Hartley Pond and Dam Feasibility Study, Alternative Recommendations and Next Steps

May 8, 2024

Welcome and Team Introduction

Presentation on the Hartley Pond and Dam Feasibility Study
Recommendations and Next Steps

Formal public input will be subsequently managed by the City of Duluth

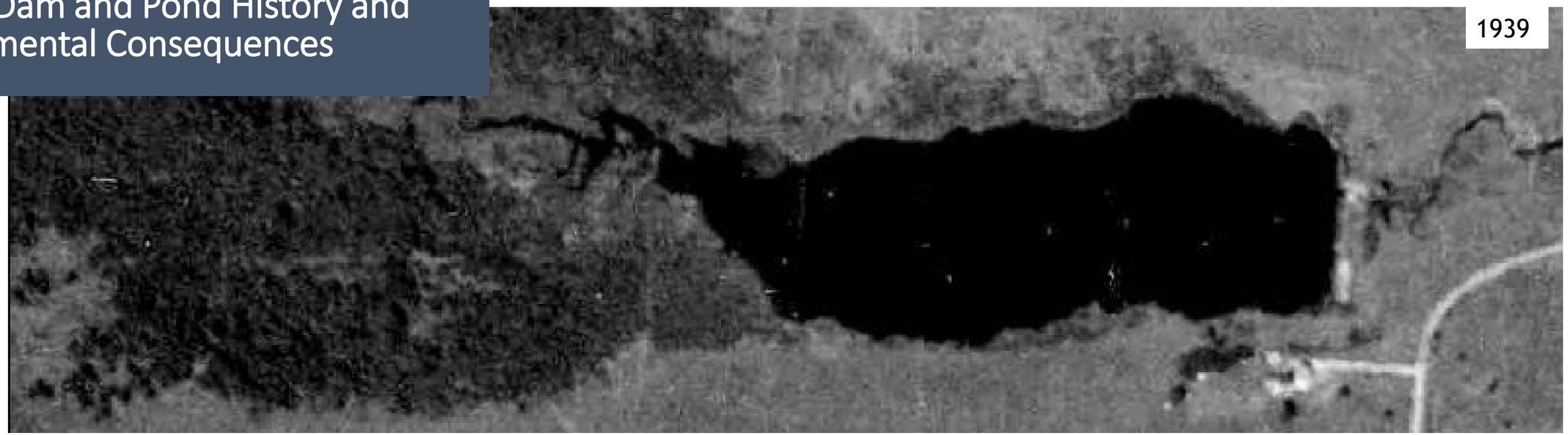
- **City of Duluth – Kate Kubiak**
- **Minnesota Department of Natural Resources – John Lindgren**
- **GEI – Cole Webster, Rebecca Eiden, Scott Dierks, Rob Peterson**
- **Beaver River Consulting – Keith Anderson**

Hartley Park Management Plans

1. Hartley Duluth Natural Areas Program Management Plan, City of Duluth, 2019.
2. Hartley Park Mini-Master Plan, City of Duluth, 2014.
3. Essential Spaces: Duluth Parks, Recreation, Open Space & Trails Plan, City of Duluth, 2022
4. Restoration Strategy – Duluth Urban Area Watershed Restoration and Protection Strategy Document, MPCA, 2017.

Hartley Pond Feasibility Study is identified as an action item in Hartley Duluth Natural Areas Program Management Plan and Hartley Park Mini-Master Plan

Hartley Dam and Pond History and Environmental Consequences



Project Goal and Objectives

Goal: Assess the most effective and efficient alternatives to protect cold-water species like brook trout and preserve flood mitigation, focusing on engineering and environmental considerations.

Restore a natural stream hydrology (connectivity and floodplain)

Restore a stable floodplain and habitat diversity

Enhance temperature and sediment transport

Restore longitudinal and lateral connectivity

Maintain recreational services

Enhance brook trout fishing

Restore natural conditions

Maintain or enhance educational opportunities

Do not increase risk of flood damage downstream

Feasibility Study Process

Initial Alternative Feasibility Assessment:

- Review previously proposed alternatives
- Public and stakeholder input
- Reassess and define alternatives

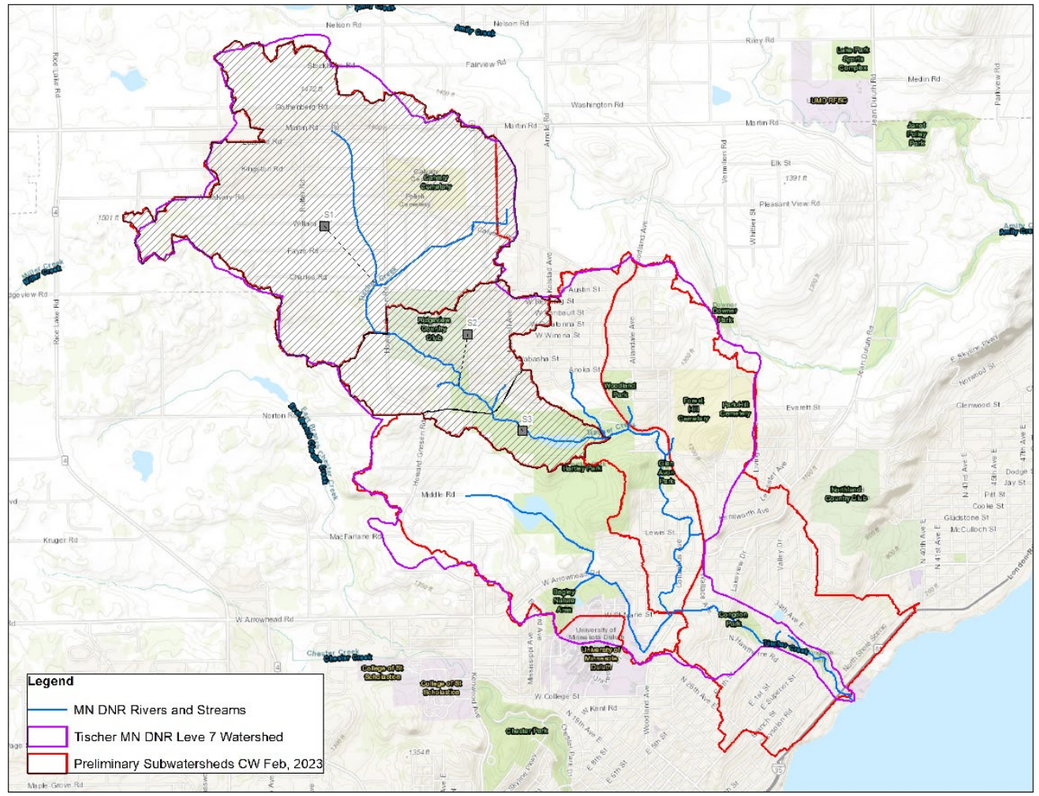
Modeling/Design:

