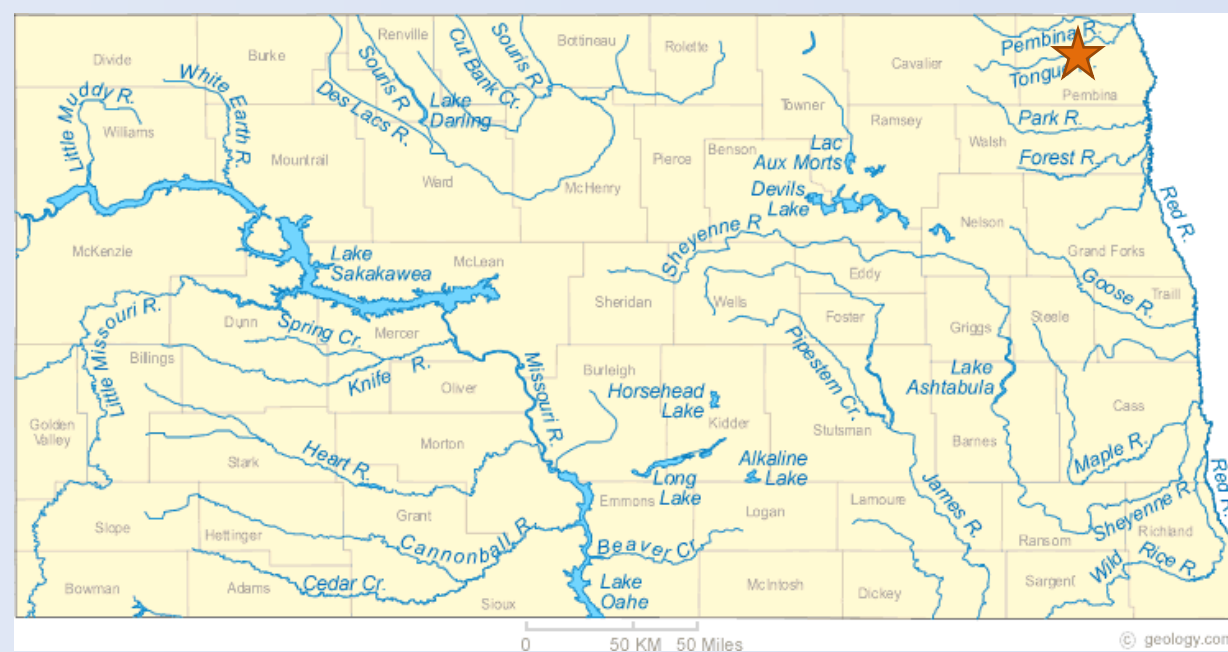




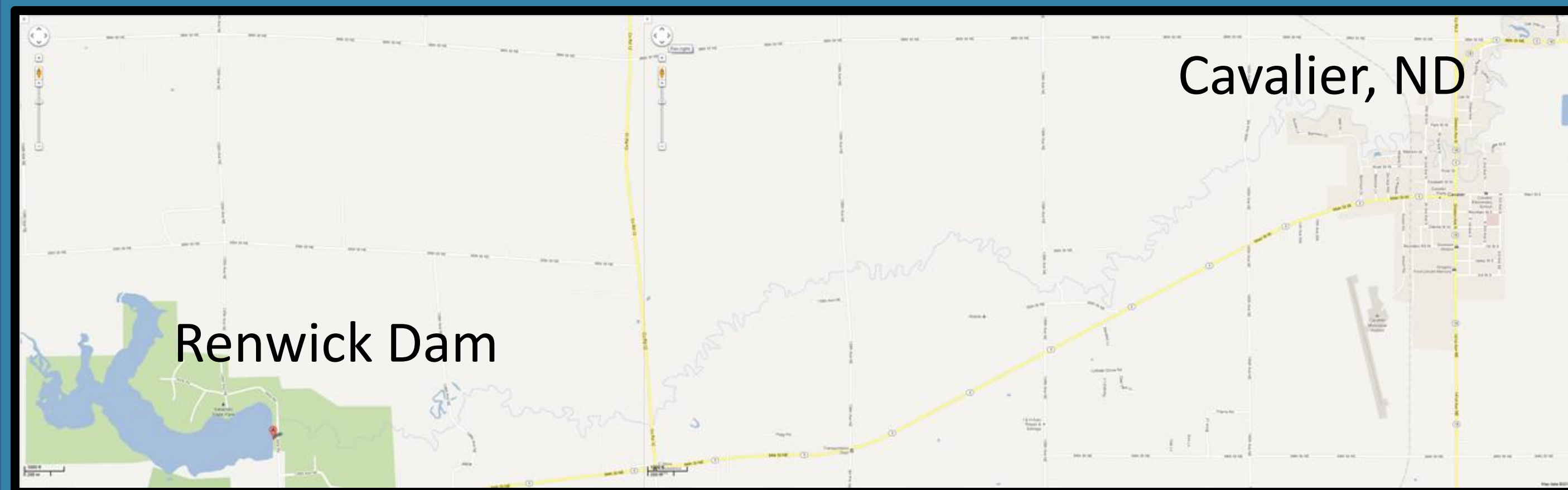
Tongue River Hydraulic Modeling and Stream Bank Stability Assessment for the City of Cavalier, ND



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Introduction



Tongue River from the Renwick Dam to Cavalier, ND.

Recently land owners along the Tongue River in Cavalier, ND have been experiencing severe erosion of the banks. The Red River Basin Riparian Project group has been working with the landowners on an individual basis.



Erosion on the Tongue River in Cavalier, ND

A United States Geological Survey station is located 300 ft downstream of the Renwick Dam which was installed in 1961 due to the severe flooding in 1950. The peak streamflow since 1961 occurred in 2009 and is approximately equivalent to a 25 year return period.

