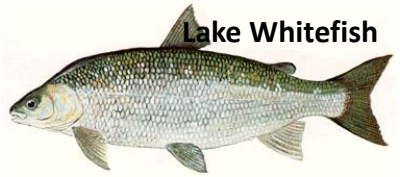
# Little Rapids Habitat Restoration
# St. Marys River AOC

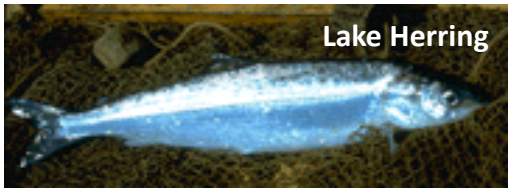
Engineering and Design Project Update
November 13,2012



# Why Restore the Rapids?

- Rapids are productive habitat for a number of important species.
- Much of the historic rapids in the St. Marys River have been destroyed.
- Habitat is limiting fishery populations in the St. Marys River.
- An improved fishery will have economic benefits.







1. Main Rapids
2. Little Rapids
3. Rapids btwn Sugar Island and Neebish Island
4. West of Neebish Island

# Frequently Asked Questions?

**Q1:** What will be the impact on river flows? Will flow and/ or water level change in the main shipping channel, through the little rapids area and north of the island?

**Answer:** The flow diverted through the lower rapids is approximately 4% of total flow above the rapids. 95% of this flow is from the shipping channel. The diverted flow volume is small compared to total flow. Thus, changes to water depths and velocity in the shipping channel and Lake George Channel are small (<0.1 ft and <0.1 ft/s at low flows)

**Q2:** How will flow changes impact shipping, water quality, ice formation (in the shipping channel and within the little rapids area), the ferry, and the causeway.

**Answer:** Since flow, depth and velocity changes in the Shipping Channel and Lake George channel are very small conditions related to water quality and ice formation will not change. In the Little Rapids area velocities increase (this is the goal of the project). This will reduce ice formation in the rapids area. Velocities near the ferry dock are the same with and without modifications to the causeway and thus no change related to ice in this area is predicted.

**Q3:** How will this project affect the North End WWTP issues?

**Answer:** The water diverted through the rapids lessens flow in the Lake George channel, but does not "pull" water from near the WWTP back to the rapids. Thus, conditions in the Little Rapids area will not change from as they currently exist.

**Q4:** How much will O&M be on the bridge and who will pay for it? **Answer:** TBD. Once the preferred alternative is selected O&M will be estimated.

# Frequently Asked Questions?

**Q5:** How large of a bridge is expected? **Answer:** We are considering spans from 400 feet to 1,000 feet

**Q6:** Traffic maintenance during construction is critical to Island Residents. How will this be done?

**Answer:** One lane of traffic will be maintained during construction. Queuing and timing of traffic will be coordinated with ferry operations. Construction is expected to take 6 - 8 months.

**Q7:** The lower little rapids is very nice swimming during the summer and because of solid ice supports ice skating and snowshoeing during the summer. Will the project impact these activities?

**Answer:** The project will mostly increase velocities in the main channel of the lower little rapids. Near shore areas will change less. Thus, impacts to swimming near shore will be minimally impacted and swimmers in the main channel will have to contend with increased velocities and flow. Increased velocities and flow will also reduce ice formation in this area.

**Q8:** Many residents get their drinking water from Little Rapids Bay. Will the project impact their water supply?

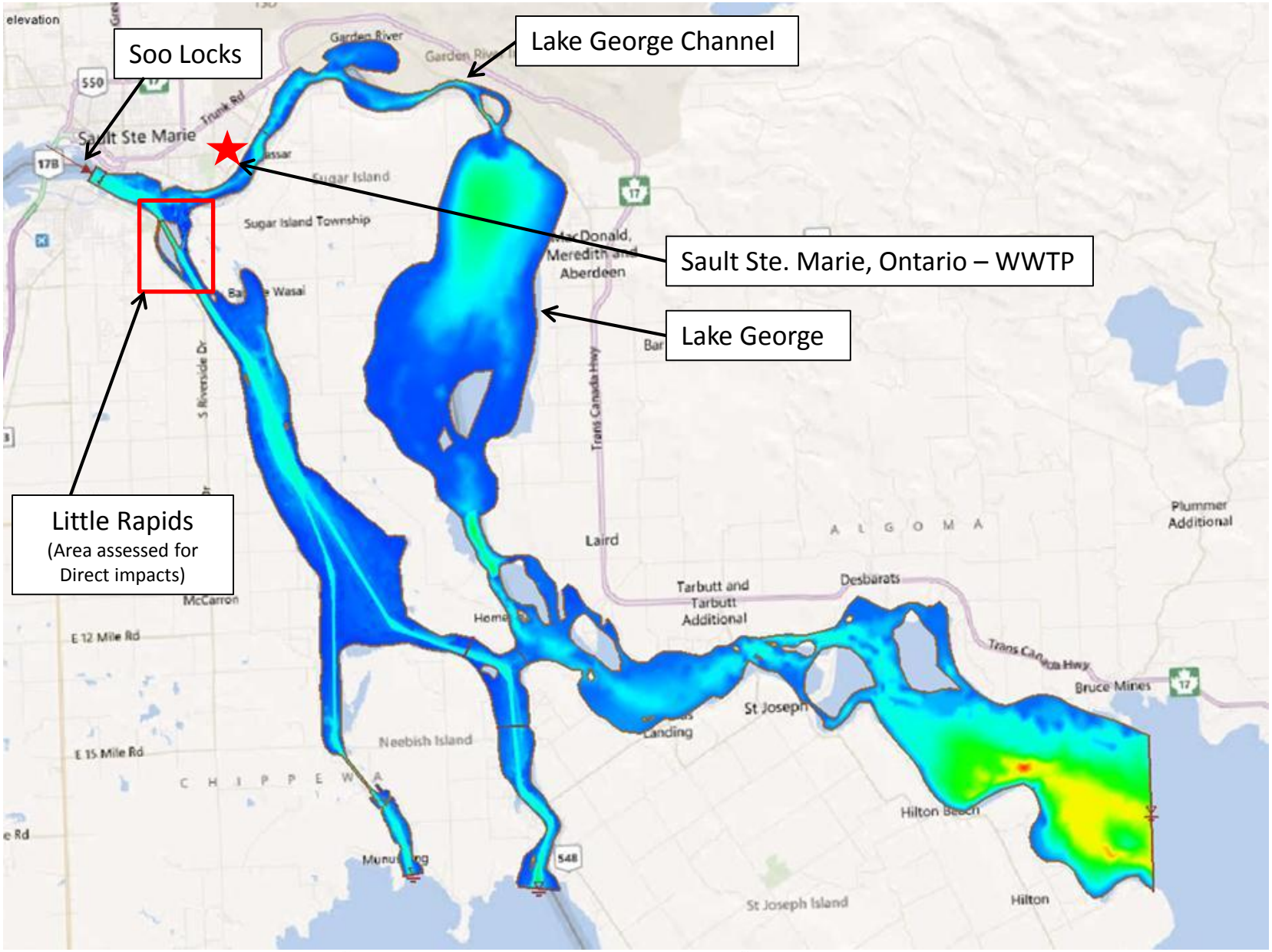
**Answer:** No. Changes to flow and velocity will not affect drinking water supply.