- **Existing Conditions**
  - Understand existing hydrology and hydraulics
    - UMD data allowed for preliminary calibration
- **Alternatives Modeling**
  - Hydrologic and hydraulic modeling of each alternative in comparison to existing conditions model
  - Alternatives modeling/design iterations

Multi –Criteria Decision Analysis (MCDA): Ranking the strengths and weaknesses of each alternative.

- Objectives

Recommend alternative based on MCDA and Stakeholder Input



Proposed Alternatives

***Alternative 1*: No Action**

***Alternative 2*: Stream Route Around**

Leave dam in place, route a channel around the dam, and excavate small portion of pond

***Alternative 3*: Dam Removal**

Remove existing dam and restore stream channel in the original stream valley. Excavate off-line pond.

***Alternative 4*: Open-Bottom Culvert**

Keep existing earthen berm, construct culvert through dam embankment, and restore stream channel in the original stream valley.

4a: Excavate off-line pond

4b: without excavated off-line pond

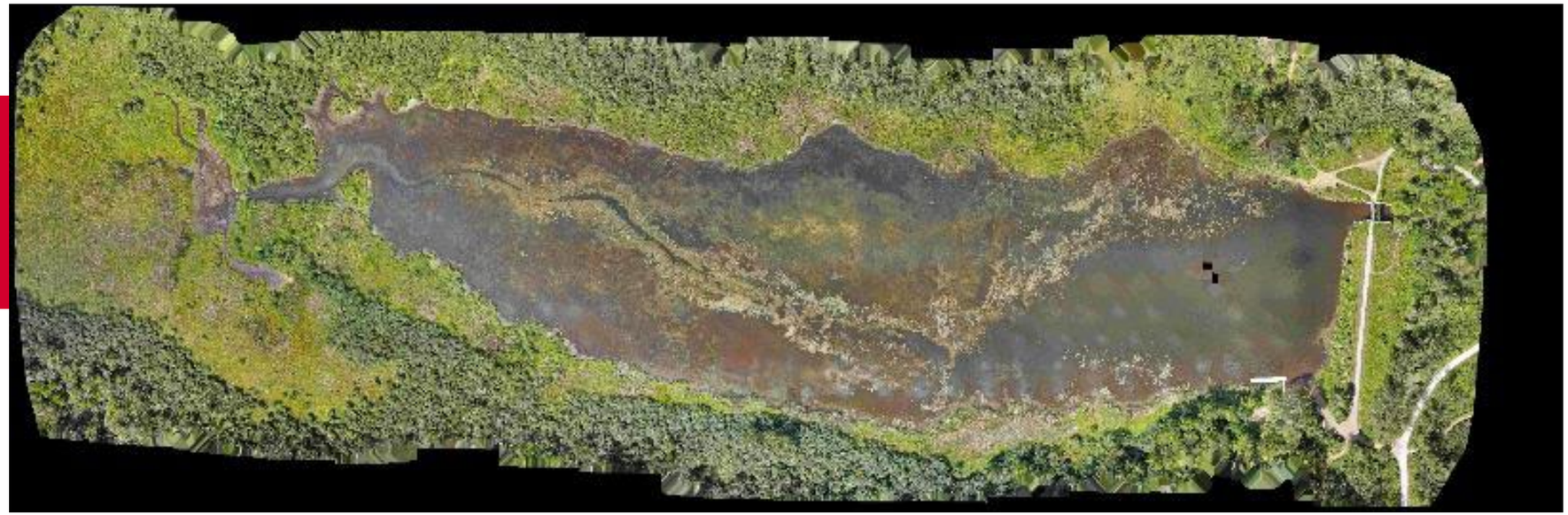
Other Alternatives Considered:

