

# Watertown - Building the Connectivity between People and their River with minimal impact upstream of the dam



CEGE 8602: Stream Restoration Practice; Instructors: Chris Paola and Vaughan Voller.  
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## 1.- Problem

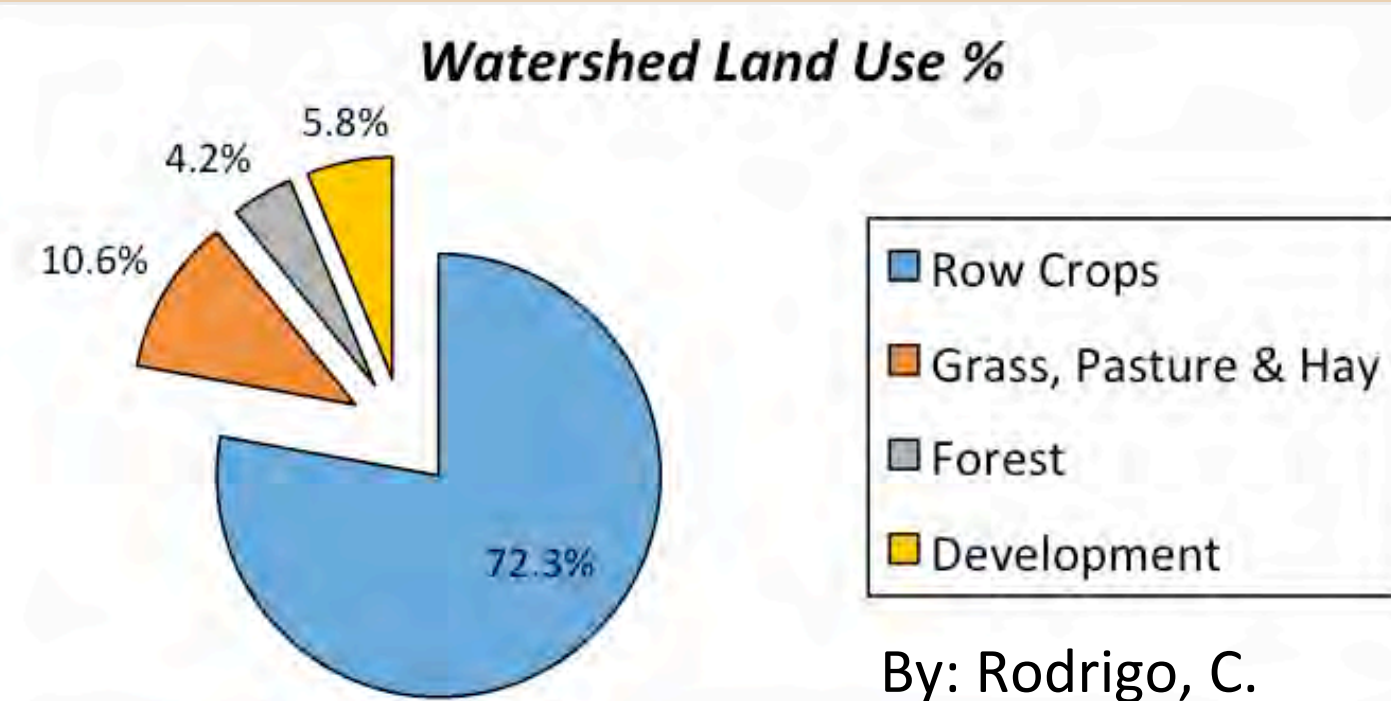
A stream restoration program has been proposed on the South Fork of the Crow River to restore biological connectivity in the river. Most importantly, the restoration project is aimed at restoring fish passage beyond the small dam and providing recreation opportunities. This dam is the last remaining barrier in the South Fork of the Crow River.



Current condition of the Watertown Dam in 2015. By: Garcia-Serrana, M.

## 2.- Background

### Watershed Land Use



By: Rodrigo, C.

