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NHC Reference No. 5010407

January 21, 2026

LEI Engineering & Surveying of Oregon, LLC
2564 19th St SE
Salem, OR 97302

Attention: Jamie VanAgtmael, PLS
Via email: jamie@leiengineering.com

Re: Devil's Lake Dredging Flood Impact Assessment
No-Rise Certification Letter, Rev. 0

Dear Jamie VanAgtmael:

This letter is intended to accompany the City of Lincoln City, Oregon floodplain development permit application for the Devil's Lake Dredging Project, proposed by Devils Lake Water Irrigation District (DLWID). This letter documents the development and use of a 2-dimensional HEC-RAS model and demonstrates that the project meets the City's code for development within a Zone AE floodplain. The analysis is based on surveyed existing topography and bathymetry developed by Northwest Hydraulic Consultants, Inc. (NHC) and the proposed dredging design provided by DLWID's engineer, LEI Engineering & Surveying of Oregon, LLC (LEI).

1 PROJECT DESCRIPTION

The outlet of Devil's Lake is located approximately 500 feet from the beach with the D River connecting the lake outlet to the Pacific Ocean. Large, long period ocean waves (infragravity waves) during high tides drive water and sand far up the D River into the lake outlet. This shoal, seen in Figure 1.1, extends approximately 300 feet upstream of the lake outlet.

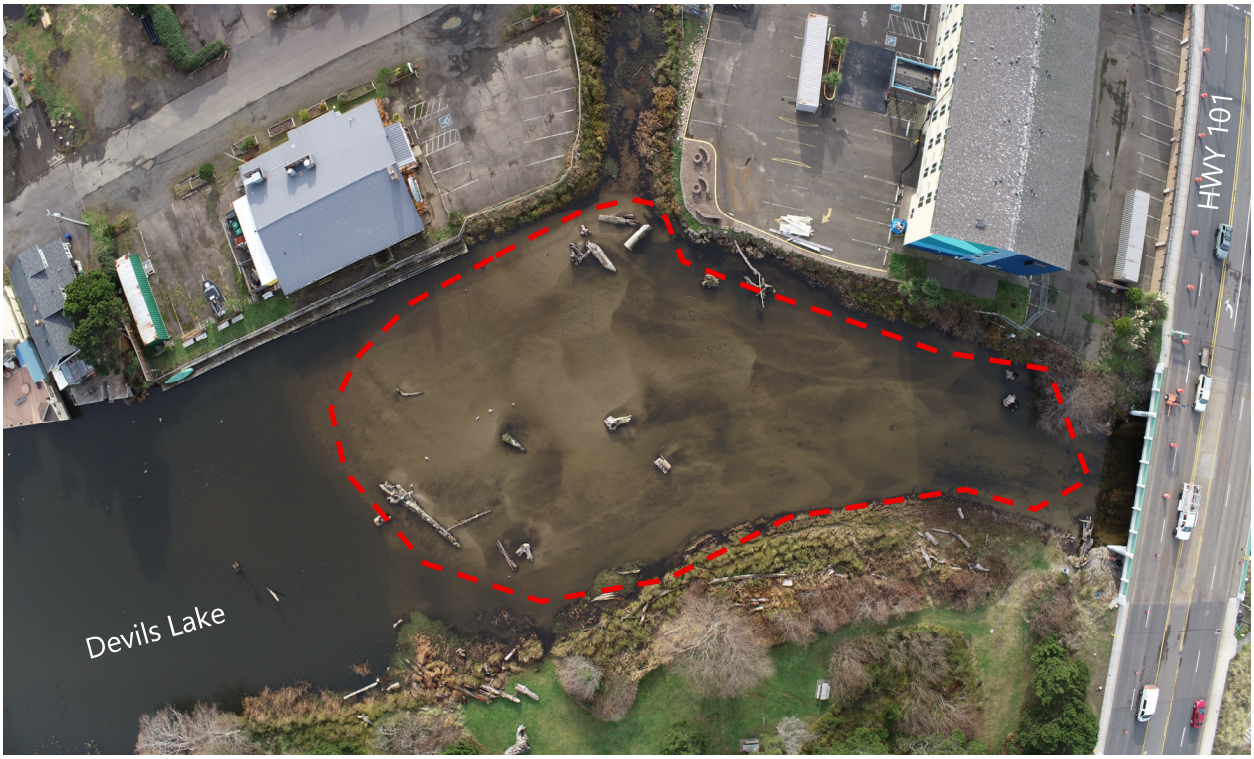


Figure 1.1 Photo from December 10, 2024, at low flow during the NHC survey. Extents of sand deposition in Devils Lake outlet are identified by dashed red line.

In an effort to reduce ongoing flooding issues in the vicinity of the lake outlet, DLWID has hired LEI to develop designs to dredge the sandy shoal and remove the accumulated material. Based on the December 2024 NHC bathymetric survey of the lake outlet region, the elevation of the shoal is in the range of approximately 10.5 to 12.5 feet (NAVD88). The proposed dredging project removes the aggraded material to a maximum elevation of 10.69 feet. Figure 1.2 shows the project details in plan and profile. The project will remove 1,673 cubic yards of accumulated sediment.