- Rock Arch Rapids
- Double Limiting Culvert
- Spillway Flood Gate

Photo Courtesy of Tim Beaster, South St. Louis SWCD

Alternative 1: No Action

FEASIBILITY SCORE: 18/45



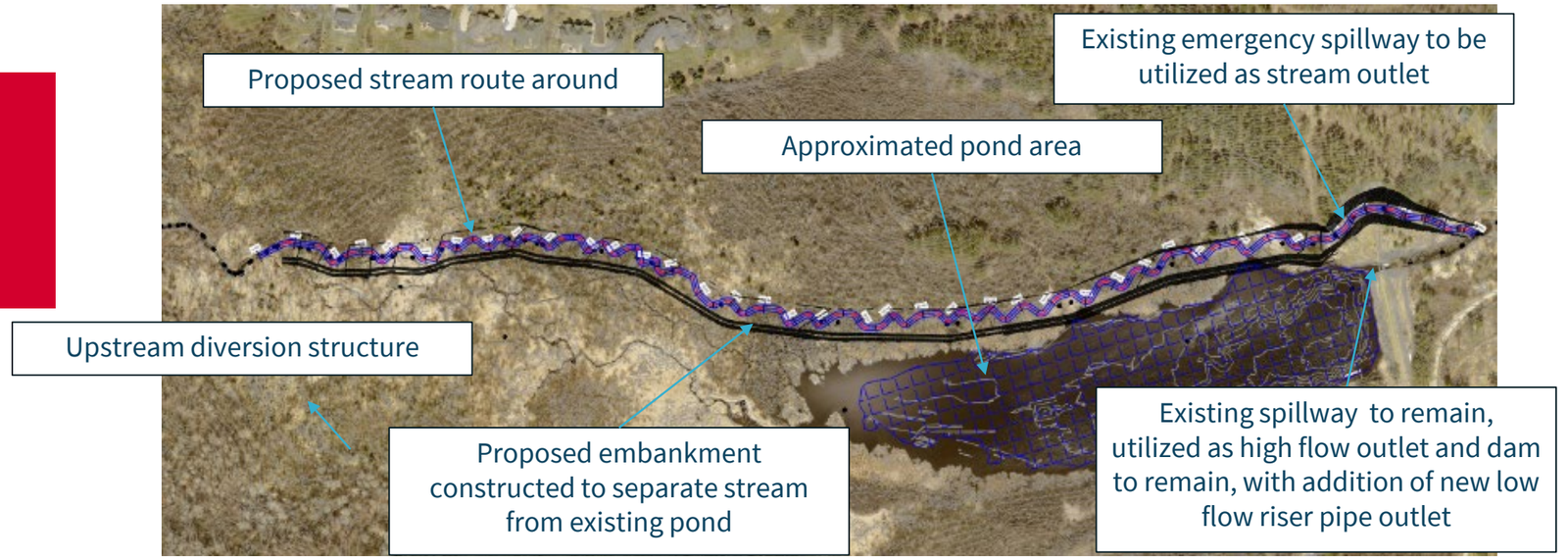
Strengths	Weaknesses
No Immediate Capital Costs	Maintains a Class I – High Hazard Dam
Existing Pond Remains	Remains a Fish Passage Barrier
100-year Storm Peak Flows are Reduced	Water Quality Degrades (High Temps, Low Dissolved Oxygen)
	Interferes with Sediment Transport
	Alters Natural Flow
	Ongoing and Future Maintenance Costs (Emergency Spillway Cleanout, Embankment Maintenance, Dredging)

UNKNOWNS:

- Long-term maintenance
- Pond conditions long term

Alternative 2: Stream Route Around

FEASIBILITY SCORE: 36/45



Strengths	Weaknesses
Removes Fish Passage Barrier	Maintains a Class I – High Hazard Dam
Restores Longitudinal Connectivity	Design Complexities with Flow Split and Hydraulic Interactions with New Outlet
Improves Water Quality	Potential Sediment Deposition Maintenance Upstream and in the Pond Area

UNKNOWNS:

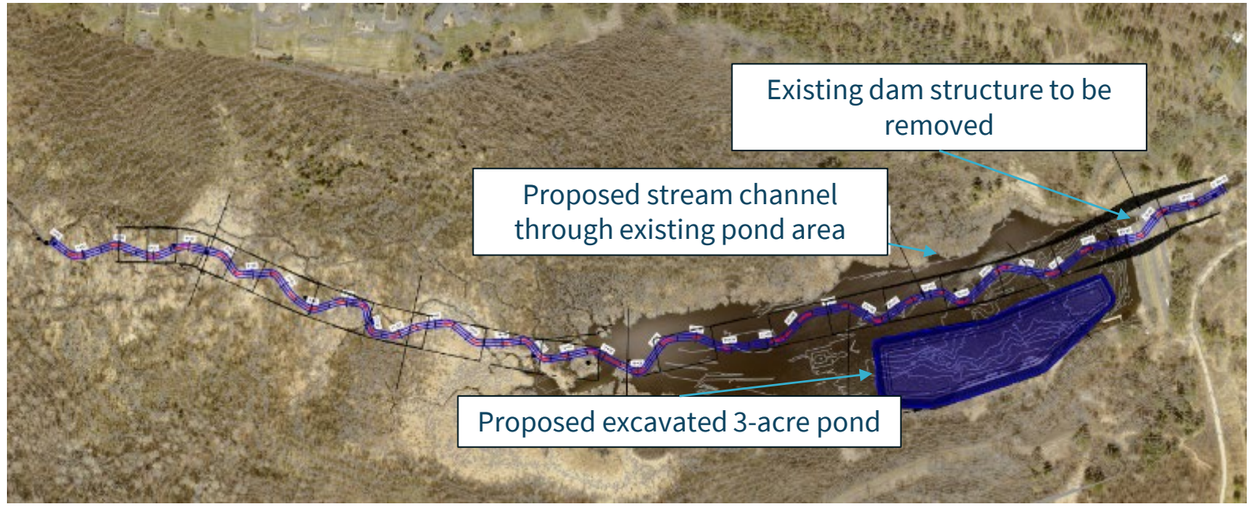
- Pond water level maintains existing level.
- Bedrock Conditions
- Stream/Pond water level interaction, stream does not flow to pond underground
- Area where stream is split may require maintenance

ASSUMPTIONS:

- Bankfull flows manageable with an upstream diversion structure.
- Existing dam and new berm will maintain structural integrity.
- Constructed berm and channel resistant to erosion in high-flow events.
- Sufficient depth to bedrock for channel construction.
- Groundwater input maintains baseflow for both the channel and pond.
- Existing pond will be excavated to improve and maintain water quality.

