

Appendix 5

**Memo: Brunswick-Topsham, Frank J Wood Bridge, Downstream Alternative
Hydraulics**

To: Joel Kittredge, Project Manager **From:** Norman Baker
Date: August 22, 2017
Address: Bridge Program, MaineDOT **CC:** Kristen Chamberlain, Env
Re: Brunswick-Topsham, Frank J Wood Bridge, Downstream Alternative Hydraulics

MEMORANDUM

Early in the investigation of alternatives for potential replacement bridges for the Frank J Wood Bridge between Brunswick and Topsham, two-dimensional (2D) hydraulics analyses were completed for the existing bridge as well as upstream and downstream parallel alignments. The modeled river section extended upstream of the existing bridge approximately 500 ft to the dam and downstream more than 1500 ft. The 2D hydraulic analysis was required to model the complex flow conditions within the river reach resulting from the split flow conditions caused by the upstream dam, the highly irregular river channel bottom, and highly irregular river bank configuration. Results of the hydraulic modeling for the 100-year discharge regulatory flood event for the existing bridge configuration and the downstream alignment configuration are included in Appendix A for sections extending upstream of the existing bridge 400 ft and downstream 200 ft.

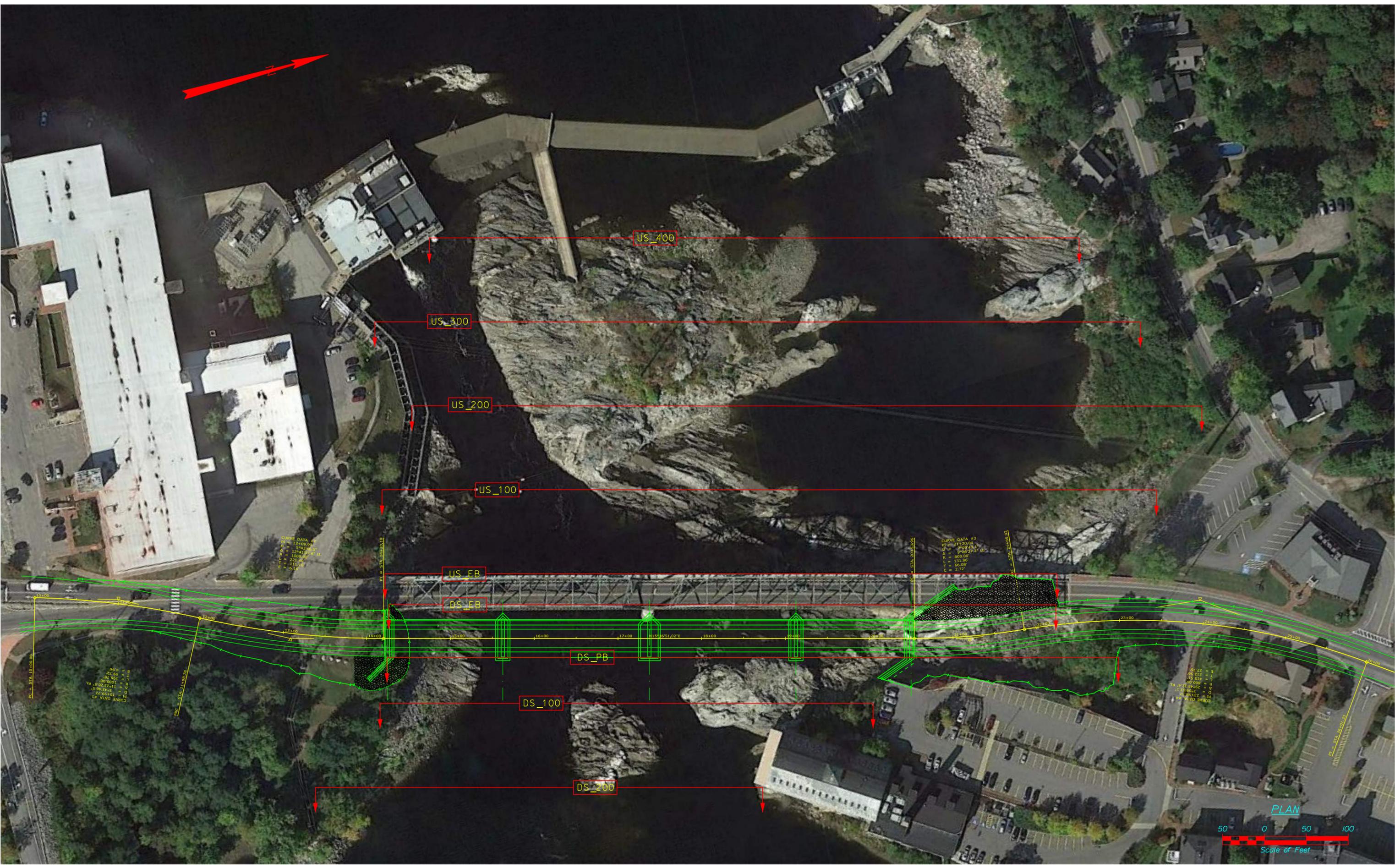
The existing condition hydraulic modeling includes the influence of the existing bridge. These results show that the river water surface elevation (WSE) across any section of the river is highly variable and significantly influenced by the split flow conditions and the river's highly variable geometry. Upstream of the bridge the WSE across the river varies up to approximately 6 to 8 feet and is generally higher on the Topsham side of the river where the riverbed is higher. At the location of the existing bridge, the WSE is still higher on the Topsham side of the river and is much more highly variable (up to approximately 16 feet) across the river section and also influenced by the existing bridge piers. Immediately downstream of the existing bridge, the WSE remains highly variable, and the WSE on the Topsham side tends to rise due to the blockage of conveyance downstream where the Bowdoin Mill complex and parking area significantly narrow the downstream river channel. Near this location, vector output from the hydraulic modeling shows the water turns nearly perpendicular to the channel and runs along the Bowdoin Mill complex before re-entering the main river channel. Further downstream (200 feet downstream of the existing bridge), the WSE is still highly variable and conveyance results in higher water surface elevations on the Brunswick side of the river channel. Of significant interest is the developed area along the existing Bowdoin Mill complex parking area and the southwest corner of the Seadog Restaurant located 50 to 150 feet downstream of the existing bridge. Along the Bowdoin Mill complex parking area the existing WSE is up to near El 30, and at the southwest corner of the Seadog the 100-Year event water surface elevation is near El 25. The parking area of the Bowdoin Mill complex is near EL 35, and the Sea Dog Restaurant floor elevation is at EL 24 ±, and the existing condition is considered the maximum impact allowed and any new structure should look to meet or improve this.