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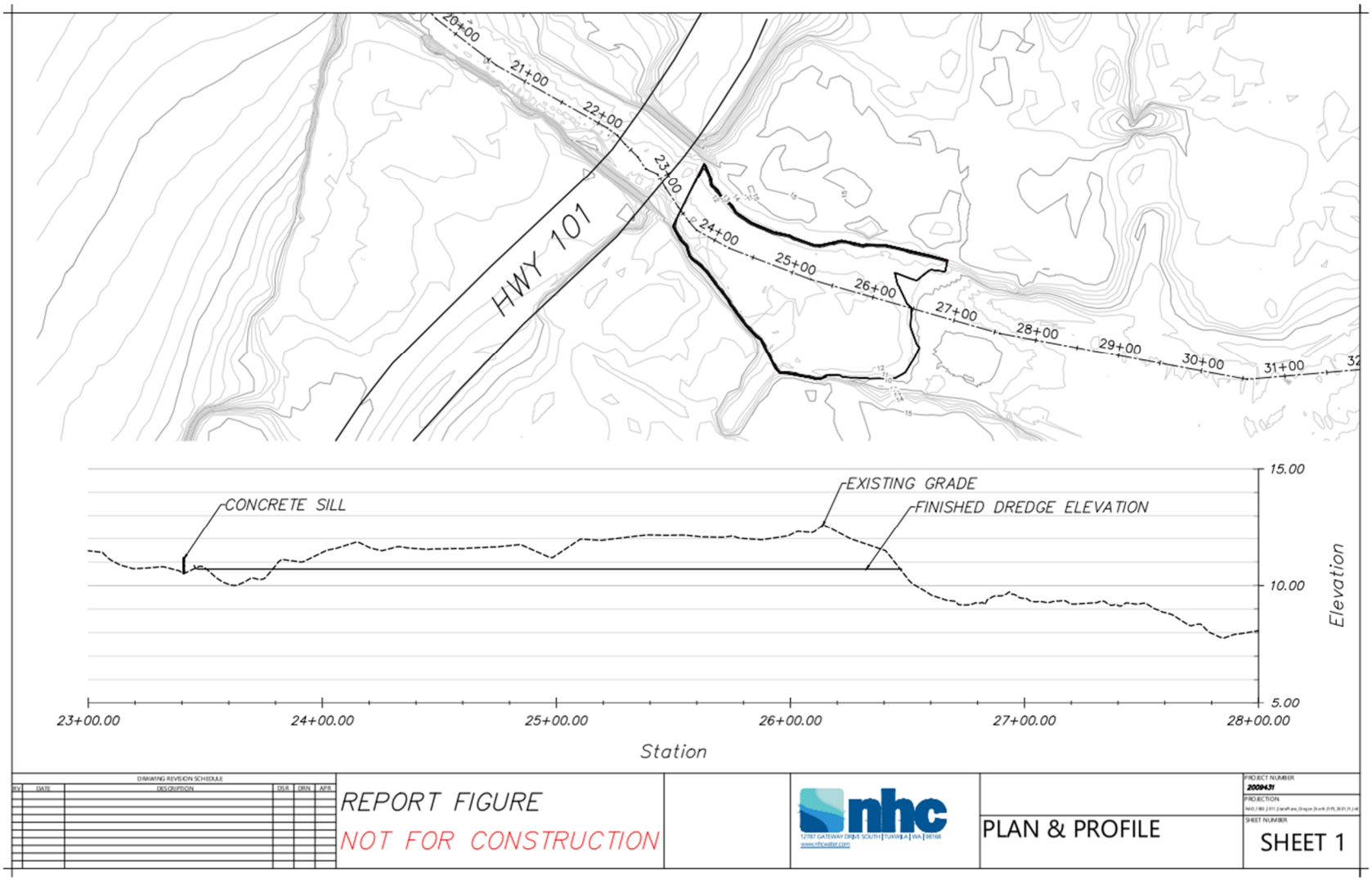


Figure 1.2 Schematic grading plan developed by LEI for the proposed dredging project. Elevations in NAVD88

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2 LINCOLN CITY FLOOD HAZARD CODE REQUIREMENTS

This section outlines the applicable flood hazard regulations and the modeling approached used to evaluate the Devil's Lake Dredging Project. The project is located within a FEMA Zone AE floodplain without a designated floodway and is subject to Lincoln City's flood code. The following subsections summarize the relevant code provisions, anticipated development in the project area, and the methods used to assess potential flood level changes.

2.1 Relevant Code

The proposed Devil's Lake Dredging Project is located within a FEMA Zone AE floodplain with a mapped base flood elevation, but no floodway as seen in Figure 2.1. As such, it is subject to the requirements of Lincoln City Municipal Code Title 15, Section 16.610 titled "Before the Regulatory Floodway." This code section states that:

"In areas where a regulatory floodway has not been designated, no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and 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 and will not result in the net loss of flood storage volume."

2.2 Anticipated Development

As described in Section 3 below, the FEMA effective model is not readily available in a non-PDF format. The hydraulic model used in this analysis was developed in 2025 and uses the most recent and best available topo-bathymetric data which includes all existing development in the project region. There is one future project known in this project area. A sewer line crossing is proposed to cross Devil Lake near the lake outlet and would be installed below grade. Since the project is below grade, it is not expected to interact with the flow of water in the lake outlet and therefore not impact base flood elevations of either existing conditions or with-project conditions models. No other development is anticipated in the project region that would impact current of future base flood elevations.