Alternative 3: Dam Removal

FEASIBILITY SCORE: 41/45



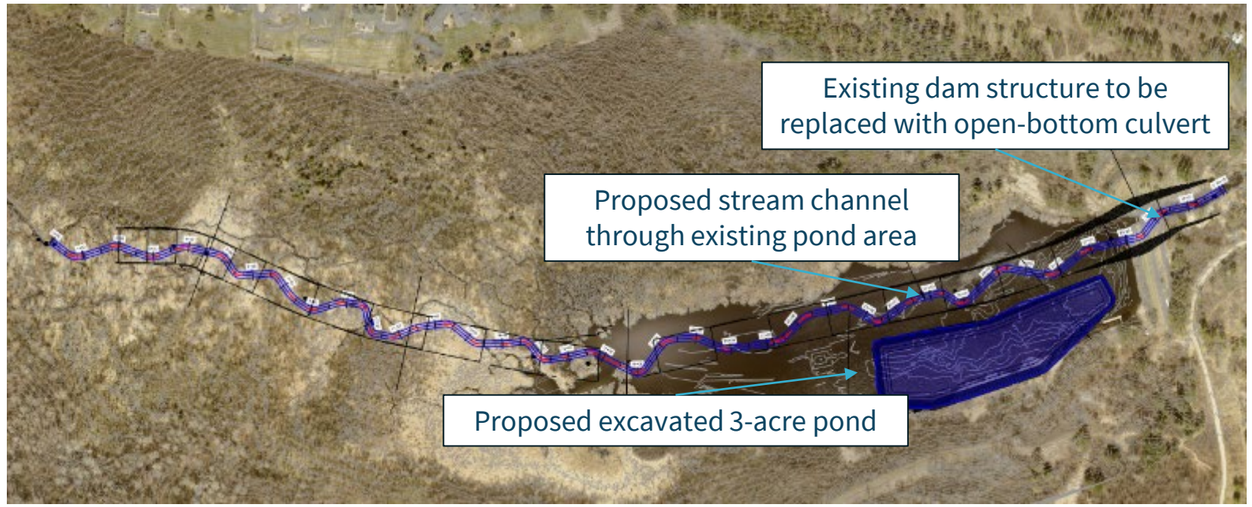
Strengths	Weaknesses
Eliminates Class I – High Hazard Dam	Removing the Dam does not Provide Peak Flow Attenuation
Removes Fish Passage Barrier	Reduced Open Water Pond Area
Restores Longitudinal Connectivity and Improves Sediment Transport	
Improves Water Quality	
Less Complicated Design and Construction Process	

ASSUMPTIONS:

- Stream and valley ecosystem recovers post-restoration.
- Groundwater input maintains baseflow.
- Excavate pond to improve and maintain water quality.

Alternative 4A and 4B: Open-Bottom Culvert With and Without Pond

FEASIBILITY SCORE: 40 (38)/45



Strengths	Weaknesses
Removes Fish Passage Barrier	Long-term Maintenance Will be Required on the Existing Dam Embankment
Restores Channel Longitudinal Connectivity	Short-term Ecological and Geomorphological Impacts with Construction of Channel and Floodplain
Improves Water Quality	Potential Need for Downstream Hard Armoring
Stream Design with Ensure Fast Recovery of Stream and Floodplain Through Pond	Impedes on Floodplain Connectivity
Passive Flood Control, Reducing/Maintaining Downstream Flood Conditions	
May Not Require An EIS for Removal of the Public Water of the State	

ASSUMPTIONS:

- Flow-limiting culvert design will effectively reduce flood flows.
- Design will withstand peak flow stresses.
- Excavated pond will have good water quality.

UNKNOWNS:

- Exact sizing of the culvert and substrate placed in culvert.
- Evaluation of Continuous Water Head/Energy Pressure on the Embankment to be investigated further in design phase

Open-bottom culvert examples

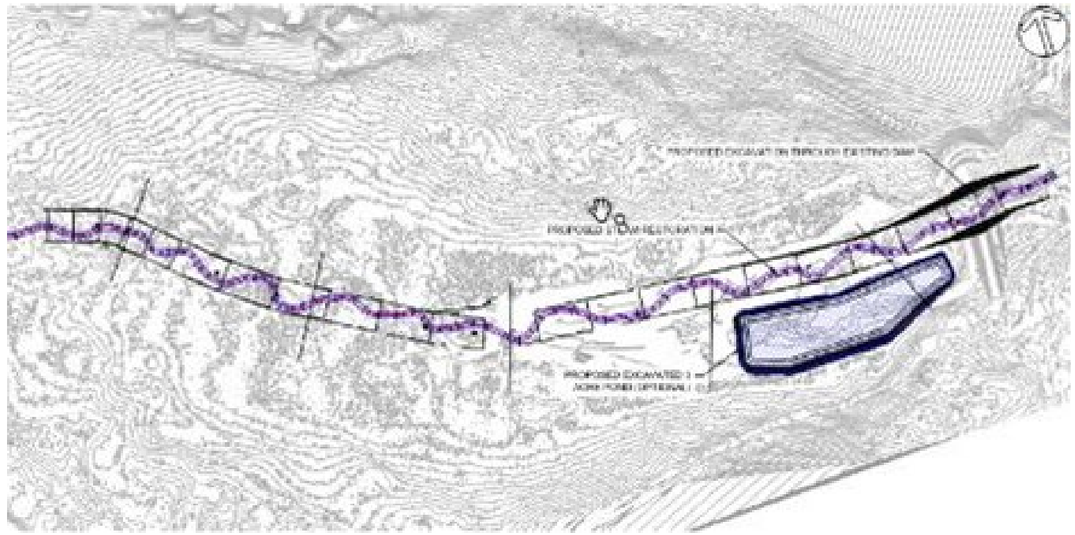
COMBINED MCDA TABLE

Alternatives:	Feasibility Criteria											
	Restore Natural Stream Hydrology	Restore a stable floodplain and habitat diversity	Enhance temperature and sediment transport	Restore longitudinal and lateral connectivity	Maintain recreational services	Enhance brook trout fishing	Restore to natural conditions	Maintain or enhance educational opportunities	Do not increase risk of flood damage downstream	Permit Consideration	Projected Cost	Score
1 – No Action	1	1	1	1	4	1	1	3	5	NA	Maintenance	**18**
2 – Stream Route Around	3	3	4	4	5	4	3	5	5	Possibility to permit / EAW considering partial drainage / changing dimensions of Hartley Pond	3.6 million	**36**
3 – Dam Removal	5	5	5	5	5	5	5	5	1	Possibility to permit / EAW considering partial drainage / changing dimensions of Hartley Pond	2.5 million	**41**
4a and 4b – Open-Bottom Culvert with and without Pond	4	3	4	4	5 (4)	5	4	5 (4)	5	Possibility to permit / EAW considering partial drainage / changing dimensions of Hartley Pond	3.4 million	**40 (38)**