USGS Peak Streamflow for Tongue River

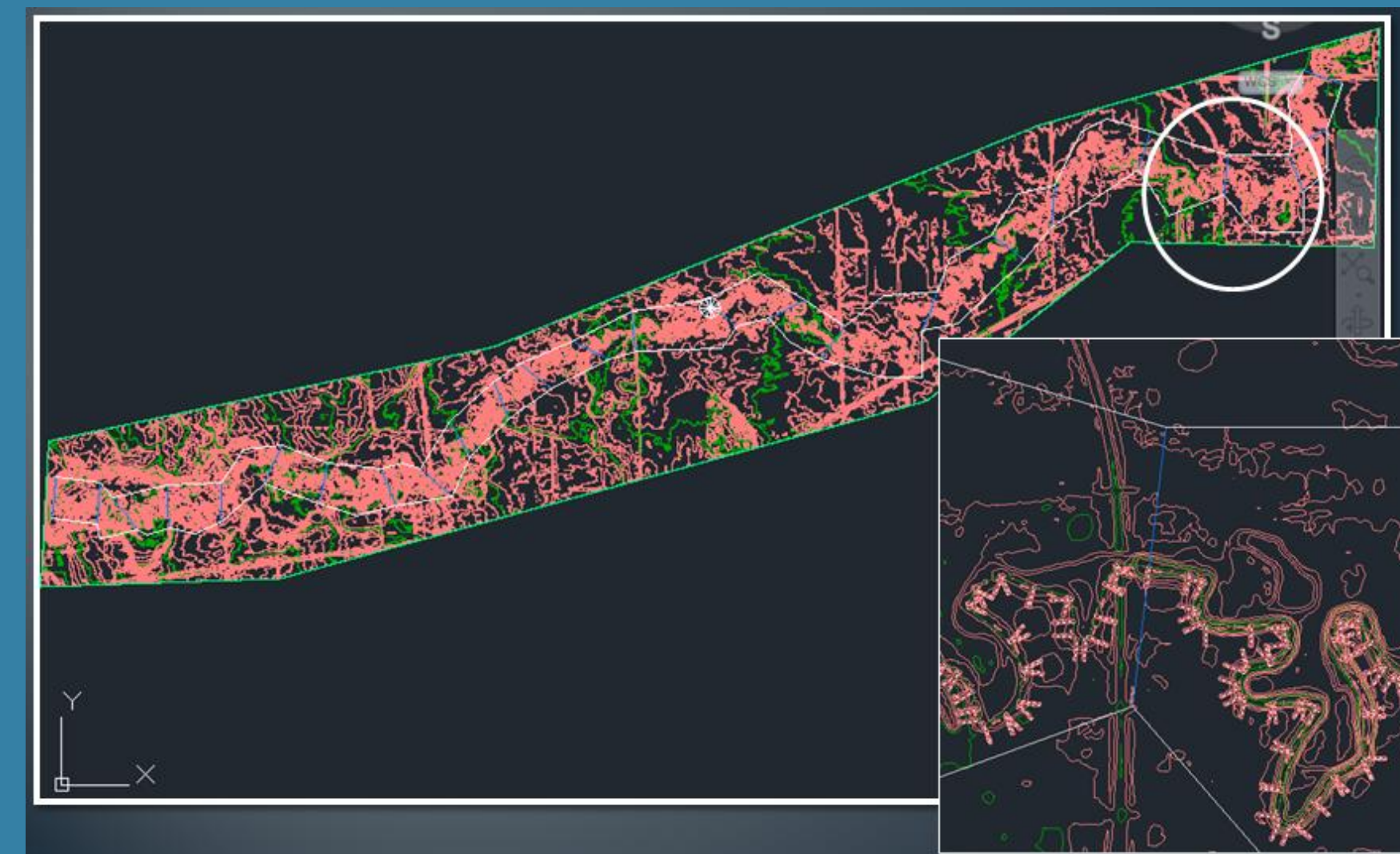
Water Year	Date	Gage Height (ft)	Streamflow (cfs)
1950	April 18	48.70	11,800
1961	March 27	4.56	60.0
1979	April 22	16.75	900
2009	April 16	17.12	1,150