**Q9:** Water levels are low now, but were historically higher. Will the project assess impacts at other lake levels?

**Answer:** The project assessed impacts at 4 lake level and flow conditions. These included historically low (42,000 cfs) and high (127,000 cfs) levels, biologically important (82,000 cfs) flows and an average of recent conditions (62,000 cfs).

# Analysis Steps

1. Identify project study area
2. Identify surrogate restoration metrics for habitat
3. Identify alternatives for evaluation
4. Simulate flow, velocity and depth for each alternative
5. Evaluate impacts of each alternative
6. Develop costs for each alternative
7. Select preferred alternative
8. Develop detailed design plans for preferred alternative

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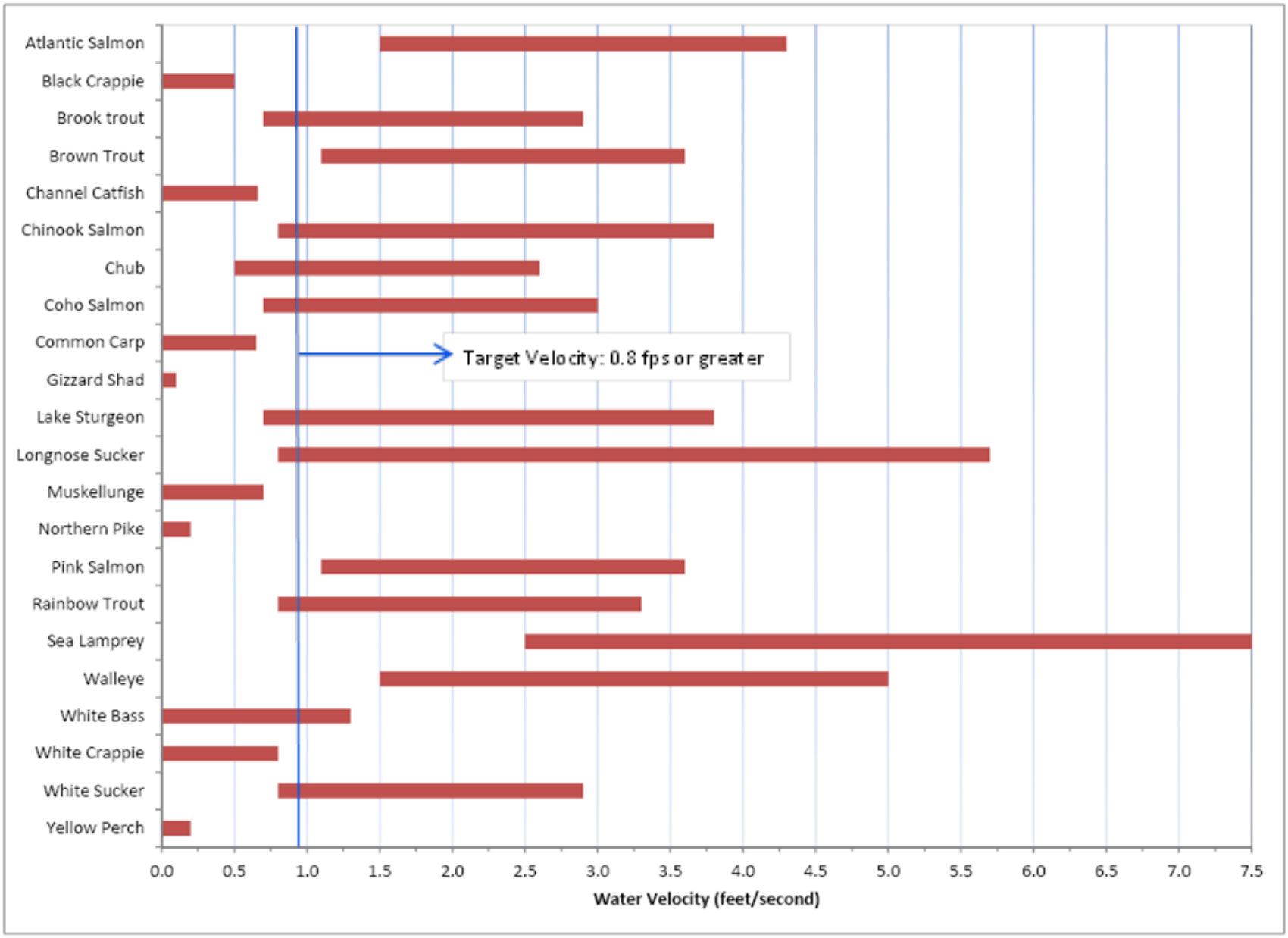
Study Area for Environmental Assessment

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Habitat Restoration Target








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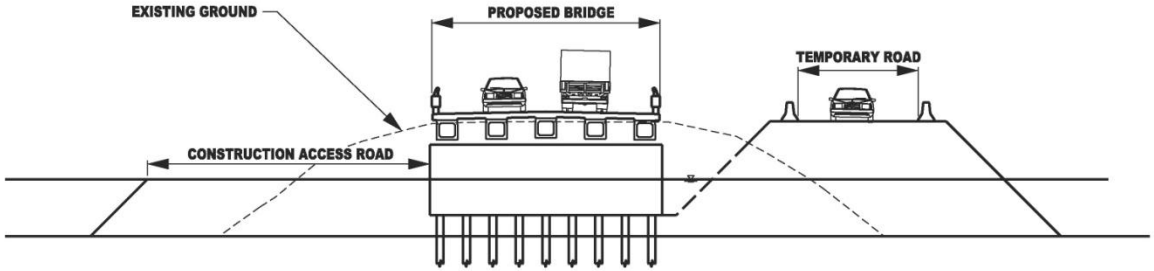
Proposed Bridge Alternatives


Impacts Related to Construction:

- Noise
- Air quality
- Transportation
- Utilities
- Cultural Resources




CROSS-SECTION THROUGH BRIDGE (LOOKING WEST)

TRAFFIC SIGNALS WILL CONTROL TRAFFIC OVER THE TEMPORARY ONE-LANE ROAD, ALLOWING ONE DIRECTION OF TRAFFIC TO FLOW AT A TIME. THE TRAFFIC SIGNALS WILL CONTAIN SENSORS THAT CAN DETECT TRAFFIC IN ORDER TO MINIMIZE TRAFFIC DELAYS.