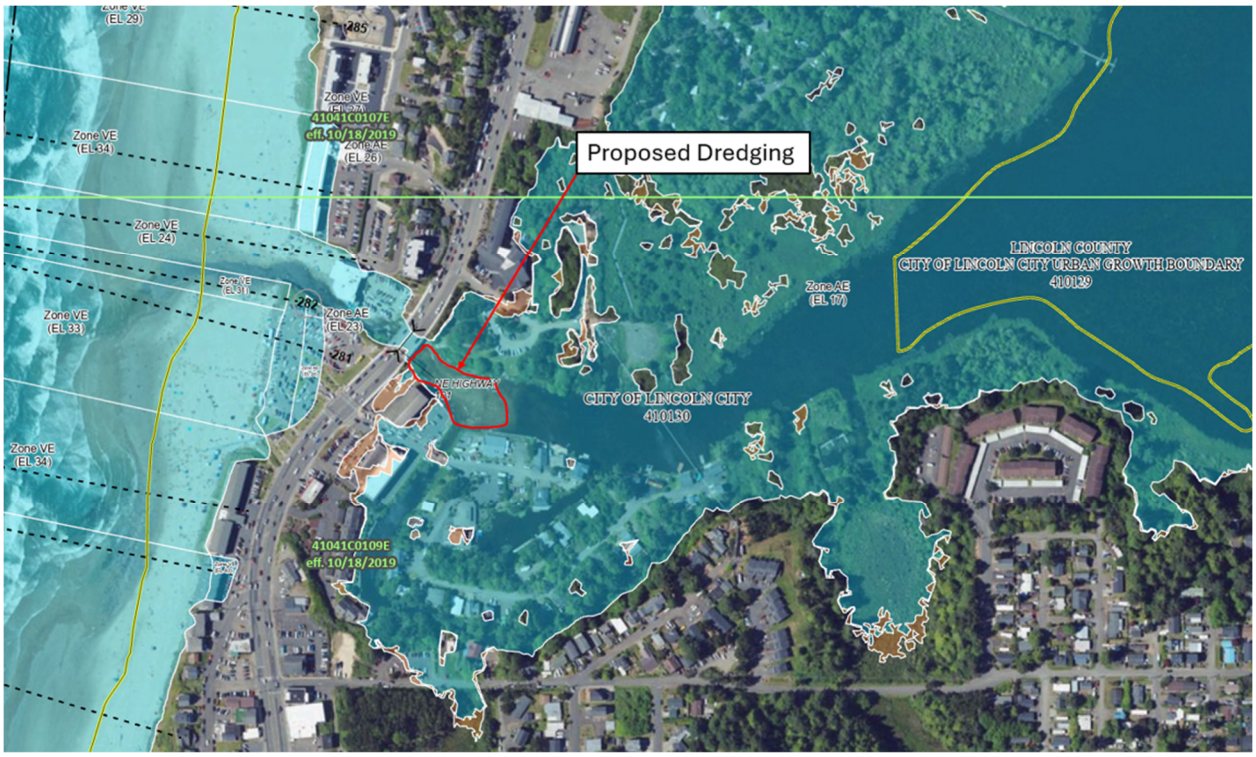


Figure 2.1 Subset of FIRM panel 41041C0109E (effective October 18, 2019) showing the location of the Devil's Lake Dredging Project.

2.3 Flood Storage Volume

City code requires no "net loss of flood storage volume" because of the project and is intended for projects which interact with the floodplain, either as fill or as a new structure. The dredging project proposed by DLWID is expected to remove approximately 1,673 cubic yards of sediment below the base flood elevation and the flood storage volume is expected to be increased by that amount.

3 MODELING APPROACH

The following sections outline the modeling approach for evaluating the project. The FEMA effective model was available only in PDF format, therefore according to FEMA guidance (FEMA, 2023), a corrected effective model is not required, and an existing conditions model can be used for flood hazard analysis. NHC has developed a calibrated existing conditions 2D model of Devil's Lake as part of an ongoing project for the City of Lincoln City. This model served as the basis for the flood hazard assessment and is detailed in the following sections.

3.1 Hydrology

A 100-yr base flood discharge is not published in the FIS for Devils Lake. Only a base flood elevation is provided. To determine the effects of the dredging project on base flood levels, a base flood flow is needed. This was approached by developing inflows for the major tributaries of Devils Lake that maintain the base flood elevation under steady state conditions.

The major tributaries that feed Devil's lake are ungaged or have gages that have been out of service for several years. For the largest (by drainage area) 8 tributaries, an estimated 100-yr discharge for each tributary was computed using the regression methods incorporated within the US Geological Survey's StreamStats (USGS, 2019) web application. These 100-yr tributary inflows were then simulated in the 2D existing conditions model and run for a twelve-hour "ramp up" period to allow the model to reach the 100-year inflow value slowly and maintain model stability.

The estimated 100-year inflow was then simulated for 156 hours to allow tributary inflows and lake outflows to stabilize and reach steady-state conditions. Initial model results overestimated the base flood elevation of the lake, therefore the inflows to each tributary were scaled until the base flood elevation reported by the model matched that of the FIRM. A discharge multiplier of 0.89 was used to generate a lake water surface that agreed with the mapped BFE of Devil's Lake. The resulting flows were used to assess the Post-Project Condition flood hazard. Table 3.1 shows the individual tributary 100-year flows calculated using StreamStats and the calibrated flows used in the flood impact analysis.

Table 3.1 Table of inflows used in the flood impact analysis showing StreamStats regression flows and the calibrated flows used to match the mapped FEMA BFE for Devil's Lake.

