# Appendix F:
# Utica Harbor Grading Analysis, Gomez and Sullivan, February 2015

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**Re: Hydraulic analysis for Utica Harbor development, effects of proposed re-grading.**

Gomez and Sullivan Engineers, D.P.C. is pleased to provide this report of our study and hydraulic analysis of the continuing phase of development of the Utica Harbor area.

## BACKGROUND

The previous screening-level assessment conducted by Gomez and Sullivan Engineers showed that development plans for Utica Harbor are within the Floodplain Fringe portion of the 100-year floodplain and avoid the restricted Regulatory Floodway portion. Although in general development is allowed within the Flood Fringe if it follows certain FEMA and local requirements, for larger developments or those involving considerable fill it may be required to demonstrate that the project will produce "no adverse effects" on neighboring properties by altering the floodplain. This report describes our hydraulic analysis comparing the base flood elevations for the before- and after-development cases, and is based on the modeling used to determine the currently effective FEMA base flood elevations. The after-development case accounts for the anticipated re-grading contours as provided to us for this study.

The FEMA Flood Insurance Study (FIS) and floodplain mapping for the City of Utica became effective in 2013. The MIKE11 modeling used to produce the FEMA mapping was provided to us by NYS DEC. The modeling data included initial modeling done by Michael Baker Inc. and the final model version with revisions carried out by RAMPP.

The model uses a constant discharge hydrograph with a duration of six days to insure steady flow. Flow is introduced at the upstream end of the model and as incremental flow increases downstream at representative tributary inflow locations. A rating curve is used as the boundary condition for the downstream end of the model. The final model reflects the summer, navigation operating conditions using the Canal Corporation's moveable gates to set navigation water surface elevations.

The model topography was developed using survey and a TIN derived from NYS LiDAR data collected for the flood mapping project. Interpolation was used for some overbank and some underwater locations. Three cross section geometry configurations were considered for the FEMA FIS model:

1. Calibration runs include levee reaches at some locations. At these locations the cross section area landward of the levee is excluded from the conveyance. A 1-percent- annual-chance model using this with-levees configuration was also run.
2. Cross section data without levee topography has all levees in the floodplain removed and area landward of the levee is used for conveyance. The without-levee configuration is used for the Multiple Profile (MP) modeling for the flood study including 10-, 2-, 1-, and 0.2-percent-annual-chance flood profile modeling.
3. The Floodway modeling has the without-levee topography; and all conveyance is restricted to the floodway encroachments.