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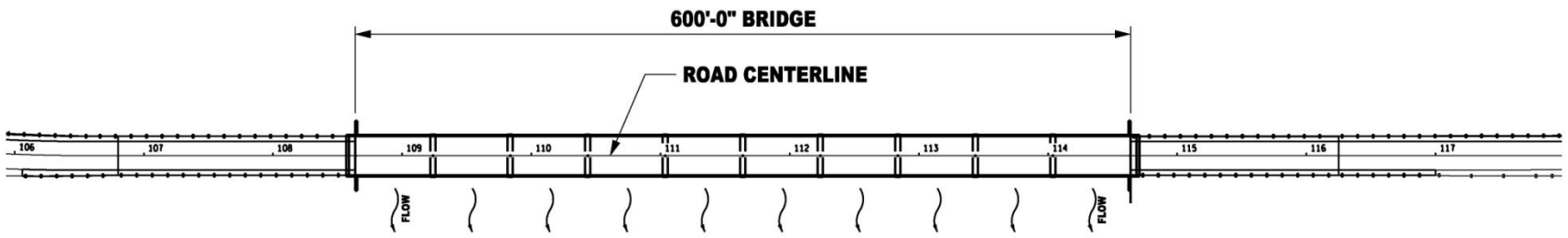
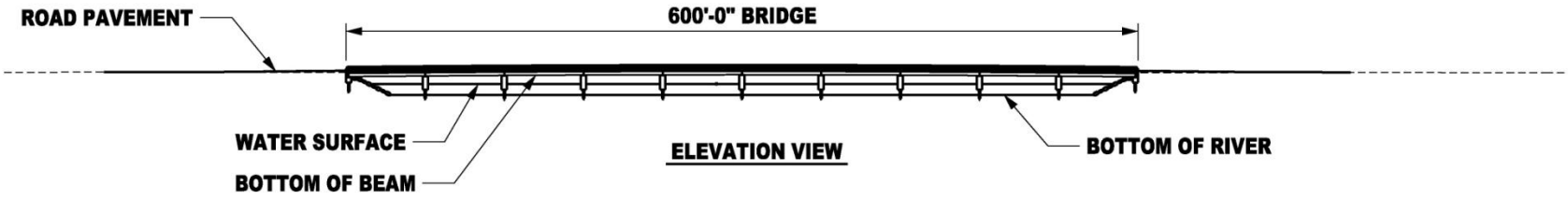
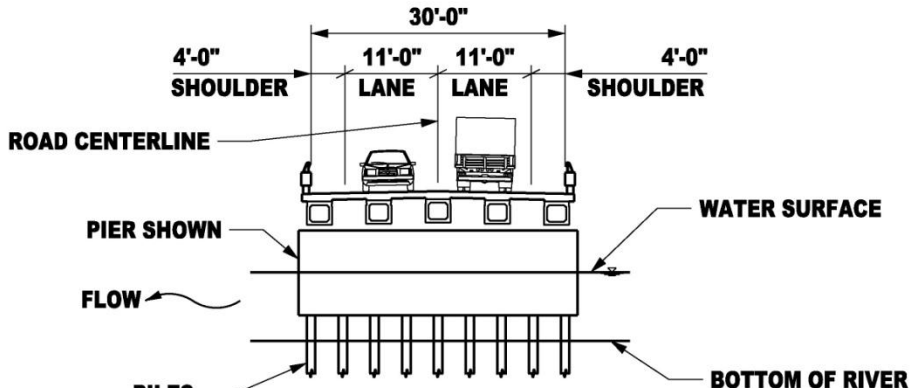
CONSTRUCTION AND TRAFFIC STAGING




PLAN VIEW




ELEVATION VIEW




CROSS-SECTION
(LOOKING WEST)

**NOTE:**
**ROAD AND BRIDGE SURFACE CHARACTERISTICS SHOWN WOULD BE SIMILAR FOR CULVERT OPTIONS**

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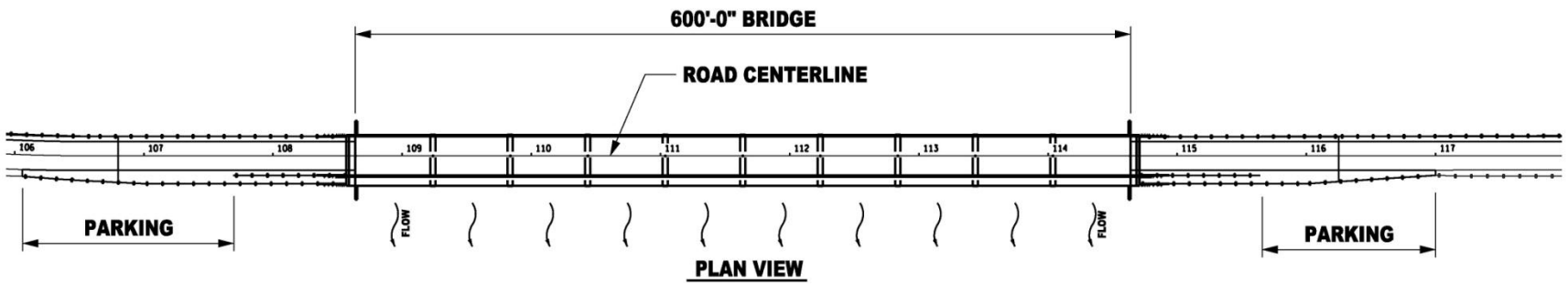
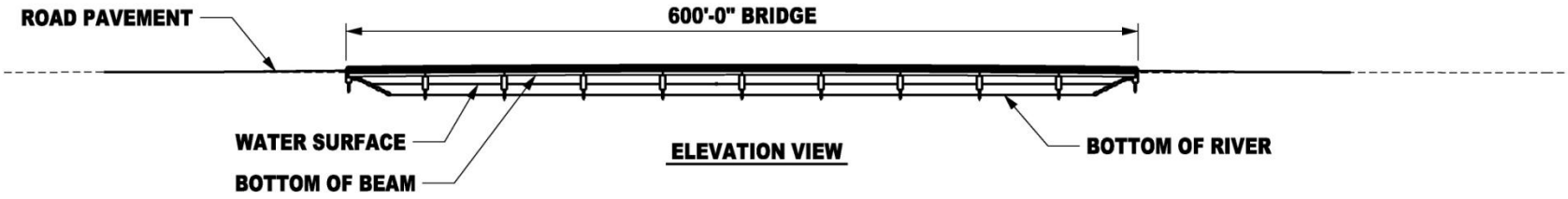
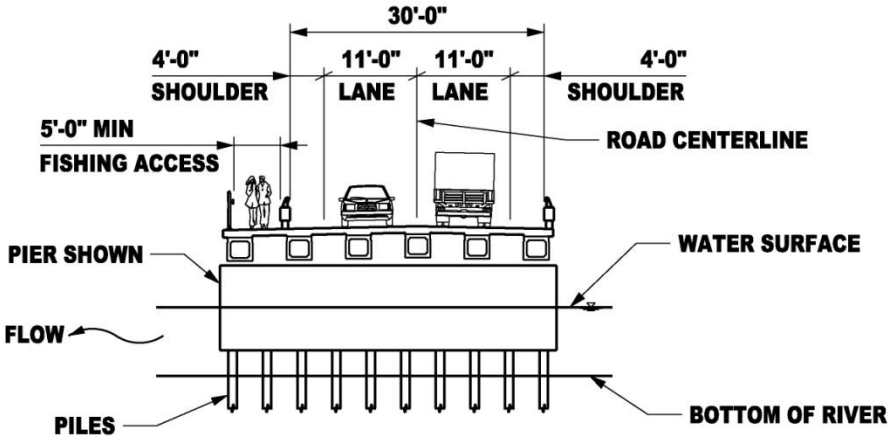
BRIDGE ALTERNATIVE
NO FISHING ACCESS




