was to consider changes or improvements to the current Porter Tract Restoration actions.

Hydrodynamic Model Development History

A two-dimensional hydrodynamic model was originally developed for the Dooher Property (Kilchis River Estuary Restoration Phase1; ESA 2014). Model geometry or topographic extents along the Kilchis River and Tillamook Bay tidelands are described in the Phase 1 report. This report also describes model calibration to observed water levels, and hydrologic (tidal water level and riverine flow) boundary condition scenario development to examine typical tidal conditions as well as extreme storm events. The Phase 1 model was later updated to reflect Porter Tract Concept Restoration Designs (W2r 2017), and then it was updated for minor revisions associated with the final engineering designs (W2r 2019a and W2r 2019b). An overview of the Porter Tract elements is shown in Figure 1.

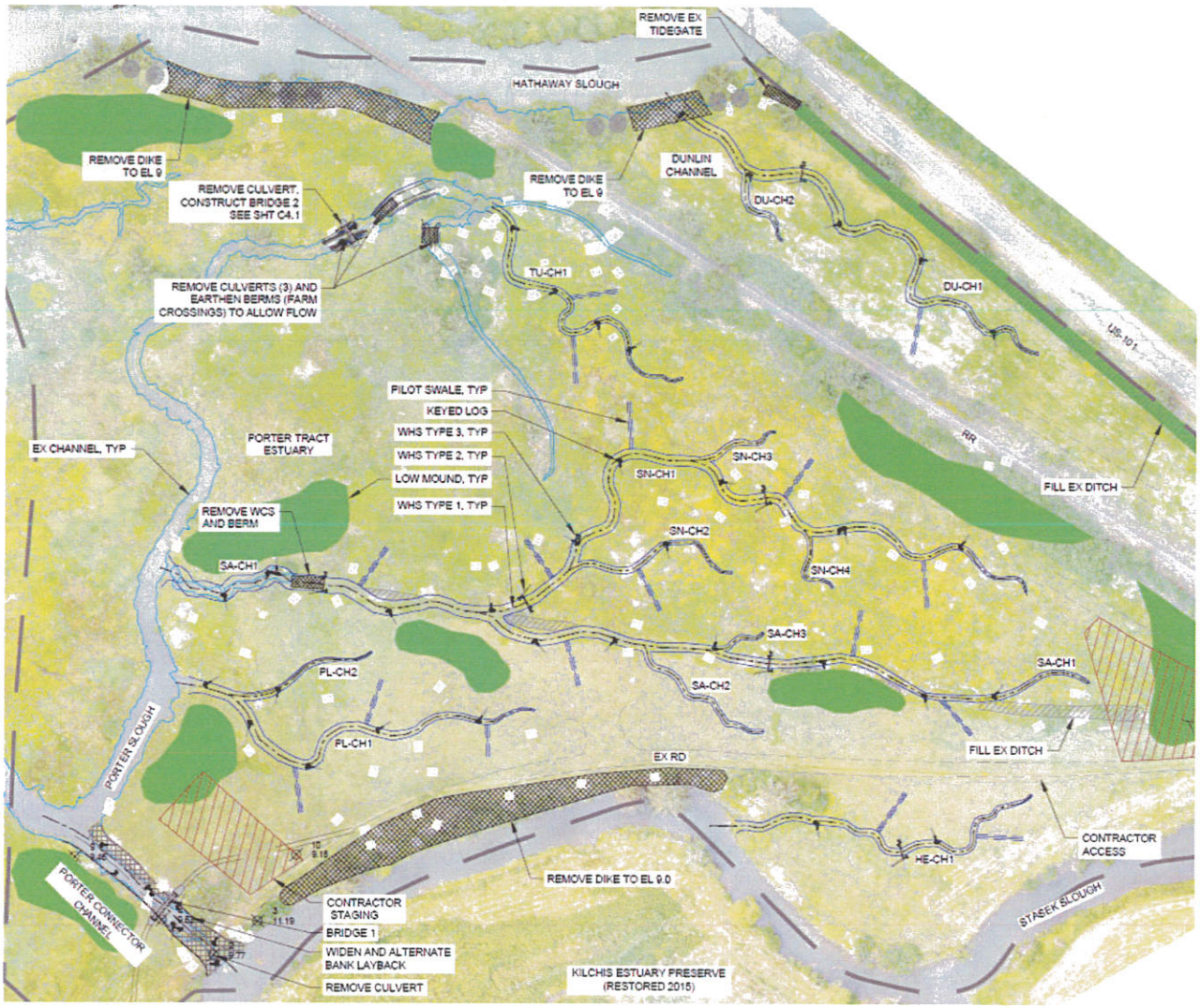


Figure 1 Porter Tract restoration site overview indicating restored channels, filled ditches, dike removals, new bridges, and low mounds.

Model Refinements

Comments, questions, and recommendations from the Hydraulic Review included the following:

1. **Winter events**: consider more common or frequent winter river and tide levels rather than extreme or more rare combined events,
2. **Vaughn Creek**: adding tributary flows from Vaughn Creek, located north of the Hathaway Slough drainage, into the model,
3. **Connector Channel**: further widen the Stasek Slough connector channel,
4. **Stasek Berm**: would retaining the Stasek and Hathaway berms (as proposed in the Porter Tract Restoration) reduce inundation upstream,
5. **Highway 101 drainage**: consider new drainage paths or channels between the railroad and Highway 101 embankments,
6. **Stasek sedimentation**: removing sediment from Stasek Slough near the mouth where the 2015 storm deposited sediment in the channel,
7. **Other potential refinements** to improve drainage especially during common winter periods.

Model scenarios were developed to address items 1, 2, 3, 6, and 7. Item 4, Stasek Berm, was not evaluated further because it is clear through inspection of prior model results that these low, discontinuous berms do not impede overland or in-channel flows from tidal events or Kilchis River overflows. Item 5, Highway 101 drainage, was also not considered explicitly as the current Porter Tract Restoration (base case) already includes a new drainage channel and removal of drainage impairments (old tide gate and earthen berm), and it was unsure how to improve drainage further from this region. Item 7 includes evaluation of bank treatments along the Kilchis River where the levee was removed as part of the Kilchis Restoration (Phase 1, or Dooher Tract Restoration) – see Model Refinements Section of this memo. A summary map showing model changes and/or elements considered is shown in Figure 2.

Hydrologic Time Period

The hydrologic scenario of January 2017 (ESA 2014; W2r 2017; NHC 2021) was selected for this re-analysis for several reasons. It includes peak flows in the Kilchis River much lower than the 2015 and other events previously analyzed. It also allows for convenient comparison to prior modeling results,

and it includes tides and river flows (before and after the peak of the scenario) that occur for long periods of time during the winter – the recommended focus hydrology from the Hydraulic Review.

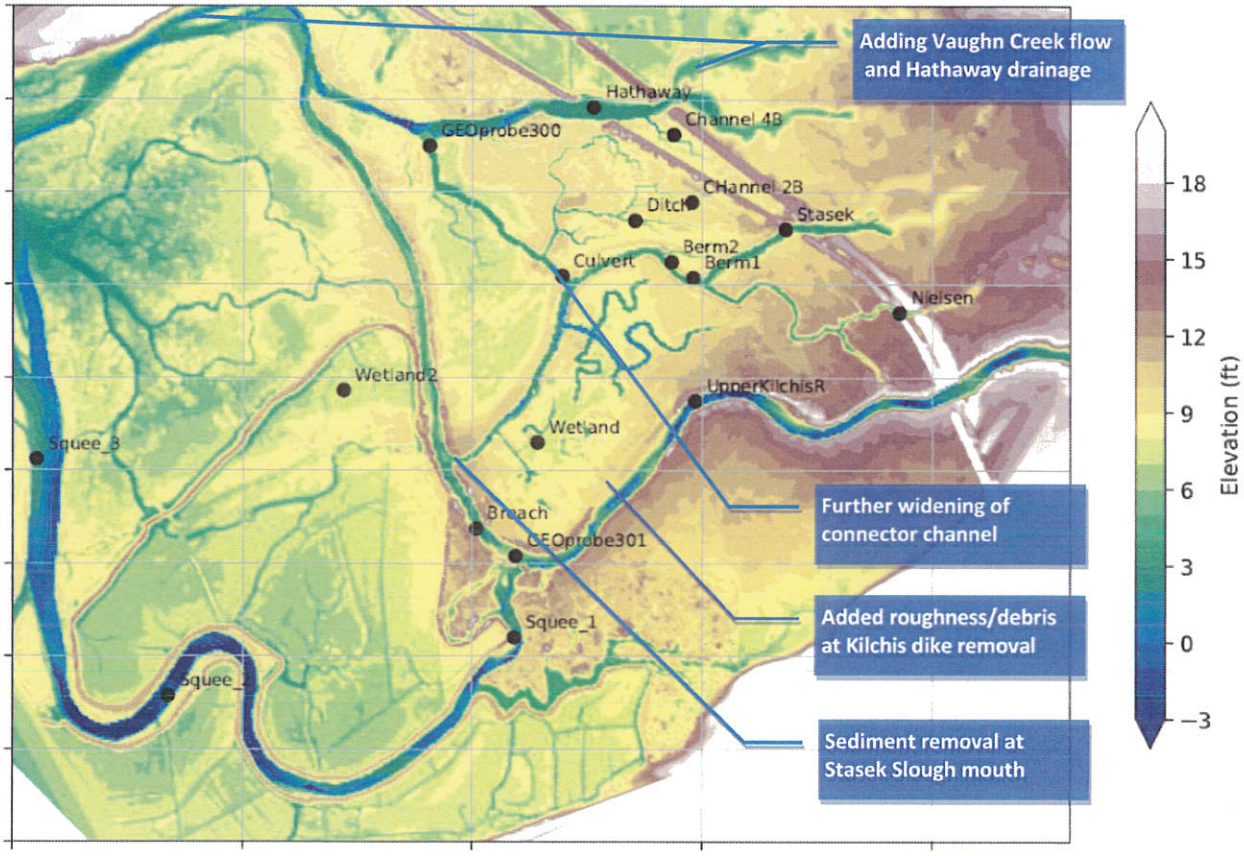


Figure 2 Summary of actions/ model scenarios developed to refine and improve the Porter Tract Restoration; model output locations are also shown for reference.

Vaughn Creek and Hathaway Slough Drainage

Vaughn Creek and Hathaway Slough (unnamed drainage that flows into the slough) flows were added to the January 2017 hydrologic scenario. The Hathaway Slough drainage was added even though not mentioned in the Hydraulic Review because its contributing watershed area is not insignificant compared to Vaughn Creek, and including this drainage would make results more conservative -- further elucidating any limitations from originally not including these local, northeast, freshwater inputs. Vaughn Creek and Hathaway flows were estimated using USGS Streamstats regression results (Risley J. et al 2008), and the 95% chance exceedance flows for the month of January were entered into the model at a constant flow rate over the simulation period.

Kilchis Riverbank Roughening / Large Wood Addition

In another model scenario, large wood structures were added to the crest of the Kilchis River bank where the levee was removed in 2015, intending to roughen (i.e., dissipate energy) from overflows that top the river banks. The intention of this test scenario was to allow natural overtopping and hydrologic connectivity, but to do so in a manner similar to that which occurs in mature forested tidal wetlands – where energy is dissipated and distributed broadly near the river bank by thick vegetation and/ or logs that have rafted onto the bank (similar to those that washed up and remain from the 2015 event). Typically in mature forested wetlands, high energy flows would be impeded immediately, likely reducing the overall magnitude of flows and total volume of water flowing across and through the wetland. This has been observed and simulated with a similar hydraulic model at the Fort Columbia Tidal Wetland in the Lower Columbia River Estuary (restored in 2011; Columbia River Estuary Study Taskforce).

The geometric representation of this scenario in the hydrodynamic model is shown in Figure 3.

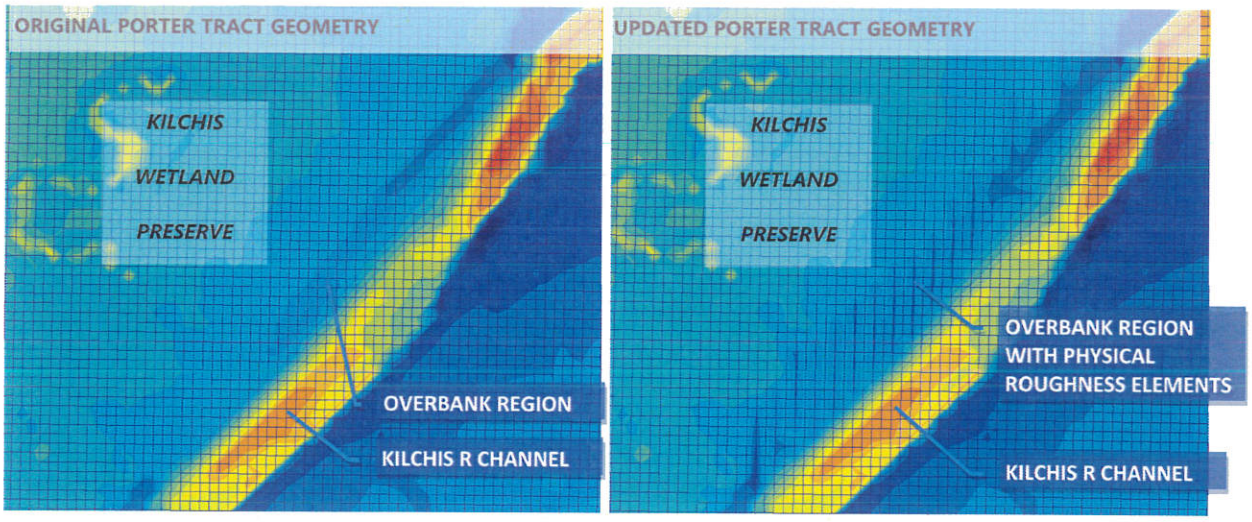


Figure 3 Representation of large wood roughness elements in the hydrodynamic model (without obstructions – left) as physical obstructions (right) that allow overbank flow between elements.

Stasek Slough Mouth Sediment Removal

Sediment that deposited at the mouth of Stasek Slough and in the general vicinity (from the 2015 storm) was also removed as a test scenario. The intent of this scenario was to evaluate if sediment removal would improve drainage through this slough during any parts of the simulation. Elevations of the slough that were not affected by deposition (generally in the 0 to 1 feet NAVD88 range as

originally constructed in the Kilchis Restoration) were continued along the channel bottom along Stasek Slough and along affected portions of the river in this scenario.

Model results

From the revisions described in the previous section, three new model scenarios were developed:

- **Scenario 1:** Vaughn Creek and Hathaway drainage flows were added (otherwise the same as the base case scenario);
- **Scenario 2**: Roughness elements added at the Kilchis levee removal location; this scenario also includes the added Vaughn and Hathaway flows in Scenario 1; and
- **Scenario 3**: Sediment removal at the Stasek Slough mouth (also includes changes in Scenarios 1 – which are considered a model improvement and thus included in Scenarios 2 and 3. This scenario does not include the roughness elements of Scenario 2.

Results of these scenarios were compared to the base case scenario, which is the Porter Tract Restoration scenario (W2r 2017) at two locations: Figure 4 at Stasek Slough and Figure 5 at Hathaway Slough. Results are also shown alongside observed tidal water levels at the NOAA South Beach Station (nearest observed tidal station in Yaquina Bay) for reference. Both figures also show water levels in the Kilchis River at Squeedunk Slough to understand the river stages relative to general land surface elevations and elevations of the Kilchis River bank where the levee was removed (and roughness elements were added in Scenario 2). To note, Kilchis bank elevations are in the range of 10 to 12 feet NAVD88 where the levee was removed (i.e., river stages above 10 to 12 feet NAVD88 will flow into the Preserve and towards Stasek Slough and the other tidal channels).

Several key observations are made from the comparison of simulated water levels across the scenarios:

1. **Vaughn Creek**: the addition of flow inputs at Vaughn Creek (and Hathaway Slough drainage) does not appear to have appreciable effects on water levels. At both Stasek and Hathaway locations, the thin blue line (Vaugh + Hathaway) is slightly higher than the base case (bold blue line) for a brief period of time when water levels are just below 10 feet NAVD88 which occurs for a day after 1/19/2017. There are also a few other brief periods during low tides when water levels are also very slightly elevated above the base case towards the end of the simulation.

   Although results are not particularly sensitive to the creek inputs, this model refinement is

warranted as there may be other time periods or conditions when creek inflows may have effects on nearby water levels. Subsequent simulations will incorporate the same or perhaps refined (non-constant) creek inflows so that water levels during low tide periods are not underestimated.

2. **Kilchis Riverbank roughness**: of the test evaluations considered, adding roughness to the river bank at the location of the prior levee removal has the strongest effect on reducing water levels at Stasek and Hathaway Sloughs compared to the based case and the preceding Scenario 1 Vaughn and Hathaway flows inputs. The red curves at Stasek and Hathaway show significant declines of up to 0.5 feet at Stasek and slightly less at Hathaway relative to the base case and Vaugh/Hathaway scenarios. The reduction in water levels is due to less conveyance of overbank flows when river stages are above and just below 10 feet NAVD88.

   One very important note is that while the model scenario assumed physical roughness elements on the bank of the river via addition of large wood (primarily due to a limitation in the hydrodynamic model's ability to represent variable ground roughness values), roughness (flow resistance) could also occur due to vegetation such as willows and other woody shrubs such as those currently growing along the bank and throughout the Kilchis Preserve (Dooher Tract). In fact, vegetation is currently very robust throughout the restored wetland – such that the flow resistance assumed in the model scenario may already exist or may develop at some point in the near future. In other words, this scenario may already be representing existing conditions rather than a hypothetical scenario.

   Further, as wetland vegetation continues to establish and mature, bank roughness will continue to increase commensurately. With this, the associated water level impacts (reductions reflected by this scenario) are likely to continue to increase to moderate – if not significant – degrees. Future storms bringing sediment, nutrients, and additional logs are expected to further support wetland habitat and vegetation health which in turn will buffer and dissipate high water levels in the same manner demonstrated by the hydrodynamic model.

3. **Stasek sediment removal**: this scenario had minor effects on water levels relative to the preceding Scenario 2 (Kilchis bank roughness). At both locations, the green curves representing the sediment removal scenario is essentially the same as results from Vaughn + Hathaway (which show slightly higher water levels than the base case due to the additional flow inputs which are also a part of this scenario).

4. **Connector channel widening**: although it is not shown here, initial review of base case simulation results at the connector channel between Stasek and Hathaway Sloughs shows no

local increase in velocities or gradients in water surface during peak ebb or flood tides. A local acceleration of flows or drop in water surface would suggest a constriction and be reason to consider further widening. As mentioned, this channel is already being widened significantly and to similar dimensions as the downstream Hathaway tributary channel to which it connects.

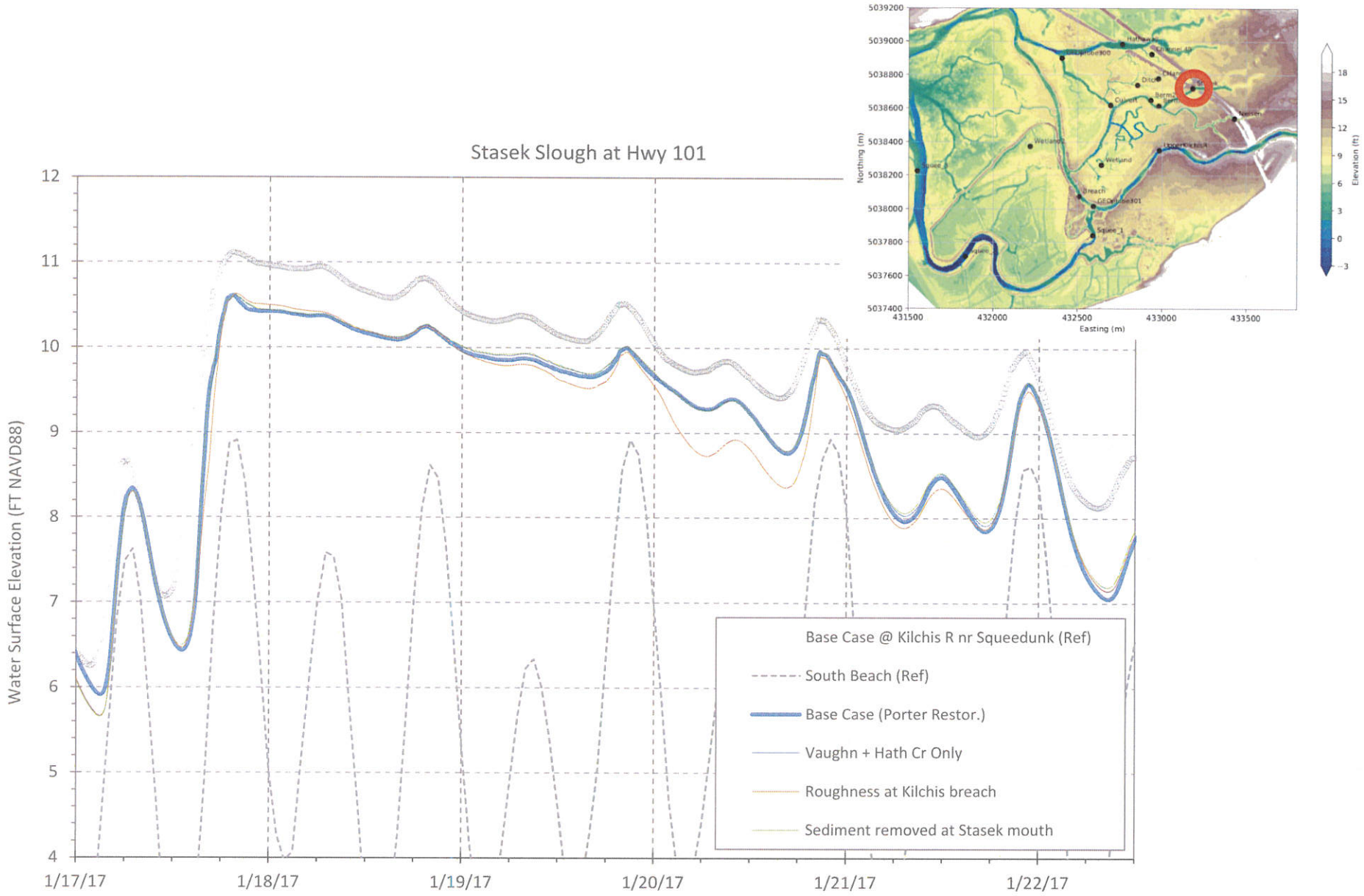


Figure 4 Comparison of simulated water surface elevations between the base case and the test scenarios in Stasek Slough at Highway 101.

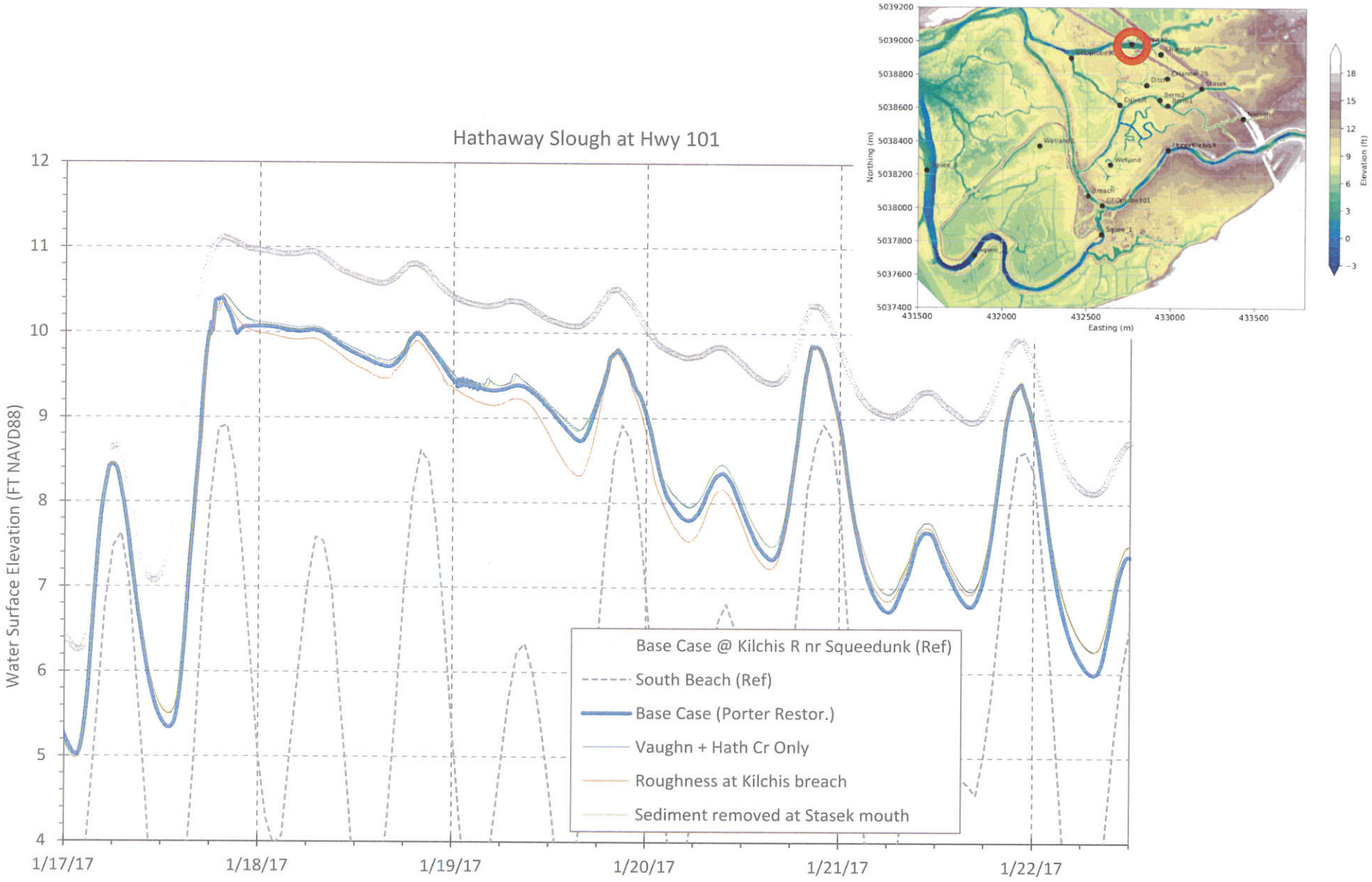


Figure 5 Comparison of simulated water surface elevations between the base case and the test scenarios in Hathaway Slough at Highway 101.

Cumulative Water Level Frequency Curves

To highlight the subtle differences in water level results shown in Figure 4 and Figure 5, cumulative water level frequency curves were developed for the Hathaway Slough results (see Figure 6 below). This figure shows the percentage of time that water levels are exceeded over the simulation periods for each scenario. For example, higher water levels on the left of the figure correspond to low frequencies of exceedance, and lower water levels on the right of the figure are exceeded a higher percent of the time; the curves thus slope down and to the right.

Results shown from Figure 6 correspond to those from the preceding figures, with the Kilchis bank roughness scenario showing lower frequencies (lower percentage of time) that water levels are at a given stage (i.e., the red curve is generally below the others except when water levels are below about 7.5 feet NAVD88).

Winter Days When Water Levels are Above a Threshold

Another benefit of the cumulative frequency curves described above is that frequencies can be converted into number of days in a particular period for a more familiar comparison of results. Exceedence frequencies shown in Figure 6 were converted to "number of days exceeded" by assuming the simulation was representative or could reoccur over a 90-day winter period. This assumption may be true in some years, but it may not be true in others (when winter water levels might be either higher or lower than the January 2017 sequence). It is believed to be mostly representative, but if the 2017 event were to be higher in stage for example than the true typical winter, this analysis would show a higher number of days at a particular threshold. However, the relative differences between number of days between scenarios will be accurate regardless of the 2017 period being higher or lower than an average winter.

Results of the conversion of water level frequencies are shown in Table 1. Three water level criteria were selected to draw out the number of days at or above that level: elevations 10, 9, and 8 feet NAVD88. This range is considered meaningful, as the differences between scenarios at water levels above 10 appear to diminish. Also, water level frequencies below 8 feet NAVD88 are also believed to be less important when considering inundation, as most ground elevations in areas of interest are above elevation 8 feet NAVD88.

To illustrate the conversion from frequency to number of days, red text and arrows indicate that the Kilchis bank roughness scenario (red line in Figure 6) is above elevation 9.0 feet NAVD88 for approximately 42% of the time. And, 42% of 90 days is equal to 37.5 days, as shown in the orange column and middle row of Table 1.

The Vaughn/Hathaway flow and sediment removal scenarios in the medium blue and green columns, respectively, show number of days over the winter exceeding the water level thresholds that are very similar to the base case; there is only a 1 to 3 day difference (increase) when these either the flow inputs or sediment removal actions are considered.

In contrast, the Kilchis bank roughness scenario shows a significant reduction in days exceeding the thresholds compared to the base and Vaughn scenarios. At elevation 10 feet NAVD88 which is mostly likely closest to that affecting lands upstream of Highway 101, the number of days is reduced in half, from 9.5 and 10.5 to just over 4 days. The changes at lower water surface elevations from additional roughness start to diminish.

It is important to note that the specific number of days reported in the table should not be the focus, as the number of days at a given water level will vary depending on the particular water year - especially the Kilchis River flow regime. Instead, the differences or relative change in number of days across the scenarios is more important to consider.

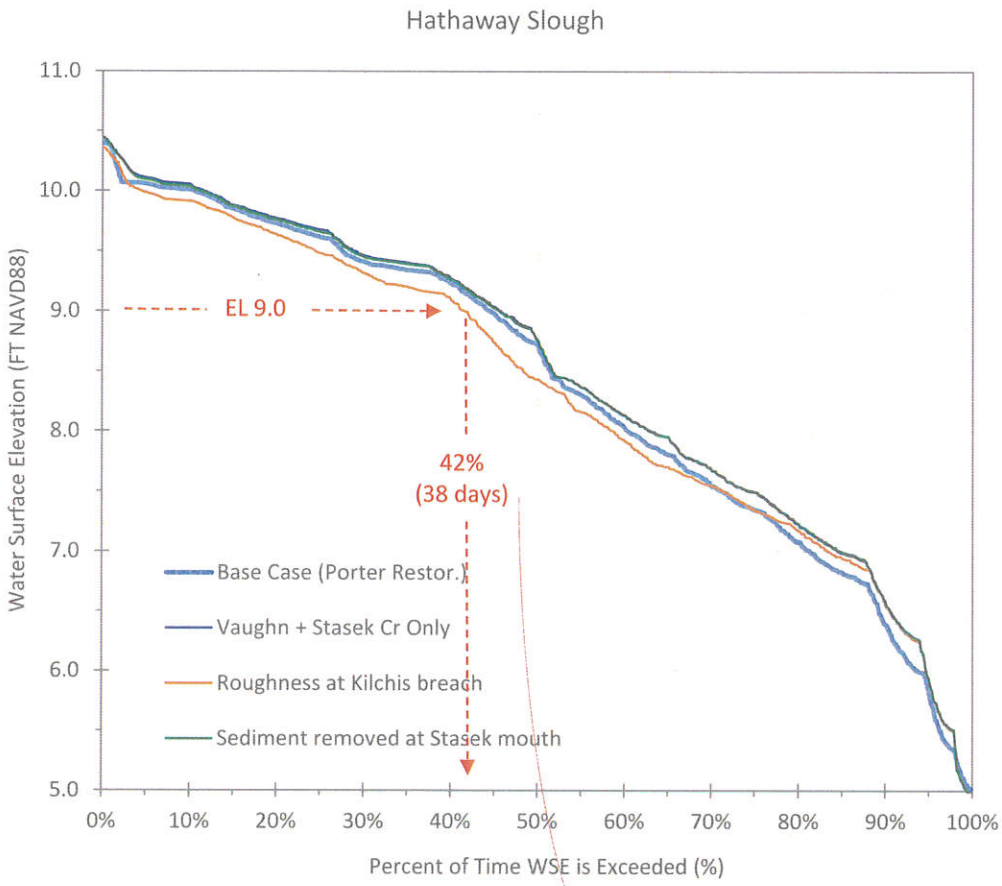


Figure 6 Cumulative water surface elevation (WSE) frequency exceedence curves at Hathaway Slough for the various scenarios.

Table 1 Number of winter days that simulated water surface elevations exceed various thresholds in Hathaway Slough.

Water Surface Elevation (WSE) Criterion (FT NAVD88)	# of Winter Days* That WSE Exceeds Elevation Criterion			
	Base Case (Porter Restor.)	***Vaughn + Hath. Cr Only***	***Roughness at Kilchis breach***	***Sediment removed at Stasek mouth***
10.0	9.5	10.5	4.1	10.1
9.0	39.9	41.0	37.5	41.0
8.0	54.3	56.8	52.8	56.7

**Specific number of days is less important than relative differences in days between scenarios.*

References

ESA 2014. Kilchis River Tidal Wetland Restoration Design, Supplemental Hydrodynamic Modeling Assessment of Flooding and Evolved Bed Conditions. Memo prepared by Environmental Science Associates (ESA), Portland, OR, prepared for The Nature Conservancy of Oregon, July 2014

FEMA 2018. Federal Emergency Management Agency Flood Insurance Study, Tillamook and Incorporated Areas, Volumes 1 and 2, effective Sep. 28, 2018.

NHC 2021. Kilchis Porter Restoration Review. Report prepared by Northwest Hydraulic Consultants (NHC), and prepared for The Nature Conservancy in Oregon, revised 10/1/2021.

NHC 2019. Kilchis River Estuary Porter Tract Restoration – Detailed Design, Hydrodynamic Model Results. Letter Report prepared by Northwest Hydraulic Consultants (NHC); prepared for Wolf Water Resources, Portland, Oregon, revised 7/8/2019.

Tillamook Co. 2019. Tillamook County GIS Portal. URL: http://tillamookcountymaps.co.tillamook.or.us/geomoose2

Risley, John, Stonewall, Adam, and Haluska, Tana, 2008, Estimating flow-duration and low-flow frequency statistics for unregulated streams in Oregon: U.S. Geological Survey Scientific Investigations Report 2008-5126, 22 p.

W2r 2019a. Porter Tract Restoration, Kilchis Estuary Preserve - Basis of Design Report (Final Design). Report prepared by Wolf Water Resources, Portland, OR; prepared for The Nature Conservancy of Oregon, February 2019.

W2r 2019b. Flood Analysis Memo – Porter Tract Restoration. Prepared for The Nature Conservancy of Oregon, prepared by Wolf Water Resources, September 2019.

W2r 2017. Porter Tract Restoration, Feasibility Analysis and Conceptual Design. Report prepared by Wolf Water Resources, Portland, OR; prepared for The Nature Conservancy of Oregon, November 2017.

Attachment A – NHC Technical Hydraulic Review

Kilchis River Estuary Porter Tract Restoration – Detailed Design, Hydrodynamic Model Results, Northwest Hydraulic Consultants, revised 7/8/2019.

WOLF WATER RESOURCES TECHNICAL MEMORANDUM HYDRAULIC REVIEW

(JULY 5, 2022)

1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

""

Technical Memorandum

Date: 7/5/2022

To: Dick Vander Schaaf, Project Manager
Associate Coast and Marine Conservation Director
The Nature Conservancy of Oregon

From: Curtis Loeb, PE, Principal Engineer
Wolf Water Resources
Portland, OR

Project: Porter Tract Restoration -
Kilchis Estuary Preserve

Subject: Technical Response to Hydraulic Review of Kilchis Estuary Reserve Project

Introduction

The Nature Conservancy of Oregon (TNC) is continuing efforts to restore and enhance tidal wetland habitats along the margins of Tillamook Bay with restoration of the Kilchis Estuary Preserve (Preserve or Project) located in the floodplain of the Kilchis River in Tillamook County west of Highway 101 and north of the town of Tillamook. The overall goal of restoration of the Kilchis Estuary Preserve is to restore freshwater and tidal hydrologic connections, provide off-channel rearing habitat for salmonids, and reestablish spruce swamp habitat.

The Preserve is comprised of two former land tracts: the Dooher Tract, which was the original Kilchis Preserve wetland restoration project that was constructed by TNC in 2015; and the second tract, the

WOLF WATER RESOURCES
1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

Porter Tract located immediately north of the Dooher Tract has been designed but not yet constructed. The cumulative area of these restoration efforts would result in 127 acres of high functioning estuarine habitat. Both tracts are located in the lower Kilchis River watershed, approximately one mile from the mouth of the Kilchis River, and the general region is influenced by both river flow and ocean tides.

As part of the recommendations from the Tillamook County project review process for the Porter Tract, TNC and other County stakeholders solicited a third-party review (Hydraulic Review) of the completed restoration phase (Dooher Tract) and the proposed Porter Tract phase (NHC 2021). The NHC Hydraulic Review included three primary sections: (1) observed (water level logger) water level and hydraulic model review; (2) review of Dooher Tract impacts, and (3) review of proposed Porter Tract impacts. The scope and purpose of this technical response memo is primarily to consider and respond to comments in these three sections related to observed water level reviews of Dooher Tract and Porter Track impacts:

- Stasek Slough and other water level data logger station datum estimations, specifically those related to Dooher restoration observations that resulted in higher water on farmlands along Stasek Slough at times during winter flows.
- Water levels and sedimentation related to Dooher Tract restoration
- Other related issues and/or limitations of the Hydraulic Review and implications on both Dooher and Porter Tract restoration.

Response to water level analysis and review (Section 2.1 of Hydraulic Review)

NOAA Garibaldi Gage Translation

The Hydraulic Review commented that summer tidal water levels at the NOAA Garibaldi tide gage were used to estimate corrections for TNC water level records measured at Stasek and Hathaway Sloughs. The Hydraulic Review stated that data from Stasek and Squeedunk gages were adjusted until a good match was achieved with Garibaldi stages at high tide levels.

In general, it is agreed that using observed summer (non-fluvial or those with a lower fluvial influence) water levels at an established NOAA tidal gage may be the best available way to estimate those at other locations. However, adjusting observed water level tidal amplitudes to a known established tidal gage can be problematic or have limited usefulness for several reasons. One primary reason is that there is no consistent way to estimate differences in high tide levels (either decreases or increases) from a known gage to another location. High tide water levels can vary by important magnitudes (i.e., those on the order of 1 foot or less) due to several mechanisms including minor (summer base flow) fluvial inputs, estuary or embayment constrictions or expansions that

WOLF WATER RESOURCES
1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

cause water levels to either magnify or be muted, and differences in the hypsometry (the shape or tidal prism volumes across a range of elevations) from one location to the other. Thus, it may be acceptable to use established water level station data for general or comparative purposes; but, relying heavily on water levels corrected by nearby, but still-distant, stations for precise or specific purposes may have limited usefulness.

Because minor-to-moderate differences typically exist at individual sites, it is always a best practice to install water level gages locally and establish site-specific tidal datums. Small differences in water levels are much more important in tidally-driven systems than in fluvially-driven systems because of the relatively low energy, high frequency, and narrow band of water levels that influence tidal marsh vegetation and productivity.

The Hydraulic Review also noted a -0.30-foot adjustment or relationship between Mean Lower Low Water (MLLW) and the NAVD88 vertical datum was determined by the Tillamook County surveyor at the NOAA Garibaldi tidal station. This value is consistent with, though slightly less than, the -0.33-foot difference reported in Table 3-2 of ESA PWA 2013b (originally cited by NOAA 2004) which shows a similar conversion between MLLW and NAVD88.

Observed Stasek and Hathaway Slough Water Levels

Section 2.1 of the Hydraulic Review also describes challenges with periods of observed water levels in Stasek and Hathaway Sloughs and associated corrections made. It is agreed that summer high tide water levels in and around relatively small sites like the Hathaway and Stasek Slough network should be similar, within a few tenths of a foot.

Truncated low tides. However, the Hydraulic Review also notes numerous periods when water level records (particularly Stasek Slough post-2016 data) "went dry" at low tide and corrections were made. Figure 1 below is a repeat of the graph from the Hydraulic Review (Figure 3, page 7 of NHC 2021) shown for convenience, and this figure shows the low tide correction in dashed blue.

It is unclear from the data and Hydraulic Review if these data loggers go dry, or if they have truncated low tides due to relatively high gravel bars in the channels downstream that limit drainage of the low tide. The truncated low tide and surveyed gravel bars (i.e., low point "sills" in the gravel bars at approximately elevation +4 feet NAVD88) were noted and observed originally in the 2013 Kilchis Dooher Tract Restoration Conceptual Design Report (ESA PWA 2013b). If the water level time series had "gone dry," it would be expected that the low tide values would go the zero (or close to it reflecting 0.0 feet of water pressure and only barometric pressure), rather than much higher flat (constant water level) readings in the 4 to 5 feet range. In summary, this low tide correction may not be especially consequential (since it appears that the overall time series including tidal peaks was not corrected uniformly), though the correction could overstate low tide drainage from the sloughs.

1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

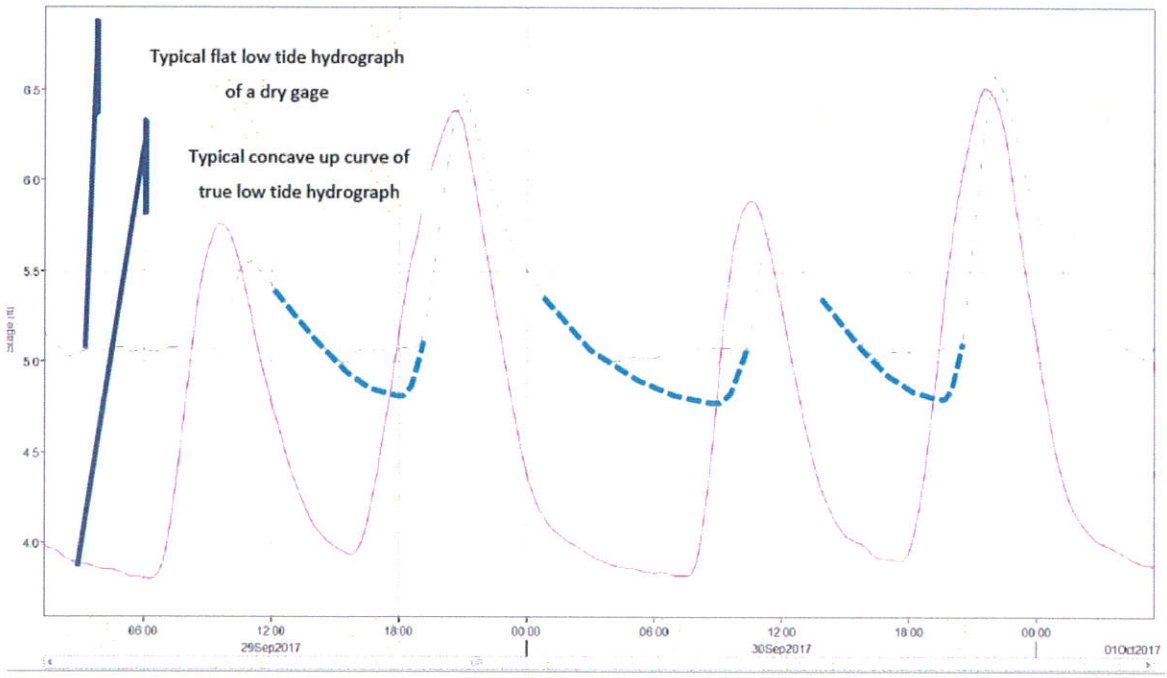


Figure 1. Repeated water level time series at Stasek (gray) and Hathaway Sloughs (pink) (from Figure 3 of the Hydraulic Review document – NHC 2021) showing low water level corrections.

Response to Dooher Project impact analysis (Section 3.1 of Hydraulic Review)

General – Normal Flow Impacts

The primary analysis from the Hydraulic Review focuses on "normal" (non-extreme) flows including summer low flows and higher but frequent winter flows (and tide levels – though focus was on Kilchis River flows). The historical time periods evaluated in this section considered Kilchis River flows between 400 and approximately 1,000 cfs (between a mean annual / 1.01-year flow and significantly less than the estimated 2-year flow of about 8,000 cfs (ESA PWA 2013b).

The primary basis of evaluation of normal flow impacts was comparing observed data from pre- and post-Dooher restoration periods. One period highlighted in the analyses along with their associated tidal and river levels is shown in Figure 2 below and summarized as:

- **Pre-restoration** – February and March 2014

WOLF WATER RESOURCES
1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

- Tidal peaks and overall range: most peaks >9 feet NAVD88 with the highest of the record at nearly 10' NAVD88, and >10' tide range (-1 to +9 feet NAVD88)
- Kilchis River flow: mostly between 400 cfs to 600 cfs with a peak near1,000 cfs

- **Post-restoration** – late October 2016
  - Tidal peaks and overall range: most tidal peaks between 8 and 9 feet NAVD88 (approximately 1' lower than the pre-restoration period) and a slightly smaller 8 to 9' tide range
  - Kilchis River flow: flows varying between 500 cfs and 900 cfs, which are generally about 100 cfs larger on average based on visual inspection

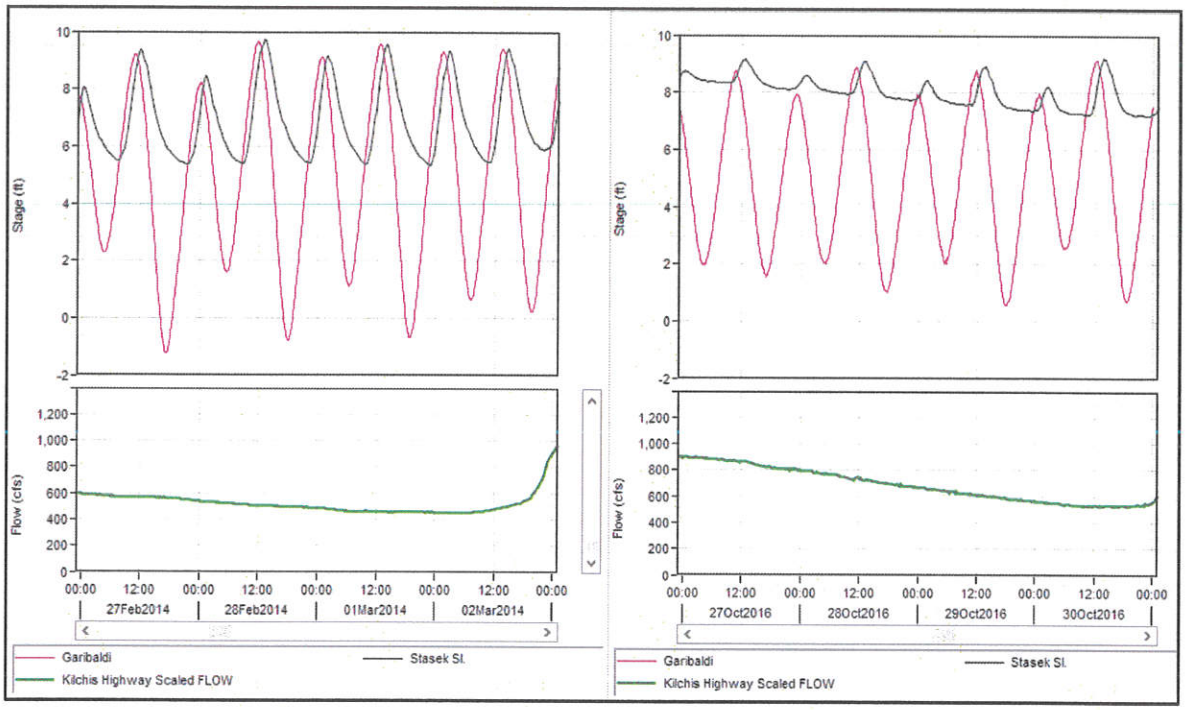


Figure 2. Repeated from Figure 4 (NHC 2021), water level time series and Kilchis River flows pre- (left) and post-restoration (right).

The Hydraulic Review continues comparison of pre- (2012 to 2014) and post-restoration (2016 to 2019) water levels and calculation of daily min/max/mean water levels averaged over a bi-weekly period, with some years without observed data). Per the Review, maximum average observed water levels in Stasek Slough increased from 7.3 to 7.9 feet NAVD88 (approximately 0.6 feet), and other

WOLF WATER RESOURCES
1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

differences on the order of a few tenths of a foot were noted at Hathaway Slough. Differences during winter periods were more significant, up to 2 feet in Stasek Slough. A maximum noted increase of 2.5 feet was seen in Stasek Slough during most sensitive flows in the Kilchis River of around 1,000 cfs.

In general, there are several important difficulties in making the above comparisons and drawing inferences between observed water levels from different time periods. These difficulties include:

- **Different hydrologic periods**: making detailed observations from two different time periods is like comparing apples and oranges because underlying precipitation, river flow, and potentially other hydrologic conditions could be vastly different during the two time periods. For example, water levels in the sloughs are likely dependent on Kilchis River flows as is mentioned in the Hydraulic Review (and as is generally accepted), but it is not clear if Kilchis River flows (e.g., mean annual flows or total water year runoff, etc.) were similar or different between 2014 (the observed time series at Stasek Slough) and the 2016 to 2019 post-restoration periods. The hydrologic year-types of 2016 to 2019 could have been much wetter than that of 2014, perhaps partially or nearly-fully resulting in higher tidal water level metrics. Thus, it is difficult to pull out or ascertain increases or decreases attributable to the restoration versus those from differing Kilchis River flows or other hydrologic differences between the periods of comparison.

  Further, there may have been physical differences in the Kilchis River and other slough channels pre-2014 and post-2014. Physical difference could include:

  - More or less accumulation of debris or blockage in the Stasek Slough connector channel culvert (both of which are common after large events such as the 2015 storm) that would have affected the cross-drainage between Stasek and Hathaway Sloughs,

  - Adjacent landowners could have maintained dikes using Kilchis River channel sediment – also a common practice after large storms or when otherwise necessary- which could have affected river bottom elevations and associated high tide levels in different ways,

  - The Squeedunk log jam on the south bank of the Kilchis River downstream of the Dooher Tract dike removal is also very dynamic in terms of its sediment accumulation at the toe of the structure and its composition of logs. For example, this log jam caused a significant hydraulic eddy and bank erosion in 2013, eroding away an installed water level logger and a large portion of the Dooher Tract bank during a storm much smaller than the 2015 sequence of flows. This log jam likely changed significantly during the 2015 storms, potentially changing both bed elevations along the lower river reach, and the distribution of flows down Squeedunk Slough versus the river channel.

- These and potentially other unknown physical changes further complicate evaluation of the effects of the Dooher Tract restoration based on comparison of observed water levels from two different periods.

Evaluating changes related to restoration or other 'what if' questions is often best done using hydraulic models because (1) the same hydrologic forcings can be applied, and (2) even if there are questions or limitations with a particular model, these limitations are typically minimized through model set-up; and further, any limitations or errors usually apply in similar ways to both pre- and post-restoration or other scenarios - making comparative analyses still useful.

- **2015 post-restoration Kilchis Riverbed aggradation**: the December 2015 Kilchis River storm and upstream landslide event brought debris (gravel, logs, organic material) and significant deposition of several vertical feet in the river at the Dooher Tract dike removal location. The restoration did not cause this hydrologic/watershed event, but restoration resulted in the sediment and debris deposition to focus at the dike removal location. Had restoration not occurred, this sediment and debris would have still been transported to the lower river reach downstream of Highway 101 and instead likely spread out broadly from the highway to the Hathaway Slough confluence and beyond. To some unknowable extent, this rare and impactful event would have affected slough water levels even if restoration had not occurred, making evaluation of changes due to restoration alone less clear. And, this storm-related disturbance event that occurred after the 2015 restoration is likely exaggerating the assumed effects of the Dooher restoration.

Dooher Tract Impacts on Slough Water Levels

The summary in Table 2 of the Hydraulic Review mentions higher winter levels in sloughs as a result of Dooher Tract restoration. The magnitudes of these changes should be qualified or evaluated further because they are based on comparison of different hydrologic periods and bring the associated challenges mentioned in the preceding section.

The section on Stasek Slough in Table 2 also mentions a generally higher water table in the low-lying areas around the slough in the wet season. This higher water table assertion is difficult to rely on because groundwater levels are a function of many factors including rainfall, local ponding and runoff, general ground elevations relative to high tide levels, among others. Several of these watershed/land-based factors have not changed due to Dooher Tract restoration. Water table monitoring has not been conducted within the project or adjacent areas.

WOLF WATER RESOURCES

1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

Response to Porter Project impact analysis (Section 3.2 of Hydraulic Review)

The Hydraulic Review describes that the Dooher Tract would have (has had) a greater impact on area hydrology than the proposed Porter Tract restoration would have. The larger impact from Dooher actions is due to removing the Kilchis River dike and connecting Stasek Slough directly to the river. In contrast, the Porter Tract would further increase flow and connectivity between Stasek and Hathaway Sloughs.

Under Porter Tract restoration, Stasek Slough water levels would be slightly lower by just less than 1 foot, and Hathaway Slough water levels would be slightly higher by about half a foot during Kilchis River flows between 1,000 and nearly 3,000 cfs (high winter flows), when Porter Tract effects are greatest. During the winter normal flows (500-1000 cfs), effects would be similar in Stasek and Hathaway Sloughs, but to a lesser degree than during higher river flows. The Porter Tract actions would essentially reduce the head (water surface gradient) between these tidal channel branches.

The above summary observations and conclusions, as well as those summarized in Table 3 that describe the likely combined effects of the Dooher / Porter restorations, are consistent with prior modeling observations and site understanding. In general, these observations of the Porter Tract restoration actions (alone or in combination with Dooher Tract actions) suggest that normal and flood water levels and drainage would either show no/very little change or improve if the Porter Tract restoration actions were implemented.

References

ESA PWA 2013. Hydrodynamic Modeling to Support Feasibility Analysis - Kilchis River Tidal Wetland Restoration Project. Report prepared by Environmental Science Associates (ESA PWA), Portland, OR, prepared for The Nature Conservancy of Oregon, December 2013.

ESA PWA 2013b. Kilchis River Tidal Wetland Restoration Engineering and Design – Feasibility Analysis and Conceptual Design. Report prepared by Environmental Science Associates (ESA PWA), Portland, OR, prepared for The Nature Conservancy of Oregon, December 2013.

ESA 2014. Kilchis River Tidal Wetland Restoration Design, Supplemental Hydrodynamic Modeling Assessment of Flooding and Evolved Bed Conditions. Memo prepared by Environmental Science Associates (ESA), Portland, OR, prepared for The Nature Conservancy of Oregon, July 2014

WOLF WATER RESOURCES

1001 SE Water Ave.
Suite 180
Portland, OR 97214
503.207.6688

FEMA 2018. Federal Emergency Management Agency Flood Insurance Study, Tillamook and Incorporated Areas, Volumes 1 and 2, effective Sep. 28, 2018.