Inflow Tributary	StreamStats Estimated 100-year flow (cfs)	Calibrated 100-year flow to reproduce FEMA BFE in Devil's Lake (cfs)
Rock Creek	1060	943
Thompson Creek	187	166
North	118	105
Clubhouse Drive	103	91.7
Hospital	53.5	47.6
3rd St.	49.6	44.1
Spring Creek	30.4	27.1
Lighthouse Square	22.5	20.0
Total Inflow	**1624**	**1445**

Existing Conditions Model

NHC previously developed a hydraulic model of Devil's Lake and the D River that includes the whole lake and near-shore region, the D River, and a section of the coast adjacent to the lake using the U.S. Army Corps of Engineers (USACE) River Analysis System (HEC-RAS) Two Dimensional (2D) model version 6.6 (USACE, 2025). The model has been calibrated to observed lake levels for recent storm events as part of an ongoing project for the City of Lincoln City. This model was considered the best available model to use for hydraulic analysis of the project.

3.1.1 Model Domain and Boundary Conditions

The project model domain extends from off the coast upstream through the entirety of Devil's Lake to include all shoreline areas with elevations just above the FIRM base flood elevation of 17 feet. The model boundaries were used to capture the upstream inflow sources to the lake and the downstream tidal conditions of the D River as shown in Figure 3.1. The coastal boundary used a constant stage of mean high water (MHW), based on the nearby South Beach tide gauge, and does not influence water levels in the lake for the present analysis. A total of eight inflow tributaries were used in the model and represent the largest subbasin areas of the Devil's Lake watershed. Inflows for tributaries were placed along the lake shore at the confluence of the tributary with the lake. The inflow hydrographs used in the model reflect steady-state conditions as described in Section 3.1.

3.1.2 Model Mesh

To balance hydraulic accuracy in the project area with efficient model run times, an irregular mesh with variable characteristic cell sizes was developed. Because detailed hydraulic output was not required across most of the lake, a typical cell size of 300 feet was used throughout much of the lake. This allows accurate accounting for lake storage, while minimizing model run times. The mesh was assigned a similar 300-foot cell size off the coast, except along the beach forming the D River outflow channel, where the mesh was refined to 50 feet.

Within the primary area of interest for this project, a 10-foot typical cell size was used to support detailed hydraulic assessment in the project area. A transition zone was incorporated to gradually reduce cell sizes toward the lake outlet and into the D River channel. A single 2D connection was added to represent the existing dam sill. The full model mesh is shown in Figure 3.1, and Figure 3.2 presents the detailed mesh configuration within the project area.