**NOTE:**
**ROAD AND BRIDGE SURFACE CHARACTERISTICS SHOWN WOULD BE SIMILAR FOR CULVERT OPTIONS**

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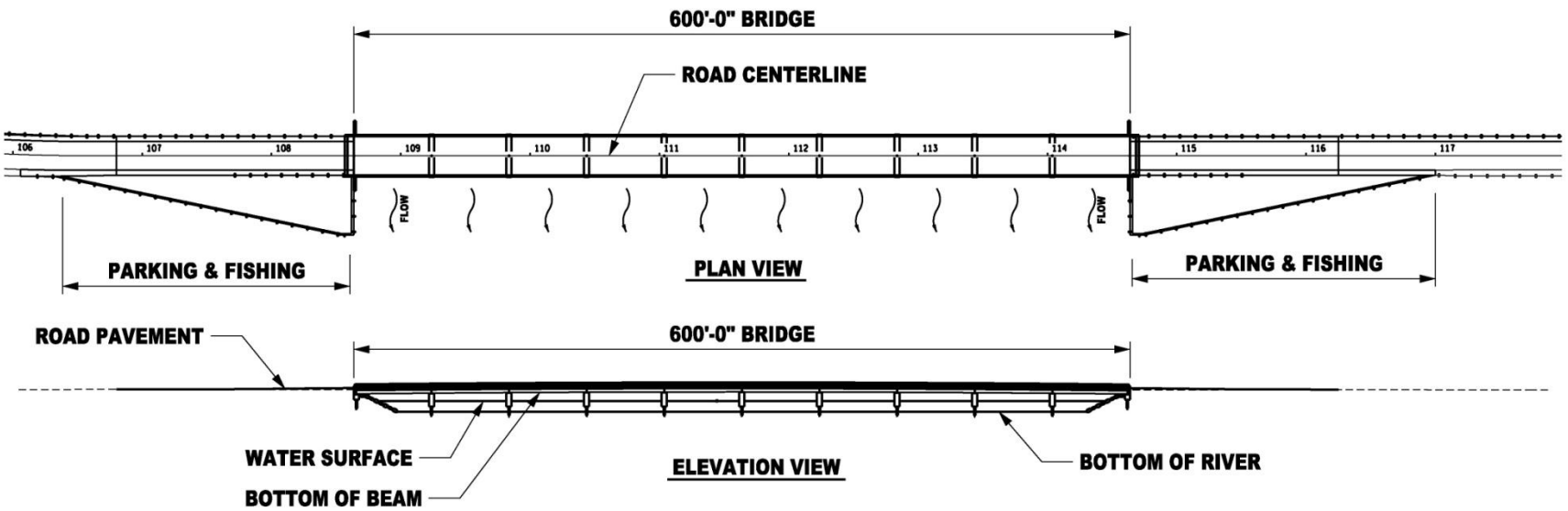
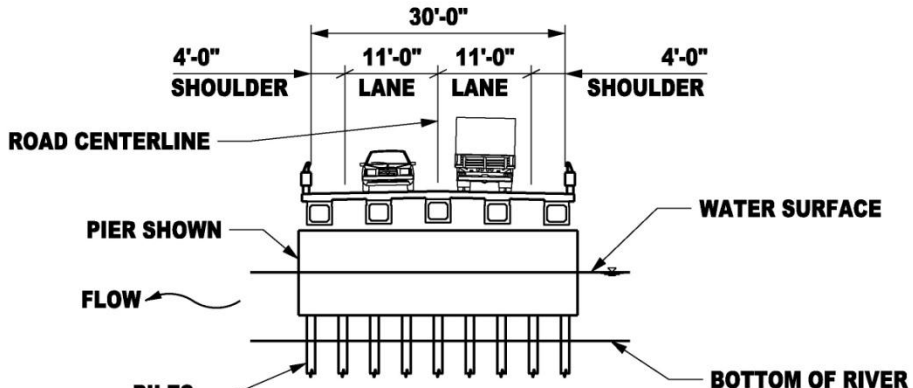
BRIDGE ALTERNATIVE
FISHING ON BRIDGE
PARKING EAST AND WEST OF BRIDGE