Objectives

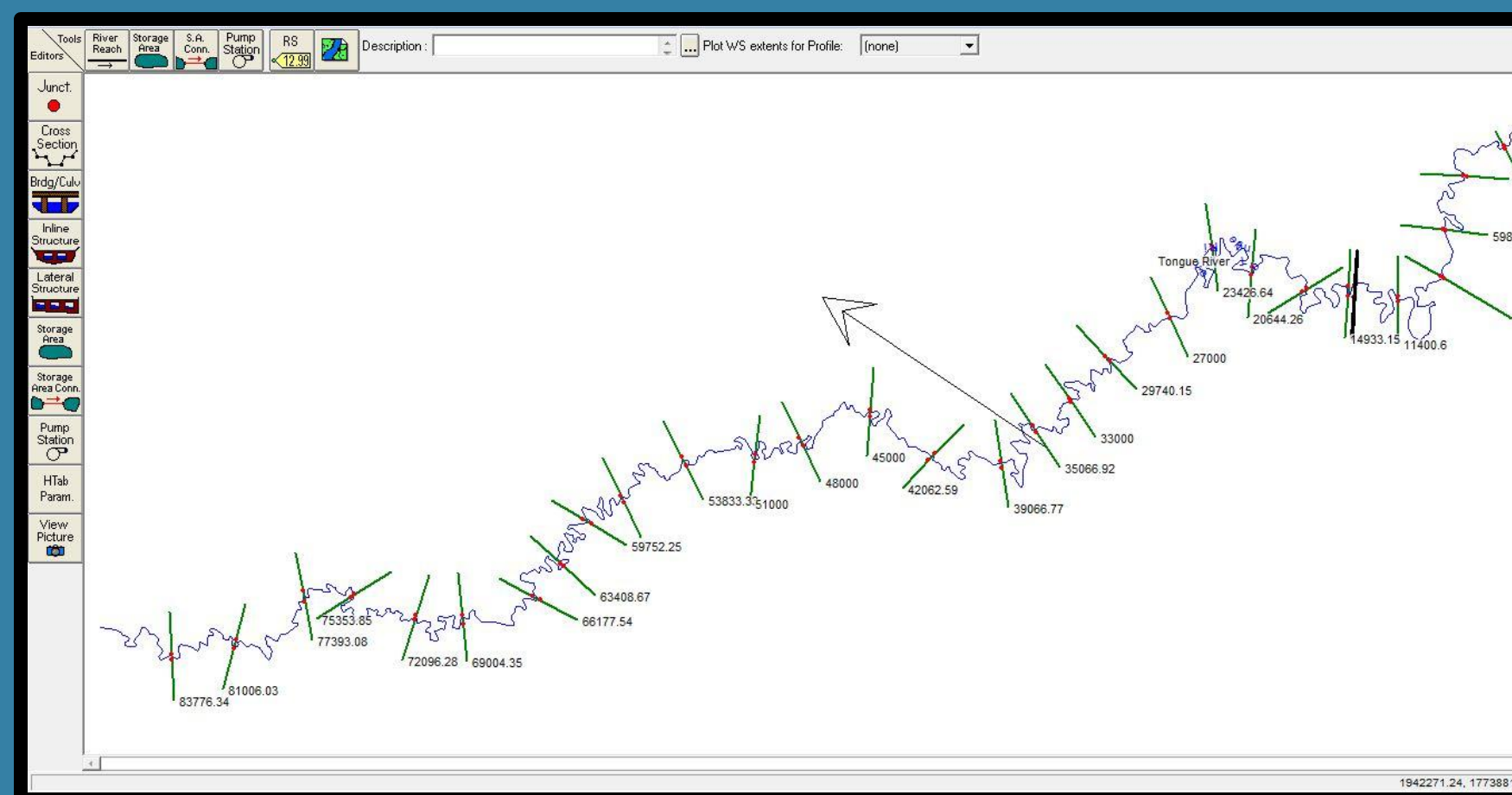
- Model the hydraulics of the Tongue River
- Provide an assessment framework for active stream bank erosions found along a significant stretch of the river reaches in the city of Cavalier, ND.
- Perform a short term assessment of the feasibility of a city-wide solution in place of the individual modifications which are currently taking place.

Method

In order to create a surface, Light Detection and Radar (LiDAR) data was collected from the Red River Basin Commission website. This was opened in AutoCAD as shown and an alignment was created. This file could then be exported into Hydrologic Engineering Centers River Analysis System (HEC-RAS). After the LiDAR data was collected, a small condemned railroad dam within the city was replaced with a series of three rock weirs.



