February 11, 2024

Northwest Watersheds LLC
Portland Oregon
https://northwestwatersheds.com/

Project name:
Marysville Riverwalk Shoreline Substantial Development Permit and Floodplain Development Permit Support

City SLP 23031

Project ref:
23020

To: Christina Woolman CFM

CC: Peter Battuello, LG

From:
Stephen Blanton, PE

Date:
February 11, 2024

Technical Memorandum

Subject: Snohomish River Hydraulic Analysis Support Shoreline Permit Application 23031

Purpose

The City of Marysville is embarking on re-purposing city lands currently used for light industrial purposes into a water-dependent mixed-use development on the Ebey Slough waterfront. The Riverwalk project is intended to meet the City's vision for its downtown as presented in the 2019 Downtown Master Plan. The location of the Riverwalk project site is shown in Figure 1

The project is located at 80 Columbia Avenue and 60 State Avenue, in Marysville, WA, within the NW 1/4 of Section 33 of Township 30N, Range 05E, W.M (the Site). It includes portions of 13 residential parcels the City acquired as part of the 1st Street bypass project in 2019. The Riverwalk project is a mixed-use development including multi-family luxury apartments, a hotel, restaurants, a sports facility, a public plaza, and open space connections to the Ebey Waterfront trail and connecting commercial uses. The majority of the site is within the 1% annual chance floodplain. The City's preferred method of structural protection is to elevate the entire site to be above the base flood elevation (13-feet) and apply for a map change to remove the site from the floodplain. The City's fill plans show an estimated quantity of 182,500 cubic yards to be added to the site.

In order to address the informational requirements of the Shoreline Substantial Development Permit and support issuance of the floodplain development permit, a hydraulic modeling analysis was conducted to assess the potential floodplain impacts resulting from the proposed application of fill required to elevate the Riverwalk site above the regulatory floodplain. The hydraulic assessment used a calibrated US Army Corps Hydrologic Engineering Center – River Analysis System (HEC-RAS) 2D model of the Snohomish River to assess the potential impacts to the estimated water surface elevation due to the proposed Riverwalk project. The model included future conditions predictions for the late century climate change scenario as predicted by the University of Washington Climate Impacts Group.

Figure 1: Riverwalk Project Location Map

Snohomish River FEMA

The Riverwalk site is located along Ebey Slough, a side channel of the Snohomish River. Figure 2 shows the Flood Insurance Rate Map (FIRM) which illustrates the extent of the FEMA floodplain at the Riverwalk project site (shown in red), with a Base Flood Elevation (BFE) of 13 feet (NAVD88). The Riverwalk site is hydraulically separated from Ebey slough by an uncertified levee system. The elevation data used in the hydraulic modeling (WSE 2021) conducted for this effort shows the elevation of the top of the levee is 12.8 feet along the Riverwalk site.

Figure 3 shows the flood profile for Ebey Slough along the Riverwalk project site (FEMA 2020). The Ebey Slough profile for the lower reach does not illustrate the water surface profile as the reach is under coastal/tidal influence. The profile directs users to the Flood Insurance Rate Map for the BFE. Figure 3 includes the mapped elevation of 13 feet reflected in the FIRM shown in Figure 2.

