Pocket Estuary Restoration Design and Implementation in the Salish Sea

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Blue Coast Engineering

June 11, 2025

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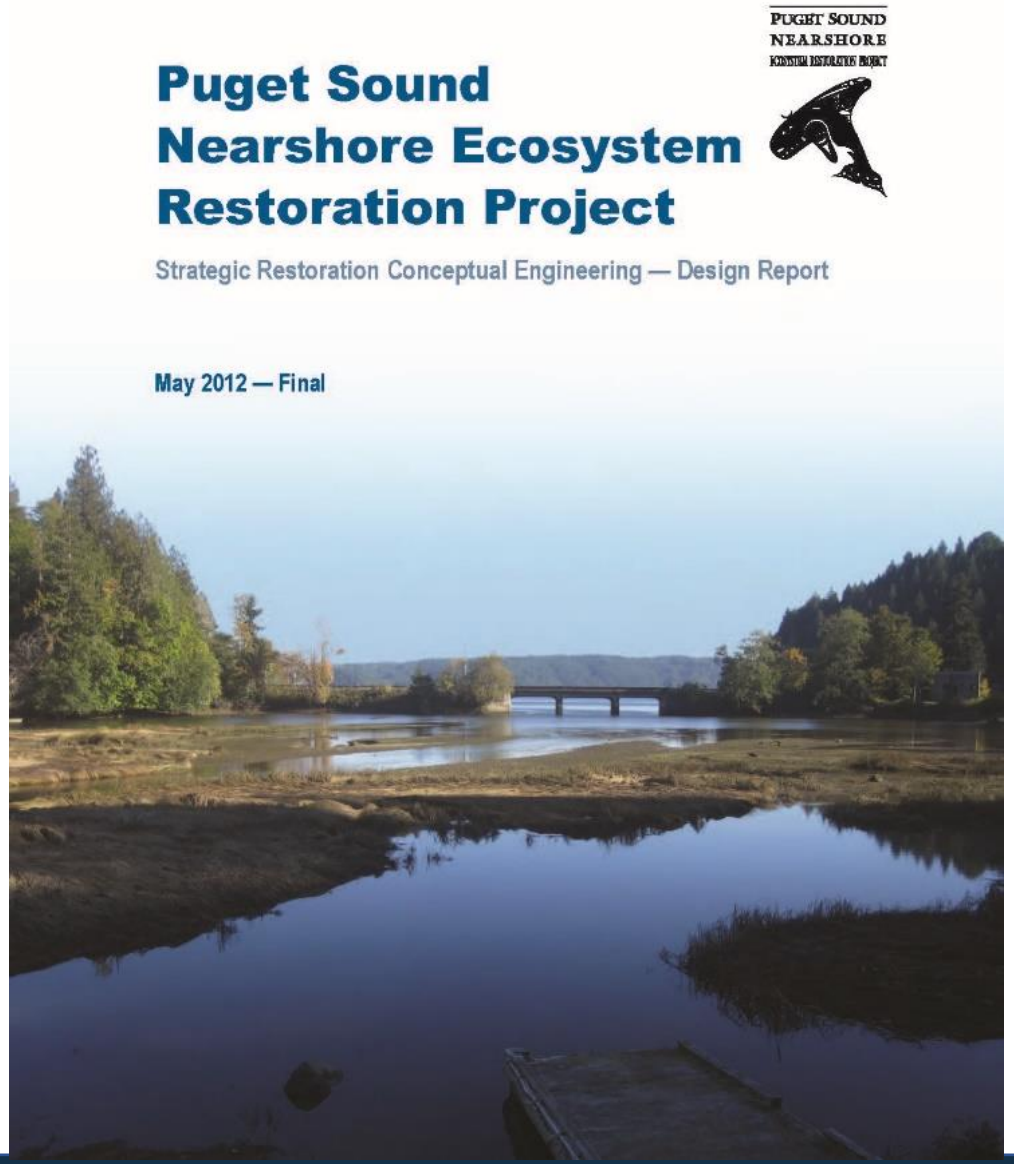
40% of pocket estuaries have been filled or restricted