**NOTE:**
**ROAD AND BRIDGE SURFACE CHARACTERISTICS SHOWN WOULD BE SIMILAR FOR CULVERT OPTIONS**

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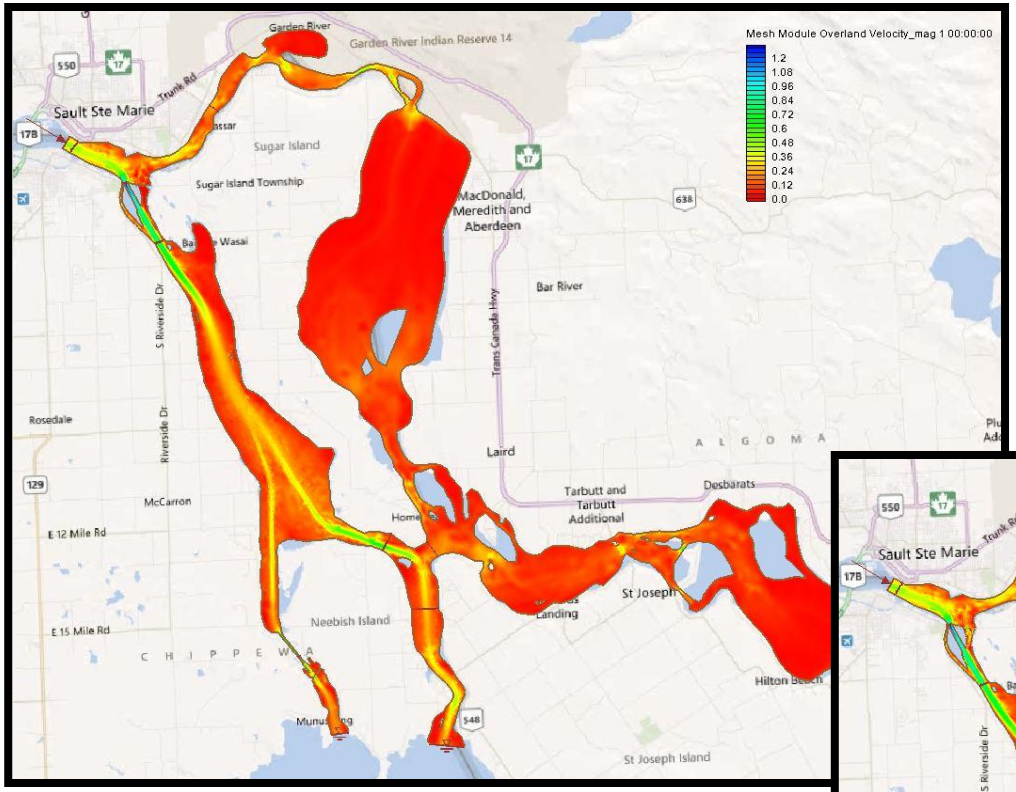
BRIDGE ALTERNATIVE
NO FISHING ACCESS ON BRIDGE
FISHING AND PARKING EAST AND WEST OF BRIDGE

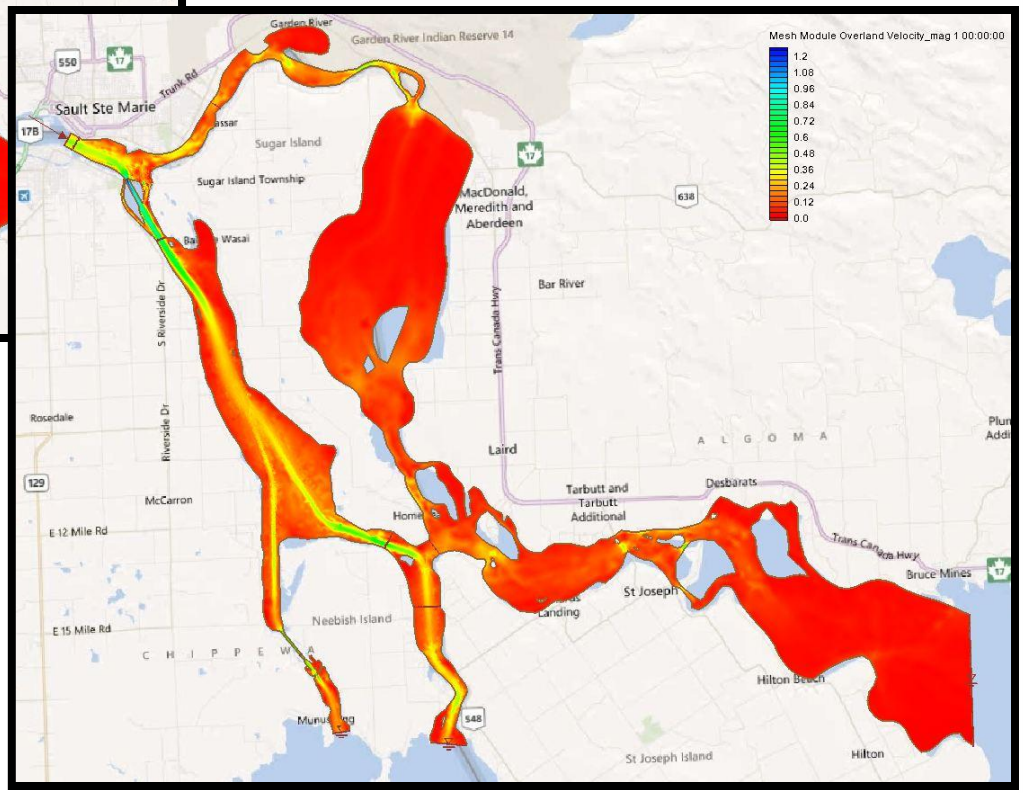
# Summary of Alternatives

- Length (400 ft to 1,000 ft and/ or 1 to 2 spans)
- Bridge or culverts (3-sided, 4-sided or CMP)
- Width (pedestrian access and/ or parking)
- Fishing access (on bridge or near bridge)

**Choices related to these drive the costs and benefits!**




Velocities, water depths and flow are identical for all alternatives considered for most of the study area. Only near the Little Rapids area are differences predicted (See Table Inset for differences).