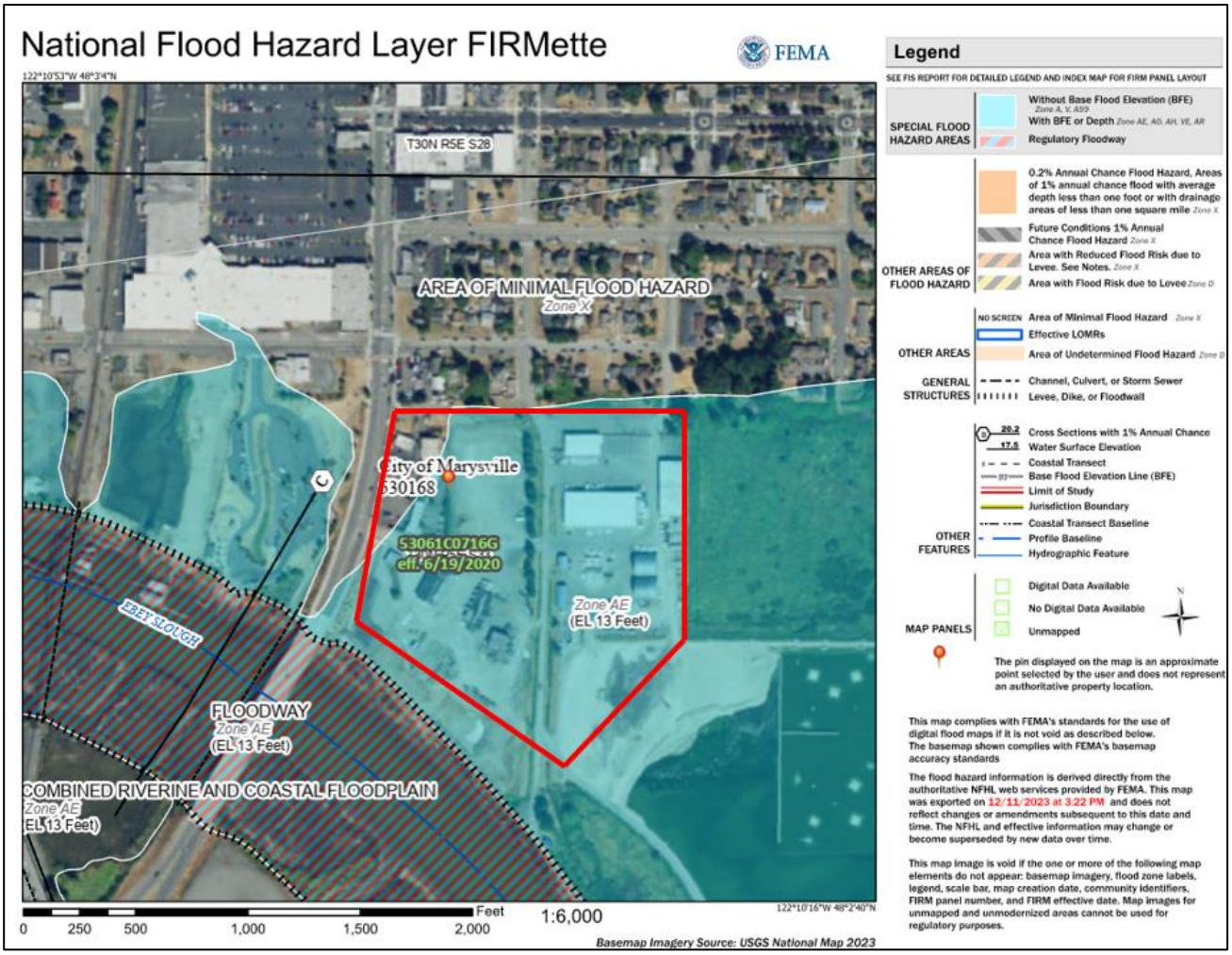

Figure 2: Aerial Image Snohomish River FEMA Boundaries near the Riverwalk Site

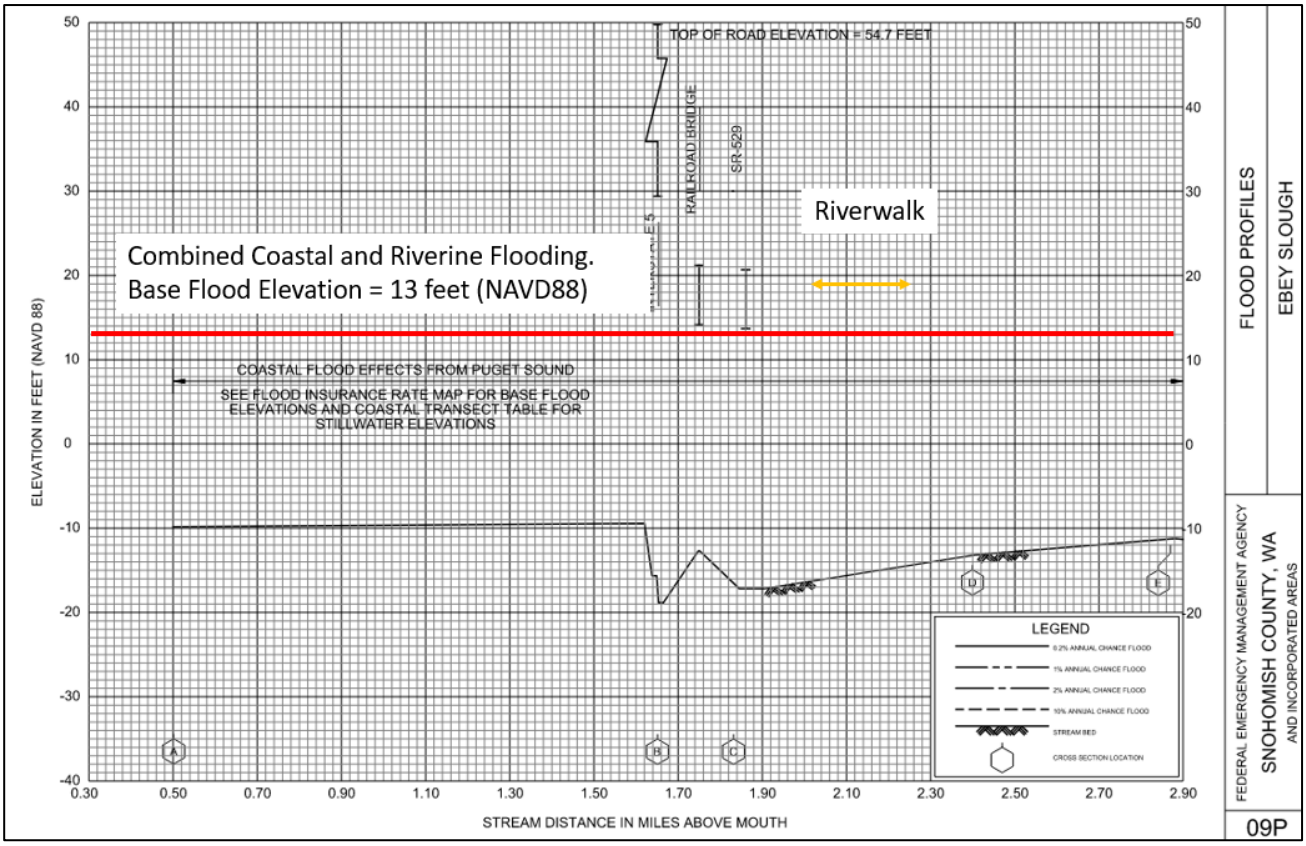

Figure 3: Ebey Slough Flood Profile (Panel 09P) (FEMA, 2020)

HEC-RAS Hydraulic Modeling

A 2-D hydraulic model of the Snohomish River was developed using the HEC-RAS program (USACE 2019). The HEC-RAS model was developed and calibrated by Watershed Science and Engineering (WSE). Figure 4 shows the extent of the WSE HEC-RAS model. The WSE model was developed and used to evaluate river-related flooding (WSE 2021). The WSE modeling effort focused on the hydrology of three time periods: recorded; 2040-2069; and 2070-2099. The future time periods included predicted stream flow increases as determined by the University of Washington Climate Impacts Group.

The analysis conducted for the Riverwalk CLOMR-F effort used the 2070-2099 time period. The river flows used in the 2070-2099 period were estimated as percent increase ranging from 20.6 – 26.2 percent (WSE 2021) of the existing conditions flows. The downstream boundary of the modeling effort, Possession Sound, used a constant tidal elevation based on future climate conditions resulting in a Mean Higher High Water tidal datum of 10.71 ft (NAVD88) for the 2070-2099 conditions.

Figure 5 shows the existing terrain of the Riverwalk project site. For the proposed condition modeling effort, the terrain within the Riverwalk boundary shown in Figure 5 will be elevated to 16 feet. This elevation allows for the Riverwalk site to be above the base flood elevation so the potential impact of the Riverwalk project on the hydraulics of the adjacent floodplain can be assessed. No other modifications were made between the existing and proposed conditions modeling efforts. The proposed conditions surface elevation is assumed and does not reflect future proposed final grading.