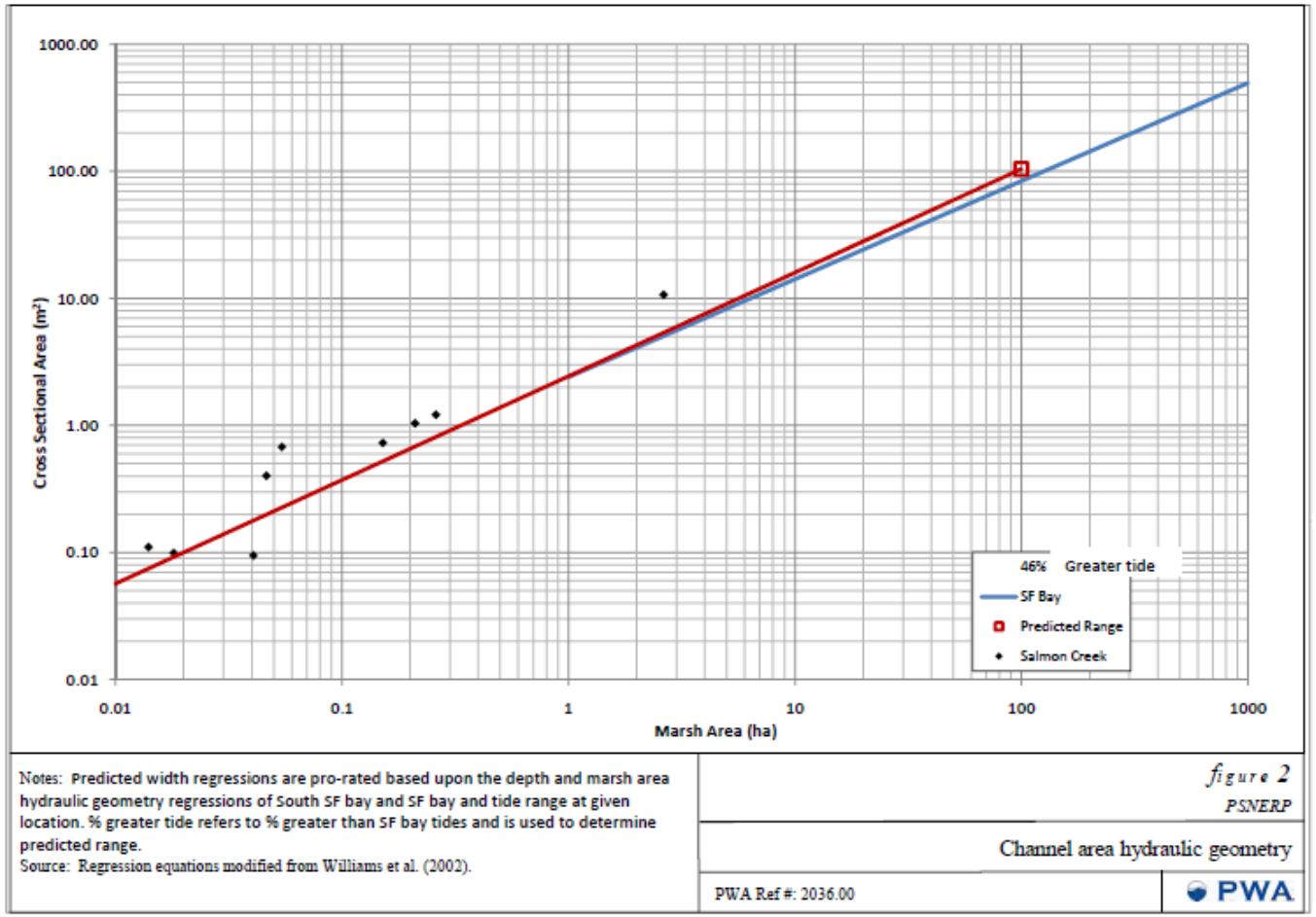
H. Shipman

Filled Estuary & Houses built on barrier spits

Sediment Depletion

Replace PSNERP Guidelines for Sizing Primary Tidal Channel

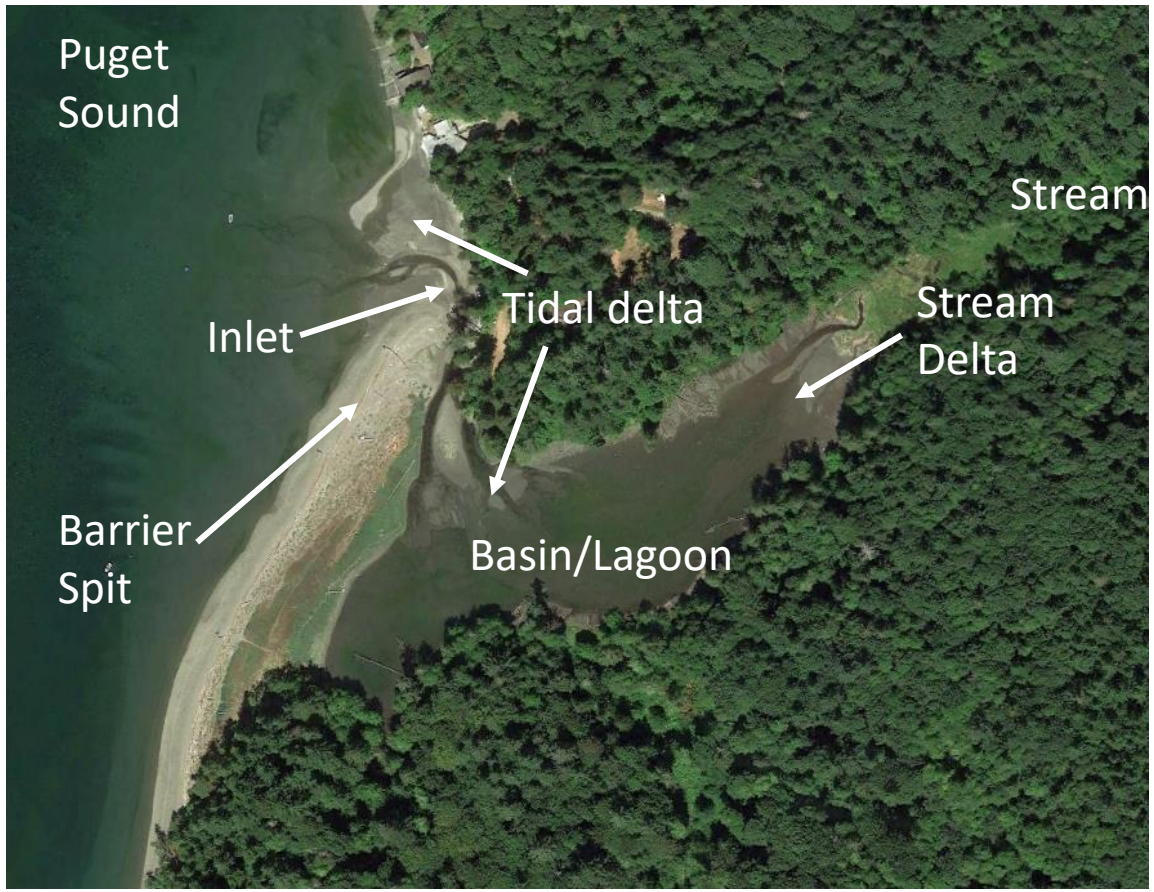


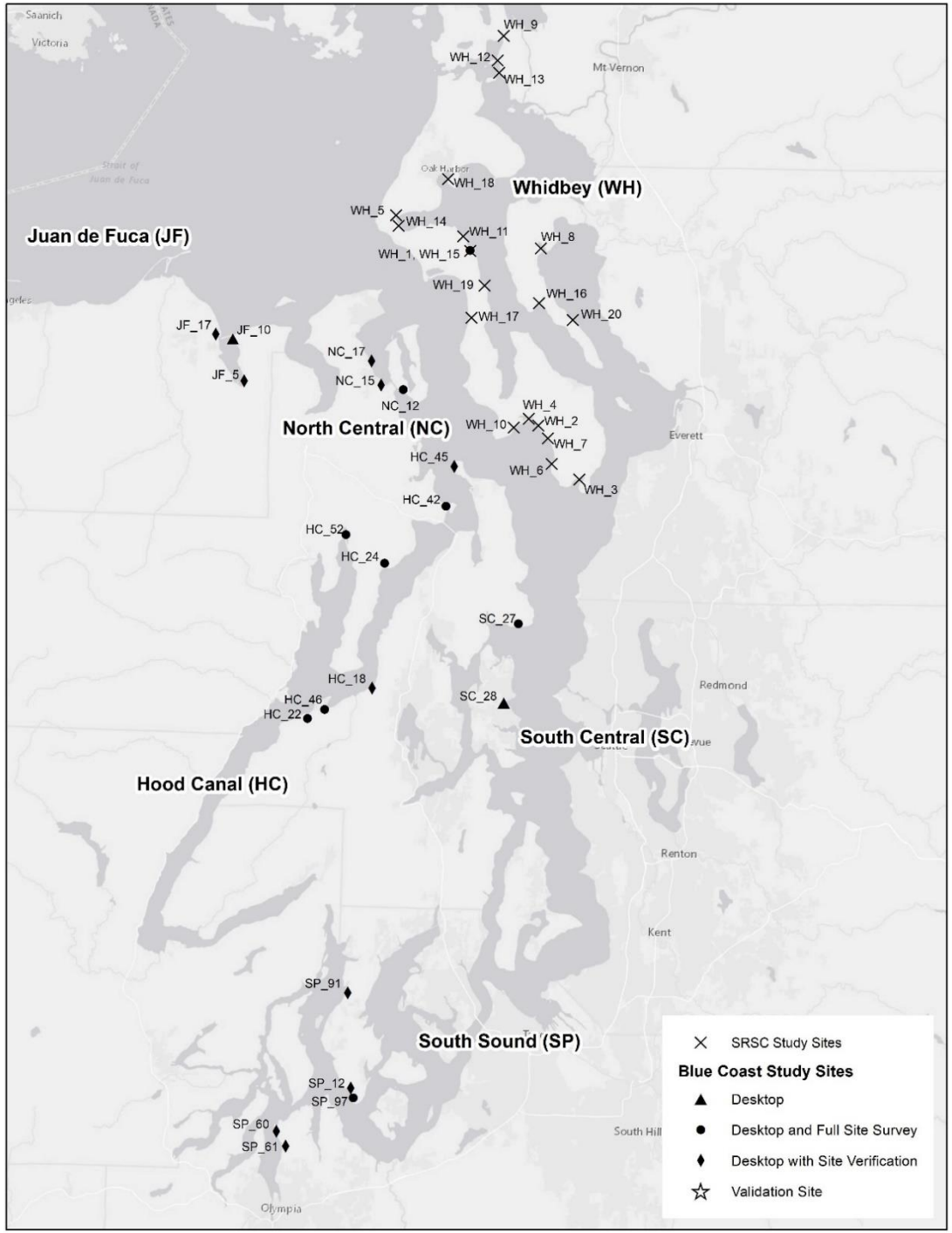


Notes: Predicted width regressions are pro-rated based upon the depth and marsh area hydraulic geometry regressions of South SF bay and SF bay and tide range at given location. % greater tide refers to % greater than SF bay tides and is used to determine predicted range.
Source: Regression equations modified from Williams et al. (2002).

figure 2
PSNERP
Channel area hydraulic geometry
PWA Ref #: 2036.00
PWA

Design Guidelines for Barrier Embayments in Puget Sound

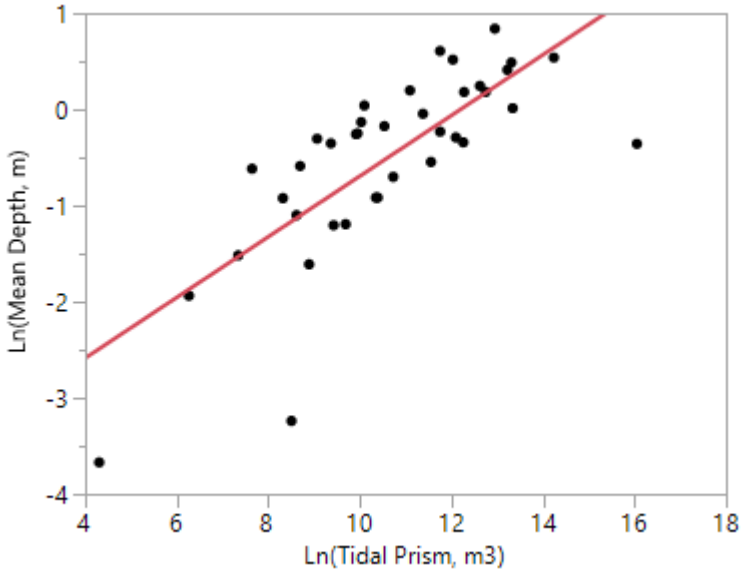




Study Sites

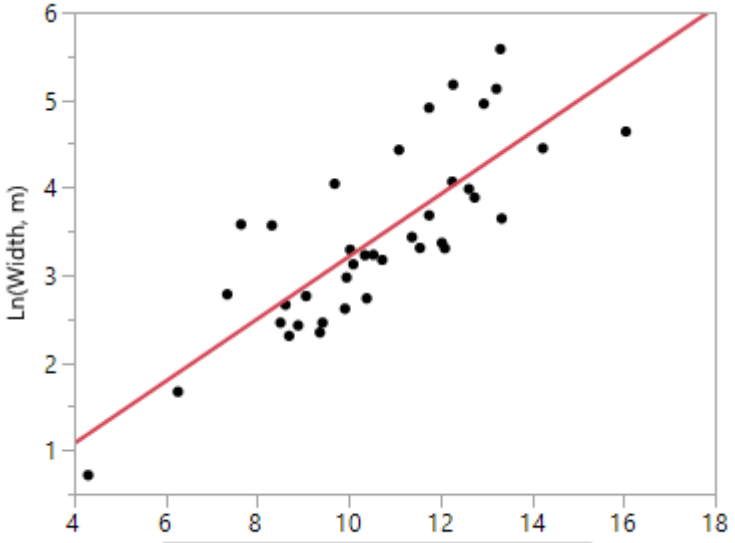
- No sites in the San Juans
- 10 sites where in situ data were collected
- 38 sites with desktop data extracted, 2 were removed as outliers during analysis

Regression Analysis – Tidal Prism v2 – All Data



RSquare	0.580112
RSquare Adj	0.568448
Root Mean Square Error	0.630453
Mean of Response	-0.5034
Observations (or Sum Wgts)	38

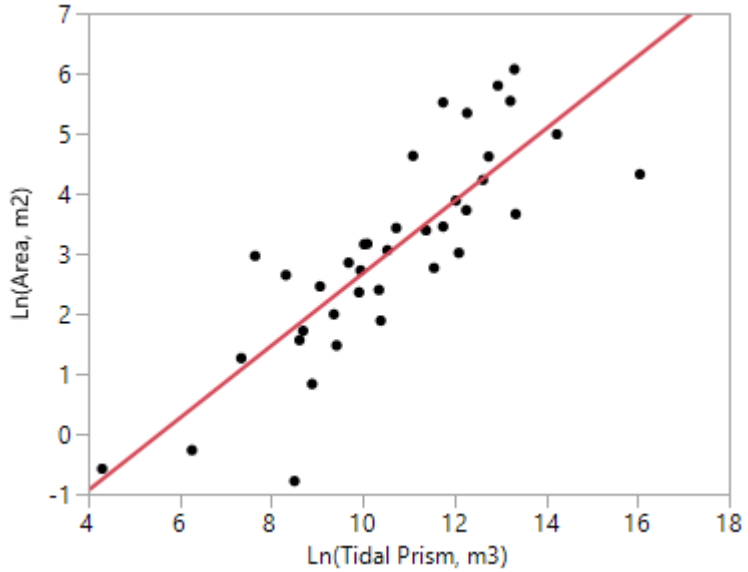
idal Prism, m3)



Summary of Fit

RSquare	0.645194
RSquare Adj	0.635338
Root Mean Square Error	0.619562
Mean of Response	3.422819
Observations (or Sum Wgts)	38

, m3)



Ln(Area, m2) = -3.344402 + 0.6016819*Ln(Tidal Prism, m3)

Summary of Fit

RSquare	0.682151
RSquare Adj	0.673322
Root Mean Square Error	0.964926
Mean of Response	3.032797
Observations (or Sum Wgts)	38

Evaluation of Outliers

- Embayment Geomorphology
  - Barrier Estuary
  - Drowned Stream Valley

Dabob Bay, Hood Canal


Impoundment

Tide Flat – Thorndyke Bay

Marsh – Doe Kag Watts

Application of Guidance

- Report documents detailed step-by-step instructions
- Excel tool with regressions is provided
- Hydraulic modeling is recommended
- Iterative process
- Not applicable to freshwater dominated systems
  - Tidally Influenced Streams
  - Drowned Stream Valleys

Puget Sound Channel Design Guidelines for Barrier Embayment Restoration

Phase 4 Report: Final Data Analysis and Design Guideline Recommendations

Prepared for:
Washington Department of Fish and Wildlife
Estuary and Salmon Restoration Program
PO Box 43200
Olympia, WA 98504-3200