NHC 2021. Kilchis Porter Restoration Review. Report prepared by Northwest Hydraulic Consultants (NHC), and prepared for The Nature Conservancy in Oregon, revised 10/1/2021.

NOAA 2013. NOAA Tides and Current, Center for Operational Oceanographic Products and Services (CO-OPS), URL: http://tidesandcurrents.noaa.gov/, 2013.

NOAA 2004. Technical Memorandum - Background tides and sea level variations at Seaside, Oregon, PMEL-126. Prepared by Mofjield, H., A. Venturato, F. Gonzalez, V. Titov, Sep. 2004.

W2r 2019. Porter Tract Restoration, Kilchis Estuary Preserve - Basis of Design Report (Final Design). Report prepared by Wolf Water Resources, Portland, OR; prepared for The Nature Conservancy of Oregon, February 2019.

OUTLINE DOCUMENT

Tillamook County Planning Permit Document

Kilchis Porter Tidal Wetland Restoration Project

The Nature Conservancy

Project Manager: Dick Vander Schaaf

October 16, 2019

Note: Highlighted areas are drafting notes and are addressed in Discussion sections that follow.

Outline for Tillamook County Planning Permit Document

A. Project Site and Design Overview

   Maps and Supporting Documents

B. Development Permit

   Development Permit Application

   Flood Hazard Overlay Zone

   Conditional Letter Of Map Revision (CLOMR)

C. Estuary Zone Criteria Compliance

   Estuary Natural Zone (EN)

   Estuary Conservation Zone 1 (EC1)

   Estuary Development Standards

D. Goal 17 Shorelands Criteria Compliance

E. Conditional Use Review

   Estuary and Farm Zones Criteria

   SB1517 Criteria

A. Project Site and Restoration Design Overview

The Kilchis Porter wetland restoration project is designed to restore tidal wetlands and wetland functionality to the 60-acre Porter tract owned by The Nature Conservancy (Figure 1). The eastern half of the site (~30 acres) was converted to pastures over 50 years ago while the west half (~30 acres) has remained in native tidal marshes. The site historically was covered by Sitka spruce swamp and scrub-shrub habitats that contained numerous tidal channels which provided

important aquatic habitat for juvenile fish and flocks of waterbirds. The east half of the property is separated from the west half by Porter Slough that diverges from the lower end of Hathaway Slough and then winds through the site. Porter Slough once allowed tidal waters to access much of the site through small tidal channels that branched from it. The site is bordered by Highway 101 on the east, Stasek Slough on the south, Hathaway Slough on the north and private farmland on the west. The Tillamook Bay Railroad line runs along the eastern border of the property parallel to Highway 101. A small part of the Porter tract borders the lower Kilchis River in the northwest corner of the site. There is no terrestrial public access to the Porter property but boaters can get to the site from the Kilchis River and the adjoining sloughs.

Tidal wetlands provide habitat for a wide range of species that are important to coastal ecosystems. Salmon utilize tidal marshes and aquatic habitats for rearing and refuge during high water events. Salmon species known to occur in the Kilchis River drainage include Chinook, Coho, and Chum as well as Steelhead and Sea-run cutthroat trout. Oregon Coastal Coho salmon are federally listed as a Threatened species. In addition to salmon, tidal marshes are important for many juvenile forms of marine species including Dungeness crab, rockfish, starry flounder and many others. Finally, the marshes host numerous waterbirds throughout the year including migrating ducks, seabirds, shorebirds and colonial birds such as great blue heron and egrets. The site also provides habitat for common wildlife species including many birds and small mammals.

The restored Porter tract wetlands will complement the Kilchis Preserve managed by The Nature Conservancy that is located immediately to the south and across Stasek Slough. The restored Porter wetlands will provide critical habitat to juvenile salmon as well as waterbirds and other species that utilize these habitats. The wetland restoration activities will occur on the eastern half the site which occupies 30 acres and was previously used as seasonal pasture and hayfields. The remaining 30 acres of the Porter tract on the west side of the site are already covered by native tidal wetland habitat and receive ongoing weed abatement stewardship actions.

A detailed account of proposed restoration activities is available in the site conceptual plan (W2R 2017), the 100% final engineering plans (W2R 2019a) and the 100% Final Basis of Design Report (W2R 2019b); all documents are included under separate covers.

The major wetland restoration activities include:

- Lower dikes along Hathaway and Stasek Sloughs, approximately 1070 linear feet of dike, to elevations that represent 2-year flood or annual exceedance levels of 9-10 feet; 2150 CY excavated materials
- Fill agricultural ditches, approximately 500 linear feet, 140 CY fill using excavated materials
- Re-create tidal channels, 5835 linear feet; 9790 CY excavated materials
- Remove 5 water control structures to allow for unrestricted tidal water access to the wetlands
- Remove the box culvert on the connector channel between Porter and Stasek Sloughs for improved tidal flow in the project area
- Build two light duty bridges over interior channels for site management and emergency access
- Re-vegetate the site with appropriate native wetland species
- Create elevated mounds from excess excavated materials and plant with wetland species

Restoration activities are discussed in the 100% Basis of Design Report and shown in detail in the 100% Engineering Plans that are attached. Special construction provisions are further defined in the Construction Specifications Report that is also attached.

The project area for the restoration activities is approximately 30 acres in size and is largely confined to the eastern half of the Porter tract. Ground disturbance due to restoration activities is estimated to affect approximately 7 acres of the site. Ground disturbance areas include temporary road and pathways, construction staging areas, areas of dike lowering and connector channel realignment, and locations of vegetated mounds. The areas of ground disturbance will have erosion control measures implemented including erosion control seeding mix applied to them and will be have additional revegetation efforts applied as well. The erosion control measures are specified in the 100% Engineering Plans. The entire project area of 30 acres will be subject to wetland revegetation activities. Approximately 13 acres have already been revegetated with native wetland species by The Nature Conservancy as part of the overall restoration work.

Maps and Supporting Documents—attached

Final Engineering Plan, 100% Design

Final Basis of Design Report, 100% Design

Construction Specifications: Special Provisions Report, Final Design

Conceptual Restoration Design Report

Hydrodynamic Modeling memo—enclosed

Army Corps of Engineers JAP Removal/Fill Permit—in progress

Kilchis Estuary Preserve Management Plan

Stamped engineer statement stating no project impacts to hydrology—enclosed

B. Development Permit

Development Permit Application and fee

Section 3.510 Flood Hazard Overlay (FH) Zone

Relates to FEMA FIRM maps

Regulatory Floodway is still east of Hwy 101

In FH zone (an AE zone is within FH), then need to file a CLOMR if any change in elevation of floods will occur (5) (page 9) or change in the boundary of the Special FH Area. File with FEMA, DLCD.

Section 3.510 (9) (f) notes that areas subject to tidal and overland flow influences are not subject to floodway determination of no rise (<1'). Includes Kilchis River below line C which corresponds to the railroad and/or highway alignment.

Discussion

The Develop Permit Application is included with this County permit review. The permit application details construction activities that will be undertaken in the project area. Relevant criteria for the permit are addressed below.

- **Fill:** The project is not within a Coastal High Hazard Area and it is not within a Regulatory Floodway. No fill associated with the project will be placed within either of these designations. Materials brought onto the site will consist of gravel and/or cobble to be used in substructures for the bridges to be constructed or for stabilizing construction staging areas or temporary roadways, the above-mentioned bridges located over Porter Slough (see engineering plans), and large logs that will be used as wood habitat structures in the tidal channels. Material generated on the site from excavation activities will be used on the site to fill drainage ditches according to the restoration plans. Any excess materials will be placed in vegetated mounds that are designed to provide topographic diversity at the site and elevated planting habitats. The mounds will not impede drainage or the flow of floodwaters on the site. Materials amounts generated by the excavations equal 9790CY; material from dike lowering equals 2150CY. Materials brought onto the site total 569CY: 400CY gravel, 129CY logs, 40CY bridge works.
- **Structures:** No enclosed structures will be developed in the restoration project. Five small water control structures will be removed from the site and two light-duty bridges will be constructed. Most of the water control structures are in deteriorated and non-functional condition. Thirty-three (33) wood habitat structures will be installed at the site within the re-created tidal channels to provide habitat diversity and to secure channel cross-sections and walls.

The project area lies entirely within the Flood Hazard Overlay Zone (FH) and classified on FEMA FIRM maps as in the AE zone with a base flood elevation of 12.5 feet (Figure 2). The designated Floodway lies to the east of Highway 101 and does not extend into the project area.

The proposed restoration project is designed to restore tidal marshes and tidal channels that support natural communities and native species. These restored habitats will also provide watershed benefits during high water events including flood conditions by providing additional off channel storage of flood waters. The benefits may extend beyond the project boundaries depending upon the severity of the flood conditions and combined effects of tidal waters and storm surge.

Section 3.510(9)(f) of TCLUO notes that the Kilchis River downstream of cross-section C is not subject to provision (e) which states that no development will occur unless it is demonstrated that it will not raise the water surface elevation of the base flood more than one foot. The project area is in the Kilchis River drainage and downstream of cross-section C that approximates Highway 101. The hydrodynamic model developed for the project shows that under base flood conditions (12.5 feet elevation for the site and project area), there will be no rise in water level elevations in the project area after restoration actions have been completed. The base flood elevation for cross-section C is 14.2 feet; this base flood elevation is used to evaluate impacts of the project on adjacent lands immediately east of Highway 101. Hydrodynamic model runs of post-restoration conditions determined that base flood levels will not be exceeded for areas east of Highway 101 along Stasek Slough.

FEMA Considerations: 3.510(5)(a) states that if a hydrologic analysis indicates in increase in flood levels, then a Conditional Letter of Map Revision (CLOMR) needs to be obtained from FEMA before development is permitted (TCLUO p.9). A LOMR is required post development after the CLOMR is filed or if conditions differ. The base flood elevation for the project area and for adjacent lands will not be affected by restoration activities, according to the hydrodynamic model runs, hence no CLOMR is required.

C. Estuary Zone (EN) Criteria Compliance

Section 3.100 Estuary Zones

Conditional Use—same criteria as EFU criteria for conditional use so can draft once

Section 3.102 Estuary Natural Zone

Porter site is within Estuary Management Unit EN30

Bridge Crossings and supports, see 3.102 (2) (g). uses permitted with standards.

Restoration, see 3.102 (3) (e), uses permitted conditionally. Conditional use criteria same as for EFU Zone and found in 3.040 (1) through (6). (page 2, TCLUO 3.040)

Restoration, see 3.102 (4) (c) regulated activities in conjunction with restoration. dredging or fill/removal

Discussion

The Kilchis Porter project area includes areas of mapped estuary zones (Figure 3) including Estuary Natural (EN) zoning and Estuary Conservation 1 (EC1) zoning, as well as areas that may qualify as estuary lands due to the presence of aquatic vegetation or are below the Mean Higher High Water (MHHW) line of 8.32 feet (Garibaldi Tidal Station, accepted 4-24-2018). The project area is within the Tillamook County Estuary Management Unit EN30. Some of the planned restoration activities are located within identified estuary zoned lands as portrayed in Figure 3.

Estuary lands can be used for farming; applicable Goal 3 (protection of farmlands) policies are addressed in the Farm zone policy section.

Restoration is a conditional use within Estuary Natural zoning (3.102(3)(e)). Conditional use criteria evaluation for the proposed restoration action in estuary zoned lands will be assessed together with the conditional use criteria evaluation for farmland zoning. Conditional use criteria for Estuary Natural zoning is detailed in TCLUO 6.040.

Restoration is a use permitted with standards for Estuary Conservation 1 Zone (EC1) as defined in TCLUO 3.106(2)(i). Procedure is defined in Section 3.120 and Standards are defined in Section 3.140. These sections will be discussed below.

The proposed restoration of the Porter project area includes tidal channel re-creation, lowering of dikes along portions of Stasek and Hathaway Sloughs, removal of dilapidated water control structures, installation of large wood structures, development of vegetation mounds and wetland revegetation. Restoration of the Porter tract supports the general priorities of estuary zones (TCLUO 3.100 (1)) by maintaining the integrity of the estuarine ecosystem and by not degrading or reducing the natural estuarine resources and values. The proposed restoration supports the primary purpose of EN zoning of preserving and protecting significant fish and wildlife habitats by re-establishing both the aquatic as well as the marsh habitats in the project area. The restoration will enhance the ability of the site to contribute natural productivity to the estuarine ecosystem of Tillamook Bay. In addition, it will provide for enhanced ecosystem function of tidal marsh habitats by restoring natural tidal flow to the site and by re-establishing tidal interactions within the marsh habitat.

Two, light-duty bridges that are not connected with public roadways are proposed for the site to facilitate restoration and site management. The bridges will also provide emergency access to the lower Kilchis River and to Hathaway Slough. Bridges are considered uses that are permitted with standards in EN zoning.

The proposed restoration activities for the Porter project area are detailed in the Basis of Design Report (W2R 2019a) and the 100% Engineering Plans (W2R 2019b). The activities will enhance restoration tidal wetland functionality to the site by improving access of tidal flow to the wetlands, restoring former aquatic habitat lost due to farming practices and revegetating the site with native wetland species. The restored tidal wetlands will provide essential habitat for juvenile salmon during high flow events and throughout time which they occupy freshwater and tidal habitats. The wetlands will also support habitat used by waterbirds, marine fishes and other species. Finally, the restored wetlands will provide flood control benefits within the watershed as the site will provide storage for excess waters during high river flows.

TCLUO 3.120 Review of Regulated Activities

Regulated activities include: a-Fill, b-Dredging, e-Shoreline stabilization

Review will entail assessment of Federal and State permits in conjunction with Zone requirements.

ACE permit and federal compliance notices.

Text Discussion

Necessary permits for the proposed restoration project, as detailed in the Engineering Plans (W2R 2019a) and Basis of Design Report (W2R 2019b) have been applied for from the US Army Corps of Engineers (ACE) and from Oregon Department of Environmental Quality (DEQ). The following permits have been received or applied for and are attached for review if they have been finalized by the agency.

- Permit NWP 218-197: Army Corps of Engineers, included within the Nationwide Permit 27 for restoring aquatic vegetation under Section 10 of the Clean Harbors Act. Received June 13, 2018.

- Removal/Fill Permit, Joint Application Permit (JAP): Army Corps of Engineers and Oregon Department of State Lands for removal and fill activities associated with restoration. Section 404, Clean Water Act.
- Water Quality Certification Permit: Oregon Department of Environmental Quality, Nationwide 401Water Quality Certification Approval. June 19, 2018.
- Federal Compliance with ESA, NEPA and NHPA for cultural resources: the ACE is the lead agency for federal compliance for the project.
- SHPO compliance: A cultural resource inventory is being conducted on the site to determine in advance of restoration activities the potential for disturbance of cultural resources. Results of the inventory will be made available to SHPO and local Indian tribes. Recommendations for future actions will be detailed in the results.

The restoration project is in the process of getting the necessary permits from state and federal agencies listed above. Each agency will require the project meets their own requirements as defined under each permit. Comments received from the permitting agencies to date have been incorporated in updated project designs that are included in the final engineering plans (W2R 2019a) attached with this application. The restoration project will not permanently degrade or reduce estuarine natural values; to the contrary, the project will enhance estuarine natural values.

TCLUO 3.140 Estuary Development Standards

(5) Dredging: in estuary zones, to create tidal channels

(a) necessary to produce public benefit (p. 7-8)

(k) to create new water surfaces or channels (p.9)

(m) impact assessment for estuarine waters dredging. See section 3.020.

(7) Fill. see whole section for specifics

(a) show public benefit (p. 12)

(d) in water work window

(f, g) erosion control measures used

(h) Clean water conditions, federal regulations

(10) Land transportation facilities

(15) Restoration and Enhancement: (p. 21-22) in estuary zones and shoreland overlay zone, standards (a) through (j)

Note (d), present evidence that restoration will result in overall improvement in cultural, historic, economic or navigation features, which will outweigh any adverse impacts. Can show: no degradation of above features, can show benefits to fish and wildlife species, benefits to flood control. Also in (e) state the project is consistent with protection of significant fish and wildlife habitats, research and education goals.

Discussion

Four sections of the Estuary Development Standards (3.140) may be pertinent to the Kilchis Porter tidal wetland restoration project application. They are discussed below:

- **Section (5) Dredging** estuarine waters and wetlands: Dredging typically takes place for navigation or other water dependent uses and does not characterize excavation activities that are associated with restoration. This restoration project will re-create tidal channels that will result in the excavation of natural materials including soil and rock. Water quality in nearby tidal sloughs will be protected by erosion controls including sediment fencing and straw waddles; see engineering plans (W2R 2019a) for details. All activities will be conducted during in-water work windows as established by ODFW. The project will result in enhanced tidal marsh and aquatic habitats at the site.
- **Section (7) Fill** in estuarine waters: Materials will be generated by excavation of tidal channels at the restoration project and by the lowering of dikes along portions of the tidal sloughs at the site. The materials will be used to fill former agricultural ditches at the site. Excess excavation materials will be used to create vegetated mounds that may rise 1.5-2.5 feet above the wetland surface and will provide slight topographic diversity to the site. The fill materials are required to meet the restoration goals for the site. All areas where fill is placed (ditches, mounds) will be located and shaped to minimize impeding flood waters across the site. The mounds will be seeded with erosion control grasses immediately after construction is completed to prevent sediment and turbidity in nearby sloughs. Mounds will be targeted with additional revegetation activities in the planting season. Locations of fill placement are detailed on the engineering plans provided. All fill related activities will take place during the in-water work window established by ODFW. Erosion prevention measures will be employed at fill locations; these are detailed in the engineering plans. The fill materials will be beneficial to the overall restoration design for the project area as they will add habitat diversity by way of the created mounds.
- **Section (10) Land Transportation Facilities:** The restoration project will remove a failing box culvert on the connector channel (ditch) between Stasek and Porter Sloughs. This box culvert was installed in 1965 to allow for drainage of farmlands east of Highway 101 along Stasek Slough. The culvert also provided access across the site to the west half of the tract as well as access to the lower Kilchis River. The project will place a light-duty bridge across the connector channel; the bridge will be used for site management activities and will be available for emergency access to the lower Kilchis River as needs arise. Such access was utilized as recently as 2015 to remove a logjam so it is a very real concern. A second light-duty bridge will be installed across Porter Slough at a crossing that currently has an undersized culvert. This crossing will provide management access to the north and west side of the site. The bridges are not connected to public roadways and will not be used by the public unless access is granted by the landowner on a limited basis. They will be positioned and maintained to allow for fish passage and will be constructed in such a manner to withstand expected winter high water flows and flooding. The connector channel and its connection with Stasek Slough

will be improved to enhance fish passage; see attached engineering plans for details. The bridges are consistent with Estuary Natural zoning resource capabilities and purposes; they are critical to the restoration and management of the site as well.

- **Section (15) Restoration and Enhancement:**

(a) Policy requirements in the Tillamook County Comprehensive Plan (Comp Plan) met. The Policy requirements are detailed under the Goal 16 Estuarine Resources section. The overarching objective of Goal 16 is:

To recognize and protect the unique environmental, economic and social values of each estuary and associated wetlands; and
To protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries.

Restoration is further defined in the Comp Plan in 6. Policies for Estuaries Uses, Section 6.12 Restoration and Enhancement.

1. *Habitat types...which are in the shortest supply as compared with historical abundance shall be identified as part of the restoration plan element.* The Porter project targets restoring spruce swamp as well as other tidal marsh habitats; spruce swamps have suffered the greatest percentage loss of any tidal marsh habitats in the state and over 90% loss in Tillamook County.
2. NA
3. *Revitalize functional characteristics and processes such as diked lands restoration, priority given to marginal, low-lying diked areas adjacent to estuarine wetland.* The Porter project will restore and improve functional aspects of the site by lowering dikes along sloughs and generally improving access of tidal waters to the former wetlands. The site is adjacent to natural tidal marshes as well as recently restored tidal marshes, thus increasing the overall viability of the entire Estuary Management Unit EN30. The project area is low-lying as represented by the scrub-shrub and spruce swamp tidal habitats that formerly occupied the site. It was only seasonally used for farming and was challenging due to high water levels and being largely undiked.

7. *Active restoration permitted in all estuary zones based upon requirements.*
(a) Estuary Natural Zone: limited to restoration of fish and wildlife habitat. The proposed restoration will increase the amount and the quality of rearing habitat for juvenile salmon. It will also provide additional foraging and resting habitat for a variety of waterbirds as well as for juvenile marine fishes and nongame species.

(b) The restored Porter project area will be restored to tidal marsh habitats specifically spruce swamp, scrub-shrub and riparian habitats (Figure 4), that will also include restored tidal channels; see engineering plans (W2R 2019a) for a complete depiction of restoration actions proposed. The restored areas were non-functioning habitat prior to restoration due to their loss of tidal flow and loss of tidal marsh vegetation. These losses were caused by the conversion of the site to farm use in the past century.

(c) *Estuary enhancement* will improve the current condition of the former tidal marshes that are currently dominated by non-native species and no longer support tidal channels that deliver tidal waters on incoming tides and provide habitat for aquatic species. The loss of these habitats is due to historic farming activities, primarily on the east half of the project area where restoration activities are concentrated. Proposed activities are documented in the attached engineering plans.

(d) *Improved conditions due to enhancement activities*. The proposed Kilchis Porter restoration project will improve the estuary habitat conditions at the site while not degrading other features present. The improved habitat conditions will provide increased rearing habitat for juvenile salmon that will result in improved condition of outgoing smolts and increased numbers of returning adults in the Kilchis drainage, according to studies done in comparable river systems (Nickelson 2012, Jones et al, 2014, Beamer et al, 2017). The improved salmon numbers may result in increases for recreational and commercial angler opportunities in future years. The restored wetlands may also have positive benefits for flood control as they will provide flood storage in some instances and will not result in significant impacts for adjacent lands according to hydrodynamic modeling results for the proposed project (W2R 2019 memo). The restored tidal wetlands will be a positive benefit to visitors to Tillamook County who enjoy the scenic railroad route that passes along the restored site. The visitors will see restored tidal wetlands and channels sited beside active farms, promoting the understanding that both activities can co-exist in proximity in the County. As a precursor to the restoration, the site will be surveyed for cultural resources and a report detailing findings will be developed. The survey will be followed up with on-site archeological monitoring during construction to document any cultural resources that may be discovered there. This survey and monitoring will further our knowledge of cultural resources in the area and will insure that any discovered resources will be adequately protected.

(e) *Evidence that project is of benefit to fish and wildlife.* Restoration of tidal marsh habitat has been shown to benefit salmon species that use these habitats for rearing before venturing out to sea. An enclosed letter from ODFW documents the benefits to fish and wildlife species that will come from the restored site (Knutsen 2019). Some of the best studies that document beneficial use have occurred in the Salmon River estuary, 50 miles south of Tillamook. Studies here showed that Chinook salmon smolts (Bottom 2005, Hering 2010) used both natural and restored marsh channels in the Salmon River. Other studies have shown the enhanced growth rates of salmon smolts reared in floodplain estuaries vs in riverine habitats (Jacob Katz, personal communication 2018). These results have also been supported for coho salmon as well (Nickelson 2012).

(i) *Dredge and fill activities.* All fill and removal activities will be reviewed by the appropriate permitting agencies and will be conducted according to the standards.

(j) *Shoreland Overlay zone standards.* The project area falls within a Significant Wetland Biological Habitat as defined in the Tillamook County Comprehensive Plan, Goal 17 Coastal Shorelands. Restoration is considered a Conditional Use in the

Shoreland Overlay zone and is subject to standards defined in TCLUO Section 3.140(15), Estuary Development Standards. Goal 17 Coastal Shoreland Protection is discussed below.

(k) Agencies notified of the restoration project include: ODFW, DSL, DLCD, EPA, USFWS, and ACE.

Literature Cited

Beamer, E., R. Henderson, C. Ruff, and K. Wolf. 2017. Juvenile Chinook salmon utilization of habitat associated with the Fisher Slough Restoration Project, 2009 - 2015. Report prepared for The Nature Conservancy, Washington.

Bottom, D. L., K. K. Jones, T. J. Cornwell, A. Gray and C. A. Simenstad. 2005. Patterns of Chinook salmon migration and residency in the Salmon River Estuary (Oregon). Estuarine Coastal and Shelf Science 64:79-93.

Hering, D. K. 2010. Growth, residence, and movement of juvenile Chinook salmon within restored and reference estuarine marsh channels in Salmon River, Oregon. MS Thesis, Oregon State University.

Jones, K.K., T.J. Cornwell, D.L. Bottom, L.A. Campbell, and S. Stein. 2014. The contribution of estuary-resident life histories to the return of adult *Oncorhynchus kisutch.* Journal of Fish Biology doi: 10.1111/jfb.12380.

Nickelson, T. 2012. Future analysis for wetlands restoration in the Coquille River basin: How many coho salmon might we expect to be produced? Report to The Nature Conservancy.

D. Goal 17 Shorelands Protection

TCLUO Section 3.545 Shorelands overlay zone

Discussion

Careful planning of activities in and around coastal shorelands is necessary to protect the environmental and economic resources and benefits derived from them. The State planning objective for coastal shorelands is to "conserve, protect, where appropriate develop and where appropriate restore the resources and benefits of all coastal shorelands". Most if not all of the Porter restoration site is within the Shorelands overlay zone (SH) as defined by Section 3.545 of the TCLUO. The restoration site falls within the category of Shorelands under 3.545 (3)(b) of Estuarine Element and Coastal Shorelands Element of the Comprehensive Plan as:

(1) Significant shoreland and biological wetland habitat.

The uses permitted within the Shorelands overlay zone reflect those permitted either outright or through conditional use in the underlying zone(s). Conditional uses under 3.545 (5) include estuarine restoration actions as subject to the standards in Section 3.140 (15), discussed

previously. Restoration will enhance and protect shoreland areas and habitats within the restoration project area.

E. Conditional Use Review

Section 6.010 Conditional use procedures and criteria

Estuary (6.040) and Farm (6.060) Zones Criteria for decision

Planning Application (see forms)

Application fee $1089

Compliance with estuary standards in 3.140 (sections 5,7,10, 15)

Discussion

Restoration is considered a Conditional Use within Estuary and Exclusive Farm Use zones, both of which occur in the project area. Restoration is a use that is consistent with the goals and policies of the Tillamook County Comprehensive Plan as detailed by Goal 16. Estuarine Resources goal, Goal 16, has its stated objective to protect, maintain, … and where appropriate restore the environmental …values of Oregon's estuaries (TCCP, Goal 16). Conditional use criteria for Estuary and Farm Use zones are similar and are discussed below relative to the proposed project.

The project area is an ideal candidate for restoration as it occupies former tidal marsh habitat that has good connectivity to tidal waters of Tillamook Bay via Hathaway and Stasek Sloughs that that border the property on two sides. The site is also ideal as it is relatively isolated from active farmlands being located all but adjacent to Tillamook Bay. The Kilchis Preserve owned by The Nature Conservancy borders the project area to the south, across Stasek Slough, and is dominated by restored tidal marsh habitat that is complementary to the intended restored marsh habitat on the project area. The project site also borders Highway 101 and the Tillamook Bay railroad line on its eastern border, both of which are located on elevated berms that are far above tidal and flood elevations and not affected by restoration. The project area will restore 30 acres of spruce swamp habitat, a habitat that has suffered 90% loss countywide and is very important for salmon rearing in associated tidal channels as well as providing habitat for other wildlife species.

The project area was formerly used for grazing and haying but it is largely unprotected from tidal and flood waters and could only be used seasonally; it was in disuse in recent years, in part because it also had challenging access issues being isolated by Highway 101 from the base farm. The site has few improvements on it that would impede restoration actions and the site size, 30 acres, is manageable in terms of doing the major restoration construction work is a single season which reduces any temporary impacts to the area.

The proposed restoration will return the property to tidal marsh habitat with natural vegetative communities and tidal channels being key aspects on the restored site. As the site is adjacent to tidal sloughs and existing marsh habitats it will fit into the surrounding lands both visually as well as functionally. The tidal wetlands character of the site will be especially apparent to

visitors who enjoy the Railriders business that traverses the railroad across the property; boaters on the sloughs will also be able to see the site from the adjacent waterways. Because of limited public access there won't be an appreciable increase in public use at the site.

The restored site will not interfere with adjacent land uses focused on farming as the project area is separated from farmlands by two existing tidal sloughs, Stasek and Hathaway, and by native wetlands that occur on the western border of the site. The site is also separated from adjacent land uses east of Highway 101 which runs along the eastern border of the site. Water levels in the adjoining sloughs will not be significantly affected by restoration actions as determined by the hydrodynamic model developed for the project. The restored wetlands will function as an overflow and storage zone for floodwaters, thus offering some minor flood relief to adjacent lands in the Kilchis drainage. The restored tidal channels and reconstructed connection between Stasek and Porter Sloughs will also promote more rapid drainage on lands located along Stasek Slough on the east side of Highway 101.

The proposed wetland revegetation efforts will be confined to the site and will not result in any spread of noxious weeds or native species to adjoining lands. TNC takes an active role in controlling noxious weeds on its ownerships as directed by the Kilchis Preserve Management Plan (attached). The native species used in the revegetation activities are not prone to spreading and are mostly wetland obligate species that are found in surrounding tidal swamps and marshes on the North Coast.

The restored site will also not interfere with any transportation uses along the Highway 101 corridor or the Tillamook Bay Railroad line, both of which occur along the eastern edge of the site. The Highway and railroad are located on berms that are elevated to 14.8 feet and 15.6 feet respectively, well above the base flood elevation of 12.5 feet for the site. Current users of the railroad line on the recreation-focused Railriders business, will get a firsthand view of active marsh restoration and newly restored natural habitats in Tillamook County. There is currently no public or deeded access across the project area so the restoration will not be a factor for any access issues and will not cause transportation-related concerns. An emergency corridor to the Kilchis River will be maintained across the restored site and a light-duty bridge over the connector channel replacing the failing box culvert will make emergency vehicle access possible.

The proposed use of the site will have no detrimental affect on existing solar energy systems, wind energy conversion systems or windmills. There are currently none of these systems in the immediate area and none are planned at this time. The proposed use is timely with regards to any potential impacts to public facilities and services as no existing facilities will be affected by the restoration or by the continued conservation actions at the site.

Farm Zone Wetland Restoration Criteria Compliance

Wetlands Restoration in EFU Zone, Section 6.060, Conditional Use Criteria (page 3)

a. Not force significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest use;
b. Not significantly increase the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use.

Discussion

Senate Bill 1517 was passed by the Oregon Legislature in 2016, establishing a pilot project in Tillamook County that would further regulate wetland restoration in EFU farmlands. The regulations created conditional use criteria to be met by certain wetland restoration projects in the County. The Porter Kilchis tidal wetland restoration falls within the project description defined by legislation.

The Porter Kilchis restoration project is proposed for a parcel of land in the lower Kilchis River watershed that is largely isolated from active farmlands. The 60 acre Porter tract is zoned approximately 35% estuary zoning (EN, EC1) and 65% farmland zoning (Figure 3). The 30 acre restoration project area is approximately 25% estuary zoning and 75% farmland zoning. There are no active forestry programs on neighboring lands. The project area, which is mostly to the east of Porter Slough and the connector channel, has shared property boundaries with farmlands that are either separated by natural waterways, native wetlands or Highway 101 (Figure 5).

The farmland across Stasek Slough to the south-east is owned by Prince Farms and is used for forage production, being cut 4-5 times a year. Farmland on the east side of Highway 101 is also owned or leased by Prince Farms and used for silage production. The farmland to the north of the project area across Hathaway Slough is managed by Averill Farm and used for grazing and forage production. This parcel is enclosed by a high dike with a tide gate. The farmland to the west of the Kilchis Porter project area is owned by Geinger Farms and used for forage production. Native tidal marsh habitat located on the TNC Porter tract lies between the Porter project area (east of Porter Slough) and the Geinger farmland. Geinger accesses this farmland parcel by fording the Kilchis River during summertime low flows.

The dairy farms in the surrounding area use their land base primarily for forage production which has traditionally been dominated by pasture grasses. These lands are also integral to the manure management programs for the farms. In the last ten years, many farms planted an increasing acreage in corn for silage but at least one neighboring farm replanted their fields to pasture grasses last year. This shows that farming practices continue to evolve and change with market forces.

The Kilchis Preserve—Dooher Tract which has been managed by The Nature Conservancy since 2010 has coexisted with neighboring farms for nine years. The Preserve had undergone tidal wetland restoration actions in 2015 and there have been no impacts to neighboring farmlands attributed to the restoration. Management of the Kilchis Preserve which includes the restored Dooher tract as well as the Porter tract, is directed by the Kilchis Preserve Management Plan (attached). The Conservancy has dedicated staff for preserve management located on the coast as well as staff located at its Oregon chapter office in Portland.

The restored Porter project area within the Porter tract will also not interfere with adjacent farmland management as it is separated from neighboring farmlands by Stasek and Hathaway Sloughs and by native wetlands that occur on the western portion of the Porter tract. The native wetlands will not be subject to major restoration activities. The Porter tract is separated from farmlands on its eastern border by Highway 101. Restoration activities on the Porter tract will primarily take place within the interior of the tract. Only a minor amount of low dike along Hathaway Slough will be lowered so there will be little increase in overland flow of high waters onto the Porter tract from the sloughs at peak tides.

The natural sloughs that border the restoration area significantly dampen any effects that raised water tables on the project area may have on farmlands that are on the opposite sides of the sloughs. The farmlands west of the Porter tract have been adjacent to natural tidal wetlands for many decades and will not suffer any increased impacts due to the restoration project that is proposed to take place on the eastern half of the Porter tract, east of the existing wetlands.

TNC and Geinger Farms exchanged native wetland acres under Geinger ownership for existing farmlands on the Porter tract before the acquisition was completed to protect both priority farmland and existing native wetlands. This exchange resulted in more acres being brought under active farmland management while protecting existing tidal wetlands that historically were too wet to farm.

Changing water levels in the sloughs adjacent to the project area are a primary concern for farmers who have lands that also border these natural sloughs. The sloughs are principally tidally influenced or in other words their water levels respond to and track tidal elevations under most conditions. The only time that water elevations in the sloughs do not track the tides is during high river flow events that cause overland flooding and may eventually back up flows to Tillamook Bay, restricting drainage of the sloughs. To assess the effects of the restoration on water levels in the project area, on the sloughs and the Kilchis River in the surrounding area, TNC contracted with W2R to develop a hydrodynamic model (see attached Hydrodynamic Model memo from NHC 2019). The model is based on waterway bathymetry and elevations of the surrounding area with inputs of water levels from water level loggers, tidal heights and projected river flows determined from nearby gauged rivers. The Kilchis River does not have a recording, water level gauge so data from the Wilson River is used with adjustments made to reflect the differing watershed size. The hydrodynamic model was initially developed for the Dooher tract restoration project and was recently updated to reflect potential effects of the 2015 flood that occurred in the region. Further refinement of the model has occurred to reflect the proposed hydrologic changes associated with the planned restoration at the Porter project area.

The hydrodynamic model was run under several scenarios that reflect current and restored wetland conditions under 1) low river flow (summer) conditions, 2) high river flow (winter) conditions, both under high and low tides, as well as base flood (100 year) conditions, again with high and low tide levels. The model showed relatively good results when compared against known water levels in the slough and the river derived from water level loggers that TNC has maintained in these waterways. Results are documented in the attached Conceptual Restoration Plan (W2R 2017) and in the hydrology effects memo specific to the hydrodynamic model (NHC 2019). Overall, the model predicts that water levels in the sloughs will not be significantly altered by restoration actions, either directly adjacent to the site or upstream of the site. As noted above in the discussion of the Flood Hazard Zone conditions (TCLUO 3.150), the base flood level for the project area of 12.5 feet will not be affected by the restoration and the base flood level of 14.2 feet for areas upstream or east of Highway 101 in the sloughs will also not be raised by restoration actions. A memo detailing the hydrologic effects of the proposed restoration project is enclosed along with an engineer's stamp of certification (W2R 2019).

The restored wetlands in fact will function as overflow and storage zones for floodwaters in the sloughs, thus offering some minor relief to adjacent lands in the Kilchis drainage during high flow conditions. The restored connector channel between Stasek and Porter Sloughs has been predicted by the hydrodynamic model to promote more rapid drainage on lands located upstream

along Stasek Slough on the east side of Highway 101, at least for several hours after the peak flood in flood conditions, due to less constrained flow through the re-engineered channel. Floodwaters can be a significant impact to farms as they affect farmlands, manure management and livestock. Restoration in the Porter project area will not exacerbate the impacts of flooding that already occur in the region.

Another concern is that the restoration will result in the spread of noxious weeds or native species to adjoining lands. TNC takes an active role in controlling noxious weeds on its ownerships. A management plan that details weed control management for the Kilchis Preserve is attached to this permit application. Restoration will not result in a spread of noxious species to adjacent farmlands as TNC will be aggressively managing detections of weeds through manual and chemical control. The herbicides that TNC uses for revegetation and weed abatement include glyphosate and trichlopyr. The herbicides are applied by trained, licensed applicators using spot-spray techniques with hand sprayers. These herbicides have recommended limitations on pastures used by lactating animals but none of the TNC lands are currently or will be used in the future for pasture or haying operations, thus there are no potential impacts to farm animals. Herbicide application is curtailed during wet weather and care is taken in application near waterways using appropriate surfactants. The native species used in the revegetation activities at the project are not prone to spreading and are mostly wetland obligate species that will not spread or become established in managed farm or pasture lands.

Additional concerns of wetland restoration impact on farmlands include enhanced wildlife damage and increased public use on private lands. Wildlife use may increase on the restored project area as natural habitats are improved but as there won't be any increases in food that attract geese, for instance, it is not expected to result in more geese being attracted to the site or surrounding farmlands. It has been suggested that deer could become more numerous on the restored site but wetlands don't offer the best habitat for deer so use will be limited. Public use is not expected to increase in the project area as there is no defined public access to the site. Therefore, public use is not expected to increase on neighboring farmlands.

TNC prides itself in being a good neighbor in the community as we bring land management expertise to our properties and we willingly share knowledge and what we learn from our sites with our neighbors. At the Kilchis Preserve, TNC has maintained a series of water level loggers in the created tidal channels, in the natural sloughs (Stasek, Nielsen and Hathaway) and in the Kilchis River. The water levels that have been recorded by these loggers are shared upon request to interested neighbors. We also share information about the restoration activities that we are managing at the site including how restoration actions are progressing, our weed management activities and any changes that we are noticing in wildlife and fisheries in the area. We remain interested in farming practices as well, and how the timing of them may affect the Preserve. Lastly, we stand ready and willing to assist neighbors with management issues that range from riparian management along sloughs to tidal water flow through waterways.

TNC believes that the proposed restoration meets the conditional use criteria of (a) not forcing significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest use; and (b) not significantly increasing the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use. Adjacent farmlands will not experience rising water levels, increased wildlife depredation, or more public use because of the restoration on the Porter project area. Therefore, the adjacent farms should not be forced to make significant

changes to accepted farm practices due to restored wetlands on the Porter project area. The relatively isolated nature of the restoration site that lies west of Highway 101 should not pose a conflict to neighboring farms that do not share roads, access, fences or even close boundaries for the most part. Because of this, there should be no significant increase in costs of accepted farm practices due to the presence of the restored project area.

PERMIT FIGURES

Tillamook County Planning Permit Documents

Kilchis Porter Tidal Wetland Restoration Project

October 17, 2019

The Nature Conservancy

Figures

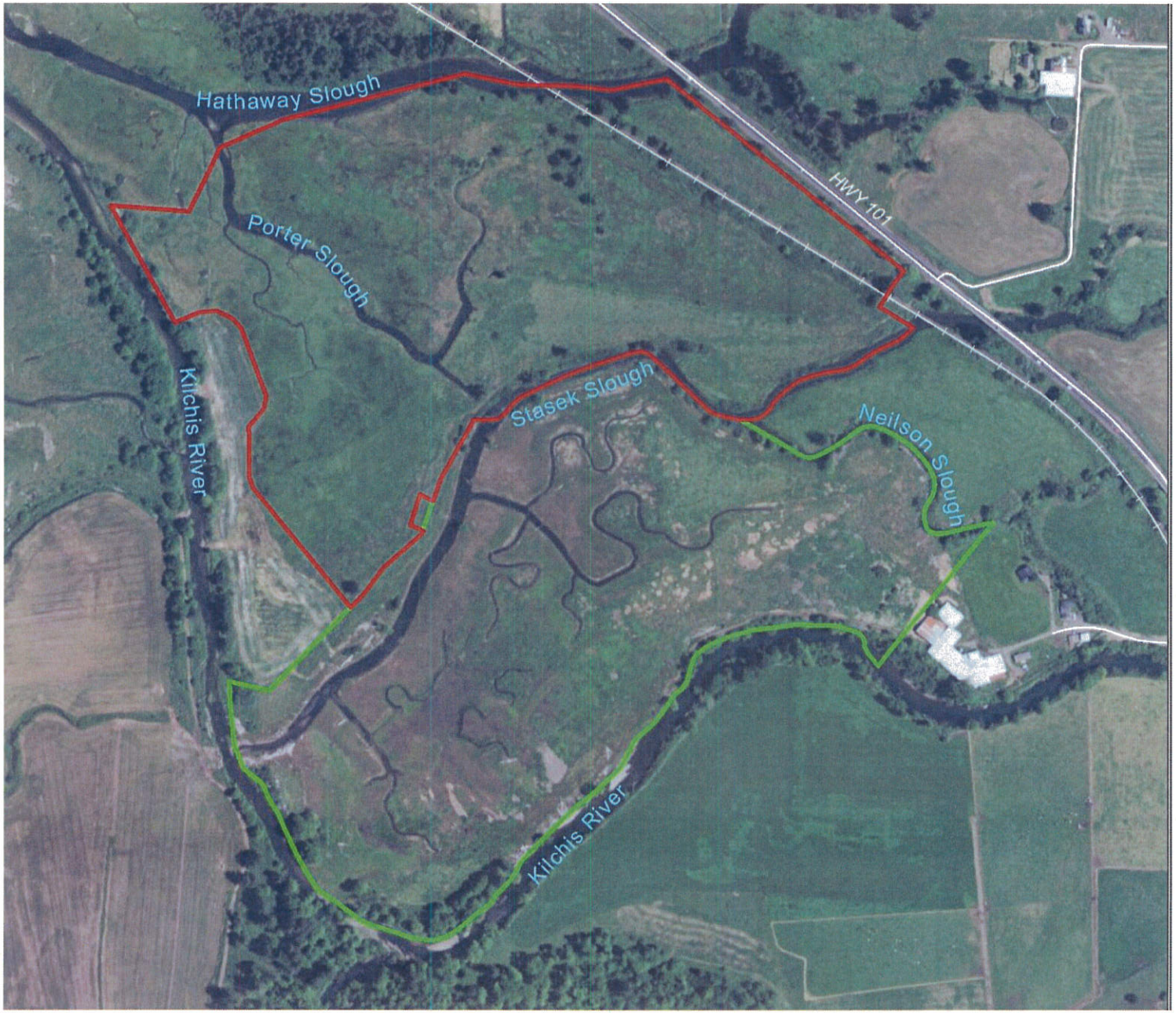


Figure 1. Kilchis Porter Project Area, Tillamook County Oregon. Project Area

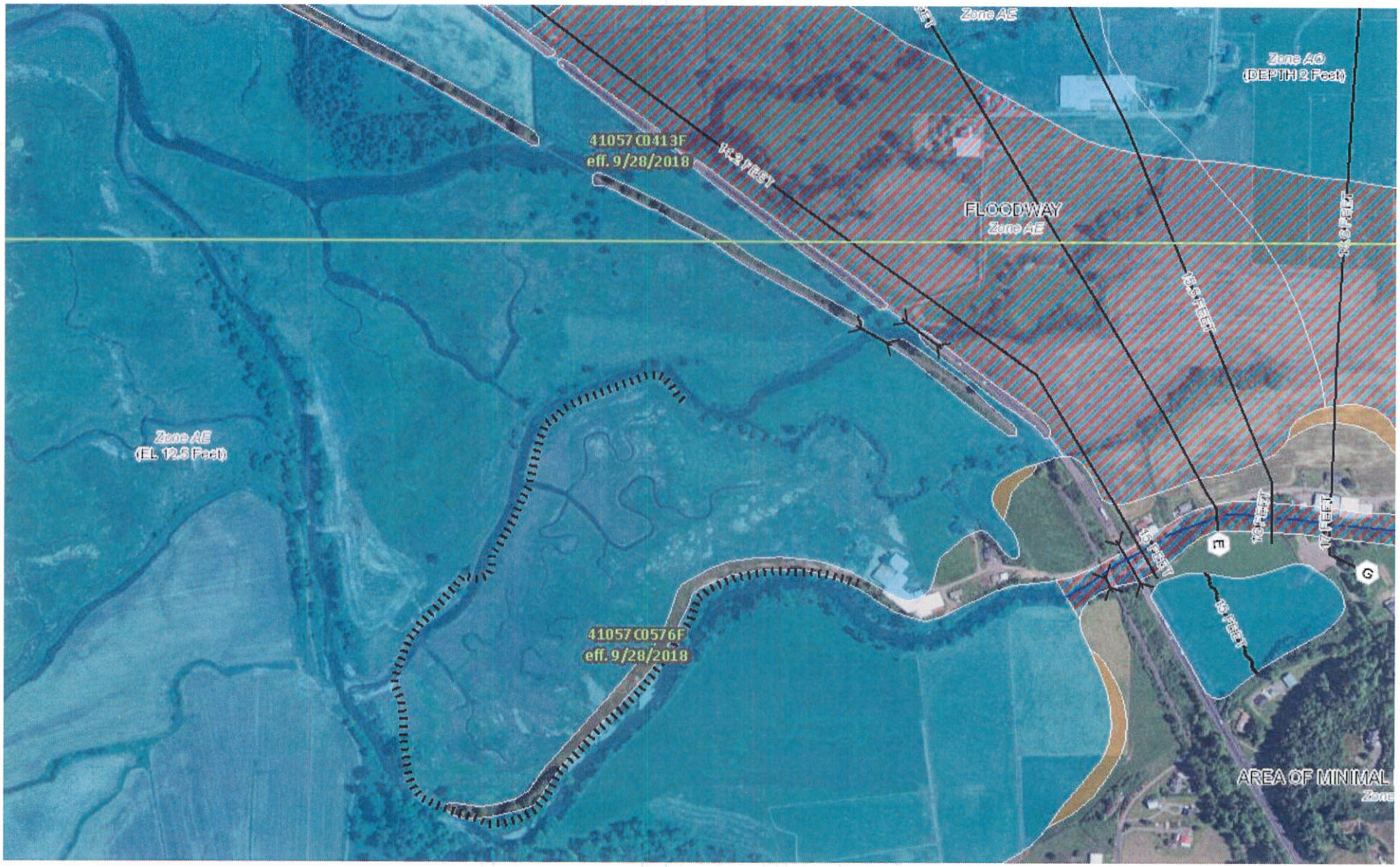


Figure 2. FEMA FIRM Map of Project Area, Kilchis Porter Restoration, Map #41057C0576F, eff. 9/28/2018. Base flood elevation 12.5 feet.

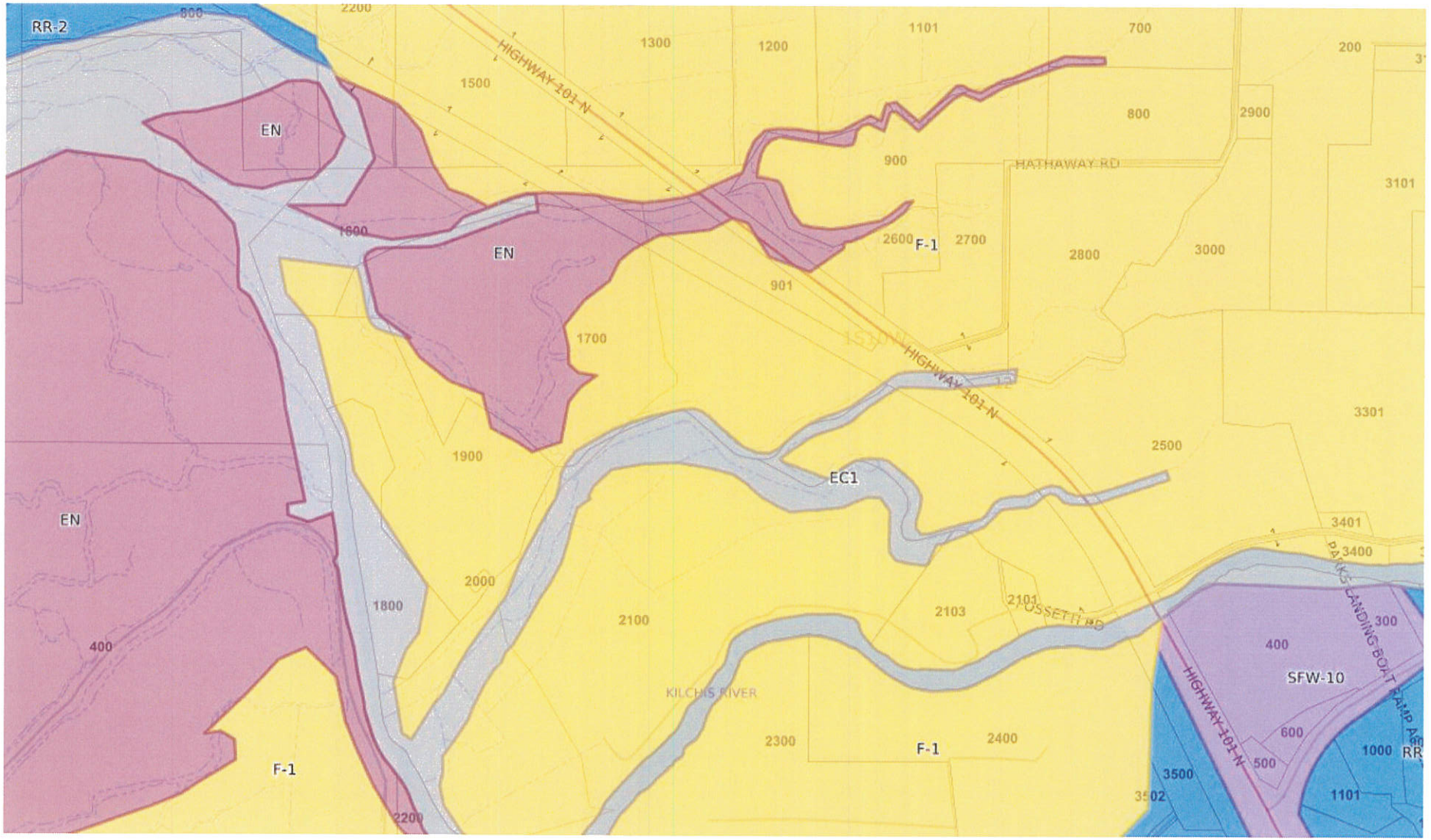


Figure 3. Tillamook County Zoning: Porter Tract and surrounding lands. Porter tract includes taxlots 1900, 1700 and 901. Restoration activities are largely confined to TL 1700 and 901. Zoning includes EN: Estuary Natural; EC1 Estuary Conservation 1; and F-1 Farmland.