The downstream alternative investigated was a 625ft four span bridge on a parallel alignment located immediately downstream of the existing bridge and between the existing bridge and the westerly edge of the Bowdoin Mill complex parking lot as shown in Appendix A. The Topsham approach and abutment are located within an area where the water passing below the existing bridge piles-up before turning near perpendicular to the channel to run along the upstream side of the Bowdoin Mill complex parking area and the Seadog building. Wings are orientated to smooth out the bank edge and help transition flow through the proposed bridge opening and toward the downstream conveyance channel. Replacing the approach section and moving the abutment back to near the existing river bank was also briefly considered, but this span arrangement would increase right of way impacts (likely including the taking of the Dentist office at the corner entrance to the Bowdoin Mill complex), require an additional span, and require construction of a pier then orientated perpendicular to the flow of water making this turn along the bank. The obstruction caused by the pier would be similar to the effects of the proposed approach and abutment.

Results of the hydraulics analysis of this proposed downstream span configuration show that the upstream WSE is not significantly influenced by the proposed bridge indicating that the proposed bridge opening would be adequate from a conveyance perspective and does not result in any significant rise in backwater. The profile of the WSE through the existing and proposed bridge sections varied due to the bridge geometry, but the maximum WSE in these sections remained similar. The analysis also however shows that the WSE downstream of the proposed bridge near the Sea Dog Restaurant increases by over 6 feet. Reasonable measures to mitigate this effect were considered, but could not be found. Attempting to span this reach of the river and avoid foundations would be cost prohibitive and also cause substantial Right of Way impacts along the Topsham approach roadway. Longer spans would require an increase in the profile grade of the roadway so that headwater clearance under the bridge could be maintained. This grade increase would likely require taking the dentist office on the northeast corner of the bridge in Topsham.

The downstream alternative was dismissed from further consideration due to an unacceptable rise in WSE near the Seadog. Comparative plots of the river section WSEs are included in Appendix A.