Prepared By:
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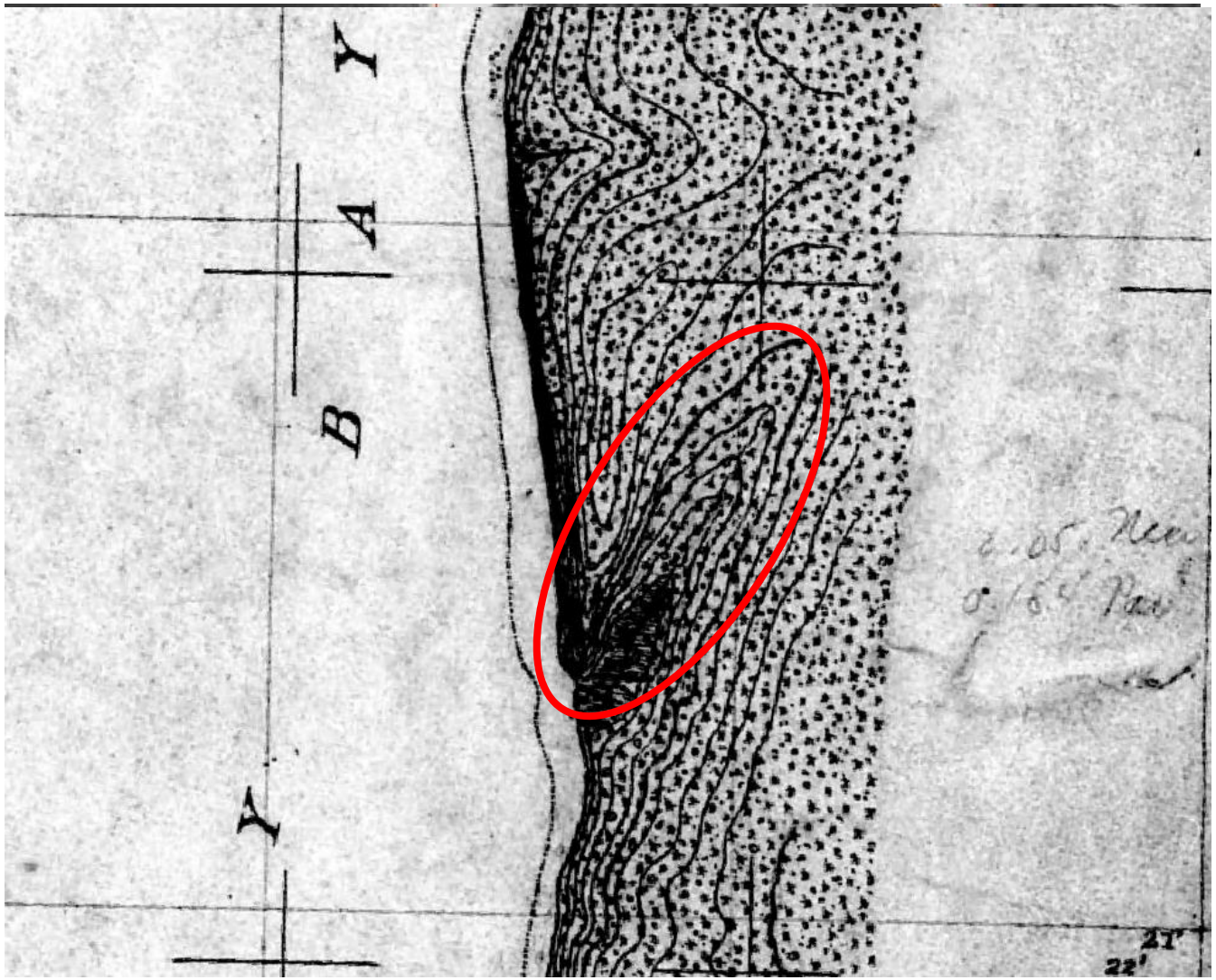
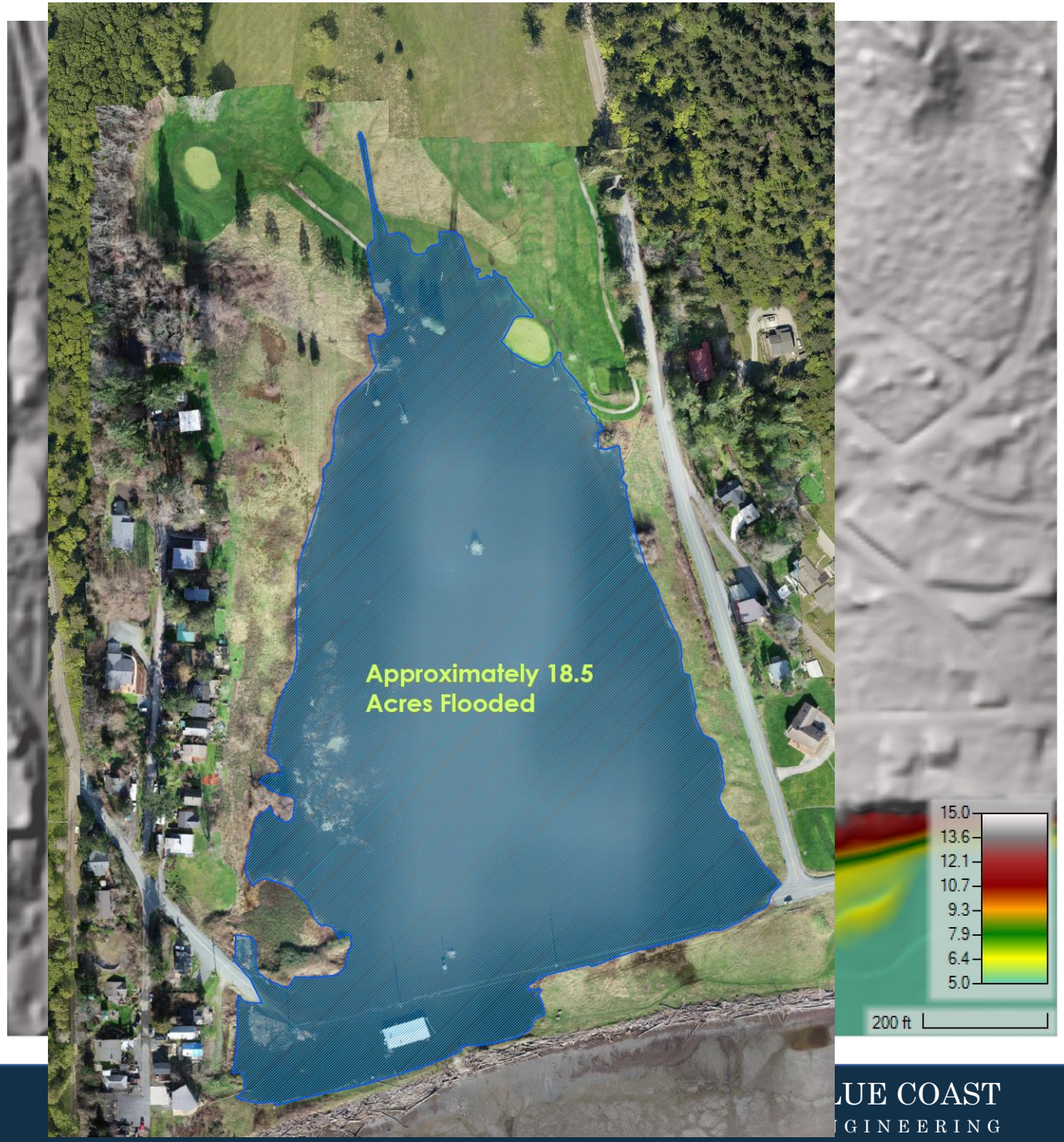
Eric Beamer, Skagit River System Cooperative

February 5, 2023

McSorley Creek – Drowned Stream Valley




Approximately 18.5
Acres Flooded
15.0
13.6
12.1
10.7
9.3
7.9
6.4
5.0
200 ft

Similk

Case Studies

Point No Point
County Park

Rose Point
Private Property

Rose Point

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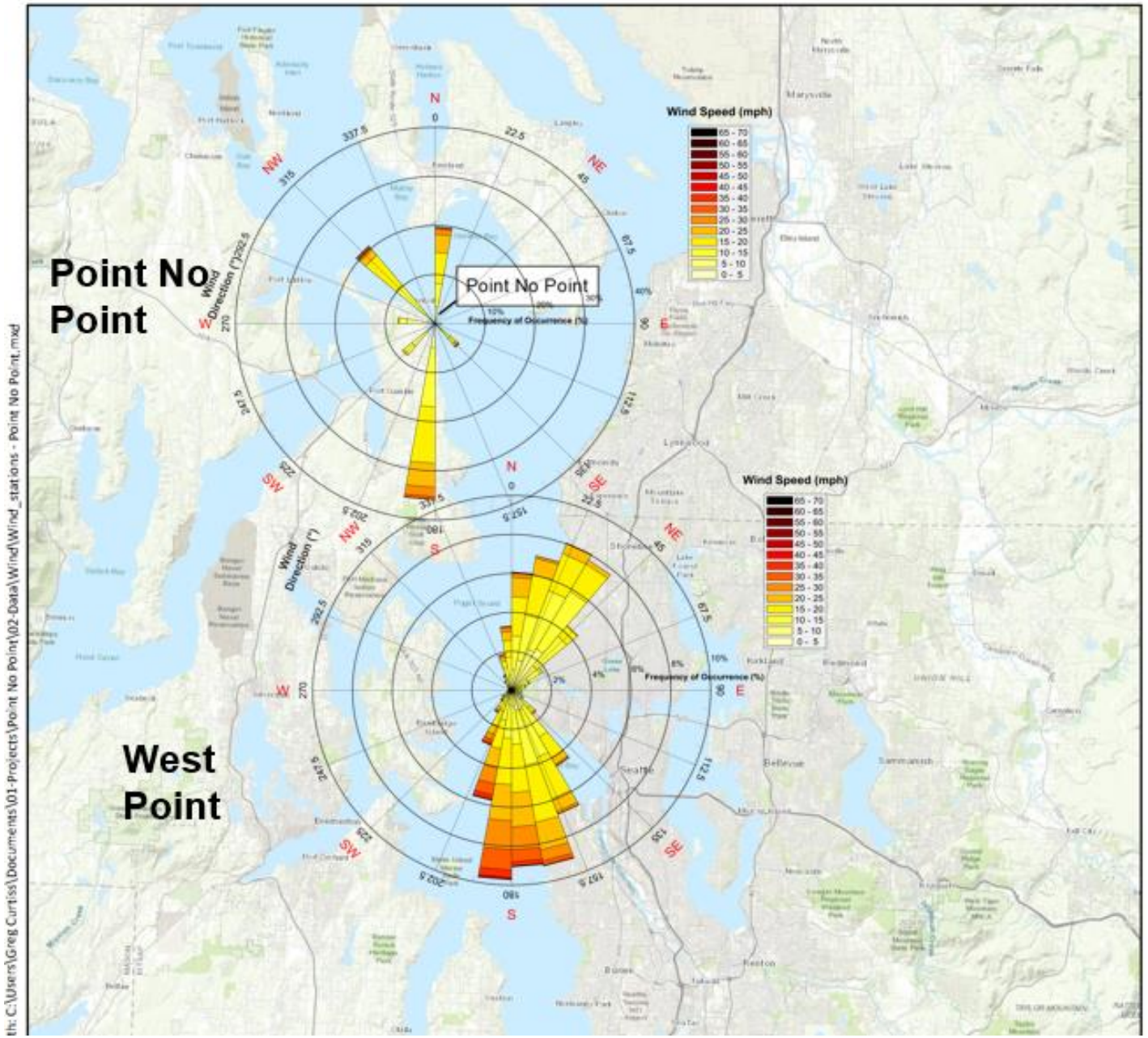
Historic
Barrier
Estuary

