

## MEMORANDUM - DRAFT

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Date: July 9, 2024  
To: Dave Nakagawara, PE, Port of Port Townsend  
From: Kathryn Ketteridge, PhD, PE and Kyle List, PE, Blue Coast Engineering



Project: Boat Haven Stormwater Improvements  
Subject: Hydraulic Evaluation – Floodplain Impacts

### PURPOSE

Blue Coast Engineering (Blue Coast) conducted a hydraulic evaluation for the proposed Boat Haven Stormwater Improvements project located on Port of Port Townsend property on the Port Townsend Bay waterfront (Project site). This hydraulic evaluation demonstrates that the proposed stormwater design elements and improvements at the Project site will not adversely affect base flood elevations (BFEs) as determined by the Federal Emergency Management Agency (FEMA)<sup>1</sup>. The project complies with Port Townsend Municipal Code (PTMC) Section 16.08.200 Encroachments as well as Jefferson County Code (JCC) Chapter 15.15.080 Provisions for Flood Hazard Reduction. This memorandum provides a summary of the evaluation, including background information and conclusions.

### BACKGROUND

This section provides information about the existing FEMA 100-year floodplain at the Project site and the improvements within the floodplain proposed as part of this Project. This information was used to evaluate potential impacts, if any, to BFEs at and adjacent to the Project site due to proposed improvements.

### FEMA 100-year Floodplain

Figure 1 shows an excerpt of the FEMA Flood Insurance Rate Map (FIRM) FIRMette in the vicinity of the Project site (FEMA, 2024); the approximate extents of the stormwater improvement features are

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<sup>1</sup> This hydraulic evaluation is limited to impacts of the proposed project on the existing coastal FEMA floodplain at the project site. Blue Coast Engineering has provided no hydraulic analysis on the performance of the proposed stormwater system itself; that system has been designed in whole by others.

indicated by the red outline in the figure. The Project site is located on FIRM Panels #53031C0131C and #53031C0132C, which have an effective date of June 7, 2019 (FEMA 2019a). See Attachment 1 for the full FIRM Panels including the highlighted approximate boundary of the proposed project. This Project site is adjacent to Port Townsend Bay to the southeast and the BFE is impacted by coastal flooding processes. The BFE is not impacted by non-coastal flooding sources such as streams and rivers.

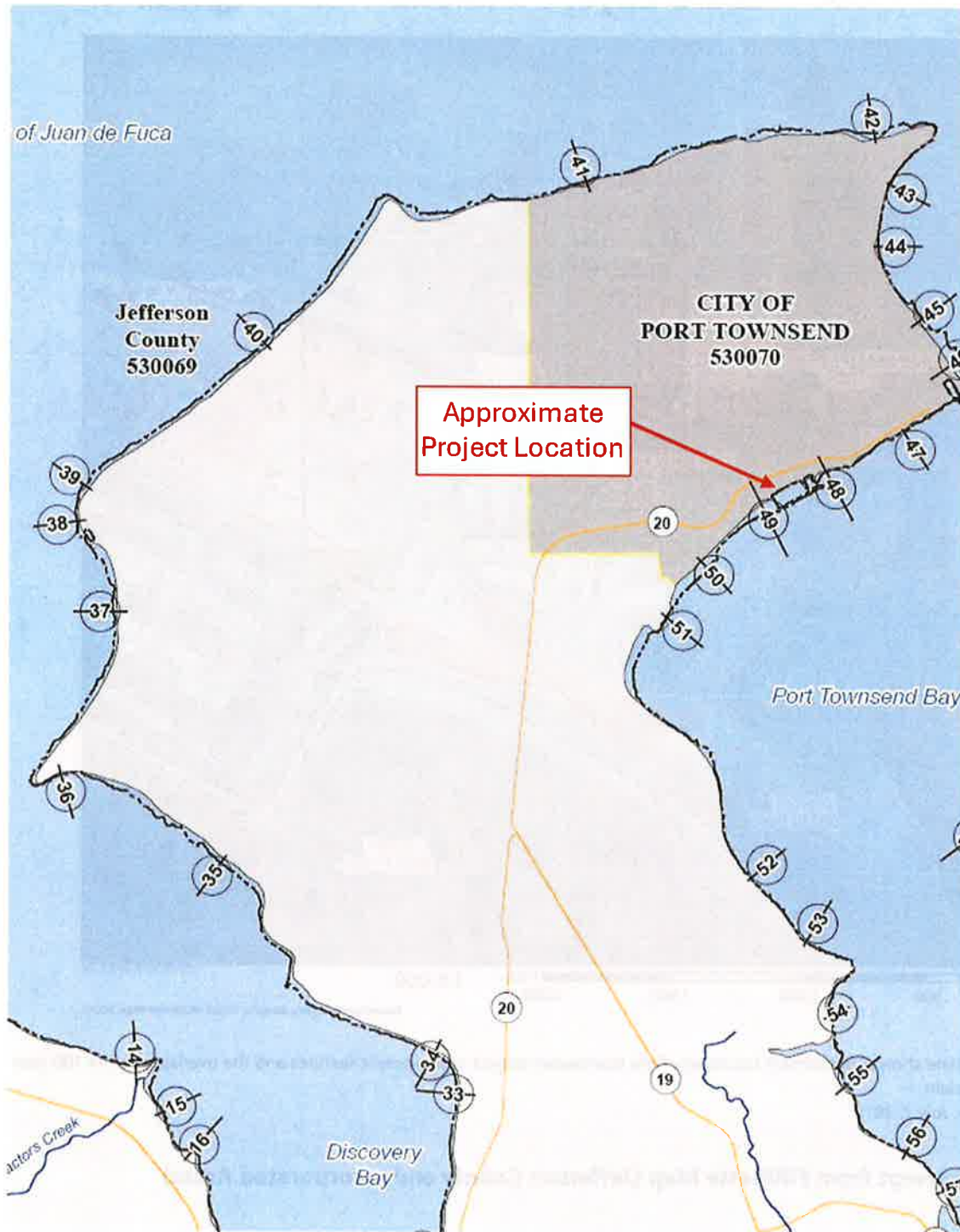
Coastal transect-based modeling was used by FEMA to determine the BFE at the Project site. The location of FEMA coastal transects in Port Townsend in the vicinity of the Project site is shown in Figure 2, which is taken from the FEMA Flood Insurance Study for Jefferson County Washington and Incorporated Areas (Figure 9, FEMA 2019b). As shown in Figure 2, the BFE established at the Project site is located within the floodplain associated with coastal transects 48 and 49 (i.e., Port Townsend Bay transects 48 and 49 presented in Table 17: Coastal Transect Parameters in FEMA 2019b).