Tongue River LiDAR Data in AutoCAD

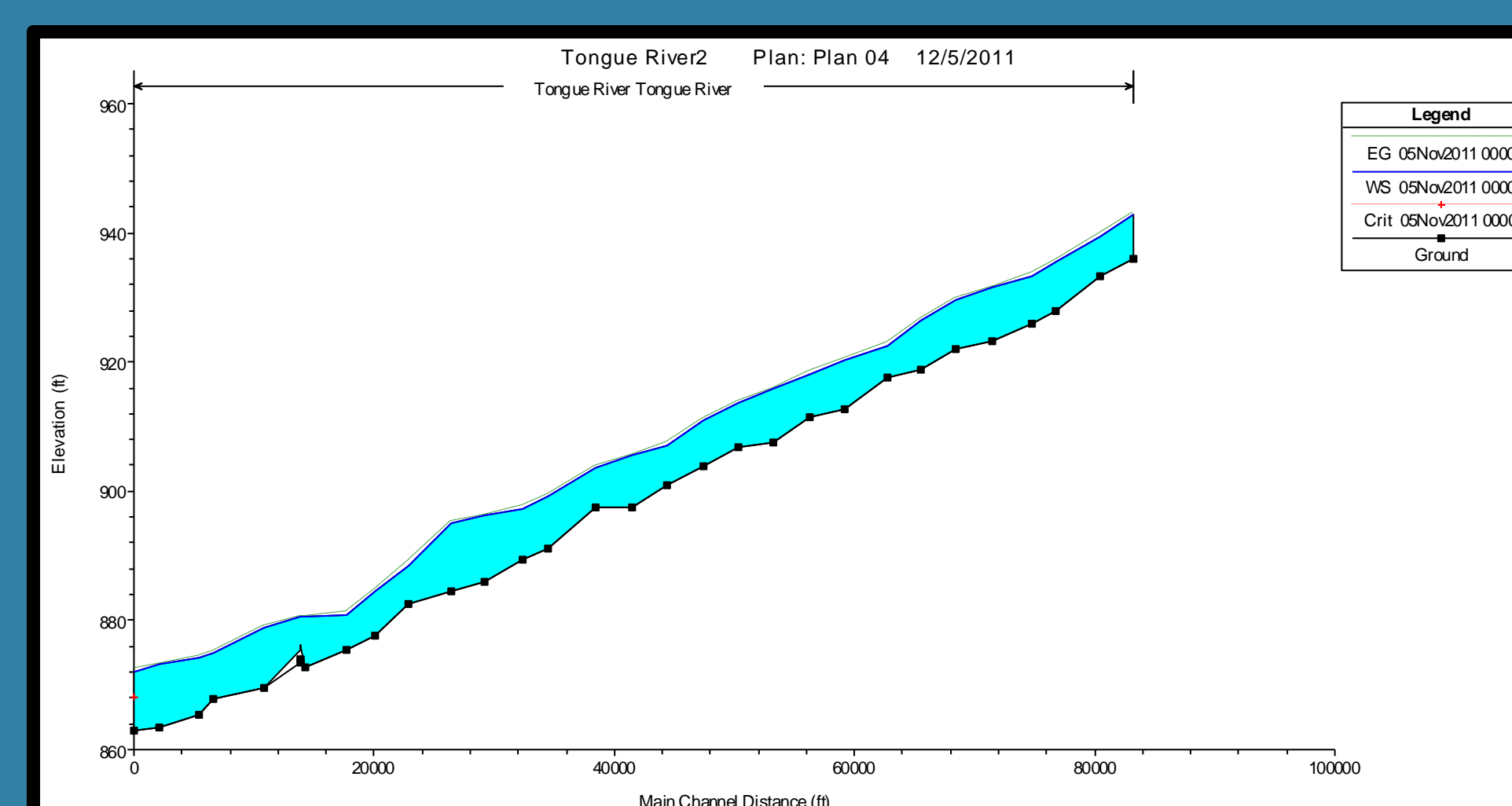


HEC-RAS Geometry Data for Tongue River

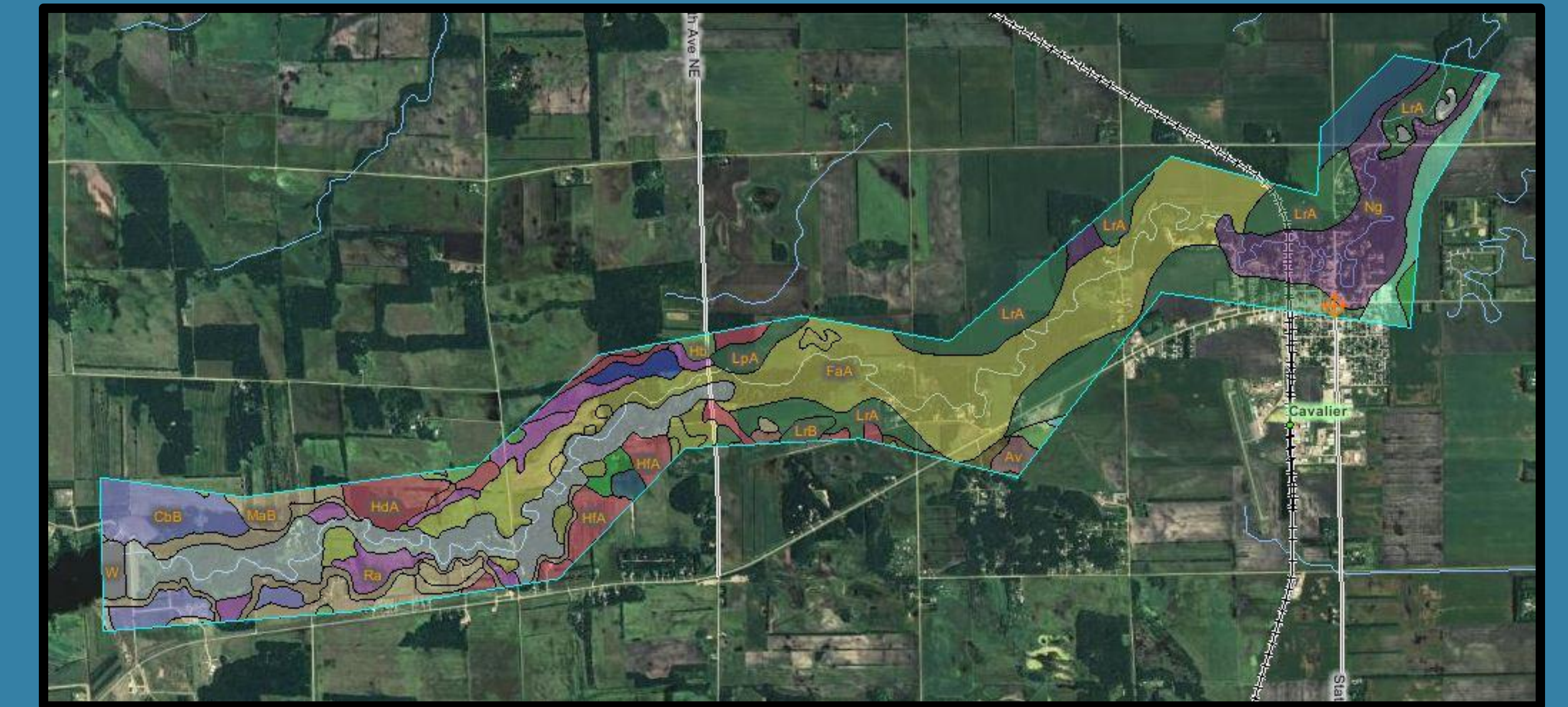


Left: Rock Weirs Right: Using a sledge hammer to create a hole in the ice to place the surveying rod

Survey data of the weir cross sections as well as several other cross sections within town were entered into HEC-RAS and interpolated to create an estimated bed surface.



Water Surface Profile with estimated bed surface in HEC-RAS
Natural Resources Conservation Service (NRCS) Web Soil Survey Data was then collected in order to create a gradation for the model.