### Data collection



Flow tracker and Wolman pebble count



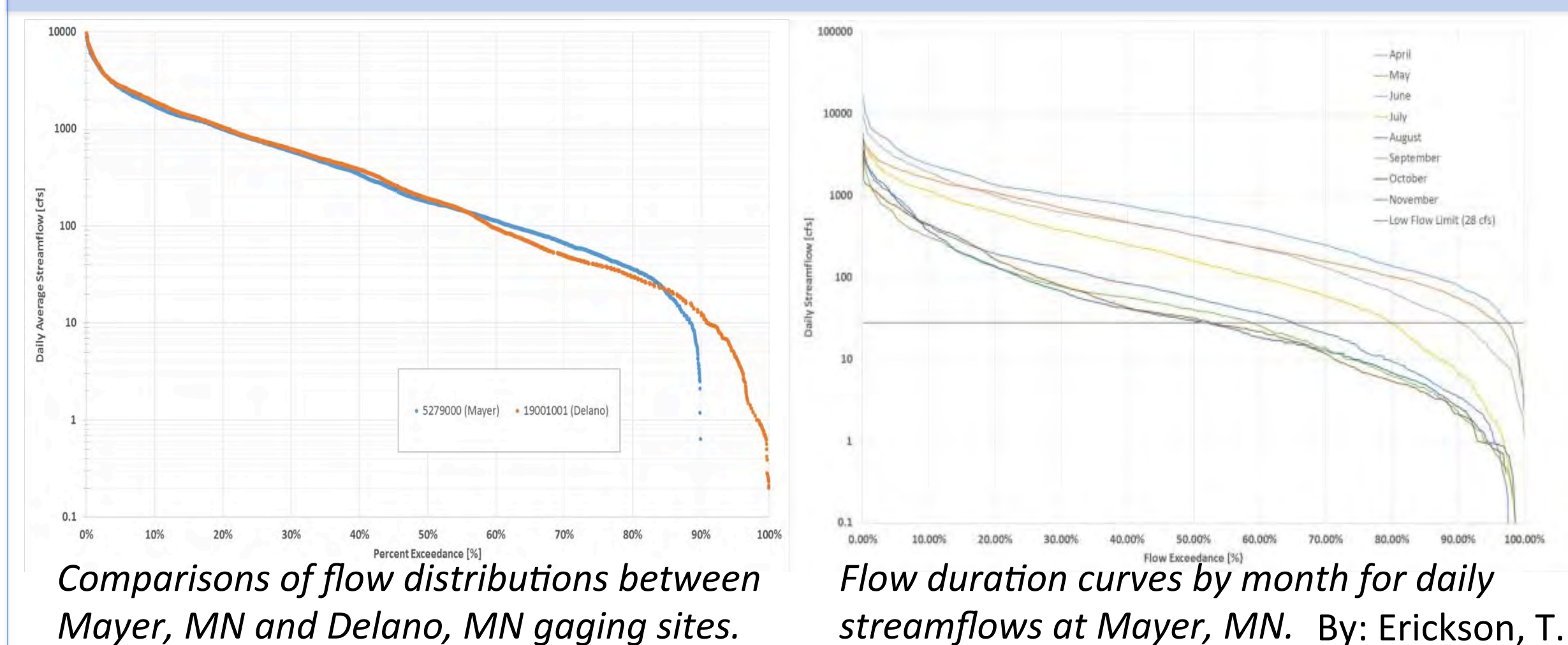
DO measurements. By: Takbiri, Z.

### Historical Data

- ✓ The original intent of the dam was to provide more lentic habitat for fish and access for fishing. Any benefit from the dam for flood mitigation would be limited.
- ✓ In order to create a lower maintenance structure that retains the upstream pool, a concrete weir was constructed in 1988.