# National Flood Hazard Layer FIRMette



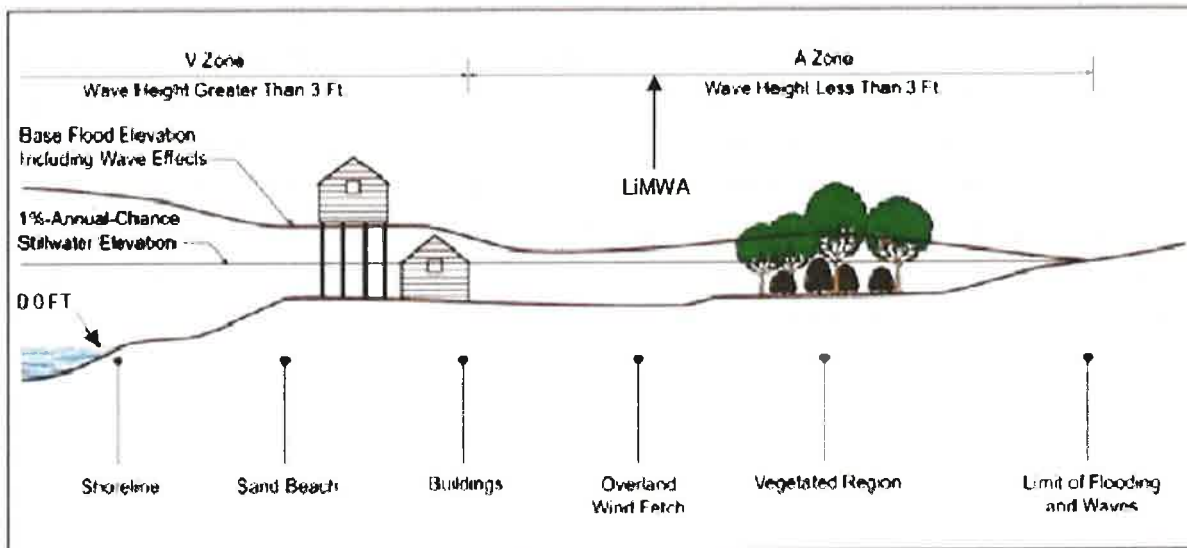
Note: Red outline shows approximate boundary of the stormwater project improvement features and the overlap with the 100-year coastal floodplain  
Source: FEMA, July 7, 2019

**Figure 1: Excerpt from FIRMette Map (Jefferson County and Incorporated Areas)**



**Figure 2: FEMA Coastal Transects, Port Townsend (Taken from Figure 9, FEMA 2019b)**

As discussed above, the BFEs for the Project site are coastal BFEs, which are calculated along transects extending from offshore to the limit of coastal flooding upland. The BFE is estimated as the total stillwater elevation (stillwater elevation including tides, surge, and setup) for the 1% annual chance storm plus the additional flood hazard from wave runup and wave overtopping (FEMA 2019b). Figure 3 illustrates the general relationship between the stillwater elevation and wave effects, as well as the definition of the Coastal VE Flood Zone (wave heights greater than 3 feet) and the Coastal AE Flood Zone (wave heights less than 3 feet).



**Figure 3: Coastal Transect Schematic (taken from FEMA 2019b)**

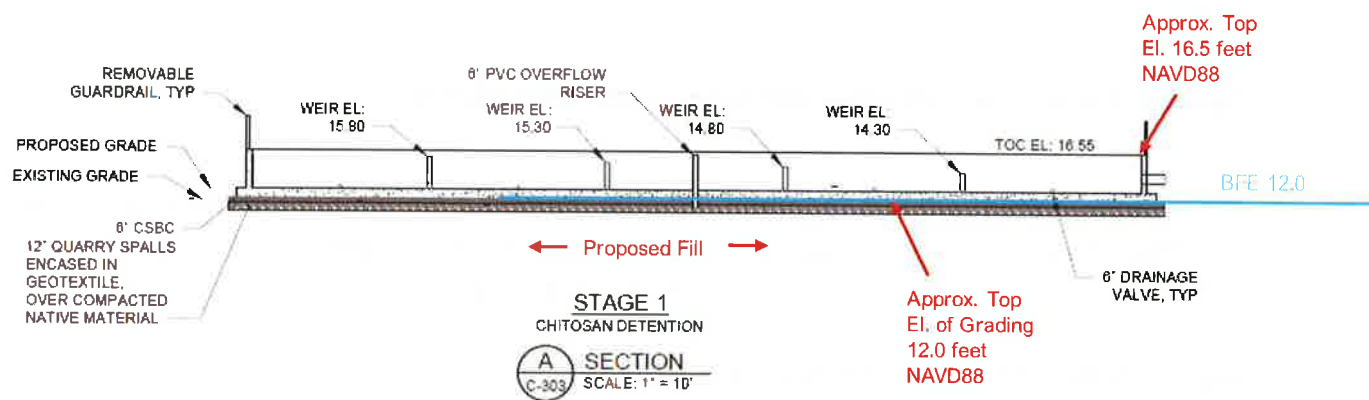
The established BFE's near Port Townsend, including the Project site, were calculated using numerical modeling of wave generation, runup, and overtopping using the U.S. Army Corps of Engineers ADCIRC model in November 2012 (see Table 17 in FEMA 2019b).