APPENDIX A



CURVE DATA #1
PI = 13200.00
PA = 543.00
RA = 1000.00
TL = 115.00
E = 6.34

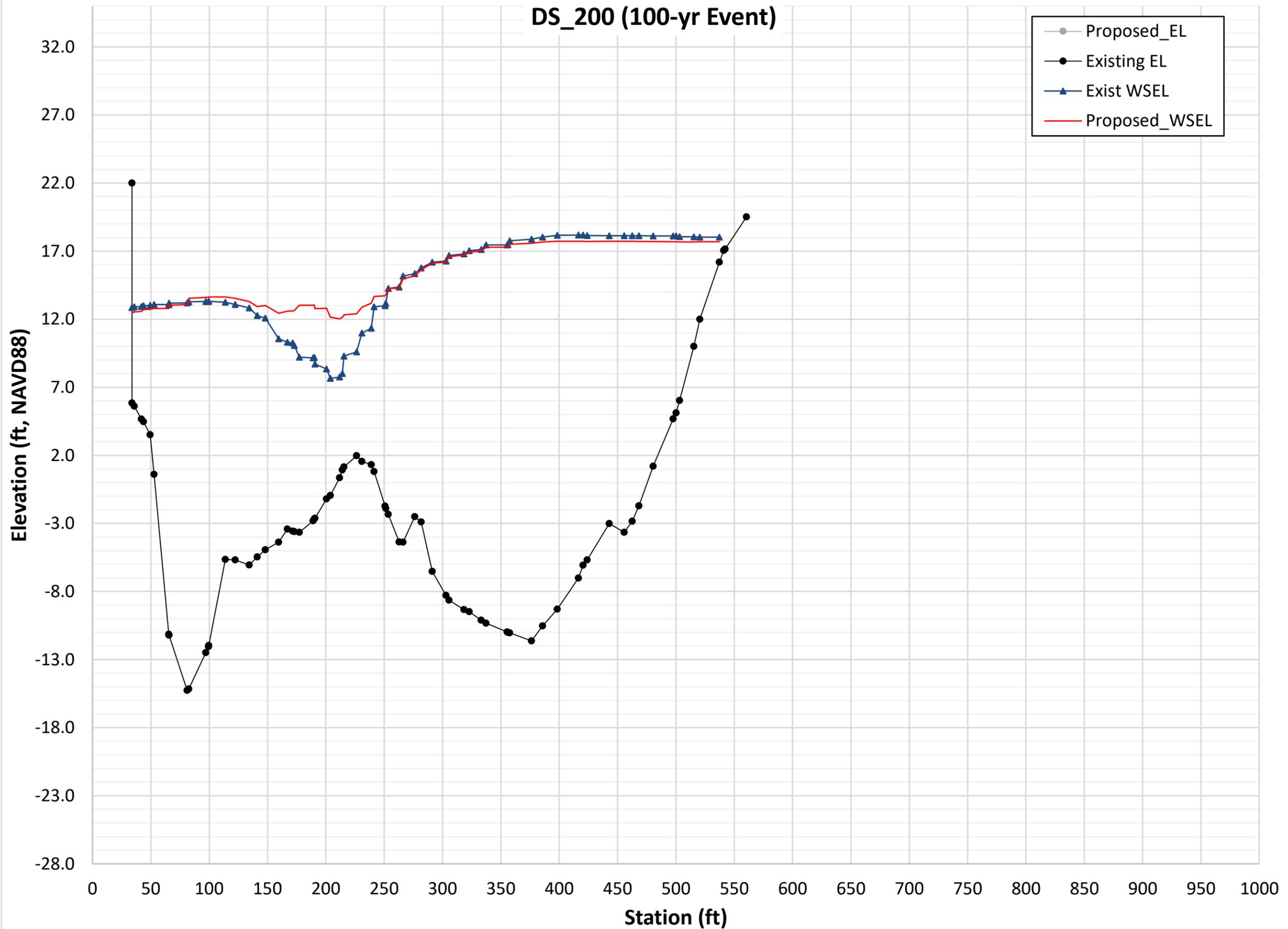
CURVE DATA #3
PI = 21500.00
PA = 700.00
RA = 800.00
TL = 131.00
E = 2.72