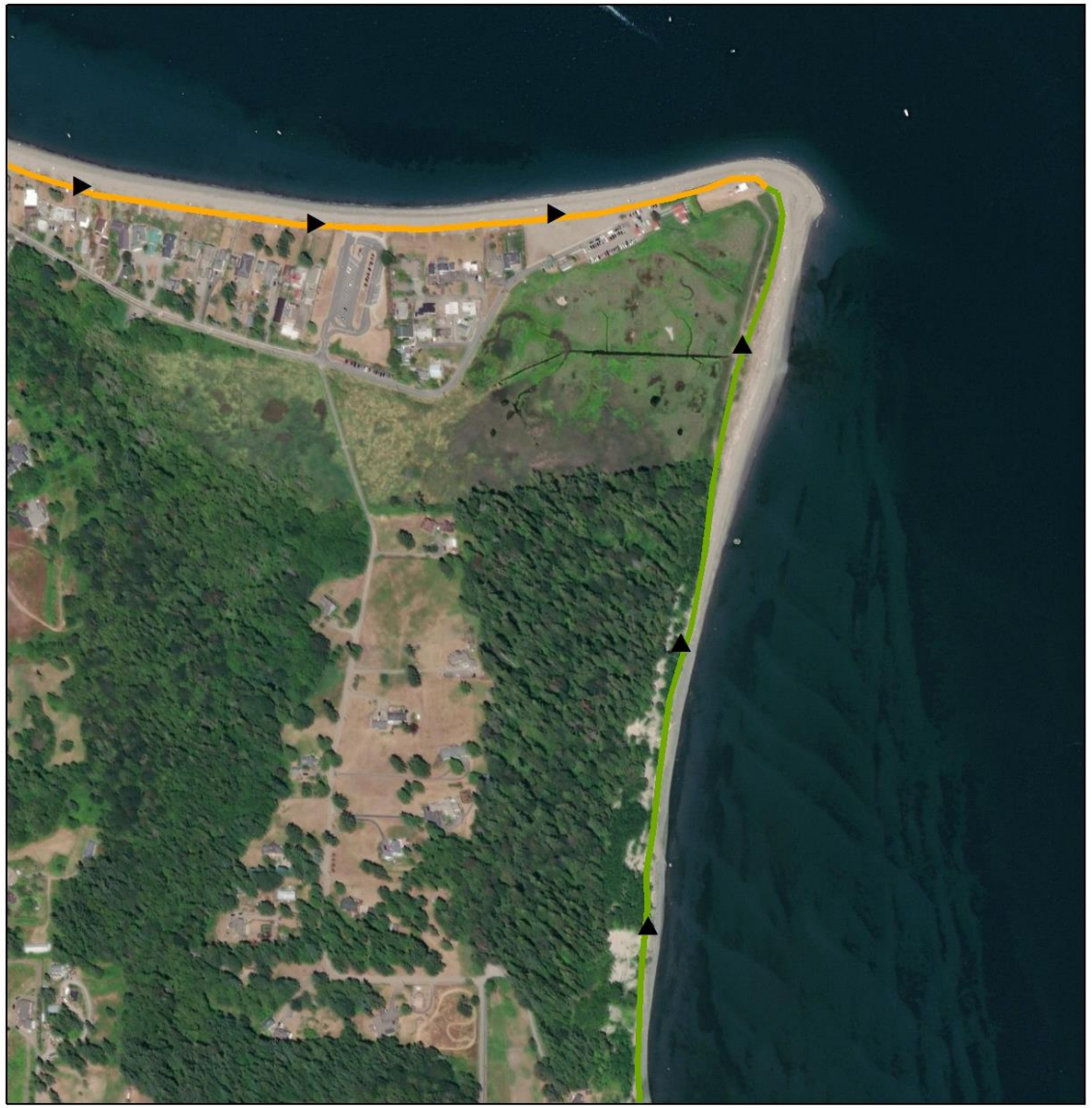
t-sheet
survey 1872



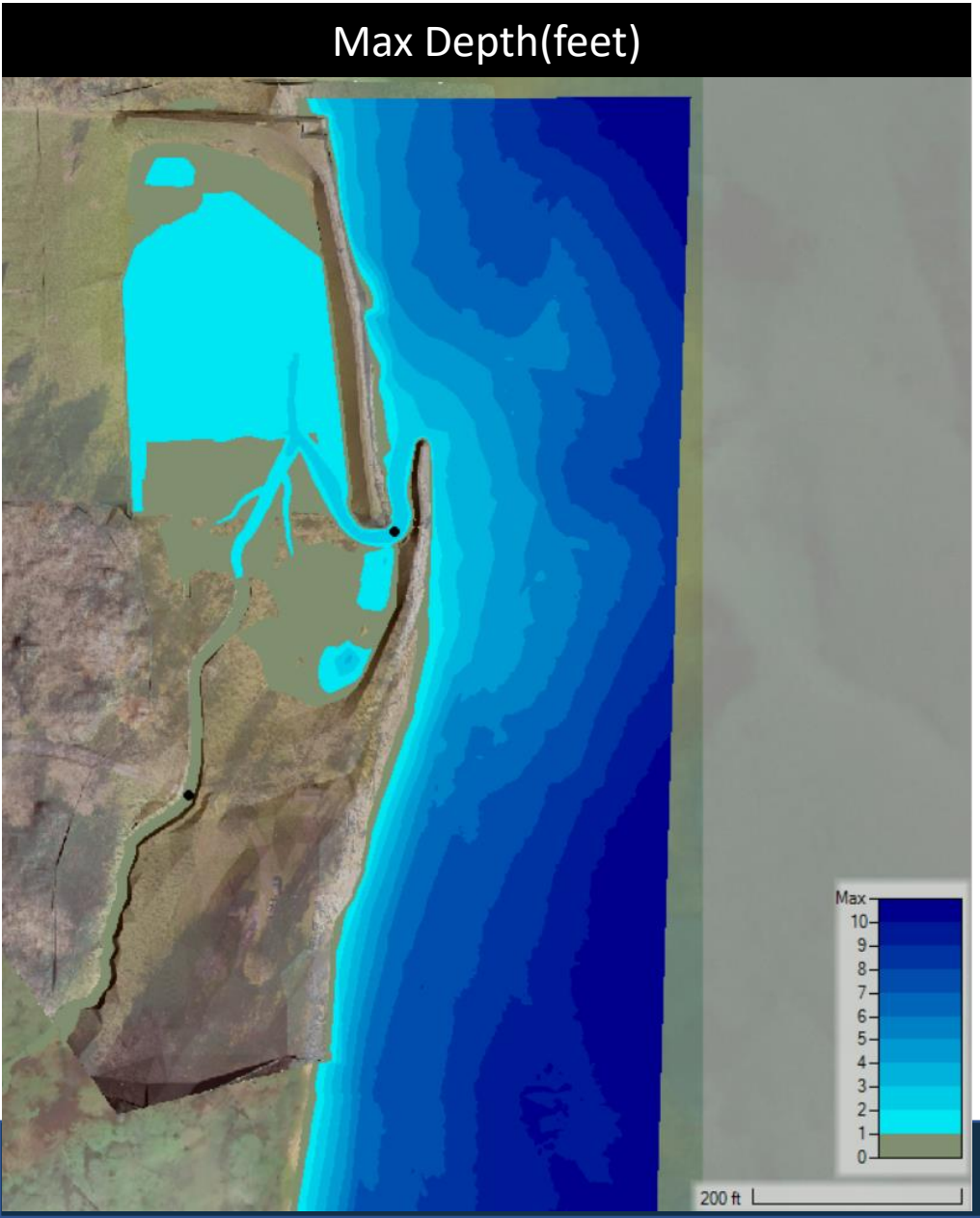
Wind Wave Hindcast

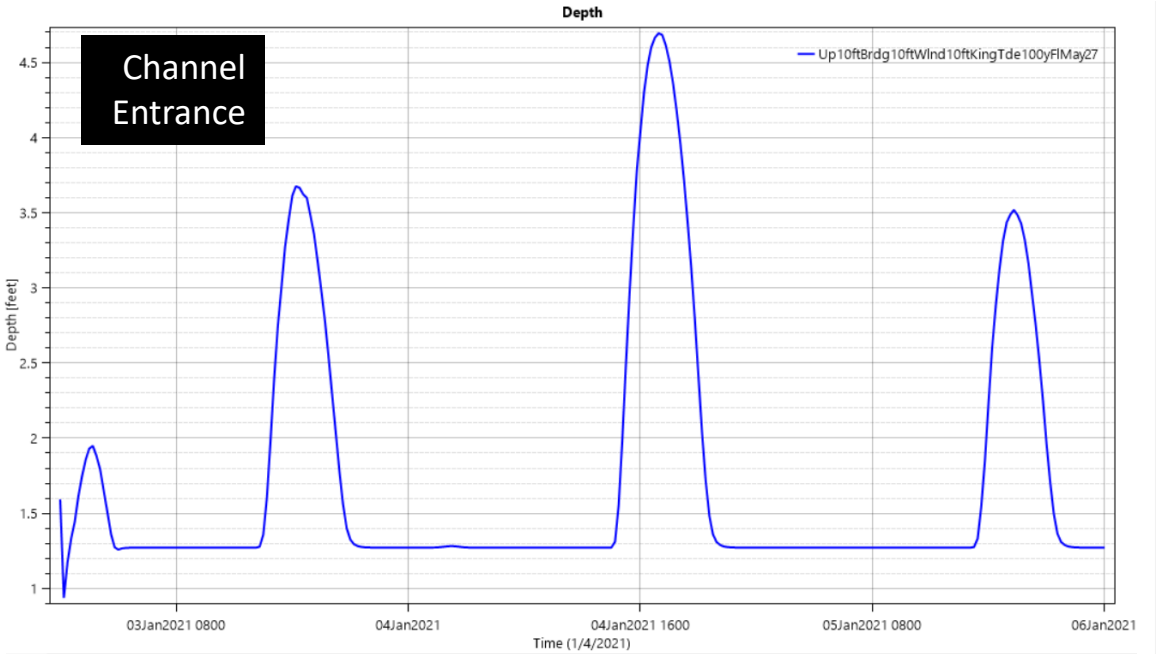
Sediment Transport

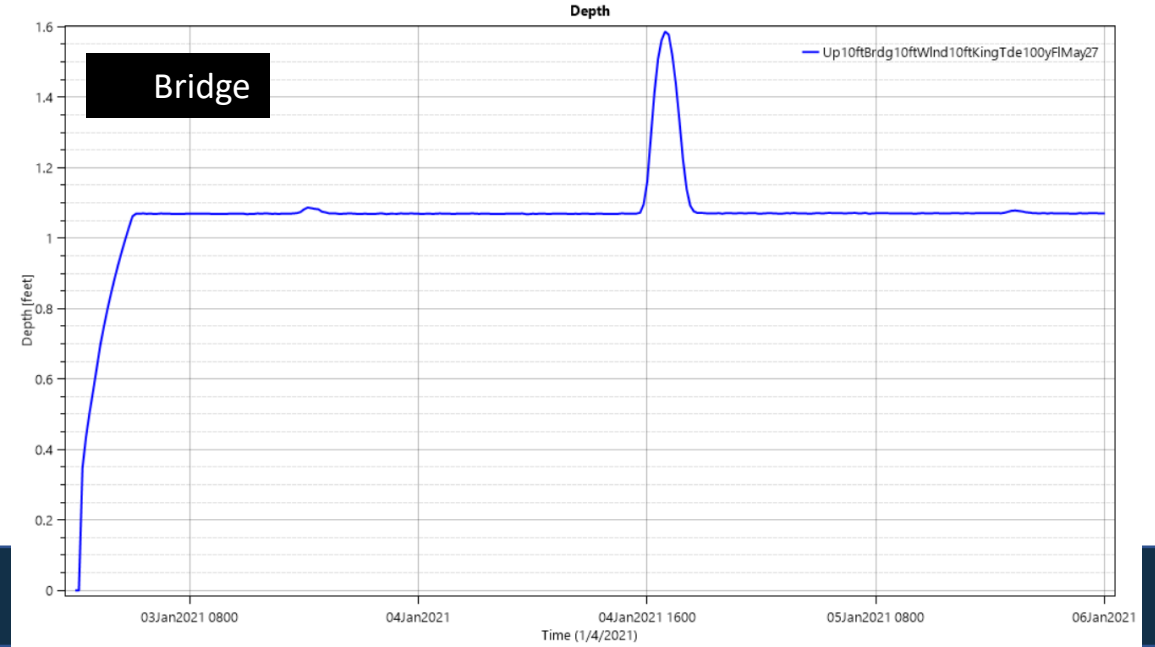
- Feeder bluffs
- Sediment Supply
- Littoral Drift
- Impediments to transport



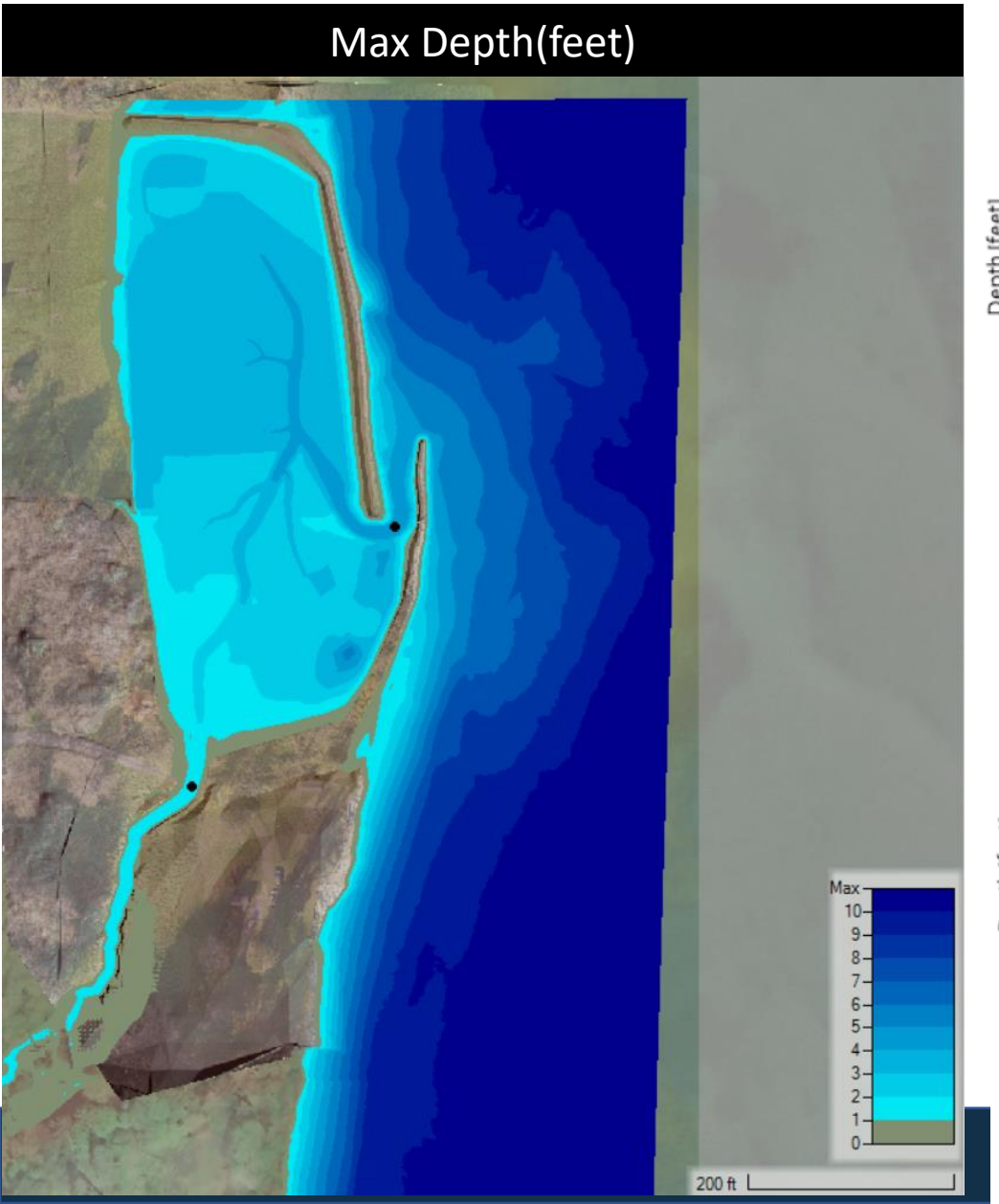
Average Tide, Low Flow Condition (2 cfs)