### Project Work Within the 100-Year Floodplain

The Project site is partially located within a coastal AE flood zone. Some of the proposed project features are on the boundary with the offshore coastal AE flood zone with a defined BFE of 13 feet NAVD88 but these features do not extend into this zone (Figure 1). No part of the Project site is located within a coastal V flood zone or a regulatory floodway. coastal BFE at the Project site is equal to 12 feet NAVD88. As stated previously, a coastal BFE is defined as the sum of the 1% stillwater elevation (from tides and storm surge) plus impacts from waves (wave runup and overtopping). The 1% stillwater elevation estimated by FEMA for coastal transect 48 and 49 (the closest transect to the Project site) is 11.5 feet NAVD88 and because the BFE, when rounded to the nearest whole number, is 12 ft

NAVD88, the effect of offshore wave conditions must be less than or equal to 0.9 ft at the Project site (see Table 17, FEMA 2019b) such that total flood stage rounds to 12 ft NAVD88<sup>2</sup>. There were no directly reported significant wave height values in the effective Table 17 (all wave heights were reported as 0.0 feet)<sup>3</sup>.

Project improvements proposed within the FEMA 100-year floodplain include fill above the surrounding grade to support the installation of a catch-basin system as well as a network of stormwater infrastructure improvements, much of which will be subterranean and will require paving or resurfacing after excavation. The approximate thickness of the proposed fill above existing grade is up to 5 feet to support the installation of the catch-basin system. The grading is located in a small area of the southwest corner of the project area (yellow circled area of Figure 1) and is oriented in a shore-perpendicular fashion with a maximum fill elevation of 12 feet NAVD 88. Some of the features of the stormwater system will be above the BFE, with portions of the proposed weirs up to 16.5 ft NAVD88. The proposed grading and detention basin features are not designed to and will not improve or prevent existing coastal flooding or divert these coastal floodwaters to other areas. The preliminary detail of the proposed detention basin is shown in Figure 4. Attachment 2 provides the 60% Design grading plan for the project showing the proposed fill.



<sup>2</sup> Total water level heights could range between 11.5 and 12.4 ft NAVD88 (rounds to the BFE of 12.0 ft NAVD88).

<sup>3</sup> In discussions with FEMA on February X via email exchange, approximate wave heights for transects 48 and 49 are approximately the difference between BFE and stillwater level.

## Figure 4: Project Fill Details Relative to FEMA 100-year Floodplain

### EVALUATION AND CONCLUSIONS

Clause 15.15.080 of the JCC provides standards for construction in flood-prone areas, including all “A” flood zones. Item 3 of this code states that:

*“no new construction, substantial improvements, or other development (including fill) shall be permitted within zone AE on the community’s FIRM, 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.”*

The Port Townsend Municipal Code (PTMC) Section 16.08.200 is consistent with the JCC language for projects within the floodplain with established base flood levels.

*“The cumulative effect of any proposed development, where combined with all other existing and anticipated development, shall not increase the water surface elevation of the base flood more than one foot at any point. (Ord. 3224 § 1 (Exh. A), 2019; Ord. 3173 § 1 (Exh. A), 2017; Ord. 2161 § 5.5, 1989).”*

The following discussion demonstrates that these floodplain requirements will be satisfied by the proposed project.

As discussed in the description of the project, the BFE defined within the AE flood zone at the Project site is due to coastal processes only, which includes tides, storm surge and wave runup contributions. The 1% still water flood elevation in coastal flood zones is estimated by the combined influence of tides and storm surge. Then an additional height is added to the still water flood elevation to account for wave run-up (which is the vertical height waves run up a shoreline area after they break). To cause a change in a coastal BFE, the proposed project must increase or decrease either the offshore wave conditions in the adjacent marine water body or the wave runup over land between the shoreline and the project location.

The proposed Project site improvements will be constructed entirely within the upland (although with a small setback from the shoreline of approximately 40 ft) and will therefore have no impact on offshore wave conditions in Port Townsend Bay. Therefore, the only concern is related to potential changes to the wave runup over land between the shoreline to the north and the project site due to the proposed fill in the AE flood zone (see Figure 1). If the proposed fill increases wave runup at or near the project site by more than 1 foot, this would be an unacceptable increase to the BFE at the Project site per JCC and PTMC.

The wave runup contributions to the coastal BFE are predicted by FEMA using the methods described in FEMA 2019b. In general, wave runup is estimated along each coastal transect using offshore wave heights (in Port Townsend Bay for the Project site) predicted by the ADCIRC and SWAN models for the area (FEMA 2018b) and the average slope of the nearshore beach and bluff areas along a defined coastal transect below the 1% stillwater flood elevation. Since the proposed project will not be impacting offshore wave heights and the project will not be changing the average slope of the floodplain between the shoreline and the uplands (due to the small footprint of the grading changes), the proposed fill and project elements cannot have any impact on wave runup heights calculated by FEMA (FEMA, 2019b).