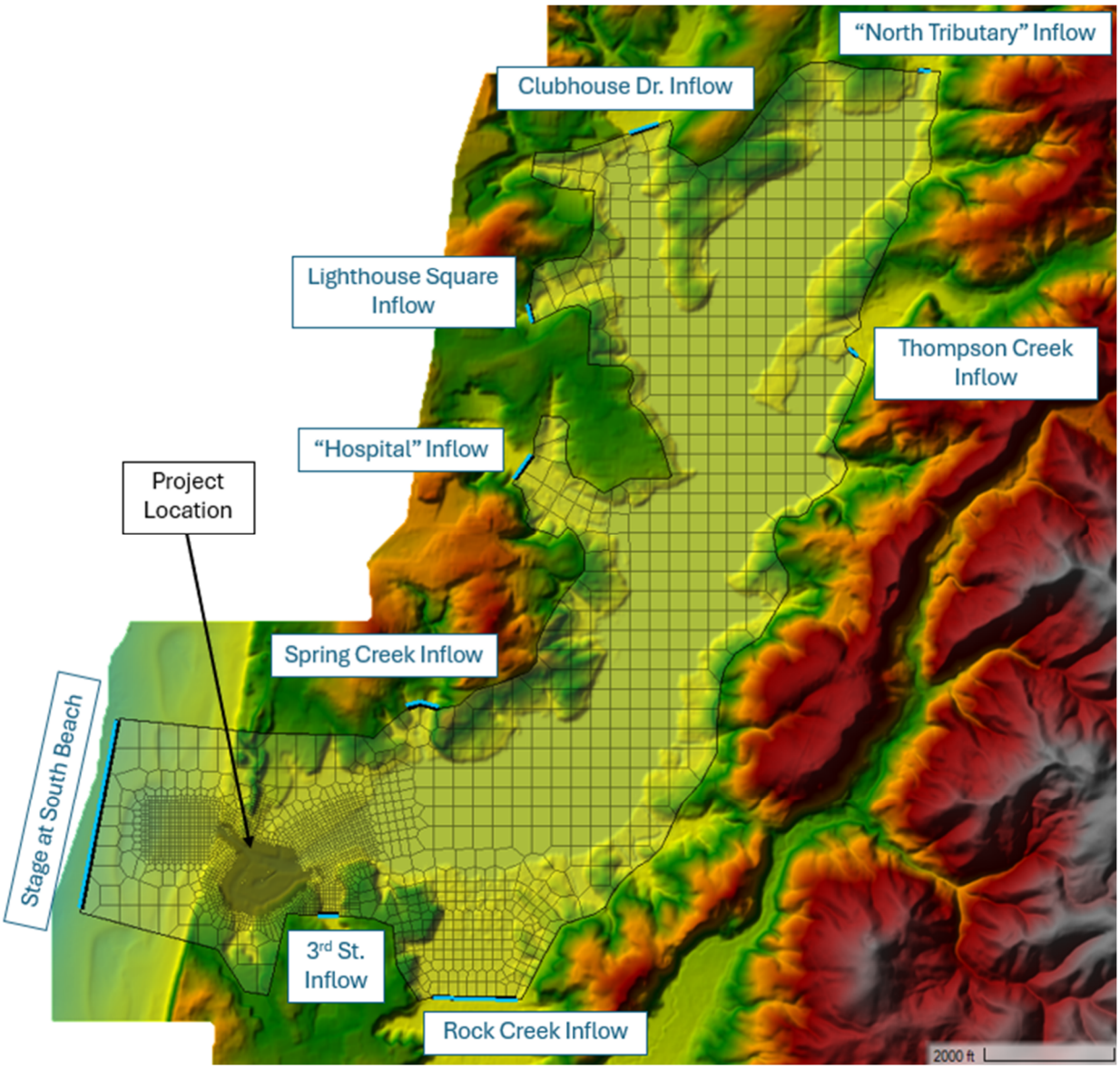


Figure 3.1 HEC-RAS Model Domain and Boundary Locations

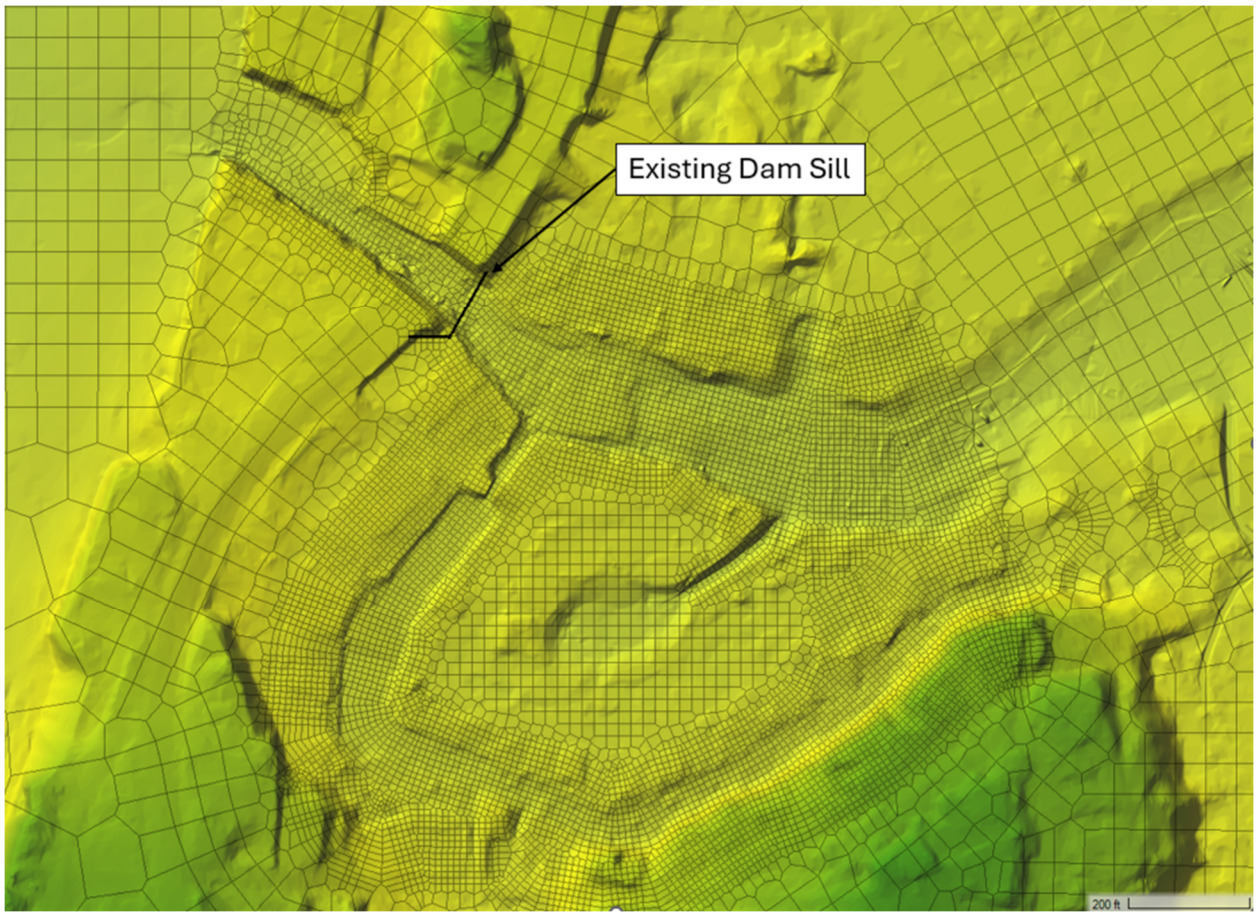


Figure 3.2 Example of mesh and 2D connection used in the existing conditions and with-project models.

3.1.3 Terrain and Mannings Roughness

The terrain used in the existing conditions model was a composite of topo-bathymetric survey and LiDAR collected by various agencies and companies between 2009 and 2024 (NHC, 2025).

Mannings roughness regions were developed from aerial imagery and applied to regions representing 11 roughness types. Roughness values were applied to these regions based on guidance from Chow (1959) and the National Land Cover Database (MRLC, 2011). Upstream of the NHC survey, a composite roughness value was applied to the full grid, with individual roughness regions applied in the lake outlet and surrounding overbank. Table 3.2 details the roughness regions and corresponding Manning's value used in the hydraulic model.