Recommended Alternatives

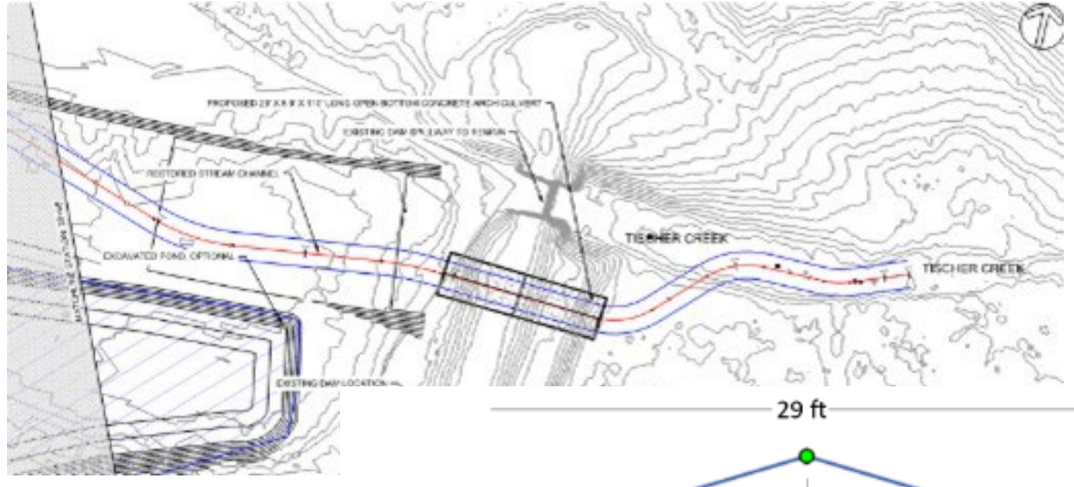
***Alternative 3*: Dam Removal**

- Most Climate-Resilient and Sustainable Alternative
- Restores Natural Stream Hydrology
- Eliminates Risk of Dam Failure
- Requires Property Acquisition within Floodplain



***Alternative 4a*: Open-Bottom Culvert with Off-line Pond**

- Most Cost-Effective, Fish Passage, and Flood Attenuation Alternative
- Restores Natural Stream Hydrology
- Further evaluation of culvert design, embankment integrity, geotechnical analysis, floodplain extents, etc. to be completed in the design phase
- Culvert based on preliminary modeling



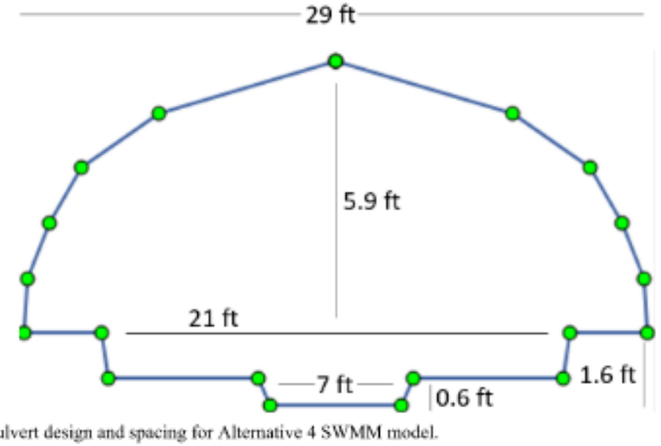


Figure 24. Culvert design and spacing for Alternative 4 SWMM model.

AI Rendering of Alternative 4a

Next Steps

Advance an Alternative

- City of Duluth and Stakeholders select a preferred Alternative to advance to the design phase

Funding and Design

- DNR seeks funding from the EPA - GLRI
- Develop comprehensive design plans to meet objectives
  - Reduced temperature, fish passage, and flood control
- Final design would include:
  - Legacy sediment investigation
  - Hydrologic and Hydraulic model calibration
  - Geotechnical evaluation

Permitting and Construction

- *Permitting and construction would be advanced if design criteria can be met and approved by the City of Duluth and Stakeholders.*