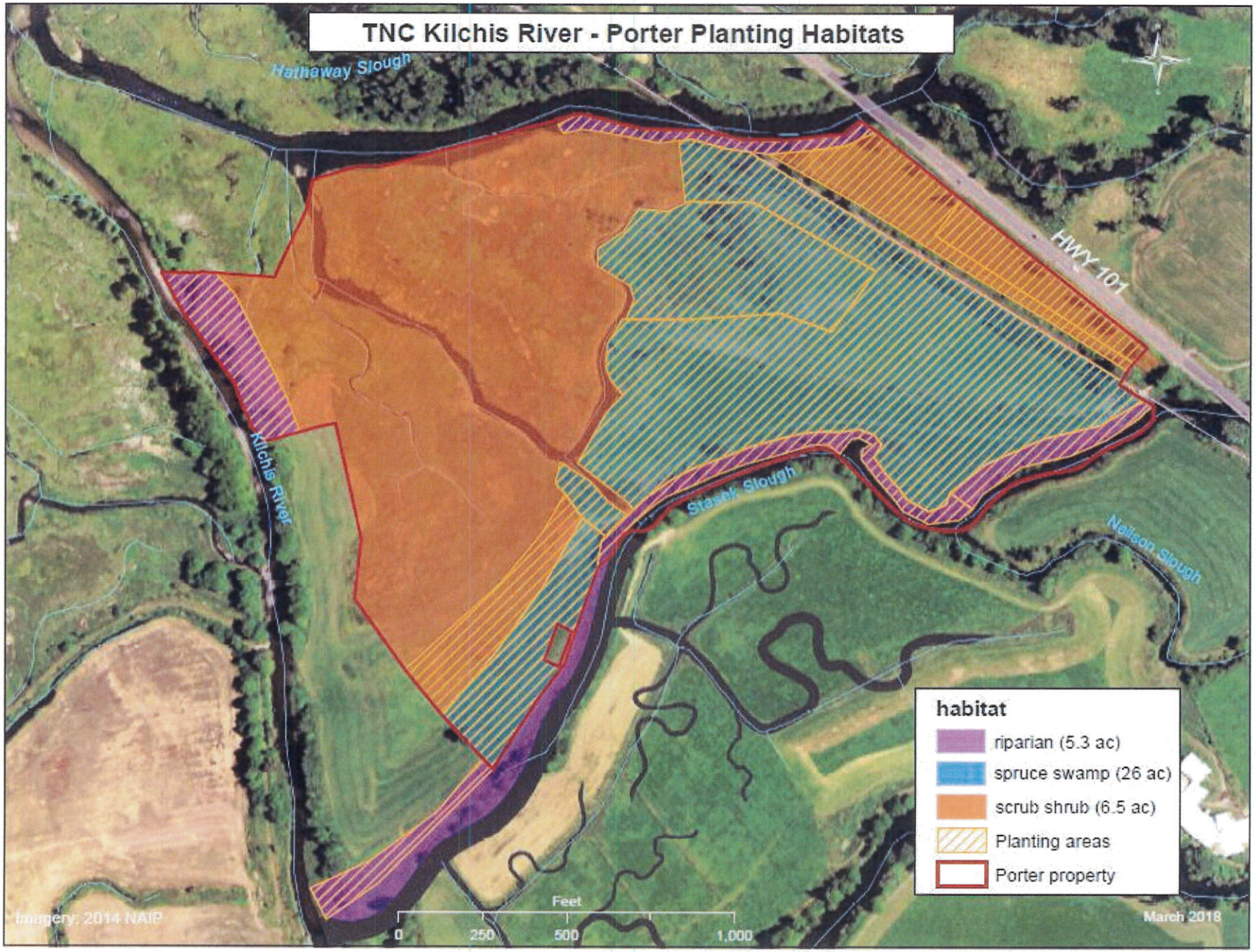


Figure 4 Kilchis Porter Habitats and Planting Areas, Tillamook County, Oregon

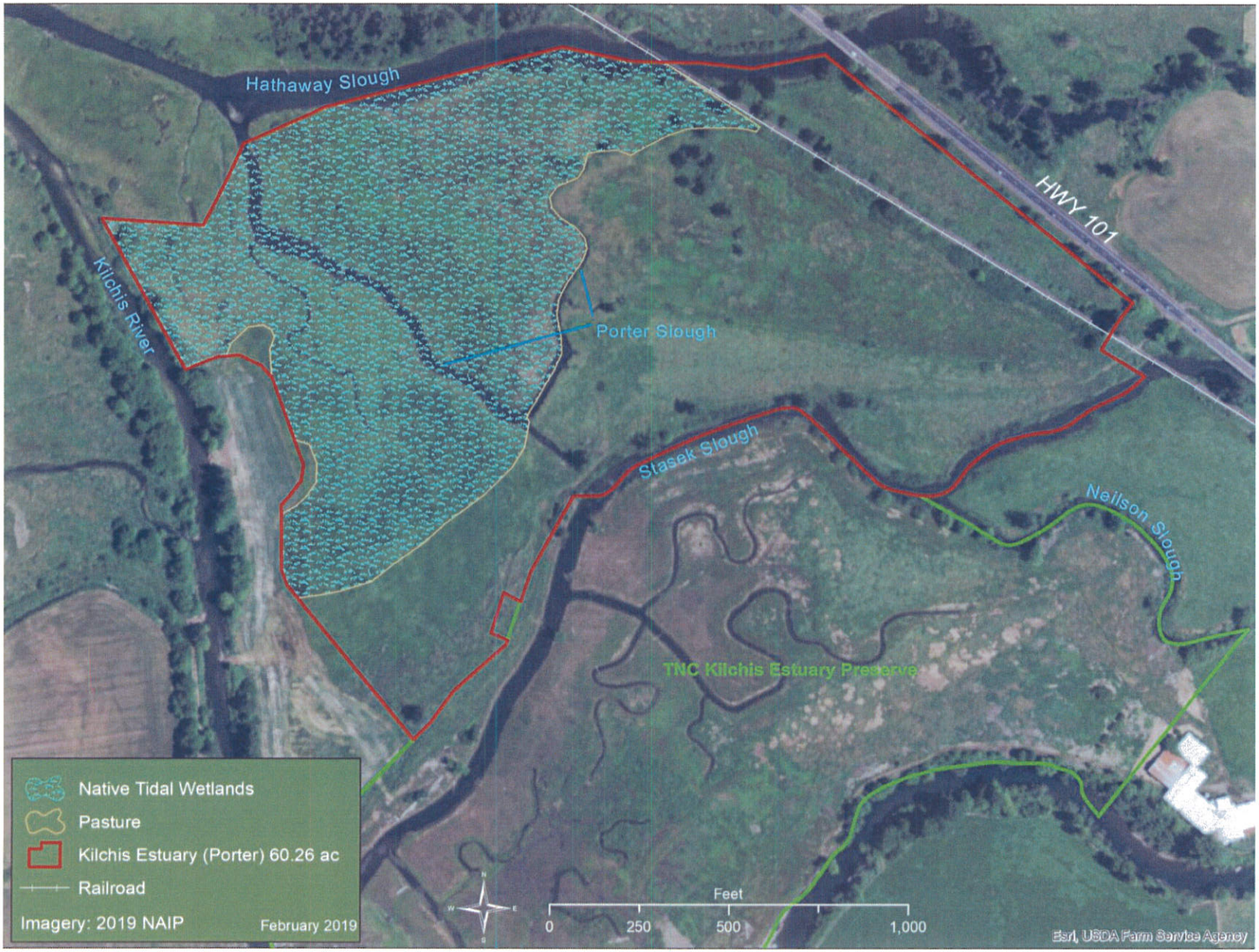


Figure 5. Native Tidal Wetlands, Kilchis Porter Project Area

DESCRIPTION & CRITERIA RESPONSES

Tillamook County Planning Permit Document

Kilchis Porter Tidal Wetland Restoration Project

The Nature Conservancy

Project Manager: Dick Vander Schaaf

October 16, 2019

Note: Highlighted areas are drafting notes and are addressed in Discussion sections that follow.

Outline for Tillamook County Planning Permit Document

A. Project Site and Design Overview

   Maps and Supporting Documents

B. Development Permit

   Development Permit Application

   Flood Hazard Overlay Zone

   Conditional Letter Of Map Revision (CLOMR)

C. Estuary Zone Criteria Compliance

   Estuary Natural Zone (EN)

   Estuary Conservation Zone 1 (EC1)

   Estuary Development Standards

D. Goal 17 Shorelands Criteria Compliance

E. Conditional Use Review

   Estuary and Farm Zones Criteria

   SB1517 Criteria

A. Project Site and Restoration Design Overview

The Kilchis Porter wetland restoration project is designed to restore tidal wetlands and wetland functionality to the 60-acre Porter tract owned by The Nature Conservancy (Figure 1). The eastern half of the site (~30 acres) was converted to pastures over 50 years ago while the west half (~30 acres) has remained in native tidal marshes. The site historically was covered by Sitka spruce swamp and scrub-shrub habitats that contained numerous tidal channels which provided

important aquatic habitat for juvenile fish and flocks of waterbirds. The east half of the property is separated from the west half by Porter Slough that diverges from the lower end of Hathaway Slough and then winds through the site. Porter Slough once allowed tidal waters to access much of the site through small tidal channels that branched from it. The site is bordered by Highway 101 on the east, Stasek Slough on the south, Hathaway Slough on the north and private farmland on the west. The Tillamook Bay Railroad line runs along the eastern border of the property parallel to Highway 101. A small part of the Porter tract borders the lower Kilchis River in the northwest corner of the site. There is no terrestrial public access to the Porter property but boaters can get to the site from the Kilchis River and the adjoining sloughs.

Tidal wetlands provide habitat for a wide range of species that are important to coastal ecosystems. Salmon utilize tidal marshes and aquatic habitats for rearing and refuge during high water events. Salmon species known to occur in the Kilchis River drainage include Chinook, Coho, and Chum as well as Steelhead and Sea-run cutthroat trout. Oregon Coastal Coho salmon are federally listed as a Threatened species. In addition to salmon, tidal marshes are important for many juvenile forms of marine species including Dungeness crab, rockfish, starry flounder and many others. Finally, the marshes host numerous waterbirds throughout the year including migrating ducks, seabirds, shorebirds and colonial birds such as great blue heron and egrets. The site also provides habitat for common wildlife species including many birds and small mammals.

The restored Porter tract wetlands will complement the Kilchis Preserve managed by The Nature Conservancy that is located immediately to the south and across Stasek Slough. The restored Porter wetlands will provide critical habitat to juvenile salmon as well as waterbirds and other species that utilize these habitats. The wetland restoration activities will occur on the eastern half the site which occupies 30 acres and was previously used as seasonal pasture and hayfields. The remaining 30 acres of the Porter tract on the west side of the site are already covered by native tidal wetland habitat and receive ongoing weed abatement stewardship actions.

A detailed account of proposed restoration activities is available in the site conceptual plan (W2R 2017), the 100% final engineering plans (W2R 2019a) and the 100% Final Basis of Design Report (W2R 2019b); all documents are included under separate covers.

The major wetland restoration activities include:

- Lower dikes along Hathaway and Stasek Sloughs, approximately 1070 linear feet of dike, to elevations that represent 2-year flood or annual exceedance levels of 9-10 feet; 2150 CY excavated materials
- Fill agricultural ditches, approximately 500 linear feet, 140 CY fill using excavated materials
- Re-create tidal channels, 5835 linear feet; 9790 CY excavated materials
- Remove 5 water control structures to allow for unrestricted tidal water access to the wetlands
- Remove the box culvert on the connector channel between Porter and Stasek Sloughs for improved tidal flow in the project area
- Build two light duty bridges over interior channels for site management and emergency access
- Re-vegetate the site with appropriate native wetland species
- Create elevated mounds from excess excavated materials and plant with wetland species

Restoration activities are discussed in the 100% Basis of Design Report and shown in detail in the 100% Engineering Plans that are attached. Special construction provisions are further defined in the Construction Specifications Report that is also attached.

The project area for the restoration activities is approximately 30 acres in size and is largely confined to the eastern half of the Porter tract. Ground disturbance due to restoration activities is estimated to affect approximately 7 acres of the site. Ground disturbance areas include temporary road and pathways, construction staging areas, areas of dike lowering and connector channel realignment, and locations of vegetated mounds. The areas of ground disturbance will have erosion control measures implemented including erosion control seeding mix applied to them and will be have additional revegetation efforts applied as well. The erosion control measures are specified in the 100% Engineering Plans. The entire project area of 30 acres will be subject to wetland revegetation activities. Approximately 13 acres have already been revegetated with native wetland species by The Nature Conservancy as part of the overall restoration work.

Maps and Supporting Documents—attached

Final Engineering Plan, 100% Design

Final Basis of Design Report, 100% Design

Construction Specifications: Special Provisions Report, Final Design

Conceptual Restoration Design Report

Hydrodynamic Modeling memo—enclosed

Army Corps of Engineers JAP Removal/Fill Permit—in progress

Kilchis Estuary Preserve Management Plan

Stamped engineer statement stating no project impacts to hydrology—enclosed

B. Development Permit

Development Permit Application and fee

Section 3.510 Flood Hazard Overlay (FH) Zone

Relates to FEMA FIRM maps

Regulatory Floodway is still east of Hwy 101

In FH zone (an AE zone is within FH), then need to file a CLOMR if any change in elevation of floods will occur (5) (page 9) or change in the boundary of the Special FH Area. File with FEMA, DLCD.

Section 3.510 (9) (f) notes that areas subject to tidal and overland flow influences are not subject to floodway determination of no rise (<1'). Includes Kilchis River below line C which corresponds to the railroad and/or highway alignment.

Discussion

The Develop Permit Application is included with this County permit review. The permit application details construction activities that will be undertaken in the project area. Relevant criteria for the permit are addressed below.

- **Fill:** The project is not within a Coastal High Hazard Area and it is not within a Regulatory Floodway. No fill associated with the project will be placed within either of these designations. Materials brought onto the site will consist of gravel and/or cobble to be used in substructures for the bridges to be constructed or for stabilizing construction staging areas or temporary roadways, the above-mentioned bridges located over Porter Slough (see engineering plans), and large logs that will be used as wood habitat structures in the tidal channels. Material generated on the site from excavation activities will be used on the site to fill drainage ditches according to the restoration plans. Any excess materials will be placed in vegetated mounds that are designed to provide topographic diversity at the site and elevated planting habitats. The mounds will not impede drainage or the flow of floodwaters on the site. Materials amounts generated by the excavations equal 9790CY; material from dike lowering equals 2150CY. Materials brought onto the site total 569CY: 400CY gravel, 129CY logs, 40CY bridge works.
- **Structures:** No enclosed structures will be developed in the restoration project. Five small water control structures will be removed from the site and two light-duty bridges will be constructed. Most of the water control structures are in deteriorated and non-functional condition. Thirty-three (33) wood habitat structures will be installed at the site within the re-created tidal channels to provide habitat diversity and to secure channel cross-sections and walls.

The project area lies entirely within the Flood Hazard Overlay Zone (FH) and classified on FEMA FIRM maps as in the AE zone with a base flood elevation of 12.5 feet (Figure 2). The designated Floodway lies to the east of Highway 101 and does not extend into the project area.

The proposed restoration project is designed to restore tidal marshes and tidal channels that support natural communities and native species. These restored habitats will also provide watershed benefits during high water events including flood conditions by providing additional off channel storage of flood waters. The benefits may extend beyond the project boundaries depending upon the severity of the flood conditions and combined effects of tidal waters and storm surge.

Section 3.510(9)(f) of TCLUO notes that the Kilchis River downstream of cross-section C is not subject to provision (e) which states that no development will occur unless it is demonstrated that it will not raise the water surface elevation of the base flood more than one foot. The project area is in the Kilchis River drainage and downstream of cross-section C that approximates Highway 101. The hydrodynamic model developed for the project shows that under base flood conditions (12.5 feet elevation for the site and project area), there will be no rise in water level elevations in the project area after restoration actions have been completed. The base flood elevation for cross-section C is 14.2 feet; this base flood elevation is used to evaluate impacts of the project on adjacent lands immediately east of Highway 101. Hydrodynamic model runs of post-restoration conditions determined that base flood levels will not be exceeded for areas east of Highway 101 along Stasek Slough.

FEMA Considerations: 3.510(5)(a) states that if a hydrologic analysis indicates in increase in flood levels, then a Conditional Letter of Map Revision (CLOMR) needs to be obtained from FEMA before development is permitted (TCLUO p.9). A LOMR is required post development after the CLOMR is filed or if conditions differ. The base flood elevation for the project area and for adjacent lands will not be affected by restoration activities, according to the hydrodynamic model runs, hence no CLOMR is required.

C. Estuary Zone (EN) Criteria Compliance

Section 3.100 Estuary Zones

Conditional Use—same criteria as EFU criteria for conditional use so can draft once

Section 3.102 Estuary Natural Zone

Porter site is within Estuary Management Unit EN30

Bridge Crossings and supports, see 3.102 (2) (g). uses permitted with standards.

Restoration, see 3.102 (3) (e), uses permitted conditionally. Conditional use criteria same as for EFU Zone and found in 3.040 (1) through (6). (page 2, TCLUO 3.040)

Restoration, see 3.102 (4) (c) regulated activities in conjunction with restoration. dredging or fill/removal

Discussion

The Kilchis Porter project area includes areas of mapped estuary zones (Figure 3) including Estuary Natural (EN) zoning and Estuary Conservation 1 (EC1) zoning, as well as areas that may qualify as estuary lands due to the presence of aquatic vegetation or are below the Mean Higher High Water (MHHW) line of 8.32 feet (Garibaldi Tidal Station, accepted 4-24-2018). The project area is within the Tillamook County Estuary Management Unit EN30. Some of the planned restoration activities are located within identified estuary zoned lands as portrayed in Figure 3.

Estuary lands can be used for farming; applicable Goal 3 (protection of farmlands) policies are addressed in the Farm zone policy section.

Restoration is a conditional use within Estuary Natural zoning (3.102(3)(e)). Conditional use criteria evaluation for the proposed restoration action in estuary zoned lands will be assessed together with the conditional use criteria evaluation for farmland zoning. Conditional use criteria for Estuary Natural zoning is detailed in TCLUO 6.040.

Restoration is a use permitted with standards for Estuary Conservation 1 Zone (EC1) as defined in TCLUO 3.106(2)(i). Procedure is defined in Section 3.120 and Standards are defined in Section 3.140. These sections will be discussed below.

The proposed restoration of the Porter project area includes tidal channel re-creation, lowering of dikes along portions of Stasek and Hathaway Sloughs, removal of dilapidated water control structures, installation of large wood structures, development of vegetation mounds and wetland revegetation. Restoration of the Porter tract supports the general priorities of estuary zones (TCLUO 3.100 (1)) by maintaining the integrity of the estuarine ecosystem and by not degrading or reducing the natural estuarine resources and values. The proposed restoration supports the primary purpose of EN zoning of preserving and protecting significant fish and wildlife habitats by re-establishing both the aquatic as well as the marsh habitats in the project area. The restoration will enhance the ability of the site to contribute natural productivity to the estuarine ecosystem of Tillamook Bay. In addition, it will provide for enhanced ecosystem function of tidal marsh habitats by restoring natural tidal flow to the site and by re-establishing tidal interactions within the marsh habitat.

Two, light-duty bridges that are not connected with public roadways are proposed for the site to facilitate restoration and site management. The bridges will also provide emergency access to the lower Kilchis River and to Hathaway Slough. Bridges are considered uses that are permitted with standards in EN zoning.

The proposed restoration activities for the Porter project area are detailed in the Basis of Design Report (W2R 2019a) and the 100% Engineering Plans (W2R 2019b). The activities will enhance restoration tidal wetland functionality to the site by improving access of tidal flow to the wetlands, restoring former aquatic habitat lost due to farming practices and revegetating the site with native wetland species. The restored tidal wetlands will provide essential habitat for juvenile salmon during high flow events and throughout time which they occupy freshwater and tidal habitats. The wetlands will also support habitat used by waterbirds, marine fishes and other species. Finally, the restored wetlands will provide flood control benefits within the watershed as the site will provide storage for excess waters during high river flows.

TCLUO 3.120 Review of Regulated Activities

Regulated activities include: a-Fill, b-Dredging, e-Shoreline stabilization

Review will entail assessment of Federal and State permits in conjunction with Zone requirements.

ACE permit and federal compliance notices.

Text Discussion

Necessary permits for the proposed restoration project, as detailed in the Engineering Plans (W2R 2019a) and Basis of Design Report (W2R 2019b) have been applied for from the US Army Corps of Engineers (ACE) and from Oregon Department of Environmental Quality (DEQ). The following permits have been received or applied for and are attached for review if they have been finalized by the agency.

- Permit NWP 218-197: Army Corps of Engineers, included within the Nationwide Permit 27 for restoring aquatic vegetation under Section 10 of the Clean Harbors Act. Received June 13, 2018.

- Removal/Fill Permit, Joint Application Permit (JAP): Army Corps of Engineers and Oregon Department of State Lands for removal and fill activities associated with restoration. Section 404, Clean Water Act.
- Water Quality Certification Permit: Oregon Department of Environmental Quality, Nationwide 401Water Quality Certification Approval. June 19, 2018.
- Federal Compliance with ESA, NEPA and NHPA for cultural resources: the ACE is the lead agency for federal compliance for the project.
- SHPO compliance: A cultural resource inventory is being conducted on the site to determine in advance of restoration activities the potential for disturbance of cultural resources. Results of the inventory will be made available to SHPO and local Indian tribes. Recommendations for future actions will be detailed in the results.

The restoration project is in the process of getting the necessary permits from state and federal agencies listed above. Each agency will require the project meets their own requirements as defined under each permit. Comments received from the permitting agencies to date have been incorporated in updated project designs that are included in the final engineering plans (W2R 2019a) attached with this application. The restoration project will not permanently degrade or reduce estuarine natural values; to the contrary, the project will enhance estuarine natural values.

TCLUO 3.140 Estuary Development Standards

(5) Dredging: in estuary zones, to create tidal channels

(a) necessary to produce public benefit (p. 7-8)

(k) to create new water surfaces or channels (p.9)

(m) impact assessment for estuarine waters dredging. See section 3.020.

(7) Fill. see whole section for specifics

(a) show public benefit (p. 12)

(d) in water work window

(f, g) erosion control measures used

(h) Clean water conditions, federal regulations

(10) Land transportation facilities

(15) Restoration and Enhancement: (p. 21-22) in estuary zones and shoreland overlay zone, standards (a) through (j)

Note (d), present evidence that restoration will result in overall improvement in cultural, historic, economic or navigation features, which will outweigh any adverse impacts. Can show: no degradation of above features, can show benefits to fish and wildlife species, benefits to flood control. Also in (e) state the project is consistent with protection of significant fish and wildlife habitats, research and education goals.

Discussion

Four sections of the Estuary Development Standards (3.140) may be pertinent to the Kilchis Porter tidal wetland restoration project application. They are discussed below:

- **Section (5) Dredging** estuarine waters and wetlands: Dredging typically takes place for navigation or other water dependent uses and does not characterize excavation activities that are associated with restoration. This restoration project will re-create tidal channels that will result in the excavation of natural materials including soil and rock. Water quality in nearby tidal sloughs will be protected by erosion controls including sediment fencing and straw waddles; see engineering plans (W2R 2019a) for details. All activities will be conducted during in-water work windows as established by ODFW. The project will result in enhanced tidal marsh and aquatic habitats at the site.
- **Section (7) Fill** in estuarine waters: Materials will be generated by excavation of tidal channels at the restoration project and by the lowering of dikes along portions of the tidal sloughs at the site. The materials will be used to fill former agricultural ditches at the site. Excess excavation materials will be used to create vegetated mounds that may rise 1.5-2.5 feet above the wetland surface and will provide slight topographic diversity to the site. The fill materials are required to meet the restoration goals for the site. All areas where fill is placed (ditches, mounds) will be located and shaped to minimize impeding flood waters across the site. The mounds will be seeded with erosion control grasses immediately after construction is completed to prevent sediment and turbidity in nearby sloughs. Mounds will be targeted with additional revegetation activities in the planting season. Locations of fill placement are detailed on the engineering plans provided. All fill related activities will take place during the in-water work window established by ODFW. Erosion prevention measures will be employed at fill locations; these are detailed in the engineering plans. The fill materials will be beneficial to the overall restoration design for the project area as they will add habitat diversity by way of the created mounds.
- **Section (10) Land Transportation Facilities:** The restoration project will remove a failing box culvert on the connector channel (ditch) between Stasek and Porter Sloughs. This box culvert was installed in 1965 to allow for drainage of farmlands east of Highway 101 along Stasek Slough. The culvert also provided access across the site to the west half of the tract as well as access to the lower Kilchis River. The project will place a light-duty bridge across the connector channel; the bridge will be used for site management activities and will be available for emergency access to the lower Kilchis River as needs arise. Such access was utilized as recently as 2015 to remove a logjam so it is a very real concern. A second light-duty bridge will be installed across Porter Slough at a crossing that currently has an undersized culvert. This crossing will provide management access to the north and west side of the site. The bridges are not connected to public roadways and will not be used by the public unless access is granted by the landowner on a limited basis. They will be positioned and maintained to allow for fish passage and will be constructed in such a manner to withstand expected winter high water flows and flooding. The connector channel and its connection with Stasek Slough

will be improved to enhance fish passage; see attached engineering plans for details. The bridges are consistent with Estuary Natural zoning resource capabilities and purposes; they are critical to the restoration and management of the site as well.

- **Section (15) Restoration and Enhancement:**

(a) Policy requirements in the Tillamook County Comprehensive Plan (Comp Plan) met. The Policy requirements are detailed under the Goal 16 Estuarine Resources section. The overarching objective of Goal 16 is:

To recognize and protect the unique environmental, economic and social values of each estuary and associated wetlands; and
To protect, maintain, where appropriate develop, and where appropriate restore the long-term environmental, economic, and social values, diversity and benefits of Oregon's estuaries.

Restoration is further defined in the Comp Plan in 6. Policies for Estuaries Uses, Section 6.12 Restoration and Enhancement.

1. *Habitat types...which are in the shortest supply as compared with historical abundance shall be identified as part of the restoration plan element.* The Porter project targets restoring spruce swamp as well as other tidal marsh habitats; spruce swamps have suffered the greatest percentage loss of any tidal marsh habitats in the state and over 90% loss in Tillamook County.
2. NA
3. *Revitalize functional characteristics and processes such as diked lands restoration, priority given to marginal, low-lying diked areas adjacent to estuarine wetland.* The Porter project will restore and improve functional aspects of the site by lowering dikes along sloughs and generally improving access of tidal waters to the former wetlands. The site is adjacent to natural tidal marshes as well as recently restored tidal marshes, thus increasing the overall viability of the entire Estuary Management Unit EN30. The project area is low-lying as represented by the scrub-shrub and spruce swamp tidal habitats that formerly occupied the site. It was only seasonally used for farming and was challenging due to high water levels and being largely undiked.

7. *Active restoration permitted in all estuary zones based upon requirements.*
(a) Estuary Natural Zone: limited to restoration of fish and wildlife habitat. The proposed restoration will increase the amount and the quality of rearing habitat for juvenile salmon. It will also provide additional foraging and resting habitat for a variety of waterbirds as well as for juvenile marine fishes and nongame species.

(b) The restored Porter project area will be restored to tidal marsh habitats specifically spruce swamp, scrub-shrub and riparian habitats (Figure 4), that will also include restored tidal channels; see engineering plans (W2R 2019a) for a complete depiction of restoration actions proposed. The restored areas were non-functioning habitat prior to restoration due to their loss of tidal flow and loss of tidal marsh vegetation. These losses were caused by the conversion of the site to farm use in the past century.

(c) *Estuary enhancement* will improve the current condition of the former tidal marshes that are currently dominated by non-native species and no longer support tidal channels that deliver tidal waters on incoming tides and provide habitat for aquatic species. The loss of these habitats is due to historic farming activities, primarily on the east half of the project area where restoration activities are concentrated. Proposed activities are documented in the attached engineering plans.

(d) *Improved conditions due to enhancement activities*. The proposed Kilchis Porter restoration project will improve the estuary habitat conditions at the site while not degrading other features present. The improved habitat conditions will provide increased rearing habitat for juvenile salmon that will result in improved condition of outgoing smolts and increased numbers of returning adults in the Kilchis drainage, according to studies done in comparable river systems (Nickelson 2012, Jones et al, 2014, Beamer et al, 2017). The improved salmon numbers may result in increases for recreational and commercial angler opportunities in future years. The restored wetlands may also have positive benefits for flood control as they will provide flood storage in some instances and will not result in significant impacts for adjacent lands according to hydrodynamic modeling results for the proposed project (W2R 2019 memo). The restored tidal wetlands will be a positive benefit to visitors to Tillamook County who enjoy the scenic railroad route that passes along the restored site. The visitors will see restored tidal wetlands and channels sited beside active farms, promoting the understanding that both activities can co-exist in proximity in the County. As a precursor to the restoration, the site will be surveyed for cultural resources and a report detailing findings will be developed. The survey will be followed up with on-site archeological monitoring during construction to document any cultural resources that may be discovered there. This survey and monitoring will further our knowledge of cultural resources in the area and will insure that any discovered resources will be adequately protected.

(e) *Evidence that project is of benefit to fish and wildlife.* Restoration of tidal marsh habitat has been shown to benefit salmon species that use these habitats for rearing before venturing out to sea. An enclosed letter from ODFW documents the benefits to fish and wildlife species that will come from the restored site (Knutsen 2019). Some of the best studies that document beneficial use have occurred in the Salmon River estuary, 50 miles south of Tillamook. Studies here showed that Chinook salmon smolts (Bottom 2005, Hering 2010) used both natural and restored marsh channels in the Salmon River. Other studies have shown the enhanced growth rates of salmon smolts reared in floodplain estuaries vs in riverine habitats (Jacob Katz, personal communication 2018). These results have also been supported for coho salmon as well (Nickelson 2012).

(i) *Dredge and fill activities.* All fill and removal activities will be reviewed by the appropriate permitting agencies and will be conducted according to the standards.

(j) *Shoreland Overlay zone standards.* The project area falls within a Significant Wetland Biological Habitat as defined in the Tillamook County Comprehensive Plan, Goal 17 Coastal Shorelands. Restoration is considered a Conditional Use in the

Shoreland Overlay zone and is subject to standards defined in TCLUO Section 3.140(15), Estuary Development Standards. Goal 17 Coastal Shoreland Protection is discussed below.

(k) Agencies notified of the restoration project include: ODFW, DSL, DLCD, EPA, USFWS, and ACE.

Literature Cited

Beamer, E., R. Henderson, C. Ruff, and K. Wolf. 2017. Juvenile Chinook salmon utilization of habitat associated with the Fisher Slough Restoration Project, 2009 - 2015. Report prepared for The Nature Conservancy, Washington.

Bottom, D. L., K. K. Jones, T. J. Cornwell, A. Gray and C. A. Simenstad. 2005. Patterns of Chinook salmon migration and residency in the Salmon River Estuary (Oregon). Estuarine Coastal and Shelf Science 64:79-93.

Hering, D. K. 2010. Growth, residence, and movement of juvenile Chinook salmon within restored and reference estuarine marsh channels in Salmon River, Oregon. MS Thesis, Oregon State University.

Jones, K.K., T.J. Cornwell, D.L. Bottom, L.A. Campbell, and S. Stein. 2014. The contribution of estuary-resident life histories to the return of adult *Oncorhynchus kisutch.* Journal of Fish Biology doi: 10.1111/jfb.12380.

Nickelson, T. 2012. Future analysis for wetlands restoration in the Coquille River basin: How many coho salmon might we expect to be produced? Report to The Nature Conservancy.

D. Goal 17 Shorelands Protection

TCLUO Section 3.545 Shorelands overlay zone

Discussion

Careful planning of activities in and around coastal shorelands is necessary to protect the environmental and economic resources and benefits derived from them. The State planning objective for coastal shorelands is to "conserve, protect, where appropriate develop and where appropriate restore the resources and benefits of all coastal shorelands". Most if not all of the Porter restoration site is within the Shorelands overlay zone (SH) as defined by Section 3.545 of the TCLUO. The restoration site falls within the category of Shorelands under 3.545 (3)(b) of Estuarine Element and Coastal Shorelands Element of the Comprehensive Plan as:

(1) Significant shoreland and biological wetland habitat.

The uses permitted within the Shorelands overlay zone reflect those permitted either outright or through conditional use in the underlying zone(s). Conditional uses under 3.545 (5) include estuarine restoration actions as subject to the standards in Section 3.140 (15), discussed

previously. Restoration will enhance and protect shoreland areas and habitats within the restoration project area.

E. Conditional Use Review

Section 6.010 Conditional use procedures and criteria

Estuary (6.040) and Farm (6.060) Zones Criteria for decision

Planning Application (see forms)

Application fee $1089

Compliance with estuary standards in 3.140 (sections 5,7,10, 15)

Discussion

Restoration is considered a Conditional Use within Estuary and Exclusive Farm Use zones, both of which occur in the project area. Restoration is a use that is consistent with the goals and policies of the Tillamook County Comprehensive Plan as detailed by Goal 16. Estuarine Resources goal, Goal 16, has its stated objective to protect, maintain, … and where appropriate restore the environmental …values of Oregon's estuaries (TCCP, Goal 16). Conditional use criteria for Estuary and Farm Use zones are similar and are discussed below relative to the proposed project.

The project area is an ideal candidate for restoration as it occupies former tidal marsh habitat that has good connectivity to tidal waters of Tillamook Bay via Hathaway and Stasek Sloughs that that border the property on two sides. The site is also ideal as it is relatively isolated from active farmlands being located all but adjacent to Tillamook Bay. The Kilchis Preserve owned by The Nature Conservancy borders the project area to the south, across Stasek Slough, and is dominated by restored tidal marsh habitat that is complementary to the intended restored marsh habitat on the project area. The project site also borders Highway 101 and the Tillamook Bay railroad line on its eastern border, both of which are located on elevated berms that are far above tidal and flood elevations and not affected by restoration. The project area will restore 30 acres of spruce swamp habitat, a habitat that has suffered 90% loss countywide and is very important for salmon rearing in associated tidal channels as well as providing habitat for other wildlife species.

The project area was formerly used for grazing and haying but it is largely unprotected from tidal and flood waters and could only be used seasonally; it was in disuse in recent years, in part because it also had challenging access issues being isolated by Highway 101 from the base farm. The site has few improvements on it that would impede restoration actions and the site size, 30 acres, is manageable in terms of doing the major restoration construction work is a single season which reduces any temporary impacts to the area.

The proposed restoration will return the property to tidal marsh habitat with natural vegetative communities and tidal channels being key aspects on the restored site. As the site is adjacent to tidal sloughs and existing marsh habitats it will fit into the surrounding lands both visually as well as functionally. The tidal wetlands character of the site will be especially apparent to

visitors who enjoy the Railriders business that traverses the railroad across the property; boaters on the sloughs will also be able to see the site from the adjacent waterways. Because of limited public access there won't be an appreciable increase in public use at the site.

The restored site will not interfere with adjacent land uses focused on farming as the project area is separated from farmlands by two existing tidal sloughs, Stasek and Hathaway, and by native wetlands that occur on the western border of the site. The site is also separated from adjacent land uses east of Highway 101 which runs along the eastern border of the site. Water levels in the adjoining sloughs will not be significantly affected by restoration actions as determined by the hydrodynamic model developed for the project. The restored wetlands will function as an overflow and storage zone for floodwaters, thus offering some minor flood relief to adjacent lands in the Kilchis drainage. The restored tidal channels and reconstructed connection between Stasek and Porter Sloughs will also promote more rapid drainage on lands located along Stasek Slough on the east side of Highway 101.

The proposed wetland revegetation efforts will be confined to the site and will not result in any spread of noxious weeds or native species to adjoining lands. TNC takes an active role in controlling noxious weeds on its ownerships as directed by the Kilchis Preserve Management Plan (attached). The native species used in the revegetation activities are not prone to spreading and are mostly wetland obligate species that are found in surrounding tidal swamps and marshes on the North Coast.

The restored site will also not interfere with any transportation uses along the Highway 101 corridor or the Tillamook Bay Railroad line, both of which occur along the eastern edge of the site. The Highway and railroad are located on berms that are elevated to 14.8 feet and 15.6 feet respectively, well above the base flood elevation of 12.5 feet for the site. Current users of the railroad line on the recreation-focused Railriders business, will get a firsthand view of active marsh restoration and newly restored natural habitats in Tillamook County. There is currently no public or deeded access across the project area so the restoration will not be a factor for any access issues and will not cause transportation-related concerns. An emergency corridor to the Kilchis River will be maintained across the restored site and a light-duty bridge over the connector channel replacing the failing box culvert will make emergency vehicle access possible.

The proposed use of the site will have no detrimental affect on existing solar energy systems, wind energy conversion systems or windmills. There are currently none of these systems in the immediate area and none are planned at this time. The proposed use is timely with regards to any potential impacts to public facilities and services as no existing facilities will be affected by the restoration or by the continued conservation actions at the site.

Farm Zone Wetland Restoration Criteria Compliance

Wetlands Restoration in EFU Zone, Section 6.060, Conditional Use Criteria (page 3)

a. Not force significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest use;
b. Not significantly increase the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use.

Discussion

Senate Bill 1517 was passed by the Oregon Legislature in 2016, establishing a pilot project in Tillamook County that would further regulate wetland restoration in EFU farmlands. The regulations created conditional use criteria to be met by certain wetland restoration projects in the County. The Porter Kilchis tidal wetland restoration falls within the project description defined by legislation.

The Porter Kilchis restoration project is proposed for a parcel of land in the lower Kilchis River watershed that is largely isolated from active farmlands. The 60 acre Porter tract is zoned approximately 35% estuary zoning (EN, EC1) and 65% farmland zoning (Figure 3). The 30 acre restoration project area is approximately 25% estuary zoning and 75% farmland zoning. There are no active forestry programs on neighboring lands. The project area, which is mostly to the east of Porter Slough and the connector channel, has shared property boundaries with farmlands that are either separated by natural waterways, native wetlands or Highway 101 (Figure 5).

The farmland across Stasek Slough to the south-east is owned by Prince Farms and is used for forage production, being cut 4-5 times a year. Farmland on the east side of Highway 101 is also owned or leased by Prince Farms and used for silage production. The farmland to the north of the project area across Hathaway Slough is managed by Averill Farm and used for grazing and forage production. This parcel is enclosed by a high dike with a tide gate. The farmland to the west of the Kilchis Porter project area is owned by Geinger Farms and used for forage production. Native tidal marsh habitat located on the TNC Porter tract lies between the Porter project area (east of Porter Slough) and the Geinger farmland. Geinger accesses this farmland parcel by fording the Kilchis River during summertime low flows.

The dairy farms in the surrounding area use their land base primarily for forage production which has traditionally been dominated by pasture grasses. These lands are also integral to the manure management programs for the farms. In the last ten years, many farms planted an increasing acreage in corn for silage but at least one neighboring farm replanted their fields to pasture grasses last year. This shows that farming practices continue to evolve and change with market forces.

The Kilchis Preserve—Dooher Tract which has been managed by The Nature Conservancy since 2010 has coexisted with neighboring farms for nine years. The Preserve had undergone tidal wetland restoration actions in 2015 and there have been no impacts to neighboring farmlands attributed to the restoration. Management of the Kilchis Preserve which includes the restored Dooher tract as well as the Porter tract, is directed by the Kilchis Preserve Management Plan (attached). The Conservancy has dedicated staff for preserve management located on the coast as well as staff located at its Oregon chapter office in Portland.

The restored Porter project area within the Porter tract will also not interfere with adjacent farmland management as it is separated from neighboring farmlands by Stasek and Hathaway Sloughs and by native wetlands that occur on the western portion of the Porter tract. The native wetlands will not be subject to major restoration activities. The Porter tract is separated from farmlands on its eastern border by Highway 101. Restoration activities on the Porter tract will primarily take place within the interior of the tract. Only a minor amount of low dike along Hathaway Slough will be lowered so there will be little increase in overland flow of high waters onto the Porter tract from the sloughs at peak tides.

The natural sloughs that border the restoration area significantly dampen any effects that raised water tables on the project area may have on farmlands that are on the opposite sides of the sloughs. The farmlands west of the Porter tract have been adjacent to natural tidal wetlands for many decades and will not suffer any increased impacts due to the restoration project that is proposed to take place on the eastern half of the Porter tract, east of the existing wetlands.

TNC and Geinger Farms exchanged native wetland acres under Geinger ownership for existing farmlands on the Porter tract before the acquisition was completed to protect both priority farmland and existing native wetlands. This exchange resulted in more acres being brought under active farmland management while protecting existing tidal wetlands that historically were too wet to farm.

Changing water levels in the sloughs adjacent to the project area are a primary concern for farmers who have lands that also border these natural sloughs. The sloughs are principally tidally influenced or in other words their water levels respond to and track tidal elevations under most conditions. The only time that water elevations in the sloughs do not track the tides is during high river flow events that cause overland flooding and may eventually back up flows to Tillamook Bay, restricting drainage of the sloughs. To assess the effects of the restoration on water levels in the project area, on the sloughs and the Kilchis River in the surrounding area, TNC contracted with W2R to develop a hydrodynamic model (see attached Hydrodynamic Model memo from NHC 2019). The model is based on waterway bathymetry and elevations of the surrounding area with inputs of water levels from water level loggers, tidal heights and projected river flows determined from nearby gauged rivers. The Kilchis River does not have a recording, water level gauge so data from the Wilson River is used with adjustments made to reflect the differing watershed size. The hydrodynamic model was initially developed for the Dooher tract restoration project and was recently updated to reflect potential effects of the 2015 flood that occurred in the region. Further refinement of the model has occurred to reflect the proposed hydrologic changes associated with the planned restoration at the Porter project area.

The hydrodynamic model was run under several scenarios that reflect current and restored wetland conditions under 1) low river flow (summer) conditions, 2) high river flow (winter) conditions, both under high and low tides, as well as base flood (100 year) conditions, again with high and low tide levels. The model showed relatively good results when compared against known water levels in the slough and the river derived from water level loggers that TNC has maintained in these waterways. Results are documented in the attached Conceptual Restoration Plan (W2R 2017) and in the hydrology effects memo specific to the hydrodynamic model (NHC 2019). Overall, the model predicts that water levels in the sloughs will not be significantly altered by restoration actions, either directly adjacent to the site or upstream of the site. As noted above in the discussion of the Flood Hazard Zone conditions (TCLUO 3.150), the base flood level for the project area of 12.5 feet will not be affected by the restoration and the base flood level of 14.2 feet for areas upstream or east of Highway 101 in the sloughs will also not be raised by restoration actions. A memo detailing the hydrologic effects of the proposed restoration project is enclosed along with an engineer's stamp of certification (W2R 2019).

The restored wetlands in fact will function as overflow and storage zones for floodwaters in the sloughs, thus offering some minor relief to adjacent lands in the Kilchis drainage during high flow conditions. The restored connector channel between Stasek and Porter Sloughs has been predicted by the hydrodynamic model to promote more rapid drainage on lands located upstream

along Stasek Slough on the east side of Highway 101, at least for several hours after the peak flood in flood conditions, due to less constrained flow through the re-engineered channel. Floodwaters can be a significant impact to farms as they affect farmlands, manure management and livestock. Restoration in the Porter project area will not exacerbate the impacts of flooding that already occur in the region.

Another concern is that the restoration will result in the spread of noxious weeds or native species to adjoining lands. TNC takes an active role in controlling noxious weeds on its ownerships. A management plan that details weed control management for the Kilchis Preserve is attached to this permit application. Restoration will not result in a spread of noxious species to adjacent farmlands as TNC will be aggressively managing detections of weeds through manual and chemical control. The herbicides that TNC uses for revegetation and weed abatement include glyphosate and trichlopyr. The herbicides are applied by trained, licensed applicators using spot-spray techniques with hand sprayers. These herbicides have recommended limitations on pastures used by lactating animals but none of the TNC lands are currently or will be used in the future for pasture or haying operations, thus there are no potential impacts to farm animals. Herbicide application is curtailed during wet weather and care is taken in application near waterways using appropriate surfactants. The native species used in the revegetation activities at the project are not prone to spreading and are mostly wetland obligate species that will not spread or become established in managed farm or pasture lands.

Additional concerns of wetland restoration impact on farmlands include enhanced wildlife damage and increased public use on private lands. Wildlife use may increase on the restored project area as natural habitats are improved but as there won't be any increases in food that attract geese, for instance, it is not expected to result in more geese being attracted to the site or surrounding farmlands. It has been suggested that deer could become more numerous on the restored site but wetlands don't offer the best habitat for deer so use will be limited. Public use is not expected to increase in the project area as there is no defined public access to the site. Therefore, public use is not expected to increase on neighboring farmlands.

TNC prides itself in being a good neighbor in the community as we bring land management expertise to our properties and we willingly share knowledge and what we learn from our sites with our neighbors. At the Kilchis Preserve, TNC has maintained a series of water level loggers in the created tidal channels, in the natural sloughs (Stasek, Nielsen and Hathaway) and in the Kilchis River. The water levels that have been recorded by these loggers are shared upon request to interested neighbors. We also share information about the restoration activities that we are managing at the site including how restoration actions are progressing, our weed management activities and any changes that we are noticing in wildlife and fisheries in the area. We remain interested in farming practices as well, and how the timing of them may affect the Preserve. Lastly, we stand ready and willing to assist neighbors with management issues that range from riparian management along sloughs to tidal water flow through waterways.

TNC believes that the proposed restoration meets the conditional use criteria of (a) not forcing significant change in accepted farm or forest practices on surrounding lands devoted to farm or forest use; and (b) not significantly increasing the cost of accepted farm or forest practices on surrounding lands devoted to farm or forest use. Adjacent farmlands will not experience rising water levels, increased wildlife depredation, or more public use because of the restoration on the Porter project area. Therefore, the adjacent farms should not be forced to make significant

changes to accepted farm practices due to restored wetlands on the Porter project area. The relatively isolated nature of the restoration site that lies west of Highway 101 should not pose a conflict to neighboring farms that do not share roads, access, fences or even close boundaries for the most part. Because of this, there should be no significant increase in costs of accepted farm practices due to the presence of the restored project area.

Tillamook County Planning Permit Documents

Kilchis Porter Tidal Wetland Restoration Project

October 17, 2019

The Nature Conservancy

Figures

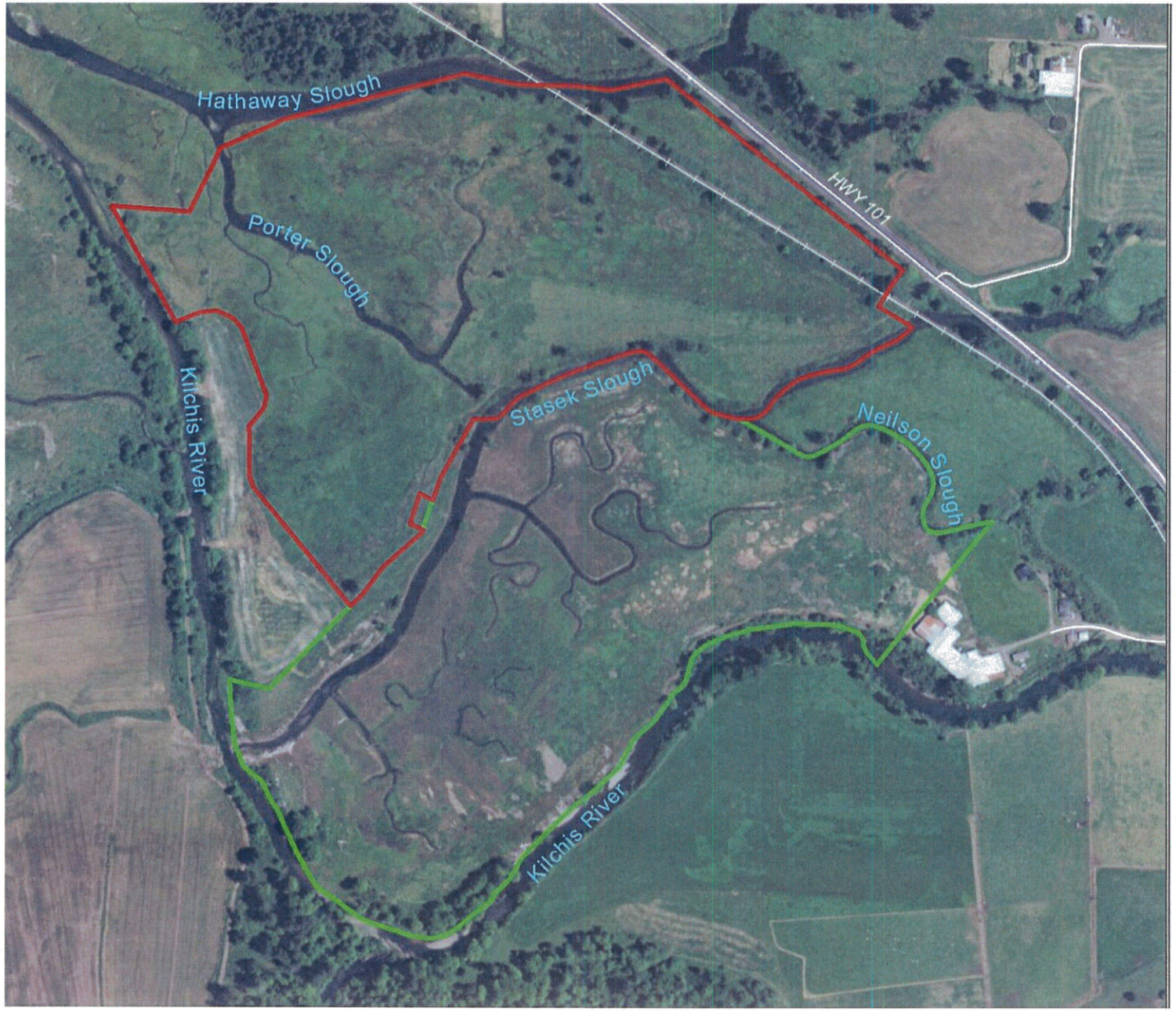


Figure 1. Kilchis Porter Project Area, Tillamook County Oregon. Project Area

Figure 2. FEMA FIRM Map of Project Area, Kilchis Porter Restoration, Map #41057C0576F, eff. 9/28/2018. Base flood elevation 12.5 feet.

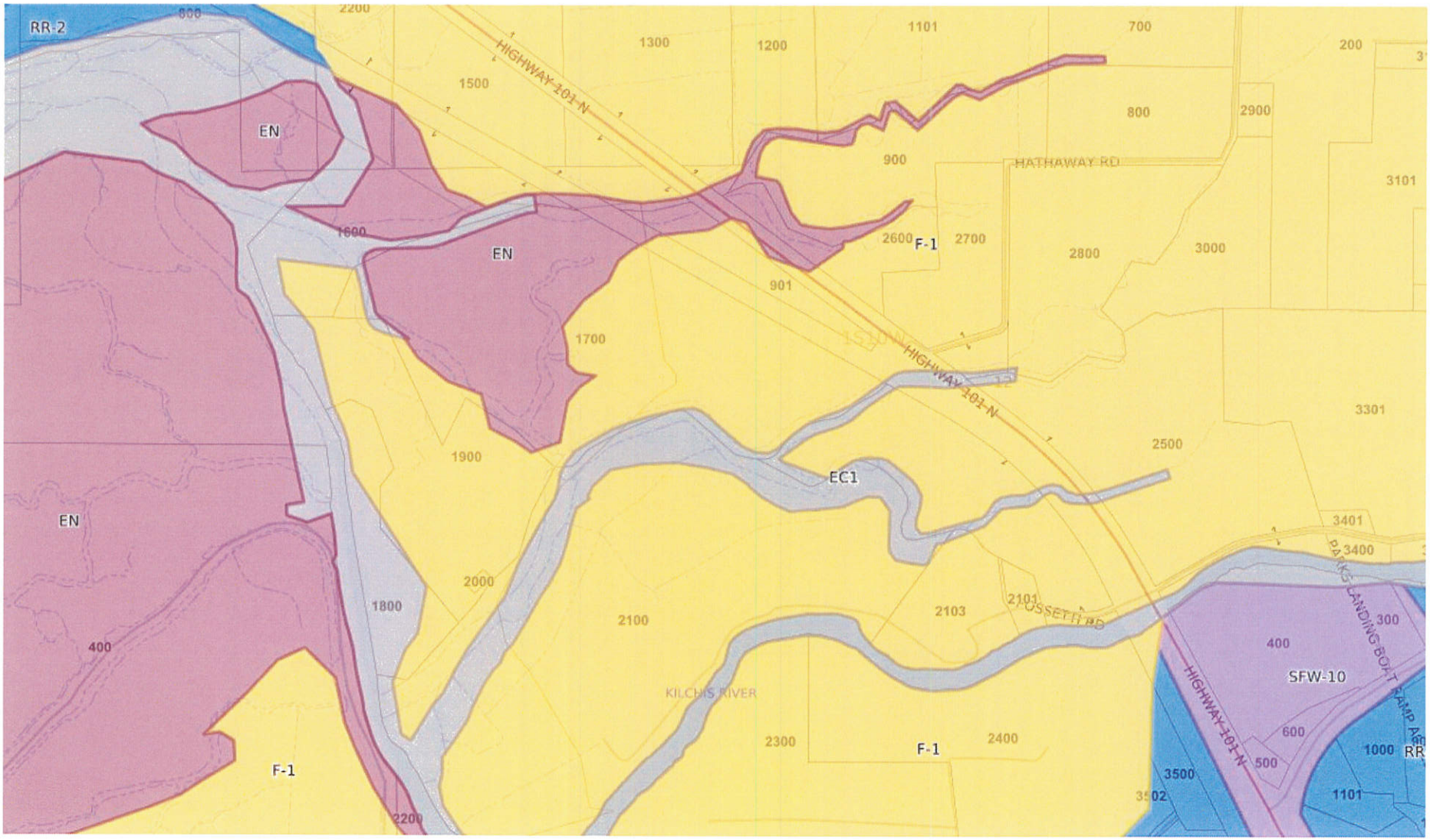


Figure 3. Tillamook County Zoning: Porter Tract and surrounding lands. Porter tract includes taxlots 1900, 1700 and 901. Restoration activities are largely confined to TL 1700 and 901. Zoning includes EN: Estuary Natural; EC1 Estuary Conservation 1; and F-1 Farmland.