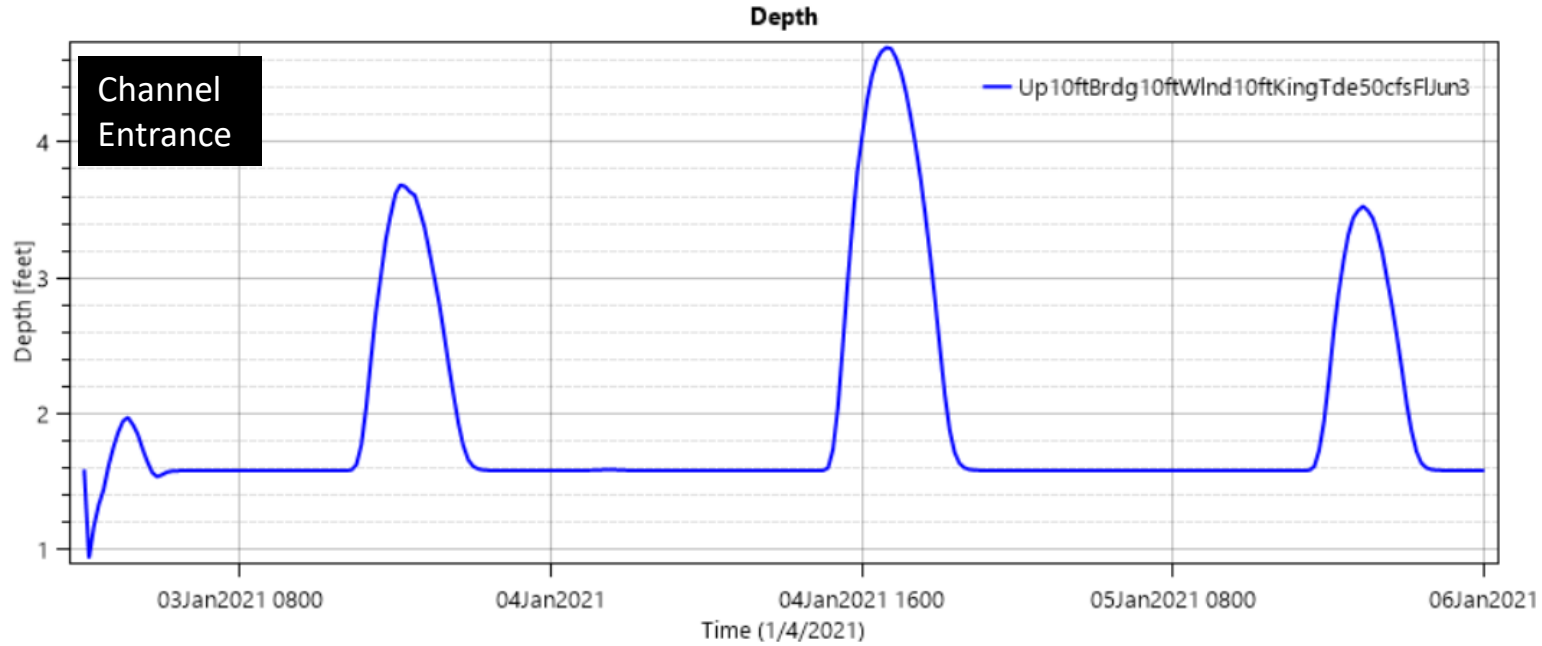


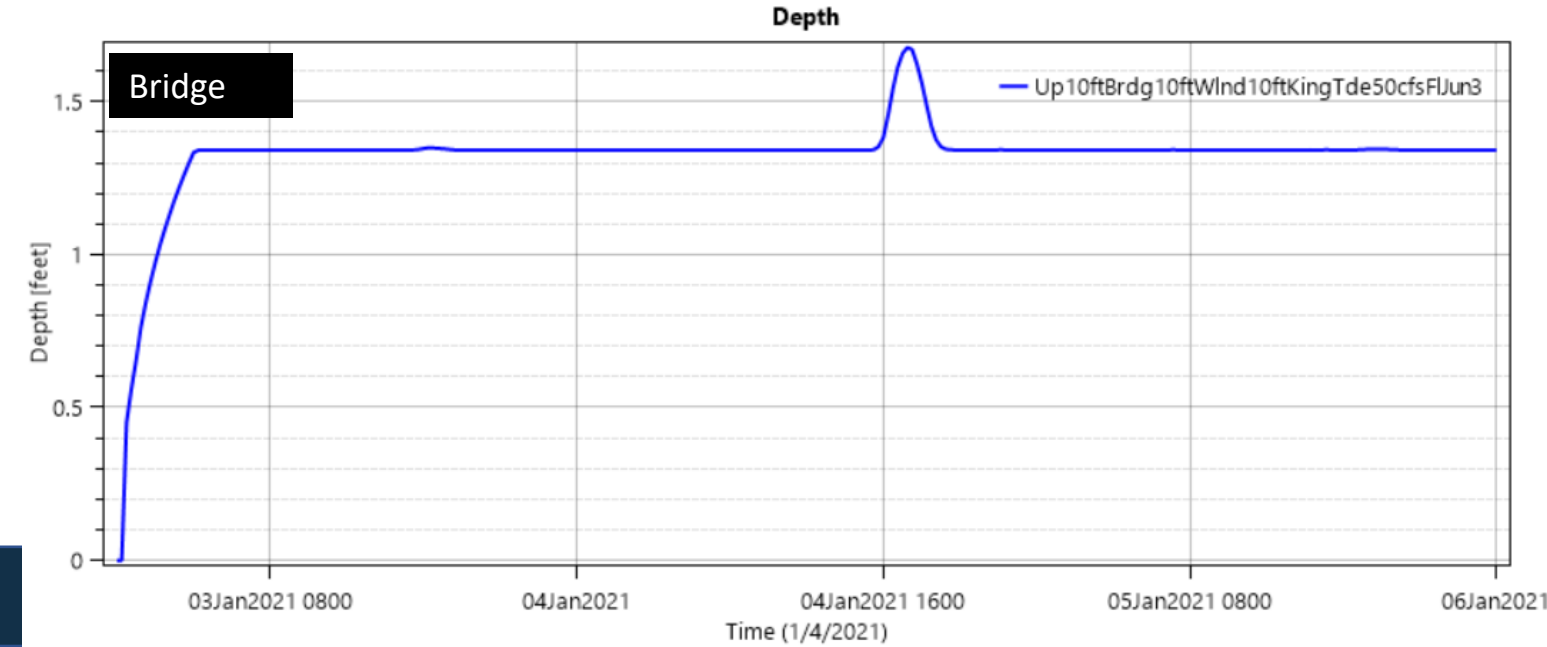




King Tide, 50 cfs

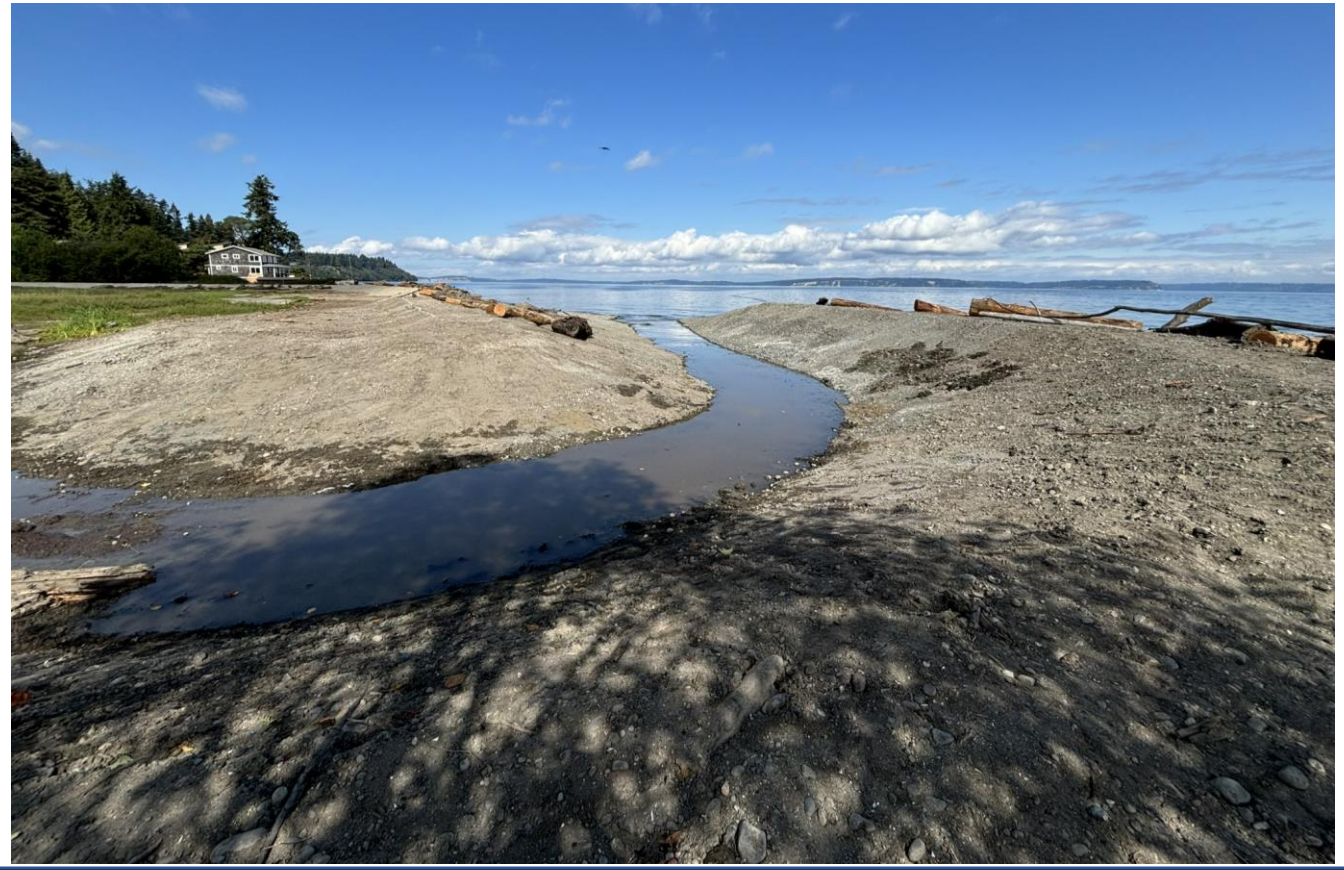






Rose Point Restoration

- Restore the historic barrier embayment, re-connecting the natural freshwater streamflow to tidal saltwater
- Create fish habitat, particularly for juvenile salmonids
- Remove invasive species and add native plantings
- Educate shoreline landowners about negative effects of shoreline armoring on their properties and encourage removal