Acknowledgements

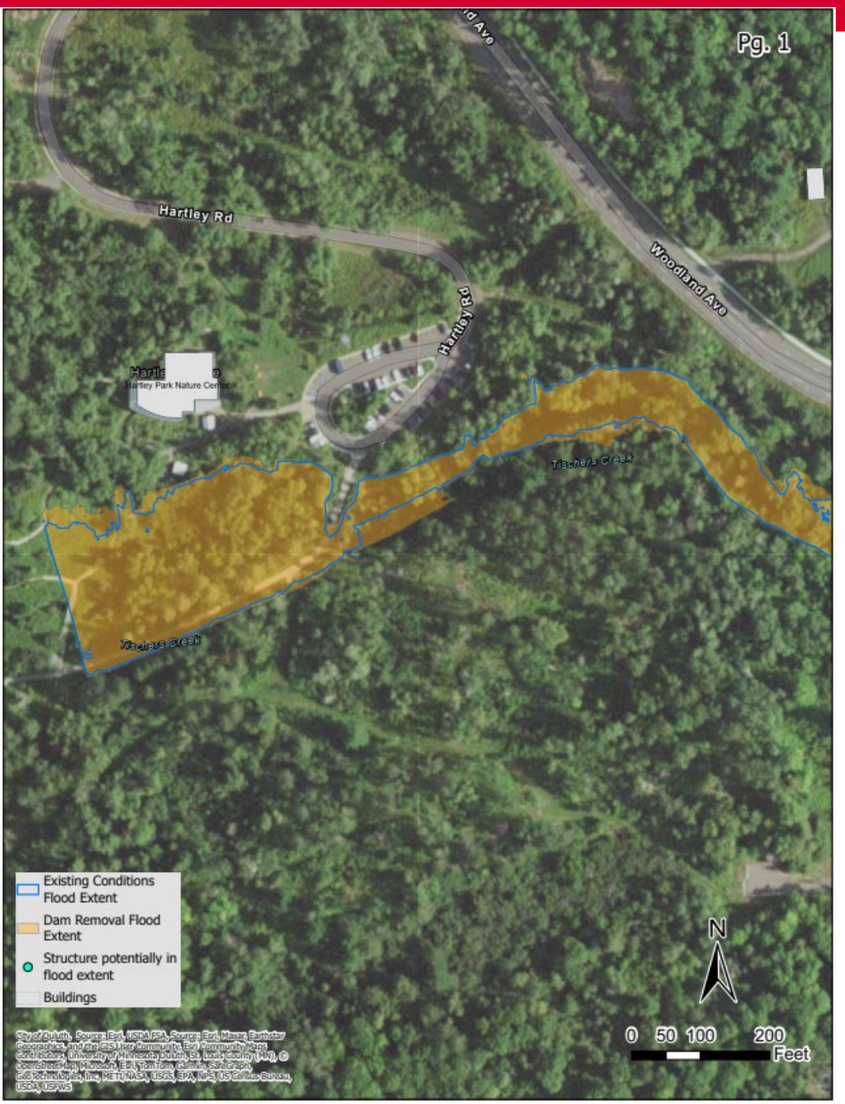
City of Duluth
Minnesota Department of Natural Resources
GEI Consultants
Beaver River Consulting
University of Minnesota Duluth
Hartley Nature Center staff, Stewardship Committee and Board
Minnesota Pollution Control Agency
Members of the Steering Committee

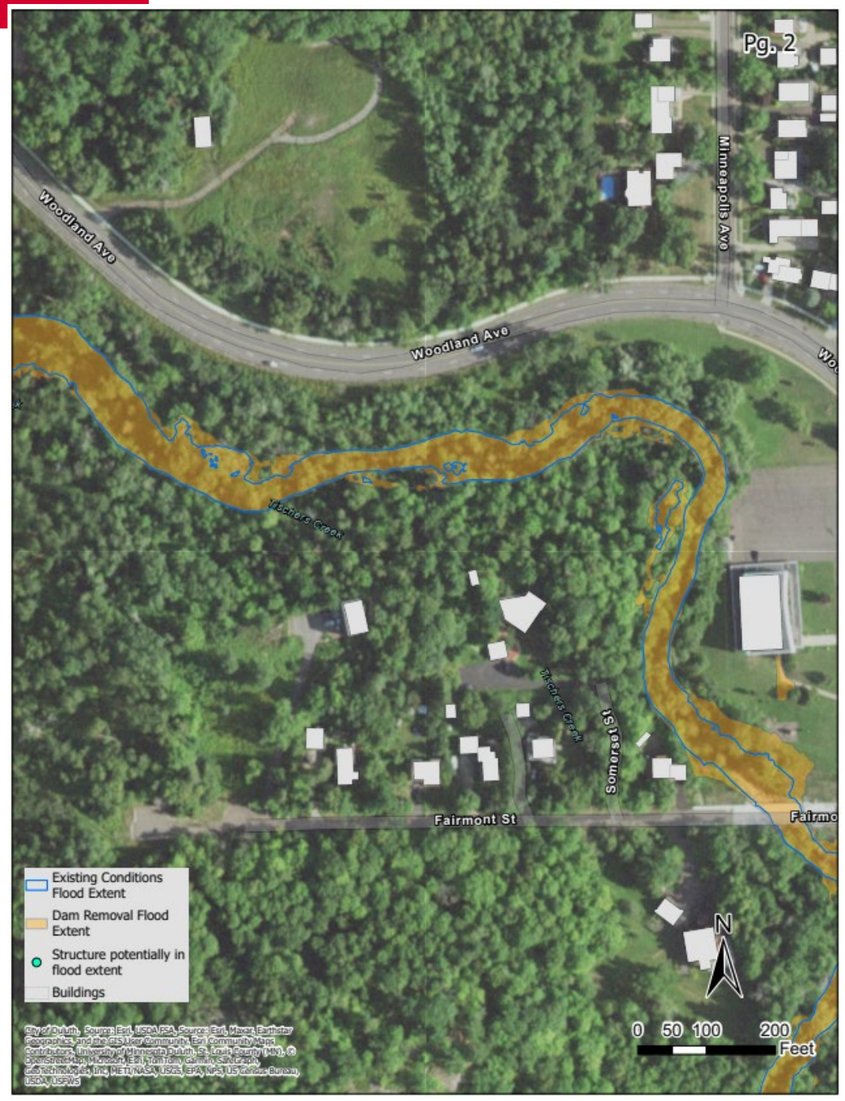
Thank You!
Questions?