Table 3.2 Manning's Roughness regions applied to the hydraulic model

Roughness Region	Manning's n
Forest	0.1
Composite Upstream Lake and Shore	0.05
Grass/Shrub	0.07
Lake Near-shore and Riverbanks	0.075
Sand	0.02
Gravel	0.03
Cobble	0.034
Deep Water Lakebed	0.04
Pavement	0.012
Residential Development	0.1
Low and Medium Density Development	0.12

Notes:

a. A small roughness region was also applied to the area under Kyllo's Restaurant along the D River channel. This area contains larger boulders and concrete piers and was given a composite roughness value of 0.06.

3.2 With-Project Model

The only change made to the existing conditions model to develop the with-project model was modifying the terrain to include the proposed dredged surface provided by LEI. No changes to the outlet roughness were warranted since the channel material is not expected to change. No changes were made to the computational mesh from the existing model to limit the possibility of numerical discrepancies between the existing and with-project models. All other hydraulic model parameters remained the same between the existing and with-project models. Figure 3.3 compares the terrain changes made from the existing conditions model to the with-project model.

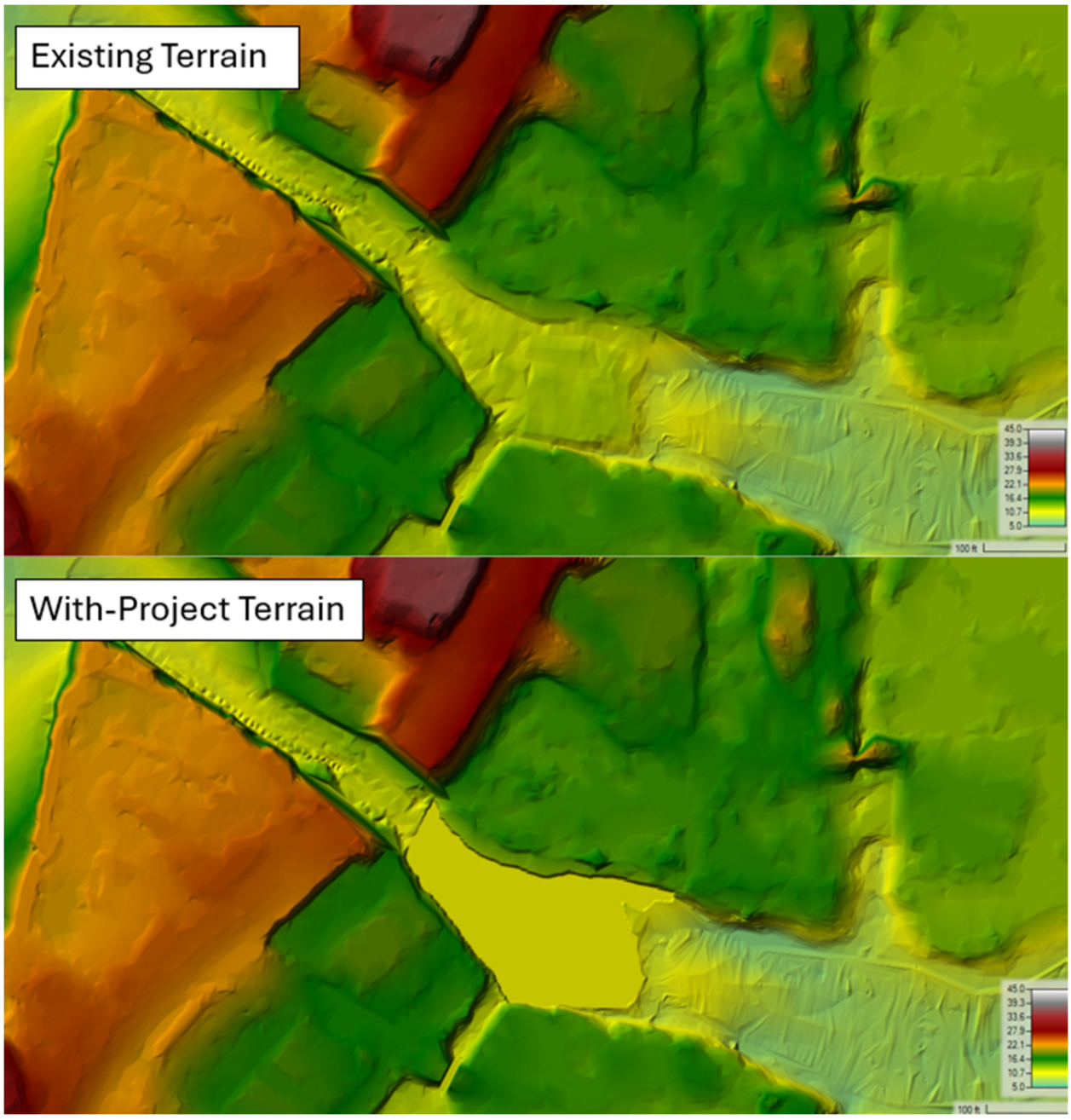


Figure 3.3 Model terrain comparison of existing conditions and with-project conditions.

4 PROJECT FLOOD IMPACTS

This section summarizes the results of hydraulic modeling conducted to assess potential changes in flood impacts from the proposed Devil's Lake Dredging Project. The primary criterion for compliance with City development code is whether the base flood elevation increases by

more than one foot. Flood level changes were modeled for all areas adjacent to Devil's Lake that could be affected by alterations to the lake's base flood elevation. It has already been shown that the project does decrease net available flood storage (the other City requirement) since the project is only removing material from the flood zone.