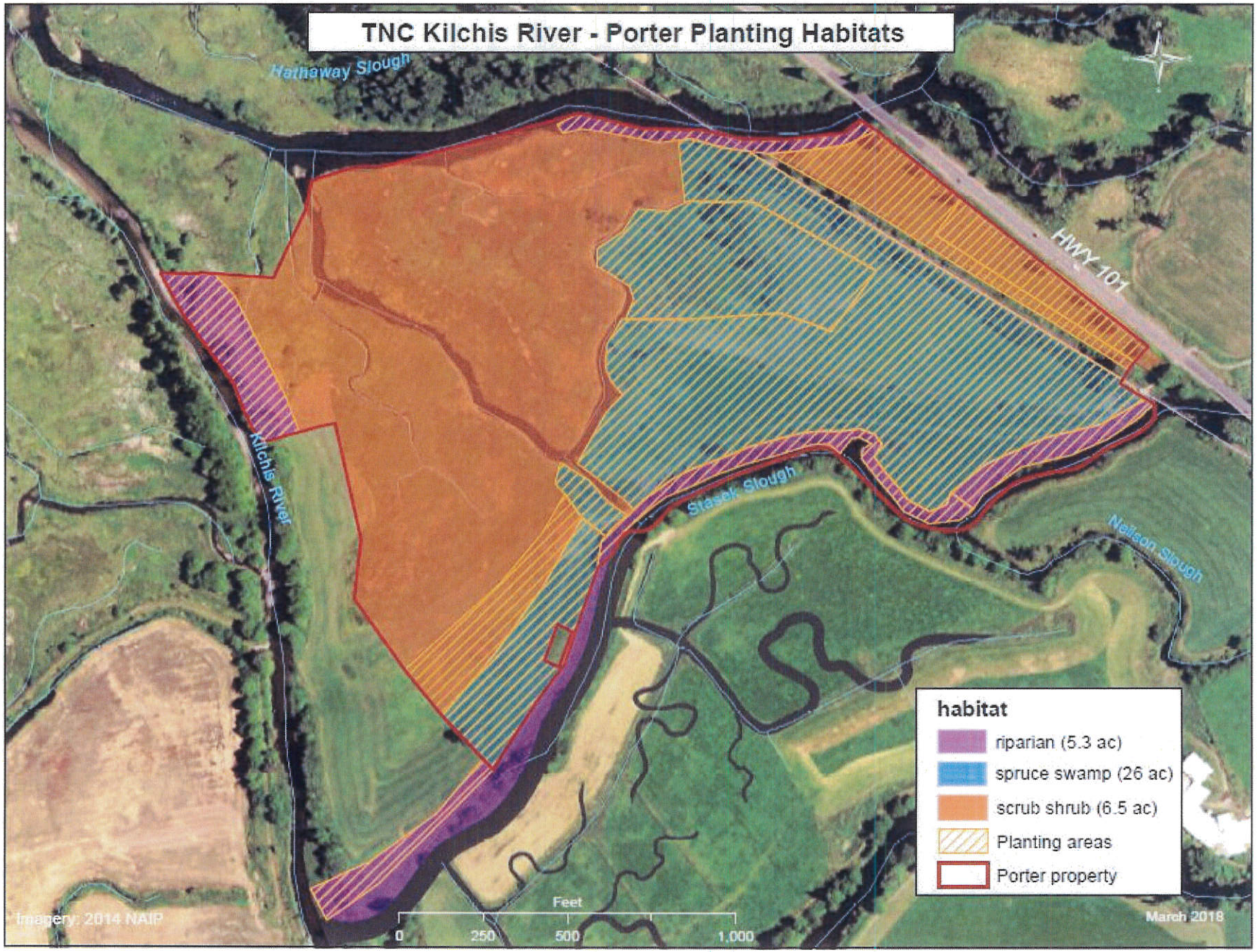


Figure 4 Kilchis Porter Habitats and Planting Areas, Tillamook County, Oregon

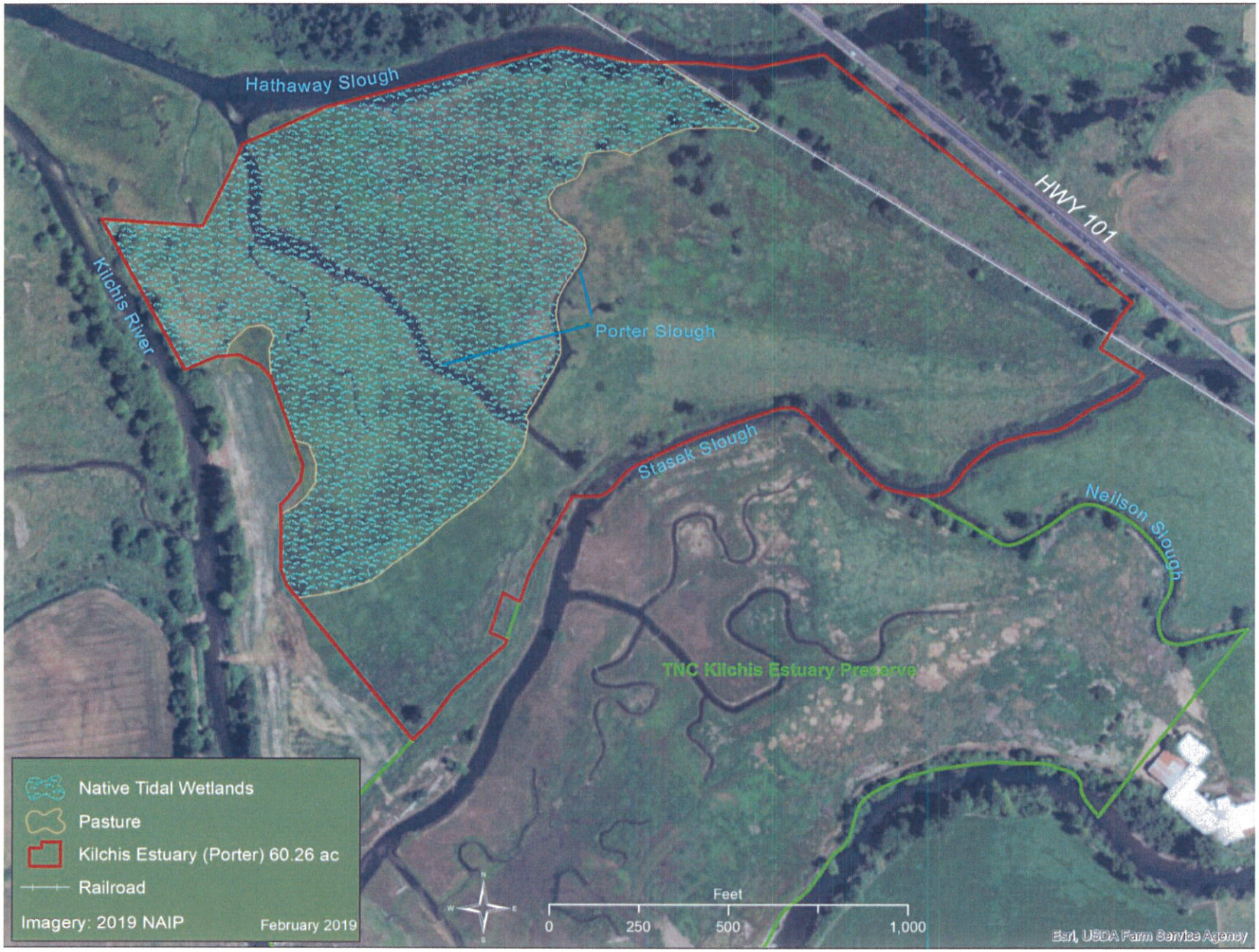
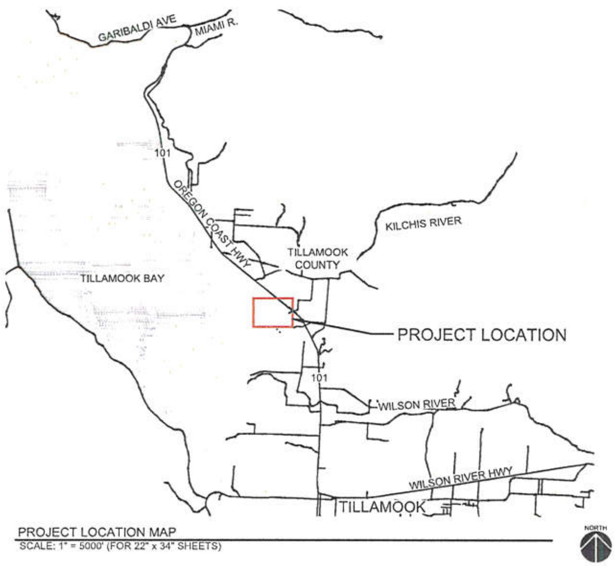


Figure 5. Native Tidal Wetlands, Kilchis Porter Project Area

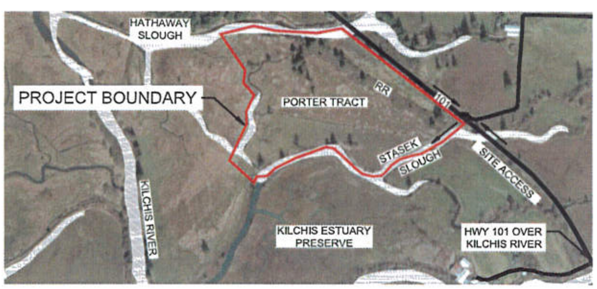
FINAL PLAN DESIGN VOLUME 1

PORTER TRACT ESTUARY RESTORATION

TILLAMOOK COUNTY, OREGON
THE NATURE CONSERVANCY
2019



PROJECT LOCATION MAP
SCALE: 1" = 5000' (FOR 22" x 34" SHEETS)



VICINITY MAP
1" = 500' (FOR 22" x 34" SHEETS)

SHEET INDEX

PROJECT OWNER

THE NATURE CONSERVANCY
DICK VANDER SCHAAF
821 SE 14TH AVENUE
PORTLAND, OR 97214
(503) 802-8100

PROJECT ENGINEERS

WOLF WATER RESOURCES
CURTIS LOEB, PE
AMANDA JONES, PE
JOE RULDOPH, ECOLOGIST
1001 SE WATER AVE , SUITE 180
PORTLAND, OR 97214
(503) 207-6688

GEOTECHNICAL ENGINEER

GEOTECHNICS LLC
ANDRE MARE, PE, GE
7629 SE HARRISON STREET
PORTLAND, OR 97215
(503) 730-2469

ODFW IN-WATER WORK WINDOW
JUL 1 TO SEP 30

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	AJ
DRAWN BY	AJ/JR
CHECKED BY	CL
APPROVED BY	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
COVER
TILLAMOOK, OR

JOB NO.
SHEET NO.
G1.0

ABBREVIATIONS

APPROX	APPROXIMATE
AVG	AVERAGE
BMP	BEST MANAGEMENT PRACTICE
BOT	BOTTOM
CAR	CONTRACTING AGENCY'S REPRESENTATIVE
CH	CHANNEL
CL	CENTERLINE
CLC	CENTERLINE OF CHANNEL
CP	CONTROL POINT
CY	CUBIC YARD
DEMO	DEMOLISH
DIA	DIAMETER
DTL	DETAIL
DWG	DRAWING
E	EASTING
(E) EXIST	EXISTING
EG	EXISTING GRADE
EL	ELEVATION
ESC	EROSION & SEDIMENT CONTROL
FG	FINISHED GRADE
FT	FOOT, FEET
GS	GROUND SPOT
IE	INVERT ELEVATION
IR	IRON ROD
JURISD	JURISDICTIONAL
MAX	MAXIMUM
MGMT	MANAGMENT
MHW	MEAN HIGH WATER
MHHW	MEAN HIGHER HIGH WATER
MIN	MINIMUM
MTL	MATERIAL
N	NORTHING
NAVD88	NORTH AMERICA VERTICAL DATUM 1988
NTS	NOT TO SCALE
N-S	NORTH TO SOUTH
OHW	ORDINARY HIGH WATER
RCG	REED CANARYGRASS
ROW	RIGHT-OF-WAY
SS	SIDE SLOPE
SHT	SHEET
SPEC	SPECIFICATION
STA	STATION
STD	STANDARD
TEMP	TEMPORARY
TOB	TOP OF BANK
TOE	TOE OF CHANNEL
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
WCS	WATER CONTROL STRUCTURE
WHS	WOOD HABITAT STRUCTURE
W/	WITH
WSE	WATER SURFACE ELEVATION
YPC	YELLOW PLASTIC CAP

CHANNEL NAME ABBREVIATIONS

DU	DUNLIN
PL	PLOVER
SA	SANDPIPER
SN	SNIPE
TU	TURNSTONE
HE	HERON

GENERAL NOTES

1. IN-WATER WORK WINDOW: JULY 1 - SEPTEMBER 30. NO IN WATER WORK OUTSIDE OF THIS TIME FRAME WITHOUT SPECIAL WRITTEN APPROVAL.
2. GROUND CONTROL SURVEY PROVIDED BY STATEWIDE LAND SURVEYING, 2012 TO 2017.
   HORIZONTAL DATUM: STATE PLANE, OREGON NORTH ZONE, NAD83, US INTERNATIONAL FEET
   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
3. TOPOGRAPHY CONTOURS BASED ON LIDAR.
4. CONTRACTORS WORKING IN PUBLIC ROW SHALL BE LICENSED FOR THEIR WORK AND MAINTAIN LIABILITY INSURANCE REQUIREMENTS CONSISTENT WITH TILLAMOOK COUNTY'S UTILITIES ORDINANCE. EVIDENCE OF INSURANCE SHALL BE PROVIDED TO THE TILLAMOOK COUNTY ROAD DEPARTMENT.
5. CONTRACTOR IS RESPONSIBLE FOR MEETING ALL STATE & COUNTY TRAFFIC SIGNAGE AND/OR FLAGGING REQUIREMENTS.
6. CONTRACTOR IS RESPONSIBLE FOR MEETING ALL PERMIT REQUIREMENTS. ANY FINES INCURRED DUE TO PERMIT VIOLATIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. THE CONTRACTOR IS RESPONSIBLE FOR VISITING THE SITE AND OBSERVING SITE CONDITION IN ALL WORK AREAS PRIOR TO BIDDING.
8. LAND SURFACE ELEVATIONS WITHIN THE WORK AREA RANGE FROM 6 FT TO 15 FT NAVD88. WORK AREA IS PROTECTED BY DIKE W/ LOW POINT OF APPROX 10 FT NAVD88.
9. PREDICTED TIDE ELEVATIONS DURING CONSTRUCTION ARE BETWEEN 3 FT AND 9 FT NAVD88. BETWEEN JULY AND OCTOBER, THE HIGHEST PREDICTED TIDE IS 9 FT NAVD88.
10. ALL QUANTITY ESTIMATES ARE APPROXIMATE.
11. PROPERTY BOUNDARY PER C. WAYNE COOK LAND SURVEYING PARTITION SURVEY ("REBOB SURVEY") SEP 2010 VIA TNC.

SURVEY CONTROL POINTS

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	686162.42	7341923.80	14.81	SET HUB AND MAG
2	685500.47	7340454.41	9.77	SET MAG NAIL
3	685545.47	7340513.24	11.19	SET NAIL SPIKE RPC
4	685546.88	7340386.05	9.53	SET NAIL SPIKE RPC
5	685143.31	7340293.08	9.61	FD 5/8" IRON ROD YPCTERRY JONES
6	685039.97	7340255.53	9.64	FD 5/8" IRON ROD YPCTERRY JONES
7	685058.01	7340205.66	9.51	FD 5/8" IRON ROD YPCTERRY JONES
8	685161.41	7340243.34	9.54	FD 5/8" IRON ROD YPCTERRY JONES
9	685628.87	7340269.87	9.46	SET NAIL SPIKE RPC
10	685632.48	7340563.96	9.18	SET NAIL SPIKE RPC
11	685880.40	7342192.61	16.63	SET 5/8 IR LGCAP
12	685854.70	7341996.47	15.62	SET 5/8 IR LGCAP

FLOOD / TIDAL WATER LEVELS	ELEV (FT NAVD88)
100 - YR BASE FLOOD	12.0
10 - YR	11.5
JURISD OHW	11.4
5 - YR	10.8
MHHW	7.8
MHW	7.0
MTL	3.9
NAVD88 DATUM	0.0
MLLW	-0.3

NOTICE TO EXCAVATORS:
ATTENTION: OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THE RULES BY CALLING THE CENTER.
(NOTE: THE TELEPHONE NUMBER FOR THE OREGON UTILITY NOTIFICATION CENTER IS 503-232-1987).

POTENTIAL UNDERGROUND FACILITY OWNERS
Dig Safely.
Call the Oregon One-Call Center
DIAL 811 or 1-800-332-2344

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2018 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

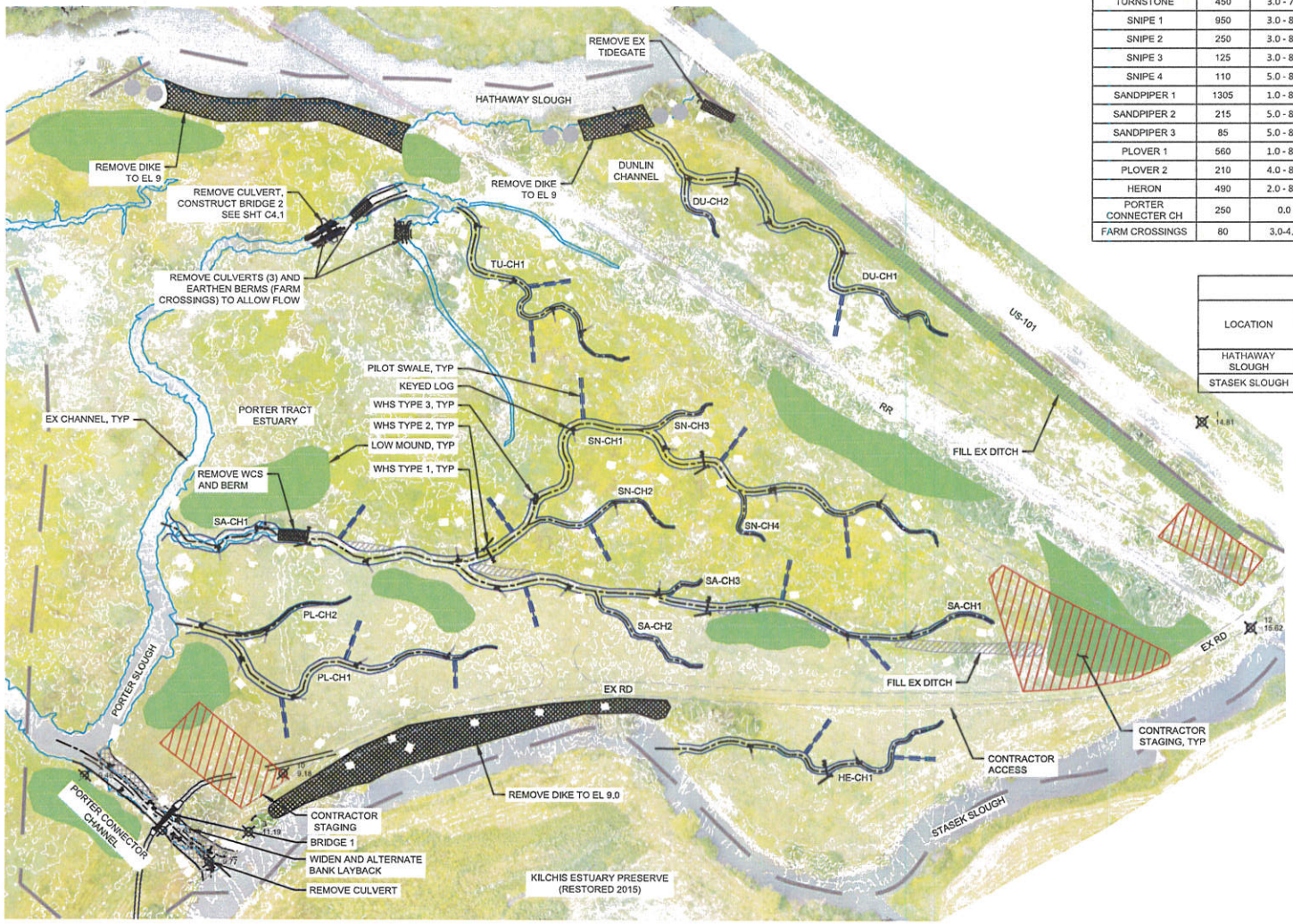
FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
NOTES & ABBREVIATIONS
TILLAMOOK, OR

JOB NO.

SHEET NO. G1.1

DWG: Z:\Shared\W2r\CAD\20170002-TNC-Kilchis\DWG\G1.1 NOTES - ABBREVIATIONS.dwg USER: User
DATE: Feb 18, 2019 1:20pm XREFS:X-TB-22X34-TNC PORTER-GIS BASE



PLAN - SITE OVERVIEW

N

SCALE

80 0 40 80 160

SCALE FEET

CHANNEL EXCAVATION - SUMMARY TABLE

CHANNEL SEGMENT	APPROX LENGTH (FT)	BOTTOM ELEVATION (FT NAVD88)	APPROX BOTTOM WIDTH (FT)	APPROX TOP WIDTH (FT)	APPROX CHANNEL AREA (SF)	APPROXIMATE EXCAVATION VOLUME (CY)
DUNLIN 1	710	1.0 - 7.0	2 - 8	3 - 16	8,485	1,150
DUNLIN 2	125	4.0 - 7.0	2 - 6	3 - 11	575	150
TURNSTONE	450	3.0 - 7.0	2 - 6	3 - 13	2,850	555
SNIPE 1	950	3.0 - 8.0	2 - 8	3 - 15	11,050	1,300
SNIPE 2	250	3.0 - 8.0	2 - 4	3 - 10	1,615	195
SNIPE 3	125	3.0 - 8.0	2 - 4	3 - 9	585	150
SNIPE 4	110	5.0 - 8.0	2	3 - 7	575	150
SANDPIPER 1	1305	1.0 - 8.0	2 - 12	3 - 20	17,985	2,910
SANDPIPER 2	215	5.0 - 8.0	2 - 4	3 - 10	1,530	150
SANDPIPER 3	85	5.0 - 8.0	2 - 4	3 - 7	500	150
PLOVER 1	560	1.0 - 8.0	2 - 8	3 - 20	6,010	1,055
PLOVER 2	210	4.0 - 8.0	2 - 6	3 - 12	1,340	180
HERON	490	2.0 - 8.0	2 - 6	3 - 12	4,035	605
PORTER CONNECTER CH	250	0.0	12	30-40	5,035	1,430
FARM CROSSINGS	80	3.0-4.0	5	15	1,200	180
					TOTAL	10,320

DIKE REMOVAL - SUMMARY TABLE

LOCATION	APPROX LENGTH (FT)	APPROX TOP WIDTH (FT)	APPROX DEPTH (FT)	APPROX REMOVAL AREA (SF)	APPROXIMATE EXCAVATION VOLUME (CY)
HATHAWAY SLOUGH	450	22	3.0	9,900	1,300
STASEK SLOUGH	620	45	2.0	22,500	1,670
				TOTAL	2,970

NOTES:

1. ENTER SITE AT DESIGNATED ENTRANCE POINT UNLESS APPROVED BY ENGINEER.
2. USE APPROPRIATE TRAFFIC CONTROL MEASURES WHEN ENTERING PUBLIC ROADWAY, SEE SPECIFICATIONS.
3. ALL ACCESS ROUTES AND SITE ENTRANCES SHALL BE RESTORED ACCORDING TO SPECIFICATIONS AND SEEDING PLAN.
4. CONSTRUCT CHANNELS HERE ON AND PER CHANNEL LAYOUT SHEETS. KEEP EXISTING DIKES AND CHANNEL CONNECTION IN PLACE UNTIL GRADING IN THE CENTER OF THE SITE IS FINISHED. DO NOT REMOVE THE BERM AND CULVERT AT THE PORTER CONNECTION CHANNEL UNTIL THE CHANNEL GRADING AND BRIDGE HAS BEEN FINISHED.
5. SEE ESC1.1 FOR EROSION CONTROL.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2005
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC
1001 SW 5TH AVE, SUITE #1100
PORTLAND, OR 97214
503.207.6668

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
2	2/15/19	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

SITE OVERVIEW

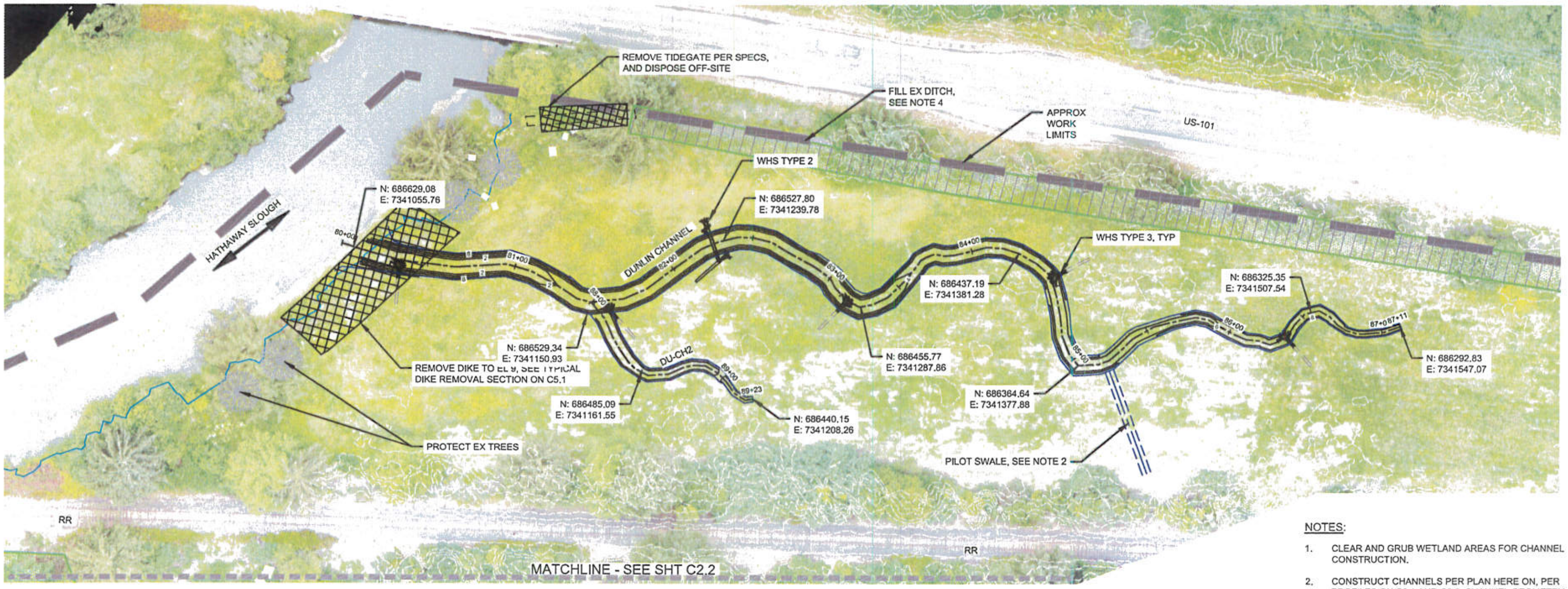
TILLAMOOK, OR

JOB NO.

SHEET NO.
C1.1

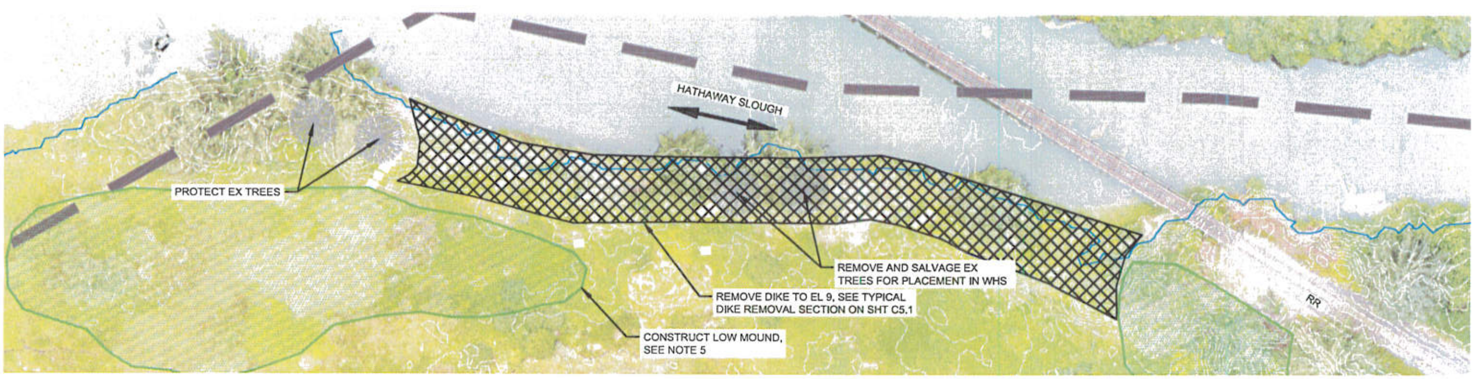
DWG: Z:\Shared\Wrz\CAD\20170020-TNC-Kilchis\DWG\C1.1 OVERVIEW.dwg USER: lber
DATE: Feb 18, 2019 1:21pm XREFS:X-TB-222X34-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE

DWG: Z:\Shared\W2r\CAD\20170002-TNC-Kilchis\DWG\C2.1-C2.X CH LAYOUT.dwg USER: User
DATE: Feb 18, 2019 1:23pm XREFS:X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE



PLAN - NORTHERN CHANNELS

SCALE
30 0 15 30 60
SCALE FEET



PLAN - HATHAWAY SLOUGH BERM REMOVAL

SCALE
30 0 15 30 60
SCALE FEET

NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON, THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2016
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

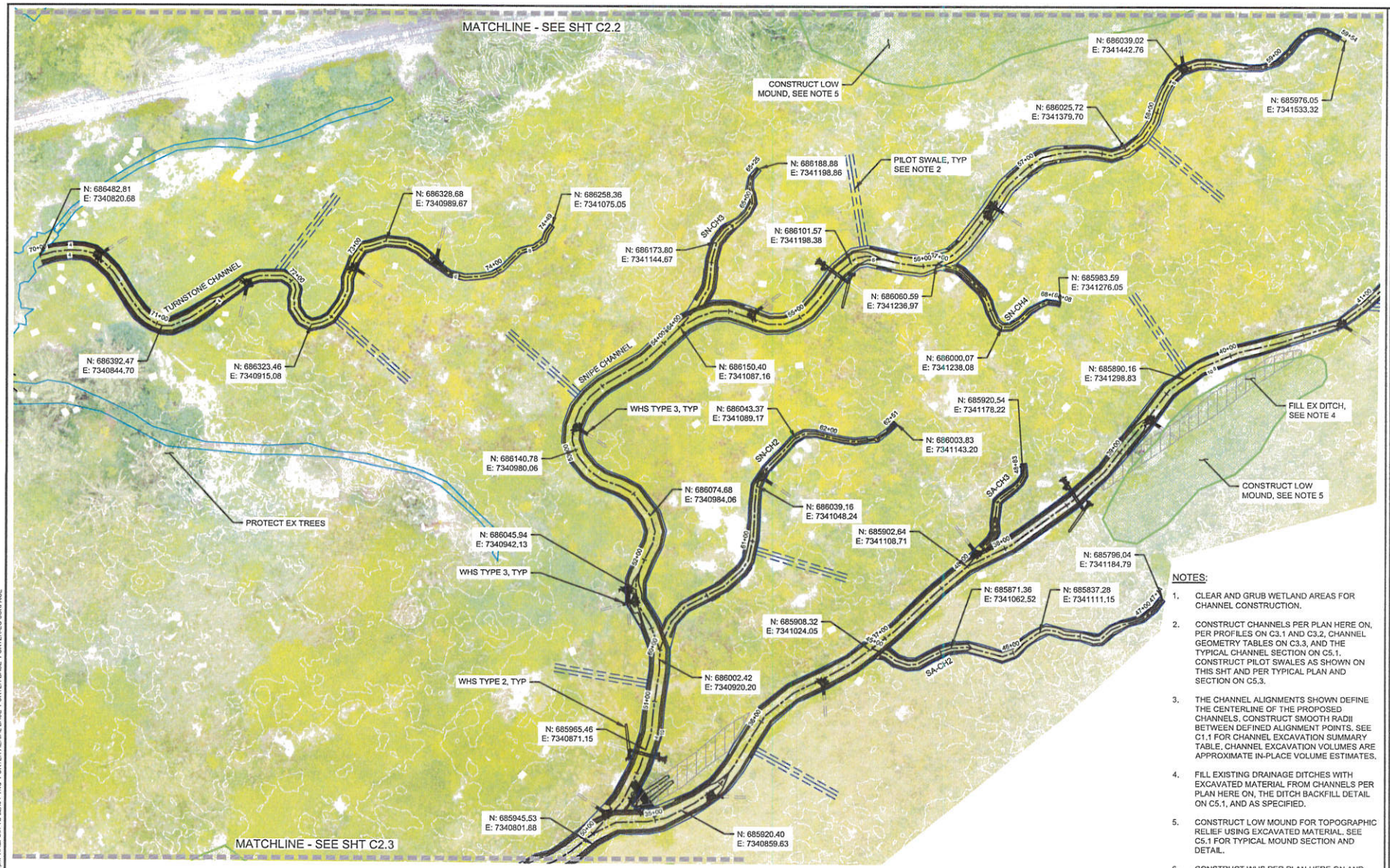
THE NATURE CONSERVANCY
PORTER TRACT

CH LAYOUT & GRADING PLAN 1

TILLAMOOK, OR

JOB NO.

SHEET NO.
C2.1



PLAN - CENTRAL CHANNELS

SCALE

30 0 15 30 60

SCALE FEET

NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON. THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2019
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SW 5TH AVE, SUITE #1160
PORTLAND, OR 97214
503.227.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	3/13/19	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

CH LAYOUT & GRADING PLAN 2

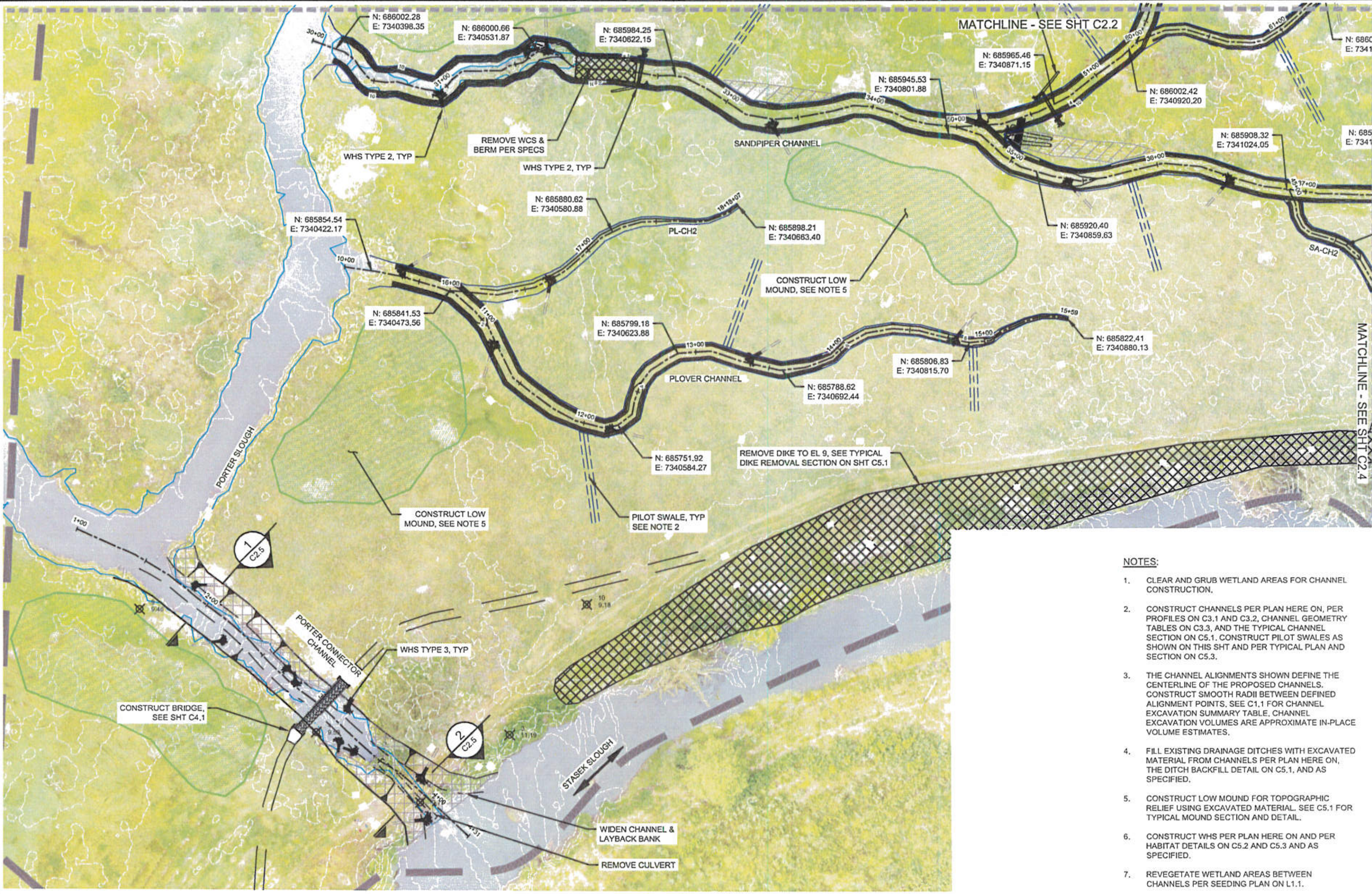
TILLAMOOK, OR

JOB NO.

SHEET NO.
C2.2

DWG Z:\Shared\Wgv\CAD\2017\002-TNC-Allen\DWG\C2.1-C2.X CH LAYOUT.dwg USER User
DATE Feb 18, 2019 1:24pm XREFS:X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE

DWG: Z:\Shared\W2r\CAD\20170002-TNC-Kilchis\DWG\C2.1-C2.X CH LAYOUT.dwg USER: Amanda-PC
DATE: Feb 18, 2019 2:32pm XREFS:X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE



PLAN - CENTRAL CHANNELS

SCALE
30 0 15 30 60
SCALE FEET

NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON, THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR. 8, 2019 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	AJ
DRAWN BY	AJ/JR
CHECKED BY	CL
APPROVED BY	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN
		REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

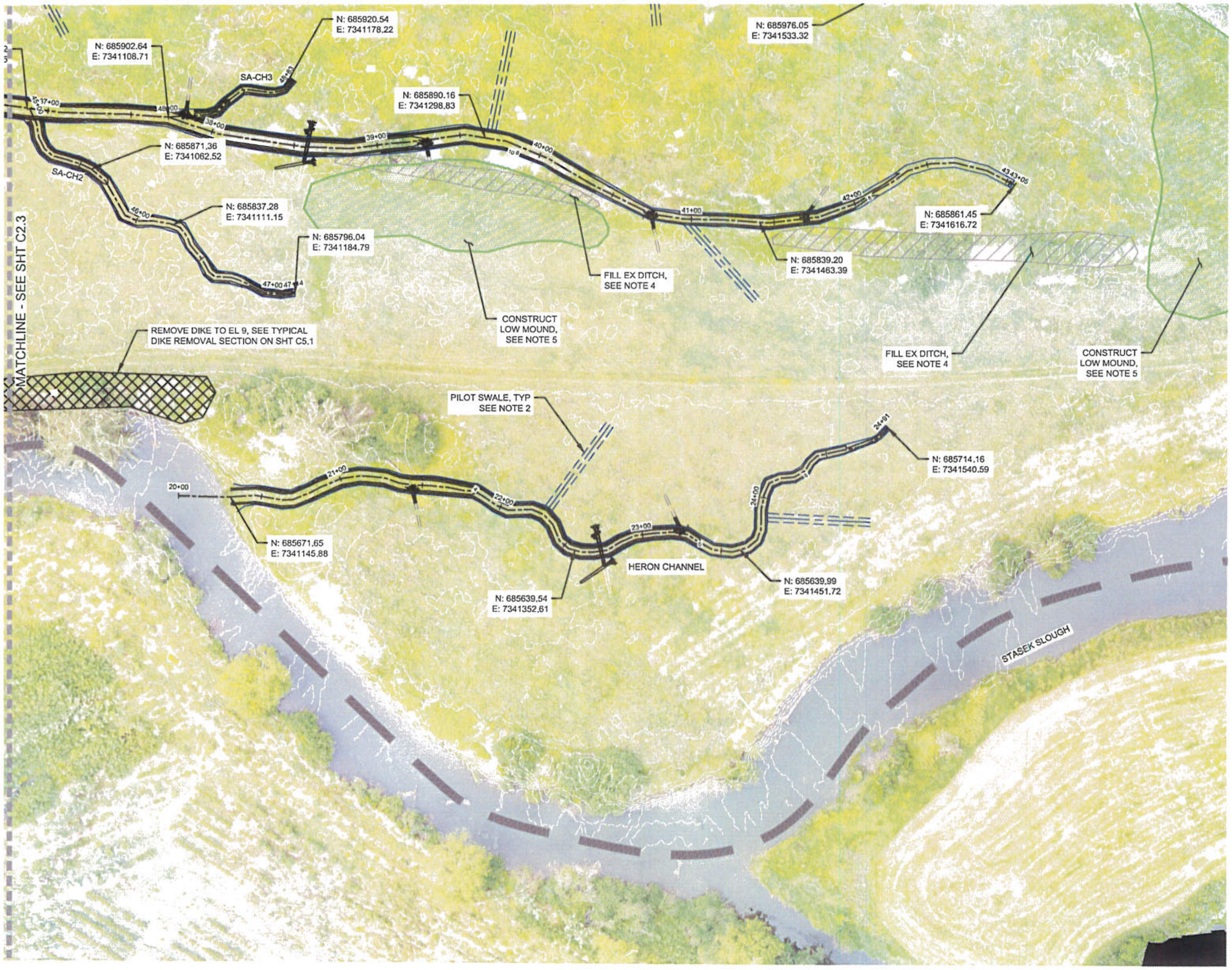
CH LAYOUT & GRADING PLAN 3

TILLAMOOK, OR

JOB NO.

SHEET NO.
C2.3

DWG: Z:\Shared\W2r\CAD\20170002-TNC-Kilchis\DWG\C2.1-C2.X CH LAYOUT.dwg USER: User
DATE: Feb 18, 2019 1:25pm XREFS:X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE



PLAN - SOUTHERN CHANNELS

SCALE
30 0 15 30 60
SCALE FEET

NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON, THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR. 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

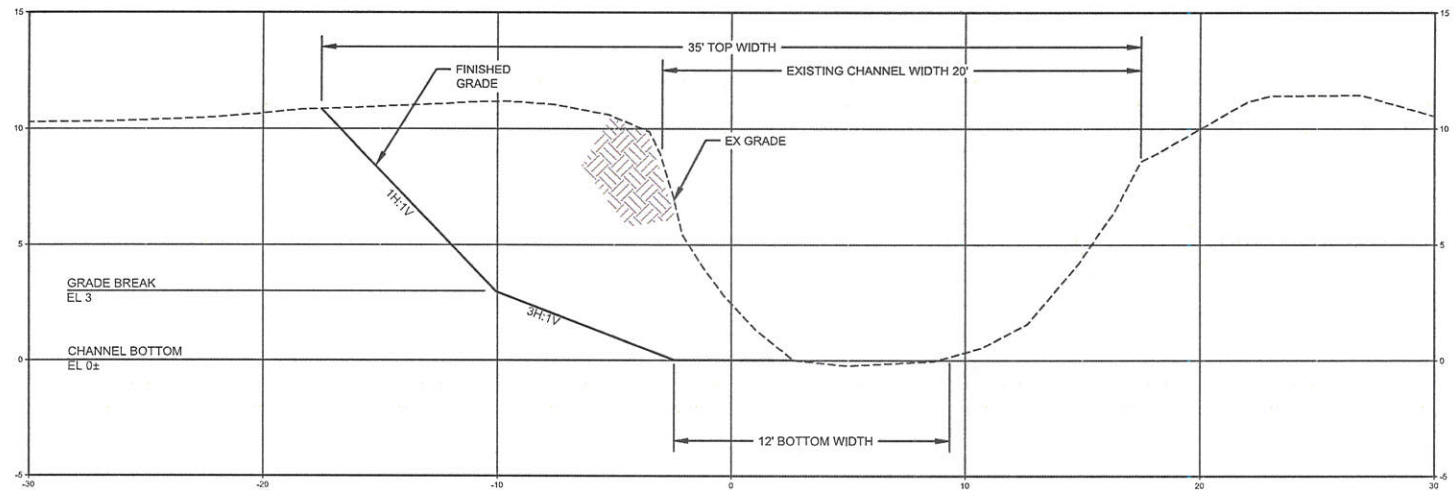
THE NATURE CONSERVANCY
PORTER TRACT

CH LAYOUT &
GRADING PLAN 4

TILLAMOOK, OR

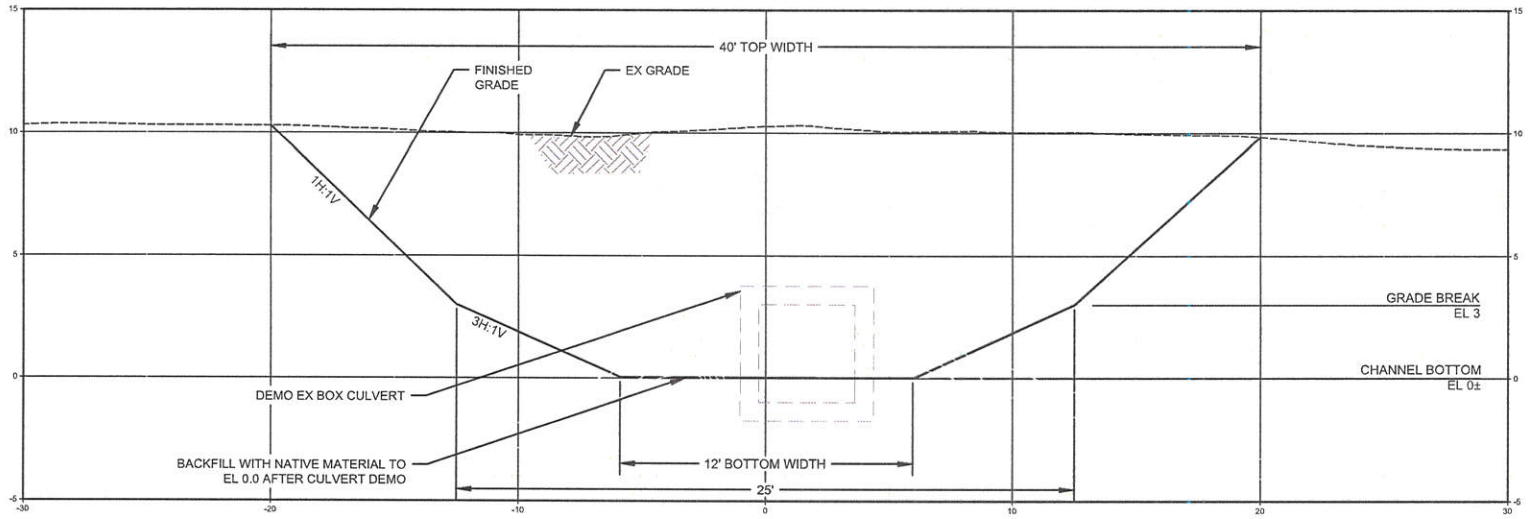
JOB NO.

SHEET NO.
C2.4



SECTION 1 - PORTER CROSSING DOWNSTREAM OF BRIDGE

SCALE: 1" = 3'



SECTION 2 - PORTER CROSSING UPSTREAM OF BRIDGE

SCALE: 1" = 3'

NOTES:

1. SECTIONS ARE SHOWN LOOKING EAST (UPSTREAM).
2. SECTIONS ARE 1H:1V.
3. VERTICAL DATUM IS NAVD88 IN FEET.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC
1001 SE WATER AVE, SUITE #160
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/19	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

CONNECTOR CHANNEL SECTIONS

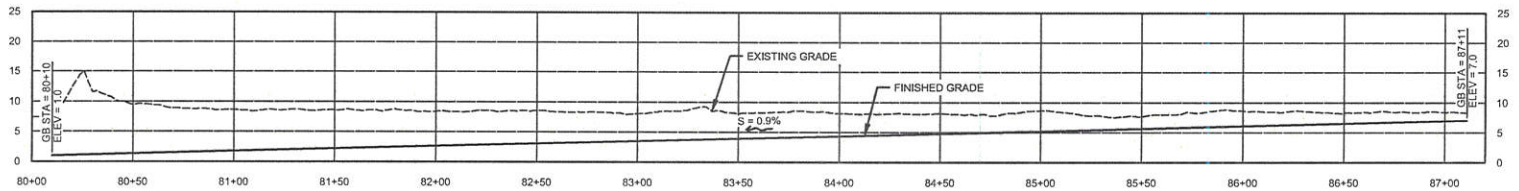
TILLAMOOK, OR

JOB NO.

SHEET NO.
C2.5

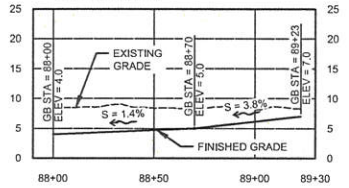
DWG: Z:\Shared\W2\CAD\20170002-TNC-Kilchis\DWG\C2.5 CONNECTOR CHNL SECTIONS.dwg USER: Amanda-PC
DATE: Feb 18, 2019 2:08pm XREFS:X-TB-22X3-TNC PORTER-BASE PORTER-EG SURFACE

FINAL PLAN DESIGN VOLUME 2



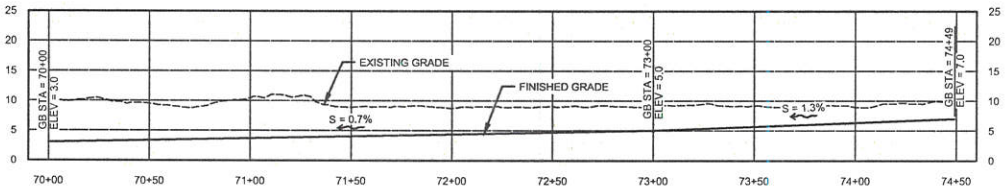
PROFILE - DUNLIN

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



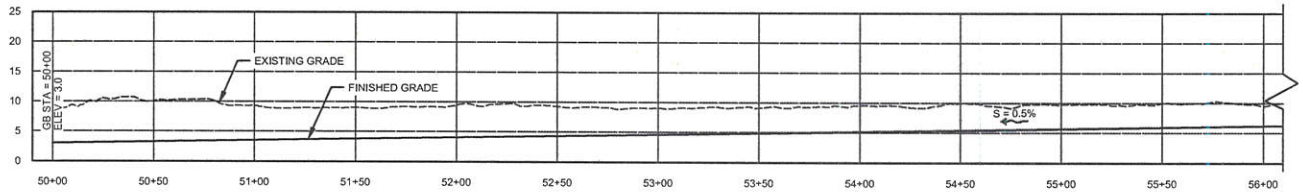
PROFILE - DUNLIN 2

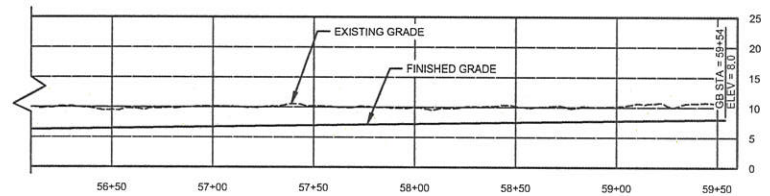
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - TURNSTONE

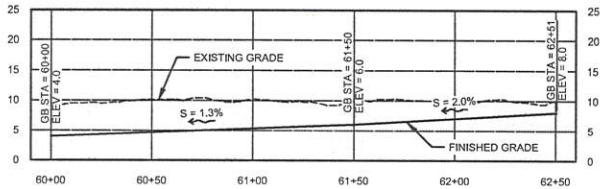
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10





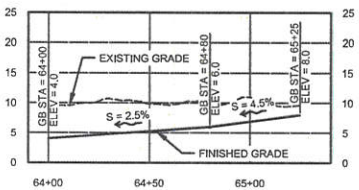
PROFILE - SNIPE

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



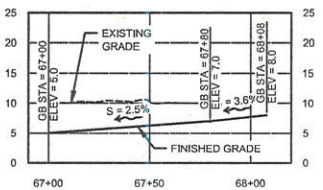
PROFILE - SNIPE 2

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - SNIPE 3

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - SNIPE 4

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10

NOTES:

1. CONSTRUCT CHANNEL PER PLAN ON C2.1 TO C2.4 AND PER PROFILES THIS SHEET. FINISHED GRADE PROFILES REPRESENT CHANNEL BOTTOM ELEVATIONS. EXISTING GRADE IS BASED OFF OF LIDAR AND MAY VARY.
2. ELEVATIONS SHOWN ARE RELATIVE TO FEET NAVD88.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 6, 2018
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.227.6688

The Nature Conservancy
1521 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
2	2/15/19	Final Design

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

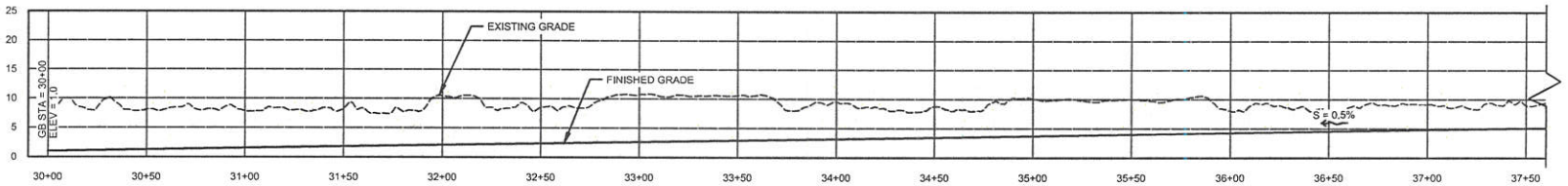
CHANNEL PROFILES 1

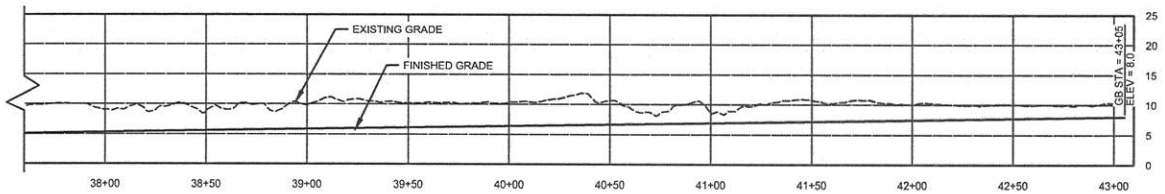
TILLAMOOK, OR

JOB NO.

SHEET NO.
C3.1

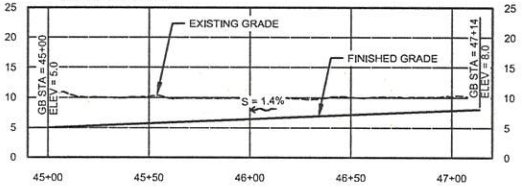
DWG: Z:\Shared\W2x\CAD\2017\000-TNC-Kitchin\DWG\C3.1 CH PROFILES.dwg USER: User
DATE: Feb 18, 2019 1:25pm XREFS:X-TB-22X34-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE





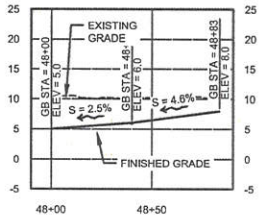
PROFILE - SANDPIPER

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



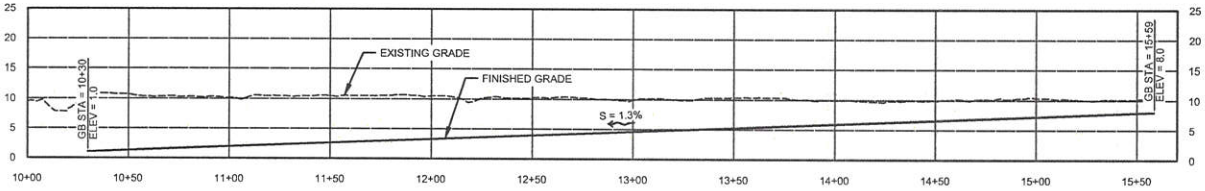
PROFILE - SANDPIPER 2

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



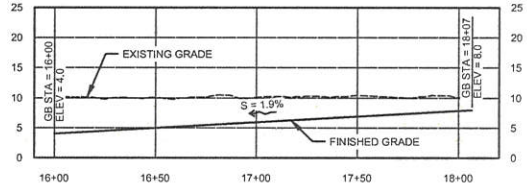
PROFILE - SANDPIPER 3

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



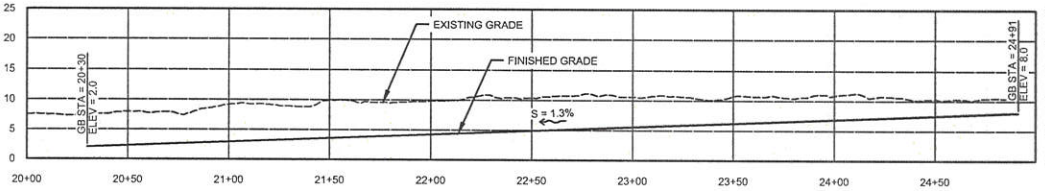
PROFILE - PLOVER

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - PLOVER 2

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - HERON

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10

NOTES:

1. CONSTRUCT CHANNEL PER PLAN ON C2.1 TO C2.4 AND PER PROFILES THIS SHEET, FINISHED GRADE PROFILES REPRESENT CHANNEL BOTTOM ELEVATIONS. EXISTING GRADE IS BASED OFF OF LIDAR AND MAY VARY.
2. ELEVATIONS SHOWN ARE RELATIVE TO FEET NAVD88.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 9, 2006
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.227.6668

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
2	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

CHANNEL PROFILES 2

TILLAMOOK, OR

JOB NO.