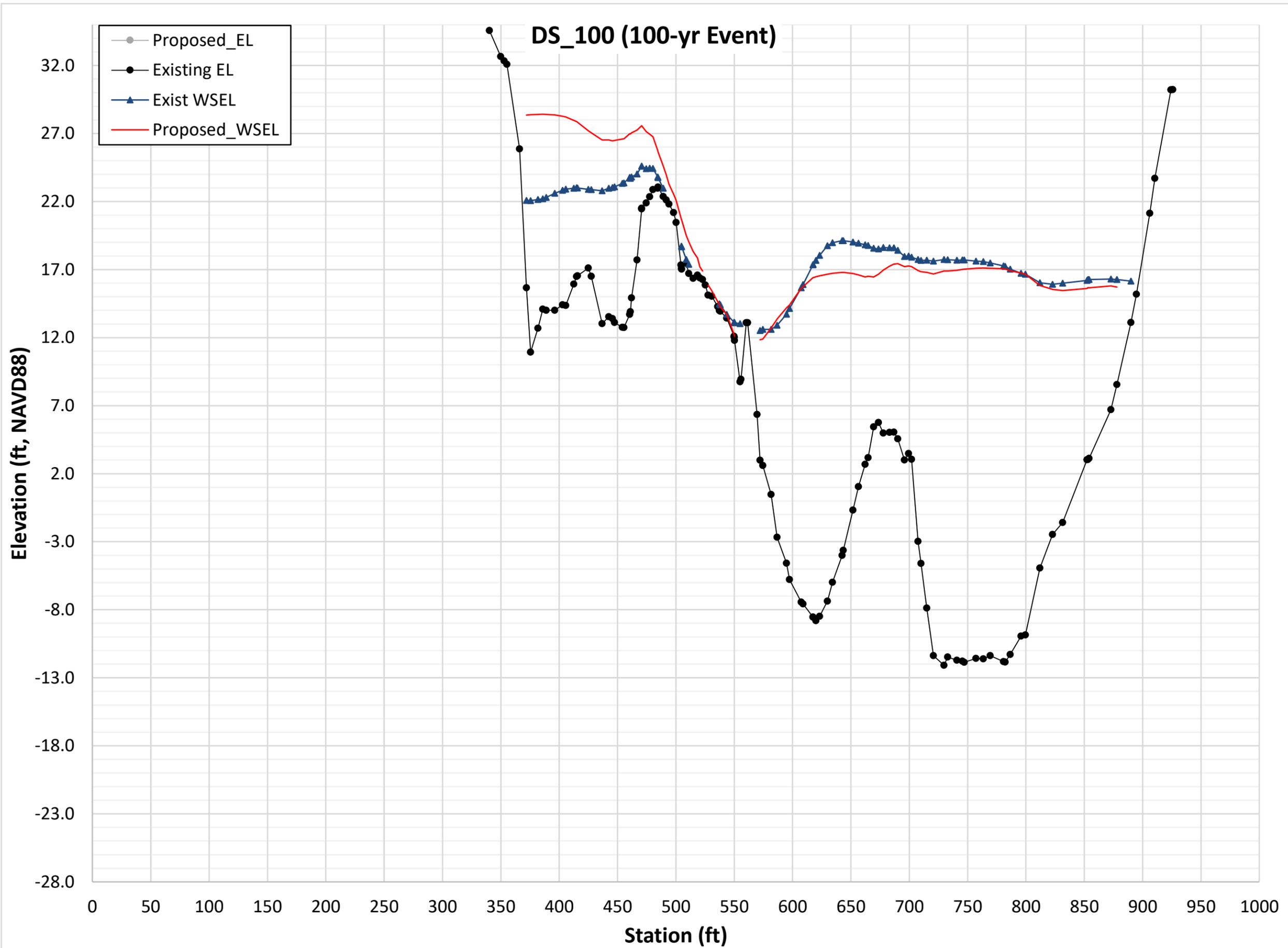
CURVE DATA #1
PI = 10000.00
PA = 112.00
RA = 1000.00
TL = 115.00
E = 6.34