Coastal BFEs are not impacted by changes in floodplain storage due to fill in the floodplain because: 1) coastal BFEs are not calculated using the same methods as non-coastal BFEs where storage is a factor (i.e., flooding from rainfall, streams, or rivers); and 2) there is infinite storage available for floodwaters in a marine body of water. Because the proposed fill will be an extension of the will not in any way block or divert the coastal base flood waters, the elevation of the top of the fill will be at or below the coastal BFE, coastal floodwaters will not be diverted to other areas of the floodplain due to the project nor will flooding be reduced by the project in areas further inland.

Based on this evaluation, the proposed project will not result in any rise in the coastal BFE or increase in coastal flooding at the project location or surrounding properties.



## REFERENCES

Email Correspondence, 2024. Email exchange with Josha Crowley. RSC Lead | STARR II - Region 10 Service Center. February 28, 2024.

FEMA, 2018. *Guidance for Flood Risk Analysis and Mapping, Coastal Wave Runup and Overtopping*. Guidance Document 89, February 2018.

FEMA, 2019a. *Flood Insurance Rate Map for Jefferson County and Incorporated Areas*. Map Number #53031C0131C and #53031C0132C, Effective Date: July 7, 2019.

FEMA, 2019b. *Flood Insurance Study for Jefferson County and Incorporated Areas*. Flood Insurance Study Number 53031CV000A, July 7, 2019.

FEMA, 2024. *Flood Insurance Rate Map – FIRMette*. Flood Insurance Study Number 53031CV000A, Generated February 20, 2024.

Jefferson County, 2023. Jefferson County Code Chapter 15.15 Flood Damage Protection.

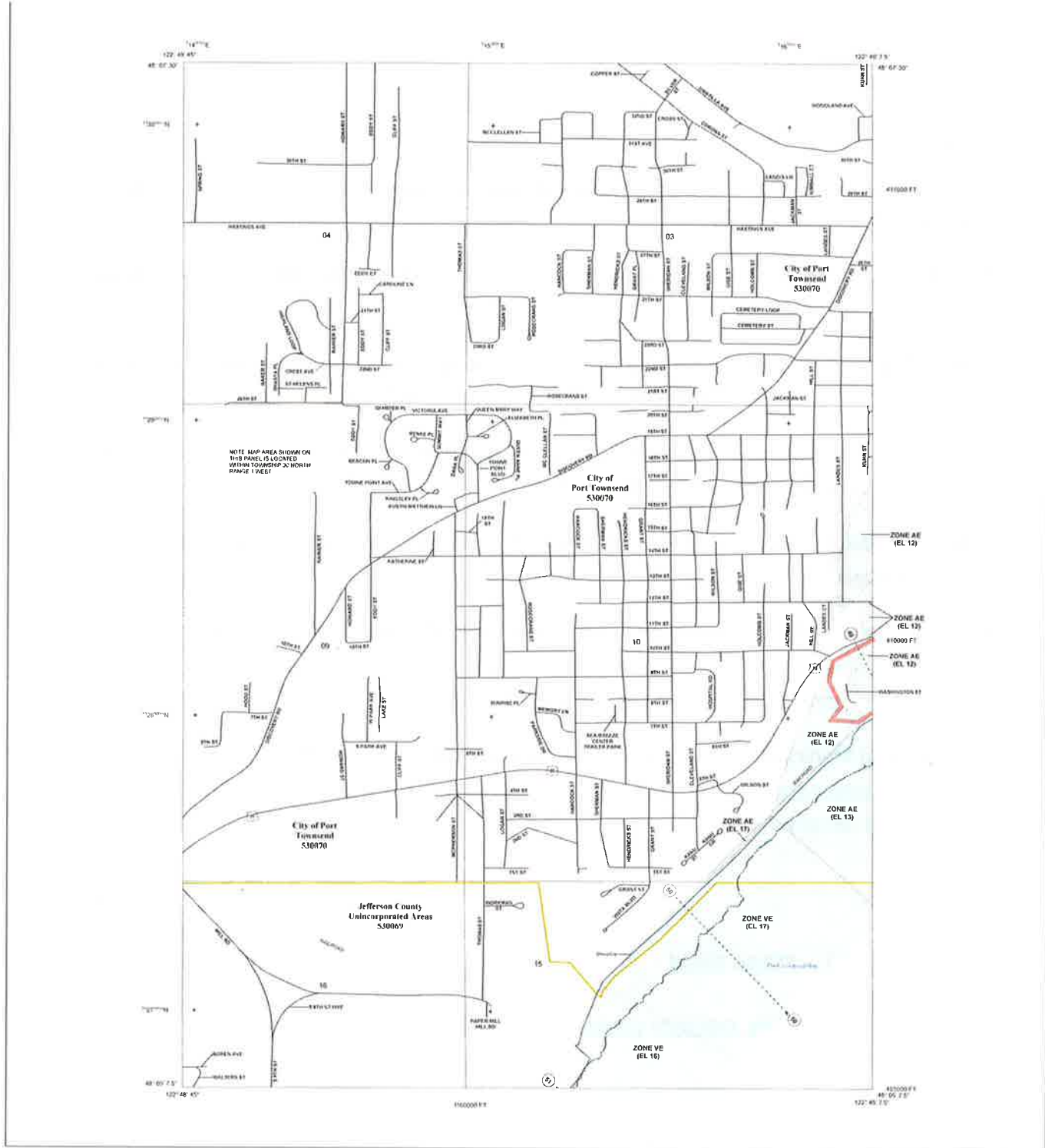
<https://www.codepublishing.com/WA/JeffersonCounty/html/JeffersonCounty15/JeffersonCounty1515.html#15.15.080>. December 18, 2023.

Port Townsend Municipal Code, 2024. Chapter 16.08.200 Flood Damage Protection – Encroachments.

<https://www.codepublishing.com/WA/PortTownsend/#!/PortTownsend16/PortTownsend1608.html>. January 2, 2024.