SHEET NO.
C3.2

DWG: Z:\Shared\Wgr\CAD\2017\2002-TNC-Killchis\12\WOC3.1 CH PROFILES.dwg USER: User
DATE: Feb 18, 2019 1:26pm XREFS:X-TB-22X34-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE

STA	BOTTOM WIDTH FT	TOP WIDTH FT
SNIPE		
50+20	8	15
56+00	8	12
56+20	6	10
57+20	6	10
57+40	4	8
58+60	4	8
58+80	2	5
59+50	2	3
SNIPE CH2		
60+00	4	10
61+40	4	8
61+50	2	8
62+50	2	3
SNIPE CH3		
64+00	4	9
64+80	4	8
64+80	2	6
65+25	2	3
SNIPE CH4		
67+00	2	7
68+10	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
SANDPIPER		
30+00	12	20
33+45	12	20
33+65	10	17
35+05	10	17
35+30	8	14
36+90	8	13
37+10	6	12
40+20	6	11
40+65	4	7
42+00	4	7
42+10	2	5
43+05	2	3
SANDPIPER CH2		
45+00	4	10
46+80	4	7
46+85	2	5
47+15	2	3
SANDPIPER CH3		
48+10	2	7
48+83	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
DUNLIN		
80+00	8	16
83+45	8	12
83+65	6	10
85+45	6	9
85+65	4	6
86+70	4	6
86+80	2	4
87+10	2	3
DUNLIN CH2		
88+00	6	11
88+40	6	10
88+50	4	8
89+00	4	6
89+00	2	4
89+25	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
PORTER CONNECTION CHANNEL		
1+85	12	40
2+40	12	35
2+65	12	30
3+20	12	30
3+45	12	35
3+70	12	40

STA	BOTTOM WIDTH FT	TOP WIDTH FT
PLOVER		
10+30	8	20
11+80	8	15
12+00	6	13
13+60	6	11
13+80	4	8
15+00	4	7
15+10	2	5
15+60	2	3
PLOVER CH2		
16+00	6	12
16+60	6	11
16+70	4	9
17+50	4	7
17+60	2	5
18+10	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
HERON		
20+30	6	12
21+60	6	12
21+80	4	9
24+60	4	8
24+80	2	5
24+90	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
TURNSTONE		
70+00	6	13
71+40	6	11
71+60	4	9
73+50	4	8
73+60	2	6
74+50	2	3

NOTES:

1. CONSTRUCT CHANNELS PER GEOMETRY ON THIS SHEET AND CROSS SECTION DETAIL ON SHEET 5.1.
2. LAYOUT CHANNEL HORIZONTAL ALIGHMENTS ACCORDING TO PLANS ON SHEETS C2.1 AND C2.4 AND PER ELECTRONIC CAD FILE PROVIDED BY CONTRACTOR.
3. CHANNEL SIDE SLOPES ARE IN 1H:2V UNLESS OTHERWISE DENOTED.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SW 5TH AVE., SUITE #1100
PORTLAND, OR 97214
503.227.6658

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/19	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

CHANNEL GEOMETRY

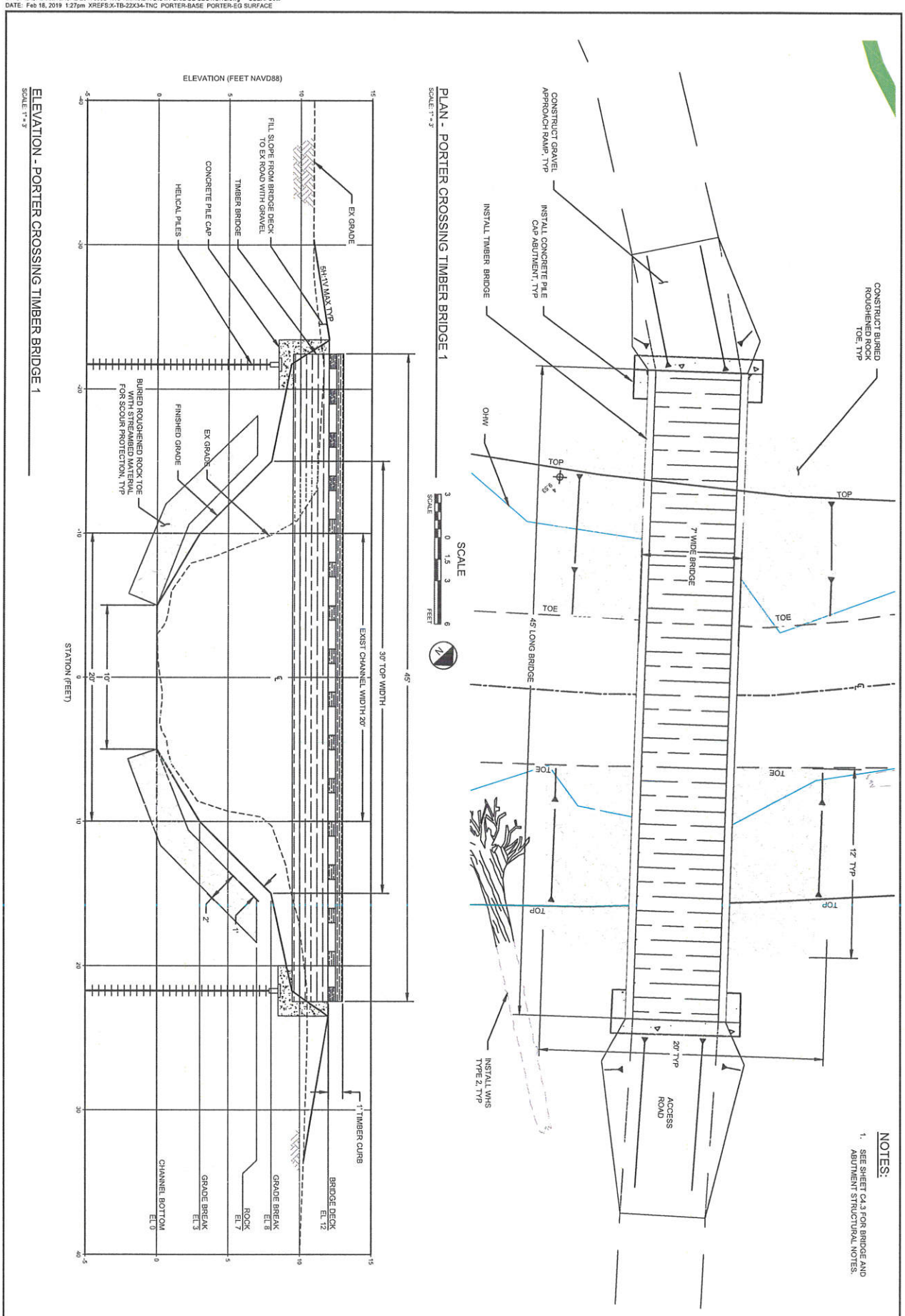
TILLAMOOK, OR

JOB NO.

SHEET NO.
C3.3

DWG: Z:\Shared\W2x\CAD\2017\002-TNC-Kilchis\DWG\C3.3 CHANNEL GEOMETRY.dwg USER: User
DATE: Feb 18, 2019 1:26pm XREFS:X-TB-22X34-TNC

DWG: Z:\Shared\W2r\CAD\20170002-TNC-Klichis\DWG\C4.1 BRIDGE SECTIONS.dwg USER: User
DATE: Feb 18, 2019 1:27pm XREFS:X-TB-22X34-TNC PORTER-BASE PORTER-EG SURFACE



NOTES:

1. SEE SHEET C4.3 FOR BRIDGE AND ABUTMENT STRUCTURAL NOTES.

THE NATURE CONSERVANCY PORTER TRACT BRIDGE 1 PLAN & SECTION TILLAMOOK, OR	FINAL DESIGN	NO. DATE DESCRIPTION: 2/15/2019 FINAL DESIGN — REVISION	DESIGNED BY AJ; DRAWN BY AJ/JR; CHECKED BY CL; APPROVED BY CL/AJ

The Nature Conservancy, 1821 SE 14TH AVE, PORTLAND, OR 97214

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6658

REGISTERED PROFESSIONAL ENGINEER — OREGON — MICHAEL A. JONES — RENEWAL 6/30/2019

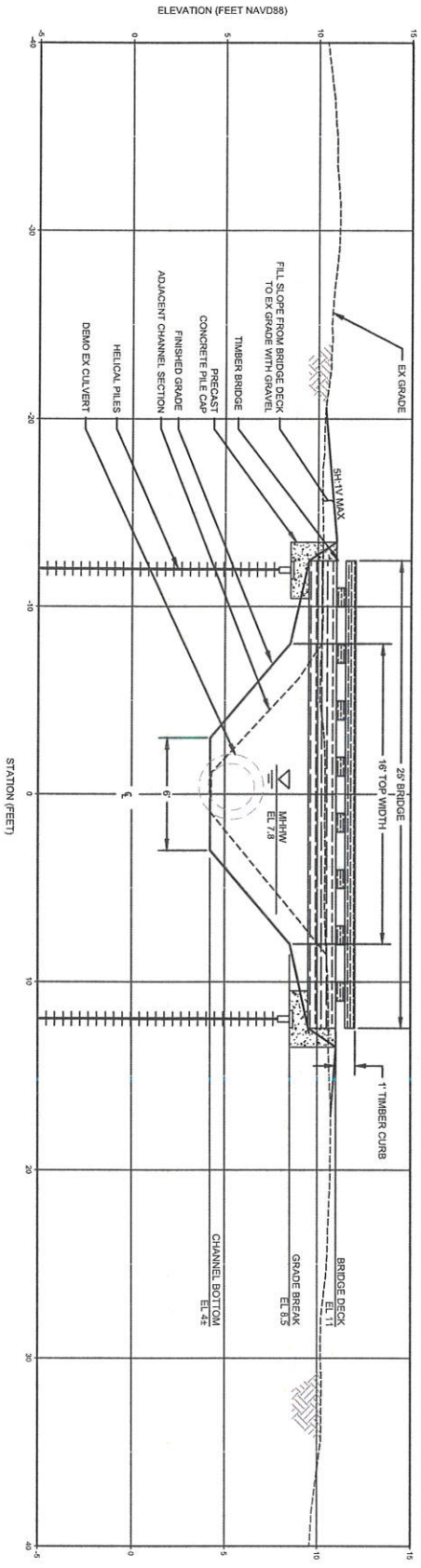
JOB NO.

SHEET NO. C4.1

DWG: Z:\Shared\W2r\CAD\20170002-TNC-Kilchis\DWG\C4.1 BRIDGE SECTIONS.dwg USER: Amanda-PC
DATE: Feb 18, 2019 2:08pm XREFS:X-TB-22X34-TNC PORTER-BASE PORTER-EG SURFACE

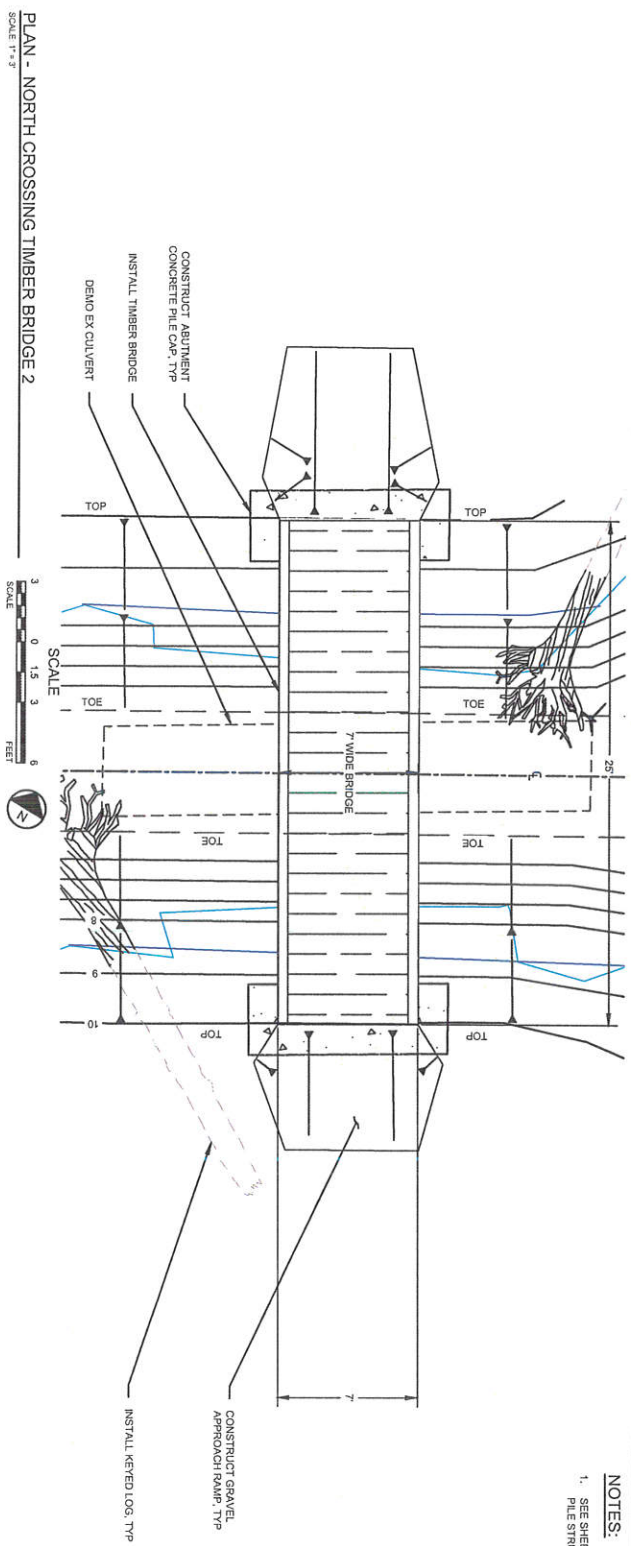
ELEVATION - NORTH CROSSING TIMBER BRIDGE 2

SCALE: 1" = 3'



PLAN - NORTH CROSSING TIMBER BRIDGE 2

SCALE: 1" = 3'



NOTES:

1. SEE SHEET C4.3 FOR BRIDGE AND HELICAL PILE STRUCTURAL NOTES.

SHEET NO.	C4.2	
JOB NO.		
THE NATURE CONSERVANCY PORTER TRACT	BRIDGE 2 PLAN & SECTION	TILLAMOOK, OR
FINAL DESIGN		
NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN
REVISION		
DESIGNED BY	AJ	
DRAWN BY	AJ/JR	
CHECKED BY	CL	
APPROVED BY	CL/AJ	

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.207.6688

REGISTERED PROFESSIONAL ENGINEER — OREGON — AMANDA L. JONES — RENEWS: 6/30/2019

BRIDGE STRUCTURAL NOTES:

1. BRIDGE AND ABUTMENT SYSTEM SHOWN IS CONCEPTUAL. CONTRACTOR SHALL SUBMIT PREFAB BRIDGE AND ABUTMENT SYSTEM PLAN FOR ENGINEER REVIEW AND APPROVAL. BRIDGES SHALL BE TIMBER (ALASKAN YELLOW CEDAR OR APPROVED EQUIVALENT WITHOUT PRESSURE TREATMENT).

2. PERFORMANCE SPECIFICATIONS FOR PREFABRICATED BRIDGE AND ABUTMENT SYSTEM:
   - LENGTH:
     - PORTER CROSSING - 45' TOTAL (BRIDGE 1)
     - NORTH CROSSING - 25' TOTAL (BRIDGE 2)
   - WIDTH: APPROX 7' TOTAL
   - USE: LIGHT VEHICLES & PEDESTRIAN ACCESS
   - DECK EL:
     - PORTER CROSSING - EL 12 FT NAVD88
     - NORTH CROSSING - EL 11 FT NAVD88
   - GUARDRAIL: NONE, 6" CURB RAILS ON 6" BLOCKS (12" TOTAL CURB HEIGHT)
   - LOADING:
     - LIVE : 90 PSF
     - DEAD: STRUCTURE WEIGHT
     - LATERAL: 2 FT/S DEBRIS
   - WIND: 85 MPH - EXPOSURE C
   - DECK: ALASKAN YELLOW CEDAR
   - TREATMENT: NO TREATMENT ALLOWED

3. STEEL COMPONENT SPECIFICATIONS:

   STEEL SHAPES : ASTM A36
   HARDWARE : ASTM A307 (A325 AS NOTED)
   HOT DIP GALVANIZE ALL STEEL SHAPES AFTER FABRICATION.
   HOT DIP GALVANIZE ALL HARDWARE.
   ALL WELDING TO BE PER AWS SPECIFICATIONS CERTIFIED WELDERS.
   TREAT ALL FIELD MODIFICATIONS W/ COLD GALVANIZING PAINT.

4. WOOD SURFACE SEALER SHALL BE APPLIED ACCORDING TO MANUFACTURER SPECIFICATIONS AND SLOPES V REQUIREMENTS.

5. BEARING PADS, ANCHOR BOLTS, AND ALL BRIDGE/ABUTMENT CONNECTION HARDWARE SHALL BE SUPPLIED WITH BRIDGE.

6. CERTIFIED TEST REPORTS SHALL BE FURNISHED FOR THE STRUCTURAL BRIDGE ELEMENTS, HIGH STRENGTH BOLTS, ELASTOMERIC BEARING PADS, AND ANCHOR BOLTS.

7. CAR AND ENGINEER TO VERIFY COORDINATES IN FIELD BEFORE PLACEMENT. BRIDGE COORDINATES AT ENDS (ALONG MIDLINE):
   - PORTER CONNECTION BRIDGE 2:
     - NORTH: N: 685547.81
       E: 7340373.80
     - SOUTH: N: 685580.80
       E: 7340404.38
   - NORTHERN BRIDGE 1:
     - NORTH: N: 686458.01
       E: 7340625.06
     - SOUTH: N: 686436.62
       E: 7340637.87

8. REMOVED CULVERTS TO BE TAKEN OFF SITE AND DISPOSED OF IN A MANNER AND LOCATION APPROVED BY CAR.

9. BRIDGE ABUTMENT SYSTEM SHALL COMPLY WITH REQUIREMENTS OF GEOTECHNICAL ENGINEERING REPORT (GEOTECHNICS LLC) AVAILABLE UPON REQUEST FROM CAR.

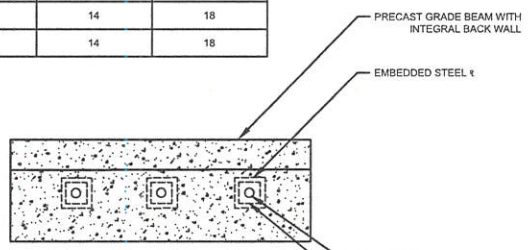
10. ABUTMENTS SHALL BE PRECAST REINFORCED CONCRETE PILE CAPS SUPPORTED BY HELICAL PILES, AND SHALL BE CONSTRUCTED PER BRIDGE MANUFACTURER SPECIFICATIONS. CAR AND ENGINEER TO APPROVE BRIDGE AND ABUTMENT SYSTEM PRIOR TO MANUFACTURING.

11. RECOMMENDED HELIX CONFIGURATIONS OF SINGLE SHAFT, 2-7/8 INCH OUTSIDE DIAMETER ARE SHOWN IN THE TABLE BELOW.

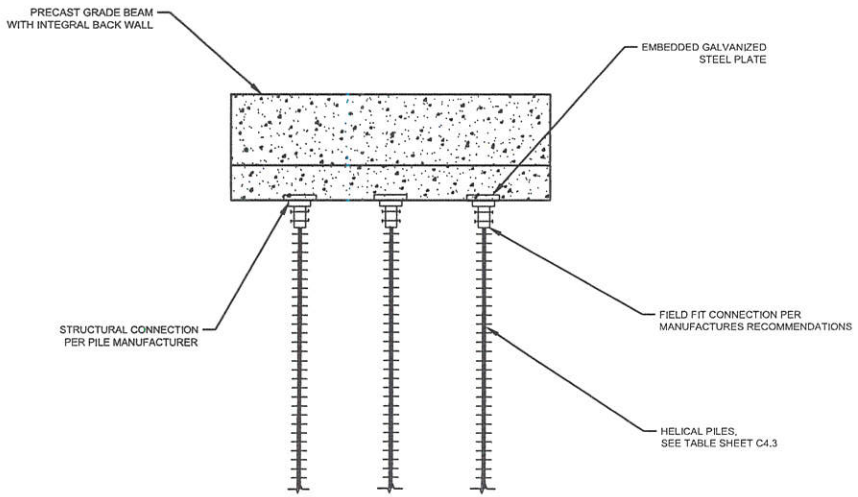
12. BRIDGE 2 HELICAL PILE ALTERNATIVES REFER TO THE NUMBER OF PILES (2 OR 3).

HELICAL ANCHOR DESIGN RECOMMENDATIONS

	# OF H-PILES PER END	HELIX CONFIGURATION	MINIMUM SPACING (FT)	MINIMUM TORQUE (FT-LB)	MINIMUM PILE DEPTH	ESTIMATED PILE DEPTH AT MIN TORQUE
BRIDGE 1	3	10"/12"	3.0	890	12	15
BRIDGE 2 - ALT 1	2	10"/12"	3.0	890	14	18
BRIDGE 2 - ALT 2	3	8"/10"	2.5	560	14	18



PLAN - ABUTMENT
SCALE: NTS



ELEVATION - HELICAL PILES
SCALE: NTS

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2006
AMANDA L. JONES
RENEWS: 6/30/2019

WSP E WATER RESOURCES INC.
1001 SW 5TH AVE., SUITE #1100
PORTLAND, OR 97214
503.207.5688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY AJ | DRAWN BY AJ/JR | CHECKED BY CL | APPROVED BY CL/AJ

NO.	DATE	DESCRIPTION
2	2/15/19	FINAL DESIGN

REVISION

FINAL DESIGN

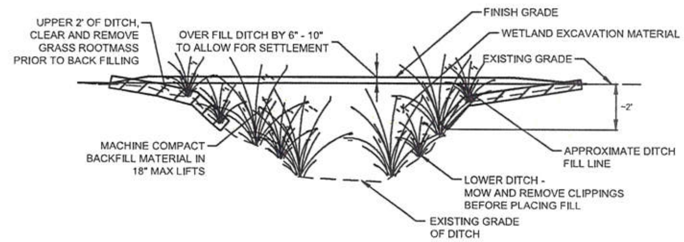
THE NATURE CONSERVANCY
PORTER TRACT
BRIDGE STRUCTURAL NOTES
TILLAMOOK, OR

JOB NO.

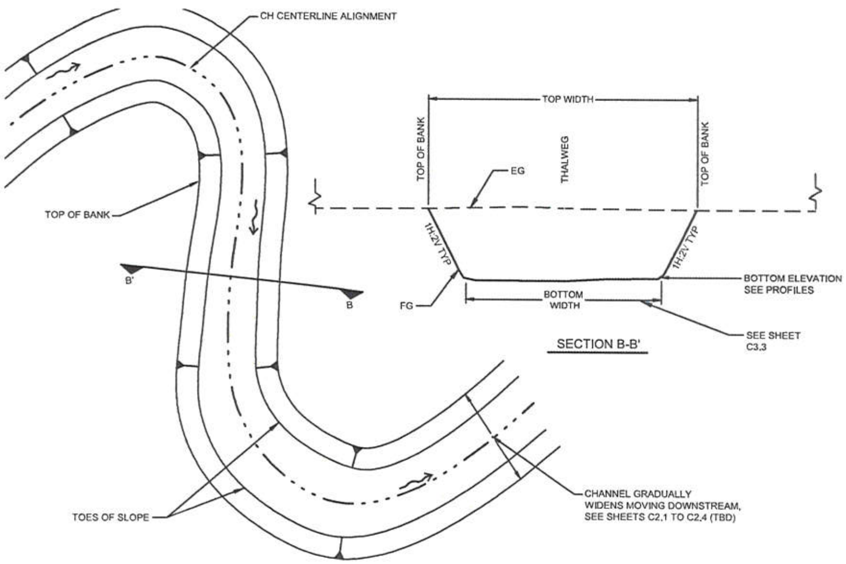
SHEET NO.
C4.3

NOTE:

1. DEWATER DITCHES COMPLETELY PRIOR TO BACKFILLING IN ACCORDANCE WITH SPECIFICATIONS.
2. REMOVE ORGANIC MATERIAL FROM EXCAVATION MATERIAL BEFORE PLACING AS FILL.



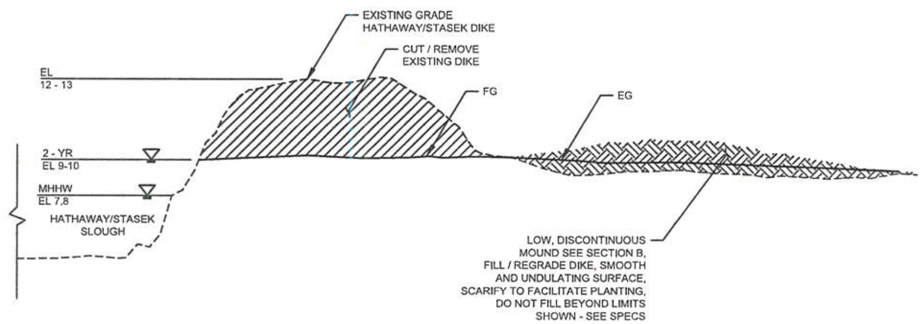
1 DITCH BACKFILL DETAIL
NOT TO SCALE



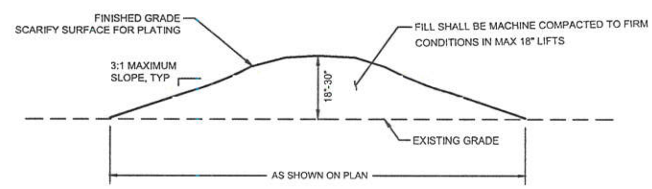
NOTES:

1. SEE GEOMETRY TABLES FOR BOTTOM ELEVATIONS AND BOTTOM WIDTHS (TBD).

2 TYPICAL CHANNEL PLAN & SECTION
NOT TO SCALE



3 HATHAWAY AND STASEK SLOUGH DIKE REMOVAL - TYPICAL SECTION
NOT TO SCALE



4 LOW MOUND - TYPICAL SECTION
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

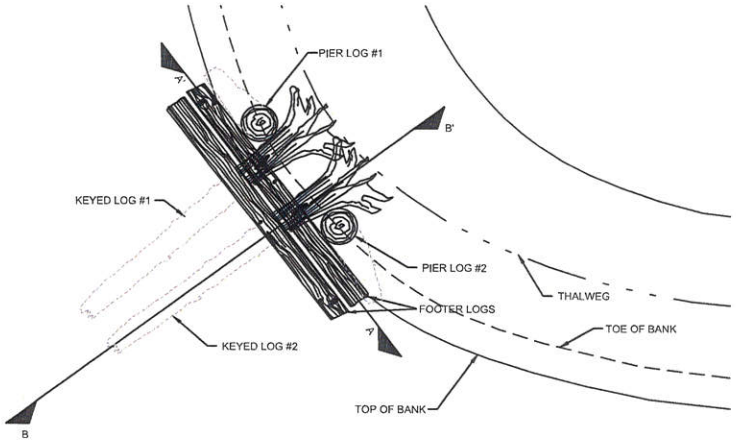
REVISION

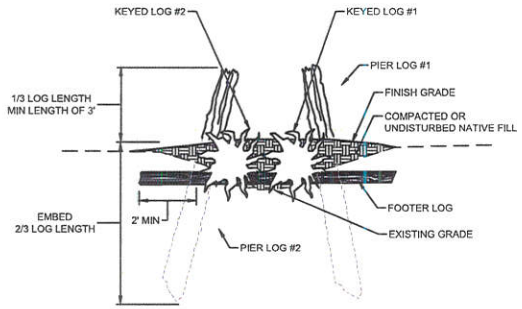
FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
GRADING DETAILS
TILLAMOOK, OR

JOB NO.

SHEET NO.
C5.1

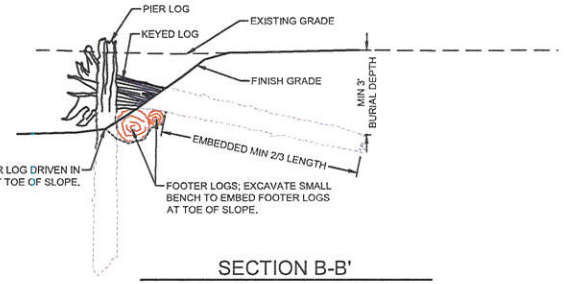




SECTION A-A'

NOT TO SCALE

BANK STRUCTURE LOG SIZES		
LOG TYPE	DIA.	LENGTH
KEYED LOG	24"	20' MIN
PIER LOG	18"	15' MIN
FOOTER LOG	24"	12' MIN

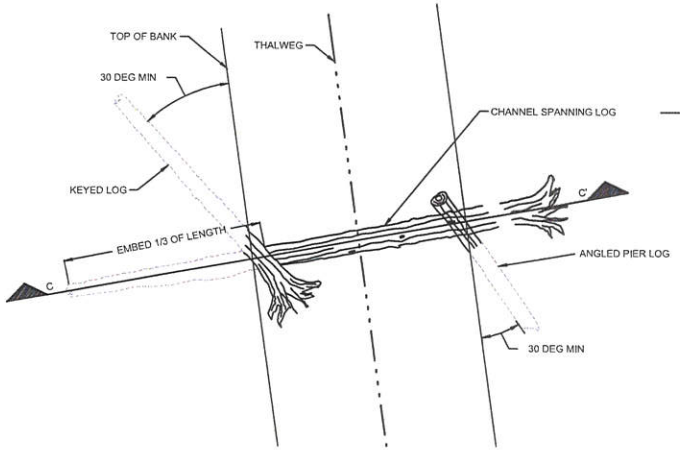


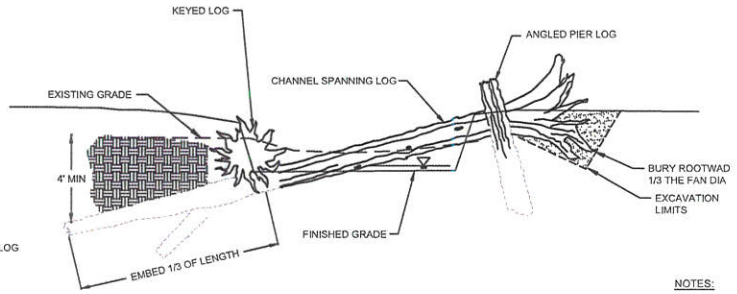
SECTION B-B'

NOT TO SCALE

1 WHS TYPE 1 - BANK DETAIL

NOT TO SCALE





SECTION C-C'

NOT TO SCALE

CHANNEL SPANNING STRUCTURE LOG SIZES		
LOG TYPE	DIA.	LENGTH
CH. SPANNING	24"	30' - 40'
KEYED LOG	16" - 20"	20'
PIER LOG	12" - 18"	12'

2 WHS TYPE 2 - CHANNEL SPANNING DETAIL

NOT TO SCALE

NOTES:

1. SEE INDIVIDUAL LOG DETAILS ON SHT C5.3.
2. THE WHS-CHANNEL SPANNING STRUCTURE WILL BE CONSTRUCTED IN TWO DIFFERENT SIZES, PROPORTIONAL TO THE CHANNEL SIZE. REFER TO LOG SIZE TABLES AND SPECIFICATIONS FOR LOG REQUIREMENTS AND NUMBER OF EACH SIZE.
3. INSTALL ALL LOGS BY SHARPENING ENDS WITH A CHAINSAW AND DRIVING THE LOG INTO THE GROUND. EXCAVATE ONLY AS NECESSARY.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SW 5TH AVE., SUITE #1100
PORTLAND, OR 97214
503.227.6808

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
1	2/15/19	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

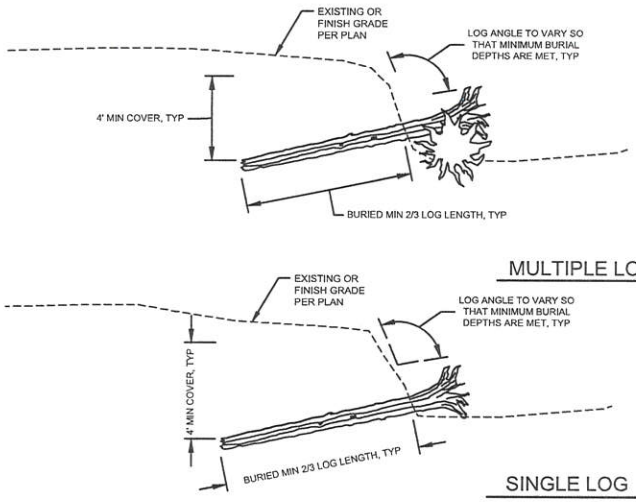
HABITAT DETIALS 1

TILLAMOOK, OR

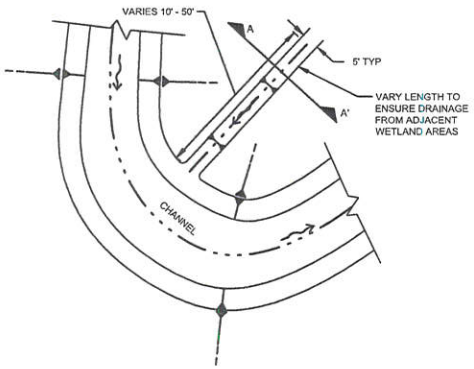
JOB NO.

SHEET NO.
C5.2

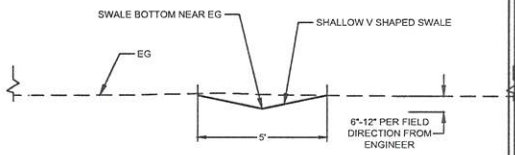
DWG: Z:\Shared\Wolf\CAD\2017\002-TNC-Kilchis\DWG\C5.1 - HABITAT-DETAILS.dwg USER: User
DATE: Feb 18, 2019 1:29pm XREFS:X-TB-22X34-TNC2 PORTER-DETAILS



1 WHS TYPE 3 - KEYED LOG
NOT TO SCALE

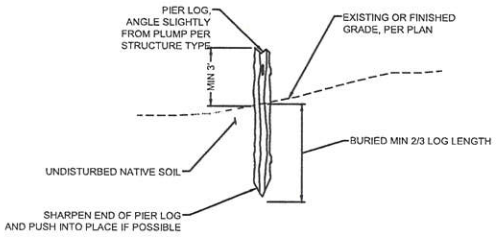


TYPICAL PLAN



TYPICAL SECTION A - A'

3 PILOT SWALE DETAIL
NOT TO SCALE



2 PIER LOG
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
RENEWS: 6/30/2019
WOLF WATER RESOURCES, INC.
1001 SW 5TH AVE., SUITE #1100
PORTLAND, OR 97214
503.207.6888
The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
2	2/14/2019	FINAL DESIGN

REVISION

THE NATURE CONSERVANCY
PORTER TRACT

HABITAT DETIALS 2

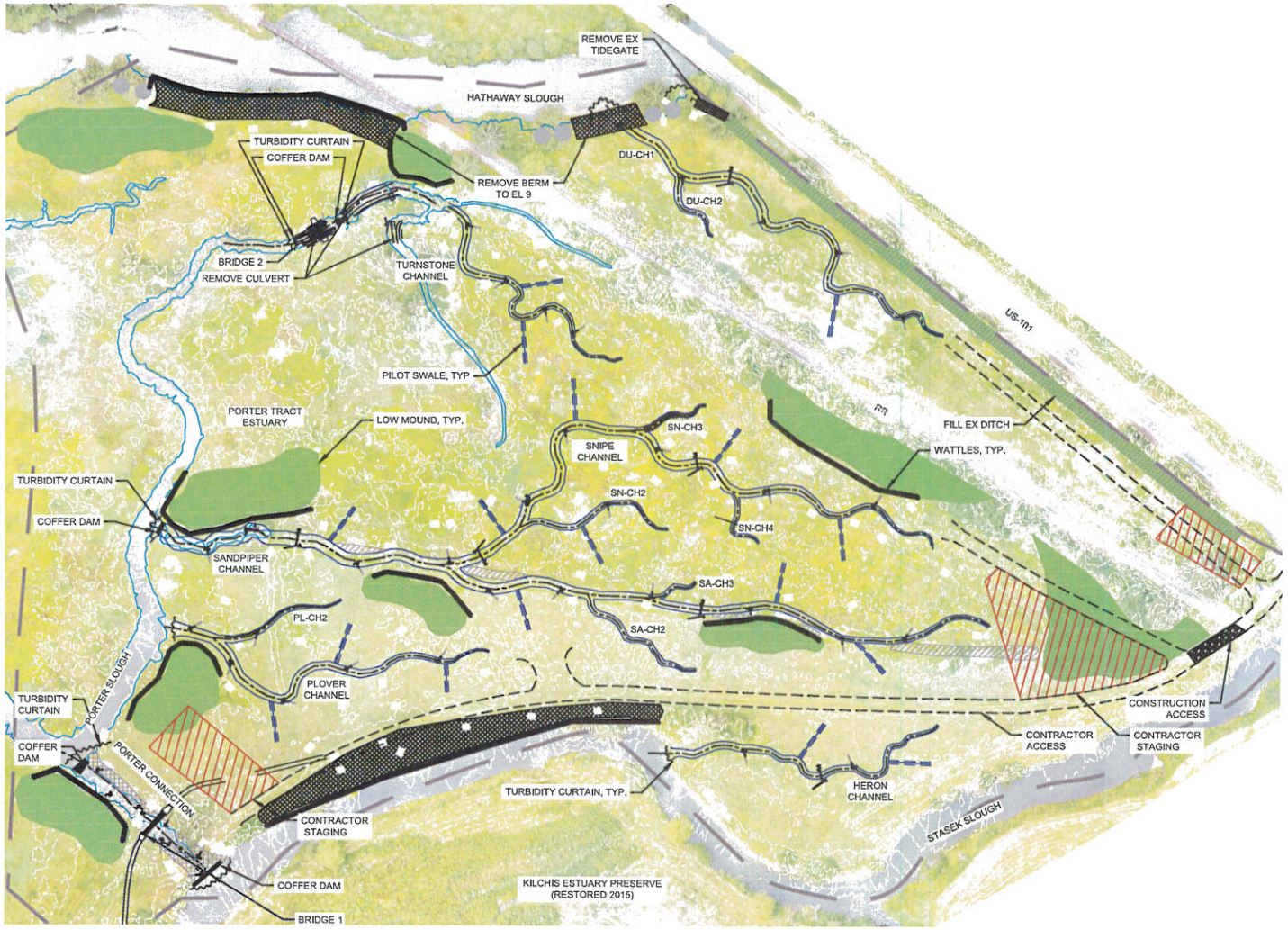
TILLAMOOK, OR

FINAL DESIGN

JOB NO.

SHEET NO.
C5.3

DWG Z:\Shared\W2\dCAD\2017\2002-TNC-Kilchis\DWG\C5.1 - HABITAT-DETAILS.dwg USER: User
DATE: Feb 18, 2019 1:30pm XREFS:X-TB-22X34-TNC2 PORTER-DETAILS



PLAN - EROSION CONTROL

1" = 500' (FOR 22" x 34" SHEETS)

N

SCALE

80 0 40 80 160

SCALE FEET

EROSION CONTROL LEGEND:

WATTLES

TURBIDITY CURTAIN

NOTES:

1. ENTER SITE AT DESIGNATED ENTRANCE POINT UNLESS APPROVED BY ENGINEER.
2. ALL ACCESS ROUTES AND SITE ENTRANCES SHALL BE RESTORED ACCORDING TO SPECIFICATIONS AND SEEDING PLAN.
3. CHANNELS ONE AND TWO SHALL BE GRADED FIRST. KEEP EXISTING DIKES IN PLACE UNTIL GRADING IN THE CENTER OF THE SITE IS FINISHED. DO NOT CONNECT CHANNEL 3 TO THE KILCHIS RIVER AND THE STASEK SLOUGH UNTIL THE CHANNEL GRADING HAS BEEN FINISHED. DEMO CULVERTS AND RECONSTRUCT EARTHEN BERMS AS A LAST STAGE OF CONSTRUCTION.
4. SEE SHEET C2.2 FOR DIKE REMOVAL SUMMARY TABLE.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2019
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
5335 SW MEADOWS RD, SUITE #180
LAKE OSWEGO, OR 97035
1001 SW 5TH AVE, SUITE #1100
PORTLAND, OR 97214
503.207.6888

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
2	2/15/19	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

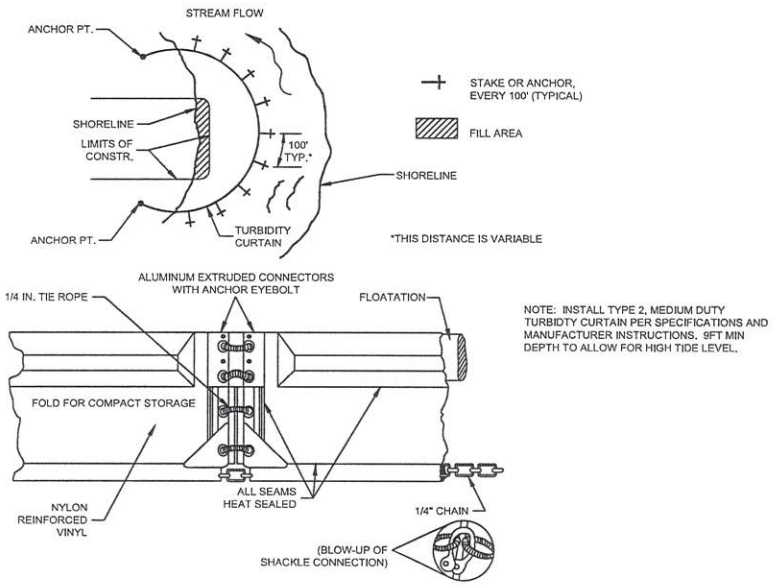
ESC PLAN

TILLAMOOK, OR

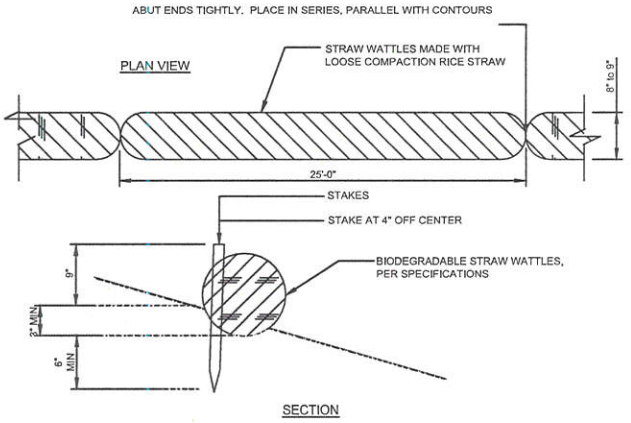
JOB NO.

SHEET NO.
ESC1.1

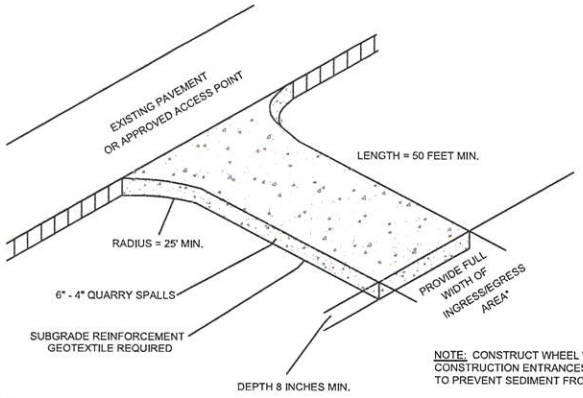
DWG: Z:\Shared\W2\CAD\20170202-TNC-K&hs\DWG\ESC1.1 EROSION CONTROL.dwg USER: User
DATE: Feb 18, 2019 1:31pm XREFS:X-TB-22X34-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE



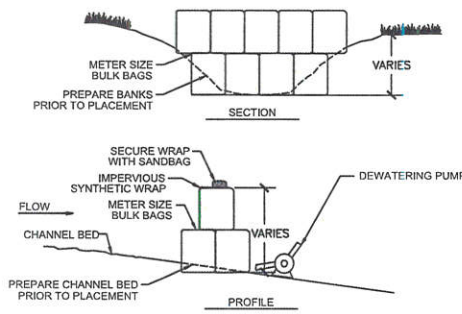
1 TURBIDITY CURTAIN
NTS

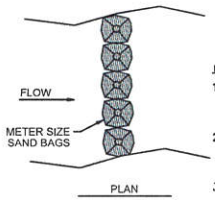


3 STRAW WATTLE
NTS



2 CONSTRUCTION ENTRANCE
NTS





NOTES:
1. INSTALL TEMPORARY COFFER DAMS AS SHOWN ON PLANS TO ISOLATE THE EXCAVATION AREAS.
2. IN ADDITION TO BULK BAGS, USE AN IMPERVIOUS SYNTHETIC LINER TO REDUCE PERMEABILITY OF THE COFFER DAM.
3. HEIGHT OF THE COFFER DAMS SHALL BE HIGH ENOUGH TO PREVENT BYPASS FLOWS FROM ENTERING THE ISOLATED WORK AREA. DAM HEIGHTS AND MATERIALS SHALL BE INCLUDED IN THE CONTRACTOR'S WORK CONTAINMENT AND DEWATERING PLAN.

4 TEMPORARY COFFER DAM
NTS

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.227.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/R	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

ESC DETAILS

TILLAMOOK, OR

JOB NO.

SHEET NO.
ESC 1.2

DWG: Z:\Shared\WG\CAD\2017\2002-TNC-Alder\DWG\ESC\1.3 EROSION CONTROL DETAILS.dwg USER: User
DATE: Feb 18, 2019 1:32pm XREFS:ITTL_22x34 PORTER-DETAILS X-TS-22X34-TNC

GENERAL NOTES FOR EROSION, SEDIMENT & POLLUTANT CONTROL

1. EROSION, SEDIMENT AND POLLUTANT CONTROL IS REQUIRED FOR THIS PROJECT.
2. PREPARE AN EROSION, SEDIMENT AND POLLUTANT CONTROL PLAN (ESPCP) BEFORE BEGINNING WORK. KEEP A COPY OF THE ESPCP ON SITE AT ALL TIMES DURING THE PROJECT.
3. THE EROSION AND SEDIMENT CONTROL FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR THE ANTICIPATED SITE AND SEASONAL CONDITIONS. UPGRADE THESE FACILITIES TO ADDRESS CHANGING WORK OR WEATHER CONDITIONS.
4. SELECT BEST MANAGEMENT PRACTICES (BMPs) FROM THE FOLLOWING DOCUMENTS: 1) THE CITY OF PORTLAND EROSION AND SEDIMENT CONTROL MANUAL; 2) THE STANDARD CONSTRUCTION SPECIFICATIONS AND 3) THE PROJECT SPECIAL PROVISIONS.
5. INSTALL, MONITOR, REPLACE AND UPGRADE ALL FACILITIES AND MEASURES. PERFORM MAINTENANCE TO ENSURE THEIR CONTINUED FUNCTIONING.
6. INSPECT AND MAINTAIN ALL FACILITIES AND MEASURES UNTIL WORK AREAS ARE RESURFACED OR STABILIZED.
7. COMPLETE AN EROSION CONTROL MONITORING FORM AFTER EACH INSPECTION. INCLUDE THE INSPECTION DATE AND TIME. RETAIN THESE COMPLETED FORMS ON SITE AND PROVIDE THEM UPON REQUEST.
8. NO VISIBLE AND MEASURABLE SEDIMENT OR POLLUTANT SHALL EXIT THE SITE, ENTER A PUBLIC RIGHT-OF-WAY OR BE DEPOSITED INTO ANY WATER BODY OR STORM DRAINAGE SYSTEM.
9. FOLLOWING A STORM EVENT, INSPECT AND ADJUST, REPAIR, IMPROVE OR REPLACE ALL DEFICIENT OR FAILING FACILITIES AND MEASURES.
10. PROTECT ALL FUNCTIONING STORM WATER INLETS AND CATCH BASINS FROM RECEIVING UNFILTERED SEDIMENT -LADEN RUNOFF.
11. REMOVE SEDIMENT AND DEBRIS FROM INLETS AND CATCH BASINS BEFORE PAVING. DO NOT FLUSH SEDIMENT-LADEN WATER INTO THE DOWNSTREAM SYSTEM.
12. STABILIZE ALL EXPOSED SOIL IMMEDIATELY FOLLOWING GROUND DISTURBING ACTIVITY.
13. STABILIZE AND PROTECT STOCKPILED SOIL WITH APPROVED MEASURES.
14. REMOVE EROSION AND SEDIMENT CONTROL FACILITIES AFTER THE PROJECT IS COMPLETED AND ACCEPTED.

SITE CONDITION	MINIMUM FREQUENCY
1. ACTIVE PERIOD	DAILY WHEN STORMWATER RUNOFF, INCLUDING RUNOFF FROM SNOW MELT, IS OCCURRING. AT LEAST ONCE EVERY 14 DAYS, REGARDLESS OF WHETHER STORMWATER RUNOFF IS OCCURRING.
2. PRIOR TO THE SITE BECOMING INACTIVE OR IN ANTICIPATION OF SITE INACCESSIBILITY	ONCE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURE ARE IN WORKING ORDER. ANY NECESSARY MAINTENANCE AND REPAIR MUST BE MADE PRIOR TO LEAVING THE SITE.
3. INACTIVE PERIODS GREAT THAN FOURTEEN (14) CONSECUTIVE CALENDAR DAYS	ONCE EVERY MONTH
4. PERIODS DURING WHICH THE SITE IS INACCESSIBLE DUE TO INCLEMENT WEATHER	IF PRACTICAL, INSPECTIONS MUST OCCUR DAILY AT A RELEVANT AND ACCESSIBLE DISCHARGE POINT OR DOWNSTREAM LOCATION.
5. PERIODS DURING WHICH DISCHARGE IS UNLIKELY DUE TO FROZEN CONDITIONS	MONTHLY. RESUME MONITORING IMMEDIATELY UPON MELT, OR WHEN WEATHER CONDITIONS MAKE DISCHARGES LIKELY.