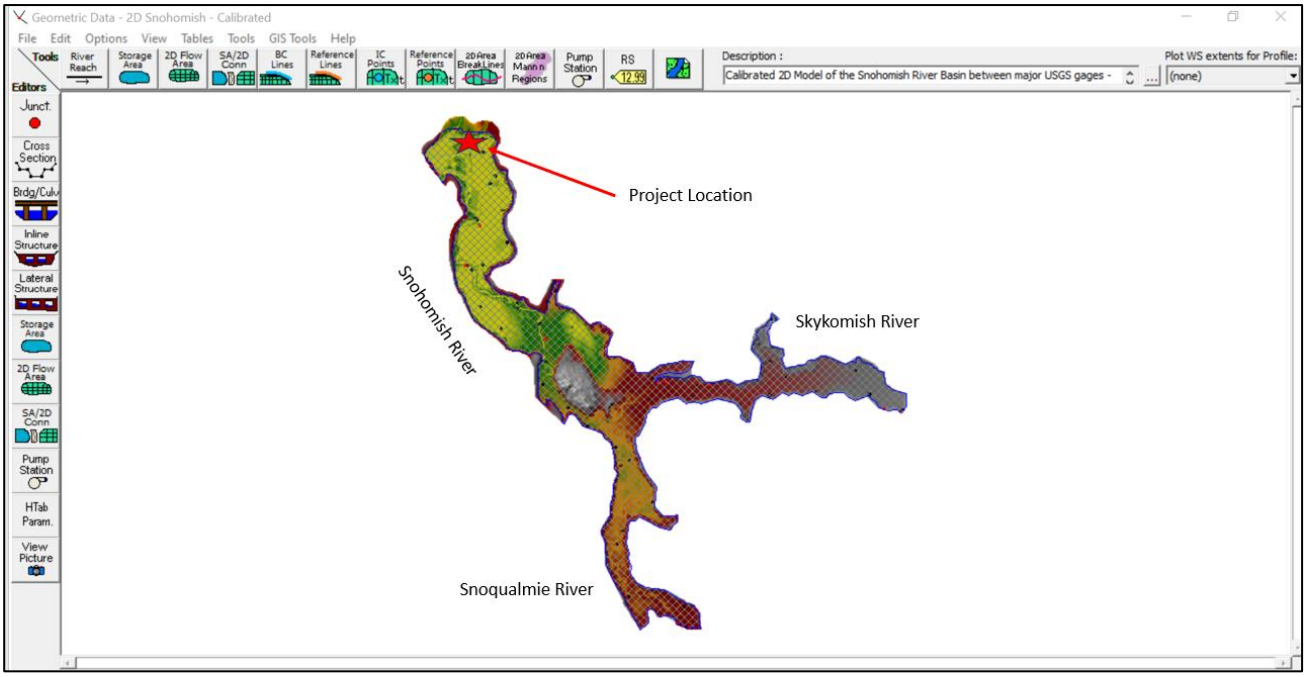

Figure 4: Snohomish River HEC-RAS Schematic (WSE 2021)