November 2024
March 2025

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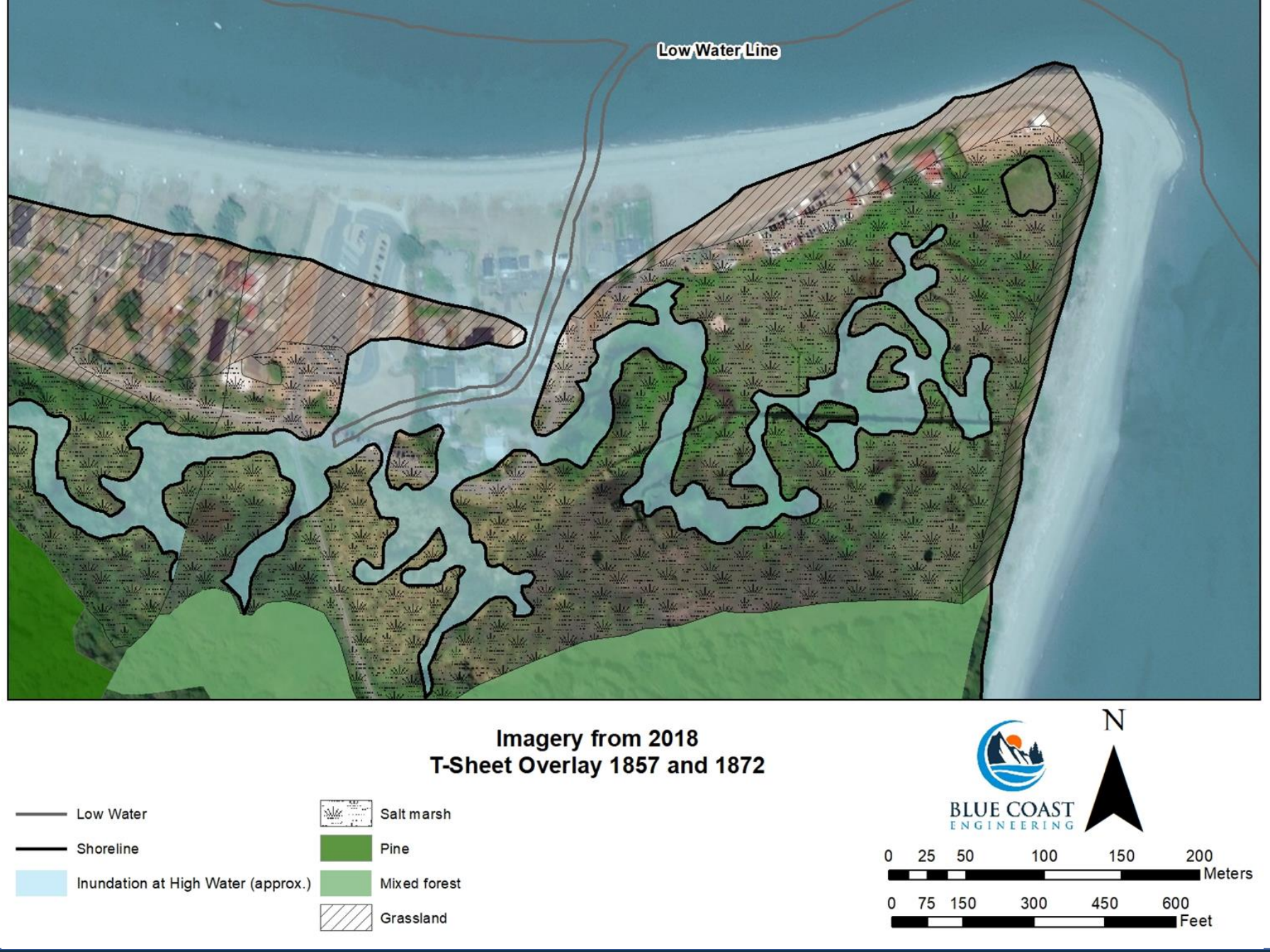
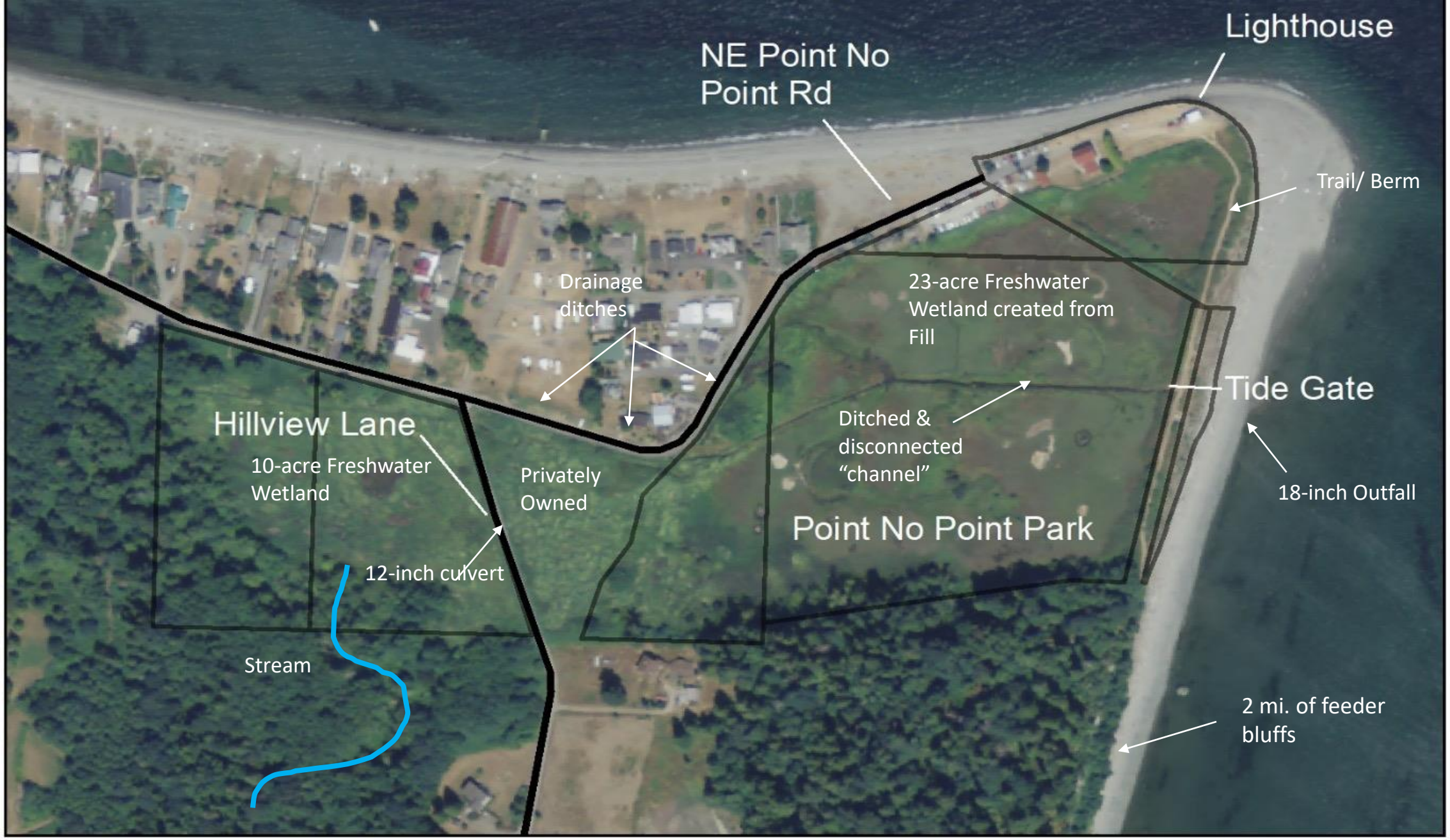
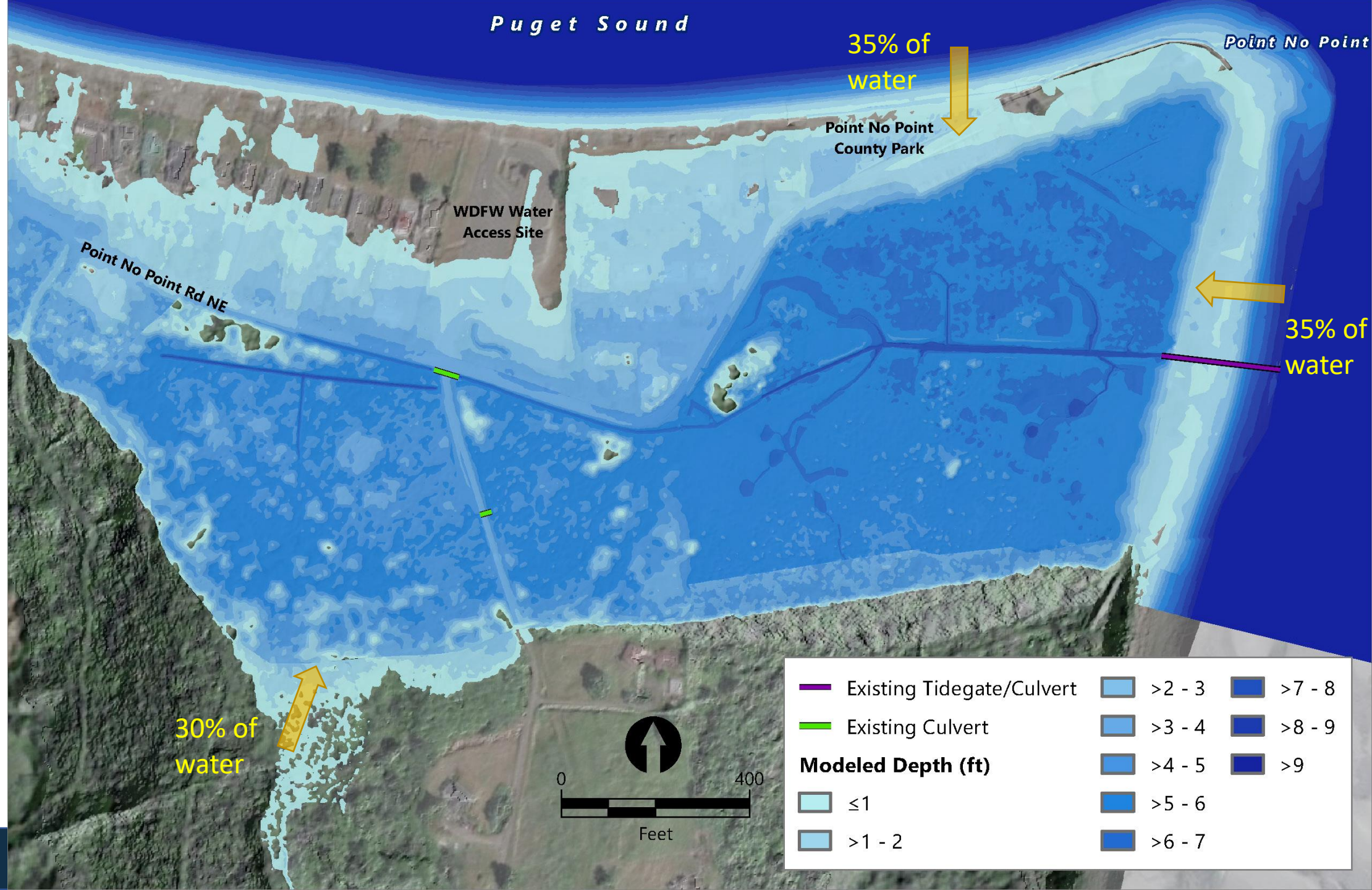
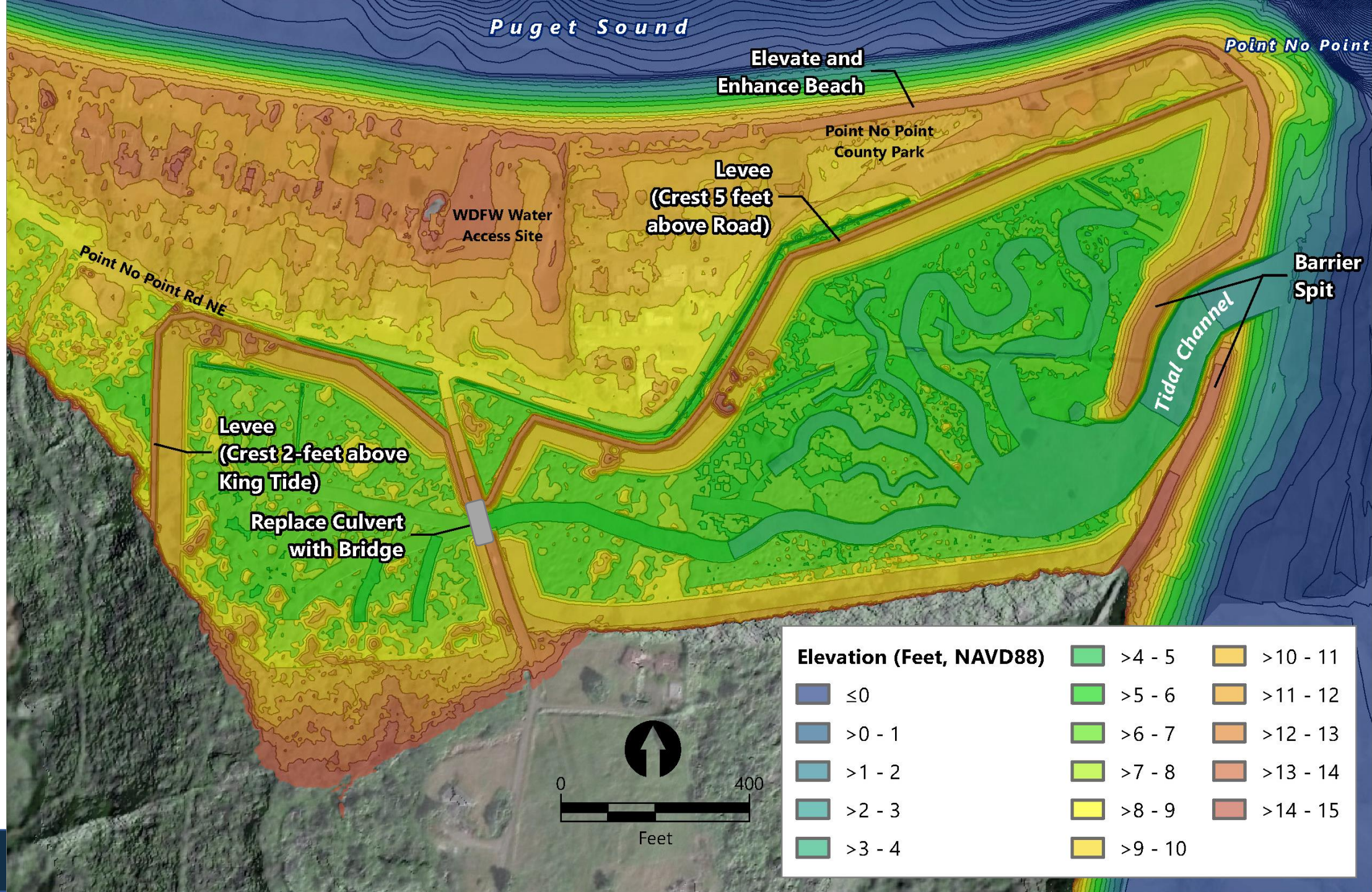
Point No Point Barrier Estuary