## ATTACHMENT 1 – FEMA FIRM

## ATTACHMENT 2 – 60% DESIGN GRADING PLAN



**FLOOD HAZARD INFORMATION**

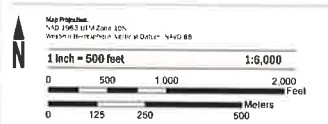
SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP  
 THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING  
 DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT  
[HTTPS://MSC.FEMA.GOV](https://msc.fema.gov)

- SPECIAL FLOOD HAZARD AREAS**
  - Without Base Flood Elevation (BFE) Zone A1, A99
  - With BFE or Depth Zone AE, AO, AH, V1, V2
  - 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
  - Future Conditions 1% Annual Chance Flood Hazard
  - Area with Reduced Flood Risk due to Levee See Notes
- OTHER AREAS OF FLOOD HAZARD**
  - (NO SCREEN) Areas Determined to be Outside the 0.2% Annual Chance Floodplain
  - Area of Undetermined Flood Hazard
- OTHER AREAS**
  - Channel, Culvert, or Storm Sewer Accredited or Provisionally Accredited Levee, Dike, or Floodwall
  - Non accredited Levee, Dike, or Floodwall
- GENERAL STRUCTURES**
  - Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
  - Coastal Transect
  - Coastal Transect Baseline
  - Profile Baseline
  - Hydrographic Feature
  - Base Flood Elevation Line (BFE)
  - Limit of Study
  - Jurisdiction Boundary
- OTHER FEATURES**

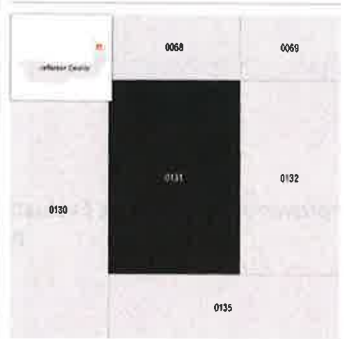
**NOTES TO USERS**

For information and questions about this map, a detailed product manual, with the FEMA product manual version of the FIS report, see the products at the National Flood Insurance Program website. Also see the FEMA map information and page 1 of the FIS report at <https://msc.fema.gov> and the FIS report manual. Other website at <https://msc.fema.gov>. Publications may include, previously issued, a letter of map change, a final insurance policy, and an approved flood insurance policy. These products may be obtained directly from the insurer. Users may determine the geographic area for which flood insurance is available by using the FIS report, but not the location of the FIS report information on the map. Community information is subject to change and is a current copy of the information panel as well as the current FIS report. This may be ordered directly from the Map Service Center at the number listed above. For community and insurance information, see the Flood Insurance Study report for this jurisdiction. For more information on flood insurance, see the National Flood Insurance Program website at <https://msc.fema.gov>. See the National Flood Insurance Program website at <https://msc.fema.gov>.

**SCALE**



**PANEL LOCATOR**



**National Flood Insurance Program**

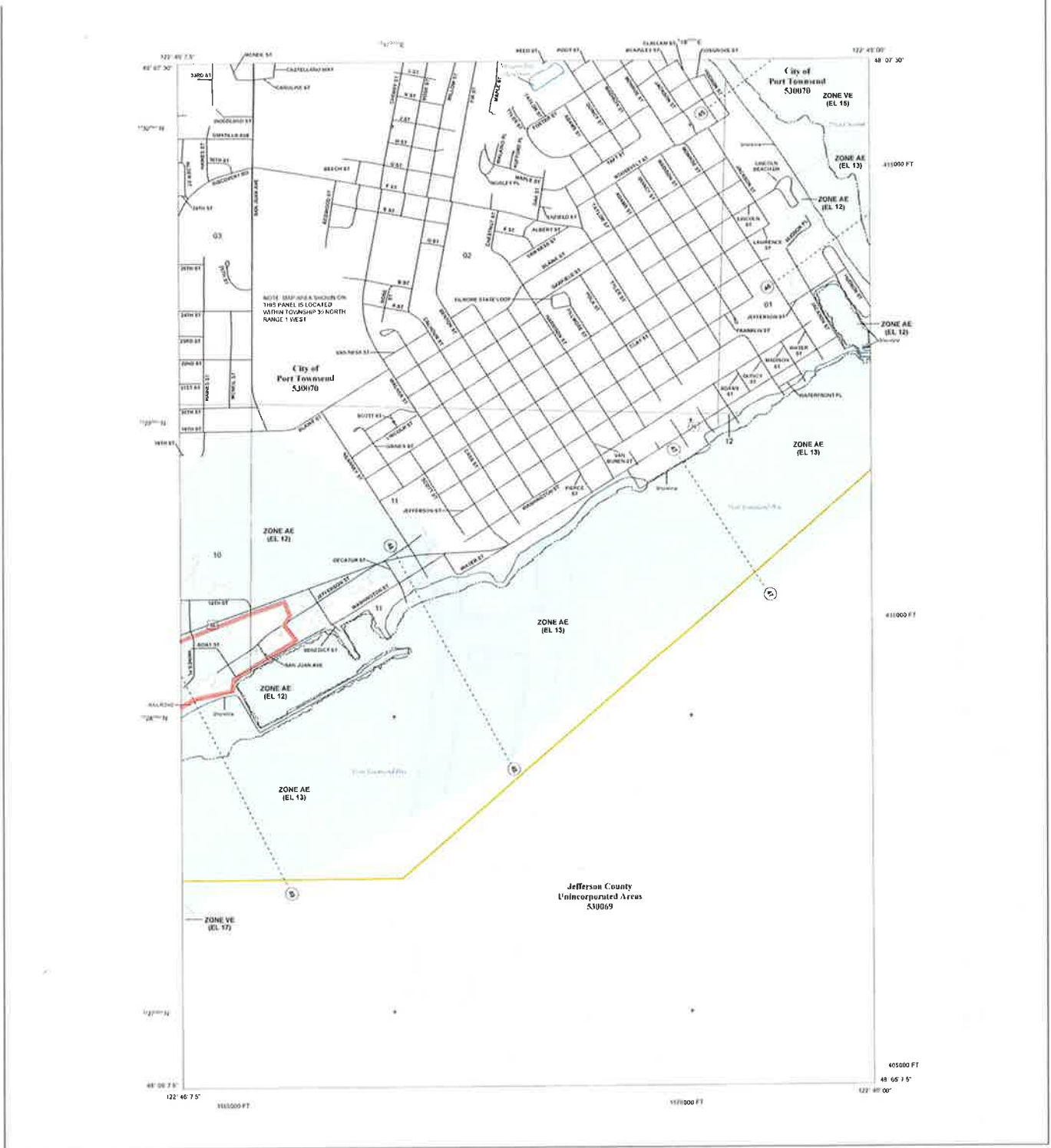
**NATIONAL FLOOD INSURANCE PROGRAM**  
 4000 WASHINGTON AVENUE  
 WASHINGTON, DC 20548  
 TEL: 202-690-6600  
 WWW.NFIP.GOV