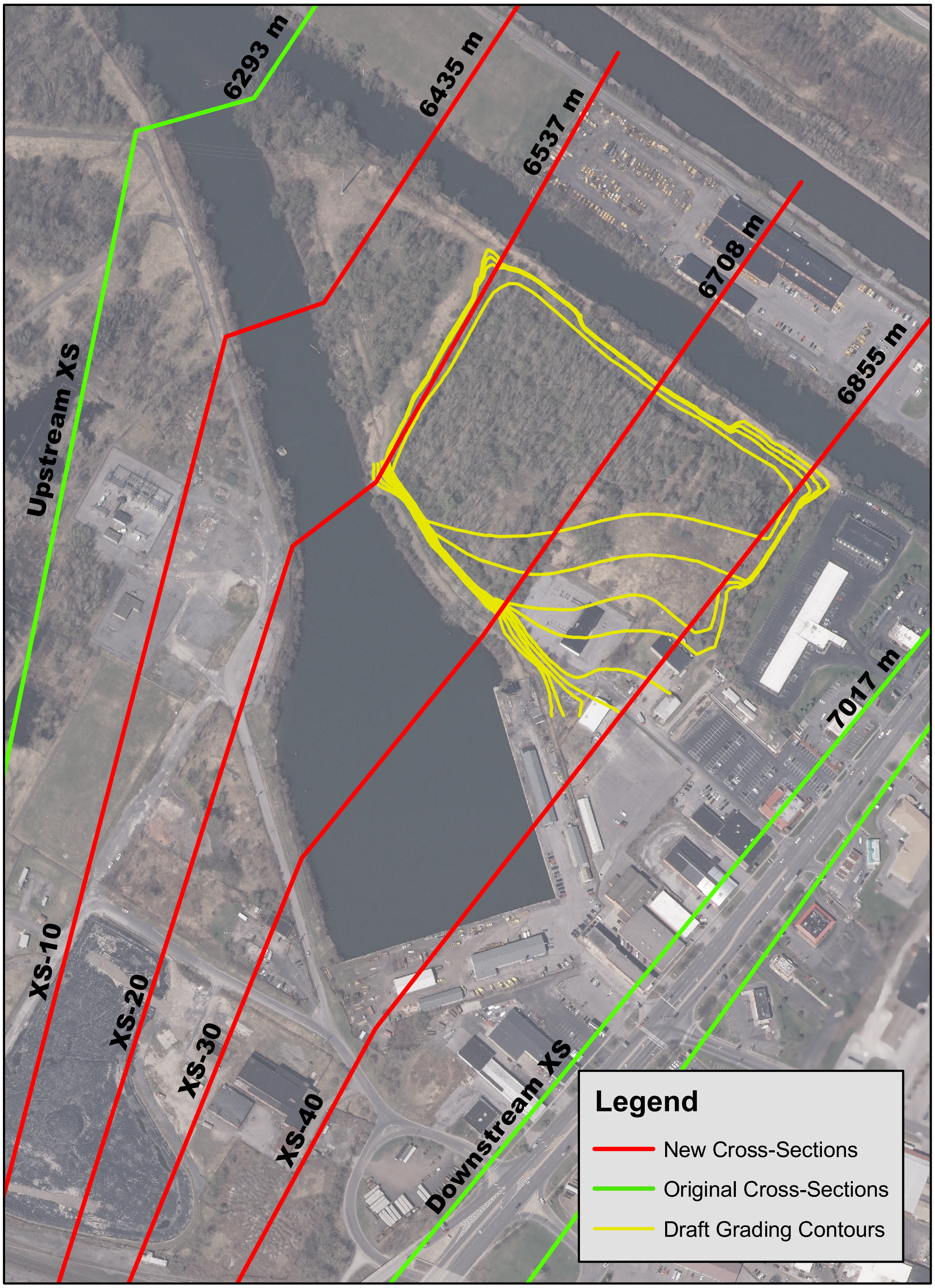
The Multiple Profile 1-percent-annual-chance flood model from the above geometry configuration number 2 is considered to be the FIS model used by FEMA to determine the Base Flood Elevation (BFE) and floodplain mapping for the 2013 FIS. A comparison of the model at the Utica Harbor cross sections with the FIS mapping as reported in the DFIRM database (DFIRM item S_XS viewable with GIS software) shows small differences in water surface elevation. These small differences of 0.1 to 0.2 cm (or 0.04 to 0.06 inches) are insignificant and may have originated from rounding and converting from meters to feet for reporting in the FIS. Therefore, this FIS model of the 1-percent annual-chance flood, also commonly known as the100-year return period flood, is used in the present study as the base model to determine the effects of the proposed grading on the flood levels at Utica Harbor.

## MODELING THE GRADING GEOMETRY FOR UTICA HARBOR

For investigation of the proposed grading, Utica Harbor was located in the 100-year flood model between two cross sections in the upstream portion of the MIKE11 model geometry. These two cross sections were considered the boundaries of our study. The area between these two bounding cross sections includes a former dredging-spoils disposal area consisting of a system of berms enclosing low ground. The proposed grading plan would both fill the low areas and cut down the higher berms. Modifications were made to the model between the two bounding cross sections, using additional cross sections to represent before- and after-grading geometries. The effects of these modifications were judged by comparing the before- and after-grading water surface elevations at the FIS model cross sections and at the added cross sections.

The model cross sections for this study are identified according to the MIKE11 convention by their “chainage,” the distance in meters from the upstream end of the model. For this study the two original bounding cross sections are an upstream cross section at chainage 6293 meters, and the downstream bounding cross section at chainage 7017 meters. Four new cross sections were added between these original bounding cross sections to model the details of the proposed grading at Utica Harbor. Table 1 identifies the new- and original-model cross sections in the study and their location by chainage.