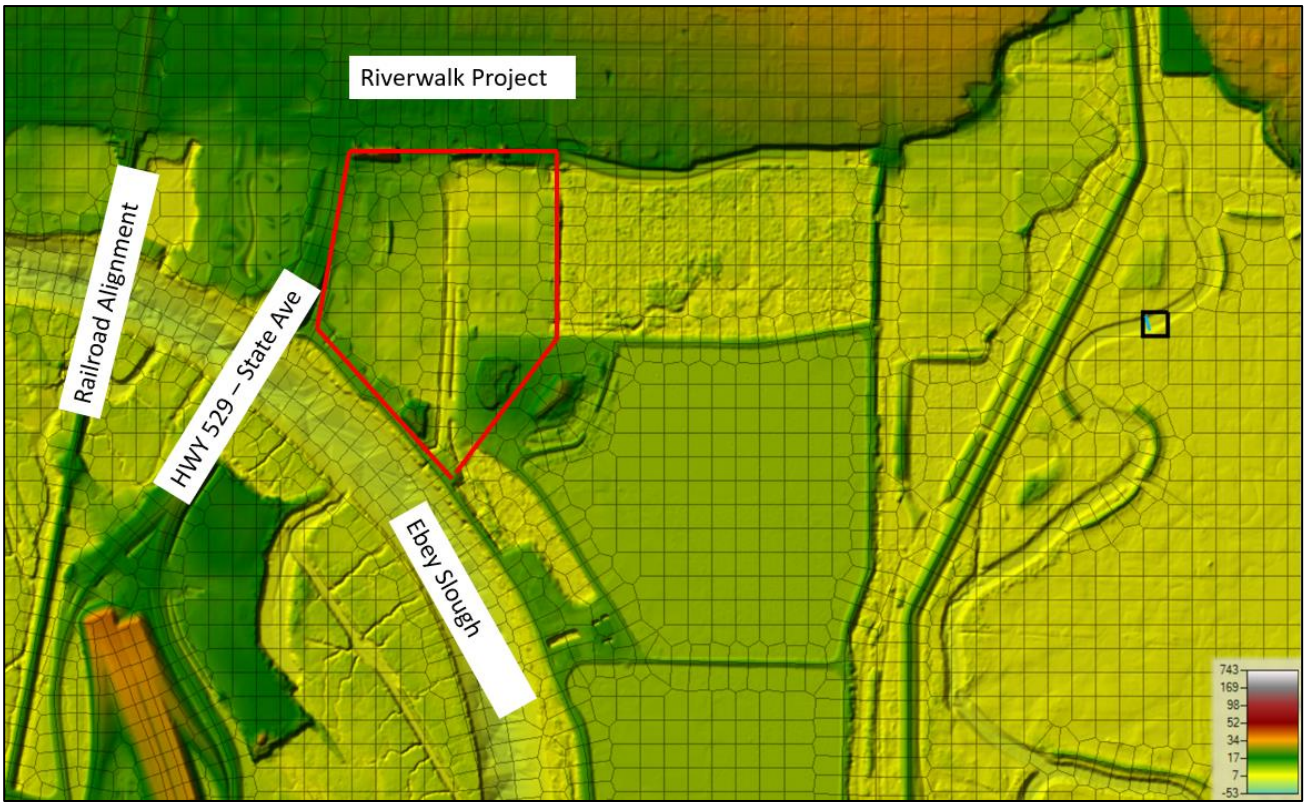

Figure 5: Existing Conditions Terrain Data at the Riverwalk Project Site

HEC-RAS Results

The HEC-RAS modeling results for the existing conditions model effort are shown in Figure 6 and Figure 7. The HEC-RAS uses a hydrograph, not a steady flow condition, so the peak water surface elevations shown in Figure 6 do not necessarily occur at the same time. As shown in Figure 6, the Riverwalk project site experiences some inundation (blue areas), with a few higher sections currently above the base flood elevation. The flow path arrows show the high flows entering the Riverwalk site come from the east and the site is not directly hydraulically connected to Ebey Slough. There is an approximately 0.8 foot of water surface elevation difference between the Riverwalk site and Ebey Slough suggesting flows entering the Riverwalk site pool until the water surface elevation exceeds the elevation of the top of the levee, approximately 13 feet.

Figure 7 illustrates the water surface profile along HEC-RAS Profile Line identified in Figure 6. The water surface shows how the higher water levels in the eastern portion of the figure are driving flows towards the Riverwalk site. The HEC-RAS modeling efforts estimated the peak flows entering the Riverwalk site from the east to be approximately 130 cfs.

In Figures 6 and 7, WSE refers to the water surface elevation.