**JEFFERSON COUNTY, WASHINGTON**  
 500 UNIVERSITY AVENUE  
 PORT TOWNSEND, WA 98158  
 TEL: 360-336-3300  
 WWW.JCWA.GOV

PANEL 131 of 1670

COMMUNITY	NUMBER	PANEL	SUFFIX
JEFFERSON COUNTY	53026P	131	1
PORT TOWNSEND, WA	53026P	131	1

VERSION NUMBER: 2.3.2.2  
 MAP NUMBER: 53031C0131C  
 EXPIRES DATE: JUNE 7, 2019



**FLOOD HAZARD INFORMATION**

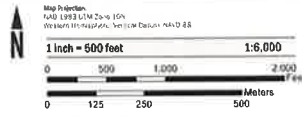
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	Without Base Flood Elevation (BFE) Zone A1-A30
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	Non accredited Levee, Dike, or Floodwall
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	Coastal Transport
	Coastal Transport Baseline
	Profile Baseline
	Hydrographic Feature
	Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

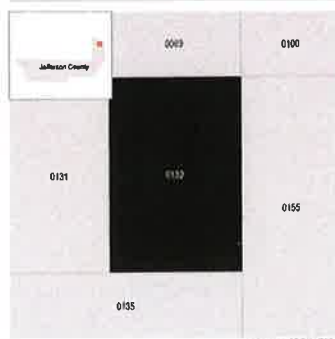
**NOTES TO USERS**

For information and accurate flood risk map, available products associated with the FIS report including...  
 For community and countywide map data refer to the Flood Insurance Study report for the jurisdiction...  
 For a complete list of symbols and their descriptions in the community contact your local office of the National Flood Insurance Program at: 800-685-8882  
 Base map information shown on this FIS report was provided on digital format by the USGS National Geospatial Survey (NGS) the National Center for Earth and Space Information