Figure 1. Cross Sections for Utica Harbor Analysis of Proposed Grading



| Cross-Section | Chainage | Model |
|---|---|---|
| Upstream | 6293 | Original |
| XS 10 | 6435 | New |
| XS 20 | 6537 | New |
| XS 30 | 6708 | New |
| XS 40 | 6855 | New |
| Downstream | 7017 | Original |

**Table 1. Grading Study Cross-Sections**

These cross section and their locations relative to Utica Harbor are shown on Figure 1.

Inclusion of the new cross-sections allows two geometry configurations to be added to the original MIKE11 model. A Before-Grading geometry was constructed by extracting overbank geometry elevations for the new cross sections from the NYS LiDAR data at the locations indicated. An After-Grading geometry was constructed by adding elevation data extracted from the proposed grading contours to the Before-Grading new cross section data. The channel bottom elevations were copied from downstream adjoining cross-sections with similar channel geometry. The channel geometry of the upstream bounding cross section was wider because it crosses the opening of the harbor. The channel invert of the original model was at a constant depth throughout the studied area.

The new cross section XS-10 crosses the floodplain just upstream of the proposed grading, therefore the Before- and After-Grading geometry for XS-10 are identical. The remaining cross-sections, XS-20, XS-30, and XS-40 cross the proposed grading area and produce the change between the Before-Grading and the After-Grading test geometries. Note that an adjustment of the storage width was made in the Before-Grading geometry as XS-30 and XS-40 to account for the anticipated blocking of flow by some higher topography upstream in XS-20. This higher topography was to be leveled in the proposed grading plan, and so the adjustment was not needed for the After-Grading geometry. An additional test run was conducted for an alternative before-grading scenario. In this alternative scenario the berms surrounding the dredging-spoils areas are removed from the model geometry. This considers that the integrity of the berms and their ability to withstand flood conditions is unknown and that they could be removed by erosion during a severe flood. This alternative before-grading geometry can be considered as a worst-case scenario when comparing with the after-grading model configuration.

## MODEL RUNS AND RESULTS

The before-grading modeling results (water surface elevations for the 100-year flood) were initially compared to the original FIS modeling for validation at the two original bounding cross sections. This comparison is presented in Table 2.

| Model | Upstream XS-6293 | Downstream XS-7017 |
|---|---|---|
| FIS model | 125. 260 m | 125. 189 m |
| Before-Grading, with berms | 125.262 m | 125.204 m |
| Before-Grading alternative, without berms | 125.262 m | 125.204 m |
| Difference from FIS in meters (both alternatives) | +0.002 m | +0.015 m |
| Difference from FIS in feet (both alternatives) | +0.007 ft | +0.049 ft |

**Table 2. Before-Grading and FIS modeled water surface elevations for 100-year flooding at the upstream and downstream bounding cross-sections.**

Table 2, comparing the Before-Grading results with the original FIS model shows the effect of adding the intermediate topography using the four intermediate cross-sections. The water surface elevations at the bounding cross-sections increased by small amounts over the original FIS model geometry; the maximum change of 0.59 inches (0.049 ft.) is shown at the downstream cross section. Both of the before-grading scenarios showed the same result when compared to the FIS model. This result shows that for both scenarios the addition of cross sections representing the un-graded topography did not significantly change the water surface elevation compared to the original FIS model. Therefore the two Before-Grading geometries were used to represent the un-graded topography.