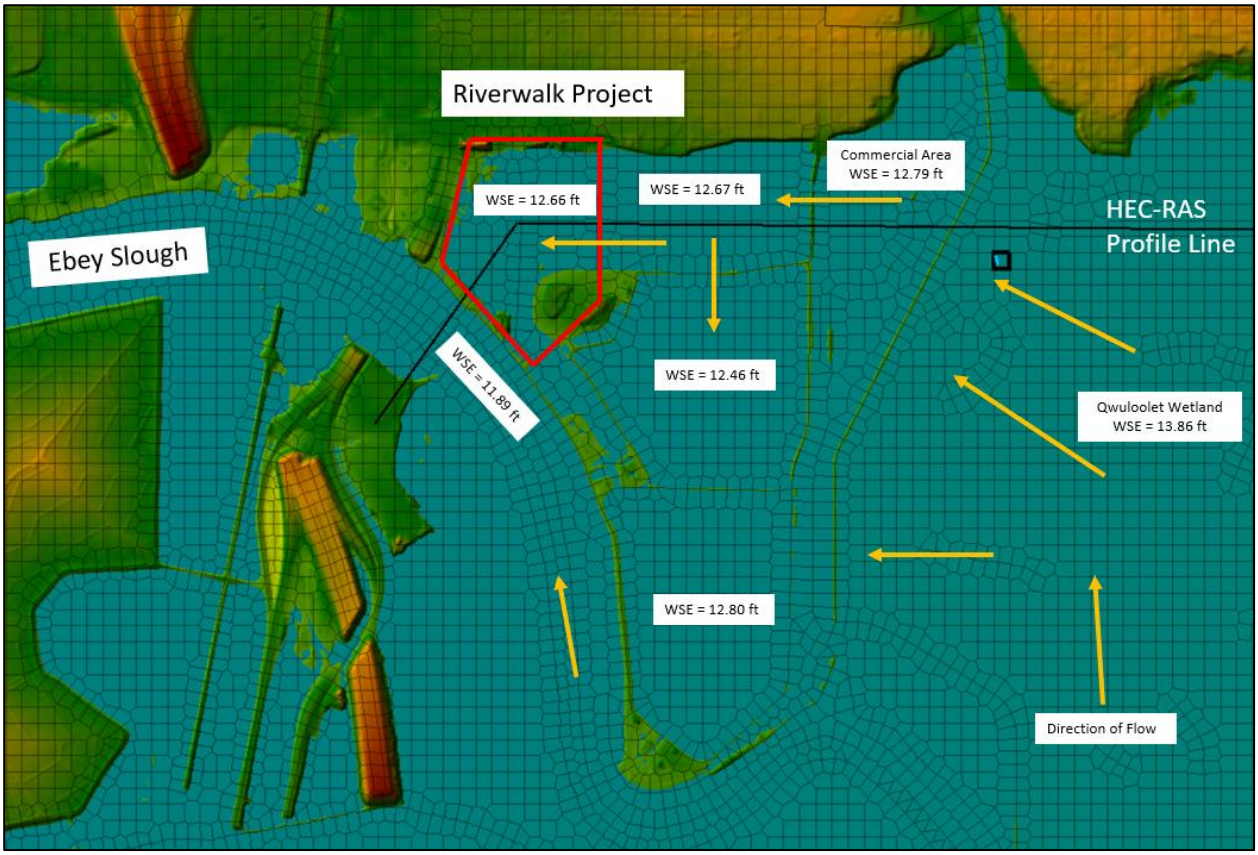

Figure 6: Existing Conditions Flood Elevations and Flow Paths

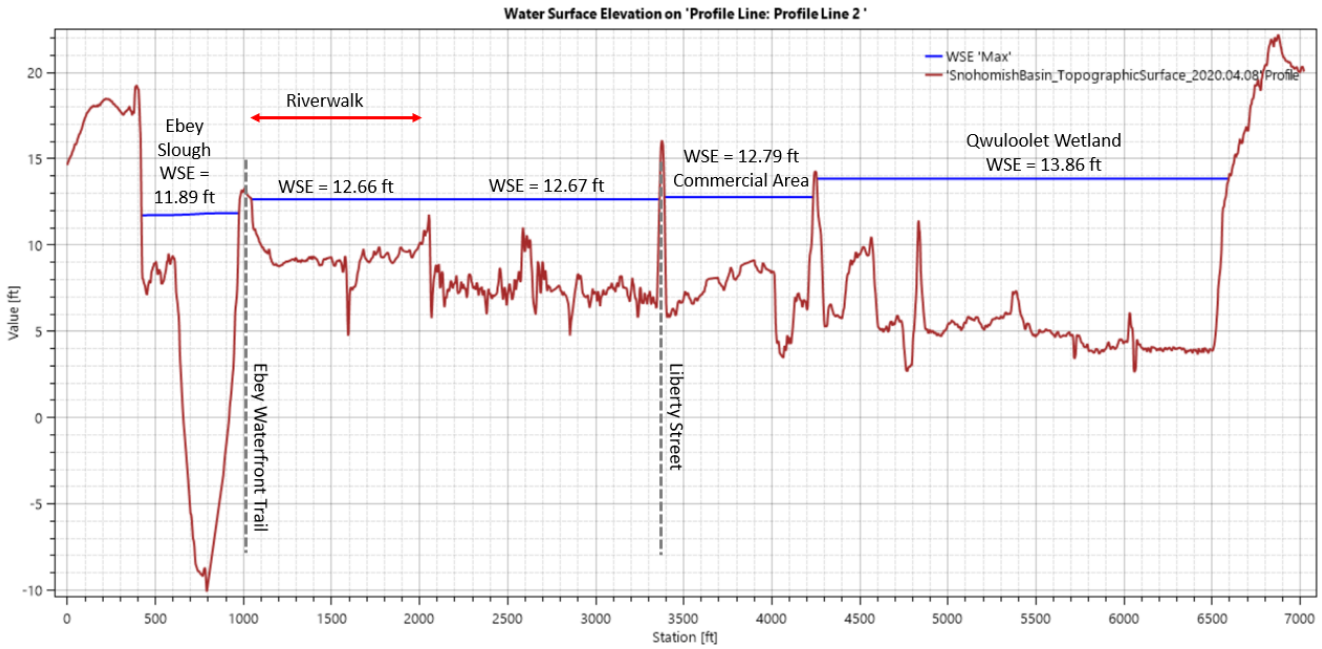

Figure 7: Water Surface Profile for the Existing Conditions at the Riverwalk Project Site.