4.1 Changes to Flood Levels

The effects of the Devil's Lake dredging project on lake levels are presented in this section. Note that this assessment focuses on relative water level differences because of the project using proposed and existing conditions results from the 2D hydraulic model. No comparison with the effective mapped BFE is given, as this does not reflect project impacts. This allows for assessment of the flood impacts of the project in respect to the City code, which requires any rise be less than one foot "at any point in the community."

The difference in flood elevation was calculated by subtracting the maximum water surface elevation of the with-project conditions from the maximum water surface elevation of the existing condition model. The results of this calculation are presented in Figure 4.2 and Figure 4.2. The lake shows a drop in flood elevation of 0.02 feet while a small rise occurs just upstream of the Hwy 101 bridge. The maximum rise calculated in the entire model domain is less than 0.05 feet.

The slight rise in base flood elevations near the bridge is likely due to slightly increased conveyance of the lake outlet. This slight increase in flow at the bridge section results in the slight increase in water surface. Additionally, the dredging changes have also resulted in slightly lower velocities approaching the confined bridge section causing a minor rise from the existing conditions. Note that this rise is well below the one-foot threshold laid out by the City's flood hazard code, and no rise occurs on insurable structures.

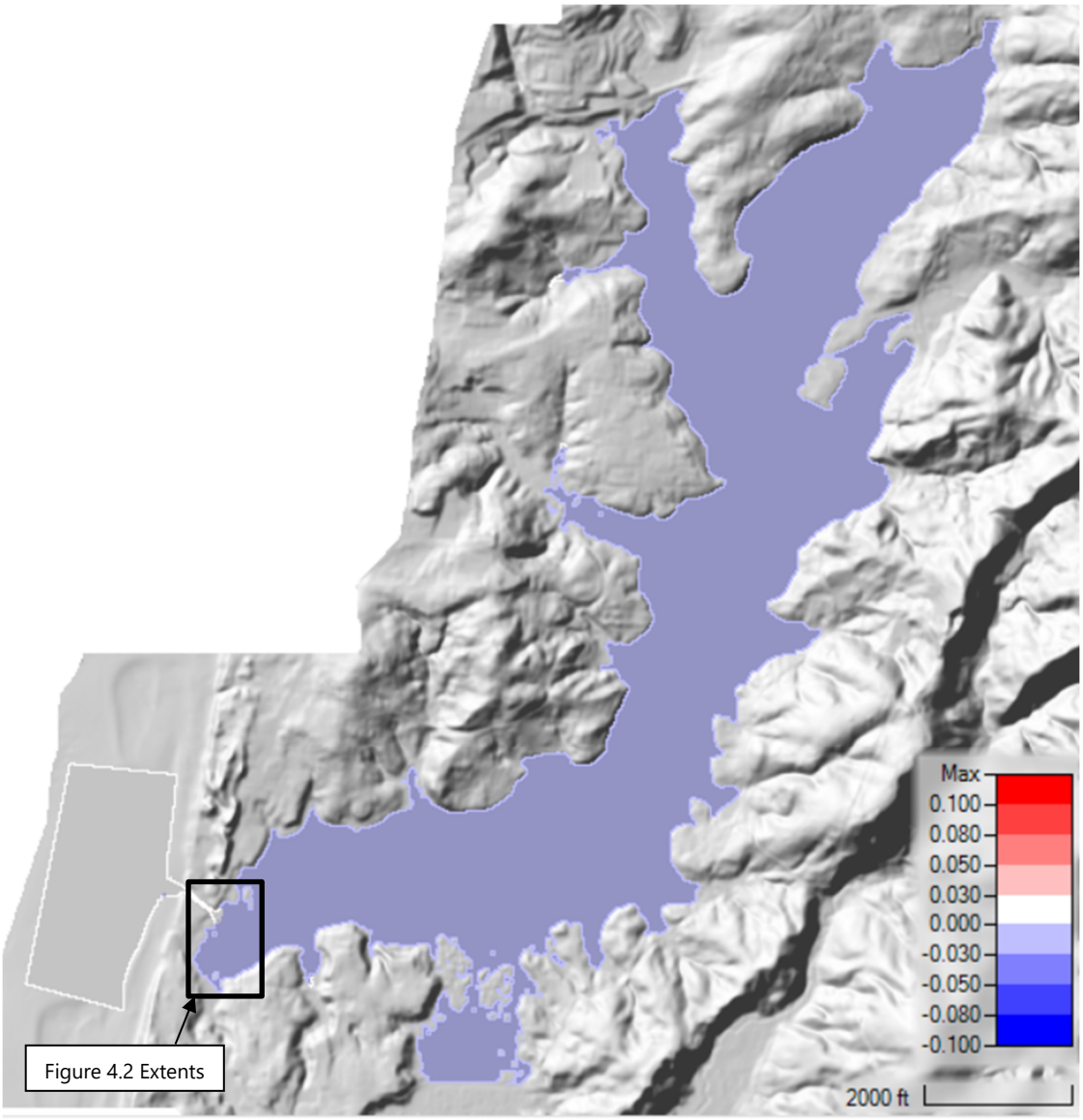


Figure 4.1 Difference in peak water-surface elevation between with-project and existing conditions across the full Devils Lake model domain. Red shades indicate increases in water-surface elevation; blue shades indicate decreases. An inset showing elevation changes near the lake outlet is provided in Figure 4.2.