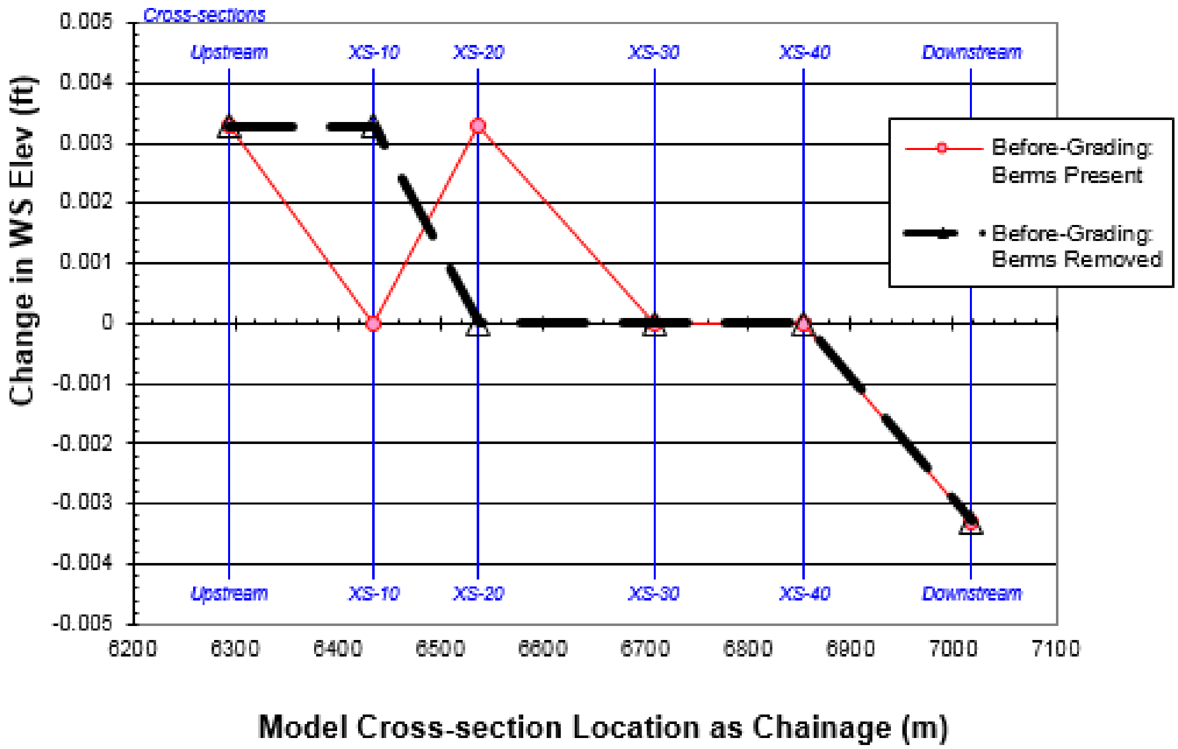
In Table 3 the After-Grading model results are compared to both the Before-Grading (with berms) and the alternative Before-Grading (without berms) models to show the effects of the proposed grading at the added cross-sections.

| Model | Upstream XS-6293 | XS-10 6435 | XS-20 6537 | XS-30 6708 | XS-40 6855 | Dwnstream XS-7017 |
|---|---|---|---|---|---|---|
| Before-Grading with berms (m) | 125.262 | 125.252 | 125.243 | 125.237 | 125.227 | 125.204 |
| Before-Grading without berms (m) | 125.262 | 125.251 | 125.244 | 125.237 | 125.227 | 125.204 |
| After-Grading (m) | 125.263 | 125.252 | 125.244 | 125.237 | 125.227 | 125.203 |
| Difference with berms (ft) | +0.003 | 0.00 | +0.003 | 0.00 | 0.00 | -0.003 |
| Difference without berms (ft) | +0.003 | +0.003 | +0.003 | 0.00 | 0.00 | -0.003 |

**Table 3. Comparison of water surface elevations of Before-Grading and After-Grading models.**

Table 3 shows that the proposed grading produces modeled water surface elevation changes of at most a fraction of a foot. The with- and without-berms scenarios, although slightly different, both show equally small differences in comparison to the After-Grading model. These results are also presented graphically on Figure 2.

**Figure 2. Water Surface Elevation Change After Grading**




Based on these results the proposed grading at Utica Harbor would have a negligible effect on the floodplain water surface elevation for the 1-percent-annual-chance (100-year) flood.

Should you have any questions or require additional information, please call me at (315) 724 - 4860.

Very Truly Yours,

Jerry A. Gomez, P.E.
Principal