The proposed conditions Riverwalk site modeling effort removed the project area from potential flooding by elevating the terrain above the water surface elevation. The HEC-RAS model results are shown in Figure 8. As shown, the proposed Riverwalk site is no longer inundated. The modeling terrain for the proposed conditions blocked existing flows (130 cfs) from entering the site, removing the flood storage volume associated with the site. The result is the wetland area, immediately to the east of the Riverwalk site, experiences an increase of the water surface elevation of 0.03 feet (12.67 ft to 12.70 ft).

Figure 9 shows the estimated proposed conditions water surface profile along the HEC-RAS Profile Line. As shown the Riverwalk project site was elevated to 16 feet (NAVD88). The proposed Riverwalk surface elevation is assumed and does not reflect future proposed final grading. The intent of the increased elevation of 16 feet was to ensure the Riverwalk site did not get inundated by the modeled high flow event.

In Figures 8 and 9, WSE refers to the water surface elevation.

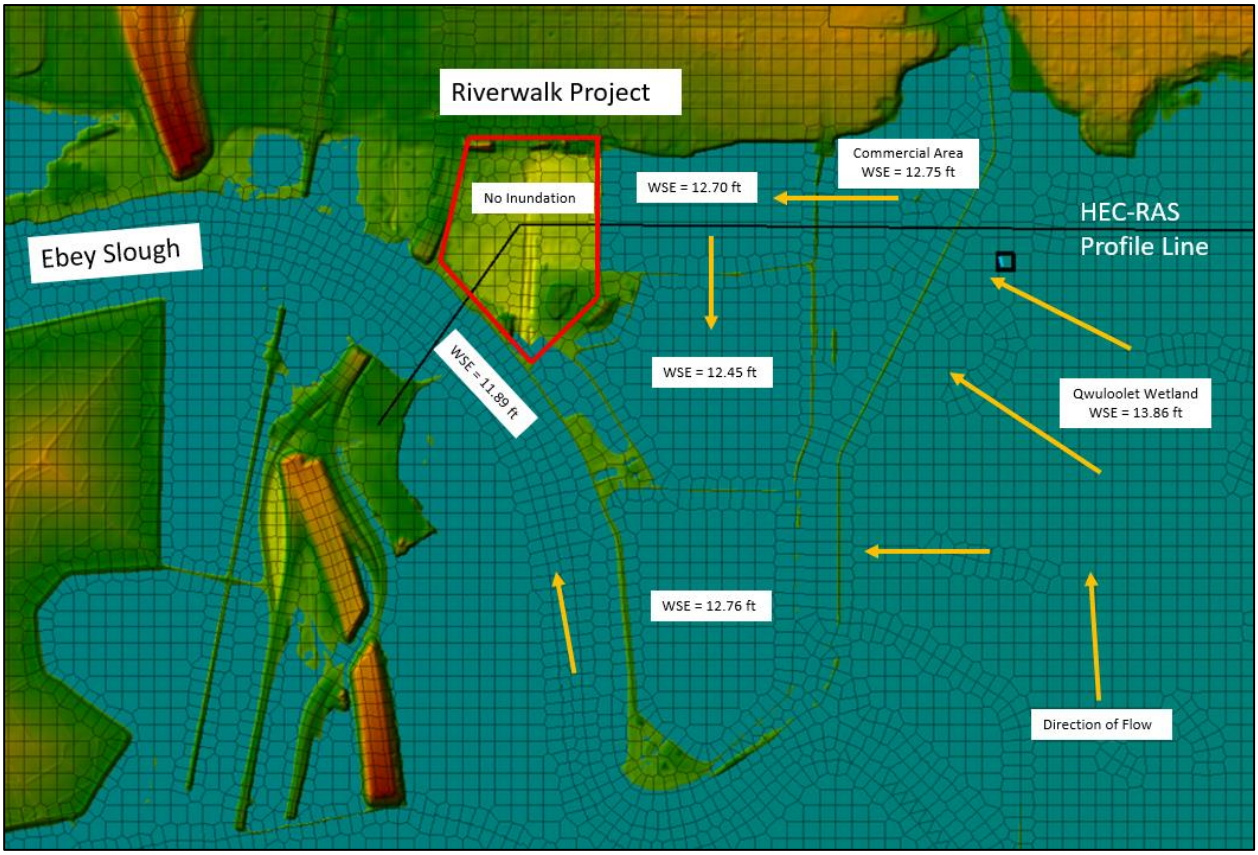

Figure 8: Proposed Conditions Flood Elevations and Flow Paths

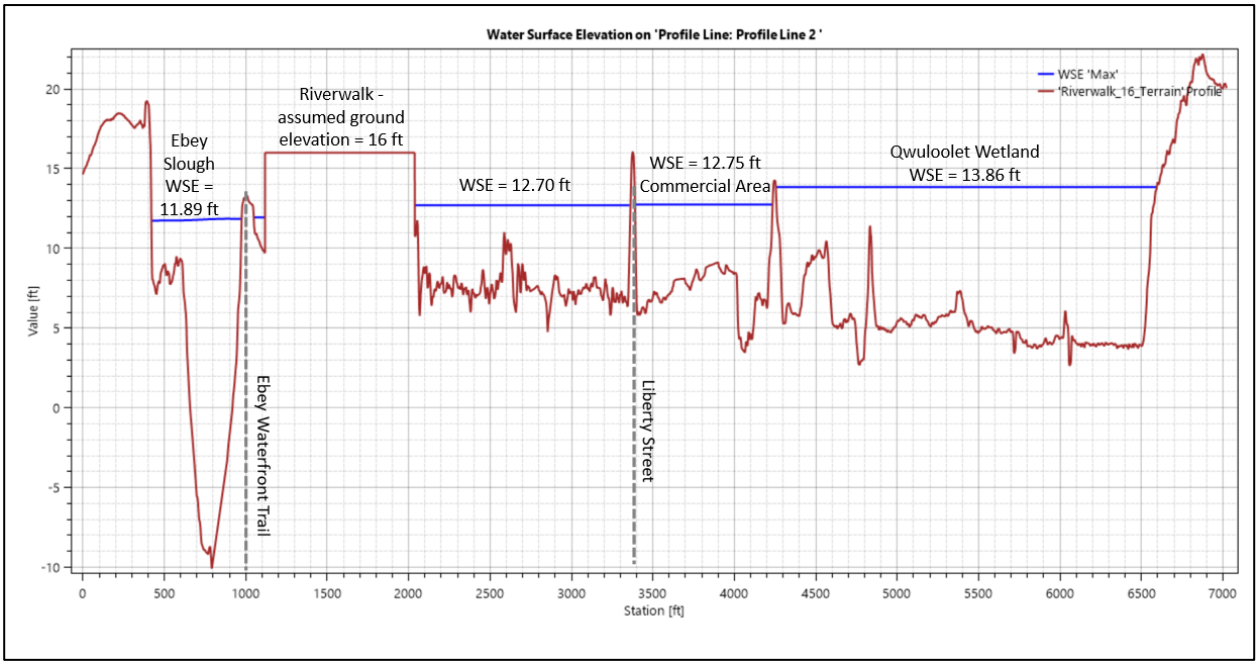

Figure 9: Water Surface Profile for the Proposed Conditions at the Riverwalk Project Site

Summary

The existing Riverwalk project site is located within the FEMA regulatory floodplain with a BFE of 13 feet. The proposed Riverwalk project will elevate the site above potential high flow inundation elevations. HEC-RAS modeling was conducted to assess the existing and proposed hydraulic conditions associated with the Riverwalk site.