Diff. between Existing Conditions and No Causeway at 82,000 CFS

| Location | Discharge (CFS) | Velocity (feet/sec) | Water Surface Elevation (feet IGLD) |
|---|---|---|---|
| Shipping Channel | -3,742 | -0.2 | 0.0 |
| North Channel | -176 | 0.0 | 0.0 |
| Lower Little Rapids | 3,918 | 3.0 | -0.1 |
| St. Marys River below Cloverland Power Canal | 0 | 0 | 0 |

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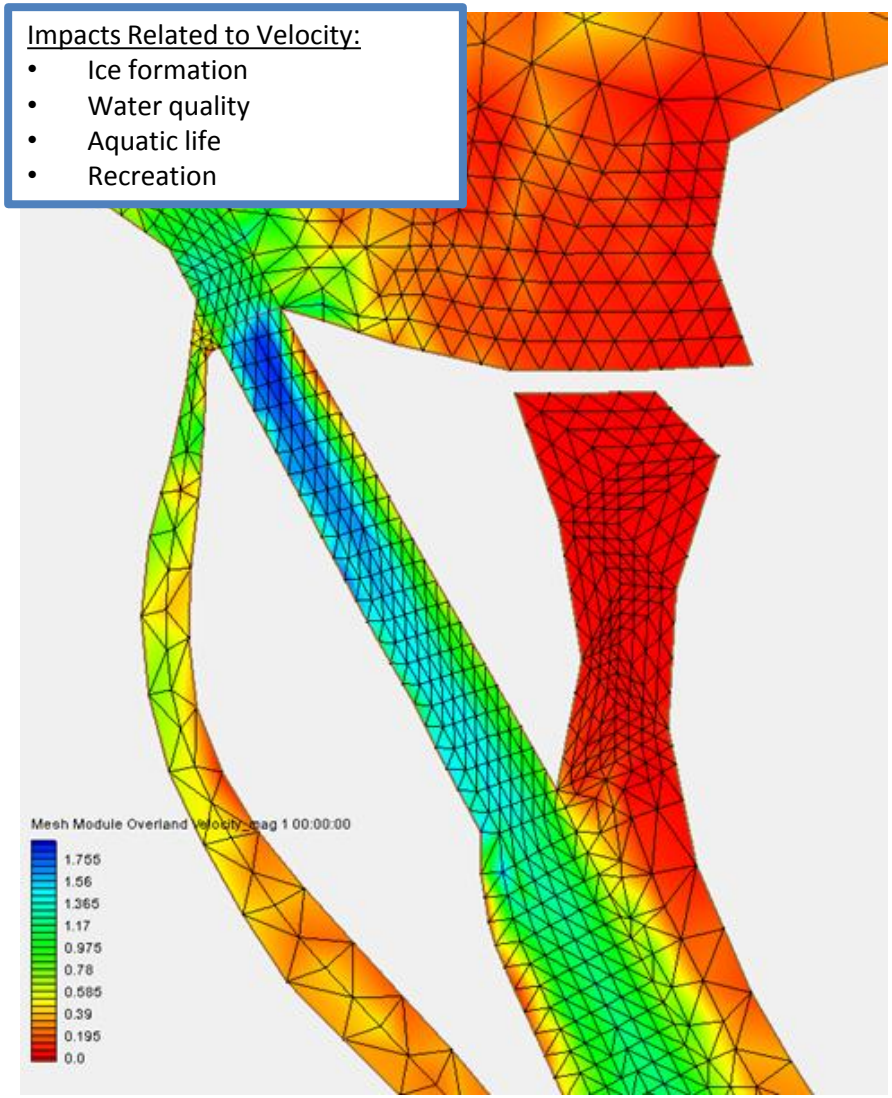
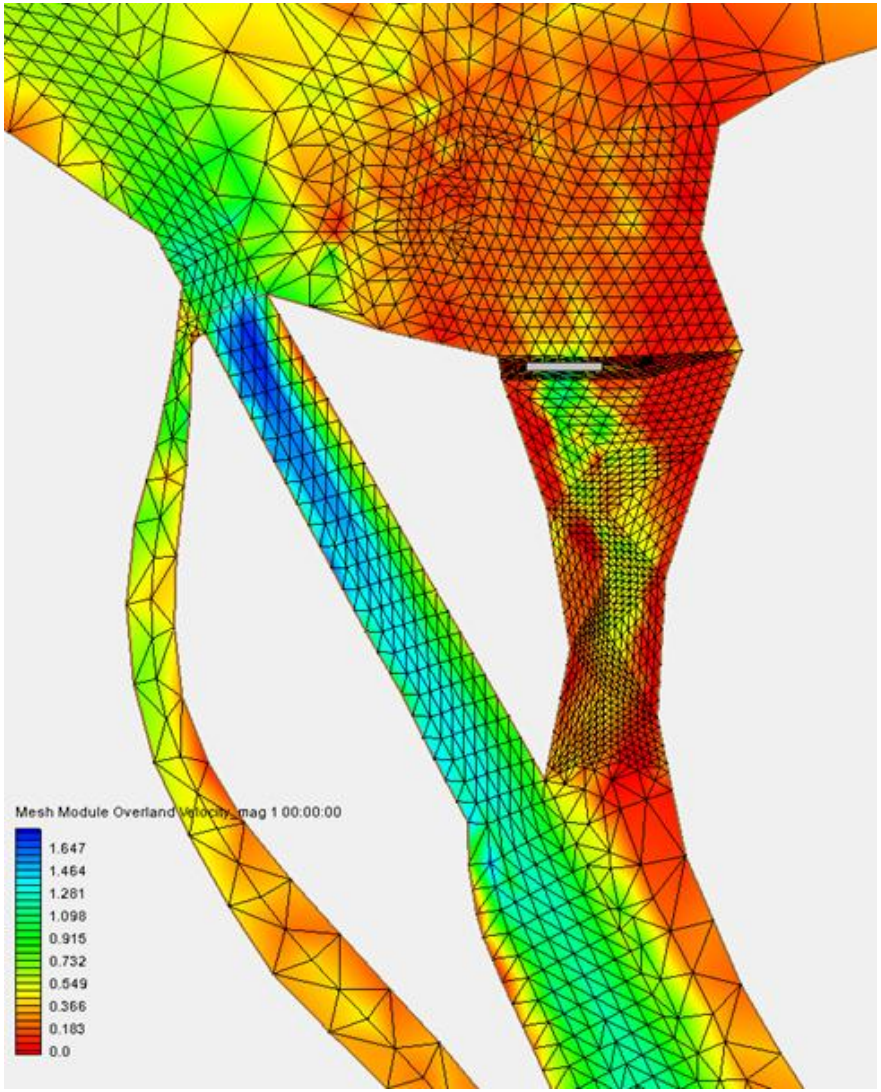
Velocities comparison for existing conditions and no causeway conditions

Impacts Related to Velocity:

- Ice formation
- Water quality
- Aquatic life
- Recreation




Velocities above and below the causeway under existing conditions are less than 0.1 m/s (0.33 ft/s)




Velocities above and below the causeway with a 600’ bridge under high flow conditions are a maximum of 1.15 m/s (3.8 ft/s)

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Velocities comparison for 600’ bridge under high flow conditions of 3,596 $m^3/s$ (127,000 $f^3/s$)