CURVE DATA #2
PI = 20000.00
PA = 200.00
RA = 1000.00
TL = 115.00
E = 6.34

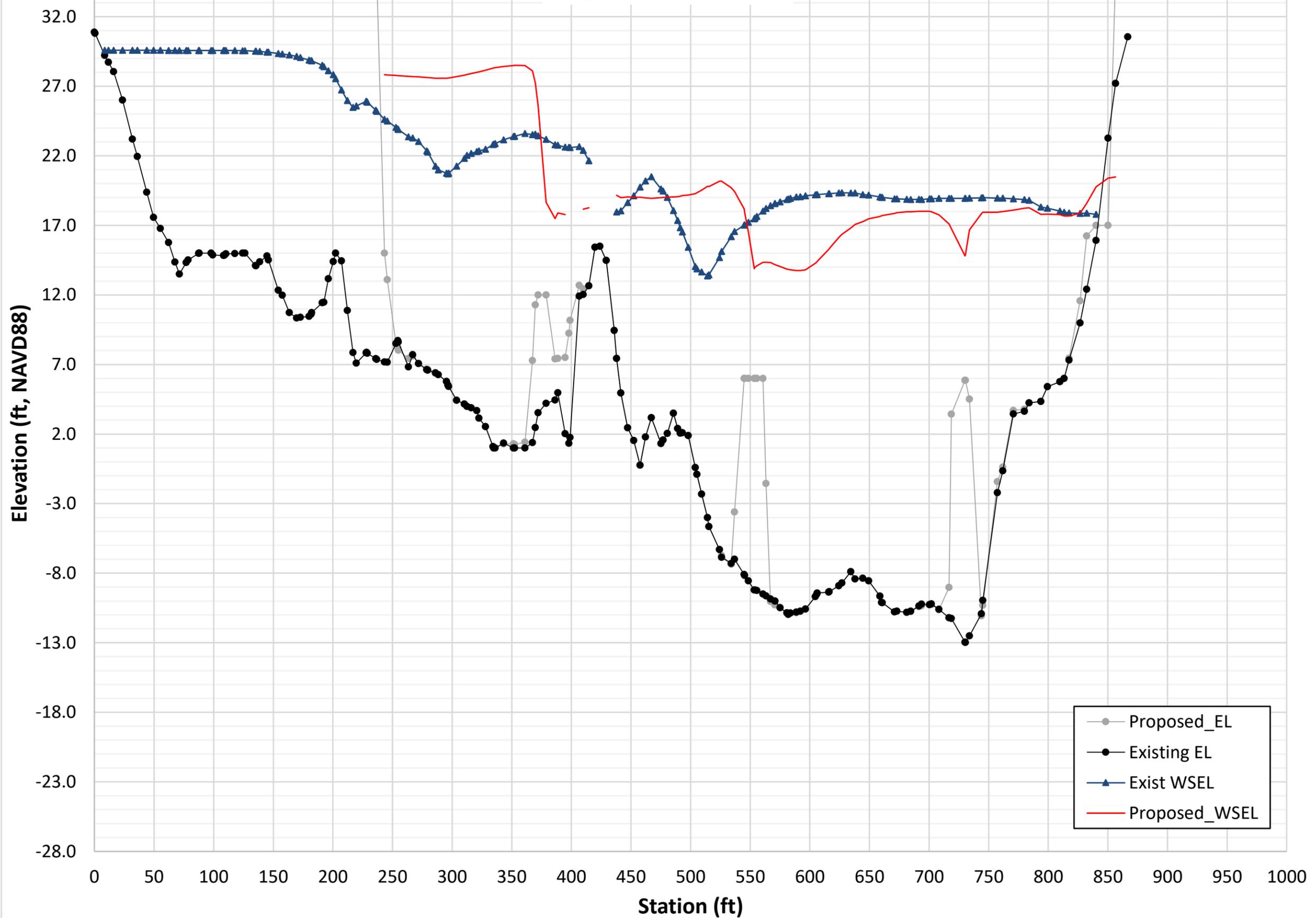
PLAN
50 0 50 100
Scale of Feet

DS_200 (100-yr Event)