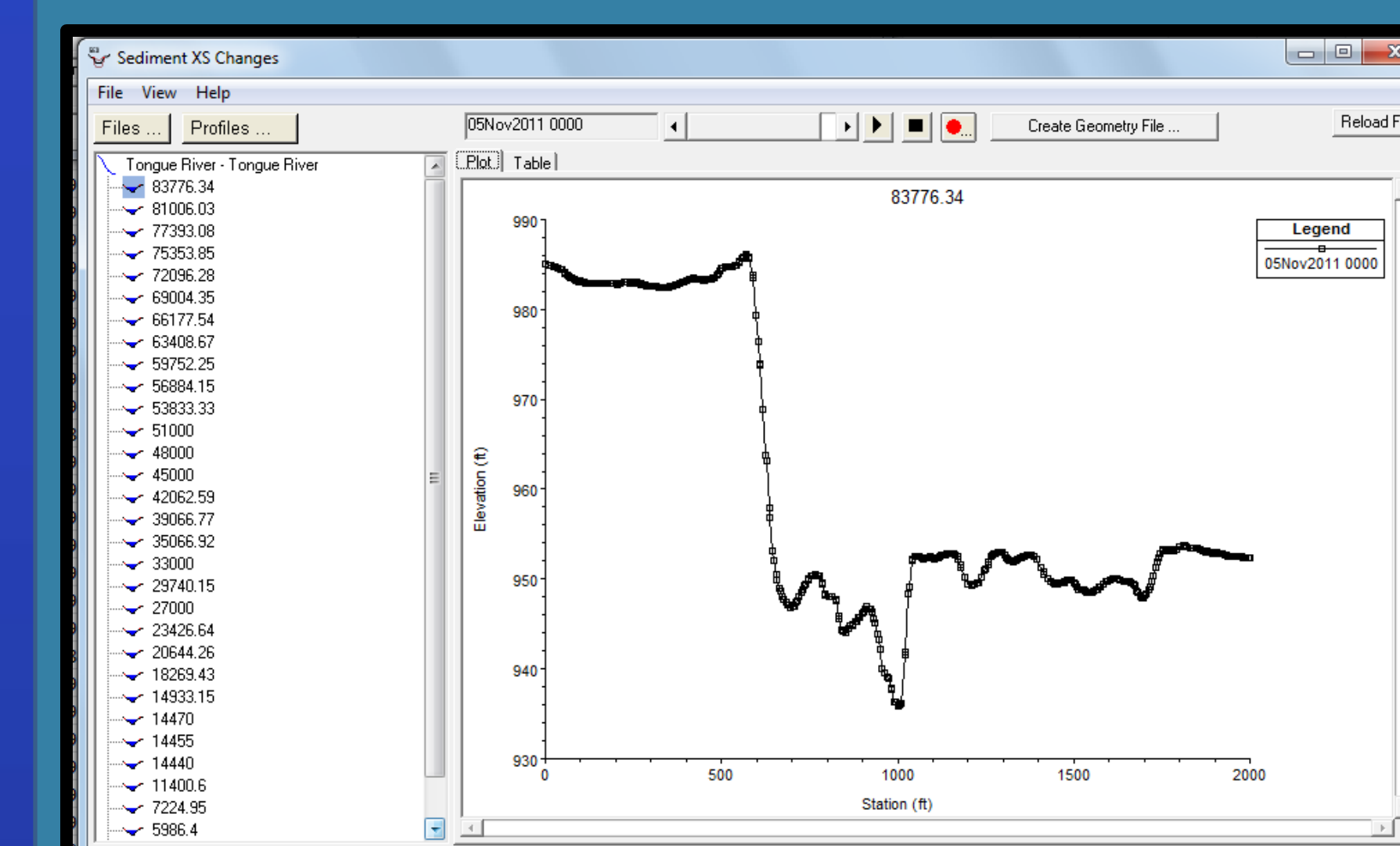
NRCS Web Soil Survey of Tongue River

Soil Region	Description
LvD (grey)	La Prairie Fairdale Silty Clay Loam
FaA (yellow)	Fairdale Silty Clay Loam
Ng (purple)	Neché Silty Clay Loam

It was found to all be silty clay loam and a d_{50} value and gradation were estimated for the preliminary model.

Conclusion

The existing model needs to be refined in order to better represent the Tongue River. In order to do this, a surveying field trip has been planned for the end of March 2012 to collect more cross sections, samples for gradations, and sediment loads. When this is entered into the model, a sediment cross section graph will be created similar to the one shown here.



Screen Shot of Sediment Cross Section Changes

Once the model is complete, it will be used to analyze and compare the current methods of erosion protection to decide whether a city-wide erosion solution is feasible.

Acknowledgements

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