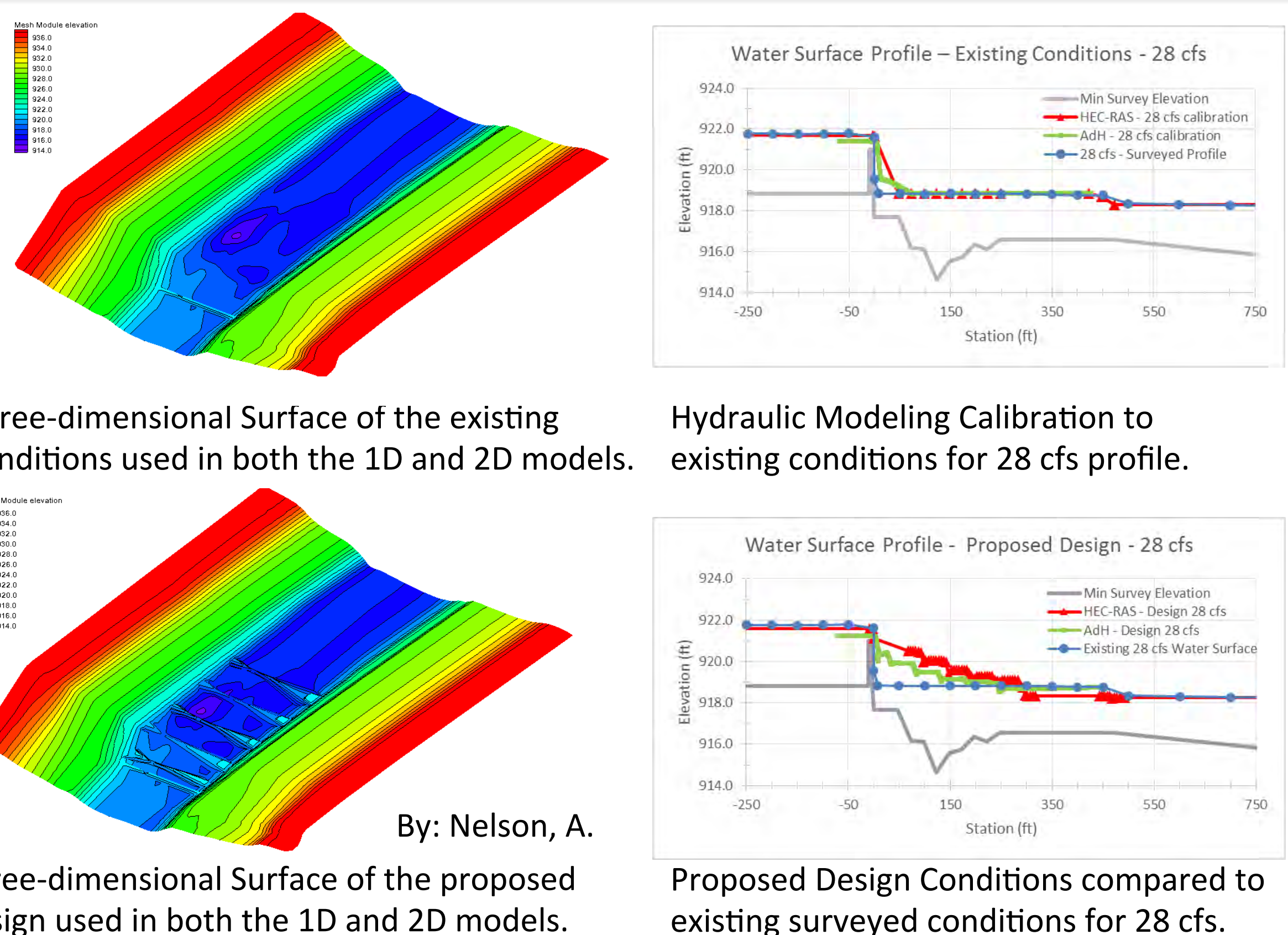
## 3.- Method

### Hydrologic Modeling



Comparisons of flow distributions between Mayer, MN and Delano, MN gaging sites. Flow duration curves by month for daily streamflows at Mayer, MN. By: Erickson, T.

### Hydraulic Modeling



Three-dimensional Surface of the existing conditions used in both the 1D and 2D models. Hydraulic Modeling Calibration to existing conditions for 28 cfs profile. Three-dimensional Surface of the proposed design used in both the 1D and 2D models. Proposed Design Conditions compared to existing surveyed conditions for 28 cfs.

### Erosion and Sediment Transport

	Summary of bedload (m <sup>2</sup> /s)	Meyer-Peter & Müller formula	Ashida-Michiue	Parker (1979) fit to Einstein (1950)
○ Bedload				
○ Suspended load (Van Rijn,1984): Proposed design would increase 5.5% the load.		0.01	0.02	0.01
○ Scour downstream of deflectors (see figure)		0.08	0.12	0.09

Estimate annual bank erosion - Combining Bank Erosion Hazard Index and Near Bank Stress ratings to predict annual erosion rate from slope on right bank: 0.06 tons/foot/year and 132 cubic feet per year

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## 4.- Findings

### Fish Habitat

- By restoring fish passage in Watertown we will reconnect 96 miles of stream.
- Modifications to the dam will allow 55% of fish species to pass through the dam at 28 and 575 cfs