**SCALE**



**PANEL LOCATOR**



National Flood Insurance Program

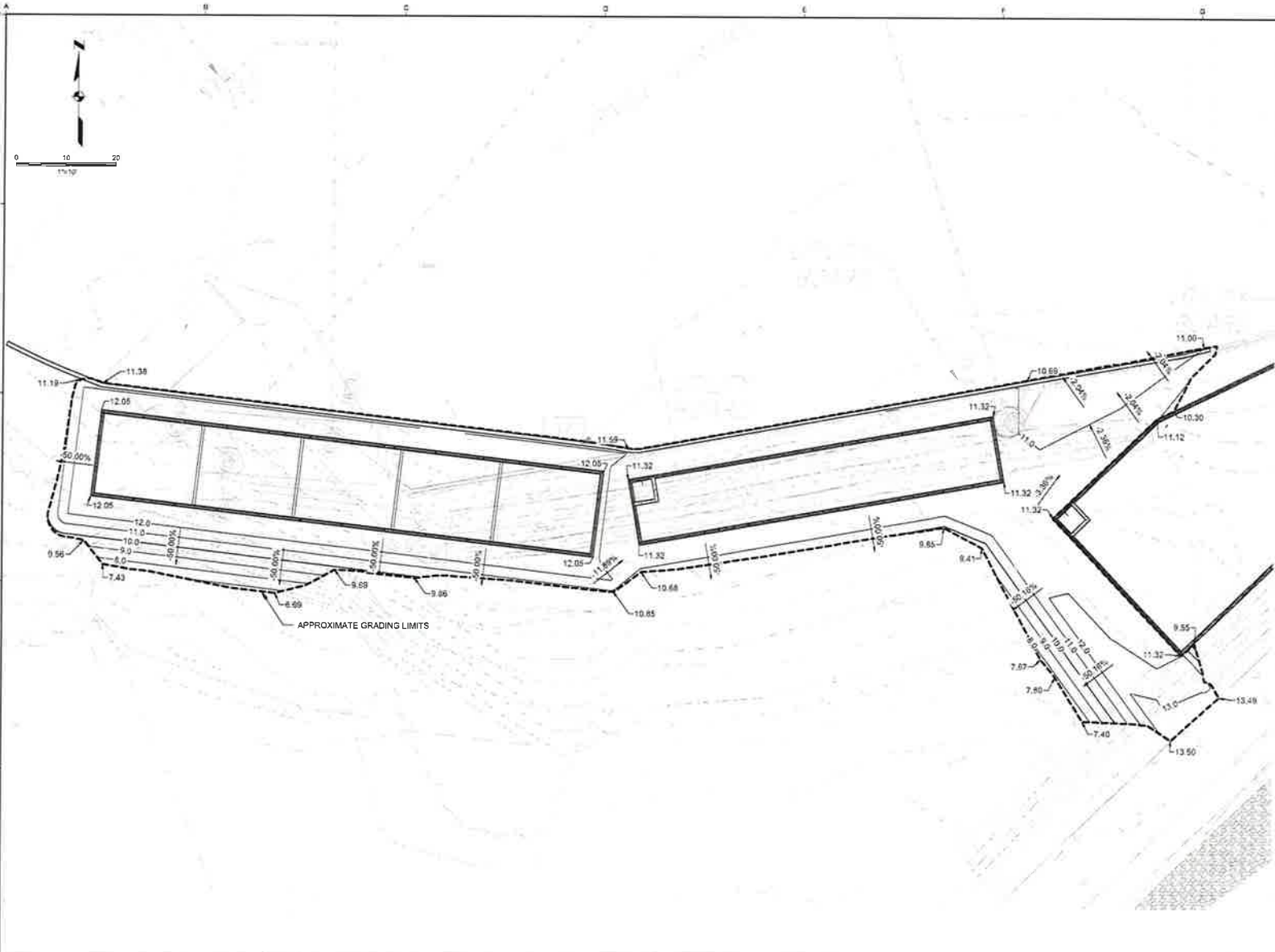
NATIONAL FLOOD INSURANCE PROGRAM  
 FLOOD INSURANCE RATE MAP

JEFFERSON COUNTY, WASHINGTON  
 AND INCORPORATED AREAS

PANEL 132 of 1670

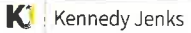
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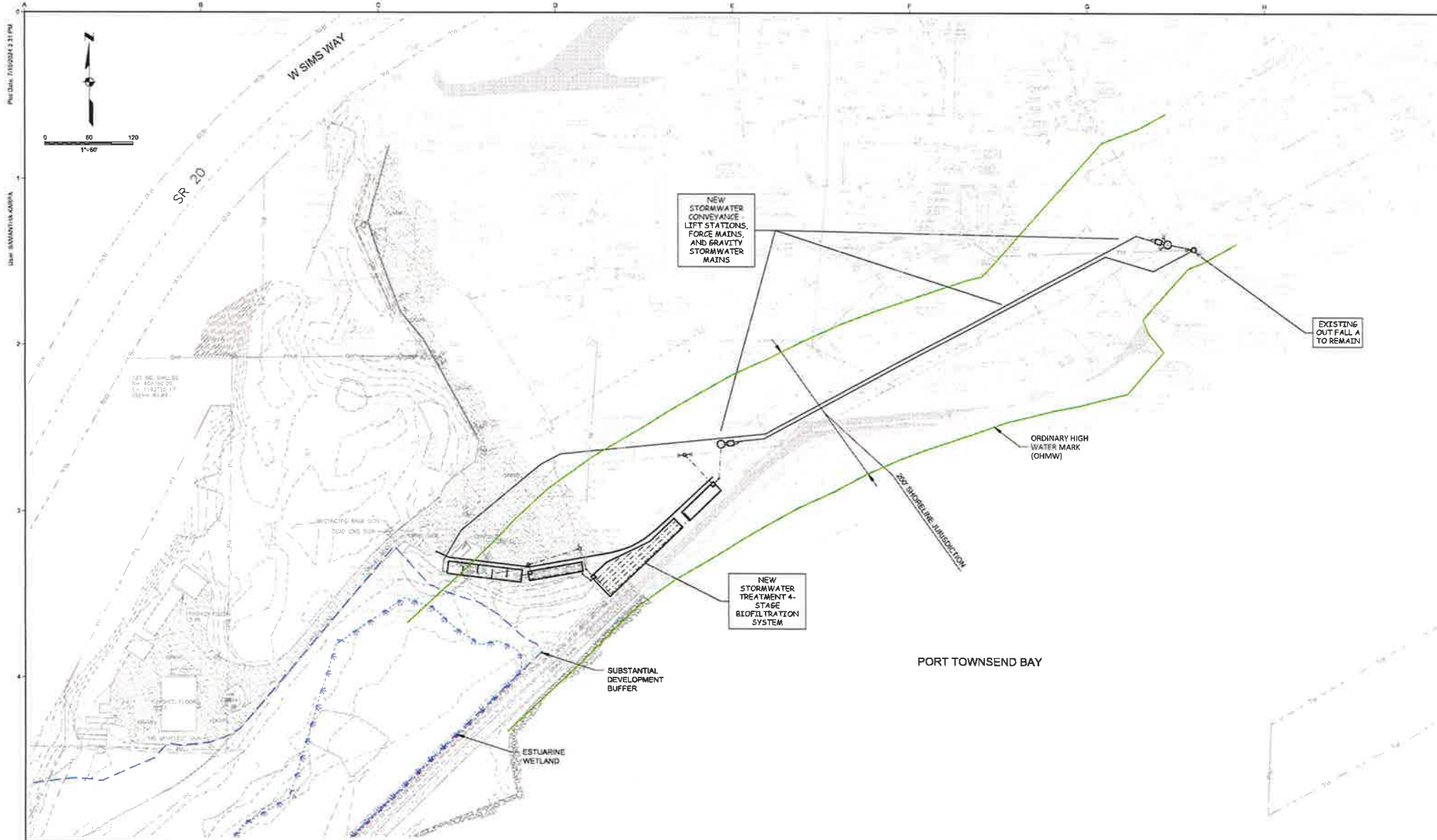
VERSION NUMBER  
**2.3.2.2**  
 REPORT NUMBER  
**5303AC03.22C**  
 EFFECTIVE DATE  
**JUNE 7, 2019**