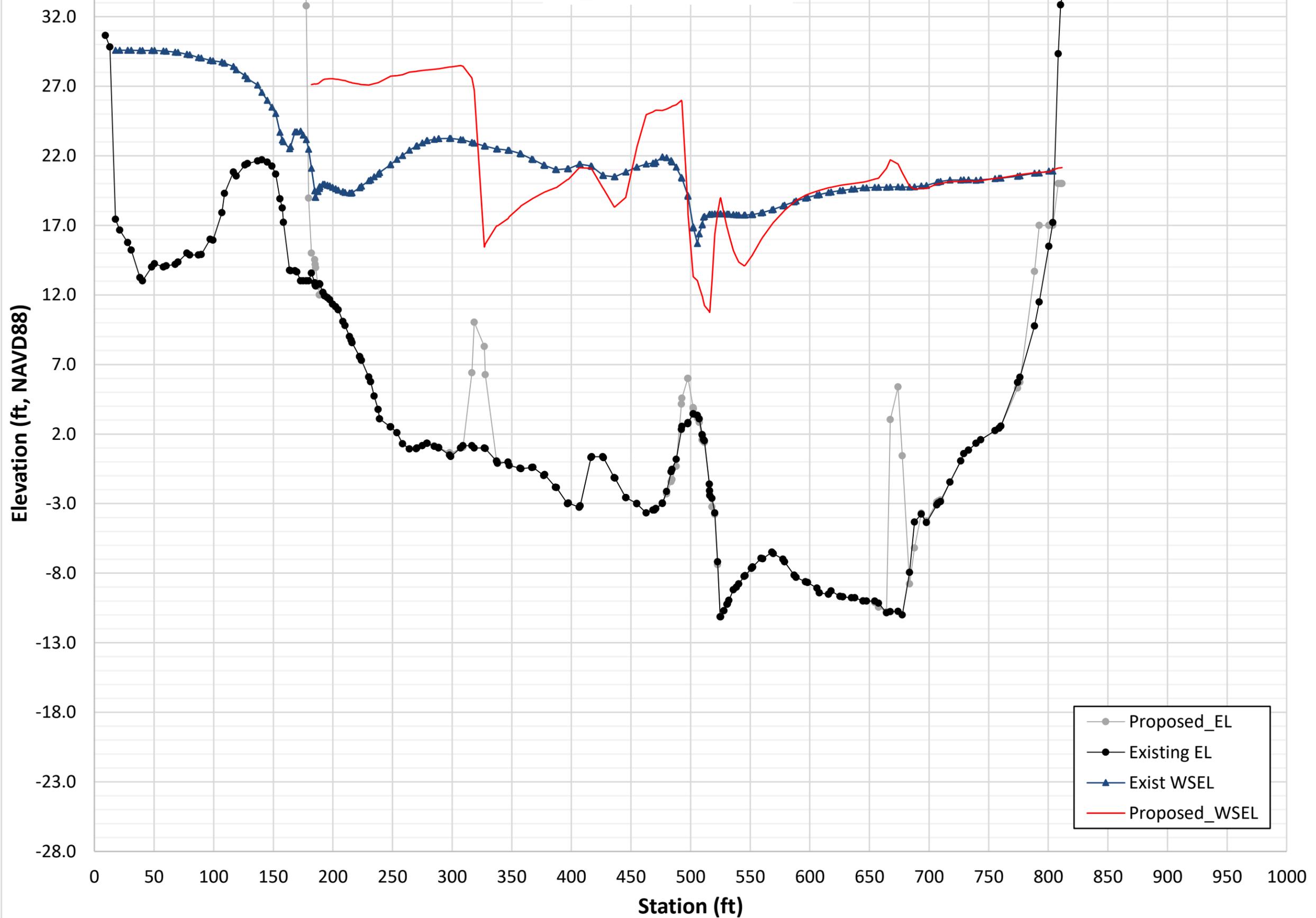


DS_PB (100-yr Event)



- Proposed_EL
- Existing EL
- Exist WSEL
- Proposed_WSEL

DS_EB (100-yr Event)