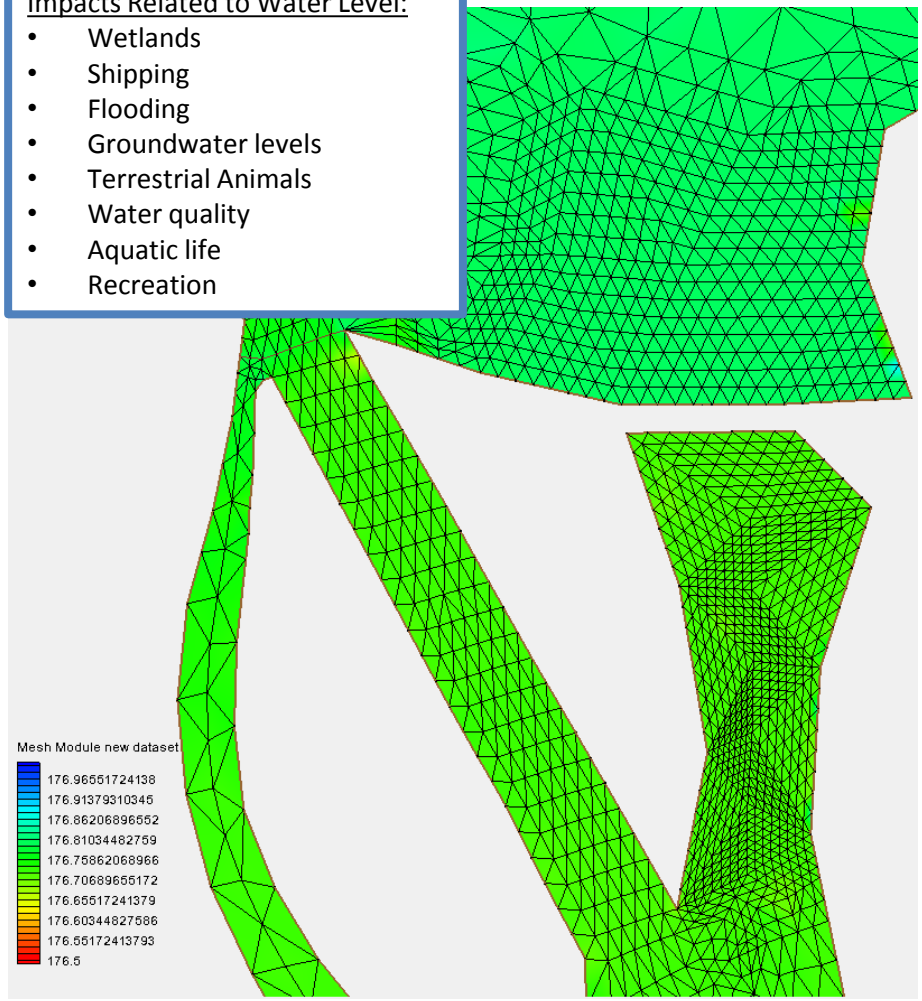
# Comparison of Predicted Velocities and Extreme Flows

| Little Rapids Velocities (fps) at 42,000 cfs Inflow | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alternative | Ship Channel | North Channel | Upper Rapids West | Upper Rapids East | Lower Rapids West | Lower Rapids East | Lake George | Habitat (Acreage >0.8 fps) |
| Causeway (Ex) | 3.2 | 0.8 | 0.2 | 0.1 | 0.0 | 0.0 | 0.2 | 0.17 |
| No Causeway | 3.1 | 0.8 | 0.7 | 0.6 | 1.6 | 2.1 | 0.3 | 9.32 |
| A (600 ft) | 3.2 | 0.8 | 0.5 | 0.0 | 1.3 | 0.1 | 0.2 | 7.02 |
| B (400 ft) | 3.2 | 0.8 | 0.9 | 0.0 | 2.0 | 0.0 | 0.2 | 2.94 |
| C (800 ft) | 3.2 | 0.8 | 0.9 | 0.9 | 1.2 | 0.7 | 0.2 | 2.84 |
| D (1,000 ft) | 3.1 | 0.8 | 0.9 | 0.8 | 1.3 | 0.6 | 0.2 | 8.12 |
| E (600 ft) | 3.2 | 0.8 | 0.9 | 1.0 | 1.3 | 0.8 | 0.2 | 3.02 |
| F (800 ft) | 3.1 | 0.8 | 0.8 | 0.7 | 1.4 | 0.5 | 0.2 | 8.58 |