Based on the HEC-RAS modeling effort, the rise in elevation of the Riverwalk site potentially blocks flows and removes flood storage, resulting in an estimated 0.03 feet water surface elevation increase within the adjacent wetland east of Riverwalk site, a modeled 0.04 feet decrease in water surface elevation within the existing commercial area on Liberty Street, and no increase of water surface elevation in the Qwuloolet Wetland restoration area.

Without the planned drainage infrastructure improvements, the estimated increase in water surface elevations is minimal, only 0.03 feet, and localized to the adjacent wetlands. The terrain near the Riverwalk site limits the expansion of the floodplain extent due to the minimal increase of water surface elevation, so potential adverse impacts to residential structure are not anticipated. The commercial area on Liberty Street is within the flood inundation area under existing conditions with a modeled decrease of 0.04 feet in the peak water surface elevation.

References

Federal Emergency Management Agency (FEMA), 2020. Flood Insurance Study. Snohomish County, Washington and Incorporated Areas, June 19, 2020.

USACE (2019) HEC-RAS, River Analysis System. Version 5.0.7, U.S. Army Corps of Engineers, Hydrologic Engineering Center. Davis CA, Hydrologic Engineering Center

Watershed Science and Engineering (WSE) (2021), Hydraulic and Hydrologic Modeling in the Snohomish Watershed. Prepared for Snohomish County Public Work, Surface Water Management Division.