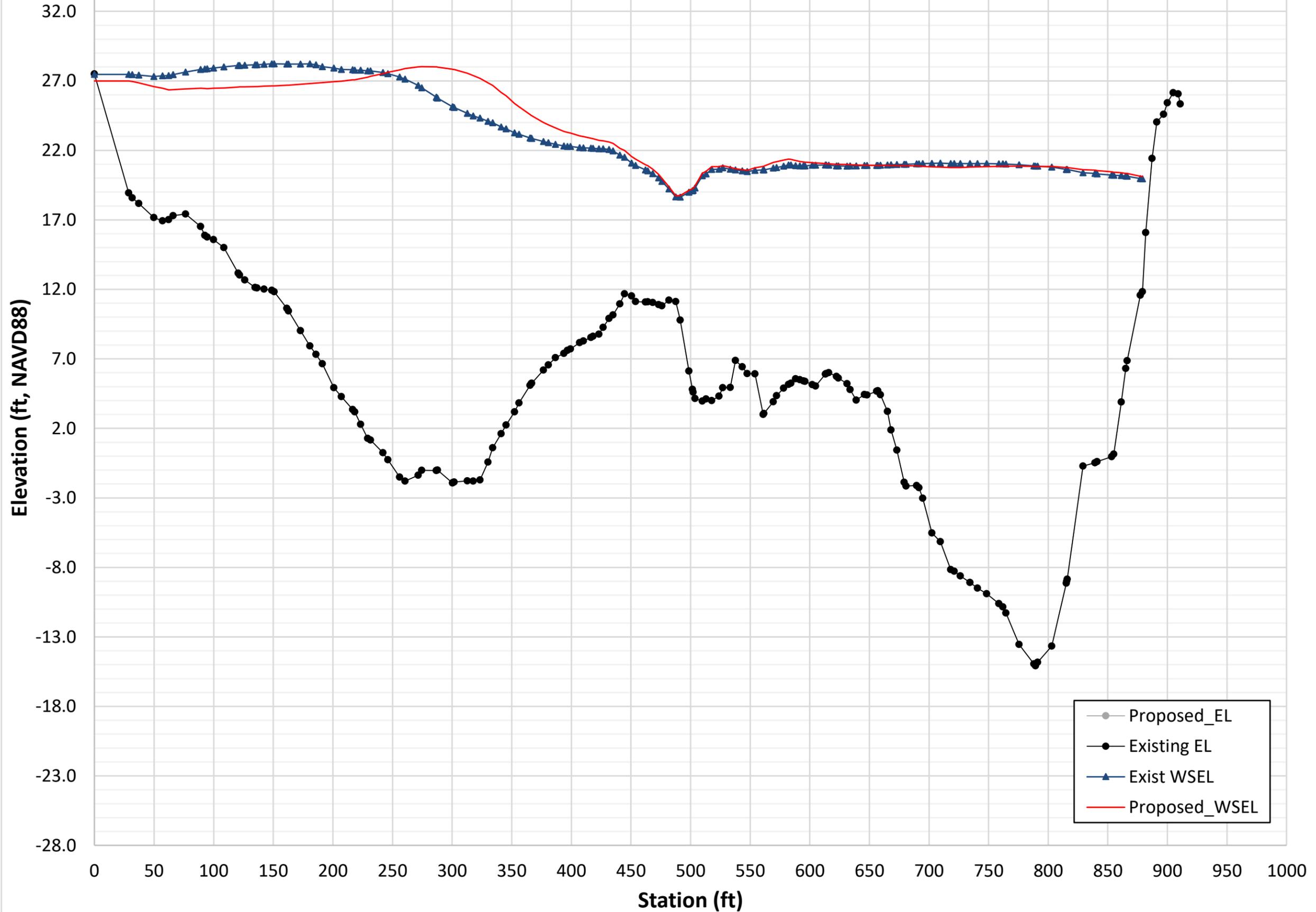


- Proposed_EL
- Existing EL
- Exist WSEL
- Proposed_WSEL

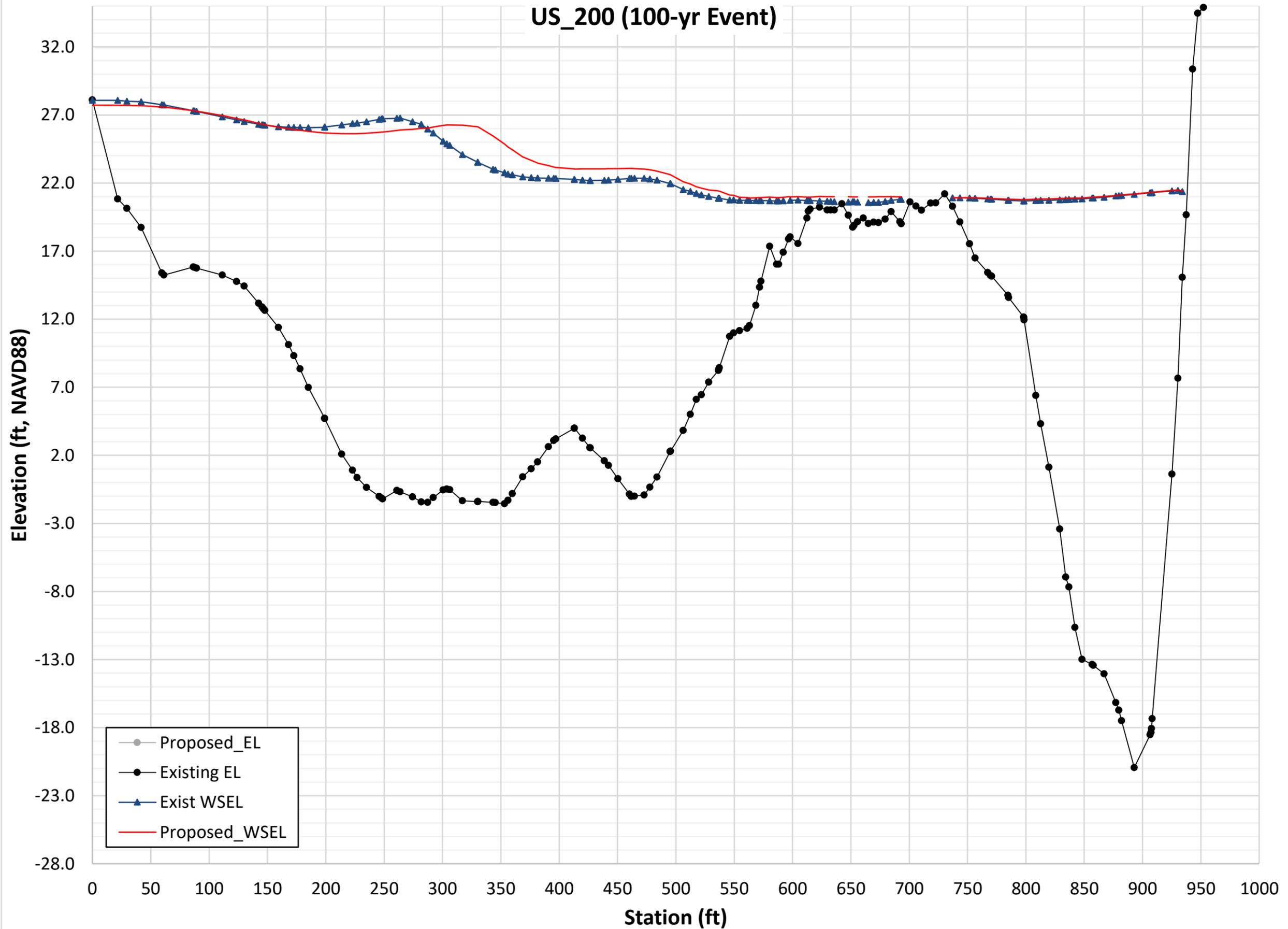
US_EB (100-yr Event)