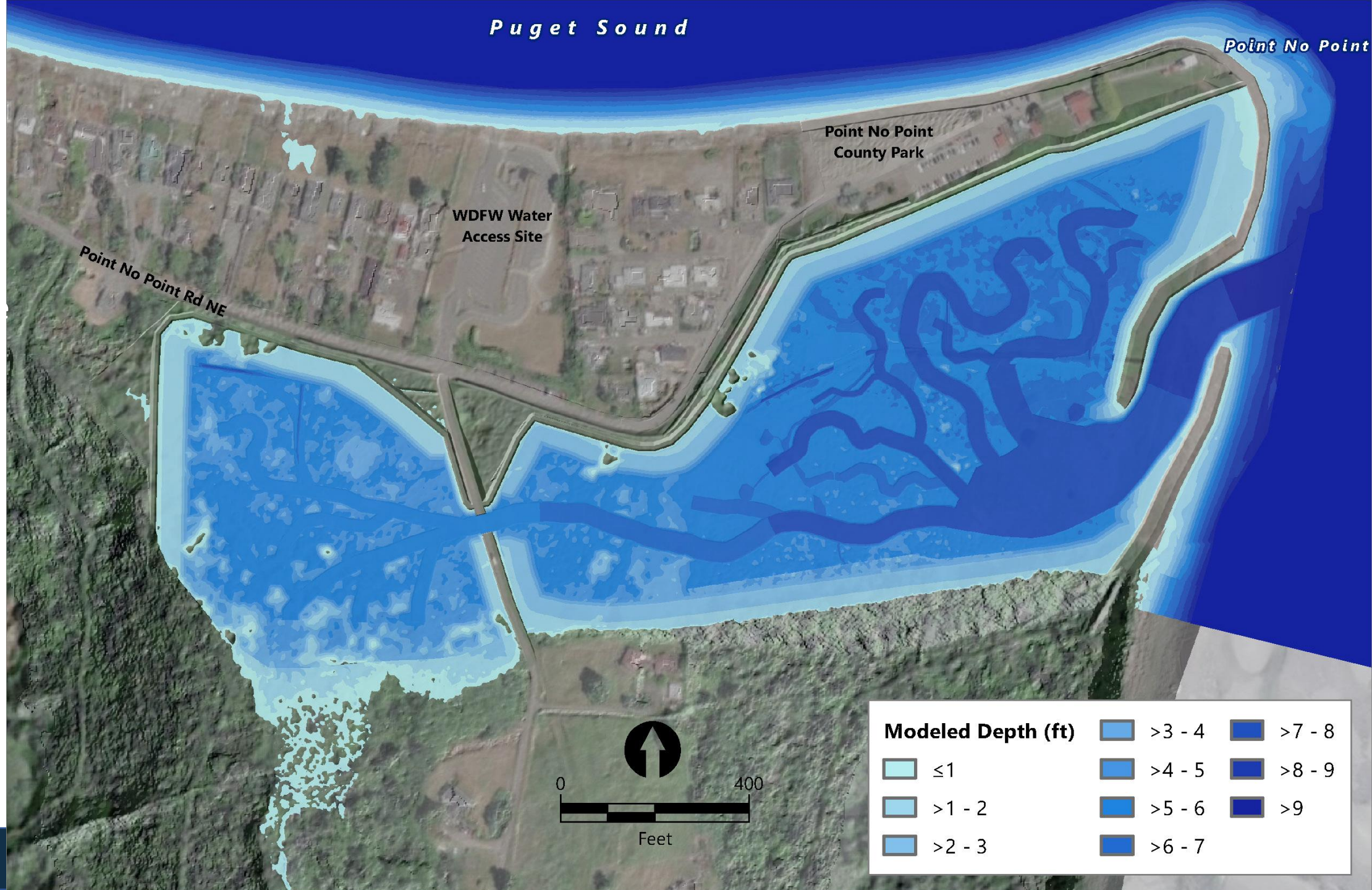


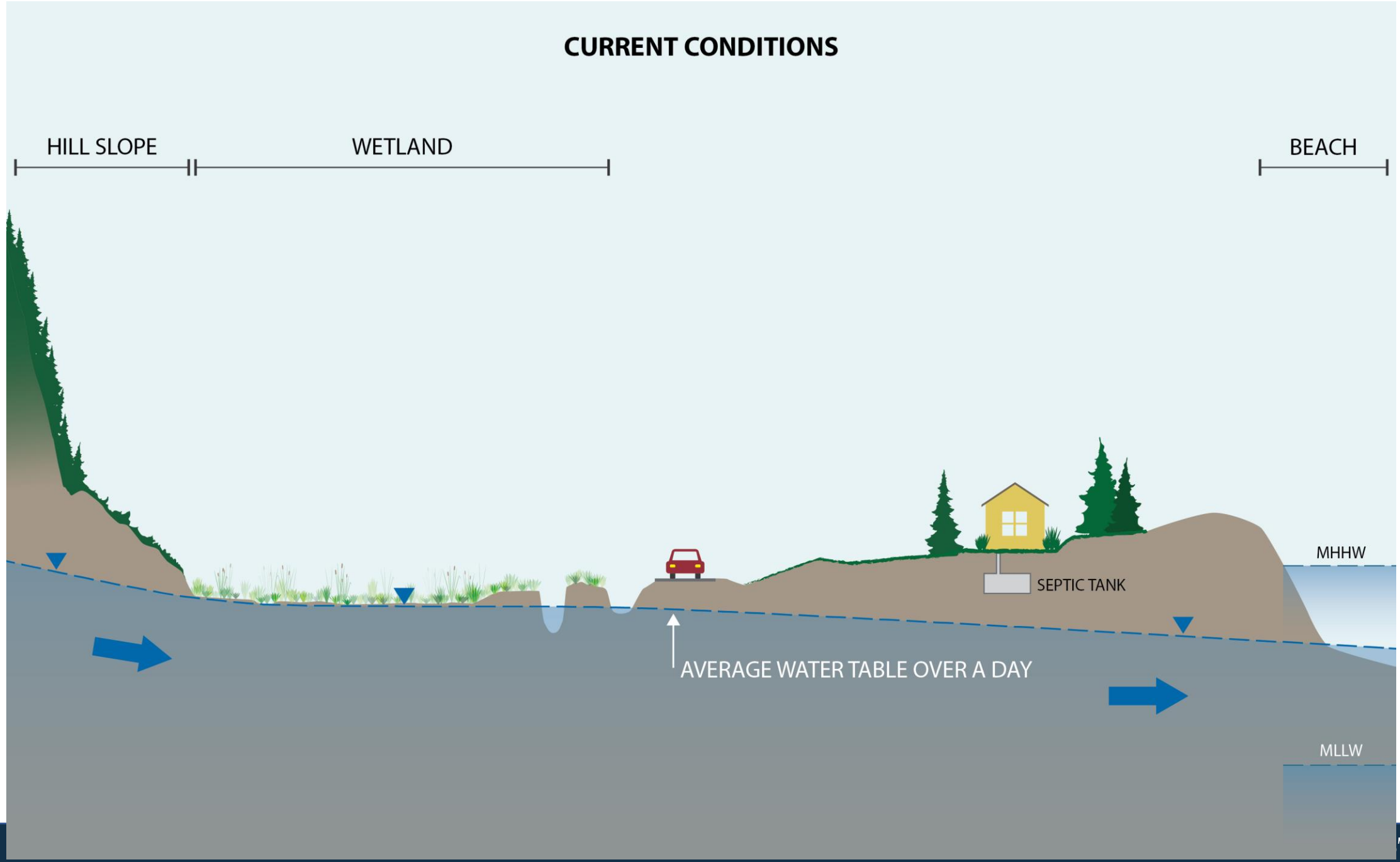

Lighthouse
NE Point No Point Rd
Trail/ Berm
Drainage ditches
23-acre Freshwater Wetland created from Fill
Tide Gate
Hillview Lane
10-acre Freshwater Wetland
Privately Owned
Ditched & disconnected "channel"
18-inch Outfall
Point No Point Park
12-inch culvert
Stream
2 mi. of feeder bluffs

December 2022


Puget Sound
35% of water
Point No Point
Point No Point County Park
WDFW Water Access Site
Point No Point Rd NE
35% of water
30% of water
0
400
Feet
Existing Tidegate/Culvert
Existing Culvert
Modeled Depth (ft)
≤1
>1 - 2
>2 - 3
>3 - 4
>4 - 5
>5 - 6
>6 - 7
>7 - 8
>8 - 9
>9


Puget Sound
Point No Point
Elevate and Enhance Beach
Point No Point County Park
Levee (Crest 5 feet above Road)
WDFW Water Access Site
Point No Point Rd NE
Barrier Spit
Tidal Channel
Levee (Crest 2-feet above King Tide)
Replace Culvert with Bridge
0
400
Feet
Elevation (Feet, NAVD88)
≤0
>0 - 1
>1 - 2
>2 - 3
>3 - 4
>4 - 5
>5 - 6
>6 - 7
>7 - 8
>8 - 9
>9 - 10
>10 - 11
>11 - 12
>12 - 13
>13 - 14
>14 - 15


Puget Sound
Point No Point
Point No Point
County Park
WDFW Water
Access Site
Point No Point Rd NE
0
400
Feet
Modeled Depth (ft)
≤1
>1 - 2
>2 - 3
>3 - 4
>4 - 5
>5 - 6
>6 - 7
>7 - 8
>8 - 9
>9