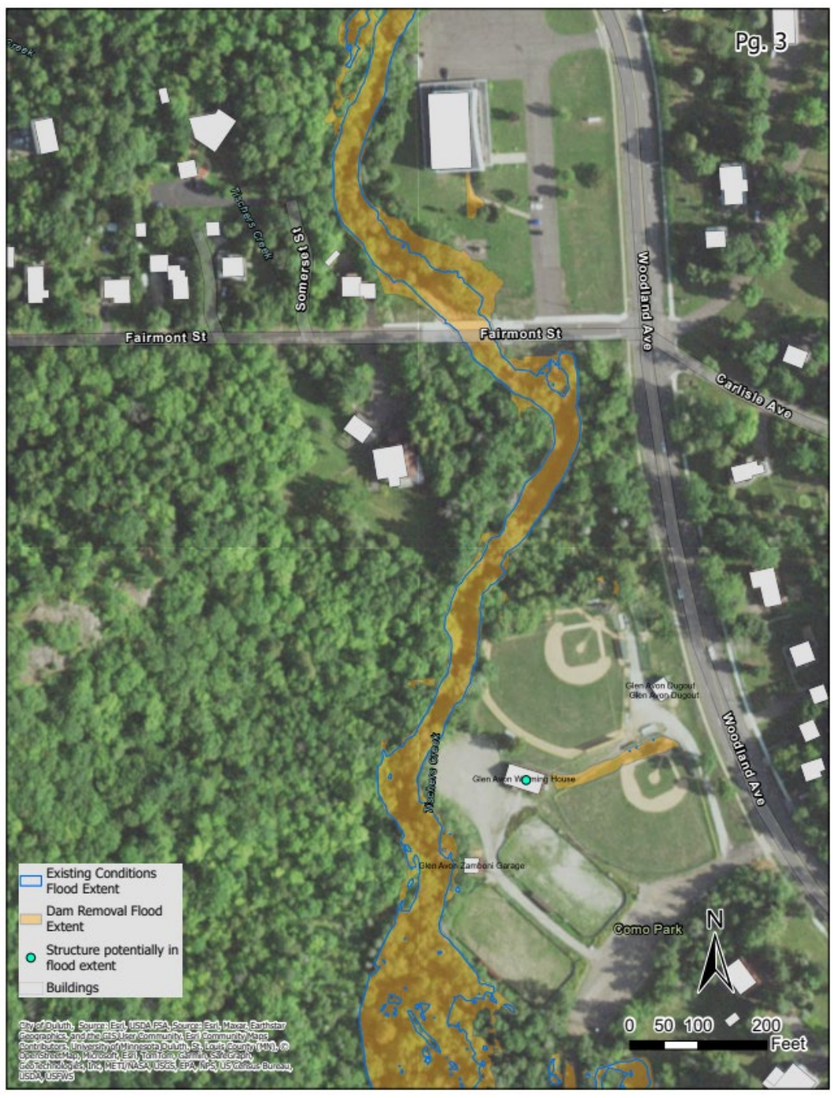
Hartley Pond and Dam Feasibility Study

May 1, 2024

Dam Removal – Downstream Impacts







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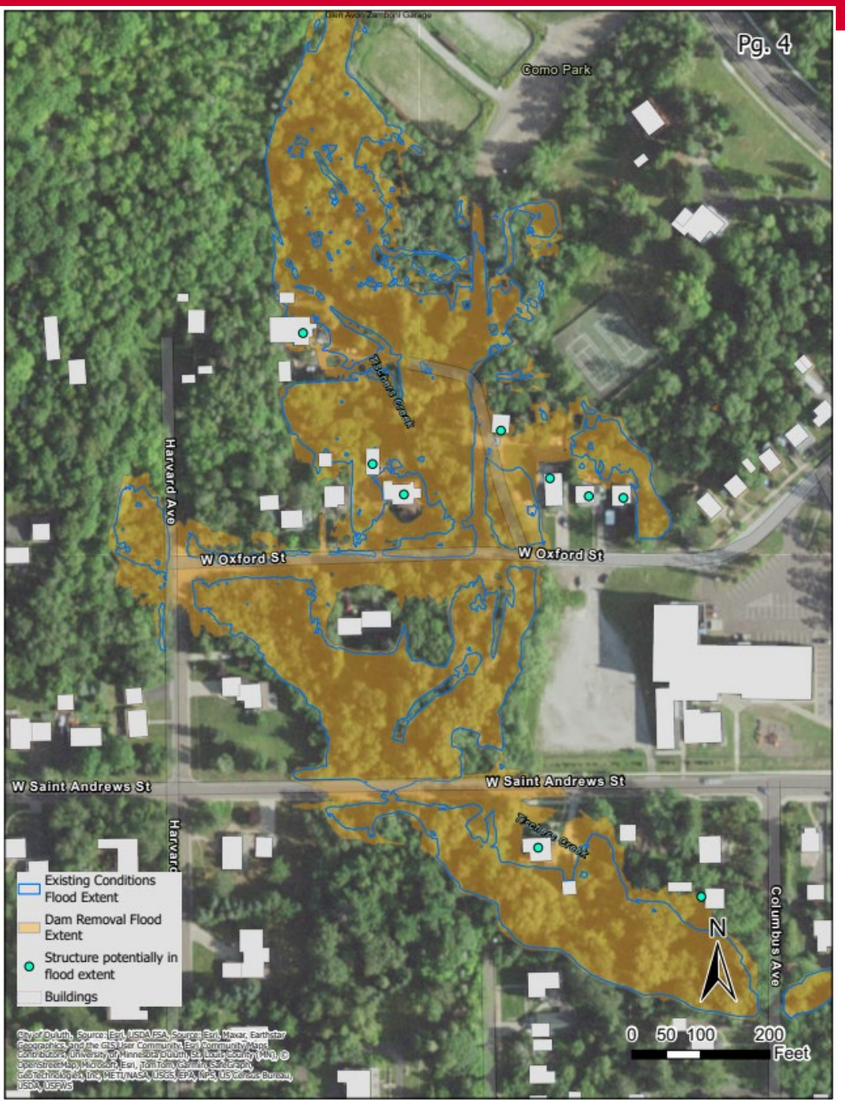