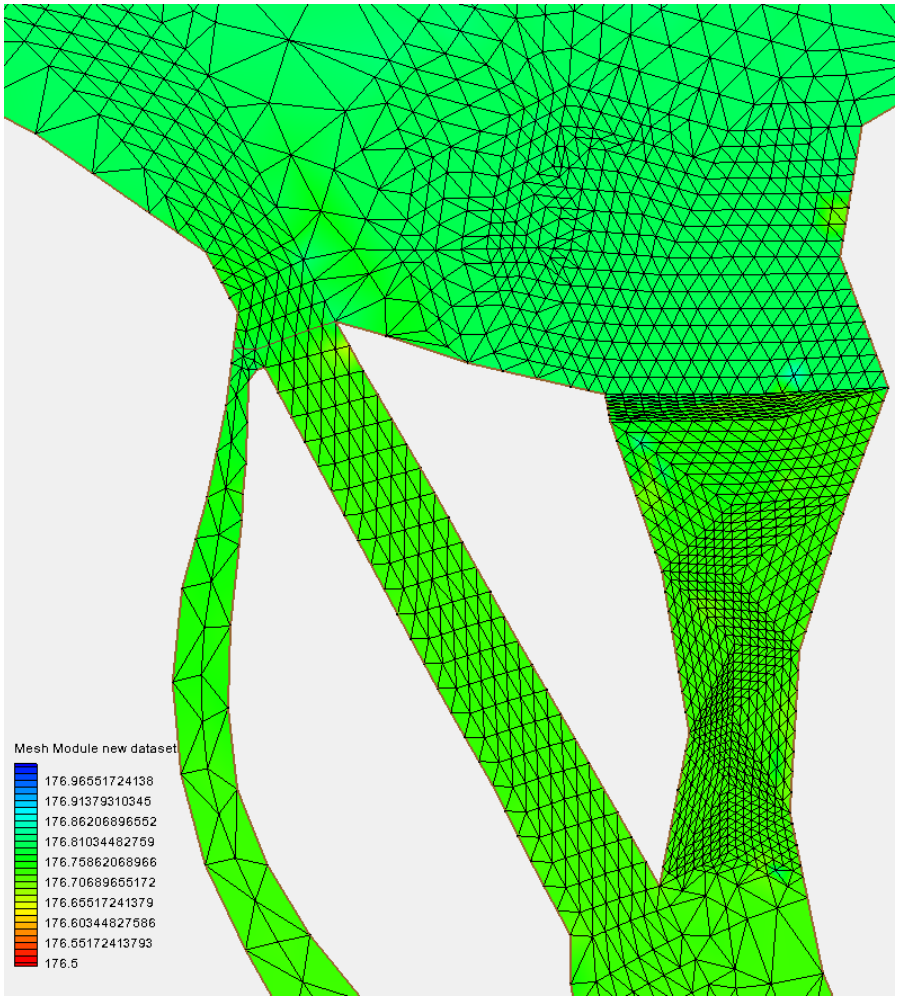
| Little Rapids Velocities (fps) at 127,000 cfs Inflow | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Alternative | Ship Channel | North Channel | Upper Rapids West | Upper Rapids East | Lower Rapids West | Lower Rapids East | Lake George | Habitat (Acreage >0.8 fps) |
| Causeway (Ex) | 6.0 | 1.3 | 0.2 | 0.1 | 0.0 | 0.0 | 0.5 | 4.95 |
| No Causeway | 5.3 | 1.4 | 1.3 | 2.1 | 2.6 | 3.1 | 0.4 | 116.79 |
| A (600 ft) | 5.6 | 1.5 | 1.5 | 0.1 | 3.8 | 0.1 | 0.4 | 57.45 |
| B (400 ft) | 5.8 | 1.5 | 1.6 | 0.1 | 3.1 | 0.1 | 0.4 | 43.13 |
| C (800 ft) | 5.6 | 1.4 | 1.3 | 2.3 | 2.7 | 2.2 | 0.4 | 69.92 |
| D (1,000 ft) | 5.5 | 1.4 | 1.3 | 2.1 | 3.2 | 1.8 | 0.4 | 84.67 |
| E (600 ft) | 5.6 | 1.4 | 1.4 | 2.5 | 2.6 | 2.4 | 0.4 | 75.36 |
| F (800 ft) | 5.5 | 1.4 | 1.3 | 2.3 | 3.6 | 1.2 | 0.4 | 79.01 |

Impacts Related to Water Level:

- Wetlands
- Shipping
- Flooding
- Groundwater levels
- Terrestrial Animals
- Water quality
- Aquatic life
- Recreation




Water surface elevations above and below the causeway under existing conditions




Water surface elevations above and below the causeway with a 600’ bridge. Water elevations throughout study area unchanged.

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Water surface elevation comparison for 600’ bridge with flow conditions of 2,322 $m^3/s$ (82,000 $f^3/s$)

# Summary of Results and Impacts

- Modifying the causeway will increase velocity and flow in Little Rapids, but not have significant impacts anywhere else.
- Velocities in the Lower Little Rapids will increase under restoration alternatives reducing ice formation.
- Island residents and visitors will experience temporary impacts to during construction.
- A large percentage (up to 90%) of habitat can be restored depending on alternative selected. Actual acreage varies depending on the alternative selected and flow conditions.

# Preliminary Cost Estimates

| Alternative | Effective Length | Bridge w/Full Length Fishing | Bridge No Fishing | Bridge Fishing at Ends | Full Length Fishing | | |
|---|---|---|---|---|---|---|---|
| | | | | | Box Culverts | Three Sided Culverts | CMP Culverts |
| A | 600 | $5,125,560 | $4,267,560 | $4,767,560 | $5,894,394 | $9,458,988 | $6,733,122 |
| B | 400 | $3,417,040 | $2,845,040 | $3,345,040 | $3,929,596 | $6,305,992 | $4,488,748 |
| C | 800 | $6,834,080 | $5,690,080 | $6,190,080 | $7,859,192 | $12,611,984 | $8,977,496 |
| D | 1000 | $8,542,600 | $7,112,600 | $7,612,600 | $9,823,990 | $15,764,980 | $11,221,870 |
| E | 600 | $5,125,560 | $4,267,560 | $4,767,560 | $5,894,394 | $9,458,988 | $6,733,122 |
| F | 800 | $6,834,080 | $5,690,080 | $6,190,080 | $7,859,192 | $12,611,984 | $8,977,496 |

Caveats/disclaimers:

1. Limited soil information (This is a BIG one. This affects substructure, temporary roads, etc)
2. Doesn't account for number of spans
3. Study level cost analysis (i.e. not very detailed)
4. Study level structural analysis
   - A. sheeting at approach fishing areas not designed
   - B. abutments not designed
   - C. Piers not yet designed
   - D. scour depths not yet known

| | Length of Spans | August 2009 Scenario | 4-year Scenario | High Scenario | % Restored |
|---|---|---|---|---|---|
| Model Run | (feet) | Acreage >0.8 fps | Acreage >0.8 fps | Acreage >0.8 fps | (Aug 09 - 4-yr – High) |
| Existing Conditions | N/A | 0.17 | 0.62 | 4.95 | NA |
| No Causeway | 2,500 | 9.32 | 25.97 | 116.79 | 100% |
| Alt. A | 600 | 7.02 | 20.38 | 57.45 | 75% - 78% - 49% |
| Alt. B | 400 | 2.94 | 9.05 | 43.13 | 32% - 35% - 37% |
| Alt. C | 400 & 400 | 2.84 | 11.00 | 69.92 | 30% - 42% - 60% |
| Alt. D | 600 & 400 | 8.12 | 25.40 | 84.67 | 87% - 98% - 72% |
| Alt. E | 400 & 200 | 3.02 | 12.68 | 75.36 | 32% - 49% - 65% |
| Alt. F | 600 & 200 | 8.58 | 24.92 | 79.01 | 92% - 96% - 68% |

# Next Steps

- A preferred alternative needs to be selected (2012).
  - Length, width, etc
- Detailed design of causeway modifications need to be completed (2013).
- Environmental Assessment (2013) and Permitting (????)
- Construction Activities (????)

# Project Deliverables in this Phase

- Environmental Assessment
  - Determine impacts and mitigation actions for impacts to natural and built environment
- Hydrodynamic Modeling (flows, velocities and depth)
  - Determine impacts of alternatives to flows, velocities and depth under a variety of conditions
- Engineering and Design
  - Develop several conceptual alternatives and a detailed design for the selected alternative