ODEQ STANDARD ESCP NOTES:

1. HOLD A PRE-CONSTRUCTION MEETING OF PROJECT CONSTRUCTION PERSONNEL THAT INCLUDES THE INSPECTOR TO DISCUSS EROSION AND SEDIMENT CONTROL MEASURES AND CONSTRUCTION LIMITS. (SCHEDULE A.8.C.I.(3))
2. ALL INSPECTIONS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS. (SCHEDULE A.12.B AND SCHEDULE B.1)
3. INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS. (SCHEDULE B.1.C AND B.2)
4. RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY. DURING INACTIVE PERIODS OF GREATER THAN SEVEN (7) CONSECUTIVE CALENDAR DAYS, THE ABOVE RECORDS MUST BE RETAINED BY THE PERMIT REGISTRANT BUT DO NOT NEED TO BE AT THE CONSTRUCTION SITE. (SCHEDULE B.2A.C)
5. ALL PERMIT REGISTRANTS MUST IMPLEMENT THE ESCP. FAILURE TO IMPLEMENT ANY OF THE CONTROL MEASURES OR PRACTICES DESCRIBED IN THE ESCP IS A VIOLATION OF THE PERMIT. (SCHEDULE A 8.A)
6. THE ESCP MUST BE ACCURATE AND REFLECT SITE CONDITIONS. (SCHEDULE A.12.C.I)
7. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS. SUBMIT ALL NECESSARY REVISION TO DEQ OR AGENT WITHIN 10 DAYS. (SCHEDULE A.12.C.IV. AND V)
8. PHASE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION. (SCHEDULE A.7.A.III)
9. IDENTIFY, MARK, AND PROTECT (BY CONSTRUCTION FENCING OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED. IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS. (SCHEDULE A.8.C.I.(1) AND (2))
10. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED. (SCHEDULE A.7.A.V)
11. MAINTAIN AND DELINEATE ANY EXISTING NATURAL BUFFER WITHIN THE 50-FEET OF WATERS OF THE STATE. (SCHEDULE A.7.B.I.AND (2)(A)(B))
12. INSTALL PERIMETER SEDIMENT CONTROL, INCLUDING STORM DRAIN INLET PROTECTION AS WELL AS ALL SEDIMENT BASINS, TRAPS, AND BARRIERS PRIOR TO LAND DISTURBANCE. (SCHEDULE A.8.C.I.(5))
13. CONTROL BOTH PEAK FLOW RATES AND TOTAL STORMWATER VOLUME, TO MINIMIZE EROSION AT OUTLETS AND DOWNSTREAM CHANNELS AND STREAMBANKS. (SCHEDULE A.7.C)
14. CONTROL SEDIMENT AS NEEDED ALONG THE SITE PERIMETER AND AT ALL OPERATIONAL INTERNAL STORM DRAIN INLETS AT ALL TIMES DURING CONSTRUCTION, BOTH INTERNALLY AND AT THE SITE BOUNDARY. (SCHEDULE A.7.D.I)
15. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK. (SCHEDULE A.8.C.I.(6))
16. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES. TEMPORARY OR PERMANENT STABILIZATIONS MEASURES ARE NOT REQUIRED FOR AREAS THAT ARE INTENDED TO BE LEFT UNVEGETATED, SUCH AS DIRT ACCESS ROADS OR UTILITY POLE PADS.(SCHEDULE A.8.C.II.(3))
17. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS. (SCHEDULE A.8.C.I.(7))
18. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: CONSTRUCTION ENTRANCE, GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND- DISTURBING ACTIVITIES. (SCHEDULE A 7.D.II AND A.8.C.I(4))
19. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE. (SCHEDULE A.7.D.II.(5))
20. CONTROL PROHIBITED DISCHARGES FROM LEAVING THE CONSTRUCTION SITE, I.E., CONCRETE WASH-OUT, WASTEWATER FROM CLEANOUT OF STUCCO, PAINT AND CURING COMPOUNDS. (SCHEDULE A.6)
21. USE BMPS TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, FERTILIZER, PESTICIDES AND HERBICIDES, PAINTS, SOLVENTS, CURING COMPOUNDS AND ADHESIVES FROM CONSTRUCTION OPERATIONS. (SCHEDULE A.7.E.I.(2))
22. IMPLEMENT THE FOLLOWING BMPS WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES. (SCHEDULE A.7.E.III.)
23. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL. (SCHEDULE A 7.A.IV)
24. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE. (SCHEDULE A.9.B.III)
25. IF AN ACTIVE TREATMENT SYSTEM (FOR EXAMPLE, ELECTRO-COAGULATION, FLOCCULATION, FILTRATION, ETC.) FOR SEDIMENT OR OTHER POLLUTANT REMOVAL IS EMPLOYED, SUBMIT AN OPERATION AND MAINTENANCE PLAN (INCLUDING SYSTEM SCHEMATIC, LOCATION OF SYSTEM, LOCATION OF INLET, LOCATION OF DISCHARGE, DISCHARGE DISPERSION DEVICE DESIGN, AND A SAMPLING PLAN AND FREQUENCY) BEFORE OPERATING THE TREATMENT SYSTEM. OBTAIN PLAN APPROVAL BEFORE OPERATING THE TREATMENT SYSTEM. OPERATE AND MAINTAIN THE TREATMENT SYSTEM ACCORDING TO MANUFACTURER'S SPECIFICATIONS. (SCHEDULE A.9.D)
26. TEMPORARILY STABILIZE SOILS AT THE END OF THE SHIFT BEFORE HOLIDAYS AND WEEKENDS, IF NEEDED. THE REGISTRANT IS RESPONSIBLE FOR ENSURING THAT SOILS ARE STABLE DURING RAIN EVENTS AT ALL TIMES OF THE YEAR. (SCHEDULE A 7.B)
27. AS NEEDED BASED ON WEATHER CONDITIONS, AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPS MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS. (SCHEDULE A.7.E.II.(2))
28. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND BARE GROUND ACTIVITIES DURING WET WEATHER. (SCHEDULE A.7.A.I)
29. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL. (SCHEDULE A.9.C.I)
30. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT AND BEFORE BMP REMOVAL. (SCHEDULE A.9.C.I)
31. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT. (SCHEDULE A.9.C.III & IV)
32. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN-UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DIVISION OF STATE LANDS REQUIRED TIMEFRAME. (SCHEDULE A.9.B.I)
33. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS. (SCHEDULE A.9.B.II)
34. THE ENTIRE SITE MUST BE TEMPORARILY STABILIZED USING VEGETATION OR A HEAVY MULCH LAYER, TEMPORARY SEEDING, OR OTHER METHOD SHOULD ALL CONSTRUCTION ACTIVITIES CEASE FOR 30 DAYS OR MORE. (SCHEDULE A.7.F.I)
35. PROVIDE TEMPORARY STABILIZATION FOR THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES CEASE FOR 14 DAYS OR MORE WITH A COVERING OF BLOWN STRAW AND A TACKIFIER, LOOSE STRAW, OR AN ADEQUATE COVERING OF COMPOST MULCH UNTIL WORK RESUMES ON THAT PORTION OF THE SITE. (SCHEDULE A.7.F.II)
36. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED, ALL TEMPORARY EROSION CONTROLS AND RETAINED SOILS MUST BE REMOVED AND DISPOSED OF PROPERLY, UNLESS DOING SO CONFLICTS WITH LOCAL REQUIREMENTS. (SCHEDULE A.8.C.III(1) AND D.3.C.II AND III)

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 9, 2018 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

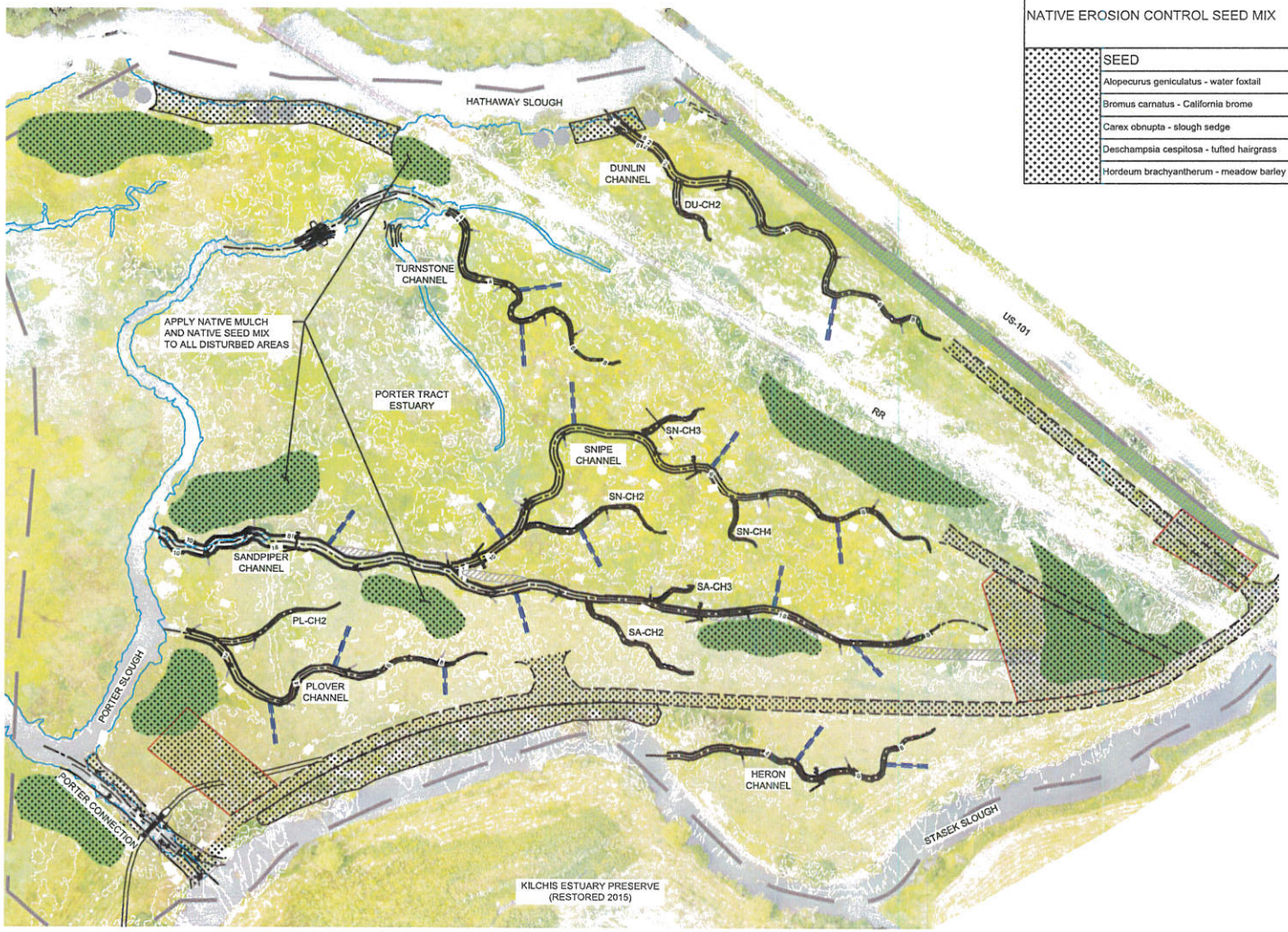
FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
ESC NOTES
TILLAMOOK, OR

JOB NO.

SHEET NO.
ESC1.3

DWG: Z:\Shared\W2r\CAD\20170002-TNC-Kilchis\DWG\ESC1.2 EROSION CONTROL DETAILS.dwg USER: User
DATE: Feb 18, 2019 1:32pm XREFS: TITL_22x34 PORTER-DETAILS X-TB-22X34-TNC



PLAN - REVEGETATION

1" = 500' (FOR 22" x 34" SHEETS)

N

SCALE

80 0 40 80 160

SCALE FEET

NATIVE EROSION CONTROL SEED MIX			APPROX. AREA = 7.5 AC
	SEED		
	Alopecurus geniculatus - water foxtail	1.09 lbs	APPLICATION RATE
	Bromus carnatus - California brome	12.20 lbs	Pounds of Pure Live Seed (PLS) PER ACRE
	Carex obnupta - slough sedge	0.71 lbs	
	Deschampsia cespitosa - tufted hairgrass	1.02 lbs	
	Hordeum brachyantherum - meadow barley	25.11 lbs	

NOTES:

1. EROSION CONTROL SEED MIX IS SHOWN ON THIS SHEET.
2. WITHIN 24 HOURS OF SEED APPLICATION, NATIVE STRAW MULCH SHALL BE APPLIED WITH A BLOWER OR BY HAND.
3. NATIVE STRAW SHALL BE APPLIED AT THE RATE OF ONE TON PER ACRE.
4. NATIVE STRAW MULCH SHALL BE CERTIFIED WEED FREE.
5. SEEDING AREAS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL APPLY SEEDING TO ALL DISTURBED AREAS.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2019
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SW 5TH AVE., SUITE #1160
PORTLAND, OR 97214
503.297.6668

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY AJ | DRAWN BY AJ/JR | CHECKED BY CL | APPROVED BY CL/AJ

NO.	DATE	REVISION DESCRIPTION
2	2/15/19	FINAL DESIGN

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

REVEGETATION PLAN

TILLAMOOK, OR

JOB NO.

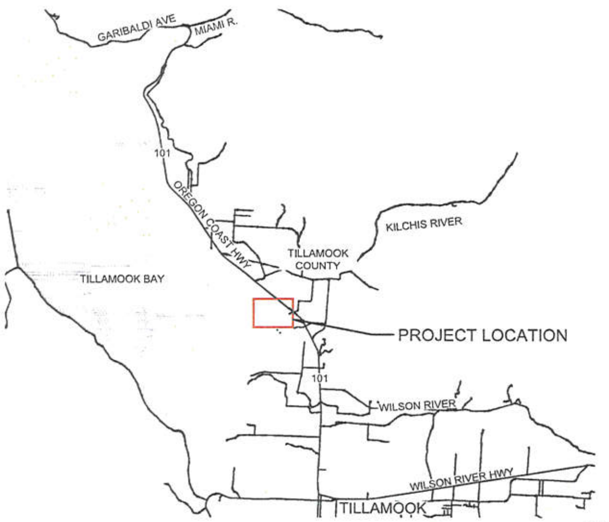
SHEET NO.
L1.1

DWG: Z:\Shared\W2\CAD\2017\002-TNC-Kilchis\DWG\L1.1 REVEGETATION.dwg USER: Uher
DATE: Feb 18, 2019 1:33pm XREFS:X-TB-22X34-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE

ENGINEERING PLANS

PORTER TRACT ESTUARY RESTORATION

TILLAMOOK COUNTY, OREGON
THE NATURE CONSERVANCY
2019



PROJECT LOCATION MAP
SCALE: 1" = 5000' (FOR 22" x 34" SHEETS)

SHEET INDEX

G1.0	COVER
G1.1	NOTES & ABBREVIATIONS
C1.1	SITE PLAN & OVERVIEW
C2.1	CH LAYOUT & GRADING PLAN 1
C2.2	CH LAYOUT & GRADING PLAN 2
C2.3	CH LAYOUT & GRADING PLAN 3
C2.4	CH LAYOUT & GRADING PLAN 4
C2.5	CONNECTOR CHANNEL SECTIONS
C3.1	CHANNEL PROFILES 1
C3.2	CHANNEL PROFILES 2
C3.3	CHANNEL GEOMETRY
C4.1	BRIDGE 1 PLAN & ELEVATION
C4.2	BRIDGE 2 PLAN & ELEVATION
C4.3	BRIDGE STRUCTURAL NOTES
C5.1	GRADING DETAILS
C5.2	HABITAT DETAILS 1
C5.3	HABITAT DETAILS 2
ESC1.1	EROSION & SEDIMENT CONTROL PLAN
ESC1.2	EROSION & SEDIMENT CONTROL DETAILS
ESC1.3	EROSION & SEDIMENT CONTROL NOTES
L1.1	RESTORATION & SEEDING PLAN

PROJECT OWNER

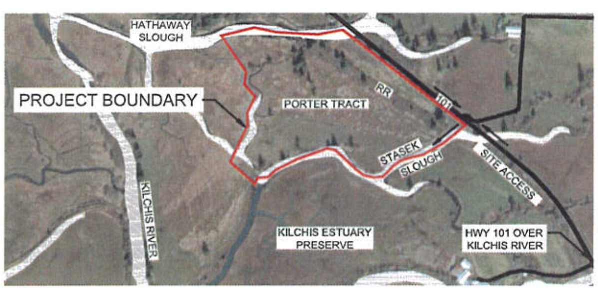
THE NATURE CONSERVANCY
DICK VANDER SCHAAF
821 SE 14TH AVENUE
PORTLAND, OR 97214
(503) 802-8100

PROJECT ENGINEERS

WOLF WATER RESOURCES
CURTIS LOEB, PE
AMANDA JONES, PE
JOE RULDOPH, ECOLOGIST
1001 SE WATER AVE , SUITE 180
PORTLAND, OR 97214
(503) 207-6688

GEOTECHNICAL ENGINEER

GEOTECHNICS LLC
ANDRE MARE, PE, GE
7629 SE HARRISON STREET
PORTLAND, OR 97215
(503) 730-2469



VICINITY MAP
1" = 500' (FOR 22" x 34" SHEETS)

ODFW IN-WATER WORK WINDOW
JUL 1 TO SEP 30

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY AJ
DRAWN BY AJ/JR
CHECKED BY CL
APPROVED BY CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
COVER
TILLAMOOK, OR

JOB NO.
SHEET NO. G1.0

DWG: Z:\Shared\W2\CAD\20170002-TNC-Kilchis\DWG\G1.0 COVER.dwg USER: User
DATE: Feb 18, 2019 1:20pm XREFS:X-TB-22X34-TNC PORTER-GIS BASE

ABBREVIATIONS

APPROX	APPROXIMATE
AVG	AVERAGE
BMP	BEST MANAGEMENT PRACTICE
BOT	BOTTOM
CAR	CONTRACTING AGENCY'S REPRESENTATIVE
CH	CHANNEL
CL	CENTERLINE
CLC	CENTERLINE OF CHANNEL
CP	CONTROL POINT
CY	CUBIC YARD
DEMO	DEMOLISH
DIA	DIAMETER
DTL	DETAIL
DWG	DRAWING
E	EASTING
(E) EXIST	EXISTING
EG	EXISTING GRADE
EL	ELEVATION
ESC	EROSION & SEDIMENT CONTROL
FG	FINISHED GRADE
FT	FOOT, FEET
GS	GROUND SPOT
IE	INVERT ELEVATION
IR	IRON ROD
JURISD	JURISDICTIONAL
MAX	MAXIMUM
MGMT	MANAGMENT
MHW	MEAN HIGH WATER
MHHW	MEAN HIGHER HIGH WATER
MIN	MINIMUM
MTL	MATERIAL
N	NORTHING
NAVD88	NORTH AMERICA VERTICAL DATUM 1988
NTS	NOT TO SCALE
N-S	NORTH TO SOUTH
OHW	ORDINARY HIGH WATER
RCG	REED CANARYGRASS
ROW	RIGHT-OF-WAY
SS	SIDE SLOPE
SHT	SHEET
SPEC	SPECIFICATION
STA	STATION
STD	STANDARD
TEMP	TEMPORARY
TOB	TOP OF BANK
TOE	TOE OF CHANNEL
TYP	TYPICAL
UON	UNLESS OTHERWISE NOTED
WCS	WATER CONTROL STRUCTURE
WHS	WOOD HABITAT STRUCTURE
W/	WITH
WSE	WATER SURFACE ELEVATION
YPC	YELLOW PLASTIC CAP

CHANNEL NAME ABBREVIATIONS

DU	DUNLIN
PL	PLOVER
SA	SANDPIPER
SN	SNIPE
TU	TURNSTONE
HE	HERON

GENERAL NOTES

1. IN-WATER WORK WINDOW: JULY 1 - SEPTEMBER 30. NO IN WATER WORK OUTSIDE OF THIS TIME FRAME WITHOUT SPECIAL WRITTEN APPROVAL.
2. GROUND CONTROL SURVEY PROVIDED BY STATEWIDE LAND SURVEYING, 2012 TO 2017.
   HORIZONTAL DATUM: STATE PLANE, OREGON NORTH ZONE, NAD83, US INTERNATIONAL FEET
   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)
3. TOPOGRAPHY CONTOURS BASED ON LIDAR.
4. CONTRACTORS WORKING IN PUBLIC ROW SHALL BE LICENSED FOR THEIR WORK AND MAINTAIN LIABILITY INSURANCE REQUIREMENTS CONSISTENT WITH TILLAMOOK COUNTY'S UTILITIES ORDINANCE. EVIDENCE OF INSURANCE SHALL BE PROVIDED TO THE TILLAMOOK COUNTY ROAD DEPARTMENT.
5. CONTRACTOR IS RESPONSIBLE FOR MEETING ALL STATE & COUNTY TRAFFIC SIGNAGE AND/OR FLAGGING REQUIREMENTS.
6. CONTRACTOR IS RESPONSIBLE FOR MEETING ALL PERMIT REQUIREMENTS. ANY FINES INCURRED DUE TO PERMIT VIOLATIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
7. THE CONTRACTOR IS RESPONSIBLE FOR VISITING THE SITE AND OBSERVING SITE CONDITION IN ALL WORK AREAS PRIOR TO BIDDING.
8. LAND SURFACE ELEVATIONS WITHIN THE WORK AREA RANGE FROM 6 FT TO 15 FT NAVD88. WORK AREA IS PROTECTED BY DIKE W/ LOW POINT OF APPROX 10 FT NAVD88.
9. PREDICTED TIDE ELEVATIONS DURING CONSTRUCTION ARE BETWEEN 3 FT AND 9 FT NAVD88. BETWEEN JULY AND OCTOBER, THE HIGHEST PREDICTED TIDE IS 9 FT NAVD88.
10. ALL QUANTITY ESTIMATES ARE APPROXIMATE.
11. PROPERTY BOUNDARY PER C. WAYNE COOK LAND SURVEYING PARTITION SURVEY ("REBOB SURVEY") SEP 2010 VIA TNC.

SURVEY CONTROL POINTS

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
1	686162.42	7341923.80	14.81	SET HUB AND MAG
2	685500.47	7340454.41	9.77	SET MAG NAIL
3	685545.47	7340513.24	11.19	SET NAIL SPIKE RPC
4	685546.88	7340386.05	9.53	SET NAIL SPIKE RPC
5	685143.31	7340293.08	9.61	FD 5/8" IRON ROD YPCTERRY JONES
6	685039.97	7340255.53	9.64	FD 5/8" IRON ROD YPCTERRY JONES
7	685058.01	7340205.66	9.51	FD 5/8" IRON ROD YPCTERRY JONES
8	685161.41	7340243.34	9.54	FD 5/8" IRON ROD YPCTERRY JONES
9	685628.87	7340269.87	9.46	SET NAIL SPIKE RPC
10	685632.48	7340563.96	9.18	SET NAIL SPIKE RPC
11	685880.40	7342192.61	16.63	SET 5/8 IR LGCAP
12	685854.70	7341996.47	15.62	SET 5/8 IR LGCAP

FLOOD / TIDAL WATER LEVELS	ELEV (FT NAVD88)
100 - YR BASE FLOOD	12.0
10 - YR	11.5
JURISD OHW	11.4
5 - YR	10.8
MHHW	7.8
MHW	7.0
MTL	3.9
NAVD88 DATUM	0.0
MLLW	-0.3

NOTICE TO EXCAVATORS:

ATTENTION: OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THE RULES BY CALLING THE CENTER.
(NOTE: THE TELEPHONE NUMBER FOR THE OREGON UTILITY NOTIFICATION CENTER IS 503-232-1987).

POTENTIAL UNDERGROUND FACILITY OWNERS

Dig Safely.

Call the Oregon One-Call Center
DIAL 811 or 1-800-332-2344

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
JULY 9, 2019
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #150
PORTLAND, OR 97214
503.297.6666

The Nature Conservancy
821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	REVISION
	3/15/2019	FINAL DESIGN

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
NOTES & ABBREVIATIONS
TILLAMOOK, OR

JOB NO.

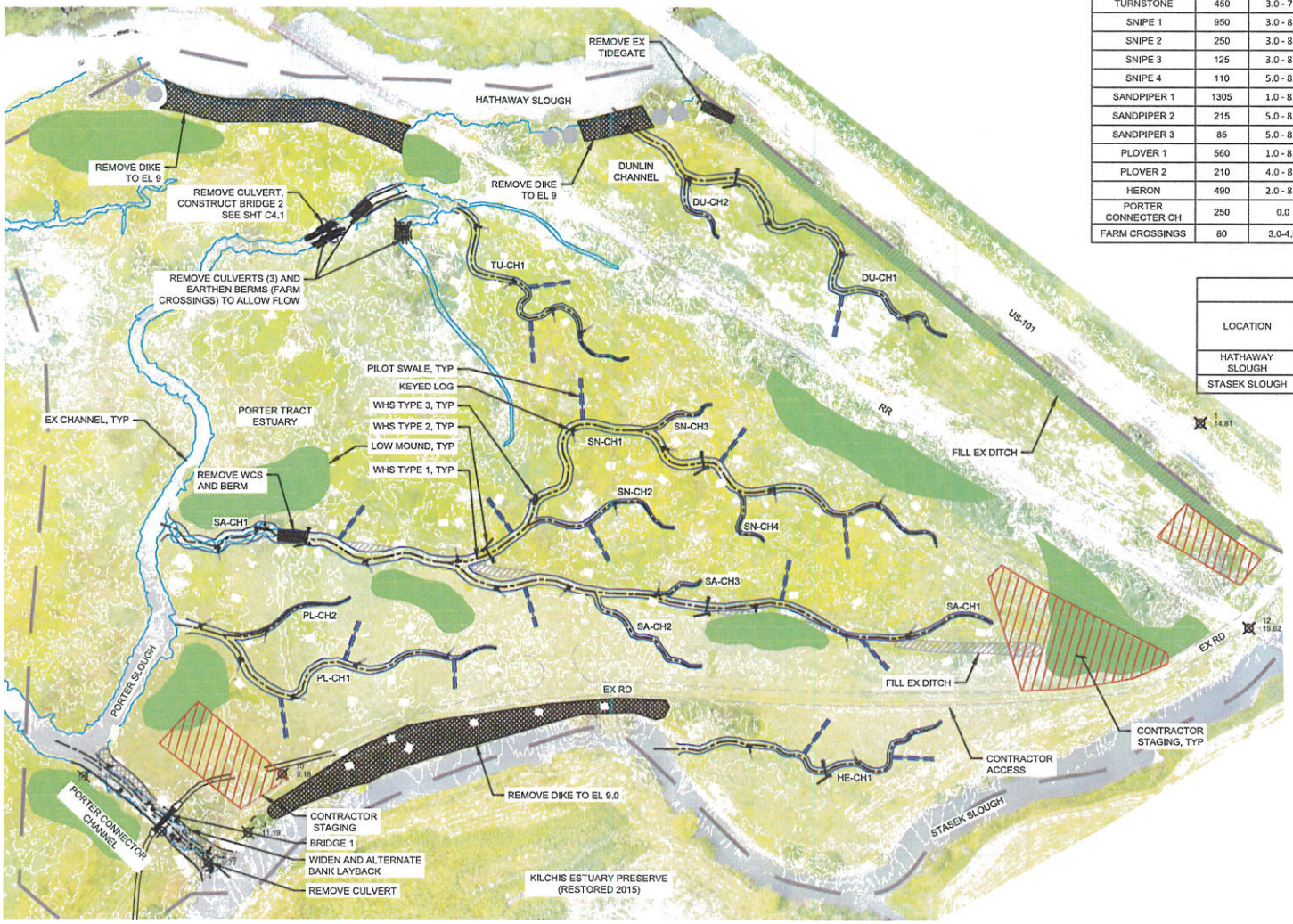
SHEET NO.
G1.1

CHANNEL EXCAVATION - SUMMARY TABLE

CHANNEL SEGMENT	APPROX LENGTH (FT)	BOTTOM ELEVATION (FT NAVD88)	APPROX BOTTOM WIDTH (FT)	APPROX TOP WIDTH (FT)	APPROX CHANNEL AREA (SF)	APPROXIMATE EXCAVATION VOLUME (CY)
DUNLIN 1	710	1.0 - 7.0	2 - 8	3 - 16	8,485	1,150
DUNLIN 2	125	4.0 - 7.0	2 - 6	3 - 11	575	150
TURNSTONE	450	3.0 - 7.0	2 - 6	3 - 13	2,850	555
SNIPE 1	950	3.0 - 8.0	2 - 8	3 - 15	11,050	1,300
SNIPE 2	250	3.0 - 8.0	2 - 4	3 - 10	1,615	195
SNIPE 3	125	3.0 - 8.0	2 - 4	3 - 9	585	150
SNIPE 4	110	5.0 - 8.0	2	3 - 7	575	150
SANDPIPER 1	1305	1.0 - 8.0	2 - 12	3 - 20	17,985	2,910
SANDPIPER 2	215	5.0 - 8.0	2 - 4	3 - 10	1,530	150
SANDPIPER 3	85	5.0 - 8.0	2 - 4	3 - 7	500	150
PLOVER 1	560	1.0 - 8.0	2 - 8	3 - 20	6,010	1,055
PLOVER 2	210	4.0 - 8.0	2 - 6	3 - 12	1,340	180
HERON	490	2.0 - 8.0	2 - 6	3 - 12	4,035	605
PORTER CONNECTER CH	250	0.0	12	30-40	5,035	1,430
FARM CROSSINGS	80	3.0-4.0	5	15	1,200	180
					TOTAL	10,320

DIKE REMOVAL - SUMMARY TABLE

LOCATION	APPROX LENGTH (FT)	APPROX TOP WIDTH (FT)	APPROX DEPTH (FT)	APPROX REMOVAL AREA (SF)	APPROXIMATE EXCAVATION VOLUME (CY)
HATHAWAY SLOUGH	450	22	3.0	9,900	1,300
STASEK SLOUGH	620	45	2.0	22,500	1,670
				TOTAL	2,970



PLAN - SITE OVERVIEW

SCALE
80 0 40 80 160
SCALE FEET

NOTES:

1. ENTER SITE AT DESIGNATED ENTRANCE POINT UNLESS APPROVED BY ENGINEER.
2. USE APPROPRIATE TRAFFIC CONTROL MEASURES WHEN ENTERING PUBLIC ROADWAY, SEE SPECIFICATIONS.
3. ALL ACCESS ROUTES AND SITE ENTRANCES SHALL BE RESTORED ACCORDING TO SPECIFICATIONS AND SEEDING PLAN.
4. CONSTRUCT CHANNELS HERE ON AND PER CHANNEL LAYOUT SHEETS. KEEP EXISTING DIKES AND CHANNEL CONNECTION IN PLACE UNTIL GRADING IN THE CENTER OF THE SITE IS FINISHED, DO NOT REMOVE THE BERM AND CULVERT AT THE PORTER CONNECTION CHANNEL UNTIL THE CHANNEL GRADING AND BRIDGE HAS BEEN FINISHED.
5. SEE ESC1.1 FOR EROSION CONTROL.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.231.6668

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY AJ | DRAWN BY AJ/JR | CHECKED BY CL | APPROVED BY CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

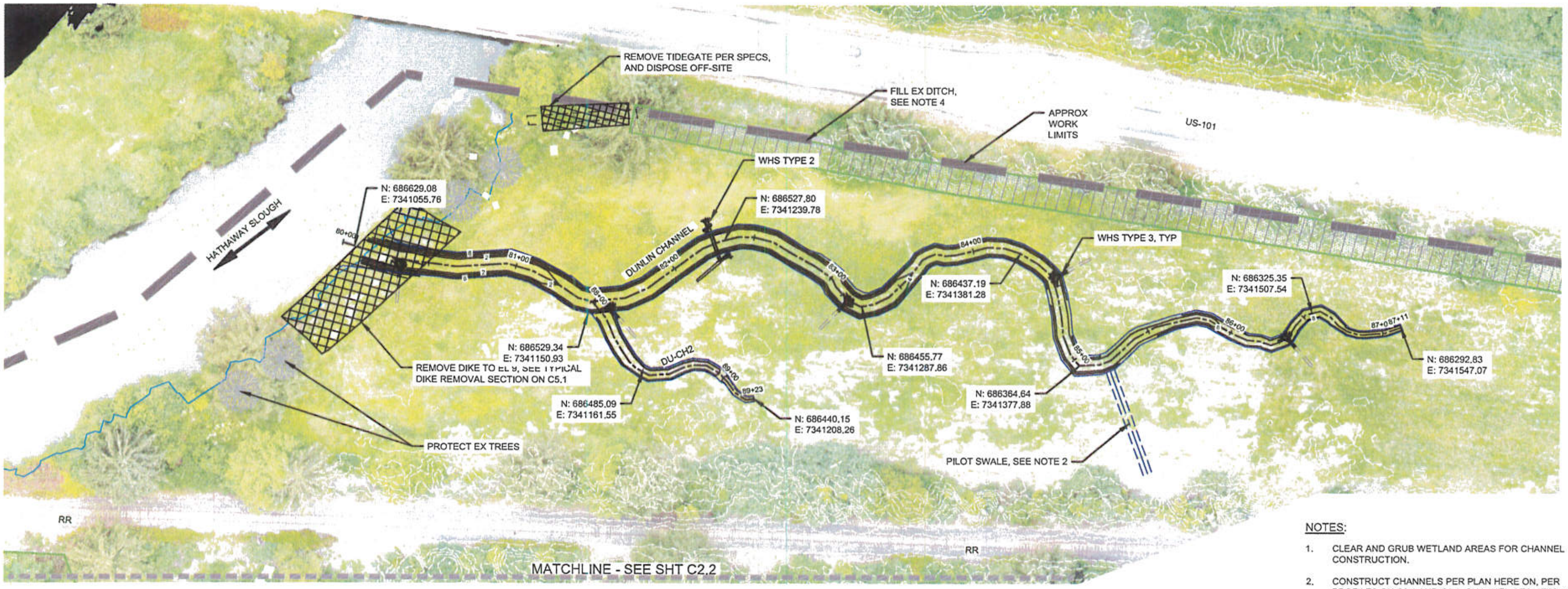
THE NATURE CONSERVANCY
PORTER TRACT

SITE OVERVIEW

TILLAMOOK, OR

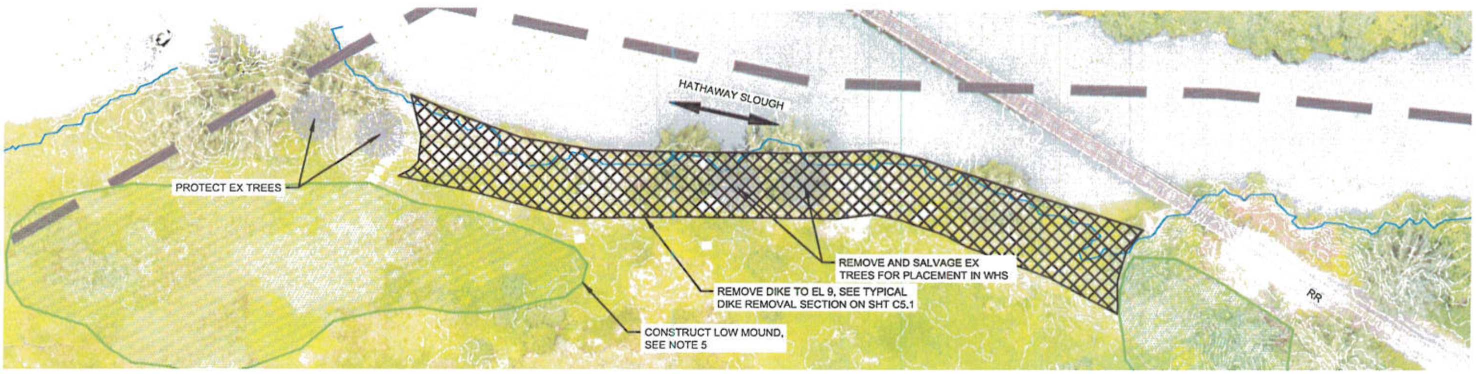
JOB NO.

SHEET NO.
C1.1



PLAN - NORTHERN CHANNELS

SCALE 30 0 15 30 60 FEET



PLAN - HATHAWAY SLOUGH BERM REMOVAL

SCALE 30 0 15 30 60 FEET

NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON, THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR. 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	AJ
DRAWN BY	AJ/JR
CHECKED BY	CL
APPROVED BY	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN
REVISION		

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

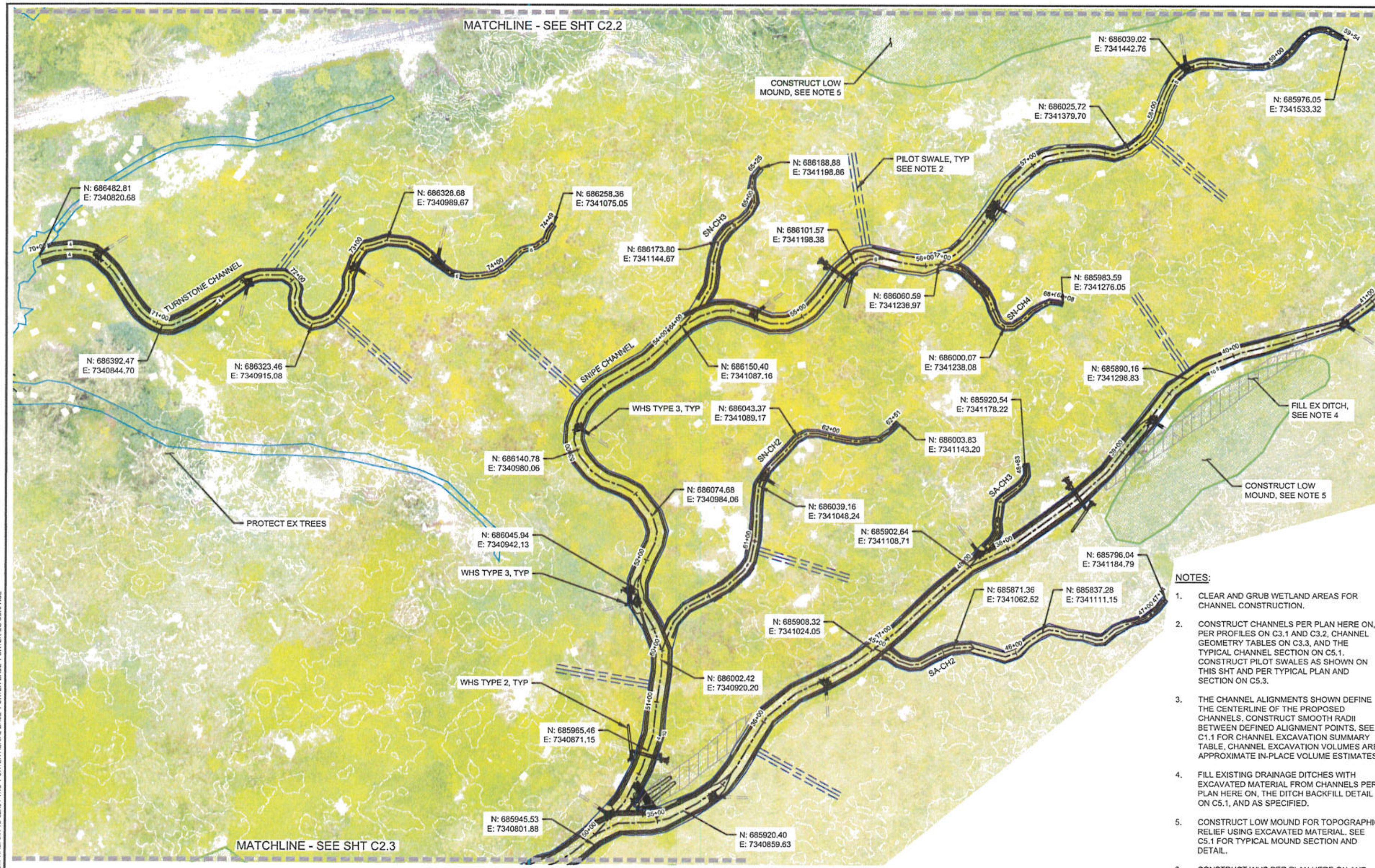
CH LAYOUT & GRADING PLAN 1

TILLAMOOK, OR

JOB NO.

SHEET NO. C2.1

DWG Z:\Shared\W2\CAD\2017\0002-TNC-Kilchis\DWG\C2.1-C2.X CH LAYOUT.dwg USER User
DATE Feb 18, 2019 1:23pm XREFS X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE



PLAN - CENTRAL CHANNELS

N

SCALE

30 0 15 30 60

SCALE FEET

NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON, THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2016
AMANDA L. JONES

RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	AJ
DRAWN BY	AJ/JR
CHECKED BY	CL
APPROVED BY	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN
		REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

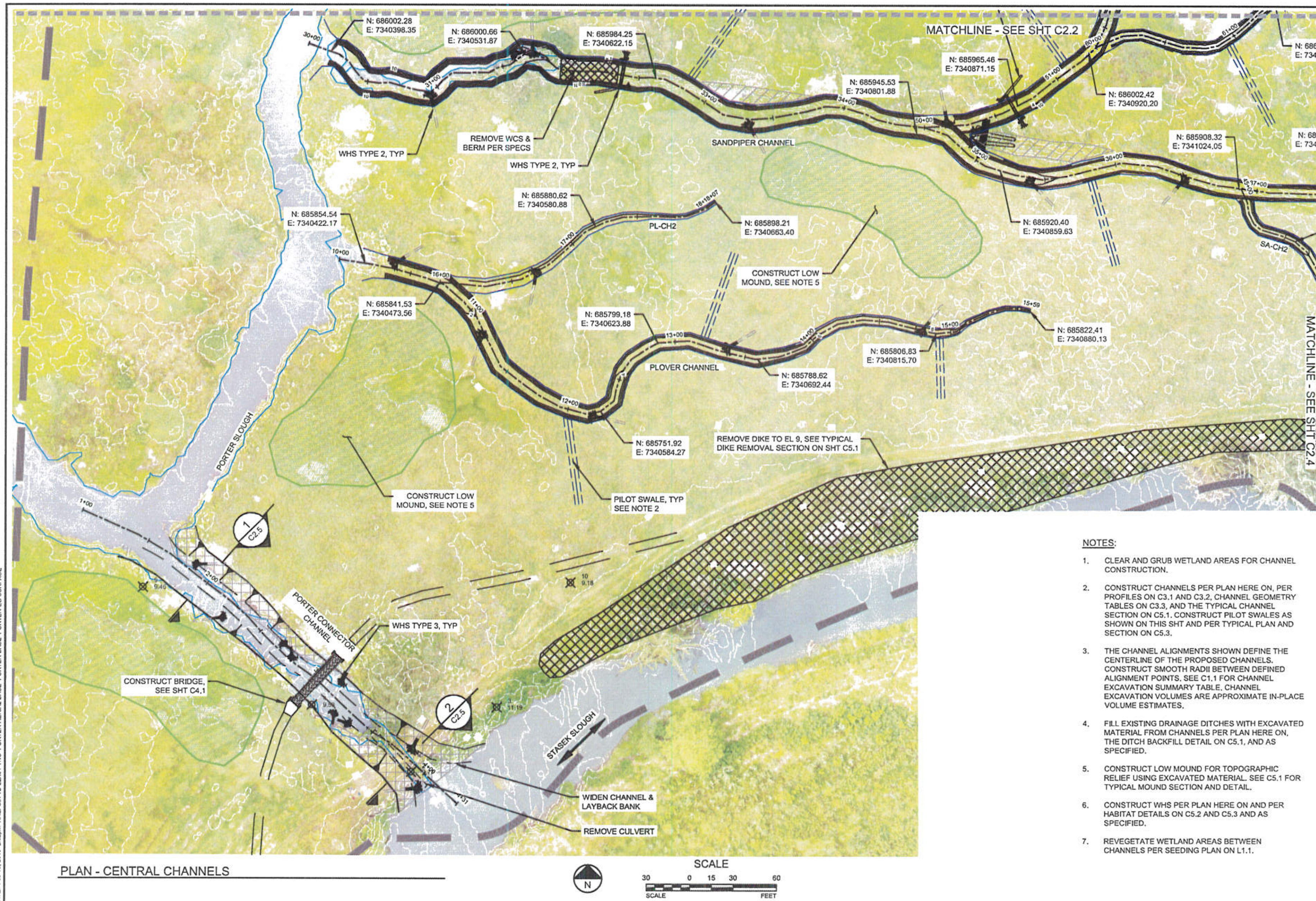
CH LAYOUT &
GRADING PLAN 2

TILLAMOOK, OR

JOB NO.

SHEET NO.
C2.2

DWG: Z:\Shared\W2\CAD\2017002-TNC-Alstrict\DWG\C2.1-C2.X CH LAYOUT.dwg USER: User
DATE: Feb 16, 2019 1:24pm XREFS: X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE



NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON, THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2016 AMANDA L JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE, SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	AJ
DRAWN BY	AJ/JR
CHECKED BY	CL
APPROVED BY	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN
		REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

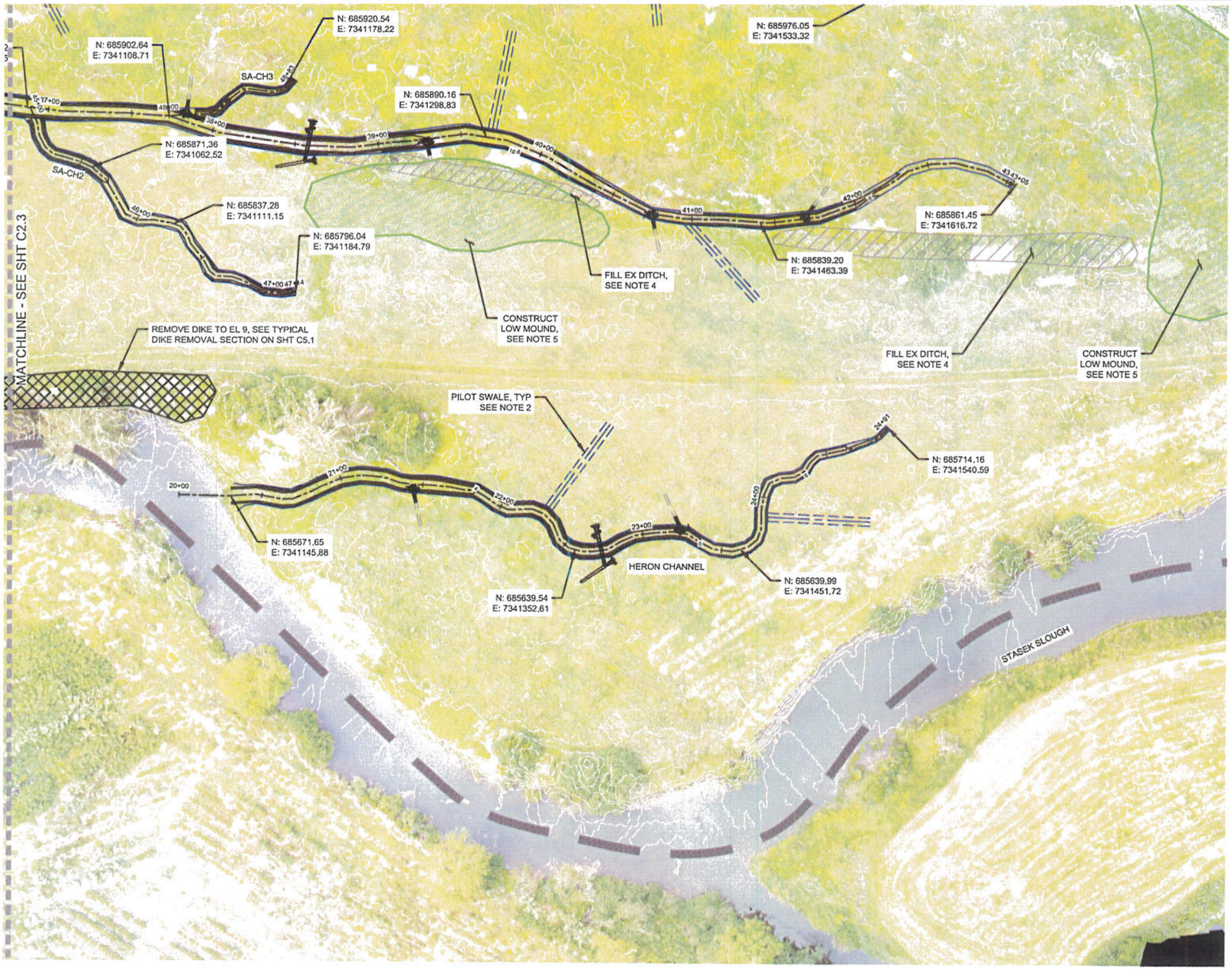
CH LAYOUT & GRADING PLAN 3

TILLAMOOK, OR

JOB NO.

SHEET NO. C2.3

DWG: Z:\Shared\WW2CAD\2017\0002-TNC-Kilchis\DWG\C2.1-C2.X CH LAYOUT.dwg USER: Amanda-PC
DATE: Feb 18, 2019 2:32pm XREFS: X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE



PLAN - SOUTHERN CHANNELS

SCALE 30 0 15 30 60 FEET

NOTES:

1. CLEAR AND GRUB WETLAND AREAS FOR CHANNEL CONSTRUCTION.
2. CONSTRUCT CHANNELS PER PLAN HERE ON, PER PROFILES ON C3.1 AND C3.2, CHANNEL GEOMETRY TABLES ON C3.3, AND THE TYPICAL CHANNEL SECTION ON C5.1. CONSTRUCT PILOT SWALES AS SHOWN ON THIS SHT AND PER TYPICAL PLAN AND SECTION ON C5.3.
3. THE CHANNEL ALIGNMENTS SHOWN DEFINE THE CENTERLINE OF THE PROPOSED CHANNELS. CONSTRUCT SMOOTH RADII BETWEEN DEFINED ALIGNMENT POINTS. SEE C1.1 FOR CHANNEL EXCAVATION SUMMARY TABLE. CHANNEL EXCAVATION VOLUMES ARE APPROXIMATE IN-PLACE VOLUME ESTIMATES.
4. FILL EXISTING DRAINAGE DITCHES WITH EXCAVATED MATERIAL FROM CHANNELS PER PLAN HERE ON, THE DITCH BACKFILL DETAIL ON C5.1, AND AS SPECIFIED.
5. CONSTRUCT LOW MOUND FOR TOPOGRAPHIC RELIEF USING EXCAVATED MATERIAL. SEE C5.1 FOR TYPICAL MOUND SECTION AND DETAIL.
6. CONSTRUCT WHS PER PLAN HERE ON AND PER HABITAT DETAILS ON C5.2 AND C5.3 AND AS SPECIFIED.
7. REVEGETATE WETLAND AREAS BETWEEN CHANNELS PER SEEDING PLAN ON L1.1.

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR. 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

REVISION

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

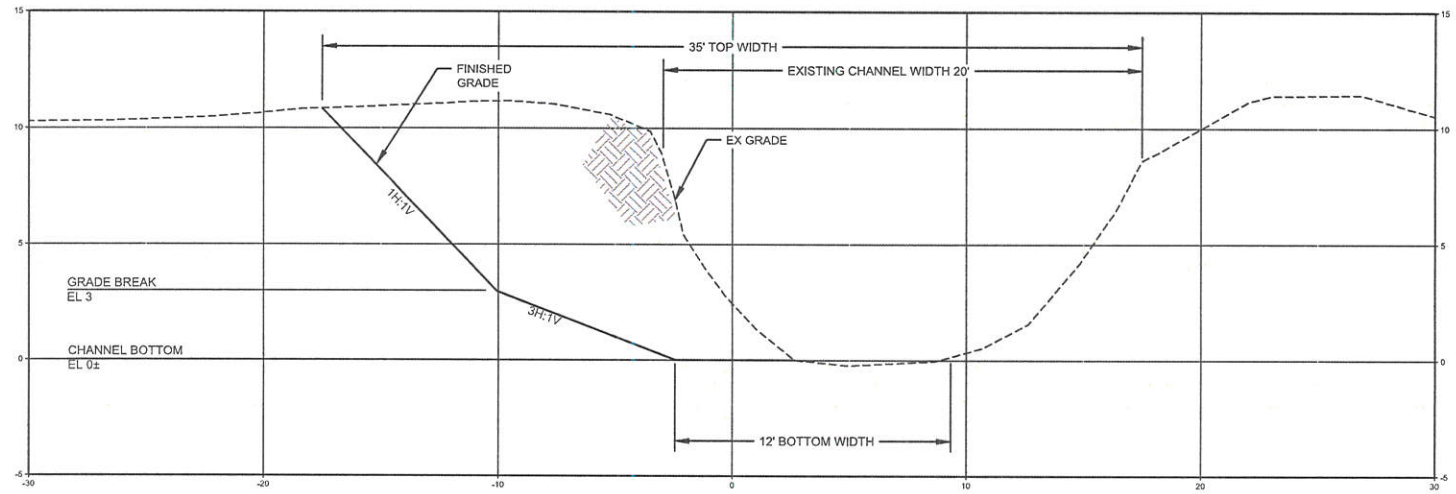
FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
CH LAYOUT & GRADING PLAN 4
TILLAMOOK, OR

JOB NO.

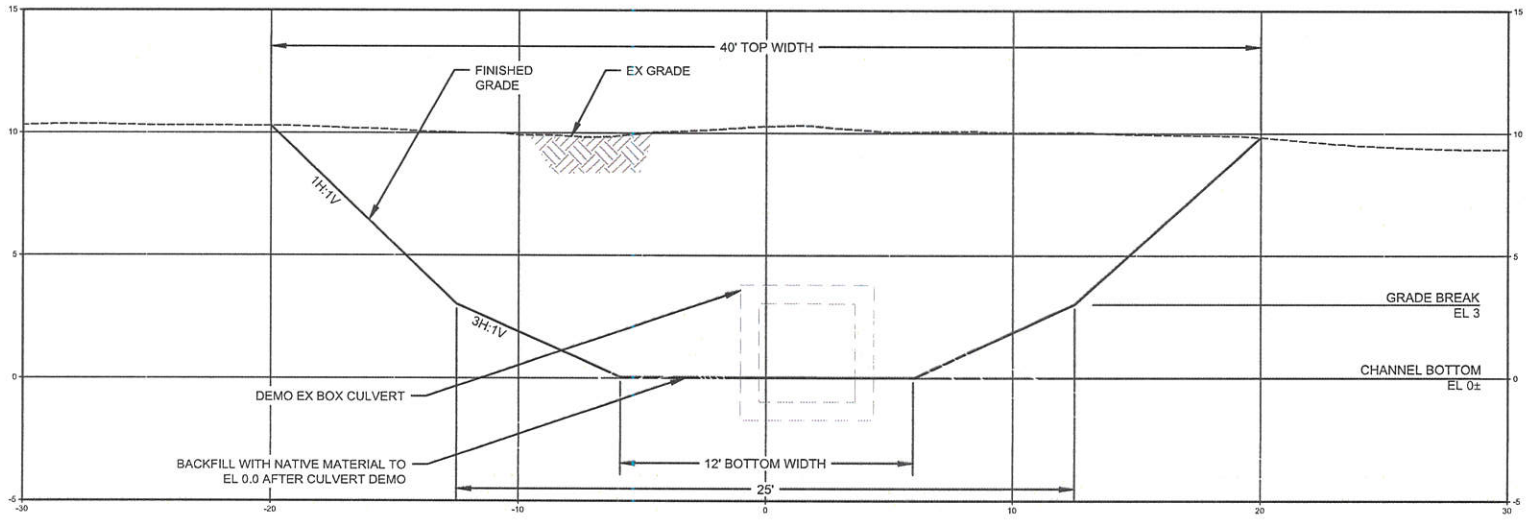
SHEET NO. C2.4

DWG: Z:\Shares\WW2\CAD\2017\0002-TNC-Kilchis\DWG\C2.1-C2.X CH LAYOUT.dwg USER: User
DATE: Feb 18, 2019 1:25pm XREFS:X-TB-22X34-TNC PORTER-AERIAL BASE PORTER-BASE PORTER-EG SURFACE



SECTION 1 - PORTER CROSSING DOWNSTREAM OF BRIDGE

SCALE: 1" = 3'



SECTION 2 - PORTER CROSSING UPSTREAM OF BRIDGE

SCALE: 1" = 3'

NOTES:

1. SECTIONS ARE SHOWN LOOKING EAST (UPSTREAM).
2. SECTIONS ARE 1H:1V.
3. VERTICAL DATUM IS NAVD88 IN FEET.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.207.6568

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	REVISION DESCRIPTION
	2/13/2019	FINAL DESIGN

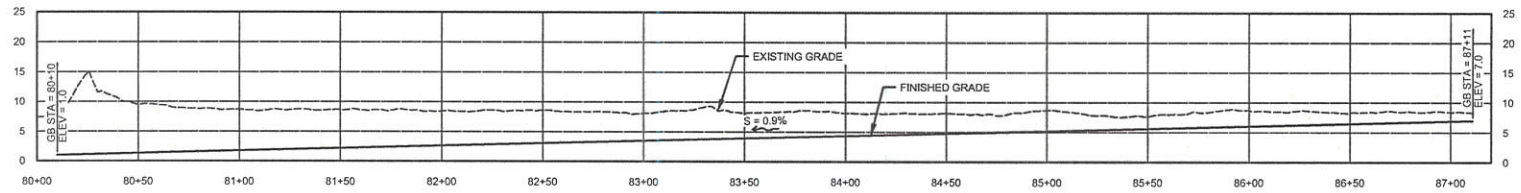
FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
CONNECTOR CHANNEL SECTIONS
TILLAMOOK, OR

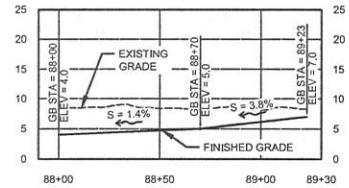
JOB NO.