- GENERAL SHEET NOTES**
1. EXISTING GRADE SHALL BE MATCHED AT THE GRADING LIMITS SHOWN UNLESS NOTED OTHERWISE
  2. GRADES SHOWN ARE TO TOP OF THE FINISHED SURFACE UNLESS OTHERWISE NOTED

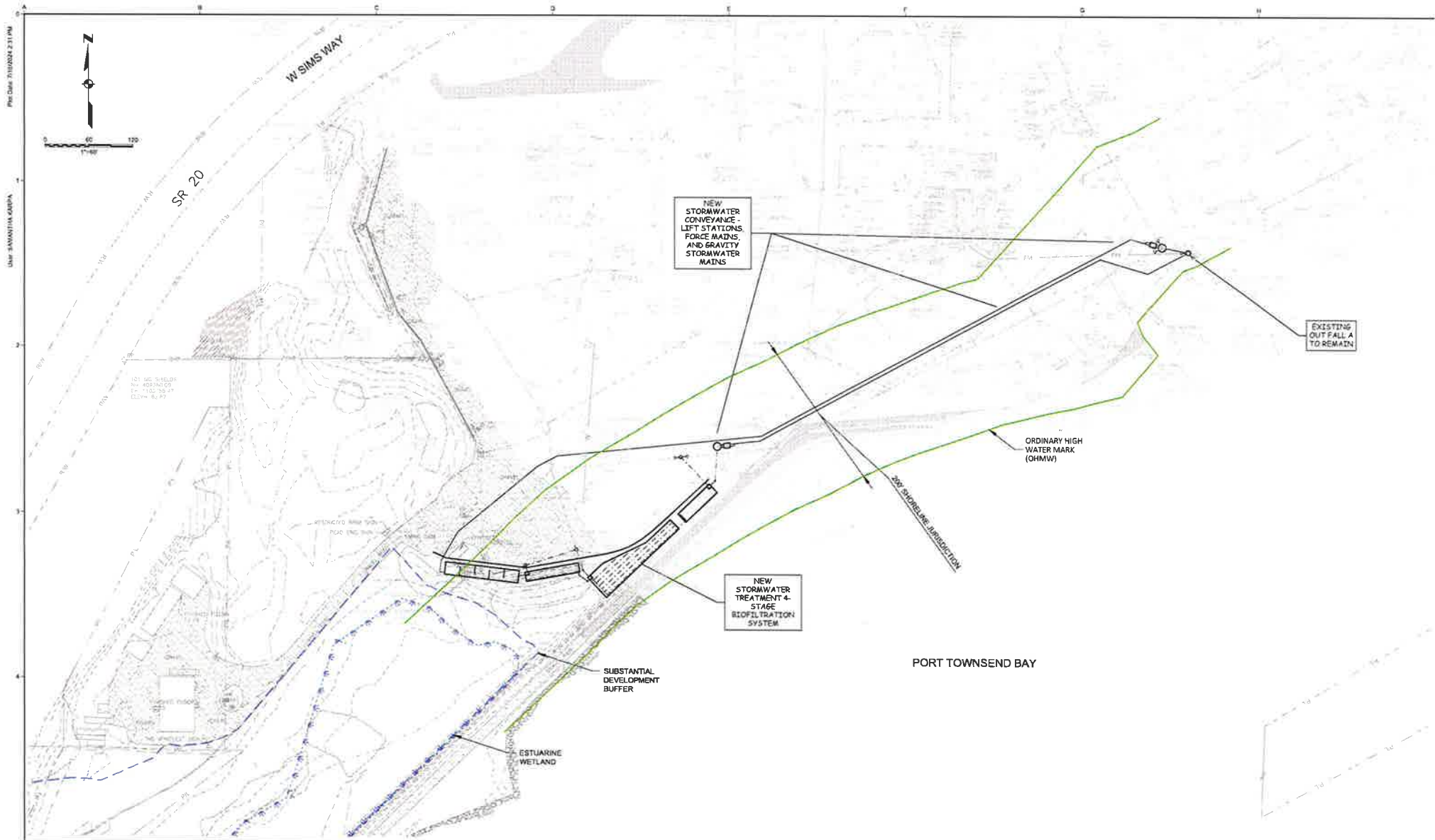
<b>60% SUBMITTAL</b>							
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NO	REVISION	DATE	BY	SCALES 0" = 1" 0" = 25m IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.	DESIGNED	PORT OF PORT TOWNSEND PORT TOWNSEND, WASHINGTON BOAT HAVEN STORMWATER IMPROVEMENT PROJECT	SHORELINE JARPA DRAWING	SCALE 1" = 60'
					DRAWN			JOB NO. 2207020 01
					CHECKED	Kennedy Jenks		DATE AUGUST 2024
								SHEET 01





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	DESIGNED	SCALE: 1" = 60'						
				IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.	DESIGNER:	PORT OF PORT TOWNSEND PORT TOWNSEND, WASHINGTON <b>BOAT HAVEN</b> STORMWATER IMPROVEMENT PROJECT Kennedy Jenks	<b>SHORELINE JARPA</b> <b>DRAWING</b>	JOB NO: 2297203.01
				CHECKED:	PORT OF PORT TOWNSEND PORT TOWNSEND, WASHINGTON <b>BOAT HAVEN</b> STORMWATER IMPROVEMENT PROJECT Kennedy Jenks			<b>SHORELINE JARPA</b> <b>DRAWING</b>
				DATE:		PORT OF PORT TOWNSEND PORT TOWNSEND, WASHINGTON <b>BOAT HAVEN</b> STORMWATER IMPROVEMENT PROJECT Kennedy Jenks	<b>SHORELINE JARPA</b> <b>DRAWING</b>	