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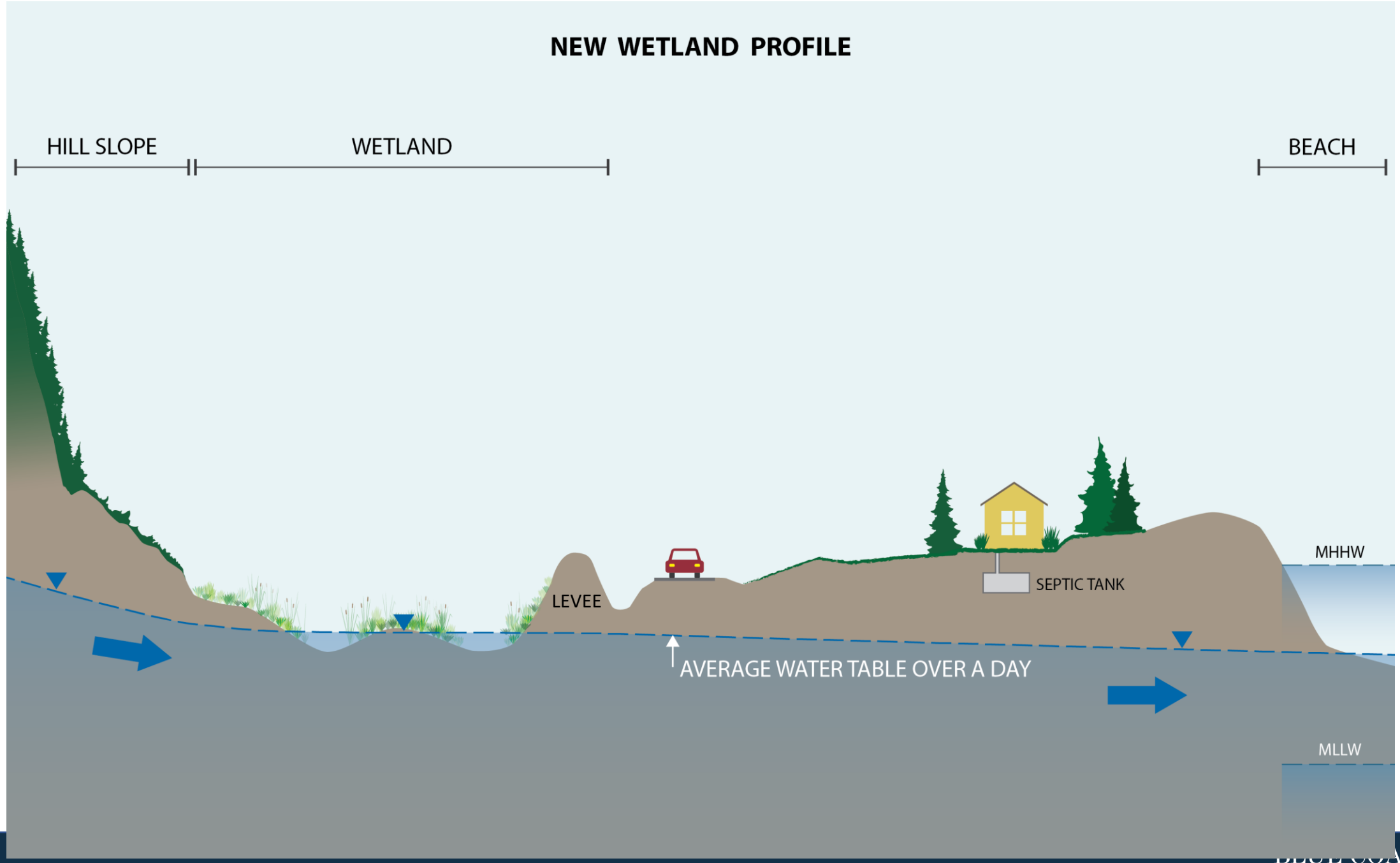
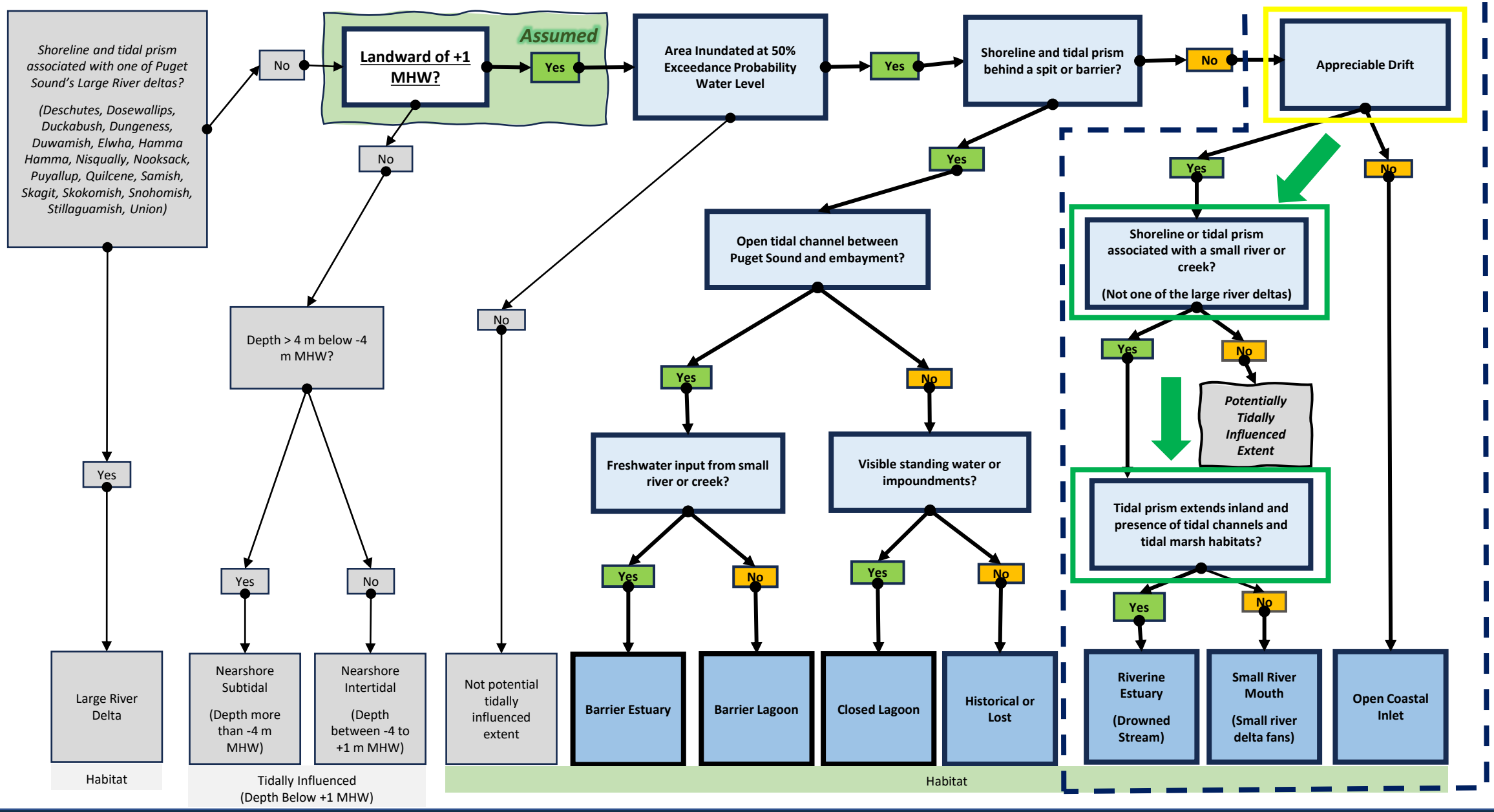

NEW WETLAND PROFILE
HILL SLOPE
WETLAND
BEACH
LEVEE
SEPTIC TANK
MHHW
AVERAGE WATER TABLE OVER A DAY
MLLW

Decision Tree



Decision Tree Proposed Modifications

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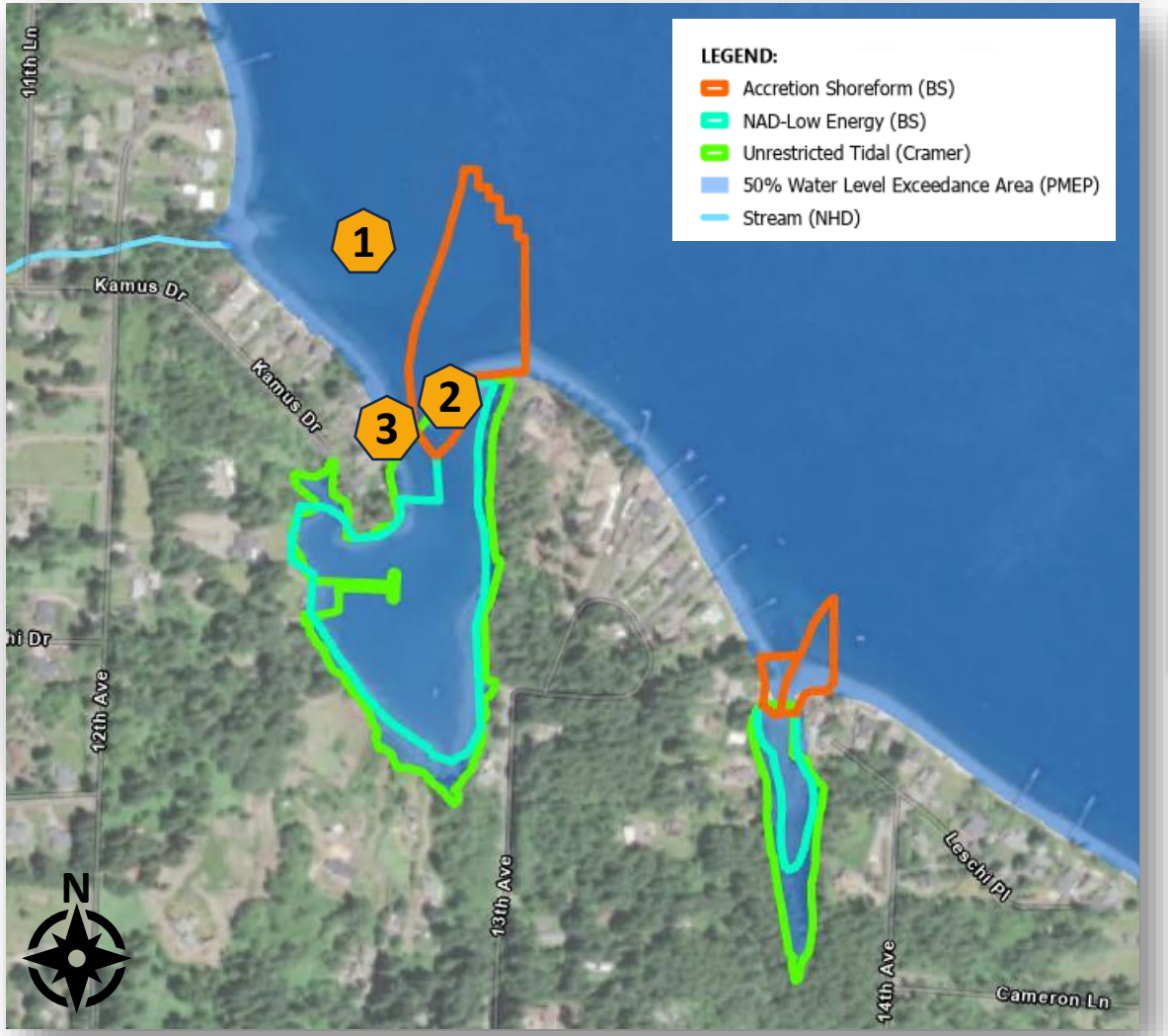
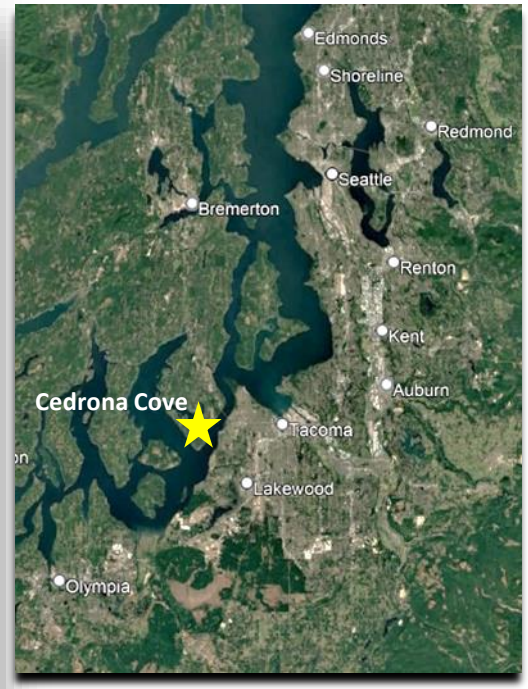
Barrier Lagoon

1. Inundation at 50% Exceedance Water Level ✓
2. Shoreline & Tidal Prism behind a Spit or Barrier ✓
3. Open Tidal Channel between PS & Embayment ✓
4. FW Input from Small River or Creek ✗





Notes:

1. Shoretype is WDFW Beach Strategies.
2. 50% water level exceedance is West Coast USA Current and Historical Estuary Extent, Pacific Marine and Estuarine Fish Habitat Partnership.
3. Tidally influenced areas are Cramer (2025).
4. Streams area National Hydrography Dataset.
5. Aerial basemap is Firefly via Esri.


Questions