SHEET NO.
C2.5

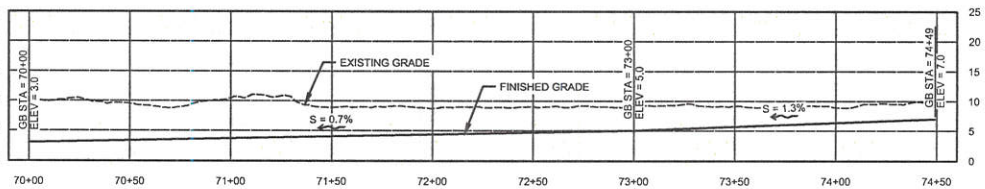
DWG Z:\Shared\WDK\CAD\2017\003.TNC-Kilchis\DWG\C2.5 CONNECTOR CHNL SECTIONS.dwg USER: Amanda-PC
DATE Feb 18, 2019 2:06pm XREFS:X-TR-22X34-TNC PORTER-BASE PORTER-EG SURFACE



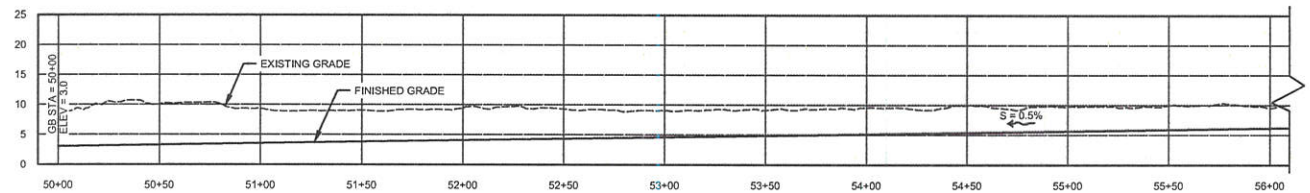
PROFILE - DUNLIN
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10

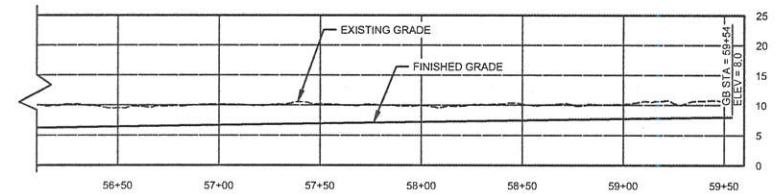


PROFILE - DUNLIN 2
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10

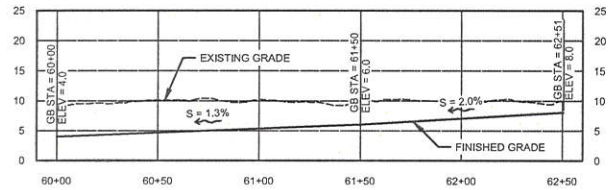


PROFILE - TURNSTONE
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10

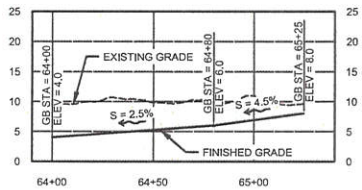




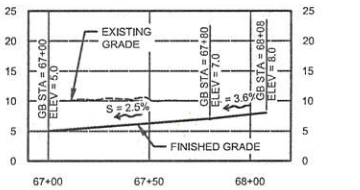
PROFILE - SNIPE
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - SNIPE 2
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - SNIPE 3
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - SNIPE 4
SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10

NOTES:

1. CONSTRUCT CHANNEL PER PLAN ON C2.1 TO C2.4 AND PER PROFILES THIS SHEET. FINISHED GRADE PROFILES REPRESENT CHANNEL BOTTOM ELEVATIONS. EXISTING GRADE IS BASED OFF OF LIDAR AND MAY VARY.
2. ELEVATIONS SHOWN ARE RELATIVE TO FEET NAVD88.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR 8, 2019
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.239.6688

The Nature Conservancy
821 SE 14TH AVE.
PORTLAND, OR 97214

NO.	DATE	DESCRIPTION	DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
	2/15/2019	FINAL DESIGN	AJ	AJ/JR	CL	CL/AJ

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

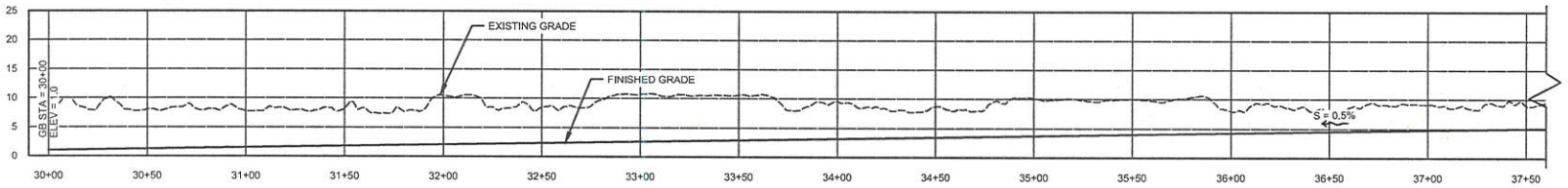
CHANNEL PROFILES 1

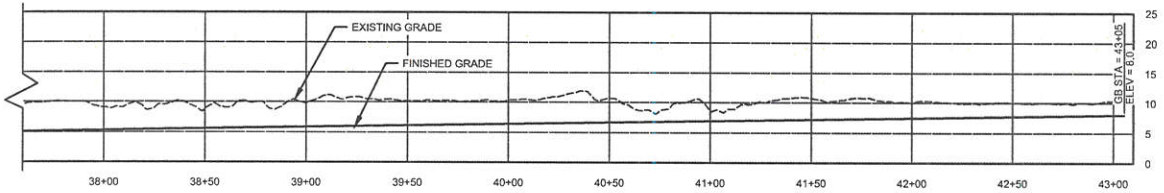
TILLAMOOK, OR

JOB NO.

SHEET NO.
C3.1

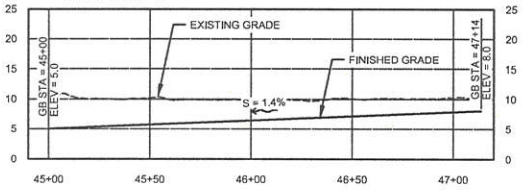
DWG: Z:\Shared\WW\CAD\2017\005-TNC-Kilchis\DWG\C3.1 CH PROFILES.dwg USER: User
DATE: Feb 18, 2019 1:25pm XREFS:X-TB-223A-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE





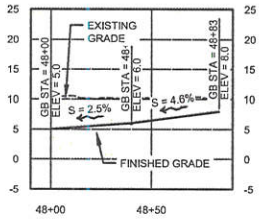
PROFILE - SANDPIPER

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



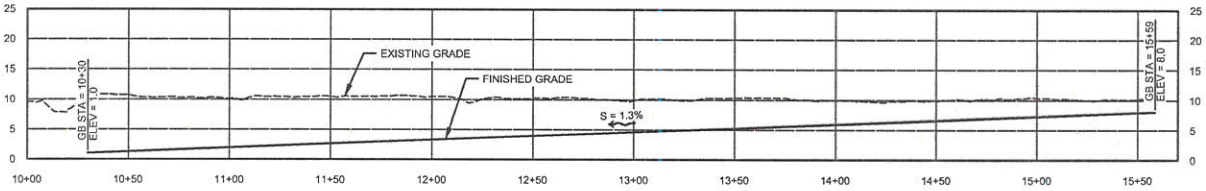
PROFILE - SANDPIPER 2

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



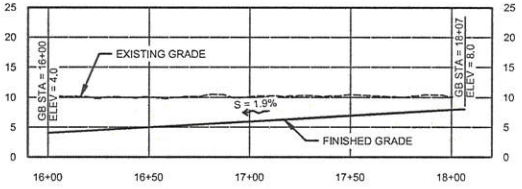
PROFILE - SANDPIPER 3

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



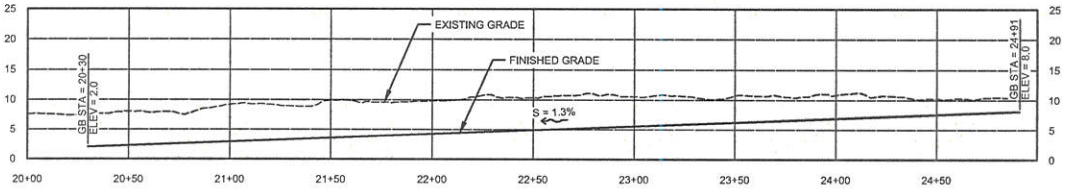
PROFILE - PLOVER

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - PLOVER 2

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10



PROFILE - HERON

SCALE: HORIZONTAL 1" = 30'
SCALE: VERTICAL 1" = 10

NOTES:

1. CONSTRUCT CHANNEL PER PLAN ON C2.1 TO C2.4 AND PER PROFILES THIS SHEET. FINISHED GRADE PROFILES REPRESENT CHANNEL BOTTOM ELEVATIONS. EXISTING GRADE IS BASED OFF OF LIDAR AND MAY VARY.
2. ELEVATIONS SHOWN ARE RELATIVE TO FEET NAVD88.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.207.6969

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

NO.	DATE	REVISION	APPROVED BY	CHECKED BY	DRAWN BY	DESIGNED BY
	2/15/2019	FINAL DESIGN	CL/AJ	CL	AJR	AJ

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

CHANNEL PROFILES 2

TILLAMOOK, OR

JOB NO.

SHEET NO.
C3.2

STA	BOTTOM WIDTH FT	TOP WIDTH FT
SNIPE		
50+20	8	15
56+00	8	12
56+20	6	10
57+20	6	10
57+40	4	8
58+60	4	8
58+80	2	5
59+50	2	3
SNIPE CH2		
60+00	4	10
61+40	4	8
61+50	2	8
62+50	2	3
SNIPE CH3		
64+00	4	9
64+80	4	8
64+80	2	6
65+25	2	3
SNIPE CH4		
67+00	2	7
68+10	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
SANDPIPER		
30+00	12	20
33+45	12	20
33+65	10	17
35+05	10	17
35+30	8	14
36+90	8	13
37+10	6	12
40+20	6	11
40+65	4	7
42+00	4	7
42+10	2	5
43+05	2	3
SANDPIPER CH2		
45+00	4	10
46+80	4	7
46+85	2	5
47+15	2	3
SANDPIPER CH3		
48+10	2	7
48+83	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
DUNLIN		
80+00	8	16
83+45	8	12
83+65	6	10
85+45	6	9
85+65	4	6
86+70	4	6
86+80	2	4
87+10	2	3
DUNLIN CH2		
88+00	6	11
88+40	6	10
88+50	4	8
89+00	4	6
89+00	2	4
89+25	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
PORTER CONNECTION CHANNEL		
1+85	12	40
2+40	12	35
2+65	12	30
3+20	12	30
3+45	12	35
3+70	12	40

STA	BOTTOM WIDTH FT	TOP WIDTH FT
PLOVER		
10+30	8	20
11+80	8	15
12+00	6	13
13+60	6	11
13+80	4	8
15+00	4	7
15+10	2	5
15+60	2	3
PLOVER CH2		
16+00	6	12
16+60	6	11
16+70	4	9
17+50	4	7
17+60	2	5
18+10	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
HERON		
20+30	6	12
21+60	6	12
21+80	4	9
24+60	4	8
24+80	2	5
24+90	2	3

STA	BOTTOM WIDTH FT	TOP WIDTH FT
TURNSTONE		
70+00	6	13
71+40	6	11
71+60	4	9
73+50	4	8
73+60	2	6
74+50	2	3

NOTES:

1. CONSTRUCT CHANNELS PER GEOMETRY ON THIS SHEET AND CROSS SECTION DETAIL ON SHEET 5.1.
2. LAYOUT CHANNEL HORIZONTAL ALIGHMENTS ACCORDING TO PLANS ON SHEETS C2.1 AND C2.4 AND PER ELECTRONIC CAD FILE PROVIDED BY CONTRACTOR.
3. CHANNEL SIDE SLOPES ARE IN 1H:2V UNLESS OTHERWISE DENOTED.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.227.4668

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/R	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

CHANNEL GEOMETRY

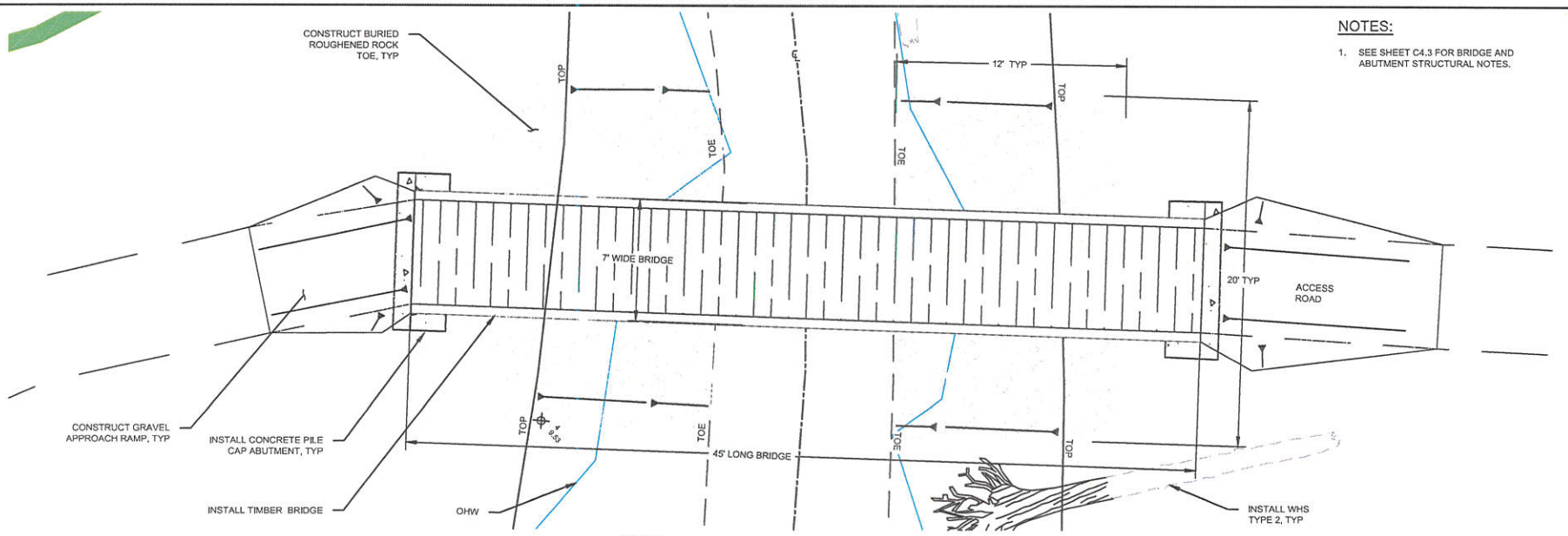
TILLAMOOK, OR

JOB NO.

SHEET NO.
C3.3

NOTES:

1. SEE SHEET C4.3 FOR BRIDGE AND ABUTMENT STRUCTURAL NOTES.



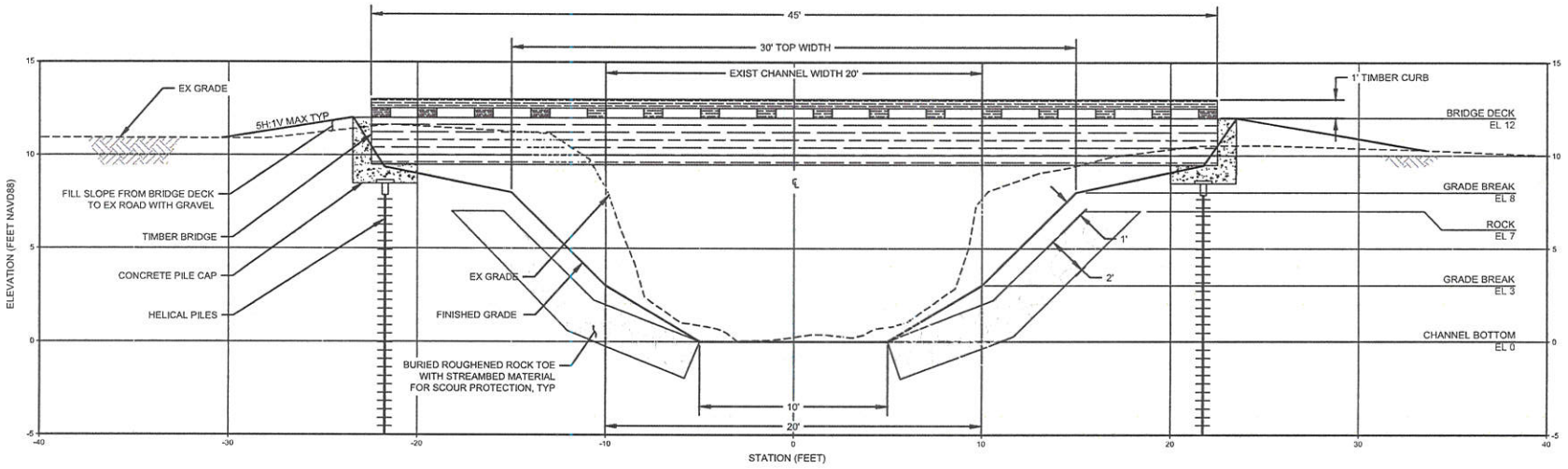
PLAN - PORTER CROSSING TIMBER BRIDGE 1

SCALE: 1" = 3'

SCALE

3 0 1.5 3 6

SCALE FEET



ELEVATION - PORTER CROSSING TIMBER BRIDGE 1

SCALE: 1" = 3'

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 9, 2005
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.297.6666

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	REVISION DESCRIPTION
	2/15/2019	FINAL DESIGN

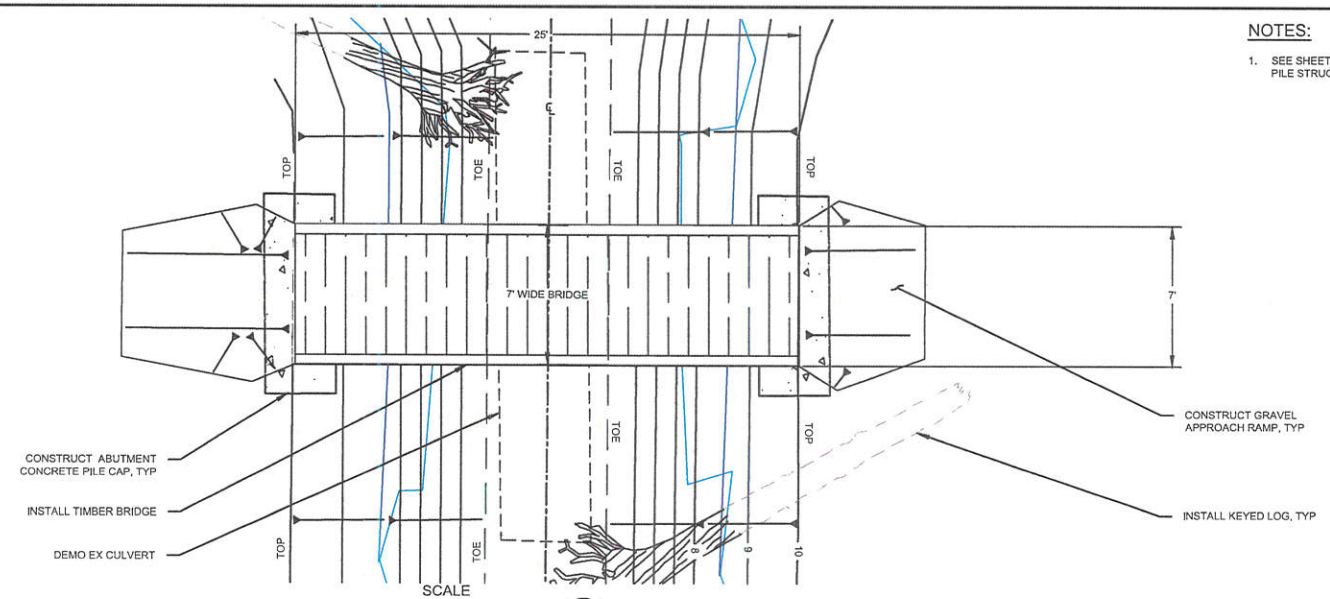
FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
BRIDGE 1
PLAN & SECTION
TILLAMOOK, OR

JOB NO.

SHEET NO.
C4.1

DWG Z:\Shared\WW\CAD\20170302-TNC-Kilchis\DWG\C4.1 BRIDGE SECTIONS.dwg USER: User
DATE Feb 18, 2019 1:27pm XREFS:X-TB-22X34-1 INC PORTER-BASE PORTER-EG SURFACE

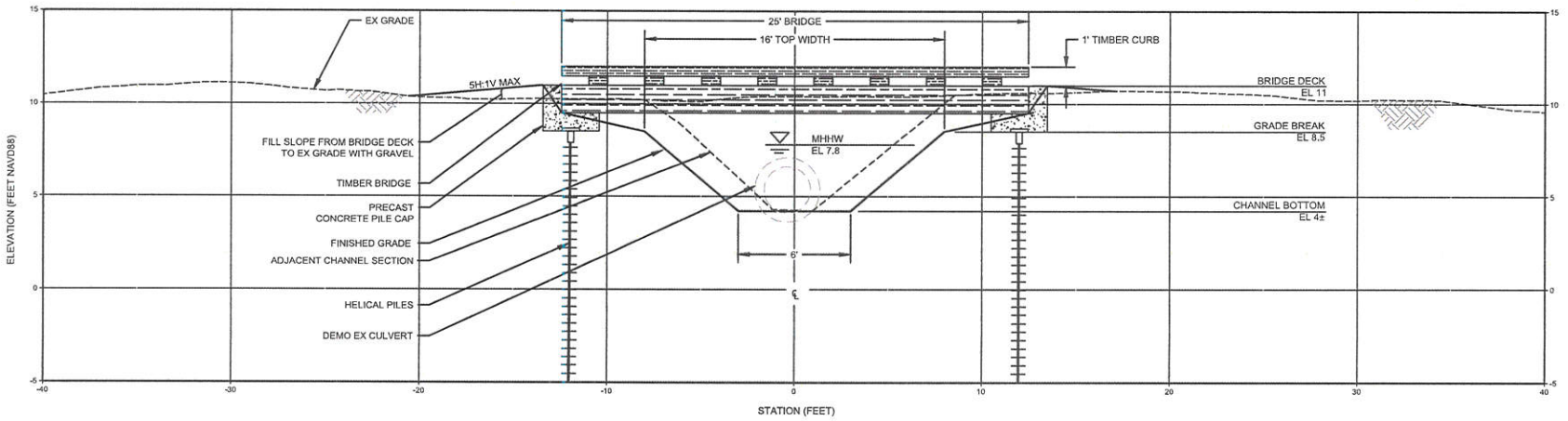


PLAN - NORTH CROSSING TIMBER BRIDGE 2

SCALE: 1" = 3'

SCALE 3 0 1.5 3 6 FEET

N



ELEVATION - NORTH CROSSING TIMBER BRIDGE 2

SCALE: 1" = 3'

NOTES:

1. SEE SHEET C4.3 FOR BRIDGE AND HELICAL PILE STRUCTURAL NOTES.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR 8, 2019
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.207.6868

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
		REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
BRIDGE 2
PLAN & SECTION
TILLAMOOK, OR

JOB NO.

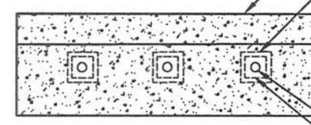
SHEET NO.
C4.2

BRIDGE STRUCTURAL NOTES:

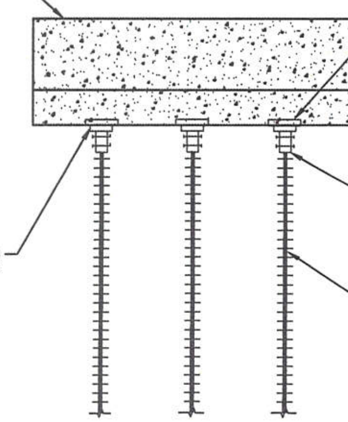
1. BRIDGE AND ABUTMENT SYSTEM SHOWN IS CONCEPTUAL. CONTRACTOR SHALL SUBMIT PREFAB BRIDGE AND ABUTMENT SYSTEM PLAN FOR ENGINEER REVIEW AND APPROVAL. BRIDGES SHALL BE TIMBER (ALASKAN YELLOW CEDAR OR APPROVED EQUIVALENT WITHOUT PRESSURE TREATMENT).
2. PERFORMANCE SPECIFICATIONS FOR PREFABRICATED BRIDGE AND ABUTMENT SYSTEM:
   - LENGTH:
     - PORTER CROSSING - 45' TOTAL (BRIDGE 1)
     - NORTH CROSSING - 25' TOTAL (BRIDGE 2)
   - WIDTH: APPROX 7' TOTAL
   - USE: LIGHT VEHICLES & PEDESTRIAN ACCESS
   - DECK EL:
     - PORTER CROSSING - EL 12 FT NAVD88
     - NORTH CROSSING - EL 11 FT NAVD88
   - GUARDRAIL: NONE, 6" CURB RAILS ON 6" BLOCKS (12" TOTAL CURB HEIGHT)
   - LOADING:
     - LIVE : 90 PSF
     - DEAD: STRUCTURE WEIGHT
     - LATERAL: 2 FT/S DEBRIS
   - WIND: 85 MPH - EXPOSURE C
   - DECK: ALASKAN YELLOW CEDAR
   - TREATMENT: NO TREATMENT ALLOWED
3. STEEL COMPONENT SPECIFICATIONS:
   - STEEL SHAPES : ASTM A36
   - HARDWARE : ASTM A307 (A325 AS NOTED)
   - HOT DIP GALVANIZE ALL STEEL SHAPES AFTER FABRICATION.
   - HOT DIP GALVANIZE ALL HARDWARE.
   - ALL WELDING TO BE PER AWS SPECIFICATIONS CERTIFIED WELDERS.
   - TREAT ALL FIELD MODIFICATIONS W/ COLD GALVANIZING PAINT.
4. WOOD SURFACE SEALER SHALL BE APPLIED ACCORDING TO MANUFACTURER SPECIFICATIONS AND SLOPES V REQUIREMENTS.
5. BEARING PADS, ANCHOR BOLTS, AND ALL BRIDGE/ABUTMENT CONNECTION HARDWARE SHALL BE SUPPLIED WITH BRIDGE.
6. CERTIFIED TEST REPORTS SHALL BE FURNISHED FOR THE STRUCTURAL BRIDGE ELEMENTS, HIGH STRENGTH BOLTS, ELASTOMERIC BEARING PADS, AND ANCHOR BOLTS.
7. CAR AND ENGINEER TO VERIFY COORDINATES IN FIELD BEFORE PLACEMENT. BRIDGE COORDINATES AT ENDS (ALONG MIDLINE):
   - PORTER CONNECTION BRIDGE 2:
     - NORTH: N: 685547.81, E: 7340373.80
     - SOUTH: N: 685580.80, E: 7340404.38
   - NORTHERN BRIDGE 1:
     - NORTH: N: 686458.01, E: 7340625.06
     - SOUTH: N: 686436.62, E: 7340637.87
8. REMOVED CULVERTS TO BE TAKEN OFF SITE AND DISPOSED OF IN A MANNER AND LOCATION APPROVED BY CAR.
9. BRIDGE ABUTMENT SYSTEM SHALL COMPLY WITH REQUIREMENTS OF GEOTECHNICAL ENGINEERING REPORT (GEOTECHNICS LLC) AVAILABLE UPON REQUEST FROM CAR.
10. ABUTMENTS SHALL BE PRECAST REINFORCED CONCRETE PILE CAPS SUPPORTED BY HELICAL PILES, AND SHALL BE CONSTRUCTED PER BRIDGE MANUFACTURER SPECIFICATIONS. CAR AND ENGINEER TO APPROVE BRIDGE AND ABUTMENT SYSTEM PRIOR TO MANUFACTURING.
11. RECOMMENDED HELIX CONFIGURATIONS OF SINGLE SHAFT, 2-7/8 INCH OUTSIDE DIAMETER ARE SHOWN IN THE TABLE BELOW.
12. BRIDGE 2 HELICAL PILE ALTERNATIVES REFER TO THE NUMBER OF PILES (2 OR 3).

HELICAL ANCHOR DESIGN RECOMMENDATIONS

	# OF H-PILES PER END	HELIX CONFIGURATION	MINIMUM SPACING (FT)	MINIMUM TORQUE (FT-LB)	MINIMUM PILE DEPTH	ESTIMATED PILE DEPTH AT MIN TORQUE
BRIDGE 1	3	10"/12"	3.0	890	12	15
BRIDGE 2 - ALT 1	2	10"/12"	3.0	890	14	18
BRIDGE 2 - ALT 2	3	8"/10"	2.5	560	14	18



PLAN - ABUTMENT
SCALE: NTS



ELEVATION - HELICAL PILES
SCALE: NTS

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC. 1001 SE WATER AVE. SUITE #180 PORTLAND, OR 97214 503.207.6688

The Nature Conservancy 1821 SE 14TH AVE. PORTLAND, OR 97214

DESIGNED BY AJ | DRAWN BY AJ/JR | CHECKED BY CL | APPROVED BY CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

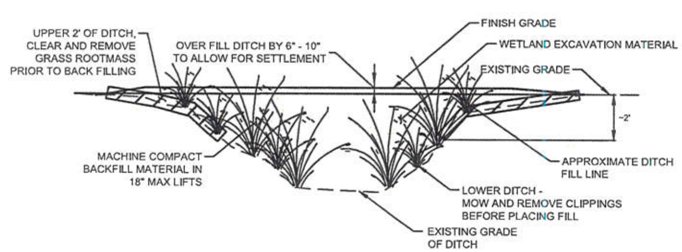
THE NATURE CONSERVANCY
PORTER TRACT
BRIDGE STRUCTURAL NOTES
TILLAMOOK, OR

JOB NO.
SHEET NO. C4.3

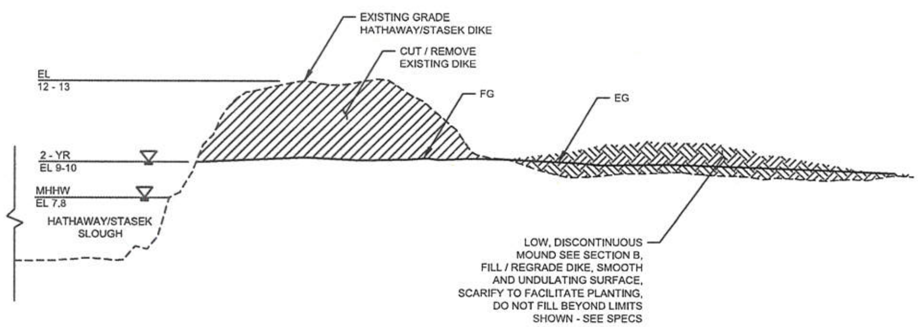
DWG: Z:\Shared\W2\CAD\2017002-TNC-Kilchis\DWG\C4.1 BRIDGE SECTIONS.dwg USER: Amanda-PC
DATE: Feb 18, 2019 3:29pm XREFS: X-TB-22X34-TNC PORTER-BASE PORTER-EG SURFACE

NOTE:

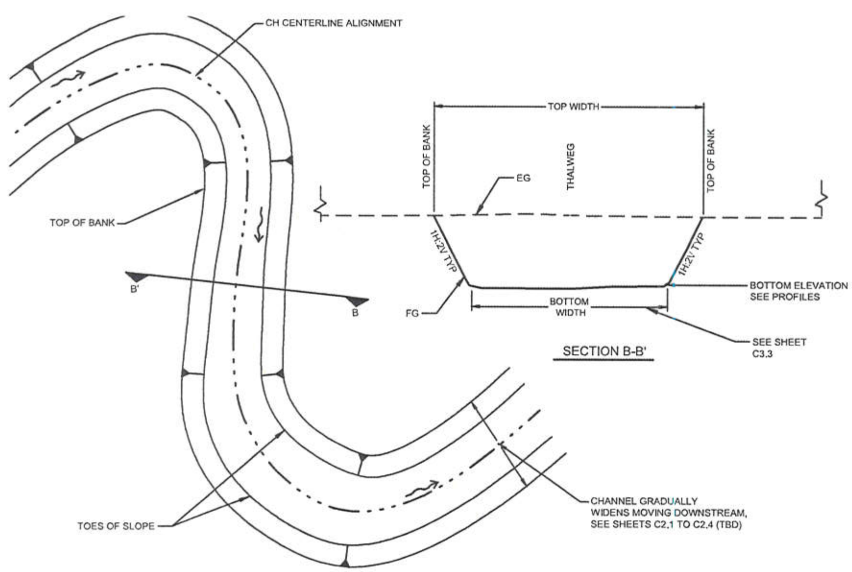
1. DEWATER DITCHES COMPLETELY PRIOR TO BACKFILLING IN ACCORDANCE WITH SPECIFICATIONS.
2. REMOVE ORGANIC MATERIAL FROM EXCAVATION MATERIAL BEFORE PLACING AS FILL.



1 DITCH BACKFILL DETAIL
NOT TO SCALE



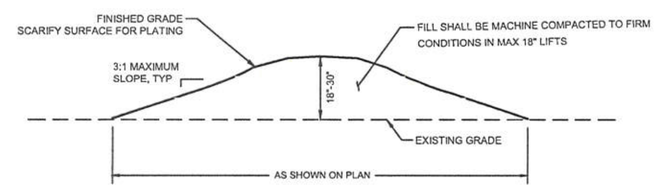
3 HATHAWAY AND STASEK SLOUGH DIKE REMOVAL - TYPICAL SECTION
NOT TO SCALE



NOTES:

1. SEE GEOMETRY TABLES FOR BOTTOM ELEVATIONS AND BOTTOM WIDTHS (TBD).

2 TYPICAL CHANNEL PLAN & SECTION
NOT TO SCALE



4 LOW MOUND - TYPICAL SECTION
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2016 AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

REVISION

NO.	DATE	DESCRIPTION
	3/15/2019	FINAL DESIGN

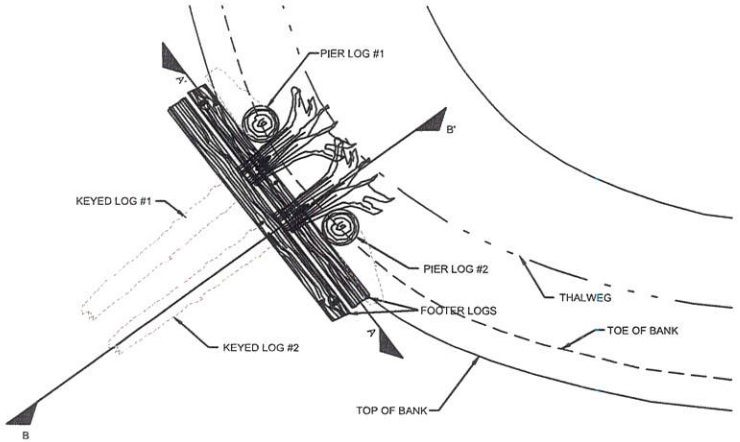
FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
GRADING DETAILS
TILLAMOOK, OR

JOB NO.

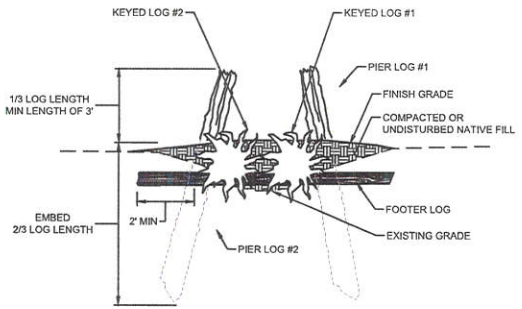
SHEET NO. C5.1

DWG: Z:\Shared\WWR\... USER: User
DATE: Feb 19, 2019 11:28am



1 WHS TYPE 1 - BANK DETAIL

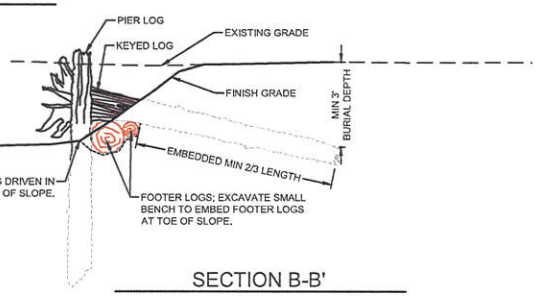
NOT TO SCALE



SECTION A-A'

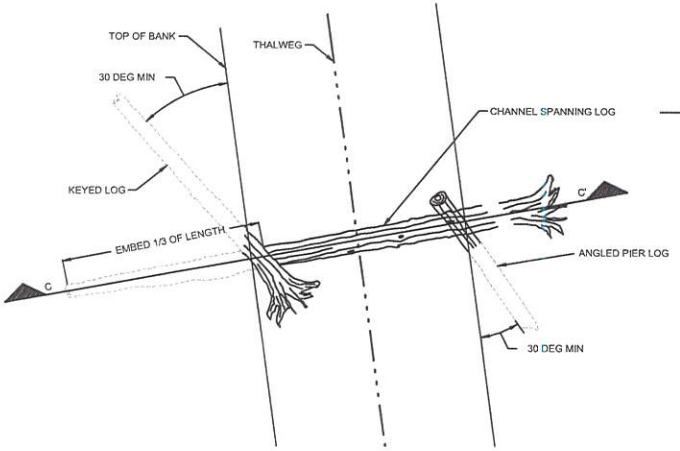
NOT TO SCALE

BANK STRUCTURE LOG SIZES		
LOG TYPE	DIA.	LENGTH
KEYED LOG	24"	20' MIN
PIER LOG	18"	15' MIN
FOOTER LOG	24"	12' MIN



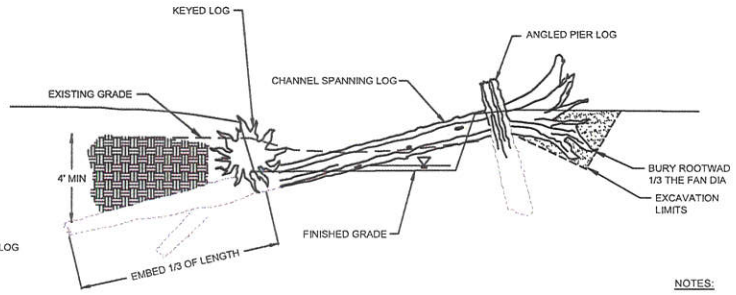
SECTION B-B'

NOT TO SCALE



2 WHS TYPE 2 - CHANNEL SPANNING DETAIL

NOT TO SCALE



SECTION C-C'

NOT TO SCALE

CHANNEL SPANNING STRUCTURE LOG SIZES		
LOG TYPE	DIA.	LENGTH
CH. SPANNING	24"	30' - 40'
KEYED LOG	16" - 20"	20'
PIER LOG	12" - 18"	12'

NOTES:

1. SEE INDIVIDUAL LOG DETAILS ON SHT C5.3.
2. THE WHS-CHANNEL SPANNING STRUCTURE WILL BE CONSTRUCTED IN TWO DIFFERENT SIZES, PROPORTIONAL TO THE CHANNEL SIZE. REFER TO LOG SIZE TABLES AND SPECIFICATIONS FOR LOG REQUIREMENTS AND NUMBER OF EACH SIZE.
3. INSTALL ALL LOGS BY SHARPENING ENDS WITH A CHAINSAW AND DRIVING THE LOG INTO THE GROUND. EXCAVATE ONLY AS NECESSARY.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR 9, 2018
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.297.6656

The Nature Conservancy
821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/5/2019	FINAL DESIGN

REVISION

THE NATURE CONSERVANCY
PORTER TRACT
TILLAMOOK, OR

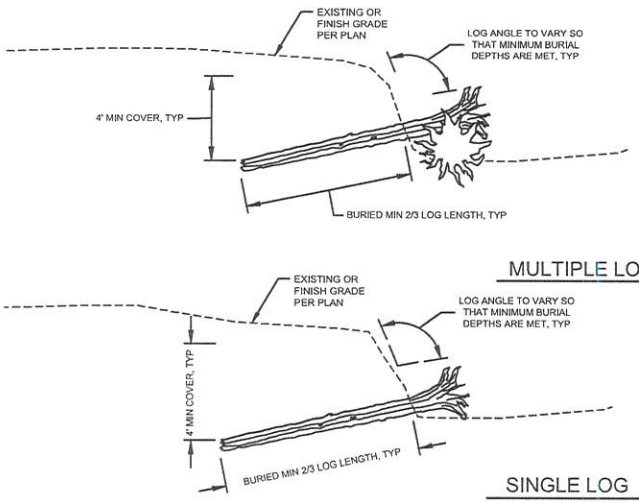
FINAL DESIGN

HABITAT DETIALS 1

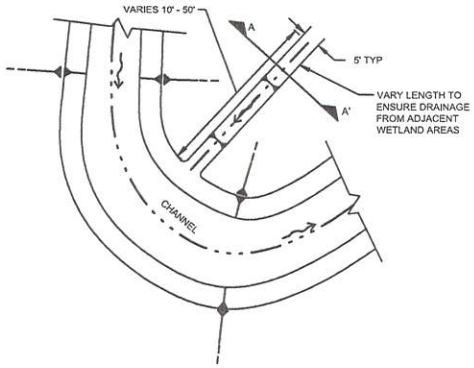
JOB NO.

SHEET NO.
C5.2

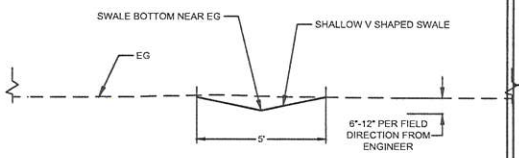
DWG Z:\Shared\WW\CAD\2017\0002-TNC-Kilchis\DWG\C5.1 - HABITAT-DETAILS.dwg USER: User
DATE Feb 16, 2019 1:29pm XREFS:X-TE-22X34-TNC2_PORTER-DETAILS



1 WHS TYPE 3 - KEYED LOG
NOT TO SCALE

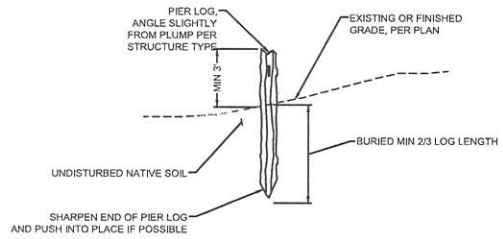


TYPICAL PLAN



TYPICAL SECTION A - A'

3 PILOT SWALE DETAIL
NOT TO SCALE



2 PIER LOG
NOT TO SCALE

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.297.6656

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

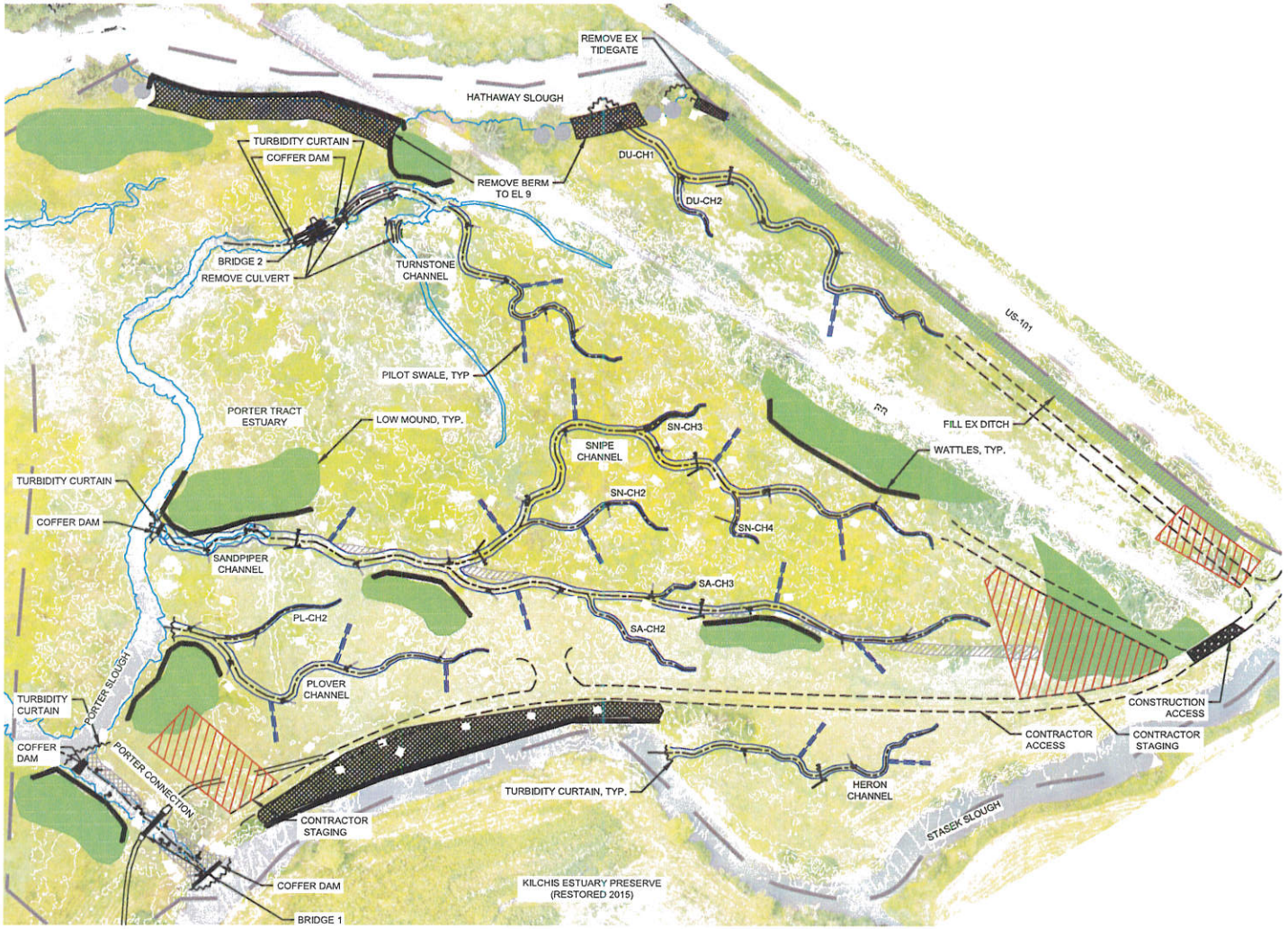
HABITAT DETIALS 2

TILLAMOOK, OR

JOB NO.

SHEET NO.
C5.3

DWG: Z:\Shared\W2\CAD\2017\0002-TNC-Kilchis\DWG\C5.1 - HABITAT-DETAILS.dwg USER: User
DATE: Feb 18, 2019 1:36pm XREFS:X-TB-22X34-TNC2 PORTER-DETAILS



EROSION CONTROL LEGEND:

- WATTLES
- TURBIDITY CURTAIN

NOTES:

1. ENTER SITE AT DESIGNATED ENTRANCE POINT UNLESS APPROVED BY ENGINEER.
2. ALL ACCESS ROUTES AND SITE ENTRANCES SHALL BE RESTORED ACCORDING TO SPECIFICATIONS AND SEEDING PLAN.
3. CHANNELS ONE AND TWO SHALL BE GRADED FIRST, KEEP EXISTING DIKES IN PLACE UNTIL GRADING IN THE CENTER OF THE SITE IS FINISHED. DO NOT CONNECT CHANNEL 3 TO THE KILCHIS RIVER AND THE STASEK SLOUGH UNTIL THE CHANNEL GRADING HAS BEEN FINISHED. DEMO CULVERTS AND RECONSTRUCT EARTHEN BERMS AS A LAST STAGE OF CONSTRUCTION.
4. SEE SHEET C2.2 FOR DIKE REMOVAL SUMMARY TABLE.

PLAN - EROSION CONTROL
1" = 500' (FOR 22" x 34" SHEETS)

N

SCALE
80 0 40 80 160
SCALE FEET

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.227.6668

The Nature Conservancy
1821 SE 10TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
2	2/15/2019	FINAL SUBMITTAL

REVISION

THE NATURE CONSERVANCY
PORTER TRACT

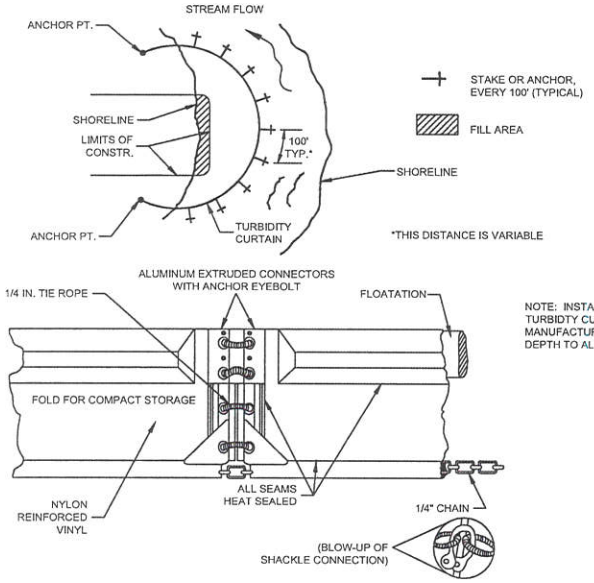
FINAL DESIGN

ESC PLAN
TILLAMOOK, OR

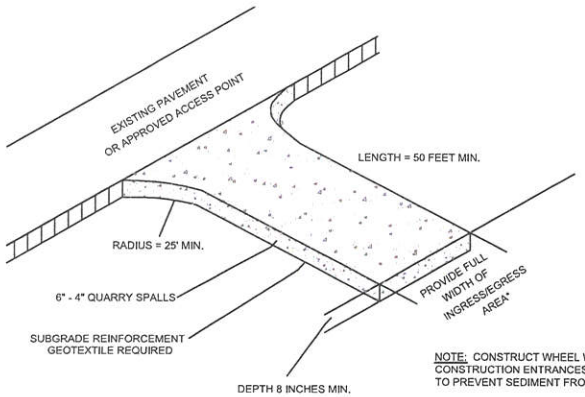
JOB NO.

SHEET NO.
ESC1.1

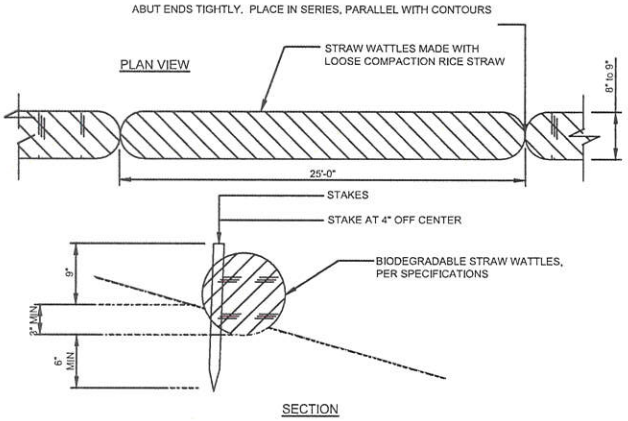
DWG: Z:\Shared\WWR\CAD\2017\2017000-TNC-KilchisRD\DWG\ESC1.1 EROSION CONTROL.dwg USER: User
DATE: Feb 18, 2019 1:31pm XREFS:X-TB-22X34-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE



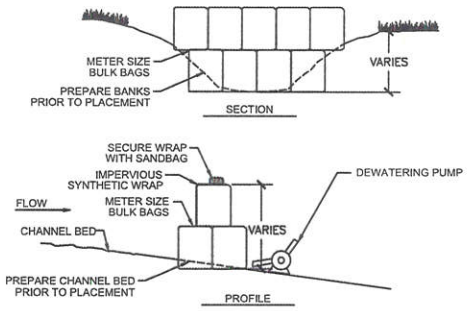
1 TURBIDITY CURTAIN
NTS



2 CONSTRUCTION ENTRANCE
NTS



3 STRAW WATTLE
NTS



NOTES:
1. INSTALL TEMPORARY COFFER DAMS AS SHOWN ON PLANS TO ISOLATE THE EXCAVATION AREAS.
2. IN ADDITION TO BULK BAGS, USE AN IMPERVIOUS SYNTHETIC LINER TO REDUCE PERMEABILITY OF THE COFFER DAM.
3. HEIGHT OF THE COFFER DAMS SHALL BE HIGH ENOUGH TO PREVENT BYPASS FLOWS FROM ENTERING THE ISOLATED WORK AREA. DAM HEIGHTS AND MATERIALS SHALL BE INCLUDED IN THE CONTRACTOR'S WORK CONTAINMENT AND DEWATERING PLAN.

4 TEMPORARY COFFER DAM
NTS

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT

ESC DETAILS

TILLAMOOK, OR

JOB NO.

SHEET NO.
ESC 1.2

DWG Z:\Shared\WG\CAD\2017\005-TNC-Kilchis\DWG\ESC\1.2 EROSION CONTROL DETAILS.dwg USER: User
DATE Feb 18, 2019 1:32pm XREFS:TTL_22x34 PORTER-DETAILS X-TB-22X34-TNC

GENERAL NOTES FOR EROSION, SEDIMENT & POLLUTANT CONTROL

1. EROSION, SEDIMENT AND POLLUTANT CONTROL IS REQUIRED FOR THIS PROJECT.
2. PREPARE AN EROSION, SEDIMENT AND POLLUTANT CONTROL PLAN (ESPCP) BEFORE BEGINNING WORK. KEEP A COPY OF THE ESPCP ON SITE AT ALL TIMES DURING THE PROJECT.
3. THE EROSION AND SEDIMENT CONTROL FACILITIES SHOWN ON THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR THE ANTICIPATED SITE AND SEASONAL CONDITIONS. UPGRADE THESE FACILITIES TO ADDRESS CHANGING WORK OR WEATHER CONDITIONS.
4. SELECT BEST MANAGEMENT PRACTICES (BMPs) FROM THE FOLLOWING DOCUMENTS: 1) THE CITY OF PORTLAND EROSION AND SEDIMENT CONTROL MANUAL; 2) THE STANDARD CONSTRUCTION SPECIFICATIONS AND 3) THE PROJECT SPECIAL PROVISIONS.
5. INSTALL, MONITOR, REPLACE AND UPGRADE ALL FACILITIES AND MEASURES. PERFORM MAINTENANCE TO ENSURE THEIR CONTINUED FUNCTIONING.
6. INSPECT AND MAINTAIN ALL FACILITIES AND MEASURES UNTIL WORK AREAS ARE RESURFACED OR STABILIZED.
7. COMPLETE AN EROSION CONTROL MONITORING FORM AFTER EACH INSPECTION. INCLUDE THE INSPECTION DATE AND TIME. RETAIN THESE COMPLETED FORMS ON SITE AND PROVIDE THEM UPON REQUEST.
8. NO VISIBLE AND MEASURABLE SEDIMENT OR POLLUTANT SHALL EXIT THE SITE, ENTER A PUBLIC RIGHT-OF-WAY OR BE DEPOSITED INTO ANY WATER BODY OR STORM DRAINAGE SYSTEM.
9. FOLLOWING A STORM EVENT, INSPECT AND ADJUST, REPAIR, IMPROVE OR REPLACE ALL DEFICIENT OR FAILING FACILITIES AND MEASURES.
10. PROTECT ALL FUNCTIONING STORM WATER INLETS AND CATCH BASINS FROM RECEIVING UNFILTERED SEDIMENT -LADEN RUNOFF.
11. REMOVE SEDIMENT AND DEBRIS FROM INLETS AND CATCH BASINS BEFORE PAVING. DO NOT FLUSH SEDIMENT-LADEN WATER INTO THE DOWNSTREAM SYSTEM.
12. STABILIZE ALL EXPOSED SOIL IMMEDIATELY FOLLOWING GROUND DISTURBING ACTIVITY.
13. STABILIZE AND PROTECT STOCKPILED SOIL WITH APPROVED MEASURES.
14. REMOVE EROSION AND SEDIMENT CONTROL FACILITIES AFTER THE PROJECT IS COMPLETED AND ACCEPTED.