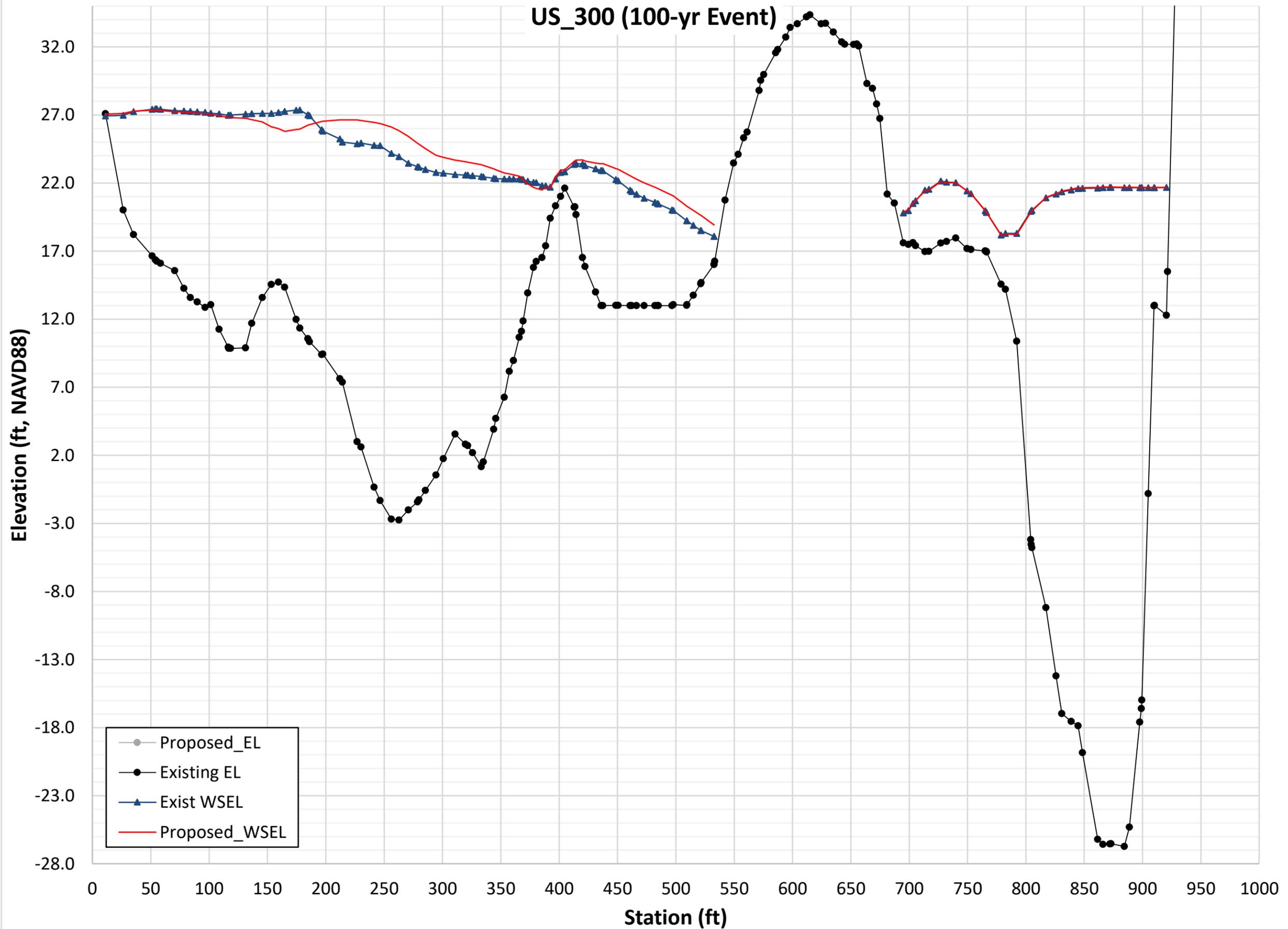
US_100 (100-yr Event)



US_200 (100-yr Event)



US_300 (100-yr Event)



US_400 (100-yr Event)