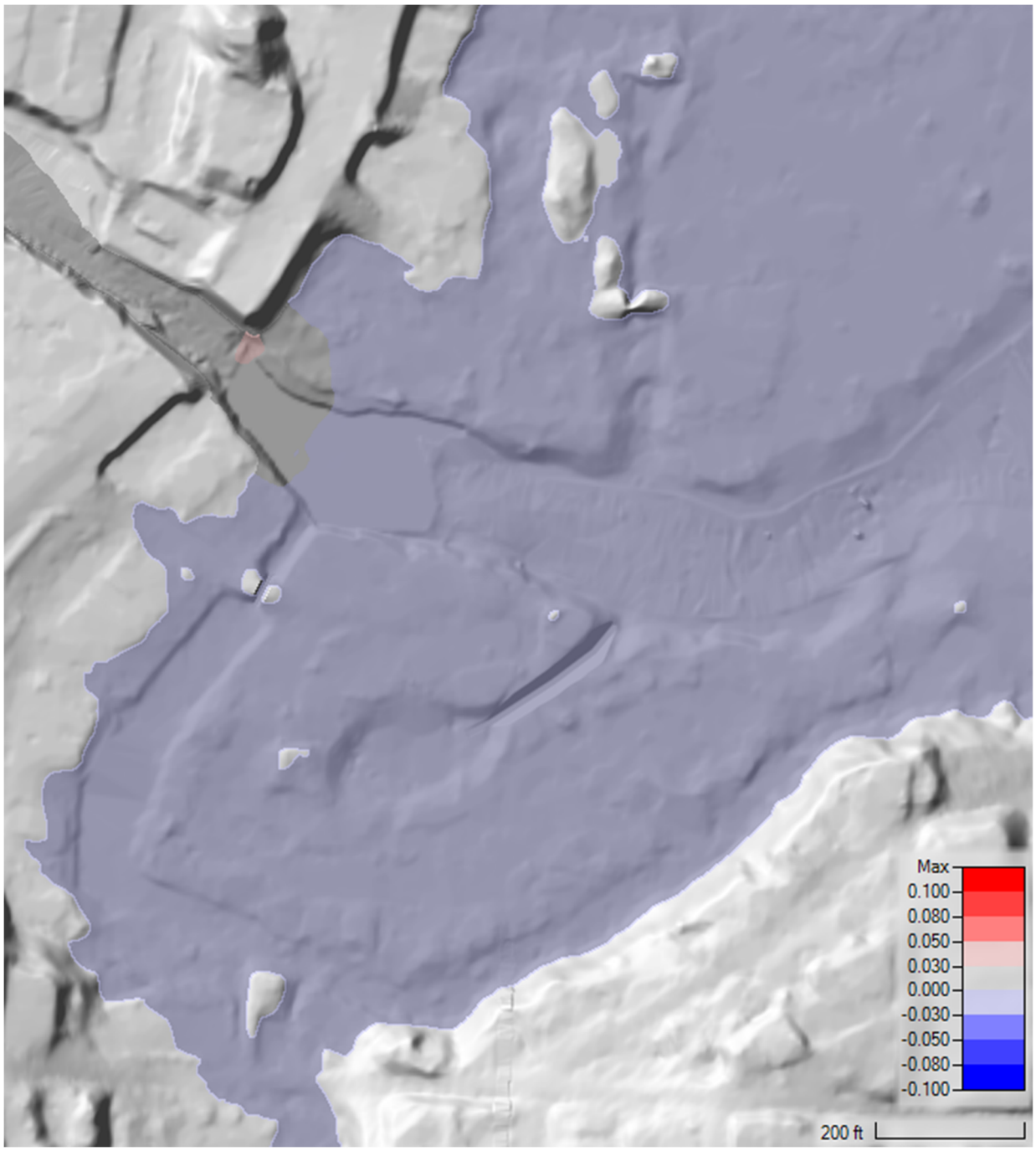


Figure 4.2 Inset from Figure 4.1 showing the difference in maximum water-surface elevation between with-project and existing conditions. The with-project scenario results in a maximum increase of 0.05 feet just upstream of the Highway 101 bridge, while areas farther upstream in the lake show decreases of up to 0.02 feet. No other areas of the model domain show an increase in base flood elevations.

5 CERTIFICATION

This is to certify that the technical data and analysis described above supports the fact that the proposed Devil's Lake Dredging Project and all other existing and anticipated development described above will not decrease the flood storage volume nor will the project increase the 100-year flood elevations for Devil's Lake more than one-foot at any location covered by the Flood Insurance Study for the community of Lincoln City, Oregon, dated October 18, 2019.
Closure

We trust this report meets your needs. If you have any questions or requests, please feel free to contact the undersigned.

Sincerely,

Northwest Hydraulic Consultants Inc.

Prepared by or under the direct supervision of:



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Project Manager

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Principal Engineer
Principal-in-Charge

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Hydraulic Engineer
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6 REFERENCES

Chow, V.T. (1959). *Open-channel hydraulics.* New York, McGraw-Hill Book Co.

FEMA (2023). *Guidance for Flood Risk Analysis and Mapping: MT-2 Requests* (18).

Northwest Hydraulic Consultants (2025). *Flooding on Devils Lake: Phase 2 & 3 – Hydraulics, Hydrology, Coastal Processes, and Flood Reduction Solutions Report – DRAFT*.

U.S. Geological Survey (USGS), 2024, Annual NLCD Collection 1 Science Products: U.S. Geological Survey data release, https://doi.org/10.5066/P94UXNTS.

U.S. Geological Survey. (2019)i *The StreamStats program, online at https://streamstats.usgs.gov/ss/*.

US Army Corps of Engineers (2005). *HEC-RAS 6.6*.

DISCLAIMER

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