SITE CONDITION	MINIMUM FREQUENCY
1. ACTIVE PERIOD	DAILY WHEN STORMWATER RUNOFF, INCLUDING RUNOFF FROM SNOW MELT, IS OCCURRING. AT LEAST ONCE EVERY 14 DAYS, REGARDLESS OF WHETHER STORMWATER RUNOFF IS OCCURRING.
2. PRIOR TO THE SITE BECOMING INACTIVE OR IN ANTICIPATION OF SITE INACCESSIBILITY	ONCE TO ENSURE THAT EROSION AND SEDIMENT CONTROL MEASURE ARE IN WORKING ORDER. ANY NECESSARY MAINTENANCE AND REPAIR MUST BE MADE PRIOR TO LEAVING THE SITE.
3. INACTIVE PERIODS GREAT THAN FOURTEEN (14) CONSECUTIVE CALENDAR DAYS	ONCE EVERY MONTH
4. PERIODS DURING WHICH THE SITE IS INACCESSIBLE DUE TO INCLEMENT WEATHER	IF PRACTICAL, INSPECTIONS MUST OCCUR DAILY AT A RELEVANT AND ACCESSIBLE DISCHARGE POINT OR DOWNSTREAM LOCATION.
5. PERIODS DURING WHICH DISCHARGE IS UNLIKELY DUE TO FROZEN CONDITIONS	MONTHLY. RESUME MONITORING IMMEDIATELY UPON MELT, OR WHEN WEATHER CONDITIONS MAKE DISCHARGES LIKELY.

ODEQ STANDARD ESCP NOTES:

1. HOLD A PRE-CONSTRUCTION MEETING OF PROJECT CONSTRUCTION PERSONNEL THAT INCLUDES THE INSPECTOR TO DISCUSS EROSION AND SEDIMENT CONTROL MEASURES AND CONSTRUCTION LIMITS. (SCHEDULE A.8.C.I.(3))
2. ALL INSPECTIONS MUST BE MADE IN ACCORDANCE WITH DEQ 1200-C PERMIT REQUIREMENTS. (SCHEDULE A.12.B AND SCHEDULE B.1)
3. INSPECTION LOGS MUST BE KEPT IN ACCORDANCE WITH DEQ'S 1200-C PERMIT REQUIREMENTS. (SCHEDULE B.1.C AND B.2)
4. RETAIN A COPY OF THE ESCP AND ALL REVISIONS ON SITE AND MAKE IT AVAILABLE ON REQUEST TO DEQ, AGENT, OR THE LOCAL MUNICIPALITY. DURING INACTIVE PERIODS OF GREATER THAN SEVEN (7) CONSECUTIVE CALENDAR DAYS, THE ABOVE RECORDS MUST BE RETAINED BY THE PERMIT REGISTRANT BUT DO NOT NEED TO BE AT THE CONSTRUCTION SITE. (SCHEDULE B.2A.C)
5. ALL PERMIT REGISTRANTS MUST IMPLEMENT THE ESCP. FAILURE TO IMPLEMENT ANY OF THE CONTROL MEASURES OR PRACTICES DESCRIBED IN THE ESCP IS A VIOLATION OF THE PERMIT. (SCHEDULE A 8.A)
6. THE ESCP MUST BE ACCURATE AND REFLECT SITE CONDITIONS. (SCHEDULE A.12.C.I)
7. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS. SUBMIT ALL NECESSARY REVISION TO DEQ OR AGENT WITHIN 10 DAYS. (SCHEDULE A.12.C.IV. AND V)
8. PHASE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION. (SCHEDULE A.7.A.III)
9. IDENTIFY, MARK, AND PROTECT (BY CONSTRUCTION FENCING OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED. IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS. (SCHEDULE A.8.C.I.(1) AND (2))
10. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED. (SCHEDULE A.7.A.V)
11. MAINTAIN AND DELINEATE ANY EXISTING NATURAL BUFFER WITHIN THE 50-FEET OF WATERS OF THE STATE. (SCHEDULE A.7.B.I.AND (2(A)(B))
12. INSTALL PERIMETER SEDIMENT CONTROL, INCLUDING STORM DRAIN INLET PROTECTION AS WELL AS ALL SEDIMENT BASINS, TRAPS, AND BARRIERS PRIOR TO LAND DISTURBANCE. (SCHEDULE A.8.C.I.(5))
13. CONTROL BOTH PEAK FLOW RATES AND TOTAL STORMWATER VOLUME, TO MINIMIZE EROSION AT OUTLETS AND DOWNSTREAM CHANNELS AND STREAMBANKS. (SCHEDULE A.7.C)
14. CONTROL SEDIMENT AS NEEDED ALONG THE SITE PERIMETER AND AT ALL OPERATIONAL INTERNAL STORM DRAIN INLETS AT ALL TIMES DURING CONSTRUCTION, BOTH INTERNALLY AND AT THE SITE BOUNDARY. (SCHEDULE A.7.D.I)
15. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK. (SCHEDULE A.8.C.I.(6))
16. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES. TEMPORARY OR PERMANENT STABILIZATIONS MEASURES ARE NOT REQUIRED FOR AREAS THAT ARE INTENDED TO BE LEFT UNVEGETATED, SUCH AS DIRT ACCESS ROADS OR UTILITY POLE PADS.(SCHEDULE A.8.C.II.(3))
17. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS. (SCHEDULE A.8.C.I.(7))
18. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: CONSTRUCTION ENTRANCE, GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND- DISTURBING ACTIVITIES. (SCHEDULE A 7.D.II AND A.8.C.I(4))
19. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE. (SCHEDULE A.7.D.II.(5))
20. CONTROL PROHIBITED DISCHARGES FROM LEAVING THE CONSTRUCTION SITE, I.E., CONCRETE WASH-OUT, WASTEWATER FROM CLEANOUT OF STUCCO, PAINT AND CURING COMPOUNDS. (SCHEDULE A.6)
21. USE BMPS TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, FERTILIZER, PESTICIDES AND HERBICIDES, PAINTS, SOLVENTS, CURING COMPOUNDS AND ADHESIVES FROM CONSTRUCTION OPERATIONS. (SCHEDULE A.7.E.I.(2))
22. IMPLEMENT THE FOLLOWING BMPS WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES. (SCHEDULE A.7.E.III.)
23. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL. (SCHEDULE A 7.A.IV)
24. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE. (SCHEDULE A.9.B.III)
25. IF AN ACTIVE TREATMENT SYSTEM (FOR EXAMPLE, ELECTRO-COAGULATION, FLOCCULATION, FILTRATION, ETC.) FOR SEDIMENT OR OTHER POLLUTANT REMOVAL IS EMPLOYED, SUBMIT AN OPERATION AND MAINTENANCE PLAN (INCLUDING SYSTEM SCHEMATIC, LOCATION OF SYSTEM, LOCATION OF INLET, LOCATION OF DISCHARGE, DISCHARGE DISPERSION DEVICE DESIGN, AND A SAMPLING PLAN AND FREQUENCY) BEFORE OPERATING THE TREATMENT SYSTEM. OBTAIN PLAN APPROVAL BEFORE OPERATING THE TREATMENT SYSTEM. OPERATE AND MAINTAIN THE TREATMENT SYSTEM ACCORDING TO MANUFACTURER'S SPECIFICATIONS. (SCHEDULE A.9.D)
26. TEMPORARILY STABILIZE SOILS AT THE END OF THE SHIFT BEFORE HOLIDAYS AND WEEKENDS, IF NEEDED. THE REGISTRANT IS RESPONSIBLE FOR ENSURING THAT SOILS ARE STABLE DURING RAIN EVENTS AT ALL TIMES OF THE YEAR. (SCHEDULE A 7.B)
27. AS NEEDED BASED ON WEATHER CONDITIONS, AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPS MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS. (SCHEDULE A.7.E.II.(2))
28. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND BARE GROUND ACTIVITIES DURING WET WEATHER. (SCHEDULE A.7.A.I)
29. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL. (SCHEDULE A.9.C.I)
30. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT AND BEFORE BMP REMOVAL. (SCHEDULE A.9.C.I)
31. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT. (SCHEDULE A.9.C.III & IV)
32. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS. ANY IN-STREAM CLEAN-UP OF SEDIMENT SHALL BE PERFORMED ACCORDING TO THE OREGON DIVISION OF STATE LANDS REQUIRED TIMEFRAME. (SCHEDULE A.9.B.I)
33. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS. (SCHEDULE A.9.B.II)
34. THE ENTIRE SITE MUST BE TEMPORARILY STABILIZED USING VEGETATION OR A HEAVY MULCH LAYER, TEMPORARY SEEDING, OR OTHER METHOD SHOULD ALL CONSTRUCTION ACTIVITIES CEASE FOR 30 DAYS OR MORE. (SCHEDULE A.7.F.I)
35. PROVIDE TEMPORARY STABILIZATION FOR THAT PORTION OF THE SITE WHERE CONSTRUCTION ACTIVITIES CEASE FOR 14 DAYS OR MORE WITH A COVERING OF BLOWN STRAW AND A TACKIFIER, LOOSE STRAW, OR AN ADEQUATE COVERING OF COMPOST MULCH UNTIL WORK RESUMES ON THAT PORTION OF THE SITE. (SCHEDULE A.7.F.II)
36. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. ONCE CONSTRUCTION IS COMPLETE AND THE SITE IS STABILIZED, ALL TEMPORARY EROSION CONTROLS AND RETAINED SOILS MUST BE REMOVED AND DISPOSED OF PROPERLY, UNLESS DOING SO CONFLICTS WITH LOCAL REQUIREMENTS. (SCHEDULE A.8.C.III(1) AND D.3.C.II AND III)

REGISTERED PROFESSIONAL ENGINEER 84779PE DIGITAL SIGNATURE OREGON MAR 8, 2018 AMANDA L. JONES

RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC.
1001 SE WATER AVE. SUITE #180
PORTLAND, OR 97214
503.207.6688

The Nature Conservancy
1821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY	DRAWN BY	CHECKED BY	APPROVED BY
AJ	AJ/JR	CL	CL/AJ

NO.	DATE	DESCRIPTION
	2/15/2019	FINAL DESIGN

REVISION

FINAL DESIGN

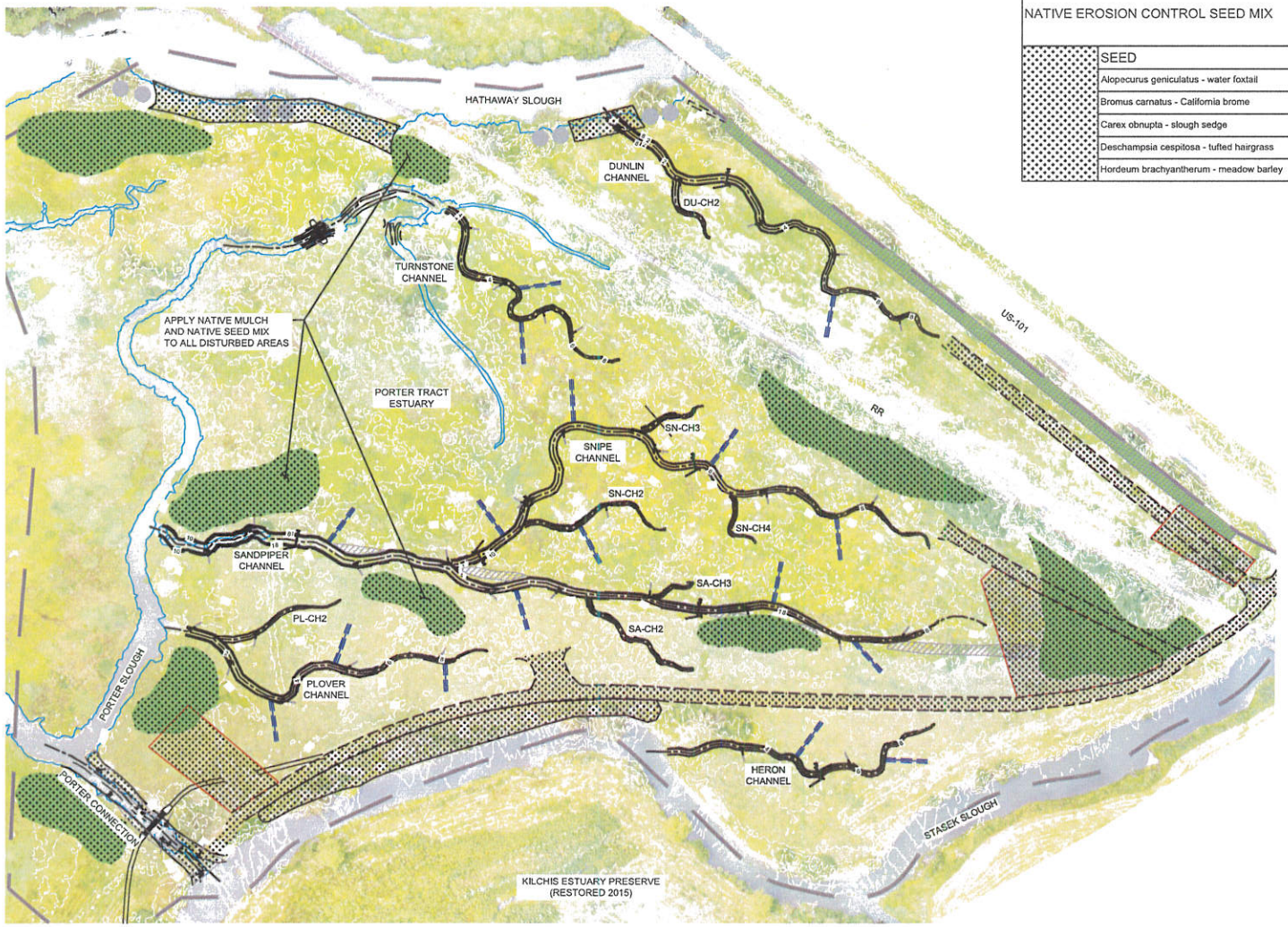
THE NATURE CONSERVANCY
PORTER TRACT

ESC NOTES

TILLAMOOK, OR

JOB NO.

SHEET NO. ESC1.3



PLAN - REVEGETATION

1" = 500' (FOR 22" x 34" SHEETS)

N

SCALE

80 0 40 80 160

SCALE FEET

NATIVE EROSION CONTROL SEED MIX			APPROX. AREA = 7.5 AC
	SEED		
	Alopecurus geniculatus - water foxtail	1.09 lbs	APPLICATION RATE
	Bromus carnatus - California brome	12.20 lbs	Pounds of Pure Live Seed (PLS) PER ACRE
	Carex obnupta - slough sedge	0.71 lbs	
	Deschampsia cespitosa - tufted hairgrass	1.02 lbs	
	Hordeum brachyantherum - meadow barley	25.11 lbs	

NOTES:

1. EROSION CONTROL SEED MIX IS SHOWN ON THIS SHEET.
2. WITHIN 24 HOURS OF SEED APPLICATION, NATIVE STRAW MULCH SHALL BE APPLIED WITH A BLOWER OR BY HAND.
3. NATIVE STRAW SHALL BE APPLIED AT THE RATE OF ONE TON PER ACRE.
4. NATIVE STRAW MULCH SHALL BE CERTIFIED WEED FREE.
5. SEEDING AREAS SHOWN ARE APPROXIMATE. CONTRACTOR SHALL APPLY SEEDING TO ALL DISTURBED AREAS.

REGISTERED PROFESSIONAL ENGINEER
84779PE
DIGITAL SIGNATURE
OREGON
MAR. 8, 2018
AMANDA L. JONES
RENEWS: 6/30/2019

WOLF WATER RESOURCES, INC
1001 SE WATER AVE. SUITE #160
PORTLAND, OR 97214
503.297.6858

The Nature Conservancy
821 SE 14TH AVE.
PORTLAND, OR 97214

DESIGNED BY AJ
DRAWN BY AJ/JR
CHECKED BY CL
APPROVED BY CL/AJ

NO.	DATE	DESCRIPTION
	2/15/19	FINAL SUBMITTAL

REVISION

FINAL DESIGN

THE NATURE CONSERVANCY
PORTER TRACT
REVEGETATION PLAN
TILLAMOOK, OR

JOB NO.

SHEET NO.
L1.1

DWG Z:\Shared\WR2\CAD\20170002-TNC-Kilchis\DWG\L1.1 REVEGETATION.dwg USER User
DATE Feb 18, 2019 1:33pm XREFS X-TB-22X34-TNC PORTER-BASE PORTER-AERIAL BASE PORTER-EG SURFACE

FINAL DESIGN REPORT

The Nature Conservancy
Protecting nature. Preserving life.™

Porter Tract Restoration

Kilchis Estuary Preserve

Basis of Design Report
Final Design

February 2019

Cover photo:

Isometric aerial photograph of the Porter Tract of the Kilchis Estuary Preserve with the Connector Channel and Stasek Slough in the foreground and Hathaway Slough in the background.

Prepared by:

WOLF WATER RESOURCES

Portland, Oregon

Table of Contents

Figures

Tables

1) Introduction

The Nature Conservancy (TNC) seeks to continue restoration of rare tidal wetland habitats along the margins of Tillamook Bay with restoration of the Porter Tract, an approximately 60-acre parcel in Tillamook County, Oregon. The Porter Tract is in the lower Kilchis River watershed, one of the five large river tributaries to Tillamook Bay. The restoration site is situated approximately one mile from the mouth of the Kilchis River and is influenced by both river flow and ocean tides. The Porter Tract would become part of the recently restored Kilchis Estuary Preserve (former Dooher Property) that was constructed in 2015 by the TNC. The cumulative area of these restoration efforts would result in 127 acres of high functioning estuarine habitat.

The overall goal of the Kilchis Estuary Preserve project is to restore freshwater and tidal hydrologic connections to the Porter Tract wetlands, providing off-channel rearing habitat for salmonids and re-establishing spruce swamp habitat. TNC has retained Wolf Water Resources (W2r) to develop engineering designs and provide permitting support to restore the property.

1.1 Background

A significant majority of historic tidal wetlands adjacent to Tillamook Bay have been lost due to agricultural and other developments. Approximately 85 percent of the historic tidal marsh and 91 percent of historic tidal swamp has been lost due to diking or other major tidal restrictions (Ewald and Brophy 2012); most of these wetlands have been converted to agricultural uses (TBNEP 1999). The high losses of tidal swamp (forested and shrub tidal wetland) are typical of the Oregon coast; tidal spruce swamp habitats have suffered over 95 percent loss overall in Oregon (Christy 2004).

The TNC has prioritized conservation and restoration of tidal wetland habitats that support salmonids and other estuary-dependent species including forage fish, juvenile groundfish species, marine invertebrates, waterfowl, shorebirds and many terrestrial species that spend some portion of their life histories in tidal wetlands. One of the primary limiting factors for salmonids in the Kilchis River system is the lack of off-channel rearing habitat, especially within the salt-freshwater transition zone of the estuary. Coho salmon populations have been particularly affected by this loss, as access to tidal sloughs are limited by tide gates which also contribute to poor water quality in those sloughs (TBNEP 1999). In addition to habitat loss, tidal wetlands such as these are expected to be affected by sea level rise and other local effects of climate change such as changes in storm frequencies and storm surges and increased frequencies of reduced baseflows in streams.

1.2 Scope

This scope of this report includes documenting the basis of the design for the various project elements included in the restoration of the Porter Tract (Figure 1). This engineering design phase follows the recently completed Porter Tract Feasibility Report (Feasibility Analysis and Conceptual Restoration Plan Report; W2r 2017). Restoration elements include removing water control structures, filling linear ditches, removing dikes, excavation of new and tidal channels and enhancement (widening and deepening) of existing channels, beneficial reuse of excavation material placed onsite in low mounds, two new pedestrian bridges across tidal channels for access to maintain vegetation, and plantings throughout the site.

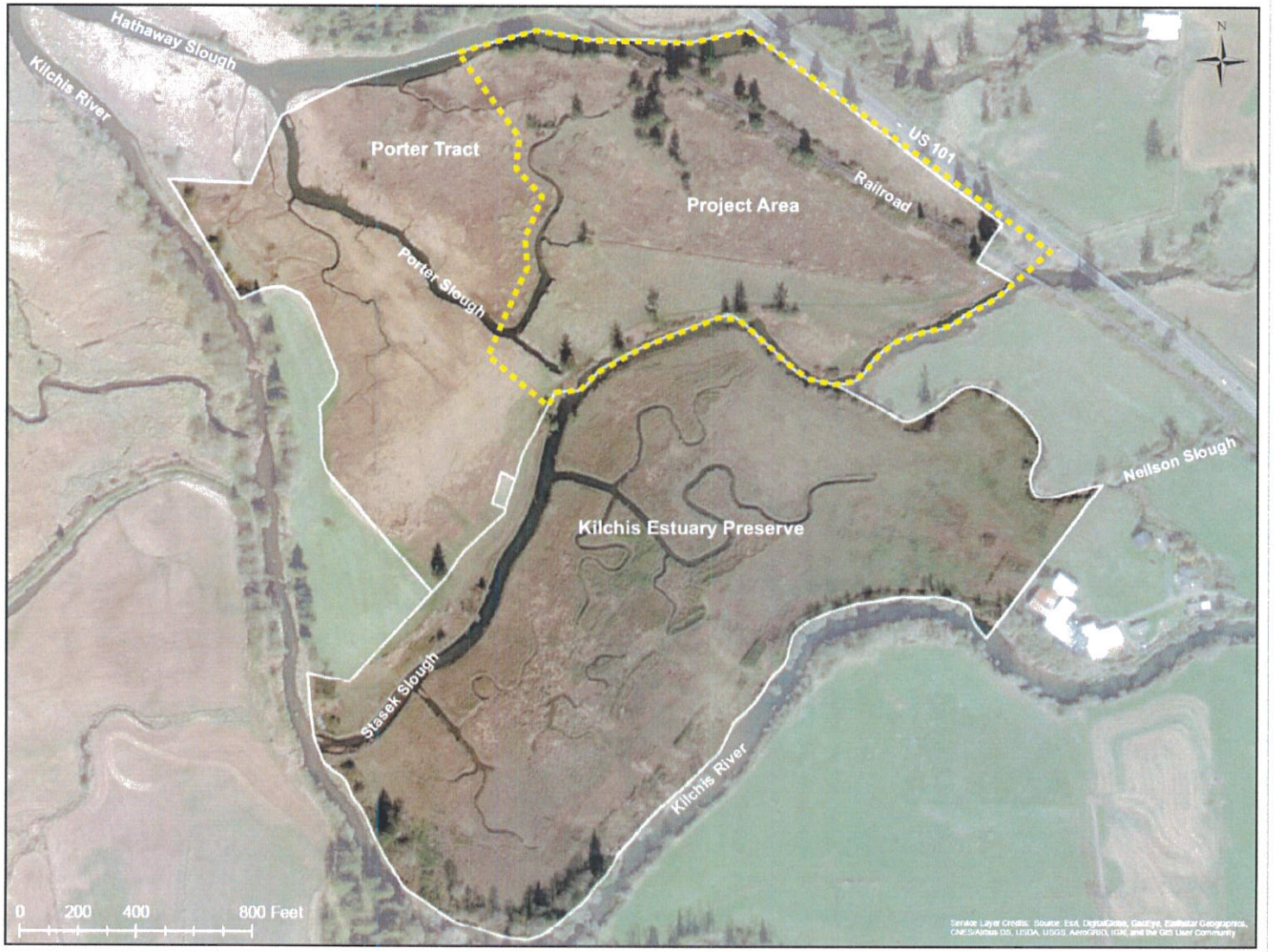


Figure 1. Porter Tract to the north and adjacent Dooher Property which comprise the Kilchis Estuary Preserve.

2 Project Understanding

2.1 Goals and Objectives

As an extension of the Kilchis Estuary Preserve, the overall goal for the Porter Tract restoration is to restore estuarine habitat for listed and other native estuarine-dependent species. Towards this end, restoration objectives include:

- Restore freshwater and tidal connections.
- Provide off-channel rearing habitat for salmonids.
- Restore spruce swamp habitat.
- Create habitat for estuary-dependent species including forage fish, juvenile groundfish species, marine invertebrates, waterfowl, shorebirds, and many terrestrial species that spend some portion of their life histories in tidal wetlands.
- Contribute to the improved understanding of tidal wetland restoration planning, design, and project construction by using a systematic, science-based adaptive management approach.
- Increase resiliency of restored hydrologic processes and the aquatic habitats they support to climate change.

Restoring freshwater and tidal connections reestablishes the processes that support and sustain natural habitats. One of the primary limiting factors for salmonids in the Kilchis River system is the availability of off-channel rearing habitat in low-lying areas, especially habitat in the salt / freshwater transition zone of the estuary (TBNEP 1999). Tidal wetland losses have been particularly severe for tidal spruce swamp habitats which have suffered over 95% loss in Oregon (Christy 2004).

Other important considerations, or operating principles, include:

- Cost-effectiveness of project implementation will be considered in the planning and design process.
- A focus on the restoration of natural processes rather than a form-based focus, so that the site may evolve under natural perturbations such as erosion, sedimentation, and other natural watershed processes.
- Improving hydrologic complexity and redundancy of flow paths to accommodate potential river and tidal channel evolution (sedimentation, erosion, avulsion, reestablishment, etc.).
- TNC proposes to plan and implement the project so productive relationships are developed and maintained with adjacent landowners and the community at large.

2.2 Constraints

The identification of constraints early in the design processes assist in guiding and refining the restoration design process.

- Adjacent properties must maintain existing use and capacity, despite restored connectivity within the project area. Upslope properties must maintain adequate drainage, matching that or improving upon existing drainage conditions.
- The project must not significantly increase the risk of offsite flooding in the area.
- Invasive species are present at the site, including nutria (who displace beneficial beaver colonization and whose burrows degrade the dikes) and reed canary grass (RCG), which will require active management to control RCG propagation under restored conditions.
- Access to various regions of the property is desired for maintenance of vegetation, monitoring, and private land access. This will require crossings (bridges or culverts) of tidal channels.

3 Existing Conditions

General site assessment and land uses were characterized in detail the Feasibility Report (W2r 2017). To summarize, much of the Porter Tract was managed for pastureland in the recent past. These areas were partially-diked and drained. The site is presumed to have subsided due to draining and decomposition of organic soils, though the level of subsidence is expected to be low in general and low relative to the Kilchis Estuary Preserve. The site is bordered by private land to the west, Hathaway Slough to the north, and Stasek Slough to the south. The closest existing infrastructure is a railroad corridor along the northeast boarder. Figure 1Figure 3 shows the Porter Tract boundary, the adjacent Kilchis Estuary Preserve, and other sloughs and existing site features.

The earliest available aerial photograph from 1939 (see Figure 2) show numerous tidal channels across much of the site, especially the northwest portion of the tract. This more natural hydrologic condition contrasts with linear ditches and farmed areas in the southwest and east portions of the property. As with much of this region, this property was subject to timber operations and wetland conversion to pasture or other agricultural uses.

3.1 Drainage Infrastructure

There are several flow control structures located within the project area (see Figure 3). Two culverts facilitate crossing of ditches / channels along the northern portion of the site near Hathaway Slough. There is also a water control structure (culvert with dilapidated closure gate) in the interior of the site that drains much of the eastern portion of the property into Porter Slough.

A large timber, box culvert along the southern edge of the project area connects Porter Slough and Stasek Slough along the Connector Channel. Another culvert with tide gate is located between US 101 and the railroad northeast of the main project area. This culvert facilitates drainage of the topographically isolated area to Hathaway Slough. Removing these structures is fundamental to the restoration of Stasek Slough and the rest of the wetland.

Figure 2. Historic 1939 photograph of the Porter Tract and Kilchis Estuary Preserve.

3.2 Dikes and Enhanced Levees

The site is partially bordered by dikes and/or enhanced natural levees that were historically constructed to reduce flooding. In general, dikes refer to small and less distinct "improvements" built on top of the natural tidal or fluvial levees. Existing dikes are located along the northern boundary of the project area along Hathaway Slough as shown in Figure 3. The dikes are relatively low, with crests that are approximately 3 to 4 feet above the adjacent, natural floodplain surface.

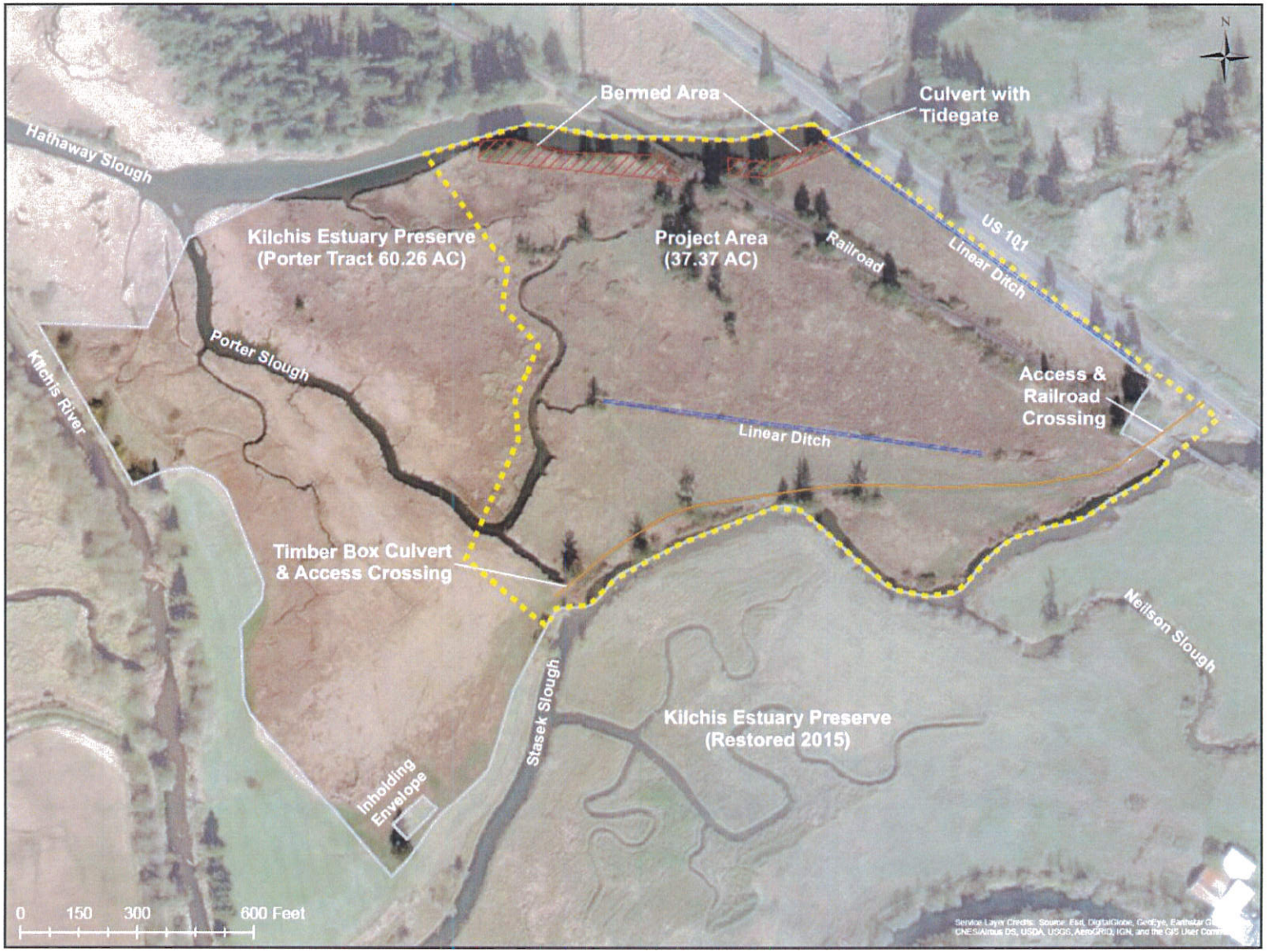


Figure 3 Existing Conditions Map for the Porter Tract.

3.3 Topography, Bathymetry, and Control Survey

Survey data have been collected by Statewide Land Survey (SWLS) at numerous times between 2012 and 2017. The most recent data collection in 2017 focused on resurveys of several sloughs and the Kilchis River and lands upstream of Hwy 101 along Neilson and Stasek Sloughs. These data are shown in Figure 4 and include:

- The linear drainage ditch upstream of the water control structure on the Porter Tract,
- Hathaway Slough and the Connector Channel near the timber culvert that will be removed,
- 10,000 feet of Kilchis River channel (thalweg survey) approximately from Hwy 101 to Hathaway Slough,
- High sediment deposition regions of the former Dooher property that was restored in 2015,
- Restored portions of Stasek Slough,
- Ground elevations along the Dooher home and east of Hwy 101 along Neilson and Stasek Sloughs,
- The high point (ridge) separating Neilson and Hathaway Sloughs,
- Water level logger instrument elevations,
- Control points throughout the surveyed regions.

The surveyed control points used for design and for construction are shown on the Plans on sheet C1.1 in Appendix

Because of the large area of the site, topography is generally defined by LiDAR data flown in 2015 collected under the U.S. Army Corps of Engineers National Coastal Mapping Program (NCMP) for Tillamook Bay, Oregon (NCMP 2015). The LiDAR accuracy was preliminarily assessed in the Feasibility Report. The assessment compared the 2015 LiDAR dataset with ground survey transects along Porter Slough and within the Kilchis site. The primary finding was that in areas of dense native vegetation (not farmed) such as along Porter Slough, LiDAR-based elevations were 1 to 3 feet higher than ground survey points. In areas recently farmed or with a mix of native, non-native, and/or invasive plants, the LiDAR was 0.8 feet higher than ground survey points on average.

These bias magnitudes were not used manipulate the LiDAR-based terrain because there is no simple or automatic way to adjust LiDAR data. Instead, the general bias magnitudes are factored into the channel excavation and grading quantities, and they will also be used to develop the permanent planting plans by TNC.

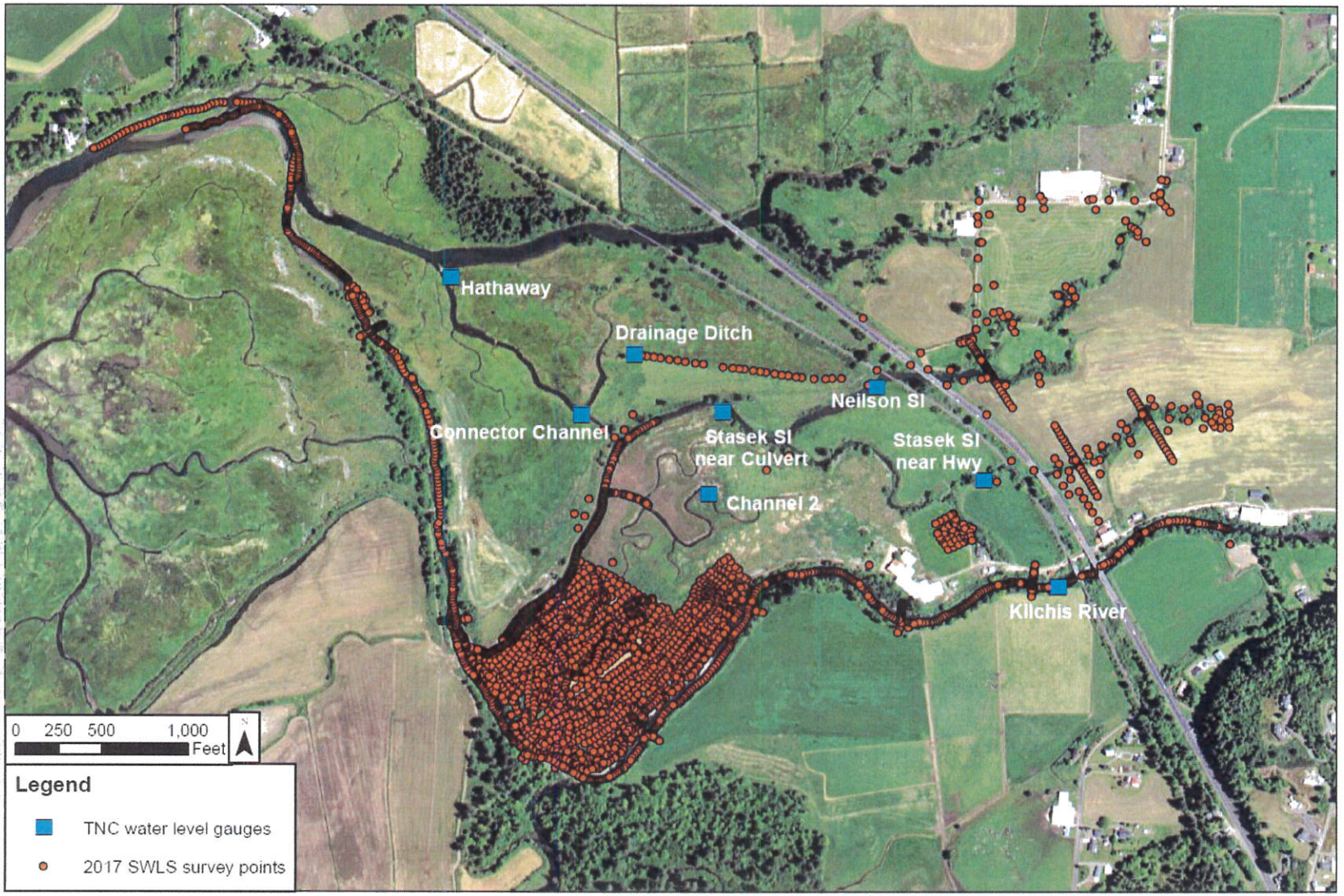


Figure 4. Topographic and Bathymetric Survey Data Collected in 2017.

(source, ESA 2017).

3.4 Hydrology and Flooding

The Kilchis River flows through an unimpaired watershed that drains approximately 46,920 acres (65 sq. miles). The watershed drains the west slope of the relatively low elevation Coast Range and is generally steep in slope. Because of the steep slope, runoff response during rainfall events is relatively quick, especially under saturated ambient soil conditions. For example, peak flows are high in magnitude and occur with 24 hours of the peak precipitation. In contrast, dry season flows are relatively low due to high permeability of the tertiary volcanic soils and sedimentary rocks that underlie much of the watershed. The results are extreme seasonal flow variability, with high stream flows in the wet season and low flows in the dry season (Follensbee 1998).

Tidal datums and extreme tides for the project site are documented below in Table 1.

Table 1. Tidal and extreme water levels.

Datum / Recurrence Interval	NOAA Gage at Garibaldi (Feet NAVD88)	Water Levels at Project Site (Feet NAVD88)	Notes
FEMA Base Flood	--	11 – 12*	
50-Yr	--	11.8	
25-Yr	--	11.6	
10-Yr	--	11.5	
Highest observed	11.55	11.42	Taken to be OHW at site
5-Yr	--	10.80	
Typical Spring Tide Peak	9.2 - 9.4	9.0 – 9.3	Recent spring tide peaks
MHHW	7.93	7.80	
MHW	7.22	7.01	
MTL	4.10	3.89	
MLW	0.98	0.98	
NAVD88 Datum	--	0.00	
MLLW	-0.38	-0.33	

General source: ESA PWA 2013

Note that ordinary high water at the site was taken to be approximately equivalent to the recent, observed high water level (i.e., still water level) in the period of record. Storm surge and wave runup may result in total water levels above the still water level that is recorded at NOAA and other gaging stations.

4 Restoration Design

Selection of preferred restoration measures was described in the Feasibility Report (W2r 2017). These measures included channel excavation, dike removal, filling drainage ditches, constructing low mounds (fill areas), construction small wood habitat structures in the channels, tidal channel crossing structures (bridges), and native plantings. A summary of restoration measures is shown in Figure 5.

4.1 Tidal Channels

The channel network design was based on the historical pattern of channels within the Porter Tract, including primarily the lesser-disturbed regions on the west side of Porter Slough. A nearby reference site within the tidal tributary drainages of Tillamook Bay were also examined for channel shape, orientation, density, and other parameters. Initial channel configuration and density were refined by computing the combined density of constructed and tertiary channels present at the Kilchis Estuary Preserve. Channel densities were also calculated for the entirety of Porter Tract and for the main Porter Slough restored tributary (channel 2 from the Feasibility Report/ Sandpipe and Snipe Channels – see Appendix A) drainage area. The channel density comparison is shown in Table 2.

Table 2. Channel density assessment.

Parameter	Constructed Kilchis Channels	Constructed Kilchis Channels incl. Pilot/ Tertiary Channels	Porter Tract (Overall)	Reference Site	Porter Tract Channel 2 Only
Site Area (AC)	70	70	60	16	16.5
Total Channel Length (LF)	6,680	8,684	8,920	3,270	3,730
Total Channel Length per Area (Density) (LF/AC)	***95.4***	***124.1***	***148.7***	***204.4***	***226.1***

4.1.1 Passive Versus Active Channel Creation

Passive tidal channel creation is a restoration approach whereby the channel network is not fully or partially excavated during construction. If a restored tidal wetland is only breached and/or only pilot channels are excavated, future channel development relies on the tidal inundation and drainage to scour channels primarily through head-cutting and incision until the channel size and extent comes into equilibrium with the tidal prism and drainage area. Passive channel creation is best applied to large sites with wetland elevations substantially below MHHW (e.g., Cornu and Sadro 2002).

The design intent for the restored tidal channels is to fully excavate them, rather than rely on passive channel formation. In the Porter Tract wetland, the lowest elevations are approximately 7 to 8 feet NAVD88, less than 1 feet below MHHW which is 7.8 feet NAVD88. Consequently, incorporating passive channel formation is not recommended. It is not likely that pilot channels would evolve in a reasonable time frame (e.g., 5 to 10 years) or that a complex tributary channels network would form. The relatively well-developed channel network shown in the Plans is intended to be constructed to full width and depth. A summary of the channel plan design is shown in Table 3.

Design of the channel widths and geometries is based on a tidal stream simulation design approach and techniques detailed in the *Design Guidelines for the Enhancement and Creation of Estuarine Habitats in the Middle Reaches of the Lower Columbia River* (ESA PWA and PC Trask 2011). Tidal stream simulation is an applied geomorphic approach analogous to the preferred fluvial stream simulation approach for design of stream and river crossing structures (WDFW 2013; ODFW 2004; NMFS 2008), except that it is applicable to tidally-influenced systems.

Table 3. Restored tidal channel design summary.

Tidal channel and tributary channel names	Approx. Length (LF)	Bottom Elev. (FT NAVD)	Top Width (FT)	Approx. Excavation Vol (CY)
Dunlin 1	710	1.0 – 7.0	3 – 16	1,150
Dunlin 2	125	4.0 – 7.0	3 – 11	150
Turnstone	450	3.0 – 7.0	3 – 13	555
Snipe 1	950	3.0 – 8.0	3 – 15	1,300
Snipe 2	250	3.0 – 8.0	3 – 10	195
Snipe 3	125	3.0 – 8.0	3 – 10	150
Snipe 4	110	5.0 – 8.0	3 – 9	150
Sandpiper 1	1305	1.0 – 8.0	3 – 20	2,910
Sandpiper 2	215	5.0 – 8.0	3 – 10	150
Sandpiper 3	85	5.0 – 8.0	3 – 7	150
Plover 1	560	1.0 – 8.0	3 – 20	1,055
Plover 2	210	4.0 – 8.0	3 – 12	180
Heron	490	2.0 – 8.0	3 – 12	605
Porter Connection	250	0.0	30-40	1,430
Total	***5,576***	***NA***	***NA***	***10,130***

4.2 Dike Removal

Two segments of tidal dikes adjacent to Hathaway Slough and one segment along Stasek Slough will be removed. One segment on the Hathaway Dike is west of the railroad embankment, and one segment is between the railroad and Hwy 101 embankments. The segments are bordered by one or more mature Sitka spruce trees that will be preserved and protected during construction. Removal will involve complete excavation of the earthen berms, down to the natural floodplain elevations of approximate 8 to 9 feet NAVD88.

The total dike length and estimated quantity of earth material generated from the Hathaway and Stasek Slough dike removal are 1,080 linear feet and 2,970 CY, respectively.

The excavation material will be beneficially reused to fill the borrow ditch immediately south of Hwy 101 and repurposed to create topographic relief in low mounds.

4.3 Filling Drainage Ditches

Excavation material from channel construction and dike removal would be beneficially reused onsite, reducing the overall costs associated with project materials. For the most part, excavated material would be used to fill agriculture drainage ditches and as backfill at new bridge placements.

Filling the drainage ditches would also assist in natural channel system development, restore wetland topography to a state closer to pre-disturbance conditions, and reduce the risk of stranding of juvenile fishes transported into the wetland during high water events. Specific locations of the existing ditches are shown on the conceptual plan (Figure 5). Based on aerial photographs, LiDAR data and field observations, there are an estimated 500 LF of ditches onsite, requiring approximately 2,000 CY of fill material.

4.4 Low Mounds and Fill Areas

The balance of excess excavation material can be used to raise the lowest areas of the site and to create low mounds that can be used for plantings and topographic diversity. Areas that have subsided due to drainage and decomposition of organic soils or areas used as borrow pits for dike repairs would be prioritized. Raising low areas to re-establish intertidal elevations to pre-disturbance conditions would support desired target wetland classes such as Sitka spruce tidal swamp. Reusing excess excavation material to raise low areas or create low mounds would also reduce the cost of excavation by eliminating off-haul and disposal. The restoration plan will not necessarily seek material from channel and dike excavation for raising subsided areas, but it may utilize excess material to help achieve cost savings compared to transporting excavated material offsite.

Placing fill along the tops of the bank of larger channels would simulate a natural wetland surface that slopes gradually downward away from the channel because of higher sedimentation close to the channel. In general, fill would be placed to elevations ranging from approximately one to two feet below OHW. For the design an average depth of 2.5 feet of fill is placed over 2.8 acres. The volume of this fill is approximately 11,300 CY.

4.5 Pedestrian Bridges

To restore full tidal connectivity and enhance drainage for upstream properties, a light duty timber bridge will span the Porter Connection Channel. A second light duty timber bridge will span the north terminus of the Porter Slough. The purpose of these crossings is to allow TNC staff to access and maintain the west and north regions of the property. The larger bridge across the connection channel is also required to maintain access to the inholding property adjacent to Stasek Slough. Light duty timber bridges were determined during the feasibility phase to be most cost effective and functional for TNC needs.

4.5.1 Tidal Stream Simulation Design Approach

The stream crossing structure design approach for both tidal channels is tidal stream simulation. The stream simulation approach intends to mimic or provide geomorphic, habitat, and hydraulic conditions similar to those upstream and downstream of the crossing structures, such that there are no significant or discernable effects on conditions at each crossing.

Pedestrian Bridge 1 (Porter Connection Channel)

The connection channel is a man-made channel created between 1955 and 1966 based on aerial photographs (ESA PWA 2013). Presumably the channel was constructed when the Lower Stasek Slough was filled/disconnected from the river. The connection was required to drain rainfall-runoff and floodwaters from the Kilchis River into Tillamook Bay via Hathaway Slough (see Figure 5).

During the Kilchis Estuary Preserve project in 2015, the connection channel was kept in place as a secondary drainage pathway as an issue to be re-evaluated during a second phase of restoration (the current Porter Tract restoration). The current design approach for the Porter Connection Channel includes slightly widening the channel to a bankfull width of approximately 30 to 35 feet and providing a crossing structure for maintenance access to the other side. This approach is justified by the following:

- The secondary drainage pathway facilitates restoration buy-in from the adjacent landowner, who wishes for the channel to remain open.
- The connection channel is practical as a redundant drainage pathway.
- Based on the 1955 aerial photograph, the channel was constructed at the location of an existing natural channel, so the current channel serves as drainage from the adjacent marsh into the south tributary of Hathaway Slough as it did historically.
- The proposed connection channel is not large relative to Stasek Slough.
    - The estimated cross-sectional areas of the widened connector channel and Stasek Slough are approximately 130 SF and 550 SF, respectively. The widened channel is only 20% of the size of the Stasek Slough.
    - It is estimated that the connection channel is not large enough to significantly influence tidal or storm hydraulics or sedimentation in the lower (west) portion of Stasek Slough. The potential negative risks of keeping the secondary connection are not high.
- The size of the tidal channel network as well as the size of the channels themselves that were constructed on the Kilchis Preserve in 2015 are considered conservative (on the high side of what is estimated to be appropriate). The channel network and geometry errored on the high side to provide improved initial tidal aquatic habitat, and to ensure that habitat could evolve appropriately under combined fluvial and tidal processes. Thus, tidal hydraulics are likely sufficient to support a secondary drainage pathway such as the connection channel without a significant detrimental geomorphic response.
- Secondary and distributary tidal channels networks are common in natural or least-disturbed settings. A nearby example is the Squeedunk Slough distributary channel located southwest of the Kilchis Estuary Preserve. Squeedunk Slough apparently began as a small distributary (avulsed) channel based on early site photographs (thought its size is believed to have been enhanced by the landowner).

Based on the Porter Connection Channel widened bankfull width of 30 feet at the bridge location, a bridge length of 45 feet (1.5 times greater than the active channel width; NOAA 2001) was selected. Similar to pedestrian bridge 2, this bridge length was determined in part (slightly oversized) to accommodate a relatively low sloped channel (1.5H:1V) and reduce the risk of scour of the high bridge abutments. The bridge abutments were located high relative to the ground surface to avoid excavation and water management during abutment construction in the relatively wet and low-strength soils in this location. The proposed bridge and proposed channel cross section are shown in comparison to the existing connector channel cross section on the bridge plan and elevation on the Plans in Appendix A.

Pedestrian Bridge 2 (Porter Slough)
Pedestrian bridge 2 is located near the north terminus of Porter Slough. The field-measured active width of the channel downstream (west) of the crossing location ranges from 16 to 17 feet. Measurements were taken at three locations, all within 150 feet of the crossing location. The channel size increases significantly beyond 150 feet. As a note, the channel upstream (east) of the crossing has been impacted with two additional culverts and other drainage manipulations such that bankfull measurements upstream were not useful.

Based on the noted active width range, a bridge length of 25 feet (1.5 times greater than the active width) was selected. The bridge length was also determined in part (slightly oversized) to accommodate a relatively low sloped channel (1.5H:1V; other designed tidal channel sideslopes are near vertical, 0.5H:1V) and reduce the risk of scour of the high bridge abutments. The bridge abutments were located high relative to the ground surface to avoid excavation and water management during abutment construction in the relatively wet and low-strength soils in this location. The proposed bridge and proposed cross section are shown relative to the existing channel (and culvert) on the pedestrian bridge 2 plan and elevation in Appendix A.

4.6 Wood Habitat Structures

Wood habitat structures (WHSs) would be placed in newly created and existing tidal channels within the site to provide cover, as well as hydraulic and habitat complexity for estuarine fishes and other wildlife. WHSs cause scour and deposition-induced channel bedforms which result in a greater variability of in-channel habitats. Woody debris is also currently lacking in the Kilchis River estuary, where many log complexes of varying scales were removed during historic agricultural development (Follensbee 1998).

The intent of wetland restoration is to allow the tidal channels to adjust, migrating laterally and vertically within the wetland, in response to changes in the tidal prism and, also episodic scour and sedimentation. Because WHS logs may be subject to periodic scour and displacement, the restoration design assumes this is an acceptable natural, morphological process. However, we do not expect significant loss of logs, and accumulation of new woody debris would likely be as prevalent as log displacement.

WHSs placed in clusters or groups of 1 to 3 logs are likely appropriate for tidal channels of the sizes within the site. Logs within the clusters would be buried and/or driven into the channel embankment to

resist flotation and displacement. The logs will not require rock, anchors, or other ballasting mechanisms due to the relatively low velocities in the tidal channels and sufficient embedment into the wetland soils. A total of approximately 70 logs will be constructed throughout the new and enhanced tidal channels.

4.7 Planting Strategy

The Porter Tract currently includes regions of well-developed, native estuarine marsh on the northern portion of the site adjacent to Hathaway Slough. This native patch transitions to a mix of native estuarine plants and relic pasture grasses to the south and east. We recommend a planting strategy that jump starts the desired estuarine species, supports existing marsh species, and increases wetland species heterogeneity. The planting plan is also informed by the initial response of planting activities from the Kilchis Preserve restoration project. Soil testing information will also be valuable to increase the likelihood of success for certain plants. If possible, reference site information should be applied to verify plant list and target proper elevations.

Sitka-spruce swamp development patterns depend on complex successional patterns. These processes can last centuries to achieve climax stage development. Hummock-hollow formation is dependent in part by nurse logs and sediment deposition patterns. Nurse logs add roughness to marsh surface that can facilitate additional debris and sediment deposits. New restoration techniques are being applied to jump-start Sitka spruce development patterns. Examples include the Fort Clatsop and Kandoll restoration projects in the Columbia River Estuary. This includes the disposal of excess fill material to emulate topographic hummocks. Hummocks or low mounds were also created on the adjacent Kilchis Preserve restoration project and have proved successful.

The current planting plan includes low mounds and plantings intended to facilitate spruce colonization over time. The zones depicted in Figure 6 and Table 4 offer areas to adaptively manage the plantings for sea level rise. Some consideration may be warranted to develop transition zones in anticipation of marsh upward migration patterns from 1 foot of sea level rise within a 50-year planning horizon. Figure 6 below is a conceptual plan developed by TNC staff depicting position and orientation of potential plant communities at the site.

A strong revegetation effort is advisable to minimize reed canarygrass spread and impact on existing native vegetation communities. The initial effort might include both dense herbaceous plantings and well-planned woody plantings to jump-start shading-out of reed canarygrass and development of swamp habitat. In existing dense stands of reed canarygrass, herbicide use, scalping and offsite disposal of the reed canarygrass root mat is advisable, followed by intensive herbaceous and woody species plantings.

Low salinity levels may make it more difficult to control reed canarygrass after restoration. Disturbed sites that are low in salinity (e.g. less than 10 PPT) favor reed canarygrass. If salinity monitoring suggests that internal salinities will be less than 10 parts per thousand (PPT), woody plantings tolerant of very wet conditions (e.g. willow) may be the best approach, even on lower elevation areas. Willow plantings are relatively cheap and can be effective in controlling reed canarygrass. Retaining desirable native vegetation to the extent practicable is also recommended.