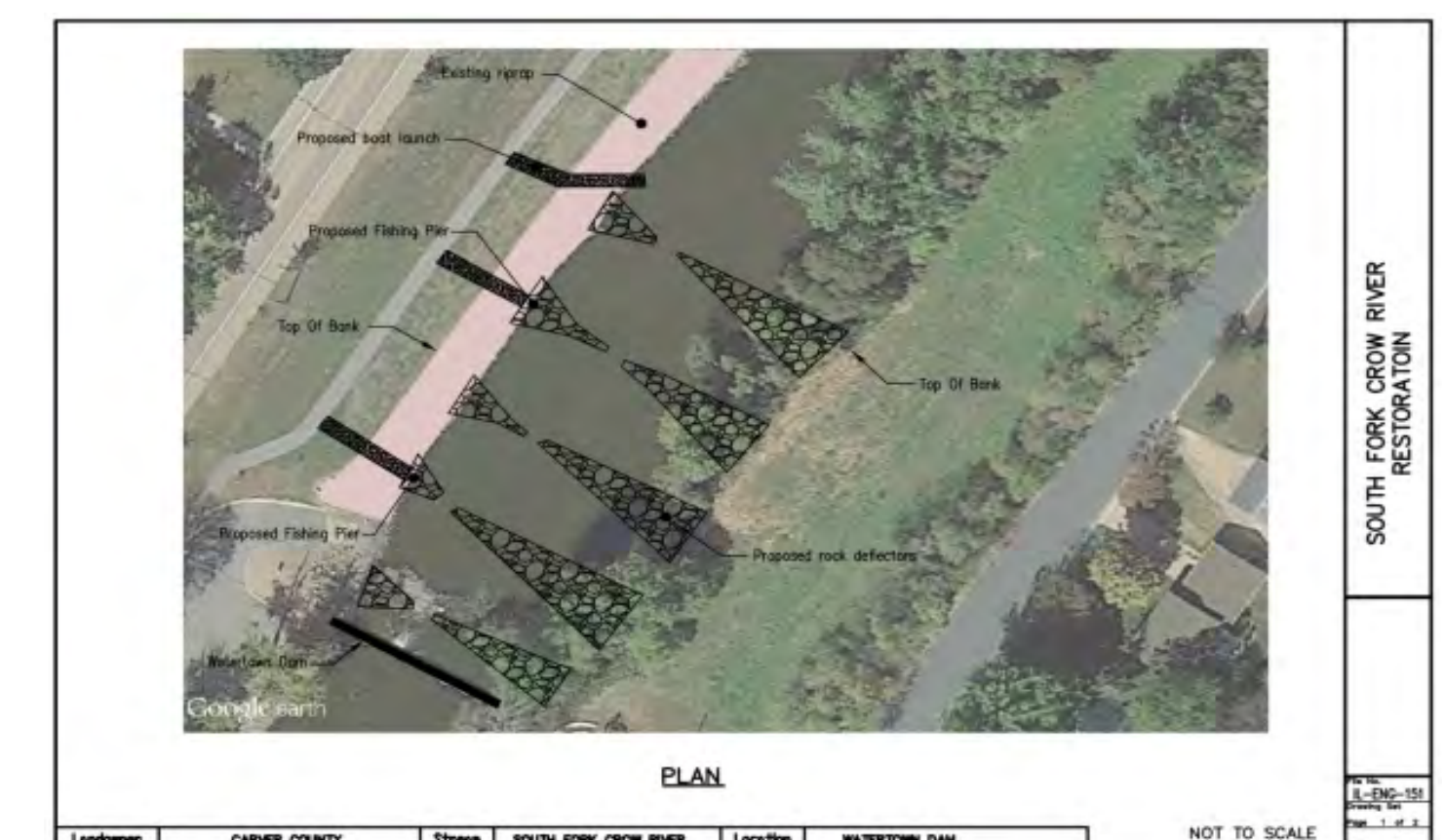
### Whitewater Design

- Design is a balance between allowing fish passage and providing an enjoyable canoeing experience.
- Rock deflectors will have about 6 ft of space to allow for canoe passage.
- Main channel will shift left and right for an easy challenge

### Post-construction Monitoring Plan

- First 2 years semi-annual inspections, next 3 years annual inspections + post heavy rain inspections.
- Objectives to be checked: 1- enhanced fish habitat, 2- connectivity between upstream and downstream, 3- keep upstream water elevation 4-maintain structure stability.

## 5.- Recommendations



By: Frye, M.

The proposed configuration with 5 double deflectors allows fish passage for flows as low as the calibrated 28 cfs profile. Configurations with more deflectors could allow fish passage for even lower flows. Our balanced design allows fish passage under most conditions as well as an enjoyable family friendly canoe or kayak paddling experience.

## References

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