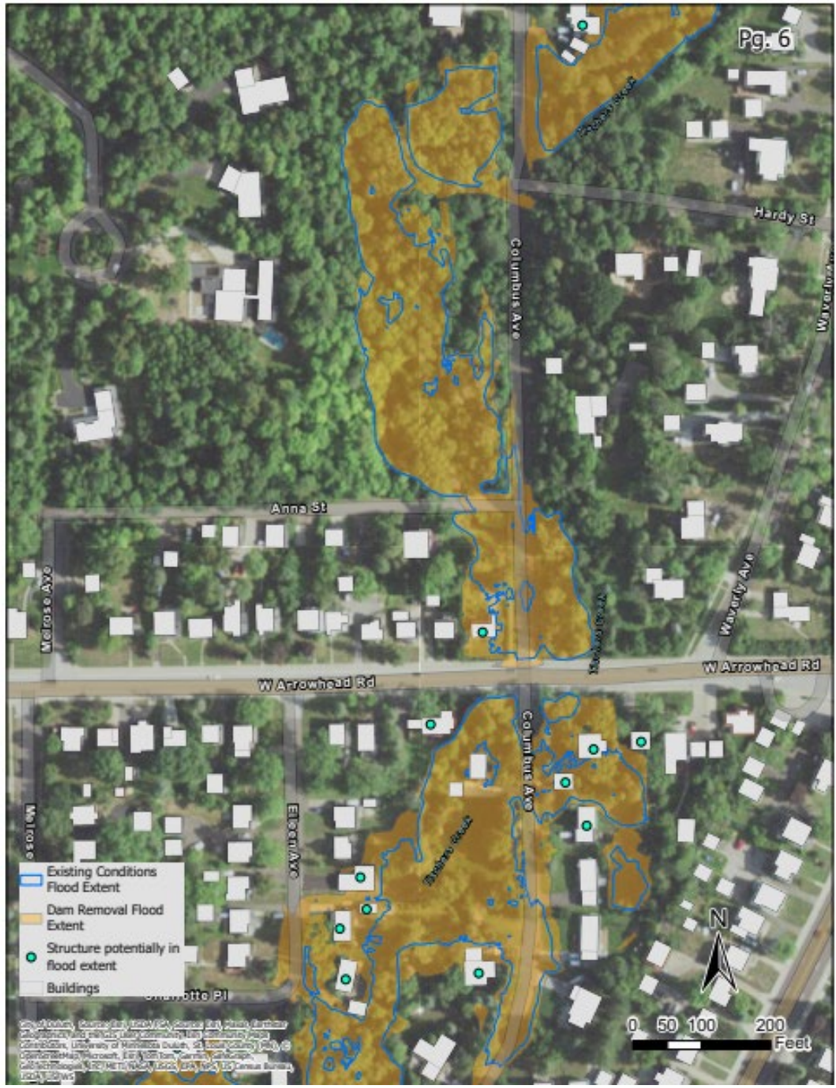

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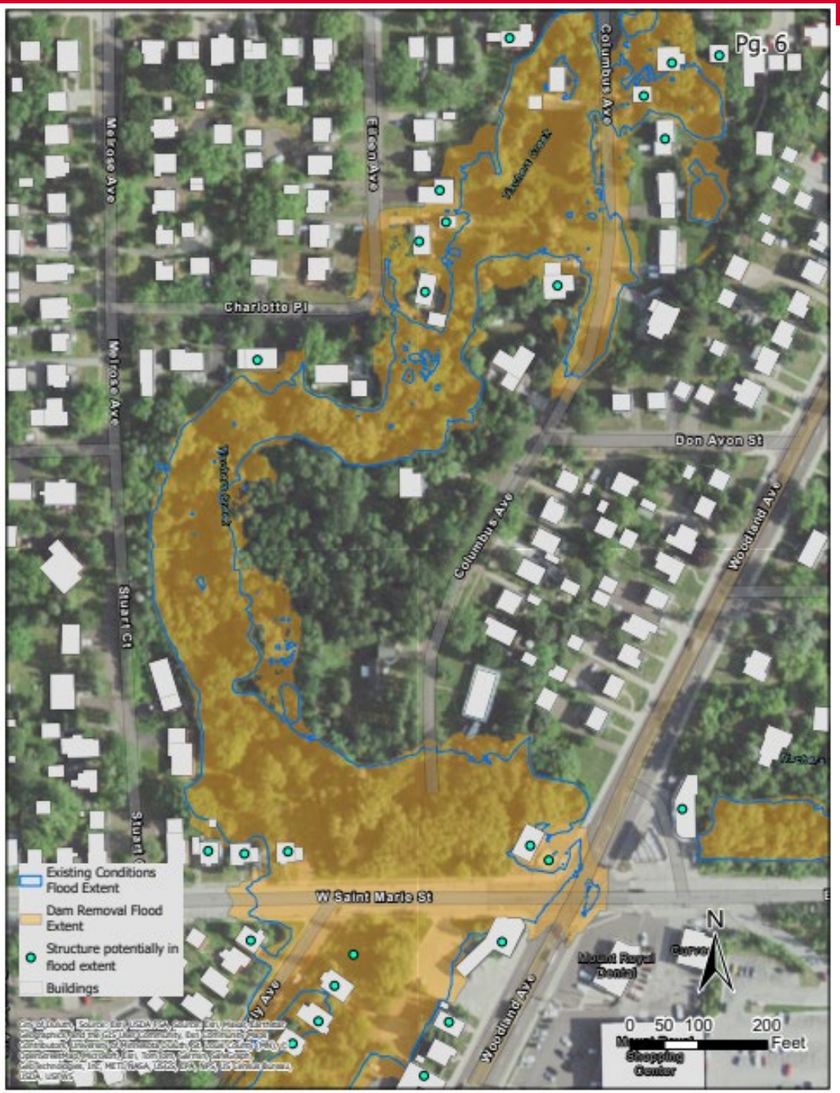

Similar Projects

Mill Pond Dam, Davisburg, MI

- Drained 20-acre Mill Pond and restored stream channel
- Replaced dam with open-bottom arch culvert. Davisburg Road runs on top of embankment so the embankment stayed in-place.

20’x32' arch pipe with > 5000 ac-feet of storage at brim full
embankment height = approximately 90 feet

Federal Highway Administration and Dam Safety Regulators

- Stream crossings through culverts under roads and bridges are considered dams if certain criteria is met.
  - Intent is to store/impound water (Lyon County, MN)
  - In MN – 6 ft high and 15-acre feet of storage